MEMORANDUM

March 10, 2021

To: Silver Oaks Cellars
c/o Ms. Annalee Sanborn and Mr. Jim Bushey
PPI Engineering, Inc. (PPI)
Sent via email (asanborn@ppiengineering.com)
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Job No. 729-NPA01

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

Re: Results of Napa County Tier 1 and Tier 2 Water Availability Analyses
Vineyard Development Project at Carmelite House of Prayer Property
20 Mount Carmel Drive
Vicinity Oakville, Napa County, California

Introduction

This Memorandum presents the key findings, conclusions, and preliminary recommendations regarding the Water Availability Analysis (WAA) prepared by RCS for the proposed vineyard development project at the Carmelite House of Prayer property in Napa County, California. This document was prepared for the property owner to provide hydrogeologic analyses in conformance with Napa County Tier 1 and Tier 2 WAA requirements, as described in the Napa County WAA Guidelines Document (WAA, 2015).

The Carmelite House of Prayer property (referred to herein as "subject property") is comprised by a single parcel and is located at the address of 20 Mt. Carmel Drive in the Oakville area of Napa County (County). Figure 1, "Location Map," shows the boundary of the subject property superimposed on a USGS topographic map. This parcel boundary was adapted from the County Assessor's parcel data, which are freely available on the County GIS website. Also shown on Figure 1 is the location of the existing onsite water well (labeled as "Onsite Well"), and the locations of other nearby offsite wells owned by others. The locations of the proximal offsite wells shown on Figure 1 are considered to be approximate only, and those plotted offsite wells are not considered to represent all existing nearby wells owned by others. Figure 2, "Aerial Photograph Map," shows the same property boundary and well locations that are illustrated on Figure 1, but the basemap for Figure 2 is an aerial photograph of the area, which was obtained using the ArcGIS Pro software package. Other features shown on Figures 1 and 2 are discussed later in this Memorandum.

As reported by the subject property owner representative, Father James Zakowicz, the subject property is currently developed with a residence (main house), a monastery, other associated buildings to the monastery, and associated landscaping; no actively farmed vineyards currently exist on the property, although a 0.86-acre vineyard block on less than 5% average slope is currently under development. Water demands for the existing onsite developments have historically been met primarily via an offsite spring (labeled on Figures 1 and 2) for which a water easement reportedly exists to the subject property; onsite water demands are also supplemented by groundwater pumped from the existing Onsite Well.

RCS understands the proposed project is to develop 3.0 acres of new vineyards on the subject property. Water demands for these new vineyards and the 0.86 acre vineyard under development are proposed to be met using groundwater pumped from the Onsite Well. Water demands for existing onsite uses will not increase as part of the vineyard development and will continue to be supplied primarily by the offsite spring, and supplemented by the Onsite Well only when necessary.

The basic 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. Also, as shown on Figures 1 and 2, there are at least two known offsite wells, owned by others, located within 500 feet (ft) of the Onsite Well (i.e., the "project well"); those wells are labeled as Neighbor 1 and Neighbor 2 on the figures herein. Hence, a "Tier 2" WAA (i.e., a well interference evaluation) needed to also be performed to provide estimates of the possible water level drawdown interference that might be induced in these two neighboring wells from future pumping by the project well.

Site Conditions

From review of in-house data provided by the property owner, and from the field visit by an RCS geologist to the subject property on June 1, 2020, the following key items were noted and/or observed (refer to Figures 1 and 2):

a. The Carmelite House of Prayer property is comprised by a single parcel having a County Assessor's Parcel Number (APN) of 027-280-006. The total County-assessed area of the subject property is 28.20 acres.

b. The subject property is situated on the western side of Napa Valley near the base of foothills, and approximately 1 mile southwest of Oakville. Based on the topographic contours illustrated on Figure 1, ground surface on the subject property slopes slightly to the northeast towards Highway 29 and the Napa River.

c. There are no mapped "blueline streams" located on the subject property. However, two "dashed blueline" drainages[1] are shown on Figure 1 to be located north and south of the subject property. Based on the topographic contours, runoff along these intermittent creeks would flow to the northeast. As shown on Figure 2, no creek channels are visible east of the subject property across Walnut Drive, as the creeks are diverted to pipes underneath the offsite vineyards.

d. Currently, there is a residence (i.e., the main house), a monastery building, associated buildings to the monastery, and associated landscaping on the subject property. There are no vineyards planted on the property as of the date of this report. There is a 0.86-acre vineyard block under development on a portion of the property that is less than 5% slope, and therefore, does not require an Erosion Control Plan (ECP).

[1] Such drainages shown as "dashed lines" on a USGS topographic map denote intermittent status.

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e. Water demands for the existing onsite developments are supplied primarily by an offsite spring source. This spring (and the infrastructure that collects the spring water) is located approximately 2,100 ft west of the subject property (see Figures 1 and 2). This offsite spring source for the property is located within the northern intermittent creek channel discussed above.

f. As shown on Figures 1 and 2, there is one water-supply well (the Onsite Well) on the subject property. The Onsite Well, which is located in the southern portion of the property, is used to supplement existing water demands to the subject property when groundwater flow from the spring becomes low and cannot solely meet the onsite demands (typically during the late summer period of each year).

g. Development on offsite areas to the east of the subject property consist primarily of vineyards and residences. Areas further offsite to the west are primarily undeveloped and consist of naturally vegetated areas (see Figure 2).

h. During the June 2020 site visit, RCS geologists traveled along Oakville Grade and Walnut Drive near the property in an attempt to identify possible locations and/or the existence of nearby, but offsite wells owned by others. RCS refers to such work as a "windshield survey." During this survey, RCS geologists attempted to identify possible offsite well locations by observing typical well-house enclosures, pressure tanks, storage tanks, power lines, or direct observation of a wellhead.

   RCS geologists also contacted the County Planning, Building, and Environmental Services (PBES) in attempt to acquire "Well Completion Reports" (also known as "driller's logs") that might exist for the Onsite Well, and for possible wells located on those neighboring offsite properties. In addition, RCS geologists also used the California Department of Water Resources (DWR) online Well Completion Report website in an attempt to locate and download driller's logs for wells within the immediate vicinity of the subject property. As a result of those inquiries, several driller's logs were obtained and/or locations were reported 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. Those locations are not considered to be inclusive of all actual offsite wells in the area. Note there are at least two offsite wells that appear to be located within 500 ft of the Onsite Well (labeled as "Neighbor Well 1" and "Neighbor Well 2" on Figures 1 and 2); these two offsite wells are approximately 290 ft southeast and 445 ft south, respectively, from the project well.

Key Construction and Testing Data for the Onsite Well

A DWR Well Completion Report is available for the Onsite Well; a copy of this report is appended to this Memorandum. Table 1, "Summary of Well Construction and Yield Data," provides a tabulation of key well construction data and original groundwater airlifting data that are available for the Onsite Well. A geophysical electric log survey was not conducted in the pilot hole of the Onsite Well at the time of its construction.

Well Construction Data

Based on data listed on the available driller's log and/or information identified during the site visit, key well construction data for the Onsite Well listed on Table 1 include:

a. The Onsite Well was drilled and constructed by Huckfeldt Drilling (Huckfeldt) of Napa, California, in August 1986; the drilling method used to the well is listed on the driller's log as "direct air rotary".

b. The pilot hole depth (the borehole drilled before the well casing was placed downwell) was reported to be 421 ft below ground surface (bgs).

c. The well was cased with PVC well casing having a nominal diameter of 5 inches; the total casing depth is reported to be 421 ft bgs.

d. Casing perforations in the well are factory-cut slots and have slot opening widths of 0.125 inches (125-slot). The perforation depth intervals were reported to be from 240 ft to 420 ft bgs.

e. The gravel pack material reported on the available driller's log is "3/8 pea gravel" and it was placed in the annular space of the well between the depths of 27 ft and 420 ft bgs.

f. The Onsite Well was constructed with a sanitary seal consisting of cement, which was set to a depth of 27 ft bgs.

Summary of Key Airlifting "Test" Data

The driller's log for the Onsite Well provided the depth to the original post-construction static water levels (SWL) in the well, along with the original driller-reported airlifting test rate, as shown on Table 1. These data include:

- An initial SWL depth following completion of well construction in August 1986 was reported to be 127 ft bgs in the Onsite Well.
- Reported maximum airlift rates for the initial post-construction airlifting operations in the Onsite Well were estimated by the driller to be approximately 107 gallons per minute (gpm), at the time of well construction. 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.
- Water level drawdown values during airlifting were not listed on the driller's logs for the Onsite Well, because water level drawdown cannot be measured during airlifting operations; thus, the original post-construction specific capacity[2] value for the well cannot be calculated using the data provided on the driller's log.
- Oakville Pump Service (OPS) is the pumping contractor which most recently serviced the pump in the well. They were contracted by the well owner to rebuild the existing permanent pump in the subject well. This pump work was reportedly performed in July 2016. However, OPS could not provide RCS with any information or data related to

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[2] 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.

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the current yield or pumping rate, or information of the depth setting of the permanent pump in this well.

Well Data from Site Visit

As discussed above, a site visit to the subject property was performed by RCS geologists on June 1, 2020. The following information for the Onsite Well was gathered from that site visit:

- The Onsite Well was observed to be equipped with a permanent pump, and the pump was turned off (not pumping) during the June 2020 visit. A SWL of 161.5 brp was measured by the RCS geologist during that site visit; the reference point for the measurement was approximately 1.3 ft above ground surface (ags). The well was also observed to be equipped with totalizer flowmeter device, which had a reading of 518,760 gallons at the time of our site visit. According to the pumping contractor, OPS, this totalizer device was newly installed (i.e., had a meter reading of “0” gallons) when the pump was re-built in July 2016.
- The Onsite Well is reportedly only used during the late portions of summer each year, as a supplemental source to meet existing onsite water demands.

Pumping Test Data by Others for the Onsite Well

On November 2, 2020, an 8-hour constant rate pumping of the Onsite Well was performed by LGS Drilling, Inc. (LGS), of Vacaville, California. Testing of the well was performed using the permanent pump that existed at the time of testing; the permanent pump was reported by LGS to be a 5-horsepower pump and installed to a depth of approximately 378 ft bgs. Water levels and pumping rates were measured and recorded by the LGS pumper during the pumping test. In addition, water levels were also recorded automatically during the constant rate pumping test using a pressure transducer that had been programmed by RCS geologists and shipped to LGS for installation and use during the pumping test. Figure 3, “Water Level Data During Constant Rate Pumping Test,” illustrates the water level changes in the Onsite Well during the 8-hour pumping test period. Key data available for this November 2020 pumping test by LGS include:

- A SWL of 192.4 ft below reference point (brp) was recorded by the LGS pumper prior to testing.
- A maximum pumping water level (PWL) of 209.1 ft brp was measured at the end of the 8-hour pumping period; this represents a water level drawdown of 16.7 ft at the end of the test. The data show that water levels remained relatively stable at the end of the pumping test. Specifically, PWLs fluctuated by only approximately 0.3 ft in the last 5 hours of the pumping test. This represents a water level decline of about 0.06 ft/hour. Additionally, PWLs were reported to be about 169 ft above the reported pump intake depth.
- Based on the totalizer flow meter readings provided by LGS, an average pumping rate of 25 gpm was calculated for the 8-hour test. Based on this average pumping rate, and the total water drawdown of 16.7 ft, the specific capacity of the Onsite Well is calculated to be 1.5 gallons per minute per foot of water level drawdown (gpm/ft ddn) at the time of this LGS test in November 2020.

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Following the end of the pumping test, water levels recovered to a depth of 193.2 ft (or approximately 99% recovery) after a period of approximately 8 hours of non-pumping (see Figure 3).

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 Rutherford (2005) quadrangle, as published by the California Geological Survey (CGS). As shown on Figure 4, the key earth materials mapped at ground surface in the area, from geologically youngest to oldest, include the following:

a. Alluvial-type deposits. These deposits consist of undifferentiated and/or undivided alluvium and/or alluvial fan deposits (map symbols Qhf and Qf on Figure 4). These deposits are generally unconsolidated, and consist of layers and lenses of sand, gravel, silt, and clay. These alluvial deposits primarily occur at ground surface across the floor of Napa Valley and along the eastern portions of the subject property. Based on topography of the subject property and surrounding area, these geologic materials are interpreted to be relatively thin where they are mapped along the eastern edge of the property.

b. Landslide deposits. Landslide deposits[3] (map symbol Qls) have been mapped in the region by others (see the yellow-colored areas on Figure 4). Arrows within these mapped landslide areas show the general direction of downslope movement within each landslide mass. There are no exposed landslide deposits on the subject property.

c. Sonoma Volcanics. The Sonoma Volcanics are comprised by a highly variable sequence of chemically and lithologically diverse volcanic rocks. The rock types shown on Figure 4 include andesitic lava flows (map symbol Tsvasl), andesite flow breccias (map symbol Tsvabsl), and andesite ash flow tuff and tuff breccia (map symbol Tsvatsl). As shown on Figure 4, andesitic lava flows are primarily exposed at ground surface across much of the subject property; andesite flow breccias are mapped in a small area on the western edge of the property. Andesite ash flow tuff and tuff breccia are exposed in an area to the south of the subject property.

d. Great Valley Sequence and Franciscan Graywacke. These geologically older (Cretaceous- and Jurassic-aged) Great Valley Sequence and Franciscan Graywacke rocks (map symbol KJgv and KJfs, respectively) are exposed offsite at ground surface to the west and northwest of the subject property, respectively, and they primarily are exposed at ground surface in much of the hillside area west of the property (KJgv), as shown on Figure 4. These rocks consist mainly of well-consolidated to cemented thickly bedded sandstone, conglomerate, siltstone, and shale (KJgv), and graywacke with minor interbeds of shale (KJfs). These geologically older rocks are considered to be the bedrock of the area and are known to underlie the volcanic rocks at depth

[3] Note that it was not a part of our Scope of Hydrogeologic Services for this project to study, investigate, analyze, determine, or opine on the potential activity of landslides, and/or on the potential impact that landslides might have on any of the onsite structures, or to any onsite and/or offsite wells used for the subject property.

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beneath the subject property. Serpentinite (map symbol sp), is exposed at ground surface to the northwest of the subject property.

RCS interpretation of the driller's descriptions of the drill cuttings listed on the available driller's log for the Onsite Well reveals that typical rocks of the Sonoma Volcanics were encountered when drilling the total depth of this well. Typical driller-terminology for the drill cuttings on this log included: "volcanic molaz;" and "red volcanic rock." Therefore, based on the generalized terminology used by the drilling contractor for this well, the Sonoma Volcanics are interpreted by RCS to extend to depths of at least 421 ft bgs beneath this well site.

Geologic Structure

Several fault traces[4] of the West Napa fault system, as mapped by others, have been interpreted by others to exist in the vicinity of the subject property as shown by the dark-colored, lines and/or dashed lines on Figure 4 (CGS 2005). Specifically, one of these northwest-southeast trending fault traces, which is part of the West Napa fault system, is shown to be mapped through the western edge of the property. Faults can serve to increase the number and frequency of fracturing in the local earth materials, including the underlying Sonoma Volcanics. 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. The possible nature of the onsite fault discussed above is unknown.

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 are:

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 Sonoma Volcanic 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 within the pore spaces created by the grain-to-grain interaction in volcanic tuff and ash, if and where present at depth beneath the subject property.

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.

[4] 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.

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- 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 not only in the subsurface, but also 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.
- The existence and thickness of possible fine-grained ash flow tuffs of relatively low permeability beneath the property.
- To a lesser extent, the size of the pore-spaces formed by the grain-to-grain interactions of volcanic ash particles, if these rock types exist beneath the subject property.

As stated above, the principal rock types expected in the subsurface beneath the property and its environs, based on the driller's logs of the onsite wells and wells on nearby properties, appear to be mainly the hard, volcanic flow rocks that may be fractured to varying degrees; some weathered ash flow tuffs are likely to also be present. The basic descriptions of drill cuttings by the driller that have been recorded on the available driller's log for the Onsite Well and for other nearby offsite wells are consistent with the typical descriptions of the various rocks known in the Sonoma Volcanics. 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 have ranged widely, from rates as low as a few gpm (if abundant ash flow tuff is present), to rates as high as 200 gpm or more (if abundant hard fractured flow rocks are present).

Potentially Nonwater-Bearing Rocks

This category includes the geologically older and fine-grained sedimentary rocks of the Great Valley Sequence, the Franciscan Graywacke, and the serpentinite. These potentially nonwater-bearing rocks are interpreted to underlie the volcanic rocks that exist beneath the subject property at depths greater than 421 ft bgs in the vicinity of the Onsite Well as interpreted by RCS from the driller's generalized descriptions listed on the available driller's log for this well, and those of nearby offsite wells.

In essence, these diverse and geologically old 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 bedrock materials 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 bedrock materials, and the water quality can be marginal to poor in terms of total dissolved solids concentrations, and other dissolved constituents.

Project Groundwater Demands

For the purposes of this WAA, the Onsite Well is considered to be the "project well", as it will be used to meet the new water demands of the proposed vineyard development project. Other existing onsite water demands will continue to be primarily supplied by the collection of water from the offsite spring source, and supplemented by groundwater pumped from the Onsite Well, when

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necessary. Table 2, "Groundwater Use Estimates," is intended to categorize the specific water demands of the property; the estimated future annual groundwater demands for the property are discussed below.

Existing Groundwater Demands

Existing groundwater demands for the subject property have been estimated by RCS geologists using totalizer data available from the Onsite Well. As discussed above, a totalizer reading of 518,760 gallons was recorded by the RCS geologist on June 1, 2020. Reportedly, this totalizer device was installed new (i.e., a reading of "0" gallons on July 8, 2016). Thus, for the purposes of this WAA, we will assume that approximately 518,760 gallons of groundwater (or 1.6 acre-feet, AF) have been pumped from the Onsite Well for period of roughly 4 years. This equates to approximately 0.4 AF of supplemental groundwater having been pumped each year since mid-2016 to meet existing onsite water demands. No records are available to determine the annual volume of water provided to the property from the offsite spring.

Proposed Groundwater Demands

Groundwater demands for the proposed new vineyards and the vineyards under development will be met by pumping groundwater from only the project well (the Onsite Well). Water demands for all other existing onsite uses, including the main house, monastery, associated monastery buildings, and associated landscaping, will not increase as a part of the proposed project and will continue to be supplied primarily by surface collection from the offsite spring source, and supplemented by groundwater pumped from the Onsite Well (approximately 0.4 AF/yr on average as noted above) in addition to the proposed vineyard.

Groundwater demands for the property are estimated as follows:

a. Existing onsite groundwater demand = 0.4 AF/yr
    - Includes supplemental water for the main house, monastery, associated monastery buildings, and associated landscaping.
b. Proposed irrigation groundwater demand for vineyard under development = 0.43 AF/yr
    - Based on the 0.86-acre vineyard under 5% average slope currently being developed (and not considered by the ECP), and a unit water demand of 0.5 AF of water per acre of vines per year[5].
c. Proposed irrigation groundwater demand for new vineyards = 1.5 AF/yr
    - Based on the total proposed new vineyard acreage of 3.0 acres (for which the project ECP is being prepared), and a unit water demand of 0.5 AF of water per acre of vines per year[5].
d. Total estimated future annual groundwater demand = a + b + c = 2.33 AF/yr

As stated above, groundwater demand is expected to increase by only 1.93 AF/yr as a result of the development of the 0.86-acre vineyard block and the proposed new vineyards. This future proposed groundwater use increase will be solely applied to onsite vineyards; water demands for the other existing onsite uses will not increase.

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[5] This unit water demand estimate is based values presented for specified land uses provided in Appendix B of the County's WAA Guidance Document (WAA 2015).

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Proposed Pumping Rates

To determine an appropriate pumping rate necessary from the Onsite Well to meet the total future groundwater demand of 2.33 AF/yr, it was conservatively estimated that groundwater demands (1.93 AF/yr) from the Onsite Well for the 3.86 acres of future onsite vineyards will be required during a 20-week irrigation season each year. Based on these assumptions, in order to meet the groundwater demands of the onsite vineyards, the Onsite Well would need to pump at a rate of about 6.3 gpm to meet vineyard irrigation demands. This pumping rate assumes that the Onsite Well would be pumped on a 50% operational basis (12 hours/day, 7 days/week) during the irrigation season.

It is assumed that supplemental water demands for existing onsite uses (0.4 AF/yr) will be required during an 8-week period in the late summer each year (as reported by the property owner). It is further assumed that this 8-week supplemental groundwater delivery period will occur during the same time of year when groundwater is required for vineyard irrigation. Therefore, when the 20-week irrigation season and the 8-week supplemental water delivery period overlap near the end of the irrigation season, the Onsite Well will need to pump at a rate of 10 gpm, assuming the same 50% operational basis described above. During the remainder of the year (when the vineyards are not being irrigated and the spring flow is sufficient to meet other onsite demands), pumping the Onsite Well will not be necessary.

Based on the reported results of the most recent pumping test performed on the Onsite Well in November 2020, the Onsite Well was pumped at an average rate of 25 gpm and for a continuous period of 8 hours. As discussed above pumping water levels were relatively stable in the well at the end of the test, and water levels nearly recovered back to the pre-test static water level. The pumping rate of the Onsite Well during that pumping test (25 gpm) is more than two times greater than the pumping rate required from this well to meet the total groundwater demand of the subject property in the future (10 gpm).

Tier 2 “Well Interference Evaluation”

As discussed above, an 8-hour pumping test of the Onsite Well was performed by LGS on November 2, 2020. As shown on Figures 1 and 2, several offsite wells are reported to be located nearby and/or on adjacent properties. Two of these offsite wells (labeled on Figures 1 and 2 as “Neighbor Well 1” and “Neighbor Well 2”) are located approximately 290 ft southeast, and approximately 445 ft south from the Onsite Well, respectively. Therefore, according to the County WAA Guidelines (WAA 2015), because these wells are located within 500 ft of the project well (Onsite Well), a Tier 2 WAA (Well Interference Evaluation) is required for this project. Data from the November 2020 pumping test performed by LGS were also used for the Tier 2 WAA analysis.

Results of the November 2020 Pumping Test

The constant drawdown pumping test for the Onsite Well was performed for a continuous period of 8 hours (480 minutes) and was pumped at a relatively constant rate of 25 gpm, until a relatively stable pumping level was recorded at the end of the test. Pumping rates and pumping water levels were recorded by the LGS pumper and reported on a “Test Pump Log”; a copy of this log is appended to this Memorandum. In addition, water levels were also recorded automatically during the constant rate pumping test using a pressure transducer that had been programmed by RCS geologists and shipped to LGS for installation. Figure 3, “Water Level Data During Constant

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Rate Pumping Test," graphically illustrates the water level changes in the Onsite Well during the 8-hour constant rate pumping test period. The following is a summary of those data:

- Onsite Well (the pumping well) – A pre-test SWL of 192.4 ft brp was measured in this well just before the pump was turned on to begin the constant rate pumping test. The well was pumped at an average pumping rate of 25 gpm, which was determined from totalizer dial readings recorded by the LGS pumper throughout the pumping period. After 8 hours (480 minutes) of continuous pumping, the maximum PWL in the Onsite Well was measured at a depth of 209.1 ft brp, as shown on Figure 3. This represents a self-induced maximum water level drawdown of 16.7 ft during the 8-hour pumping test. As shown on Figure 3, pumping water levels in the Onsite Well appeared to be relatively stable near the end of the pumping test. In the last 5 hours of the pumping test, water levels were decreasing at a rate of only about 0.06 ft/hour.

  Following pump shut-off, manual water level recovery measurements were collected by the LGS pumper for approximately 30 minutes. Water levels were also collected automatically by the pressure transducer in the Onsite Well following the shut-off of the test pump. Based on the water levels recorded automatically by the pressure transducer, water levels recovered to a depth of 193.2 ft brp (or approximately 99% recovery) after a period of approximately 12 hours of non-pumping.

There were no observation well water level data collected during the test. Mr. David Shein, the project applicant, attempted to contact the owner of the offsite wells to explore the possibility of measuring water level data in the offsite wells during the pumping test, but received no response. Thus, definitive water level drawdown interference impacts (if any) on the two offsite wells located within 500 ft during this pumping test was unknown.

Specific Capacity Data

A useful indicator of well performance or efficiency (in terms of changes in water level drawdown over time with respect to pumping rate) is the specific capacity of a well, which can be calculated from the results of an aquifer (pumping) test or from data generated during regular periods of pumping and water level monitoring. In general, when groundwater is pumped from an active water well, a hydraulic gradient is established toward the well, and a cone of water level depression forms within the local aquifer system, with the pumping well located at the locus (center) of this cone. In general, the greater the pumping rate (and/or the longer the duration of pumping), the greater the water level drawdown will be in the pumping well (drawdown represents the vertical distance between the non-pumping [or static] water level and the resulting pumping water level in the well). As an indication of the relative efficiency or productivity of a well, the term "specific capacity" is commonly used to define the amount of water (in gpm) that the well will yield for each foot of water level drawdown created while the well is pumping at a particular rate. The specific capacity[6] of a well is calculated using the pumping rate of the well (in gpm) divided by the total water level drawdown (in ft) created in that well while pumping at that rate, and is expressed in units of gallons per minute per foot of water level drawdown (gpm/ft ddn). As is typical for any

[6] The specific capacity of a well depends on several factors, including the hydrogeologic characteristics and thickness of the local aquifer system, the method of well construction, well design details such as gravel pack gradation and gravel envelope thickness, the type and degree of well development performed, the age and current condition of the casing perforations and gravel pack, and the pumping rate and pumping duration of the pumping event being monitored. Hence, it can be difficult to compare specific capacity values from one well to another even if the two wells are in the same aquifer system, but such comparisons can yield valuable information when conditions are similar.

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well, the higher the pumping rate and/or the longer the duration of continuous pumping will result in a lower specific capacity.

During the 8-hour pumping test of the Onsite Well in November 2020, the specific capacity was calculated to be 1.5 gpm/ft ddn. There are no other pumping data available for this well to compare to the monitored results of these recent testing data. Generally, longer pumping periods tend to create greater water level drawdowns in a pumping well than shorter pumping periods at similar pumping rates; hence, specific capacity values calculated for long-term pumping tests typically tend to be lower than calculations resulting from relatively short-term tests, assuming the tests were conducted at similar pumping rates. Regardless, the specific capacity value calculated from the pumping test described above is considered to be typical for geologic materials within the Sonoma Volcanics into which the Onsite Well has been constructed.

Calculation of Aquifer Parameters

Important aquifer parameters such as transmissivity (T) and storativity (S) can be determined using data collected during a pumping test of a well. Transmissivity is a measure of the rate at which groundwater can move through an aquifer system, and therefore is essentially a measure of the ability of an aquifer to transmit water to a pumping well. Transmissivity is expressed in units of gallons per day per foot of aquifer width (gpd/ft). Storativity (S) is a measure of the volume of groundwater taken into or released from storage in an aquifer for a given volume of aquifer materials; storativity is dimensionless and has no units. Storativity calculations can only be made using actual amounts of water level drawdown, if any, monitored in an observation well during a pumping test of another well; storativity cannot be calculated using water level drawdown data acquired solely from the pumping well.

Water level drawdown and recovery data collected from the Onsite Well during the November 2020 constant rate pumping test were input into the software program AQTESOLV (version 4.5 Professional). Note, since no observation water level data were collected, storativity (S) could not be calculated from the pumping and water level data from the Onsite Well. Numerous analytical solutions were then applied to the Onsite Well data in an attempt to determine transmissivity values using an automatic curve fitting procedure. The solutions utilized consisted of unconfined, confined, semi-confined, and/or fractured aquifer solutions; several variations of these solutions were evaluated by RCS.

Certain assumptions are made about the aquifer when applying these solutions. In general, for the solutions listed below, key assumptions are: that the aquifer has an infinite areal (lateral) extent; that the aquifer is isotropic (the same in all directions); that the pumping well fully and/or partially penetrates the aquifer system(s); and that groundwater is instantaneously released from storage with the decline of hydraulic head. Also, for the purposes of this evaluation, the assumption is made that the saturated aquifer thickness at the Onsite Well is approximately 228 ft at the date of the pumping test. This saturated aquifer thickness was determined by taking the vertical distance between the static water level in the Onsite Well (approximately 192.4 ft brp on November 2, 2020) and the bottom of the casing perforations in the Onsite Well (at a depth of approximately 420 ft bgs; see Table 1).

Listed below are the curve-fitting solutions used, the transmissivity values calculated, and the figure number in this Memorandum on which the water level data and fitted-curve are presented. For each solution used, a storativity value could not be calculated because water level data were not monitored in any offsite wells during the constant rate pumping test of the Onsite Well.

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- Theis/Hantush – Figure 5A, "Constant Rate Pumping Test Analysis, Theis/Hantush Solution, Confined Aquifer, Carmelite Onsite Well (Pumping Well)." As shown on the figure, the curve for the confined aquifer solution has been "best fit" to the later-time water level drawdown data observed in the Onsite Well. A transmissivity value of approximately 2,987 gpd/ft is calculated for these data.
- Moench – Figure 5B, "Constant Rate Pumping Test Analysis, Moench, Leaky Aquifer, Carmelite Onsite Well (Pumping Well)." As shown on the figure, the curve for the leaky aquifer solution has been matched somewhat well to the later-time portion of the water level drawdown data collected during the pumping period in the New Well. A transmissivity value of approximately 921 gpd/ft is calculated for these data.
- Gringarten-Witherspoon – Figure 5C, "Constant Rate Pumping Test Analysis, Gringarten-Witherspoon, Fractured Aquifer, Carmelite Onsite Well (Pumping Well)." As shown on the figure, the curve for the fractured aquifer solution has been reasonably fit to much of the water level drawdown data acquired during the pumping test of the Onsite Well. A transmissivity value of approximately 3,052 gpd/ft is calculated for these data.

Transmissivity values determined from the November 2020 pumping test in the Onsite Well using AQTESOLV vary between approximately 920 and 3,050 gpd/ft, depending on the analytical solution chosen. Transmissivity values reported by others for Sonoma Volcanic-type rocks can vary from as low as approximately 100 gpd/ft to as high as approximately 20,000 gpd/ft. Thus, it appears the transmissivity values presented above fall within this range and are therefore considered to be representative of the local Sonoma Volcanic rocks.

An independent evaluation of transmissivity (T) using data from the subject pumping test, were made via the empirical relationship $T \approx 1{,}750^*(Q/s)$[7], where (Q/s) is the specific capacity of the pumping well (1.5 gpm/ft ddn, as calculated from the November 2020 pumping test of the Onsite Well) and 1,750 is an empirical constant for the semi-confined aquifer system assumed to exist in the rocks of the Sonoma Volcanics. Applying this relationship to the specific capacity value calculated for the subject pumping test of the Onsite Well yields a transmissivity value on the order of 2,625 gpd/ft. This theoretical transmissivity value falls within the range of values of T determined via the analytical solutions determined using AQTESOLV software and the pumping test data (between 921 gpd/ft via the Moench analysis, and 3,052 gpd/ft via the Gringarten-Witherspoon analysis). This empirical method to estimate transmissivity only considers drawdown and does not factor in any water level recovery, whereas the curve-fitting solutions used in AQTESOLV tend to utilize both drawdown and recovery to determine transmissivity. Transmissivity values determined by the curve-fitting solutions are considered to be more representative of the regional spatial area and more indicative of long-term pumping conditions.

Theoretical Drawdown in Nearby Wells

As shown on Figures 1 and 2, there are two offsite wells located within 500 ft of the Onsite Well. RCS assigned designations of "Neighbor Well 1" and "Neighbor Well 2" for these wells for the purpose of our analysis of theoretical amount of potential water level drawdown interference. The approximate distance and direction of each of this offsite well, relative to the Onsite Well, is as follows:

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[7] This methodology is described in Driscoll (1986)

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- Neighbor Well 1 (approximately 290 ft to the southeast)
- Neighbor Well 2 (approximately 445 ft south)

As mentioned above, the project applicant attempted to contact the owner of Neighbor Well 1 and Neighbor Well 2 for inclusion during the testing period, but received no response. To calculate the theoretical drawdown in the offsite Neighbor Well 1 and Neighbor Well 2 that might possibly be induced by the future pumping of the Onsite Well, and to help satisfy requirements of the County's Tier 2 WAA, RCS used the AQTESOLV software to perform a "predictive simulation" of the potential (theoretical) water level drawdowns that might occur in the region due to future pumping by the Onsite Well. For the subject simulations, RCS specifically used the Theis (1935)/Hantush (1961) solution in the AQTESOLV software as the T value provided by the Theis/Hantush solution fell between the ranges of T determined by the Moench and Gringarten-Witherspoon solutions, and also, and was within the value calculated by the empirical method. In addition, the known construction of the Onsite Well, the known construction of both of the Neighbor Wells (as derived from the Well Completion Reports included in the Appendix), and a number of other assumptions related to the hydrogeologic properties of the local Sonoma Volcanic rock aquifer system into which the wells have been constructed were also used for the "predictive simulation." Below is a list of the inputs/assumptions used as part of our theoretical drawdown calculations:

- Inherent Theis Assumptions – Again, the Theis (1935)/Hantush (1961) solution assumes numerous conditions about the aquifer system, including that aquifer is homogeneous and isotropic (the same in all directions) and that the aquifer is of infinite areal extent.
- Well Penetration – For the purposes of the simulation, the Onsite Well is assumed to be a "partially penetrating" well. AQTESOLV states that "the screens of partially penetrating wells only extend over a portion of the aquifer's saturated thickness". Casing perforations for the Onsite Well reportedly begin at a depth of approximately 240 ft bgs, and the top of the "aquifer" is assumed to be at a depth of roughly 192 ft bgs (the SWL measured in the Onsite Well prior to the start of the pumping test on November 2, 2020).

  For this analysis, we will assume that Neighbor Well 1 is a "partially penetrating" well and Neighbor Well 2 is a "fully penetrating well" respective to the aquifer(s) penetrated by the wells. This is because Neighbor Well 1 is constructed to 480 ft bgs, and Neighbor Well 2 is constructed to 570 ft bgs. Hence, because Neighbor Well 2 is deeper than both the Neighbor Well 1 and the Onsite Well, the assumption for this portion of the analysis will be that Neighbor Well 2 defines the bottom of the aquifer in the area.
- Aquifer Thickness – The thickness of the saturated Sonoma Volcanic rock aquifer system near the Onsite Well is estimated to be 378 ft. This represents the vertical distance from the current SWL water level in the Onsite Well (about 192 ft bgs as of November 2, 2020), and the 570-foot depth to the bottom of perforations in Neighbor Well 2.
- Transmissivity and Storativity – To perform the required calculations, it was first necessary to calibrate the theoretical equations by simulating a future 8-hour period of continuous pumping in the Onsite Well and then attempt to reproduce the water level drawdown values that were automatically recorded by the pressure transducer in the pumping well during the November 2020 pumping test. Based on the results of the previous curve-fitting procedures to determine the aquifer parameters (see the previous section "Calculation of Aquifer Parameters"), transmissivity (T) values ranged between 921 gpd/ft and 3,052

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gpd/ft. Because no water level observation data were recorded during the pumping period of the Onsite Well (the pumping well), a value for storativity could not be directly calculated. A storativity[8] value of $3.8x10^{-4}$, which represents a dimensionless value, is assumed for the local aquifer system. Note that this is considered to be a conservative assumption for storativity for the local volcanic rocks.

To better calibrate the software to the actual drawdown values that were automatically recorded by the pressure transducer in the Onsite Well during the 8-hour pumping test, adjustments were made to the assumed transmissivity value used in the AQTESOLV simulation. After an iterative process, a transmissivity value of 4,594 gpd/ft was found to provide drawdown values that were more comparable to those that were actually monitored in the field in the pumping well (i.e., Onsite Well). This transmissivity value of 4,594 gpd/ft yielded a theoretical water level drawdown value of approximately 16.5 ft in the Onsite Well, which is similar to the drawdown actually observed during testing of the Onsite Well (16.7 ft). Figure 6A, "Theoretical Drawdown Calculations in Onsite Well (Pumping Well)/8 Hours//25 gpm/T=4,594 gpd/ft," shows the theoretical amounts of water level drawdown that were calculated to occur after 8 hours of continuous pumping of the Onsite Well at a constant rate of 25 gpm, based on a transmissivity of 4,594 gpd/ft and a storativity of $3.8x10^{-4}$.

Once the transmissivity value was better calibrated to drawdown values actually observed in the field in the Onsite Well, the predictive water level drawdown simulation was performed to include Neighbor Well 1 and Neighbor Well 2. Figure 6B, "Theoretical Drawdown Calculations in Observation Wells/12 Hours/10 gpm/T=4,594 gpd/ft," has been prepared to show the theoretically-calculated water level drawdown values in the Onsite Well and also in the two observation wells after pumping the Onsite Well for the assumed continuous period of 12 hours and at the assumed constant pumping rate of 10 gpm. The simulation shown on Figure 6B is considered to be more representative of the future operational pumping rate and pumping duration that are anticipated to occur in the Onsite Well at the property (as mentioned above, the peak pumping rate estimated to be needed from the Onsite Well is about 10 gpm, pumping 12 hours per day when the assumed 20-week irrigation season and the 8-week supplemental water delivery period overlap). In this scenario, the two offsite water level observation wells are assumed to be not pumping during the Onsite Well pumping period. As shown on Figure 6B, the results of the predictive simulation for water level drawdown values during pumping of the Onsite Well are presented as follows:

- Onsite Well (pumping well) – After pumping at a future rate of 10 gpm for a continuous period of 12 hours, an approximate theoretical water level decline (i.e., self-induced water level drawdown) of 6.7 ft is calculated for this well.
- Neighbor Well 1 (offsite observation well No. 1) – A theoretical water level drawdown interference value of approximately 0.8 ft is predicted as a result of pumping the Onsite Well at 10 gpm for 12 continuous hours. Recall that no water levels were measured in this offsite well during the pumping test of the Onsite Well.
- Neighbor Well 2 (offsite observation well No. 2) – A theoretical water level drawdown interference value of approximately 0.6 ft is theoretically predicted as a result of the future

[8] In Appendix F, Table F-3 of the WAA Guidance document (WAA 2015), the specific storage value for "rock, fissured" ranges between $1x10^{-6}$ and $2.1x10^{-5}$ (ft^{-1}). Multiplying these specific storage values by the estimated aquifer thickness of 378 ft yields a range of dimensionless storativity values between $3.8x10^{-4}$ and $7.9x10^{-3}$. Therefore, using an S value of $3.8x10^{-4}$ is a conservative assumption for this analysis.

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pumping of the Onsite Well at 10 gpm for a continuous period of 12 hours. Note that water levels were not measured in this offsite well during the pumping test of the Onsite Well.

These calculated theoretical water level drawdown interference values of approximately 0.6 ft and 0.8 ft are considerably less than the acceptable values defined in the "Default Well Interference Criteria" shown on Table F-1 of the May 12, 2015 Napa County WAA Guidelines (WAA 2015). Those drawdown criteria in the WAA Guidelines (WAA 2015) show that drawdown is not considered significant by the County: if less than 10 ft for offsite wells that have a casing diameter of six inches or less; and if less than 15 ft for offsite wells that have a casing diameter greater than six inches.

Rainfall

Long-term rainfall data are essential for estimating the average annual recharge that may occur at the subject property. Long-term rainfall data exist for the St. Helena rain gage, which is located approximately 6 miles northwest of the subject property. Data for this rain gage are available from the Western Regional Climate Center (WRCC) website. For this rain gage, the available period of record is 1907 through December 2020; data for this gage are listed by calendar year (January through December), not water year (beginning October 1 through September 30 of the following year). Note that there are several months and/or years of rainfall data missing in 1907, between 1915 and 1922, between 1979 and 1980, between 1985 and 1988, in 1992, and between 2011 and 2012. For the available period of record, the average annual rainfall at this St. Helena gage is 33.3 inches (2.78 ft), as reported by the WRCC. This rainfall gage is located at a similar elevation (±225 ft above sea level, asl) to that of the subject property (between ±220 and ±360 ft asl), and therefore the average long-term annual rainfall at the subject property could be similar to that experienced at this known gage location.

The Dry Creek Fire Station is the closest rain gage with available rainfall data and is located roughly 1.6 miles southwest of the subject property. Data for this rain gage are available from the Napa One Rain website between water year (WY) 2006-07 through WY 2019-20; this website is maintained by Napa County. The average annual rainfall at this Dry Creek rain gage for WY 2006-07 through WY 2019-20 was calculated to be 31.4 inches (2.62 ft). Because the period of record for this gage is short (14 years) and includes only a couple of years of drought (as defined by DWR), RCS does not consider these data to be representative of the long-term annual average rainfall in the area surrounding the subject property. The rain gage is also located at a higher elevation (±565 ft asl) than that of the subject property, and therefore the average water year rainfall at the subject property could be lower than that experienced at this gage.

The Hopper Creek at Highway 29 gage is another nearby Napa One rain gage with a relatively short rainfall record. It is located near Yountville, CA, approximately 3 miles southeast of the subject property. Data for this rain gage are available from WY 2003-04 through WY 2019-20, and the average water year rainfall for this gage was calculated to be 27.7 inches (2.31 ft). As with the Dry Creek Fire Station rain gage, the period of rainfall record for the Hopper Creek at Highway 29 rain gage is short (17 years), includes several years of drought, and is located at a lower elevation than the subject property. Therefore, RCS does not consider these data to be representative of the long-term average water year rainfall near the subject property and in the surrounding area.

To help corroborate the average annual rainfall data derived from the WRCC and/or Napa One Rain gages, RCS reviewed the precipitation data published by the PRISM Climate Group at

Oregon State University. This dataset, 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 Napa County, including the region of the subject property. Using this dataset, RCS determined that the average rainfall for the subject property for the stated date range is approximately 35.3 inches (2.94 ft).

An additional, though 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 the 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 on the published map 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 RCS 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 40 inches (3.33 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 35.3 inches (2.94 ft), as derived from the PRISM data set. The 35.3-inch per year estimate is based on the data source with a relatively long period of record (30 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 directly on the subject property and becomes available to deep percolate into the local aquifer system(s) 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 surface; 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, government agencies, and RCS (for other projects in the Napa Valley).

Annual 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 (by calendar year or water year) 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.

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

Estimates of groundwater recharge as a percentage of rainfall were 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 (not reproduced herein). Figure 7, "Watershed Boundaries," was prepared for this project using those same watershed boundaries provided by MBK Engineers (MBK), for which watershed water balance data are available in the LSCE&MBK, 2013 report. As shown on Figure 7, the subject property is located within the watershed referred to by MBK as the "Napa River Watershed near Napa". As shown on Table 8-9 on page 97 of the referenced report (LSCE&MBK, 2013), 17% of the average annual rainfall that occurs within the "Napa River Watershed near Napa", was estimated to be able to deep percolate as groundwater recharge. Note that, as shown on Table 8-8 of LSCE&MBK (2013), several sub-watershed areas are tributary to the "Napa River Watershed near Napa." Groundwater recharge estimates from rainfall into the Sonoma Volcanics by RCS for the nearby "The Vineyard House" project (2019), which is located within the "Napa River Watershed near Napa" and overlying similar volcanic geologic materials as the subject property, provided a more conservative 14% estimate for that property.

As stated above, the total surface area of the subject property is 28.2 acres. Assuming 35.3 inches (2.94 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 82.9 AF/yr (28.2 acres x 2.94 ft/yr). Conservatively assuming that 14% of the average annual rainfall volume would be able to deep percolate to the groundwater within the Sonoma Volcanics directly beneath the subject property over the long term, then the average annual groundwater recharge at the subject property would be approximately 11.6 AF/yr (82.9 AF/yr x 14%). This estimated annual recharge volume of 11.6 AF/yr is greater than the estimated proposed average annual groundwater demand from the subject property of 2.33 AF/yr.

Estimate of Groundwater in Storage

To help evaluate potential water level impacts to the groundwater in 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 the property in the future can be compared to an estimate of the current volume of groundwater that may be 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 property available for groundwater recharge = 28.2 acres

b) Depth to base of perforations in the Onsite Well = 420 ft bgs

   - Based on this depth in the Onsite Well, and on the data listed on the driller's log for this well and other nearby offsite wells, rocks of the Sonoma Volcanics could possibly extend to a greater depth than the 420-foot total depth of the Onsite Well. Thus, it is highly likely that the saturated zone beneath the property could extend deeper than is estimated using the perforation depths for only the Onsite Well.

c) To present a conservative calculation of groundwater in storage, RCS will also assume that the current saturated thickness of the local aquifers beneath the recharge area is

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about 228 vertical feet. This value is calculated using the Onsite Well data by subtracting the LGS-measured SWL of about 192 ft brp (on November 2, 2020) from the reported depth to the bottom of its perforations at 420 ft bgs. Based on the water level data presented herein, the November 2020 SWL is the deepest recorded SWL measured for this well thus far, and therefore, is used to help 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 fracture zones within the rocks. A conservative estimate provided by Kunkel and Upson for the specific yield of the Sonoma Volcanics shows a range 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) strictly beneath a portion of the subject property (as of November 2020) is calculated as:

- S = theoretical recharge area of property (subpart a, above) times saturated thickness (subpart c, above) times average specific yield (subpart d, above) = (28.2 ac)*(228 ft)*(2%) = 129 AF

In comparison, the proposed average annual groundwater demand from the Onsite Well is estimated to be 2.33 AF/yr. Hence, the estimated groundwater demand from the Onsite Well represents only about 2% of the groundwater conservatively estimated to currently be in storage in the volcanic rocks directly beneath the subject property based on conservative, site-specific water level data for the Onsite Well. Furthermore, this percentage does not include annual groundwater recharge that will occur from rainfall into the onsite aquifers. Based on the foregoing, groundwater extractions needed to meet the estimated groundwater demands of the property in the future required from the Onsite Well are not expected to cause a net deficit in the volume of groundwater within the aquifers beneath the property so as to adversely impact wells on nearby but offsite properties to a point that they would not be able to support their 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.

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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[9] – five years

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. The WY 1975-76 to WY 1976-77 drought period recorded by the St. Helena rain gage and reported by the WRCC had the lowest total rainfall at 40% (drought period average was 13.4 inches, compared to the long-term average (33.3 inches), and that specific drought lasted two years. The WY 1928-29 to WY 1933-34 and WY 1986-87 to WY 1991-92 drought periods lasted for six years, but rainfall during these drought periods were 72% and 74% of the average annual rainfall at the WRCC rain gage, respectively. 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 OneRain gages data; because the period of record for these gages are short, and includes a couple of drought years, the last available drought year period (WY 2011-12 to WY 2015-16) rainfall percentages are shown to be 83% and 84% of the long-term average, respectively.

Hence, for the purposes of this analysis, a "prolonged" drought period rainfall is conservatively considered to be 40% of the average annual rainfall that occurred in the region (using the rainfall data from the WRCC St. Helena 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 quite conservative estimate, because the 40%-average figure corresponds with a two-year drought period, not a six-year drought period.

To meet six consecutive years of groundwater demand for the subject property, a total onsite groundwater extraction of 14 AF is estimated to be required (2.33 AF/yr of groundwater demand

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[9] 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 the rains in WY 2016-17, various sources, including the National Drought Mitigation Center website declared an end to the drought in Northern California in 2017, which included Napa County. As of February 19, 2021, the area of Napa County in which the subject property lies, is currently mapped as "Extreme Drought" on the NDMC website (NDMC, 2021).

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multiplied by 6 years = 14 AF). Assuming groundwater recharge is reduced to 40% of the average annual recharge during each year of 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, a conservative estimate of the average annual groundwater recharge on the subject property is estimated to be 11.6 AF/yr. Taking 40% of this annual volume yields a drought period recharge volume of 4.6 AF/yr.
- Assuming a drought period duration of 6 continuous years, then a total of 27.6 AF (4.6 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, extreme, six-year drought period during which only 40% of the average annual rainfall might occur, a conservative estimate of the total drought-period recharge at the subject property (27.6 AF) would be greater than the estimate of the total proposed onsite groundwater demand (14 AF) that may occur over the same six-year period.

Key Conclusions and Recommendations

1. The existing Carmelite House of Prayer property is currently developed with a main house, a monastery building, associated buildings to the monastery, and associated landscaping. There are no existing vineyards on the property, although a 0.86-acre vineyard block (that is less than 5% average slope) is under development.
2. There is one water-supply well (the Onsite Well) on the subject property, which is used to supplement existing water demands during the late summer period. Onsite water demands are primarily supplied by the collection of water from the offsite spring source.
3. The proposed project consists of developing 3.0 acres of new vineyards on the subject property.
4. The future average annual groundwater demand for the property (including the existing onsite uses, the 0.86-acre vineyard block currently under development, and the proposed vineyards) was estimated to be 2.33 AF/yr, using standard assumptions for water use published in the County's WAA guidance document (WAA, 2015) for the proposed vineyards, and as determined using totalizer flow meter readings installed at the Onsite Well for the existing onsite uses. Total groundwater demands met by pumping the onsite well for the subject property are proposed to increase by 1.93 AF per year (from 0.4 AF/yr existing, to 2.33 AF/yr).
5. The groundwater demand for the 0.86-acre vineyard block currently under development and the proposed new vineyards will be met by pumping groundwater from the Onsite Well. The existing onsite water demands (the monastery, and associated monastery buildings and landscaping) will continue to be supplied by the offsite spring, and supplemented with water pumped from the Onsite Well, as needed, during the late summer months.
6. To meet the estimated groundwater demands of the property in the future (1.93 AF for vineyards + 0.4 AF/yr supplemental water demands for the existing onsite uses during

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the 8-week period in the late summer each year when the two groundwater uses are expected to overlap, the Onsite Well would need to pump at a rate of about 10 gpm. This pumping rate assumes the well would be pumped on a 50% operational basis (12 hours/day, 7 days/week) during that overlap period of demand.

7. Based on the results of the constant rate pumping test conducted in the Onsite Well in November 2020 (it was pumped at a reported average rate of 25 gpm and for a period of 8 continuous hours), this well appears to be capable of pumping at rates well above the rates required to meet the future groundwater demands needed for the proposed onsite vineyards.

8. Groundwater recharge at the subject property on an average annual basis is estimated to be 11.6 AF; this value is based on estimates of the long-term average annual rainfall at the property (35.3 inches per year) and estimates by others of rainfall (14%) that could be available to deep percolate into the pore spaces and/or fractures and joints in the Sonoma Volcanics that underlie the subject property. This estimated annual recharge volume is approximately six times greater than the anticipated annual groundwater demand from the onsite well.

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 40% of the average annual rainfall might occur, a total of 27.6 AF of rainfall recharge is estimated to occur strictly within the boundaries of the subject property. This theoretical drought period recharge estimate of 27.6 AF is more than the estimated future groundwater demand of the property of 14 AF for the same continuous six-year period.

10. Because there are two offsite wells (the "Neighbor Well 1" and "Neighbor Well 2") located within 500 ft of the Onsite Well, a Tier 2 WAA was performed, with key assumptions for the analysis based on data derived from the pumping test of the Onsite Well.

    Using drawdown data collected from the Onsite Well during the November 2020 pumping test, estimates of the theoretical amount of water level drawdown that might be induced in the pumping well and other nearby offsite wells were calculated. Results of these predictive simulations using AQTESOLV showed that theoretical drawdowns that might be induced in the nearby offsite Neighbor Well 1 and Neighbor Well 2, by virtue of pumping the Onsite Well at a rate and duration necessary for the project, would be 0.8 ft and 0.6 ft, respectively. These values are much less than the default drawdown interference criteria listed in Table F-1 of the 2015 WAA guidance document.

11. RCS recommends implementation of a groundwater monitoring program at the subject property. This would include the frequent, ongoing monitoring of static and pumping water levels in the Onsite Well, and also continuing the monitoring of instantaneous flow rates and cumulative pumped volumes from the Onsite Well using the existing totalizer flow meter. RCS also recommends that a water level transducer be purchased and installed in the onsite well to permit the automatic, frequent, and accurate recording of water levels in the well. By continuing to observe the trends in groundwater levels and future well production rates/volumes over time by qualified

MEMORANDUM

professionals, potential declines in water levels and well production in the Onsite Well, along with possible changes in operational pumping scenarios, can be addressed in a timely manner.

MEMORANDUM

References

- **(CGS 2005)** Clahan, et al., 2005. Geologic Map of the Rutherford 7.5" Quadrangle, Sonoma and Napa Counties, 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 2011)** Luhdorff & Scalmanini Consulting Engineers, February 2011. Napa County Groundwater Conditions and Groundwater Monitoring Recommendations, prepared for Napa County Department of Public Works.
- **(LSCE&MBK 2013)** Luhdorff & Scalmanini Consulting Engineers and MBK Engineers, January 2013. Updated Hydrogeologic Conceptualization and Characterization of Conditions, Prepared for Napa County.
- **(USGS 1960)** Kunkel, F., and J.E. Upson, 1960. Geology and Groundwater in Napa and Sonoma Valleys, Napa and Sonoma Counties, California. USGS Water-Supply Paper 1945.
- **(WAA 2015)** Napa County Board of Supervisors, Adopted May 12, 2015. Water Availability Analysis (WAA) – Guidance Document.
- **(Yeh 2009)** Yeh HF, Lee CH, Hsu KC, Chang PH (2009) GIS for the assessment of the groundwater recharge potential zone. Environ Geol 58:185–195

Websites:

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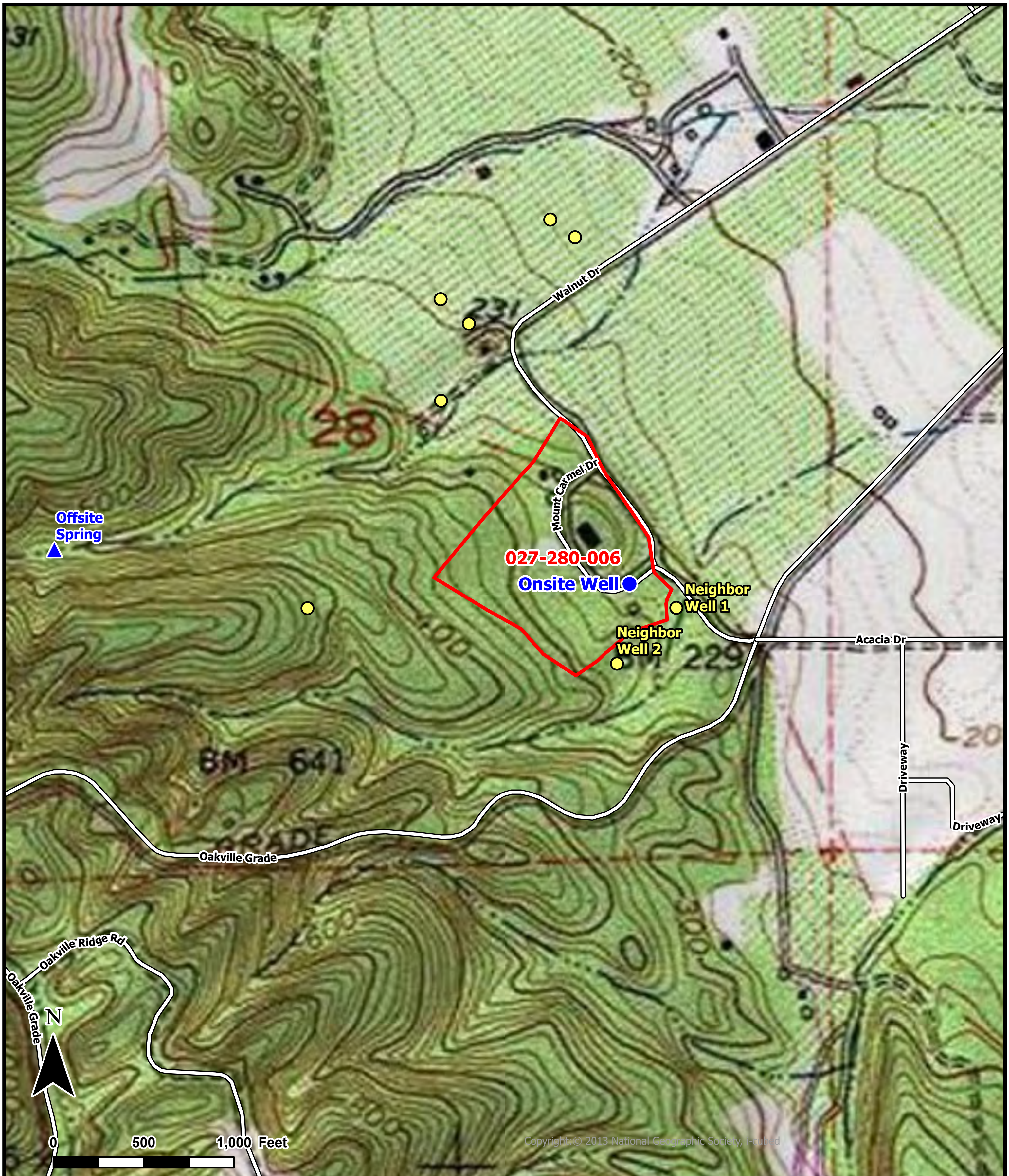
- California Department of Water Resources, Well Completion Report Map Application Database, 2021.

  https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37
- Napa County GIS database, 2021. https://gis.napa.ca.gov.
- Napa OneRain, 2021; https://napa.onerain.com
- (NDMC, 2021) National Drought Mitigation Center website, 2021. https://droughtmonitor.unl.edu/
- U.S. Quaternary Faults Database, USGS, 2021.

  https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf
- Western Regional Climate Center, 2021. https://wrcc.dri.edu/



LEGEND

Subject Property

Offsite Well Location (Approx.)

Onsite Well Location

Offsite Spring Location (Approx.)

RCS

FIGURE 1
LOCATION MAP

RCS Job No. 729-NPA01

March 2021

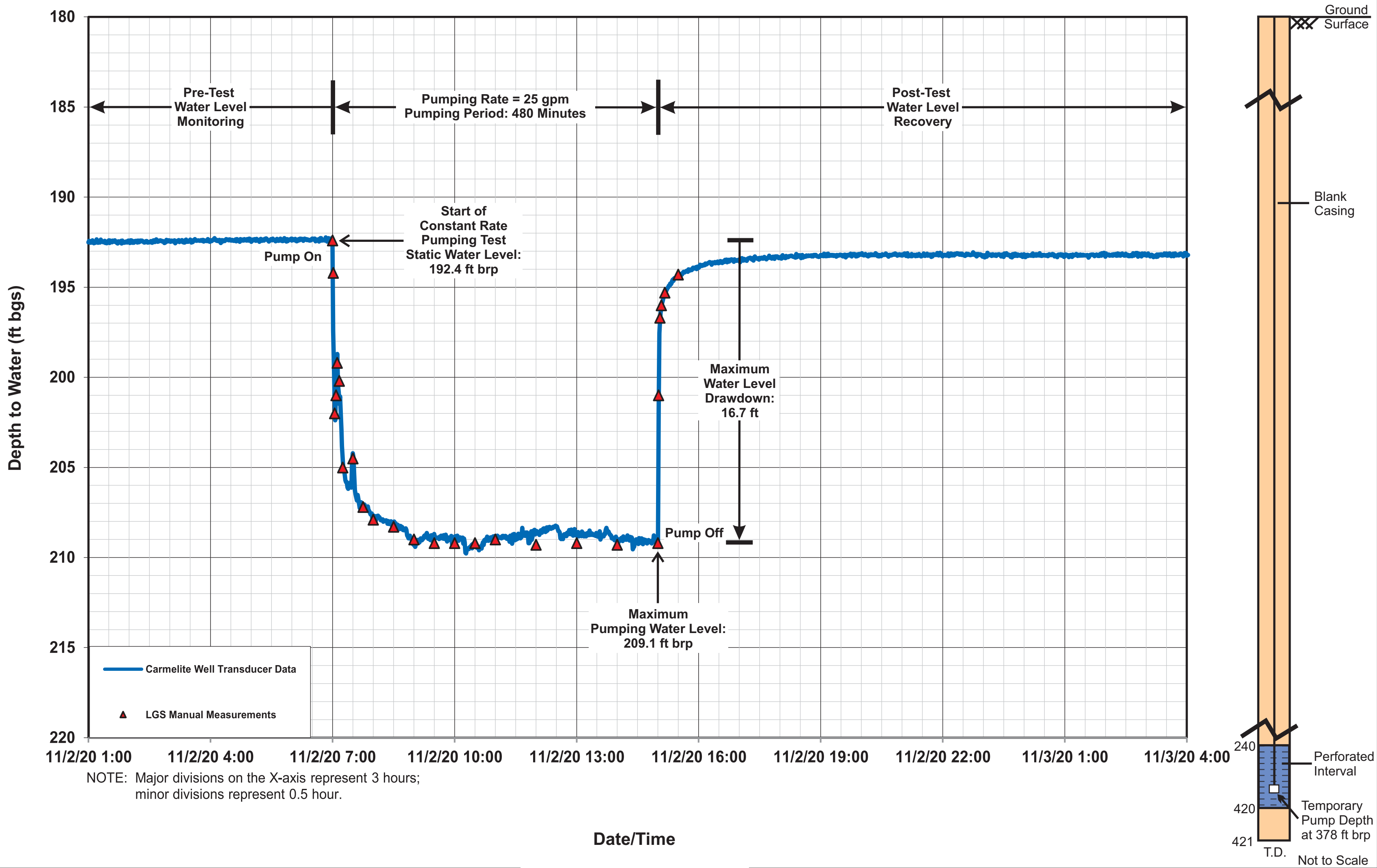
LEGEND

Subject Property
Offsite Well Location (Approx.)
Onsite Well Location
Offsite Spring Location (Approx.)

RCS

FIGURE 2
AERIAL PHOTOGRAPH MAP

RCS Job No. 729-NPA01 March 2021



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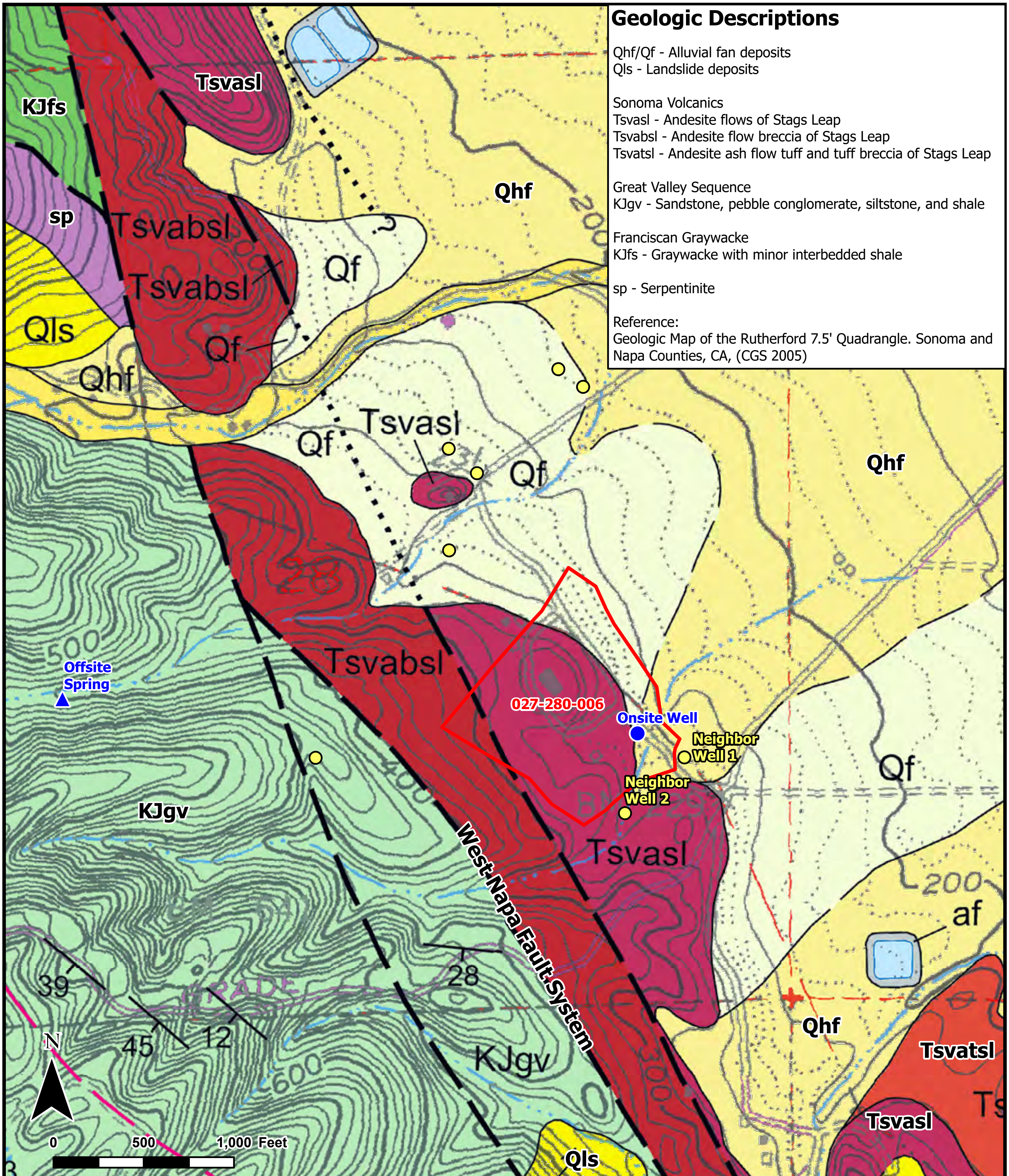
CONSULTING GROUNDWATER GEOLOGISTS
14051 Burbank Blvd., Suite 300
Sherman Oaks, CA 91401
Southern California: (818) 506-0418
Northern California: (707) 963-3914
www.rcslade.com

FIGURE 3
WATER LEVEL DATA DURING CONSTANT RATE PUMPING TEST
CARMELITE ONSITE WELL

Job No. 729-NPA01 **March 2021**



Geologic Descriptions

Qhf/Qf - Alluvial fan deposits
Qls - Landslide deposits

Sonoma Volcanics
Tsvasl - Andesite flows of Stags Leap
Tsvabsl - Andesite flow breccia of Stags Leap
Tsvatsl - Andesite ash flow tuff and tuff breccia of Stags Leap

Great Valley Sequence
KJgv - Sandstone, pebble conglomerate, siltstone, and shale

Franciscan Graywacke
KJfs - Graywacke with minor interbedded shale

sp - Serpentinite

Reference:
Geologic Map of the Rutherford 7.5' Quadrangle. Sonoma and Napa Counties, CA, (CGS 2005)

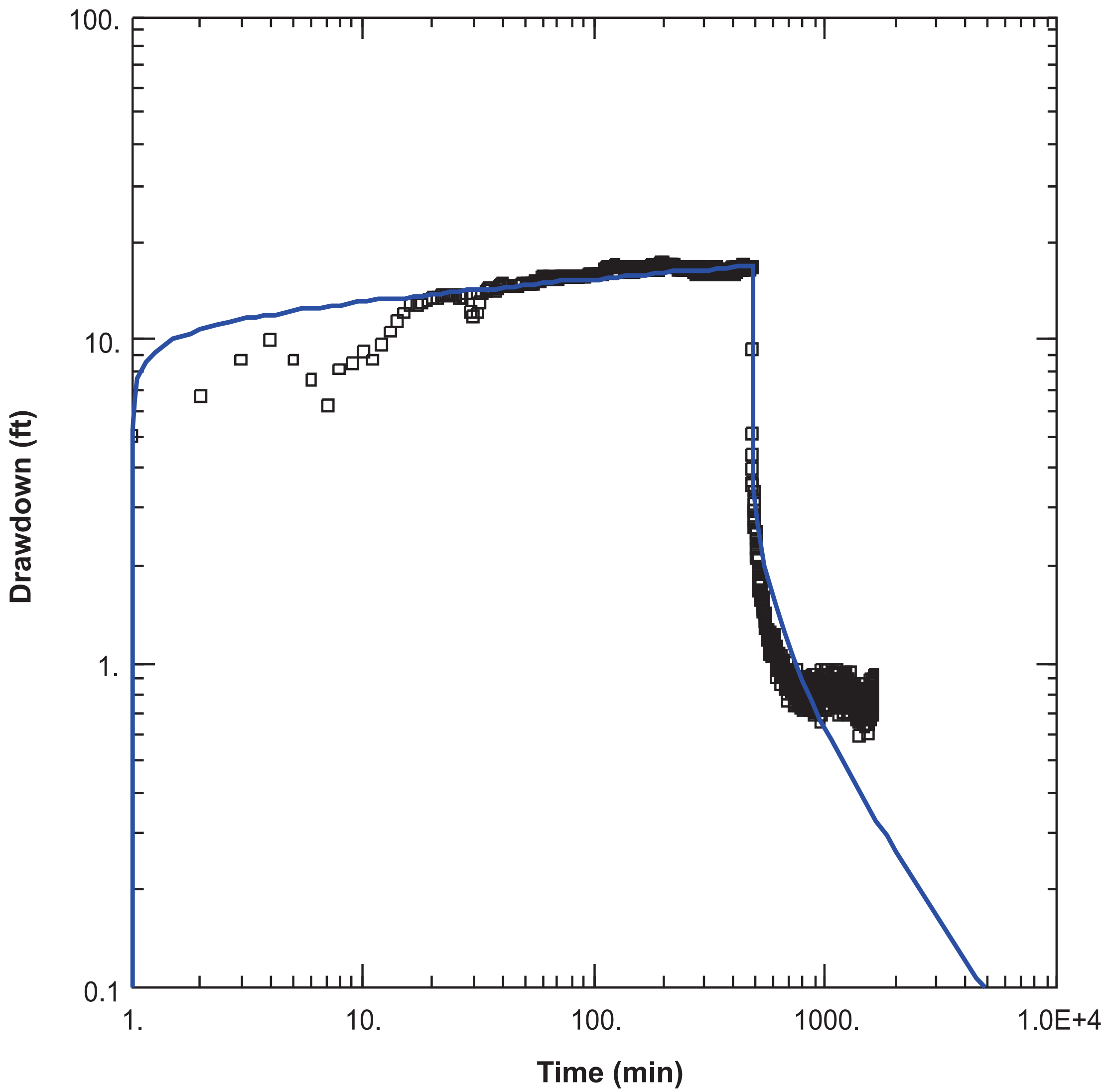
LEGEND

- Subject Property
- Offsite Well Location (Approx.)
- Onsite Well Location
- Offsite Spring Location (Approx.)

RCS

FIGURE 4
GEOLOGIC MAP

RCS Job No. 729-NPA01 **March 2021**



Obs. Wells

□ Onsite Well (pumping well)

Aquifer Model

Confined

Solution

Theis/Hantush

Parameters

T = 2,987 gal/day/ft

*A storativity (S) value can only be calculated from water levels from an observation well.

Test Date = November 2, 2020
(8-hour test)
Pre-Test
Static Water Level = 192.4 ft brp

Average pumping rate = 25 gpm

Graphical Solution by:
AQTESOLV Vers. 4.50 Pro
by Hydrosolve, Inc.

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Figure 5A
Constant Rate Pumping Test Analysis
Theis/Hantush Confined Aquifer Solution
Carmelite Onsite Well (Pumping Well)

Job No. 729-NPA01

March 2021

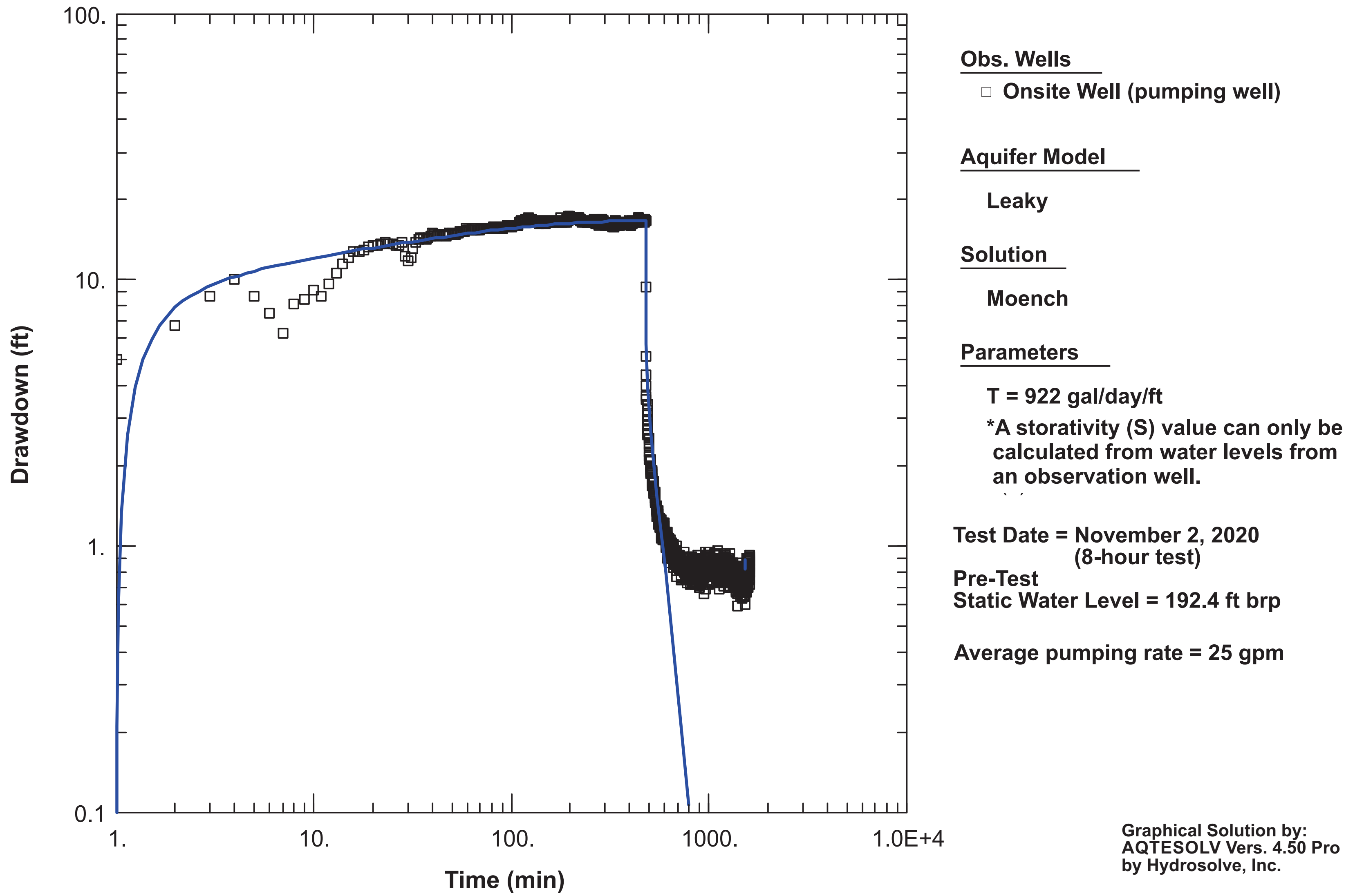

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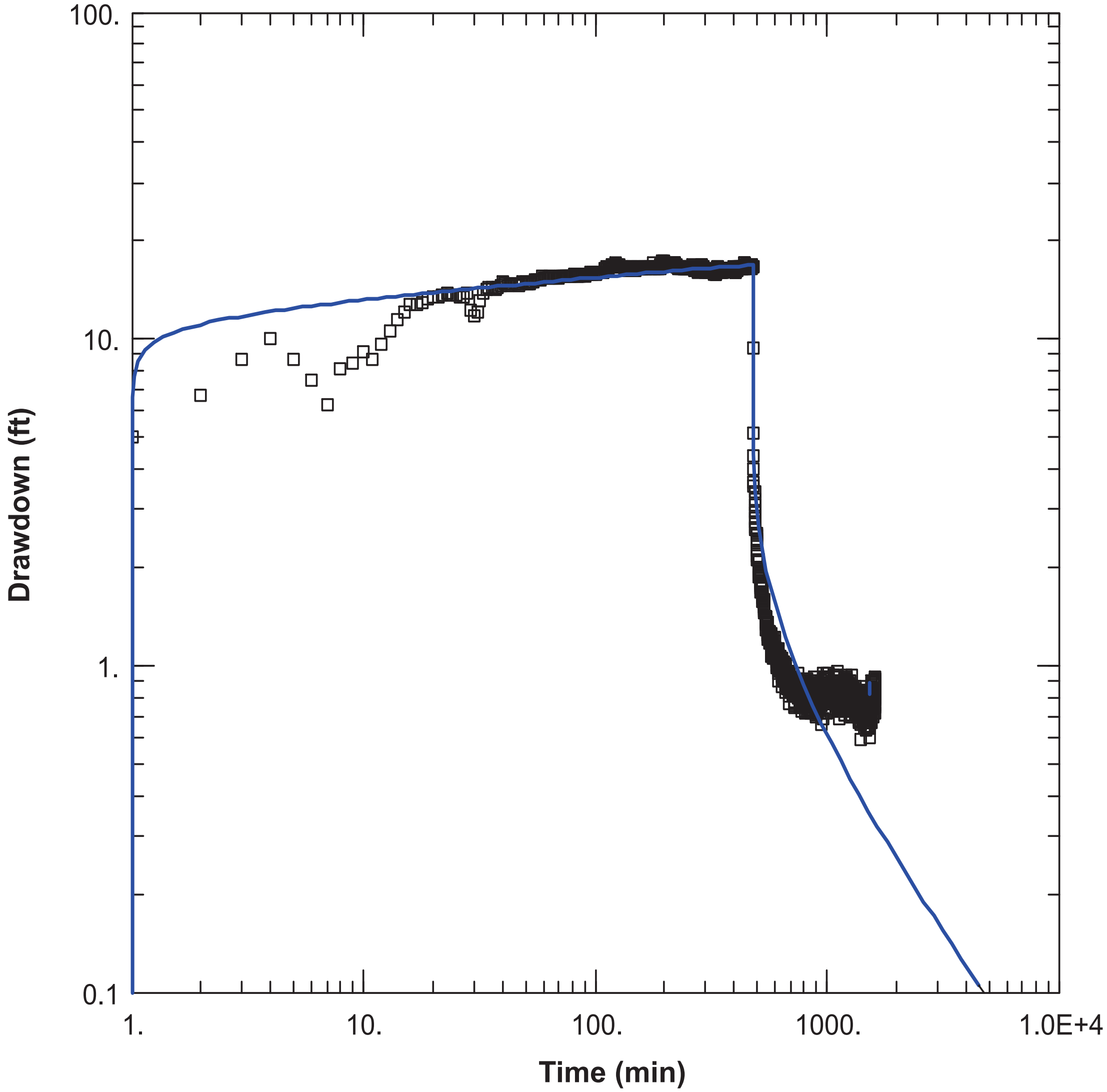
Figure 5B
Constant Rate Pumping Test Analysis
Moench Confined Aquifer Solution
Carmelite Onsite Well (Pumping Well)

Job No. 729-NPA01

March 2021



Obs. Wells

□ Onsite Well (pumping well)

Aquifer Model

Fractured

Solution

Gringarten-Witherspoon

Parameters

T = 3,052 gal/day/ft

*A storativity (S) value can only be calculated from water levels from an observation well.

Test Date = November 2, 2020
(8-hour test)

Pre-Test
Static Water Level = 192.4 ft brp

Average pumping rate = 25 gpm

Graphical Solution by:
AQTESOLV Vers. 4.50 Pro
by Hydrosolve, Inc.

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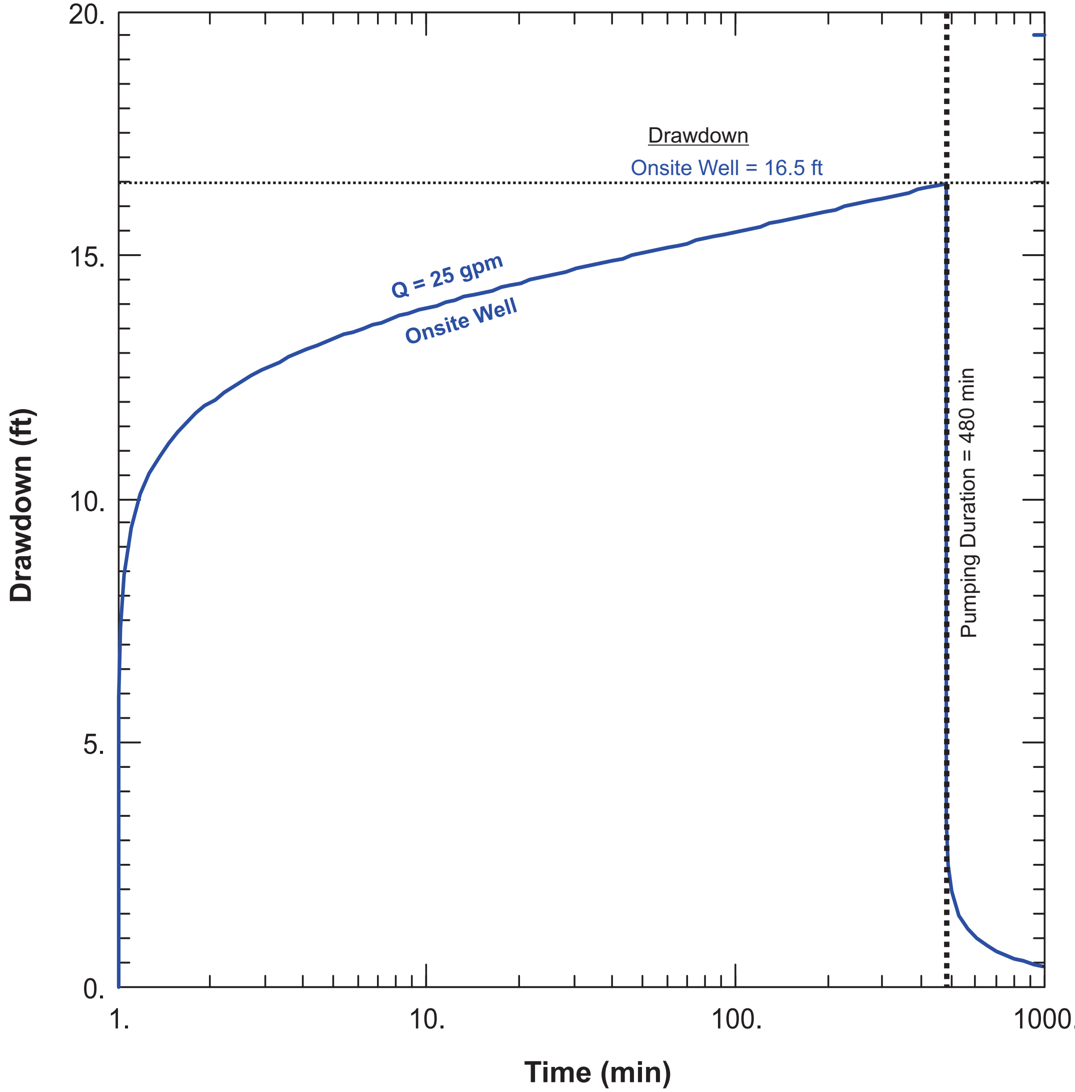
Figure 5C
Constant Rate Pumping Test Analysis
Gringarten-Witherspoon Fractured Aquifer Solution
Carmelite Onsite Well (Pumping Well)

Job No. 729-NPA01

March 2021



Pumping Well

□ Onsite Well

Aquifer Model

Confined

Solution

Theis/Hantush

Parameters

T = 4,594 gal/day/ft
S = 0.00038 (unitless)
Pumping Rate = 25 gpm
Duration = 8 hours (480 minutes)

Graphical Solution by:
AQTESOLV Vers. 4.50 Pro
by Hydrosolve, Inc.

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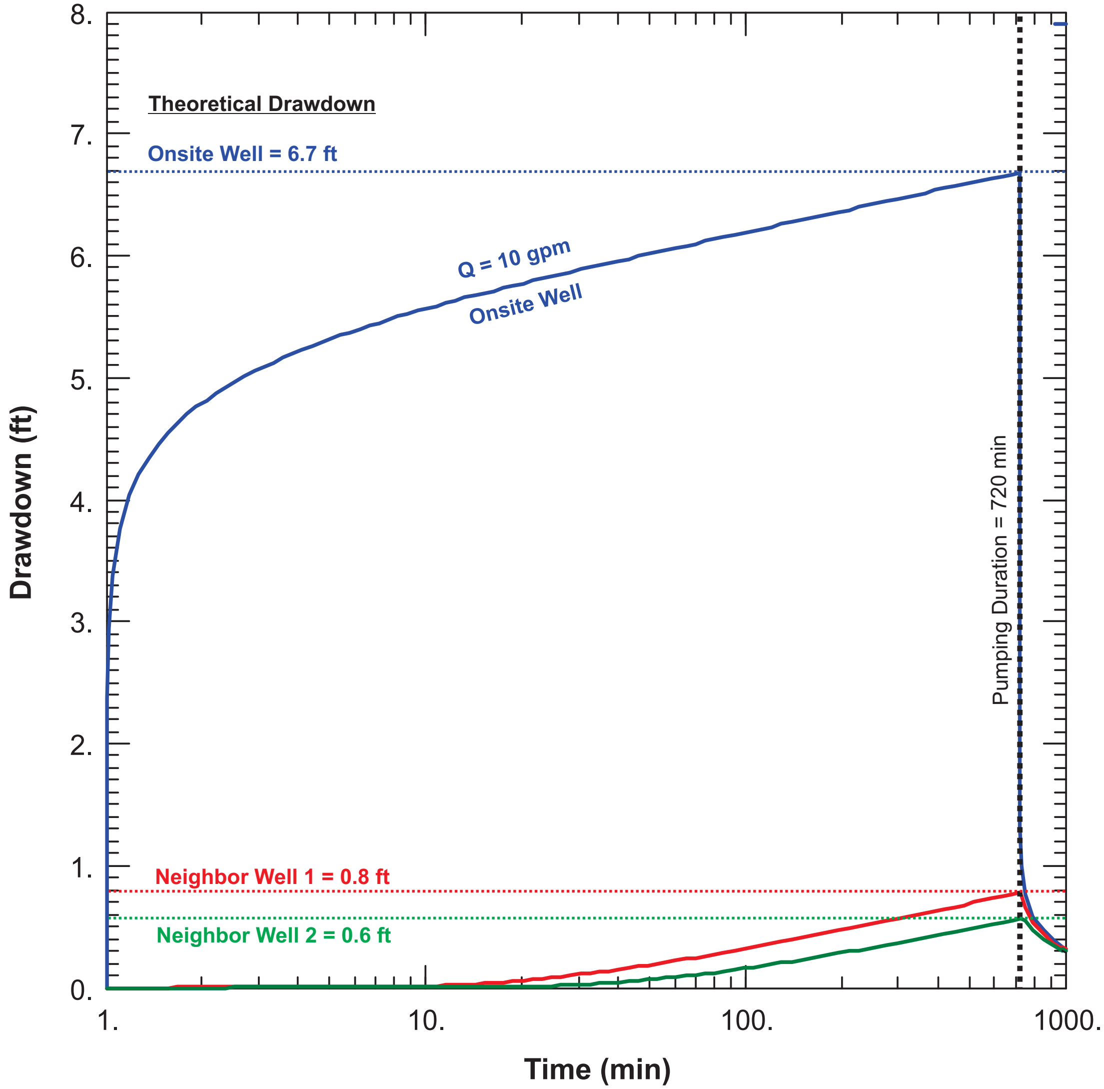
Figure 6A
Theoretical Drawdown Calculations in Onsite Well (Pumping Well)
8 hours/25 gpm/T=4,594 gpd/ft

Job No. 729-NPA01

March 2021



Pumping Well

Onsite Well

Observation Wells
(distance from Onsite Well)

Neighbor Well 1 (290 ft)

Neighbor Well 2 (445 ft)

Aquifer Model

Confined

Solution

Theis/Hantush

Parameters

T = 4,594 gal/day/ft

S = 0.00038 (unitless)

Pumping Rate = 10 gpm

Duration = 12 hours (720 minutes)

Graphical Solution by:
AQTESOLV Vers. 4.50 Pro
by Hydrosolve, Inc.

RCS

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Figure 6B
Theoretical Drawdown Calculations in Observation Wells
12 Hours/10 gpm/T=4,594 gpd/ft

Job No. 729-NPA01

March 2021

LEGEND

★ Subject Property

▭ Napa County Watershed Boundary

RCS

FIGURE 7 WATERSHED BOUNDARIES

RCS Job No. 729-NPA01

March 2021

Table 1
Summary of Well Construction and Yield Data
Carmelite House of Prayer Property

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
Onsite Well	196148	August 1986	Direct Air Rotary	421	421	PVC	5	10	27 (cement)	240-420	Factory-Cut 0.125"	27-421 3/8" Pea Gravel

POST-CONSTRUCTION YIELD DATA

Reported Well Designation	Date & Type of Yield Data	Duration of "Test" (hrs)	Estimated Flow Rate (gpm)	Static Water Level (ft)	Pumping Water Level (ft)	Estimated Specific Capaity (gpm/ft ddn)	Reported Pump Intake Depth (ft)
Onsite Well	August 1986 Airlift	2	107	127	ND	ND	ND
	November 2020 Pump	8	25	192	209.1	1.52	378

Notes:
ND = No data or not listed
ft bgs = feet below ground surface
in = inches
hrs = hours
gpm = gallons per minute
gpm/ft ddn = gallons per minute per foot of water level drawdown

Table 2
Groundwater Use Estimates
Carmelite House of Prayer Property

Groundwater Use	Estimated Groundwater Use (acre-feet/year)	
	Existing	**Future**
Domestic and Landscaping Groundwater Use		
Existing Monastery, Associated Buildings and Landscaping[1]	0.40	0.40
Total Domestic and Landscaping Groundwater Use	**0.40**	**0.40**
Irrigation Groundwater Use		
Vineyard - Existing 0 acres	0.0	--
Vineyard - Less than 5% average slope (under development) 0.86 acres[(2)]	---	0.43
Vineyard - Proposed 3 acres[(2)]	---	1.50
Total Irrigation Groundwater Use	**0.0**	**1.93**
Total Combined Groundwater Use (Domestic and Landscaping + Irrigation)	**0.4**	**2.33**

Notes:

[1]Based on the assumed total groundwater extraction of 1.59 AF from the Onsite Well from July 2016 to June 2020.

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

1 acre-foot = 325,851 gallons

Table 3
Comparison of Rainfall Data Sources
Carmelite House of Prayer Property

Rain Gage and/or Data Source	Years of Available Rainfall Record	Average Annual Rainfall in Inches (ft)	Elevation of Rain Gage (ft asl)	Approximate Distance of Rain Gage from Subject Property (miles)	Gage Elevation Relative to Subject Property[1]
WRCC St. Helena	1907 through December 2020[2]	33.3 (2.78)	225	6.0	similar
Napa One Rain Hopper Creek at Highway 29	WY 2003-04 through WY 2019-20	27.7 (2.31)	123	3.0	lower
Napa One Rain Dry Creek Fire Station	WY 2006-2007 through WY 2019-20	31.4 (2.62)	565	1.6	higher
PRISM	1981 to 2010	35.3 (2.94)	---	---	---
Napa County Isohyetal Map	1900 to 1960	40.0 (3.33)	---	---	---

Notes:

1. The subject property is located at elevations between ±220 and ±360 ft asl
2. Missing and/or erroneous rainfall data in: 1907; 1915-1922; 1979-1980; 1985-1988; 1992; and 2011-2012.

Table 4
Drought Period Rainfall as Percentage of Average
Carmelite House of Prayer Property

Statewide Drought Period as Defined by DWR/NDMC	Drought Duration (years)	Average Rainfall by Raingage								
		St Helena WRCC Period of Record - 1907 to December 2020			Hopper Creek at Highway 29 Napa OneRain Period of Record - WY 2003-04 to WY 2019-20			Dry Creek Fire Station Napa OneRain Period of Record - WY2006-07 to WY 2019-20		
		[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	[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	33.3	23.9	72%	ND	ND	ND	ND	ND	ND
WY 1975-76 to WY 1976-77	2	33.3	13.4	40%	ND	ND	ND	ND	ND	ND
WY 1986-87 to WY 1991-92	6	33.3	18.3*	55%*	ND	ND	ND	ND	ND	ND
WY 2006-07 to WY 2008-09	3	33.3	24.8	74%	27.7	17.5	63%	31.4	26.4	84%
WY 2011-12 to WY 2015-16	5	33.3	21.7*	65%*	27.7	23.0	83%	31.4	26.3	84%

Notes:

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.

APPENDIX

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

ORIGINAL
File with DWR Onsite Well

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

K | J

Do not fill in
No. 196148

State Well No. ____
Other Well No. 07N05W28

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

(1) OW

Address ____
City ____

(2) LOCATION OF WELL (See instructions):
County Napa Owner's Well Number ____
Well address if different from above same
Township ____ Range ____ Section ____
Distance from cities, roads, railroads, fences, etc. ____
A.P. # 27-280-06

WELL LOCATION SKETCH

[redacted]

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

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

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

(6) GRAVEL PACK:
Yes [X] No [ ] Size 3/8 pea
Diameter of bore 8" 10"
Packed from 27 to 421 ft.

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

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

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	421	5"	c200 pvc	240	420	1/8

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 27 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ____ ft.
Method of sealing cement

(10) WATER LEVELS:
Depth of first water, if known 260 ft.
Standing level after well completion 127 ft.

(11) WELL TESTS:
Was well test made? Yes [X] No [ ] If yes, by whom? driller
Type of test Pump [ ] Bailer [ ] Air lift [X]
Depth to water at start of test 127 ft. At end of test 178 ft
Di[redacted]harge 107 gal/min after 2 hours Water temperature ____
[redacted]cal analysis made? Yes [ ] No [X] If yes, by whom? ____
Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

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

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	2	rock mix & Brn. clay
2	135	brn. clay
135	180	yellow clay
180	248	brn. clay
248	255	yellow clay
255	410	volcanic molaz
410	416	red volcanic rock
416	421	volcanic molaz

Work started Aug. 19 86 Completed Aug. 25 19 86

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
SIGNED LLOYD HUCKFELDT L.V. Huckfeldt (Well Driller)
NAME HUCKFELDT DRILLING (Person, firm, or corporation) (Typed or printed)
Address 2110 Penny Lane
City Napa, Ca. Zip 94558
License No. 439746 Date of this report Aug. 28, 86

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

C· 01/6/17

ORIGINAL
File with DWR
Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

Owner's Well No. 2-2016 Neighbor Well 1

No. **e0319706**

Date Work Began 8/1/2016 Ended 8/17/2016

Local Permit Agency Napa County Environmental Mgmt

Permit No. E15-00882 Permit Date 11/6/2015

DWR USE ONLY — DO NOT FILL IN

07N05W28

STATE WELL NO./STATION NO.

38 2526 N 122 2460 W

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL HORIZONTAL ANGLE (SPECIFY)

DRILLING METHOD ROTARY FLUID BENTONITE

DEPTH FROM SURFACE Ft	to Ft	DESCRIPTION *Describe material, grain, size, color, etc.*
0	20	BROWN CLAY
20	85	SHALE WITH SANDY BROWN CLAY
85	110	SHALE & CLAY
110	175	50% BROWN CLAY / 50% SAND & GRAVEL
175	180	BROWN CLAY
180	250	SAND & GRAVEL WITH BROWN CLAY
250	270	MIXED VOLCANICS
270	305	RED VOLCANICS
305	422	GRAY & BROWN VOLCANICS
422	465	GRAY & TAN VOLCANIC ASH
465	500	GRAY VOLCANICS
500	525	GRAY & TAN VOLCANICS
525	580	GRAY & BLUE VOLCANICS
580	635	GRAY VOLCANICS WITH ASH
635	640	HARD GRAY & BROWN VOLCANICS
		CONTINUED CASING LAYOUT
460	480	SCREEN PVC 6" .032 SLOT
480	500	BLANK PVC 6"

TOTAL DEPTH OF BORING 640 (Feet)

TOTAL DEPTH OF COMPLETED WELL 500 (Feet)

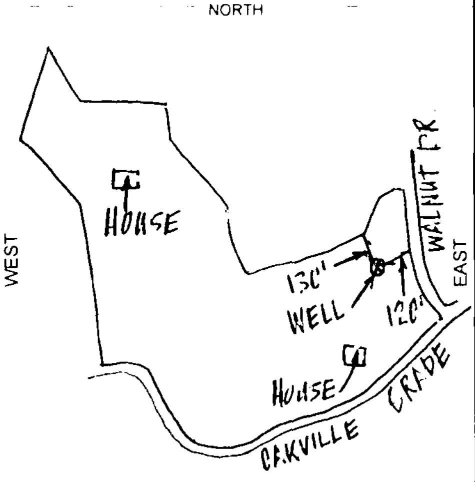
WELL OWNER

WELL LOCATION

Address 1700 Walnut Drive
City Oakville CA
County Napa
APN Book 027 Page 280 Parcel 060
Township Range Section
Latitude DEG MIN SEC DEG MIN SEC

LOCATION SKETCH

NORTH



SOUTH

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

ACTIVITY (✓)

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

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 20 (Ft.) BELOW SURFACE 1

DEPTH OF STATIC WATER LEVEL 151 (Ft.) & DATE MEASURED 8/17/2016

ESTIMATED YIELD 100 (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	510	12								
510	640	9								
0	260		✓				PVC F480	6	SDR-21	
260	440			✓			PVC F480	6	SDR-21	.032
440	460		✓				PVC F480	6	SDR-21	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft	to Ft	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	61	✓			10 SK SAND
61	220			✓	#6 SAND
220	230		✓		TABLETS
230	510			✓	#6 SAND
510	640			✓	CUTTINGS

ATTACHMENTS (✓)

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

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

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

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

2110 Penny Lane Napa CA 94559
ADDRESS CITY STATE ZIP

Signed WELL DRILLER/AUTHORIZED REPRESENTATIVE 08/24/16 DATE SIGNED 439-746 C-57 LICENSE NUMBER

DWR 188 REV 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Owner's Well No. 1-2016 Neighbor Well 2

Date Work Began 7/15/2016 , Ended 8/1/2016

Local Permit Agency Napa County Environmental Mgmt

Permit No. E15-00881 Permit Date 11/6/2015

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. e0314665

R · 1/6/17

DWR USE ONLY -- DO NOT FILL IN

07N05W28

STATE WELL NO./STATION NO.

38.2526 N 122.2460 W

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL HORIZONTAL ANGLE (SPECIFY)

DRILLING METHOD ROTARY FLUID BENTONITE

DEPTH FROM SURFACE Ft	to Ft	DESCRIPTION *Describe material, grain, size, color, etc.*
0	7	BROWN CLAY
7	15	TAN VOLCANIC TUFF
15	25	BROWN VOLCANIC ROCK
25	120	GRAY VOLCANIC ROCK
120	129	GRAY, RED VOLCANICS
129	133	GRAY ASH
133	220	BROWN CLAY WITH SAND & GRAVEL
220	240	SAND & GRAVEL
240	268	FRACTURED GRAY VOLCANICS
268	325	GRAY, RED VOLCANICS
325	468	GRAY VOLCANICS
468	473	RED ASH
473	510	BROWN CLAY WITH SANDS
510	540	BROWN, BLUE SANDY ASH
540	550	BROWN, GRAY VOLCANICS
550	575	GRAY MIXED VOLCANICS
575	580	BROWN ASH
580	600	BROWN, GRAY MIXED VOLCANICS W/ ASH
		CONTINUED CASING LAYOUT
330	450	SCREEN PVC 6" .032 SLOT
450	530	BLANK PVC 6"
530	570	SCREEN PVC 6" .032 SLOT
570	590	BLANK PVC 6"

TOTAL DEPTH OF BORING 600 (Feet)

TOTAL DEPTH OF COMPLETED WELL 590 (Feet)

WELL OWNER

WELL LOCATION

Address 1700 Walnut Drive

City Oakville CA

County Napa

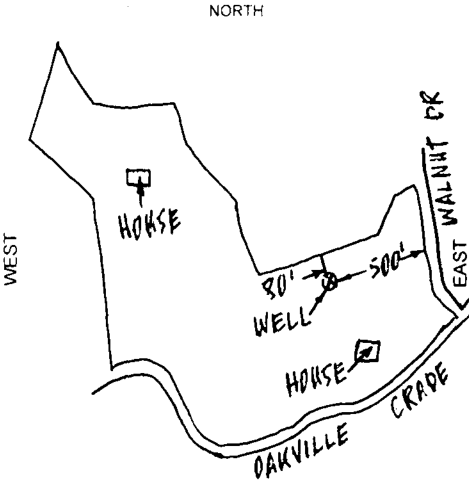
APN Book 027 Page 280 Parcel 060

Township Range Section

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

LOCATION SKETCH

NORTH



SOUTH

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

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
- Deepen
- Other (Specify)

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

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 35 (Ft.) BELOW SURFACE 1

DEPTH OF STATIC WATER LEVEL 80 (Ft.) & DATE MEASURED 8/1/2016

ESTIMATED YIELD · 175 (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	600	12								
0	70		✓				PVC F480	6	SDR-21	
70	110			✓			PVC F480	6	SDR-21	.032
110	230		✓				PVC F480	6	SDR-21	
230	310			✓			PVC F480	6	SDR-21	.032
310	330		✓				PVC F480	6	SDR-21	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	52	✓			10 SK SAND
52	590			✓	#6 SAND

ATTACHMENTS (✓)

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

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

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

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

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

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE

08/01/16 DATE SIGNED

439-746 C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

APPENDIX

NOVEMBER 2, 2020 PUMPING TEST
OF THE ONSITE WELL
BY
LGS DRILLING, INC.

LGS

LGS DRILLING, INC.

Date: 11-20-20

Job No: Silver Oak

WELL ID: Carmelite	Remarks:	Sheet 1 of 1
GPS: N 38-25-31	Well Depth 420'	Observers Smith
W 122-24-51	Pump Set 378'	
	Pump HP 5 hp VFD	

TYPE OF TEST
25 GPM

Time of Day	Elapsed Time min.	sec.	Depth to water from R.P. (ft)	Depth below static level. (ft)	Remarks
					T = 1,150,430
7:00	0		192.40	0	25 GPM
	1		194.20		
	3		202.00		
	5		201.00		Variable Speed Pump Controller
	7		199.20		Fluxuating water levels
	10		200.20		
	15		205.00		
	30		204.50		
	45		207.20		
	60		207.90		T= 1,151,920 25 GPM
	90		208.30		
	120		209.00		1,153,420 25 GPM
	150		209.20		
	180		209.20		1,154,920 25 GPM
	210		209.20		
	240		209.00		T=1,156,420 25 GPM
	300		209.30		
	360		209.20		T= 1,159,580 25+ GPM
	420		209.30		
	480		209.20		T= 1,162,680 25+ GPM
Recovery	1		201.00		
	3		196.20		
	5		196.00		
	10		195.30		
	15				
	30				

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