

STATE OF CALIFORNIA
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
STATE WATER RESOURCES CONTROL BOARD

DIVISION OF WATER RIGHTS

ORDER WR 2020-0101-DWR

**In the Matter of the Status of the Water Within the
Coyote Valley Basin Aquifer in
Lake County**

BY THE DEPUTY DIRECTOR FOR WATER RIGHTS:

1. Applicable Law

In Decision 1639 issued in 1999, the State Water Resources Control Board (State Water Board) provided clarification regarding the legal classification of groundwater, as follows:

The California Water Code defines the water that is subject to appropriation and is thus subject to the SWRCB's permitting authority. Water Code section 1200 states:

"Whenever the terms stream, lake or other body of water occurs in relation to applications to appropriate water or permits or licenses issued pursuant to such applications, such term refers only to surface water, and to subterranean streams flowing through known and definite channels." (Emphasis added.)

Groundwater which is not part of a subterranean stream is classified as "percolating groundwater." The distinction between subterranean streams and percolating groundwater was set forth by the California Supreme Court in 1899 in *Los Angeles v. Pomeroy* (1899) 124 Cal. 597 [57 P. 585]. In *Los Angeles v. Pomeroy*, the court stated that it is undisputed that subterranean streams are governed by the same rules that apply to surface streams. (*Id.* at 632 [57 P. at 598].) Percolating groundwater is not subject to the Water Code sections that apply to surface streams. Thus, the SWRCB has permitting authority over subterranean streams but does not have permitting authority over percolating groundwater.

Absent evidence to the contrary, groundwater is presumed to be percolating groundwater, not a subterranean stream. (*Id.* at 628 [57 P. at 596].) The burden of proof is on the person asserting that groundwater is a subterranean stream flowing through a known and definite channel. (*Ibid.*) Proof of the existence of a subterranean stream is shown by evidence that the water flows through a known and defined channel. (*Id.* at 633-634 [57 P. at 598].) In *Los Angeles v. Pomeroy*, the court stated:

"'Defined' means a contracted and bounded channel, though the course of the stream may be undefined by human knowledge; and the word 'known' refers to knowledge of the course of the stream by reasonable inference." (*Id.* at 633 [57 P. at 598].)

A channel or watercourse, whether surface or underground, must have a bed and banks which confines the flow of water. (*Id.* at 626 [57 P. at 595].) Although in *Los Angeles v. Pomeroy* the court stated that the bed and banks of a subterranean stream must be impermeable¹ (*Id.* at 631 [57 P. at 597]), all geologic materials are permeable to some degree. Therefore, if the rock forming the bed and banks is relatively impermeable compared to the aquifer material filling the channel, a subterranean stream exists.

In summary, for groundwater to be classified as a subterranean stream flowing through a known and definite channel, the following physical conditions must exist:

1. A subsurface channel must be present;
2. The channel must have relatively impermeable bed and banks;
3. The course of the channel must be known or capable of being determined by reasonable inference; and
4. Groundwater must be flowing in the channel.

(State Water Board Decision D-1639, pp. 3-4.)

2. In *North Gualala Water Company v. State Water Resources Control Board* (2006) 139 Cal.App.4th 1577, 1585-1586, 1606, the court held that the four-part test set forth in Decision 1639 is consistent with the language and intent of Water Code section 1200's subterranean streams provision.

3. **Need for Determination**

Hidden Valley Lake Community Services District (HVLCS D) serves drinking water to the community of Hidden Valley Lake in southern Lake County. HVLCS D was issued a water right permit by the Division of Water Rights (Division) in 1994 (which was subsequently split into a water right license and a

permit) for four wells drawing water from the Coyote Valley Basin aquifer (Department of Water Resources Bulletin 118 Basin 5-18) based on HVLCSD's assertion at the time that the groundwater aquifer was part of the underflow (or subterranean stream) associated with Putah Creek and therefore, within the permitting authority of the State Water Board.

The Division of Water Rights issued Notices of Water Unavailability (e.g., curtailment) to HVLCSD in 2014 and 2015, due to the then-ongoing drought and HVLCSD's relatively lower-priority water rights in the Putah Creek watershed. As a result of the curtailment, the State Water Board's Division of Drinking Water (DDW) found that HVLCSD's water supply was inadequate and unreliable, since future curtailments could result in inadequate supply for health and human safety. DDW imposed a service connection moratorium on HVLCSD through a compliance order issued in October 2014.

In May 2019, HVLCSD submitted a technical report to DDW and the Division asserting that its water sources (the Coyote Valley Basin aquifer) for two points of diversion under its water right permit and license were not part of a subterranean stream and therefore, were not under the permitting authority of the State Water Board and do not require a permit or license.

4. **Technical Analysis and Findings**

Division staff reviewed the HVLCSD technical report and other available geological reports and information to conduct a basin-wide analysis for the Coyote Valley aquifer to determine if it meets the four-part test for a subterranean stream flowing within a known and definite channel contained in Decision 1639.

Based on review of available information, Division staff issued a technical memorandum dated April 17, 2020 (Attachment A to this Order) documenting the information considered, technical analyses, and the following conclusions:

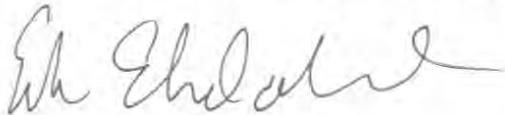
1. The Coyote Valley aquifer is bound by rock formations that make up the banks of a channel; however, there is no evidence that these formations form a subsurface channel bed.
2. Even if Division staff presumes that the alluvium is bounded by both bed and banks, the geologic formations are not relatively impermeable when compared to the alluvium.
3. Because the bounding units are not relatively impermeable compared to the alluvium, the water within the quaternary alluvium is not bound.
4. The alluvial aquifer within Coyote Valley fails parts one and two of the four-part test provided in Decision 1639.

5. The water within Coyote Valley is determined to be percolating groundwater and is not within the permitting authority of the State Water Board

BASED ON THE FOREGOING INFORMATION, IT IS HEREBY ORDERED:

1. The State Water Resources Control Board, Division of Water Rights shall treat the water in the alluvium of Coyote Valley Basin (Department of Water Resources Bulletin 118 Basin 5-18), underlying Putah Creek, in Lake County, as shown in Attachment B, as percolating groundwater and not water that is part of a subterranean stream flowing through a known and definite channel.
2. Nothing in this Order is intended to or shall be construed to limit or preclude the State Water Board from exercising its authority under any statute, regulation, ordinance, doctrine, or other law, including, but not limited to, the authority to take enforcement action against any party for waste or unreasonable use or unreasonable method of use of water in violation of Article X of the California Constitution.
3. Nothing in this Order shall excuse parties that extract or seek to extract groundwater from the Coyote Valley Basin aquifer from meeting any more stringent requirements that are imposed, or may be imposed hereafter, by applicable legally binding legislation, regulations, policies or water right permit requirements.

STATE WATER RESOURCES CONTROL BOARD



*Erik Ekdahl, Deputy Director
Division of Water Rights*

Dated: JUL 10 2020



State Water Resources Control Board

TO: File Permit 20770B (A030049B) and License 13527A (A030049A)

FROM: Zach Mayo, Engineering Geologist
Sacramento Valley Enforcement Unit
Division of Water Rights 

DATE: April 14, 2020

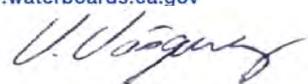
SUBJECT: SUBTERRANEAN STREAM DETERMINATION, COYOTE VALLEY, LAKE COUNTY

This State Water Resources Control Board (State Water Board), Division of Water Rights (Division) staff memorandum contains an analysis of regional and local geology of Coyote Valley to determine if water within the Coyote Valley Basin alluvial aquifer meets the Garrapata four-part test for subterranean streams. Hidden Valley Lake Community Services District (HVLCS D) submitted a report prepared by its consultant, Wagner & Bonsignore, in support of HVLCS D's assertion that its source wells are not drawing water from a subterranean stream, and that report has been reviewed by Division staff as part of this analysis. Division staff also evaluated the surface and subsurface geology of Coyote Valley through published literature, geologic maps, and well completion reports obtained from the Department of Water Resources (DWR). As discussed in more detail in sections below, Division staff concludes that the water in the Coyote Valley Basin alluvial aquifer is not within the permitting authority of the State Water Board because there is insufficient evidence to reasonably infer that the Coyote Valley alluvial aquifer meets all the parts of the Garrapata four-part test for subterranean streams.

The evidence indicates the following:

- 1) There is evidence to suggest that there is not a clearly defined bed that would form a subsurface channel; therefore, the alluvium is not uniformly bound by bed and banks.
- 2) The known geologic units bounding the Coyote Valley alluvial aquifer are not relatively impermeable.
 - a. The northern margin of the alluvium shows outcropping of Plio-Pleistocene olivine basalt and Plio-Pleistocene Cache Formation, and there is evidence to suggest that both of these units have producing groundwater extraction wells developed.
 - b. Division staff found evidence that suggests that the Cache Formation is water bearing and underlies most of the alluvial sediments of Coyote

E. JOAQUIN ESQUIVEL, CHAIR | EILEEN SOBECK, EXECUTIVE DIRECTOR


Approved 04/14/2020

Valley as indicated by published literature and interpretation of well completion reports.

- c. The production of the alluvial aquifer varies greatly over the extent of Coyote Valley and although the HVLCSD wells demonstrate greater production, elsewhere in the valley the groundwater production of the alluvial aquifer is similar to the well production of the underlying olivine basalt and Cache Formation to the north.

INTRODUCTION

Pursuant to Water Code Sections 1200 and 1201, all water flowing in a natural channel, including subterranean streams flowing through known and definite channels, is public water of the state and is subject to appropriation and therefore, within the permitting authority of the State Water Board. In Decision 1639 (certified June 17, 1999), the State Water Board identified a four-part test to define what constitutes a subterranean stream flowing in a known and definite channel, which has since been referred to informally as the Garrapata four-part test for subterranean streams flowing through known and definite channels.

Division staff performed a subterranean stream analysis of the groundwater within the alluvial aquifer of Coyote Valley, which is located approximately four miles northeast of Middletown along Putah Creek in Lake County. Coyote Valley trends along a northwest to southeast axis and is approximately five miles long and 2.5 miles wide at the widest margin (Figure 1). Coyote Valley Basin is a groundwater basin recognized by the Department of Water Resources as a “very low priority” groundwater basin according to the Sustainable Groundwater Management Act Basin Prioritization for 2019.

HVLCSD owns and operates five groundwater extraction wells within the Coyote Valley Basin aquifer and extracts water through these wells under appropriative water right Permit 20770B and License 13527A issued by the State Water Board. At the time of its applications for these appropriative water rights in 1991, HVLCSD claimed that the water diverted through its wells is part of Putah Creek underflow, and therefore, was determined to be within the State Water Board’s permitting authority (Figure 3). At the time of permit issuance, the State Water Board did not dispute or investigate HVLCSD’s assertion that the wells were drawing water from Putah Creek underflow. Also, the State Water Board has stated in 1999 in Decision 1639 that underflow is a subset of a subterranean stream; however, “while subterranean streams include underflow, it is not necessary that groundwater be underflow to establish the existence of a subterranean stream flowing through a known and definite channel”. Therefore, since HVLCSD asserted that the wells were drawing water from underflow, its applications to appropriate water were approved by the State Water Board. HVLCSD has also claimed riparian water rights for underflow of Putah Creek at the same locations as their pumps and points of diversions under Permit 20770B and License 13527A.

On January 3, 2013, HVLCSD filed petitions to change the place of use and to remove conditions contained in water rights Licenses 13527A and Permit 20770B that require groundwater level monitoring and conditions that require pumping of groundwater into Putah Creek upstream of United States Geological Survey (USGS) Guenoc gaging station to supplement flows in Putah Creek during low flow periods.

On October 14, 2014, HVLCSD was issued Compliance Order No. 02_03_14R_004 by the Division of Drinking Water (DDW) stating that HVLCSD did not have a reliable and adequate supply of water for its existing customers because the State Water Board can curtail HVLCSD's post-1914 appropriative water rights during drought conditions, such as it did in years 2014 and 2015. The DDW compliance order included a moratorium on new service connections unless HVLCSD can demonstrate it has a reliable and adequate supply of water.

On May 9, 2019 HVLCSD provided the Division with a memo and a report prepared by their consultant, Wagner & Bonsignore. In this memo, HVLCSD states that the filing of the water rights applications for Putah Creek was done in 1991 out of an abundance of caution in order to meet the deadline to establish surface water right claims under the Putah Creek stream adjudication. The report provided by HVLCSD's consultants asserts that the groundwater aquifer in Coyote Valley is not a subterranean stream, and consequently, at least two of their wells do not require a post-1914 water right.

REVIEW OF HVLCSD REPORT

The memo and report submitted by HVLCSD, dated April 4, 2019, followed similar methodology, discussed below, as Division staff to conclude that at least two wells (Well GR-4 and Ag Well) operated by HVLCSD are not drawing water from a subterranean stream. Division staff reviewed the report and found the methodology to be logical and sound and found the analysis provided within the report to be an accurate representation of the available data within Coyote Valley.

The main points of the report are listed below:

- HVLCSD wells are drawing water from the alluvial aquifer of Coyote Valley and three of their wells may encounter Cache Formation (Well GR-2, Well GR-3, and Well GR-4).
- Water within the Coyote Valley alluvium may be bound by relatively impermeable bed and banks to the northwest but is not bound by relatively impermeable bed and banks to the northeast because the olivine basalt is shown to be water bearing and there is currently insufficient data to conclude that the Cache Formation is or is not water bearing.
- There is no evidence of a relatively well-defined subsurface channel because of the interbedded fine and coarse-grained strata that shows the variability of alluvial deposits present throughout Coyote Valley.
- Because the water within the alluvial aquifer of Coyote Valley does not meet all four parts of the Garrapata four-part test, the two wells operated by HVLCSD

(Well GR-4 and Ag Well) are not within the permitting authority of the State Water Board.

STAFF ANALYSIS

METHODS

The methods used by Division staff to analyze if there is enough evidence to reasonably infer if the water within the alluvium of Coyote Valley is part of a subterranean stream are similar to methods used by previous Division staff. Below is a list of these methods:

- A review of regional geology and local geologic information which includes formation analysis, formation thickness as inferred from stratigraphic analysis of published literature, and depositional analysis.
- Review of specific capacities to identify relative permeabilities of the Coyote Valley geologic formations.
- Comparison and analysis of geologic information and well completion reports to interpret subsurface lithology and thickness of alluvium and other geologic formations.
- Analysis of the Garrapata four-part test for subterranean streams and comparison of the geologic information with respect to the four parts of the test.

GARRAPATA FOUR-PART TEST FOR SUBTERRANEAN STREAMS

For groundwater to be classified as a subterranean stream flowing through a known and definite channel, the following physical conditions must exist (pursuant to State Water Board Decision 1639):

1. A subsurface channel must be present;
2. The channel must have relatively impermeable bed and banks;
3. The course of the channel must be known or capable of being determined by reasonable inference; and
4. Groundwater must be flowing in the channel.

Division staff will present information that pertains to the geology of Coyote Valley to perform an analysis of the geology and hydrogeology with respect to whether the water within the alluvial aquifer can be reasonably inferred to meet the four parts of the Garrapata four-part test. Specifically discussed will be the geologic units, hydrogeology, publicly available published literature, specific capacity of water wells in Coyote Valley and surrounding areas, and well completion reports within Coyote Valley and surrounding areas.

COYOTE VALLEY GEOLOGY

Division staff reviewed the geology of the Coyote Valley to determine which geologic formations are water bearing and if these are underlain by relatively impermeable formations. Division staff reviewed in detail quadrangle geologic maps available in

reports by Brice (1950) and Koenig (1963) which included Coyote Valley and surrounding areas. According to the geologic maps, Coyote Valley is a Quaternary alluvium filled valley that is bounded to the west and northwest by sediments of the Jurassic-Cretaceous Franciscan-Knoxville groups and undifferentiated Cretaceous rocks (Koenig, 1963). To the north, east, and southwest of Coyote Valley, Plio-Pleistocene Cache Formation outcrops along with Plio-Pleistocene olivine basalt (Brice, 1950 and Koenig, 1963). Basic intrusive rocks, predominantly serpentine, outcrops throughout the valley and are bounding Coyote Valley alluvial sediments to the south along with Upper Jurassic Knoxville group (Brice, 1950; Koenig, 1963; Appendix A, see Brice, 1953 F-F'). The Cache Formation and olivine basalt appear to be shallowly interfingered with the Cache Formation eventually underlying the olivine basalt at depth. Cache Formation, and possibly olivine basalt, appears to underly much of the alluvium of Coyote Valley (Brice, 1950; Upson and Kunkel, 1955; DWR, 1962). The Quaternary alluvium, olivine basalt, and Cache Formation are all in conformable contact which indicates that there is no gap in time or erosional surface between the alluvium and Cache Formation (Brice, 1953; Upson and Kunkel, 1955; and DWR, 1962).

QUATERNARY ALLUVIUM

The Quaternary alluvium within Coyote Valley consists of unconsolidated to semi-consolidated sinuous deposits of fine to coarse-grained floodplain and stream channel deposits, and of inconsistently stratified fine-grained material of alluvial fan, lacustrine, and colluvial deposits (DWR, 1962). The stream channel deposits consist of angular to rounded sand and gravel and are the most productive water bearing units in the alluvium (DWR, 1962). The flood plain deposits are considered to have low permeability; consist of fine-grained sand, silt, and clay; and generally, occur between stream deposits and colluvium (DWR, 1962). The lacustrine deposits were deposited during periods of fresh-water lake inundation and are generally fine-grained sand, silt, and blue clays that have low permeabilities (DWR, 1962). The thickness of the alluvium within Coyote Valley is variable but appears to be between 100 and 200 feet thick and possibly as much as 300 feet thick in places (Brice, 1953; DWR, 1962; and Upson and Kunkel, 1955).

The most productive wells within Coyote Valley are those that are owned and operated by HVLCSD and appear to be screened at variable intervals approximately 20 to 170-ft below ground surface in coarse-grained stream channel layers that are bounded between silty or sandy clay intervals (Figure 3; Appendix A). However, the stream channel deposits appear to be inconsistently stratified throughout the valley and most of the well completion reports appear to be screened in fine-grained alluvial deposits (Figure 5; Appendix A). Division staff did not find well completion reports that indicate wells that are as productive as HVLCSD wells, nor did Division staff find well completion reports for wells that encountered stream channel deposits as abundant as deposits encountered by HVLCSD wells.

PLIO-PLEISTOCENE OLIVINE BASALT

The Plio-Pleistocene olivine basalt flows are described as remnants of several overland lava flows that occurred over time and that they are nearly contemporaneous with Cache Formation deposition (Brice, 1953). The olivine basalt is highly fractured in places, quartz-bearing, vesicular, and ranges in thickness from 50 to 500 feet thick (Brice, 1953 and DWR, 1962). The outcrop of olivine basalt to the north of Coyote Valley is approximately 4 miles wide and 8 miles long. DWR describes the olivine basalt as being highly fractured and having a high permeability, and when the basalt occurs at or beneath the level of various valley floors within the Clear Lake quadrangle, it is within the zone of saturation and could potentially provide abundant quantities of water. DWR also describes the olivine basalt as a unit that is notable for accepting recharge for the groundwater basin by acting as a forebay for groundwater when the olivine basalt is within the zone of saturation. Therefore, based on DWR's description of the olivine basalt of the region, Division staff deduces that the olivine basalt bounding the Coyote Valley alluvium, especially to the north of Coyote Valley where Putah Creek's surface flow is on olivine basalt, could potentially be within the zone of saturation. Based on the Brice and Koenig geologic maps, Division staff also interprets that the olivine basalt is locally extensive and could potentially be a significant source of recharge to the groundwater within the alluvial aquifer of Coyote Valley. DWR describes the olivine basalt as being highly permeable and, given the size of the olivine basalt outcrop with respect to the size of Coyote Valley, the unit could be an area where long-term water storage is taking place and providing recharge to the alluvial aquifer when recharge to the alluvial aquifer is not being provided by Putah Creek surface flow (Appendix A).

PLIO-PLEISTOCENE CACHE FORMATION

The Cache Formation consists of continental deposits of semi-consolidated silts, gravels, and clays, with beds of tuffaceous sand, marl, limestone, and diatomite (Brice, 1953; DWR, 1962; and Koenig, 1963). The thickness of the Cache Formation ranges from 300 to as much as 6,500 feet thick within the Lower Lake quadrangle (Brice, 1953 and DWR, 1962). Stratigraphic sections for the Lower Lake quadrangle and upper Putah Creek basin differ with respect to which formations bound the Cache Formation at depth. The stratigraphic section presented by DWR suggests that Cache Formation is bounded by Pliocene Sonoma Volcanics consisting of flows of andesite and rhyolite with interbeds of sandy tuff and mudflows that are generally low in permeability but have some higher yields in the sandy tuffs. The stratigraphic section presented by Brice suggests that the Cache Formation is underlain by Paleocene Tejon Formation that is a white conglomeratic sandstone which Division staff assumes would have some level of permeability. Division staff interprets this to mean that the Cache Formation is in conformable contact with Sonoma Volcanics and in areas where Cache Formation is underlain by Tejon Formation there is an unconformable contact. In either scenario, if Cache Formation is underlain by Sonoma Volcanics or Tejon Formation, both units appear to be permeable and are likely not bounding the water that is within the Cache Formation.

Cache Formation is intercalated with olivine basalt and has many productive wells drilled within these formations to the northeast of Coyote Valley (Figure 2; Appendix A). DWR suggests that the groundwater in Coyote Valley is found in the Cache Formation and in the recent alluvium along buried stream channels of Putah Creek and that because the deposition of the Cache Formation and alluvium is heterogenous, that there is no evidence of any well-defined aquifer in the Coyote Valley basin. Collayomi Valley and Long Valley, south of Coyote Valley, are similarly situated and are depositional valleys that provide an illustrative proxy to Coyote Valley in that the Quaternary alluvium has been deposited in a heterogenous nature with buried stream channels and fine grained lacustrine, alluvial fan, and colluvial deposits with varying production of the groundwater wells (Figure 5 and DWR, 1962).

SPECIFIC CAPACITY OF WELLS

For the purpose of the analysis in this memorandum, the specific capacity (SC) of wells was calculated in order to qualitatively analyze the production of wells within representative units. SC is defined as the pumping rate of a well, typically measured in gallons per minute (gpm) divided by the distance of drawdown, typically in feet. The units of SC are gpm/ft. The representative units that are analyzed are the Quaternary Alluvium, the Plio-Pleistocene Cache Formation, and the Plio-Pleistocene olivine basalt. These three formations have the most well completion reports associated with them and offer the most information with respect to whether the groundwater in the alluvium within Coyote Valley can be shown to form a subterranean stream bounded by relatively impermeable bed and banks. The SC values of wells within these units were closely analyzed in order to determine if there is a reasonable inference that well production throughout the Coyote Valley alluvial aquifer is overwhelmingly more productive than that of the underlying Cache Formation or olivine basalt, which would indicate that the water within the alluvium is bound by relatively impermeable bed and banks. Typically, in order to obtain an accurate specific capacity, a well pump test will be performed continuously for 24 hours before recording the drawdown to allow the drawdown to stabilize (Driscoll, 1986). However, none of the well completion reports within Coyote Valley or the surrounding areas indicate that pump tests were performed for 24 hours. The tests were typically performed between two and eight hours. Also, the diameters of the wells vary greatly, and Division staff views this as problematic when comparing specific capacities of wells throughout Coyote Valley and the surrounding area. However, there are no other metrics available to Division staff to evaluate relative permeabilities of formations in Coyote Valley.

In general, the most productive wells within Coyote Valley and the surrounding area are the wells that are owned and operated by HVLCS D (Figure 3), which are screened in the quaternary alluvium. These wells have SC values that are on average two orders of magnitude greater than most of the wells developed in the Cache Formation or the olivine basalt (Table 1). Division staff located eight wells developed within the area of mapped olivine basalt that are within one to two orders of magnitude as productive as the most productive alluvial aquifer wells. The olivine basalt wells yield an average SC value of 0.6 gpm per foot of drawdown with the highest yielding 1.43 gpm per foot of

drawdown. For comparison, the most productive alluvial aquifer well that Division staff analyzed is HVLCSD's Ag well that has an SC value of 59 gpm per foot of drawdown (Appendix A, Well No. 32402; Table 1).

Published literature suggests that wells in Lower Lake that are producing water from Cache Formation have the potential to yield a minimum of 150 gpm and may yield as much as 200 gpm (Upson and Kunkel, 1955). However, Division staff could not locate these wells and they may no longer produce this amount or be productive at all. Division staff interprets that this is an indication that the Cache Formation is productive. Also, there are two wells to the northwest of Coyote Valley, 007478 and 002295, that are screened at 360-550 ft and 380-560 ft which is likely below the alluvium and may be within the Cache Formation.

Table 1: Specific Capacity

Well Number	Water Elevation	Geologic Unit	SC Value
007478	Not Logged	Quaternary Alluvium	N/A
002295	Not Logged	Quaternary Alluvium	N/A
264476	960	Quaternary Alluvium	16.48
375939 HVLCSD Well #3	931	Quaternary Alluvium	1.06
769936 HVLCSD Well #4	938	Quaternary Alluvium	2.27
32402 HVLCSD Ag well	945	Quaternary Alluvium	58.82
784498	904	Quaternary Alluvium	0.19
713807	950	Quaternary Alluvium	0.45
228005	965	olivine basalt	1.11
84195	1290	olivine basalt	1.43
e033469	900	olivine basalt	0.33
211175	1042	olivine basalt	0.7

WELL COMPLETION REPORTS

Division staff reviewed approximately 875 well completion reports obtained from DWR for wells completed within Coyote Valley and the surrounding areas. Division staff reviewed well completion reports for adjacent geologic units and alluvial valleys; however, those well completion reports and the geology therein will not be taken into consideration for this analysis with the exception of comparing Coyote Valley to Collayomi Valley and Long Valley as an illustrative comparison of the Quaternary alluvium cross section reviewed in published literature (Figure 5). Division staff chose

not to consider well completion reports for adjacent alluvial valleys because evaluating the alluvium thickness and contact to geologic units was uncertain in adjacent valleys, as it is in Coyote Valley, and did not reveal any valuable information that allowed Division staff to determine if the water within the Coyote Valley alluvium could be inferred to be part of a subterranean stream. Division staff's primary focus was on well completion reports that had detailed geologic descriptions of the subsurface Quaternary alluvium, Plio-Pleistocene Cache Formation, and Plio-Pleistocene olivine basalt.

In general, none of the well completion reports indicated precise or detailed changes in lithology nor did they call out contacts between formations (i.e. alluvium-Cache Formation contact). The information presented in many of the well completion reports is oversimplified and lacking detail, and Division staff had to interpret lithologic changes by assuming likely contact depth and the geographic location of the well. However, Division staff has interpreted that several well completion reports within the Quaternary alluvium have encountered Cache Formation and, in some instances, Cretaceous undifferentiated sedimentary units (Appendix A). This supports the assertion by Brice, Upson, and DWR that the alluvium in Coyote Valley is likely underlain by Cache Formation or olivine basalt. All the well completion reports developed within the Quaternary alluvium show that the screened intervals are within Quaternary alluvium with two exceptions (Table 2; Appendix A). Wells 002295 and 007478 are both drilled to approximately 600 ft below ground surface (bgs) and both wells are screened at two intervals (Figure 4; Appendix A). Well 002295 is screened at 180-340 ft bgs and 380-560 ft bgs, and well 007478 is screened at 180-340 ft bgs and 360-550 ft bgs. Both well completion reports offer poor descriptions of the subsurface geology and have logged most intervals as either clay or hard rock (Appendix A). Division staff interprets that these wells are likely drilling through the Quaternary alluvium and into deeper production units at the lower screened intervals. While the upper screened intervals could potentially be drawing water, at least partially, from Quaternary alluvium, the deeper screened intervals are likely deeper than the extent of alluvium and are likely developed into either Plio-Pleistocene Cache Formation or olivine basalt. Division staff interprets this to mean that while the water drawn from these wells is likely saturating the quaternary alluvium, the intent of drilling these wells and screening them at such depths is to reach water that exists in a productive unit below the alluvium.

As with the wells developed in Quaternary alluvium, all the wells developed to the north of Coyote Valley that are geographically located in mapped Plio-Pleistocene olivine basalt are screened at depth in intervals that are drawing water from either olivine basalt or Cache Formation. Division staff was unable to determine lithologic unit changes from the well completion reports for wells developed in the olivine basalt and assumes that some of the wells are drawing water from Cache Formation because of the interbedded nature of Cache Formation and olivine basalt as described in published literature.

Table 2: Wells with Screened Elevations

Well Number	Elevation	Water Elevation	Geologic Unit	Screened Interval Below Ground Surface	SC Value	Screened Elevation
007478	1010	Not Logged	Quaternary Alluvium	180-340 ft 360-550 ft	N/A	820-660 640-450
002295	1000	Not Logged	Quaternary Alluvium	180-340 ft 380-560 ft	N/A	820-660 620-440
264476	980	960	Quaternary Alluvium	50-100 ft	16.48	930-880
375939 HVLCS Well #3	960	931	Quaternary Alluvium	80-170 ft.	1.06	880-790
769936 HVLCS Well #4	960	938	Quaternary Alluvium	50-110 ft and 148- 188 ft.	2.27	910-850 812-772
32402 HVLCS Ag well	960	945	Quaternary Alluvium	20-32, 35- 50, 54-74, 78-86, 96- 106 ft	58.82	940-854
784498	920	904	Quaternary Alluvium	30-80 ft	0.19	890-840
713807	970	950	Quaternary Alluvium	45-85ft	0.45	925-885
228005	1300	965	olivine basalt	295-335 ft	1.11	1005-965
84195	1300	1290	olivine basalt	45-85 ft	1.43	1255- 1215
e033469	1120	900	olivine basalt	140-220 ft	0.33	980-900
211175	1180	1042	olivine basalt	205-305 ft	0.7	975-875

SUBTERRANEAN STREAM ANALYSIS

GARRAPATA 4-PART TEST

In this section, Division staff applies the Garrapata four-part test to the geologic and hydrologic information presented in the previous section.

Subsurface Channel

The Quaternary alluvium of Coyote Valley is bound to the west and northwest by sediments of the Jurassic-Cretaceous Franciscan-Knoxville groups and undifferentiated Cretaceous rocks forming the west bank of the subsurface channel (Koenig, 1963). However, there is no evidence to suggest to what depth these formations bound the Quaternary alluvium. The east limb of the subsurface channel is comprised of olivine basalt and Cache Formation. Division staff interprets that the Cache Formation is likely underlying Coyote Valley at some depth and the presumption is that this formation is forming the bed of the subsurface channel. The Quaternary alluvium is irregular and poorly defined because the alluvial sediments within Coyote Valley have a heterogenous origin. Well completion reports for wells within Coyote Valley alluvium show a subsurface that is comprised of lacustrine fine-grained sediments, cemented to semi-cemented conglomeritic strata (which may be Cache Formation), fine to coarse-grained stream channel deposits, and fine-grained alluvial fan deposits (see Figure 5 as an illustrative proxy).

Division staff has interpreted published literature, geologic maps, and well completion reports and has determined that the available evidence suggests that there are formations to the north and south of Coyote Valley that would form the banks of a subsurface channel; however, there is no clearly defined contact between the alluvium and other formations that would form a bed of a subsurface channel.

For the purpose of this analysis, Division staff will presume that there are formations bounding the alluvium at some depth in order to continue evaluating the other parts of the Garrapata four-part test.

Impermeable Bed and Banks

Division staff analyzed approximately 875 well completion reports, multiple geologic maps, and multiple published papers discussing the hydrology of Coyote Valley and the surrounding geology. Division staff has determined that there is a reasonable amount of information available to suggest that the northwest of the Coyote Valley alluvial aquifer is at least partially bounded by impermeable bedrock at some depth because the rock that outcrops in this area is mapped as sediments of the Jurassic-Cretaceous Franciscan-Knoxville groups and undifferentiated Cretaceous rocks; however, Division staff cannot rule out the possibility that permeable olivine basalt or, more likely, Cache Formation is underlying the alluvium (Koenig, 1963). This interpretation is based on the small outcropping of Cache Formation mapped to the northwest of Coyote Valley and the well completion reports for wells 007478 and 002295 which indicate that there may be a productive formation below the Quaternary alluvium by screening an interval at depth that Division staff interprets as being below the extent of the Quaternary alluvium. Division staff has also analyzed several well completion reports that may be drilled to a depth where Cache Formation was encountered.

Division staff has determined that there is enough evidence to suggest that the water within the Coyote Valley alluvial aquifer is not bounded by relatively impermeable bed and banks to the north and east of Coyote Valley. There are outcrops of Plio-Pleistocene Cache Formation and Plio-Pleistocene olivine basalt mapped to the north and east of Coyote Valley and several descriptions in published literature suggest that these formations underlie much of Coyote Valley and are likely water bearing (Brice, 1953; Upson and Kunkel, 1955; DWR, 1962; Koenig, 1963).

DWR also describes the olivine basalt as being notable for accepting recharge for the groundwater basin by acting as a forebay for groundwater recharge. The assertion that the Cache Formation and olivine basalt may be water bearing is further supported by the presence of multiple wells drilled north of Coyote Valley within the olivine basalt and the well completion reports for these wells indicate that their screened intervals are within either olivine basalt or Cache Formation (Appendix A). There is no indication that any of the wells developed to the east of Coyote Valley are drilled through the olivine basalt formation. Division staff analyzed the SC values of each well within the Quaternary alluvium and found that there is abundant variability over the extent of Coyote Valley and even HVLCSD wells 32402 and 375939, which are approximately 1,100 feet apart, exhibit highly variable subsurface geology and SC values (Appendix A; Table 1). Also, when comparing the SC values of wells developed within the olivine basalt and Cache Formation to the east of Coyote Valley with most of the wells developed in the Quaternary alluvium of Coyote Valley, the values are similar. Division staff interprets this to mean that the olivine basalt and Cache Formation are likely not bounding the water within the Coyote Valley alluvial aquifer (Appendix A; Table 1). Also, because the SC values differ greatly over the alluvial aquifer wells, Division staff interprets this to mean that water likely moves rapidly through unconfined coarse-grained materials of stream channel deposits but that the overall productivity of the Coyote Valley alluvial aquifer is similar to that of the olivine basalt and Cache Formation and, as suggested by published literature, the alluvial aquifer may even be supported by the olivine basalt acting as a forebay and accepting recharge for groundwater (DWR, 1962).

Additional analysis performed by Groundwater Ambient Monitoring and Assessment (GAMA) Unit engineering geologist staff within the State Water Board's Division of Water Quality indicate that the water in the Coyote Valley alluvial aquifer is likely mostly sourced from the surrounding olivine basalt based on water quality evaluations, which provides additional evidence that the olivine basalt is not an impermeable unit that bounds the water within the alluvial aquifer. GAMA Unit staff reviewed information regarding the water quality within HVLCSD wells that are available through the GAMA Program and found that the HVLCSD wells contain "relatively elevated concentrations of hexavalent chromium (Cr6), above the Health Based Screening Level of 20 µg/L" (State Water Boards Division of Water Quality GAMA Unit Staff Review of the Subterranean Stream Determination for Coyote Valley, Lake County, February 2020). GAMA Unit staff further states that the "presence of Cr6 at these concentrations indicates that groundwater accessed by the HVLCSD wells is at least partially connected to the Olivine Basalt formation" and that "although the aquifer may be in

hydraulic connection with the Putah Creek seasonally (high water flow), the distance, local geology and presence of Cr6 in groundwater do not support an idea that the Putah Creek and associated sub-terranean stream is a sole source of water for the HVLCSD wells”.

Course of the Channel

Division staff attempted to infer the course of the subsurface channel by interpreting geologic maps and well completion reports. Division staff concludes that the course of the subsurface channel is likely following the general east to southeast gradient of the Coyote Valley land surface as demonstrated in the topography information in the geologic maps. Well completion reports indicate that the alluvium in Coyote Valley is likely undulating and irregular and some of the well completion reports indicate that Cache Formation may have been encountered. Division staff concludes that the well completion reports do not refute the conclusion that the course of the subsurface channel is following the general east to southeast gradient of Coyote Valley.

Flowing Water

Division staff did not find evidence to support that there is water flowing through a known and definite channel even though Division staff presumes that a subsurface channel may be present. The bed and east bank of the subsurface channel is comprised of Cache Formation and olivine basalt, both of which are permeable as suggested from Division staff interpretation of well completion reports, published literature, and water quality analysis by GAMA Unit staff. Division staff attempted to infer a direction of flow by evaluating water elevation between well completion reports and found that there is not enough evidence to support that water is flowing. As stated before, there is evidence to suggest that groundwater may be sequestered to storage within olivine basalt to the north of Coyote Valley (DWR, 1962). Division staff deduces from this information that if there is water flowing through a subsurface channel, it is likely flowing into formations that may be bounding the alluvium but not bounding the water.

CONCLUSIONS

Division staff has determined that the information presented in this memorandum provides sufficient evidence to reasonably infer that there is no subsurface channel bed present and that the water within the alluvial aquifer of Coyote Valley is not bound by relatively impermeable bed and banks; therefore, the water within the alluvial aquifer of Coyote Valley does not meet all four parts of the Garrapata four-part test. Division staff interprets the published literature, geologic maps, and well completion reports as reasonable pieces of information that suggest the Cache Formation and olivine basalt is underlying a majority of the alluvial aquifer in Coyote Valley and that even if Division staff presumes that these formations do form a subsurface channel, they are not sufficiently impermeable and are not confining the water within the alluvial aquifer. Therefore, Division staff concludes that the water within the alluvial aquifer of Coyote

Valley is percolating groundwater and is not subject to the permitting authority of the State Water Board.

As presented in the review of the HVLCSD report, Division staff came to similar conclusions as the HVLCSD report. Division staff has concluded, as did the HVLCSD report, that there is enough evidence to suggest that the water within the alluvial aquifer of Coyote Valley is not bound by relatively impermeable bed and banks throughout the valley; however, Division staff concludes that the olivine basalt is not a bounding unit for water but rather is a unit that provides water storage and acts as a forebay for groundwater recharge when surface flows are not providing recharge. Division staff also concluded that there does appear to be enough evidence within published literature and interpretation of well completion reports to suggest that the Cache Formation is permeable and would likely not be bounding the water within the alluvial aquifer of Coyote Valley.

RECOMMENDATIONS

Based on the above analysis and conclusions, the water of the Coyote Valley aquifer is percolating groundwater and not within the permitting authority of the State Water Board. Division staff recognizes that HVLCSD and other water extractors that draw water from the Coyote Valley aquifer currently have a water right permit or license from the State Water Board or have filed Statements of Diversion and Use for riparian or pre-1914 water rights claims (Table 3) that are not required for a percolating groundwater source. In addition, there may be other groundwater extractors in Coyote Valley currently not known to the Division. Division staff also recognizes that the continued extraction of groundwater in Coyote Valley, although not showing significant impact on groundwater levels at this time nor likely to do so in the near future, could start to significantly overdraft the basin, deplete surface water flows in Putah Creek, and adversely impact senior water rights holders and public trust resources within and downstream of Coyote Valley if groundwater extractions occur unregulated or without any oversight or sustainability plan in place. Therefore, Division staff recommends the following:

1. The appropriative surface water rights held by HVLCSD (Permit 020770B and License 013527A) should be voluntarily or statutorily revoked.
2. Other water rights permits or licenses or Statements of Diversion and Use for water from the Coyote Valley aquifer should be voluntarily or statutorily revoked or inactivated.
3. If unregulated percolating groundwater extraction results in overdraft, the Department of Water Resources should re-evaluate the Coyote Valley aquifer to determine if the current basin prioritization of “very low priority” under SGMA (Sustainable Groundwater Management Act) should be revised to a higher priority.
4. HVLCSD and others that are extracting water from the Coyote Valley aquifer should consider forming a Groundwater Sustainability Agency (GSA), or some

other local management body, to monitor groundwater levels and ensure that current and future groundwater extractions are sustainable and not in jeopardy of critically over drafting the basin and impacting downstream senior water rights holders or public trust resources.

5. HVLCSD continue to monitor instream flows at the USGS Guenoc gaging station to assure that groundwater extraction is not negatively impacting surface flows, downstream water rights users, and public trust resources.

While a water right permit or license may not be required to extract water that has been determined to be percolating groundwater, the Division and the State Water Board has other regulatory mechanisms to evaluate and address public trust and senior water rights impacts that may occur due to unregulated groundwater extraction. The State Water Board reserves the right to take enforcement action for waste and unreasonable use and impacts to public trust resources resulting from unregulated groundwater extractions in Coyote Valley. Additionally, should the Coyote Valley basin be determined to be a higher priority basin in the future based on groundwater extractions, groundwater use in the basin will be subject to regulations under SGMA, including the formation of a GSA.

Table 3: Water Rights to Underflow of Putah Creek

WATER RIGHT ID	SOURCE	FACE VALUE (AF)	DIVERSION TYPE	WATER RIGHT TYPE (Priority Date)	OWNER
A030049A	Putah Creek Underflow	651	Direct Diversion	Licensed (12/16/1991)	HVLCSD
A030049B	Putah Creek Underflow	1649	Direct Diversion	Permitted (12/16/1991)	HVLCSD
S014734	Putah Creek Underflow	641	Diversion to Storage	Riparian Claim	HVLCSD
S014735	Putah Creek Underflow	604	Diversion to Storage	Riparian Claim	HVLCSD
S014736	Putah Creek Underflow	543	Diversion to Storage	Riparian Claim	HVLCSD
S022191	Putah Creek Underflow	724	Direct Diversion	Riparian Claim	HVLCSD
S014742	Putah Creek Underflow	1593	Diversion to Storage	Riparian Claim	Sutter Home Vineyards
S014744	Putah Creek Underflow	1593	Diversion to Storage	Riparian Claim	Sutter Home Vineyards
S014745	Putah Creek Underflow	1593	Diversion to Storage	Riparian Claim	Sutter Home Vineyards
S014746	Putah Creek Underflow	1593	Diversion to Storage	Riparian Claim	Sutter Home Vineyards
A024667A	Putah Creek Underflow	28	Diversion to Storage	Licensed (08/13/1974)	Sutter Home Vineyards
A024667B	Putah Creek Underflow	44.6	Direct Diversion	Licensed (04/22/1982)	Sutter Home Vineyards

REFERENCES

Brice, J.C., 1953 Geology of the Lower Lake quadrangle. California: California Division of Mines and Geology Bulletin 16. 72 p.

California Department of Water Resources. 1962. Reconnaissance Report on Upper Putah Creek Basin Investigation. Sacramento. Bulletin 99. 254p.

Driscoll, F.G. (1986) Groundwater and Wells. 2nd Edition, Johnson Division, St Paul, 1089.

Koenig, J.B., 1963. Geologic map of California: Santa Rosa Sheet: California Division of Mines and Geology, scale 1:250,000.

State Water Boards Division of Water Quality GAMA Unit Staff Review of the Subterranean Stream Determination for Coyote Valley, Lake County, February 2020

Upton, J.E., Kunkel, F. 1955. Groundwater of the Lower Lake-Middletown Area, Lake County, CA. United States Geologic Survey Water-Supply Paper 1297.

Figure 1:
Inset Map of Hidden Valley Lake Southern Lake County

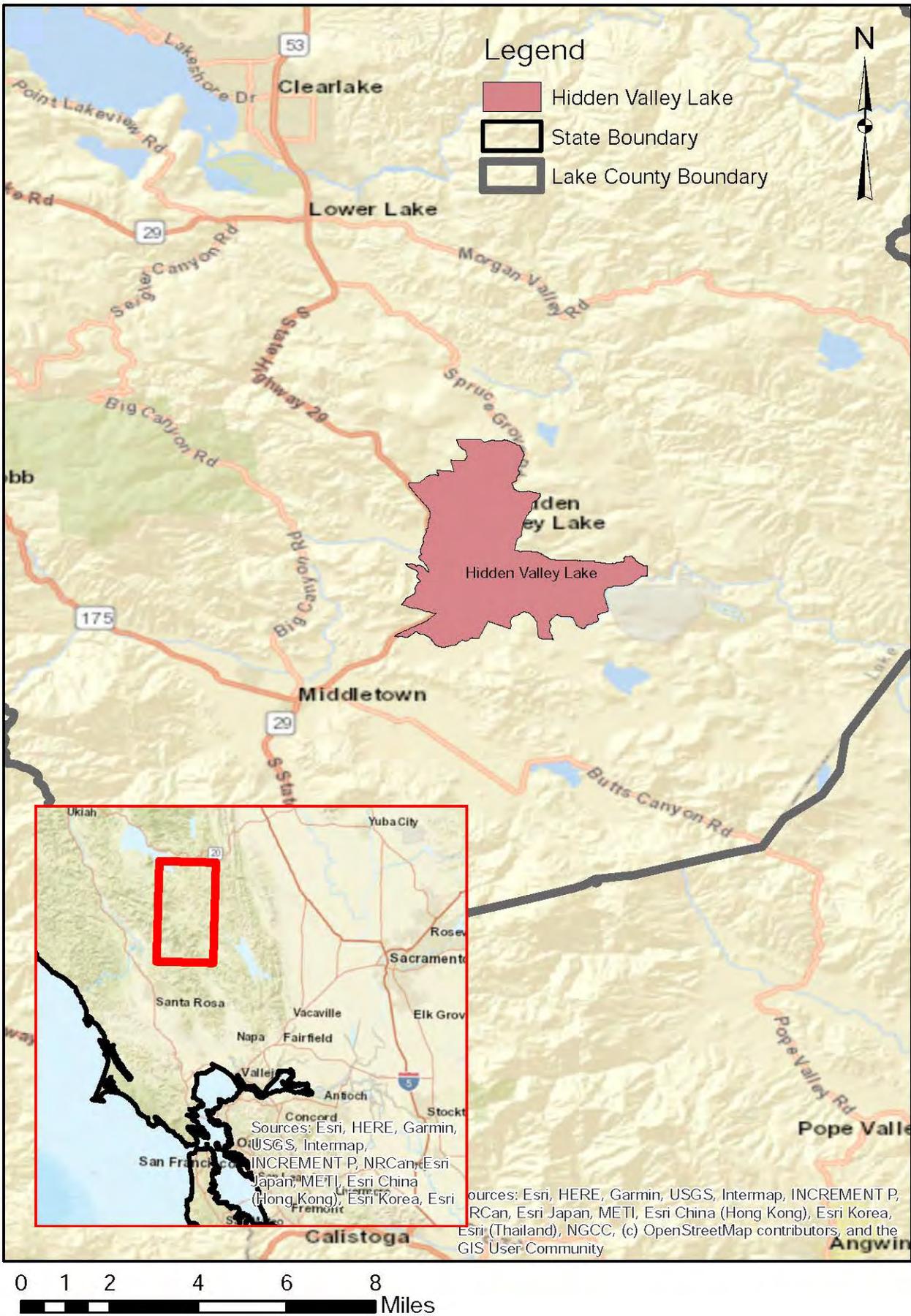
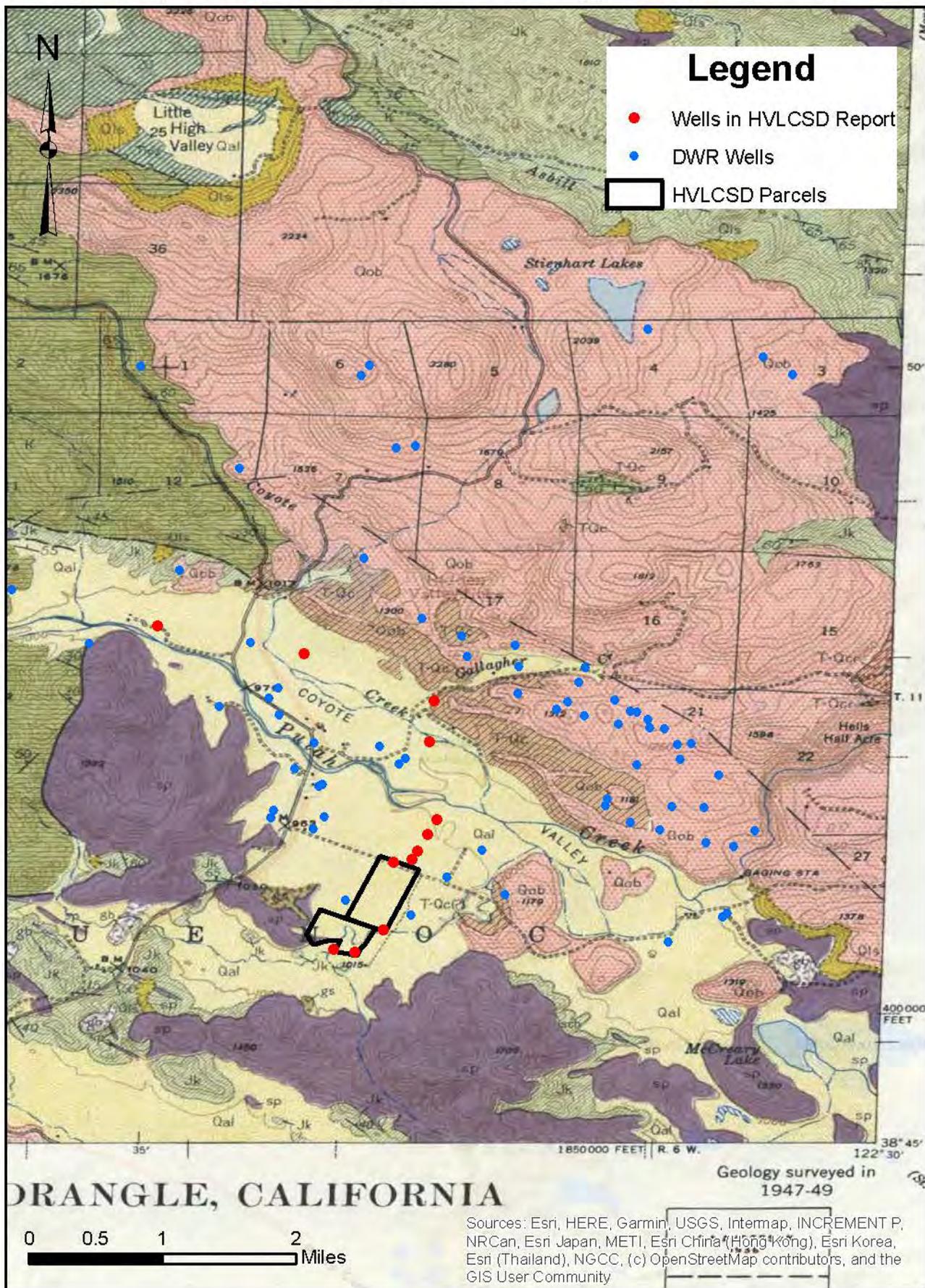


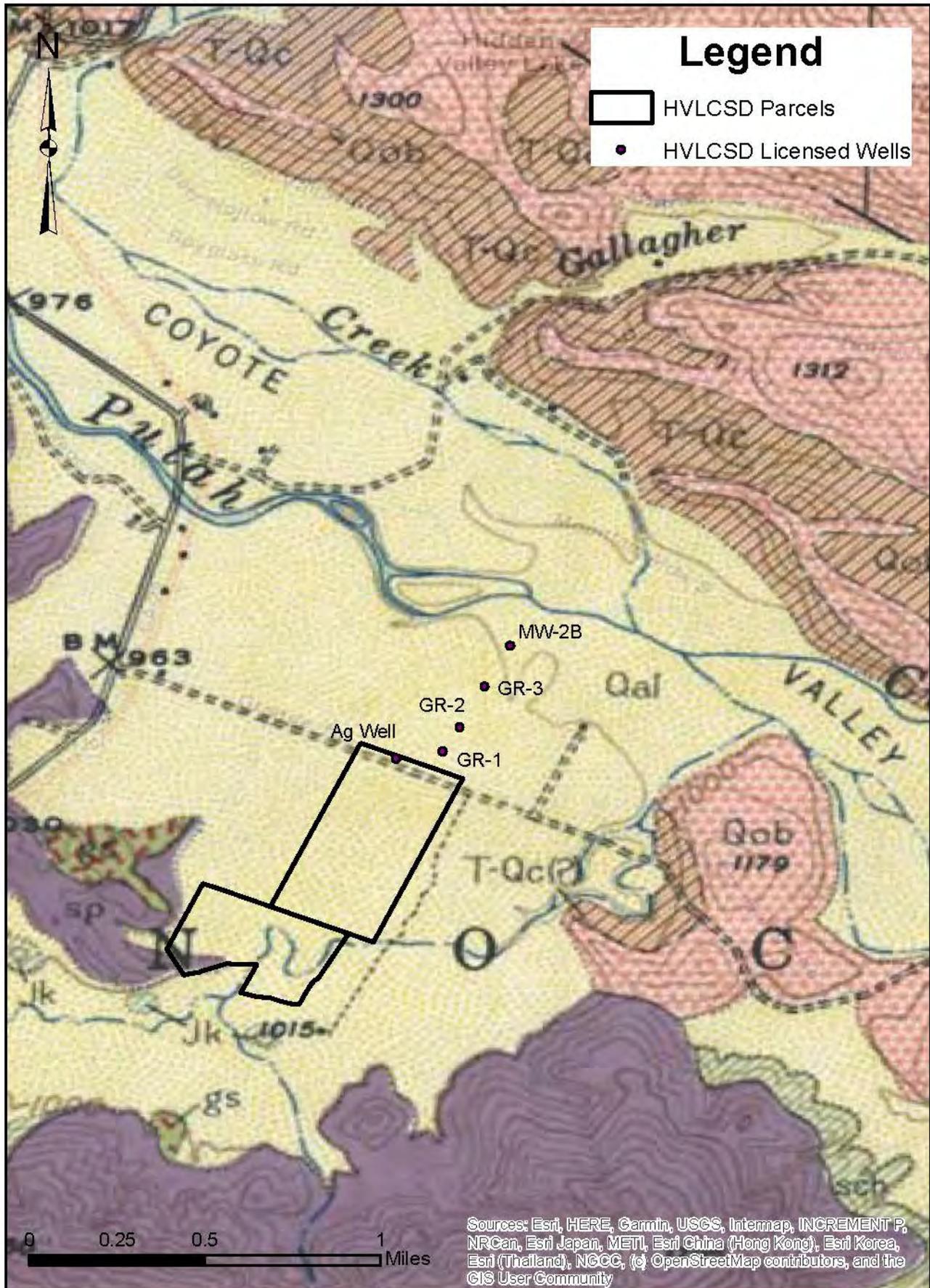
Figure 2:

Geologic Map of Coyote Valley with DWR Approximate Well Locations



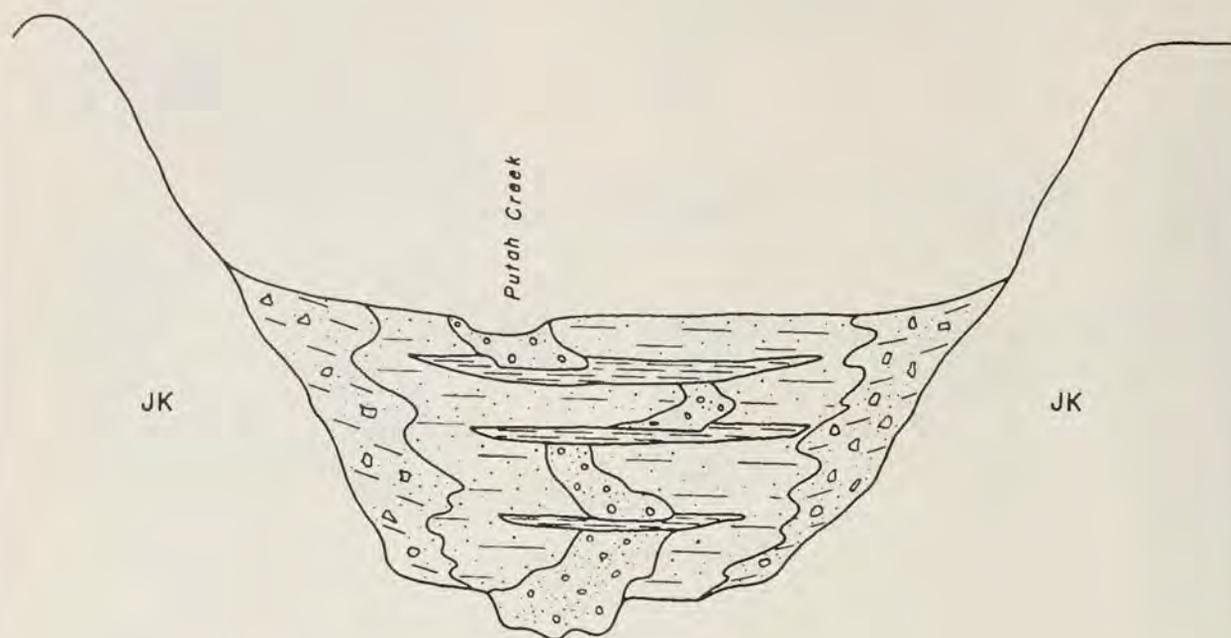
Modified from Koenig, 1963.

Figure 3:
Geologic Map of Coyote Valley with HVLCSD Licensed Wells



Modified from Koenig, 1963.

Figure 5: Diagrammatic Geologic Section of Stratified Materials in the Collayomi-Long Valley Groundwater Basin (to be used as a proxy for Coyote Valley)



LEGEND

	STREAM DEPOSITS COARSE-GRAINED MATERIALS, GOOD PERMEABILITY
	LAKE DEPOSITS FINE-GRAINED MATERIAL, LOW PERMEABILITY
	FLOOD PLAIN MEDIUM-FINE-GRAINED MATERIAL, LOW PERMEABILITY
	SLOPEWASH COARSE-TO FINE-GRAINED MATERIAL, POORLY SORTED, GENERALLY LOW PERMEABILITY
	JURASSIC-CRETACEOUS BEDROCK, IMPERMEABLE

NOTE: GEOLOGIC SECTION NOT TO SCALE.

DIAGRAMMATIC GEOLOGIC SECTION OF STRATIFIED MATERIALS IN THE COLLAYOMI-LONG VALLEYS GROUND WATER BASIN

Appendix A

State of California
Well Completion Report
 Form DWR 188 Complete 4/6/2018
 WCR2018-002295

Owner's Well Number DIAMOND RANCH #3 Date Work Began 08/18/2017 Date Work Ended 11/22/2017
 Local Permit Agency Lake County Health Services Department - Environmental Health Division
 Secondary Permit Agency _____ Permit Number WE-4922 AG Permit Date 08/15/2017

Well Owner (must remain confidential pursuant to Water Code 13752)	Planned Use and Activity
Name <u>XXXXXXXXXXXXXXXXXXXXXX</u>	Activity <u>New Well</u>
Mailing Address <u>XXXXXXXXXXXXXXXXXXXXXX</u> <u>XXXXXXXXXXXXXXXXXXXXXX</u>	Planned Use <u>Water Supply Irrigation - Agriculture</u>
City <u>XXXXXXXXXXXXXXXXXXXXXX</u> State <u>XX</u> Zip <u>XXXXX</u>	

Well Location	
Address <u>18545 S 29 HWY</u>	APN <u>014-250-11</u>
City <u>MIDDLETOWN</u> Zip <u>95461</u> County <u>Lake</u>	Township <u>11 N</u>
Latitude _____ N Longitude _____ W	Range <u>07 W</u>
Deg. Min. Sec. Deg. Min. Sec.	Section <u>24</u>
Dec. Lat. <u>38.7968300</u> Dec. Long. <u>-122.5772600</u>	Baseline Meridian <u>Mount Diablo</u>
Vertical Datum _____ Horizontal Datum <u>WGS84</u>	Ground Surface Elevation <u>990</u>
Location Accuracy _____ Location Determination Method _____	Elevation Accuracy <u>Unknown</u>
	Elevation Determination Method <u>GPS</u>

Borehole Information	
Orientation <u>Vertical</u> Specify _____	
Drilling Method <u>Reverse Circulation</u> Drilling Fluid <u>Bentonite</u>	
Total Depth of Boring <u>600</u> Feet	
Total Depth of Completed Well <u>570</u> Feet	

Water Level and Yield of Completed Well	
Depth to first water _____ (Feet below surface)	
Depth to Static _____	
Water Level _____ (Feet) Date Measured _____	
Estimated Yield* _____ (GPM) Test Type _____	
Test Length _____ (Hours) Total Drawdown _____ (feet)	
*May not be representative of a well's long term yield.	

Geologic Log - Free Form		
Depth from Surface	Feet to Feet	Description
0	5	TOP SOIL
5	35	GRAVEL
35	60	CLAY
60	80	GRAVEL
80	100	CLAY
100	140	CLAY / HARD ROCK
140	160	CLAY
160	190	BLACK HARD ROCK
190	200	CLAY / HARD ROCK
200	210	CLAY
210	230	BLACK HARD ROCK
230	240	CLAY
240	250	CLAY, HARD ROCK
250	260	CLAY
260	290	BLACK HARD ROCK

290	300	CLAY
300	310	BLACK HARD ROCK
310	320	CLAY / HARD ROCK
320	370	CLAY
370	390	CLAY / HARD ROCK
390	430	CLAY
430	450	HARD ROCK
450	470	HARD ROCK / CLAY
470	480	CLAY
480	530	HARD ROCK
530	600	HARD ROCK / CLAY

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	60	Conductor or Fill Pipe	Low Carbon Steel	Grade: ASTM A53	0.375	30			
2	0	180	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	180	340	Screen	Low Carbon Steel	Grade: ASTM A53	0.25	12.75	Milled Slots	0.08	
2	340	380	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	380	560	Screen	Low Carbon Steel	Grade: ASTM A53	0.25	12.75	Milled Slots	0.08	
2	560	570	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	570	600	No Casing Installed	Other	N/A					NO CASING

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	60	Cement	10.3 Sack Mix		ANNULAR CEMENT SEAL
60	600	Filter Pack	Other Gravel Pack	4 X 16	GRAVEL PACK

Other Observations:

Borehole Specifications		
Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	60	36
60	600	20

Certification Statement			
I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief			
Name	WELL INDUSTRIES INC		
	Person, Firm or Corporation		
	3282 HIGHWAY 32	CHICO	CA 95973
	Address	City	State Zip
Signed	<i>electronic signature received</i>	03/08/2018	812678
	C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number

DWR Use Only			
CSG #	State Well Number	Site Code	Local Well Number
		N	W
Latitude Deg/Min/Sec		Longitude Deg/Min/Sec	
TRS:			
APN:			

State of California
Well Completion Report
 Form DWR 188 Complete 10/8/2018
 WCR2018-007478

Owner's Well Number DIAMOND 4 Date Work Began 08/28/2017 Date Work Ended 08/04/2018
 Local Permit Agency Lake County Health Services Department - Environmental Health Division
 Secondary Permit Agency _____ Permit Number WE-4923 AG Permit Date 08/15/2017

Well Owner (must remain confidential pursuant to Water Code 13752)	Planned Use and Activity
Name <u>XXXXXXXXXXXXXXXXXXXXXX</u>	Activity <u>New Well</u>
Mailing Address <u>XXXXXXXXXXXXXXXXXXXXXX</u> <u>XXXXXXXXXXXXXXXXXXXXXX</u>	Planned Use <u>Water Supply Irrigation - Agriculture</u>
City <u>XXXXXXXXXXXXXXXXXXXXXX</u> State <u>XX</u> Zip <u>XXXXX</u>	

Well Location	
Address <u>0 DIAMOND RANCH RD</u>	APN <u>014-230-111</u>
City <u>MIDDLETOWN</u> Zip <u>95461</u> County <u>Lake</u>	Township <u>11 N</u>
Latitude _____ N Longitude _____ W	Range <u>07 W</u>
Deg. Min. Sec. Deg. Min. Sec.	Section <u>13</u>
Dec. Lat. <u>38.8036000</u> Dec. Long. <u>-122.5913200</u>	Baseline Meridian <u>Mount Diablo</u>
Vertical Datum _____ Horizontal Datum <u>WGS84</u>	Ground Surface Elevation <u>1010</u>
Location Accuracy _____ Location Determination Method _____	Elevation Accuracy <u>Unknown</u>
	Elevation Determination Method <u>GPS</u>

Borehole Information	
Orientation <u>Vertical</u> Specify _____	
Drilling Method <u>Downhole Rotary Hammer</u> Drilling Fluid <u>Bentonite</u>	
Total Depth of Boring <u>600</u> Feet	
Total Depth of Completed Well <u>560</u> Feet	

Water Level and Yield of Completed Well	
Depth to first water _____ (Feet below surface)	
Depth to Static _____	
Water Level _____ (Feet) Date Measured _____	
Estimated Yield* _____ (GPM) Test Type _____	
Test Length _____ (Hours) Total Drawdown _____ (feet)	
*May not be representative of a well's long term yield.	

Geologic Log - Free Form		
Depth from Surface	Feet to Feet	Description
0	50	COBBLE
50	260	BLACK ROCK - HARD
260	600	BLACK ROCK - HARD

Casings										
Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	50	Conductor or Fill Pipe	Low Carbon Steel	Grade: ASTM A53	0.375	30			
2	0	180	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	180	340	Screen	Low Carbon Steel	Grade: ASTM A53	0.25	12.75	Milled Slots	0.08	
2	340	360	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			
2	360	550	Screen	Low Carbon Steel	Grade: ASTM A53	0.25	12.75	Milled Slots	0.08	
2	550	560	Blank	Low Carbon Steel	Grade: ASTM A53	0.25	12.75			

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	50	Cement	10.3 Sack Mix		ANNULAR CEMENT SEAL
50	560	Filter Pack	Other Gravel Pack	4 X 8	GRAVEL PACK

Other Observations:

Borehole Specifications		
Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	50	36
50	560	20
560	600	7.875

Certification Statement			
I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief			
Name	WELL INDUSTRIES INC		
	Person, Firm or Corporation		
	3282 HIGHWAY 32	CHICO	CA 95973
	Address	City	State Zip
Signed	<i>electronic signature received</i>	08/31/2018	812678
	C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number

DWR Use Only			
CSG #	State Well Number	Site Code	Local Well Number
		N	
			W
		Latitude Deg/Min/Sec	
		Longitude Deg/Min/Sec	
		TRS:	
		APN:	

ORIGINAL
File with DWR

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

Do not fill in
No. 084094

of Intent No. _____
Local Permit No. or Date _____

State Well No. _____
Other Well No. 11N06W18

(2) LOCATION OF WELL (See instructions):
County Lake Owner's Well Number _____
Well address if different from above Hidden Valley Lake
Township _____ Range _____ Section _____
Distance from cities, roads, railroads, fences, etc. _____
A.P. # 144-131-01

(12) WELL LOG: Total depth _____ ft. Depth of completed well _____ ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0 - 20 **bed clay**
20 - 30 **volcanic ash**
30 - 33 **blue vol. rock**
33 - 60 **volcanic ash**

(3) TYPE OF WORK:
New Well Deepening
Reconstruction 60 - 90 **fract. blue vol.**
Reconditioning _____
Horizontal Well 90 - 250 **hard blue vol. rock**
Destruction (Describe destruction materials and procedures in Item 12) _____
250 - 260 **red vol.**

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

WELL LOCATION SKETCH

(5) EQUIPMENT:
Rotary Reverse Air Bucket
Cable Other
(6) GRAVEL PACK:
Yes No Size 3/8
Diameter of bore _____
Raked from 20 to 260 ft.
(7) CASING INSTALLED:
Steel Plastic Concrete
(8) PERFORATIONS:
Type of perforation or size of screen _____

From ft.	To ft.	Dia. in.	Casing or Wall	From ft.	To ft.	Slot size
0	260	4"	c160	220	260	1/8
			psi			

(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 cement

(10) WATER LEVELS:
Depth of first water, if known _____ ft.
Standing level after well completion 30 ft.

(11) WELL TESTS:
Was well test made? Yes No If yes, by whom? driller
Type of test Pump Bailer Air lift
Depth to water at start of test 30 ft. At end of test 250 ft.
Flow rate 30 gal/min after 2 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

Work started 11-27 19 79 Completed 11-29 19 79

WELL DRILLER'S STATEMENT: 00941
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED LARRY HERMAN by kathy read
NAME FISCH-HERMAN DRILLING (Well Driller)
Address 5001 Gravenstein Hwy. N.
City Sebastopol, Calif. Zip 95472
License No. 304138 Date of this report 12-10-79

11N/06W-28M

ORIGINAL
File with DWR

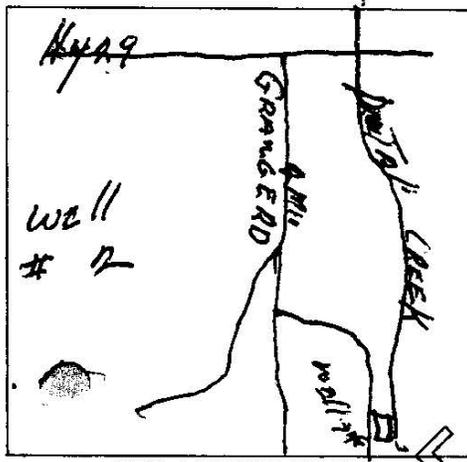
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 133871

Not a Patent No. _____
Local permit No. or Date _____

State Well No. _____
Other Well No. _____

(2) LOCATION OF WELL (See instructions):
County LAKE Owner's Well Number _____
Well address if different from above LOCHETT RANCH END GRANGE RD
Township MIDDLEBURY Range 6 Well N Section 2728
Distance from cities, roads, railroads, fences, etc. 11N/6W-28
2 1/2 MILES IN FROM GRANGE ROAD



(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

(12) WELL LOG: Total depth 190 ft. Depth of completed well 190 ft.
from ft. to ft. Formation (Describe by color, character, size or material)
0 - 35 Top Soil - BROWN
35 - 60 Clay + GRAVELS - BROWN
60 - 62 GRAVEL - WATER
62 - 105 Blue Clay -
105 - 110 Rock -
110 - 135 - BLUE GRAVEL - WATER
135 - 170 SORT BLUE -
170 - 190 BOLDERS
190 - BED ROCK -
well - pumping 400 GPM
130
MAR 23 1998

(5) EQUIPMENT:
Rotary Reverse
Cable Air
Other Bucket

(6) GRAVEL PACK:
Yes No Size 1/2"
Diameter of bore _____
Packed from _____ to _____

(7) CASING INSTALLED:
Steel Plastic Concrete

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

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
<u>72</u>	<u>180</u>	<u>10</u>	<u>198</u>	<u>35</u>	<u>175</u>	<u>1/2 X 3"</u>

(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 _____

(10) WATER LEVELS:
Depth of first water, if known 30 ft.
Standing level after well completion 19 ft.

(11) WELL TESTS:
Was well test made? Yes No If yes, by whom? Rain Bow
Type of test Pump Bailer Air lift
Depth to water at start of test 18 ft. At end of test 18 ft.
Discharge 300 gal/min after 4 hours Water temperature Cold
Chemical analysis made? Yes No If yes, by whom? _____
Was electric log made? Yes No If yes, attach copy to this report

Work started May 6 19 99 Completed May 15 19 99
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 RUGENE ROUSOME (Well Driller)
NAME RUGENE ROUSOME (Person, firm, or corporation) (Typed or printed)
Address PO BOX 65
City LOWER LAKE Zip 95457
License No. 196290 Date of this report MAY-17-99

ORIGINAL
File with DWR

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

11N/06W-20M
Do not fill in
No. 211175

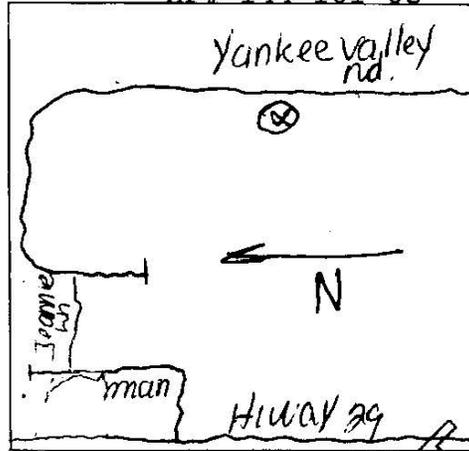
Notice of Intent No. _____
Local No. or Date WE173

State Well No. _____
Other Well No. _____

(2) LOCATION OF WELL (See instructions):
County LAKE Owner's Well Number _____
Well address if different from above _____
Township 11N Range 6W Section Rancho
Distance from cities, roads, railroads, fences, etc. Guenoc
20802 Yankee Valley Road
Middletown, California
AP# 144-101-03

(12) WELL LOG: Total depth 306 ft. Depth of completed well 306 ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0 - 8	Red clay and boulder
8 - 22	Gray rock
22 - 34	Maroon rock
34 - 98	Gray rock
98 - 124	Red rock
124 - 126	Gray rock
126 - 140	Brown rock
140 - 306	Volcanic conglomerate, fractured.



(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 1/2"
- Diameter of bore 6 3/4, 9 7/8, 7 7/8
- Packed from 22 to 306

(7) CASING INSTALLED:

- Steel Plastic Concrete

(8) PERFORATIONS:

- Type of perforation or size of screen micro

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	306	5 1/2	CL200	205	305	.032

(9) WELL SEAL:

- Was surface sanitary seal provided? Yes No If yes, to depth 22 ft.
- Were strata sealed against pollution? Yes No Interval _____ ft.
- Method of sealing cement on gravel pack

(10) WATER LEVELS:

- Depth of first water, if known _____ ft.
- Standing level after well completion 138 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 138 ft. At end of test 280 ft.
- Discharge 100 gal/min after 2 hours Water temperature cool
- Chem. analysis made? Yes No If yes, by whom? _____
- *Was electric log made? Yes No If yes, attach copy to this report

Work started 5-4- 19 90 Completed 5-10 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 By: Don Sinclair
(Well Driller)
NAME WEEKS DRILLING AND PUMP COMPANY
(Person, firm, or corporation) (Typed or printed)
Address P.O. Box 176-6100 Sebastopol Road
City Sebastopol, California Zip 95473
License No. C57-177681 Date of this report May 24, 1990

11N/06W-19M

ORIGINAL
File with DWR

FEB 13 1996

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

Do not fill in

No. 211420

No. of Intent No. _____
Local Permit No. or Date WE 1277

State Well No. _____
Other Well No. _____

5 1/2 QUINN VILLAGE

(12) WELL LOG: Total depth 104 ft. Depth of completed well 94 ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0 - 2 Embedded gravels in
brown clay
2 - 104 Gravel and boulders

(2) LOCATION OF WELL (See instructions):

County LAKE Owner's Well Number _____
Well address if different from above _____
Township 11N Range 7W 06W Section Rancho Guenoc
Distance from cities, roads, railroads, fences, etc. 19
18696 Putah Lane
Middletown
A.P. # 014-362-03



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 _____
- Diameter of bore 9 7/8, 11"
- Packed from 50 to 104 ft.

(7) CASING INSTALLED:

- Steel Plastic Concrete

(8) PERFORATIONS: microperf

Type of perforation or size of screen _____

From ft.	To ft.	Dia. in.	Cage or Wall	From ft.	To ft.	Slot size
0	94	6"	CL200	54	94	.032

(9) WELL SEAL:

- Was surface sanitary seal provided? Yes No If yes, to depth 50 ft.
- Were strata sealed against pollution? Yes No Interval _____ ft.
- Method of sealing cement on sandpack

Work started 1-10 1996 Completed 1-16 1996

(10) WATER LEVELS:

Depth of first water, if known _____ ft.
Standing level after well completion 15' ft.

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and the responsibility of the knowledge and belief. Ward Thompson

(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 15 ft. At end of test 79 ft.
- Charge 15 gal/min after 2 hours Water temperature 64°
- Chemical analysis made? Yes No If yes, by whom? _____
- Was electric log made? Yes No If yes, attach copy to this report

SIGNED Ward Thompson By: Thurman Adams
(Well Driller)
NAME WEEKS DRILLING AND PUMP COMPANY
(Person, firm, or corporation) (Typed or printed)
Address P.O. Box 176-6100 Sebastopol Road
City Sebastopol, California Zip 95473
License No. C57-177681 Date of this report January 19, 1996

sub Division

11N/06W-28M
Do not fill in

ORIGINAL

File with DWR

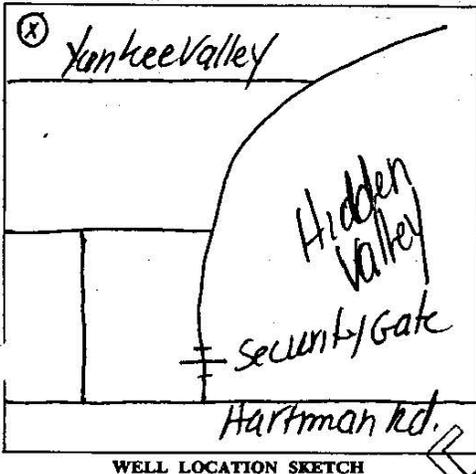
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

No. 213736

County of Intent No. _____
Local Permit No. or Date _____

State Well No. _____
Other Well No. HN06W18

(1) _____
Address _____
City _____
(2) LOCATION OF WELL (See instructions):
County Lake Owner's Well Number _____
Well address if different from above _____
Township 11N Range 06W Section 28
Distance from cities, roads, railroads, fences, etc.
Yankee Valley Road, Hidden Valley
Middletown
A.P. # 144-111-06



(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

(12) WELL LOG: Total depth 261 ft. Depth of completed well 262 ft.
from ft. to ft. Formation (Describe by color, character, size or material)
0 - 27 Very hard red and brown rock
27 - 38 Very hard black rock with traces of red rock
38 - 79 Very hard black rock
79 - 92 Hard multicolored conglomerate rock
92 - 148 Hard black rock with red and green rock
148 - 189 Extremely hard blue-green rock
189 - 240 Red rock and red volcanic ash
240 - 261 Hard black and red rock

(5) EQUIPMENT:
Rotary Reverse
Cable Air
Other Bucket

(6) GRAVEL PACK:
Yes No Size _____
Diameter of bore 10 5/8, 6 3/4, 6 1/2
Packed from 20' to 261' ft.

(7) CASING INSTALLED:

From ft.	To ft.	Dia. in.	Cage or Wall
0	262	4 1/2	CL200

(8) PERFORATIONS: saw out
Type of perforation or size of screen _____

(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 cement on gravel pack

(10) WATER LEVELS:
Depth of first water, if known _____ ft.
Standing level after well completion 131 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 131 ft. At end of test 260 ft.
Flow 30 gal/min after 1/2 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

WATER CODE SEC. 13752
SEP 04 1986
Work started 11/7 19 85 Completed 11/8 19 85

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Don Sinclair
SIGNED: Gerald Thompson by Don Sinclair
(Well Driller)
NAME: WEEKS DRILLING AND PUMP COMPANY
(Person, firm, or corporation) (Typed or printed)
Address: P.O. Box 176 - 6100 Sebastopol Road
City: Sebastopol, California Zip 95472
License No. C57-177681 Date of this report November 12, 1985

11N 06W 07M

ORIGINAL

STATE OF CALIFORNIA

Do not fill in

File with DWR

THE RESOURCES AGENCY

DEPARTMENT OF WATER RESOURCES

No. 245343

WATER WELL DRILLERS REPORT

State Well No. _____

Other Well No. _____

Permit No. or Date _____

(1) Address _____
 City _____

(2) LOCATION OF WELL (See instructions):
 County Lake Owner's Well Number _____
 Well address if different from above North Shore
 Township Hidden Valley Lake Section 7
 Distance from cities, roads, railroads, fences, etc.
A.P. # 142- 122-10

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

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	45	hard blue vol. rock
45	50	red vol.
50	70	blue vol.
70	100	red vol.
100	130	blue vol.
130	210	volcanic ash
210	245	fract. blue vol.
245	273	gray vol.
273	290	extreme hard gray vol. w/ embedded quartz

(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

WELL LOCATION SKETCH

(5) EQUIPMENT:
 Rotary Reverse
 Cable Air
 Other Bucket

(6) GRAVEL PACK:
 Yes No Size 3/8
 Diameter of bore _____
 Packed from 20 to 290 ft.

(7) CASING INSTALLED:
 Steel Plastic Concrete

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

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	290	5"	c160	210	290	1/8
			psi			

(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 cement

(10) WATER LEVELS:
 Depth of first water, if known _____ ft.
 Standing level after well completion 150 ft.

(11) WELL TESTS:
 Was well test made? Yes No If yes, by whom? driller
 Type of test Pump Bailer Air lift
 Discharge water at start of test 150 ft. At end of test 260 ft.
 Discharge 25 gal/min after 2 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

Work started 3-3 19 82 Completed 3-4 19 82

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 LARRY HERMAN by kathy baker
 (Well Driller)
 NAME FISCH HERMAN DRILLING CO. 00941
 (Person, firm, or corporation) (Typed or printed)
 Address 5001 Gravenstein Hwy. N.
 City Sebastopol, Ca. Zip 95472
 License No. 399226 Date of this report 3-5-82

11N/06W-19M

STATE OF CALIFORNIA
THE RESOURCES AGENCY

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ORIGINAL
File with DWR

DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

No. 264476

of Intent No. _____
Local Permit No. or Date _____

State Well No. _____
Other Well No. _____

(1) Ad
Ci
(2) LOCATION OF WELL (See instructions):
County LAKE Owner's Well Number _____
Well address if different from above _____
Township 11N Range 6W Section 19
Distance from cities, roads, railroads, fences, etc. 50' NORTH OF
GRANGE RD 1 MI. EAST OF HWY 29
MIDDLETOWN

(12) WELL LOG: Total depth 103 ft. Completed depth 100 ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0 - 4 Brown soil
4 - 19 Brown clay
19 - 51 Brown clay + Gravel Mix
51 - 58 Muddy Brown Gravel
58 - 80 Brown clay + Gravel Mix
80 - 95 clayey semi cemented
Gravel
95 - 100 Brown clay + Gravel Mix



(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)

MAXIMUM Recommended Pumping
RATE 300 GPM
MAXIMUM Recommended Drawdown
50 Feet

(5) EQUIPMENT:
Rotary Reverse
Cable Air
Other Bucket

(6) GRAVEL PACK:
Yes No
Diameter of bore 12 inches
Packed from 20 to _____

(7) CASING INSTALLED:
Steel Plastic Concrete
From ft. To ft. Dia. in. Cage or Wall ft.
0 100 8 138

(8) PERFORATIONS:
Type of perforation or size of screen
From ft. To ft. Slot size
50 100 1/2 x 3
Double

(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 CEMENT

(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? Dunkin
Type of test Pump Bailer Air lift
Time to water at start of test 30 ft. At end of test 41 ft.
Flow rate 340 gal/min after 4 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 2/3 1989 Completed 2/14 1989
WELL DRILLER'S STATEMENT: 833
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signature Dave Giese
NAME DAVE GIESE Well Drilling
Address 200 GOBBLER LN
City UKIAH CA ZIP 95482
License No. 304165 Date of this report 3/20/89

11N/06W-28M

ORIGINAL File with DWR

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

Do not fill in

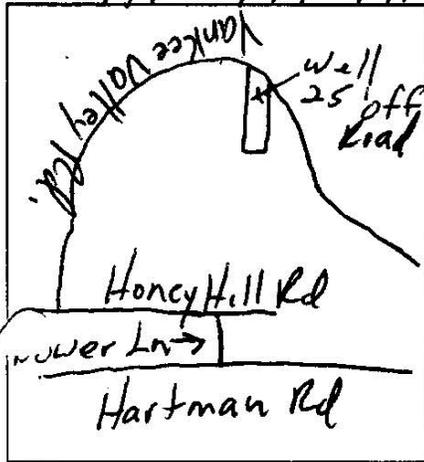
No. 302060

Notice of Intent No. WE-307 Local Permit No. or Date

State Well No. Other Well No.

(2) LOCATION OF WELL (See instructions):

County Lake Owner's Well Number Well address if different from above Township 11N Range 6W Section 28 Distance from cities, roads, railroads, fences, etc. 214 1/2 Yankee Valley Rd, Middletown AP# 144-141-007



WELL LOCATION SKETCH

(3) TYPE OF WORK:

- New Well [X] Deepening [] Reconstruction [] Reconditioning [] Horizontal Well [] Destruction [] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

- Domestic [X] Irrigation [] Industrial [] Test Well [] Municipal [] Other [] (Describe)

(5) EQUIPMENT:

- Rotary [X] Reverse [] Cable [] Air [X] Other [] Bucket []

(6) GRAVEL PACK:

- Yes [X] No [] Size 6/12 Diameter of bore 6.25 Packed from 270 to 290

(7) CASING INSTALLED:

- Steel [] Plastic [X] Concrete []

(8) PERFORATIONS:

- Type of perforation or size of screen

Table with columns: From ft, To ft, Dia in, Gage or Wall, From ft, To ft, Slot size. Row 1: 0, 290, 4.5, F480, 2.50, 290, 48

(9) WELL SEAL:

Was surface sanitary seal provided? Yes [X] No [] If yes, to depth 20 ft. Were strata sealed against pollution? Yes [] No [X] Interval Method of sealing Grout Cement

(10) WATER LEVELS:

Depth of first water, if known 270 ft. Standing level after well completion 145 ft.

(11) WELL TESTS:

Well test made? Yes [X] No [] If yes, by whom? Driller Pump [] Bailer [] Air lift [X] Depth to water at start of test 2 ft. At end of test Discharge 30 gal/min after 2 hours Water temperature Chemical analysis made? Yes [] No [X] If yes, by whom? Was electric log made Yes [] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth ft. Completed depth ft. from ft. to ft. Formation (Describe by color, character, size or material)

0 - 90 Boulders & Broken Volcanics

90 - 270 Hard Blue Volcanics

270 - 290 Green sandy Rock

DIAGONAL WATER CODE SEC. 13752 stamp

DEC 10 1990

Work started NOV 19 90 Completed NOV 19 90

WELL DRILLER'S STATEMENT: 1562

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

Signed Larry Herman (Well Driller)

NAME Larry Herman Drilling (Person, firm, or corporation) (Typed or printed)

Address 11321 Hwy 27 Lower Lake, Ca ZIP 95437

City License No. 465071 Date of this report 11-15-90

ORIGINAL
File with DWR

Page ___ of ___

Owner's Well No. _____

Date Work Began 7-12-96 Ended _____

Local Permit Agency Health Dept.

Permit No. NE-1330 Permit Date 7-10-96

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. **445157**

DWR USE ONLY - DO NOT FILL IN

11N/06W-21M

STATE WELL NO./STATION NO.

LATITUDE _____ LONGITUDE _____

APN/TRS/OTHER _____

GEOLOGIC LOG

ORIENTATION (°)		VERTICAL		HORIZONTAL		ANGLE		(SPECIFY)	
		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
DEPTH FROM SURFACE		DEPTH TO FIRST WATER <u>180</u> (Ft.) BELOW SURFACE							
Ft. to Ft.		DESCRIPTION							
		Describe material, grain size, color, etc.							
0	65	Volcanic Ash							
65	80	Red Volcanics							
80	95	Red & Black Volcanics							
95	140	Fractured Blue Volcanics							
140	180	Hard Blue Volcanics							
180	185	Fractured Red & Blue Volcanics							
185	215	Volcanic Ash							
215	250	Red Volcanics							
250	275	Green Tuffs							
		180' 2 gpm							
		215-230 15 gpm							
		230-245 30 gpm							
		245-260 50 gpm							
		260-275 100 gpm							
TOTAL DEPTH OF BORING		<u>275</u> (Feet)							
TOTAL DEPTH OF COMPLETED WELL		<u>275</u> (Feet)							

WELL LOCATION

Address 19175 Comstock Ct.

City Middletown

County Lake

APN Book 144 Page 111 Parcel 10

Township 11N Range 06W Section 21

Latitude _____ NORTH Longitude _____ WEST

LOCATION SKETCH

ACTIVITY (°)

NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify) _____

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

PLANNED USE(S)

(°)

___ MONITORING

WATER SUPPLY

Domestic

___ Public

___ Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify) _____

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

DRILLING METHOD air rotary FLUID _____

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 100 (Ft.) & DATE MEASURED 7-17-96

ESTIMATED YIELD 100 (GPM) & TEST TYPE air lift

TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN _____ (Ft.)

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

DEPTH FROM SURFACE	BORE-HOLE DIA. (Inches)	CASING(S)					DEPTH FROM SURFACE	ANNULAR MATERIAL			
		TYPE (°)	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)		CE-MENT (°)	BEN-TONITE (°)	FILL (°)	FILTER PACK (TYPE/SIZE)
Ft. to Ft.	(Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE		Ft. to Ft.	(°)	(°)	(°)	
0	20	9"					0	30	X		
20	275	7"					20	275			3/16 Pea
0	100		X			PVC 4" 160					
100	215		X			" " " 52 40					
215	275		X			" " " 48					

ATTACHMENTS (°)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil / Water Chemical Analyses

___ Other _____

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

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

NAME Larry Herman Drilling

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

ADDRESS 13011 Hwy 29 Lower Lake Ca 95457 CITY STATE ZIP

Signed [Signature] DATE SIGNED 7-14-96 465071

WELL DRILLER/AUTHORIZED REPRESENTATIVE C-57 LICENSE NUMBER

ORIGINAL
File with DWR

STATE OF CALIFORNIA

MAY 21 2001

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

DWR USE ONLY - DO NOT FILL IN

11N 06W-18 M

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

Page ___ of ___

Owner's Well No. #1

#1

No. 775265

Date Work Began 4-4-01

4-4-01

Ended

4-10-01

Local Permit Agency

LAKE COUNTY HEALTH DEPARTMENT

Permit No. WE2056

Permit Date 3-22-01

GEOLOGIC LOG

ORIENTATION () VERTICAL HORIZONTAL ANGLE (SPECIFY)

DRILLING METHOD **AIR ROTARY** FLUID **N/A**

DEPTH FROM SURFACE		DESCRIPTION
Ft.	to Ft.	
0	34	Red clay, boulders & cobble
34	196	Hard gray volc. Rock
196	221	Red & tan clay & conglomerate rock
221	340	Volcanic Conglomerate rock

Describe material, grain size, color, etc.

WELL LOCATION

Address 20572 Honey Hill Road,

City Hidden Valley

County LAKE

APN Book 114 Page 07 Parcel 10

Township 11N Range 06W Section 18

Latitude _____ Longitude _____

DEG. MIN. SEC. NORTH WEST

LOCATION SKETCH

NORTH

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

REMEDICATION

OTHER (SPECIFY)

WEST EAST

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.

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER _____ (Ft.) BELOW SURFACE

DEPTH OF STATIC

WATER LEVEL 175' (Ft.) & DATE MEASURED 4-10-01

ESTIMATED YIELD 60+ (GPM) & TEST TYPE AIR LIFTED

TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 320' (Ft.)

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

TOTAL DEPTH OF BORING 340' (Feet)

TOTAL DEPTH OF COMPLETED WELL 335' (Feet)

DEPTH FROM SURFACE	BORE-HOLE DIA. (Inches)	CASING (S)						DEPTH FROM SURFACE	ANNULAR MATERIAL				
		TYPE ()				MATERIAL / GRADE	INTERNAL DIAMETER (Inches)		GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)	TYPE		
Ft.	to Ft.	BLANK	SCREEN	CON-DUCTOR	FILL PIPE								
0	20	12 1/4						0	20	x			
20	340	8HB						20	340			x	PEA GRAVEL
+2	335		x			PVC/F480 5"	CL200						
235	335		x										

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.

WEEKS DRILLING & PUMP COMPANY

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

P.O. BOX 176, Sebastopol, Ca 95473

ADDRESS CITY STATE ZIP

Signed **WARD THOMPSON BY: THURMAN ADAMS** DATE SIGNED 4-12-01 177681

WELL DRILLER/AUTHORIZED REPRESENTATIVE

DATE SIGNED

C-57 LICENSE NUMBER

ORIGINAL
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

DWR USE ONLY - DO NOT FILL IN

11N / Obw-30

STATE WELL NO./STATION NO.

LATITUDE _____ LONGITUDE _____

APN/TRS/OTHER _____

Page 1 of 1

Owner's Well No. 2 No. **784508**

Date Work Began 8-24-01, Ended 8-28

Local Permit Agency Lake Co Permit Date _____

GEOLOGIC LOG

ORIENTATION () VERTICAL HORIZONTAL ANGLE _____ (SPECIFY)

DRILLING METHOD Air Rotary FLUID Water

DEPTH FROM SURFACE		DESCRIPTION
Ft.	to Ft.	
0	2	Road gravel
2	27	Brown clay
27	57	Brown clay w/ Gravel
57	103	Dark gray rock

Describe material, grain size, color, etc.

** casing set 3 Ft in height above grade **

WELL LOCATION

Address 19573 Grange Rd

City Middletown

County Lake

APN Book 014 Page 370 Parcel 03

Township 11N Range Obw Section 30

Latitude _____ NORTH _____ WEST _____
DEG. MIN. SEC.

Longitude _____
DEG. MIN. SEC.

LOCATION SKETCH

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) _____

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.**

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 37 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 37 (Ft.) & DATE MEASURED 8-27-01

ESTIMATED YIELD * 20 (GPM) & TEST TYPE Air Blew

TEST LENGTH _____ (Hrs.) TOTAL DRAWDOWN _____ (Ft.)

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

DEPTH FROM SURFACE	BORE-HOLE DIA. (Inches)	CASING (S)						
		TYPE ()				MATERIAL / GRADE		
Ft.	to Ft.	BLANK	SCREEN	CON-DUCTOR	FILL PIPE		INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS
22	13	✓				Steel	65/8	-188
22	8	✓				"	"	"
60	8	✓				"	"	3/8 x 1
100	8	✓				Steel	65/8	-188

DEPTH FROM SURFACE	ANNULAR MATERIAL				
	TYPE				
Ft.	to Ft.	CE-MENT ()	BEN-TONITE ()	FILL ()	FILTER PACK (TYPE/SIZE)
0	22	✓			

- 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 Rural Drilling Company (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINTED)

ADDRESS P.O. Box 1617 Laytonville CA 95454 CITY STATE ZIP

Signed [Signature] DATE SIGNED 9-5-01 C-57 LICENSE NUMBER 666592

JUN 01 2015

STATE OF CALIFORNIA
WELL COMPLETION REPORT

Refer to Instruction Pamphlet

DWR USE ONLY ... DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

Page 1 of 1

Owner's Well No. WELL #1

No. **e0267546**

Date Work Began 4/17/2015, Ended 4/28/2015

Local Permit Agency Lake County Environmental

Permit No. WE-3066

Permit Date 1/16/2015

GEOLOGIC LOG

WELL OWNER

ORIENTATION (✓) VERTICAL HORIZONTAL ANGLE _____ (SPECIFY)

DRILLING METHOD AIR FLUID N/A

DEPTH FROM SURFACE	DESCRIPTION	CITY	STATE	ZIP
Ft. to Ft.	Describe material, grain, size, color, etc.	WELL LOCATION		
0: 43	Red ash and rock	Address <u>15519 Spruce Grove Road</u>		
43: 62	Extra hard gray rock	City <u>Middletown CA</u>		
62: 83	Red lava rock and voids	County <u>Lake</u>		
83: 131	Burgundy colored rock	APN Book <u>013</u> Page <u>060</u> Parcel <u>060</u>		
131: 141	Extra hard gray rock	Township <u>11N</u> Range <u>06E</u> Section <u>06</u>		
141: 176	Burgundy and purple rock	Latitude <u>38 49 898 N</u> <u>122 33 684 W</u>		
176: 304	Hard gray, black and green rock	DEG. MIN. SEC. DEG. MIN. SEC.		
304: 343	Gray, black, green and red rock	LOCATION SKETCH NORTH		
343: 408	Extra hard blue/gray rock			
408: 472	Gray, black and green rock with water producing fractures from 447' to 451'			
472: 540	Extra hard blue/gray rock	<input type="checkbox"/> DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG") PLANNED USES (✓) <input checked="" type="checkbox"/> WATER SUPPLY <input type="checkbox"/> Domestic <input type="checkbox"/> Public <input type="checkbox"/> Irrigation <input type="checkbox"/> Industrial <input type="checkbox"/> MONITORING <input type="checkbox"/> TEST WELL <input type="checkbox"/> CATHODIC PROTECTION <input type="checkbox"/> HEAT EXCHANGE <input type="checkbox"/> DIRECT PUSH <input type="checkbox"/> INJECTION <input type="checkbox"/> VAPOR EXTRACTION <input type="checkbox"/> SPARGING <input type="checkbox"/> REMEDIATION <input type="checkbox"/> OTHER (SPECIFY)		

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.

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER N/A (Ft.) BELOW SURFACE 1

DEPTH OF STATIC WATER LEVEL 310 (Ft.) & DATE MEASURED 4/28/2015

ESTIMATED YIELD 6 (GPM) & TEST TYPE Air Developed

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

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

TOTAL DEPTH OF BORING 540 (Feet)

TOTAL DEPTH OF COMPLETED WELL 532 (Feet)

DEPTH FROM SURFACE	BORE-HOLE DIA. (Inches)	CASING (S)					ANNULAR MATERIAL			
		TYPE (✓)	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)	TYPE			
Ft. to Ft.		BLANK SCREEN CON. DUCTOR FILL PIPE					CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0: 20	11									
20: 540	8						✓			CONCRETE
+2: 372		✓	PVC	5	SDR21			✓		
372: 532		✓	PVC	5	SDR21	.032			✓	3/8 Pea Gravel

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

CERTIFICATION STATEMENT

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

NAME Weeks Drilling & Pump
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. Box 176 Sebastopol CA 95473
ADDRESS CITY STATE ZIP

Signed [Signature] 05/22/15 177681
WELL DRILLER AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

MAR 23 2016

Well Completion Report

Page 1 of 1

Owner's Well Number #1

No. e0303696

Date Work Began 01/13/2016

Date Work Ended 2/3/2016

Local Permit Agency Lake County Environmental

Permit Number WE-4664

Permit Date 12/16/15

DWR Use Only - Do Not Fill In

11N 06W 06

State Well Number/Site Number

Latitude Longitude

APN/TRS/Other

Geologic Log		
Orientation <input checked="" type="radio"/> Vertical <input type="radio"/> Horizontal <input type="radio"/> Angle Specify _____		
Drilling Method Direct Rotary Drilling Fluid Bentonite mud		
Depth from Surface	Description	
Feet to Feet	Describe material, grain size, color, etc	
0 to 75	Red ash, cobbles and boulders	
70 to 100	Gray ash and crushed rock	
100 to 220	Gray volcanic rock	
220 to 240	Gray volcanic rock with large fractures	
24 to 280	Gray volcanic rock	
280 to 370	Red volcanic rock with red and burgundy cinders	
370 to 380	Tan ash and gray rock	
380 to 420	Green ash and gray rock	
420 to 550	Burgundy and red volcanic rock and cinders	
550 to 592	Fractured gray volcanic rock	
592 to 600	Shale clay	
Total Depth of Boring 600 Feet		
Total Depth of Completed Well 594 Feet		

Well Location

Address 15591 Spruce Grove Road

City Middletown County Lake

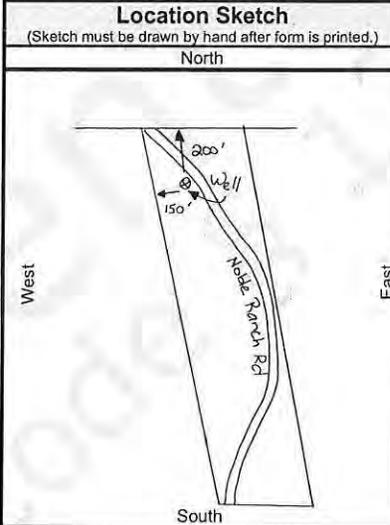
Latitude 38 50 100 N Longitude 122 33 687 W

Deq. Min. Sec. Deq. Min. Sec.

Datum _____ Decimal Lat. _____ Decimal Long. _____

APN Book 013 Page 060 Parcel 070

Township 11N Range 6W Section 6



Activity

New Well
 Modification/Repair
 Deepen
 Other _____
 Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

Water Supply
 Domestic Public
 Irrigation Industrial

Cathodic Protection
 Dewatering
 Heat Exchange
 Injection
 Monitoring
 Remediation
 Sparging
 Test Well
 Vapor Extraction
 Other _____

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Water Level and Yield of Completed Well

Depth to first water 550 (Feet below surface)

Depth to Static _____

Water Level 270 (Feet) Date Measured 02/01/2016

Estimated Yield * 20 (GPM) Test Type Air Lift

Test Length 8.0 (Hours) Total Drawdown 580 (Feet)

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

Casings							
Depth from Surface	Borehole Diameter	Type	Material	Wall Thickness	Outside Diameter	Screen Type	Slot Size
Feet to Feet	(Inches)			(Inches)	(Inches)		(Inches)
0 to 60	13						
60 to 600	10						
0 to 494		Blank	PVC Sch. 40	SDR21	6		
494 to 594		Screen	PVC Sch. 40	SDR21	6	Milled Slots	0.032

Annular Material			
Depth from Surface	Fill	Description	
Feet to Feet			
0 to 54	Cement		
54 to 58	Bentonite		
58 to 594	Filter Pack	3/8 Pea Gravel	

Attachments

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

Attach additional information, if it exists.

Certification Statement

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

Name Weeks Drilling & Pump Co.
Person, Firm or Corporation

P.O. Box 176 Address Sebastopol City CA 95473 State Zip

Signed *Aime Angiolini* 3/11/16 Date Signed 177681 C-57 License Number

Do not fill in
File
Stonehouse

DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

No. 375939

WELL #3

Form No. WE 561

State Well No. _____
Other Well No. _____

OWNER: Name Stonehouse Mutual Water Company
& Winzler & Kelly, 495 Tesconi Circle
Santa Rosa, CA ZIP 95401

(12) WELL LOG: Total depth 205 ft. Completed depth 180 ft.

LOCATION OF WELL (See instructions): 14-270-66

Lake _____ Owner's Well Number _____
Address if different from above 18963 Grange Road
City Middletown Range _____ Section _____
Distance from cities, roads, railroads, fences, etc. _____

from ft. to ft. Formation (Describe by color, character, size or material)

0	- 10	Brown sandy clay & sandy gravel with cobbles
10	- 115	Sandy gravel with conglomerate and boulders
115	- 120	Sand & gravel with conglomerate and boulders, small amounts of silty clay & sandy clay
120	- 165	Sandy gravel with conglomerate and boulders
165	- 170	Conglomerate sand & gravel with boulders
170	- 180	Conglomerate brown clay with embedded rock
190	- 198	Brown clay
198	- 205	Tan sandy clay

(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) Public

WELL LOCATION SKETCH

EQUIPMENT:

- Rotary Reverse
Table Air
Other Bucket

(6) GRAVEL PACK: Yes No
Size 20
Diameter of bore 12
Packed from 50 to 180

CASING INSTALLED:

- Plastic Concrete

(8) PERFORATIONS: Type of perforation Screen

From ft.	To ft.	Slot size
80	180	.070

WELL SEAL:

Surface sanitary seal provided? Yes No If yes, to depth 50 ft.
Strata sealed against pollution? Yes No Interval _____ ft.
Method of sealing Sand Grout On Pack

WATER LEVELS:

Depth of first water, if known _____ ft.
Standing level after well completion 29 ft.

WELL TESTS:

Well test made? Yes No If yes, by whom? Weeks
Type of test Pump Blaker Air lift
Duration at start of test 29 ft. At end of test 123 ft.
Discharge 100 gal/min after 6 hours. Water temperature 67°
Mineral analysis made? Yes No If yes, by whom? _____
Electric log made? Yes No If yes, attach copy to this report

Work started 10-9 1991 Completed 10-22 1991

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 POB 176

City Sebastopol, CA ZIP 95473

License No. CS7-177681 Date of this report 11-14-91

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

** 500 G.P.M. At 80' **

Grange Road Well #4

RECEIVED MAR 1 0 2003

- TOP OF CASING
ELEV 956.89

TRIPPLICATE
Owner's Copy

STATE OF CALIFORNIA
WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. **769936**

DWR USE ONLY - DO NOT FILL IN

STATE WELL NO / STATION NO.

LATITUDE LONGITUDE

APN/RS/OTHER

Page 1 of 1

Owner's Well No. Well #4 4

Date Work Began 1/23/2003, Ended 2/26/2003

Local Permit Agency Lake Co. Environ Health

Permit No. WE-2201 Permit Date 1/29/2003

GEOLOGIC LOG

WELL OWNER

ORIENTATION (°)		DRILLING METHOD	FLUID
<input checked="" type="checkbox"/> VERTICAL	<input type="checkbox"/> HORIZONTAL	<u>MUD ROTARY</u>	<u>Bentonite</u>
DEPTH FROM SURFACE	FL. TO FL.	DESCRIPTION	
0	12	Tan clay	
12	59	Sand and gravel, cobble and boulders	
59	72	Clay	
72	84	Sand and gravel	
84	87	Clay	
87	94	Sand and gravel	
94	95	Clay	
95	115	Sand and gravel and clay streaks	
115	135	Clay	
135	138	Sand and gravel	
138	147	Clay with embedded gravel	
147	167	Sand and gravel and streaks of clay	
167	180	Clay with streaks of sand and gravel	
180	189	Blue clay with embedded gravel and streaks of loose gravel	
189	199	Clay with embedded rock	
199	204	Hard serpentine	
204	231	Stiff clay	

Name Hidden Valley Com. Service District

Mailing Address 19400 Hartman Road
Middletown CA

CITY STATE ZIP

WELL LOCATION

Address 18963 Grange Road

City Middletown CA

County Lake

APN Book 014 Page 270 Parcel 67

Township _____ Range _____ Section _____

Latitude _____

LOC. SKETCH

WEST SOUTH EAST

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 _____

REMEDICATION _____

OTHER (SPECIFY) _____

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER _____ (FL.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 22 (FL.) & DATE MEASURED 2/26/2003

ESTIMATED YIELD 100 (GPM) & TEST TYPE BAILED

TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN 44 (FL.)

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

DEPTH FROM SURFACE	BORE-HOLE DIA. (Inches)	CASING (S)				INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
		TYPE (°)	MATER. / GRADE	SCREEN	FILL PIPE			
0	231	7 7/8						
50	218	22						
+3	206		STEEL		14			
0	50		S. STEEL		24			
50	110		S. STEEL				.050	
148	188		S. STEEL				.050	

DEPTH FROM SURFACE	FL. TO FL.	ANNULAR MATERIAL			
		CEMENT (°)	BENTONITE (°)	FILL (°)	FILTER PACK (TYPE/SIZE)
0	50	<input checked="" type="checkbox"/>			sand gravel
50	206			<input checked="" type="checkbox"/>	8 x 16 sand

- ATTACHMENTS (°)**
- Geologic Log
 - Well Construction Diagram
 - Geophysical Log(s)
 - Soil Water Chemical Analysis
 - Other _____
- ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

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

NAME Weeks Drilling & Pump

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

P.O. Box 176 Sebastopol CA 95473

ADDRESS CITY STATE ZIP

Signed Melissa G. Lopez DATE SIGNED 03/05/03 C-67 LICENSE NUMBER 177661

WELL DRILLER/AUTHORIZED REPRESENTATIVE

AG Well?

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 5
(Insert appropriate number)

WATER WELL DRILLERS REPORT
ON MICROFILM (Sections 7076, 7077, 7078, Water Code)
STATE OF CALIFORNIA

LOCATION NOT CHECKED
Do Not Fill In
No. **32402**
State Well No. _____
Other Well No. UNL6W39A1

84

(2) LOCATION OF WELL:

County LAKE Owner's number, if any—
R. F. D. or Street No. R6W, T1N, Sec. 29
ABOUT 1 MILE EAST OF
JUNCTION HIGHWAY 53 AND QUERE
GRANGE ROAD IN COYOTE VALLEY.
AND ABOUT 40 FT. SOUTH

(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 <input checked="" type="checkbox"/> DOUBLE <input type="checkbox"/>		Gage of Wall	If gravel packed		
From	to		Diameter of Bore	from	to
ft. to	ft.	Diam.	ft.	ft.	ft.
110	14	10			
Type and size of shoe or well ring <u>5/8 x 4</u>			Size of gravel:		
Describe joint <u>BUTT NEW</u>					

(7) PERFORATIONS:

Type of perforator used <u>MILLS</u>		in. length, by	in.
Size of perforation	From		
<u>2 1/2</u>	<u>90</u> ft. to <u>32</u> ft.	<u>9</u>	<u>1 1/4</u>
	<u>35</u> " <u>50</u> "	<u>11</u>	<u>11</u>
	<u>54</u> " <u>74</u> "	<u>11</u>	<u>11</u>
	<u>78</u> " <u>86</u> "	<u>11</u>	<u>11</u>
	<u>96</u> " <u>106</u> "	<u>11</u>	<u>11</u>

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes No To what depth _____ ft.

Were any struts sealed against pollution? Yes No If yes, note depth of struts

From _____ ft. to _____ ft.

Method of Sealing _____

(9) WATER LEVELS:

Depth at which water was first found 15 ft.

Static level before perforating 12 ft.

Static level after perforating 12 ft.

(10) WELL TESTS:

Was a pump test made? Yes No If yes, by whom? HUTTON - SUTHERLAND

Yield: 1000 gal./min. with 17 ft. draw down after 6 hrs.

Temperature of water _____ Was a chemical analysis made? Yes No

Was electric log made of well? Yes No

(11) WELL LOG:

Total depth 110 ft. Depth of completed well 110 ft.

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

ft. to	ft.	Soil
0	10	SOIL
10	15	GRAVEL (DRY)
15	32	" (WATER-BEAR.)
32	35	BROWN CLAY
35	50	GRAVEL 1/2" TO 1"
50	54	BROWN CLAY
54	74	GRAVEL (SANDY)
74	78	SAND
78	86	GRAVEL (1/2" TO 1")
86	96	BROWN CLAY
96	106	GRAVEL
106	110	HARD PAN

CONFIDENTIAL
Section 7076-1, Water Code

FOR OFFICIAL USE ONLY

Work started Aug 10 1957. Completed Aug 14 1957

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 HUTTON - SUTHERLAND
(Person, firm, or corporation) (Typed or printed)

Address UPPER LAKE

(SIGNED) [Signature] Well Driller

License No. 12749 Dated 7/55 1955

ICATE
s Copy

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

GR-2
Do not fill in

No. 177233

Site No. or Date

State Well No.
Other Well No.

VNER: Name Stonehouse Mutual Water Co.
/c William Hamann, P. O. Box 471
Addleton, CA Zip 95461

(12) WELL LOG: Total depth 292 ft. Depth of completed well 120 ft.
from ft. to ft. Formation (Describe by color, character, size of material)

LOCATION OF WELL (See instructions):
Lake Owner's Well Number #2
Use if different from above Grange Road
Addleton Range Section
from cities, roads, railroads, fences, etc.

0 - 7	Topsoil
7 - 22	Conglomerate boulders and gravel
22 - 51	Conglomerate boulders, cobbles, and gravel
51 - 58	Conglomerate gravels, cobbles & traces of brown clay
58 - 74	Gravels and cobbles
74 - 113	Conglomerate boulders, cobbles, and gravels

RECEIVED
MAR - 7 1991
JAMES C. HANSON

(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

113 - 117	Brown clay
117 - 150	Brown sandy clay with cemented gravel
150 - 160	Brown clay
160 - 178	Brown sandy clay with streaks of gravel
178 - 181	Brown clay & cemented boulders
181 - 192	Brown clay
192 - 205	Brown clay with streaks of gravel
205 - 208	Brown clay
208 - 219	Brown clay with seams of cemented gravel
219 - 248	Blue clay with layers of cemented gravel
248 - 260	Brown clay

WELL LOCATION SKETCH

EQUIPMENT:
 Reverse
 Air
 Bucket

(6) GRAVEL PACK: Monterey sand
Yes No Size 8 x 16
Diameter of bore 12 1/2 - 18"
Packed from 53 to 120 ft.

260 - 263	Blue clay
263 - 265	Streaks of small blue gravel
265 - 282	Blue clay with streaks of cemented gravel
282 - 292	Cemented conglomerate

PIPE INSTALLATION:
Photo Concrete

(8) PERFORATIONS:
Rosco Moss SuperFlo
Type of perforation or size of screen

To ft.	Dia. in.	Cage or Wall	From ft.	To ft.	Slot size
120	23/4	.250	70	115	.050

WELL SEAL:
Is secondary seal provided? Yes No If yes, to depth 53 ft.
Was sealed against pollution? Yes No Interval _____ ft.
Type of sealing Sand grout on pack

Work started 5/17 1985 Completed 5/15 1985

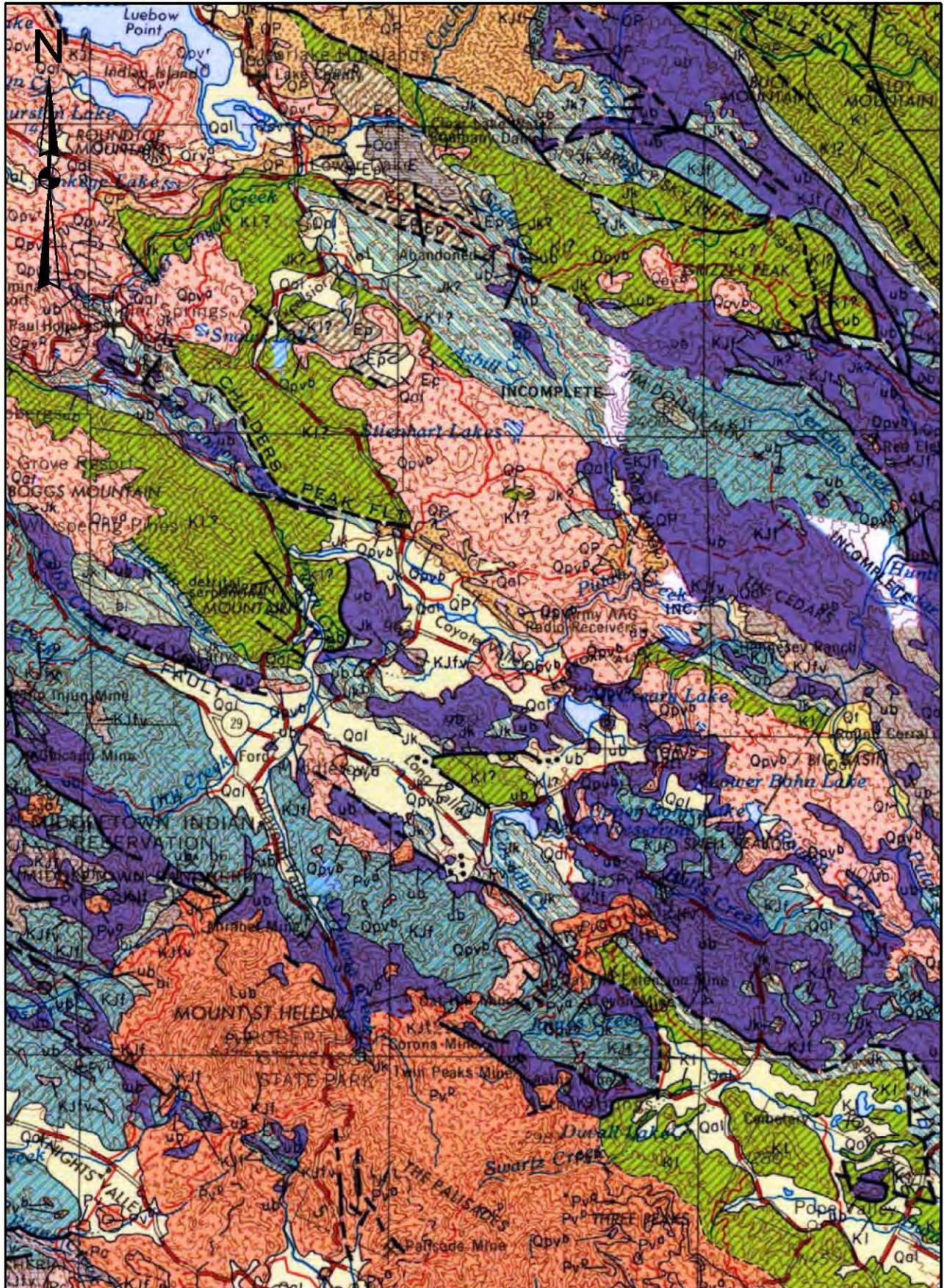
WATER LEVELS:
Is base water, if known _____ ft.
Level after well completion 227 ft.

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

WELL TESTS:
Test made? Yes No If yes, by whom? To be tested
Pump Blower Air lift
At start of test 23 ft. At end of test 70 ft.
Flow rate 2 gal/min after 4 hours. Water temperature 30.2
Analysis made? Yes No If yes, by whom?
Site log made? Yes No If yes, attach copy to this report

SIGNED Cerald 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. C57-17768L Date of this report May 15, 1985

Geologic Map of Coyote Valley and Surrounding Area
Modified from Koenig, 1963

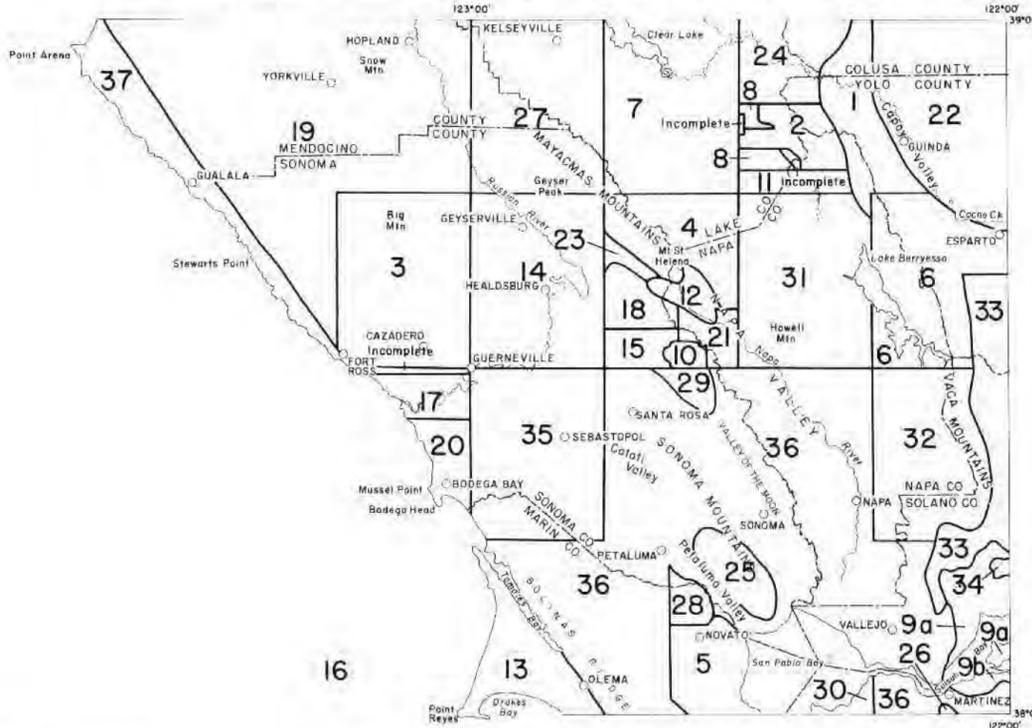


0 15 30 60 90 120
Miles

EXPLANATORY DATA
SANTA ROSA SHEET
GEOLOGIC MAP OF CALIFORNIA
OLAF P. JENKINS EDITION
Compiled by James B. Koenig 1963

(Third Printing, 1976)

INDEX TO GEOLOGIC MAPPING
USED IN THE COMPILATION OF THE SANTA ROSA SHEET



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For a complete list of published geologic maps of this area see Division of Mines and Geology Special Reports 52 and 52-A.

STRATIGRAPHIC NOMENCLATURE—SANTA ROSA SHEET

AGE	STATE MAP SYMBOL	STATE MAP UNIT <small>State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California</small>	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES <small>(The formally named formations grouped within an individual State Map Unit are listed in stratigraphic sequence from youngest to oldest.)</small>		
CENOZOIC	QUATERNARY	Recent	Qs	RECENT DUNE SAND Dune sand and associated beach deposits.	
			Qal	RECENT ALLUVIUM Stream and valley alluvium. Artificial fill. Mud flats and salt marsh deposits bordering San Pablo Bay.	
			Qsc	RECENT RIVER AND MAJOR STREAM CHANNEL DEPOSITS IN THE GREAT VALLEY River silts and sands (deposits along channels and natural levees of major streams).	
			Qf	RECENT ALLUVIAL FAN DEPOSITS IN THE GREAT VALLEY Alluvial-fan deposits (Pleistocene and Recent).	
		Qb	RECENT BASIN DEPOSITS IN THE GREAT VALLEY Sediments deposited during flood stages of major streams in areas between natural levees and alluvial fans. Sacramento-San Joaquin River delta mud, loam, muck and peat.		
		Qrv	RECENT VOLCANIC ROCKS:	Qrv	UNDIFFERENTIATED Andesite and basalt. ¹
				Qrv ^r	RHYOLITIC Olivine dacite. ¹
				Qrv ^b	BASALTIC Basalt. ¹
				Qrv ^p	PYROCLASTIC Basaltic lapilli and other ejecta, forming cinder cone south of Clear Lake. ¹
		Qt	QUATERNARY NONMARINE TERRACE DEPOSITS River and stream terrace sands, silts and gravels. In Big Valley, near Kelseyville, these deposits form a thin veneer over diatomaceous silts and gravels of the Cache Formation. Includes older alluvium on west side of Sonoma Valley.		
		Qm	PLEISTOCENE MARINE DEPOSITS AND MARINE TERRACE DEPOSITS Millerton Formation— <i>fossiliferous sands, clays and gravels</i> (on Tomales Bay and near Carquinez). Marine and nonmarine deposits on wave-cut terraces along coast.		
		Qc	PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS Red Bluff Formation— <i>poorly-sorted reddish-brown sands and gravels, and minor clay beds</i> (may include post-Red Bluff stream terrace gravels). Montezuma Formation— <i>gravels, sands and clays</i> . Huichica Formation— <i>clay and silt, and gravelly and sandy clay, with reworked pumice and tuff near base</i> . Unnamed silts, clays, sands, gravels, and minor peat deposits (in part called Older Alluvium in alluviated valleys).		
		Qpv	PLEISTOCENE VOLCANIC ROCKS:	Qpv ^r	RHYOLITIC Rhyolite flows and tuffs of Cobb Mountain. ¹ Rhyodacite. ¹ Silicic dacite. ¹ Obsidian (in part Recent). ¹
				Qpv ^a	ANDESITIC Andesite. ¹
				Qpv ^b	BASALTIC Basalt and olivine basalt, largely quartz-bearing (basal flows intercalated with the Cache Formation; may be in part Pliocene). ¹
				Qpv ^p	PYROCLASTIC Rhyolitic tuff of the Cache Formation, stratigraphically below quartz-bearing basalts (Qpv ^b).
		QP	PLIOCENE-PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS Cache Formation— <i>silts, gravels, and clays, with beds of tuffaceous sand, marl, limestone, and diatomite</i> . Glen Ellen Formation— <i>poorly sorted silts, gravelly clays, and sands and gravels, with basal reworked tuff beds</i> . (Includes Older Alluvium of Travis, 1952, and upper part of the Sonoma Group of Gealey, 1950. Lower section of the Glen Ellen Formation is interbedded with the Merced Formation and with the Sonoma Group.) Unnamed silts, sandy clays, sands, and gravels bordering Lake Berryessa, and near Hopland. Unnamed conglomerates, siltstones, and lenses of limestone and coal, along Little Sulphur Creek (includes lagoonal or marine lenses).		
		*	QUATERNARY AND/OR PLIOCENE CINDER CONES Quaternary cinder cone south of Clear Lake.		
		Pc	UNDIVIDED PLIOCENE NONMARINE SEDIMENTARY ROCKS Alluvial and lacustrine sand, silt, gravel, diatomite, and gravelly clay, largely tuffaceous. (Considered to be part of the Sonoma Group: see Pv, Pv ^a).		
Puc	UPPER PLIOCENE NONMARINE SEDIMENTARY ROCKS Tehama Formation— <i>fluvialite and lacustrine (?) silt, clay, silty sand with sand and gravel lenses, and basal beds of reworked tuff</i> . (May locally include correlatives of the Red Bluff Formation.)				
Pu	UPPER PLIOCENE MARINE SEDIMENTARY ROCKS Merced Formation— <i>fossiliferous marine sandstone, siltstone, silty clay, with interbedded gravels and with basal tuff beds</i> (grades into nonmarine beds eastward along Petaluma and Santa Rosa Valleys, where it interfingers with rocks of the Sonoma Group; age ranges from middle Pliocene to early Pleistocene). Ohlson Ranch Formation— <i>marine sandstone, siltstone, and conglomerate, and fluvialite or lacustrine conglomerate</i> (middle to late (?) Pliocene age).				
Pmlc	MIDDLE AND/OR LOWER PLIOCENE NONMARINE SEDIMENTARY ROCKS	Pmlc	Wolfskill Formation— <i>sandstone, conglomerate and andesitic tuff</i> (in vicinity of Port Chicago). Petaluma Formation— <i>sandstone, conglomerate and clay shales of fluvialite, lacustrine and estuarine origin</i> (Petaluma Valley area). Orinda Formation— <i>conglomerate, sandstones, clays, ostracodal limestone</i> (west of Pinole). (These three formations may be in part contemporaneous—Weaver, 1949.)		
		Pml	MIDDLE AND/OR LOWER PLIOCENE MARINE SEDIMENTARY ROCKS Siltstone, diatomaceous siltstone, sandstone, and claystone (on Pt. Reyes; early Pliocene age).		
Pv	PLIOCENE VOLCANIC ROCKS:	Pv	UNDIFFERENTIATED Sonoma Group ² — <i>andesite, basalt and rhyolite flows, tuffs and breccias, agglomerates, minor pumice and obsidian, with associated water-laid sediments of volcanic origin</i> . (Probably of middle and late Pliocene age. Interfingers in part with the Merced Formation and with the Glen Ellen Formation: see Pu and QP.)		
		Pv ^r	RHYOLITIC Rhyolite of the Sonoma Group, ² including the St. Helena Rhyolite— <i>rhyolitic flows and tuffs, perlite, pumice and obsidian, with interbedded agglomerate, sands, clays and gravels</i> .		
		Pv ^a	ANDESITIC Andesite flows, tuffs, breccias, and agglomerates of the Sonoma Group. ²		
		Pv ^b	BASALTIC Basalt flows and breccias of the Sonoma Group. ²		
		Pv ^p	PYROCLASTIC Tuffs, tuff breccias, agglomerates, water-laid sands, gravels, diatomaceous clays and silts, minor pumice and perlite, and interbedded flows of the Sonoma Group. ² Namlaki Tuff Member of the Tehama Formation— <i>pumiceous dacitic tuff</i> (along the border of Sacramento Valley). Lawlor Tuff— <i>andesitic tuffs and gravels</i> (in Los Medanos Hills; early to middle Pliocene). Pinole Tuff— <i>andesitic tuff and interbedded sand, gravel and clay</i> (in vicinity of Pinole; early to middle Pliocene).		
Mu	UPPER MIOCENE MARINE SEDIMENTARY ROCKS San Pablo Group— <i>marine sandstones, tuffs and shales</i> consisting of: Neroly Sandstone— <i>fine- to coarse-grained sandstone, with thin shale beds</i> ; Cierbo Sandstone— <i>sandstone, white tuff, and gray tuffaceous shale</i> ; Briones Sandstone— <i>quartz sandstone and local conglomerate lenses, and Hercules Shale Member of Briones Sandstone—siliceous and bituminous shale</i> .				
Mm	MIDDLE MIOCENE MARINE SEDIMENTARY ROCKS Monterey Group— <i>six alternating shale and sandstone units</i> : Rodeo Shale— <i>siliceous and chalky shale</i> ; Hambre Sandstone— <i>brown-gray sandstone and minor sandy shale</i> ; Tice Shale— <i>chalky bituminous shale</i> ; Oursan Sandstone— <i>sandstone and tuffaceous sandstone</i> ; Claremont Shale— <i>shale with minor grit lenses</i> ; Sobrante Sandstone— <i>fine- to coarse-grained sandstone</i> . "Monterey Shale"— <i>siliceous shales, glauconitic sandstone, and bedded chert</i> (on Pt. Reyes). ³				
MI	LOWER MIOCENE MARINE SEDIMENTARY ROCKS Point Arena Beds— <i>foraminiferal clay shales, bituminous sandstone, cherty shale</i> (may be in part of middle Miocene age). Gallaway Beds— <i>sandy shales, mudstones and sandstones</i> (on Pt. Arena; may be in part Oligocene). ³ Sandstone, mudstone, shale, and minor volcanic rock of early Miocene age, near Fort Ross. ³				
Ø	OLIGOCENE MARINE SEDIMENTARY ROCKS San Ramon Formation— <i>silty shale, and interbedded sandstone and conglomerate</i> . (Considered by many paleontologists to be earliest Miocene, rather than Oligocene.)				

STRATIGRAPHIC NOMENCLATURE—Continued

AGE	STATE MAP SYMBOL	STATE MAP UNIT <small>State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California</small>	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES <small>(The formally named formations grouped within an individual State Map Unit are listed in stratigraphic sequence from youngest to oldest.)</small>		
CENOZOIC	Eocene	E	Eocene Marine Sedimentary Rocks	Markley Formation— <i>sandstone, sandy shale and clay shale</i> (includes Jameson Shale Member); Nortonville Shale— <i>clay shales and siltstones</i> ; Domingine Formation— <i>clay shales and massive sandstone</i> (includes "Ione-type" quartzitic sandstone of Tolman, 1943); Capay Formation— <i>clay shales and siltstones, basal conglomerate</i> . Unnamed sandstones and shales in Conn Valley, in Potrero Hills, and in vicinity of Vacaville. Sandstone, mudstone, and conglomerate of middle and late Eocene age north of Fort Ross, and of probable Late Cretaceous to Oligocene (?) age east of Point Arena. ²	
		Paleocene	Ep	Paleocene Marine Sedimentary Rocks	Martinez Formation— <i>micaceous sandstone, gray foraminiferal shale, glauconitic sandstone</i> (includes "Lower Meganos (?)" shale and sandstone of Tolman, 1943, in the Potrero Hills). Vine Hill Sandstone— <i>massive, glauconitic sandstone</i> (same as lower part of "Martinez Formation"). Unnamed massive conglomerate and siltstone on Pt. Reyes. ³ Sandstone, conglomerate, and mudstone of Paleocene and possibly Late Cretaceous age, north of Fort Ross. ⁵
			Tc	Tertiary Nonmarine Sedimentary Rocks	Unnamed siltstone, claystone, sandstone, and minor conglomerate of fluvial, lacustrine and partially-marine origin, in the English Hills area. Includes detritus from Putnam Peak Basalt; age estimated to be Oligocene (?) to Pliocene (?)—Thomasson, Olmsted and LeRoux, 1960.
	Tertiary	Undivided	Tib	Tertiary Intrusive (Hypabyssal) Rocks:	Hornblendite and "Solano" diabase of Weaver, 1949, on Sulphur Springs Mountain (pre-middle Eocene; probably Mesozoic). Rhyolitic plugs, northeast of Santa Rosa. Sulphur Springs Mountain Andesite— <i>altered reddish-buff, shallow-intrusive andesite</i> (post-Knoxville and pre-middle Eocene).
			Tif	BASALTIC	
			Tia	RHYOLITIC ANDESITIC	
	Tertiary	Undivided	Tvb	Tertiary Volcanic Rocks:	Putnam Peak Basalt— <i>dense, black, vesicular basalt</i> (age estimated to be Oligocene (?) to Pliocene (?)—Thomasson, Olmsted and LeRoux, 1960). Skooner Gulch Basalt— <i>flow breccia and amygdaloidal basalt</i> (also called Iversen Basalt by Weaver, 1944; Eocene to Miocene in age). Unnamed black spilitic at Black Point. ⁴ Vent breccia, west of Petaluma (post-Franciscan and pre-Merced, Johnson, 1943).
			Tvp	BASALTIC PYROCLASTIC	
	MESOZOIC	Cretaceous	K	Undivided Cretaceous Marine Sedimentary Rocks	Unnamed graywacke sandstones, shales, conglomerates, and mildly metamorphosed equivalents, in the coastal belt east of the San Andreas Fault zone. (Now considered by E. H. Bailey, oral communication, 1963, to be equivalent to the upper part of the Franciscan Formation.)
			Ku	Upper Cretaceous Marine Sedimentary Rocks	Gualala Group, of Weaver— <i>sandstone, conglomerate, and shale</i> (restricted herein to those beds of known Late Cretaceous age). "Chico Formation"— <i>massive to thin-bedded sandstones and shales and minor conglomerate</i> . Forbes, Guinda, Funks, Sites, Yolo and Venado Formations— <i>green, gray, tan, and black shales, massive to thin-bedded buff and gray sandstones and siltstones, and conglomerate lenses</i> . Unnamed sandstones, shales and conglomerates in the Vaca Mountains, including "Salt Creek Conglomerate." Novato Conglomerate— <i>massive cobble and pebble conglomerate</i> (possibly of Early Cretaceous age). Unnamed arkosic sandstone, quartzitic sandstone, and thin-bedded shales, in vicinity of Novato. Includes rocks of probable Early Cretaceous age in hills west of Oakville.
Kl			Lower Cretaceous Marine Sedimentary Rocks	Rocks of the Shasta Series, including the "Horsetown" and "Paskenta" Formations— <i>shales, siltstones, sandstones, conglomerates, and local detrital serpentine</i> . Unnamed massive conglomerates and minor shales north and west of Healdsburg and in vicinity of Cazadero and Jenner. (Areas shown as Kl (?) may include rocks of Late Cretaceous or Jurassic age.)	
Cretaceous		Undivided	Kjf	Franciscan Formation	Franciscan Formation— <i>graywacke, shale, conglomerate, chert, minor lenses of limestone, and glaucophane schists and related metamorphic rocks</i> . Locally may include basalt, greenstone and diabase, or peridotite and dunite bodies, largely serpentinized. (May include rocks of the Knoxville Formation locally.) Areas shown as Kjf glaucophane schist or Kjf schist are major zones of glaucophane schist and related metamorphic rocks of the Franciscan Formation.
			Kjfv	Franciscan Volcanic and Metavolcanic Rocks	Greenstone, basalt, and diabase of the Franciscan Formation.
			grt	Tonalite (Quartz Diorite) and Diorite	"Bodega Diorite"— <i>quartz diorite, granodiorite and diorite</i> (Pt. Reyes, Tomales Point, and Bodega Head).
			bi	Mesozoic Basic Intrusive Rocks	Gabbro and diorite (closely associated with serpentine, and with diabase intrusive bodies of the Franciscan Formation).
			ub	Mesozoic Ultrabasic Intrusive Rocks	Serpentine, peridotite, dunite, and pyroxenite, and minor amounts of silica-carbonate rock derived from alteration of serpentine.
			Jk	Knoxville Formation	Knoxville Formation— <i>shale, siltstone, sandstone, and conglomerate, with local limestone lenses; detrital serpentine in Knoxville area</i> . Rocks of the Knoxville Formation largely are recognized on the presence of the fossil pelecypod <i>Buchia piochii</i> . (Areas shown as Jk (?) may include rocks of the Franciscan Formation, or other rocks of Early Cretaceous age.)
			m	Pre-Cretaceous Metamorphic Rocks, Undifferentiated, ls = Limestone and/or Dolomite	Quartzite and mica schist (considered to be "Sur Series" by Weaver, 1949). Crystalline limestone (considered to be "Sur Series" by Weaver, 1949).

NOTES

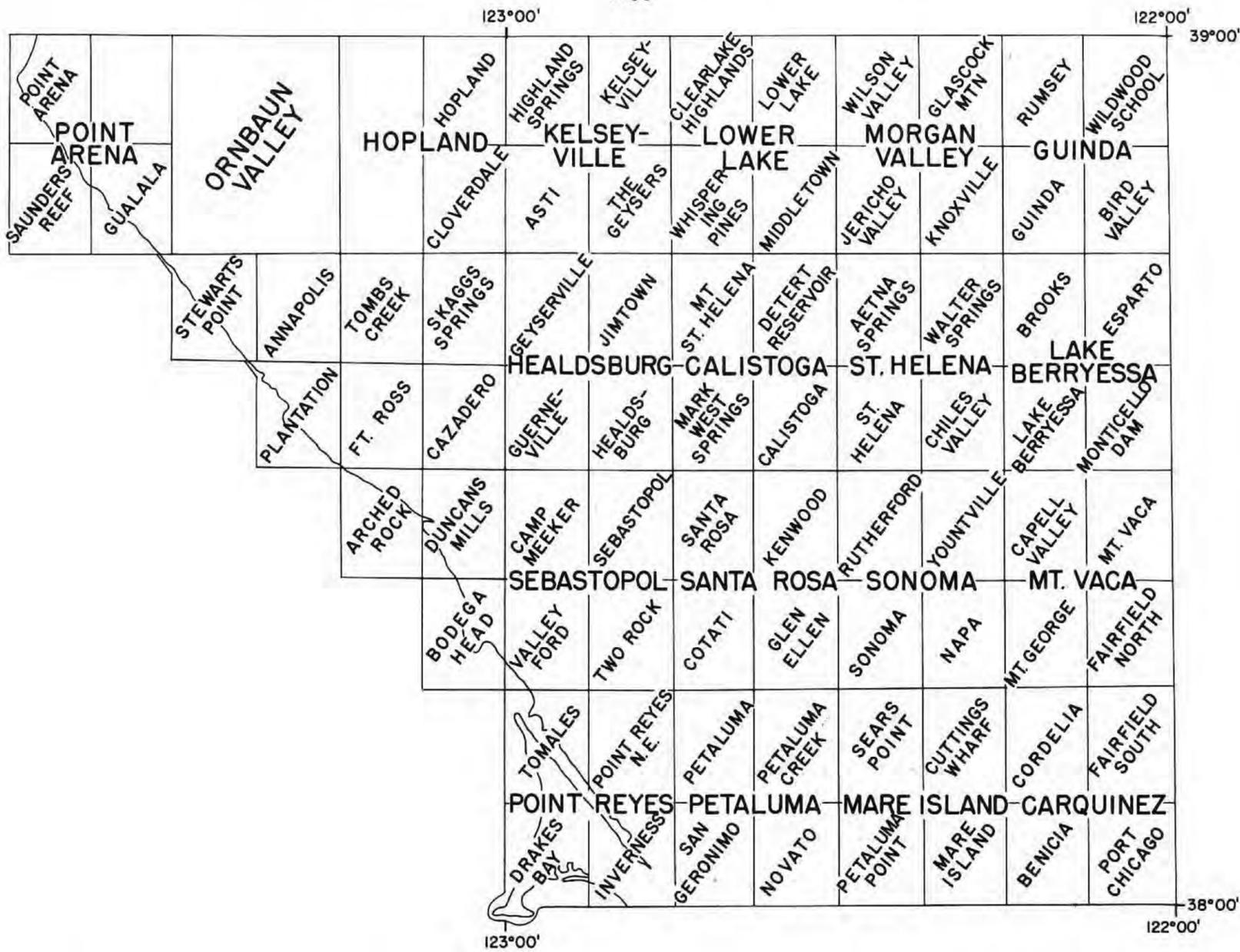
1. Part of the Clear Lake Volcanic Series of Brice, 1953.
2. Also called Sonoma Volcanics. Described by V. C. Osmond, 1904, Calif. Univ. Pub., Dep't. Geol. Bull., v. 4, pp. 39-87, as consisting of Mark West Andesite, Sonoma Tuff, and St. Helena Rhyolite. These are no longer considered mappable units, except for the St. Helena Rhyolite in the southern part of Napa Valley and along the east side of Sonoma Valley (Kunkel and Upson, 1960, p. 24).
3. Includes part of the Laird Sandstone of Weaver, 1949.
4. This unit was named Galloway Beds by C. E. Weaver, 1943, Calif. Div. Mines Bull. 118, pp. 628-632. However, in 1944, Weaver, Univ. Washington Pubs. Geol., v. 6, p. 4, renamed this the Galloway Formation, and designated the lower 350 feet of coarse-grained sandstone as the Skooner Gulch Formation of Oligocene (?) age.
5. Considered by Weaver, 1943, to be part of the Gualala Group of Late Cretaceous age, but separated herein on the basis of mapping by Carl Wentworth, Stanford University, Ph.D. thesis in preparation, 1963.
6. Underlies Paleocene rocks formerly assigned to the Gualala Group, and is possibly of Cretaceous age.



View southeast along the San Andreas Fault Zone, which separates rocks of the Franciscan Formation (mainland, left) from the quartz diorite pluton exposed on Bodega Head (right center) and Tomales Point (top of photo, center). The San Andreas Fault Zone, here approximately two miles wide, extends for over 650 miles across California. The 1906 San Francisco earthquake caused displacement of the land surface in the fault zone, with a maximum of about 20 feet of lateral displacement recorded near Olema. Physical features caused by repeated fault movement during the geologic past include the steep escarpment at the juncture of Bodega Head with the sand beach tying it to the mainland, and the trench-like form of Tomales Bay (top of photo, center).
Photo by Aero Photographers, Sausalito, 1959

TOPOGRAPHIC QUADRANGLES
WITHIN THE SANTA ROSA SHEET
AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY

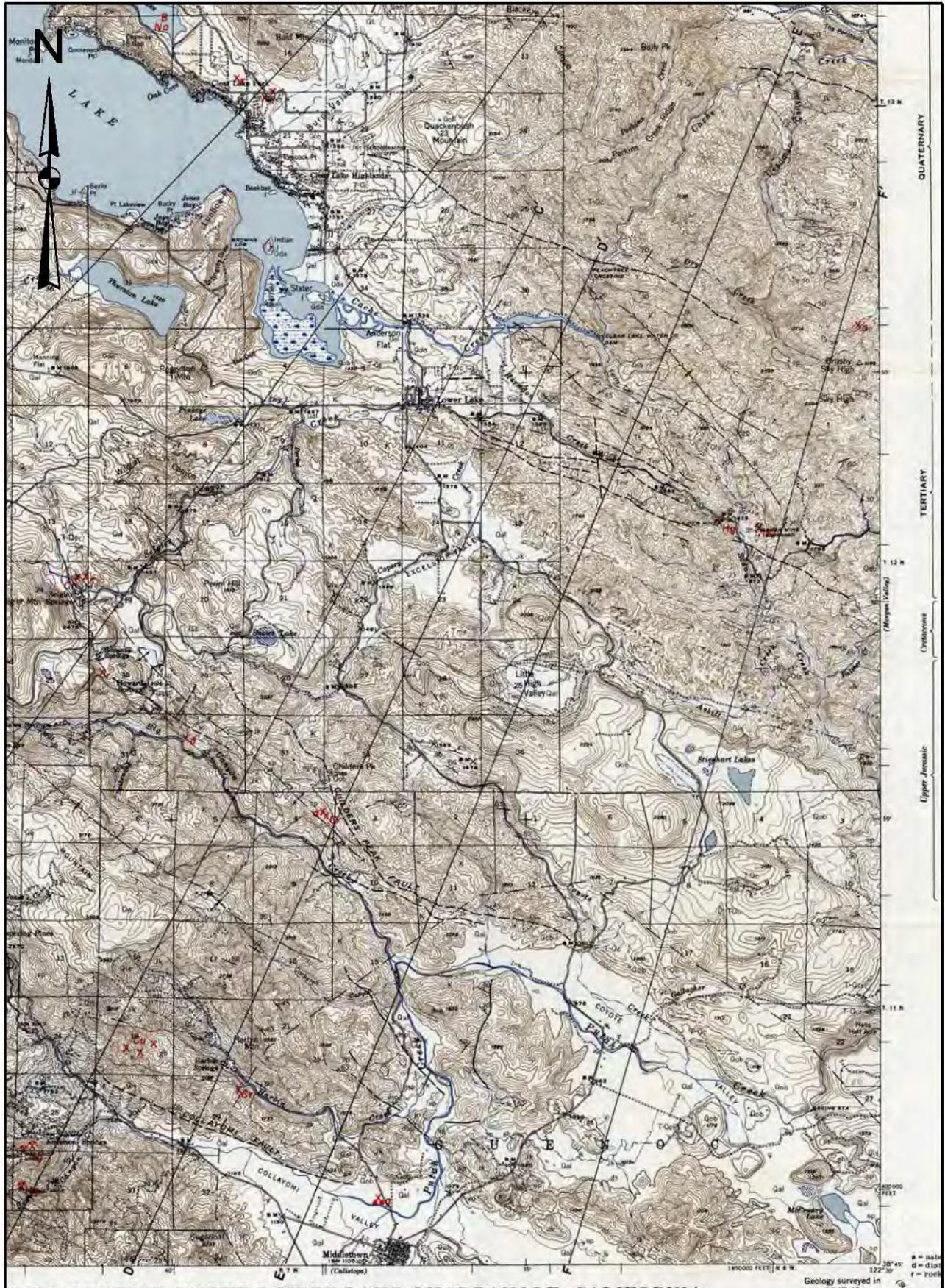
1963



View northwest across Clear Lake (Santa Rosa and Ukiah map sheets). The lake, it is believed, was formed by a lava flow damming pre-existing stream valleys. Mt. Konociti (upper left), composed of Pleistocene dacite and andesite, rises nearly 3000 feet above the lake. Beyond Mt. Konociti is alluvium-filled Big Valley. The hills west of Big Valley and along the north shore of Clear Lake are principally composed of rocks of the Franciscan Formation. Borax Lake (dark patch, right center) was the first commercial source of borax in California. Beyond Borax Lake lies Sulphur Bank Point, famous for mercury and sulphur production. The plain in the foreground is formed by sediments of the Cache Formation, capped by basalt, dacite, and obsidian, and bordered by alluvium. Volcanic activity in this area probably continued into Recent time.

Photo by Aero Photographers, Sausalito, 1959

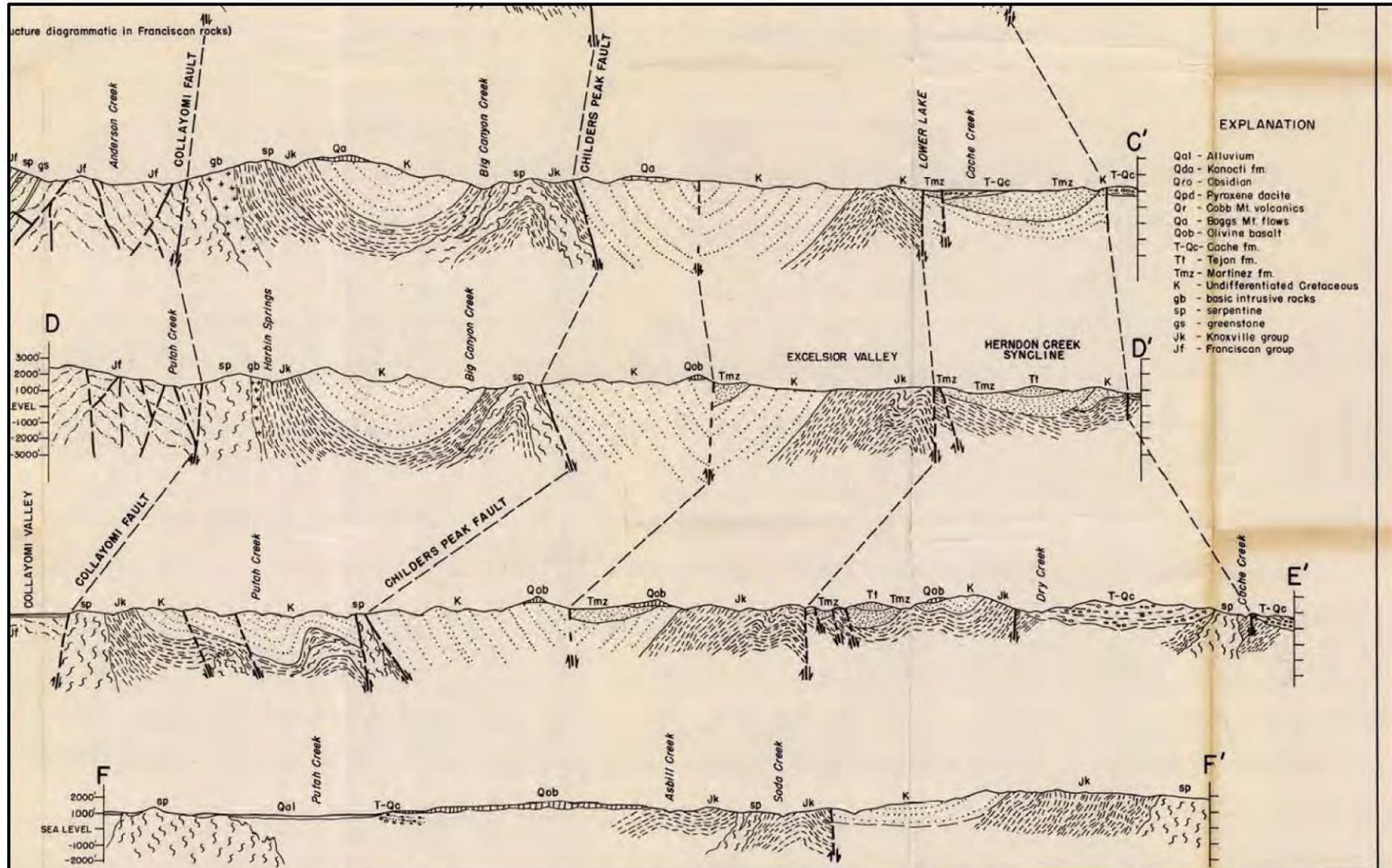
Location Map of Cross Section Lines F-F'
Modified from Brice, 1953



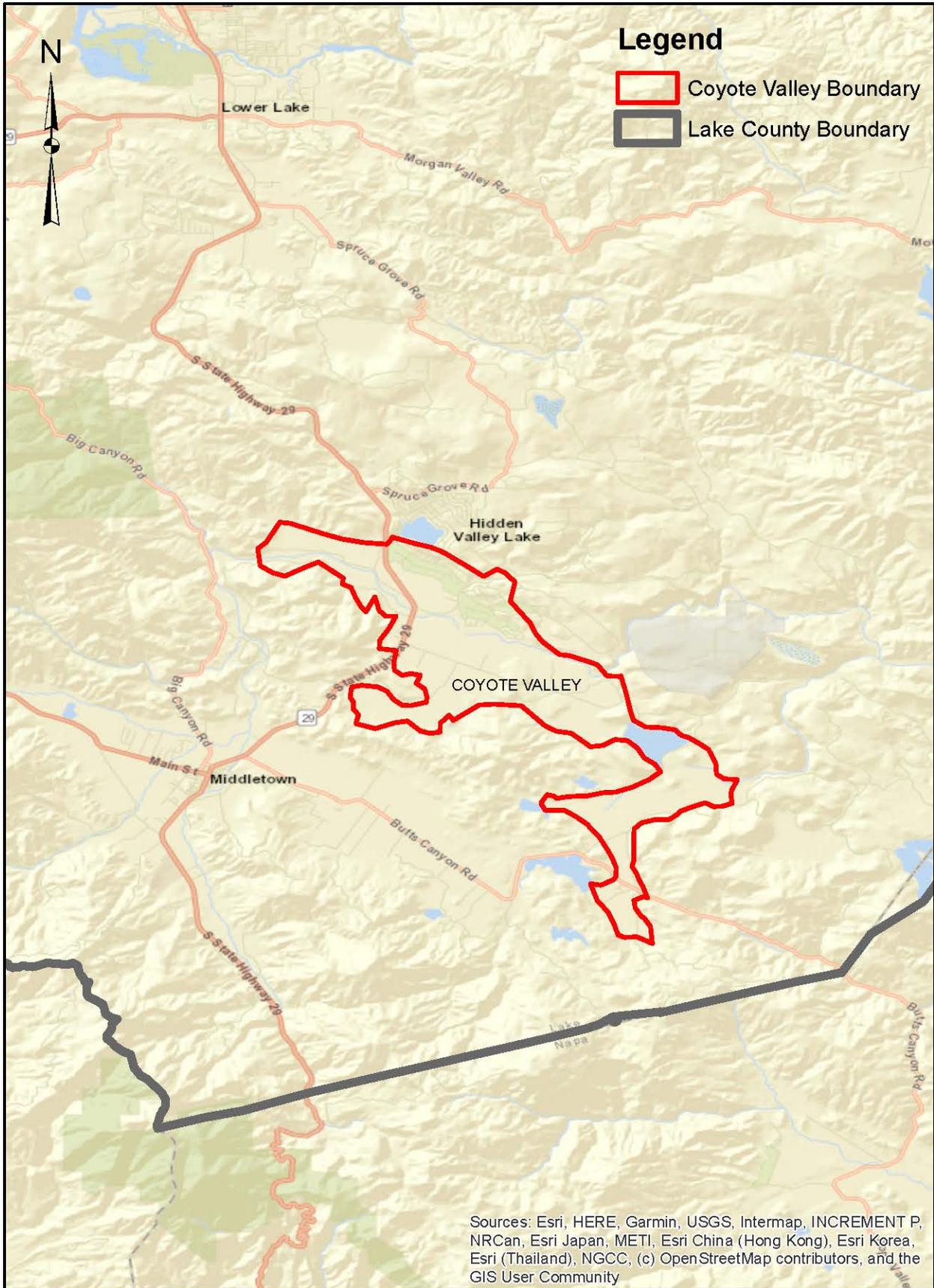
0 40 80 160 240 320 Miles

Cross Section F-F'

Modified from Brice, 1953



Order WR 2020-0101-DWR - Attachment B



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