HYDROGEOLOGIC ASSESSMENT REPORT

334 Purvine Road
Petaluma, CA 94952
APN 022-230-020

PREPARED FOR:

Sam Magruder
334 Purvine Road
Petaluma, California 94952

May 1, 2018

PREPARED BY:

HURVITZ ENVIRONMENTAL SERVICES INC.
105 Morris Street, Suite 188
Sebastopol, California 95472

Lee S. Hurvitz, PG #7573 CHG #1015
Certified Hydrogeologist

PROJECT NO. 4026.01

HURVITZ ENVIRONMENTAL
GEOLOGIC & ENVIRONMENTAL CONSULTING

May 1, 2018

Sam Magruder
334 Purvine Road
Petaluma, California 94952

RE: Hydrogeologic Assessment Report
334 Purvine Road (the site)
Petaluma, California 94952
APN: 022-230-020

Hurvitz Environmental Project No. 4026.01

Dear Mr. Magruder:

Hurvitz Environmental Services, Inc. (HES) is pleased to submit this Hydrogeologic Assessment Report (HAR) for the above referenced property. HES prepared this HAR in accordance with the Sonoma County Permit and Resource Management Department (Permit Sonoma) Policy and Procedure Number 8-1-14 and General Plan Policy WR-2e. The purpose of this HAR was to evaluate the aquifer conditions at the site, which is located within a Zone 2 groundwater availability area, and to determine if the proposed groundwater usage will cause overdraft conditions, well interference or impact nearby stream-flow.

The quantity of groundwater to be used for the project and within the Cumulative Impact Area compared to the quantity of available groundwater indicates that pumping for the Project is unlikely to result in significant declines in groundwater resources over time. Based on the findings of this report, pumping and groundwater extraction at the Project well will not significantly impact neighboring wells or near-site stream flow conditions. Water quality concerns have been identified however through various treatment options they can be mitigated and therefore they not considered to prohibit the development of the proposed project. In addition, based on the relative distance to the coastal areas, the depth of the site well and the proposed water usage rates, salt water intrusion is not considered to be a concern to this Assessment.

We appreciate the opportunity to provide you with these services. Please do not hesitate to contact us at your convenience, should have any questions or comments regarding this report or our recommendations.

Sincerely,
HURVITZ ENVIRONMENTAL SERVICES, INC

Lee S. Hurvitz, PG# 7573 CHG #1015
Certified Hydrogeologist

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1.0 INTRODUCTION AND SCOPE OF SERVICES

The current owner is applying to Sonoma County for approval to develop cannabis cultivation facilities at the property 334 Purvine Road, Petaluma, California (the site). The site is located within Sonoma County Groundwater Availability Class 2 - Major natural recharge[1]. According to Sonoma County General Plan Policy WR-2e, development of property intending to use groundwater within Groundwater Availability Zone 2 does not typically require completion of a Hydrogeologic Assessment unless specifically requested by Sonoma County Permit and Resource Management Department (now referred to as Permit Sonoma). Permit Sonoma requested a Hydrogeologic Assessment for this proposed development.

On behalf of the property owner, Hurvitz Environmental Services (HES) conducted a Hydrogeologic Assessment for the site in accordance with the Permit Sonoma Procedures for Groundwater Analysis and Hydrogeologic Reports (Policy No. 8-1-14).

Policy WR-2e states that procedures for proving adequate groundwater should consider groundwater overdraft, land subsidence, saltwater intrusion, and the expense of such study in relation to the water needs of the project.

Therefore, this groundwater report includes the following elements:

- Delineation of a Cumulative Impact Area.
- Estimates of existing and future potential water uses within the Cumulative Impact Area.
- Characterization of local hydrogeologic conditions within the site watershed and sub-basin.
- Compilation of Well Completion Reports (drillers' logs) from the area.
- Review of a recent Well Yield Tests performed at an on-site well.
- Estimates of annual groundwater storage and recharge relative to existing and proposed groundwater uses.
- Review of groundwater quality analysis conducted for on-site water samples.
- Assess potential for the project to create salt water intrusion.
- Assess potential for well interference between the project well and neighboring wells and between the project well and nearby streams.

[1] Groundwater Availability Map, Sonoma County Permit and Resource Management Division, April 1, 2004

2.0 SITE DESCRIPTION

The site is located at 334 Purvine Road, between Middle Two Rock and Spring Hill Road in an unincorporated, rural agricultural area of Sonoma County, approximately 5.8 miles west of downtown Petaluma, California. (PLATE 1 – SITE LOCATION MAP). The Sonoma County Assessor's Office identified the site as Assessor's Parcel No. (APN) 022-230-020 (PLATE 2 – ASSESSORS PARCEL MAP). On June 30, 2016, Sonoma County Assessor records show a major lot line adjustment recorded for APN 022-230-018, a 61.53-acre parcel that includes the site. The Permit Sonoma records indicate the lot adjustment resulted in two parcels 36.13 acres (the site – APN 022-230-020) and 25.4 acres (the adjacent parcel – APN 022-230-019). The site parcel is zoned Land Extensive Agriculture (LEA), is located in the jurisdiction of the North Coast Regional Water Quality Board and is located in Groundwater Availability Zone 2. The site is not located in a State defined Priority Groundwater Management Basin. The site is located within an area designated by Sonoma County as the Petaluma Dairy Belt Area, where residential development is mostly related to the agricultural uses of the land.[2]

The site is a roughly rectangular, 36.13-acre parcel elongated northeast-southwest with a maximum length of approximately 1,800 feet and a maximum width (northwest-southeast) of approximately 960 feet. The site topography is gently sloping southwesterly with a high elevation of approximately 320 feet in the northwest corner to a low elevation of approximately 260 feet in the southwest corner (PLATE 3 - PROPOSED ENGINEERED SITE LAYOUT).

The property features two separate residences with garage, five outbuildings, and three large barns that were used historically for cattle and poultry rearing. The parcel is currently leased as grazing land and the barns on the property have recently been removed under permit. One operating domestic water well is in a pump house in the northwest portion of the site and there are two shallow "hand dug" water wells, one located approximately 220 feet south of the domestic well and the other located approximately 370 hundred feet south of the domestic well. Site photographs are presented in APPENDIX A.

No obvious channels or swales exist on-site, although approximately 1,000 feet west of the property line, a stream channel is visible with down-cut topography and riparian vegetation. This channel flows west through pastureland and then turns north just east of the Coast Guard Training Facility, before its confluence with Stemple Creek. Stemple Creek flows for another approximately five miles before its confluence with Estero de San Antonio, which flows for another five miles through open pastureland before emptying near Bodega Bay, north of Dillon Beach. A small northeastern portion of the site drains to the south to Laguna Lake, situated at the Sonoma and Marin County line.

[2] The Petaluma Dairy Belt Area Plan priorities are to 1) Preserve and enhance the agricultural resources and protect the agricultural industry in this area, 2) Preserve the area's scenic beauty, 3) Accommodate a variety of rural life styles, and 4) Encourage the development of an adequate transportation network which will accommodate proposed development and projected travel needs, and which will facilitate movement of agricultural products to the market place.

2.1 USGS 7.5 MINUTE QUADRANGLE MAP

HES reviewed the most recent United States Geological Survey (USGS) 7.5-minute Quadrangle Map, 2018 (PLATE 4).[3] The general site topography slopes from approximately 320 feet mean sea level (MSL) at its eastern section to approximately 240 feet MSL at its southwestern edge. Most of the site is in the Hydrologic Unit Code (HUC) 12 – 180500050303, Stemple Creek, Estero de San Antonio Watershed. A small northeastern section of the site is located within the HUC 12 – 180500050202, Walker Creek Watershed. Most of the land in the area is open grass land and wooded areas primarily along the surface water drainages. Several properties near the site utilize retention ponds for livestock and irrigation.

2.2 HISTORICAL AERIAL PHOTOGRAPHY

HES reviewed aerial photographs from years 1993-2017 depicting the site and vicinity to obtain information about historical development and other surficial features. In 1993 the site and the land in the immediate vicinity of the site appear similar to present day conditions. In 2005 more land in the vicinity was developed as farms with residential dwellings and barns. But overall, the site and site vicinity have remained relatively unchanged from 1993 through 2017.

2.3 NEIGHBORING PROPERTIES

The surrounding land uses are predominantly pasture land, dairy farms and rural residential developments. The Pacific Ocean is approximately 12 miles to the west. The developed properties are serviced by private septic systems and groundwater wells. There are several retention ponds located approximately one-half mile northwest and southeast of the site. Access to neighboring properties is provided from the north off Bodega Avenue and Middle Two Rock Road or from the south via Spring Hill Road.

2.4 SITE DEVELOPMENT AND WATER USE

On July 5, 2017, the Permit Applicant (Applicant) completed a Pre-Application to Permit Sonoma for a Cannabis Use Permit (PRE17-0009), a major pre-application for mixed light green house and outdoor cultivation. On August 16, 2017, the Applicant submitted a request for cannabis cultivation Use Permit (UPC17-0020) including up to 10,000 square feet (SF) small mixed light, 5,000 SF specialty indoor, and 28,560 SF medium outdoor cultivation. A recent permit history records review indicates that a March 5, 2018 Agricultural Cannabis Permit Application (APC18-0004) is currently under review.

The proposed project (the Project) will convert two of the barns to mixed-light cultivation (Greenhouse/Indoor Cultivation), convert an unused pasture to Outdoor Cultivation, and will maintain the current grazing lease for the rest of the grassland portion of the parcel. The grazing lease allows grazing cattle on 25 acres from January 1, 2018 to January 5, 2019. The applicant anticipates an average of five on-site farm workers throughout the year.

[3] USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data | USGS The National Map: 3D Elevation Program. Data refreshed January 2018. | USGS TNM – National Hydrography Dataset. Data refreshed January 2018.

2.4.1 Greenhouse/Indoor Cultivation Water Use

Greenhouse/Indoor cultivation will consist of a total of 4,500 plants in a 15,000 SF area which includes all plants as they move through their life cycle from clones, to vegetative to flower stage. Water use has been estimated using the anticipated peak water use for the whole facility.

The Applicant determined that they will use 0.33 gallons of water/per plant/per day, so daily water use for each watering event will be:

> Greenhouse/Indoor Cultivation Water Use per Day =
>
> 0.33 gallons water x 4,500 plants = 1,485 gallons/day

The Greenhouse/Indoor watering event will consist of watering plants over a 5 to 8-hour period using point drip emitter system. The Greenhouse/Indoor crop will be watered once per day for 365 days per year.

> Annual Greenhouse/Indoor Cultivation Water Use = 1,485 gallons/day x 365 days/year = (542,025 gallons/year) / (325,851 gallons/acre-feet) = 1.66 acre-feet/year.

NOTE: This water use estimate is based on the Applicant's 20 years of cultivation experience and directly from the Applicant's current water consumption metered by the City of San Francisco at a 100 light, 3,500 SF indoor cultivation.

The Applicant also plans to implement water conservation methods as part of the proposed greenhouse/indoor cultivation project including the installation of a rainwater catchment system attached to the greenhouses and indoor buildings. The proposed rainwater catchment system will capture rain from approximately 15,000 SF of existing and proposed roof structure and will be stored in four (4) 10,000-gallon poly tanks. Based on the surface area available for rain capture and the annual rainfall in the area, we estimate the following amount of water could potentially be captured and utilized on-site.

> Rainwater capture area = 15,000 SF (roof) / 43,560 SF/acre = 0.34-acre
>
> Annual Rainfall Capture Potential = 0.34-acre (rainwater capture area) x 2.5 feet (annual on-site precipitation[4]) = 0.85 acre-feet/year

The greenhouse/indoor cultivation will operate through most of the winter and spring so the actual groundwater usage during those months could be significantly offset by the captured rainwater. Details on potential rainwater offset are presented in TABLE 1.

In addition to rainwater catchment, the Applicant plans to capture runoff from the indoor and greenhouse operations as well as household "gray water" and distribute it through a gray water system

[4]Sonoma County Mean Seasonal Precipitation in Flood Control Design Criteria manual: Plate No. B-3, Sonoma County Water Agency, Revised January 2005

for landscape watering. Details on the proposed engineered gray water system are presented in APPENDIX B.

2.4.2 Outdoor Cultivation Water Use

The Applicant will develop an 28,560 SF Outdoor Cultivation area to maintain approximately 1,000 plants. The Applicant will utilize dry farming methods for outdoor plants, including deep tilling of the soil to trap moisture. In early spring the land will be deep tilled allowing for maximum penetration of rain and moisture during the spring. After the last frost the Applicant intends to plant rooted plants directly into the ground allowing them to set into the ground with little to no watering. The Applicant will implement this early planting method so the plants will root in with a deep root base accessing water deep in the soil. Also, the micro climate of the West Petaluma Area typically has heavy morning fog and remains cool and mild throughout the summer months allowing for significantly less watering than most other areas in Sonoma County. This early planting method is used by nearby residents to dry-farm corn, tomatoes, squash, potatoes, and peppers. Once a month for the five months season the Applicant will use a point drip emitter system to deliver 3.5 gallons per plant over a 5-hour period. Water use for each month will be:

> Outdoor Cultivation Water Use per Month = 3.5 gallons water x 1,000 plants = 3,500 gallons/month
>
> Annual Outdoor Cultivation Water Use = 3,500 gallons/month x 5 months/year = 17,500 gallons/year / (325,851 gallons/acre-feet) = 0.05 acre-feet/year

Based on the Applicant's water use plans, the estimated annual Project water use is 0.05 acre-feet (Outdoor cultivation) + 1.66-acre feet (Greenhouse/Indoor Cultivation) = 1.71 acre-feet/year

> Applicant's Estimate of Annual Project Water Use = 1.72 acre-feet/year.

The Applicant is an experienced cannabis grower and is designing the proposed cultivation systems to use a minimal amount of water. However, per Permit Sonoma request, and to prepare a more conservative Project water use estimate for this report, HES reviewed statistical information used by California Fish and Wildlife, and recent water use statistics calculated by NORML and Humboldt Growers Association. Articles co-authored by Scott Bauer of California Fish and Wildlife in Bioscience and PLOS[5] both cite a 2010 Humboldt Growers Association average water use per plant estimate of six gallons per plant per day. This water use estimate has been found to be inaccurate and excessive, and not representative of Northern California cannabis growing methods however it can also be considered a worst-case scenario approach to estimating water usage.

Alternative studies have been performed to more accurately assess cannabis water usage in Northern California. Sacramento NORML and Cal NORML canvassed growers from 11 outdoor farms in El Dorado, Placer, Humboldt and Mendocino counties. The NORML survey indicated that typical water usage ranged from one gallon per plant to 3.5 gallons per plant, although plants were

[5] https://www.plos.org

not necessarily watered daily, and less water was used while the plants were immature. NORML also noted that cannabis cultivators often scale back on watering at the end of the season to encourage flowering. The NORML survey found the average gallons of water used daily per plant for a typical Northern California outdoor cultivation was 2.30 gallons per day. The typical outdoor season is approximately 150 to 180 days. Six gallons per plant per day is possible during July and August but is not representative of the entire season.[6] HES recalculated the Project Outdoor Cultivation water use with the NORML average water use:

2.3 gallons/day x 180 days/year x 1,000 plants/year = 414,000 gallons

414,000 gallons / (325,851 gallons/acre-feet) =

Typical Annual Outdoor Cultivation Water Use = 1.27 acre-feet/year

So, a significantly more conservative estimated annual Project water use estimate is 1.27 acre-feet (Outdoor cultivation) + 1.66-acre feet (Greenhouse/Indoor Cultivation) =

Annual Project Water Use = 2.93 acre-feet/year.

Note: The Annual Project Water Use estimates in this report do not include the beneficial water use offsets (reduction in total water use) obtained from the Applicant's rainwater capture and grey water reuse plans.

2.4.3 On-site Domestic Water Use

Domestic water use at the site initially consists of two residential dwellings however we understand that site development plans may include the conversion of the granny unit into an employee office for several farm workers (anticipate average of 5 workers per day annually). Previous studies by others have estimated domestic water usage in Northern California. A 2003 Kleinfelder groundwater pilot study[7] reported that the Northern California water use per household is 0.50 to 1.0 acre-feet per year. A Sonoma County Water Agency study found the average annual water use for a "family" in Santa Rosa was approximately 99,000 gallons or 0.30 acre-feet per year.[8] Water use for minor to moderate landscaping is included in these estimates. The established Napa County Water Availability Analysis methods specify annual domestic water use for a property at 0.75 acre-feet for first dwelling and 0.5 acre-feet for additional dwellings, and 15 gallons per day per worker.[9] So, for this assessment we used the Napa County water use criteria to estimate the annual domestic water use at the site as follows:

Annual Onsite Worker Water Use = 5 (average number of daily employees) x 15

gallons/day (daily employee water usage) x 365 days/year) =

[6] http://www.canorml.org/news/Cal_NORML_Challenges_Fish_and_Wildlife_Figures_on_Marijuana_Water_Consumption.html
[7] Pilot Study of Groundwater Conditions in the Joy Road, Mark West Springs and Bennett Valley Areas of Sonoma County, California, Kleinfelder, September 17, 2003.
[8] http://www.scwa.ca.gov/quick-facts/
[9] Water Availability Analysis (WAA) Guidance Document, Napa County, Adopted May 12, 2015.

27,375 gallons/year / (325,851 gallons/acre-feet) = 0.08 acre-feet/year

And, 0.75 acre-feet (1st dwelling domestic) + 0.5 acre-feet (2nd dwelling domestic) + 0.08 acre-feet/year (on-site workers) = Annual Site Domestic Water Use = 1.33 acre-feet/year.

2.4.4 Onsite Pasture Land Dairy Land Water Use

HES searched available sources for information regarding water use at farms raising livestock, most notably grazing dairy cows. HES also inquired with Sonoma and Napa County planning department staff, Sonoma and Marin County Agriculture Commission staff and found there is no definitive local estimates. The USDA reports that water demand per cow is commonly estimated to be 40 to 50 gallons of water per cow per day. A University of Michigan published study monitored water usage at a commercial dairy farm in Ohio using 13 water meters at key locations for two years. The average milk production on this farm was 80 pounds per cow per day. There were 854-1005 total cows on the farm during the study period. Over the two study years, the average drinking water per cow (both milking and dry cows) was 23.6 gallons and the average waste water (water used for cleaning) was 6.3 gallons/day for an average total water use of 29.9 gallons per cow per day (essentially 30 gallons per cow per day) which is significantly lower than the 40 to 50 gallons per cow per day commonly cited in the literature.[10]

As noted in this Report, the property owner leases 25 acres of current pasture/dairy land onsite for cattle grazing. HES assumed that all pasture/dairy land are irrigated by groundwater and that 2 cows per acre is the sustainable amount allowed. Therefore, HES estimated the current water demand for pasture/dairy land onsite as follows:

25 (Acres of Current Pasture Dairy Land) x 2 (Sustainable Number of Cows/Acre) x 30 (gallons of water/cow/day) x 365 (days/year) = 547,500 gallons/year

547,500 gallons/year / (325,851 gallons/acre-feet) =

Current Pasture Dairy Water Use Onsite = 1.68 acre-feet/year

Therefore, the Annual Total Site Water Use is estimated by combining Annual Site Project and Annual Site Domestic Water Use and Current Pasture Dairy Water Use Onsite:

2.93 acre-feet per year (Site Project) + 1.33 acre-feet per year (Domestic) + 1.68 acre-feet per year (Cattle Grazing) =

Annual Site Total Water Use = 5.94 acre-feet/year.

The rainfall capture potential previously calculated in this Section of the Report may offset the site groundwater water usage by up to 0.85 acre-feet per year, approximately a 14% reduction. Considering this reduction, the net demand on groundwater at the site can be recalculated as:

[10] http://msue.anr.msu.edu/news/water_use_on_dairy_farms

5.94 acre-feet/year (site groundwater usage) – 0.85 acre-feet/year (rain capture potential) =

5.09 acre-feet/year = Annual Site Groundwater Usage after Rainwater Offset.

The anticipated monthly Project and Domestic Water Use is summarized below in TABLE 1.

TABLE 1 – ESTIMATED ANNUAL SITE WATER USAGE

Source	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	----------Gallons----------												
Indoor/ Mixed Light	45,169	45,169	45,169	45,169	45,169	45,169	45,169	45,169	45,169	45,169	45,169	45,169	542,028
Outdoor*	0	0	0	15,000	40,000	70,000	85,000	85,000	70,000	49,000	0	0	414,000
Domestic (house, 2nd Unit & employees)	36,115	36,115	36,115	36,115	36,115	36,115	36,115	36,115	36,115	36,115	36,115	36,115	433,382
Cattle Grazing	45,625	45,625	45,625	45,625	45,625	45,625	45,625	45,625	45,625	45,625	45,625	45,625	547,500
TOTAL USAGE	**126,909**	**126,909**	**126,909**	**141,909**	**166,909**	**196,909**	**211,909**	**211,909**	**196,909**	**175,909**	**126,909**	**126,909**	**1,936,908**
Rainwater Capture Potential**	50,606	54,617	38,840	16,543	8,940	1,645	0	822	2,055	14,590	34,011	50,606	273,275
TOTAL USAGE after potential rainwater offset	**76,303**	**72,292**	**88,069**	**125,366**	**157,969**	**195,264**	**211,909**	**211,087**	**194,854**	**161,319**	**92,898**	**76,303**	**1,663,633**

* Outdoor water usage is based on NORML Study discussed in Section 2.1 of this Report. (Applicants actual water usage is projected to be much less).
** Rainwater capture total based on average monthly rainfall in Petaluma (USclimatedata.com).

3.0 CUMULATIVE IMPACT AREA

HES reviewed available water well records obtained from Permit Sonoma and California Department of Water Resources (DWR) and assessed information obtained from peer-reviewed scientific publications as referenced in this report to determine an appropriate Cumulative Impact Area for the site. HES delineated the Cumulative Impact Area based on known geologic, hydrologic and groundwater characteristics in the area. The Cumulative Impact Area is a circular area centered at the Project well with a radius extending approximately 0.5 mile from the site. The total area of the Cumulative Impact Area is approximately 500 acres. Some properties within the Cumulative Impact Area extend outside of the Cumulative Impact Area. Approximately 654 acres extend outside of the Cumulative Impact Area.

HES identified 22 properties in the Cumulative Impact Area including the site (TABLE 2). The Cumulative Impact Area includes the entire site and all or portions of the other 21 properties (PLATE 5 - SITE PLAN AND CUMULATIVE IMPACT AREA). The property sizes included in the Cumulative Impact Area range from 1.0 acre to 313.17 acres with an average size of approximately 52 acres. A total of 19 of the 22 Cumulative Impact Area properties are developed with residences or single, family homes. Three of the 22 residential properties appear to be commercial dairies however smaller herds of dairy cattle were noted on other properties. Three of the properties are undeveloped with pastureland only.

Twenty of the 22 Cumulative Impact Area properties, including the site are zoned as Land Extensive Agriculture (LEA) with 100-acre density. Two of the 22 properties are zoned as Land Extensive Agriculture with 60-acre density. Zoning in this area is unlikely to change significantly so future development is anticipated to be consistent with currently allowed conditions.

Five of the 22 properties in the Cumulative Impact Area are listed as being in both Groundwater Availability Areas: Zone 2 - Major natural recharge area and Zone 4 - Areas with low or highly variable water yield. Seventeen of the 22 properties, including the site, are listed in Groundwater Availability Area: Zone 2 - Major natural recharge area.

TABLE 2 CUMULATIVE IMPACT AREA PROPERTIES

APN	Assessor Use Code	Land Use	Groundwater Availability	ACRES	Distance to Site Well (feet)
022-190-012	0541 [Pasture w/ Residence]	LEA 100	Zone 2, Zone 4	28.90	2,522
022-190-015	0541 [Pasture w/ Residence]	LEA 100	Zone 2, Zone 4	44.64	2,972
022-190-018	0471 [Dairy w/ Residence]	LEA 100	Zone 2, Zone 4	313.71	4,281
022-200-011	0051 [Rural Res/Single Res]	LEA 100	Zone 2	12.87	1,259
022-200-013	0541 [Pasture w/ Residence]	LEA 100	Zone 2	17.80	2,031
022-200-029	0541 [Pasture w/ Residence]	LEA 60	Zone 2	200.92	2,199
022-200-030	0541 [Pasture w/ Residence]	LEA 60	Zone 2	57.44	2,320
022-200-043	0051 RR/single Res	LEA 100	Zone 2	5.01	1,732
022-200-044	0541 [Pasture w/ Residence]	LEA 100	Zone 2	55.39	1,583
022-220-001	0541 [Pasture w/ Residence]	LEA 100	Zone 2	18.31	1,525
022-220-016	0540 [Pasture]	LEA 100	Zone 2, Zone 4	100.00	2,015
022-220-017	0051 [Rural Res/Single Res]	LEA 100	Zone 2	2.93	2,978
022-220-018	0051 [Rural Res/Single Res]	LEA 100	Zone 2	8.70	1,961
022-220-019	0051 [Rural Res/Single Res]	LEA 100	Zone 2	8.37	2,580
022-230-004	0541 [Pasture w/ Residence]	LEA 100	Zone 2, Zone 4	33.23	2,519
022-230-005	0546 [Pasture w/ Manufactured Home]	LEA 100	Zone 2	93.45	2,771
022-230-007	0541 [Pasture w/ Residence]	LEA 100	Zone 2	63.34	1,623
022-230-011	0540 [Pasture]	LEA 100	Zone 2	23.96	1,670
022-230-014	0010 [Single Family Dwelling]	LEA 100	Zone 2	1.00	1,084
022-230-017	0051 [Rural Res/Single Res]	LEA 100	Zone 2	3.20	1,454
022-230-019	0051 [Rural Res/Single Res]	LEA 100	Zone 2	25.40	965
022-230-020	0541 [Pasture w/ Residence] Currently undeveloped	LEA 100	Zone 2	36.13	SITE
			Acres Inside Cumulative Impact Area	500.0	
			Acres Outside Cumulative Impact Area	654.0	

Table details obtained from various on-line sources, Permit Sonoma and Google Earth.

3.1 GROUNDWATER USAGE

Based on available information including a Google Earth June 2017 aerial photograph[11], HES estimated the land use acreage within the 500-acre Cumulative Impact Area as follows:

5 acres	Drainage and Wooded Land
40 acres	Residential use including houses and landscaping (~ 2 acres per residential)
255 acres	Current Pasture/Dairy Land
200 acres	Future Potential Dairy Land

The wooded land within the Cumulative Impact Area is situated primarily along drainages, providing limited but valued privacy between properties so further reduction of existing wooded

[11] Details derived from Google Earth aerial photograph, dated June 16, 2017.

land may not be feasible or pursued.

3.1.1 Current Domestic Water Use

Prior groundwater studies performed by Kleinfelder (2003)[12] for the County of Sonoma cited an average annual household water demand in Northern California ranging from 0.5 to 1 acre-feet per year. Napa County similarly estimates average household domestic water usage at 0.75 acre-feet per year for the primary dwelling and 0.5 acre-feet per year for each additional dwelling on a property. HES reviewed the June 2017 aerial photograph[13] to estimate the number of dwellings on each property in the Cumulative Impact Area (excluding the subject site) and found 18 primary dwellings and 16 additional dwellings. Therefore, the annual domestic (residential dwelling) groundwater demand in the Cumulative Impact Area (excluding the subject site) can be conservatively estimated as follows:

18 (primary dwellings) x 0.75 acre-feet/dwelling + 16 (additional dwellings) x 0.5 acre-feet/dwelling = Total Annual Domestic Water Use = 21.5 acre-feet/year

This estimate assumes that all residential dwelling water is supplied from groundwater; other sources of water (recycled water, reservoirs or surface water) were not included. This estimate does not include domestic water use for workers.

3.1.2 Future Domestic Water Demand

Future domestic water demand within the Cumulative Impact Area assumes that the three currently undeveloped properties in the Cumulative Impact Area will be developed with residential homes and 2nd units, including landscaping. The future domestic water demand also assumes that the seven properties currently with only one dwelling will be developed with a second dwelling. Using the methods described above Future Domestic Water Demand was calculated as follows.

3 (primary dwellings) x 0.75 acre-feet/dwelling + 10 (additional dwellings) x 0.5 acre-feet/dwelling = Potential Additional Annual Domestic Water Use = 7.25 acre-feet/year

So, 21.5 acre-feet/year (Current Domestic Water Use) + 7.25 acre-feet/year (Potential Additional Domestic Water Use) = Future Domestic Water Demand = 28.75 acre-feet/year

3.1.3 Pasture Land Dairy Land Water Use

Water use for ranch/dairy farming within the Cumulative Impact Area is likely much more significant than the domestic water use. As discussed in Section 2.1.4 of this Report HES searched available sources for information regarding water use at farms raising livestock, most notably grazing dairy cows. HES also inquired with Sonoma and Napa County planning department staff, Sonoma and Marin County Agriculture Commission staff and found there is no definitive local

[12] Pilot Study of Groundwater Conditions in the Joy Road, Mark West Springs and Bennett Valley Areas of Sonoma County, California, Kleinfelder, September 17, 2003

[13] Google Earth aerial photograph, dated June 16, 2017

estimates. The USDA reports that water demand per cow is commonly estimated to be 40 to 50 gallons of water per cow per day. A University of Michigan published study monitored water usage at a commercial dairy farm in Ohio using 13 water meters at key locations for two years. The average milk production on this farm was 80 pounds per cow per day. There were 854-1005 total cows on the farm during the study period. Over the two study years, the average drinking water per cow (both milking and dry cows) was 23.6 gallons and the average waste water (water used for cleaning) was 6.3 gallons/day for an average total water use of 29.9 gallons per cow per day (essentially 30 gallons per cow per day) which is significantly lower than the 40 to 50 gallons per cow per day commonly cited in the literature.[14]

As noted in Section 3.1 of this Report, HES estimated that there are currently approximately 255 acres of current pasture/dairy land (including 25-acres on the site) within the Cumulative Impact Area and there is an additional 200 acres of pasture/dairy land that theoretically could be developed in the future. HES conservatively assumed that all pasture/dairy land areas found within the Cumulative Impact Area are irrigated by groundwater and that 2 cows per acre is the sustainable amount allowed. Therefore, HES estimated the current water demand for pasture/dairy land within the Cumulative Impact Area as follows:

230 (Acres of Current Pasture Dairy Land Offsite) x 2 (Sustainable Number of Cows/Acre) x 30 (gallons of water/cow/day) x 365 (days/year) = 5,037,000 gallons/year

5,037,000 gallons/year / (325,851 gallons/acre-feet) =

Current Pasture Dairy Water Use in Cumulative Impact Area = 15.46 acre-feet/year

Future pasture/dairy land water demand within the Cumulative Impact Area assumes that the additional 200-Acres will be developed with dairy or other livestock. Using the same approach described above, HES estimated the Potential Additional Annual Pasture Dairy Land Water Demand as follows.

200 (Acres of Potential Pasture Dairy Land) x 2 (Sustainable Number of Cow/Acre) x 30 (gallons of water/cow/day) x 365 (days/year) = 4,380,000 gallons/year

4,380,000 gallons/per year / (325,851 gallons/acre-feet) =

Potential Additional Pasture Dairy Land in Cumulative Impact Area = 13.44 acre-feet/year

So, 15.46 (Current Pasture Dairy Land Offsite) + 13.44 (Potential Additional Pasture Dairy Land) =

Future Pasture Dairy Land Water Use in Cumulative Impact Area = 28.9 acre-feet/year

3.1.4 Total Water Demand in Cumulative Impact Area

Based on the conservative assumptions discussed above, HES estimated Current Annual

[14] http://msue.anr.msu.edu/news/water_use_on_dairy_farms

Groundwater Demand (in acre-feet/year) for the Cumulative Impact Area:

> 21.5 acre-feet/year (Current Domestic) + 15.46 acre-feet/year (Pasture Dairy Land) + 2.93 acre-feet/year (Proposed Project) + 1.33 acre-feet/year (Onsite Domestic) + 1.68 acre-feet/year (Onsite Grazing) =
>
> Current Groundwater Demand in Cumulative Impact Area = 42.9 acre-feet/year

Based on the conservative assumptions discussed above, HES estimated Future Potential Annual Groundwater Demand for the Cumulative Impact Area as follows:

> 28.75 acre-feet/year (Potential Domestic) + 28.9 acre-feet/year (Potential Pasture Dairy Land) + 2.93 acre-feet/year (Proposed Project) + 1.33 acre-feet/year (Onsite Domestic) + 1.68 acre-feet/year (Onsite Grazing) =
>
> Future Groundwater Demand in Cumulative Impact Area = 63.59 acre-feet/year

The Project's water demand of 2.93 acre-feet/year (discussed in Section 2.1) increases the current total water demand within the Cumulative Impact Area by 8.6% and the future total water demand within the Cumulative Impact Area by 4.8%. A breakdown of estimated groundwater usage within the Cumulative Impact Area is presented on Table 3.

TABLE 3 – ESTIMATED WATER USAGE IN CUMULATIVE IMPACT AREA

Location (APN)	**Water Use Type**	**Projected Water Use per Day Average**	**Projected Water Use per Day Peak**	**Projected Water use per Month Average**	**Projected Water Use per Month Peak**	**Projected Water Use Annual**
18 existing primary residences and 16 existing 2nd units within Cumulative Impact Area	Existing Domestic Water	19,194 gallons 0.06 acre-feet	19,194 gallons 0.06 acre-feet	583,816 gallons 1.79 acre-feet	583,816 gallons 1.79 acre-feet	7,005,797 gallons 21.5 acre-feet
3 potential residential properties and 10, potential 2nd units within the Cumulative Impact Area	Future Potential Domestic Water	6,472 gallons 0.02 acre-feet	6,472 gallons 0.02 acre-feet	196,868 gallons 0.6 acre-feet	196,868 gallons 0.6 acre-feet	2,362,420 gallons 7.25 acre-feet
230-acres of existing grazing land in Cumulative Impact Area	Existing Ranch Water	13,800 gallons 0.04 acre-feet	13,800 gallons 0.04 acre-feet	419,750 gallons 1.29 acre-feet	419,750 gallons 1.29 acre-feet	5,037,000 gallons 15.79 acre-feet
200-acres of potential grazing land in Cumulative Impact Area	Future Potential Ranch Water	12,000 gallons 0.04 acre-feet	12,000 gallons 0.04 acre-feet	365,000 gallons 1.12 acre-feet	365,000 gallons 1.12 acre-feet	4,380,000 gallons 13.44 acre-feet
Site Domestic	House,2nd Unit and 5 Employees	1,187 gallons 0.004 acre-feet	1,187 gallons 0.004 acre-feet	36,115 gallons 0.11 acre-feet	36,115 gallons 0.11 acre-feet	433,381 gallons 1.33 acre-feet
Site Grazing	25 Acres for Cattle	1,500 gallons 0.004 acre-feet	1,500 gallons 0.004 acre-feet	45,625 gallons 0.14 acre-feet	45,625 gallons 0.14 acre- feet	547,500 gallons 1.68 acre-feet
Site Project	Proposed Indoor and Outdoor Cannabis Cultivation	2,616 gallons 0.008 acre-feet	4,199 gallons 0.012 acre-feet	79,562 gallons 0.24 acre-feet	130,169 gallons 0.4 acre-feet	954,743 gallons 2.93 acre-feet
Total Water Usage Estimate	**Existing and Proposed Water Demand**	**56,769 gallons 0.17 acre-feet**	**58,352 gallons 0.18 acre-feet**	**1,726,737 gallons 5.3 acre-feet**	**1,777,344 gallons 5.45 acre-feet**	**20,720,841 gallons 63.59 acre-feet**

Note: Projected water usage for cannabis cultivation provided by NORML Study cited in Section 2.1 and estimates on household water use are based on 1 acre-foot per property.

4.0 HYDROGEOLOGICAL CONDITIONS

The site is located outside and west of the Petaluma Valley within the northwest trending structural province of the Coast Ranges of northern California. The regional structure consists primarily of northwest-trending folds and a few major faults, the most prominent of which is the San Andreas fault, a right-lateral fault, about 12 miles west of the area. The Petaluma Valley occupies a northwest-trending structural depression in the southern part of the Coast Ranges of northern California. This depression divides the Mendocino Range on the west from the Mayacamas and Sonoma Mountains on the east. West of the southern end of Petaluma Valley are the Marin Mountains, in which Burdell Mountain, immediately adjacent to the Valley, rises to an altitude of 1,560 feet.

The 1980 Special Report 120 "Geology for Planning in Sonoma County[15] indicates the site is underlain by the Plio-Pleistocene aged Merced Formation consisting of fine-grained sandstone and local minor coarse-grained grit and tuff breccia (PLATE 7 - GEOLOGIC MAP DETAIL). Other geologic formations identified within close proximity include the Franciscan Assemblage and quaternary aged alluvial deposits (PLATE 8 – REGIONAL GEOLOGIC MAP).

The 2002 Geologic Map of the Petaluma 7.5 Quadrangle16, shows the site underlain by the Miocene aged Wilson Grove Formation (formerly identified as the Merced Formation), a light gray to light yellow-brown marine sandstone. The sandstone is fine grained, well sorted, and massive to poorly bedded. Locally the Wilson Grove Formation contains thin lenses of pebble conglomerate. Exposed near ground surface to the east and west and underlaying the Wilson Grove formation is the Franciscan Assemblage (Jurassic-Cretaceous), a tectonic mixture consisting predominantly of a matrix of sheared greywacke and shale and to a lesser extent serpentinite enclosing blocks of less sheared greywacke and greywacke interbedded with shale. The unit is characterized by hard, resistant tectonic blocks of chert, greenstone, and exotic high grade metamorphic rocks. Native sediment and rock underlying the site consist of light brown clayey to silty fine-grained sand (Wilson Grove Formation), and light brown sandstone, and dark serpentinite (Franciscan Complex). The Wilson Grove Formation is a principal aquifer in western Sonoma County.

The soil type at the site is SnC: 85% Steinbeck, 4% Cotati, 4% Goldridge, 4% Pajaro and 3% Unnamed. The farmland class is Prime farmland if irrigated and drained. Drainage class is Moderately well drained. The minimum depth to bedrock is approximately 56 inches or 4.7 feet. Soil Suitability Rating for Agriculture is Grade 1- Excellent (California Revised Storie Index).[17]

4.1 STEMPLE CREEK WATERSHED

Most of the site is in the Stemple Creek, Estero de San Antonio Watershed, Hydrologic Unit Code (HUC) 12 – 180500050303 which extends into northern Marin County and southern Sonoma County. The watershed's area is about 32,980 acres, or 51.5 square miles. The watershed is characterized by grassy, rolling hills most with slopes of 30 percent or less and most

[15] Special Report 120, "Geology for Planning in Sonoma County, California Department of Mines and Geology, 1980.
[16] Geologic Map of Petaluma 7.5' Quadrangle Sonoma and Marin Counties, California: A digital Database Version 1.0, California Department of Conservation California Geological Survey, 2002.
[17] https://casoilresource.lawr.ucdavis.edu/gmap/

of the land is used for agriculture purposes. Stemple Creek flows westward through the watershed to the Estero de San Antonio which empties into the Pacific Ocean between Bodega Bay and Dillon Beach. The Estero de San Antonio is an important coastal resource and is included in the Gulf of the Farallones National Marine Sanctuary.

The Stemple Creek Watershed at depth is underlain by Franciscan formation, a hard, metamorphic rock with frequent and deep fractures. Water enters the Franciscan formation and travels along its many fractures. Groundwater discharge occurs when a slope or stream channel cuts across the fractures; thus, the "springs" of Spring Hill (south of the site).

The Wilson Grove formation overlays the Franciscan formation in much of the watershed and stores a large amount of groundwater, especially where the sandstone is massive and not excessively interbedded with shale lenses. Groundwater in the Wilson Grove is not confined to fractures as it is in the Franciscan formation. Therefore, water flows more evenly downslope. Unless it meets a geologic intrusion that forces flow to the surface, the water tends to stay below ground. However, the near-surface flow that occurs in the Wilson Grove formation and the valley alluvium can support lush riparian vegetation. [18]

The Stemple Creek Watershed upland soils are mostly residual soils on terraces and uplands that have eroded and are the source of sediment deposited in the flood plain. These soils include the Steinbeck and Sebastopol soils series. Slopes range from 2% to 15%. Both have an enrichment of clay in the subsoil with moderately slow permeability. Both are in soil hydrologic group B, which has moderate runoff potential. Other upland soils include the Los Osos, Sobega, Tomales, and Yorkville soil series. Slopes range from 2% to 50%. Except for the Sobega series, all these soils have an enrichment of clay in their subsoils and have moderate to very slow permeabilities. In addition, all soils are moderately deep to weathered sedimentary rock. Most of the watershed is in soil hydrologic groups B, C, and D, which have moderately high to high runoff potential. Mean annual precipitation ranges from 28 inches in the east to 36 inches in the west, with an average of 30 inches. Ninety-five percent of the rainfall occurs between October and May.[19]

4.2 WALKER CREEK WATERSHED

A small northeastern portion of the site is located within the Walker Creek Watershed, HUC 12 – 180500050202. Surface water drainage in this portion of the site flows south to Laguna Lake, a 220-acre natural lake that straddles the Sonoma County - Marin County border and is the source of Chileno Creek, which flows 6.25 miles west along Bolinas Ridge to Walker Creek. The Walker Creek Watershed drains 76 square miles and ranges from 1,500 feet to sea level where the creek empties into the northern end of Tomales Bay just south of its mouth.[20] Walker Creek flows from Southeast to Northwest, with four major tributaries entering on its way to Tomales Bay. Steep hills enclose a narrow alluvial valley along Walker Creek, Salmon Creek, and lower

[18] http://www.krisweb.com/biblio/stemple_mcrcd_prunuskeetal_1994_wep.pdf
[19] Sediment deposition in the flood plain of Stemple Creek Watershed, northern California, USDA, Geomorphology 61, 347 – 360, 2004.
[20] https://en.wikipedia.org/wiki/Walker_Creek_(Marin_County,_California)

Arroyo Sausal and Chileno Creek. Keys Creek and upper Arroyo Sausal and Chileno Creek traverse broad alluvial valleys surrounded by rolling hills.[21]

The watershed is underlain by the Franciscan Complex, which consists of sandstone, interbedded shales, mudstone, chert, greywacke, and minor conglomerate.[22] In much of the watershed, the Wilson Grove formation overlies the Franciscan formation. Soils in the watershed are those commonly associated with the Franciscan and Wilson Grove formations and generally follow the geologic boundaries. The Steinbeck and Los Osos associations are loamy soils prone to erosion through sheetwash and gullying, especially where vegetation has been removed or compromised by high grazing pressure.[23] Walker Creek has an annual rainfall of 24–32 inches and supplies about 25 percent of the annual runoff into Tomales Bay. Typically, there is little or no precipitation from May to October. During the November to March rainy season, rainfall and runoff are often intense over relatively short periods.[24]

4.3 DOMESTIC WELL INFORMATION

HES performed a domestic well search through the Department of Water Resources and Permit Sonoma to identify Well Completion Reports within a ¾ mile radius of the site. Through this research, HES identified domestic well log information for 7 properties within the Cumulative Impact Area, including the site (TABLE 4). Available well logs are included in APPENDIX C. Four of the wells were completed to total depths greater than 200 feet and four wells were completed to total depths less than 200 feet. The average well depth is 175 feet. The average screened interval thickness is 87 feet. The average specific capacity is 0.07 gpm per foot of drawdown.

[21] Geomorphology of the Walker Creek Watershed, Prunuske Chatham, Inc, August 10, 2005.
[22] Total Maximum Daily Load for Mercury In the Walker Creek Watershed, California Regional Water Quality Control Board San Francisco Bay Region, January 16, 2007, Revised April 4, 2008.
[23] Report and General Soil Map, Marin County, California, United States Department of Agriculture, Soil Conservation Service. 1967.
[24] Simulation of a century of runoff across the Tomales watershed, Marin County, California." Journal of Hydrology 186: 187, Fischer, D.T., S.V. Smith, and R.R. Churchill. 1996.

TABLE 4 WELL INVENTORY

APN	Well Test Year	Distance to Site Well (Feet)	Surface* Elevation (Feet)	Total Well Depth (Feet)	Screen Interval Elevation (Feet-MSL)	Total Screen Thickness (Feet)	Well Yield (GPM)	Draw-down (Feet)	Specific Capacity
022-190-012	2000	2,522	153	250	-97 - 23	120	20.0	220	0.09
022-190-015	1977	2,972	157	203	NA	NA	4.0	90	0.04
022-200-013	1988	2,031	231	160	73 -133	60	7.5	52	0.14
	2000			160	81-151	70	4.0	140	0.03
022-200-044	1956	1,583	319	130	NA	NA	1.0	128	0.01
022-220-019	1990	2,580	301	257	44-64 84-104 124-144 164-184	80	3.0	217	0.01
022-230-011	1987	1,670	241	220	21-26 66-106 126-186	105	11.5	202	0.06
022-230-020	2017	SITE	319	130	NA	NA	10.3	74.5	0.14
	2018	SITE	319	130	NA	NA	6.7	46.4	0.14
Average Well TD = 175 feet					Average Screen Thickness = 87 feet		Average Specific Capacity = 0.07		

Feet-MSL = elevation in feet relative to mean sea level
NA = not available

Review of the log for the on-site Project water well (Well Completion Report No. 110752) indicates the site well was drilled to a total depth of 130 feet and completed at 130 feet. The geologic conditions briefly identified on the log indicate that yellow sandstone was encountered from the surface to approximately 80 feet bgs and blue sandstone was encountered from approximately 80-130 feet bgs. The drillers noted an initial static water level at 20 feet bgs and a well yield of 12 gpm. HES calculated specific capacity for wells at seven of the Cumulative Impact Area properties including the site, based on limited well yield information provided on well completion reports. The average specific capacity for these wells is 0.07 gpm/ft.

The well logs for other nearby wells (within the Cumulative Impact Area) identified interbedded yellow and blue sandstone, brown and grey sandstone and clay, with some shale reported at depths of 180 and 240 feet. These well log descriptions suggest interbedded, fractured and faulted subsurface conditions beneath the Cumulative Impact Area. The well yields for the 13 wells varied from 1 to 20 gpm.

4.3.1 Well Yield Test for 344 Purvine Road (the site)

Ray's Well Testing Service (Ray's) conducted a well test at the on-site well on May 25, 2017. The total well depth was listed as 134 feet depth. Ray's conducted a 4-hour test and listed the static water level at 21.5 feet, a yield of 10.3 gpm and total drawdown of 74.5 feet which

indicates a specific capacity for the well of 0.14. The well yield test data and calculations are attached in APPENDIX D.

On February 27, 2018, HES conducted an 8-hour well yield test at the on-site domestic well. The initial water level was 25.0 feet below the top-of casing. HES used an existing ½ horsepower submersible pump set in the well at a depth of 120 feet bg to perform the test. The yield test began at 7:25 am ended on February 27, 2018 at 3:30 PM. During the well test, HES reduced the flow from the domestic well to 6.7 gpm to identify an optimal pumping rate that would meet the project demands and minimize the potential radius of pumping influence. The stabilized drawdown during the test was 45.6 feet and the average sustained yield was 6.7 gpm. Therefore, the specific capacity was 0.15 gpm per foot of drawdown (i.e., 6.7 gpm / 45.6 feet). The well yield test data and calculations are attached in APPENDIX D.

HES also used the specific capacity calculation from the well yield test to calculate an aquifer transmissivity (T) and hydraulic conductivity (K). Using relationships between specific capacity and transmissivity (Discoll, 1986, Appendix 16D) aquifer transmissivity is approximately equal to specific capacity x 1,500 for unconfined aquifers and 2,000 for confined aquifers. Assuming generally unconfined conditions at the site we calculated the following aquifer Transmissivity:

T = 0.15 gpm/ft (Specific Capacity from well test) x 1,500 (unconfined aquifer) =

225g/ft/day = Aquifer Transmissivity

Based on the relationship between Transmissivity and Hydraulic Conductivity we can calculate the aquifers hydraulic conductivity (K) using the following relationships and equations.

K = T / D (Aquifer Thickness)

K = 225 g/ft/day (transmissivity) / 87ft (average aquifer Thickness) = 2.59 gpm/ft²

The K value calculated above generally correlates with fine to coarse sand, silt, sandstone as well as fractured igneous and metamorphic rock (Driscoll, Figure 5.1.4) and is likely representative of the Wilson Grove Formation.

4.4 GEOLOGIC CROSS SECTION

HES reviewed well completion reports (APPENDIX C) available for wells located within the Cumulative Impact Area. HES also relied on information obtained from well logs, published geologic maps and reports, and professional experience to prepare a conceptual geologic cross section of the site, generally oriented southwest to northeast across the site (PLATE 9 – GEOLOGIC CROSS SECTION).

Wells in the Cumulative Impact Area are producing groundwater from units of Wilson Grove Formation and at some deeper wells, the Franciscan Formation. Assuming the well screen interval is consistent with saturated zones in the formation, the Geologic Cross Section generally shows that a saturated zone, consisting primarily of sandstone and shale, lies approximately 60-100 feet

below the Cumulative Impact Area and has a thickness approximately 87 feet. The exact thickness of the saturated zone is not known and is likely more variable than depicted on the Geologic Cross Section. However, the geology of the saturated zone appears to be consistent with aquifers in the Wilson Grove Formation. The saturated zone appears to consist of sandstone with lenses of sandy clay and clayey sands.

5.0 WATER BALANCE INFORMATION

The USGS and DWR studies that included the Petaluma area provided water balance information that HES used to assess groundwater sustainability within the Cumulative Impact Area.

5.1 GROUNDWATER STORAGE

HES used well log information from five wells to estimate the aquifer thickness beneath the Cumulative Impact Area. The average screened interval for 5 wells was estimated at 87 feet. A 2013 USGS study in the nearby Santa Rosa Plain estimated the average specific yield of the Santa Rosa region at 5 percent (0.05)[25]. Therefore, using this data the Aquifer Storage can be estimated using the following equation

87 feet (Aquifer Thickness) x 0.05 (Specific Yield) x 500 acres (Cumulative Impact Area) =

Estimated Aquifer Storage = 2,175 acre-feet

5.2 PRECIPITATION

Precipitation, primarily as rainfall is the major source of inflow to the Petaluma Valley Watershed. Mean seasonal precipitation maps from Sonoma County Water Agency[26] and various local studies referenced in this report indicate the mean annual rainfall in the site vicinity is about 30 inches per year (about 2.5 acre-feet per year) (PLATE 6 - PRECIPITATION MAP). Precipitation over the Cumulative Impact Area is:

2.5 acre-feet (regional Precipitation) x 500 acres (Cumulative Impact Area) =

Precipitation in Cumulative Impact Area = 1,250 acre-feet/year.

5.3 GROUNDWATER RECHARGE

Groundwater recharge is the replenishment of an aquifer with water from the land surface. It is usually expressed as an average rate of inches of water per year, similar to precipitation. Thus, the volume of recharge is the rate times the land area under consideration times the time period, and is usually expressed as acre-feet per year. In addition to precipitation, other sources of recharge to an aquifer are stream and lake or pond seepage, irrigation return flow (both from canals and fields), inter-aquifer flows, and urban recharge (from water mains, septic tanks, sewers, drainage ditches).

For our defined Cumulative Impact Area, the sedimentary rock aquifer is unconfined to semi-confined. The primary sources of groundwater recharge in the Cumulative Impact Area are infiltration of precipitation, infiltration from streams, and irrigation-return flow. Soil types and

[25] Hydrologic and Geochemical Characterization of the Santa Rosa Plain Watershed, Sonoma County, California, U.S. Geological Survey, Scientific Investigations Report 2013–5118.
[26] Sonoma County Mean Seasonal Precipitation in Flood Control Design Criteria manual: Plate No. B-3, Sonoma County Water Agency, Revised January 2005.

land cover within the watershed affect the extent and magnitude of storm water runoff (retention and infiltration). It is likely that a portion of the rain water falling directly on the site infiltrates the ground surface and migrates downward through the soil matrix and until it recharges the sedimentary rock aquifer.

To estimate the groundwater recharge within the Cumulative Impact Area HES first assumed that the recharge to the aquifer is primarily through rainfall and that all rainfall accumulated within the 500-acre Cumulative Impact Area drains to the creeks proximate to the site. However, this estimate does not account for surface run-off, stream underflow, and evapo-transpiration. To estimate the percentage of rainfall that contributes to recharge of the aquifer, HES reviewed available groundwater studies including the Santa Rosa Plain Watershed Groundwater Management Plan, the USGS Scientific Investigation Report 2006-51157, as well as other regional groundwater studies in Sonoma County. Estimates for recharge found in these documents are considered to be reliable for our site evaluation. Average recharge to the ground-water system for the entire Santa Rosa Plain, including mountainous zones, is derived from an estimated average of 531,000 acre-ft of precipitation falling within the entire watershed. After accounting for runoff (188,400 acre-feet/year) and evapotranspiration (262,000 acre-feet/year), the amount of water recharging the Santa Rosa Plain Watershed equates to 80,600 acre-ft/yr or approximately 15.2% of the annual rainfall. However significant variations to this value can occur based on topography, soil infiltration rates, geology etc.., and according to these USGS and Sonoma County Water Agency Reports, the long term average precipitation that recharges groundwater in these regions can be as low as 1.67%.

While these USGS studies are not specific to the site vicinity or Stemple Creek Watershed, we estimate that the average long-term recharge to the aquifer within our defined Cumulative Impact Area likely falls within the ranges seen in the nearby Watershed referenced. Further, this site is mapped within a groundwater availability Zone 2, classified as a Major Recharge Area and therefore, to prepare a conservative estimate HES determined that 10% of rainfall likely contributes to groundwater recharge within the Cumulative Impact Area. Based on this recharge value we can re-calculate the groundwater recharge within the Cumulative Impact Area using the following data and equation.

Estimated groundwater recharge =

1,250 acre-feet (annual precipitation over Cumulative Impact Area) x 0.10 (estimated

long term average for recharge) =

Annual Aquifer Recharge = 125.00 acre-feet/year

6.0 WATER QUALITY

Elevated levels of nitrate have been identified in groundwater within the western portions of the Petaluma Valley due to past land use practices. A 2013 USGS groundwater study indicates chloride, total dissolved solids, nitrate, arsenic, boron, iron, and manganese are water-quality constituents of potential concern in the region. In addition, a report from the California Department of Water Resources in 1982 found that saltwater intrusion from the tidally influenced portion of the Petaluma River affected shallow aquifers prior to 1962, but that there had been no further incursions after that time. They attributed the lack of further saltwater intrusion to substitution of groundwater with surface water.

On May 25, 2017, water samples were collected from the on-site well and tested for volatile organic compounds (VOC's), Total Coliform and E. Coli bacteria, nitrates, arsenic, zinc, iron, manganese, boron, sodium, calcium, magnesium, total alkalinity, bicarbonate alkalinity, hydroxide alkalinity, chloride, Sulfate as SO4, Total dissolved solids (TDS), and Sodium Absorption Ratio (SAR). Results of the water sampling are presented below in TABLE 5 and APPENDIX E.

TABLE 5 – WATER QUALITY DATA

Location (APN)	VOC's	pH	EC µS/cm	Silica	Nitrate as $N03^{-}$ (Mg/L)	Total Coliform (MPN/ 100 ML)	E-Coli Bacteria (MPN/ 100 ML)	Arsenic (ug/L)	Zinc (ug/L)
022-230-020	ND	5.96	479	34	**104.9**	<1	<1	2.1	ND
California Maximum Contaminant Level (MCL)	Varies	NA	NA	NA	45	<1	<1	10	50

NA – Not Applicable
ND – Non Detect

TABLE 5 – WATER QUALITY DATA

Location (APN)	Total Alkalinity	Carbonate	Bi-Carbonate	Hydroxide	Iron	Calcium	Chloride	Magnesium
	mgCaC03/L				mg/L			
022-230-020	68	ND	68	ND	0.11	40	39	17
California Maximum Contaminant Level (MCL)	NA	NA	NA	NA	300*	NA	NA	NA

*California Secondary Maximum Contaminant Levels
NA – Not Applicable

TABLE 5 – WATER QUALITY DATA

Location (APN)	Boron	Sodium	Sulfate as SO4	TDS	SAR
022-230-020	93.3	<5.00	93.3	<5.00	910
California Maximum Contaminant Level (MCL)	NA	NA	NA	NA	300*

The results of the water quality testing performed on the on-site well indicate that nitrate contamination is present. The property owner is aware of the nitrate impact and is reportedly in the process of installing well head treatment to mitigate the elevated nitrate concentrations. HES recommend that follow-up samples be collected after the treatment system is installed to verify its efficacy. No other contaminants of concern were identified in the water test results. A copy of the proposed well head treatment system is attached in APPENDIX F.

7.0 POTENTIAL IMPACTS TO STREAMS AND NEIGHBORING WELLS

HES estimated the radius of influence of the planned site well to evaluate potential well pumping impacts to wells on other properties and impact to nearby Creek. Using general relationships discussed in Driscoll (1986), HES estimated the lateral pumping influence using information from the 8-hour well yield test performed by HES and the well Pump information provided by Rays Well Testing. HES used an approximate relationship between specific capacity calculated from the well yield test and aquifer transmissivity, based on "typical" pump test values. The results of both Rays and HES's well tests indicate that the specific capacity was similar indicating that the pumping rate used to meet the Projects water demand does not significantly alter the radius of pumping influence.

Since the site aquifer is considered to be unconfined to semi-confined, transmissivity was estimated for an unconfined aquifer, using the relationship of Specific Capacity (yield/drawdown) x 1,500 (unconfined). To develop the slope of the drawdown curve from the pumping well, HES calculated the value of Δs (drawdown over one log graph cycle) for a distance-drawdown relationship, where $T = 528Q/\Delta s$ (Driscoll,1986, Equation 9.11).

The analysis is shown on the attached semi-log plot, APPENDIX G. As estimated for an unconfined aquifer, pumping the project well at 6.7 gpm for 8 hours might result in a zone of pumping influence extending 160 feet from the well. The closest neighboring well which is approximately 1,583 feet from the site well is located outside of the potential area of pumping influence. The nearest surface water is an unnamed creek located approximately 1,700 feet southwest of the project well and is also outside the wells potential area of pumping influence.

The maximum daily Project water demand is 4,199 gallons (Outdoor and Greenhouse Cultivation), which would require about 10.5 hours of pumping with a well yield of 6.7 gpm. Therefore, the actual extent of pumping influence from the Project well may be slightly more than estimated in our calculations. However, the peak usage rate is scheduled to occur only two months a year (during peak outdoor cannabis watering) with typical daily demand being met with approximately 6 hours of pumping with a well yield of 6.7gpm.

8.0 CONCLUSIONS

The aquifers in the Wilson Grove and Franciscan Formations are generally considered unconfined to semiconfined and recharge to the aquifer proximate to the site likely occurs primarily from rainfall and stream flow in Stemple Creek. The aquifers penetrated by wells within the Cumulative Impact Area have an estimated average thickness of 87 feet extending over the 500-acre area and with a conservatively estimated specific yield of 5% produces a total aquifer storage value of 2,175 acre-feet. The annual recharge to the aquifer is estimated to be 125-acre-feet. The current annual water demand within the Cumulative Impact Area is conservatively estimated to be 42.9 acre-feet. The estimated annual water demand for the proposed Project is 2.93 acre-feet and the total annual site water demand is 5.94 acre-feet (without consideration of the Applicant's water conservation and rainwater catchment offset plans). The total annual water demand proposed for the site is sustainable based on current and future development within the Cumulative Impact Area. In summary:

2,175.00 acre-feet	Aquifer Storage
125.00 acre-feet	Annual Recharge to Aquifer
42.90 acre-feet	Cumulative Impact Area Current Annual Water Demand
63.59 acre-feet	Cumulative Impact Area Future Potential Annual Water Demand
5.94 acre-feet	Site Total Annual Water Demand (Domestic/Project/Grazing)
2.93 acre-feet	Site Project Annual Water Demand
1.68 acre-feet	Site Cattle Grazing Water Demand
1.33 acre-feet	Site Domestic Water Demand
0.85 acre-feet	Site Estimated Rainfall Catchment system offset

Based on the conservative assumptions and estimates presented in this report, the quantity of groundwater to be used for the project and within the Cumulative Impact Area compared to the quantity of available groundwater indicates that pumping for the Project is unlikely to result in significant declines groundwater resources over time. Based on the findings of this report, pumping and groundwater extraction at the Project well will not significantly impact neighboring wells or stream flow conditions in nearby creeks. In addition, based on the relative distance to the coastal areas, the depth of the site well and the proposed water usage rates, salt water intrusion is not considered to be a concern to this Assessment.

9.0 LIMITATIONS

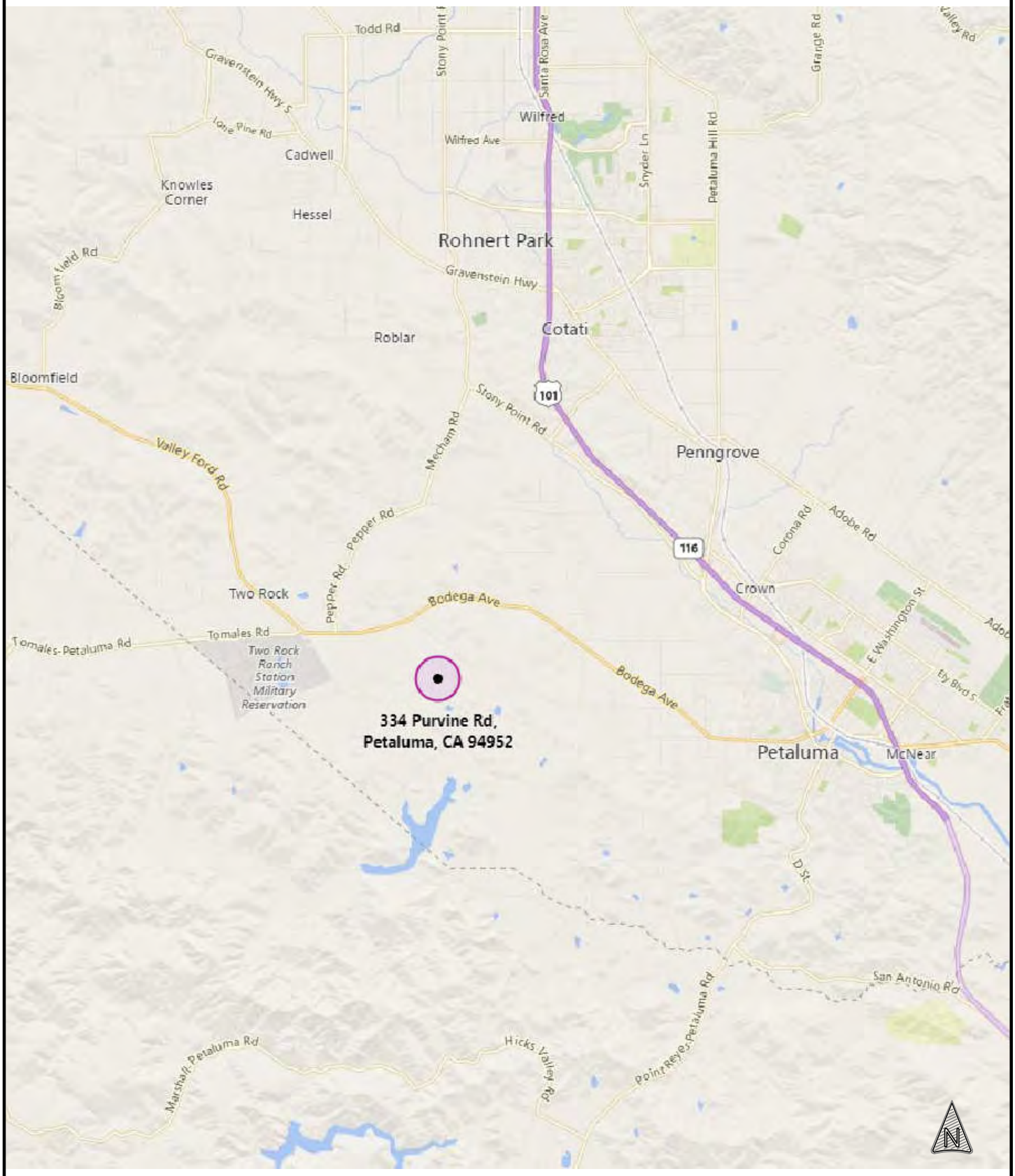
HES is not responsible for the independent conclusions, opinions or recommendations made by others based on the records review, site inspection, field exploration, laboratory test data and interpretations presented in this report.

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

It should be noted that hydro-geological assessments are inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and site evaluation. Additionally, the passage of time may result in a change in the environmental characteristics at this site and surrounding properties. This report does not warrant against future operations or conditions, nor does this warrant operations or conditions present of a type or at a location not investigated.

This study is not intended to assess if any soil contamination, waste emplacement, or groundwater contamination exists by subsurface sampling through the completion of soil borings and the installation of monitoring wells. The scope of work, determined by the client, did not include these activities.

This Report is for the exclusive use of Petaluma Hills Farms, his affiliates, designates and assignees and no other party shall have any right to rely on any service provided by Hurvitz Environmental Services without prior written consent.



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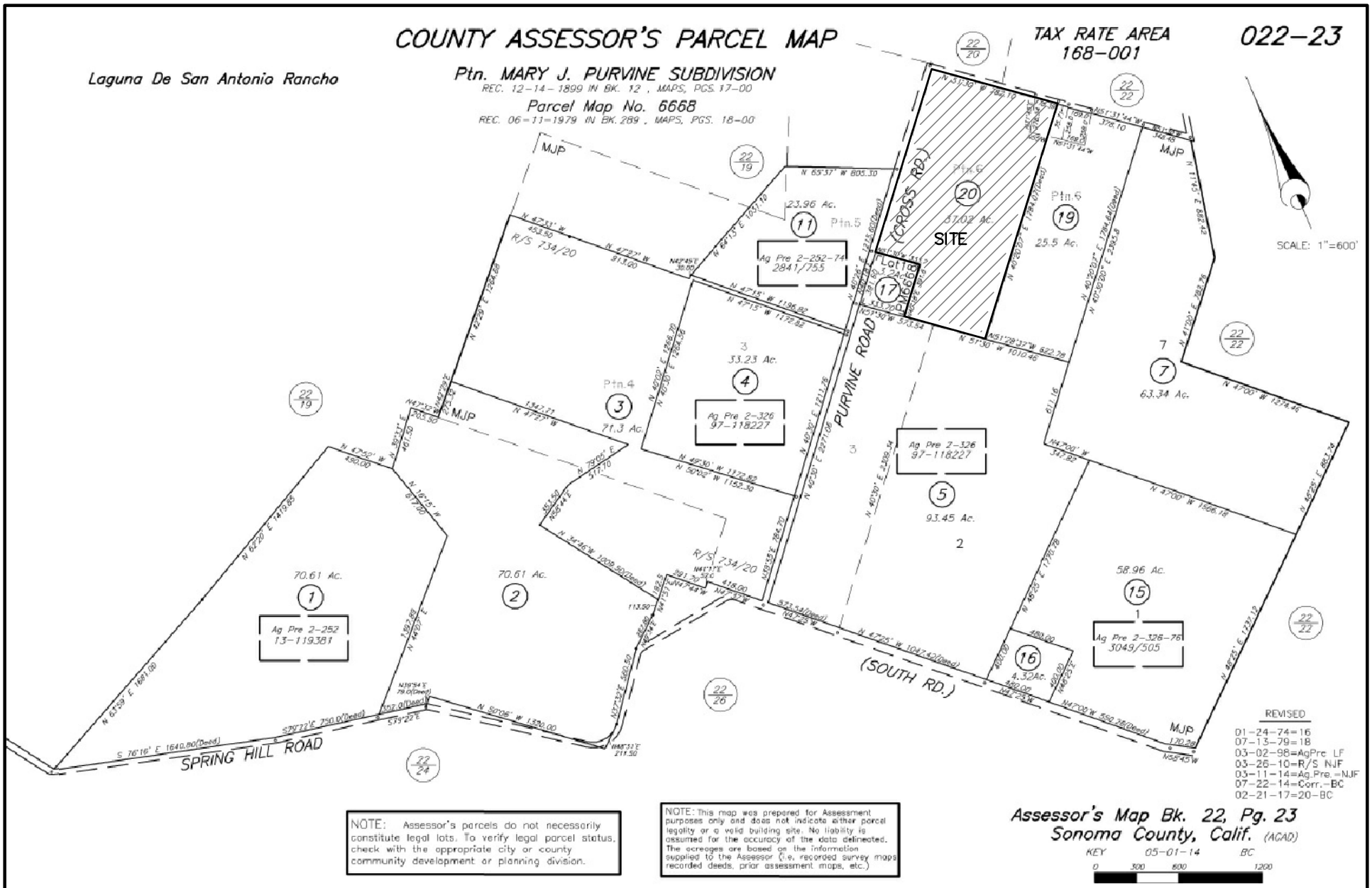
SITE LOCATION MAP

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 2/12/18
PLATE: 1



NOTE: Assessor's parcels do not necessarily constitute legal lots. To verify legal parcel status, check with the appropriate city or county community development or planning division.

NOTE: This map was prepared for Assessment purposes only and does not indicate either parcel legality or a valid building site. No liability is assumed for the accuracy of the data delineated. The acreages are based on the information supplied to the Assessor (i.e. recorded survey maps recorded deeds, prior assessment maps, etc.)

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ASSESSORS PARCEL MAP

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 3/22/18
PLATE: 2

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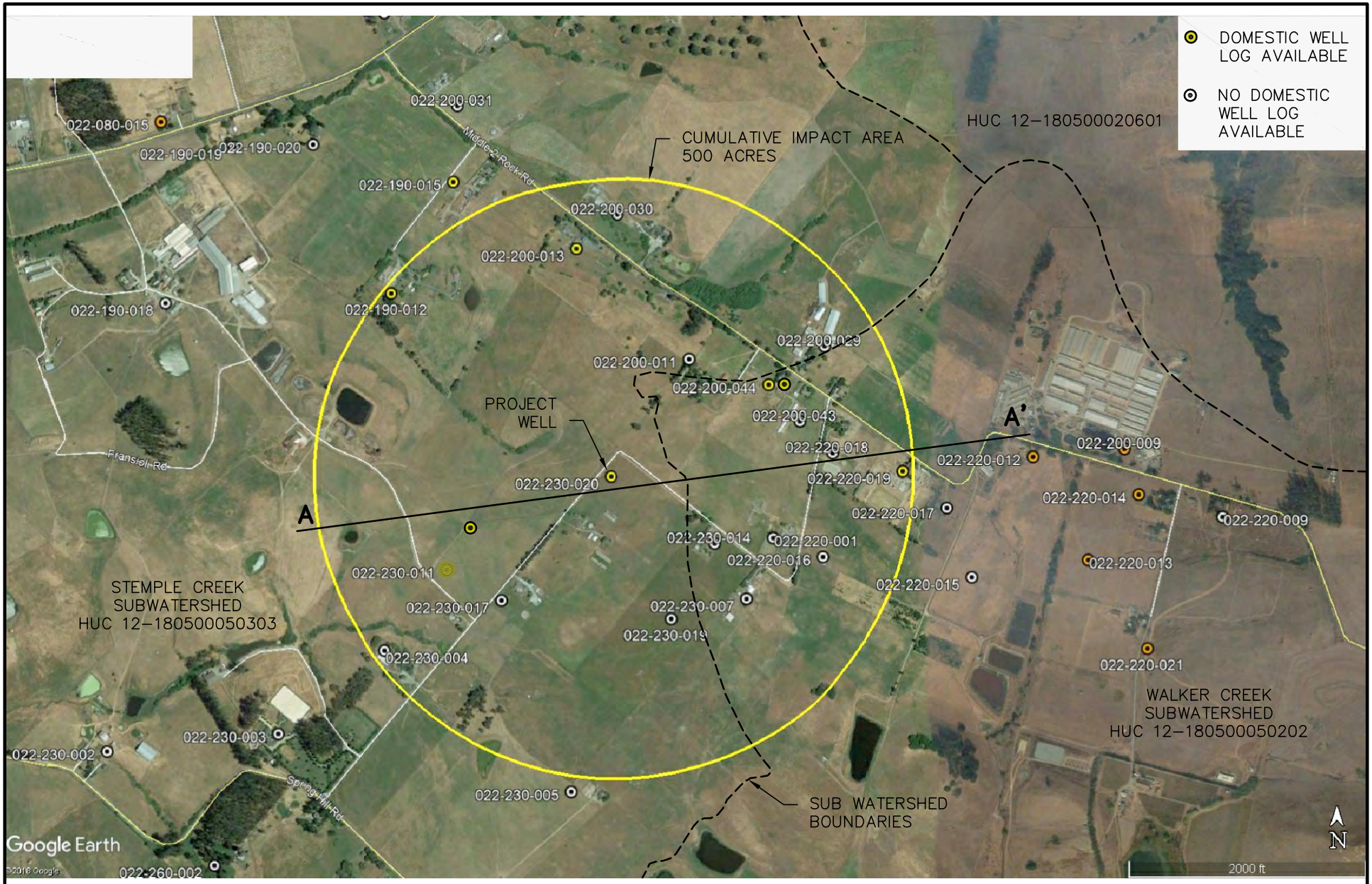
PROPOSED ENGINEERED SITE LAYOUT

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 3/26/18
PLATE: 3



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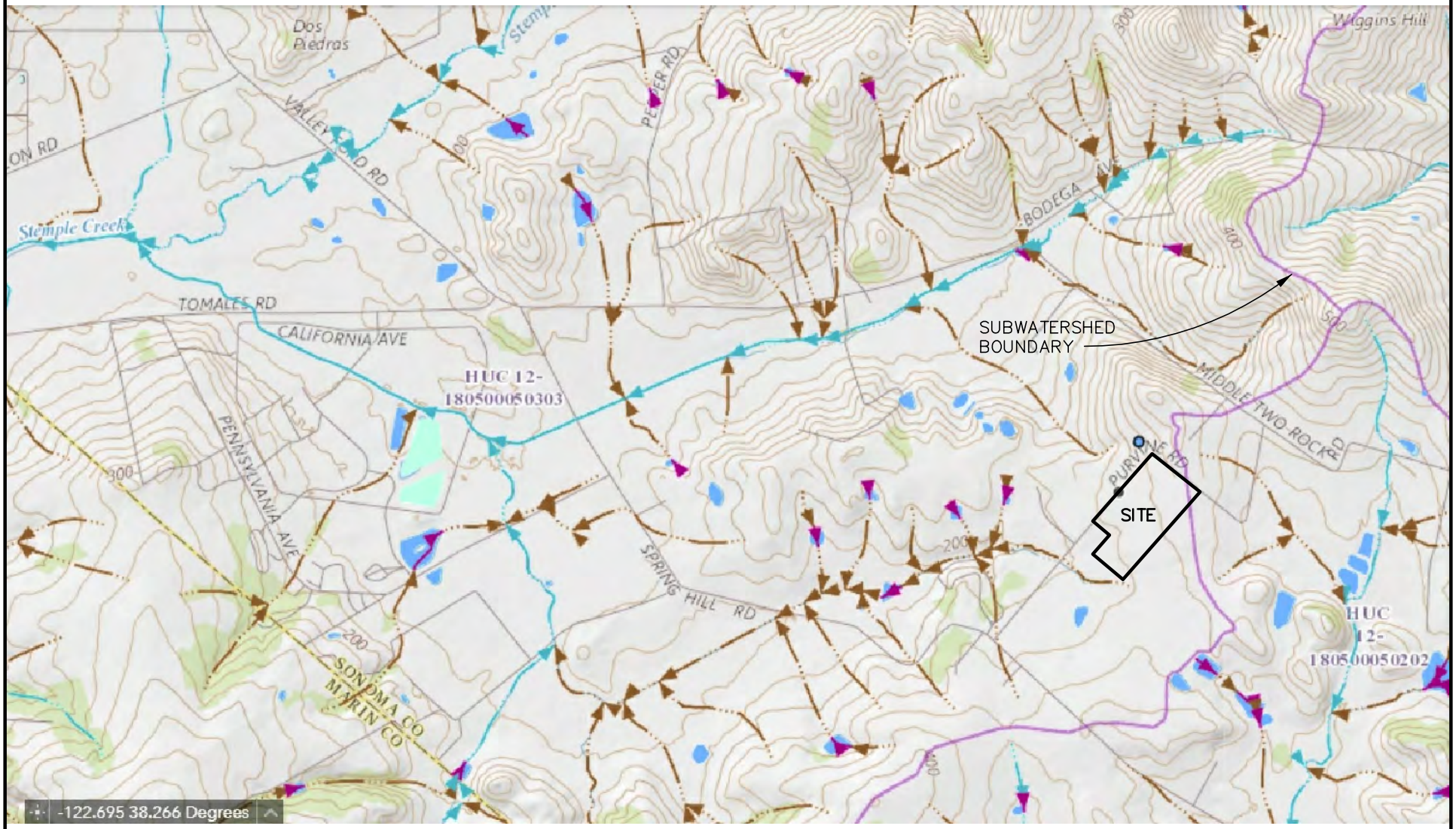
SITE PLAN WITH CUMULATIVE IMPACT AREA

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 3/26/18
PLATE: 5



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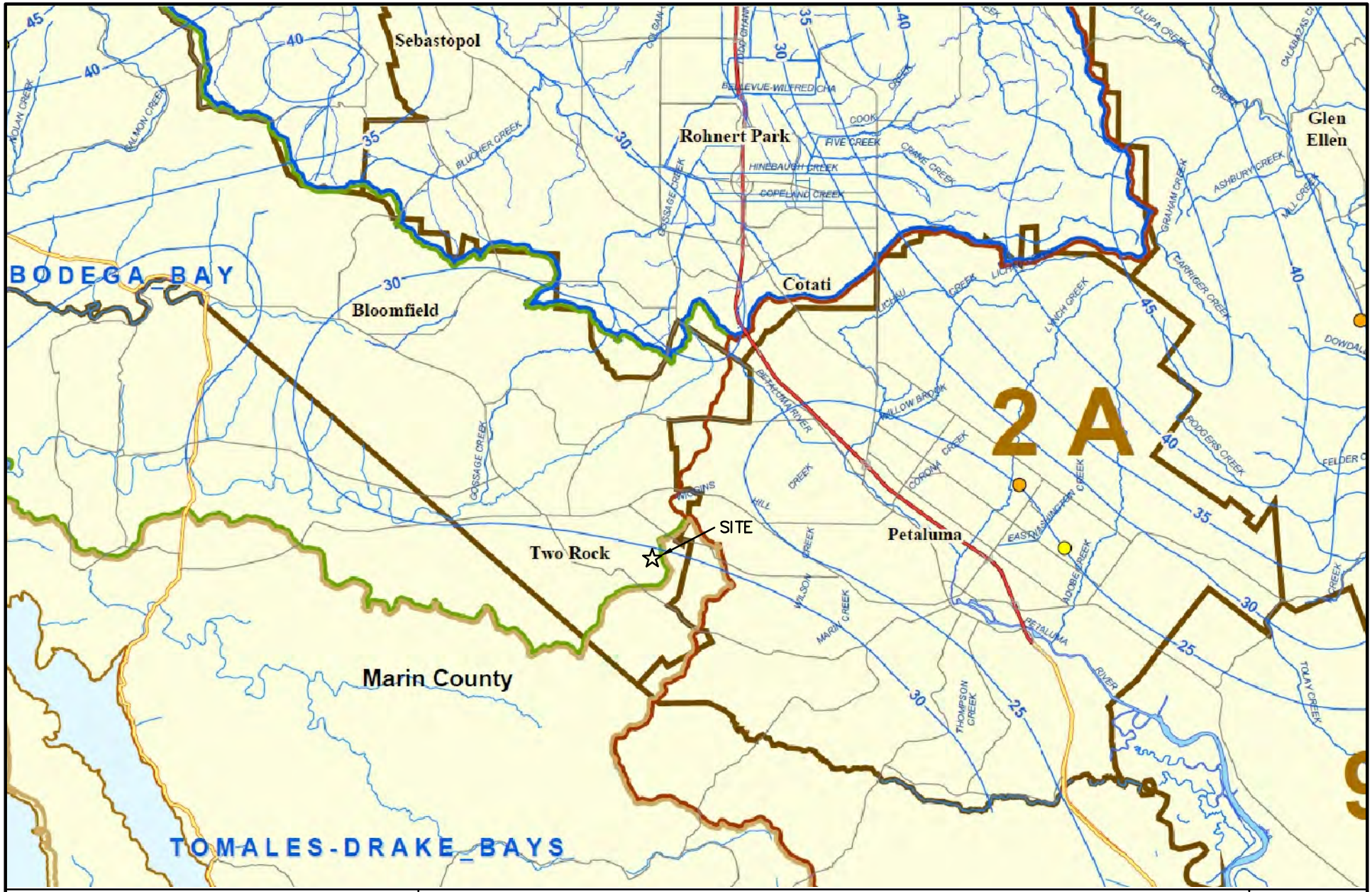
USGS TOPOGRAPHIC MAP

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 3/22/18
PLATE: 4



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PRECIPITATION MAP

334 PURVINE RD
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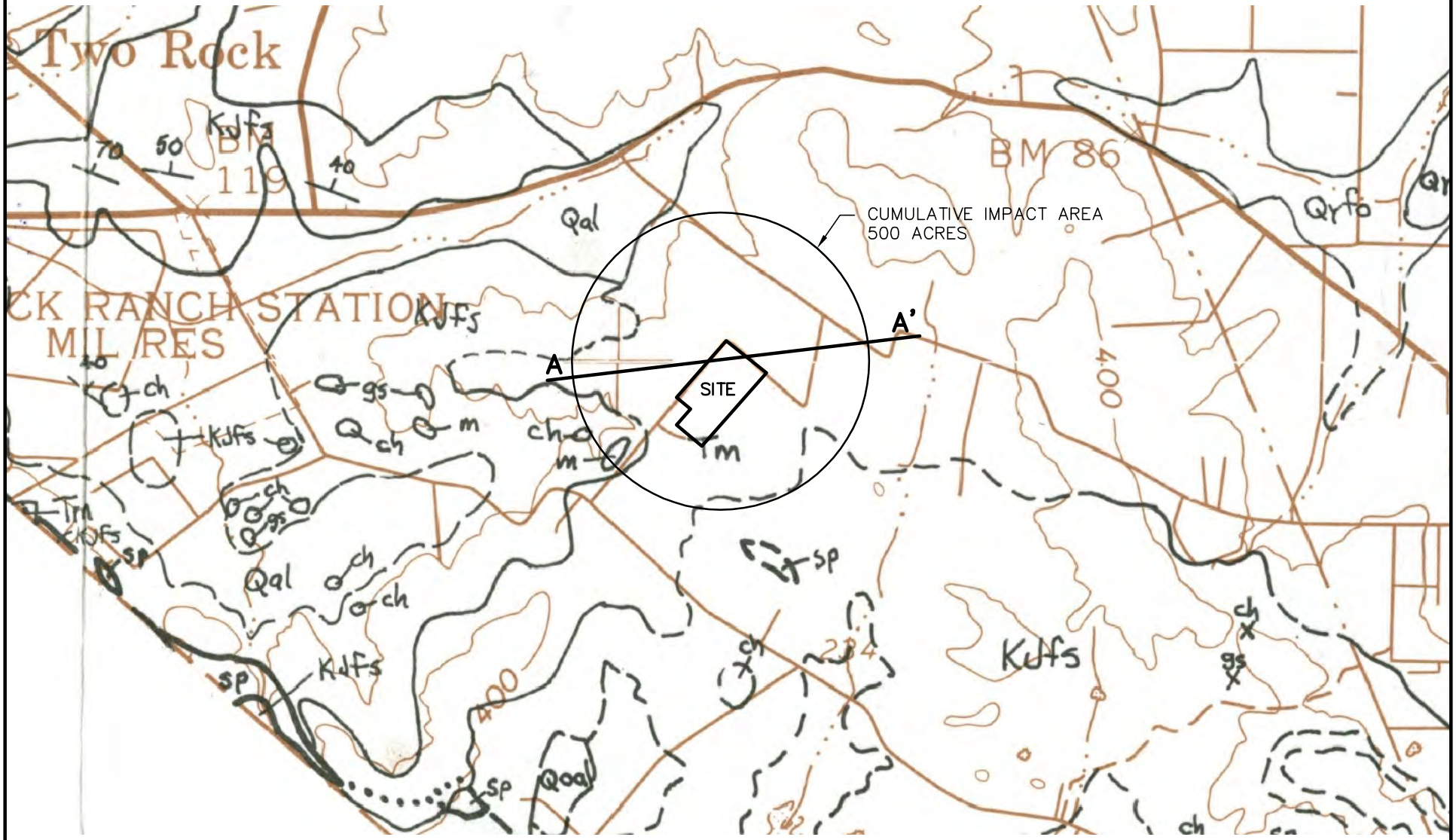
JOB NUMBER: 4026.01
DATE: 3/26/18
PLATE: 6



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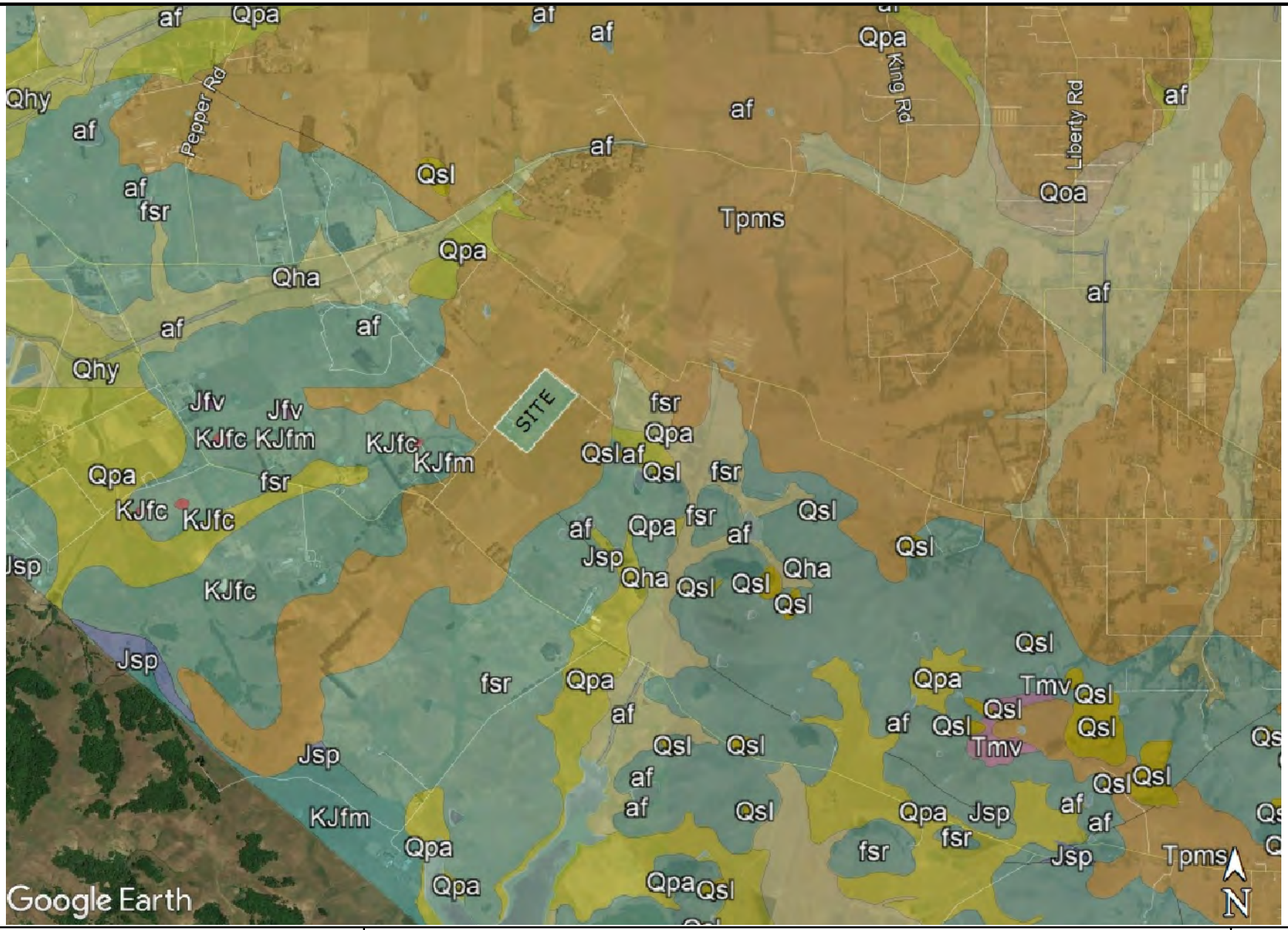
GEOLOGIC MAP DETAIL

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 3/26/18
PLATE: 7



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REGIONAL GEOLOGIC MAP

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 3/26/18
PLATE: 8A

Surficial Sediments	
af	Artificial Fill
Qhym	Mud deposits (late Holocene)
Qhy	Alluvium (late Holocene)
Qha	Alluvium (Holocene)
Qs	Beach and dune sand (Quaternary)
Qsl	Hillslope Deposits (Quaternary)
Qpa	Alluvium (Pleistocene)
Qt	Marine terrace deposits (Pleistocene)
Qoa	Alluvium (early Pleistocene)

Overlying Rocks	
QTs	Sediments (early Pleistocene and (or) Pliocene)
QTv	Volcanic rocks (early Pleistocene and (or) Pliocene)
Tps	Sedimentary rocks (Pliocene)
Tpv	Volcanic rocks (Pliocene)
Tpms	Sedimentary rocks (Pliocene and early Miocene)
Tpmv	Volcanic rocks (Pliocene and early Miocene)
Tms	Sedimentary rocks (Miocene)
Tmv	Volcanic rocks (Miocene)
Tmos	Sedimentary rocks (Miocene and (or) Oligocene)
Tmov	Volcanic rocks (Miocene and/or Oligocene)
Tmoes	Sedimentary rocks (Miocene, Oligocene, and (or) Eocene)
Tos	Sedimentary rocks (Oligocene)
Tov	Volcanic rocks (Oligocene)
Toes	Sedimentary rocks (Oligocene and (or) Eocene)
Tes	Sedimentary rocks (Eocene)
Tepas	Sedimentary rocks (Eocene and (or) Paleocene)
Tpas	Sedimentary rocks (Paleocene)
TKs	Sedimentary rocks (Paleocene and (or) Late Cretaceous)

Basement Complex Rocks	
TKfs	Franciscan Complex sedimentary rocks (Eocene, Paleocene, and (or) Late Cretaceous)
fsr	Franciscan Complex mélange (Eocen, Paleocent, and (or) Late Cretaceous)
TKfv	Franciscan Complex volcanic rocks (Paleocene and (or) Late Cretaceous)
Ks	Great Valley complex sedimentary rocks (Cretaceous)
Kfs	Franciscan Complex sedimentary rocks (Cretaceous)
Kfv	Franciscan Complex volcanic rocks (Cretaceous)
Kfm	Franciscan Complex metamorphic rocks (Cretaceous)
Kgr	Salinian complex plutonic (granite) rocks (Cretaceous)
KJs	Great Valley complex sedimentary rocks (Early Cretaceous and (or) Late Jurassic)
KJv	Franciscan or Great Valley complex volcanic rocks (Early Cretaceous and (or) Late Jurassic)
KJfs	Franciscan Complex sedimentary rocks (Early Cretaceous and (or) Late Jurassic)
KJfc	Franciscan Complex chert (Early Cretaceous and (or) Late Jurassic)
KJfv	Franciscan Complex volcanic rocks (Early Cretaceous and (or) Late Jurassic)
KJfm	Franciscan Complex metamorphic rocks (Early Cretaceous and (or) Late Jurassic)
KJfvc	Franciscan Complex volcanic rocks and chert (Early Cretaceous and (or) Late Jurassic)
KJfvs	Franciscan Complex volcanic and sedimentary rocks (Early Cretaceous and (or) Late Jurassic)
Jv	Great Valley complex volcanic rocks (Jurassic)
Ji	Great Valley complex plutonic rocks (Jurassic)
Jsp	Great Valley complex serpentinite (Jurassic)
Jfv	Franciscan Complex volcanic rocks (Jurassic)
Jig	Salinian complex plutonic rocks (Jurassic)
MzPzm	Salinian complex metamorphic rocks (Mesozoic and (or) Paleozoic)
	Depositional or intrusive contact
	Fault
	Fault active in the Holocene (within the last 11,500 years)
A	Letter showing the approximate location where a rock or fossil on this poster was found

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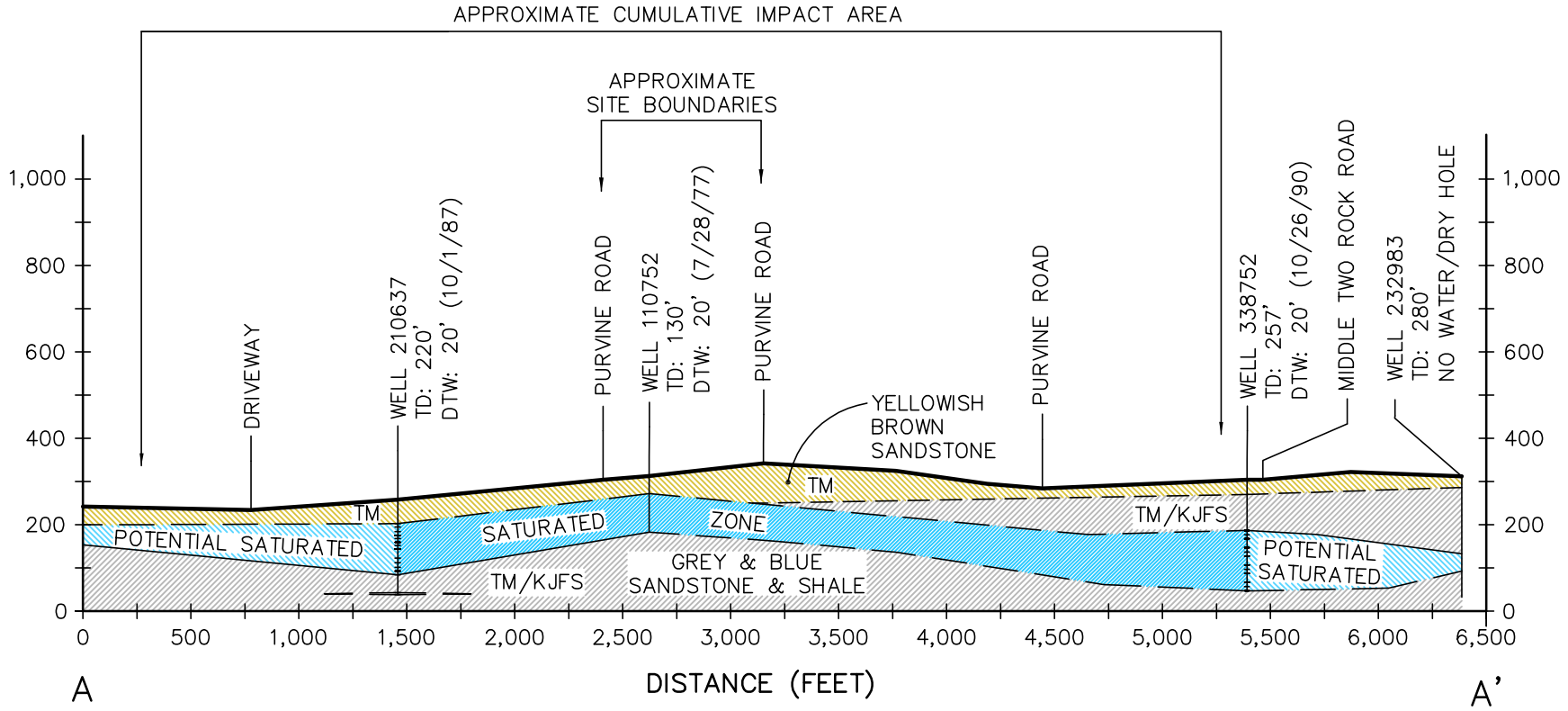
REGIONAL GEOLOGIC MAP KEY

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 3/26/18
PLATE: 8B

Tm = WILSON GROVE FORMATION (AKA MERCED FORMATION): MARINE SANDSTONE, CONGLOMERATE, TUFF.

KJfs = FRANSICAN ASSEMBLAGE: SHEARED SHALE AND SANDSTONE THAT CONTAIN GENERALLY RESISTANT MASSES OF CHERT.



NOTE:
THIS CROSS-SECTION IS AN INTERPRETATION OF SUBSURFACE CONDITIONS BASED ON WELL DRILLERS LOGS AND GEOLOGIC MAPS REFERENCED IN THE REPORT.

VERICAL SCALE
0' 200' 400'
1"=400'

HORIZONTAL SCALE
0' 400' 800'
1"=800'

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GEOLOGIC CROSS SECTION

334 PURVINE RD
PETALUMA, CALIFORNIA 94952

JOB NUMBER: 4026.01
DATE: 3/30/18
PLATE: 9

APPENDIX A
PHOTOGRAPHIC LOG

SITE PHOTOGRAPHS

Photo 1: View of main residence and garage onsite.

Photo 2: View of granny unit onsite.

Photo 3: View of Well/Pump House. Two 3,000-gallon poly tanks and a well are located inside the building.

Photo 4: View of former barn that was removed from the property and where the proposed greenhouse will be . The concrete block in the foreground is a hand dug well.

Photo 5: View of a another set of former barns that were recently removed for the purpose of future greenhouse development.

Photo 6: View third former barn that was removed for the purpose of developing outdoor cultivation space. The building on the right will be utilized for indoor cultivation.

Photo 7: Close-up view of the domestic well.

Photo 8: View of the proposed outdoor cultivation area after barn removal.

Photo 9: View of proposed greenhouse location after barn removal.

Photo 10: View of second proposed greenhouse area after barn removal.

Photo 11: Alternate view of the same former barn and proposed greenhouse area seen above.

APPENDIX B
GRAY WATER COLLECTION SYSTEM

Realm Engineering
1767 Market St., Ste C Redding CA 96001 530. 526 .7493

GRAYWATER COLLECTION SYSTEMS FOR SONOMA COUNTY

Project Name: Petaluma Hills Farms **Date:** July 23, 2017

Client Name and Address:
334 Purvine Road
Petaluma CA
APN: 000-022-230-018

The proposed project located at 334 Purvine Road in Petaluma will incorporate the use of "Graywater" in irrigating its native screening landscaping so that surface water discharges can be mitigated. Graywater is all wastewater generated from the site that does not have fecal contamination. Sources include landscape runoff, sinks, showers, baths, clothes washing machines and dish washers. As graywater contains fewer pathogens than domestic wastewater, it is generally safer to handle and easier to treat and reuse onsite for crop irrigation and other non-potable uses.

The benefits of using graywater include reducing the needs of irrigation water for native screening plants, saving money, and increasing the effective water supply for irrigation needs. While graywater is a pollutant if it is released into streams or watercourses, it is safe for irrigating plants and acts as a gentle fertilizer. Graywater can be used for the ornamentals or vegetables if it does not touch the edibles themselves. For more requirements, specifications, and regulations relating to graywater systems, see 2016 California Plumbing Code (CPC) Chapter 15. Sonoma County will refer to this document to plan check and inspect installed systems for compliance.

The proposed components of the graywater system includes bio swales, mulching basins, and a central 1500-gallon gravity fed Orenco recirculating tank which will provide the native screening landscaping with filtered dosing interval irrigation. Each landscape screening plant will be fed with a 5-gallon mulching basin within its vicinity. Since graywater cannot be stored more than 24 hours in the tank, the dosing system will deplete the tank at a constant rate so not to overwater the landscape areas and to keep the graywater from going septic.

The recirculating tank will be fed with graywater from bio swales which will be constructed downstream of the overall gradient of the property. The design of the bio swales and mulching basins are intended to handle the 24-hour irrigation runoff loads during the wet and dry seasons and most importantly keep all water on site. The water filtration system is most challenged during the winter months and the system will be designed to ensure that during

storm events it can handle both graywater and surface water. The property will also have a perimeter bio swale that will prevent storm water run-on and any possible contaminants from entering the parcel.

In summary, our professionals will design a graywater irrigation system consisting of bio swales, mulching basins and a recirculating tank that will irrigate the proposed screening landscaping along the fence and exterior to help mitigate surface water discharge. The design of the system will be based on the information provided in the two tables shown below (Chapter 15 of CPC) as well as the project's irrigation needs and projected run off. It is our goal to produce an everlasting, maintenance free solution to the irrigation and run-off issues at the site.

This was prepared for Petaluma Hills Farms for their CUP submittal and will be eventually followed up with design and construction documents of the proposed graywater irrigation system for building department review and approval for installation.

Sincerely,

Jason Vine RCE 67800

CHAPTER 15

ALTERNATE WATER SOURCES FOR NONPOTABLE APPLICATIONS

Intent

The provisions of this chapter are intended to:

1. *Conserve water by facilitating greater reuse of laundry, shower, lavatory and similar sources of discharge for irrigation and/or indoor use.*
2. *Reduce the number of non-compliant gray water systems by making legal compliance easily achievable.*
3. *Provide guidance for avoiding potentially unhealthful conditions.*
4. *Provide an alternative way to relieve stress on a private sewage disposal system by diverting the graywater.*

1501.0 General

1501.1 Applicability. ***[HCD 1]*** *Except as otherwise provided for in this chapter, the provisions of this code shall be applicable to alternate water source system installation.* ***[BSC & HCD 1]*** The provisions of this chapter shall apply to the construction, alteration, *discharge, use* and repair of alternate water source systems for nonpotable applications.

1501.1.1 Allowable Use of Alternate Water. Where approved or required by the Authority Having Jurisdiction, alternate water sources [reclaimed (recycled) water, gray water, and on-site treated nonpotable *gray* water] shall be permitted to be used in lieu of potable water for the applications identified in this chapter.

1501.2 System Design. *Alternate water source systems complying with this chapter shall be designed by a person who demonstrates competency to design the alternate water source system as required by the Enforcing Agency. The Enforcing Agency may also require plans and specifications to be prepared by a licensed design professional for Complex Systems. Components, piping, and fittings used in any alternate water source system shall be listed.*

1501.3 Permit. It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered an alternate water source system in a building or on a premise without first obtaining a permit to do such work. *Prior to commencing the issuance of permits for indoor gray water systems pursuant to state requirements relating to gray water, a city, county, city and county or other local agency shall seek consultation with the local public health department to ensure that local public health concerns are addressed in local standards or ordinances, or in issuing permits. See California Water Code Section 14877.3.*

Exception: [HCD 1] *A construction permit shall not be required for a clothes washer system meeting the requirements of Section 1502.1.1.*

1501.4 Component Identification. System components shall be properly identified as to the manufacturer.

1501.5 Maintenance and Inspection. Alternate water source systems and components shall be inspected and maintained in accordance with *the manufacturer's recommendations and/or as required by the Enforcing Agency.* ***[BSC]*** *Where no manufacturers recommendations exist, additional recommendations are listed in Table 1501.5.*

***1501.5.1* Maintenance Responsibility.** The required maintenance and inspection of alternate water source systems shall be the responsibility of the property owner, unless otherwise required by the Authority Having Jurisdiction.

1501.6 Operation and Maintenance Manual. An operation and maintenance manual for gray water and on-site treated water systems required to have a permit in accordance with Section 1501.3 shall be supplied to the building owner by the system designer *or installer.* The operating and maintenance manual shall include the following:

(1) *Diagram(s)* of the entire system and the location of system components.

(2) Instructions on operating and maintaining the system.

(3) *Instructions* on maintaining the required water quality *for on-site treated nonpotable water systems.*

(4) Details on *startup, shutdown, and* deactivating the system for maintenance, repair, or other purposes.

(5) Applicable testing, inspection, and maintenance frequencies in accordance with *Section 1501.5.*

(6) A method of contacting the *installer and/or* manufacturer(s).

(7) Directions to the owner or occupant that the manual shall remain with the building throughout the life cycle of the structure.

1501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements *for on-site nonpotable treated gray water systems, the requirements of NSF 350 shall apply.*

Exception: Water treatment is not required for gray water used *in a disposal field or* for subsurface *or subsoil* irrigation.

1501.8 Material Compatibility. Alternate water source systems shall be constructed of materials that are compatible with the type of pipe and fitting materials, water treatment, and water conditions in the system.

TABLE 1501.5 *[BSC]*
***RECOMMENDED* MINIMUM ALTERNATE WATER SOURCE TESTING, INSPECTION, AND MAINTENANCE FREQUENCY**

DESCRIPTION	MINIMUM FREQUENCY
Inspect and clean filters and screens, and replace (where necessary).	*In accordance with manufacturer's instructions, and/or the Authority Having Jurisdiction, or every 3 months.*
Inspect and verify that disinfection, filters and water quality treatment devices and systems are operational and maintaining minimum water quality requirements as determined by the Authority Having Jurisdiction.	In accordance with manufacturer's instructions, and the Authority Having Jurisdiction.
Inspect pumps and verify operation.	*In accordance with manufacturer's instructions, and/or the Authority Having Jurisdiction, or after installation and every 12 months thereafter.*
Inspect valves and verify operation.	*In accordance with manufacturer's instructions, and/or Authority Having Jurisdiction, or after installation and every 12 months thereafter.*
Inspect pressure tanks and verify operation.	*In accordance with manufacturer's instructions, and/or the Authority Having Jurisdiction, or after installation and every 12 months thereafter.*
Clear debris from and inspect storage tanks, locking devices, and verify operation.	*In accordance with manufacturer's instructions, and/or the Authority Having Jurisdiction, or after installation and every 12 months thereafter.*
Inspect caution labels and marking.	*In accordance with manufacturer's instructions, and/or the Authority Having Jurisdiction, or after installation and every 12 months thereafter.*
Inspect and maintain mulch basins for gray water irrigation systems.	As needed to maintain mulch depth and prevent ponding and runoff.
Cross-connection inspection and test*	*In accordance with this chapter, and/or the Authority Having Jurisdiction, or after installation and every 12 months thereafter.*

* The cross-connection test shall be performed in the presence of the Authority Having Jurisdiction in accordance with the requirements of this chapter, *unless site conditions do not require it. Alternate testing requirements shall be permitted by the Authority Having Jurisdiction.*

1501.9 System Controls. Controls for pumps, valves, and other devices that contain mercury that come in contact with alternate water source water supply shall not be permitted.

1501.10 Commercial, Industrial, Institutional, *and Residential* Restroom Signs. A sign shall be installed in restrooms in commercial, industrial, institutional occupancies, *and shall also be installed in residential common use area restrooms* using reclaimed (recycled) water and on-site treated *nonpotable gray* water for water closets, urinals, or both. Each sign shall contain the following text:

TO CONSERVE WATER, THIS BUILDING USES *_____* *ON-SITE TREATED NONPOTABLE GRAY WATER* TO FLUSH TOILETS AND URINALS

1501.10.1 Equipment Room Signs. Each room containing reclaimed (recycled) water and on-site treated *gray* water equipment shall have a sign posted in a location that is visible to anyone working on or near nonpotable *gray* water equipment with the following wording in 1 inch (25.4 mm) letters:

CAUTION: NONPOTABLE *_____*, DO NOT DRINK. DO NOT CONNECT TO DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

*_____*Shall indicate RECLAIMED (RECYCLED) WATER or ON-SITE TREATED *GRAY*-WATER, accordingly.

1501.11 Inspection and Testing. Alternate water source systems shall be inspected and tested in accordance with Section 1501.11.1 and Section 1501.11.2 *and/or as required by the Authority Having Jurisdiction.*

1501.11.1 Supply System Inspection and Test. Alternate water source systems shall be inspected and tested in accordance with this code for testing of potable water piping.

1501.11.2 Cross-Connection Inspection and Testing. An initial inspection and test shall be performed on both the potable and alternate water source systems. The potable and alternate water source system shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection in accordance with Section 1501.11.2.1 through Section 1501.11.2.4.

1501.11.2.1 Visual System Inspection. Prior to commencing the cross-connection testing, a dual system inspection shall be conducted by the Authority Having Jurisdiction and other authorities having jurisdiction as follows:

(1) Meter locations of the alternate water source and potable water lines shall be checked to verify that no modifications were made, and that no cross-connections are visible.

(2) Pumps and equipment, equipment room signs, and exposed piping in equipment room shall be checked.

(3) Valves shall be checked to ensure that the valve lock seals are still in place and intact. Valve control door signs shall be checked to verify that no signs have been removed.

1501.11.2.2 Cross-Connection Test. The procedure for determining cross-connection shall be followed by the applicant in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction to determine whether a cross-connection has occurred as follows:

(1) The potable water system shall be activated and pressurized. The alternate water source system shall be shut down, depressurized, and drained.

(2) The potable water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the alternate water source system is empty. The minimum period the alternate water source system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complexity of the potable and the alternate water source distribution systems, but in no case shall that period be less than 1 hour.

(3) The drain on the alternate water source system shall be checked for flow during the test and fixtures, potable and alternate water source, shall be tested and inspected for flow. Flow from an alternate water source system outlet indicates a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the alternate water source system.

(4) The potable water system shall then be depressurized and drained.

(5) The alternate water source system shall then be activated and pressurized.

(6) The alternate water source system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour.

(7) Fixtures, potable and alternate water source, shall be tested and inspected for flow. Flow from a potable water system outlet indicates a cross-connection. No flow from an alternate water source outlet will indicate that it is connected to the potable water system.

(8) The drain on the potable water system shall be checked for flow during the test and at the end of the test.

(9) Where there is no flow detected in the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

1501.11.2.3 Discovery of Cross-Connection. In the event that a cross-connection is discovered, the following procedure, in the presence of the Authority Having Jurisdiction, shall be activated immediately:

(1) The alternate water source piping to the building shall be shut down at the meter, and the alternate water source riser shall be drained.

(2) Potable water piping to the building shall be shut down at the meter.

(3) The cross-connection shall be uncovered and disconnected.

(4) The building shall be retested in accordance with Section 1501.11.2.1 and Section 1501.11.2.2.

(5) The potable water system shall be chlorinated with 50 parts-per-million (ppm) chlorine for 24 hours.

(6) The potable water system shall be flushed after 24 hours, and a standard bacteriological test shall be performed. Where test results are acceptable, the potable water system shall be permitted to be recharged.

1501.11.2.4 Annual Inspection. An annual inspection of the alternate *gray* water source system, following the procedures listed in Section 1501.11.2.1 shall be required. Annual cross-connection testing, following the procedures listed in Section 1501.11.2.2 shall be required by the Authority Having Jurisdiction, unless site conditions do not require it. In no event shall the test occur less than once in 4 years. Alternate testing requirements shall be permitted by the Authority Having Jurisdiction.

1501.12 Separation Requirements. Underground alternate water source service piping other than gray water shall be separated from the building sewer in accordance with this code. Treated nonpotable water pipes shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where horizontal piping materials do not comply with this requirement the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the treated nonpotable water piping.

1501.13 Abandonment. Alternate water source systems that are no longer in use or fail to be maintained in accordance with Section 1501.5 shall be abandoned. Abandonment shall comply with Section 1501.13.1 and Section 1501.13.2.

1501.13.1 General. An abandoned system or part thereof covered under the scope of this chapter shall be disconnected from remaining systems, drained, plugged, and capped in an approved manner.

1501.13.2 Underground Tank. An underground water storage tank that has been abandoned or otherwise discontinued from use in a system covered under the scope of this chapter shall be completely drained and filled with earth, sand, gravel, concrete, or other approved material or removed in a manner satisfactory to the Authority Having Jurisdiction.

1501.14 Sizing. Unless otherwise provided for in this chapter, alternate water source piping shall be sized in accordance with Chapter 6 for sizing potable water piping.

1502.0 Gray Water Systems. *[BSC-CG] Gray water systems shall be verified in accordance with the California Green Building Standards Code (CALGreen), Chapter 5, Division 5.3.*

1502.1 General. The provisions of this section shall apply to the construction, alteration, and repair of gray water systems. *A city, county, or city and county or other local government may adopt, after a public hearing and enactment of an ordinance or resolution, building standards that are more restrictive than the gray water building standards adopted in this code. For additional information, see Health and Safety Code Section 18941.7.*

(A) All gray water systems shall be designed with a diverter valve to allow the user to direct the flow to the building sewer and either the irrigation field or disposal field, whichever is used. The means of changing the direction flow of the gray water shall be clearly labeled and readily accessible to the user.

(B) Water used to wash diapers or similarly soiled or infectious garments or other prohibited contents shall be diverted by the user to the building sewer.

(C) Gray water shall not be used in spray irrigation, allowed to pond or runoff and shall not be discharged directly into or reach any storm sewer system or any surface body of water.

(D) Human contact with gray water or the soil irrigated by gray water shall be minimized and avoided, except as required to maintain the gray water system. The discharge point of any gray water subsoil irrigation or subsurface irrigation field shall be covered by at least (2) inches (51 mm) of mulch, rock, or soil, or a solid shield to minimize the possibility of human contact.

(E) Gray water may be released above the ground surface provided at least two (2) inches (51 mm) of mulch, rock, or soil, or a solid shield covers the release point. Other methods which provide equivalent separation are also acceptable.

(F) Gray water shall not contain hazardous chemicals derived from activities such as cleaning car parts, washing greasy or oily rags, or disposing of waste solutions.

*(1) **[HCD 1]** The prohibition in Subsection (F) includes, but is not limited to, home photo labs or other similar hobbyist or home occupational activities.*

*(2) **[BSC]** photo labs or similar activities.*

(G) Exemption from construction permit requirements of this code shall not be deemed to grant authorization for any gray water system to be installed in a manner that violates other provisions of this code or any other laws or ordinances of the Enforcing Agency.

(H) An operation and maintenance manual shall be provided to the owner. Directions shall indicate that the manual is to remain with the building throughout the life of the system and upon change of ownership or occupancy.

(I) A gray water system shall not be connected to any potable water system without an air gap, reduced-pressure principle backflow preventer, or other physical device which prevents backflow and shall not cause ponding or runoff of gray water.

***1502.1.1 [HCD 1] Clothes Washer System.** A clothes washer system in compliance with all of the following is exempt from the construction permit specified in Section 1.8.4.1 and may be installed or altered without a construction permit:*

(1) If required, notification has been provided to the enforcing agency regarding the proposed location and installation of a gray water irrigation or disposal system.

(2) The design shall allow the user to direct the flow to the irrigation or disposal field or the building sewer. The direction control of the gray water shall be clearly labeled and readily accessible to the user.

(3) The installation, change, alteration, or repair of the system does not include a potable water connection or a pump and does not affect other building, plumbing, electrical, or mechanical components including structural features, egress, fire-life safety, sanitation, potable water supply piping, or accessibility.

***Note:** The pump in a clothes washer shall not be considered part of the gray water system.*

(4) The gray water shall be contained on the site where it is generated.

(5) Gray water shall be directed to and contained within an irrigation or disposal field.

(6) Ponding or runoff is prohibited and shall be considered a nuisance.

(7) Gray water may be released above the ground surface provided at least two (2) inches (51 mm) of mulch, rock, or soil, or a solid shield covers the release point. Other methods which provide equivalent separation are also acceptable.

(8) Gray water systems shall be designed to minimize contact with humans and domestic pets.

(9) *Water used to wash diapers or similarly soiled or infectious garments shall not be used and shall be diverted to the building sewer.*

(10) *Gray water shall not contain hazardous chemicals derived from activities such as cleaning car parts, washing greasy or oily rags, or disposing of waste solutions from home photo labs or similar hobbyist or home occupational activities.*

(11) *Exemption from construction permit requirements of this code shall not be deemed to grant authorization for any gray water system to be installed in a manner that violates other provisions of this code or any other laws or ordinances of the enforcing agency.*

(12) *An operation and maintenance manual shall be provided to the owner. Directions shall indicate that the manual is to remain with the building throughout the life of the system and upon change of ownership or occupancy.*

(13) *Gray water discharge from a clothes washer system through a standpipe shall be properly trapped in accordance with Section 1005.0*

1502.1.2 Simple System. *Simple systems exceed a clothes washer system and shall comply with the following:*

(1) *The discharge capacity of a gray water system shall be determined by Section 1502.8. Simple systems have a discharge capacity of 250 gallons (947 L) per day or less.*

(2) *Simple systems shall require a construction permit, unless exempted from a construction permit by the Enforcing Agency. The Enforcing Agency shall consult with the water purveyor for any public water system (as defined in Health and Safety Code Section 116275) providing drinking water to the dwelling or non-residential structure before allowing an exemption from a construction permit.*

(3) *The design of simple systems shall meet generally accepted gray water system design criteria.*

1502.1.3 Complex System. *Any gray water system that is not a clothes washer system or simple system shall comply with the following:*

(1) *The discharge capacity of a gray water system shall be determined by Section 1502.8. Complex systems have a discharge capacity over 250 gallons (947 L) per day.*

(2) *Complex systems shall require a construction permit, unless exempted from a construction permit by the Enforcing Agency. The Enforcing Agency shall consult with the water purveyor for any public water system (as defined in Health and Safety Code, Section 116275) providing drinking water to the dwelling or non-residential structure before allowing an exemption from a construction permit.*

» **1502.2 System Requirements.** Gray water shall be permitted to be diverted away from a sewer or private sewage disposal system, and discharge to a subsurface irrigation or subsoil irrigation system, *or disposal field*. The gray water shall be permitted to discharge to a mulch basin for *residential occupancies*. Gray water shall not be used to irrigate root crops or food crops intended for human consumption that come in contact with soil.

1502.2.1 Surge Capacity. Gray water systems shall be designed to have the capacity to accommodate peak flow rates and distribute the total amount of estimated gray water on a daily basis to a subsurface irrigation field, subsoil irrigation field, *disposal field*, or mulch basin without surfacing, ponding, or runoff. A surge tank is required for systems that are unable to accommodate peak flow rates and distribute the total amount of gray water by gravity drainage. The water discharge for gray water systems shall be determined in accordance with Section 1502.8.1. «

Exception: *It is not the intent of this section to require that all gray water must be handled by an irrigation field or disposal field. It is acceptable for excess gray water to be diverted to the building sewer through a diverter valve or overflow drain as permitted in this chapter.*

1502.2.2 Diversion. The gray water system shall connect to the sanitary drainage system downstream of fixture traps and vent connections through an approved diverter valve. The diverter *valve* shall be installed in *a readily* accessible location and clearly indicate the direction of flow.

Exception: [HCD 1] *A clothes washer system in compliance with Section 1502.1.1.*

1502.2.3 Backwater Valves. Gray water drains subject to backflow shall be provided with a backwater valve *at the point of connection to the building sewer system,* so located as to be accessible for inspection and maintenance.

1502.3 Connections to Potable and Reclaimed (Recycled) Water Systems. Gray water systems shall have no *unprotected* connection to a potable water supply, on-site treated nonpotable water supply, or reclaimed (recycled) water systems. Potable, on-site treated nonpotable, reclaimed (recycled) water, *or rainwater* is permitted to be used as makeup water for a non-pressurized storagetank provided the connection is protected by an air gap, *reduced-pressure principle backflow preventer, or other physical device which prevents backflow* in accordance with this code.

1502.4 Location. No gray water system or part thereof shall be located on a lot other than the lot that is the site of the building or structure that discharges the gray water, nor shall a gray water system or part thereof be located at a point having less than the minimum distances indicated in Table 1502.4.

Exception: *When there exists a lawfully recorded perpetual and exclusive covenant to an easement appurtenant and right-of-way between adjoining land-owners of two or more contiguous lots to discharge gray water from one lot to an adjoining lot.*

1502.5 Plot Plan Submission. No permit for a gray water system shall be issued until a plot plan with data satisfactory to the Authority Having Jurisdiction has been submitted and approved.

Exception: [HCD 1] *A construction permit shall not be required for a clothes washer system in compliance with Section 1502.1.1.*

1502.6 Prohibited Location. Where there is insufficient lot area or inappropriate soil conditions for adequate absorption, no gray water system shall be permitted.

1502.7 Drawings and Specifications. The Authority Having Jurisdiction *may* require the following information to be included with or in the plot plan before a permit is issued for a gray water system, or at a time during the construction thereof:

(1) Plot plan drawn to scale and completely dimensioned, showing lot lines and structures, direction and approximate slope of surface, location of present or proposed retaining walls, drainage channels, water supply lines, wells, paved areas and structures on the plot, number of bedrooms and plumbing fixtures in each structure, location of private sewage disposal system and expansion area or building sewer connecting to the public sewer, and location of the proposed gray water system.

(2) Details of construction necessary to ensure compliance with the requirements of this chapter, together with a full description of the complete installation, including installation methods, construction, and materials.

(3) Details for holding tanks shall include dimensions, structural calculations, bracings, and such other pertinent data as required.

(4) A log of soil formations and groundwater level as determined by test holes dug in proximity to proposed irrigation *and/or disposal* area, together with a statement of water absorption characteristics of the soil at the proposed site as determined by approved percolation tests.

Exceptions:

(1) The Authority Having Jurisdiction shall permit the use of Table 1502.10 in lieu of percolation tests.

(2) The Enforcing Agency may waive the requirement for identification of groundwater level and/or soil absorption qualities based on knowledge of local conditions.

(3) The absence of groundwater in a test hole three (3) vertical feet (915 mm) below the deepest irrigation or disposal point shall be sufficient to satisfy this section unless seasonal high groundwater levels have been documented to rise to within this area.

(5) Distance between the plot and surface waters such as lakes, ponds, rivers or streams, and the slope between the plot and the surface water, where in close proximity.

TABLE 1502.4
LOCATION OF GRAY WATER SYSTEM

MINIMUM HORIZONTAL DISTANCE IN CLEAR REQUIRED FROM	SURGE TANK (feet)	SUBSURFACE AND SUBSOIL IRRIGATION FIELD AND MULCH *BASIN* (feet)	*DISPOSAL FIELD*
Building structures[1]	5[2, 3, 9]	2[3, 8]	*5*
Property line adjoining private property	5	5[8]	*5*
Water supply wells[4]	50	100	*100*
Streams and lakes[4]	50	*100*[5, 10]	*100*[5]
Sewage pits or cesspools	5	5	*5*
Sewage disposal field[10]	5	4[6]	*4*[6]
Septic tank	0	5	*5*
On-site domestic water service line	5	*0*	*0*
Pressurized public water main[7]	10	10	*10*[7]

For SI units: 1 foot = 304.8 mm

Notes:

[1] *Building structures do not include* porches and steps, whether covered or uncovered, breezeways, roofed carports, *roofed porte concheres,* roofed patios, carports, covered walks, covered driveways, and similar structures or appurtenances.

[2] The distance shall be permitted to be reduced to 0 feet for aboveground tanks where first approved by the Authority Having Jurisdiction.

[3] *Underground tanks shall not be located within a 45 degree angle from the bottom of the foundation, or they shall be designed to address the surcharge imposed by the structure. The distance may be reduced to six (6) inches (153 mm) for aboveground tanks when first approved by the Enforcing Agency.*

[4] Where special hazards are involved, the distance required shall be increased as directed by the Authority Having Jurisdiction.

[5] These minimum clear horizontal distances shall apply between the irrigation or disposal field and the ocean mean higher high tide line.

[6] Add 2 feet (610 mm) for each additional foot of depth in excess of 1 foot (305 mm) below the bottom of the drain line.

[7] For parallel construction or for crossings, approval by the Authority Having Jurisdiction shall be required.

[8] The distance shall be permitted to be reduced to 1½ feet (457 mm) for drip and mulch basin irrigation systems.

[9] The distance shall be permitted to be reduced to 0 feet for surge tanks of 75 gallons (284 L) or less.

[10] *The minimum horizontal distance may be reduced to 50 feet (15 240 mm) for irrigation or disposal fields utilizing gray water which has been filtered prior to entering the distribution piping.*

1502.8 Procedure for Estimating Gray Water Discharge. Gray water systems shall be designed to distribute the total amount of estimated gray water on a daily basis. The water discharge for gray water systems shall be determined in accordance with Section 1502.8.1 or Section 1502.8.2.

Exception: *It is not the intent of this section to require that all gray water must be handled by an irrigation field or disposal field. It is acceptable for excess gray water to be diverted to the building sewer through a diverter valve or overflow drain as permitted in this chapter*

1502.8.1 *Residential Occupancies.* The gray water discharge for *residential occupancies* shall be calculated by water use records, calculations of local daily per person interior water use, or the following procedure:

(1) The number of occupants of each dwelling unit shall be calculated as follows:

First Bedroom	2 occupants
Each additional bedroom	1 occupant

(2) The estimated gray water flows of each occupant shall be calculated as follows:

Showers, bathtubs, and lavatories	25 gallons (95 L) per day/occupant
Laundry	15 gallons (57 L) per day/occupant

(3) The total number of occupants shall be multiplied by the applicable estimated gray water discharge as provided above and the type of fixtures connected to the gray water system.

1502.8.2 Commercial, Industrial, and Institutional Occupancies. The *Authority Having Jurisdiction may utilize the* gray water discharge *procedures listed below,* water use records, or other documentation to estimate gray water discharge.

1502.8.2.1 Lavatories. *Daily discharge from lavatories may be determined by the following equation:*

(Equation 15.1)

Occupants X *lavatory flow rate* X *3*

Where:

The number of occupants = square footage of the building divided by the occupant load factor from the California Plumbing Code Chapter 4, Table A.

Lavatory fixture flow rate, new construction = That from the California Green Building Standards (CALGreen) Code Section 5.303.2.3

Lavatory fixture flow rate, existing fixtures = Actual flow rate for existing fixtures

3 = Average number of uses per person per day

1502.8.2.2 Showers. *Daily gray water discharge from showers may be determined by the following equation:*

(Equation 15.2)

Number of daily uses X *shower flow rate* X *5 minutes*

1502.8.2.3 Commercial Clothes Washers. *Daily gray water discharge from commercial clothes washers may be determined by the following equation:*

(Equation 15.3)

Cubic feet of capacity X *Water Factor* X *6*

Where:

Water Factor = Gallons per cubic foot

6 = Average number of uses per day

Note: *Cubic feet of capacity and Water Factor are contained in product specifications or are available from the washer manufacturer.*

1502.8.3 Daily Discharge*. Gray water systems using tanks shall be designed to minimize the amount of time gray water is held in the tank and shall be sized to distribute the total amount of estimated gray water on a daily basis.*

Exception: *Approved on-site treated nonpotable gray water systems.*

1502.9 Gray Water System Components. Gray water system components shall comply with Section 1502.9.1 through Section 1502.9.2.2.

[HCD 1] Gray water system components shall comply with *this chapter*.

1502.9.1 Surge Tanks. Where installed, surge tanks shall be in accordance with the following:

(1) Surge tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight. *Aboveground surge tanks shall be protected from direct sunlight or shall be constructed of UV resistant materials including but not limited to heavily tinted or opaque plastic, fiberglass, lined metal, concrete and wood.* Surge tanks constructed of steel shall be approved by the Authority Having Jurisdiction, provided such tanks are in accordance with approved applicable standards.

(2) Each surge tank shall be vented in accordance with this code. The vent size shall be determined based on the total gray water fixture units as outlined in this code.

(3) Each surge tank shall have an access opening with lockable gasketed covers or approved equivalent to allow for inspection and cleaning.

(4) Each surge tank shall have its rated capacity permanently marked on the unit. In addition, a sign stating *GRAY WATER SYSTEM, CAUTION – UNSAFE WATER* shall be permanently marked on the holding tank.

(5) Each surge tank shall have an overflow drain. The overflow drains shall have permanent connections to the building drain or building sewer, upstream of septic tanks. The overflow drain shall not be equipped with a shutoff valve.

(6) The overflow drain pipes shall not be less in size than the inlet pipe. Unions or equally effective fittings shall be provided for piping connected to the surge tank.

(7) Surge tank shall be structurally designed to withstand anticipated earth or other loads. Surge tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft^2) (1465 kg/m^2) where the tank is designed for underground installation.

(8) Where a surge tank is installed underground, the system shall be designed so that the tank overflow will gravity drain to the existing sewer line or septic tank. The tank shall be protected against sewer line backflow by a backwater valve installed in accordance with this code.

(9) Surge tanks shall be installed on dry, level, well-compacted soil where underground or on a level 3 inch (76 mm) thick concrete slab *or other approved method* where aboveground.

(10) Surge tanks shall be anchored to prevent against overturning where installed aboveground. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground where empty. The combined weight of the tank and hold down system shall meet or exceed the buoyancy forces of the tank.

(11)[HCD 1] An overflow drain and backwater valve is not required on a clothes washer system.

1502.9.2 Gray Water Pipe and Fitting Materials. Aboveground and underground building drainage and vent pipe and fittings for gray water systems shall comply with the requirements for aboveground and underground sanitary building drainage and vent pipe and fittings in this code. These materials shall extend not less than 2 feet (610 mm) outside the building.

1502.9.2.1 Animals and Insects. *Gray water tank openings shall be protected to prevent the entrance of insects, birds, or rodents into the tank and piping systems. Screens installed on vent pipes, inlets, and overflow pipes shall have an aperture of not greater than 1/16 of an inch (1.6 mm) and shall be close fitting.*

1502.9.2.2 Freeze Protection. *Tanks and piping installed in locations subject to freezing shall be provided with an approved means of freeze protection.*

1502.10 Subsurface Irrigation System Zones. Irrigation or disposal fields shall be permitted to have one or more valved zones. Each zone shall be of a size to receive the gray water anticipated in that zone.

TABLE 1502.10
DESIGN OF SIX TYPICAL SOILS

TYPE OF SOIL	MINIMUM SQUARE FEET OF IRRIGATION/*LEACHING* AREA PER 100 GALLONS OF ESTIMATED GRAY WATER DISCHARGE PER DAY	MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FOOT OF IRRIGATION/ LEACHING AREA FOR A 24-HOUR PERIOD
Coarse sand or gravel	20	5.0
Fine sand	25	4.0
Sandy loam	40	2.5
Sandy clay	60	1.7
Clay with considerable sand or gravel	90	1.1
Clay with small amounts of sand or gravel	120	0.8

For SI units: 1 square foot = 0.0929 m^2, 1 gallon per day = 0.000043 L/s

1502.10.1 Required Area of Subsurface Irrigation Fields, Subsoil Irrigation Fields and Mulch Basins. The minimum effective irrigation area of subsurface irrigation fields, subsoil irrigation fields, and mulch basins shall be determined by Table 1502.10 for the type of soil found in the excavation, based upon a calculation of estimated gray water discharge pursuant to Section 1502.8. For a subsoil irrigation field, the area shall be equal to the aggregate length of the perforated pipe sections within the valved zone multiplied by the width of the proposed subsoil irrigation field.

1502.10.2 Determination of Maximum Absorption Capacity. The irrigation field and mulch basin size shall be based on the maximum absorption capacity of the soil and determined using Table 1502.10. For soils not listed in Table 1502.10, the maximum absorption capacity for the proposed site shall be determined by percolation tests or other method acceptable to the Authority Having Jurisdiction. A gray water system shall not be permitted, where the percolation test shows the absorption capacity of the soil is unable to accommodate the maximum discharge of the proposed gray water irrigation system.

Exceptions:

(1) The Enforcing Agency may waive the requirement for identification of groundwater level and/or soil absorption qualities based on knowledge of local conditions.

(2) Irrigation fields in compliance with Section 1502.11.2 which only utilize drip type emitters are exempt from percolation tests.

1502.10.3 Groundwater Level. No excavation for an irrigation field, disposal field, or mulch basin shall extend within 3 feet (914 mm) vertical of the highest known seasonal groundwater level, nor to a depth where gray water contaminates the groundwater or surface water. The applicant shall supply evidence of

groundwater depth to the satisfaction of the Authority Having Jurisdiction.

Note: *The absence of groundwater in a test hole three (3) vertical feet (915 mm) below the deepest irrigation or disposal point shall be sufficient to satisfy this section unless seasonal high groundwater levels have been documented to rise to within this area.*

1502.11 Irrigation, Disposal Field and Mulch Basin Construction. [BSC-CG] *Irrigation design shall be verified in accordance with the California Green Building Standards Code (CALGreen), Chapter 5, Division 5.3.*

Irrigation fields, disposal fields and mulch basins used in gray water systems shall comply with this section. Gray water systems may contain either an irrigation field or a disposal field or a combination of both. This section is not intended to prevent the use of other methods of gray water irrigation or disposal approved by the Enforcing Agency.

TABLE 1502.11
SUBSURFACE IRRIGATION DESIGN CRITERIA FOR SIX TYPICAL SOILS

TYPE OF SOIL	MAXIMUM EMITTER DISCHARGE (gallons per day)	MINIMUM NUMBER OF EMITTERS PER GALLON OF ESTIMATED GRAY WATER DISCHARGE PER DAY* (gallons per day)
Sand	1.8	0.6
Sandy loam	1.4	0.7
Loam	1.2	0.9
Clay loam	0.9	1.1
Silty clay	0.6	1.6
Clay	0.5	2.0

For SI units: 1 gallon per day = 0.000043 L/s

* The estimated gray water discharge per day shall be determined in accordance with Section 1502.8 of this code.

1502.11.1 Mulch Basin. *A mulch basin may be used as an irrigation or disposal field. Mulch basins shall be sized in accordance with Table 1502.10 and of sufficient depth, length and width to prevent ponding or runoff during the gray water surge of a clothes washer, bathtub or shower. Mulch must be replenished as required due to decomposition of organic matter. Mulch basins will require periodic maintenance, reshaping or removal of dirt to maintain surge capacity and to accommodate plant growth and prevent ponding or runoff.*

1502.11.2 Irrigation Field. *The provisions of this section are not intended to prevent the use of any appropriate material, appliance, installation, device, design or method of construction. If an alternate design is not available, the following provisions may be used as guidance in the design of a gray water irrigation field:*

(1) Filters used in gray water irrigation systems shall be as specified by the manufacturer's installation instructions for the design flow rate and intended use. The filter backwash and flush discharge shall be contained and disposed of into the building sewer system, septic tank or, with approval of the Enforcing Agency, a separate mini-leachfield sized to accept all the backwash and flush discharge water. Filter backwash water and flush water shall not be used for any purpose. Sanitary procedures shall be followed when handling filter backwash and flush discharge or gray water.

(2) Emitters shall be designed to resist root intrusion and shall be of a design recommended by the manufacturer for the intended gray water flow and use. For emitter ratings, refer to Irrigation Equipment Performance Report, Drip Emitters and Micro-Sprinklers, Center for Irrigation Technology, California State University, 5730 N. Chestnut Avenue, Fresno, California 93740-0018.

(3) Each irrigation zone shall be designed to include no less than the number of emitters specified in Table 1502.11, or through a procedure designated by the Enforcing Agency. Minimum spacing between emitters in any direction shall be sufficient to prevent surfacing or runoff.

(4) The system design shall provide user controls, such as valves, switches, timers and other controllers, as appropriate, to rotate the distribution of gray water between irrigation zones.

(5) All drip irrigation supply lines shall be polyethylene tubing or PVC Class 200 pipe or better and Schedule 40 fittings. All joints shall be pressure tested at 40 psi (276 kPa), and shown to be drip tight for five minutes, before burial. All supply piping shall be covered to a minimum depth of two (2) inches (51 mm) of mulch or soil. Drip feeder lines can be poly or flexible PVC tubing and shall be covered to a minimum depth of two (2) inches (51 mm) of mulch or soil.

(6) Where pressure at the discharge side of the pump exceeds 20 psi (138 kPa), a pressure-reducing valve able to maintain downstream pressure no greater than the maximum operating pressure of the installed tubing, emitters, or other components shall be installed downstream from the pump and before any emission device.

(7) When an irrigation system utilizes a pump, and discharges water at a point higher than the pump, a backwater valve shall be installed downstream of the pump to prevent back siphonage of water and soil.

1502.11.3 Disposal Field. *The provisions of this section are not intended to prevent the use of any appropriate material, appliance, installation, device, design or method of construction. If an alternate design is not available the following provisions may be used as guidance in the design of a gray water disposal field:*

(A) Disposal systems shall be not less than three (3) inches (80 mm) in cross sectional dimension and shall be constructed of perforated high-density polyethylene pipe, perforated ABS pipe, perforated PVC pipe, leaching chambers or other approved materials, provided that sufficient openings are available for distribution of the gray water into the trench area. Material, construction, and perforation shall be in compliance with the appropriate absorption fields drainage standards and shall be approved by the Enforcing Agency.

(B) Filter material, clean stone, gravel, slag, or similar filter material acceptable to the Enforcing Agency, varying in size from three-quarter (¾) inch (19.1 mm) to two and one-half (2½) inches (64 mm) shall be placed in the trench to the depth and grade required by this section. The perforated section shall be laid on the filter material in an approved manner. The perforated section shall then be covered with filter material to the minimum depth required by this section. The filter material shall then be covered with untreated building paper, straw, or similar porous material to prevent closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspection and acceptance.

***Exception:** Manufactured leaching chambers shall be installed in compliance with the manufacturer's installation instructions.*

(C) Disposal fields shall be constructed in accordance with Table 1502.11.3.

(D) When necessary on sloping ground to prevent excessive line slopes, disposal lines shall be stepped or installed on the contour lines of the slope. The lines between each horizontal leaching section shall be made with approved water-tight joints and installed on natural or unfilled ground.

TABLE 1502.11.3
SUBSOIL IRRIGATION FIELD CONSTRUCTION

DESCRIPTION	MINIMUM	MAXIMUM
Number of drain lines per valved zone[1]	1	-
Length of each perforated line[1]	-	100 feet
Bottom width of trench[1]	12 inches	*24* inches
Spacing of lines, center to center[1]	4 feet	-
Depth of earth cover of lines	10 inches	-
Depth of filter material cover of lines	2 inches	-
Depth of filter material beneath lines[1]	3 inches	-
Grade of perforated lines level	level	3 inches per 100 feet

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m

[1] *Manufactured leaching chambers shall be installed in compliance with the manufacturer's installation instructions.*

1502.12 Gray Water System Color and Marking Information. Pressurized gray water distribution systems shall be identified as containing nonpotable water in accordance with Section 601.3 of this code. *Marking shall be at intervals not to exceed 5 feet (1524 mm). Gray water distribution piping upstream of any connection to an irrigation or disposal field or a distribution valve shall be identified with the words "CAUTION: NONPOTABLE GRAY WATER, DO NOT DRINK".*

1502.13 Other Collection and Distribution Systems. Other collection and distribution systems shall be approved as allowed by Section 301.3 of this code.

***1502.13.1 Future Connections.** Gray water stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping. Stub-out shall be permanently marked "CAUTION: NONPOTABLE GRAY WATER, DO NOT DRINK."*

1502.14 Testing. Building drains and vents for gray water systems shall be tested in accordance with this code. Surge tanks shall be filled with water to the overflow line prior to and during inspection. Seams and joints shall be left exposed, and the tank shall remain watertight. A flow test shall be performed through the system to the point of gray water discharge. Lines and components shall be watertight up to the point of the irrigation perforated and drip lines.

1502.15 Maintenance. Gray water systems and components shall be maintained in accordance with Section 1501.5.

1503.0 Reclaimed (Recycled) Water Systems.

1503.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of reclaimed (recycled) water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, aboveground and subsurface irrigation, industrial or commercial cooling or air conditioning and other uses approved by the Authority Having Jurisdiction.

1503.2 Permit. It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered a reclaimed (recycled) water system within a building or on a premises without first obtaining a permit to do such work from the Authority Having Jurisdiction.

1503.2.1 Plumbing Plan Submission. No permit for a reclaimed (recycled) water system shall be issued until complete plumbing plans, with data satisfactory to the Authority Having Jurisdiction, have been submitted and approved.

1503.3 System Changes. No changes or connections shall be made to either the reclaimed (recycled) water system or the potable water system within a site containing a reclaimed (recycled) water system without approval by the Authority Having Jurisdiction.

1503.4 Connections to Potable or Reclaimed (Recycled) Water Systems. Reclaimed (recycled) water systems shall have no connection to a potable water supply or alternate

water source system. Potable water is permitted to be used as makeup water for a reclaimed (recycled) water storage tank provided the water supply inlet is protected by an air gap or reduced-pressure principle backflow preventer in accordance with this code.

1503.5 Initial Cross-Connection Test. A cross-connection test is required in accordance with Section 1501.11.2. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

1503.6 Reclaimed (Recycled) Water System Materials. Reclaimed (recycled) water supply and distribution system materials shall comply with the requirements of this code for potable water supply and distribution systems, unless otherwise provided for in this section.

1503.7 Reclaimed (Recycled) Water System Color and Marking Information. Reclaimed (recycled) water systems shall have a colored background and marking information in accordance with Section 601.3 of this code.

1503.8 Valves. Valves, except fixture supply control valves, shall be equipped with a locking feature.

1503.9 Hose Bibbs. Hose bibbs shall not be allowed on reclaimed (recycled) water piping systems located in areas accessible to the public. Access to reclaimed (recycled) water at points in the system accessible to the public shall be through a quick-disconnect device that differs from those installed on the potable water system. Hose bibbs supplying reclaimed (recycled) water shall be marked with the words: "CAUTION: NONPOTABLE RECLAIMED WATER, DO NOT DRINK," and the symbol in Figure 1503.9.

FIGURE 1503.9

1503.10 Required Appurtenances. The reclaimed (recycled) water system and the potable water system within the building shall be provided with the required appurtenances (e.g., valves, air/vacuum relief valves, etc.) to allow for deactivation or drainage as required for a cross-connection test in accordance with Section 1501.11.2.

1503.11 Same Trench as Potable Water Pipes. Reclaimed (recycled) water pipes shall be permitted to be run or laid in the same trench as potable water pipes with 12 inches (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where piping materials do not meet this requirement the minimum horizontal separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the reclaimed (recycled) water piping. Reclaimed (recycled) water pipes laid in the same trench or crossing building sewer or drainage piping shall be installed in accordance with this code for potable water piping.

1503.12 Signs. Signs in rooms and water closet tanks in buildings using reclaimed (recycled) water shall be in accordance with Section 1501.10 and Section 1501.10.1.

1503.13 Inspection and Testing. Reclaimed (recycled) water systems shall be inspected and tested in accordance with Section 1501.11.

1504.0 On-Site Treated Nonpotable *Gray* Water Systems.

1504.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of on-site treated nonpotable *gray* water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, above and belowground irrigation, and other uses approved by the Authority Having Jurisdiction.

Other approved nonpotable water sources including swimming pool backwash operations, air conditioner condensate, rainwater, cooling tower blow-down water, foundation drainage, steam system condensate, fluid cooler discharge water, food steamer discharge water, combination oven discharge water, industrial process water, and fire pump test water may be permitted to be collected for re-use by gray water systems, as approved for the intended application.

1504.2 Plumbing Plan Submission. No permit for an on-site treated nonpotable *gray* water system shall be issued until complete plumbing plans, with data satisfactory to the Authority Having Jurisdiction, have been submitted and approved.

1504.3 System Changes. No changes or connections shall be made to either the on-site treated nonpotable *gray* water system or the potable water system within a site containing an on-site treated nonpotable *gray* water system without approval by the Authority Having Jurisdiction.

1504.4 Connections to Potable or Reclaimed (Recycled) Water Systems. On-site treated nonpotable *gray* water systems shall have no *unprotected* connection to a potable water supply or reclaimed (recycled) water source system. Potable or reclaimed (recycled) water is permitted to be used as makeup water for a non-pressurized storage tank provided the makeup water supply is protected by an air gap, *reduced-pressure principle backflow preventer or other physical device which prevents backflow* in accordance with this code.

1504.5 Initial Cross-Connection Test. A cross-connection test is required in accordance with Section 1501.11.2. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

1504.6 On-Site Treated Nonpotable *Gray* Water System Materials. On-site treated nonpotable *gray* water supply and distribution system materials shall comply with the requirements of this code for potable water supply and distribution systems, unless otherwise provided for in this section.

1504.7 On-Site Treated Nonpotable *Gray* Water Devices and Systems. Devices or equipment used to treat on-site treated nonpotable *gray* water in order to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) or approved for the intended application. Devices or equipment used to treat on-site treated nonpotable *gray* water for use in water closet and urinal flushing, surface irrigation, and similar applications shall be listed or labeled to NSF 350 or approved by the Authority Having Jurisdiction.

1504.8 On-Site Treated Nonpotable *Gray* Water System Color and Marking Information. On-site treated *nonpotable gray* water systems shall have a colored background and marking information in accordance with Section 601.3 of this code.

1504.9 Valves. Valves, except fixture supply control valves, shall be equipped with a locking feature.

1504.10 Design and Installation. The design and installation of on-site treated nonpotable *gray water* systems shall be in accordance with Section 1504.10.1 through Section *1504.10.6*.

1504.10.1 Listing Terms and Installation Instructions. On-site treated nonpotable *gray* water systems shall be installed in accordance with the terms of its listing and the manufacturer's installation instructions.

1504.10.2 Minimum Water Quality. On-site treated nonpotable *gray* water supplied to toilets or urinals or for other uses in which it is sprayed or exposed shall be disinfected. Acceptable disinfection methods shall include chlorination, ultraviolet sterilization, ozone, or other methods as approved by the Authority Having Jurisdiction. The minimum water quality for on-site treated nonpotable *gray* water systems shall meet the applicable water quality requirements for the intended applications as determined by the public health Authority Having Jurisdiction. *In the absence of local water quality requirements for on-site treated nonpotable gray water, Section 1501.7 shall apply.*

1504.10.3 Deactivation and Drainage. The on-site treated nonpotable *gray* water system and the potable water system within the building shall be provided with the required appurtenances (e.g., valves, air/vacuum relief valves, etc.) to allow for deactivation or drainage as required for a cross-connection test in accordance with Section 1501.11.2.

1504.10.4 Near Underground Potable Water Pipe. On-site treated nonpotable *gray* water pipes shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where piping materials do not meet this requirement the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the on-site treated nonpotable *gray* water piping.

1504.10.5 Required Filters. A filter permitting the passage of particulates no larger than 100 microns (100 µm) shall be provided for on-site treated nonpotable *gray* water supplied to water closets, urinals, trap primers, and drip irrigation system.

1504.10.6 Disinfection. *Where the intended use of onsite treated nonpotable gray water requires disinfection and/or other treatment, on-site treated nonpotable gray water shall be disinfected as needed to ensure the required water quality is obtained at the point of use. Where chlorine is used for disinfection or treatment, water shall be tested for residual chlorine in accordance with ASTM D1253.*

1504.11 Signs. Signs in buildings using on-site treated nonpotable *gray* water shall comply with Section 1501.10 and Section 1501.10.1, *and applicable requirements of the California Building Code.*

1504.12 Inspection and Testing. On-site treated nonpotable *gray* water systems shall be inspected and tested in accordance with Section 1501.11, and Section 1501.11.2 *and/or as required by the Authority Having Jurisdiction.*

CALIFORNIA PLUMBING CODE – MATRIX ADOPTION TABLE
CHAPTER 16 – NONPOTABLE RAINWATER CATCHMENT SYSTEMS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the code user. See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/C	1	2	3	4								
Adopt Entire Chapter																					
Adopt Entire Chapter as amended (amended sections listed below)	X			X	X																
Adopt only those sections that are listed below																					
Chapter/Section																					
Intent	X																				
1601.1	X			X																	
1601.2	X			X																	
1601.3 & Exceptions 1 & 2	X			X	X																
1601.5	X			X																	
1601.6	X			X																	
1601.7 & Exception 2				X																	
1602.4	X			X																	
1602.9.3	X																				
1602.9.3.1	X			X																	
1602.9.4	X																				
1602.9.4.1	X			X																	
Table 1602.9.4.1				X																	
1602.9.5.3	X			X																	
1602.9.5.4	X			X																	
1602.9.5.5	X			X																	
1602.9.5.6 A, B	X			X																	
1602.9.5.8	X			X																	
1602.10 - 1602.10.2	X			X																	
1602.11.2				X																	
1602.11.2.3				X																	

This state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

APPENDIX C
WELL YILED TESTS

Ray's Well Testing Service Inc.
4853 Vine Hill Rd, Sebastopol Ca 95472
Phone 707 823 3191 **Fax** 707 317 0057 **Lic#** 903708

CUSTOMER INFORMATION

REPORT #: 9142 - By: Cody Monday	DATE OF TEST: 5/25/17
CUSTOMER NAME: Sam Magruder	CONTACT: 415 624 5113
AGENT NAME: Nieves De Martini - Pacific Union Real Estate	CONTACT: 707 695 4078
PROPERTY ADDRESS: 334 Purvine Rd, Petaluma CA	SENT TO: Rhenergy7@gmail.com

WELL DATA

LOCATION OF WELL:	Pump house in pasture
TYPE OF WELL:	Drilled
DEPTH OF COMPLETED WELL:	134 Feet per notes on pump house wall
DIAMETER OF WELL CASING:	6" PVC
SANITARY WELL SEAL (PLATE SEAL AT OPENING OF WELL CASING):	Yes
ANNULAR SEAL (IN-GROUND SEAL OF BOREHOLE):	Unknown - Please Refer to well log
PUMP HP AND TYPE:	1/2 HP 230V Goulds 10LS05 Submersible. #12-4 Sub Cable.
DEPTH OF PUMP SUCTION:	120 Feet per notes on pump house wall. 1.25" Sch 80 Drop Pipe.

WATER PRODUCTION RESULTS

WATER LEVEL AT START (STATIC LEVEL):	21.5 Feet	FLOW RATE AT START:	12.5 GPM
FINAL PUMPING LEVEL:	96 Feet	FINAL FLOW RATE:	**10.3 GPM**
WATER LEVEL DRAWDOWN:	74.5 Feet	TOTAL LENGTH OF TEST:	4 Hours

CONSTANT PUMPING LEVEL INFORMATION

STABILIZED PUMPING LEVEL:	96 Feet	STABILIZED FLOW RATE (YIELD):	**10.3 GPM**
DURATION OF CONSTANT PUMPING LEVEL:	2 Hours	TOTAL YIELD:	1,236 Gallons

WATER SYSTEM INSPECTION

WELL PUMP	Functional	TECHNICAL INFO: 12.5 GPM @ 60 PSI @ 21.5', 5.2 amps, control box dated 2013
ELECTRICAL	Functional	TECHNICAL INFO: 20 Amp 2-pole breaker, sub panel located in pump house
PRESSURE TANK	Functional	TECHNICAL INFO: See Comments
STORAGE TANK	Functional	TECHNICAL INFO: See Comments
BOOSTER PUMP	Functional	TECHNICAL INFO: 3/4 HP 230V Wayne

WATER QUALITY TESTING

THE FOLLOWING SAMPLES ARE BEING ANALYZED. PLEASE REFER TO FOLLOW-UP REPORT FOR RESULTS.		
Basic Residential/Irrigation Package	DATED: 5/25/17	TURNAROUND: Standard
Volatile Organic Compounds	DATED: 5/25/17	TURNAROUND: Standard
Post Storage Tank Bacteria	DATED: 5/25/17	TURNAROUND: Standard
	DATED:	TURNAROUND:

SEE NEXT PAGE FOR FURTHER INFORMATION...

DATE: 5/25/17

ADDRESS: 334 Purvine Rd, Petaluma CA

COMMENTS:

1. The recharge rate at the end of the test was 10.3 GPM. This test may not represent the long term or seasonal yield. Continue to next page for system information.

PUMPING LOG:

5/25/17

TIME	WATER LEVEL	WATER COLOR	SAND	ODOR	GPM
10:10 AM	21.5 FEET	CLEAR	NO	NO	12.5
10:25 AM	33.8 FEET	CLEAR	NO	NO	15.6
10:40 AM	43.5 FEET	CLEAR	NO	NO	17.5
10:55 AM	59.4 FEET	CLEAR	NO	NO	17
11:10 AM	67.3 FEET	CLEAR	NO	NO	16.8
11:40 AM	84 FEET	CLEAR	NO	NO	15.9
12:10 PM	96 FEET	CLEAR	NO	NO	10.3
12:40 PM	96 FEET	CLEAR	NO	NO	10.3
1:10 PM	96 FEET	CLEAR	NO	NO	10.3
2:10 PM	96 FEET	CLEAR	NO	NO	10.3

Thank you for allowing us to do your well inspection!

APPROVED BY: NICK BRASESCO

Water levels and well depth are measured as feet below top of well casing unless otherwise noted.

All wells and springs are subject to seasonal and yearly changes in regards to water yield, production and quality. Wells may be influenced by creeks or other water sources and are likely to yield less water during dry months of the year; typically August, September, & October. We make no predictions of future water production or water quality.

COMMENTS:

1. The 1/2 HP 230V Goulds 10LS05 submersible well pump fills two 3,500 gallon polyethylene storage tanks (tank water is clear with slight fine tan sediment build up on bottom). The well pump is controlled by an electric float switch. The well pump is protected by a Pumpsaver 231 device (timer delay set for 50 minutes).

2. The 3/4 HP 230V Wayne booster pump pressurizes an 86 gallon Well-X-Trol WX 302 pressure tank (tank dated 1986, 28 PSI air charge) and a 119 gallon Well-X-Trol WX 350 pressure tank (tank dated 1989, 24 PSI air charge). The operating pressure is set 33 to 53 PSI. The booster pump pressure system serves both domestic and irrigation.

3. There are at least two hand dug wells located on the property that were not tested or inspected.

RECOMMENDATIONS:

1. The booster pump does not have a pressure relief valve. Recommend installation as a safety precaution.

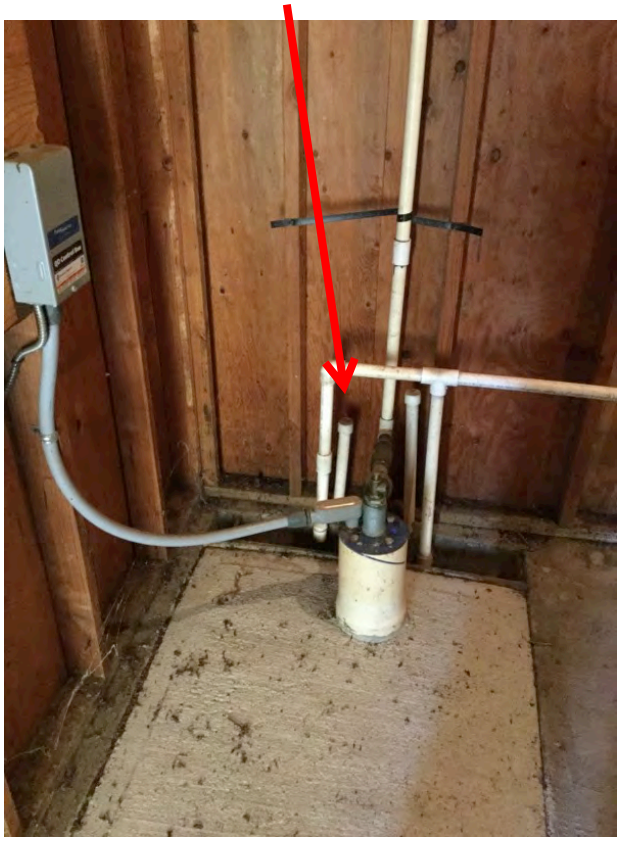
2. The booster pump is not protected from dry running. Recommend installing electric low level float switch to prevent damage to pump.

3. The storage tanks do not have overflows. Recommend installation.

4. There is a slow leak at a 1" PVC coupling at the booster pump manifold. Recommend repair.

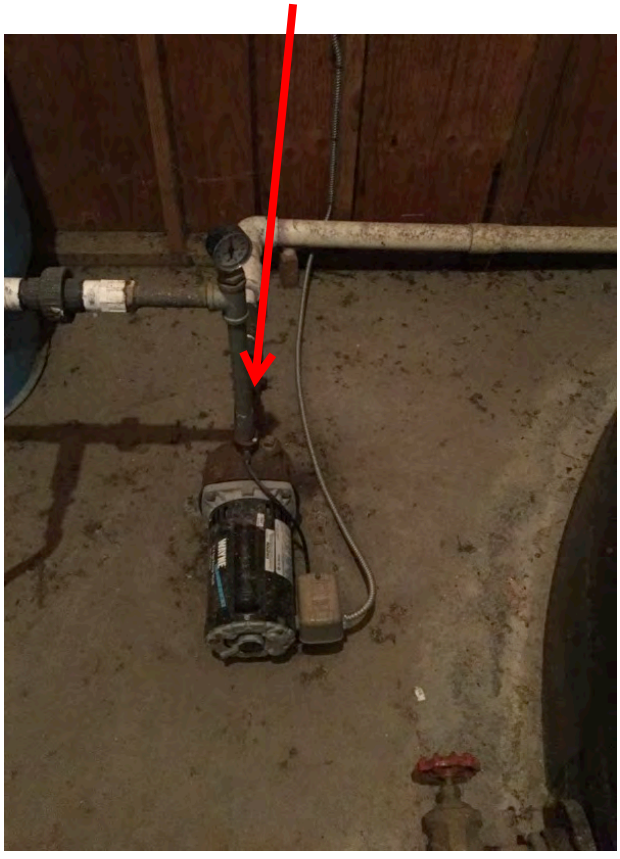
5. Water test results and possible follow up recommendations pending.

Well Head



Storage Tanks in Pump House

Booster Pump



Main Shut-off

86 Gallon Pressure Tank

119 Gallon Pressure Tank (Behind Second Unit)

Sub Panel

Not Inspected

Hand Dug Wells

COUNTY OF SONOMA
PERMIT AND RESOURCE MANAGEMENT DEPARTMENT

2550 Ventura Avenue, Santa Rosa, CA 95403-2829
(707) 565-1900 FAX (707) 565-1103

CERTIFICATION OF WATER YIELD IN WATER SCARCE AREAS

The Permit and Resource Management Department shall be notified 24 hours in advance of this test

Water Yield # NA Well Permit # NA

I. Individual performing test: Lee Hurvitz

II. Type of license/registration, number and expiration date: PG #7573 exp. 5-31-19

III. Location of well:
Address: 334 Purvine Road A.P. #: 022-230-018

IV. Type and model of test pump: 1/2hp 230V Goulds Submersible Pump

V. Test pump setting depth: 120 Feet

VI. Maximum reported yield for this pump type at this setting: _____

VII. Type of discharge measurement method: Water Meter

VIII. Type and model of flow meter (or provide an accurate description of weir or orifice plate):
3/4" DLJ Meter

Geographic coordinates (Plane Coordinate Method or distance from fixed landmarks): 38°15'01.99"N 122°44'37.49"W

IX. Estimated elevation of well head: 320 feet

X. Initial static water level (include measuring points such as top of casing, surface seal, access port): 25.0

XI. Date & time of initial static water level measurement: 2/27/18 7:20 (a.m.)/p.m.

A. Discharge Rate: 6.7 gpm
B. Dynamic Water Level: 70.4 feet
C. Specific Capacity: 0.15
D. Pump Test duration: 8hr

XII. Immediately after the test take the following measurements:

A. Dynamic water level: 70.4
B. Final discharge rate: 6.6

XIII. Post - Test Measurement:

A. Dynamic water level: 70.4
B. Static water level: 25.0
C. Percentage of recovery of final static level: 100%

Testing performed by (signature): Lee S. Hurvitz

Date: 3-2-18 Company: HES Phone Number: 707-824-1690

Approved_____ Denied_____ Specialist_____ Date_____

WLS - 010

Well Pump Test Data Recordation

Address: 334 Purvine Rd. APN - 022-230-018

Meter@Start - 2172111

Meter@Finish - 2175365

Date	Time	Interval	SWL	GPM	Commentsnt		
2-27-18	7:25	1 Min	27.5	9.5			
	7:26	1 Min	28.1	9.5			
	7:27	1 Min	29.0	9.9			
	7:28	1 Min	31.1	10			
	7:29	1 Min	32.0	10			
	7:35	5 Mins	35.0	9.9			
	7:40	5 Mins	38.7	9.8			
	7:45	5 Mins	40.5	8.7	reduce flow		
	7:50	5 Mins	42.1	8.7			
	7:55	5 Mins	43.6	7.8	reduce flow		
	8:00	5 Mins	44.9	7.8			
	8:05	5 Mins	46.1	7.8			
	8:10	5 Mins	47.5	7.8			
	8:15	5 Mins	53.6	10	increase flow		
	8:20	5 Mins	57.4	10			
	8:25	5 Mins	63.5	7.2	reduce flow		
	8:30	5 Mins	65.1	7.2			
	8:50	20 Mins	65.85	7.0			
	9:10	20 Mins	67.30	7.0			
	9:30	20 Mins	69.0	7.1			
	10:00	30 Mins	68.9	7.0			
	10:30	30 Mins	69.55	7.0			
	11:00	30 Mins	69.75	6.7	reduce flow		
	11:30	30 Mins	70.0	6.7			
	12:00	30 Mins	70.0	6.7			
	12:30	30 Mins	70.1	6.7			
	1:00	30 Mins	70.4	6.7			
	1:30	30 Mins	70.4	6.7			
	2:00	30 Mins	70.4	6.7			
	2:30	30 Mins	70.45	6.8			
	3:00	30 Mins	70.4	6.7			
	3:30	30 Mins	70.4	6.7			
		30 Mins					
		30 Mins					
		30 Mins					
		30 Mins					
		30 Mins					
		30 Mins					
		30 Mins					
		30 Mins					
		72 Hrs					

Well Test Data and Calculations

A	Initial Static Water Level	=	25.0 feet
B	Post Test Static Water Level	=	25.0 feet
C	Dynamic Pumping Level	=	70.4 feet
D	Drawdown (C-A)	=	45.4 feet
E	Recovery (C-B)	=	45.4 feet
F	Percent Recovery (E÷D)	=	100%

Specific Capacity Calculation

A	Discharge Rate Average after 4 hours	=	6.7gpm
B	Dynamic Drawdown	=	45.4 feet
C	Specific Capacity (A÷B)	=	0.15gpm/foot drawdown

Volume and Discharge Rate

A	Meter Reading Start	=	2172111
B	Meter Reading Finish	=	2175365
C	Total Volume (B-A)	=	3254
D	Total Test Duration	=	484 minutes
E	Average Discharge Rate (C÷D)	=	6.7gpm

Initial Recovery Data

Date	Time	Depth to Water	
02/27/2018	3:31	70.40	
	3:35	66.75	
	3:40	62.55	
	3:45	58.20	
	3:50	54.20	
	4:00	46.70	
	4:15	37.20	
	4:30	32.50	
	4:45	30.40	88% recovery in 74 minutes

APPENDIX D
WELL COMPLETION LOGS

ORIGINAL File with DWR

CONFIDENTIAL LOG Water Code Sec. 13752

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

No 143889

State Well No. _____

Other Well No 5N/8W-21

(2) LOCATION OF WELL:

County Ventura Owner's number, if any

Township, Range, and Section 4381 Middle Two Rock Rd.

Distance from cities, roads, railroads, etc. 22—190—15

(3) TYPE OF WORK (check):

New Well [X] Deepening [ ] Reconditioning [ ] Destroying [ ]

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

(5) EQUIPMENT:

Rotary [ ]
Cable [X]
Other [ ]

(6) CASING INSTALLED:

STEEL: OTHER:

SINGLE [X] DOUBLE [ ]

From ft.	To ft.	Diam.	Gage or Wall
0	40	8	188

If gravel packed

Diameter of Bore	From ft.	To ft.

Size of shoe or well ring: 7 x 12 x 8 Size of gravel:

Describe joint welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
	None			

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes [X] No [ ] To what depth 40 ft.

Were any strata sealed against pollution? Yes [ ] No [ ] If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing Grout

(9) WATER LEVELS:

Depth at which water was first found, if known ft. 40

Standing level before perforating, if known ft.

Standing level after perforating and developing ft. 30

(10) WELL TESTS:

Was pump test made? Yes [X] No [ ] If yes, by whom? Driller

ld: 4 gal./min. with 90 ft. drawdown after 4 hrs.

Temperature of water Was a chemical analysis made? Yes [ ] No [X]

Was electric log made of well? Yes [ ] No [X] If yes, attach copy

(11) WELL LOG:

Total depth 203 ft. Depth of completed well ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to ft.	
0-85	Hard brown sandstone
85-187	Blue & gray sandstone
187-203	Gray sandstone & clay

Work started May 5 19 77 Completed May 20 19 77

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Pettis & Sullivan
(Person, firm or corporation) (Typed or printed)

Address 1541 Mark West Springs Rd
Santa Rosa, Ca.

[SIGNED] Walter Pettis
(Well Driller)

License No. 288649 Dated May 22 19 77

SKETCH LOCATION OF WELL ON REVERSE SIDE

CONFIDENTIAL LOG
Water Code Sec. 13752

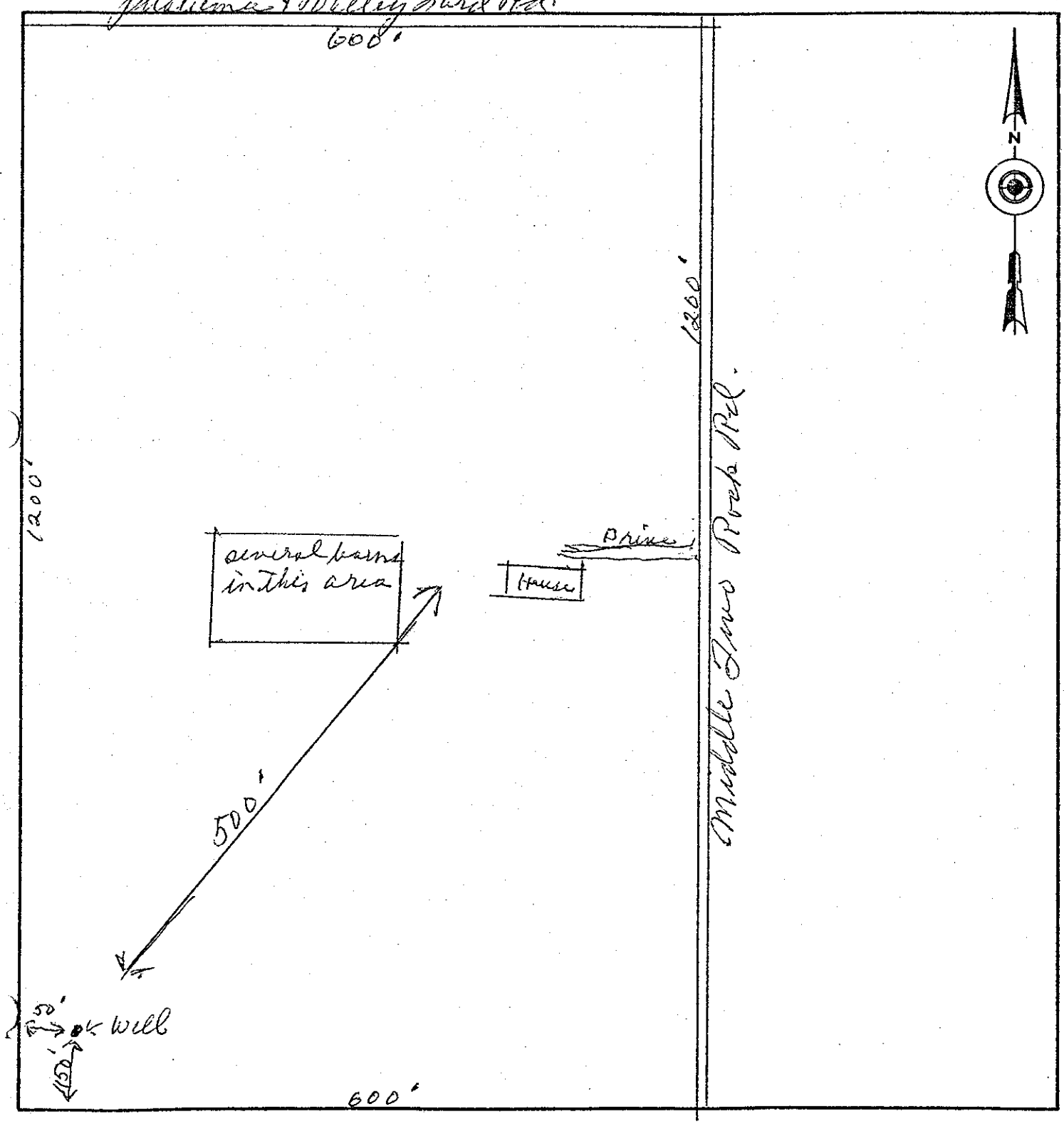
COUNTY OF SONOMA PUBLIC HEALTH SERVICE
3313 Chanate Road
Santa Rosa, California 95404
Telephone 527-2711

143889
Permit no. 639-77

WELL PERMIT APPLICATION
(Plot Plan or Sketch)

Well address 4381 Middle Two Rock Rd Petaluma A.P. # 022-190-15-1

Indicate below the exact location of well with respect to the following items: property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems. INCLUDE DIMENSIONS.



Form-PHS-EH-W-2 (2/21/73) (2000)

STATE OF CALIFORNIA

WELL COMPLETION REPORT

No. 730721

DWR USE ONLY — DO NOT FILL IN

05N/08W-31

STATE WELL NO. STATION NO.

LATITUDE LONGITUDE

APN / TRS / OTHER

OWNER'S WELL No. 4232

Date Work Began 6/14/00 Ended 6/15/00

Local Permit Agency Sonoma

Permit No. WEL99-0453 Permit Date 9-22-99

GEOLOGIC LOG

ORIENTATION Vertical Degree of Angle .....

DEPTH FROM SURFACE DEPTH TO FIRST WATER .....(ft.) BELOW SURFACE

Ft.	Ft.	DESCRIPTION
0	50	yellow sandy clay
50	120	blue sandy clay
120	160	blue sandy clay & brown sandy clay
		with some shells & sandstone stringers

WELL LOCATION

Address Same as above

City ..... County Sonoma

Apn Book 022 Page 200 Parcel 13

or

Township ..... Range ..... Section ..... 1/4 ..... 1/4

or

Latitude ..... NORTH Longitude ..... WEST

Deg. Min. Sec. Deg. Min. Sec.

LOCATION SKETCH

ACTIVITY NEW WELL PLANNED USE(S)

DRILLING METHOD ROTARY AIR FLUID

DEPTH OF STATIC WATER LEVEL 80 (Ft.) & DATE MEASURED Jun 15, 2000

ESTIMATED YIELD * 4 (G.P.M.) & TEST TYPE Airlift

TEST LENGTH. 2 (Hrs.) TOTAL DRAWDOWN 140 (FT.)

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

TOTAL DEPTH OF BORING 160 (Feet)

TOTAL DEPTH OF COMPLETED WELL 150 (Feet)

CASING

DEPTH FROM SURFACE Ft.	To Ft.	BORE-HOLE DIA.	TYPE	Material / Grade	Dia.	Gauge	Slot size
0	80	12.25	Blank	F480 PVC	6	200	
80	150	12.25	Perfs	F480 PVC	6	200	Factory

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	To Ft.	Seal Material	Filter Pack (Type / Size)
0	25	Bentonite	
25	150		Gravel/Sand 1/4 X 1/8 & 8/16

Attachments

...no... Geologic Log

...no... Well Construction Diagram

...no... Geophysical Logs

... Soil Water Chemical Analyses

...no... Other

CERTIFICATION STATEMENT

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

NAME Eisch Bros. Drilling, Inc.

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

5001 Gravenstein Hwy No. Sebastopol CA. 95472

Signed Steve Unterseher Carol Hughes 6-16-00 399226

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

941

ORIGINAL
File with DWR

Page ___ of ___
Owner's Well No. ___
Date Work Began 8/16/00 Ended 8/17/00
Local Permit Agency Permit & Resource Management
Permit No. WEL 00-0352 Permit Date 5/29/00

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 812610

DWR USE ONLY — DO NOT FILL IN
05N08W21
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

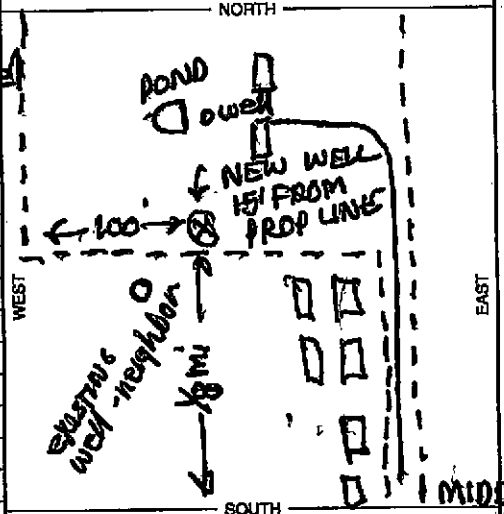
ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD rotary air FLUID ___

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0 55	yellow sandstone
55 110	blush yellow firm sandstone w/ occasional hard concretions 2 GPM
110 220	firm blue sandstone with occasional fractured concretions 6 GPM
220 240	firm blue sandstone with hard layers of fractured cemented gravel 20 GPM
240 250	yellow firm Franciscan shale

TOTAL DEPTH OF BORING 250 (Feet)
TOTAL DEPTH OF COMPLETED WELL 250 (Feet)

WELL OWNER

WELL LOCATION
Address Same
City ___
County Sonoma
APN Book 022 Page 190 Parcel 012
Township ___ Range ___ Section ___
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH


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

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

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

WATER LEVEL & YIELD OF COMPLETED WELL
DEPTH TO FIRST WATER 75 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 30 (Ft.) & DATE MEASURED 8/17/00
ESTIMATED YIELD * 20 (GPM) & TEST TYPE air lift
TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN 250 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 100	10"	✓				F480 PVC	5"	Cl 200	
100 130	8"	✓				"	"	"	
130 250	8"		✓			"	"	"	.032"

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE: CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 4	✓			
4 100		✓		
100 250	13/20	& 8/16 sand		

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

CERTIFICATION STATEMENT
I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME Nutting & Jensen Drilling (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 1924 Gravenstein Hwy So CITY Sebastopol STATE CA ZIP 95472
Signed Gary Jensen (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 8/17/00
C-57 LICENSE NUMBER 340854

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

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 323295

State Well No. 05N08W27

Other Well No.

Notice of Intent No.

Local Permit No. or Date 125-90

(1)
Ad
Cit

(2) LOCATION OF WELL (See instructions):

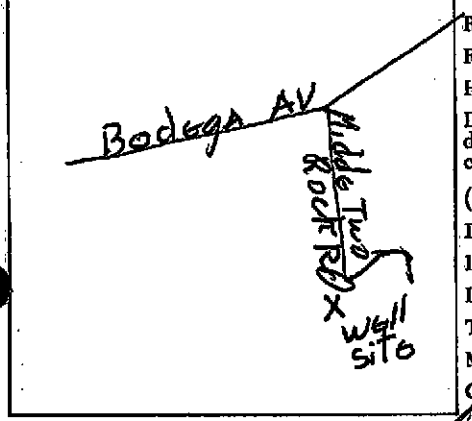
County SONOMA Owner's Well Number

Well address if different from above 3915 Middle Two Rock Rd.

Township 02N-02W Range Section Petaluma

Distance from cities, roads, railroads, fences, etc.

Hwy - 1 Mile South of the intersection OF Bodega Ave + Middle two Rock Rd



WELL LOCATION SKETCH

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

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

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

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

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

From ft.	To ft.	Dia. in.	Gage or Wall
	none		

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

From ft.	To ft.	Slot size
	none	

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☐ No ☐ If yes, to depth ft.
Were strata sealed against pollution? Yes ☐ none No ☐ Interval ft.
Method of sealing

(10) WATER LEVELS:
Depth of first water, if known NONE ft.
Standing level after well completion ft.

(11) WELL TESTS:
Was well test made? Yes ☐ No ☑ If yes, by whom?
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test ft. At end of test ft.
Discharge gal/min after none hours Water temperature
Chemical analysis made? Yes ☐ No ☐ If yes, by whom?
Was electric log made Yes ☐ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 203 ft. Completed depth ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	2	Top soil
2	16	Brn Sand
16	24	Blue Sand
24	36	Brn Sandstone
36	96	Blue Sandstone
96	180	Gritty Blue shale
180		Cuttings Blue shale

- 10" CASING SET AT Top of well + Steel plate Tackwelded on Top

Work started 4/11 19 90 Completed 4/13 19 90

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 H. Leroy Irwin (Well Driller)

NAME IRWIN WELL DRILLING (Person, firm, or corporation) (Typed or printed)

Address 3801 BISONI LANE

City FULTON CA ZIP 95439

License No. 458649 Date of this report 4-16-90

CONFIDENTIAL
NOT FOR PUBLIC USE
WATER CODE SEC. 13752

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 338752

State Well No. 05N08W27

Other Well No.

Notice of Intent No.

Local Permit No. or Date 582-90

(1
Ad
Cl

(2) LOCATION OF WELL (See instructions): 22-22-2
County Sonoma Owner's Well Number
Well address if different from above 3915 Middle Two Rock Rd.
Township Petaluma Range Section
Distance from cities, roads, railroads, fences, etc.

(12) WELL LOG: Total depth 257 ft. Completed depth 257 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	1	Topsoil
1	23	Damp Calyee brown sand
23	97	Damp clayee gray sand
97	200	Wet clayee gray sand with cemented sand ledges
200		Reemed hole out
200	257	Blue clay bands with streaks of sandstone

WELL LOCATION SKETCH

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

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

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

(6) GRAVEL PACK: Monterey sand
Yes ☒ No ☐ Size 8 x 21
Diameter of bore 12¼, 9 5/8
Packed from 100 to 257 ft.

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

From ft.	To ft.	Dia. in.	Gage or Wall
0	257	5"	Cl.200

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

From ft.	To ft.	Slot size
117-137	157-177	.032
197-217	237-257	"

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 100 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ft.
Method of sealing Sand Grout On Pack

(10) WATER LEVELS:
Depth of first water, if known ft.
Standing level after well completion 20'? ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Weeks
Type of test Pump ☐ Bailer ☒ Air lift ☐
Depth to water at start of test 20'? At end of test 237 ft.
Discharge 3 gal/min after 2½ hours Water temperature Cool
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made Yes ☐ No ☒ If yes, attach copy to this report

Work started 10-23 19 90 Completed 10-24 19 90

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 Ward Thompson (Well Driller)

NAME WEEKS DRILLING & PUMP CO. (Person, firm, or corporation) (Typed or printed)

Address P.O. BOX 176

City Sebastopol, CA ZIP 95473

License No. C57-172681 Date of this report 10-26-90

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. (Insert appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

RECEIVED
REGIONAL WATER POLLUTION
CONTROL BOARD #2
DEC 6 1956

21/28/27 7

Do Not Fill In
No 24918
State Well No. 5N/8W-28
Other Well No.

(1) OWNER:

(2) LOCATION OF WELL:

County Sonoma Owner's number, if any— 4045
R. F. D. or Street No. 4045 Middle Two Rock Rd
Petaluma, Calif.

(3) TYPE OF WORK (*check*):

New well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):

Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☐
Cable ☒
Dug Well ☐

(6) CASING INSTALLED:

SINGLE ☒ DOUBLE ☐

From ft.	to ft.	Diam.	Gage or Wall
12	8	3/16	

Type and size of shoe or well ring 8" steel
Describe joint but weld

If gravel packed

Diameter of Bore	from ft.	to ft.

Size of gravel:

(7) PERFORATIONS:

Type of perforator used none
Size of perforations in., length, by in.

From ft.	to ft.	Perf. per row	Rows per ft.

(8) CONSTRUCTION:

Was a surface sanitary seal provided? ☐ Yes ☒ No To what depth ft.
Were any strata sealed against pollution? ☐ Yes ☒ No If yes, note depth of strata

From ft.	to ft.

Method of Sealing

(9) WATER LEVELS:

Depth at which water was first found 16 ft.
Standing level before perforating 10 ft.
Standing level after perforating ft.

(10) WELL TESTS:

Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: 1 gal./min. with 128 ft. draw down after 1 hrs.
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No
Was electric log made of well? ☐ Yes ☒ No

(11) WELL LOG:

Total depth 130 ft. Depth of completed well ft.
Formation: *Describe by color, character, size of material, and structure.*

ft.	to ft.	
0	3	top soil
3	10	yellow sand stone
10	130	blue " "

FOR OFFICIAL USE ONLY

Work started 9-15-56 19 . Completed 9-19-56 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Oberto's Well Drilling
(Person, firm, or corporation) (Typed or printed)
Address ~~xxxxx~~ 421 Washington St
Petaluma, Calif.

[SIGNED] A. J. Oberto
Well Driller

License No. 81877 Dated 11-6-56, 19

95689 3-54 50M QUIN ® SPO

DWR FORM NO. 246 (REV. 3-54)

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in
No. 210637

N) of Intent No.
1. Permit No. or Date

State Well No.
Other Well No. OSNORW28

(2) LOCATION OF WELL (See instructions):

County Sonoma Owner's Well Number 022-230-11-4
Well address if different from above Same
Township Range Section
Distance from cities, roads, railroads, fences, etc.

WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☒
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:

Rotary ☐ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☒ No ☐ Size Rea
Diameter of bore 9 7/8 & 7 7/8
Packed from 20 to 220 ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	220	5"	CL200

(8) PERFORATIONS:

Type of perforation or size of screen: Micro Perforations

From ft.	To ft.	Slot size
215	220	.032
135	175	.032
55	115	.032

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ft.
Method of sealing Neat cement on pack

(10) WATER LEVELS:

Depth of first water, if known ft.
Standing level after well completion 18' ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Weeks
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test 18' ft. At end of test 220 ft
Discharge 11½ gal/min after ½ hours Water temperature Cool
analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG:

Total depth 220 ft. Depth of completed well 220 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	2	Topsoil
2	3	Brown sand
3	7	Brown clayee sand
7	8	Brown sandy clay
8	41	Firm brown sandy clay
41	159	Firm blue clayee sand & blue sandy clay with streaks of sand and streaks of sandy blue rock
159	195	Hard sandy gray rock
195	220	Hard sandy gray rock with sandy blue rock and traces of gray shale rock

Work started 9-22 19 87 Completed 9-22 19 87

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 Gerald G. Thompson, By Ward Thompson (Well Driller)
NAME WEEKS DRILLING AND PUMP COMPANY (Person, firm, or corporation) (Typed or printed)
Address P.O. Box 176
City Sebastopol, CA Zip 95472
License No. C57-177681 Date of this report 10-1-87

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

DUPLICATE
Driller's Copy

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

Do not fill in
No. 110752

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

(1) OWNER: Name Francis Collings
Address 334 Purvine
City Petaluma, California 94952 Zip

(2) LOCATION OF WELL (See instructions):
County Sonoma Owner's Well Number
Well address if different from above same
Township Range Section
Distance from cities, roads, railroads, fences, etc.

WELL LOCATION SKETCH

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

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

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

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

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

From ft.	To ft.	Dia. in.	Gage or Wall
110	130	6"	10

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

From ft.	To ft.	Slot size
None		

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

(10) WATER LEVELS:
Depth of first water, if known ft.
Standing level after well completion 20 ft.

(11) WELL TESTS:
Was well test made? Yes XX No ☐ If yes, by whom?
Type of test Pump ☐ Bailer XX Air lift ☐
Depth to water at start of test ft. At end of test 110 ft.
Discharge 12 gal/min after 4 hours Water temperature
Chemical analysis made? Yes ☐ No ☐ If yes, by whom?
Was electric log made? Yes ☐ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 130 ft. Depth of completed well ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
1	80	yellow sandstone
80	130	blue sandstone

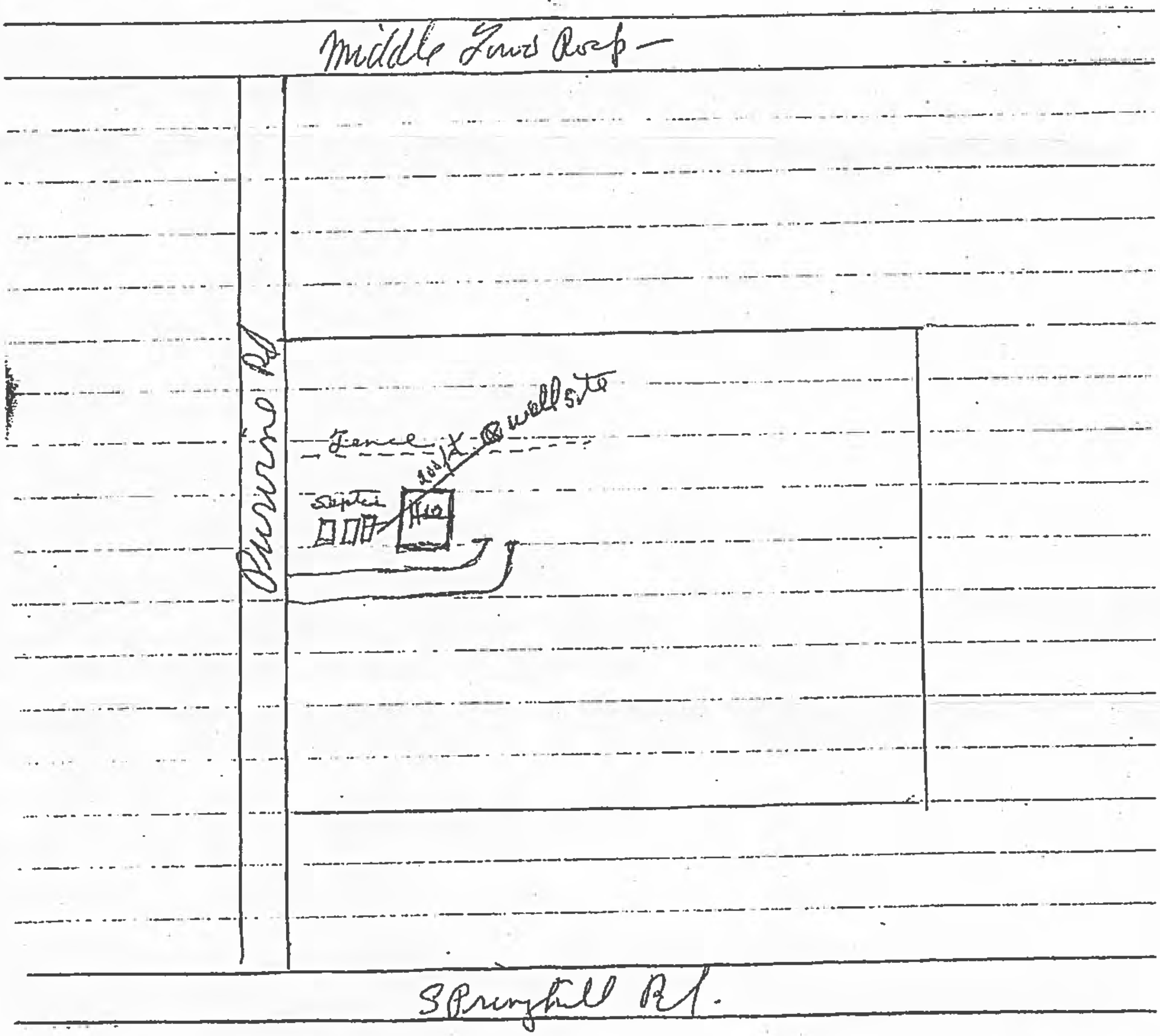
Work started 7/25/77 19 Completed 7/28/77 19

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 Kenneth Hansen (Well Driller)
NAME LES PETERSEN DRILLING & PUMP, INC. (Person, firm, or corporation) (Typed or printed)
Address 5434 Old Redwood Highway
City Santa Rosa, Calif. Zip 95401
License No. 261084 Date of this report 7/29/77

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

894-77

Francis collins



APPENDIX E
LABORATORY ANALYTICAL REPORTS

Analytical Sciences

Report Date: June 09, 2017

Laboratory Report

Ray's Well Testing Service
4853 Vine Hill Rd
Sebastopol, CA 95472

Project Name: **334 Purevine Rd.**

Lab Project Number: **7052609**

This 7 page report of analytical data has been reviewed and approved for release.

Mark A. Valentini, Ph.D.

Laboratory Director

P.O. Box 750336
Petaluma, CA 94975-0336
Telephone: (707) 769-3128

110 Liberty Street
Petaluma, CA
94952

Volatile Hydrocarbons by GC/MS

Lab#	Sample ID	Compound Name	Result (µg/L)	RDL (µg/L)
7052609-01	**Raw Well**	Dichlorodifluoromethane (F-12)	ND	0.50
		Chloromethane	ND	0.50
		Vinyl chloride	ND	0.50
		Chloroethane (CE)	ND	0.50
		Bromomethane	ND	0.50
		Trichlorofluoromethane (F-11)	ND	0.50
		Trichlorotrifluoroethane (F-113)	ND	0.50
		1,1-Dichloroethene (1,1-DCE)	ND	0.50
		Methylene chloride	ND	0.50
		trans-1,2-Dichloroethene	ND	0.50
		1,1-Dichloroethane (1,1-DCA)	ND	0.50
		cis-1,2-Dichloroethene (c1,2-DCE)	ND	0.50
		2,2-Dichloropropane	ND	0.50
		Chloroform (THM1)	ND	0.50
		Bromochloromethane	ND	0.50
		1,1,1-Trichloroethane (TCA)	ND	0.50
		1,2-Dichloroethane (EDC)	ND	0.50
		1,1-Dichloropropene	ND	0.50
		Carbon tetrachloride	ND	0.50
		Benzene	ND	0.50
		Trichloroethene (TCE)	ND	0.50
		1,2-Dichloropropane (DCP)	ND	0.50
		Dibromomethane	ND	0.50
		Bromodichloromethane (THM2)	ND	0.50
		cis-1,3-Dichloropropene	ND	0.50
		Toluene	ND	0.50
		1,1,2-Trichloroethane	ND	0.50
		1,3-Dichloropropane	ND	0.50
		Dibromochloromethane (THM3)	ND	0.50
		Tetrachloroethene (PCE)	ND	0.50
		1,2-Dibromoethane (EDB)	ND	0.50
		Chlorobenzene	ND	0.50
		1,1,1,2-Tetrachloroethane	ND	0.50
		Ethylbenzene	ND	0.50
		m,p-Xylene	ND	1.0
		Styrene	ND	0.50
		o-Xylene	ND	0.50
		Bromoform (THM4)	ND	0.50
		1,1,2,2-Tetrachloroethane	ND	0.50
		Isopropylbenzene	ND	0.50
		1,2,3-Trichloropropane	ND	0.50
		Bromobenzene	ND	0.50
		n-Propyl Benzene	ND	0.50
		2-Chlorotoluene	ND	0.50
		4-Chlorotoluene	ND	0.50
		1,3,5-Trimethylbenzene	ND	0.50
		tert-Butylbenzene	ND	0.50
		1,2,4-Trimethylbenzene	ND	0.50
		sec-Butylbenzene	ND	0.50

Volatile Hydrocarbons by GC/MS

Lab#	Sample ID	Compound Name	Result (µg/L)	RDL (µg/L)
7052609-01	**Raw Well**	1,3-Dichlorobenzene	ND	0.50
		1,4-Dichlorobenzene	ND	0.50
		1,2-Dichlorobenzene	ND	0.50
		p-Isopropyltoluene	ND	0.50
		n-Butylbenzene	ND	0.50
		1,2-Dibromo-3-chloropropane	ND	0.50
		1,2,4-Trichlorobenzene	ND	0.50
		Naphthalene	ND	0.50
		Hexachlorobutadiene	ND	0.50
		1,2,3-Trichlorobenzene	ND	0.50
		Tertiary Butyl Alcohol (TBA)	ND	12
		Methyl tert-Butyl Ether (MTBE)	ND	0.50
		Di-isopropyl Ether (DIPE)	ND	0.50
		Ethyl tert-Butyl Ether (ETBE)	ND	0.50
		Tert-Amyl Methyl Ether (TAME)	ND	0.50

Surrogates	Result (µg/L)	% Recovery	Acceptance Range (%)
Dibromofluoromethane	19.6	98	70-130
Toluene-d8	19.0	95	70-130
4-Bromofluorobenzene	20.9	105	70-130

Date Sampled:	05/25/17	Date Analyzed:	05/26/17	QC Batch: B016755
Date Received:	05/26/17	Method:	EPA 8260B	

Total Coliform & E. Coli

Lab#	Sample ID	Compound Name	Result (MPN/100 mL)		RDL (MPN/100 mL)
7052609-01	**Raw Well**	Total Coliform	<1	QT	1
		E. Coli	<1	QT	1

Date Sampled:	05/25/17	Date Analyzed:	05/27/17	QC Batch: B016742
Date Received:	05/26/17	Method:	SM 9223 B-2004	

Total Coliform & E. Coli

Lab#	Sample ID	Compound Name	Result (MPN/100 mL)		RDL (MPN/100 mL)
7052609-02	**Booster Hose Bib**	Total Coliform	1		1
		E. Coli	<1	QT	1

Date Sampled:	05/25/17	Date Analyzed:	05/27/17	QC Batch: B016742
Date Received:	05/26/17	Method:	SM 9223 B-2004	

Metals by Graphite Furnace

Lab#	Sample ID	Compound Name	Result (µg/L)	RDL (µg/L)
7052609-01	**Raw Well**	Arsenic (As)	2.1	2.0

Date Sampled:	05/25/17	Date Analyzed:	06/01/17	QC Batch: B016751
Date Received:	05/26/17	Method:	EPA 200.9	

Metals by ICP

Lab#	Sample ID	Compound Name	Result (µg/L)	RDL (µg/L)
7052609-01	**Raw Well**	Zinc (Zn)	ND	50

Date Sampled:	05/25/17	Date Analyzed:	05/31/17	QC Batch: B016750
Date Received:	05/26/17	Method:	EPA 200.7	

Metals (mg/L)

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
7052609-01	**Raw Well**	Boron (B)	ND	0.050
		Sodium (Na)	29	2.0

Date Sampled:	05/25/17	Date Analyzed:	05/31/17	QC Batch: B016750
Date Received:	05/26/17	Method:	EPA 200.7	

Hardness

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
7052609-01	**Raw Well**	Calcium (Ca)	40	0.25
		Magnesium (Mg)	17	0.10
		Hardness	170	1.0

Date Sampled:	05/25/17	Date Analyzed:	05/31/17	QC Batch: B016750
Date Received:	05/26/17	Method:	SM 2340 B-2011	

Alkalinity

Lab#	Sample ID	Compound Name	Result (mg CaC03/L)	RDL (mg CaC03/L)
7052609-01	**Raw Well**	Total Alkalinity	68	5.0
		Bicarbonate Alkalinity	68	5.0
		Carbonate Alkalinity	ND	5.0
		Hydroxide Alkalinity	ND	5.0

Date Sampled:	05/25/17	Date Analyzed:	06/01/17	QC Batch: B016770
Date Received:	05/26/17	Method:	SM 2320 B-2011	

Anions

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
7052609-01	**Raw Well**	Chloride	39	5.0
		Sulfate as SO4	16	0.50

Date Sampled:	05/25/17	Date Analyzed:	05/26/17	QC Batch: B016752
Date Received:	05/26/17	Method:	EPA 300.0	

Total Dissolved Solids

Lab#	Sample ID	Compound Name	Result (mg/L)	RDL (mg/L)
7052609-01	**Raw Well**	Total Dissolved Solids	410	10

Date Sampled:	05/25/17	Date Analyzed:	06/01/17	QC Batch: B016720
Date Received:	05/26/17	Method:	SM 2540 C-2011	

Sodium Absorption Ratio

Lab#	Sample ID	Compound Name	Result (SAR)	RDL (SAR)
7052609-01	**Raw Well**	Sodium Absorption Ratio (SAR)	0.968	0.00

Date Sampled:	05/25/17	Date Analyzed:	05/31/17	QC Batch: B016750
Date Received:	05/26/17	Method:	SAR by Calculation	

Notes and Definitions

QT	The bacterial test utilized is a quantitative test. A result of less than 1 (<1) is indicating bacteria are "absent" in 100 milliliters of sample water.
RDL	Reporting Detection Limit
ND	Analyte NOT DETECTED at or above the reporting detection limit (RDL)
mg/L	milligrams per Liter
ug/L	micrograms per Liter

PLEASE NOTE: The drinking water Maximum Contamination Limits (MCL) set by the California State Water Resource Control Board are as follows:

Arsenic (10 ug/L)
Bromate (0.010 mg/L)
Iron (300 ug/L)
Manganese (50 ug/L)
Nitrate as N (10 mg/L)
Nitrite as N (1.0 mg/L)
Lead (15 ug/L)
Copper (1300 ug/L)
Total Coliform & E. Coli (< 1 MPN/100 mL - Most Probable Number per 100 milliliters)
Hexavalent Chromium - Cr+6 (10 ug/L)

Phone: (707) 823-3191 **Fax:** (707) 317-0057 **Email:** rayswelltesting@gmail.com
Address: 4853 Vine Hill Rd, Sebastopol Ca 95472 CA Lic. #: 903708

Report of Mineral Analysis

DATE: 5/25/17

CUSTOMER NAME: Sam Magruder

PROPERTY ADDRESS: 334 Purvine Rd, Petaluma CA

PARAMETER	RESULT		RECOMMENDED RANGES
	Raw		
PH	5.96		< 7 Increasingly acidic - may be corrosive 6.8 to 8.5 - Recommended Range >7 Increasingly basic
TOTAL HARDNESS	10 gpg		< 1 gpg Soft 1 to 3.5 gpg Slightly Hard 3.5 to 7 gpg Moderately Hard 7 to 10.5 gpg Hard > 10.5 gpg Very Hard
TOTAL IRON	0.11 mg/l		0.3 mg/l - SMCL
TOTAL MANGANESE	0.03 mg/l		0.05 mg/l - SMCL
CONDUCTIVITY	479 us/cm		900 us/cm - Recommended Upper Limit 1600 us/cm - SMCL
NITRATES	104.9 mg/l		45 mg/l - MCL (tested as N03)
SILICA	34 mg/l		*There is no EPA recommended Limit
VISUAL APPEARANCE	Clear		

Abbreviations: gpg = grains per gallon
mg/l = milligrams per liter
us/cm = microseimens/centimeter
< = less than
> = greater than

MCL = Primary maximum contaminant level as set by the EPA
SMCL = Secondary maximum contaminant level as set by the EPA
NT = not tested
ND = not detected

IMPORTANT INFORMATION ON THE LIMITATIONS OF THIS REPORT:
The purpose of this report is to provide information regarding the general mineralogical character of a water supply. Unless specifically noted, this report does not include analysis for bacteria or any other health related contaminants. This analysis alone is therefore not suitable for determining the safety of a drinking water supply. This report is intended for the sole and exclusive use of our client named above. Our liability for error or omissions is expressly limited to the amount paid for the analysis.

APPENDIX F
PROPOSED WELL HEAD TREATMENT

Pelican
Water Systems

Owner's Manual

Nitrate Series Salt Based Filter System

Table of Contents

Product Operation and Specifications

Specification Description	
Rated Service Flow	10-14 GPM (depending on model)
Minimum Working Pressure	25 PSI
Maximum Working Pressure	80 PSI
Maximum Vacuum	5 inch/127 mm Hg
Operating Temperatures	36°F - 100°F
pH Range	6.5 - 11

Important Information

- Read these instructions carefully and determine the location of all system components before beginning installation.
- Check all applicable plumbing, building, and electrical codes for installation compliance.
- Install the system on the main water supply.
- Turn Electricity to Water Heater off.
- Systems that contain electronic components cannot be installed outside in uncovered areas.
- The use of Teflon Tape and/or Pipe Thread Seal Paste will be needed on all threaded connections.

⚠ WARNING:

If this or any other system is installed in a metal (conductive) plumbing system, i.e. copper or galvanized metal, the plastic components of the system will interrupt the continuity of the plumbing system. As a result any errant electricity from improperly grounded appliances downstream or potential galvanic activity in the plumbing system can no longer ground through contiguous metal plumbing. Some homes may have been built in accordance with building codes, which actually encouraged the grounding of electrical appliances through the plumbing system. Consequently, the installation of a bypass consisting of the same material as the existing plumbing, or a grounded "jumper wire" bridging the equipment and re-establishing the contiguous conductive nature of the plumbing system must be installed prior to your system's use.

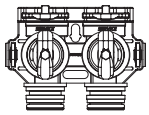
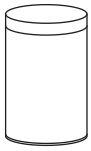
⚠ CAUTION:

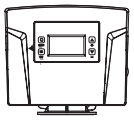
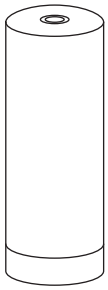
When adding a filtration/softening system to homes/buildings supplied by well water, the system should be installed following the pressure tank. **DO NOT USE this system for pneumatic or hydro pneumatic applications. If you are using a booster pump, then install this system following the booster pump.** If you have questions, please call customer service.

Complete Parts List

Note: Pelican supplies the parts below to accommodate a variety of water supply lines.

Table 1: Parts List

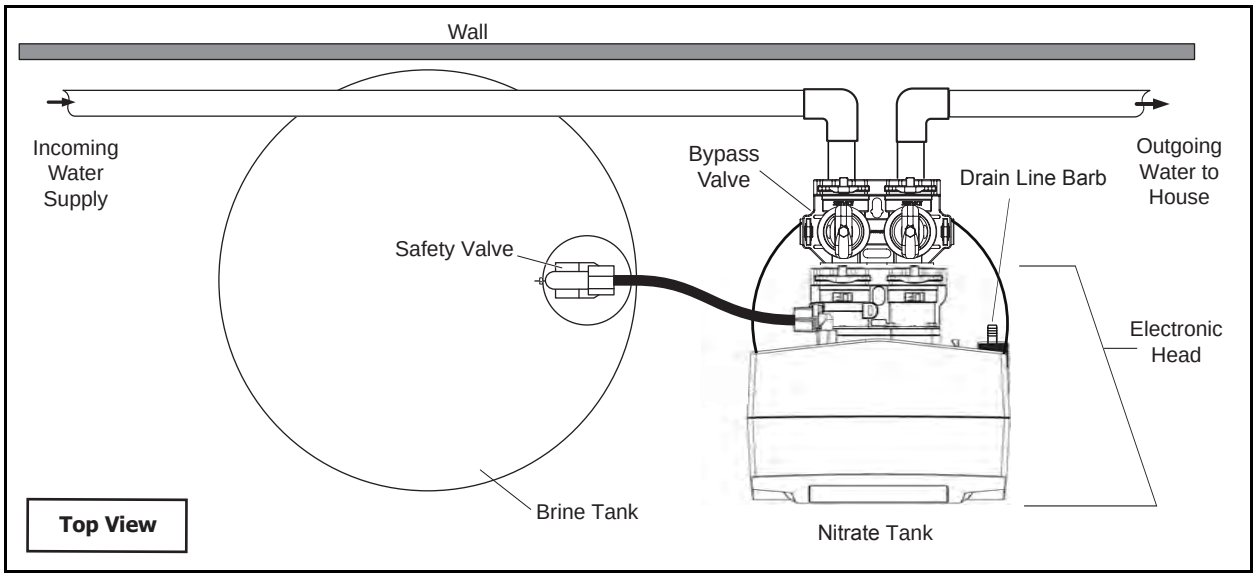
Part	Description	Qty.
	**Bypass Valve for Electronic Head**	1
	**Bypass Allen Wrench**	1
	**Brine Tank**	1
	**Non-Abrasive Auto Wax** 4 oz. Bottle	1
	**PVC Tubing Drain Line (50 ft.)**	1

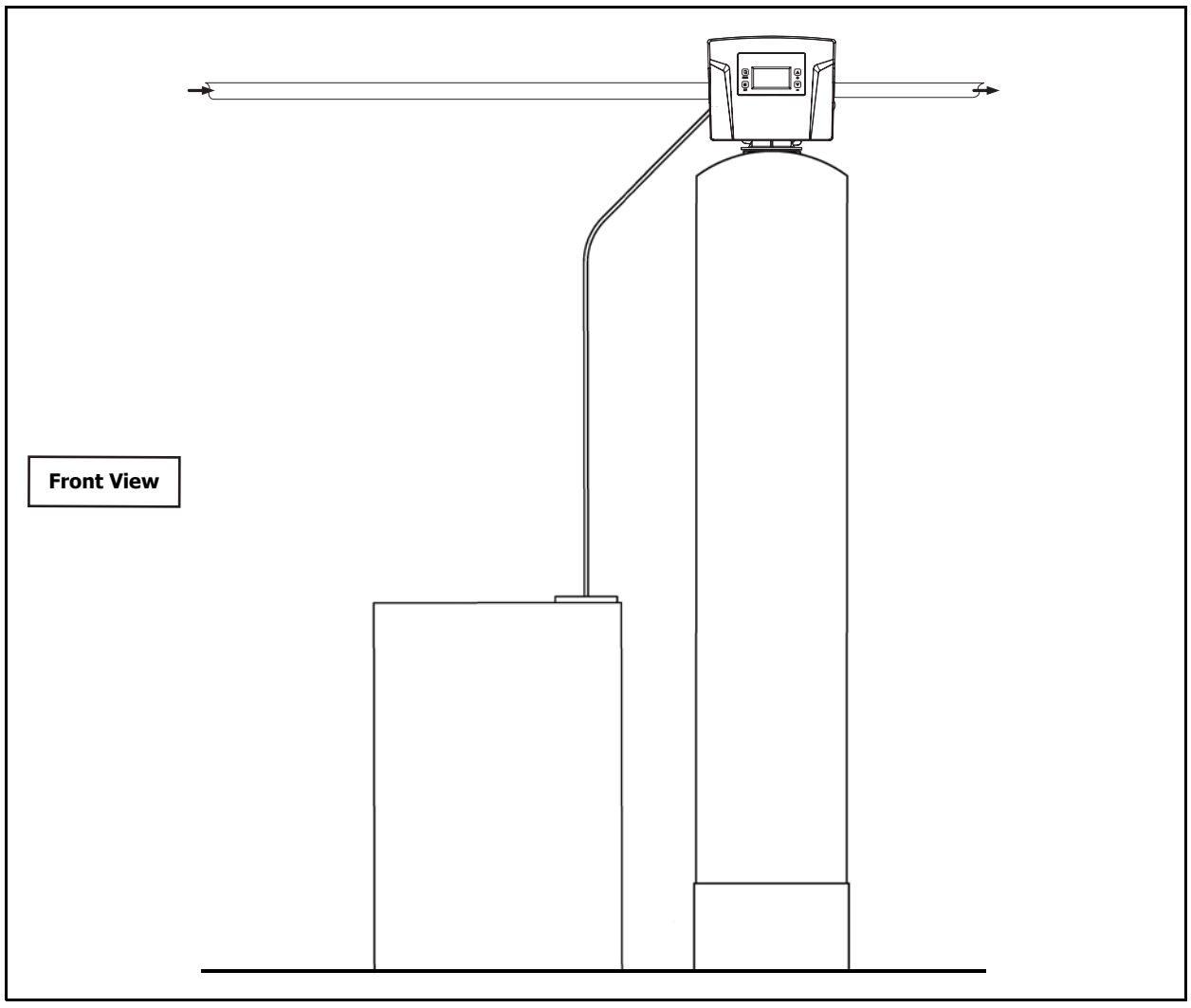
Part	Description	Qty.
	**1" PVC Tail Adaptor for Electronic Head Bypass** 90 degree 1" PVC Tail Adaptors also included	2
	**Electronic Head**	1
	**Nitrate Tank**	1

Note: Drawings are not to scale.

Additional fittings will be needed to adapt to your plumbing.

Installation Overview





Pre-Installation

Bypass Valve Installation

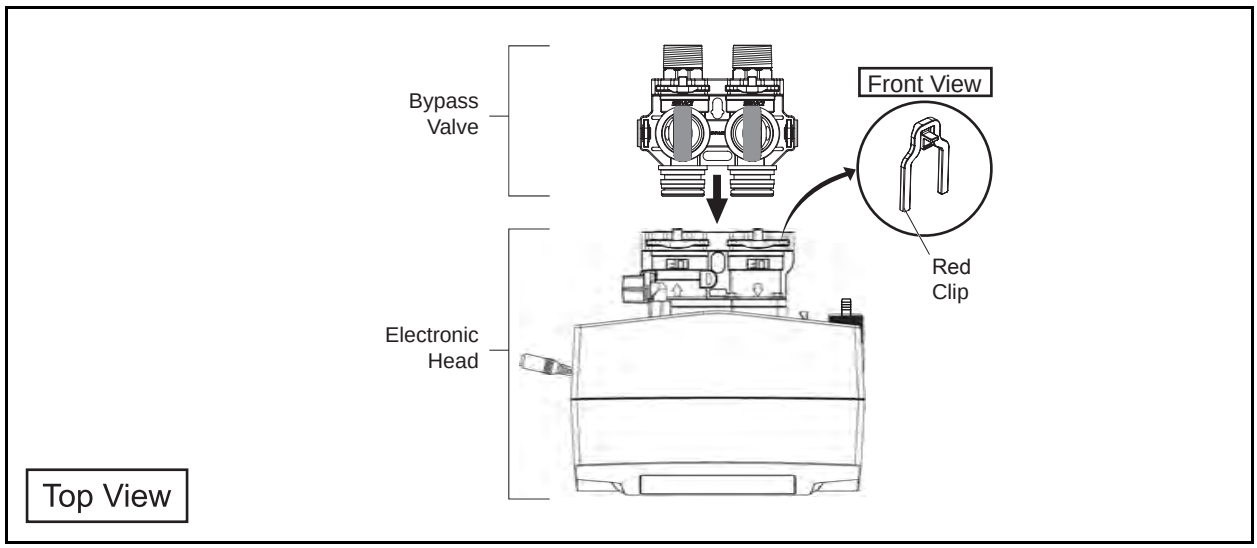
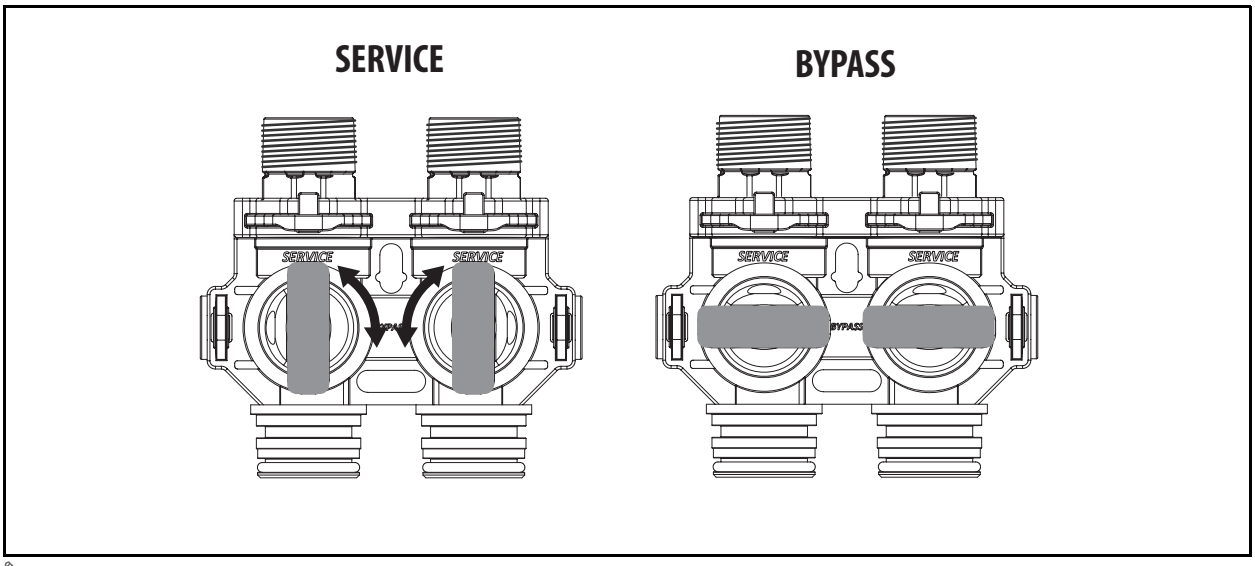


Figure 2

If the Red Clips are in the slots (female opening of Electronic Head) remove them. Push the male O-Ring side of the Bypass Valve into the female opening of the Electronic Head. Push the Red Clips back into the slots to tighten.

Bypass Valve Operation



Notice:

The Bypass Valve on the Electronic Head can be set to Bypass or Service by turning the knobs on the top of the valve. The valves can be difficult to turn by hand until the seals become saturated. Use the supplied Bypass Allen Wrench to turn the knobs if necessary.

IMPORTANT! Do not remove the red clips from the Bypass Valve after connecting to main water supply.

Installation

Install Electronic Head

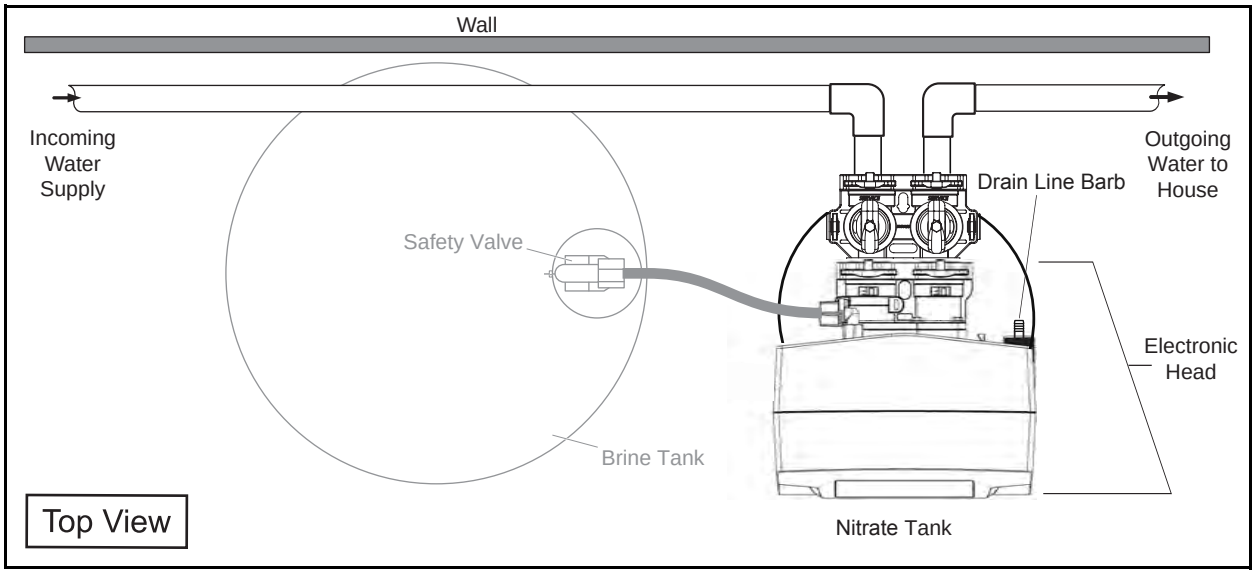


Figure 3

1. Level the Pelican Nitrate Tank.

Notice:

If the tank is not level, lift the tank straight up 6 inches and tap it on the ground until the tank stands vertical. The bottom of the tank is round and the boot allows the tank to stand upright.

2. Determine the size and material of your incoming water supply line and choose the appropriate fittings required to connect it to the Bypass Valve.

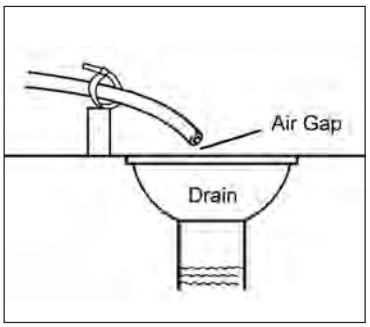
CAUTION:

Do not over-tighten any of the fittings during installation.

3. Remove the grey cap from the top of the Softener tank.
4. Screw the Electronic Head onto the tank hand-tight.
5. Install the appropriate fittings onto the inlet and outlet, following the labels on the Head.
6. Connect the incoming water supply to the fitting on the inlet side of the Bypass Valve.
7. Connect the outgoing water supply to the outlet side of the Bypass Valve.
8. Firmly press one end of the PVC Tubing Drain Line onto the drain line barb, and secure the other end of the line to a drain.

IMPORTANT!

- Ensure the PVC Tubing Backwash Drain Line is not submerged and is free of kinks.
- Maximum vertical rise of the backwash line is 6 feet.
- If incorporating two or more backwashing systems make sure to keep the drain lines separate.



Final Setup and Installation

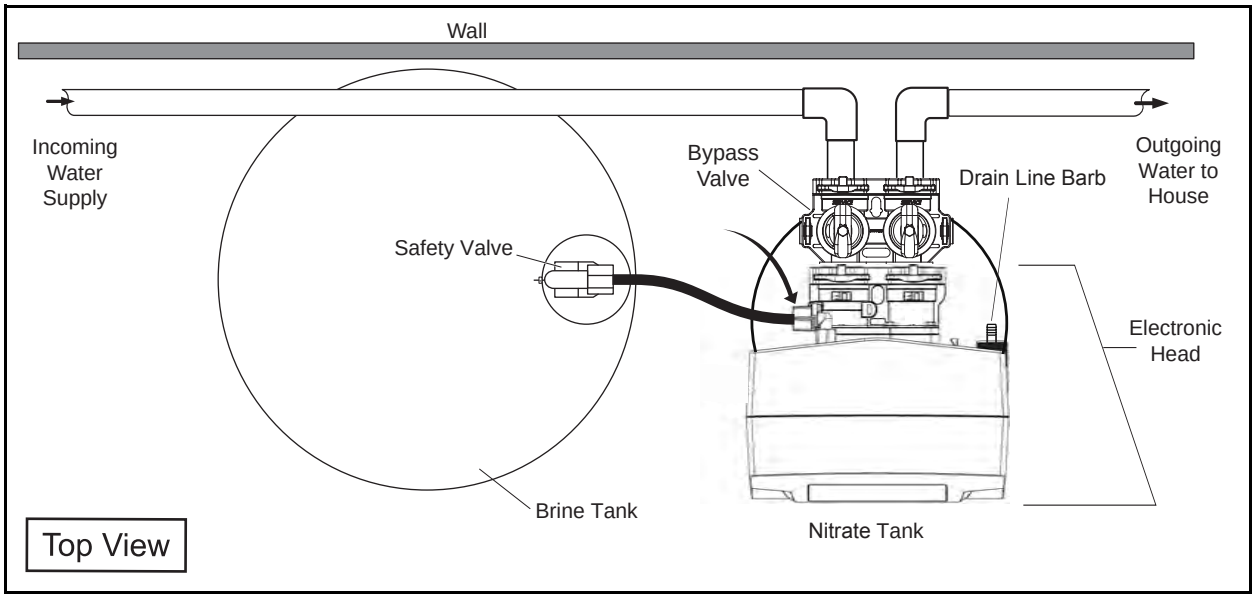


Figure 4

9. Attach the black Brine Tank hose to the connection on the top of the Electronic Head by removing the black compression nut. Slide the compression nut over the end of the black tube, fully inserting the Brine Line into the port and tighten the compression nut.
10. Add approximately 160 lbs. of salt pellets to the brine tank. (Example: four 40-pound bags)
11. Add 5 gallons of water to the brine tank.

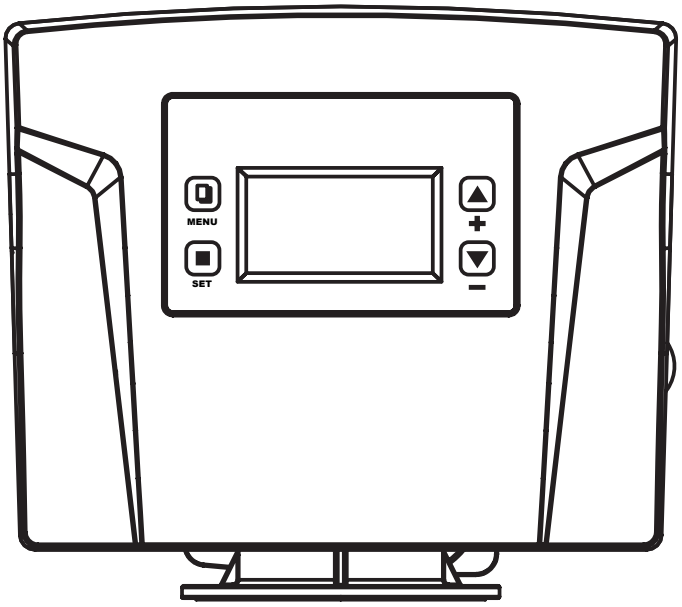
Complete the Installation

1. Set the Bypass Valve into bypass mode.
2. Slowly turn on the main water supply until all pipes are pressurized.
3. Slowly open the bypass valves.
4. Let the Nitrate Tank fill completely and then open the bypass valves the rest of the way.
5. Check for leaks.
6. Plug in the Electronic Head.
7. Wax stainless steel tank jacket with wax provided or any other non-abrasive auto wax a minimum of 1-2 times per year or as needed based on the installed environment.

Note: Power Source - For safety reasons the outlet must be protected by a Ground Fault Circuit Interrupter (GFCI).

Programming the Electronic Head

Note: Remove protective film from electronic head screen.



Step 1: Setting the **Date & Time**

1. Press and hold the MENU button until you hear the beep to unlock.
2. Press MENU button.
3. Press SET once **Date & Time Setting** is highlighted.
4. Using the UP and DOWN buttons input the correct Date and Time pressing SET after each input.
5. Once set press the MENU button to return to the main menu.

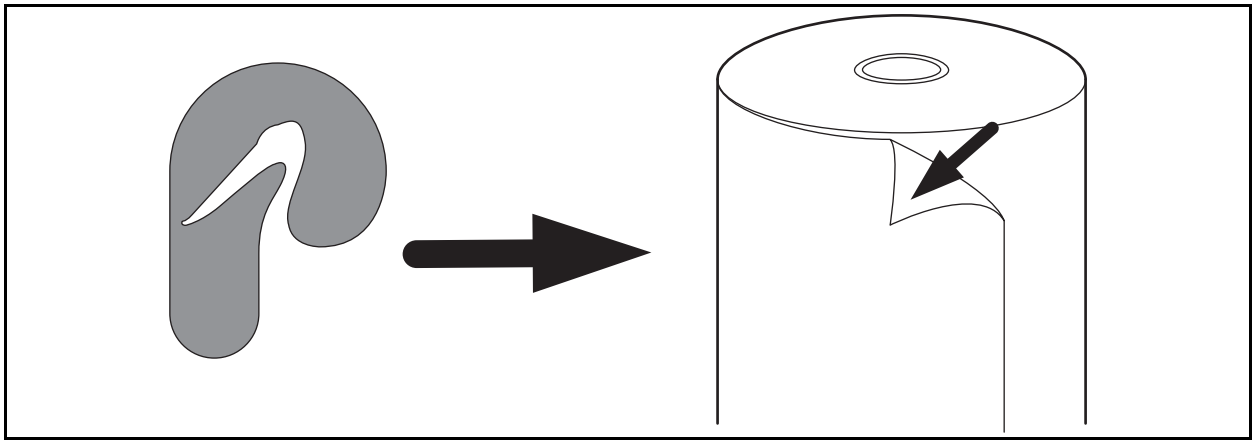
IMPORTANT!
You will need to manually regenerate (**Regen Now**) your system prior to use. To do so follow the programming below. You will not be able to use water for approximately 2 hours during this process.

Step **2**: Performing Manual Regen**eration**

1. Using the DOWN button select **Manual Regen** and press SET.
2. Using the UP or DOWN button select either **Regen Now** or **Regen Tonight**.
   -**Regen Now** will start a regeneration process immediately.
   -**Regen Tonight** will regenerate the system at the default regeneration time of 2:00 am.
3. Once selected press the SET button to confirm. Gears will make noise and water will start to flow. Allow the system to regenerate for approximately 2 hours.
4. Once complete press the MENU button to return to the main menu.

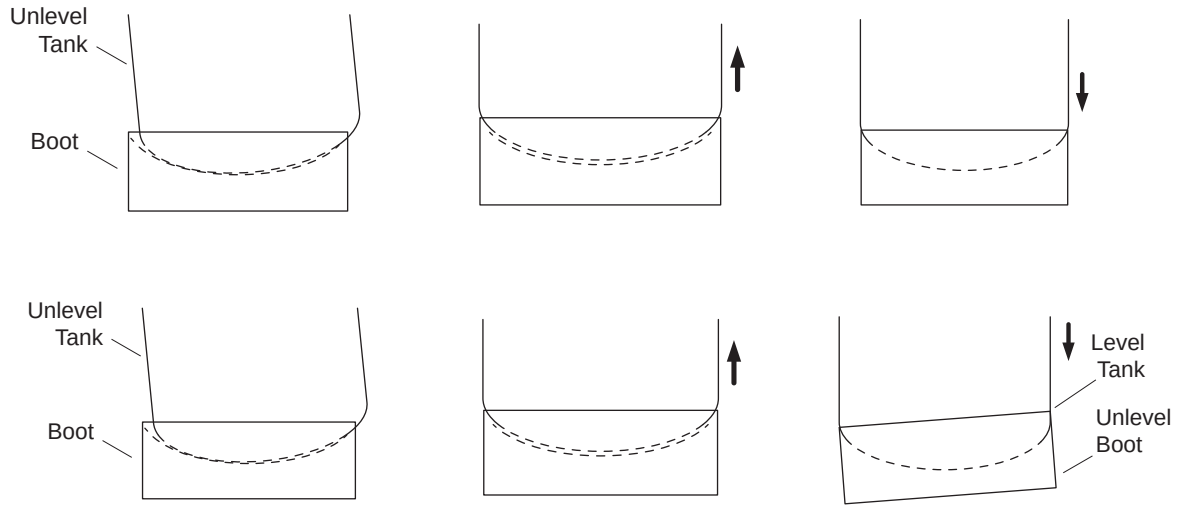
Adding the Pelican Logo Sticker

1. Peel back plastic to remove it from the tank.
2. Place sticker in the desired location on the tank.



!IMPORTANT!
Do not use where water is microbiologically unsafe or with water of unknown quality without proper disinfection before or after the filter/softener system.

Troubleshooting

Problem	Solution
Water leaking at the top of the tank around the head.	You may need to turn the head to tighten it. The tank head is installed hand-tight, do not overtighten the head (just turn it snug).
The tank leans to one side or is not level.	If the tank is not level, lift the tank straight up 6 inches and tap it on the ground until the tank stands vertical. The bottom of the tank is round and the boot allows the tank to stand upright.
	
The Brine Tank has too much water or is not filling properly.	Check and tighten all fittings on Brine Tank and Electronic Head to ensure air is not getting into the Brine Tank Hose.
The system is backwashing but it is not using up any salt.	If the salt has bridged (too much salt has been added to the tank and it has formed a solid block of salt), shake the Brine tank until the block of salt breaks apart.

!IMPORTANT!

Do not use where water is microbiologically unsafe or with water of unknown quality without proper disinfection before or after the filter/softener system.

Warranty

Pelican Limited Lifetime Warranty

Pelican Water ("Pelican") warrants to the end user ("customer") that its tanks (13" & smaller), in/out heads, bypass's, fittings, Natursoft media and housings ("Covered Items") will be free from defects in material and workmanship under normal use and service for the life of the system. No warranty is made with respect to defects or damaged due to neglect, misuse, alterations, accident, misapplication, physical damage, installation on water quality outside guidelines for system or damaged caused by fire, acts of God, or freezing.**

Pelican **7** Year Limited Warranty

Pelican Water ("Pelican") warrants to the end user ("customer") that its solid-state electronic heads ("Covered Items") will be free from defects in material and workmanship under normal use and service for a period of 7 years.

Limitations and Responsibilities

Pelican's obligation to the customer under these warranties shall be limited, at its option, to replacement or repair of Covered Items by these warranties, labor is not covered. Prior to return or repair of Covered Items, the customer must obtain a return goods authorization number from Pelican and at Pelicans option, return the Covered Items freight prepaid. Any Covered Item repaired or replaced under these warranties will be returned prepaid standard freight to the original point of shipment. Expedited freight options are available at customer expense.

No warranty is made with respect to defects or damaged due to neglect, misuse, alterations, accident, misapplication, physical damage, or damaged caused by fire, acts of God, or freezing. These warranties apply only to the original registered owner so long as the owner owns the home in which the unit was originally installed. Customer must register their system with Pelican within 90 days of purchase* in order to obtain a warranty. Warranty will discontinue after the unit is removed from the location where it was originally installed. Warranty begins on the date of delivery of product to the customer. Improper maintenance of system (i.e. not replacing filters or media) on time will be considered "neglect". Installation of any system on water conditions outside of or beyond the recommended specs of any system voids any warranty.

Pelican gives this warranty to the customer in lieu of all other warranties, express or implied, including without limitation any implied warranties of merchantability or fitness for a particular purpose or treatment of certain water and hereby expressly disclaims all other such warranties. Pelican's liability hereunder shall not exceed the cost of the product. Under no circumstances will Pelican be liable for any incidental or consequential damages or for any other loss, damage or expense of any kind, including loss of use, arising in connection with the installation or use or inability to use the Covered Items or any water treatment system the Covered Items are incorporated into. These warranties are governed by the laws of the state of Florida and may change at any time without notice.

*Failure by California and Quebec residents to complete the product registration form does not diminish their warranty rights.

**For all orders placed on or after June 3rd, 2011.

Warranty Registration Form

Send in this Warranty Registration Form to validate your warranty or visit www.PelicanWater.com to complete warranty registration form online.

Pelican Warranty Registration Form

Date Item(s) were Received:	Order ID#:	Model:

Dealer Purchased From:

Model/Serial Number:

Name:

Address:

City: **State:** **Zip:**

Send To:

Pelican Water Systems
3060 Performance Circle, Suite 2
DeLand, FL 32724
Phone: 1-(877) 842-1635

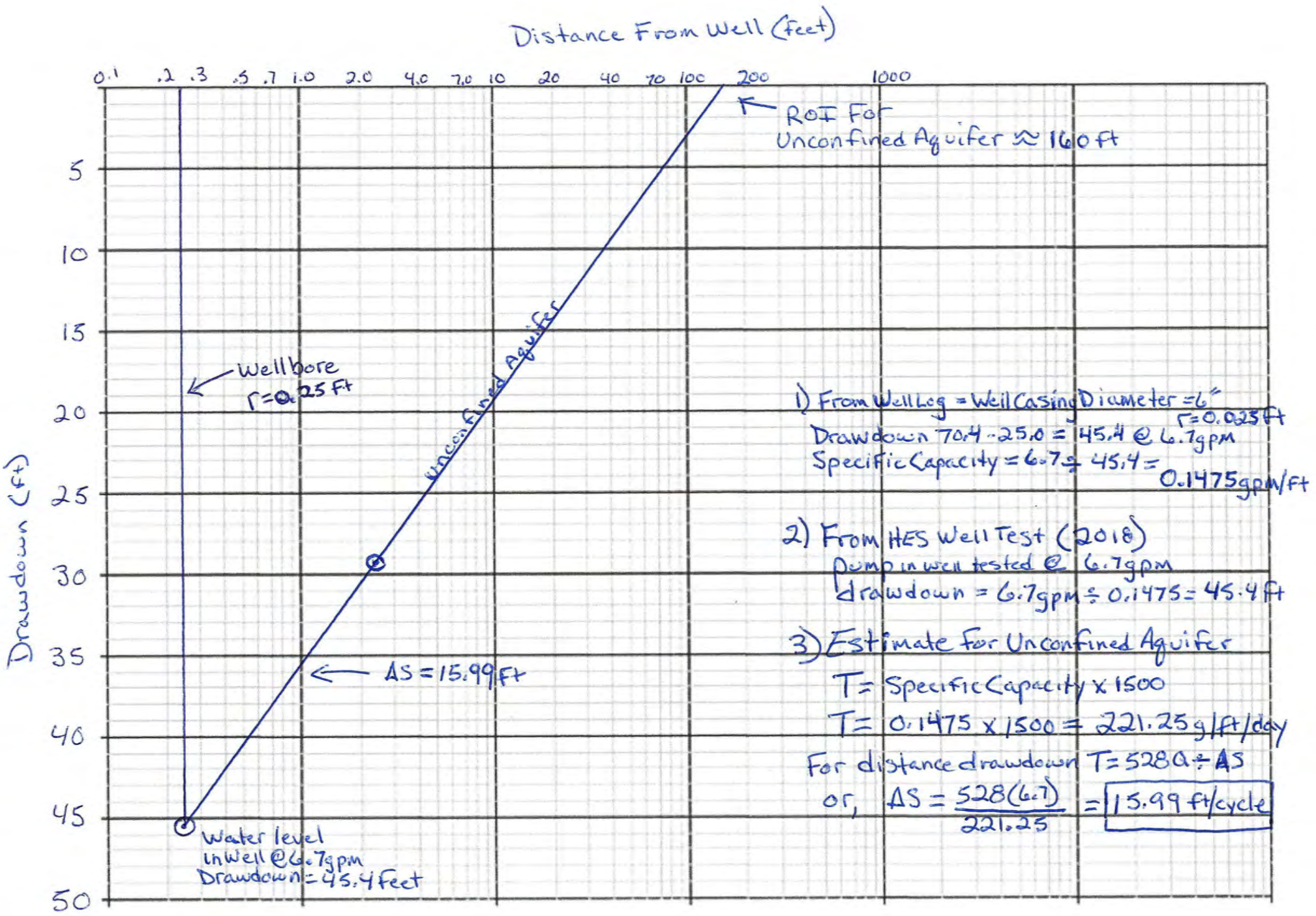
Plumber's Information (optional)

We like to recommend good plumbers throughout the USA and if you were happy with your installer please give us their information so we can pass it on as a courtesy. Thank you for your time.

Name of Plumbing Company used to install system: _____

Phone #: (_____)-_____ of the Plumbing installer

APPENDIX G
WELL PUMPING INFLUENCE ESTIMATE for PROJECT WELL



Radius of Pumping Influence
334 Puruine Rd.