September 23, 2016

Brassfield Estates Vineyards
Mr. Jonathan Walters
10915 High Valley Rd,
Clearlake Oaks, CA 95423

**RE: GROUNDWATER AVAILABILITY STUDY
BRASSFIELD ESTATES VINEYARDS
10915 HIGH VALLEY ROAD
CLEARLAKE OAKS, LAKE COUNTY, CALIFORNIA
EBA JOB No. 16-2328**

Dear Mr. Walters:

This report presents the results of a groundwater availability study conducted for Brassfield Estates Vineyards (BEV), which encompasses sixteen properties located at 10915 High Valley Road approximately two and a half miles northwest of Clearlake Oaks, in Lake County, California (see Figure 1, Appendix A for site location). The study was implemented as part of an assessment for the development of an additional 130 acres (AC) of vineyards, as well as a 100 acre-foot (AF) irrigation reservoir on the property. The purpose of this study was to determine whether there are adequate existing and future groundwater supplies to accommodate the proposed development and water demands.

1.0 BACKGROUND INFORMATION

1.1 Project Description

The sixteen properties that comprise BEV encompass approximately 2,262 acres and are identified as Assessor's Parcel Nos. (APNs) 006-004-04, -08, -10, -11, -12, -13, 006-005-08, 006-007-03, -04, -08, -35, -36, 060-350-06, -07, -08, and 060-560-01. A regional site map illustrating the primary site features is presented as Figure 2 (Appendix A). As shown on Figure 2, existing site features include approximately 190 AC of vineyard in the central portion of the project site, two irrigation ponds (High Serenity Pond and BLK 9 Pond), a winery, and a series of dirt roadways to provide access to various points across the property. The remaining portions of the site are undeveloped and characterized by hilly terrain that includes a combination of mostly chamise scrub brush and pine trees. Ground surface elevations across the site range from approximately 1,730 to 2,600 feet above mean sea level (MSL).

As reported by the owners, water supply for the existing vineyard, irrigation pond and landscaping operations is currently serviced by two agricultural wells (Wells #7 and #8). The reported well yields for these wells are each approximately 200 gallons per minute (GPM). Three additional wells (Wells #1, #2 and #5) on the property are used for domestic purposes, and have estimated yields of five, three, and five GPM, respectively. An additional three wells (Wells W1, W2 and W3) are located just south of the winery and supply the incidental water use of the winery (i.e., tasting room, winery operations, restrooms, etc.). These wells have reported yields of three, three, and two GPM, respectively. Please refer to Figure 5 (Appendix A) for the well locations.

The proposed project will entail planting approximately 130 AC of vineyards in the southern and western portions of the project site. These vineyards will be situated within portions of APNs 006-007-04, 060-350-06 and -08. Additionally, a 100-AF irrigation reservoir will be built in the southeastern portion of the property, within portions of APNs 006-007-35 and -36. The irrigation reservoir will be supplied with water from Wells #3, #4 and #6, which have reported yields of 100, 300 and 50 GPM, respectively. Please refer to Figure 3 (Appendix A) for the proposed locations of the vineyards and irrigation pond.

1.2 Local Geology and Hydrogeology

Bulletin 118 – High Valley Basin (California Department of Water Resources [CDWR], 2003) was used as the primary source for geologic interpretation and review. Information and mapping contained in this bulletin indicates that the Brassfield site area is situated in a basin that is underlain primarily by Quaternary alluvial deposits. Bordering these alluvial deposits to the north, south and west is the Jurassic-Cretaceous Franciscan Formation, which makes up the surrounding hills of the basin. Underlying the alluvial deposits within the study area and bordering the basin to the east are Holocene volcanics. A geologic map for the study area is presented as Figure 4 (Appendix A).

According to the Lake County Water Protection District's (LCWPD's) *Lake County Groundwater Management Plan (Lake County GMP)* dated March 31, 2006 (LCWPD, 2006), groundwater in the High Valley Basin occurs primarily in the Quaternary alluvium aquifer and Holocene volcanic aquifer. Both units are generally considered good water producing units. Groundwater recharge in the volcanic unit largely occurs through the coarser grained alluvial fans along the perimeter of the basin floor, whereas direct precipitation recharges the surface alluvium.

The most prominent surface water features in proximity of the project site are the two on-site irrigation ponds, Schindler Creek, which runs east through the project site, a series of ponds associated with a local fish farm to the east, as well as two additional ephemeral ponds further east. No springs were observed during the site visit.

1.3 Local Climate

According to the Western Regional Climate Center (WRCC), rainfall at the nearest weather station with historical data is located southeast of Clearlake. This weather station has data from 1954 through 2015 and includes average precipitation totals of approximately 25.4 inches per year (http://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1806). The mean annual potential evapotranspiration (ET_o) for the area is estimated to be approximately 45.5 inches per year (State of California, 2009).

2.0 RESEARCH

The following subsections provide a summary of the scope of research performed and the corresponding findings used to implement the hydrogeologic assessment. Please note that references are made herein to the cumulative impact area for this study. A description of the cumulative impact area is presented in Section 3.0 of this report.

2.1 Site Reconnaissance

EBA Engineering (EBA) conducted a site visit of the property and surrounding areas on July 12, 2016. The purpose of the site reconnaissance was to observe existing site features, site topography, local geology, location of existing wells, etc. At the time of that site reconnaissance, the existing property use and features were generally consistent with those described in Subsection 1.1 (*Project Description*) of this report. EBA observed eleven water supply wells (Wells #1 through #8, W1 through W3, and one unnamed well located just north of the winery) and collected depth to groundwater measurements, which ranged from approximately six to 247 feet below ground surface (BGS). Please note that Wells #2 and W2 were not accessible at the time of the site visit.

The site reconnaissance also encompassed the observance of neighboring properties to establish the nature of nearby developments and property uses. Please be advised that due to the rural nature of the property and limited public access, visual observations were limited to what could be seen from the property line (where readily accessible), or at a distance from public roadways. Due to these limitations, no off-site water supply wells were able to be identified. In general, most of the properties in all directions from the project site were comprised of rural properties.

The site reconnaissance work described above was supplemented with review of Google Earth Pro aerial imagery for the area. Findings from this research was generally consistent with the above findings.

2.2 Water Well Driller's Reports (WWDRs)

WWDRs maintained by CDWR were reviewed to obtain pertinent information for the area regarding water supply use, well completion depths, yields, etc. The scope of the CDWR research encompassed available records for wells located within Sections 17 through 20, 29 and 30 of Township 14 North (T14N), Range 7 West (R7W) and Sections 13 through 15 and 22 through 27 of T14N, R8W, Mount Diablo Baseline and Meridian. The off-site search radius was set at approximately one to two miles of the project site property boundary as a means of obtaining available information representative of the local hydrogeologic conditions. The results of this research identified 89 WWDRs or boreholes (multiple logs for some properties), of which 22 corresponded to locations on properties associated with the project site, 22 of which corresponded to off-site locations within the designated cumulative impact area, 38 of which corresponded to locations outside of the cumulative impact area, and seven of which an accurate location could not be determined. Please note that six of the WWDRs for the project site were outside of the cumulative impact area and not included in the analysis. As such, only the WWDRs with known locations within the cumulative impact area were used for analysis. Table 1 below provides a summary of the well/borehole and water supply characteristics for on-site and off-site wells located within the cumulative impact area in which WWDRs were available:

TABLE 1
RESULTS FROM WWDR RESEARCH

Description	***Project-Site***	***Off-Site***
Number of Water Supply Wells	16	22
Number of Dry Holes	1	0
Drilling Depths (feet BGS)	25 to 600*(1)*	50 to 700
Static Groundwater Levels (feet BGS)	25 to 299*(2)*	5 to 360*(2)*
Reported Yields (GPM)	0 to 800*(1,2)*	10 to 500*(2)*
Specific Capacity (GPM/ft)	N/A*(3)*	0.20 to 200

WWDR: Water Well Driller's Report
BGS: Below Ground Surface
GPM: Gallons per Minute
GPM/ft: Gallons per Minute per Foot of Drawdown

(1) Includes the dry hole.

(2) Does not include the WWDRs that had incomplete information for the respective measurement.

(3) No on-site WWDRs included sufficient data to allow for calculation of specific capacity.

As presented in Table 1, the reported yields range from zero (dry hole) to 800 GPM. If the dry hole is excluded, the average yield within the study area equates to approximately 222 GPM. Please be advised that the breakdowns provided above should be considered estimates based on interpretation of the WWDR information. Please refer to Figure 5 (Appendix A) for a map of the WWDR locations.

2.3 Assessor's Parcel Maps

County assessor's parcel maps for the area were reviewed to assist in identifying property boundaries and addresses. This information, in turn, was used to establish the number of properties within the designated cumulative impact area (described in Section 3.0) for this study. Findings from this exercise identified 69 parcels ranging in size from approximately 0.4 to 645 AC. Of these parcels, 15 are owned by BEV and are part of the project site.

2.4 Well Yield Pumping Tests

A well yield pumping test was conducted for Well #3 in August 2009, which revealed a sustainable pumping rate of 100 GPM with approximately one-foot of drawdown over a four-day period. Recovery to initial groundwater levels took approximately 16 hours. No pumping tests of significant duration have been performed on any other site-wells to calculate aquifer parameters.

3.0 CUMULATIVE IMPACT AREA

The "cumulative impact area" as defined for this study corresponds to the change in a specific area resulting from the incremental impact of the project when added to other existing groundwater uses in the area. Based on this criterion, existing development characteristics for surrounding properties were considered, coupled with the site hydrogeology and the nature of the proposed development, to estimate the cumulative impact area for the proposed project.

Important considerations in establishing the cumulative impact area for this project are the local topography, hydrology and hydrogeology. In this regard, the western, southern, and northern boundaries of the cumulative impact area are delineated by topographic ridges that define the local watershed of Schindler Creek. The eastern boundary was estimated by the changes in topography associated with the outflow gorge of Schindler Creek. Please refer to Figure 2 (Appendix A) for an illustration of the established cumulative impact area as defined above. Based on the stated boundary designations, the overall size of the cumulative impact area is approximately 4,899 AC and encompasses 69 rural properties (including the 15 BEV properties that fall within the cumulative impact area).

As previously outlined in Subsection 1.2 (*Local Geology and Hydrogeology*), the project site and the confined basin are underlain by Quaternary alluvium, which in turn is underlain by Holocene volcanics. Additionally, the surrounding ridges, which create the perimeter of the cumulative impact area, are comprised of rocks from the Franciscan Formation. For the purpose of this study, the alluvium and volcanic deposits are considered to represent the primary water-bearing aquifers. Conversely, the Franciscan rocks are conservatively considered to be non-water-bearing as yields from these formations are typically minor. Based on this hydrogeologic model, the formation contact between the alluvium/volcanics and the Franciscan rocks represents a boundary condition that influences groundwater supply. Please refer to Plates B-1 and B-2 (Appendix B) for the two diagrammatic cross sections presenting the estimated geologic contacts and static groundwater levels, as well as cross section locations.

It should be noted that the cumulative impact area referred to in the following sections is represented by the basin (approximately 1,973 AC), which is simply the extent of the Quaternary alluvium unit (Appendix A, Figure 4). Given that the Franciscan unit largely exhibits poor yields, the alluvium and volcanic aquifers in the basin appear to be the primary sources of groundwater in the cumulative impact area. Additionally, the Franciscan and basin areas generally have separate groundwater networks, meaning that the future water demands will only affect the alluvium and volcanic aquifers of the basin. As such, the ensuing groundwater availability estimations conservatively assume that the water available in the basin represents the availability of the whole cumulative impact area.

4.0 SUMMARY OF EXISTING / PROJECTED GROUNDWATER USE

Table 2 on the following page provides a general synopsis of both the existing and projected groundwater uses associated with the proposed development, as well as estimates of the off-site groundwater use on adjoining and nearby properties located within the cumulative impact area. The on-site water demands were provided by BEV, whereas the off-site groundwater use information was estimated by EBA using industry standard values for domestic/incidental use. As part of EBA's analysis, the website Parcel Quest was utilized to determine the number of bedrooms associated with existing dwellings. In regards to future development, a 3-bedroom dwelling was assumed for those properties in which an existing dwelling was not identified by Parcel Quest.

TABLE 2 SUMMARY OF EXISTING / PROJECTED GROUNDWATER USE			
Description	**Existing (AF/yr)**	**Future Additional (AF/yr)**	**Future Combined (AF/yr)**
BEV Groundwater Use			
Wine Production (Process Water) [(1)]	0	0	0
Domestic Use[(1)]	0	0	0
Landscape Irrigation	2.00	0	2.00
Vineyard Irrigation (without frost control)	31.20	78.00	109.20
Vineyard Irrigation (with frost control)	216.00	0	216.00
BEV Totals	***249.20***	***78.00***	***327.20***
Off-Site Groundwater Use			
Single Family Dwellings – Domestic Use[(2)]	8.00	30.00	38.00
Single Family Dwellings – Incidental Use[(3)]	3.50	10.00	13.50
Vineyard Irrigation	0	0	0
Off-Site Totals	***11.50***	***40.00***	***51.50***
Combined Groundwater Use			
Combined Totals	***260.70***	***118.00***	***378.70***

BEV: Brassfield Estates Vineyards
AF/yr: Acre-Feet per Year

(1) These groundwater uses are supplied by on-site wells W1, W2 and W3, which are completed in Franciscan Formation materials and are considered unrelated to the water supply source (Quaternary alluvium and volcanics) for this study.

(2) Based on 32 existing bedrooms and 120 future additional bedrooms at an incremental water use of 0.25 AF/yr per bedroom.

(3) Based on 14 existing dwellings and 40 future additional dwellings at an incremental water use of 0.25 AF/yr per dwelling.

As presented above, the estimated total future groundwater use within the cumulative impact area equates to 378.70 AF/yr. In cases where the cumulative impact area boundary does not fully encompass a parcel that contains a dwelling unit, the corresponding water use was included regardless of the dwelling unit's and/or water supply well's location. This was done as a conservative measure. Additionally, portions of existing BEV vineyards lie outside of the cumulative impact area; however, they were still included in the groundwater use calculations because the irrigation water for these vineyards comes from the basin water supply.

5.0 GROUNDWATER AVAILABILITY ANALYSIS

As outlined in the introduction of this report, the primary objectives of the groundwater availability analysis were to evaluate whether there are adequate existing and future groundwater supplies to accommodate the proposed project. Findings from the analysis are summarized in the following subsections.

5.1 Aquifer Storage Capacity

The calculation of aquifer storage capacity is accomplished by multiplying the volume of the aquifer by its specific yield. The areas of the aquifers were estimated based on information shown on the geologic map (Figure 4), findings from the site reconnaissance, and WWDR information. The thicknesses of the aquifers, in turn, were based on the average static groundwater level in the units from measurements taken during the site reconnaissance and the maximum aquifer depth, which was based on the average basal depth of each unit from the WWDR information. Finally, the specific yield or secondary porosity volume for each aquifer was conservatively estimated based on documented literature values for similar Quaternary alluvial deposits and fractured volcanic units. As such, the specific yields were conservatively estimated to be 15 percent for the alluvium aquifer and seven percent for the volcanic aquifer (CDWR, 2003). The storage capacity was then calculated by multiplying the respective values. The following provides a breakdown of the calculations:

Quaternary Alluvium

- Aquifer Area: 1,973 AC
- Average Static Groundwater Level: 37 feet BGS
- Average Aquifer Depth: 88 feet BGS
- Aquifer Thickness: 51 feet
- Specific Yield: 15.0 percent
- Calculated Storage Capacity: 15,093 AF

Holocene Volcanics

- Aquifer Area: 1,973 AC
- Average Static Groundwater Level: 88 feet BGS
- Average Aquifer Depth: 180 feet BGS
- Aquifer Thickness: 92 feet
- Specific Yield/Secondary Porosity: 7.0 percent
- Calculated Storage Capacity: 12,706 AF

Based on the above calculations, the combined storage capacity of the Quaternary alluvium and Holocene volcanics within the cumulative impact area equates to 27,799 AF. As presented in Section 4.0 (*Summary of Existing/Projected Groundwater Use*), the combined groundwater use (i.e., BEV and off-site) for the existing and future combined scenarios are 260.70 AF/yr and 378.70 AF/yr, respectively. These groundwater supply requirements equate to approximately 0.9 percent and 1.4 percent, respectively, of groundwater in storage within the cumulative impact area.

5.2 Water Balance

General estimates of water balance for the cumulative impact area were determined by comparing groundwater recharge characteristics to the projected groundwater use. Estimates were developed based on a historical average rainfall year. As described in Section 3.0 (*Cumulative Impact Area*), the water balance estimations for the basin area, as presented below, represent the entire cumulative impact area.

In general, groundwater recharge estimates for a defined cumulative impact area are calculated by assuming that precipitation represents the primary source of potential inflow into the system, and run-off, evapotranspiration, evaporation and spring flow represent the primary outflow variables. In regards to this project, run-off from the surrounding Franciscan rocks were identified as an additional source of inflow into the basin, therefore, Franciscan run-off was added to the precipitation volume to represent the total inflow into the system.

As for other secondary sources of inflow (e.g., groundwater inflow from upgradient boundaries, recharge from irrigation, etc.) and outflow (e.g., groundwater outflow along downgradient boundaries, etc.) that contribute to the overall groundwater recharge characteristics, they were assumed to be relatively equal, resulting in no net gain or loss. Based on this approach, the following equation was used to calculate potential groundwater recharge:

$$\textit{Groundwater Recharge} = (P + KJf) - (R + ET_a + E_{CI} + E_R)$$

where "P" is equal to precipitation (in AF/yr), "*KJf*" is equal to run-off from the Franciscan unit into the basin (in AF/yr), "R" is equal to total run-off from the basin (in AF/yr), "ET_a" is equal to actual evapotranspiration (in AF/yr), "E_{CI}" is equal to evaporative losses related to canopy interception (in AF/yr), and "E_R" is equal to evaporative losses from irrigation reservoirs (in AF/yr). Details regarding the calculation of each of these variables are presented below.

Precipitation (P)

The total volume of precipitation that falls within each area was calculated by multiplying the historical average rainfall (25.4 inches per year) by the size of the respective area (2,926 AC [Franciscan] and 1,973 AC [Basin]).

Franciscan Run-off (KJf)

The percentage of the total precipitation that results as outflow (i.e., run-off) was estimated by comparing the ground slopes within the Franciscan area to run-off coefficients (RCs) for various types of developed and natural settings (ODOT, 2014). In general, slope surfaces were separated by areas identified as "flat" (less the 2 percent), "rolling" (2 to 10 percent) and "hilly" (greater than 10 percent). In this regard, the relative percentages of slopes within the Franciscan that align with these categories are approximately one, three and 96 percent, respectively. These areas, in turn, were further separated by the types of settings. The following provides a breakdown of the setting types and range of RCs used in the analysis:

- Meadows / Pasture Land: 0 AC (RCs = 0.25 to 0.35)
- Light Residential: 0 AC (RCs = 0.35 to 0.45)
- Unimproved: 0 AC (RCs = 0.10 to 0.30)
- Woodland / Forest(1): 2,926 AC (RCs = 0.10 to 0.20)
- Cultivated Land: 0 AC (RCs = 0.50 to 0.60)

(1) As a conservative measure, the entire Franciscan area was considered to be Woodlands/Forests to limit the amount of run-off that would be added to the water balance estimation of the basin.

Using the aforementioned variables, the annual run-off volume for each type was calculated by multiplying the areas of each respective setting type by the annual precipitation volume, followed by multiplying the corresponding products by the applicable RC, which in this case was only applicable to the Woodland/Forest category. The summation of all the area run-off volumes equates to the total annual run-off volume for the entire area.

Basin Run-off (R)

Consistent with the above approach, the percentage of the total precipitation and Franciscan run-off that results as outflow was estimated by comparing the ground slopes within the basin area to RCs for various types of developed and natural settings (ODOT, 2014). The relative percentages of slopes within the basin that align with the "flat", "rolling" and "hilly" categories are approximately 78, 15 and 7 percent, respectively. These areas, in turn, were further separated by the types of settings. The following provides a breakdown of the setting types and range of RCs used in the analysis:

- Meadows / Pasture Land: 1,697 AC (RCs = 0.25 to 0.35)
- Light Residential: 4.0 AC (RCs = 0.35 to 0.45)
- Unimproved: 34 AC (RCs = 0.10 to 0.30)
- Woodland / Forest: 98 AC (RCs = 0.10 to 0.20)
- Cultivated Land: 141 AC (RCs = 0.50 to 0.60)

Once again, the summation of all the area run-off volumes equates to the total annual run-off volume for the entire area.

Actual Evapotranspiration (ET_a)

As previously noted in Subsection 1.3 (*Local Climate*), the mean annual potential evapotranspiration (ET_o) for the area is estimated to be 45.5 inches per year. The ET_a, in turn, was calculated using a Water Use Classification of Landscape Species (WUCOLS) site specific model as described in *A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California* (UC Cooperative Extension/CDWR, 2000). The WUCOLS model allowed for estimation of ET_a for the vineyards and native vegetation within the cumulative impact area. In the case of areas occupied by vineyards, ET_a was only calculated for the rainy season (October through March) as any ET_a occurring during the dry season (April through September) is offset by irrigation, the volume of which is already accounted for as part of the water use calculations. In addition, it was assumed that no ET_a occurs for seasonal grasses over the period of July through September as these grasses are typically dead over this time frame.

Canopy Interception (CI)

Canopy interception corresponds to the fraction of rainfall that is intercepted by the canopy of trees and shrubs (assumed to be negligible for grassland areas) and subsequently lost to evaporation. This fraction was estimated using equations developed by Helvey and Patric (1965) that utilize gross rainfall, throughput (i.e., rainfall that reaches the ground through spaces in the vegetative canopy and as drip from leaves, twigs and stems), and stemflow (i.e., rainfall that is caught on the canopy and reaches the ground by running down stems) variables. The calculation excluded grassland and vineyard areas as the fraction of canopy interception for these area is assumed to be negligible. With that being said, all other areas within the basin area were assumed to be subject to canopy interception losses.

Reservoir Evaporation (E_R)

There are two existing irrigation ponds on the project site, High Serenity Pond and BLK 9 Pond, which have surface areas of 757,944 square feet (ft^2) and 53,579 ft^2, respectively. An additional irrigation pond, Bickford Reservoir, is being built as part of the proposed project site increases and will have a surface area of 289,179 ft^2.

Yearly evaporation for the area was calculated using data obtained from the report entitled, *Surface Water Supply for the Clearlake, California Hot Dry Rock Geothermal*

Project, dated April 19, 1996 (Los Alamos, 1996). Although evaporation data shows a variation in evaporation rates from 40 inches per year (in/yr) to 79 in/yr, a conservative value of 75 in/yr was used to calculate the amount of water lost by evaporation for the surface area of the ponds.

Based on the aforementioned information, values of approximately 71.95, 5.09 and 27.45 AF/yr can be expected to be lost by High Serenity Pond, BLK 9 Pond and Bickford Reservoir, respectively. This equates to a projected total loss of 104.49 AF/yr for the project site

The results of the water balance calculations using the aforementioned parameters are presented in Table 3 below. The results reflect the amount of water potentially available for groundwater recharge in a given year.

SUMMARY OF WATER BALANCE CALCULATIONS TABLE 3	
Description	***Historical Average (AF)***
Precipitation (inflow)	+4,176
Franciscan Run-Off (inflow)	+919
Basin Run-Off (outflow)	-1,449
Actual Evapotranspiration (outflow)	-1,096
Canopy Interception (outflow)	-21
Reservoir Evaporation (outflow)	-104
Springs (outflow)	0
Totals	***+2,425***
Percentages of Water Demand vs. Potential Recharge	
Existing BEV + Existing Off-Site	10.8 percent
Future BEV + Existing Off-Site	14.0 percent
Future BEV + Future Off-Site	15.6 percent

AF/yr: Acre-Feet

As presented in Table 3, a positive water balance is exhibited, thereby indicating that the proposed BEV development plans are reasonable from a groundwater use perspective. Furthermore, the water demands for the existing and/or future development scenarios equate to only 11 to 16 percent of the potential groundwater recharge volume for a historical average rainfall year. While a number of estimates or assumptions are factored into the analysis, the nominal percentage of water demand versus the potential groundwater recharge volume provides an appreciable factor of safety to compensate for any variables that might deviate from said estimates and/or assumptions.

6.0 CONCLUSIONS

Based on the proposed water use and the estimates presented herein, it is concluded that the proposed BEV project should not have a significant impact on current and future groundwater availability at the project site, nor within the cumulative impact area under existing or foreseeable future use conditions. This conclusion is based on the following:

- The yield characteristics for the on-site irrigation wells appear to be more than capable of accommodating the proposed increases.
- The existing and proposed combined groundwater supply requirements (i.e., BEV and off-site) equate to approximately one to two percent of the groundwater in storage within the basin area.
- The amount of potential groundwater recharge significantly exceeds the groundwater use demands for each of the scenarios evaluated.

7.0 LIMITATIONS

This report was prepared in accordance with generally accepted standards of professional hydrogeologic consulting principles and practices at the place and time this study was performed. This warranty is in lieu of all other warranties, either expressed or implied. The conclusions presented herein are based solely on information made available to us by others, and includes professional interpretations based on limited research and data. Based on these circumstances, the decision to conduct additional investigative work to substantiate the findings and conclusions presented herein is the sole responsibility of the Client. This report has been prepared solely for the Client and any reliance on this report by third parties shall be at such party's sole risk.

9.0 CLOSING

EBA appreciates the opportunity to be of service to Brassfield Estates Vineyards on this project. If you should have any questions regarding the information contained herein, please do not hesitate to contact our office at (707) 544-0784.

Sincerely,
EBA ENGINEERING

Ryan Delmanowski
Staff Geologist

Matthew J. Earnshaw, P.G., C.Hg., QSD.
Senior Geologist

PROFESSIONAL GEOLOGIST
MATTHEW
EARNSHAW
No.947
CERTIFIED
HYDROGEOLOGIST
STATE OF CALIFORNIA
Expires Aug. 31, 2018

Appendices: Appendix A - Figures
Appendix B - Cross Sections

9.0 REFERENCES

California Department of Water Resources, October 2003, *California's Groundwater, Bulletin 118 – Update* 2003.

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State of California, September 10, 2009, *California Code of Regulations, Title 23, Division 2, Chapter 2.7 – Model Water Efficient Landscape Ordinance, Appendix A – Reference Evapotranspiration (ETo) Table*.

UC Cooperative Extension, California Department of Water Resources, August 2000, *A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California, A Landscape Coefficient Method and WUCOLS III,*.

APPENDIX A

FIGURES

EBA ENGINEERING

825 SONOMA AVENUE
SUITE C
SANTA ROSA, CA 95404
TEL: (707) 544-0784

SITE LOCATION MAP

BRASSFIELD ESTATES VINEYARD
10915 HIGH VALLEY RD
CLEARLAKE OAKS, CA 95423

FIGURE

1

16-2328

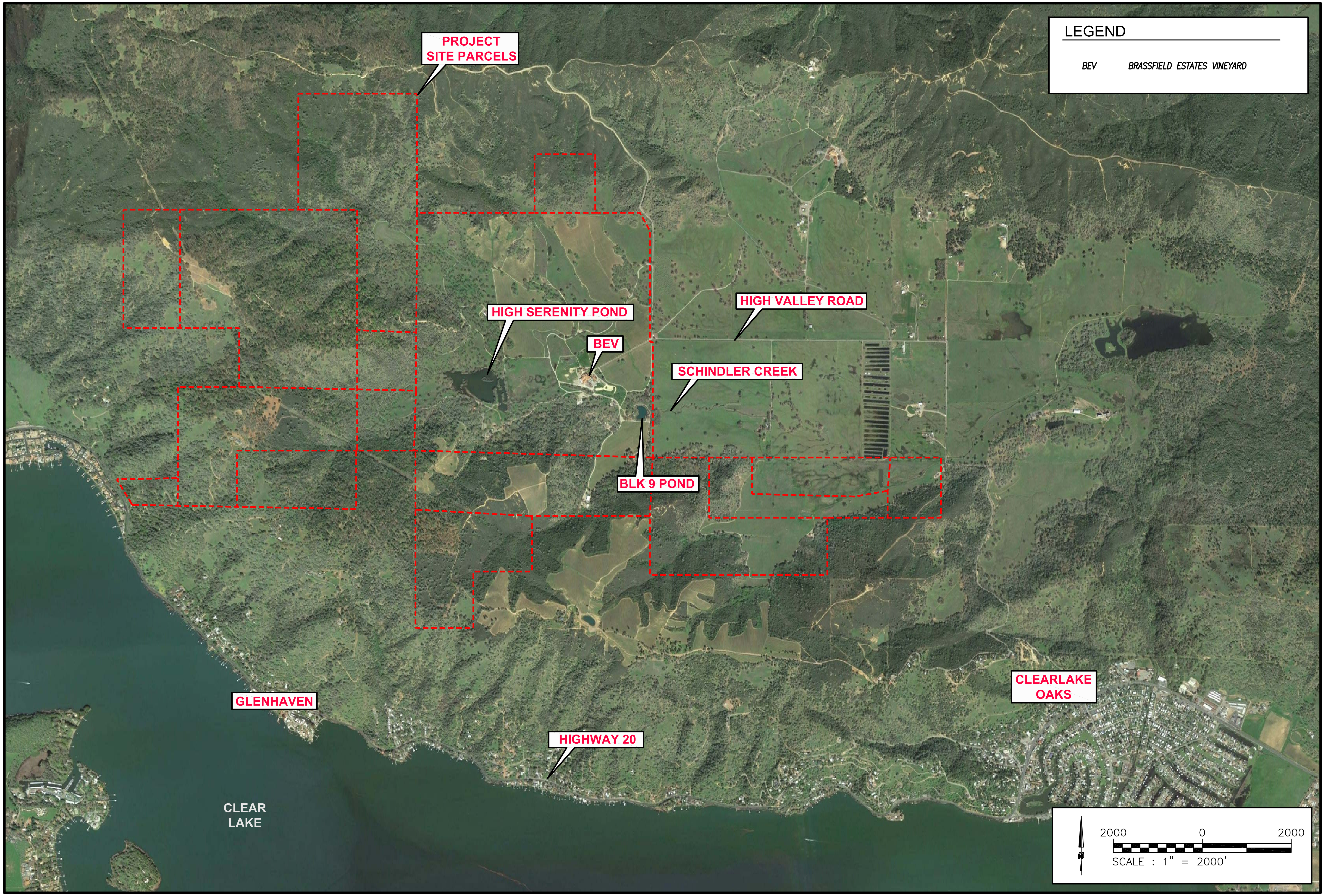


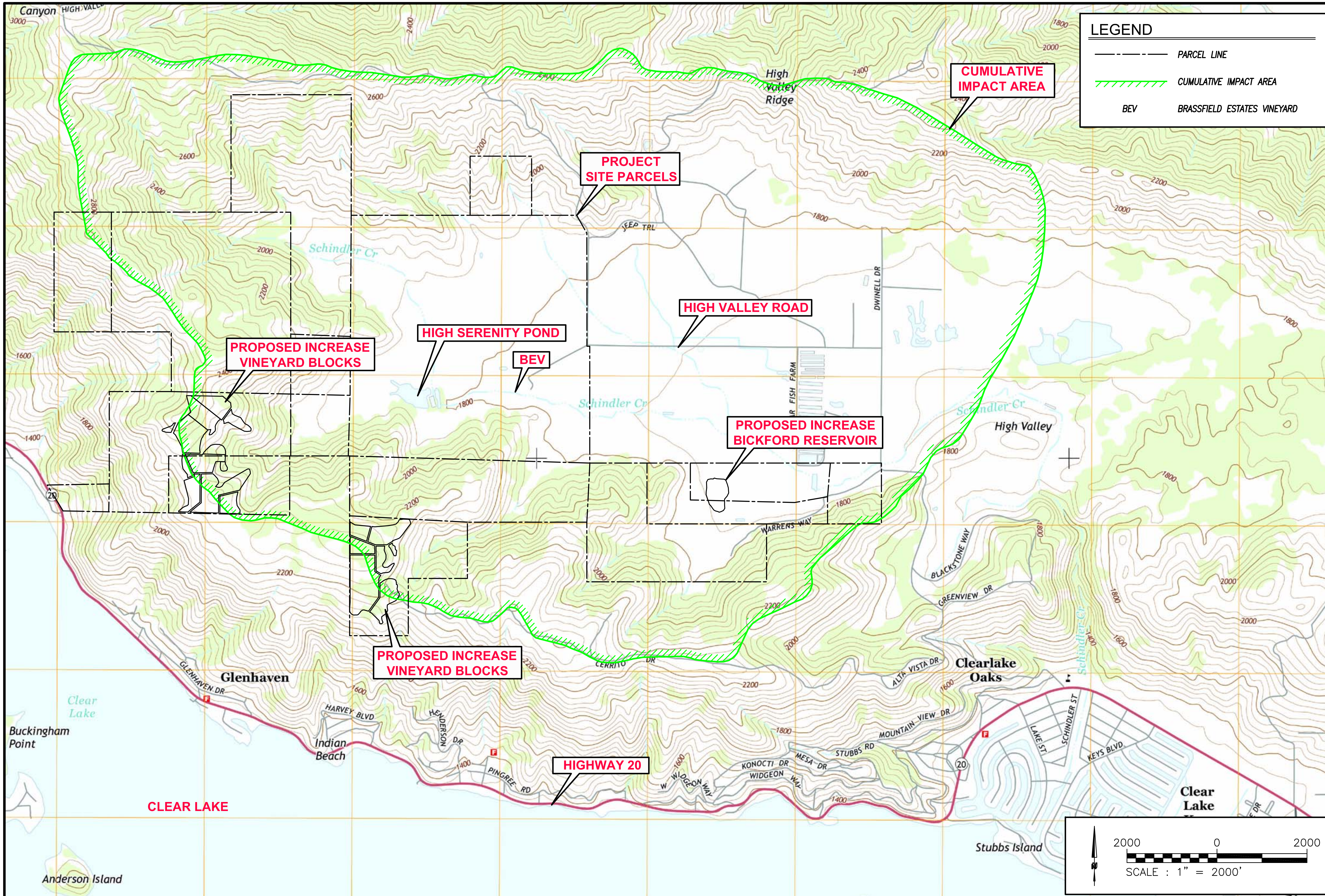
FIGURE 2

16-2328

REGIONAL SITE MAP

BRASSFIELD ESTATES VINEYARD
10915 HIGH VALLEY RD
CLEARLAKE OAKS, CA 95423

EBA ENGINEERING
825 SONOMA AVENUE
SUITE C
SANTA ROSA, CA 95404
TEL: (707) 544-0784

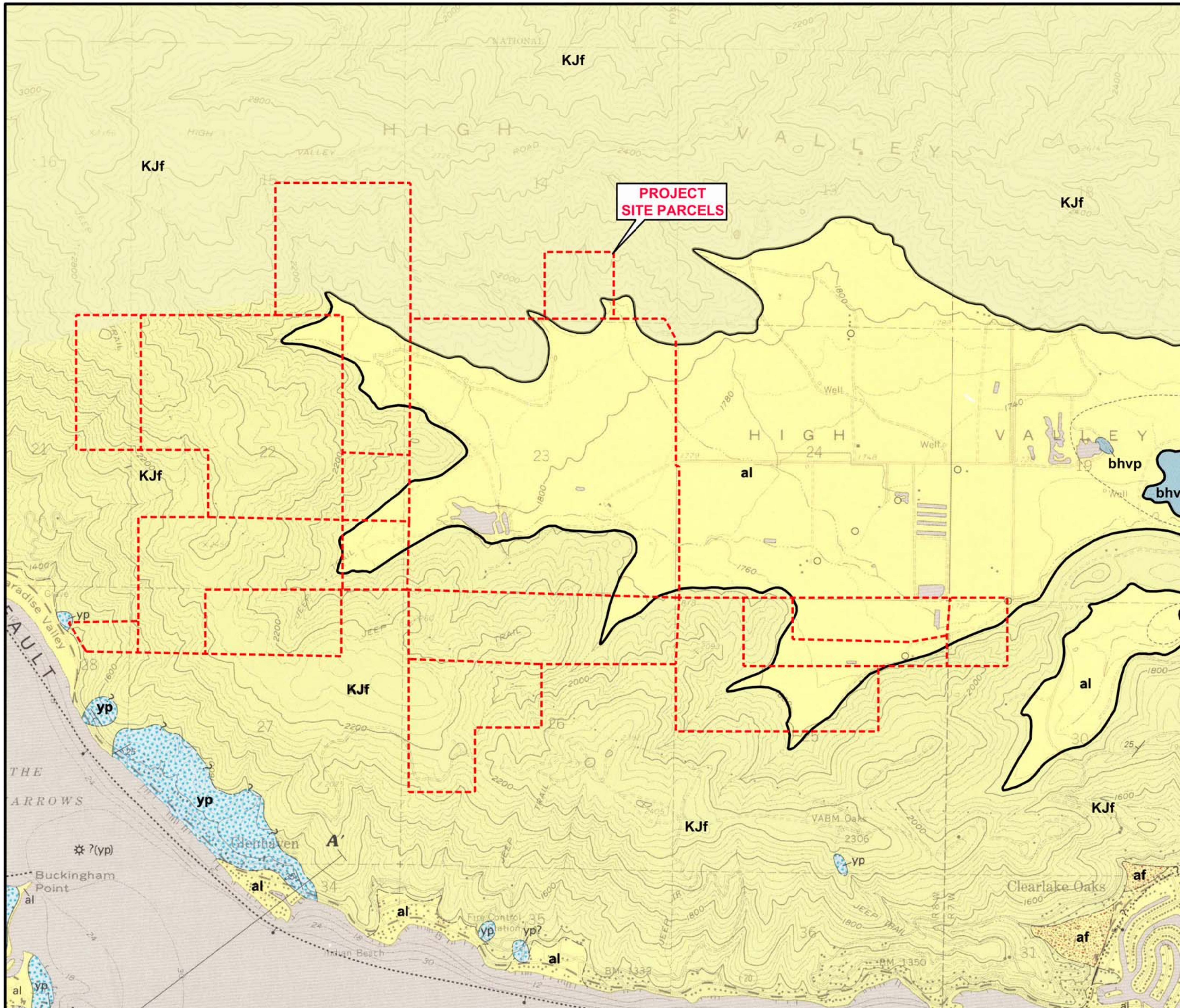


SITE PLAN WITH PROPOSED INCREASE AREAS AND CUMULATIVE IMPACT AREA

BRASSFIELD ESTATES VINEYARD
10915 HIGH VALLEY RD
CLEARLAKE OAKS, CA 95423

FIGURE 3
16-2328

EBA ENGINEERING
825 SONOMA AVENUE
SUITE C
SANTA ROSA, CA 95404
TEL: (707) 544-0784



LEGEND

al — **Alluvium (Holocene)**—Flood-plain, channel, and lake deposits of clay, silt, sand, and gravel. Locally may include youngest part of the basin deposits of Clear Lake (bcl)

af — **Alluvial-fan deposits (Holocene)**—Coarse deposits of sand and generally angular pebbles and boulders derived from nearby upslope sources

bhvp — Pyroclastic deposits—100-m-high cinder cone of Round Mountain and nearby deposits of bomb, block, and lapilli tephra

yp — **Young pyroclastic deposits (Holocene and Pleistocene)**—See description under central area and Mount Konocti

KJf — **Franciscan assemblage (Upper Cretaceous to Upper Jurassic)**—Structurally complex assemblage of varied rock types, such as chert, greenstone, graywacke, shale, and metamorphic rocks of blueschist grade. See Brice (1953), McNitt (1968a, b, c), McLaughlin (1978, 1981), and McLaughlin and others (1990) for detailed descriptions and subdivisions of this unit

65

Fault—Showing dip where known; dashed where approximately located; dotted where concealed; queried where uncertain. Bar and ball on downthrown side. Single-sided arrows on map show direction of relative horizontal movement; queried where uncertain. Sawteeth on upper plate of thrust or reverse fault. In cross section, single-sided arrows show relative up and down movement, and A and T show relative movement away and toward viewer; queried where uncertain

Strike and dip of beds—Ball indicates top of beds known from sedimentary features

65 Inclined, approxiimate where no dip amount shown

Vertical

Horizontal

35 Overturned

25 Inclined, probable deltaic foreset beds

GEOLOGIC CONTACT

NOTE:
MAP SHOWN HEREON IS A GEOLOGIC MAP AND STRUCTURE SECTIONS OF THE CLEAR LAKE VOLCANICS, NORTHERN CALIFORNIA, BY B. C. HEARN, JR., J. M. DONNELLY-NOLAN, AND F. E. GOFF, 1995. (MODIFIED)

2000 0 2000

SCALE : 1" = 2000'

FIGURE
4
16–2328

GEOLOGIC MAP
BRASSFIELD ESTATES VINEYARD
10915 HIGH VALLEY RD
CLEARLAKE OAKS, CA 95423

EBA ENGINEERING
825 SONOMA AVENUE
SUITE C
SANTA ROSA, CA 95404
TEL: (707) 544-0784

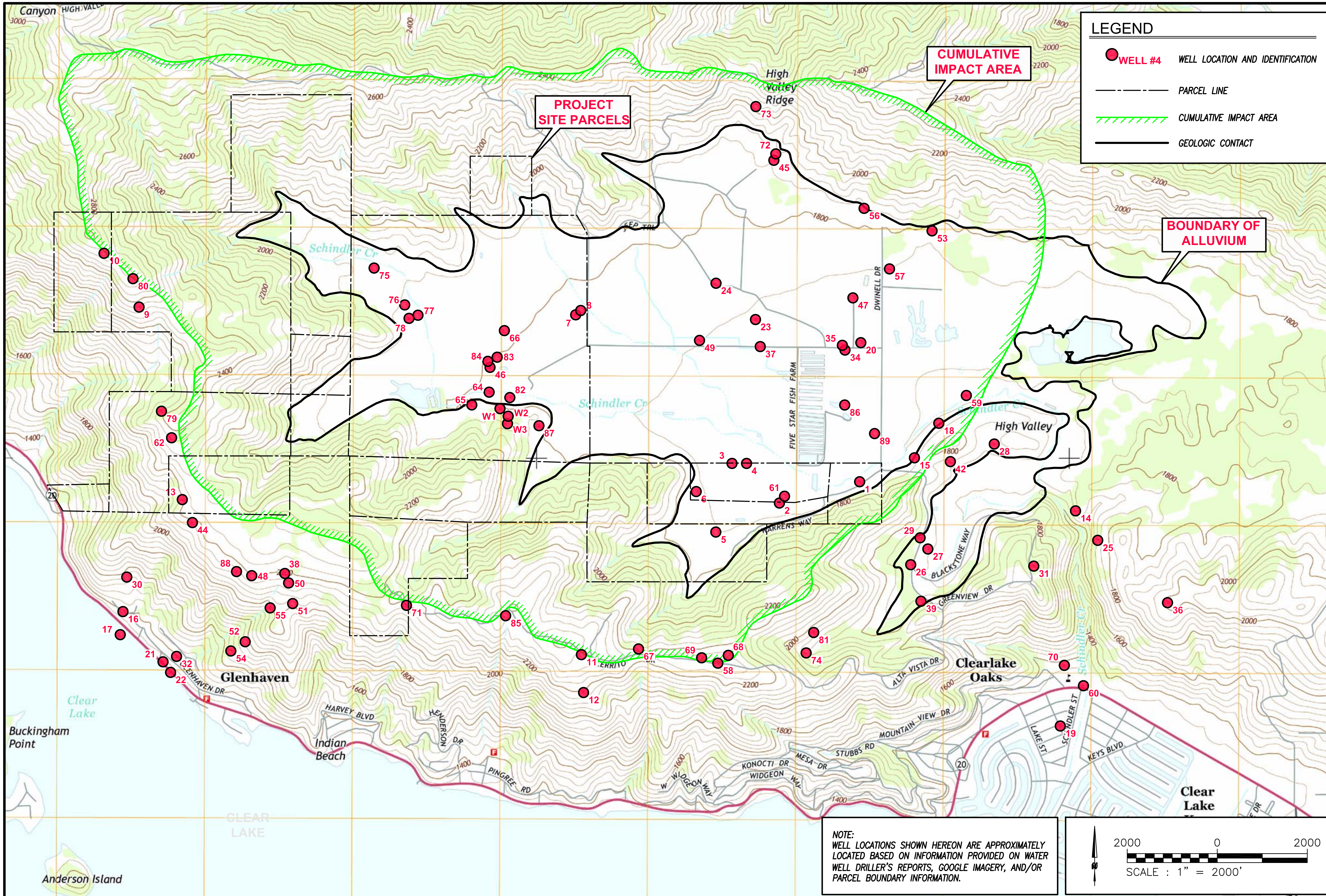


FIGURE 5

16-2328

WELL LOCATION MAP

BRASSFIELD ESTATES VINEYARD
10915 HIGH VALLEY RD
CLEARLAKE OAKS, CA 95423

EBA ENGINEERING
825 SONOMA AVENUE
SUITE C
SANTA ROSA, CA 95404
TEL: (707) 544-0784

APPENDIX B

CROSS SECTIONS

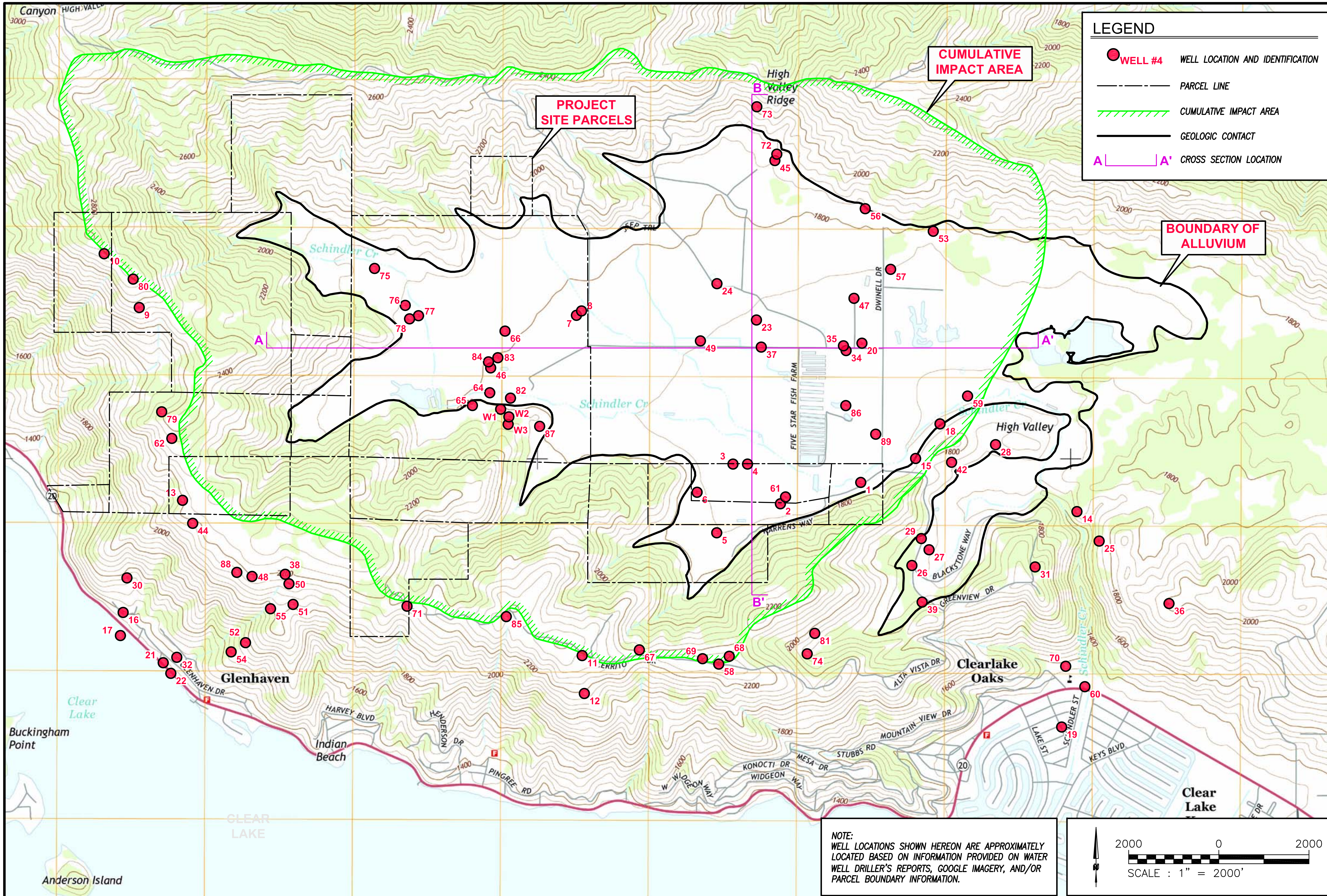


PLATE **B-1**

16-2328

CROSS SECTION LOCATION MAP

BRASSFIELD ESTATES VINEYARD
10915 HIGH VALLEY RD
CLEARLAKE OAKS, CA 95423

EBA ENGINEERING
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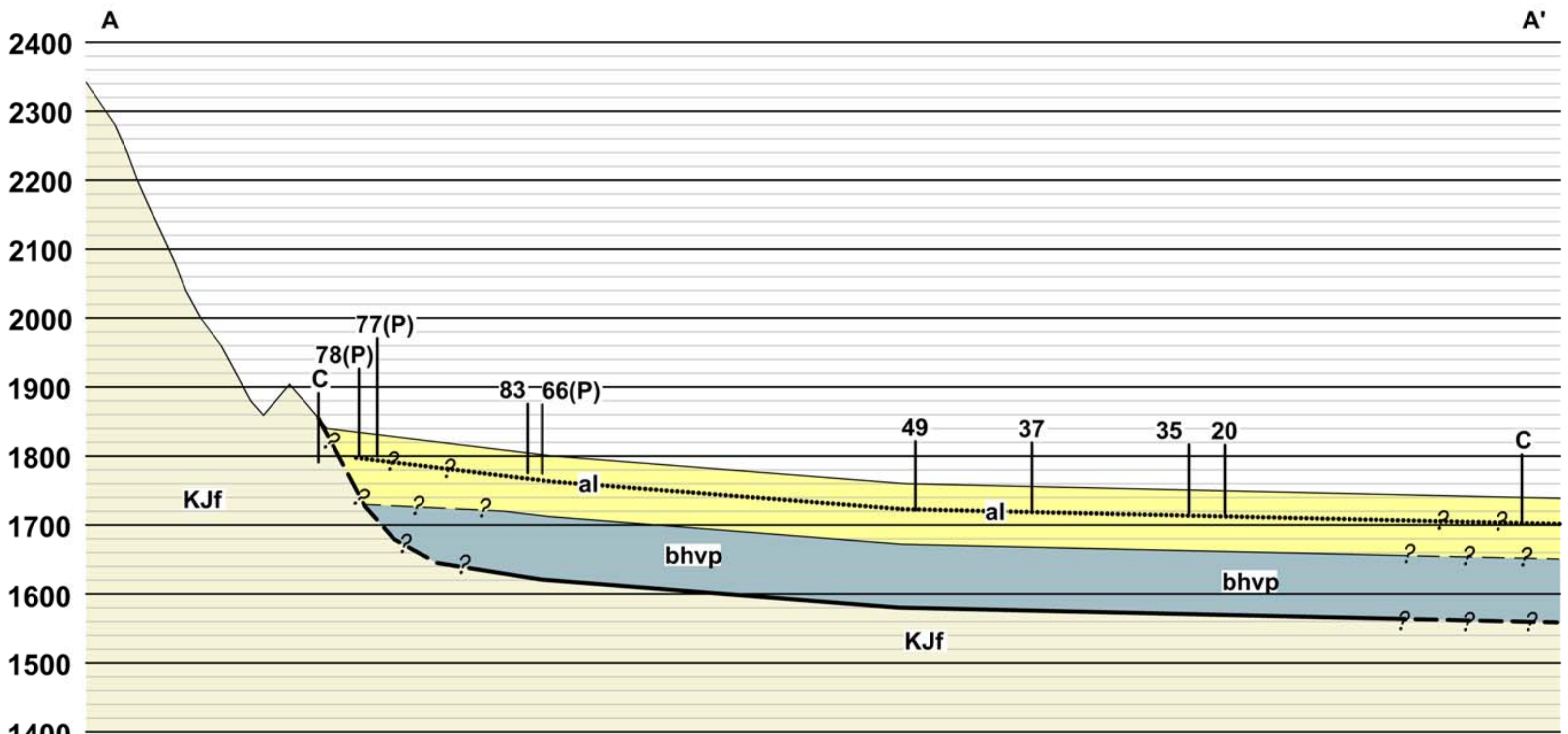
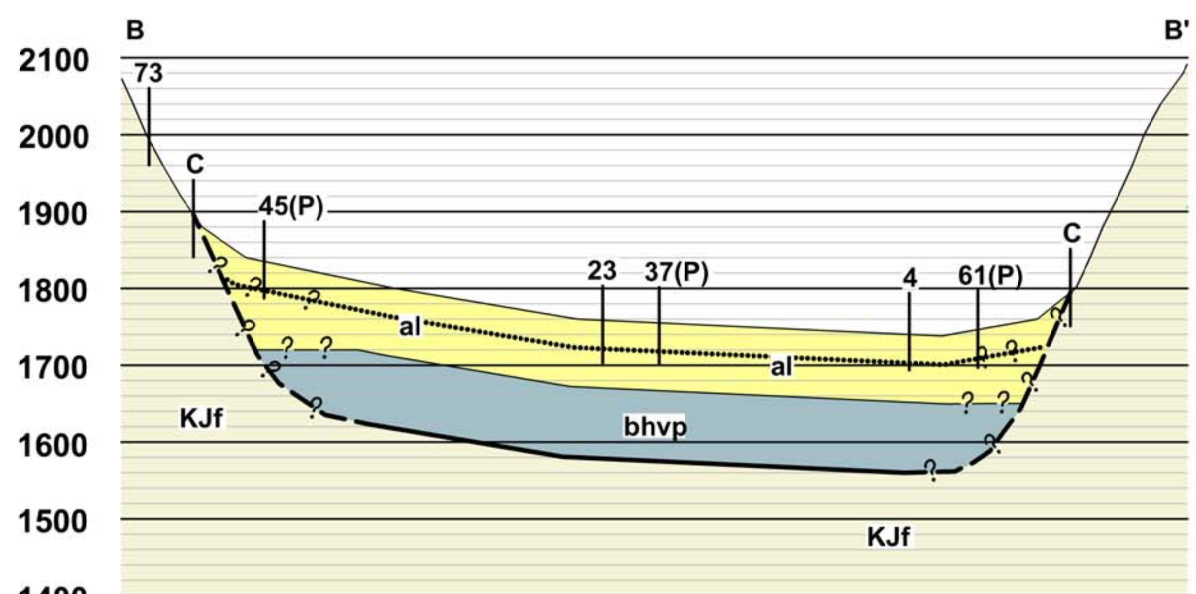
SANTA ROSA, CA 95404
TEL: (707) 544-0784



CROSS SECTION A-A'



CROSS SECTION B-B'

LEGEND

al	ALLUVIUM
KJf	FRANCISCAN ASSEMBLAGE
bhvp	PYROCLASTIC DEPOSITS
	bhvp – KJf CONTACT
	STATIC GROUNDWATER (AVERAGE)
C	SURFACE LITHOLOGIC CONTACT
19	BORING
19(P)	BORING (PROJECTED)
?	INSUFFICIENT DATA TO PROJECT

AS DELINEATED IN PLAN VIEW ON 'CROSS SECTION LOCATION MAP' - PLATE B-1

APPROXIMATE SCALE:
HORIZONTAL: 1"=2000'
VERTICAL: 1"=250'

PLATE
B-2
16-2328

DIAGRAMMATIC CROSS SECTIONS A-A' AND B-B'

BRASSFIELD ESTATES VINEYARD
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