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August 29, 2013

Jamie Kirk
Kirk Consulting
8830 Morro Road
Paso Robles, California 93442

Dear Ms. Kirk:

You have asked that we explore likely effects of pumping the wells at Cantinas Camp, with emphasis on how these may affect water levels in off-site wells.

Background

Cantinas Camp is now going through environmental review under the California Environmental Quality Act (CEQA). The County of San Luis Obispo has issued a negative declaration, which addresses hydrology and water quality. Interested parties, including neighboring residents, have responded to this document, seeking to better understand what the effects of pumping the wells may be on groundwater levels and recharge. This letter is intended to supplement the information available.

We are the professionals who investigated the Cantinas Camp area in 2011, selecting the sites and directing most of the drilling which led to meeting the anticipated water demand, which had been projected by the engineers at Fall Creek Engineering. We previously described our assignment, our approach to locating groundwater, our observations and recommendation in a report issued in July 2011 (Hecht and others, 2011). The report includes substantial technical information on the geology, water-quality, and general groundwater condition at and near Cantinas Ranch. In the interest of focusing on the issues of most concern to local residents, we have tried to avoid repeating the content from the 2011 report. Rather, we incorporate it by reference into this letter. Readers should have both the 2011 document and this letter in hand to get the maximum benefit from the letter you have requested.

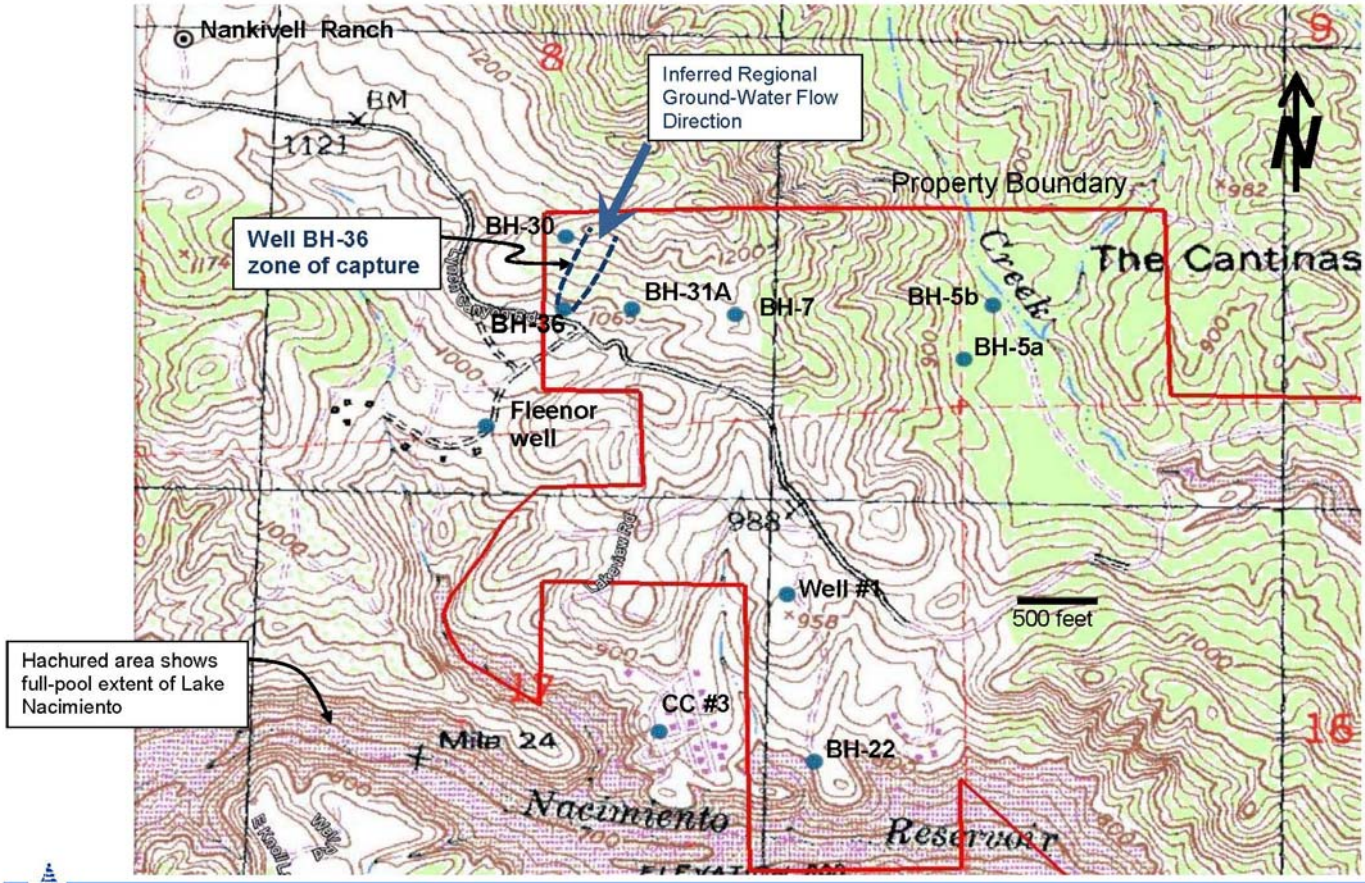

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Figure 1. Calculated zone of capture for Well BH-36, Cantinas Camp, San Luis Obispo County, California. The shape and size of the zone of capture is influenced by the pumping rate of the well, the aquifer transmissivity and the regional ground water gradient. The figure also shows location of other known wells in the area. Effects of pumping project wells on neighboring wells, if any, depend upon the degree of hydraulic connection which remains to be established.

210067 radius of influence CALCS, Zone of Capture

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The on-site wells have been completed, given initial testing, and have been protected with well-head structures. Prior to being used for the proposed project, the wells will need to be incorporated in a water system approved by the State. The approval process requires substantial additional testing. We recommend the wells be classified as 'bedrock wells', subject to a full 72 hours of dynamic "pump" testing. More water-quality testing will also be needed, including for an expanded list of constituents listed in the State's Title 22. By custom, and in some instances by statute, the testing must be completed shortly before the wells are put in service. Some of the data which will be requested by the State will be of substantial use in answering questions regarding off-site effects. If interested owners partner with you, enabling sample and data collection from their wells concurrent with the State's mandated testing, we will

be able to move even further toward a fuller analysis of this complex faulted and folded ridge-top groundwater setting. Additional details are given below.

Cantinas Camp will provide facilities for 300 campers and staff. It is presently projected to operate in summer, and occasionally during other seasons. Our analysis is based on a mean daily demand of 22,800 gallons per day, as computed by Fall Creek Engineering (Myer, 2013).[1] We also have conservatively assumed a 120-day season during the summer months, and additional winter and spring holiday season use for 30 days each.

Organization of the Letter

The sources of groundwater, the volumes in storage, and the effects of withdrawing groundwater are best informed by drawing upon three independent lines of evidence:

- The rate and sufficiency of groundwater recharge
- The quality of groundwater, and its ionic composition or 'fingerprint'
- The mechanics of the aquifer, and computations of likely effects of pumping.

Sufficiency of groundwater recharge is discussed in this section. Groundwater chemistry is considered in the next, followed by our preliminary analysis of aquifer mechanics.

The effects discussion is followed by an analysis of water use under alternative land uses.

Is Groundwater Recharge Sufficient to Sustain the Camp's Proposed Water Use?

A reasonable question to ask is whether groundwater recharge, sustained over decades, on the western portion of the Cantinas Ranch property is sufficient to meet the groundwater demand.

With mean annual rainfall of about 24 inches (per adopted SLO County Public Works Standards), rainfall recharge is likely to average about 4 to 5 inches per year, given the sandy soils at the site (Lindsey, 1983). We computed the area needed to meet the amount of annual recharge to satisfy the project demand calculated above, or about 12.6 acre feet per year if operated 180 days each year. If rainfall recharge averages 4 inches per year, water use would be offset with recharge from 38 acres; if it averages 5 inches, a more reasonable estimate given the sandy soils, recharge through 30 acres will meet the project annual

[1] Hydrologists often also consider peak demand days, typically at 2.5 times the mean daily use (see Myer, 2013). Fall Creek Engineering has computed peak-day demand to be 57,000 gallons per day, equivalent to 39.6 gallons per minute. Since the wells at the proposed project have cumulative rated capacities in excess of 120 gallons per minute, and the volume available in the aquifer is very large relative to envisioned peak demand, peak-day demand is not likely to be constrained by groundwater. The volume of water pumped during peak-use days is included in the average daily demand used in our calculations. No special provisions are needed in the groundwater supply calculations for peak-day demand, so it is not further considered in this letter.

demand. These values fall between 5 to 7 percent of the 560-acre area of Cantinas Ranch, or less than 20 percent of the western portion of the ranch north of Lynch Canyon Road.

Table 1. Available groundwater data and calculated aquifer characteristics, Cantinas Camp, San Luis Obispo County California

Well	Ground Surface Elevation *ft. WGS84*	Well Total Depth *ft. bgs*	Depth to Water *ft. bgs*	Static Water Elevation *ft. WGS84*	Pumping Water Level *ft. bgs*	Q[a] *gpm*	ΔS[b] *ft*	Specific Conductance at 25°C *µmhos/cm*	Specific Capacity[c] (Cs) Q/ΔS *gpm/ft*	Transmissivity[d] (T) 1860*Cs *gpd/ft*	Remarks
								---			
#1	943	101	44	899	68	11	*24.38*		0.45	839	Pumping test
#2	946	142	82	864	99	9	*16.97*	1023	0.53	986	Pumping test
BH-2	1015	300	190	825	---	0	*110*	4595	0.00	0	No air-lift test
BH-5a	856	180	100	756	---	10	*80*	1489	0.13	233	Air-lift test
BH-5b	841	300	75	766	---	10	*225*	4244	0.04	83	Air-lift test
BH-7	1160	580	85	1075	---	10	*495*	845	0.02	38	Air-lift test
BH-22	815	420	20	20	---	---	---	1837	---	---	---
BH-30	1180	300	85	1095	---	4	*215*	796	0.02	35	Air-lift test
BH-31A	1115	380	15	1100	---	4	*365*	439	0.01	20	Air-lift test
BH-36	1088	220	0	1088	---	100	*220*	556	0.45	845	Air-lift test
Fleenor[e]	963	---	---		---	15-20	---	1348	---	---	---
Kavanaugh Cr springs			surface			5+		3200-3650			near L.C Rd.

Notes:

a Yield values obtained by air-lift test somewhat overestimate sustainable yields.

b Drawdown (ΔS) for pumped wells is calculated as the difference between static and sustained pumping water levels, as reported by varying sources. For wells tested by air-lift, an approximation of drawdown is estimated to be the height of the water column from static water level to the bottom of the well, which will somewhat overestimate drawdown

c Specific capacities are based on measured drawdowns during 1 to 4 hour post-development tests and drawdowns measured at the end of a test or per footnote b, above for air-lifted wells.

d Transmissivity values of wells with yields obtained by air-lift may be slightly overestimated. Per standard practice A factor of 1860 was used to calculate Transmissivity: California Department of Water Resources, 1966, Bulletin 118-2, Evaluation of Ground Water Resources: Livermore and Sunol Valleys. Appendix A: Geology, August 1966. 135p.

e Ms. Fleenor kindly allowed us to measure specific conductance in here well during June 2011.

Abbreviations

bgs:	below ground surface
gpm/ft	gallons per minute per foot of drawdown
gpd:	gallons per day
µmhos/cm	micromhos per centimeter at 25°C

Deep percolation of rainfall is only one of the sources of recharge at Cantinas Ranch. Infiltration of treated effluent is another. This infiltration will be a combination of (a) water percolating to the water table from the leachfield and (b) deep infiltration of water used around the site to support landscaping. These values are estimated to total somewhat less than the water demand of the project, as a minority fraction of the water pumped will be used consumptively.

As a result, a large portion of the water pumped for the project will be used, treated and then returned to the ground as treated effluent, which represents recharge which largely offsets the project's long-term demand

What Water Chemistry Tells Us

The chemistry of groundwater tells much about its path through the earth, and the degree of connection between water-bearing zones in the subsurface. Groundwater gradually dissolves salts, acquiring a chemical signature of an aquifer or formation as it passes through it. Waters with similar concentrations of salts are likely connected or share a similar recharge history. Conversely, those with different levels of salts tend to be hydraulically separate. We can use the measured values of specific conductance, a widely-used field index of salinity, to identify the waters which likely share a common source. At a more detailed level, waters with similar ionic chemistries, or 'fingerprints', are generally closely related, while those with different proportions of ions usually originate in separate aquifers or water-bearing zones. We used these similarities and differences as a way of understanding the relationships between water-bearing zones identified during the 2011 groundwater-exploration program (See figure 8 of that report, reproduced in the appendix to this letter).

The basic data in Table 1 show a group of wells with relatively low salinities, represented by specific conductance values of about 400 to 1000 micromhos/cm, normalized (as standard) to 25°C (µmhos/cm). These include wells 30, 31b, 36 and the pond below them along Lynch Canyon Road. A separate set of wells yield waters with specific conductance values of 1300 to 1800 µmhos/cm, or roughly double the salt content of the first set. These include well 5b, well 7, well 22 and the Fleenor well. A third set of springs and boreholes yield specific conductance values in the range of 3000 to 5000 µmhos/cm. Among these are the Kavanaugh Creek springs along Lynch Canyon Road, abandoned 2011 borehole BH-2 near the center of Cantinas Camp (see Hecht and others, 2011), and waters encountered in the lower few feet of borehole 5a, as this well penetrated into the underlying 'redbed' sediments beneath the Vaqueros sandstone.

With distinct differences in salinity, it is highly probable that each of these three groups originates from and are stored as groundwater in separate sources, and are unlikely to be directly connected.

Aquifer(s) mechanics and effects of pumping

This section describes possible effects which pumping for the proposed project may have on the supply to adjacent wells, and conversely, the basis for effects which neighboring wells may have on the project wells.

We conducted preliminary desktop modeling of likely groundwater effects using data garnered from the groundwater data thus far observed, plus reasonable approximations. The questions we asked were:

A. What might be the range of likely effects of producing 22,800 gpd (15.8 gallons/ minute) from wells primarily located in the northwestern portion of the Cantinas project?

B. What can we learn from these calculations to help shape future well testing?

To estimate the effects of the project, we first used existing data to bracket likely aquifer parameters, such as transmissivity and the storage coefficient. We then simulated three likely pumping effects:

- Pumping the most productive well (Well BH-36) for 120 days to evaluate how far the zone of influence might propagate under pumping for a full summer season.
- Pumping Well BH-36 for 30 days to evaluate how far the zone of influence might extend during seasonal use, such as during the winter or spring holiday season.
- Pumping Well #1 for 120 days to estimate effects on the Christmas Cove water-supply well, if any. Pumping Well #1 for 30 days to estimate effects on the Christmas Cove water-supply well #3, if any, during the winter or spring holiday seasons.

Table 2. Two pumping scenarios (30 and 120 days) of estimated drawdown in neighboring wells while pumping Cantinas Camp wells #1 and #36, using reasonable maximum and minimum values of Storativity (S)

Well #1
Pumped 30 days at 7 gpm

	Distance from Well #1 (feet)	Drawdown (feet) *[T=839gpd/ft]*	
		S = 0.02	S = 0.002
Christmas Cove well #3	1250	0	0.8
"Fleenor's" well	2270	0	0
Nankivel Ranch	5565	0	0

Well #1
Pumped 120 days at 7 gpm

	Distance from Well #1 (feet)	Drawdown (feet) *[T=839gpd/ft]*	
		S = 0.02	S = 0.002
Christmas Cove well #3	1250	0.0	2.2
"Fleenor's" well	2270	0	1.0
Nankivel Ranch	5565	0	0

Well BH-36
Pumped 30 days at 10.6 gpm

	Distance from BH-36 (feet)	Drawdown (feet) *[T=845gpd/ft]*	
		S = 0.02	S = 0.002
"Fleenor's" well	960	0	2.0
Christmas Cove well #3	3025	0	0
Nankivel Ranch house	3165	0	0

Well BH-36
Pumped 120 days at 10.6 gpm

	Distance from BH-36 (feet)	Drawdown (feet) *[T=845gpd/ft]*	
		S = 0.02	S = 0.002
"Fleenor's" well	960	0.7	4.0
Christmas Cove well #3	3025	0	0.7
Nankivel Ranch house	3165	0	0.6

Notes
Transmissivity based on specific capacity for either Well #1 or Well 36. See Table 1.
Wells are shown as being pumped at two-thirds of rated (well #1) or total water demand (well BH-36), the equivalent of pumping them 2/3 of the time.

Methods: As explained below, we conducted this analysis to identify whether effects would be (a) indiscernible, (b) small, (c) moderate, or (d) large, as quantitative results are precluded by the assumptions of this typical method. Estimates of transmissivity were developed from the standard California Department of Water Resources equation based on specific capacity:

$$T = 1860\ \mathbf{Cs}, \text{ for 5 to 6 inch wells} \qquad (1)$$

Specific capacity **(Cs)** is the yield per foot of drawdown, which was computed from the data in Table 1. The storage coefficient ('storativity') has not been measured, so we applied maximum and minimum

reasonable values of 0.02 to 0.002. We assumed that each well would be operated 2/3 of the time, a normal and sound practice used by many water systems, which recognizes wells should be rested for maintenance and other needs.

We conducted this analysis simply to bracket a range of possible effects. In fact, the assumptions underlying this conventional analysis – typically used in continuous valley-floor systems – are fundamentally not met.[2] The aquifer(s) are not uniform, continuous and flat alluvial sediments, but rather are faulted and folded bedrock, broken by small canyons and deep drainages, and on a substantial slope. So, the results of the analysis should be used only *qualitatively*, interpreted as giving an idea of effects. Actual connectivity between wells in the region of the Cantinas project is likely considerably lower.

Results (Table 2) show either indiscernible or small effect, depending upon the storativity value chosen within the range reasonable for this formation in this area, and on the duration of pumping. Pumping for a month-long season is unlikely to have a discernible effect; a four-month season is more likely to have an effect. Wells closer to the pumped wells are more likely to be affected. The closest well we identified is one which a kind neighbor, whom we believe is Ms. Fleenor, allowed us to sample in 2011. Is there any way to estimate recovery time?

Under California's Environmental Quality Act (CEQA), it is understood that all wells may have some effects on others developed in the same aquifer or aquifer system. Small effects are generally accepted as intrinsic to sharing a groundwater source. Effects of pumping groundwater are considered 'significant' if use of a project's well will.

"Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (i.e., the

[2] Key assumptions of the Cooper-Jacob approximation for the Theis equation include:

- The water-bearing formation is uniform in character, with uniform properties in all directions.
- The formation is infinite in extent, uniform in thickness, and unfaulted or unbroken by drainages.
- The formation is not being actively recharged during the period of the test.
- The pumped well penetrates and receives water from the full thickness of the aquifer
- The pumping well is 100% efficient
- Laminar flow is occurring throughout the well and aquifer
- The water table or potentiometric surface has no slope; if it does, the effects will be predominantly in the upgradient direction.

production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)." (CEQA Appendix G guidelines)[3]

What Effects, If Any, Might Be Expected On the Oaks

Mr. Nankivell, a neighbor to the west (see Figure 1), has written a letter, which speculates that withdrawal of water from the local aquifer may lead to deteriorating oak vigor or stand quality. This does not match with our experience, so we decided to look into what the known effects are on oaks in other Central Coast areas. With one important exception noted below, California oaks are intolerant of saturated ground, not thriving in water-table situations where their "feet are wet"; rather, they generally draw upon waters percolating to the water table, and not below the water table. Where the trees can tap summer water tables, oaks often do not compete well with species such as buckeyes, bays, sycamores, or elderberries. As such, a rising water table may create more of a threat to the oak savanna at the site than a falling one.

At the regional scale, we see little record of groundwater development leading to a general loss of oaks in coastal California. Resiliency of the coastal oak savannah to groundwater withdrawals can be seen throughout its growth range. Large areas of San Luis Obispo County, such as those between Paso Robles and Creston, have seen water levels decreases 70 feet over the past 25 years (Paso Robles Tribune, 2013), with no discernible change in oak density. Further north, water levels have fallen 30 to 80 feet beneath Fort Ord, where oaks remain the dominant species in a near-continuous arboreal canopy; much the same situation occurs throughout northern Monterey County and eastern Santa Cruz County, where water levels similarly have decreased by 30 to 150 feet. Locally, oaks grow right to the edge of Lake Nacimiento, where the lake level (and presumably the water table) often fall more than 100 feet each year, and can remain depressed for several consecutive years. If falling water tables adversely affected the oak savannah, we would expect to find oak growth thinning around the lake. However, the oaks around the lake remain vigorous and, if anything, have become thicker in recent decades. Even the upland oaks growing on peninsulas extending into the lake (such as the southeastern corner of Cantinas Ranch or near the mouth of Christmas Cove) support vigorous oak woodlands, despite being disproportionately affected by frequent and protracted water-table drawdown on three sides.

One oak species, which does draw on the water table might prove an exception -- valley oak *(Quercus lobata)*, a riparian oak which grows along streams and depends on alluvial groundwater. The California Department of Fish and Wildlife considers valley oak woodland to be a sensitive habitat, particularly in the Fort Hunter Liggett area several miles to the north, which supports one of the noteworthy valley oak

[3] *www.waterboards.ca.gov/water_issues/.../2012_**ceqa**_apdx_**g**.pdf*, (p. 251)

woodlands in the state (c.f., Nacitone watershed study, p. 35). Valley oak woodland has been identified on the eastern portion of the Cantinas Ranch (Althouse and Meade, 2012) far from where most of the new wells are concentrated, and where most pumping will likely occur. There is no valley oak woodland in the western part of the ranch. Valley oaks do occur on the eastern portion of the ranch along Cantinas Creek near the edge of the lake.[4] A plan to draw groundwater from the western, upland areas of Cantinas Ranch is one which minimizes impacts on the valley oak woodland.

To further explore these questions, we reviewed both the local watershed plan ("Nacitone", 2008), and the RCD's and NRCS's regional evaluation for northern San Luis Obispo County (Upper Salinas – Las Tablas Resource Conservation District, 2002). No mention of effects of groundwater development on oaks was found. We also searched the local groundwater management literature to identify whether sustaining oak woodlands was an identified goal or objective, finding only generic mention of support of riparian vegetation (summarized in GEI and others, 2011).

We conclude that both watershed and groundwater planning documents pertinent to Cantinas Ranch do not identify maintaining groundwater levels as a goal for sustaining the important oak woodlands of the area, with the exception of the valley oak, a riparian woodland species. A rising, rather than falling, water table would adversely affect other oaks. There are very few valley oaks in the areas likely to be affected by pumping; the choice of pumping the western portion of the site is one which minimizes effects on oaks.

Alternatives Analysis

To gain some insight on effects of the project on groundwater demand, we compared the project water use at planned camp with another alternative set of land uses on the property. The 560-acre ranch includes 11 parcels. We asked: "What might be the effects of converting these 11 parcels into small estates or ranchettes?" We further hypothesized that many estate homes[5] incorporate up to 10 acres of agricultural uses, such as vineyards or equestrian facilities for up to 10 to 20 horses, uses consistent with those we have seen throughout northern SLO County. The alternative which we analyzed included estate homes on each lot, with guest or in-law quarters and a small caretaker's or ranch-hand's residence; 10 acres or vineyard or equestrian facilities for up to 10 horses are included on 4 of the 11 lots. A summary of likely water use for the 11-estate-home alternative is shown in Table 3. With only residential uses (no vineyard

[4] Many of the valley oaks at Cantinas Ranch are also affected by the 100-foot-plus drawdown of Lake Nacimiento, yet are apparently doing well.

[5] A water demand of 1.00 acre feet per year per estate home was used, at the low end of the range compatible with regional estimates of 1.0 to 2.5 acre feet year, and consistent with guidelines in use in Santa Barbara (Interface Planning and Counseling Corporation, 1989) and Monterey Peninsula (MPWMD, 2007).

or equestrian use) on each of the underlying 11 parcels, water consumption would be approximately equivalent to the proposed Camp use. The proposed project will likely use less water (up to 28 acre-feet per year) than the 11-estate-home alternative (about 60 acre feet), on average. Further, the proposed camp will be better able to conserve or even ration water during a drought emergency, while it will be difficult for vineyards to be taken out of production, or private equestrian facilities to go inactive during several continuous years of low rain. This comparison underestimates the possible difference in that the existing zoning allows two homes plus two guest structures on each parcel.

Table 3. Water demand of 11 Estate-home alternative

Land use	*Number of Parcels*	*Water Use per Home* acre ft/yr	gal/day	*Total for category* acre ft/yr
Main residence *	3	1.0		
Guest house		0.3		
Caretaker's residence		0.5		
		1.8		**5.4**
Main residence	4	1.0		
Guest house		0.3		
caretaker's residence		0.5		
equestrian facility (10 horses)		2.24	2000	
		4.04		**16.2**
Main residence	4	1.0		
Guest house		0.3		
Caretaker's residence		0.5		
10 acres of vineyard		8.0		
		9.8		**39.2**
Total	***11***			***60.8***

Notes

All values rounded

Estate home includes 0.075 acres (about 3000 sq ft) of lawn, 0.25 acres of other landscaping

Vineyard water use estimated at 0.8 acre feet per acre.

**** Large lawn or landscaped areas are allowed and are often used in this area. If lawn areas at each main residence, guest house and caretakers residence total 2 acres, water demand would increase by about 6.1 acre feet per parcel, as a total of 67 additional acre feet of consumptive water use***

Next Steps

At the time of the first building permit application, those wells which ultimately will be used for the Cantinas Camp supply should each undergo 72-hour pump tests, with water samples drawn near the conclusion of each test. Aquifer properties should be established for the areas around the tested wells by measuring drawdown in adjoining on-site wells during the tests, which will allow refinement of Table 2. A final operational plan for meeting the mean and peak demand should be developed based on results of the tests.

We suggest that, when these tests are conducted, Cantinas Camp arrange with willing and interested owners to measure the effects of the long-duration pump tests on water levels in off-site wells within a reasonable distance. At the time, samples of pumped from the off-site wells may be collected and analyzed for the major ions, and the short-term specific capacity of that pumping measured, such that any possible connections between the various wells may be established both by direct water-level measurement and by ionic fingerprint. A representative analysis of water from Lake Nacimiento should be included in the comparison. The comparative tests should be conducted under the direction of a state-registered groundwater professional, preferably with "certified hydrogeologist" specialization.

Conclusions

1. Anticipated peak water use at the proposed Cantinas Camp is 22,800 gallons per day, equivalent to about 15.8 gallons per minute of uninterrupted pumping.

2. Wells with capacities of more than 120 gallons per minute have been identified at Cantinas Camp. These capacities have been established by either airlift testing or by pump tests of one to several hours' duration. In our experience, such testing leads to higher yields than can be maintained during the 72-hour testing we recommend for these wells, and which tend to be diagnostic of longer-term sustainable values. In our previous report (2011), we recommended using two-thirds of the existing values as an estimate of the collective well yields which might be realized from these wells.

3. Groundwater recharge needed to keep these wells productive over the long-term may require about 30 to 40 acres, of which two-thirds would be in the western portion of the 560-acre ranch.

4. Given the distinct differences in salinity, it is highly probable that not all of wells in the area draw upon a single source. Effects of pumping wells from different sources tend to be much less than those drawing from a single source. Additional analyses of water quality should be performed on off-site wells as permitted by willing off-site well owners, such that the degree of connection can be better understood.

We calculated possible effects on nearby wells using conventional groundwater equations, our field measurements of transmissivity and a wide range of likely values for storativity. Conditions at this upland site meet none of the basic assumptions upon which these calculations are typically based, as we explain in Section 6. The calculations can provide only a qualitative 'general sense' of possible effects. These show that pumping sustained for 30 days – such as might occur during seasonal use --is likely to have no effects on neighboring wells. Pumping for 120 days – or a full summer season – will either have no effect, or may have up to several feet of drawdown on the known adjoining wells, effects which fall short of the CEQA definition of significant.

5. Effects of pumping will be partially offset, or mitigated, by recharge percolating to the water table from the project's advanced wastewater treatment plant. Situated near well BH-5a, this recharge will enter the water table at a location where it can reduce the effects of pumping for off-site parcels south of the project, but less so for parcels to the west.

6. Next recommended steps are to:

   A. After project approval, commence applying for a permit to operate a small water system
   B. Test each on-site well for 72 hours, in accordance with DHS' recommendations for bedrock wells
   C. Collect water samples for general mineral and nitrate analysis, and possibly measure effects of the 72-hour tests on nearby wells with willing owners, to establish potential effects.

We appreciate the opportunity to consider and explain the likely effects of developing groundwater at Cantinas Ranch. Please do not hesitate to pose questions or seek clarifications.

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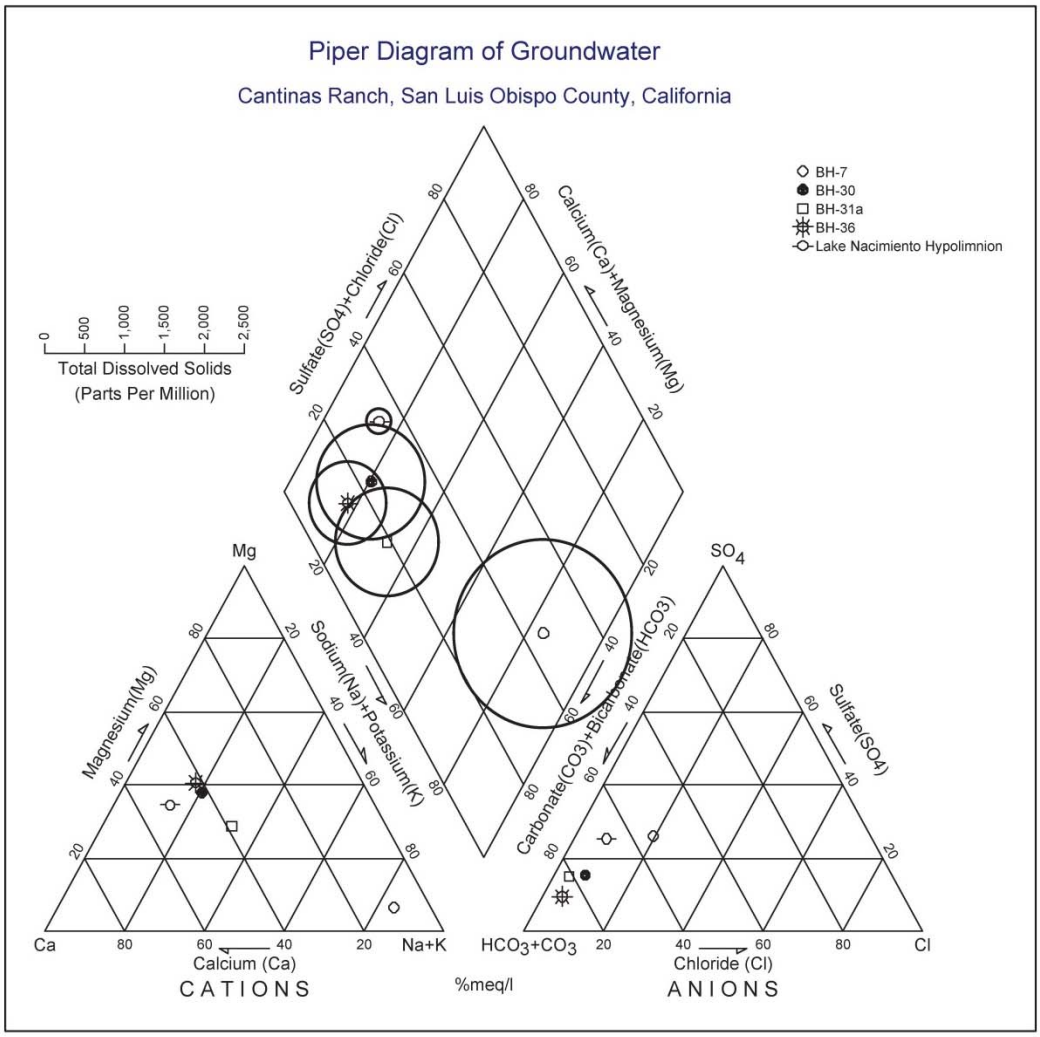
Appendix A



This diagram shows cations in the ternary graph on the left and anions on the right graph. The diamond graph in the center illustrates both cations and anions. Hardness dominated water plots to the left and top of the diamond graph, soft monovalent-salt dominated water to the right, and soft alkaline water towards the bottom. The radius of circle around the plotted points represents the concentration of dissolved solids, calibrated to the scale shown.

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Figure 8. Piper diagram illustrating ionic signatures of groundwater samples collected following well development at Cantinas Camp, San Luis Obispo County, California.