Chevron U.S.A.
1500 Louisiana Street
Houston, TX 77002

May 12, 2025

David Albright
Manager, Groundwater Protection Section
U.S. Environmental Protection Agency, Region 9

RE: Responses to Technical Review – Request for Additional Information
Chevron Kern River Eastridge CCS Project
Underground Injection Control (UIC) Permit Application Class VI Permit Application No. R9UIC-CA6-FY24-1.1-1.4

Dear Mr. Albright,

This document for the Kern River Eastridge CCS Class VI permit application (R9UIC-CA6-FY24-1.1-1.4) summarizes each of EPA's Requests for Additional Information in *italic* text, while providing Chevron's responses to each item directly below in blue plain text.

If you have any questions or require additional information, please contact Mr. Brennan Ott at (661) 203-0089 or BrennanOtt@Chevron.com.

AoR Delineation and Computational Modeling Comments

1. *The reviewers could find no explicit reference to the Geologic Model Development tool used for static geocellular modeling, but it is assumed that geologic parameters used in the dynamic flow model were drawn from Petrel by Schlumberger.* ***Please clarify the origin of the geologic parameters used in the dynamic flow model.*** *Regardless, the applicant provides a detailed explanation of how geologic characteristics are used to characterize the geologic system.*

The geologic parameters used in the dynamic flow model were generated using Petrel by SLB. These parameters and their distribution are based on site specific well logs (described in the Injection and Confining Zone Details section of the Narrative), core data (described in Appendices B and C of the Narrative), and pressure transient analysis (described within the Fault Seal Capacity section of the Narrative and the Fault Seal Analysis section of the Area of Review and Corrective Action Plan). For additional information regarding specific data sourcing, please refer to Table 11 in the Project Narrative, also included below in the response to question 18.

2. *The applicant provides details of a step rate test that they performed in 2022 within the Area of Interest (AoI) in the target Vedder Sand (storage interval) using well KCL20050X (API #040304874500) with details on how it was used to estimate the site-specific fracture gradient. The applicant used a general fracture gradient of 0.642 psi/ft from the step rate test executed in 2022. This value is indicated by the applicant to be consistent with a nearby publicly available observed fracture gradients within the Vedder Sand (0.682 psi/ft). Table 10 in the AoR and Corrective Action Plan lists the maximum bottom-hole pressure details at each zone (based on site specific step-rate test based fracture gradient, depth below surface, and using 90% of the fracture pressure) as well as the maximum expected pressure at the top of each zone to verify that fracturing does not occur due to injection in the Vedder Sand. However, no specific integrity analysis has been performed by the applicant on the confining zone (Freeman-Jewett Silt).* ***Please provide additional justification for this choice and describe the proposed site-specific integrity analysis of the confining zone.***

In addition to conducting testing on the Vedder Sand, Chevron also conducted a leak-off test in 2022 on the Freeman-Jewett Silt in KC20050X (API #040304874500). The details of this test and the relationship to the injection zone fracture pressures are provided within the Geomechanical and Petrophysical Information section of the permit application Narrative. The text and associated figures are provided for reference below.

An important aspect of a vertical confining layer is understanding the variation in fracture pressure between the mechanical top-seal and the injection horizon in such a manner as to limit fracture propagation in either layer. A LOT conducted in 2022 on the Freeman–Jewett Silt in KC20050X yielded a Fracture Closure Pressure (FCP) of 2425 psi, equivalent to 0.63 psi/ft, as shown in Figure 69. A Step Rate Test conducted in 2022 in KC20050X with water obtained a FPP gradient of 0.642 psi/ft in the Vedder Sand (Figure 70). Given a low viscosity injection fluid (water), Fracture Propagation Pressure (FPP) can act as a proxy for FCP, which provides an opportunity to compare the two fracture gradients. Although the fracture gradient for the Freeman-Jewett Silt is lower, Chevron will operate with automated, fail-safe control systems to ensure bottomhole injection pressures are no more than 90 percent of the observed Propagation Pressure in the Vedder Sand. Taking these tests into account, the equivalent maximum injection pressure will be limited to an equivalent gradient of 0.578 psi/ft, which is lower than the fracture gradient observed in the Freeman–Jewett Silt. (Narrative, Geomechanical and Petrophysical Information)

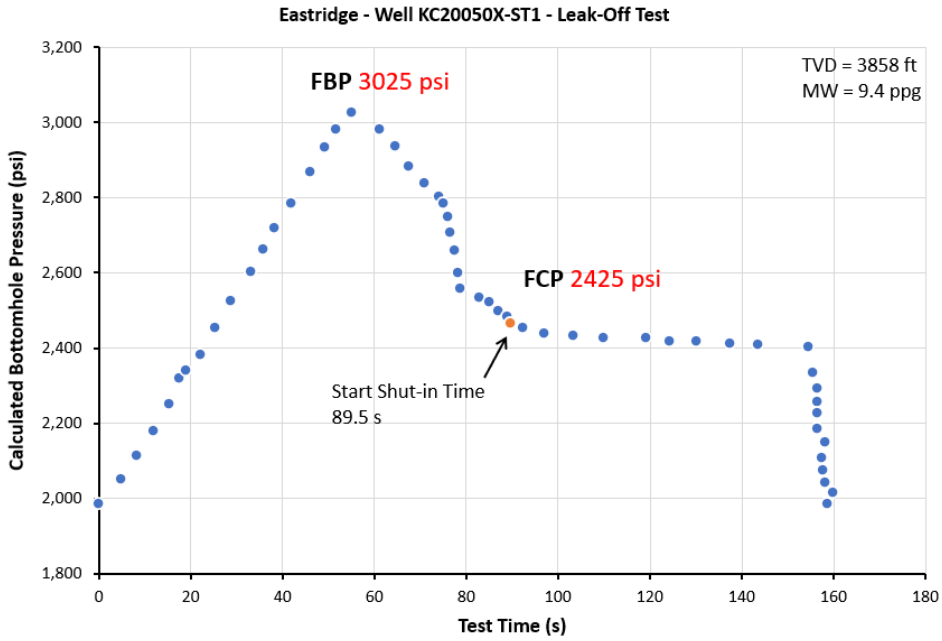

Figure 69. Interpreted LOT data from KC20050X_ST1, highlighting FBP and FCP. FCP is used for calibration of SHmin. This test was executed in the Freeman-Jewett Silt.

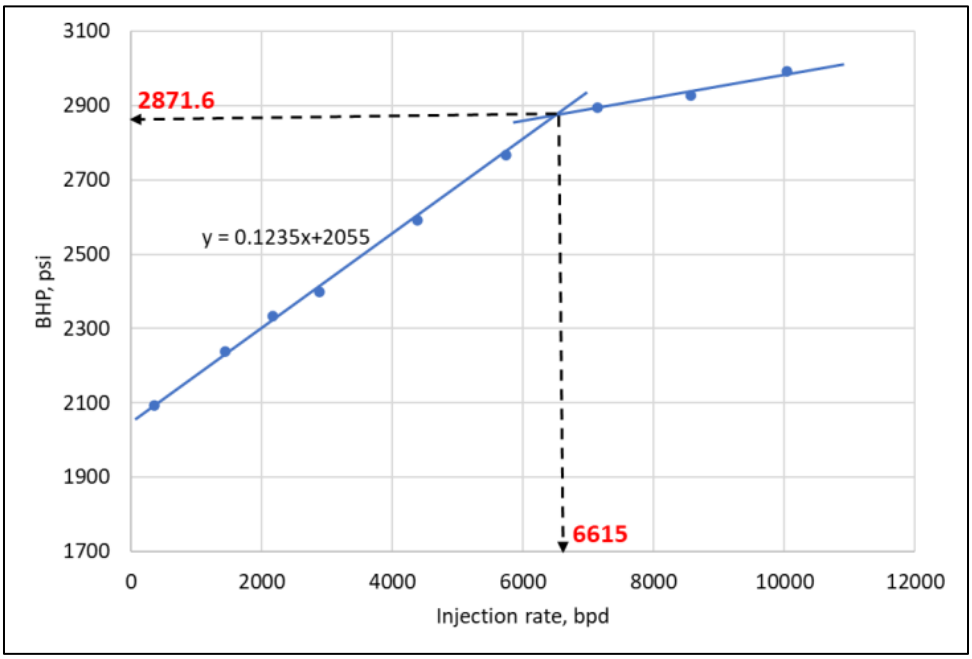

Figure 70. Interpreted Step Rate Test from KC20050X indicating a Fracture Propagation Pressure of 2871.6 psi. This test was executed in the Vedder Sand.

3. *From the Narrative of the application, the cumulative amount of sequestered CO2 is expected to total 6.82 million tonnes over the life of the Project.* ***Please clarify the total planned injection volume over the proposed life of the project and how the total volume is determined. Please clarify the amount of CO2 planned for injection in the years 2041-2042 (when the additional CO2 source comes online) and any other durations of time that CO2 injection fluid physical and chemical characteristics may change. Please modify the Figures and the text if the language should change based on the December 23, 2024 changes to the application.***

The planned injection volume for the life of the project remains 6.82 million tonnes, and the rate schedule remains unadjusted. Chevron anticipates that there will be a rate increase as shown in the injection forecast at years 2041-2042 based on additional anticipated emission streams. Based on the reservoir forecast, the AoR can accommodate this increase in volumes, as shown in the Operational Information of the Area of Review. The physical and chemical characteristics of the injectate is not anticipated to change from what has been provided in the application (as described in the Proposed Carbon Dioxide Stream section of the Narrative).

4. *Figure 95 in the Narrative provides a schematic diagram of Chevron's monitoring plan.* ***For consistency with your December 23, 2024 change, please modify Figure 95's Cogen & Pipeline reference and illustration.***

An updated Figure 95 is shown below.

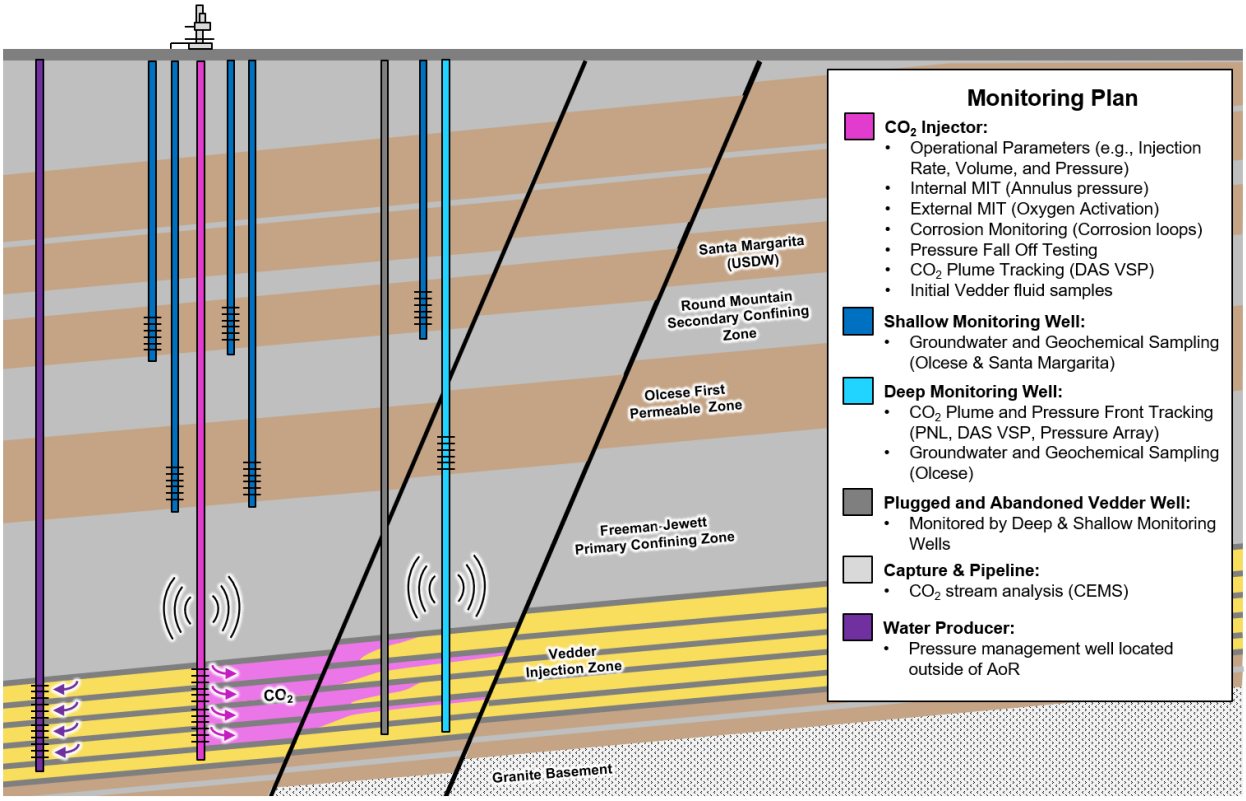

Figure 95. Schematic diagram of Chevron's monitoring plan.

Numerical Simulator Capabilities

5. *No results are shown from the model related to evaporation and salt deposition in multiphase flow of formation fluids and related to salt precipitation in salinity interaction.* ***Please illustrate these results or provide justification why the results are not shown.***

Within the Geochemistry section of the Narrative, Chevron highlights the detailed geochemical reactions simulated, which include salt precipitation. Given the low salinity of the reservoir fluids within the Vedder Sand, salt precipitation is expected to be very minimal.

6. *For residual phase trapping, capillarity effects do not appear to be explicitly considered in storage interval flow simulations, though threshold pressures are assigned to represent transmissibility across fault grid blocks.* ***Please provide a discussion of consideration of capillarity effects in the simulations of the model and the possible impacts on model predictions.***

Chevron has focused its modeling efforts on the most impactful parameters for delineation of the AoR (e.g., permeability, porosity, relative permeability, fault threshold pressure and fault transmissibility). Given the high permeability of the Vedder Sand (averages from 250mD to 3D), the capillary effects are expected to be second or third order in impact and have therefore not been included in the modeling. Based on the subsurface characteristics for the project area, inclusion of capillary effects throughout the model would result in a smaller AoR. Within the fault zones, the rock characteristics have been physically altered by smearing and cataclasis during the faulting process. For this reason, capillary effects have been included along the faults in the form of a threshold pressure as described in the Fault Seal Analysis section of the AoR and Corrective Action Plan.

Computational Model Design

7. *The grid resolution of 200x200x4 ft within the AoR and 400x400x4 ft outside the AoR is fine enough in the model to capture the localized heterogeneities that could affect fluid movement. The application does not consider sensitivity of pressure/saturation response in the reservoir and related AoR on these gridding assumptions which would be useful supporting information.* ***Please provide a discussion of the grid sensitivity considerations from the simulations of the model.***

Chevron has implemented variable grid resolution with local grid refinement in the CO2-swept area. The fine-grid cell sizes were selected based upon the size of local geologic heterogeneities within the Vedder Sand and allow for accurately capturing the impact of these geologic heterogeneities in the CO2 swept regions. This is further discussed in the Model Domain section of the Area of Review and Corrective Action Plan.

8. *It is not stated in the application how the time steps were determined in the model to evaluate if the time steps are appropriate to provide an understanding of the plume and pressure front behavior throughout the injection and post-injection phases. However, the reviewers understand that INTERSECT selects the time steps based on convergence criteria to minimize numerical artifacts, which is typical with using an industry-standard reservoir simulation code.* ***For completeness, please provide a description of how the dynamic simulation time stepping choices are handled by the simulation tool and, ideally, specify the result time steps used in the simulations.***

Within the simulator, a minimum and maximum time step are specified. Within this range, the simulator will adapt each time step based upon previous time step lengths required for convergence, which can vary depending on what is happening in the system. The specified minimum time step is 1e-8 days, while the specified maximum time step if 3 days. The initial time step is 0.01 days.

9. *Variations in hydrogeologic properties of permeability and porosity were considered in the model. The variability in porosity and permeability were characterized based on petrophysical and core analysis data associated with 30 wells (listed in Table 3 of the AoR and Corrective Action Plan). Additional reservoir properties including volume of shale (Vshale), total and effective porosity (PHIT and PHIE, respectively), total water saturation (Swt), and effective shale-corrected water saturation (Swe) were calculated using triple combo borehole geophysical logs and core data for sandstones. See Table 4 in the AoR and Corrective Action Plan (and Table 1 in these comments) for a summary of available data for depth, thickness, porosity, and permeability ranges in the Freeman-Jewett Silt, Vedder Sand, and Famoso sand formations. Reliable electric log data were utilized for calculating volume of shale (Vsh), porosity, permeability, and saturation within the Vedder Sand, in addition to 7 wells with quantitative whole-core data and logs, yielding a total of 260 individual routine core analysis data points for calibration. Figures 9-13 in the AoR and Corrective Action Plan provide net porosity and net permeability maps for each Vedder subunit. However, there is no indication of accounting for heterogeneities/variations within the formations of capillary pressure in the model.* ***Please provide a clarification and discussion of accounting for capillary pressure variability in the model.***

As mentioned in Question 6 of this document, Chevron has focused its modeling efforts on the most impactful parameters for delineation of the AoR (permeability, porosity, relative permeability, fault threshold pressure and fault transmissibility). Given the high permeability of the Vedder Sand (averages from 250mD to 3mD), the capillary effects are expected to be second or third order in impact and have therefore not been included in the modeling. If capillarity were to be considered, the results are expected to reduce the aerial extent of the delineated AoR, since there would be an additional force preventing further migration of CO2.

Descriptions of the Model Outcomes

10. *The applicant describes how the buoyant supercritical CO2 migrates vertically until it encounters barriers. However, the value for the highest pressure at each barrier is not reported.* ***Please provide the value of the highest pressure at each barrier (caprock, faults, etc.).***

The largest pressure at the base of the confining zone within the AoR in the injection zone is 1,922 psi, while the largest pressure at the Omar Sterling Cortez South (OSCS) fault is 2,227 psi. This fault was selected because of its proximity to the injectors and because the CO_2 migrates to this fault through the life of the project (as shown in Figure 23 of the Area of Review and Corrective Action Plan). As mentioned in the permit application, Chevron plans to use water producers to slightly decrease the reservoir pressure through the life of injection. Simulation results, inclusive of pressure management, have been uploaded to the Geologic Sequestration Data Tool with the permit application for further analysis.

11. *Figure 41 in the AoR and Corrective Action Plan depicts the maximum lateral extent of the CO2 plume for all Vedder Sand target zones in the year 2150, illustrating its migration 120 years after the initial injection. Figures 25 and 26 in the AoR and Corrective Action Plan illustrate the evolution of the pressure front throughout the project's 120-years (20-years injection and 100-years) duration. However, the maximum vertical extent of the CO2 plume and pressure front is not shown.* ***Please provide illustrations of the maximum vertical extent of the CO2 plume and pressure front.***

Figures 45-48 in the Area of Review and Corrective Action Plan highlight two separate cross sections through the Area of Review at various time steps through the life of the project. Figures 45 and 46 show saturation, while Figures 47 and 48 show the pressure response. Chevron has also added cross section N-N' (Figures 3.1, 3.2, and 3.3) to illustrate the maximum vertical extent of the CO2 plume and pressure front at various time steps throughout the project life. Within the cross section, it may be difficult to spot the CO_2 saturated cells of the model updip of the Canfield fault. This is due to the very fine vertical resolution of the grid cells and the relatively small volume of CO_2 that migrates through the Canfield fault.

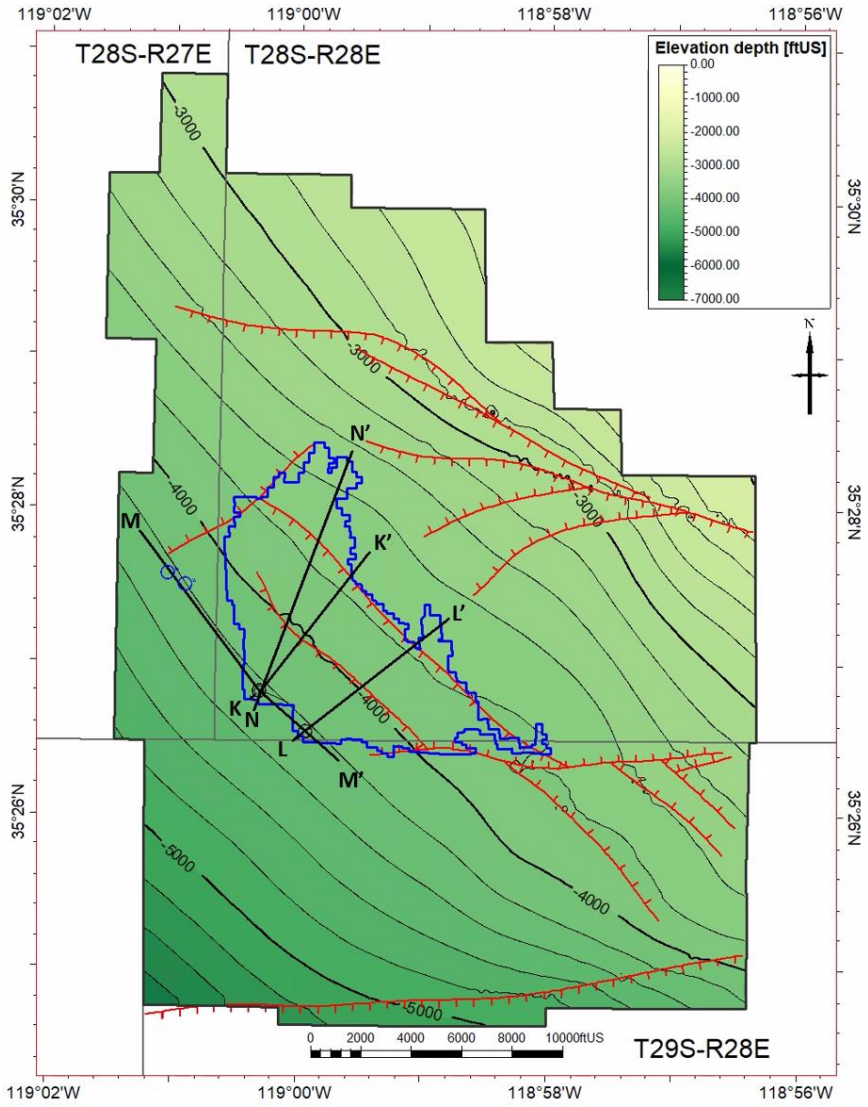

Figure 3.1. Location map for Figure 3.2. AoR for Eastridge is shown in blue area compared to the AoI shown in dark black.

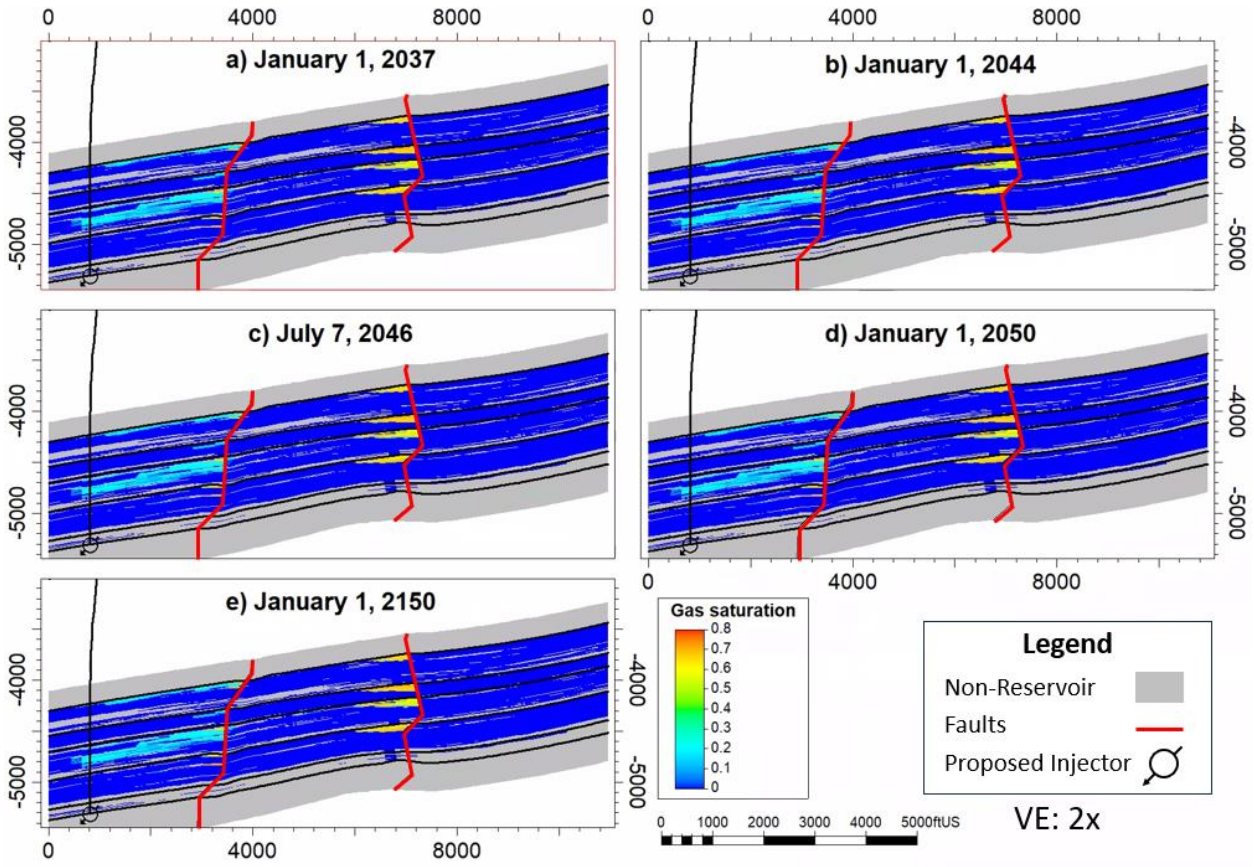

Figure 3.2. Cross section N-N' showing CO_2 saturation at different times a) January 1, 2037, last CO2 injection in Vedder 4 b) January 1, 2044 last CO2 injection in Vedder 3 c) July 7, 2046 last CO2 injection in Vedder 2 d) January 1, 2050 last CO2 injection in Vedder 1 e) January 1, 2150, 100 years after the 20-year injection life.

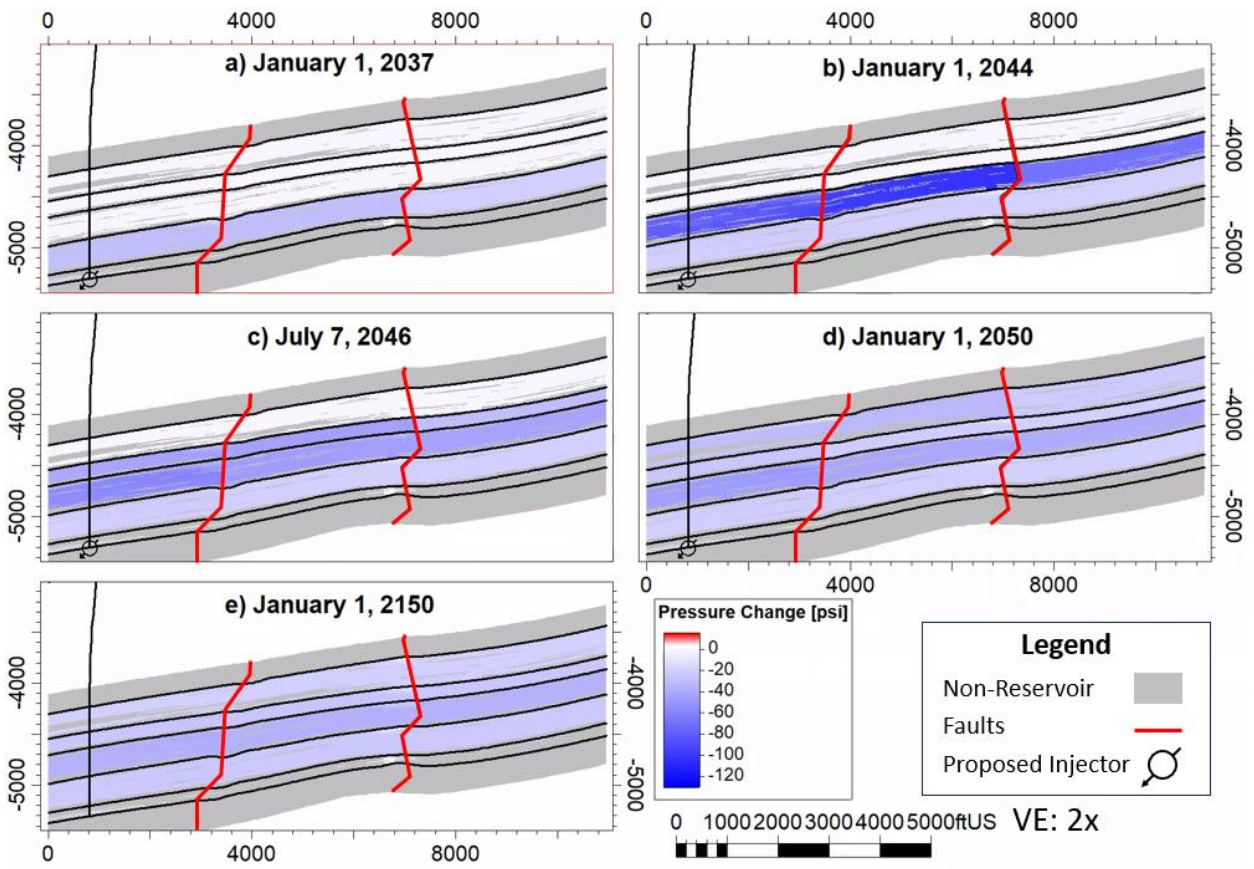

Figure 3.3. Cross section N-N' illustration pressure changes across the Vedder Sand along a dip section up dip of proposed injector ANO9004INJ through time a) January 1, 2037, last CO2 injection in Vedder 4 b) January 1, 2044 last CO2 injection in Vedder 3 c) July 7, 2046 last CO2 injection in Vedder 2 d) January 1, 2050 last CO2 injection in Vedder 1 e) January 1, 2150, 100 years after the 20-year injection life.

12. *Figure 23 and Figure 24 in the AoR and Corrective Action Plan display the maximum lateral extent of the CO2 plume at various time steps throughout the project life.* ***Please provide illustrations of the vertical extent of the CO2 plume at various time steps throughout the project life.***

Figures 45-48 in the Area of Review and Corrective Action Plan highlight two separate cross sections through the Area of Review at various time steps through the life of the project. Figures 45 and 46 show saturation, while Figures 47 and 48 show the pressure response. Chevron has also added cross section N-N' (Figures 3.1, 3.2) to illustrate the vertical extent of the CO2 plume at various time steps throughout the project life.

13. *The CO2 plume behavior is represented and discussed in the AoR and Corrective Action Plan using 2D views.* ***Please incorporate more illustrative visualizations, as 3D illustrations, to better capture and represent the vertical behavior of the CO2 plume.***

The 2D cross sections shown in Figures 45, 46, 47, and 48 of the Area of Review and Corrective Action Plan illustrate the vertical behavior of the CO2 plume through the life of the project. 3D images do not illustrate the vertical behavior as clearly because of the challenges associated with visibility (e.g., faults are needed to provide an understanding of orientation and fluid migration but get in the way of clearly seeing the migration path of the CO2).

14. *The model outputs, specifically the maximum lateral extent of the CO2 plume or the associated pressure front, were most sensitive to variations in relative permeability, permeability, porosity, the injection scheme, fault threshold pressure, and fault transmissibility. The sensitivity analysis showed that these parameters significantly impacted the AoR, with some conditions leading to expanded or reduced AoRs. Figure 56 in the AoR and Corrective Action Plan shows cases that result in an expanded AoR, while Figure 57 of the Plan shows cases that result in a reduced AoR. The applicants did not include the sensitivities impact on the vertical extent of the CO2 plume.* ***Please provide a discussion and illustrations of the sensitivities impact on the vertical extent of the CO2 plume.***

Chevron has generated Figures 3.4, 3.5, 3.6, 3.7, and 3.8 to highlight the sensitivities impacts on the vertical extent of the CO_2 plume. Within the cross sections, it may be difficult to spot the CO_2 saturated cells of the model updip of the Canfield fault. This is due to the very fine vertical resolution of the grid cells and the relatively small volume of CO_2 that migrates through the Canfield fault.

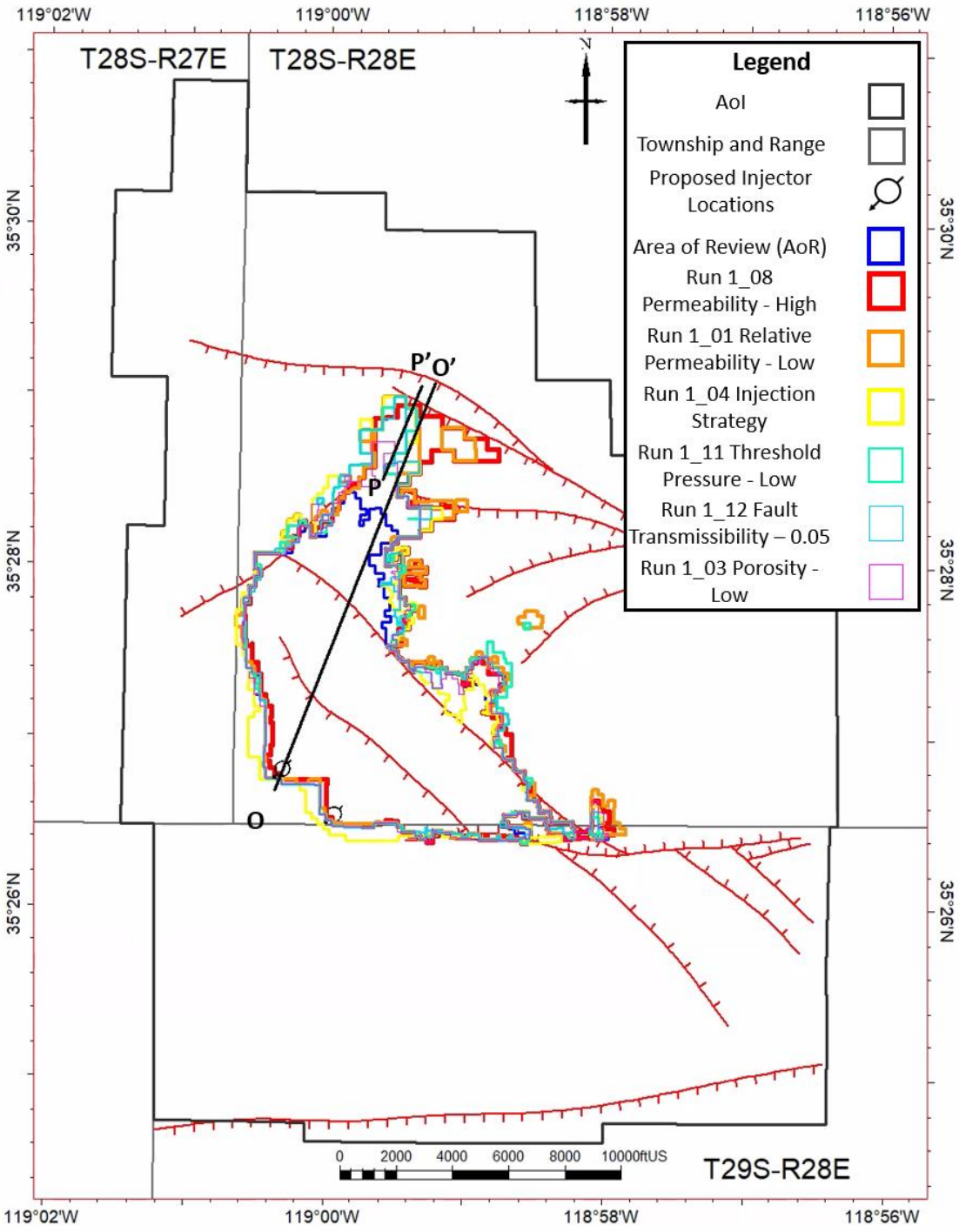

Figure 3.4. Location map for Figures 3.5, 3.6, 3.7, and 3.8 overlaid with sensitivity analysis summarizing the cases that result in an expanded AoR

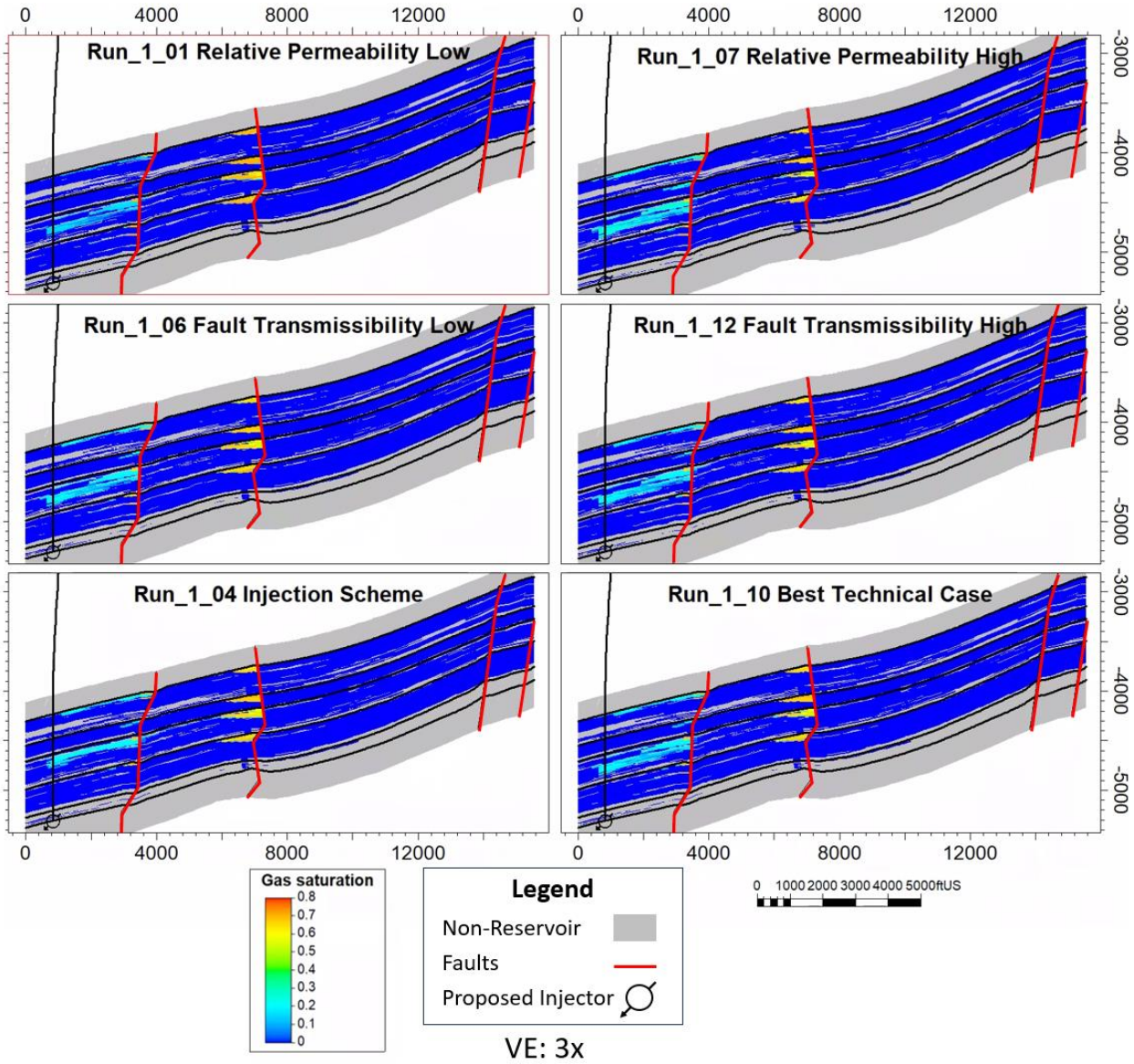

Figure 3.5. Cross section O-O' 100 years after the 20-year injection life for the sensitivities listed. Within the cross section, it may be difficult to spot the CO_2 saturated cells of the model updip of the Canfield fault. This is due to the very fine vertical resolution of the grid cells and the relatively small volume of CO_2 that migrates through the Canfield fault. Figure 3.7 provides a zoomed in view with cross section P-P'.

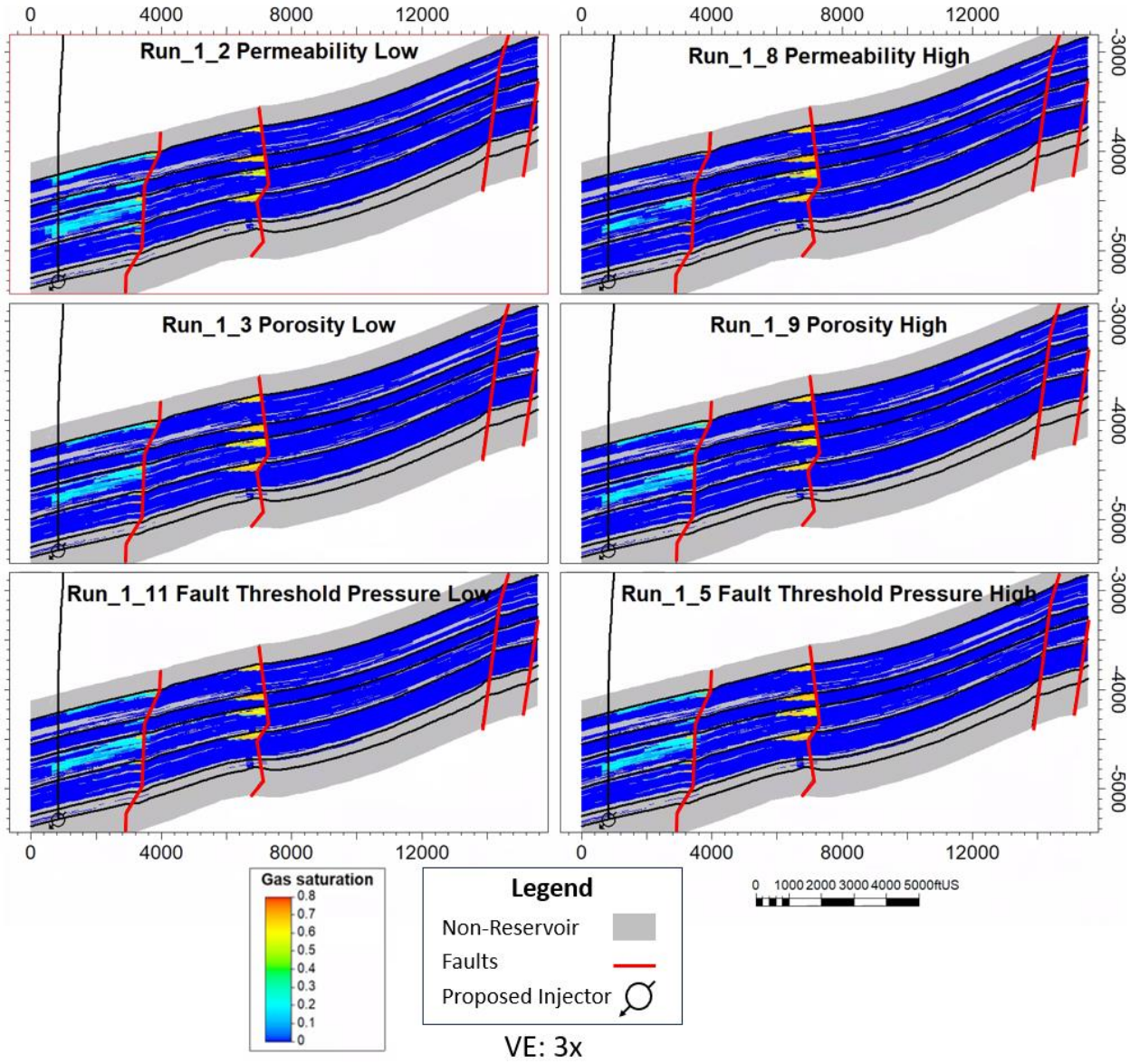

Figure 3.6. Cross section O-O' 100 years after the 20-year injection life for the sensitivities listed. Within the cross section, it may be difficult to spot the CO_2 saturated cells of the model updip of the Canfield fault. This is due to the very fine vertical resolution of the grid cells and the relatively small volume of CO_2 that migrates through the Canfield fault. Figure 3.7 provides a zoomed in view with cross section P-P'.

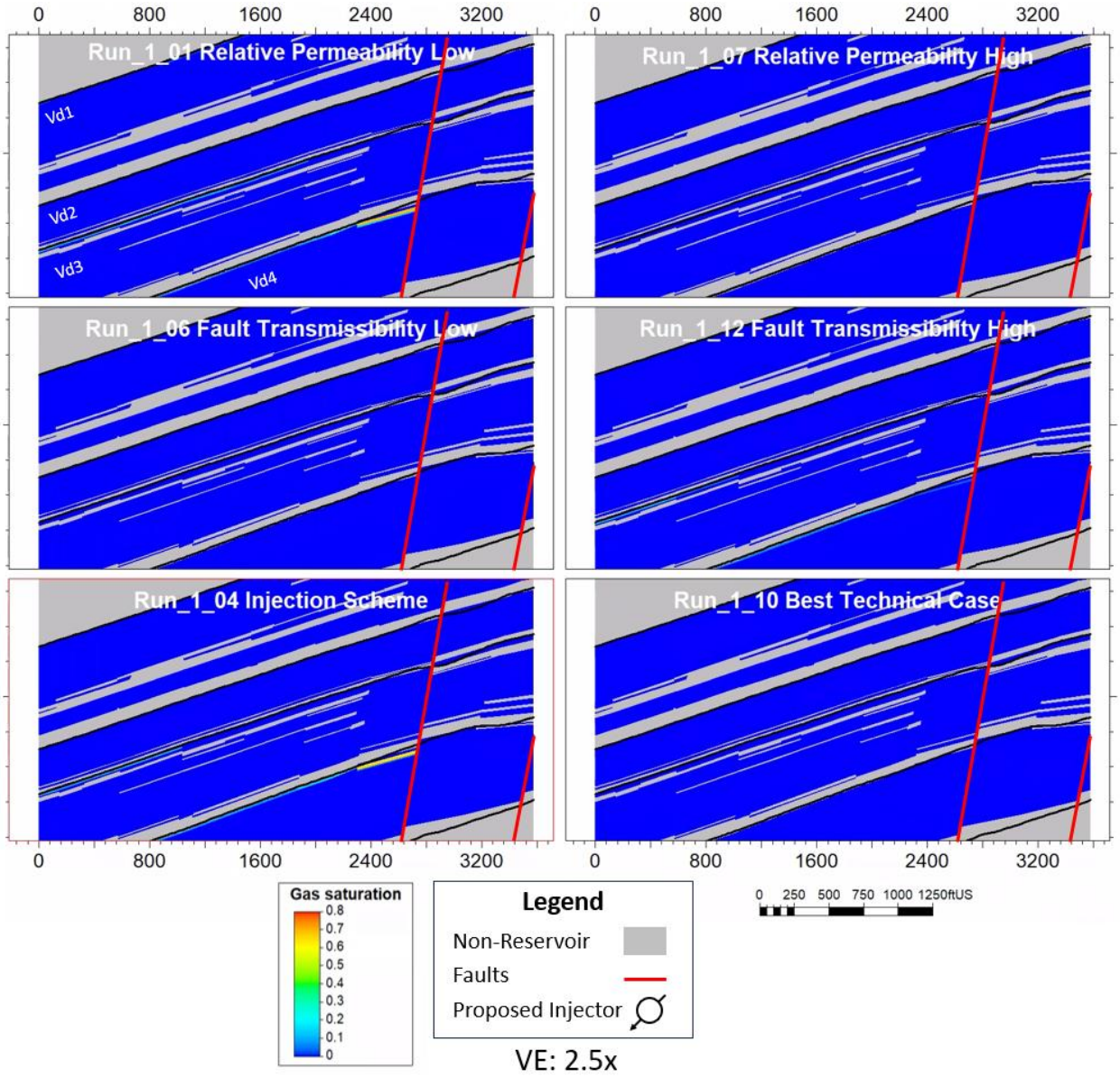

Figure 3.7. Cross section P-P' at January 1, 2150 for listed sensitivities. Within the cross section, it may be difficult to spot the CO_2 saturated cells due to the very fine vertical resolution of the grid cells. The CO2 extent is most easily seen in the Run_1_04 Injection Scheme and Run_1_01 Relative just below the top of the 4th Vedder.

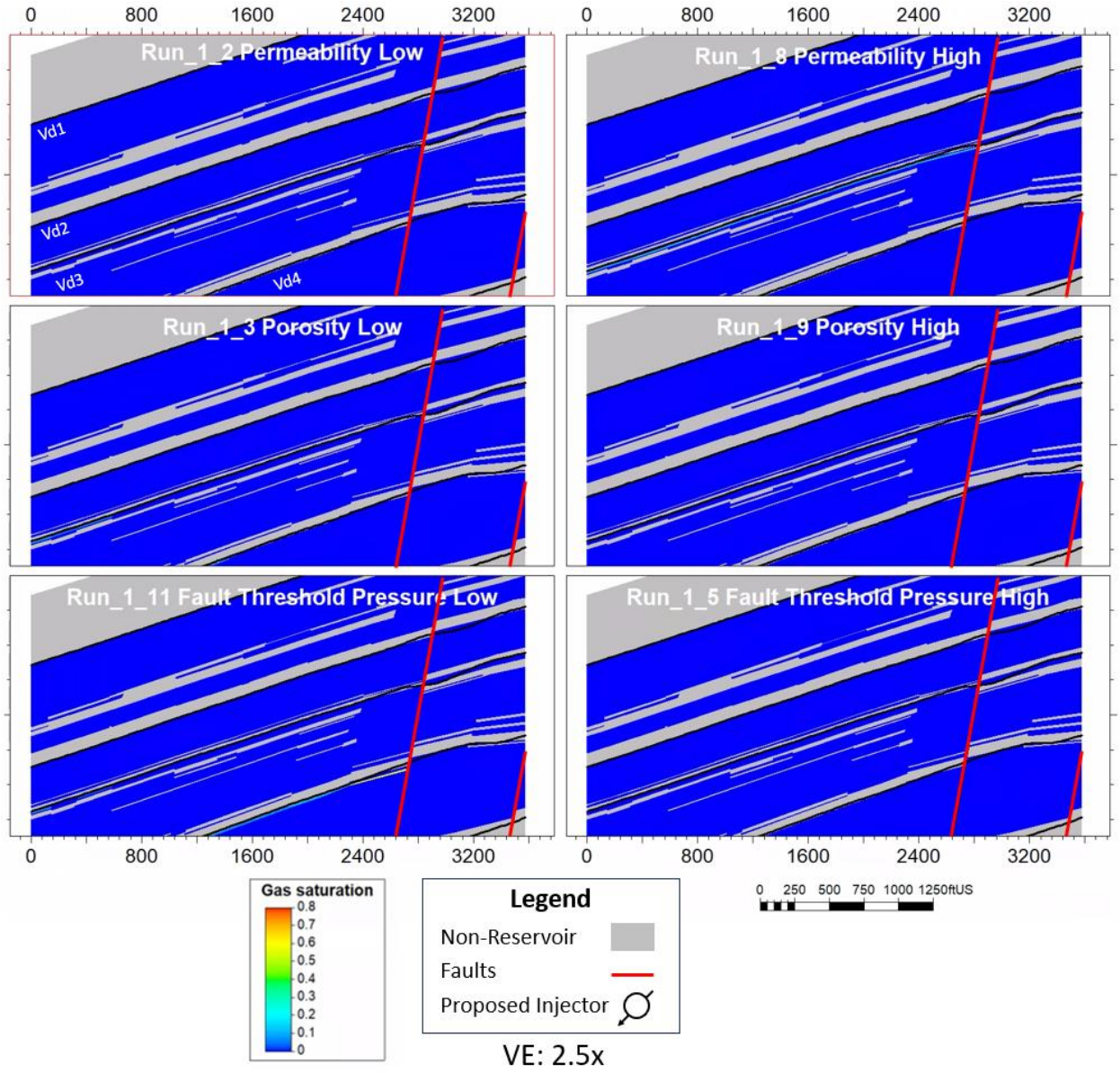

Figure 3.8. Cross section P-P' at January 1, 2150 for listed sensitivities. Within the cross section, it may be difficult to spot the CO_2 saturated cells due to the very fine vertical resolution of the grid cells. The CO2 extent is most easily seen in the Run_1_1 Fault Threshold Pressure Low where it is just below the top of the 4th Vedder.

15. *No sensitivity study was performed on the grid block size (i.e., mesh) refinement.* ***Please provide a description of a sensitivity study on mesh refinement effects in the simulations of the model and provide a discussion on the uncertainties of the mesh size and the impacts on the model results.***

Chevron has implemented variable grid resolution with local grid refinement in the CO2-swept area. Chevron has not treated mesh size as an uncertainty, but has instead selected fine-grid cell sizes based upon the size of local geologic heterogeneities within the Vedder Sand to appropriately capture the impact of these geologic heterogeneities in the CO2 swept regions.

16. *The applicant also does not discuss the choices of the finite-difference methods, sensitivity to those choices, or their effects on the results.* ***Please identify where the modeling uses finite-difference methods and provide a discussion of the choices of the method, sensitivity to those choices, and their effects on the uncertainties of the modeling approach on the results.***

The finite difference method used is a fully implicit formulation. This method is used everywhere within the model domain. The fully implicit formulation was used over the IMPES (Implicit Pressure Explicit Saturation) or AIM (Adaptively Implicit) formulations because of the stability inherent in a fully implicit formulation. To avoid numerical smoothing of results (e.g., flood front resolution) that are frequently encountered using fully implicit methods, the maximum time step size is limited to 3 days. The convergence of each time step is dictated by the max cell pressure change, saturation change, and mole fraction change. We tested IMPES, AIM, and fully Implicit formulations with negligible change to the solution, but significant changes to the run times and overall run stability (with fully implicit providing stable solutions in a predictable amount of time). The IMPES and AIM runs often suffered numerical instability that required tuning of Newtonian and linear solver convergence criteria as a function of simulation time.

Site Characterization Comments

Regional Geology, Hydrogeology, and Local Structural Geology

17. *Chevron utilized multiple geophysical well logs from around the AoR with data including spontaneous potential, gamma ray, resistivity, porosity, and nuclear magnetic resonance (NMR) permeability to characterize the project site. Figure 5 in the Narrative depicts the locations of 70 wells penetrating the injection zone with log data. The AoI is an area of approximately 25 square miles, and the delineated AoR is an area of approximately 3.5 square miles.* ***Please indicate which of the 70 wells described as within the AoI that penetrate the Vedder Sand are located within the delineated AoR.***

As referenced in the AoR and Corrective Action Plan, there are 15 wells in the AoR that penetrate the confining zone (see table below). Of the 15 wells penetrating the confining zone within AoR, all but HF_0004 penetrate the Vedder Sand. Figure 5 of the Narrative Document shows the location of these wells that penetrate the Vedder within the AoR.

	Well Name	Vedder Sand Penetration	Inside AoR
1	UC_0154	Full	Y
2	GWA0145	Full	Y
3	GWA0001WD	Full	Y
4	FEC0074	Full	Y
5	MCN0065X	Full	Y
6	VESWD-1	Full	Y
7	SOVWD-1	Full	Y
8	COR0001WD	Full	Y
9	KA_0053X	Full	Y
10	OM_0044	Full	Y
11	OM_0044X	Full	Y
12	HF_0004	None	Y
13	33_0028X	Full	Adjacent
14	AP_0051X	Full	Adjacent
15	AP_0051X_ST1	Partial	Adjacent

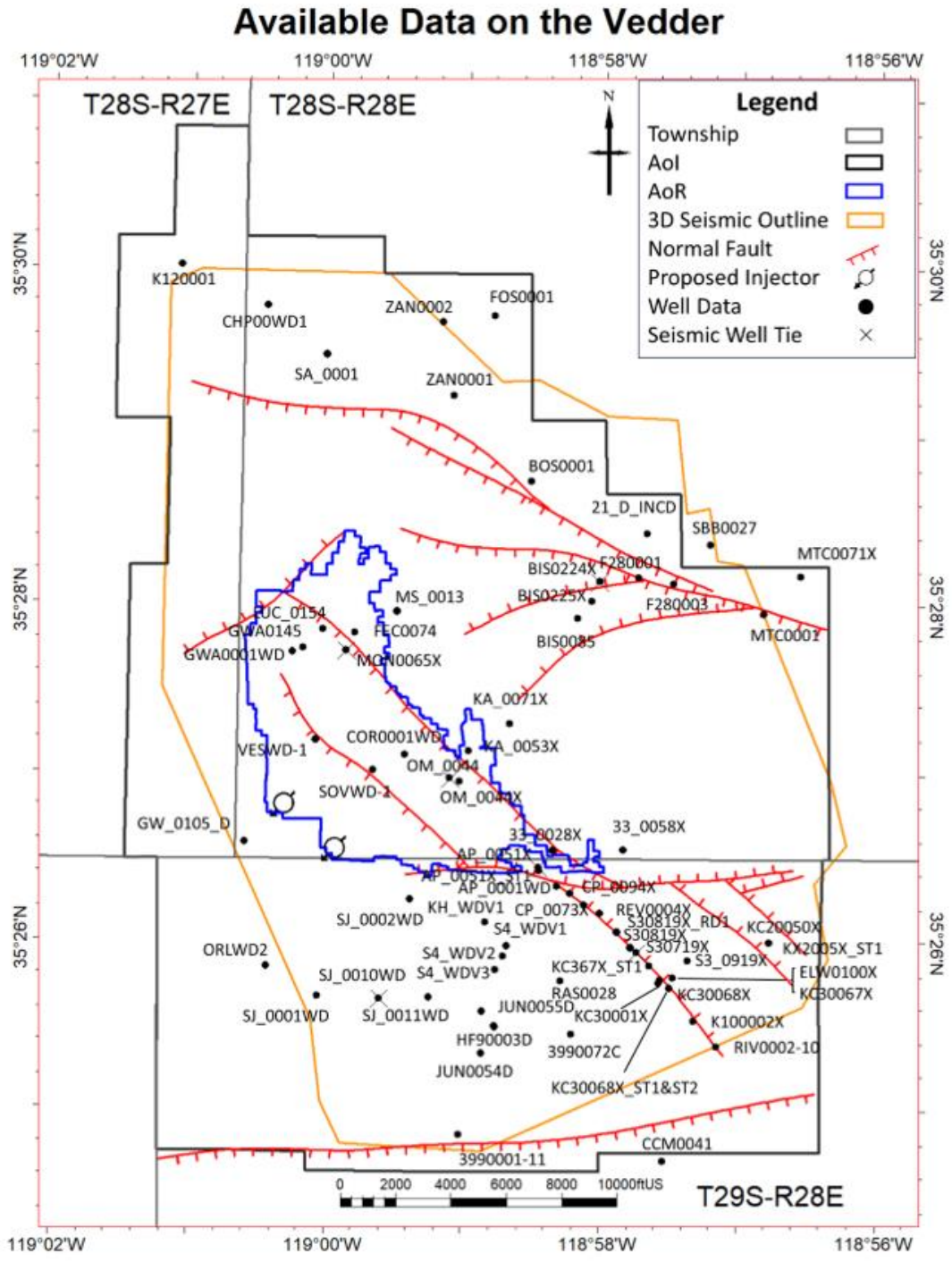

Figure 5. Location of wells within the Project AoI that penetrate the Vedder Sand and the footprint of the 3D seismic survey. Faults displayed at their intersection with the top of the Vedder Sand.

18. Please clarify whether Table 7 in the Narrative was derived from the logs of the 70 wells.

Table 7 in the Narrative covers both the Area of Interest (AoI) in the upper table and the Area of Review (AoR) in the lower table. The values in the table are taken from the 3D earth model, which uses the 70 wells as one of the inputs. The wells used for the different measurements (e.g., elevation, thickness, porosity, and permeability) depends on the available data (see Table 11).

Table 7. Summary of depth, thickness, porosity, and permeability ranges for the Freeman–Jewett Silt, Vedder Sand, and Famoso sand.

Within AoI	Elev. (ft)			Thickness (ft)			PHIE Porosity (%)			Permeability (mD)		
Unit	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**
Freeman–Jewett Silt	-2,610	-4,590	-1,100	1,140	580	1,420	---	---	---	---	---	---
1st Vedder (Vd1)	-3,750	-1,980	-5,760	270	180	360	0.29	0.20	0.34	3,580	510	17,470
2nd Vedder (Vd2)	-4,020	-2,270	-5,980	150	100	220	0.27	0.23	0.32	2,900	660	8,820
3rd Vedder (Vd3)	-4,170	-2,450	-6,200	250	140	300	0.28	0.23	0.33	470	150	940
4th Vedder (Vd4)	-4,420	-2,630	-6,450	260	170	300	0.29	0.23	0.33	4,550	1,480	9,090
5th Vedder (Vd5)	-4,680	-2,850	-6,700	140	80	220	---	---	---	---	---	---
Famoso sand	-4,820	-3,070	-6,760	---	---	---	---	---	---	---	---	---

Within AoR	Elev. (ft)			Thickness (ft)			PHIE Porosity (%)			Permeability (mD)		
Unit	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**
Freeman–Jewett Silt	-2,720	-3,020	-2,310	1,180	1,060	1,340	---	---	---	---	---	---
1st Vedder (Vd1)	-3,910	-3,470	-4,300	270	240	300	0.29	0.27	0.32	3,580	1,810	7,000
2nd Vedder (Vd2)	-4,180	-3,760	-4,540	140	130	160	0.27	0.24	0.31	3,120	1,370	6,380
3rd Vedder (Vd3)	-4,320	-3,880	-4,700	260	230	290	0.28	0.23	0.31	470	260	730
4th Vedder (Vd4)	-4,580	-4,130	-4,980	270	250	300	0.29	0.25	0.31	4,990	2,450	8,540
5th Vedder (Vd5)	-4,860	-4,410	-5,270	110	90	170	---	---	---	---	---	---
Famoso sand	-4,970	-4,530	-5,360	---	---	---	---	---	---	---	---	---

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Table 11. Summary of existing borehole datasets for wells that penetrate the Vedder Sand. Asterisk (*) denotes the recently drilled well KC20050X_ST1.

Well Info		Core & Mineralogy Data				Well Log Data									Derived Logs				
API12	Well Name	Vedder Whole core	Vedder Sidewall	Freeman–Jewett Sidewall	Vedder XRD	SP	SRES	DRES	GR	RHOB	DPHI	NPHI	NMR	FMI	RQI	PHIE	PHIT	VSH	PERM
040292497300	3990001-11					X	X	X								X	X	X	X
040296721700	AP_0051X	X			X		X	X	X	X	X	X			X	X	X	X	X
040294479200	BIS0085					X	X	X		X									
040296771100	CP_0073X		X				X	X	X	X	X	X			X	X	X	X	X
040292631600	F280001					X	X	X											
040292411200	FEC0074					X	X	X											
040296110500	GWA0001WD		X			X	X	X											
040292697300	GWA0145					X	X												
040294934300	JUN0055D		X			X	X	X	X	X	X								
040296990300	KA_0053X		X	X		X	X	X	X	X	X	X			X	X	X	X	X
040290031800	KA_0071X					X	X	X											
040296989800	KC30001X		X	X		X	X	X	X	X	X	X			X	X	X	X	X
040292803800	LUC0154		X			X	X												
040292273800	MS_0113					X	X	X											
040290009800	OM_0044		X			X	X	X											
040296655800	OM_0044X	X	X		X	X	X	X	X	X	X	X			X	X	X	X	X
040292403700	SA_0001					X	X	X											
040295391100	SJ_0001WD		X			X	X	X											
040296110600	SJ_0002WD		X			X	X	X											
040301418200	SJ_0010WD					X	X	X	X	X	X	X	X		X	X	X	X	X
040301621700	SJ_0011WD					X	X	X	X	X	X	X			X	X	X	X	X
040296641100	33_0028X	X	X		X		X	X	X	X	X	X			X	X	X	X	X
040292887200	33_0058X					X	X	X											
040294423200	3990072C					X	X	X											
040296441200	AP_0001WD		X			X	X	X	X	X	X	X			X	X	X	X	X
040298942100	CHP00WD1					X	X	X	X	X									
040295678200	COR0001WD	X				X	X	X											
040306065200	KH_WDV1		X			X	X	X	X	X	X	X	X		X	X	X	X	X
040296758700	MON0065X		X			X	X	X	X	X	X	X			X	X	X	X	X

040306215900	ORLWD2		X	X		X	X	X	X	X	X	X	X		X	X	X	X	X
040296194100	S4_WDV1		X			X	X	X	X	X	X	X	X		X	X	X	X	X
040298201900	S4_WDV2	X	X			X	X	X	X	X	X	X	X		X	X	X	X	X
040305241300	S4_WDV3					X	X	X	X	X	X	X	X		X	X	X	X	X
040297837600	SOVWD-1	X	X			X	X	X	X	X	X	X	X		X	X	X	X	X
040297837500	VESWD-1		X					X		X	X	X	X		X	X	X	X	X
040296905500	BIS0224X					X	X	X	X	X	X	X	X		X	X	X	X	X
040297107500	BIS0225X					X	X	X	X	X	X	X	X		X	X	X	X	X
040297559102	KC30068XSTD					X	X	X	X	X	X	X							
040298795500	S3_0919X		X				X	X	X	X	X	X	X		X	X	X	X	X
040294247600	JUN0054D		X			X	X	X											
040304573400	CP_0094X					X	X	X	X	X	X	X	X		X	X	X	X	X
040297301700	ELW0100X					X	X	X	X	X	X	X	X		X	X	X	X	X
040294937400	HF90001D					X	X	X	X	X	X	X	X		X	X	X	X	X
040296906900	HF90003D					X	X	X											
040297205000	K100002X					X	X	X											
040304874500	KC20050X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
040304874501	*KC20050X_ST1	X			X	X	X	X	X	X	X	X	X	X					
040297396900	KC30067X		X	X		X	X	X	X	X	X	X	X		X	X	X	X	X
040297396901	KC30067X_ST1					X	X	X	X	X	X	X							
040297393700	RIV0002-10					X	X	X											
040297135800	S3_0719X		X			X	X	X	X	X	X	X	X		X	X	X	X	X
040297371201	S3_0819XRD1		X			X	X	X	X	X	X	X	X		X	X	X	X	X
040296721701	AP_0051X_ST1					X	X	X	X	X	X	X							
040290026100	GW_0105-D		X	X		X	X	X											
040292215100	RAS0028																		
040296976200	REV0004X	X				X	X	X	X	X	X	X	X		X	X	X	X	X
040297371200	S3_0819X		X	X		X	X	X	X	X	X	X	X		X	X	X	X	X
040292404700	MTC0001					X	X	X											
040294034800	MTC0071X					X	X	X											
040292200100	BOS0001																		
040293200900	CCM0041					X	X												
040292404800	F280003					X	X	X											
040292689700	FOS0001					X	X	X											
040294615600	K120001					X		X											
040297559100	KC30068X		X	X		X	X	X	X	X	X	X	X		X	X	X	X	X
040297559101	KC30068XST					X	X	X	X	X	X	X							
040291846200	SBB0027					X	X												

040292620100	SEC21-D																		
040292402900	ZAN0001					X	X	X											
040292673800	ZAN0002					X	X												

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Depictions of the Area of Review

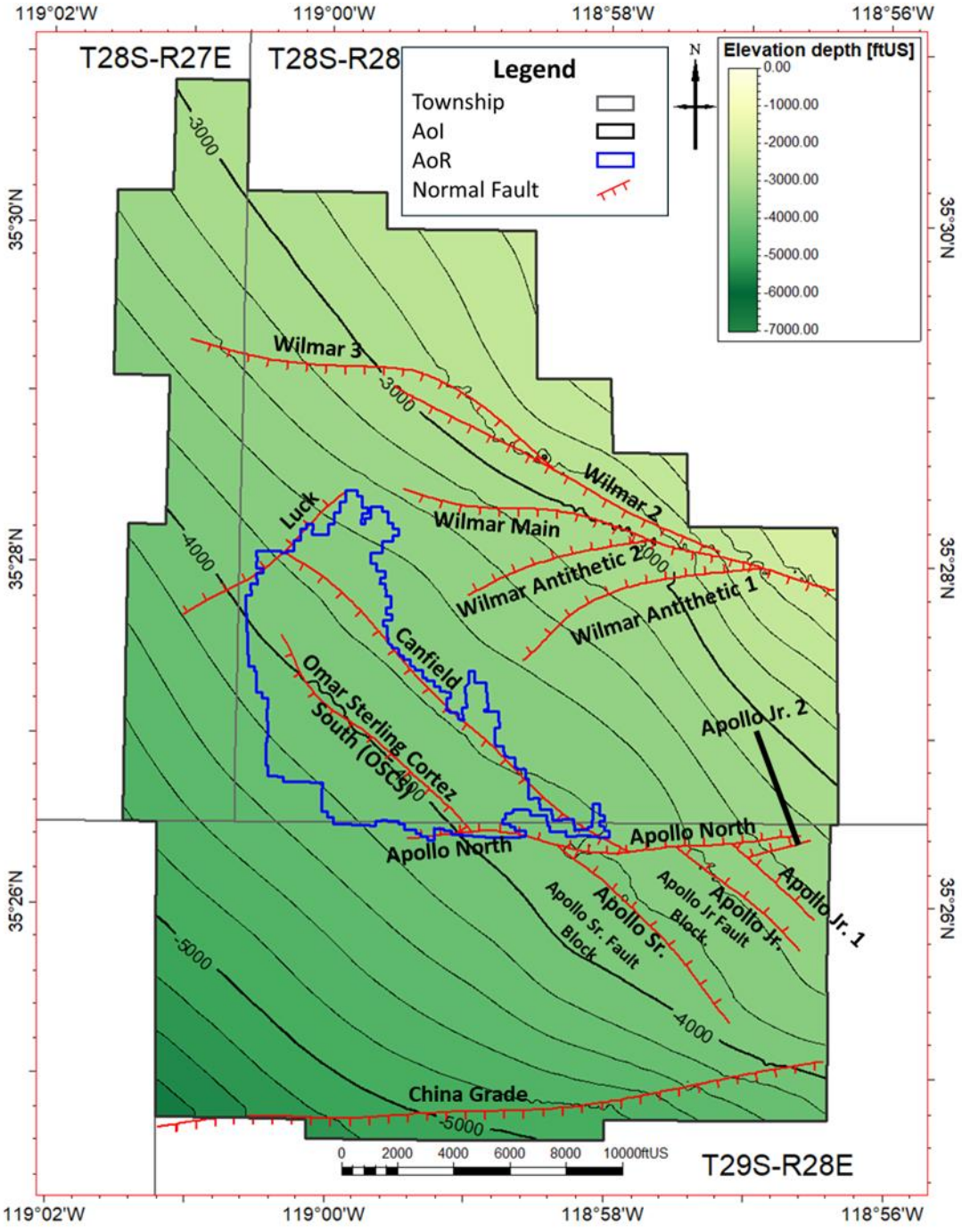
19. *Figure 5 in the Narrative depicts the proposed injection wells, AoR and AoI boundaries, the extent of Chevron's 3D seismic survey, 70 wells penetrating the Vedder Sand, seismic well ties, faults within the AoI, and township boundaries. Several elements required at 40 CFR §146.82(a)(2), including deep stratigraphic boreholes, State- or EPA-approved subsurface cleanup sites, surface bodies of water, springs, mines (surface and subsurface), quarries, water wells, roads, and structures intended for human occupancy within the AoR are missing.* ***Please revise Figure 5 or create a new figure to include all of the information required at 40 CFR 146.82(a)(2) or indicate in the Narrative that these features are not present in the AoR.***

A series of maps and figures that include all the information required by 40 CFR 146.82(a)(2) are provided in Appendix 1: AoR Maps and Well Lists of the AoR and Corrective Action Document. This includes: (1) a map of bodies of water within and adjacent to the AoR (Figure 58), (2) a map of structures for human occupancy in the AoR (Figure 59), (3) a map of roads in the AoR (Figure 60), (4) a map of destroyed water source wells within the AoR and nearest active water source wells outside the AoR (Figure 61), a map of wells penetrating the top seal of the AoR (Figure 62), and a series of maps that provide the locations of all wells aerially within the AoR including shallow wells that do not penetrate the top seal of the AoR (Figures 63-91).

Chevron performed a comprehensive search of the AoR to identify and map the features required for consideration by the program director within and directly adjacent to the AoR. A search of the California Department of Conservation's "Mines Online" map showed that there are no active or abandoned mines or quarries in our AoR (California Department of Conservation, 2023). A review of California's EnviroStor and GeoTracker databases indicated that there are no state or federal subsurface cleanup sites in our AoR (California Department of Toxic Substances Control, 2023, California Water Boards, 2023a). There are no state, tribal, or territorial boundaries within the AoR. Bodies of water are shown in Figure 58 below (California Department of Fish and Wildlife, 2023). There are no springs within the AoR.

20. Please include the delineated AOR on all figures as appropriate such as Figure 49 and Figure 81 in the Narrative.

An updated version of Figure 49 and Figure 81 with AoR is shown below.


119°02'W
119°00'W
118°58'W
118°56'W
35°30'N
35°28'N
35°26'N
T28S-R27E
T28S-R28
T29S-R28E
Legend
Township
AoI
AoR
Normal Fault
N
Elevation depth [ftUS]
0.00
-1000.00
-2000.00
-3000.00
-4000.00
-5000.00
-6000.00
-7000.00
Wilmar 3
Wilmar 2
Wilmar Main
Wilmar Antithetic 2
Wilmar Antithetic 1
Luck
Canfield
Omar Sterling Cortez South (OSCS)
Apollo Jr. 2
Apollo North
Apollo Jr. 1
Apollo Jr. Fault Block
Apollo Sr.
Apollo Sr. Fault Block
China Grade
0 2000 4000 6000 8000 10000ftUS

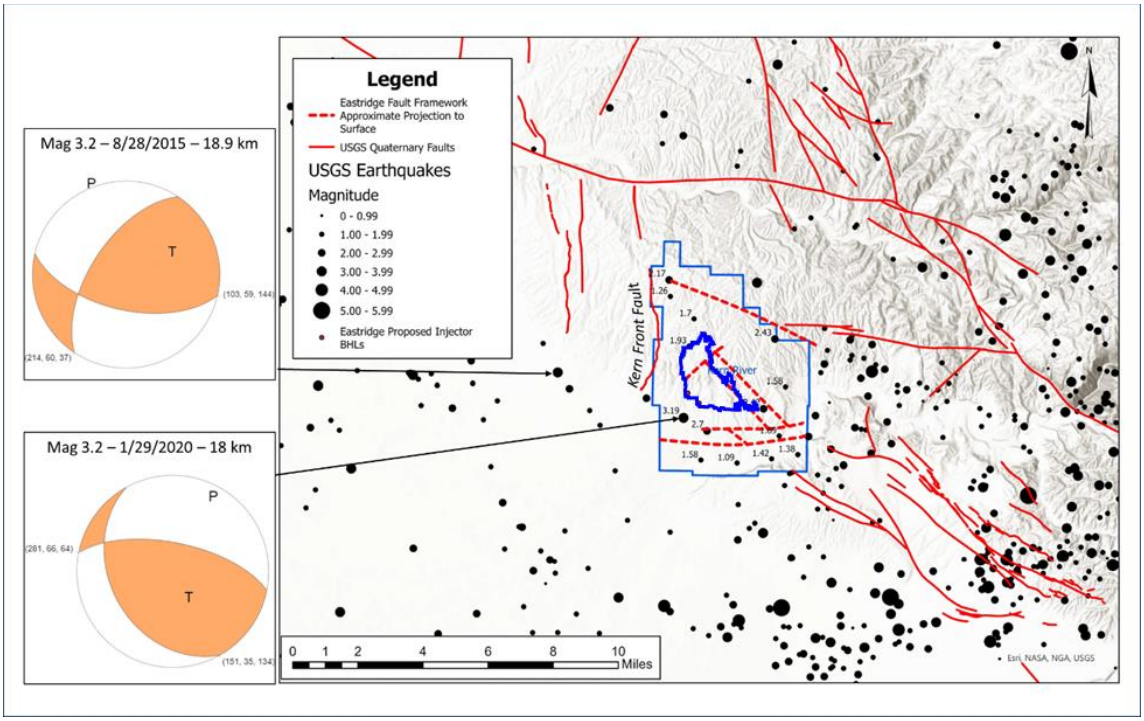


Figure 81. Shaded-relief map showing instrumental seismicity in and around the Project AoI Bartow, 1984 (blue line) and mapped faults (solid red line) with Quaternary movement based on data from the U.S. Geological Survey (U.S. Geological Survey, 2022 and 2023). Dashed red lines denote faults within the AoI that have been projected to the ground surface. Focal mechanisms of two events indicate normal-oblique fault movement (left). With the exception of a shallow quarry blast event, hypocenters occur in crystalline basement.

21. Please provide higher resolution versions of Figures such as the Geologic Cross Section and map legend in Figure 10 in the Narrative.

Figure 10 of the Narrative was modified from Bartow, 1984. The original higher resolution images are provided below including the 1) geologic cross-section line and 2) map legend.

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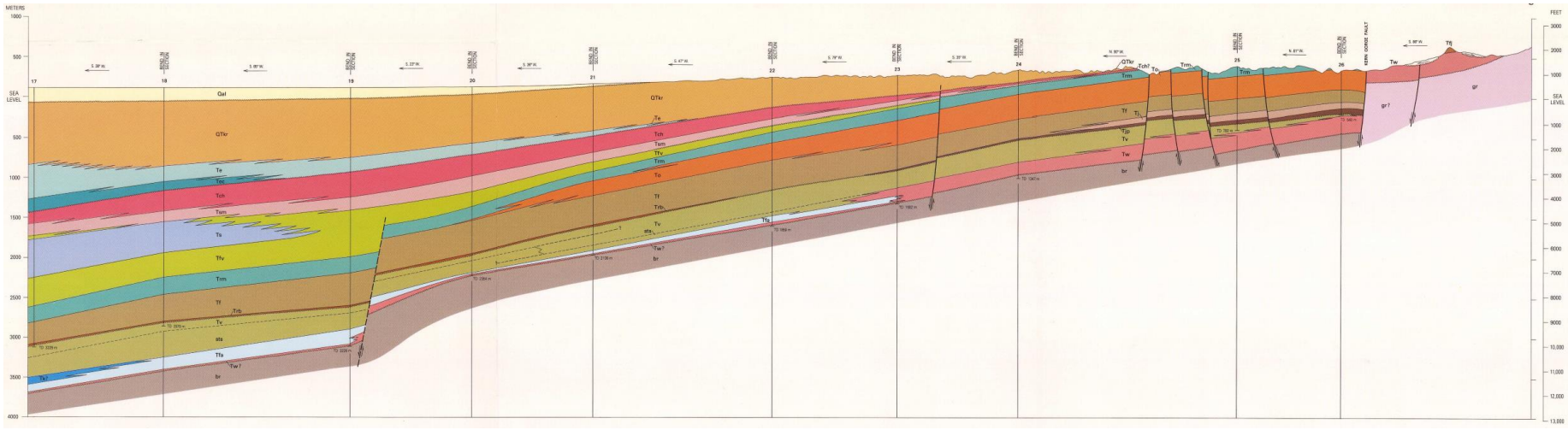

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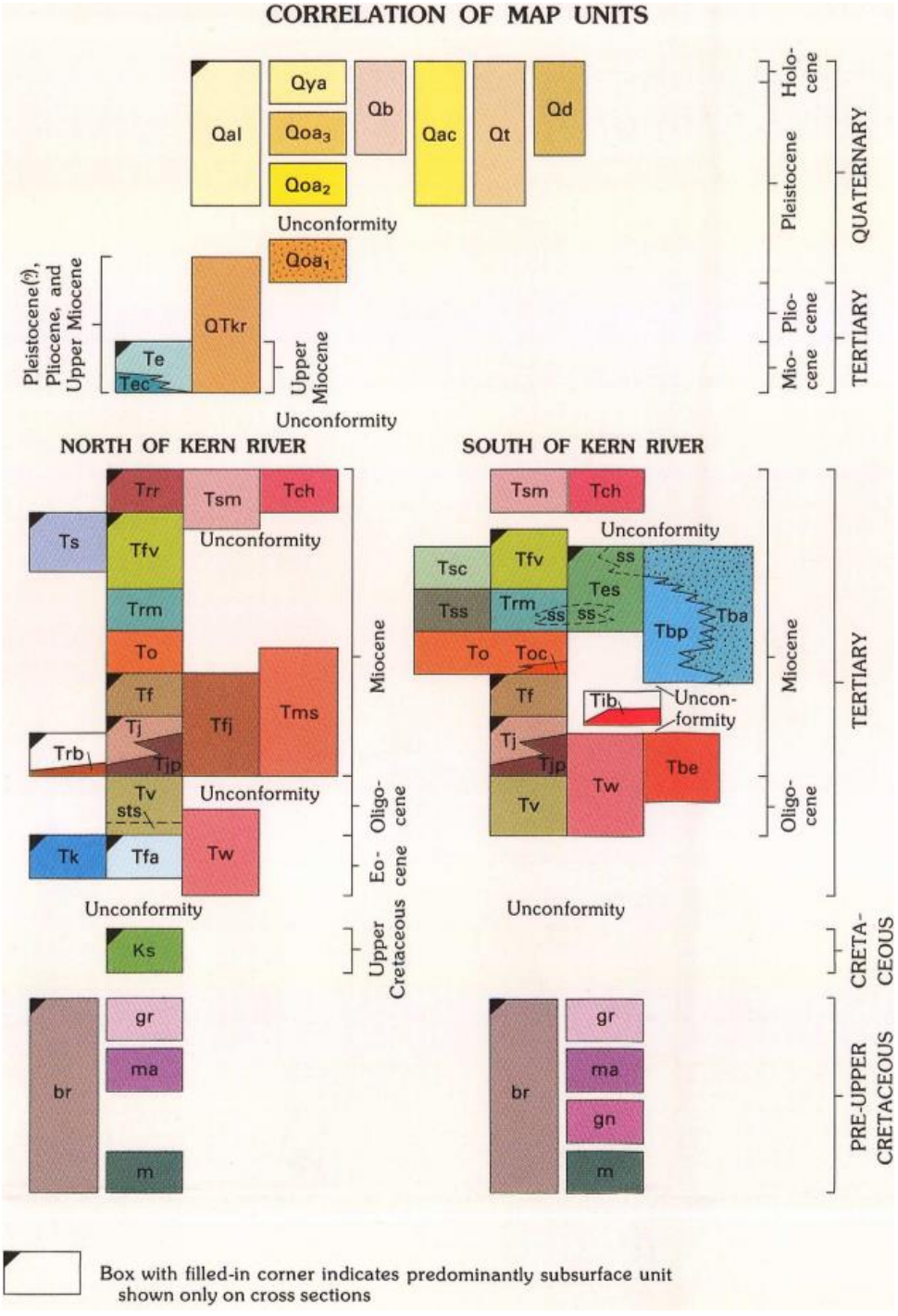

Faults and Fractures

22. *Minor faults occurring outside the AoR but within the AoI include the China Grade fault zone, a system of east-striking normal faults located near the southern boundary of the AoI, and the Kern Front fault, a south-striking normal fault located near the western boundary of the AoI. The Kern Front fault is a south-striking, west-dipping normal fault that displaces Quaternary alluvium and borders the western side of the AoI. Chevron describes the Kern Front fault as Holocene-active (according to the state of California) but currently aseismic, creeping to the north at a rate of 3 to 12 mm annually based on data collected by the National Oceanographic Survey between 1968 and 1974.* ***Please provide more recent data, if available, to describe the creep of the Kern Front Fault.***

Based on the historical data provided and historical seismicity data from 1947 to 2023, the Kern Front Fault is described as an aseismic fault with 3 to 12 mm/year of creep. The historical seismicity data provided in the Seismic History section of the narrative document extends the time series of available data from 1947 to 2023 (U.S. Geological Survey Earthquake Catalog maintained by the Earthquake Hazards Program).

23. *Chevron references oil columns in the Vedder Sand subunits as physical evidence of sealing in the Apollo Sr and Jr Faults (Figure 53 in the Narrative). Further physical evidence was collected by a pressure fall-off test conducted on well KC20050X, around 3.5 miles from the AoR, and summarized in Table 5 and Figure 56 in the Narrative. Additional evidence of fault sealing was provided using geochemical gas chromatographic analysis of oils in the injection zone subunits. Figures 57 and 58 in the Narrative show the lack of vertical fluid communication through the faults or intraformational shales in wells KC20050X, REV0004X, and S3_0819X.* ***Please provide the locations of the wells KC20050X, REV0004X, and S3_0819X and highlight/identify them on all maps indicating that they are used as data points.***

The updated inset map for Figure 53 highlights the locations of the wells ***KC20050X, REV0004X, and S3_0819X*** which are displayed in the cross section through the Apollo Fault System.

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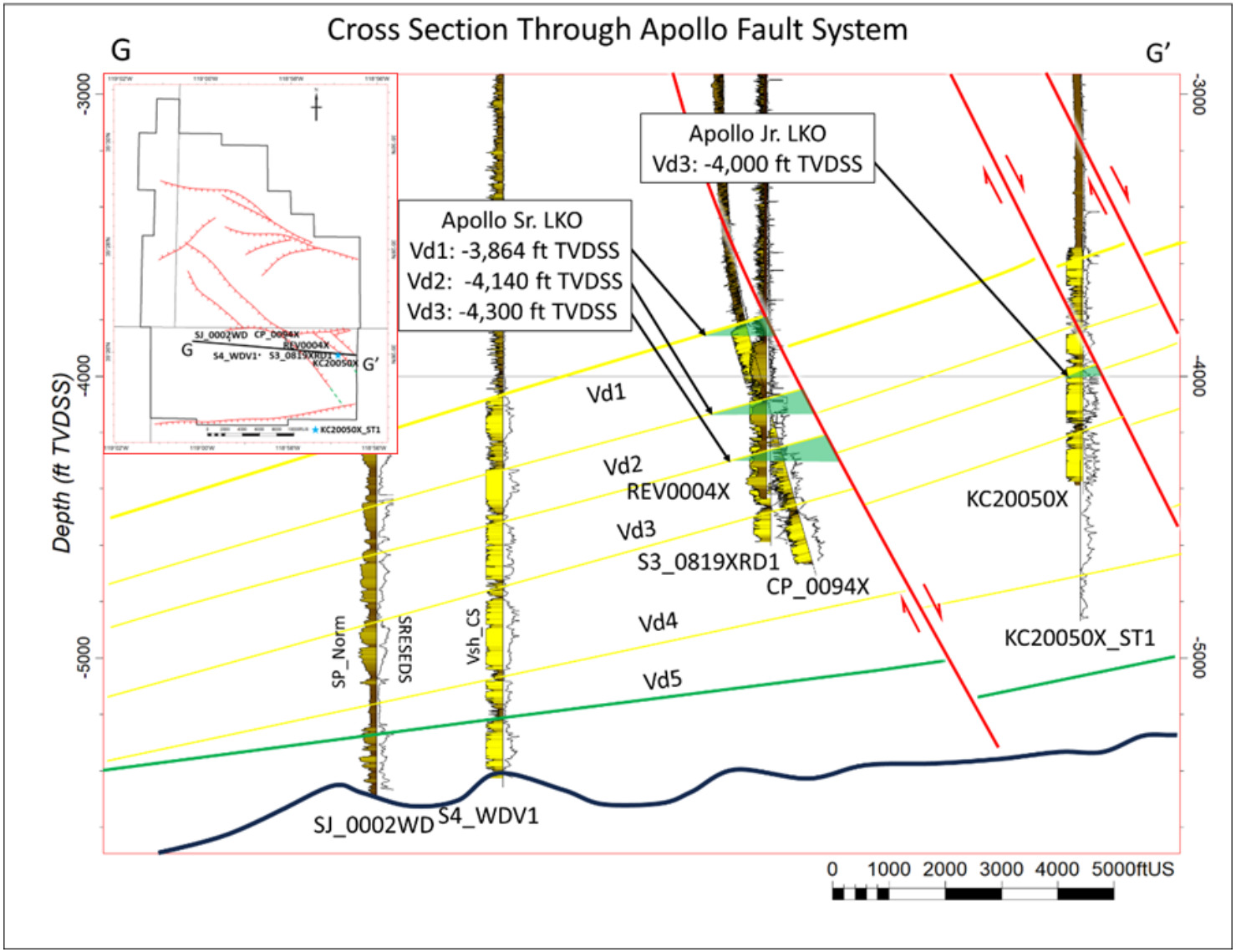

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24. *Chevron utilized legacy well logs, whole core, and sidewall core data (from wells mapped in Figures 5, 59, and 60 and provided in Appendices A, B, and C in the Narrative) in addition to mapping from 3D seismic data to characterize the depth, thickness, porosity, and permeability of the injection and confining zones. These values were summarized in Table 7 in the Narrative.* ***Please indicate which wells on Figures 59 and 60 in the Narrative have core data, logs, or both.***

Figures 59 and 60 illustrate the distribution of wells with core data for the Freeman-Jewett Silt and the Vedder Sand, respectively. All wells with core data have accompanying log data. For a list of specific logs by well please refer to Table 11.

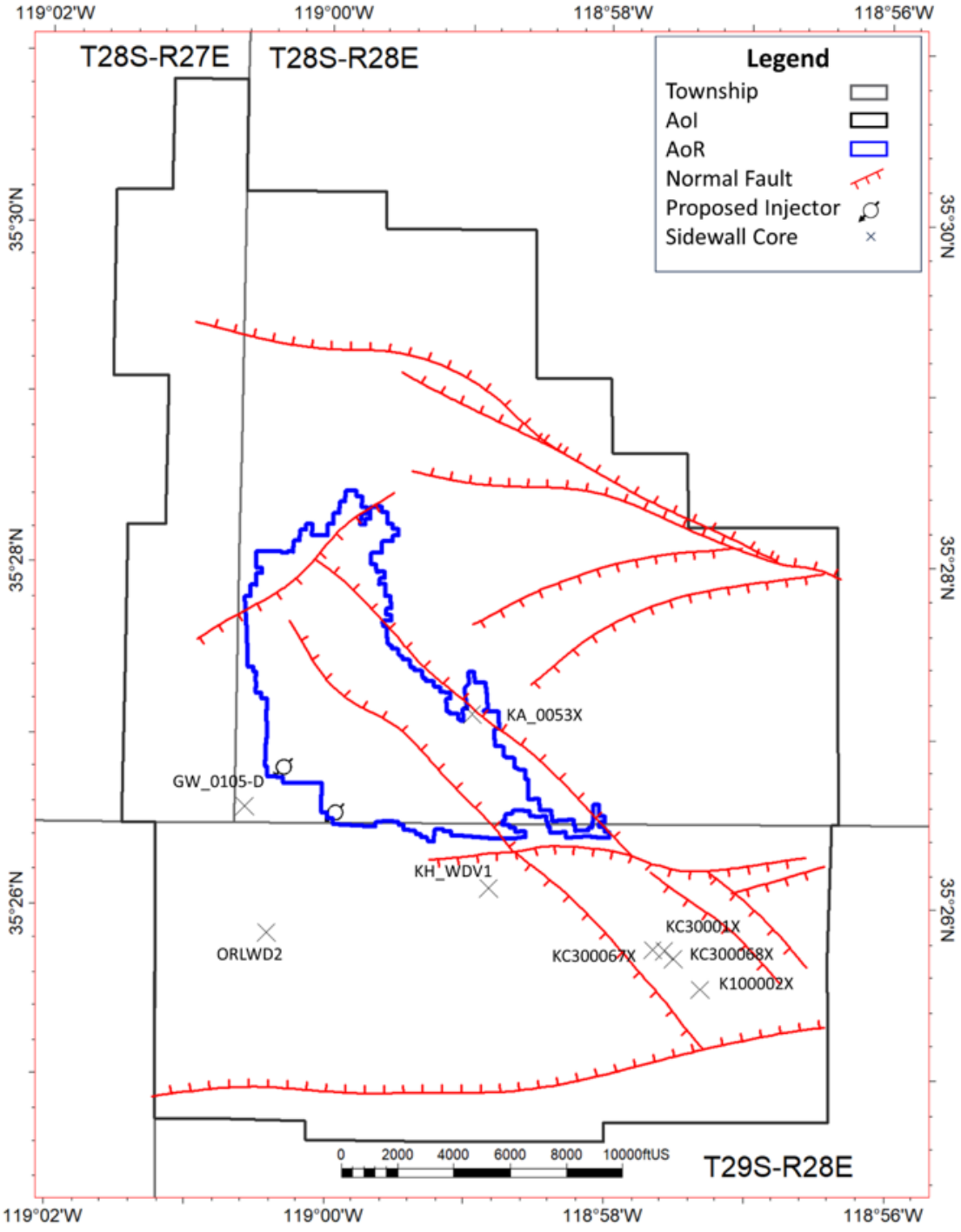

Figure 59. Location of sidewall core data used to characterize the Freeman–Jewett Silt primary seal.

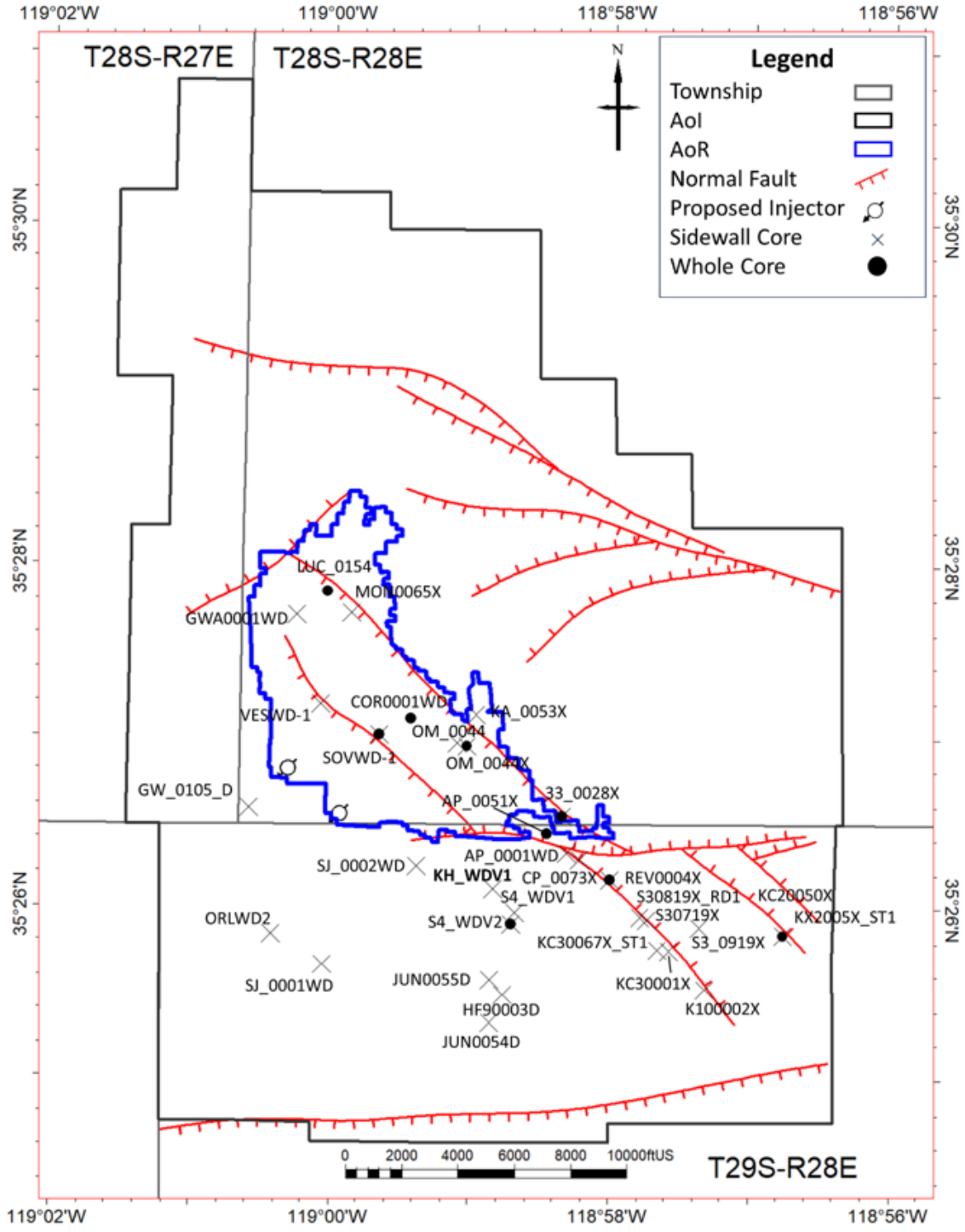

Figure 60. Location of wells with core data for the Vedder Sand.

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Table 11. Summary of existing borehole datasets for wells that penetrate the Vedder Sand. Asterisk (*) denotes the recently drilled well KC20050X_ST1.

Well Info		Core & Mineralogy Data				Well Log Data									Derived Logs				
API12	Well Name	Vedder Whole core	Vedder Sidewall	Freeman–Jewett Sidewall	Vedder XRD	SP	SRES	DRES	GR	RHOB	DPHI	NPHI	NMR	FMI	RQI	PHIE	PHIT	VSH	PERM
040292497300	3990001-11					X	X	X								X	X	X	X
040296721700	AP_0051X	X			X		X	X	X	X	X	X			X	X	X	X	X
040294479200	BIS0085					X	X	X		X									
040296771100	CP_0073X		X				X	X	X	X	X	X			X	X	X	X	X
040292631600	F280001					X	X	X											
040292411200	FEC0074					X	X	X											
040296110500	GWA0001WD		X			X	X	X											
040292697300	GWA0145					X	X												
040294934300	JUN0055D		X			X	X	X	X	X	X								
040296990300	KA_0053X		X	X		X	X	X	X	X	X	X			X	X	X	X	X
040290031800	KA_0071X					X	X	X											
040296989800	KC30001X		X	X		X	X	X	X	X	X	X			X	X	X	X	X
040292803800	LUC0154		X			X	X												
040292273800	MS_0113					X	X	X											
040290009800	OM_0044		X			X	X	X											
040296655800	OM_0044X	X	X		X	X	X	X	X	X	X	X			X	X	X	X	X
040292403700	SA_0001					X	X	X											
040295391100	SJ_0001WD		X			X	X	X											
040296110600	SJ_0002WD		X			X	X	X											
040301418200	SJ_0010WD					X	X	X	X	X	X	X	X		X	X	X	X	X
040301621700	SJ_0011WD					X	X	X	X	X	X	X			X	X	X	X	X
040296641100	33_0028X	X	X		X		X	X	X	X	X	X			X	X	X	X	X
040292887200	33_0058X					X	X	X											
040294423200	3990072C					X	X	X											
040296441200	AP_0001WD		X			X	X	X	X	X	X	X			X	X	X	X	X
040298942100	CHP00WD1					X	X	X	X	X									
040295678200	COR0001WD	X				X	X	X											
040306065200	KH_WDV1		X			X	X	X	X	X	X	X	X		X	X	X	X	X
040296758700	MON0065X		X			X	X	X	X	X	X	X			X	X	X	X	X

040306215900	ORLWD2		X	X		X	X	X	X	X	X	X	X			X	X	X	X	X
040296194100	S4_WDV1		X			X	X	X	X	X	X	X	X			X	X	X	X	X
040298201900	S4_WDV2	X	X			X	X	X	X	X	X	X	X			X	X	X	X	X
040305241300	S4_WDV3					X	X	X	X	X	X	X	X			X	X	X	X	X
040297837600	SOVWD-1	X	X			X	X	X	X	X	X	X	X			X	X	X	X	X
040297837500	VESWD-1		X					X		X	X	X	X			X	X	X	X	X
040296905500	BIS0224X					X	X	X	X	X	X	X	X			X	X	X	X	X
040297107500	BIS0225X					X	X	X	X	X	X	X	X			X	X	X	X	X
040297559102	KC30068XSTD					X	X	X	X	X	X	X								
040298795500	S3_0919X		X				X	X	X	X	X	X	X			X	X	X	X	X
040294247600	JUN0054D		X			X	X	X												
040304573400	CP_0094X					X	X	X	X	X	X	X	X			X	X	X	X	X
040297301700	ELW0100X					X	X	X	X	X	X	X	X			X	X	X	X	X
040294937400	HF90001D					X	X	X	X	X	X	X	X			X	X	X	X	X
040296906900	HF90003D					X	X	X												
040297205000	K100002X					X	X	X												
040304874500	KC20050X		X			X	X	X	X	X	X	X	X		X	X	X	X	X	X
040304874501	*KC20050X_ST1	X			X	X	X	X	X	X	X	X	X	X	X					
040297396900	KC30067X		X	X		X	X	X	X	X	X	X	X			X	X	X	X	X
040297396901	KC30067X_ST1					X	X	X	X	X	X	X								
040297393700	RIV0002-10					X	X	X												
040297135800	S3_0719X		X			X	X	X	X	X	X	X	X			X	X	X	X	X
040297371201	S3_0819XRD1		X			X	X	X	X	X	X	X	X			X	X	X	X	X
040296721701	AP_0051X_ST1					X	X	X	X	X	X	X								
040290026100	GW_0105-D		X	X		X	X	X												
040292215100	RAS0028																			
040296976200	REV0004X	X				X	X	X	X	X	X	X	X			X	X	X	X	X
040297371200	S3_0819X		X	X		X	X	X	X	X	X	X	X			X	X	X	X	X
040292404700	MTC0001					X	X	X												
040294034800	MTC0071X					X	X	X												
040292200100	BOS0001																			
040293200900	CCM0041					X	X													
040292404800	F280003					X	X	X												
040292689700	FOS0001					X	X	X												
040294615600	K120001					X		X												
040297559100	KC30068X		X	X		X	X	X	X	X	X	X	X			X	X	X	X	X
040297559101	KC30068XST					X	X	X	X	X	X	X								
040291846200	SBB0027					X	X													

040292620100	SEC21-D																		
040292402900	ZAN0001					X	X	X											
040292673800	ZAN0002					X	X												

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25. Please clarify if all of the wells in Figures 5, 59, and 60 in the Narrative penetrate to the lower confining zone. If not, please indicate on which formations they provide data.

40 wells, including the recently drilled KC20050X_ST1, penetrate the lower confining zone, the 5th Vedder interval. The remaining 30 wells on the figures are partial penetrations from the Freeman-Jewett Shale (upper confining zone) to the 4th Vedder interval.

See table below:

	Well Name	Formation TD	Penetrates Lower Confining Zone
1	040296771100	Walker	Y
2	AP_0051X	Walker	Y
3	BIS0085	Walker	Y
4	CP_0073X	Walker	Y
5	F280001	Walker	Y
6	FEC0074	Walker	Y
7	GWA0001WD	Walker	Y
8	GWA0145	Walker	Y
9	JUN0055D	Walker	Y
10	KA_0053X	Walker	Y
11	KA_0071X	Walker	Y
12	KC30001X	Walker	Y
13	LUC0154	Walker	Y
14	MS_0113	Walker	Y
15	OM_0044	Walker	Y
16	OM_0044X	Walker	Y
17	SA_0001	Walker	Y
18	SJ_0001WD	Walker	Y
19	SJ_0002WD	Walker	Y
20	SJ_0010WD	Walker	Y
21	SJ_0011WD	Walker	Y
22	33_0028X	Famoso	Y
23	33_0058X	Famoso	Y
24	3990072C	Famoso	Y

25	AP_0001WD	Famoso	Y
26	CHP00WD1	Famoso	Y
27	COR0001WD	Famoso	Y
28	KH_WDV1	Famoso	Y
29	MON0065X	Famoso	Y
30	ORLWD2	Famoso	Y
31	S4_WDV1	Famoso	Y
32	S4_WDV2	Famoso	Y
33	S4_WDV3	Famoso	Y
34	SOVWD-1	Famoso	Y
35	VESWD-1	Famoso	Y
36	KC20050X_ST1	Famoso	Y
37	BIS0224X	5th Vedder	Y
38	BIS0225X	5th Vedder	Y
39	KC30068XSTD	5th Vedder	Y
40	S3_0919X	5th Vedder	Y
41	JUN0054D	4th Vedder	N
42	CP_0094X	3rd Vedder	N
43	ELW0100X	3rd Vedder	N
44	HF90001D	3rd Vedder	N
45	HF90003D	3rd Vedder	N
46	K100002X	3rd Vedder	N
47	KC20050X	3rd Vedder	N
48	KC30067X	3rd Vedder	N
49	KC30067X_ST1	3rd Vedder	N
50	RIV0002-10	3rd Vedder	N
51	S3_0719X	3rd Vedder	N
52	S3_0819XRD1	3rd Vedder	N
53	AP_0051X_ST1	2nd Vedder	N
54	GW_0105-D	2nd Vedder	N
55	RAS0028	2nd Vedder	N
56	REV0004X	2nd Vedder	N
57	S3_0819X	2nd Vedder	N
58	MTC0001	1st Vedder	N
59	MTC0071X	1st Vedder	N
60	BOS0001	Freeman_Jewett	N
61	CCM0041	Freeman_Jewett	N
62	F280003	Freeman_Jewett	N
63	FOS0001	Freeman_Jewett	N

64	K120001	Freeman_Jewett	N
65	KC30068X	Freeman_Jewett	N
66	KC30068XST	Freeman_Jewett	N
67	SBB0027	Freeman_Jewett	N
68	SEC21-D	Freeman_Jewett	N
69	ZAN0001	Freeman_Jewett	N
70	ZAN0002	Freeman_Jewett	N

26. *Permeability for the Freeman-Jewett Silt is based on nuclear magnetic resonance (NMR) data taken from Chevron's KH_WDVl reference well (located within 1.1 miles of the project site), showing horizontal and vertical permeability averages 0.784 mD and 0.001147 mD, respectively. Average porosity over the Freeman-Jewett Silt at the reference well is 21%. Chevron proposes to collect additional information to refine the Freeman-Jewett Silt porosity and permeability as outlined in their Pre-Operational Testing Plan.* ***For clarity, when referencing a well, please describe its distance from the AoR.***

KH_WDV1 is approximately 0.3 miles from the AoR. To provide a spatial understanding of the relative position of Wells, AoR, and AoI, a scale bar has been included for maps showing well locations along with the outlines of the AoR and AoI.

27. *Page 97 of the Narrative references well AP_0051X and 33_0028X as within the AoR and OM_0044X as within the AoI. In Figure 5 in the Narrative, this appears to be the opposite.* ***Please clarify the discrepancy.***

Figure 5 in the Narrative accurately represents the location of the three wells. The text should read, "Vedder Sand mineralogy data from x-ray diffraction (XRD) measurements includes one (1) well within the AoR (OM_0044X, API# 040296655800) and an additional two (2) wells within the AoI (AP_0051X, API# 040296721700; 33_0028X, API# 040296641100).

Geomechanical and Petrophysical Information

28. *No geomechanical characterization of the Freeman-Jewett Silt was provided.* ***Please provide a summary of the geomechanical information on fractures, stress, ductility, rock strength, and in situ fluid pressures within the Freeman-Jewett Silt.***

No geomechanical data based on whole rock analysis exists for the Freeman-Jewett Silt in the AoR or AoI. The project expects to collect this data as part of the pre-operational logging and testing program.

Hydrologic and Hydrogeologic Information

29. *The Santa Margarita is the lowermost USDW in the AoR and consists of marine sandstone interbedded with shale. More than 2,500 ft of overburden exists between the top of the Vedder Sand injection zone and the base of the Santa Margarita. The Santa Margarita has an average porosity of 31% and an average permeability of 400 mD. Chevron states that "historical records" indicate a TDS ranging from 490 to 1,584 mg/L for the Santa Margarita within the AoI. The source of this information is unclear.* ***Please identify the source of the TDS data for the Santa Margarita formation.***

The Santa Margarita salinity information is sourced from a March 7, 2017 letter from the California Geologic Energy Management Division (then referred to as the California Division of Oil, Gas, and Geothermal Resources) to the United States Environmental Protection Agency regarding the 11 historically treated as exempt aquifers. A copy of the letter is included as Appendix 1 of this document. Page 22 of this letter sites salinity samples ranging from 490 mg/l – 1,584 mg/l TDS taken from wells KCL – 10 Well #2X (API# 040297205000) and Rambler 71 W (API# 040290026900).

Site Suitability

30. *The total storage capacity of the Vedder Sand injection zone is between 0.9 to 3.6 billion tons of CO2 across the San Joaquin basin according to a study by Lawrence Berkeley National Laboratory (LBNL). However, specific storage capacity at the project site is not described in the Narrative.* ***Please describe the total storage capacity of the injection zone at the project site, and how this was estimated.***

The total storage capacity of the injection zone at the project site is approximately 325 million tonnes based on a volumetric calculation that includes areal extent of the reservoir, thickness of the reservoir, net to gross, porosity, mobile fluid saturation, CO_2 density, and a storage efficiency factor.

CO_2 Storage Capacity = Area * Reservoir Thickness * Net to Gross * Porosity * Mobile Fluid Saturation * CO_2 Density * Storage Efficiency Factor

31. *As noted in the summary above, Chevron partnered with LBNL to compile their site-specific data into the TOUGHREACT geochemical simulator with the ECO2n V2.0 equation-of-state module. Input parameters and data are provided in Tables 16-18 in the Narrative. The distribution of porosity and permeability values input to the model is provided in Figure 91 in the Narrative. Using TOUGHREACT, a 2D radial model was created to simulate CO2 movement, pH changes, and dry out during CO2 injection over the course of the 20-year injection period with a minimum timestep of 1 second. The study concludes that little to no significant geochemical reaction will occur between the rock formations, the injected CO2, injected impurities, and the in-situ*

brine. The geochemical modeling does not consider the 50-year post-injection site care (PISC) period. ***Please provide the results of the geochemical modeling over the PISC period.***

Results from the injection phase indicated no significant adverse fluid-rock interactions. Additionally, based on the injectate and rock composition there is no reason to expect any adverse fluid-rock interactions. Therefore, it was not deemed necessary to extend the model timeline.

Site Geomodel

32. *The AoR and Corrective Action Plan refers to wells S3_0819X_ST1 (API #040297371201) and KCL20050X (API #040304874500); however, these wells do not appear elsewhere in the application. EPA believes these may be S3_0819X or S3_0819XRD1 and KC20050X.* ***Please clarify the names of S3_0819X_ST1 and KCL20050X and add them to all appropriate figures and tables.***

These discrepancies are typographical errors. The table provided below provides the correct Well Names and API 12s.

Well Name	API 12
S3_0819XRD1	040297371201
KC20050X_ST1	040304874501
KC20050X	040304874500

- On page 121 of the Narrative, under Geomechanical and Petrophysical Information, KCL20050X_ST1 can be corrected to KC20050X_ST1 (#040304874501).
- On page 32 of the AOR and Corrective Action Plan, under Initial Conditions, S3_0819X_ST1 is referenced in Table 7 and can be corrected to (#040297371201).
- On page 37 of the AOR and Corrective Action Plan, under Fracture Pressure and Fracture Gradient, KCL20050X can be corrected to KC20050X (#040304874500).

Pre-Operational Testing Objectives

While the application provides some site-specific data points for the injection and confining zones, additional data collection (logging and testing proposed by Chevron) is needed to reduce uncertainty in the site characterization and modeling inputs that will be needed prior to final authorization to inject. Chevron's pre-operational testing will include coring programs and additional geophysical analysis of the injection zone,

confining zone, and lowermost Underground Source of Drinking Water (USDW) within the AoR. In the Pre-Operational Logging and Testing section of the Narrative, Chevron describes the testing that it proposes to perform to meet the requirements of 40 CFR §146.87, specifically to characterize the depth, thickness, minerology, lithology, porosity, permeability, and geomechanical properties of the injection zone and the upper and lower confining zones. Based on the data gaps identified in the evaluation, EPA has identified additional preoperational testing objectives (listed below) that will help address the uncertainties. These objectives should be addressed via the testing that Chevron proposes to perform.

- Identify site-specific porosity, permeability, mineral composition, and petrophysical characteristics of the injection and upper/lower confining zones at the location of each injection well.
    - Chevron plans to collect RHOB, NPHI, NMR and FMI logs across both the injection and confining zones at each injection well. The RHOB and NPHI logs will enable characterization of site-specific porosity, and the NMR logs will enable characterization of site-specific permeability. The FMI borehole imaging logs will enable the characterization of lithofacies that can be calibrated to FMI logs at the stratigraphic well and compared to core taken from the stratigraphic well. This will enable characterization of the mineral composition of the various lithofacies. Collectively this logging suite in combination with the additional data collection detailed in Table 2 below enable a thorough petrophysical characterization of the injection and confining zones at each injection well.
- Determine the fracture gradient of the injection zone and confining zones.
    - In addition to the step rate test conducted at the stratigraphic well, which determined the fracture gradient for the injection zone, Chevron plans to perform an injection test at each injection well, which will validate that operations will remain below the fracture gradient. Stress tests conducted in the deep monitoring wells will characterize the fracture gradient of the confining zone. Additionally, leak-off tests and/or formation integrity tests conducted during drilling operations will characterize the fracture gradient of the confining zone.
- Calibrate the sealing capacity of the faults located within the AoR and confirm there are no other faults or fractures in the injection zone and confining zones.
    - A detailed description of the pressure transient analysis is provided in the AoR and Corrective Action Plan document. This testing program was used to calibrate faults within and adjacent to the AoR. In addition to this data, a fall off test will be conducted on the injection wells and FMI borehole imaging logs will be collected at the injection wells. These two pieces of data will provide additional characterization of any faults and fractures in the injection and confining zones.

- Enhance characterization of the geomechanical properties of the injection and confining zones.
    - Stress tests, injectivity tests, dipole sonic logs, and FMI borehole imaging logs in combination with the standard logging suite listed in Table 2 below will provide additional characterization of the geomechanical properties of the injection and confining zones. Additionally, geomechanical tests are being conducted on the core collected in the stratigraphic well. Chevron plans to provide this data as part of the drilling and data reports prior to authorization to inject.
- Characterize the baseline geochemistry (including Total Dissolved Solids (TDS)) of the injection and confining zones and the Olcese Sand and Santa Margarita Formations and provide information to demonstrate compatibility of the formation fluids and rock with injected CO2. The Olcese Sand Formation is immediately above the Freeman-Jewett Silt Formation (i.e., the upper confining zone).
    - Chevron plans to collect baseline fluid samples from the injection wells and fluid sampling wells. These samples will provide geochemical data across the injection zone, the Olcese Sand, and the Santa Margarita Formation.
- Confirm initial reservoir conditions assumed in the geomodel, e.g., formation pressure and temperature.
    - Prior to injection, initial formation pressure and temperature will be collected in the injection zone via a downhole pressure and temperature gauge. Details for the gauge can be found in the testing and monitoring plan document.

Chevron U.S.A.
1500 Louisiana Street
Houston, TX 77002

Table 2. Summary of pre-operational testing program. All wireline logs, denoted by an "X", will be run as deep as possible in the open hole section of the deepest string. Whole core, formation pressures (RDT), fluid samples (MDT), stress tests, pressure transient analysis (PTA, and injectivity/pressure fall off tests (Inj Test) will be collected for specific zones (SM = Santa Margarita Sandstone, OL = Olcese Sand, FJ = Freeman-Jewett Silt, V = Vedder Sand). For more information on the stratigraphic intervals see the Site Characterization Section of the Project Narrative.

Well Information			Core	Formation Testing					Basic Logging Suite							Advanced Logging Suite		
Well Name	**Well Type**	**Deepest Zone**	**Whole Core**	**RDT (Pressure)**	**MDT (Samples)**	**Stress Test**	**PTA**	**Inj Test**	**GR**	**RES**	**SP**	**RHOB**	**NPHI**	**Dielectric**	**Caliper**	**NMR**	**FMI**	**Dipole Sonic**
KC20050X_ST1	Stratigraphic	Famoso	V	V			V	V	X	X	X	X	X	X	X	X	X	X
ANO9004INJ	CO_2 Injector	Vedder		SM, V	SM, V			V	X	X	X	X	X	X	X	X	X	X
MC19001INJ	CO_2 Injector	Vedder		SM, V	SM, V			V	X	X	X	X	X	X	X	X	X	X
RCA9001OB	Deep Monitoring	Vedder							X	X	X	X	X	X	X			
COR9001OB	Deep Monitoring	Vedder	FJ			FJ			X	X	X	X	X	X	X	X	X	X
HK_9001OB	Deep Monitoring	Vedder	FJ			FJ			X	X	X	X	X	X	X	X	X	X
DDA9001OB	Deep Monitoring	Vedder							X	X	X	X	X	X	X			
ANO9001B	Shallow Monitoring	St. Margarita							X	X	X	X	X	X	X			
ANO9003OB	Shallow Monitoring	Olcese							X	X	X	X	X	X	X			
GW_9001OB	Shallow Monitoring	St. Margarita							X	X	X	X	X	X	X			
GW_9002OB	Shallow Monitoring	Olcese							X	X	X	X	X	X	X			
KER9001OB	Shallow Monitoring	St. Margarita							X	X	X	X	X	X	X			
IR_9001OB	Shallow Monitoring	St. Margarita							X	X	X	X	X	X	X			

Chevron U.S.A.
1500 Louisiana Street
Houston, TX 77002

Appendix 1: March 7, 2017 letter from the California Geologic Energy Management Division (then referred to as the California Division of Oil, Gas, and Geothermal Resources) to the United States Environmental Protection Agency regarding the 11 historically treated as exempt aquifers.

State of California • Natural Resources Agency
Department of Conservation
Division of Oil, Gas, and Geothermal Resources
801 K Street • MS 18-05
Sacramento, CA 95814
(916) 445-9686 • FAX (916) 319-9533

Edmund G. Brown Jr., *Governor*
Kenneth A. Harris Jr., *State Oil and Gas Supervisor*

March 7, 2017

Mr. Michael Montgomery
United States Environmental Protection Agency – Region IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Dear Mr. Montgomery:

By letter of March 9, 2015, the United States Environmental Protection Agency (US EPA) directed the Division of Oil, Gas, and Geothermal Resources (Division) to evaluate eleven aquifers that were historically treated as exempt to determine whether available data would support an aquifer exemption proposal for any of these aquifers or portions thereof. The Division, with concurrence from the State Water Resources Control Board (State Water Board), has completed its evaluation and has determined that the eleven aquifers should not be considered exempt, except with respect to the portions of the Walker Formation and Santa Margarita Formation that were exempted under the recently approved Round Mountain and Fruitvale aquifer exemptions, and except with respect to any portion(s) that the State identifies for exemption and US EPA approves in the future as the result of an exemption proposal. The Division hereby requests that US EPA enter into the addendum (attached hereto as Enclosure A) to the 1982 Underground Injection Control Program Memorandum of Agreement between the Division and US EPA for the purpose of clarifying the current, non-exempt status of the eleven aquifers.

By its terms, the addendum would not preclude future consideration of new exemption proposals or changes in exemption status for these aquifers. If the Division in the future receives new information establishing that any of these aquifers (or portions thereof) meet the exemption criteria and are appropriate for injection, the Division may elect to submit an aquifer exemption proposal to US EPA following the required legal procedure. This is important to note in part because the Division has formally requested in separate correspondence that US EPA approve an aquifer exemption for portions of one of the eleven aquifers (the Walker Formation underlying the Round Mountain Field). While the addendum to the Memorandum of Agreement is not intended to preclude or affect in any way US EPA's consideration of that exemption proposal, the Division nevertheless requests that the aquifer's current status be clarified along with the others as non-exempt unless and until, and only so far as, US EPA approves an exemption for the aquifer.

The Division's determinations and request for formal clarification regarding these eleven aquifers is the result of an evaluation of available water quality data for these formations (attached hereto as Enclosure B). The Division made this data its preliminary assessments available on November 15, 2016 for a 30-day public comment period, which included a public comment hearing on December 14, 2016. A copy of the November 15, 2016 public notice is attached hereto as Enclosure C. The public comments received did not change the Division's determination to request this clarifying addendum from US EPA. The Division's comment summaries and responses are attached hereto as Enclosure D.

If you have questions or wish to discuss this matter, please contact me at (916) 323-1777 or by email at Ken.Harris@conservation.ca.gov.

Sincerely,

Kenneth A. Harris Jr.,
State Oil and Gas Supervisor

Enclosures:

Enclosure A: Addendum to Underground Injection Control Program Memorandum of Agreement Between California Division of Oil, Gas, and Geothermal Resources and the United States Environmental Protection Agency Region 9.

Enclosure B: Preliminary assessment of the eleven aquifers historically treated as exempt.

Enclosure C: November 15, 2016 notice of public comment and hearing.

Enclosure D: Division's public comment summaries and responses.

ADDENDUM to

Underground Injection Control Program
Memorandum of Agreement
Between
California Division of Oil, Gas, and Geothermal Resources
and
the United States Environmental Protection Agency Region 9

Whereas the California Division of Oil, Gas, and Geothermal Resources ("Division") and the United States Environmental Protection Agency ("EPA") (collectively, the "Parties") desire to clarify, as specified below, that eleven aquifers are not exempted aquifers for purposes of the Safe Drinking Water Act, the Parties hereby agree to the following Addendum to the Underground Injection Control Program Memorandum of Agreement signed by the Parties on September 28, 1982 and September 29, 1982 ("1982 Agreement"):

1. Notwithstanding any prior statement or attachment to the 1982 Agreement or historical practice to the contrary, the following aquifers are not exempted aquifers except with respect to any portion(s) that the State identifies for exemption and EPA approves as exempt as a result of a future exemption proposal:

    - The Pico Formation underlying the boundaries of the South Tapo Canyon Field;
    - The Tumey Formation underlying the boundaries of the Blackwell's Corner Field;
    - The Kern River Formation underlying the boundaries of the Kern Bluff Field;
    - The Santa Margarita Formation underlying the boundaries of the Kern Front Field, except for portions exempted by the Fruitvale aquifer exemption;
    - The Chanac Formation underlying the boundaries of the Kern River Field;
    - The Santa Margarita Formation underlying the boundaries of the Kern River Field;
    - The Walker Formation underlying the boundaries of the Mount Poso Field;
    - The Olcese Formation underlying the boundaries of the Round Mountain Field;
    - The Walker Formation underlying the boundaries of the Round Mountain Field, except for portions exempted by the Round Mountain aquifer exemption;
    - All aquifers underlying the boundaries of the Bunker Gas Field that are not in a hydrocarbon-producing zone; and
    - All aquifers underlying the boundaries of the Wild Goose Field that are not in a hydrocarbon-producing zone

2. This Addendum does not preclude future consideration of exemption proposals, or changes to exemption status following the applicable legal procedure, for the above aquifers or portions thereof.

3. All other terms and conditions of the Agreement remain unchanged and in effect.

4. The effective date of this Addendum shall be the date of execution.

_____	_____
Alexis Strauss Acting Regional Administrator Environmental Protection Agency Region 9	Kenneth A. Harris Jr. State Oil and Gas Supervisor California Division of Oil, Gas, and Geothermal Resources
_____	_____
Date	Date

Division of Oil, Gas, and Geothermal Resources

Preliminary Assessment of Eleven Aquifers Historically Treated as Exempt

July 15, 2015

Executive Summary

The Division of Oil, Gas and Geothermal Resources has made a preliminary evaluation of whether current data support a determination that the eleven aquifers historically treated as exempt currently meet the criteria for an aquifer exemption.

The eleven aquifers historically treated as exempt, and significant relevant data for each, are as follows:

- The **South Tapo Canyon** field - the **Pico** formation (no longer being used);

  Injection Wells: 0 TDS: 1,900 ppm NaCl Depth: 0-1,000'

- The **Blackwell's Corner** field - The **Tumey** formation (no longer being used);

  Injection Wells: 0 TDS: 2,100 -2,600 mg/l Depth: 945' – 1,473'

- The **Kern Bluff** field – the **Kern River** formation (no longer being used);

  Injection Wells: 0 TDS: 400 – 900 mg/l Depth: 0-200'

- The **Kern Front** field – the **Santa Margarita** formation;

  Injection Wells: 13 TDS: 460 – 2,318 mg/l Depth: 2,197' – 2,840'

- The **Kern River** field -the **Chanac** formation;

  Injection Wells: 12 TDS: 926 – 3,325 mg/l Depth: 425' – 1,335'

- The **Kern River** field – the **Santa Margarita** formation;

  Injection Wells: 32 TDS: 490 – 1,584 mg/l Depth: 760' – 2,285'

- The **Mount Poso** field – the **Walker** formation;

  Injection Wells: 5 TDS: 1,069 mg/l Depth: 1,740' – 1,796'

- The **Round Mountain** field – the **Olcese** formation;

  Injection Wells: 6 TDS: 2,693 mg/l Depth: 710' – 850'

- The **Round Mountain** field - the **Walker** formation;

  Injection Wells: 30 TDS: 2,335 mg/l Depth: 1,890' – 2,590'

- The **Bunker Gas** field - **all aquifers** within the field that are not in a hydrocarbon producing zone (no longer being used);

  Injection Wells: 0 TDS: 1,215 mg/l Depth: 3,000'

- The **Wild Goose** field - **All aquifers** within the field that are not in a hydrocarbon producing zone (no longer being used);

  Injection Wells: 0 TDS: 2,800 -5,000* mg/l Depth: 2,700' - 3,400'

  *More recent analysis indicate TDS around 24,000 mg/l

Key portions of the above data, in spreadsheet form:

Historically Treated as Exempt Aquifers Snapshot						
Field	Formation	Number of Active Injection Wells	Total Dissolved Solids of Formation	Total Disolved Solids of Injected Fluid	Depth	Historic Volumes Injected Since 1983 in Barrels
South Tapo Canyon	Pico	0	1,900 ppm NaCl	600 ppm NaCl	1,000'	0
Blackwell's Corner	Tumey	0	2,100 - 2,600 mg/l	29,000 ppm NaCl	945' - 1,475'	2,425
Kern Bluff	Kern River	0	400 - 900 mg/l	600 mg/l	200	5,816,190
Kern Front	Santa Margarita	13	460 - 2,318 mg/l	360 - 6,400 mg/l	2,197' - 2,840'	151,820,215
Kern River	Chanac	12	926 -3,325 mg/l	491 - 2,000 mg/l	425' - 1,335'	568,987,463
Kern River	Santa Margarita	32	490 - 1,584 mg/l	491 -74,924 mg/l	760' - 2,285'	799,041,272
Mount Poso	Walker	5	1,069 mg/l	650 mg/l	1,740' - 1,796'	63,777,556
Round Moutain	Olcese	6	2,693 mg/l	1,900 mg/l	710' - 850'	160,798,008
Round Mountain	Walker	30	2,335 mg/l	1,600 - 2,900 mg/l	1,890' - 2,590'	1,529,910,014
Bunker	Undifferentiated	0	1,215 mg/l	10,675 - 11,025 ppm Chloride	3,000'	51,454
Wild Goose	Undifferentiated	0	24,349 mg/l	24,349 mg/l	2,700' - 3,400'	0

Division of Oil, Gas, and Geothermal Resources

Preliminary Assessment of Eleven Aquifers Historically Treated as Exempt

July 15, 2015

The US EPA, State Water Board, and the Division have agreed that the State will submit an evaluation of each of the 11 Historically Treated as Exempt (HTAE) aquifers with a preliminary assessment as to whether current data would support a determination that the criteria for an aquifer exemption are met.

11 HTAE aquifers historically treated as exempt are as follows:

- The **Pico** formation within the boundaries of the **South Tapo Canyon** field (no longer being used);
- The **Tumey** formation within the boundaries of the **Blackwell's Corner** field (no longer being used);
- The **Kern River** formation within the boundaries of the **Kern Bluff** field;
- The **Santa Margarita** formation within the boundaries of the **Kern Front** field;
- The **Chanac** formation within the boundaries of the **Kern River** field;
- The **Santa Margarita** formation within the boundaries of the **Kern River** field;
- The **Walker** formation within the boundaries of the **Mount Poso** field;
- The **Olcese** formation within the boundaries of the **Round Mountain** field;
- The **Walker** formation within the boundaries of the **Round Mountain** field;
- **All aquifers** within the **Bunker Gas** field that are not in a hydrocarbon producing zone and that have groundwater that has less than 10,000 TDS (no longer being used); and
- **All aquifers** within the **Wild Goose** field that are not in a hydrocarbon producing zone and that have groundwater that has less than 10,000 TDS (no longer being used).

More detail on each aquifer is set out below.

South Tapo Canyon Field, Pico Zone, Ventura District

1) Number of disposal wells permitted in the zone:
   0

2) Number of active producers:
   0

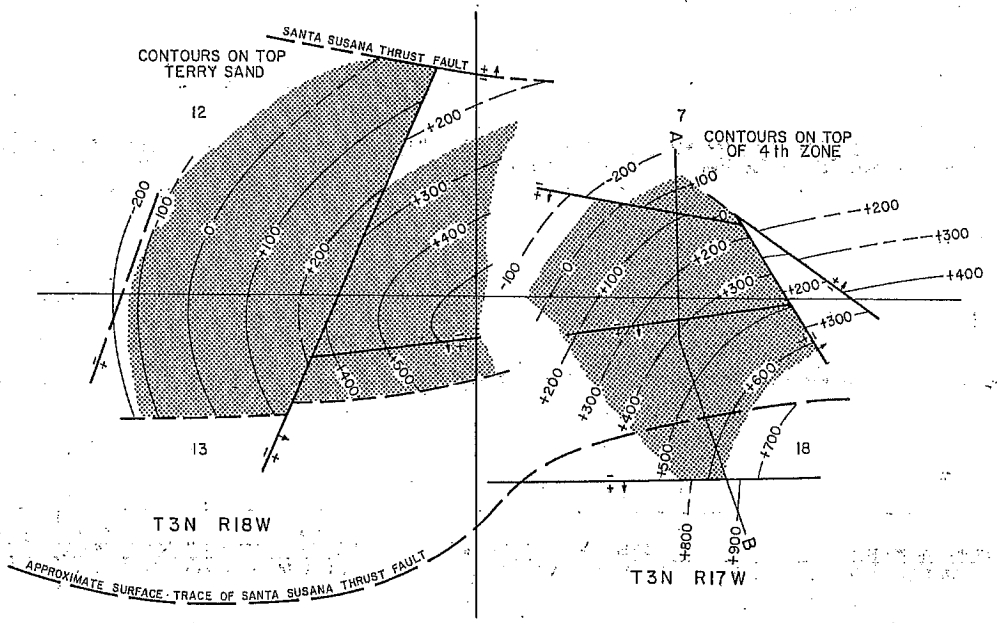
3) Depth of the zone across the field:
   At the surface on the south side of the field to 1,000' below surface depth on the north side. There are opposing thrust faults therefore, there is a wide range in zone depth across the field. Zone dips to the north across the field. This is based on the data sheet.

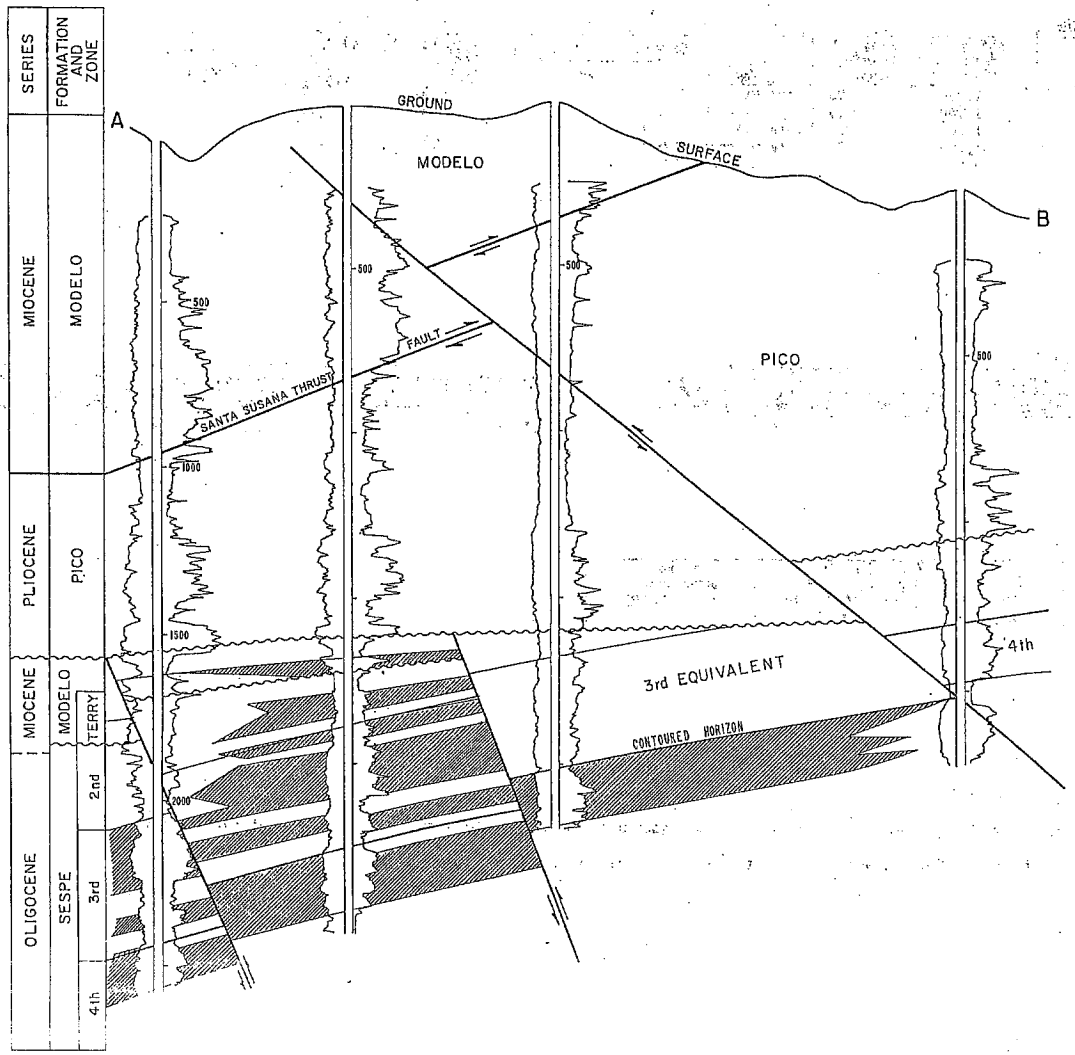
4) Volumes Injected Historically since 1983:
   None. District confirmed that there is no documentation that injection ever historically occurred in the Pico zone. The 5/17/1985 EPA letter contradicts this and indicates that injection did occur starting in 1948 and 1,903,000 Bbls was historically injected in this zone.

5) TDS of zone:
   1,900 ppm NaCl according to 5/17/1985 EPA letter

6) TDS of injection water:
   600 ppm NaCl according to the 5/17/1985 EPA letter

SOUTH TAPO CANYON OIL FIELD





LOCATION: 32 miles northeasterly of Ventura

TYPE OF TRAP: Faulted anticline

ELEVATION: 2,440

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production Oil (bbl)	Initial daily production Gas (Mcf)	Date of completion
Terry	Crown Central Petroleum Corp. "Tapo" 2	Terry and Jensen "Tapo" 2	13 3N 18W	SB	720	100	Feb 1953
2nd Sespe	Union Oil Co. of Calif. "South Tapo-Gillibrand" 11-7	Union Oil Co. of Calif. "Simi" 11-7	7 3N 18W	SB	99	411	Jul 1954
3rd Sespe	Same as above	Same as above	7 3N 18W	SB	*	*	Jul 1954
4th Sespe	Same as above	Same as above	7 3N 18W	SB	*	*	Jul 1954

Remarks: * Initial production from the 2nd, 3rd and 4th Sespe zones was commingled.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Havenstrite Oil Co. "Tapo" 1	Same	Jan 1949	13 3N 18W	SB	8,394	Llajas	Eocene

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Terry	2,200	60	Miocene	Modelo	32	*90	II
2nd Sespe	1,800	70	Oligocene	Sespe	18	1,030	II
3rd Sespe	1,880	220	Oligocene	Sespe	18	1,030	II
4th Sespe	2,200	180	Oligocene	Sespe	18	1,030	II

PRODUCTION DATA (Jan. 1, 1974)

1973 Production: Oil (bbl)	1973 Production: Net gas (Mcf)	1973 Production: Water (bbl)	1973 Proved acreage	1973 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
40,260	509	140,374	210	14	4,332,509	1,905,031	905,009	1953	50	35	240

STIMULATION DATA (Jan. 1, 1974)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 11 3/4" cem. 100; 7" combination string landed through zone and cemented through ports above zone.

METHOD OF WASTE DISPOSAL: All waste water is injected into a water-disposal well.

REMARKS: * Terry zone water is high in bicarbonates and total dissolved solids. A cyclic-steam project was started in 1964 and was discontinued in 1965 after the injection of 11,063 bbls. of water (in the form of steam).

REFERENCES: Hardoin, J.L., South Tapo Canyon Oil Field, Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 44, No. 1 (1958).

Blackwell's Corner Field, Tumey Zone, Bakersfield District office

1) Number of disposal wells permitted in the zone:
   0

2) Number of active producers:
   0

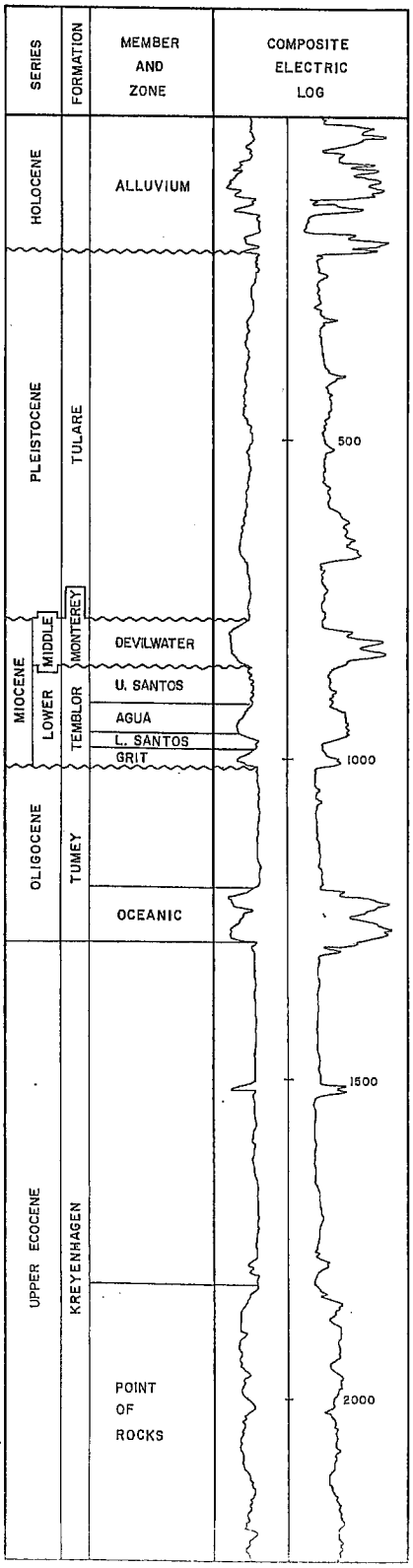
3) Depth of the zone across the field:
   945' to 1,473' below surface depth. Zone dips significantly to the Southeast across the field. Zone truncated by angular unconformity about ½ mile northwest of field.

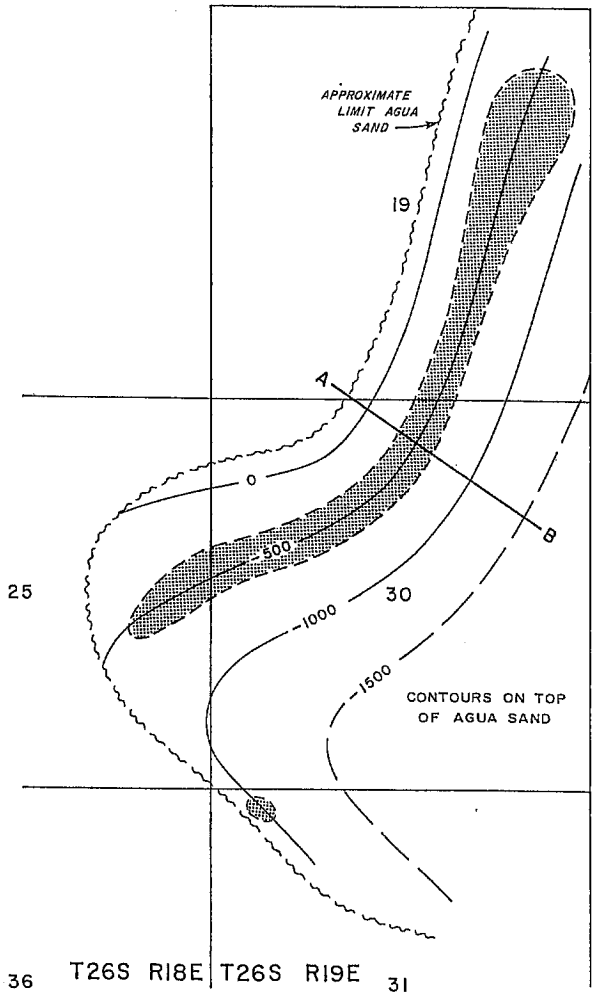
4) Volumes injected historically since 1983:
   2,425 Bbls, last injected on 5/1/1986

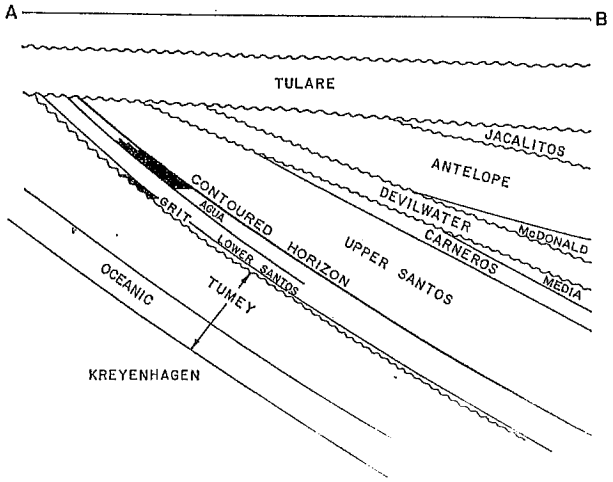
5) TDS of zone:
   Prior to injection 2,100 – 2,600 mg/l TDS (calculated) according to the 5/17/1985 EPA letter

6) TDS of injection water:
   29,000 ppm NaCl according to the 5/17/1985 EPA letter

BLACKWELLS CORNER OIL FIELD







LOCATION: 45 miles northwest of Taft

TYPE OF TRAP: Permeability barrier on an anticlinal nose

ELEVATION: 700

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production Oil (bbl)	Initial daily production Gas (Mcf)	Date of completion
Devilwater	General Crude Oil Co. Oper. "Occidental" 10	Etienne Lang "Occidental" 10-N.W. 30	30 26S 19E	MD	20	N.A.	Jun 1944
Agua	General Crude Oil Co. Oper. "Occidental" 3	Etienne Lang "Occidental" 3-N.W. 30	30 26S 19E	MD	50	N.A.	Dec 1943
Grit	General Crude Oil Co. Oper. "Occidental" 5	Etienne Lang "Occidental" 5-N.W. 30	30 26S 19E	MD	30	N.A.	Aug 1944

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
The Superior Oil Co. "O.L.C." 7	Same	Jul 1954	30 26S 19E	MD	3,224	Tumey	Oligocene

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Devilwater	700	25	middle Miocene	Temblor	13	N.A.	None
Agua	1,300	85	early Miocene	Temblor	14	790	None
Grit	1,400	5	early Miocene	Temblor	14	790	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
15,659	0	111,178	240	18	813,907	90,521	81,106	1946	63	38	250

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 7" cem. above zone; 5 1/2" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps.

REMARKS: Formerly known as Shale Hills Area.

REFERENCES: Karmelich, F.J., Blackwells Corner Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 37, No. 2 (1951).

Kern Bluff Field, Kern River Zone, Bakersfield District, East Side

1) Number of disposal wells permitted in the zone:
   0

2) Number of active producers:
   0

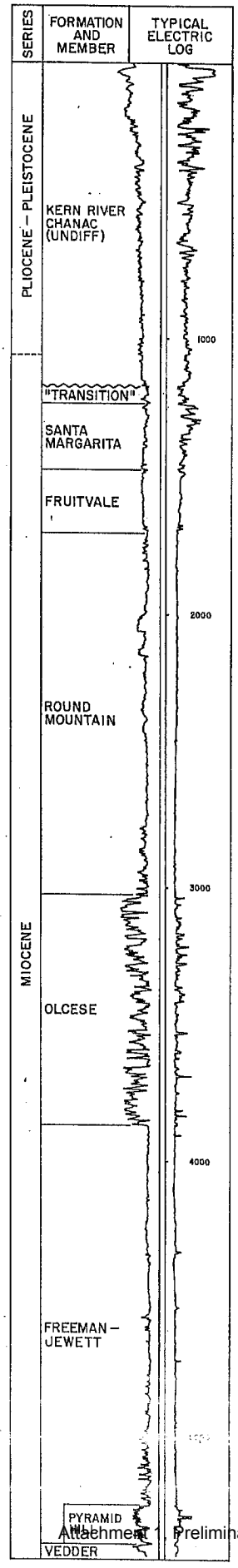
3) Depth of the zone across the field:
   Surface depth. Former WD well (API #02908849) uppermost perf is at 200' depth.

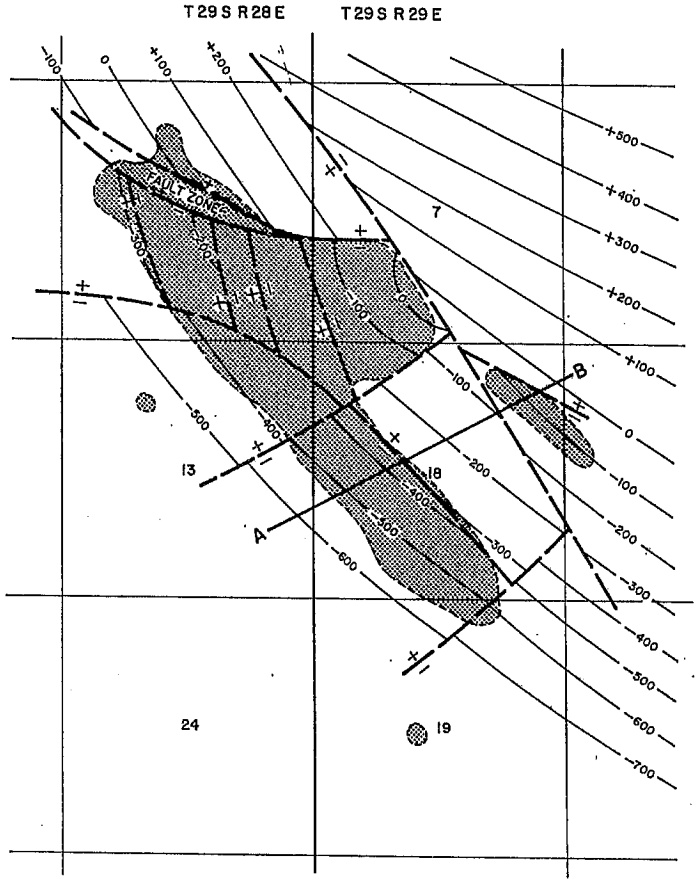
4) Volumes injected historically since 1983:
   5,816,190 Bbls, last injected on 6/1/1993

5) TDS of zone:
   400 – 900 mg/l according to the 5/17/1985 EPA letter

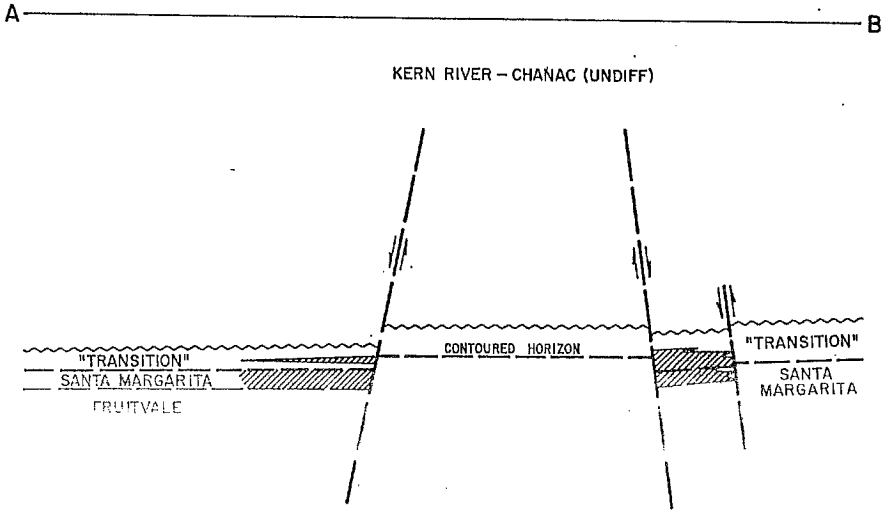
6) TDS of injection water:
   600 mg/l according to 5/17/1985 EPA letter

KERN BLUFF OIL FIELD





CONTOURS ON TOP OF SANTA MARGARITA



LOCATION: 6 miles northeast of Bakersfield

TYPE OF TRAP: Faulted homocline

ELEVATION: 800

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production Oil (bbl)	Initial daily production Gas (Mcf)	Date of completion
Transition	Shell Oil Co. "Afana" 1	Same as present	18 29S 29E	MD	18	N.A.	Feb 1944
Santa Margarita	Gulf Oil Corp. "Needham-Bloemer" 15	Oceanic Oil Co. "Needham-Bloemer" 1	7 29S 29E	MD	90	N.A.	Sep 1947

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Kernview Oil Co. "Muir" 13	Gene Reid Exploration Co. "Muir" 13	Feb 1949	18 29S 29E	MD	5,425	Vedder	early Mio

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Transition	740 - 1,350	30 - 80	late Miocene	Transition	14	5	None
Santa Margarita	950	55	late Miocene	Santa Margarita	14	5	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
216,477	0	3,365,718	670	131	9,410,522	0	845,373	1949	214	166	690

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
Cyclic-steam	1965	3,701,855	124

SPACING ACT: Applies

BASE OF FRESH WATER: 950

CURRENT CASING PROGRAM: 8 5/8" cem. above zone and across base of fresh-water sands; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Waste water is injected in disposal wells (808,148 bbls. in 1972), steam injection wells, and in unlined sumps where water quality meets Div. of Oil and Gas standards.

REMARKS:

REFERENCES: Corwin, C.H., Kern Bluff Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 36, No. 1 (1950).

Kern Front Field, Santa Margarita Zone, East Side Bakersfield District

1) Number of disposal wells permitted in the zone:
   13

2) Number of active producers:
   0

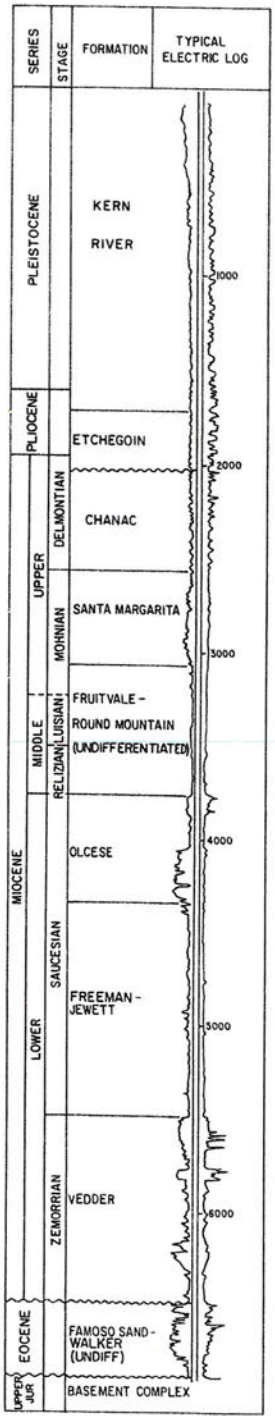
3) Depth of the zone where the injection wells are located:
   2,197' to 2,840' below surface

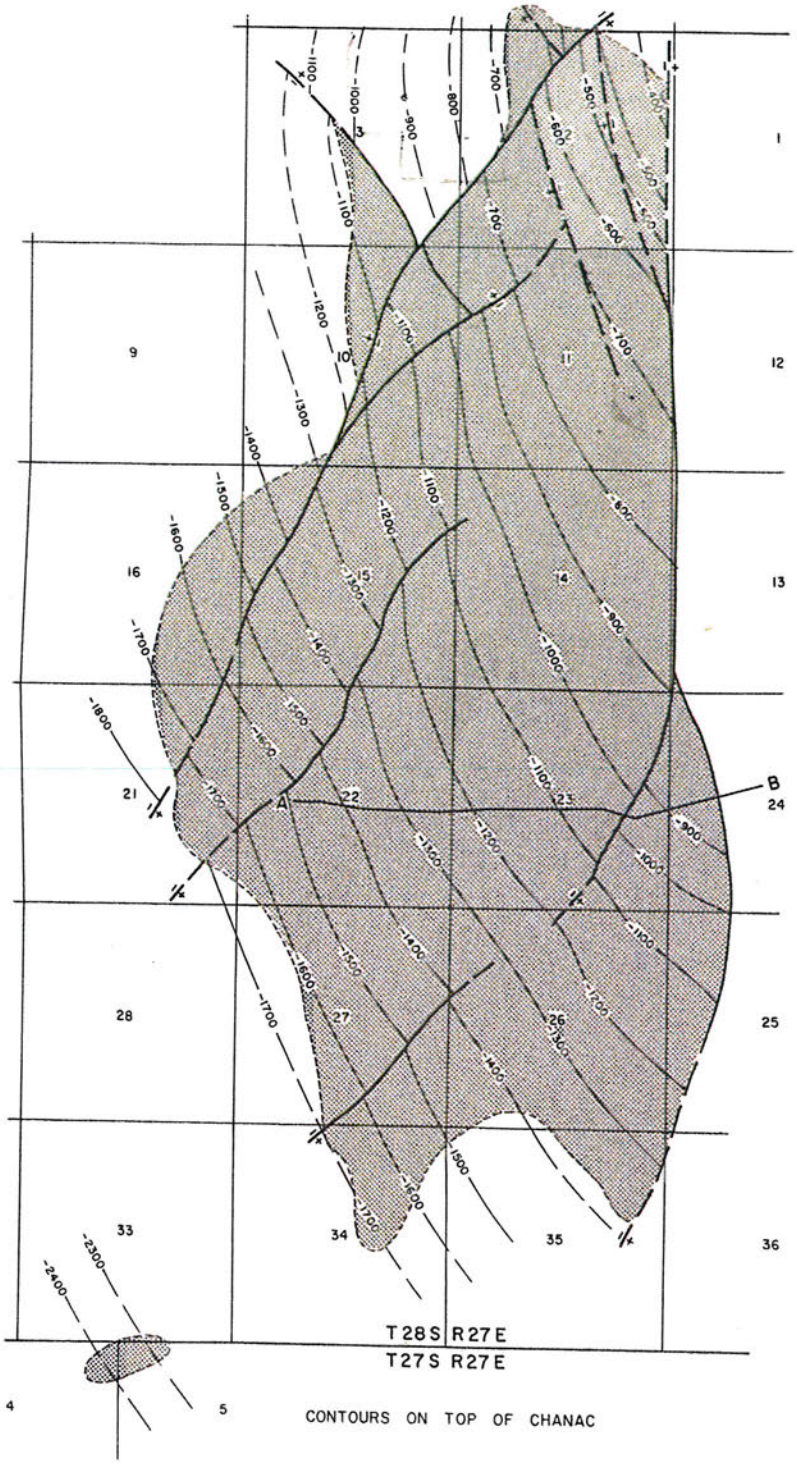
4) Volumes injected historically since 1983:
   151,820,215 Bbls injected, last injected on 3/1/2015

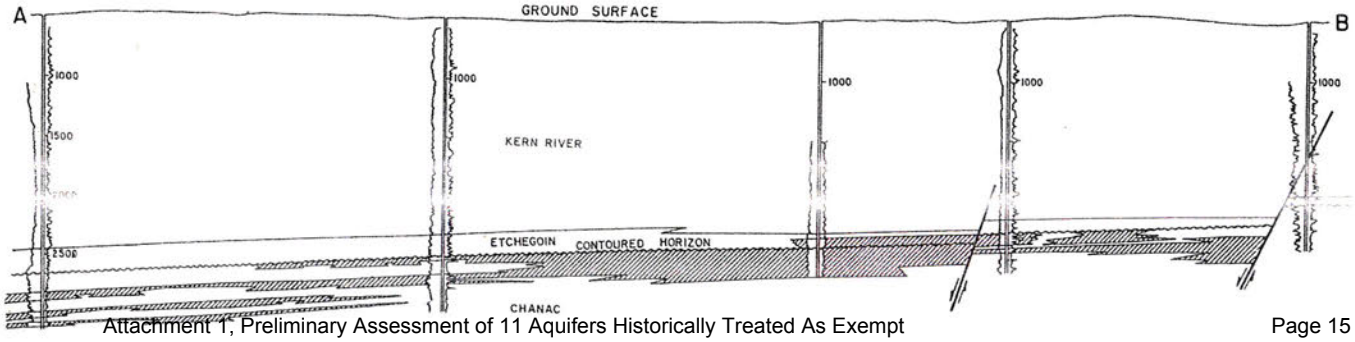
5) TDS of zone:
   460 mg/l - 2,318 mg/l TDS
   The 460 mg/l TDS sample is from the lower Santa Margarita zone in 4-4W well (029-62979) collected at a depth between 3,425'-3,255' on 12/9/1988 and the 2,318 mg/l TDS sample is from WD#1 (029-54754) well at a depth of 2,300' on 9/17/1975.

6) TDS of injection water:
   360 mg/l – 880 mg/l and 6,400 mg/l TDS.
   The 360mg/l TDS sample is from "injection wells "Movius" 3, 2 and D11 on 8/27/2010, the 880 mg/l TDS sample is from well Sec. 27 waste water to "Valley Waste KFF" on 11/2/1997 and the 6,400 mg/l TDS sample is the only high concentration sample collected from "waste water at injection well" on 4/11/2011. The 6,400 mg/l TDS sample is from project #33800012 and is most likely from the cogeneration and scrubber brine waste water. The permitted injection fluids in the Kern Front field, Santa Margarita zone consists of produced water from the Chanac, Etchegoin and Santa Margarita zones and cogeneration and scrubber brines from a plant.

KERN FRONT OIL FIELD







LOCATION: 5 miles northwest of Bakersfield

TYPE OF TRAP: Permeability variations on a faulted homocline

ELEVATION: 750

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Etchegoin	Standard Oil Co. of Calif. No. 1	Same as present	15 28S 27E	MD	10	N.A.	1912
Chanac	Standard Oil Co. of Calif. No. 1	Same as present	27 28S 27E	MD	190	N.A.	Aug 1914

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Atlantic Richfield Co. "Kramer" 1	Richfield Oil Corp. "Kramer" 1	Sep 1941	34 28S 27E	MD	7,738	Basement (slate)	Late Jur

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Etchegoin	2,265	70	Pliocene	Etchegoin	14	N.A.	None
Chanac	2,320	250	late Miocene	Chanac	15	5	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
3,148,559	293,008	25,578,898	5,000	852	128,591,808	14,667,840	4,535,059	1929	1,322	1,206	5,055

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
Cyclic-steam	1964	14,142,183	478

SPACING ACT: Does not apply

BASE OF FRESH WATER: 1,300

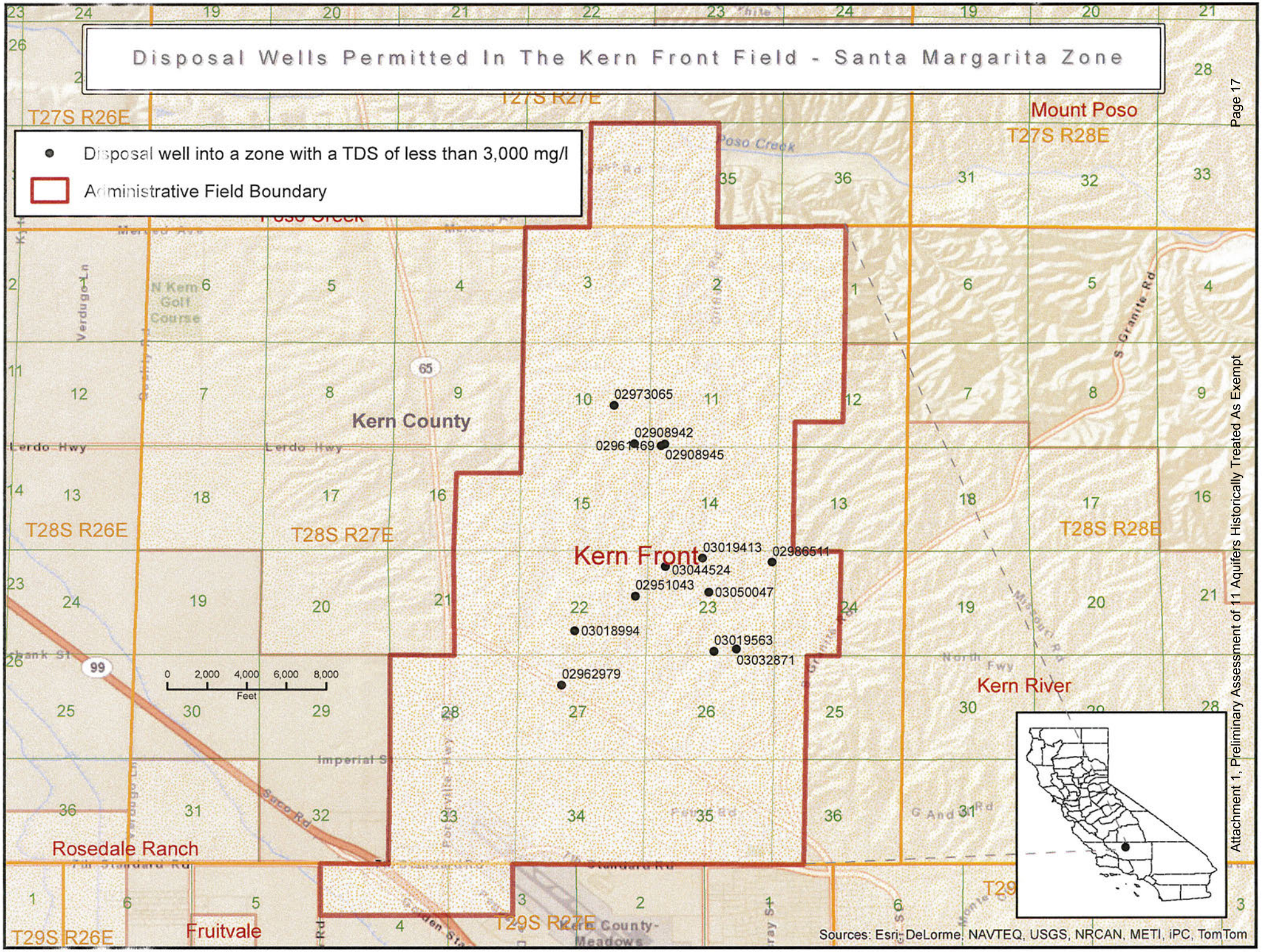
CURRENT CASING PROGRAM: 8 5/8" cem. above zone and across base of fresh-water sands; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Unlined sumps.

REMARKS: A steam displacement project was started in the Kern River - Chanac zone in 1966 and terminated after 99,587 bbls. was injected.

REFERENCES: Brooks, T.J., Kern Front Oil Field, A.A.P.G., S.E.P.M., S.E.C., Guidebook Joint Annual Meeting, Los Angeles, Calif., 1952, p. 159-161.
Park, W.H., Kern Front Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 51, No. 1 (1965).

Disposal Wells Permitted In The Kern Front Field - Santa Margarita Zone



Kern River Field, Chanac Zone, East Side Bakersfield District

1) Number of disposal wells permitted in the zone:
   12 (10 of these are permitted in both the Santa Margarita and Chanac Zones in the Kern River field)

2) Number of active producers:
   0

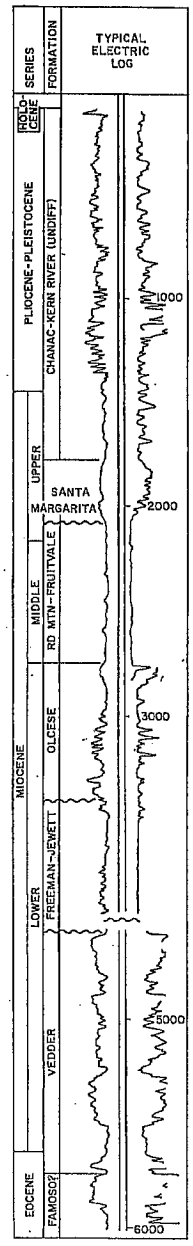
3) Depth of the zone where the injection wells are located:
   425' to 1,335' below surface. Zone dips to the Southwest across the field.

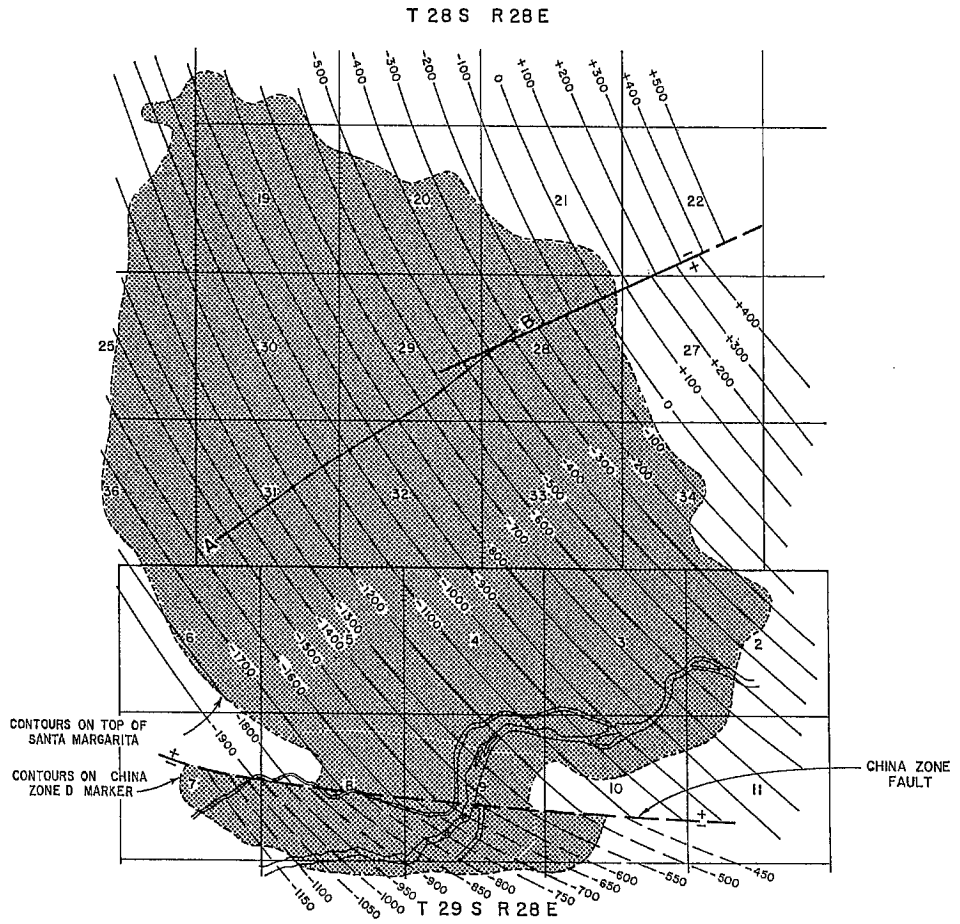
4) Volumes injected historically since 1983:
   568,987,463 Bbls, last injected on 3/1/2015

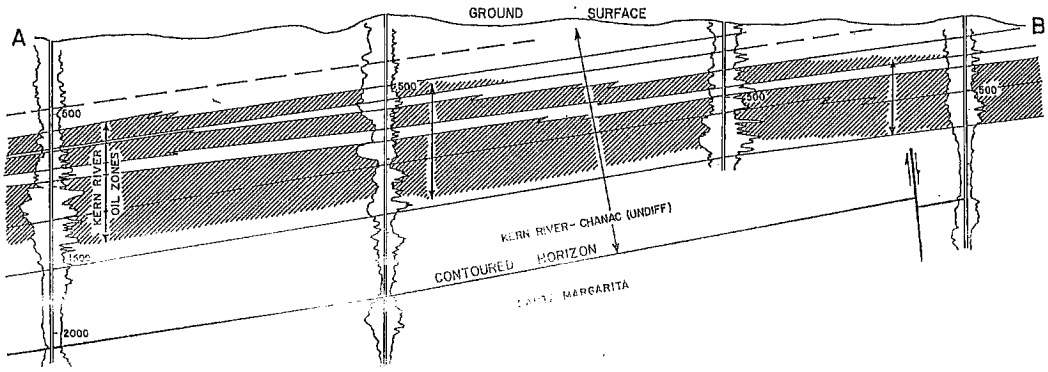
5) TDS of zone:
   926 mg/l – 3,325 mg/l TDS
   The 926 mg/l TDS sample is from well 21-4 top zone perf 1,220-1,223" (upper Chanac) on 05/22/1978 and sample 3,325 mg/l TDS sample is from "Chanac Zone KCL-10 2x" on 2/11/1987.

6) TDS of injection water:
   491 mg/l – 2,000 mg/l TDS
   The 491 mg/l TDS sample is from "Jost Plant Sec. 10, T29S/28E Waste disposal plant tank" on 11/23/1999 and sample 2,000 mg/l TDS sample is from "Cogen Disposal Water" on 11/26/1997. Permitted fluid in the Chanac zone, Kern River field consists of produced Kern River produced water from Kern River field and co-gen waste.

KERN RIVER OIL FIELD







LOCATION: 5 miles north of Bakersfield

TYPE OF TRAP: Permeability variations on a homocline

ELEVATION: 400 - 1,000

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Kern River	Elwood Brothers (no name well)	Same as present	3 29S 28E	MD	N.A.	N.A.	1899
China Zone	Westates Petroleum Co. "KCL" 1	Horace Steele and L.C. Gould "KCL" 1	8 29S 28E	MD	50	0	Sep 1947

Remarks: The discovery well was dug by hand in the spring of 1899 on what is now Chanslor-Western Oil Development Co. property. "Gassy vapors" caused the well to be abandoned without a test of its commercial possibilities. In June 1899 McWhorter Bros. drilled the first commercial well 400 feet north of the discovery well.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Standard Oil Co. of Calif. "KCL 26" 1-11	Same	Oct 1948	9 29S 28E	MD	6,986	Granite	Jurassic

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Kern River	900	700	late Pliocene	Kern River	13	5	None
China Zone	1,300	100 - 500	late Pliocene	Kern River	13	40	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
27,154,427	4,165	188,121,732	9,535	4,526	576,511,857	2,599,678	27,154,427	1972	7,942	6,978	9,850

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
Cyclic-steam	1961	300,849,501	5,215
Steam flood	1962	189,380,134	780

SPACING ACT: Does not apply

BASE OF FRESH WATER: 2,500

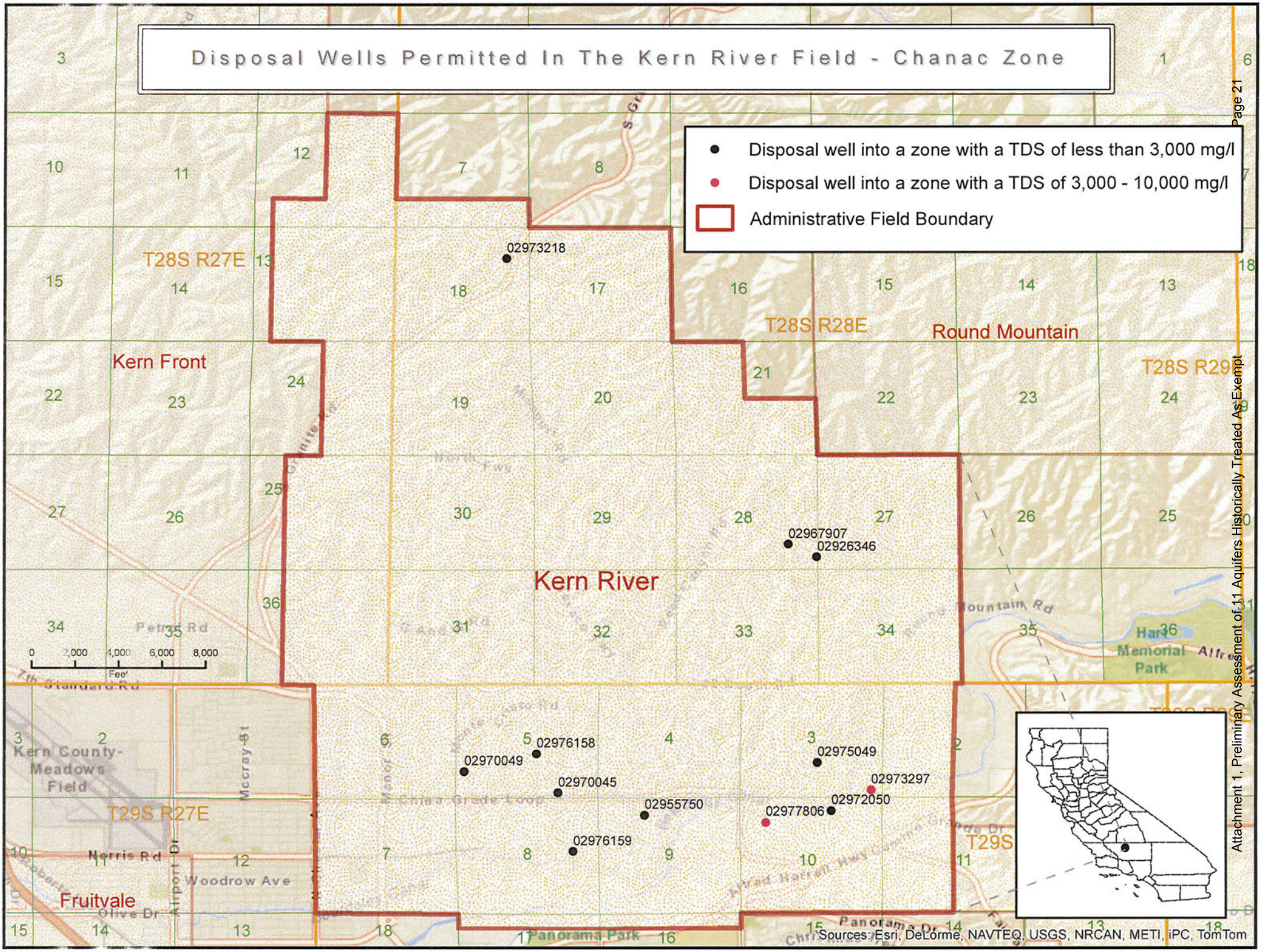
CURRENT CASING PROGRAM: 6 5/8" cem. through zone.

METHOD OF WASTE DISPOSAL: Waste water is injected into the Santa Margarita and Vedder, 12,143,578 bbls. in 1972. Waste water is also used in steam generation. The balance of the water is of a suitable enough quality that it is allowed to enter percolation ponds, irrigation canals, & the Kern River

REMARKS:

REFERENCES. Crowder, R.E., Kern River Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 38, No. 2 (1952).

Disposal Wells Permitted In The Kern River Field - Chanac Zone



Attachment 1, Preliminary Assessment of 11 Aquifers Historically Treated As Exempt

Kern River Field, Santa Margarita Zone, East Side Bakersfield District

1) Number of disposal wells permitted in the zone:
   32 (10 of these are permitted in both the Santa Margarita and Chanac Zones in the Kern River field)

2) Number of active producers:
   0

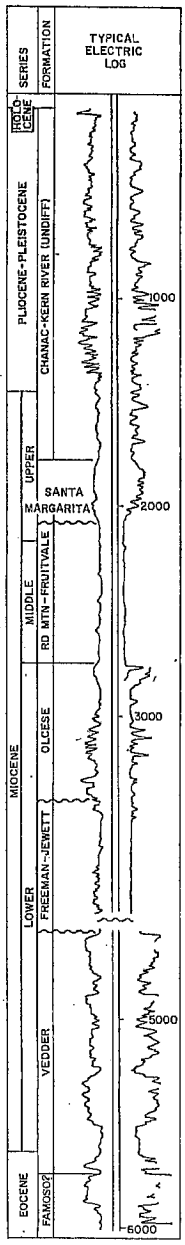
3) Depth of the zone where the injection wells are located:
   760' to 2,285' below surface. Zone dips to the Southwest across the field.

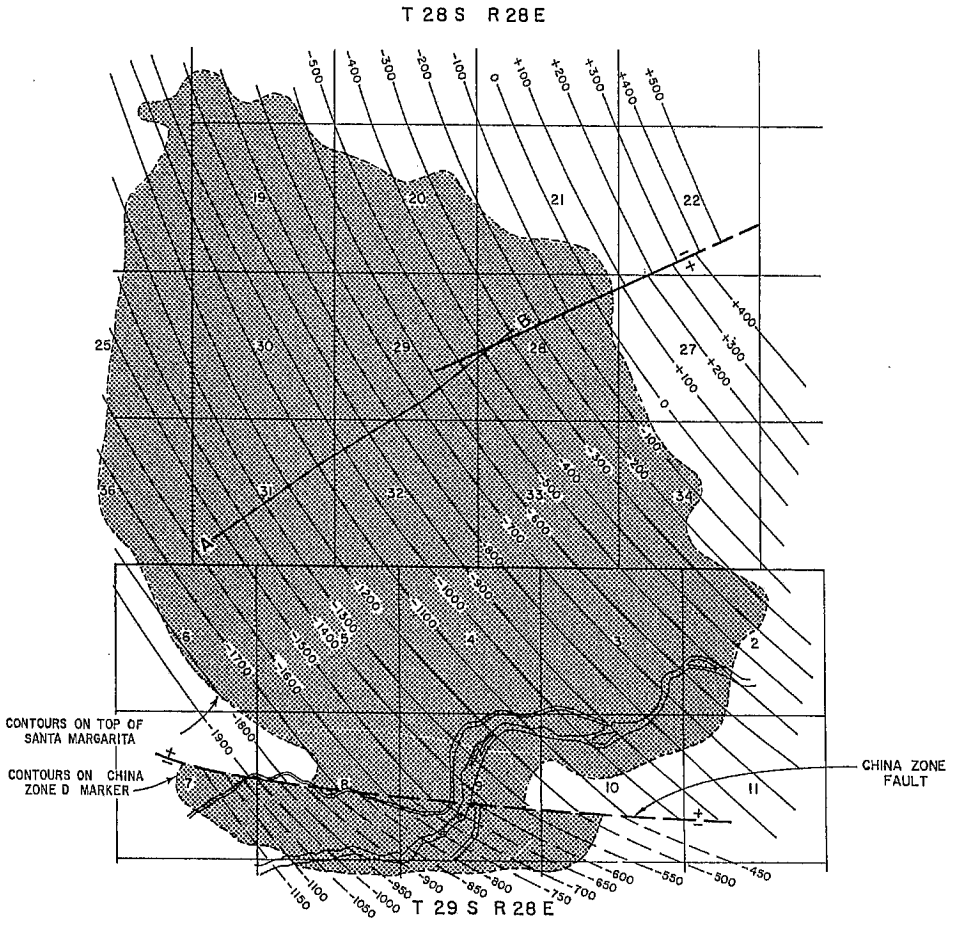
4) Volumes injected historically since 1983:
   799,041,272 Bbls, last injected on 3/1/2015

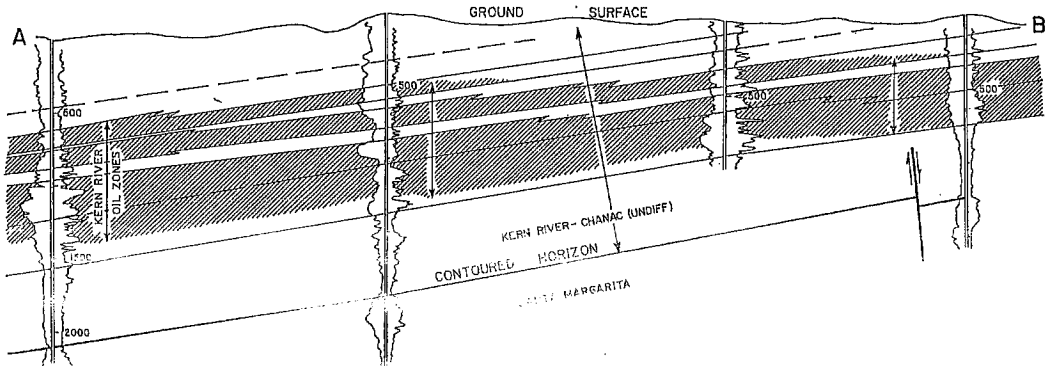
5) TDS of zone:
   490 mg/l – 1,584 mg/l TDS
   The 490 mg/l TDS sample is from "KCL – 10 Well #2X" (perf 1,068 – 1,196') on 12/30/1985 and the 1,584 mg/l TDS sample is from ""Rambler" 71 W" (perf 1,667-1,875') on 12/22/1965.

6) TDS of injection water:
   491 mg/l – 855 mg/l and 74,924 mg/l TDS
   The 491 mg/l TDS sample is from the "Jost plant Sec. 10 T29S/28E Waste Disposal Tank" on 11/23/1999, the 855 mg/l TDS sample is from the "Overland plant Sec. 28 T28S/R28E, produced water injection tank" on 11/23/1999, and the 74,924 mg/l is from the "Overland plant Sec. 28 T28S/R28E Brine Disposal Tank" (project 34000035). Permitted fluids for injection into the Santa Margarita zone, Kern River field consist of Kern River produced water, cogeneration and regeneration brine.

KERN RIVER OIL FIELD







LOCATION: 5 miles north of Bakersfield

TYPE OF TRAP: Permeability variations on a homocline

ELEVATION: 400 - 1,000

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Kern River	Elwood Brothers (no name well)	Same as present	3 29S 28E	MD	N.A.	N.A.	1899
China Zone	Westates Petroleum Co. "KCL" 1	Horace Steele and L.C. Gould "KCL" 1	8 29S 28E	MD	50	0	Sep 1947

Remarks: The discovery well was dug by hand in the spring of 1899 on what is now Chanslor-Western Oil Development Co. property. "Gassy vapors" caused the well to be abandoned without a test of its commercial possibilities. In June 1899 McWhorter Bros. drilled the first commercial well 400 feet north of the discovery well.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Standard Oil Co. of Calif. "KCL 26" 1-11	Same	Oct 1948	9 29S 28E	MD	6,986	Granite	Jurassic

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Kern River	900	700	late Pliocene	Kern River	13	5	None
China Zone	1,300	100 - 500	late Pliocene	Kern River	13	40	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
27,154,427	4,165	188,121,732	9,535	4,526	576,511,857	2,599,678	27,154,427	1972	7,942	6,978	9,850

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
Cyclic-steam	1961	300,849,501	5,215
Steam flood	1962	189,380,134	780

SPACING ACT: Does not apply

BASE OF FRESH WATER: 2,500

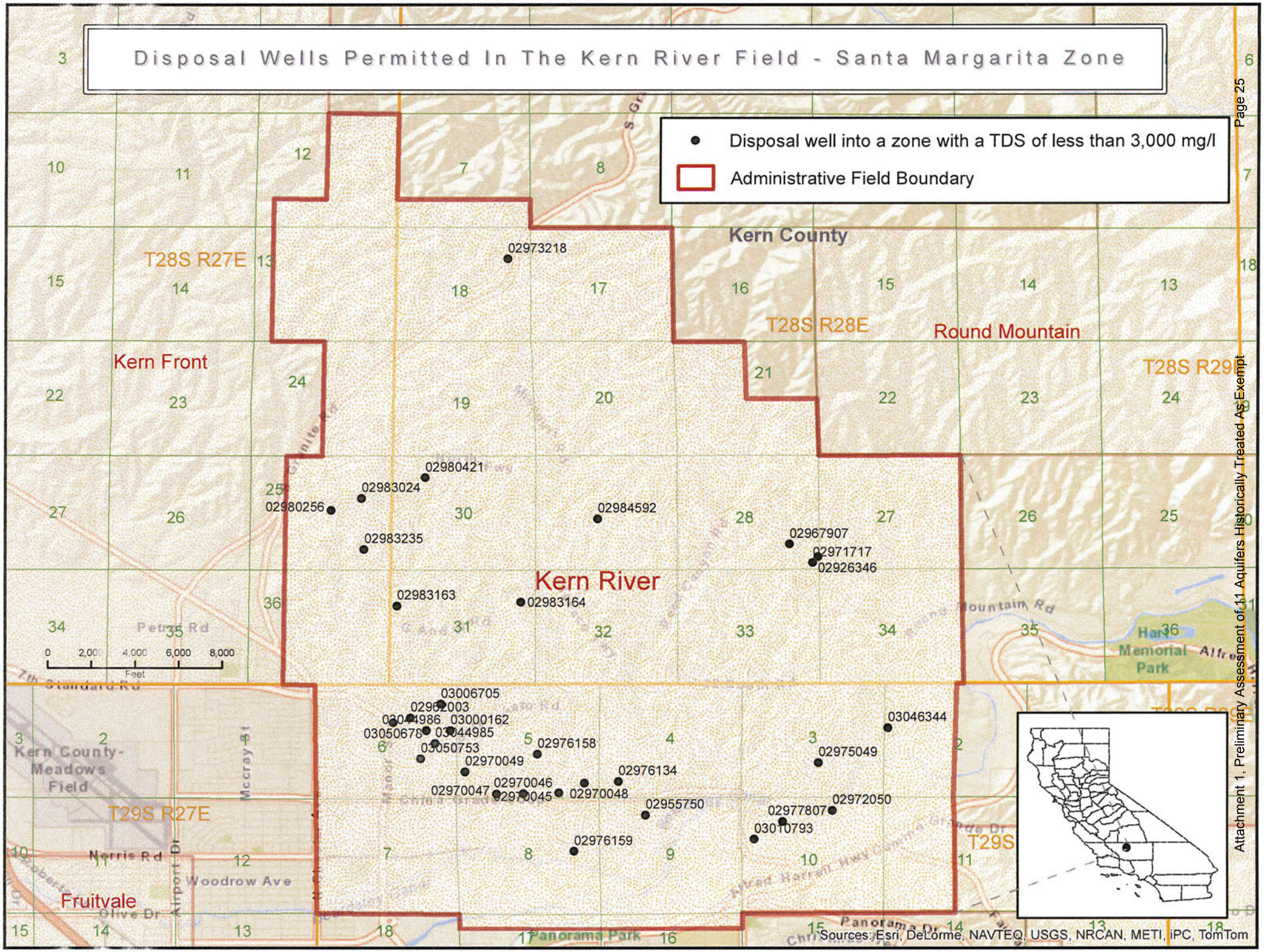
CURRENT CASING PROGRAM: 6 5/8" cem. through zone.

METHOD OF WASTE DISPOSAL: Waste water is injected into the Santa Margarita and Vedder, 12,143,578 bbls. in 1972. Waste water is also used in steam generation. The balance of the water is of a suitable enough quality that it is allowed to enter percolation ponds, irrigation canals, & the Kern River.

REMARKS:

REFERENCES: Crowder, R.E., Kern River Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 38, No. 2 (1952).

Disposal Wells Permitted In The Kern River Field - Santa Margarita Zone



Attachment 1, Preliminary Assessment of 11 Aquifers Historically Treated As Exempt

Mount Poso Field, Walker Zone, East Side Bakersfield District

1) Number of disposal wells permitted in the zone:
   5

2) Number of active producers in the zone:
   0

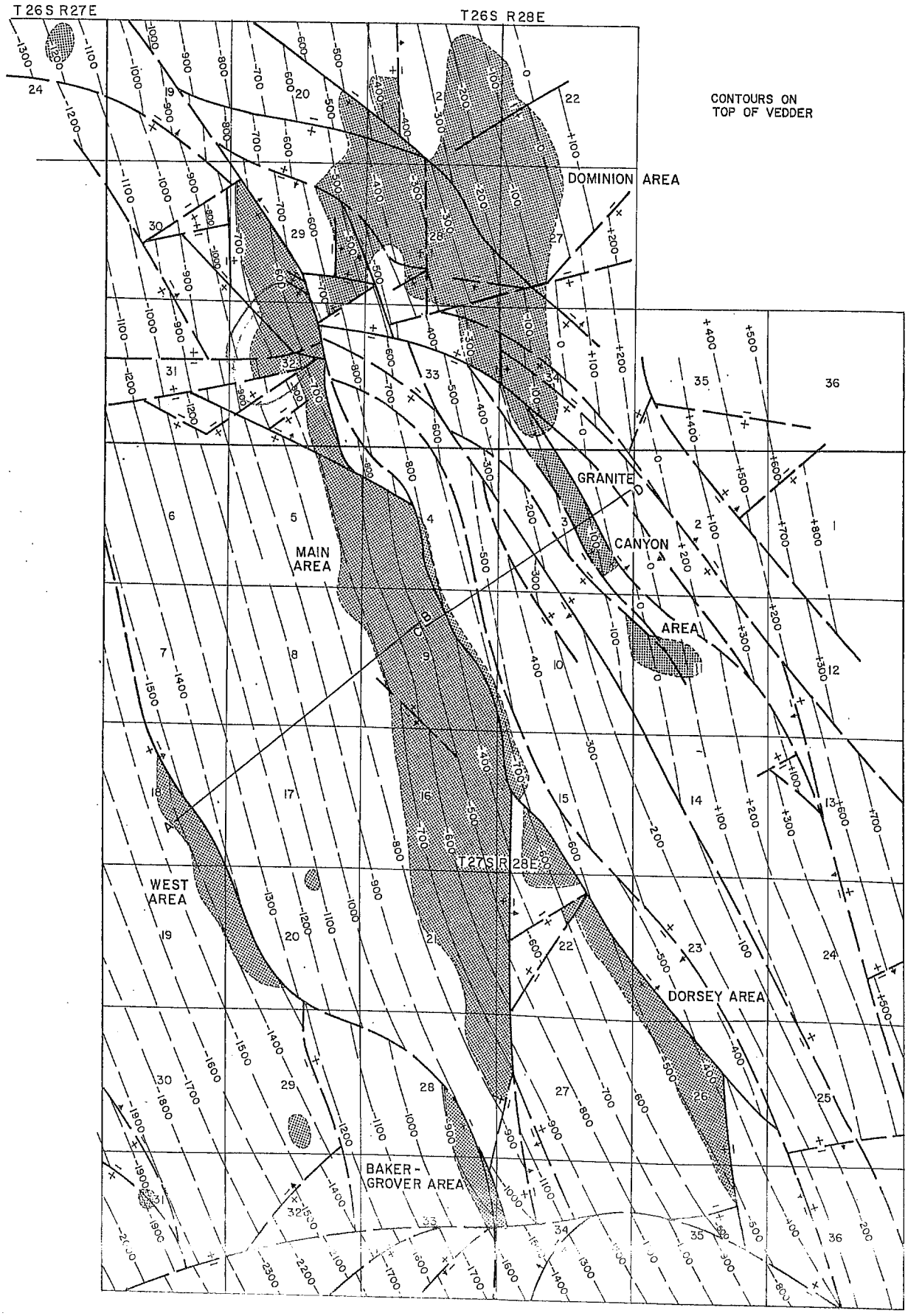
3) Depth of the zone where the injection wells are located:
   1,740' to 1,796' below surface (top of the Vedder/Walker zone). Injected only in combination with the laterally interfingered Vedder, which extends throughout the field.

4) Volumes injected historically since 1983:
   63,777,556 Bbls, last injected on 3/1/2015

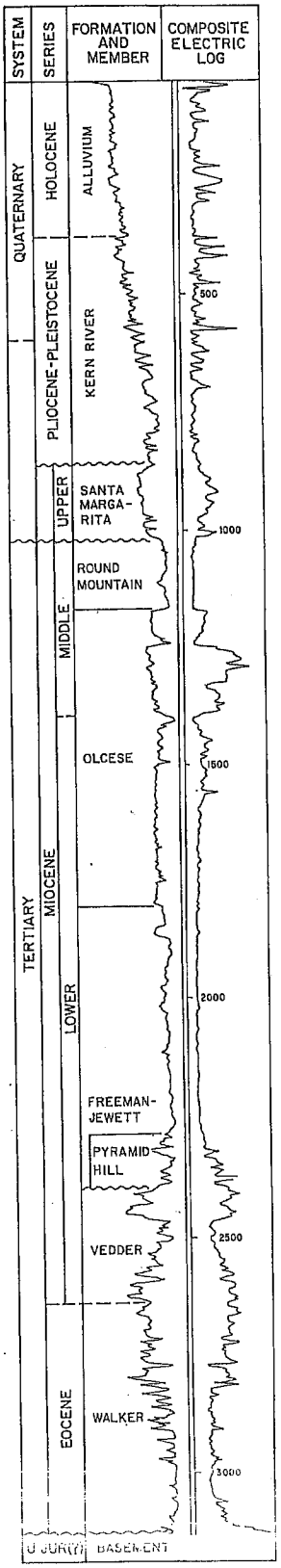
5) TDS of zone:
   1,069 mg/l TDS
   The 1,069 mg/l TDS zone sample is from "Black Foot Sump" on 05/31/1973.

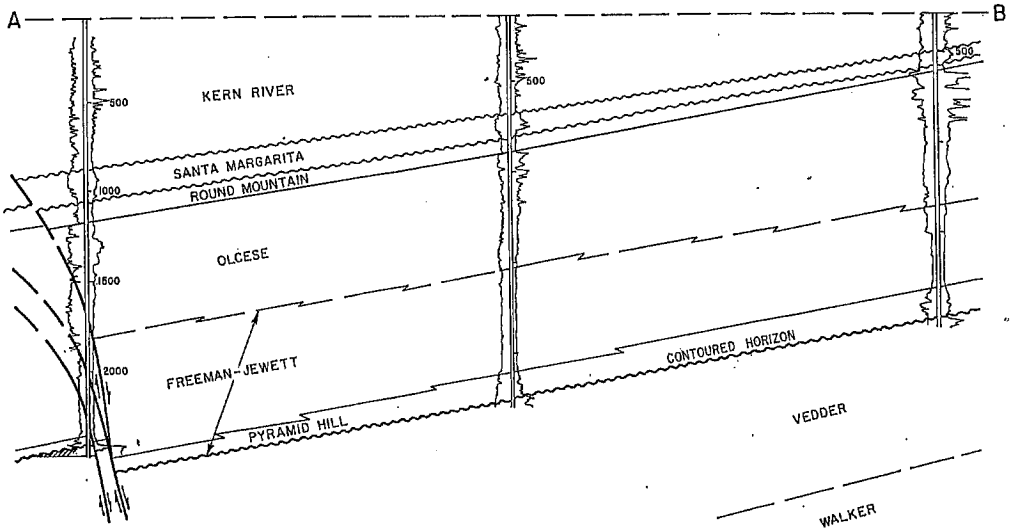
6) TDS of injection water:
   650 mg/l TDS
   The 650 mg/l TDS sample is from "Shapiro 234 Water Sample from Water Disposal" on 12/4/2008.

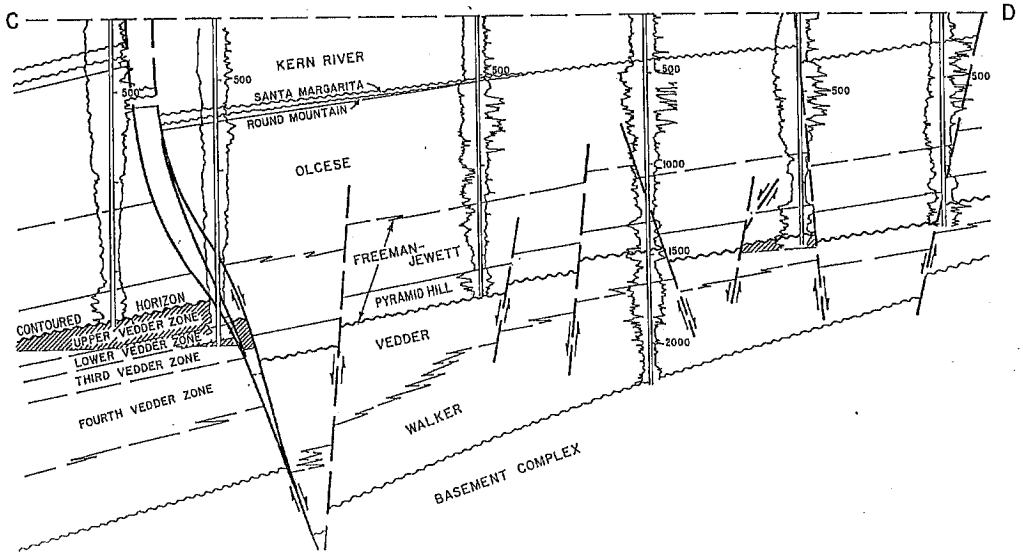
MOUNT POSO OIL FIELD



MOUNT POSO OIL FIELD







LOCATION: 13 miles northeast of Bakersfield

TYPE OF TRAP: See areas

ELEVATION: 650 - 1,450

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production Oil (bbl)	Initial daily production Gas (Mcf)	Date of completion
Pyramid Hill and Upper Vedder	Shell Oil Co. "Vedder" 1	Shell Co. of California "Vedder" 1	9 27S 28E	MD	300	N.A.	Jul 1926

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Pacific Oil and Gas Dev. Corp. "City of San Francisco" 56-32	Same	Aug 1957	32 27S 28E	MD	3,759	Walker	Eocene

PRODUCING ZONES (See areas)

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
1,830,017	728	84,316,129	3,630	532	164,558,017	1,977,245	8,427,304	1943	1,184	828	3,805

STIMULATION DATA (Jan. 1, 1973) (See areas)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection

SPACING ACT: See areas.

BASE OF FRESH WATER: See areas.

CURRENT CASING PROGRAM: See areas.

METHOD OF WASTE DISPOSAL: See areas.

REMARKS:

REFERENCES: Albright, M.B., A.G. Hluza, and J.C. Sullivan, Mount Poso Oil Field, Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 43, No. 2 (1957).

LOCATION. See map sheet of Mount Poso Oil Field

TYPE OF TRAP: Faulted regional homocline

ELEVATION: 650 - 1,050

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Upper Vedder	Emjayco "Baker" 1	Baker-Grover Co. "Baker" 1	33 27S 28E	MD	250	N.A.	Jul 1935

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
The White Hills Oil Co. No. 1	Ralph R. Whitehill No. 1	Apr 1961	34 27S 28E	MD	2,483	Vedder	early Mio

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Upper Vedder	1,750	25	early Miocene	Vedder	15	190	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
9,991	0	883,158	80	4	3,700,652	0	276,899	1937	49	23	90

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

BASE OF FRESH WATER: 1,100

CURRENT CASING PROGRAM: 7" cem. above zone; 5 1/2" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps (to be phased out).

REMARKS:

REFERENCES

LOCATION: See map sheet of Mount Poso Oil Field

TYPE OF TRAP: Faulted homocline; lithofacies variations

ELEVATION: 1,100 - 1,350

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Vedder	Robert B. Doe, "Dominion" 2	A. Bruce Frame "Dominion" 2	28 26S 28E	MD	435	N.A.	Dec 1928

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Glen H. Mitchell "SP" 1	Same	May 1945	33 26S 28E	MD	2,512	Schist	Late Jur

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Vedder	1,560	35	early Miocene	Vedder	15	10	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
107,317	0	4,482,093	675	74	5,735,208	0	197,189	1933	195	128	690

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
Cyclic-steam	1964	177,242	12

SPACING ACT: Does not apply

BASE OF FRESH WATER: No saline waters present

CURRENT CASING PROGRAM: 7" cem. above zone; 5 1/2" liner landed through zone.

METHOD OF WASTE DISPOSAL: Injection into the Vedder; evaporation and percolation sumps.

REMARKS:

REFERENCES:

LOCATION: See map sheet of Mount Poso Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION. 900 - 1,250

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production		Date of completion
					Oil (bbl)	Gas (Mcf)	
Upper Vedder	Thomas Oil Co. "Dorsey" 2	R.S. Lytle "Dorsey" 2	26 27S 28E	MD	570	N.A.	Sep 1928

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth	
						Strata	Age
Emjayco "Glide" 15-1	Harry H. Magee, Opr. "Glide" 15-1	Oct 1956	15 27S 28E	MD	2,000	Vedder	early Mio

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic		Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
			Age	Formation			
Upper Vedder	1,500	30	early Miocene	Vedder	16	5	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production			1972 Proved acreage	1972 Average number producing wells	Cumulative production		Peak oil production		Total number of wells		Maximum proved acreage
Oil (bbl)	Net gas (Mcf)	Water (bbl)			Oil (bbl)	Gas (Mcf)	Barrels	Year	Drilled	Completed	
86,429	0	1,913,270	375	47	4,676,008	0	204,880	1958	142	76	410

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Does not apply

BASE OF FRESH WATER: Basement

CURRENT CASING PROGRAM: 8 5/8" cem. above zone; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Percolation and evaporation sumps on outcrop of Round Mountain Silt; injection wells.

REMARKS: Vedder zone water contains 1.75 ppm boron.

REFERENCES:

LOCATION: See map sheet of Mount Poso Oil Field

TYPE OF TRAP: Faulted homocline; lithofacies variations

ELEVATION: 1,300

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production Oil (bbl)	Initial daily production Gas (Mcf)	Date of completion
Upper Vedder	Road Oil Sales, Inc. "SP" 2	J.J. Chevalier "Southern Pacific" 2	3 27S 28E	MD	50	N.A.	Nov 1936

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Lyle A. Garner & Assoc. "S.P." 3-1	Same	May 1952	3 27S 28E	MD	2,226	Granite	Late Jur

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Upper Vedder	1,390	30	early Miocene	Vedder	15	10	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
3,808	0	20,675	80	10	823,450	0	65,780	1949	65	30	130

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

BASE OF FRESH WATER: Basement

CURRENT CASING PROGRAM: 8 5/8" cem. above zone; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation sumps on outcrop of Round Mountain Silt.

REMARKS: A cyclic-steam project was started in 1967 and discontinued after 19,069 bbls. of water in the form of steam were injected. A pilot fire flood project, initiated in 1963, was terminated in 1965.

REFERENCES:

LOCATION: See map sheet of Mount Poso Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 700 - 1,450

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Pyramid Hill and Upper Vedder	Shell Oil Co. "Vedder" 1	Shell Oil Co. of Calif. "Vedder" 1	9 27S 28E	MD	300	N.A.	Jul 1926
Lower Vedder [A]	Shell Oil Co. "Vedder" 6	Same as present	9 27S 28E	MD	835	N.A.	Jan 1933
Third Vedder	Unknown	Unknown	4 27S 28E or 9	MD	N.A.	N.A.	Prior to 1957
Fourth Vedder [B]	Shell Oil Co. "Glide" 6	Same as present	15 27S 28E	MD	134	N.A.	Aug 1957

Remarks: The first separate well that produced from the Pyramid Hill zone was Shell Oil Co. "Security" 3, Sec. 9, T. 27S., R. 28E. Initial production was 4 barrels per day.
[A] Commingled production from Upper Vedder and Lower Vedder.
[B] Commingled production from Third Vedder and Fourth Vedder.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Trico Industries, Inc. "USL" 6-2	Trico Oil and Gas Co. "USL" 6-2	Jul 1960	6 27S 28E	MD	2,665	Vedder	early Mio

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Pyramid Hill	1,600	160	early Miocene	Pyramid Hill	17	N.A.	None
Upper Vedder	1,750	140	early Miocene	Vedder	16	80	None
Lower Vedder	1,900	80	early Miocene	Vedder	16	N.A.	None
Third Vedder	1,985	120	early Miocene	Vedder	16	75	None
Fourth Vedder	2,105	50	early Miocene	Vedder	16	65	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
1,590,436	728	75,595,054	2,225	374	146,734,300	1,977,245	7,982,576	1943	641	524	2,265

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
Steam flood	1963	9,351,042	11

SPACING ACT: Does not apply

BASE OF FRESH WATER: 1,000 - 1,500

CURRENT CASING PROGRAM: 8 5/8" cem. above zone and across base of fresh-water sands; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps; injection into Vedder sand.

REMARKS: A cyclic-steam project was started in 1963 and discontinued after 116,623 bbls. of water in the form of steam was injected. A water flood project was started in 1952 and discontinued after 608,470 bbls. of water was injected.

REFERENCES:

CALIFORNIA DIVISION OF OIL AND GAS

WEST AREA

MOUNT POSO OIL FIELD

Kern County

LOCATION: See map sheet of Mount Poso Oil Field

TYPE OF TRAP: Faulted homocline with permeability variations

ELEVATION: 700 - 1,075

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Upper Vedder	Thomas Oil Co. "Ring 18" 1	Dwight G. Vedder No. 1	18 27S 28E	MD	0	5,300	Dec 1943

Remarks: Gas cap was of limited volume. After being shut in for one year the discovery well was recompleted producing oil.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Pacific Oil & Gas Dev. Corp. "City of San Francisco" 56-32	Same	Aug 1957	32 27S 28E	MD	3,759	Walker	Eocene

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Upper Vedder	2,575	15 - 50	early Miocene	Vedder	16	60	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
32,036	0	1,421,879	195	23	2,888,399	0	190,765	1957	92	47	220

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

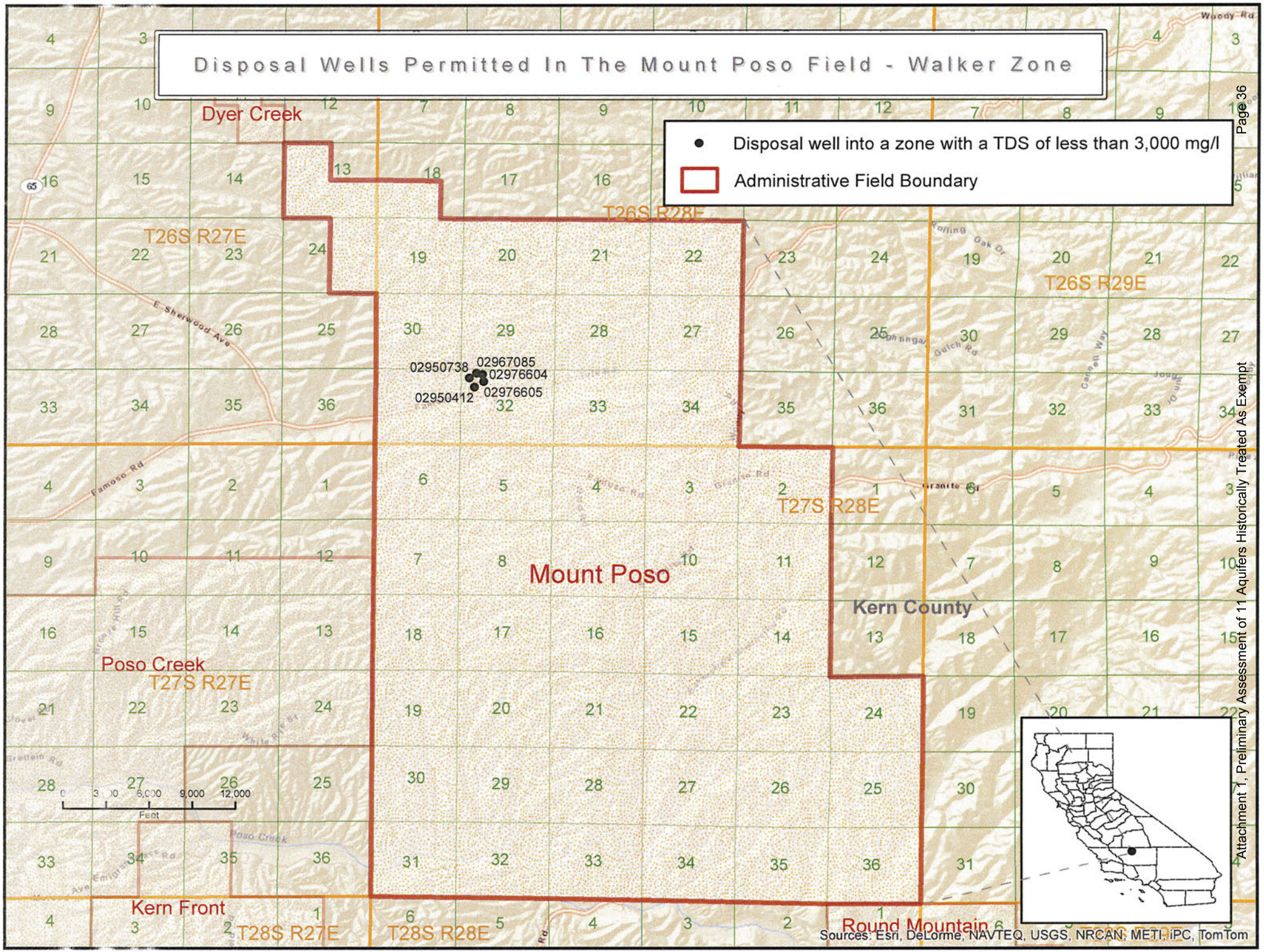
BASE OF FRESH WATER: 1,800

CURRENT CASING PROGRAM: 7" cem. above zone and across base of fresh-water sands; 5 1/2" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps (to be phased out).

REMARKS: Vedder zone water contains 3 to 4 ppm boron.

REFERENCES:


Disposal Wells Permitted In The Mount Poso Field - Walker Zone
Disposal well into a zone with a TDS of less than 3,000 mg/l
Administrative Field Boundary
Dyer Creek
T26S R27E
T26S R28E
T26S R29E
T27S R28E
T27S R27E
T28S R27E
T28S R28E
Mount Poso
Kern County
Poso Creek
Kern Front
Round Mountain
02950738
02967085
02976604
02950412
02976605
0 3,000 6,000 9,000 12,000
Feet
Sources: Esri, DeLorme, NAVTEQ, USGS, NRCAN, METI, iPC, TomTom

Round Mountain Field, Olcese Zone, East Side Bakersfield District

1) Number of disposal wells permitted in the zone:
   6 (4 wells are permitted in both the Olcese and Walker Zones in Round Mountain Field)

2) Number of active producers:
   0

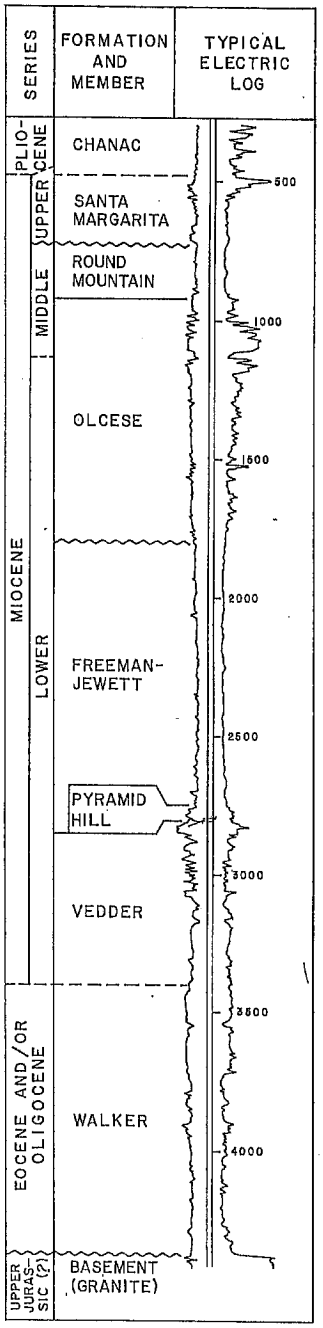
3) Depth of the zone where the injection wells are located:
   710' to 850' below surface. These zone depths are from wells API #029-18114 and API #029-18119, which are currently injecting in the Olcese zone. The remaining wells in the field (029-47441, 029-47543, 030-51960 and 030-51959) are permitted to inject in the Olcese, Freeman-Jewett, Vedder and Walker but are currently perforated in the Vedder and/or Walker zones only. For these 4 wells there are no logs available that pick the top of the Olcese zone since there is no injection there. Zone is fault bounded 1 ½ miles east of field limits, and pinches out 5 miles west of field limits.

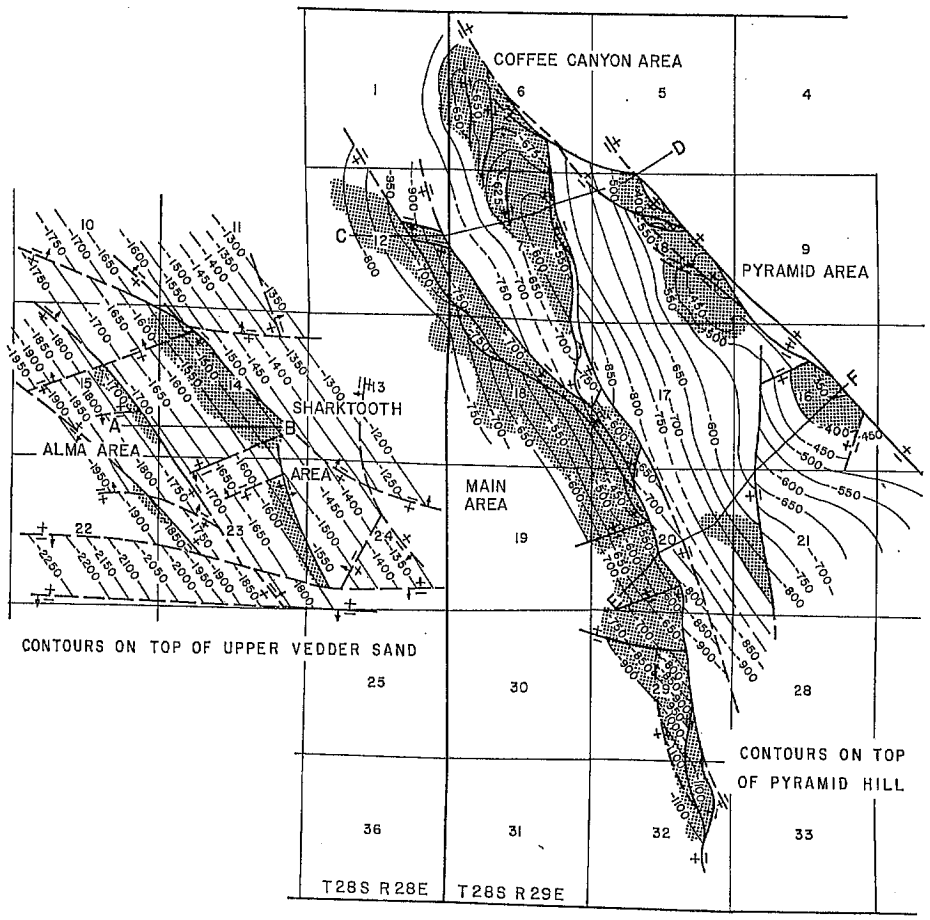
4) Volumes injected historically since 1983:
   160,798,008 Bbls, last injected on 1/1/2015

5) TDS of zone:
   2,693 mg/l TDS
   Sample collected from "water from Bishop #6 Bailer Sample at 600'" on 4/27/1974.

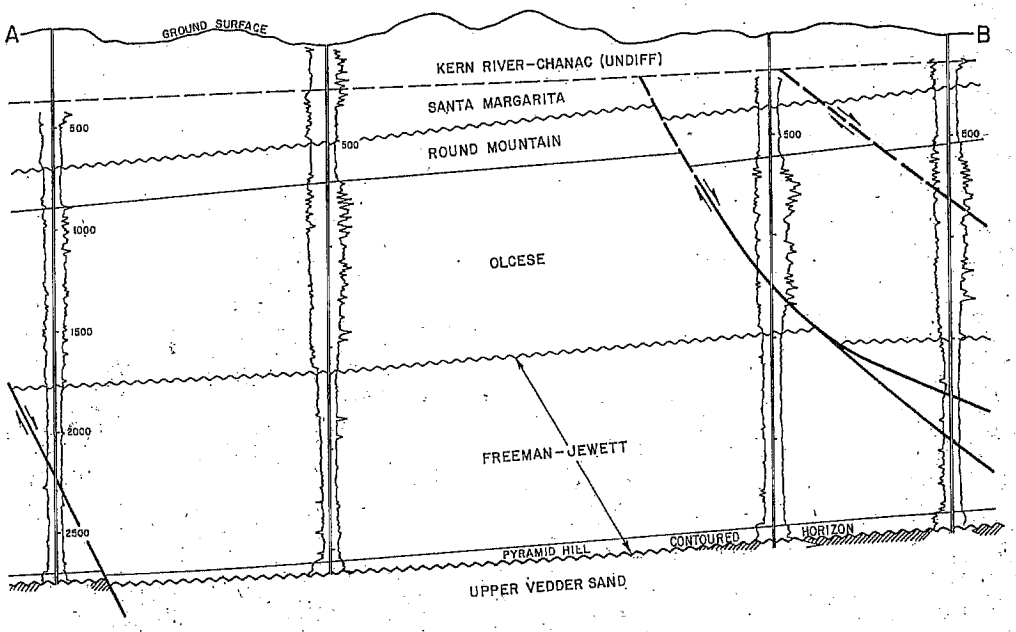
6) TDS of injection water:
   1,900 mg/l TDS
   Sample collected from "Sec. 20 produced water" (Olcese WD#342 & 343) on 2/23/2009. Permitted fluids for injection into the Olcese Zone in Round Mountain field consist of Pyramid Hill, Jewett, Freeman-Jewett and Vedder zones.

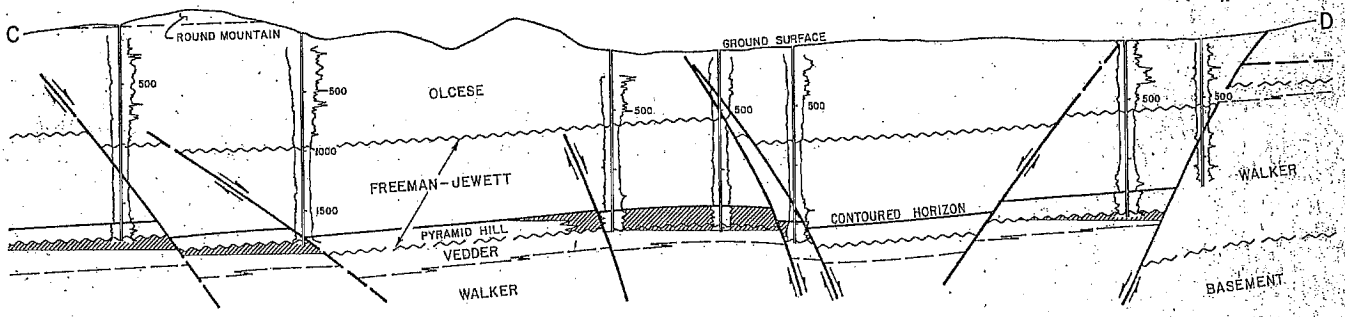
ROUND MOUNTAIN OIL FIELD

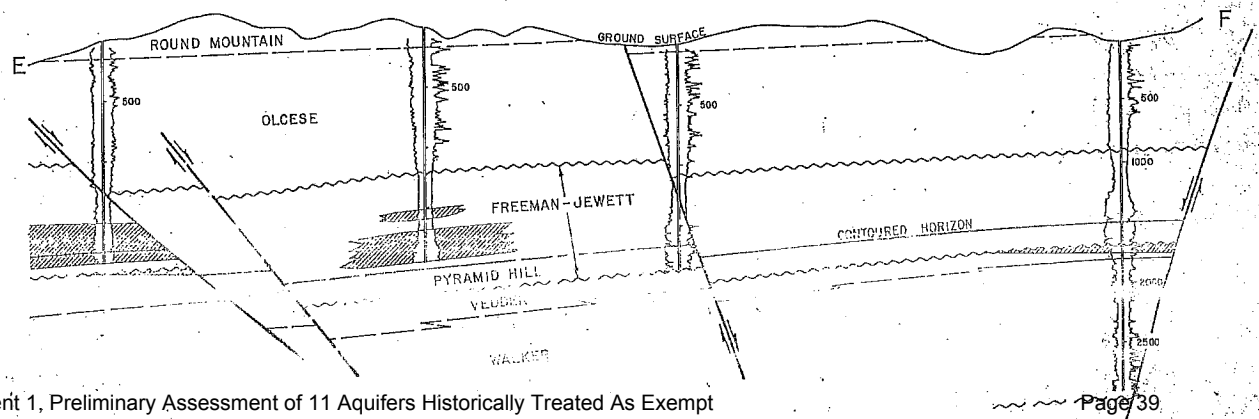




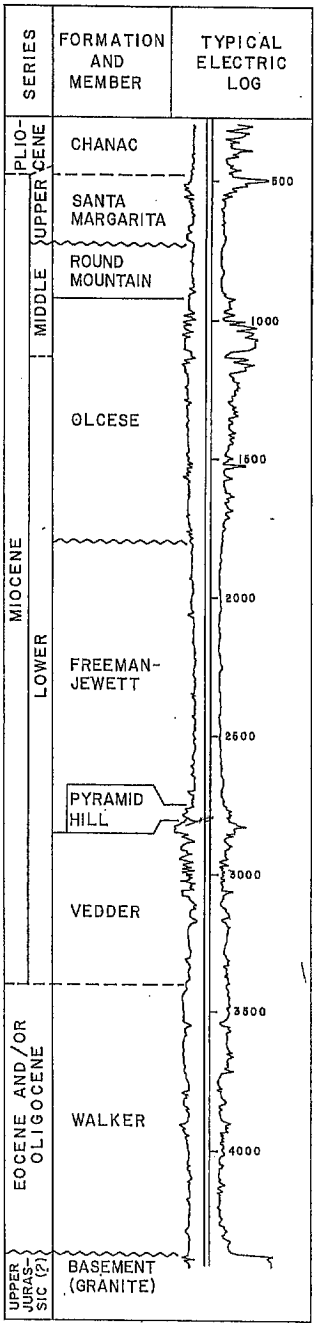
ROUND MOUNTAIN OIL FIELD

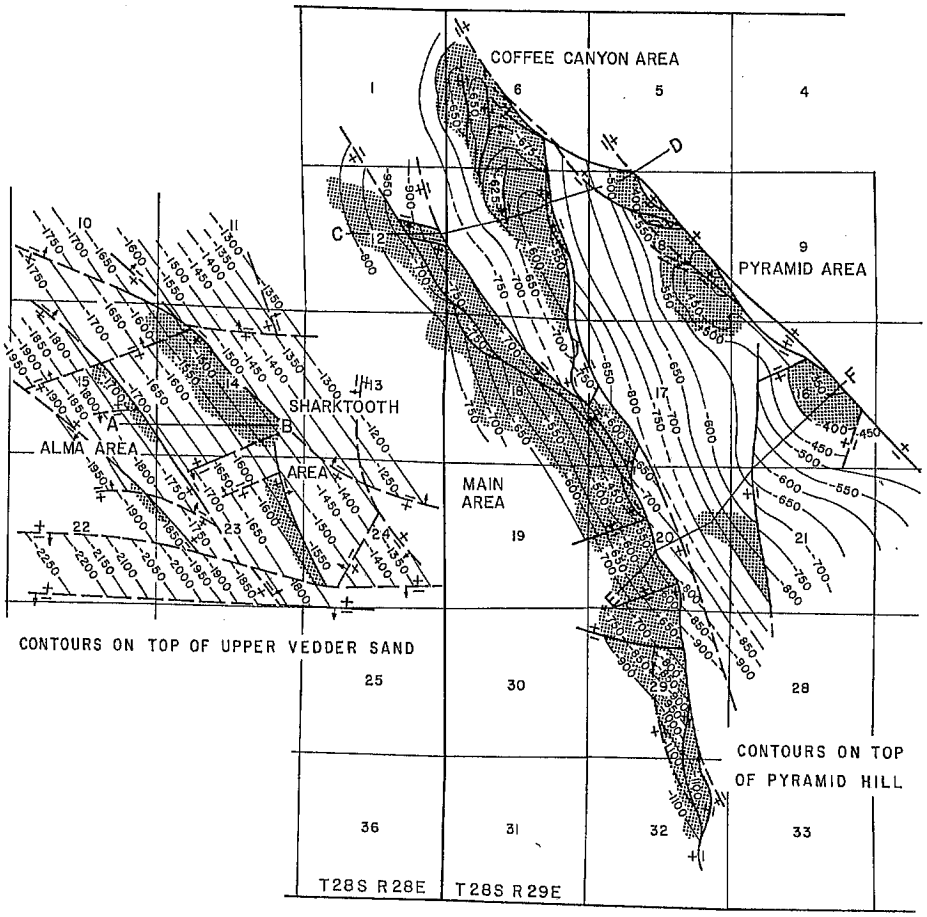






ROUND MOUNTAIN OIL FIELD





LOCATION: 14 miles northeast of Bakersfield

TYPE OF TRAP: See areas

ELEVATION: 600 - 1,500

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Jewett	Getty Oil Co. No. 2	Elbe Oil Land Dev. Co. No. 2	20 28S 29E	MD	*204	N.A.	May 1927
Pyramid Hill	Same as above	Same as above	20 28S 29E	MD	N.A.	N.A.	May 1927
Vedder	Same as above	Same as above	20 28S 29E	MD	N.A.	N.A.	May 1927

Remarks: * Production listed for Jewett is the combined production rate from the Jewett, Pyramid Hill, and Vedder zones.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
C.C. Killingsworth "Alma" 6	Barnsdall Oil Co. "Alma" 6	Mar 1948	15 28S 28E	MD	4,418	Basement (Granite)	Late Jur (?)

PRODUCING ZONES (See areas)

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
711,406	46,635	48,630,496	2,435	292	89,199,121	1,424,213	5,453,194	1938	665	468	2,590

STIMULATION DATA (Jan. 1, 1973) (See areas)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection

SPACING ACT: See areas.

BASE OF FRESH WATER: See areas.

CURRENT CASING PROGRAM: See areas.

METHOD OF WASTE DISPOSAL: See areas.

REMARKS:

REFERENCES: See areas.

CALIFORNIA DIVISION OF OIL AND GAS

ALMA AREA

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 700 - 1,270

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Vedder	Harold C. Morton & H.S. Kohlbush "Alma" 1	Same as present	15 28S 28E	MD	152	N.A.	Feb 1947

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
C.C. Killingsworth "Alma" 6	Barnsdall Oil Co. "Alma" 6	Mar 1948	15 28S 28E	MD	4,418	Basement (Granite)	Late Jur.

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Vedder	2,600	15	early Miocene	Vedder	13	N.A.	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
6,240	0	107,447	50	3	598,904	0	113,392	1948	47	21	80

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 8 5/8" cem. above zone; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps on outcrops of the Round Mountain Silt.

REMARKS:

REFERENCES: Albright, M.B. Jr., Sharktooth and Alma Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 42, No. 1 (1956).

CALIFORNIA DIVISION OF OIL AND GAS

COFFEE CANYON AREA

ROUND MOUNTAIN OIL FIELD

Kern County

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 690 - 1,300

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Pyramid Hill	Acacia Oil Co. "Coffee" 1	Reynolds Oil and Gas Co. No. 1	6 28S 29E	MD	*600	N.A.	Sep 1928
Vedder	Acacia Oil Co. "Lindsay" 1	Lindsay Oil Co. No. 1	6 28S 29E	MD	800	N.A.	Aug 1928

Remarks: * Production is commingled from Pyramid Hill and Vedder.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Richard S. Rheem, Opr. "Smoot-Vedder" 2	Same	May 1957	1 28S 28E	MD	2,313	Vedder	early Mio

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Pyramid Hill	1,500	150	early Miocene	Jewett	18	50	None
Vedder	1,650	30	early Miocene	Vedder	16	75	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
103,176	0	7,292,707	435	50	18,507,039	67,567	1,857,108	1937	133	104	475

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
Water flood	1960	3,815,746	1

SPACING ACT: Does not apply

BASE OF FRESH WATER: 0 - 200

CURRENT CASING PROGRAM: 7" cem. above zone; 5 1/2" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps on outcrops of the Round Mountain Silt.

REMARKS: A cyclic-steam injection project in the Pyramid Hill and Vedder zones was started in 1965 and terminated in 1968. Cumulative injection totals 12,200 bbls. The Pyramid Hill zone was originally known as the Elbe zone.

REFERENCES: Park, W.B., J.R. Weddle, J.A. Barnes, Main Coffee Canyon and Pyramid Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 49, No. 2 (1963).

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 600 - 1,500

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Jewett	Getty Oil Co. No. 2	Elbe Oil Land Dev. Co. No. 2	20 28S 29E	MD	*204	N.A.	May 1927
Pyramid Hill	Same as above	Same as above	20 28S 29E	MD	N.A.	N.A.	May 1927
Vedder	Same as above	Same as above	20 28S 29E	MD	N.A.	N.A.	May 1927

Remarks: * Production listed for Jewett is the combined production rate from the Jewett, Pyramid Hill, and Vedder zones.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Shell Oil Co. "Jewett" 3	Same	Jun 1928	29 28S 29E	MD	2,678	Walker	Eo &/or Olig

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Jewett	1,600	130	early Miocene	Freeman-Jewett	22	N.A.	None
Pyramid Hill	1,900	150	early Miocene	Jewett	18	N.A.	None
Vedder	2,000	80	early Miocene	Vedder	16	95	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
510,916	46,561	35,953,284	1,415	171	59,572,216	1,293,959	3,794,620	1938	302	225	1,465

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Does not apply

BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 7" cem. above zone; 5 1/2" liner landed through zone.

METHOD OF WASTE DISPOSAL: 4,845,286 bbl. of waste water was injected during 1972 into two disposal wells; percolation and evaporation sumps on outcrops of the Round Mountain Silt.

REMARKS: A water flood project in the Vedder zone was started in 1961 and terminated in 1963. Cumulative injection totals 872,587 bbls.

REFERENCES: Park, W.H., J.R. Weddle, J.A. Barnes, Main, Coffee Canyon, and Pyramid Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 49, No. 2 (1963).

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 730 - 1,470

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Pyramid Hill	Thomas Oil Co. "Olcese" 2	Harp & Brown "Olcese" 2	17 28S 29E	MD	5	0	May 1944
Vedder	Crestmont Oil Co. "Olcese" 1	Eastmont Oil Co. "Olcese" 1	16 28S 29E	MD	250	N.A.	May 1937
Walker	Crestmont Oil Co. "Staley" 11	Same as present	8 28S 29E	MD	40	N.A.	Jul 1943

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Piute Holding Co. "Smith" 1	Same	Oct 1929	17 28S 29E	MD	3,110	Walker	Eo &/or Olig

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Pyramid Hill	1,250	130	early Miocene	Jewett	18	50	None
Vedder	1,390	40	early Miocene	Vedder	16	80 - 110	None
Walker	1,535	50	Eo &/or Olig	Walker	20	N.A.	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
55,714	74	1,527,767	290	37	5,692,349	6,876	378,882	1946	98	60	300

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 8 5/8" or 7" cem. above zone; 6 5/8" or 5" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps on outcrops of the Round Mountain Silt.

REMARKS:

REFERENCES: Peak, W.H., J.R. Weddle, J.A. Barnes, Main, Coffee Canyon, and Pyramid Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 49, No. 2 (1963).

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 700 - 1,300

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Vedder	G M V Oil Co. "Signal-Mills" 1	Bandini Petroleum Co. "Signal Mills" 1	24 28S 28E	MD	214	N.A.	Sep 1943

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Mobil Oil Corp. "Bradford" 1	General Petroleum Corp. "Bradford" 1	Jun 1943	15 28S 28E	MD	2,995	Vedder	early Mio

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Vedder	2,400	25	early Miocene	Vedder	13	N.A.	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
35,360	0	3,749,291	245	31	4,828,613	55,811	503,449	1947	85	58	270

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

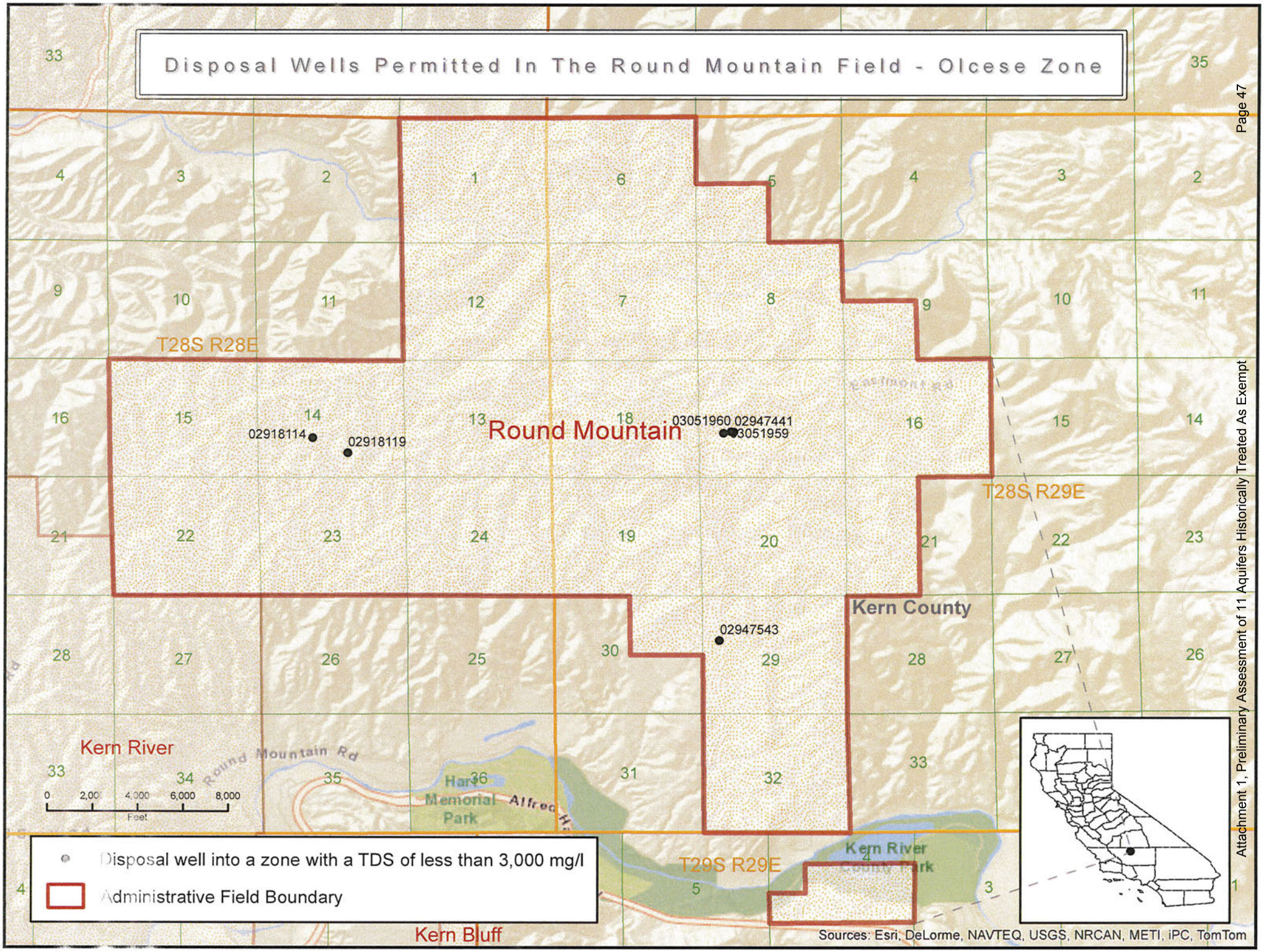
BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 8 5/8" cem. above zone; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps on outcrops of the Round Mountain Silt.

REMARKS:

REFERENCES: Albright, M.B. Jr., Sharktooth and Alma Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas. Summary of Operations--Calif. Oil Fields, Vol. 42, No. 1 (1956).


Disposal Wells Permitted In The Round Mountain Field - Olcese Zone
Round Mountain
T28S R28E
T28S R29E
T29S R29E
Kern County
Kern River
Kern Bluff
02918114
02918119
03051960
02947441
03051959
02947543
Round Mountain Rd
Harris Memorial Park
Kern River County Park
0 2,000 4,000 6,000 8,000
Feet
Disposal well into a zone with a TDS of less than 3,000 mg/l
Administrative Field Boundary
Sources: Esri, DeLorme, NAVTEQ, USGS, NRCAN, METI, iPC, TomTom

Round Mountain Field, Walker Zone, East Side Bakersfield District

1) Number of disposal wells permitted in the zone:
   30 (4 of these are permitted in both the Olcese and Walker Zones in Round Mountain Field). There are 2 gas disposal wells.

2) Number of active producers:
   4 wells (Note that although this aquifer was historically treated as exempt as a non-hydrocarbon producing formation, the Walker zone within the field has current production.)

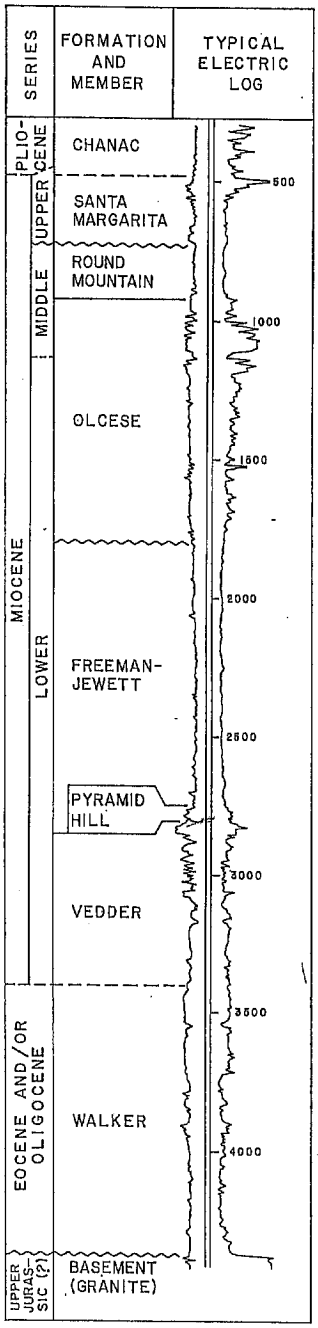
3) Depth of the zone where the disposal wells are located:
   1,890' to 2,590' below surface

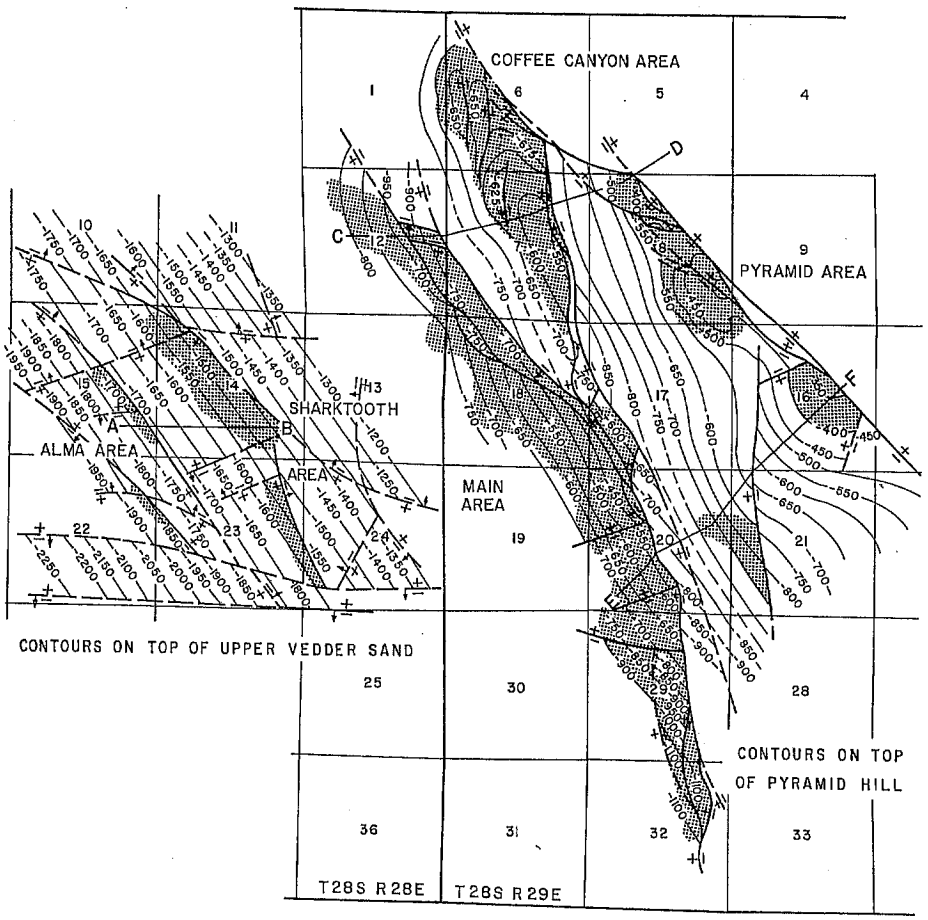
4) Volumes injected historically since 1983:
   1,529,910,014 Bbls, last injected on 3/1/2015

5) TDS of zone:
   2,335 mg/l TDS
   Sample 2,335 mg/l TDS is from "Walker zone formation water" (Round Mountain WD 1-20) on 10/17/1983.

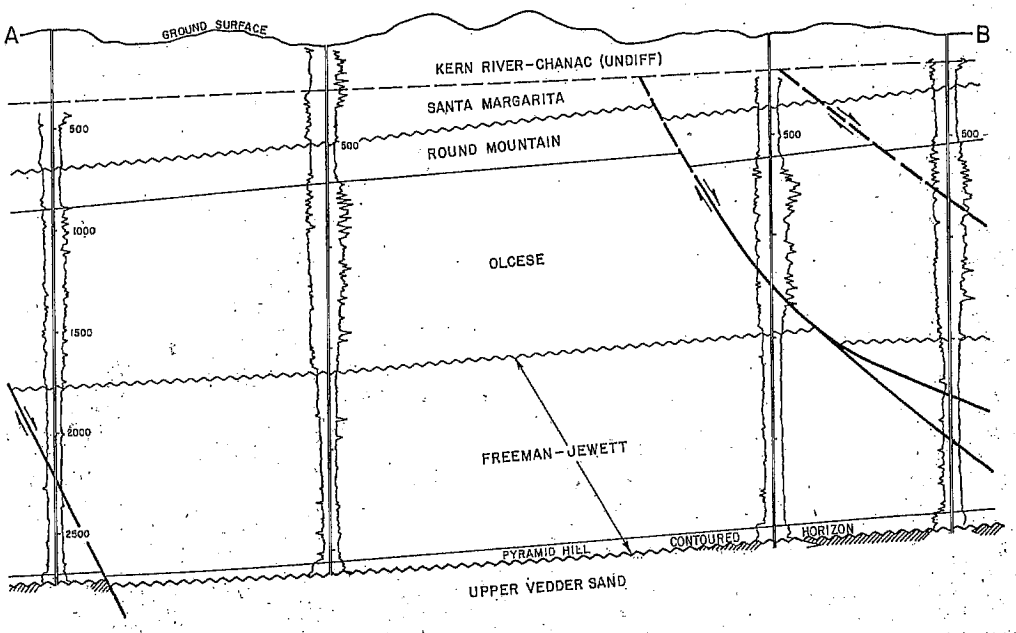
6) TDS of injection water:
   1,600 – 2,900 mg/l TDS
   The 1,600 mg/l TDS sample is from "NAM Produced water (West signal #8) on 1/1/2009 and the 2,900 mg/l TDS sample is from "18-WD7" on 9/20/2012. Permitted fluids for injection into the Walker Zone in Round Mountain field consist of Pyramid Hill, Jewett, Freeman-Jewett and Vedder zones production fluid.

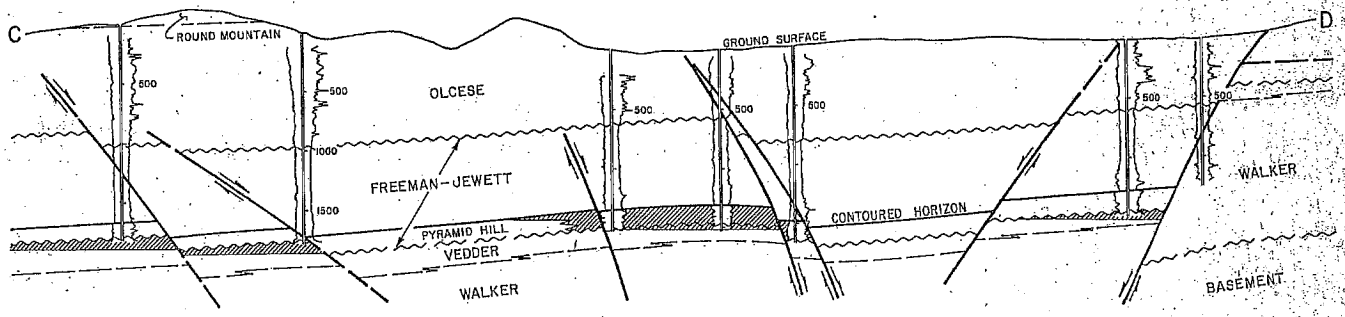
ROUND MOUNTAIN OIL FIELD

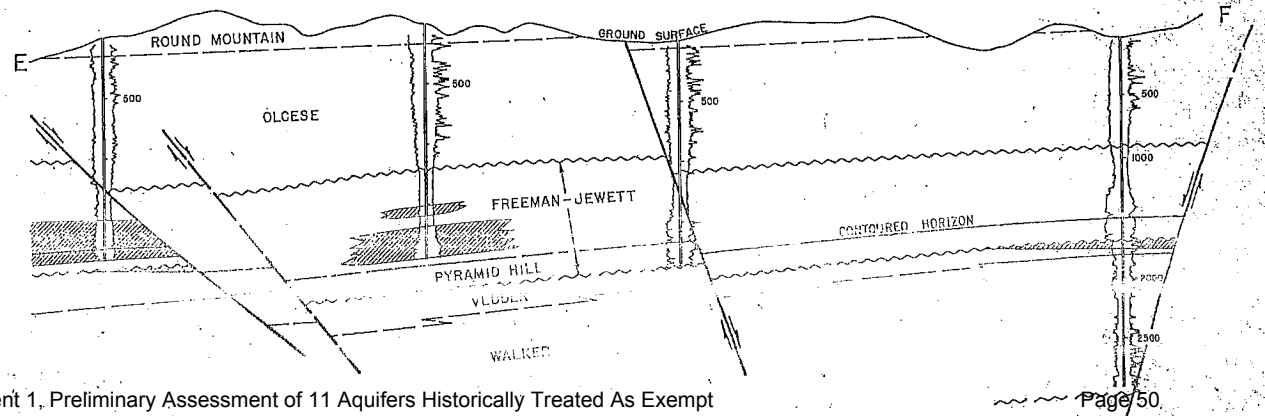




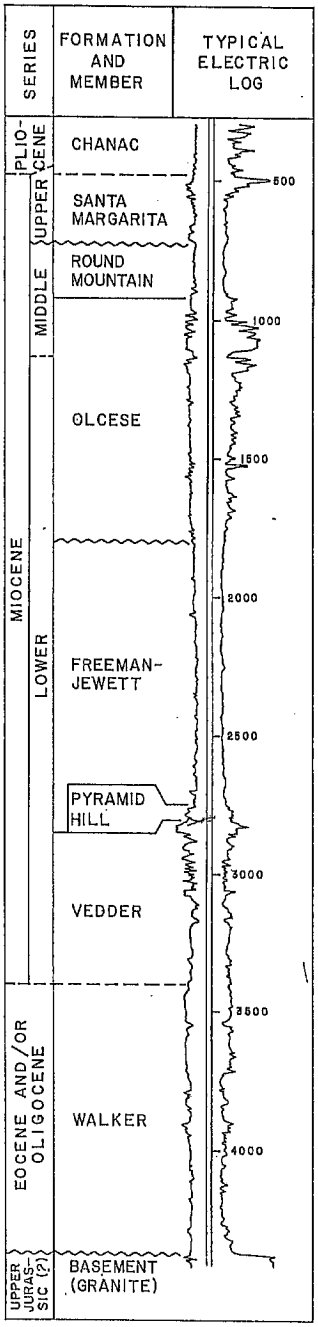
ROUND MOUNTAIN OIL FIELD

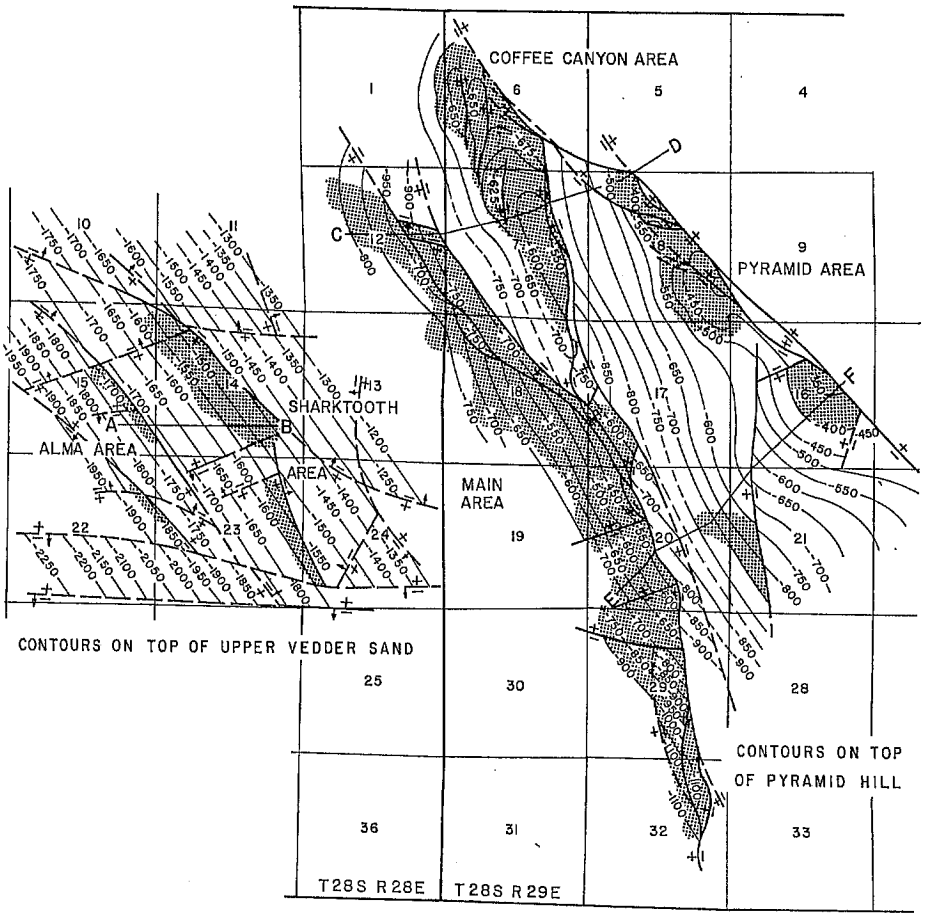






ROUND MOUNTAIN OIL FIELD





LOCATION: 14 miles northeast of Bakersfield

TYPE OF TRAP: See areas

ELEVATION: 600 - 1,500

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production Oil (bbl)	Initial daily production Gas (Mcf)	Date of completion
Jewett	Getty Oil Co. No. 2	Elbe Oil Land Dev. Co. No. 2	20 28S 29E	MD	*204	N.A.	May 1927
Pyramid Hill	Same as above	Same as above	20 28S 29E	MD	N.A.	N.A.	May 1927
Vedder	Same as above	Same as above	20 28S 29E	MD	N.A.	N.A.	May 1927

Remarks: * Production listed for Jewett is the combined production rate from the Jewett, Pyramid Hill, and Vedder zones.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
C.C. Killingsworth "Alma" 6	Barnsdall Oil Co. "Alma" 6	Mar 1948	15 28S 28E	MD	4,418	Basement (Granite)	Late Jur (?)

PRODUCING ZONES (See areas)

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
711,406	46,635	48,630,496	2,435	292	89,199,121	1,424,213	5,453,194	1938	665	468	2,590

STIMULATION DATA (Jan. 1, 1973) (See areas)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection

SPACING ACT: See areas.

BASE OF FRESH WATER: See areas.

CURRENT CASING PROGRAM: See areas.

METHOD OF WASTE DISPOSAL: See areas.

REMARKS:

REFERENCES: See areas.

CALIFORNIA DIVISION OF OIL AND GAS

ALMA AREA

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 700 - 1,270

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Vedder	Harold C. Morton & H.S. Kohlbush "Alma" 1	Same as present	15 28S 28E	MD	152	N.A.	Feb 1947

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
C.C. Killingsworth "Alma" 6	Barnsdall Oil Co. "Alma" 6	Mar 1948	15 28S 28E	MD	4,418	Basement (Granite)	Late Cret.

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Vedder	2,600	15	early Miocene	Vedder	13	N.A.	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
6,240	0	107,447	50	3	598,904	0	113,392	1948	47	21	80

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 8 5/8" cem. above zone; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps on outcrops of the Round Mountain Silt.

REMARKS:

REFERENCES: Albright, M.B. Jr., Sharktooth and Alma Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 42, No. 1 (1956).

COFFEE CANYON AREA

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 690 - 1,300

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Pyramid Hill	Acacia Oil Co. "Coffee" 1	Reynolds Oil and Gas Co. No. 1	6 28S 29E	MD	*600	N.A.	Sep 1928
Vedder	Acacia Oil Co. "Lindsay" 1	Lindsay Oil Co. No. 1	6 28S 29E	MD	800	N.A.	Aug 1928

Remarks: * Production is commingled from Pyramid Hill and Vedder.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Richard S. Rheem, Opr. "Smoot-Vedder" 2	Same	May 1957	1 28S 28E	MD	2,313	Vedder	early Mio

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Pyramid Hill	1,500	150	early Miocene	Jewett	18	50	None
Vedder	1,650	30	early Miocene	Vedder	16	75	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
103,176	0	7,292,707	435	50	18,507,039	67,567	1,857,108	1937	133	104	475

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
Water flood	1960	3,815,746	1

SPACING ACT: Does not apply

BASE OF FRESH WATER: 0 - 200

CURRENT CASING PROGRAM: 7" cem. above zone; 5 1/2" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps on outcrops of the Round Mountain Silt.

REMARKS: A cyclic-steam injection project in the Pyramid Hill and Vedder zones was started in 1965 and terminated in 1968. Cumulative injection totals 12,200 bbls. The Pyramid Hill zone was originally known as the Elbe zone.

REFERENCES: Park, W.H., J.R. Weddle, J.A. Barnes, Main, Coffee Canyon, and Pyramid Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 49, No. 2 (1963).

MAIN AREA

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 600 - 1,500

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Jewett	Getty Oil Co. No. 2	Elbe Oil Land Dev. Co. No. 2	20 28S 29E	MD	*204	N.A.	May 1927
Pyramid Hill	Same as above	Same as above	20 28S 29E	MD	N.A.	N.A.	May 1927
Vedder	Same as above	Same as above	20 28S 29E	MD	N.A.	N.A.	May 1927

Remarks: * Production listed for Jewett is the combined production rate from the Jewett, Pyramid Hill, and Vedder zones.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Shell Oil Co. "Jewett" 3	Same	Jun 1928	29 28S 29E	MD	2,678	Walker	Eo &/or Olig.

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Jewett	1,600	130	early Miocene	Freeman-Jewett	22	N.A.	None
Pyramid Hill	1,900	150	early Miocene	Jewett	18	N.A.	None
Vedder	2,000	80	early Miocene	Vedder	16	95	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
510,916	46,561	35,953,284	1,415	171	59,572,216	1,293,959	3,794,620	1938	302	225	17465

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Does not apply

BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 7" cem. above zone; 5 1/2" liner landed through zone.

METHOD OF WASTE DISPOSAL: 4,845,286 bbl. of waste water was injected during 1972 into two disposal wells; percolation and evaporation sumps on outcrops of the Round Mountain Silt.

REMARKS: A water flood project in the Vedder zone was started in 1961 and terminated in 1963. Cumulative injection totals 872,587 bbls.

REFERENCES: Park, W.H., J.R. Weddle, J.A. Barnes, Main, Coffee Canyon, and Pyramid Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 49, No. 2 (1963).

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 730 - 1,470

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Pyramid Hill	Thomas Oil Co. "Olcese" 2	Harp & Brown "Olcese" 2	17 28S 29E	MD	5	0	May 1944
Vedder	Crestmont Oil Co. "Olcese" 1	Eastmont Oil Co. "Olcese" 1	16 28S 29E	MD	250	N.A.	May 1937
Walker	Crestmont Oil Co. "Staley" 11	Same as present	8 28S 29E	MD	40	N.A.	Jul 1943

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Piute Holding Co. "Smith" 1	Same	Oct 1929	17 28S 29E	MD	3,110	Walker	Eo &/or Olig

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Pyramid Hill	1,250	130	early Miocene	Jewett	18	50	None
Vedder	1,390	40	early Miocene	Vedder	16	80 - 110	None
Walker	1,535	50	Eo &/or Olig	Walker	20	N.A.	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
55,714	74	1,527,767	290	37	5,692,349	6,876	378,882	1946	98	60	300

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
---			

SPACING ACT: Applies

BASE OF FRESH WATER: None

CURRENT CASING PROGRAM: 8 5/8" or 7" cem. above zone; 6 5/8" or 5" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps on outcrops of the Round Mountain Silt.

REMARKS:

REFERENCES: Park, W.H., J.R. Weddle, J.A. Barnes, Main, Coffee Canyon, and Pyramid Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 49, No. 2 (1963).

LOCATION: See map sheet of Round Mountain Oil Field

TYPE OF TRAP: Faulted homocline

ELEVATION: 700 - 1,300

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial daily production: Oil (bbl)	Initial daily production: Gas (Mcf)	Date of completion
Vedder	G M V Oil Co. "Signal-Mills" 1	Bandini Petroleum Co. "Signal Mills" 1	24 28S 28E	MD	214	N.A.	Sep 1943

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Mobil Oil Corp. "Bradford" 1	General Petroleum Corp. "Bradford" 1	Jun 1943	15 28S 28E	MD	2,995	Vedder	early Mio

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Oil gravity (°API) or Gas (btu)	Salinity of zone water gr/gal	Class BOPE required
Vedder	2,400	25	early Miocene	Vedder	13	N.A.	None

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Oil (bbl)	1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Average number producing wells	Cumulative production: Oil (bbl)	Cumulative production: Gas (Mcf)	Peak oil production: Barrels	Peak oil production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
35,360	0	3,749,291	245	31	4,828,613	55,811	503,449	1947	85	58	270

STIMULATION DATA (Jan. 1, 1973)

Type of project	Date started	Cumulative injection - Water, bbl; Gas, Mcf; Steam, bbl (water equivalent)	Maximum number of wells used for injection
--			

SPACING ACT: Applies

BASE OF FRESH WATER: None

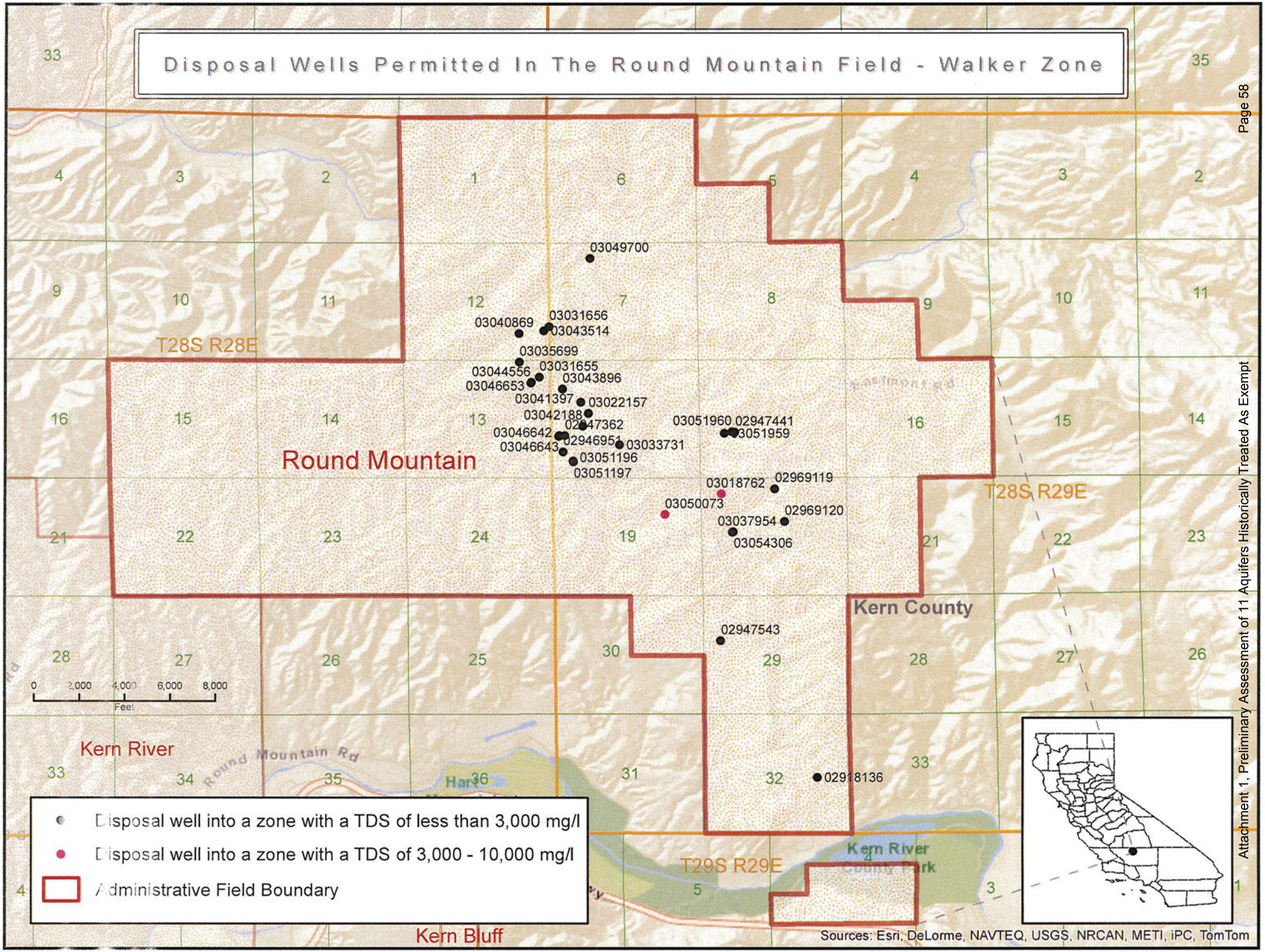
CURRENT CASING PROGRAM: 8 5/8" cem. above zone; 6 5/8" liner landed through zone.

METHOD OF WASTE DISPOSAL: Evaporation and percolation sumps on outcrops of the Round Mountain Silt.

REMARKS:

REFERENCES: Albright, M.B. Jr., Sharktooth and Alma Areas of Round Mountain Oil Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 42, No. 1 (1956).

Disposal Wells Permitted In The Round Mountain Field - Walker Zone



Bunker Gas Field, Undiff. (Post Eocene) Zone, Sacramento District Office

1) Number of disposal wells permitted in the zone:
   0

2) Number of active producers:
   0

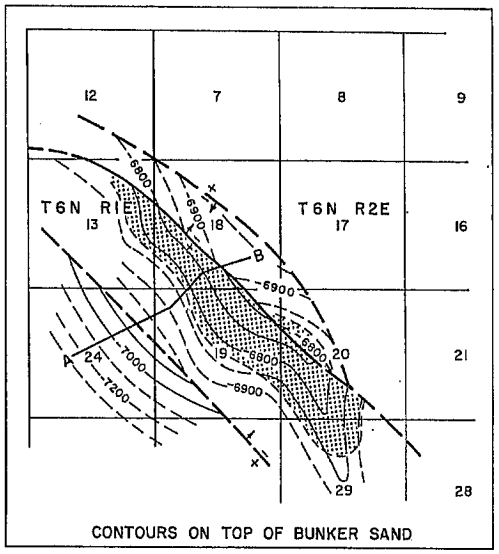
3) Depth of the zone across the field:
   3,000' below surface

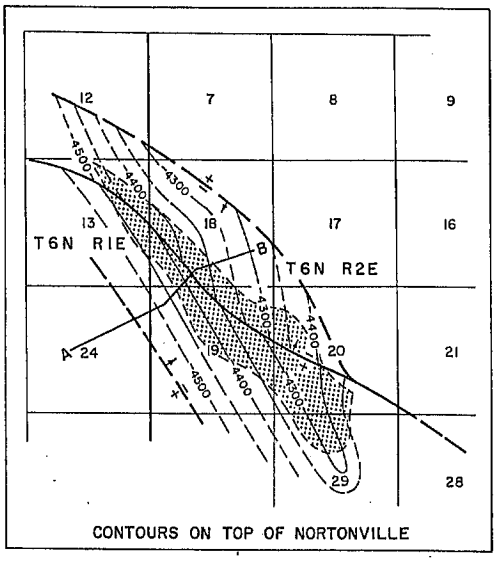
4) Volumes injected historically since 1983:
   51,454 Bbls, last injected on 11/1/1985. WD well API #095-00016 was P&A on 12/9/1986.

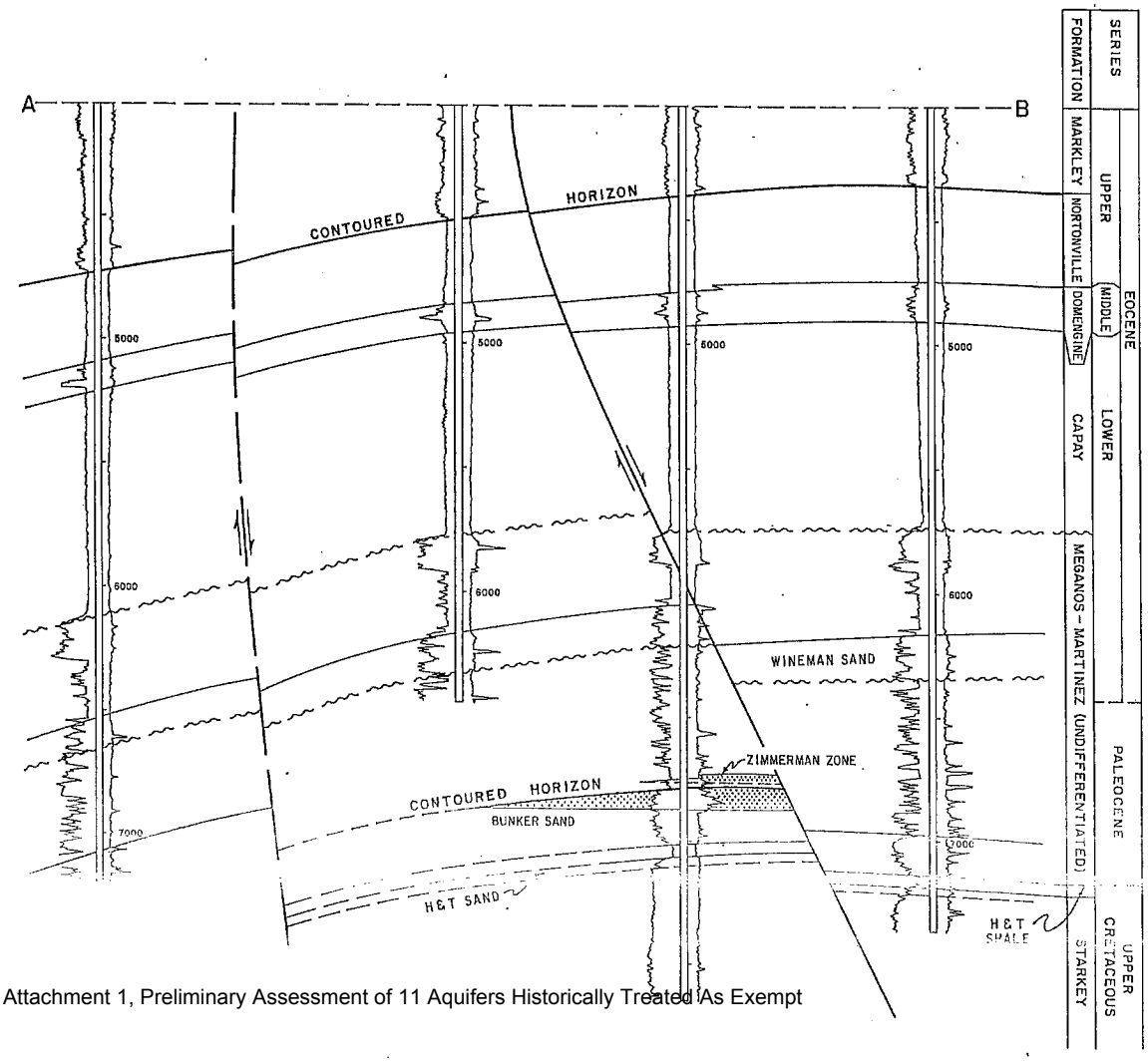
5) TDS of zone:
   1,215 mg/l TDS
   Sample collected from "BGZU" 601 well on January 16, 1974.

6) TDS of injection water:
   10,675 – 11,025 ppm Chloride
   Sample collected from "Bunker B-2 Zone" on April 26, 1973.

BUNKER GAS FIELD







LOCATION: 22 miles southwest of Sacramento

TYPE OF TRAP: Faulted anticline

ELEVATION: 25

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial production: Daily (Mcf)	Initial production: Flow pressure (psi)	Initial production: Bean size (in.)	Date of completion
Zimmerman	Amerada Hess Corp., Unit Oper. "BGZU" 901	Amerada Petroleum Corp., Oper. "Zimmerman" 1	29 6N 2E	MD	3,890	2,250	9/32	Aug. 1961
Bunker	Amerada Hess Corp., Unit Oper. "BGZU" 701	G.E. Kadane & Sons "Main Prairie Gas Unit A" 1	20 6N 2E	MD	3,425	2,250	1/4	Jun 1960

Remarks:

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Amerada Hess Corp., Unit Oper. "BGZU" 702	G.E. Kadane & Sons "Maine Prairie Gas Unit A" 2	Jan 1962	19 6N 2E	MD	10,098	Winters	Lt Cret

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Gas (btu)	Salinity of zone water gr/gal	Original zone pressure (psi)	Class BOPE required
Zimmerman	6,780	15	Paleocene	Martinez	1,075	4	2,930	IV
Bunker	6,845	25	Paleocene	Martinez	1,075	2	2,975	IV

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Maximum number producing wells	Cumulative gas production (Mcf)	Peak gas production: (Mcf)	Peak gas production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
3,073,729	6,704	810	8	53,141,694	10,457,830	1963	22	10	850

SPACING ACT: Applies

BASE OF FRESH WATER: 2,500 - 3,100

CURRENT CASING PROGRAM: 9 5/8" or 7" cem. 600; 4 1/2" cem. through zones and across base of fresh-water sands.

METHOD OF WASTE DISPOSAL:Disposal into sumps at well sites.

REMARKS: Commercial gas deliveries began in October 1961. 1972 condensate production 11,256 bbl.; cumulative condensate production 233,716 bbl.

REFERENCES: Hunter, W.J., Bunker Gas Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 47, No. 1 (1961).

Wild Goose Field, Undiff. Zone, Sacramento District Office

1) Number of disposal wells permitted in the zone:
   0 (only contains gas storage wells in this zone)

2) Number of active producers:
   0

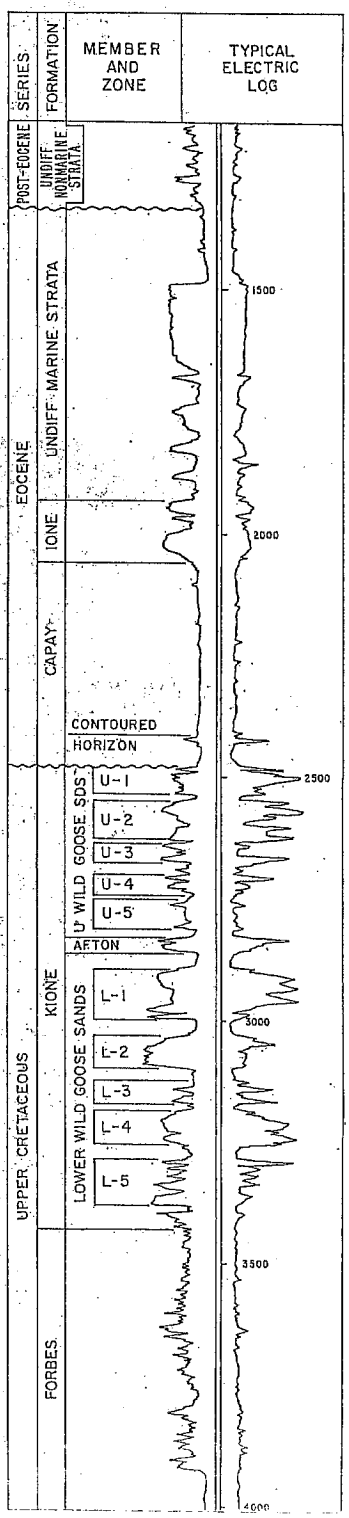
3) Depth of the zone across the field:
   2,700' – 3,400' below surface.

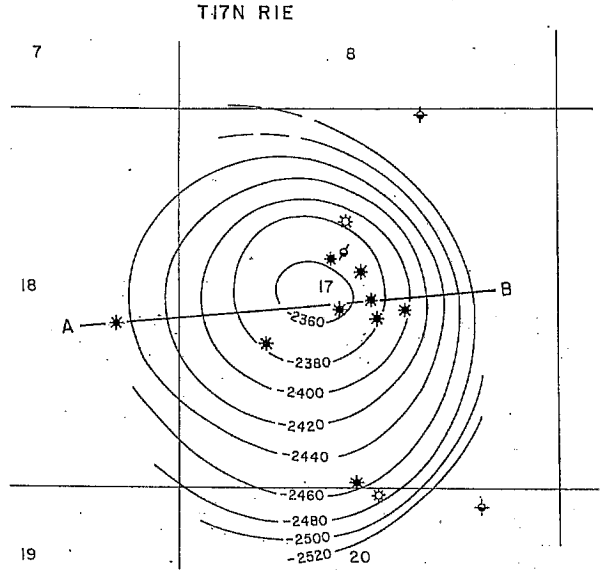
4) Volumes injected historically since 1983:
   None, only contains gas storage wells

5) TDS of zone:
   24,349 mg/l TDS
   Geochemical Analysis of Kione L4 sample provided in UIC Project File.

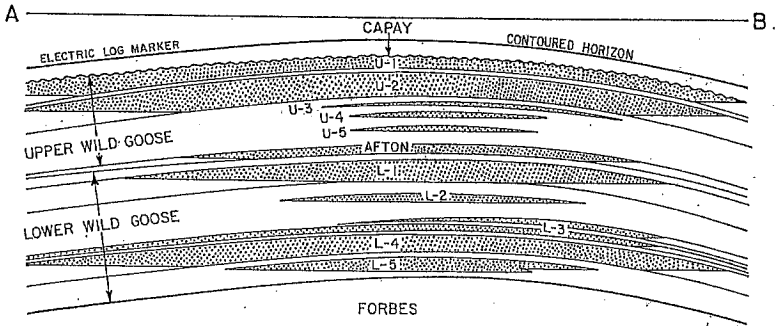
6) TDS of injection water:
   24,349 mg/l TDS
   Geochemical Analysis of Kione L4 sample provided in UIC Project File.

WILD GOOSE GAS FIELD





CONTOURS ON ELECTRIC LOG MARKER IN CAPAY



LOCATION: 10 miles northwest of Colusa

TYPE OF TRAP: Dome

ELEVATION: 65

DISCOVERY DATA

Zone	Present operator and well name	Original operator and well name	Sec. T. & R.	B & M	Initial production: Daily (Mcf)	Initial production: Flow pressure (psi)	Initial production: Bean size (in.)	Date of completion
Hangtown (Sub Capay)	Exxon Corp. "Wild Goose Gas Unit 1" 6	Humble Oil & Rfg. Co. "Wild Goose" 6	17 17N 1E	MD	4,000	940	24/64	Sep 1963
Upper Wild Goose	Exxon Corp. "Wild Goose Gas Unit 1" 4	Honolulu Oil Corp. "Honolulu-Humble Wild Goose" 4	17 17N 1E	MD	7,340	880	36/64	Jul 1953
Afton	Exxon Corp. "Wild Goose Gas Unit 1" 6	Humble Oil & Rfg. Co. "Wild Goose" 6	17 17N 1E	MD	*4,840	1,040	24/64	Sep 1963
Lower Wild Goose	Exxon Corp. "Wild Goose Gas Unit 1" 1	Honolulu Oil Corp. "Honolulu-Humble Wild Goose" 1	17 17N 1E	MD	4,020	1,370	24/64	Aug 1951

Remarks: * Commingled production from Afton and Upper Wild Goose. Honolulu Oil Corp. tested this zone in open hole at a maximum rate of 2,980 Mcf per day in "Honolulu-Humble Tule Goose" 1 (now Exxon Corp. "Wild Goose Gas Unit 1" 7) during July 1952.

DEEPEST WELL DATA

Present operator and well name	Original operator and well name	Date started	Sec. T. & R.	B & M	Depth (feet)	At total depth: Strata	At total depth: Age
Exxon Corp. "Wild Goose Gas Unit 1" 11	Humble Oil & Rfg. Co. "Wild Goose Country Club" 7	Aug 1967	18 17N 1E	MD	7,004	Dobbins	Late Cret

PRODUCING ZONES

Zone	Average depth (feet)	Average net thickness (feet)	Geologic: Age	Geologic: Formation	Gas (btu)	Salinity of zone water gr/gal	Original zone pressure (psi)	Class BOPE required
Hangtown (Sub Capay)	2,400	10	Lt Cretaceous	Kione	N.A.	N.A.	1,105	IV
Upper Wild Goose	2,500	200	Lt Cretaceous	Kione	800	1,780 - 3,250	1,200 - 1,310	IV
Afton	2,850	30	Lt Cretaceous	Kione	N.A.	N.A.	1,335	IV
Lower Wild Goose	2,900	250	Lt Cretaceous	Kione	805	1,800 - 2,650	1,345 - 1,500	IV

PRODUCTION DATA (Jan. 1, 1973)

1972 Production: Net gas (Mcf)	1972 Production: Water (bbl)	1972 Proved acreage	1972 Maximum number producing wells	Cumulative gas production (Mcf)	Peak gas production: (Mcf)	Peak gas production: Year	Total number of wells: Drilled	Total number of wells: Completed	Maximum proved acreage
1,382,761	0	340	9	99,229,200	8,248,811	1961	16	11	360

SPACING ACT: Applies

BASE OF FRESH WATER: 1,050

CURRENT CASING PROGRAM: 9 5/8" cem. 500; 5 1/2" cem. through zones and across base of fresh-water sands.

METHOD OF WASTE DISPOSAL: Water is injected into Exxon Corp. disposal well.

REMARKS: Commercial gas deliveries began in November 1951.

REFERENCES: Hunter, G.W., Wild Goose Gas Field: Calif. Div. of Oil and Gas, Summary of Operations--Calif. Oil Fields, Vol. 41, No. 1 (1955).

Attachment 2:

Plan for Class II Program Improvements

Introduction

Since at least the time of the US EPA's 1983 delegation of primacy to the Division of Oil, Gas and Geothermal Resources (Division), the Division's largest regulatory endeavor has been its Class II underground injection control (UIC) program. Significant improvements to this plan will, by necessity, require significant changes in all aspects of the Division – leadership, staffing, training, data management, establishment of metrics, internal review and monitoring against standards. Organizational change of this magnitude is profound, affecting every employee action every day. The Brown Administration, the Department of Conservation and the Division have committed to this organizational restructuring, of which this Plan for Class II UIC Program Improvements is an important – but not sole -- piece.

Given the years of work and level of resources required, it is critical to know what the target is. This plan should be understood in the context of this vision for the Division:

> The Division will become a modern, efficient, collaborative, science-driven agency that intelligently and consistently regulates State oil and gas activities using modern field tools integrated with advanced data management systems that allow for oversight of a greater number of activities. Safety and training will become integrated cultural norms. The Division will be much better connected with oil and gas-related research activities in industry, academia, and national laboratories so that it can see regulatory challenges coming in advance and apply regulations from an elevated platform of understanding. The Division will perform its duties with integrated collaboration of other State agencies to reduce the environmental impact of oil and gas development. Internal monitoring and compliance will be routine and fully integrated with all that we do so that Division performance can be measured objectively. The Division will be paperless and have instant access to data and information, and hence be able to support all stakeholder groups. Likewise, stakeholder groups will be able to routinely observe Division activities and retrieve information of interest. The Division will have more effective communications capabilities and be more comfortable engaging stakeholder groups.

BACKGROUND AND OVERVIEW

Injection wells have been an integral part of California's oil and gas operations for over 50 years. Currently, over 50,000 oilfield injection wells are operating in the state. Injection wells are used to increase oil recovery and to safely dispose of waste fluid produced with oil and natural gas. About 70-75 percent of California's oil production is the result of enhanced oil recovery (EOR) methods such as steam flood, cyclic steam, water flood, and natural gas injection, all of which involve some sort of injection activity.

Most of the oil and gas fields in the state are mature and require EOR to be productive. Each year more responsibility rests with the Division's Underground Injection Control (UIC) Program to deal with the enhanced recovery of the resource. This includes new methods and techniques developed by the industry to produce the oil and gas. The increased use of injection, such as cyclic steaming, also presents new public health and safety risks, especially in fields with older wells. These risks include groundwater contamination, reservoir fluids leaking to the surface, and fires and blowouts caused by the migration of oil and gas. Urban encroachment on or around older oil and gas wells raises additional issues and concerns.

The Horsley Witten audit, conducted at the request of the Division for the US EPA, was completed and sent to the Division in September 2011. The following issues were outlined in the audit:

- Additional plugging and cementing requirements to protect underground sources of drinking water (USDW)
- More in-depth evaluation of the zone of endangering influence (ZEI)
- Requirements for waste fluid disposal
- Changes to requirements for pressure gauges and/or monitoring of zone pressure
- Well construction and cementing
- Annual project reviews
- Standard Annual Pressure Test (SAPT) requirements
- Well monitoring requirements instead of the SAPT
- Mechanical integrity surveys and testing
- Inspections and compliance/enforcement practices and tools
- Idle well planning and testing program
- Financial responsibility requirements
- UIC staff qualifications
- Cyclic steam injection well testing requirements

In addition to the US EPA audit, the legislature has been involved with several UIC issues and has noted other areas that need to be addressed in regulation. These include:

- H2S/Waste Gas Disposal
- Freshwater usage relating to EOR projects
- CO2 EOR Projects

Additional areas of concern relating to the Division's UIC program include:

- Production from shallow diatomite formations
- Surface expressions
- Aquifer exemption process

- Well construction standards
- Injection relating to formation fracturing pressure

ACTIONS TAKEN TO DATE

The Division first identified issues with its UIC Program in 2009. Division management began a review of then-current practices in regards to approving injection projects, annual project reviews, and the evaluation of wells within the Area of Review (AOR). At the conclusion of the Division's self-assessment, it developed a general plan to work with the administration and Legislature to increase the number of staff so that several deficiencies in the program could be addressed proactively. 17 positions (PYs) established in the FY 2010-2011 budget were spread throughout the Division to add staff to the UIC program to ensure project applications were reviewed according to both the program specifications outline in the Primacy application to the US EPA and in accordance with State statutes and regulations. In addition, Division management also put in place a Letter of Expectations to remove any confusion regarding how injection project applications were to be evaluated. These expectations were issued in May 2010 and revised in November 2010. The Letter of Expectations was mentioned and supported in the Horsley Witten Report.

As the Division continued to monitor its performance and the pace of program improvements, the Division recognized that additional resources were needed to reach improvement goals and therefore requested and received additional staff in FY 2011-2012. Most of these positions were added to the UIC program to provide additional staff to conduct an adequate UIC project application review. Several PYs were used to form an internal monitoring and compliance group to dig deeper into the UIC project files to provide a more refined evaluation of the Division's internal adherence to UIC requirements. Once established, the Monitoring and Compliance Group began an assessment of the Division's activities in District 1 (Los Angeles Basin) regarding past and current work regarding UIC project approvals, area of review and zone of endangerment assessments, project monitoring and annual reviews.

To meet the objectives listed in the Letter of Expectations, Division management executed an internal strategy to explain and train staff regarding the requirements for an UIC project approval, and how existing projects were to be reviewed, remediated and monitored to move UIC projects to full compliance.

As these activities were underway, Division management recognized the need to address the emergence of cyclic steam enhanced oil recovery as not only a rapidly evolving technology but one that was being employed to produce a major fraction of the state's oil. Further, the Division set in motion steps to deal with the mismatch between existing regulations and the realities in the state's oilfields. Of greatest concern was cyclic steam production from shallow diatomite formations as this type of production was rapidly emerging, and the state's regulations were inadequate to properly regulate these activities and ensure protection of USDWs.

Moving Forward and UIC Assessment

Even though there has been consistent recognition by several top leaders within the Division that the UIC program has had significant deficiencies, Division plans and actions for UIC improvement have been less effective than needs demand. In part, the mismatch between plan objectives and results have been caused by numerous management changes. Furthermore, it was not fully understood that fundamental problems with the lack of consistent business processes, poor record-keeping and the lack of modern data management tools were only some of the root causes of the Division's lack of performance in the UIC program. Hence, until recently, a coherent plan addressing broad, fundamental foundational problems was not developed. This spring, with the strong support of the Brown administration, the Division requested and received 23 additional positions to address deficiencies in a number of areas – capacity in program leadership, monitoring and compliance, data management and geographic information systems, emerging technologies, and environmental review. Furthermore, as part of the overall plan, the Division requested and received funding for a modern data management system designed for the oil and gas regulatory environment. Further changes will be forthcoming in the weeks ahead to better align the Division for significant performance improvements.

The Division has already started its UIC program evaluation and will continue the following efforts:

- Identifying gaps in UIC Program compliance and develop a corrective action plan
- Hiring qualified personnel to fill retirement and new position vacancies
- Providing technical and regulatory training for UIC staff
- Increasing management oversight of UIC staff
- Increasing accountability for technical work
- Conducting outreach to the public regarding state and federal mandates
- Conducting outreach to the oil and gas industry to raise awareness of changes in Division regulatory approaches and monitoring
- Pursuing and implementing electronic data systems development

California is moving forward to meet the changing regulatory imperatives with respect to technology, demographics, and more aggressive oversight of oil and gas production. To reiterate, the target is to evolve the Division to a modern, efficient, collaborative, science-driven agency that intelligently and consistently regulates State oil and gas activities using modern field tools integrated with advanced data management systems that allow for oversight of a greater number of activities. Safety and continuous training and improvement will become integrated cultural norms. The Division will be much better connected with oil and gas-related research activities in industry, academia, and national laboratories so that it can see regulatory challenges coming in advance and apply regulations from an elevated platform of understanding. The Division will perform its duties with integrated collaboration of other State agencies to reduce the environmental impact of oil and gas development. Internal monitoring and compliance will be routine and fully integrated with all that is done so that Division performance can

be measured objectively. The Division will be able to support all stakeholder groups because it will be paperless and have instant access to data and information. Hence stakeholder groups will be able to routinely observe Division activities and retrieve information of interest. The Division will have more effective communications capabilities and be more comfortable engaging the constellation of stakeholder groups.

Such profound organizational renewal will consume several years and require constant, focused attention. This work plan is an important initial piece of that renewal. The UIC plan is designed to strengthen the current UIC Program through new regulations, consistent, ongoing training, enhanced compliance oversight, and an evaluation of existing projects and UIC operations.

Assessment by Monitoring and Compliance Unit

The Division has conducted a partial assessment of the Division UIC Program by sampling and reviewing program activities and compliance oversight in one of its District offices. In the development of the assessment, the Division considered the following concerns to help develop a priority list:

- Risk to the public
- Risk to health and safety
- Risk to property
- Risk to natural resources
- Risk of litigation

Based upon known conditions at the time of the assessment, the injection projects located in the Cypress District (Division – District 1) appeared to have the highest priority. The District has around 800 injection projects, which includes over 2,000 injection wells.

The assessment was designed to give greater insight into the range of shortcomings in the Division's UIC program. The UIC program standards that should be used are listed in both California's Primacy application and the federal regulations associated with the Safe Drinking Water Act and Class II injection wells. The assessment has:

- Evaluated a representative sampling of old projects that are in fields that were discovered in the 1930's and 1940's to determine if appropriate Area of Reviews (AOR) were completed and to determine if possible conduits for the injection fluid are present
- Evaluated a representative sampling of recent projects to determine if appropriate AORs were completed and to determine if possible conduits for injection fluid are present
- Evaluated a representative sampling of the records for annual project reviews to determine if they were performed and documented adequately to determine if the project is in compliance with the project approval

- Evaluated a representative sampling of the Division's UIC monitoring program to determine if adequate Mechanical Integrity Testing (MIT) surveys were conducted, evaluated, and documented to ensure mechanical integrity of the injection wells
- Evaluated a representative sampling of the Division's UIC monitoring program to determine if the Maximum Allowable Surface Pressures (MASP) are determined correctly and monitored to ensure compliance with the project approval
- Evaluated if the Division's UIC staff are appropriately educated and trained and have the necessary tools to enforce the Safe Drinking Water Act in regards to Class II wells
- Evaluated if the Division has enough staff and resources to adequately enforce the Safe Drinking Water Act in regards to Class II wells

A draft report that lists the results of the assessment in our Cypress district office has been prepared and is under final administration review.

Bonding

The State has already addressed some of the financial responsibility requirements. Effective January 1, 2014, the State has increased its bonding amounts to address the rising costs to remediate problem wells that become the responsibility of the State. These changes also affect the number of wells that may be covered by a blanket bond. What is not clear, pending further review, is the magnitude of the state's financial liabilities and whether the incremental changes heretofore are sufficient to address long-term needs.

DIVISION'S NEXT STEPS

Individual Project Evaluation

The Division will undertake improvements to its administration of the UIC Program through a series of actions including increasing program leadership talent, enhancing field monitoring of compliance with regulations, a series of rulemakings on priority topics, and a project-by-project review of each UIC project to assess the status of the project with respect to compliance with UIC regulations, testing requirements and adherence to limitations placed on the project in project approval letters. This plan will be informed based upon the findings of the partial assessment of the UIC program already conducted. The Division will take the following steps to ensure all injection projects are in compliance with State law and the Primacy agreement with the US EPA:

1. District staff will review all of the active injection projects in the State and determine what, if any, data are missing to fully evaluate the injection project and ensure the protection of Underground Sources of Drinking Water (USDW). Any data that need to be updated because of changes or modifications to the original approval, will be identified and collected, and the project files organized and

prepared to meet two goals: improved, consistent regulatory oversight and efficient uploading of project data into the coming new data management system.

2. As this project-by-project review is underway, Division staff will meet with operators to discuss the list of deficiencies and develop a compliance schedule for all issues. Operators will be given no more than 6-12 months to supply the Division with the missing or updated data. Depending on the data requests, this timeline may be greatly reduced. Based on the project-by-project review, projects could be terminated or modified.

3. Division staff will evaluate the data submitted and require operators to make changes to ensure the project is still viable. Projects will be modified or cancelled based on this analysis.

4. All projects will be evaluated by the District office and sent to Sacramento for review and concurrence by the program director prior to being approved.

5. Projects may require a new Project Approval Letter (PAL) with additional conditions and/or reporting requirements to ensure compliance.

6. All projects will be reviewed to assess containment of injection fluids. The Division will work closely with the State Water Quality Control Board on the evaluation of fluid containment and the adequacy of the required zone of endangering influence and area of review.

7. All injection data will be entered or verified in the State's databases. Because existing databases may not have the capacity to manage all the data required, the Division will implement a temporary database until the Division's data management system is developed and implemented.

8. All required mechanical integrity tests will be confirmed and verified.

9. Once every year thereafter, the projects will be evaluated to ensure the projects are operated in compliance with the PAL and all testing and monitoring requirements have been met in compliance with UIC regulations.

Project-by-Project Review Schedule

The project-by-project review process will be time consuming and demand significant investment if staff time. In the Cypress and Bakersfield districts, this effort will be very significant. Even though with the implementation of the Letter of Expectations, project applications and project files have improved, many of the injection projects were evaluated and approved under a less stringent process. Many of the Districts have had District policies in place that fell short of directives in the primacy application, statutes, and regulations. The time to complete this review will vary based upon the following:

- Number of projects in each District
- Number of injection wells in the project
- Number of wells within the AOR (project area)
- Amount and type of data missing from the project file
- Current status of the project

Division leadership expects that a review of this depth could require as much as a week (5 working days) to evaluate what is missing from a project file. Such a review can be complicated and complex since the data provided needs to be relevant and accurate, and requires comparison with the project application.

All projects are not equal in size or complexity, and based upon the project status and number of injection projects by District, the following is an estimate of time needed for initial review to evaluate existing data, identify gaps and the develop a list of compliance deficiencies:

District 1 (Cypress)
Number of projects: 817 (X 40 hours) = 32,680 hours

District 2 (Ventura)
Number of projects: 322 (X 40 hours) = 12,880 hours

District 3 (Orcutt)
Number of projects: 255 (X 40 hours) = 10,200 hours

District 4 (Bakersfield)
Number of projects: 1342 (X 40 hours) = 53,680 hours

District 5 (Coalinga)
Number of projects: 195 (X 40 hours) = 7,800 hours

District 6 (Sacramento)
Number of projects: 43 (X 40 hours) = 1,720 hours

The Division is mindful that review of all projects will not consume a full 40 hours. Some projects are no longer active, so the District staff will prioritize the projects based upon

their status. Based upon these numbers it is estimated to take anywhere from six to 18 months to complete this first phase. Phase II -- developing a compliance schedule required of operators and certifying the completion of requirements-- will consume, in total, approximately an additional 12-18 months. Therefore, the overall time to fully complete the project review, certify remedial work, and move the program into full regulatory compliance is estimated to be three years.

The Division anticipates that the review and compliance process can be completed in different districts on different schedules. Beginning October 1, 2015, the Division has developed the following schedule:

Districts 3 and 6, review complete within 7 months, compliance certification within 18 months (18 months start to finish);

Districts 2 and 5, review complete in 9 months, compliance certification in 24 months (24 months total).

District 1, review complete in 10 months, compliance certification in 28 months (28 months total).

District 4, review complete in 16 months, compliance certification in 36 months (36 months total)

A very significant unknown in this review will be the amount of time needed for joint Division and Water Board assessment and validation of containment of injected fluids. Furthermore, demands on staff time for aquifer exemption data review and preparation for the implementation of the new data management system will be significant and will have to be orchestrated to meet these timelines. Once an initial assessment of file status in each of the Districts is complete, the Division can develop a more refined assessment of schedule.

Aquifer Exemptions

The Division continues to evaluate wells that have been permitted to inject into non-exempt aquifers, according to the compliance schedule agreed upon by the Division, State Water Board, and US EPA. The Division, working with the State Water Board, is continuing to evaluate potential impacts to water supply wells and, where precautionary measures are needed, ordering wells to cease injection if there is a potential impact to any water supply well. In addition to the well evaluation, the Division and State Water Board are working with operators to obtain additional data on aquifers to determine if the State will pursue aquifer exemption applications to the US EPA. The State continues to meet its obligations to the compliance schedule and acknowledges that a failure to receive approval from the US EPA on proposed aquifer exemptions will result in additional injection well closures.

Staffing

As noted above, the Division has recently received 23 additional positions to augment the Division's program. Ten positions will be deployed to the district offices to enhance field presence and the review of UIC projects. Five positions will be added to the GIS/Data Management Unit to ensure data quality and support to the district staff evaluating UIC project applications and reviews. Three positions will be added to the California Environmental Quality Act (CEQA) Unit to ensure compliance with project approvals and environmental reviews associated with the approvals. Four positions will be added to the Monitoring and Compliance Unit, which will increase capacity to the current Monitoring and Compliance Unit to ensure there is consistency throughout the Division and that all districts are fully implementing the UIC program. We have also added one position to the legal staff to assist with rulemakings, litigation, and other legal issues associated to UIC issues.

The Division is also assessing its organizational structure, workload, and supervisory oversight requirements of the organization and is preparing to make adjustments to be more effective and to better assimilate the additional staff. These adjustments, based upon identified priorities, will be announced soon.

Compliance Monitoring

This work plan includes utilizing the Division's Monitor and Compliance Unit to verify District staff are following statutes, regulations, and policies in the regulating of the UIC projects. This unit is separate from the UIC Program and therefore can provide objective analysis of the adequacies of the UIC Program improvements. This unit is comprised of one Senior Oil and Gas Engineer to oversee the unit, seven Engineers, and one Associate Government Program Analyst. This team will provide the necessary resources to assist with the improvement plan implementation and execution, and then continued monitoring to ensure Division statutes, regulations, and policies are followed. This unit is providing feedback to the Technical Services Manager, UIC Program Manager, and the Chief Deputy to ensure accountability.

Training

The Division is seeking a Technical Training Coordinator to evaluate training needs of the Division's technical staff. As we move to fill this position, the Division is also moving to put in place training contracts and training requirements for staff to complete, prior to going into the field and evaluating UIC project applications. The Division is also in the process of developing a training plan that clearly outlines the necessary training requirements for each level of engineer as well as a list of skills, knowledge, and abilities for each level of engineer. This plan is also expected to be ready by autumn, 2015.

In addition to specific training courses, the Division will continue its meetings of engineers in the Districts. The Division has had two such meetings in the last year.

These meetings are designed to develop team work and share important information regarding different aspects of the work district engineers perform. They provide a forum to share findings regarding investigations of injection activities the Division has undertaken and provide guidance as to how to monitor and identify issues before problems occur.

Business Process

The Division lacks clear and consistent business process. To deal with this challenge, the Division has contracted for assistance with:

1. Identification of the various permitting processes throughout the Division
2. Identification of common relevant steps in each the process
3. Recommendations of statewide processes for our permitting

Along the way, the contract will ensure that legislative mandates are being captured in our existing processes. Much of the work done for this will also contribute to essential preparations for the implementation of our data management project.

Phase 1 of the contract will require 90 days. The contractor is now traveling to District offices to interview employees who have a part of the UIC program.

Data Management System

The Division has already begun working with the California Department of Technology to evaluate our current systems and to develop a plan to meet the Division's future data management needs. This plan will include looking at a data management system that captures all the required data and a method for either the Division to push data to an US EPA-wide data management system or a method for EPA to download data. The State employs a "Stage/Gate" model process to assess business needs and processes and develop deliverables and project completion schedules. The entire process of assessment to delivery of a complete system could take 3-4 years including the uploading of legacy data.

Rulemaking

The Division has identified an ambitious list of regulatory goals to be accomplished by rulemaking action. This list of regulatory goals is based on the Division's own evaluation of its UIC Program, concerns raised in the review prepared by the Horsley Witten Group, input from stakeholders, and input from other regulatory agencies. In addition, these regulatory goals dovetail with issues related to the UIC Program that were identified by the California Council on Science and Technology in the independent

scientific assessment of well stimulation treatments in California that it conducted pursuant to Senate Bill 4 (Pavley 2013).

These regulatory goals each relate to the Division's UIC Program, but some issues – such as well construction standards and idle well management – are actually broader in scope than just injection regulation. Because these rulemaking goals are likely to be more than could be effectively addressed at one time, the Division will undertake its rulemaking efforts around these goals in two phases. The regulatory goals to be addressed in these two phases of rulemaking are as follows:

<u>Phase 1</u>

- *Clarify standards for ensuring zonal isolation of injection projects*
- *Expressly define the quality of water to be protected when constructing wells*
- *Codify best practices for well construction*
- *Establish permitting and regulatory requirements specific to cyclic steam operations*
- *Establish requirements specific to cyclic steam in diatomite, including a regulatory framework for responding to surface expressions and clarification regarding injection above fracture gradient*
- *Clarifying process and standards for establishing maximum allowable surface pressure for injection operations*

<u>Phase 2</u>

- *Codify requirements for ongoing project review*
- *Establish requirements for securing idle wells and standards for well abandonment*
- *Elaborate on existing idle well testing requirements*

Generally, these rulemaking goals will be accomplished through a process of (1) identifying interested parties and engaging with stakeholders to solicit concerns and suggestions; (2) drafting proposed regulations and informally soliciting input on the draft regulations; and then (3) commencing formal rulemaking to adopt proposed regulations.

The Division has already started this process for Phase 1 of its rulemaking effort. The Division has circulated a notice identifying the Phase1 regulatory goals and encouraging people to identify themselves as interested parties for the rulemaking effort. In the near future, the Division will be sending notice to interested parties of workshops to be conducted this fall throughout the state, in order to provide an opportunity to provide

input on how to best accomplish the regulatory goals identified. The Division's goal is to informally circulate draft regulations in November 2015, commence formal rulemaking in January 2016, and complete the rulemaking process for the Phase 1 rulemaking effort by winter of 2016.

Although the Division has already begun giving consideration to Phase 2 regulatory goals, the Division will not begin working in earnest to pursue the Phase 2 rulemaking effort until formal rulemaking for the Phase 1 rulemaking effort is near completion. Accordingly, the Division estimates that the Phase 2 rulemaking effort will not begin until fall of 2016, and will not be completed until winter of 2017.

Conclusion

The job of meeting the many goals laid out here is indeed a substantial one. But with the continued support and effort of those involved, doing the job well will result in a modern and responsive regulatory unit that is able to meet the challenge of helping to shepherd our oil and gas resources in a way that will, to the greatest extent possible, both protect public health and the environment and maintain California's significant oil production economy.

Attachment 3: Public Participation Process For Aquifer Exemption Proposals

The purpose of this document is to explain the public participation process that the Department of Conservation, Division of Oil, Gas, and Geothermal Resources (Division) will follow before submitting an aquifer exemption proposal to the US Environmental Protection Agency (U.S. EPA). The Division will not submit an aquifer exemption proposal to U.S. EPA without concurrence from the State Water Board and the appropriate Regional Water Quality Control Board (collectively Water Boards) that the proposal is appropriate, and the Division will not submit a proposal for public comment unless the Division and the Water Boards agree that the proposal merits consideration.

- **Public Notice and Comment**

    - Timing. Public notice and opportunity to comment will be provided after the Division and the Water Boards make an initial determination to request U.S. EPA approval of a new aquifer exemption, but before any final proposal is submitted to U.S. EPA.

    - Newspaper Publication. The Division will publish notice of proposed aquifer exemptions in at least one newspaper. The most appropriate newspaper will be determined on a case-by-case basis, but generally will be the most widely-circulated, daily-issue newspaper in the county where the aquifer is located. Notice may be published in a second newspaper, if deemed necessary to target a wider audience or more local community. All notices will be published for three consecutive days, beginning (but not necessarily ending) on a weekday.

    - Length of Notice and Comment Period. The Division will accept public comment for a period of at least 30 days beginning on the first day notice is published in the newspaper. If substantial changes are made to the proposed exemption after the close of the initial notice and comment period, the Division will reopen a supplemental, 15-day notice and comment period beginning on the first day the supplemental notice is published in the newspaper.

    - Website. The Division will establish a webpage within its current website to hold all notices, information submitted in support of exemptions, public comments, and other materials on which the Division relies. The notices will direct readers to the webpage for more information, which will more fully inform the public and enable a meaningful opportunity to comment.

    - List Serve. The webpage for aquifer exemptions will allow individuals to join a list serve for receiving email notification of all future aquifer

exemption proposals. Email notification will be sent on the same day notice is published in the newspaper, or as soon as possible thereafter.

- Outreach. On the same day notice is published in the newspaper, or as soon as possible thereafter, the Division will email or mail notice to the following:
  - Director of the Water Management Division, U.S. EPA Region IX;
  - Chairperson of the State Water Resources Control Board;
  - Chairperson of the Regional Water Quality Control Board(s) with jurisdiction over the area in which the aquifer is located;
  - The Board of Supervisors of the county(s) in which the aquifer is located, and any other local officials identified as likely to be interested;
  - State Senators in the following committees: Agriculture; Energy, Utilities and Communications; Environmental Quality; Natural Resources and Water;
  - State Assembly Members in the following committees: Agriculture; Natural Resources; Water, Parks & Wildlife; and
  - Industry associations and non-governmental organizations identified as likely to be interested;

- **Public Comment Hearings**
  - Schedule and Notice. A joint public comment hearing will be held with a designee from the State Water Board for the purpose of providing an opportunity for people to provide oral comments. The initial notices for a proposed aquifer exemption will specify the date of the hearing date, which will always be at least 30 days from the date of the notice.
  - Location. Hearings will be held at a location convenient for the parties involved or in Sacramento.
  - Consolidation. The Division and State Water Board will set aside one day every month (or every other month, depending on the rate of proposals under review) for holding a public hearing on proposed aquifer exemptions. Several aquifer exemption proposals will normally be considered at each hearing, with each proposal allocated a separate time slot. The number of exemption proposals at issue in a hearing will depend on readiness of the proposals and their relative complexity.
  - Requests for U.S. EPA Participation. The Division and State Water Board may elect to request U.S. EPA's participation at the hearing. Requests for

U.S. EPA participation will be made at least 10 days prior to the date of the hearing.

- Conduct. Public hearings will be conducted as follows:
  - Division staff will provide a brief introduction regarding each aquifer exemption;
  - The purpose of the public comment hearings is to receive public input – the Division and State Water Board will receive public comments but will not necessarily answer questions or debate issues;
  - All attendees will be provided an opportunity to provide oral or written statements, though the Division and State Water Board may impose reasonable limitations on oral presentations;
  - Hearings will be recorded by an audio/video recording device, or by a stenographer; and
  - If an attendance list or similar document is posted or circulated at the hearing, the document will state that signing-in is voluntary and that all persons may attend regardless of whether they sign-in.

- **Outcome**
  - Notice of Substantial Changes. As noted above, the Division will reopen a 15-day supplemental notice and comment period for substantial changes made to the proposed exemption following close of the initial comment period.
  - Decision and Response to Comments. If the Division and the Water Boards elect to submit an aquifer exemption proposal to U.S. EPA, it will prepare a document that (1) announces the decision, (2) provides a concise statement of the basis for the decision, and (3) summarizes the substantive comments received (including oral comments received at a hearing) and the disposition of those comments. This document will be included in the submittal to U.S. EPA.
  - Submission to U.S. EPA. In the unlikely event it takes the Division longer than one year from the date of initial notice to submit an aquifer exemption to U.S. EPA, the Division will consider whether there are any changed circumstances that may reasonably require a new round of notice and comment.

PUBLIC NOTICE OF DETERMINATION AND REQUEST FOR U.S. EPA ACTION REGARDING ELEVEN AQUIFERS HISTORICALLY TREATED AS EXEMPT:

The Pico Formation underlying the boundaries of the South Tapo Canyon Field

The Tumey Formation underlying the boundaries of the Blackwell's Corner Field

The Kern River Formation underlying the boundaries of the Kern Bluff Field

All aquifers underlying the boundaries of the Bunker Gas Field that are not in a hydrocarbon-producing zone

The Santa Margarita Formation underlying the boundaries of the Kern River Field

The Chanac Formation underlying the boundaries of the Kern River Field

The Walker Formation underlying the boundaries of the Mount Poso Field

The Olcese Formation underlying the boundaries of the Round Mountain Field

All aquifers underlying the boundaries of the Wild Goose Field that are not in a hydrocarbon-producing zone

The Walker Formation underlying the boundaries of the Round Mountain Field

The Santa Margarita Formation underlying the boundaries of the Kern Front Field

30-DAY PUBLIC COMMENT PERIOD

Notice Published November 15, 2016

NOTICE IS HEREBY GIVEN that the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources ("Division"), in consultation with the State Water Resources Control Board ("Water Board") (collectively, "State Agencies"), intends to advise the United States Environmental Protection Agency ("US EPA") that ten of the eleven aquifers historically treated as exempt do not meet the federal regulatory criteria for exemption from the federal Safe Drinking Water Act ("SDWA"). Accordingly, the State Agencies intend to request an amendment to the Memoranda of Agreement between the Division and US EPA for the purpose of clarifying that these aquifers are not exempt aquifers.

In addition, the State Agencies intend to advise US EPA that the one other aquifer historically treated as exempt – the Walker Formation underlying the Round Mountain Field – is currently the subject of aquifer exemption proposals. The proposal for the Walker Formation has been finalized and published for public comment (but not yet submitted to US EPA). Portions of this aquifer are included in the exemption proposal, while other portions are not included. The State Agencies therefore intend to also request that the amendment to the Memoranda of Agreement between the Division and US EPA clarify that this aquifer is *not* exempt, except with respect to any portion(s) that US EPA approves for exemption as a result of a future exemption proposal.

WRITTEN COMMENT PERIOD AND PUBLIC COMMENT HEARING

Any person, or his or her authorized representative, may submit to the Department of Conservation ("Department") written statements, arguments, or comments relevant to this determination. Comments may be submitted by email to comments@conservation.ca.gov, by facsimile (fax) to (916) 324-0948, or by mail to:

Department of Conservation
801 K Street, MS 24-02
Sacramento, CA 95814
ATTN: Eleven Aquifers

The written comment period closes at 5 p.m. on December 16, 2016. The Department will not consider any comments received at the Department's offices after that time.

Additionally, any interested person, or their authorized representative, may present, either orally or in writing, comments regarding the proposed action at the public hearing, to be held at the following time and place:

December 14, 2016 at 4pm
Four Points Sheraton
5101 California Avenue
Bakersfield, CA 93309

Services, such as translation between English and other languages, may be provided upon request. To ensure availability of these services, please make your request no later than ten working days prior to the hearing by calling the staff person identified in this notice.

Servicios, como traducción de inglés a otros idiomas, pueden hacerse disponibles si usted los pide en avance. Para asegurar la disponibilidad de éstos servicios, por favor haga su petición al mínimo de diez días laborables antes de la reunión, llamando a la persona del personal mencionada en este aviso.

BACKGROUND

The Division regulates the underground injection of fluids associated with oil and gas production ("Class II injection") through an underground injection control ("UIC") program approved by US EPA pursuant to the federal SDWA. The SDWA requires the protection of underground sources of drinking water ("USDWs"), which are defined broadly in federal regulation as including any aquifer that supplies or contains a sufficient quantity of groundwater to supply a public water system and that has a total dissolved solids ("TDS") composition of less than 10,000 mg/l. (See 40 C.F.R. § 144.3.)

Under federal law, an aquifer, or a portion of an aquifer, that would otherwise qualify as a USDW may be "exempted" from protection as a USDW if it meets specific exemption criteria enumerated in federal regulation and undergoes an exemption process that involves both the State and US EPA. (See 40 C.F.R., §§ 146.4, 144.7.) Specifically, a USDW may be exempted for purposes of Class II injection if it meets the following criteria:

(a) It does not currently serve as a source of drinking water; and

(b) It cannot now and will not in the future serve as a source of drinking water because:

(1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.

(2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;

(3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or

(c) The TDS content of the ground water is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.

(40 C.F.R. § 146.4.). Exempted aquifers may be designated by the State and submitted to US EPA for review and possible approval. No aquifer exemption is valid unless and until it is approved by US EPA. (*See* 40 C.F.R. § 144.7.)

When US EPA approved the State's UIC program in 1983, the Division and US EPA entered a Memorandum of Agreement ("Primacy MOA") that identified the aquifers for which US EPA granted aquifer exemptions. Program records have produced two competing versions of the Primacy MOA, each with the same signature page and dates, which differ with respect to the non-hydrocarbon-producing aquifers US EPA agreed to exempt. One version purports to deny exemptions for eleven non-hydrocarbon-producing aquifers, while the second version purports to approve exemptions for those same aquifers. The Division and US EPA have historically treated these eleven aquifers as exempt. Following a US EPA audit of the State's UIC program in 2012, US EPA determined that these eleven aquifers may not actually be exempt, and ordered the State to reevaluate the aquifers to ascertain whether the aquifers meet the federal exemption criteria and whether the aquifers are appropriate for ongoing injection of fluid associated with oil and gas production. Additionally, US EPA prescribed detailed corrective actions to bring the State's UIC program into compliance with the SDWA. One of the corrective actions requires the State to prohibit injection into the eleven aquifers "historically treated as exempt" by December 31, 2016 absent a US EPA determination that the aquifer(s) meet the regulatory criteria for exemption. The Division has implemented this and other compliance dates in its Aquifer Exemption Compliance Schedule Regulations. (Cal. Code Regs., tit. 14, § 1779.1.)

DETAILS OF THE STATE AGENCIES' DETERMINATION

Ten Aquifers Have Not Been Shown to Meet Exemption Criteria

Based on the available information, the State Agencies' current assessment is that ten of the eleven aquifers do not meet the federal regulatory criteria for exemption from the SDWA. These aquifers may in the future serve as a source of drinking water. The ten aquifers are:

- The Pico Formation underlying the boundaries of the South Tapo Canyon Field.
- The Tumey Formation underlying the boundaries of the Blackwell's Corner Field.
- The Kern River Formation underlying the boundaries of the Kern Bluff Field.

- All aquifers underlying the boundaries of the Bunker Gas Field that are not in a hydrocarbon-producing zone.
- The Santa Margarita Formation underlying the boundaries of the Kern River Field.
- The Chanac Formation underlying the boundaries of the Kern River Field.
- The Walker Formation underlying the boundaries of the Mount Poso Field.
- The Olcese Formation underlying the boundaries of the Round Mountain Field.
- All aquifers underlying the boundaries of the Wild Goose Field that are not in a hydrocarbon-producing zone. [*]
- The Santa Margarita Formation underlying the boundaries of the Kern Front Field.

The State Agencies' current assessment of these ten aquifers, and the proposed request to US EPA, would not preclude future consideration of exemption proposals. If the State Agencies in the future receive new information establishing that any of these aquifers, or portions thereof, meet the exemption criteria and are appropriate for injection, the State Agencies may elect to submit an aquifer exemption proposal to US EPA following the required legal procedure, including public notice and a public hearing.

Portions of One Aquifer May Qualify for Exemption

Portions of one of the eleven aquifers historically treated as exempt are being considered for exemption. That aquifer is:

- The Walker Formation underlying the boundaries of the Round Mountain Field.

An exemption proposal for the Walker Formation underlying the Round Mountain Field has been finalized and the Division is currently considering public comments on the proposal.[†] Only those portions of the Walker formation that are included in the State Agencies' exemption proposal and approved for exemption by US EPA should be confirmed as exempt. The omission of any portion(s) of the formations from a final exemption proposal would be due to there being a lack of evidence for the State Agencies to find that such portion(s) are eligible for exemption. Accordingly, the State Agencies intend to request an amendment to the Memoranda of Agreement between the Division and US EPA for the purpose of clarifying that the Walker Formation underlying the Round Mountain Field is not exempt, except with respect to any portions of the formation that US EPA approves for exemption as a result of a future exemption proposal submitted to US EPA.

DOCUMENTS AVAILABLE FOR REVIEW

Documents reviewed by the State Agencies in the course of making this determination are available on the Division's public internet website at:

http://www.conservation.ca.gov/dog/Pages/Aquifer_Exemptions.aspx.

[†] The proposal and supporting materials for the Round Mountain Field exemption are available at http://www.conservation.ca.gov/dog/Pages/Aquifer_Exemptions.aspx.

RESPONSE TO COMMENTS

The State Agencies will review and respond to all timely and relevant comments received (including oral comments received at the hearing) following the written comment period and public hearing. Thereafter, the Division may proceed with the request to US EPA to amend the Memoranda of Agreement between the Division and US EPA for the purpose of clarifying the exempt status of the eleven aquifers.

CONTACT PERSON

Inquiries concerning the proposed action may be directed to:

Tim Shular
Department of Conservation
801 K Street, MS 24-02
Sacramento, CA 95814
Phone: (916) 322-3080
Email: Comments@conservation.ca.gov

Department of Conservation, Division of Oil, Gas, and Geothermal Resources
Public Comment Solicitation for Assessment of
Eleven Aquifers Historically Treated as Exempt

PUBLIC COMMENT SUMMARIES AND RESPONSES

On November 15, 2016, the Department of Conservation, Division of Oil, Gas, and Geothermal Resources ("Division"), in consultation with the State Water Resources Control Board ("Water Board"), sent public notice regarding the intent to advise the United States Environmental Protection Agency ("US EPA") that, with the exception of portions of two aquifers that are addressed in recent aquifer exemption proposals, the eleven aquifers historically treated as exempt do not meet the federal regulatory criteria for exemption from the federal Safe Drinking Water Act ("SDWA"). Accordingly, the Division and the Water Board intend to request an amendment to the Memoranda of Agreement between the Division and US EPA for the purpose of clarifying that these aquifers are not exempt aquifers. The eleven aquifers are:

- The Pico Formation underlying the boundaries of the South Tapo Canyon Field.
- The Tumey Formation underlying the boundaries of the Blackwell's Corner Field.
- The Kern River Formation underlying the boundaries of the Kern Bluff Field.
- All aquifers underlying the boundaries of the Bunker Gas Field that are not in a hydrocarbon-producing zone.
- The Santa Margarita Formation underlying the boundaries of the Kern River Field.
- The Chanac Formation underlying the boundaries of the Kern River Field.
- The Walker Formation underlying the boundaries of the Mount Poso Field.
- The Olcese Formation underlying the boundaries of the Round Mountain Field.
- All aquifers underlying the boundaries of the Wild Goose Field that are not in a hydrocarbon-producing zone. [1]
- The Santa Margarita Formation underlying the boundaries of the Kern Front Field.

Following publication of a notice in a local newspaper, and mailing or emailing notice to interested parties, public comments on the proposal were accepted from November 15, 2016 through December 16, 2016. On December 14, 2016, the Division and the State Water Board jointly conducted a public comment hearing in Bakersfield. Included below is a summary of all of the comments received from the public together with the Division's and State Water Board's responses.

Over the course of the public comment period, the Division received a number of public comments via email, regular mail, and public comment hearing. Each commenter and subsequent comment was given a unique numerical signifier. The chart below provides the numerical signifier for each commenter. Below, you will find either grouped or individual comment numerical signifiers, followed by a summary or specific comment, followed by a response (italicized).

COMMENTERS:

Number	Name and/or Entity
0001	California Resources Corporation
0002	CA State Building and Construction Trades Council
0003	Brian Pellens
0004	Natural Resources Defense Council, Clean Water Action
0005	Nancy

COMMENT SUMMARIES:

COMMENTS IN SUPPORT

0004-1
The commenter concur with the Division of Oil, Gas, and Geothermal Resources' (Division) and the State Water Resources Control Board's (Board) (collectively "State Agencies") intent to advise the U.S. EPA that ten of the eleven aquifers historically treated as exempt do not meet the federal regulatory criteria for exemption from the federal Safe Drinking Water Act (SDWA). The State Agencies' assessment makes clear that the version of the Primacy Memorandum of Agreement (MOA) between the Division and U.S. EPA that purports to approve exemptions for these eleven non-hydrocarbon-producing aquifers was issued in error, and that the version denying these exemptions is correct.

0005-1
We have laws for a reason, and in this case it appears that public safety is being pitted against economic vitality and pecuniary interests. I urge you to reject all of the proposed exemptions to the Act.

Response to comments 0004-1, 0005-1:
Thank you for your comments.

COMMENTS IN OPPOSITION

General Opposition
0001-1, 0002-1
The public comment period should be extended passed the arbitrary December 31, 2016 deadline. CRC has invested millions of dollars in water treatment, conveyance systems, and use of reclaimed water; and has identified alternative zones for water disposal. The state has not forwarded a separate aquifer exemption package or reviewed additional UIC permits related to the alternate injection zone. Many jobs will be put in jeopardy if the deadline is not extended.

0001-2
The MOA between the Division and USEPA that has been used for decades, and which was used to issue multiple permits must be formally amended. Until this happens, there is no basis to interfere with or

penalize any injection into these exempted aquifers. The Division does not provide any specific finding of environmental harm or impact. The injectate at CRC's operations in Kern Front is higher quality than the zones into which it is being injected. It is unclear why there would need to be an amendment to the MOA.

Response to comments 0001-1, 0002-1, 0001-2:
California Code of Regulations, title 14, section 1779.1, subdivision (b) provides that injection in these aquifers must cease by December 31, 2016, unless and until US EPA, subsequent to April 20, 2015, determines that the aquifer or the portion of the aquifer where injection is occurring meets the criteria for aquifer exemption. Extended the period for the public to comment on this evaluation would not affect that regulation.

Deficient Analysis

0003-1
While a proper analysis should rely on potentially thousands of pages of data, maps, cross sections, modern logs, and thousands of hours of analysis by highly skilled professional geologists, petrophysicists and others; the Division's analysis consists mainly of photocopied pages from a document first published in 1960 (with data relying on decades-old information) to delineate general locations of oil. A complete technical and economic feasibility study is needed for each of the eleven aquifers before any determination of whether the exemption criteria are met or not. As the non-applicability of the exemption criteria have not been demonstrated, any determination with respect to these aquifers should be delayed until such time as a proper analysis has been prepared and vetted.

0003-2
Any of the four clauses of 40 CFR 146.4(b) may be used to determine an aquifer exempt. Conversely, due to the fact that the "or" conjunction is used between the criteria, if one is to determine that the criteria of 40 CFR 146.4(b) are not met, one must demonstrate that **none** are met. As such, the Division's analysis must show that none of the following are true: see 40 CFR 146.4 (b) (1-4).

0003-3
The Division's analysis is clearly not complete. For example, in the evaluation of (b)(3), I would offer that it is possible that a large desalinization plant could be built to produce drinking water from sea water (as has been done in many places around the world) and piped to these field locations far cheaper on a per gallon basis, than siting a much smaller plant on top of any of these naturally-impaired aquifers for local supply. It should be noted also for the required analysis that the federal standard for exemption in (b)(3) is to "render that water fit for human consumption" -- not for agricultural or other use, such that drinking water standards are the applicable treatment goal. It should further be noted that while some widely varying and scarce data is given for Total Dissolved Solids (TDS), there are many other naturally occurring contaminants in that water which would likely complicate any process to render it fit for human consumption. Another consideration is that a coastal desalination plant may use existing water transportation infrastructure if such infrastructure has available capacity, further decreasing the costs. There may be other alternatives to the scenario above as well which must be explored. If any of these alternatives are less expensive on a per gallon basis to supply drinking water fit for human consumption, it is economically infeasible to use the water subject to the Division's determination to supply drinking water.

Response to comments 0003-1, 0003-2, 0003-3:
California Code of Regulations, title 14, section 1779.1, subdivision (b) provides that injection in these aquifers must cease by December 31, 2016, unless and until US EPA, subsequent to April 20, 2015, determines that the aquifer or the portion of the aquifer where injection is occurring meets the criteria for aquifer exemption. The data and evaluation made available for public comment indicate that the aquifers in question meet the definition in federal regulation of an underground source of drinking water. In the two instances where data and analysis has been provided to the State that indicate that portions of these aquifers do meet the criteria in federal regulation for an aquifer exemption, the State Agencies have made aquifer exemption proposals that have been approved by US EPA. If other data and analysis are provided, then the State Agencies' will work the applicant to develop other such aquifer exemption proposals.

Other

0004-2
The Division and the Water Board should institute a full investigation to determine the extent of any contamination in these 11 aquifers. As detailed in the State Agency's assessment, the HTAE aquifers contain high-quality drinking water and in some cases injection of low quality brines has been occurring for decades. The State Agencies have a duty to determine the environmental and public health impacts from this improper injection and remediate any ongoing threats.

Response to comment 0004-2:
Thank you for your comments.