

Renaissance Petroleum, LLC

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July 12, 2019

By: email only

Ms. Bonnie Luke
Ventura County – Planning Division
800 South Victoria Avenue
Ventura CA 93009-1740

**Re: Renaissance Petroleum, LLC, Cabrillo Oil Field (Cabrillo),
“Limit of the Vaca Tar Sand, Oxnard Oil Field, Ventura County, California”
3rd Party Geology and Engineering Report**

Dear Ms. Luke,

With the recent moratorium that was put in place by the Board of Supervisors I wanted to make certain that there was a clear distinction between the Vaca Tar Sand production associated with the Oxnard Oil Field and the light oil and gas production associated with the Cabrillo Oil Field. To accomplish this, Renaissance Petroleum, LLC commissioned a California registered petroleum engineer and a California registered geologist to collaborate on the generation of a report based on their research of Vaca Tar well data and critical well data beyond the known limit of the Vaca Tar Sand as well as all Cabrillo Oil Field wells and available literature. That report is attached. The conclusions of the report are as follows:

- The Vaca Tar Sand of the Oxnard Oil Field is a well-known and established resource.
- The mapped extent of the Vaca Tar Sand is well defined by over 200 wells. The tar accumulation does not extend to the southwest or south of its known extent.
- There is an excellent correspondence between the known extent of the Vaca Tar Sand resource and the Prohibition Area established by Ventura County.
- The Vaca Sand is typically greater than 400 feet thick.
- The Vaca Sand at Cabrillo Oil Field is greater than 300 feet structurally higher to the southern-most known occurrence of the Vaca Tar sand that is part of the Oxnard Oil Field.
- Other than a minor trace of tar in the VR-1 mudlog, all available well information confirms 100% water being present in the Vaca Sand in the area of the Cabrillo Oil Field.
- The Vaca Tar Sand is heavier than water and cannot migrate laterally under natural existing conditions.
- The original source of the oil that was subsequently converted to tar was oil that had migrated up the Livingston Fault where it became emplaced in the Pleistocene Vaca Sand where it was biodegraded in an aerobic environment of relatively cold fresh water.

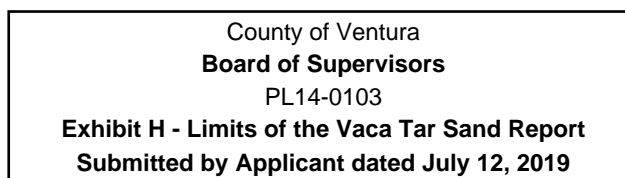
The authors of the report are Mr. Edward J. Wagner, professional petroleum engineer, CA Reg. # 1685, PO Box 11123, Houston, TX., 77227 or PO Box 9042, Bakersfield, CA., 93389, and Mr. John T. Williams, professional geologist, CA Reg. # 5899, PO Box 7028, Ventura, CA. 93006.

Please let me know if you have any questions.

Sincerely,



Marc Wade Traut
President



Attachment: “Limits of the Vaca Tar Sand, Oxnard Oil Field, Ventura County, California”

Limits of the Vaca Tar Sand
Oxnard Oil Field
Ventura County, California

July 2019

Executive Summary

In April of 2019, the Ventura County Board of Supervisors voted to enact an emergency moratorium to prohibit the drilling of new wells and the re-drilling of existing wells (sidetracks) located in an area defined by the known occurrence of the Pleistocene Vaca Tar Sand of the Oxnard Oil Field where steam injection has been used to help increase recovery of this ultra-heavy hydrocarbon resource. The prohibition was put in place in response to a preliminary ground water study by the United States Geological Survey (USGS) which found traces of thermogenic methane in ground water in the vicinity of where steam injection was being used to develop the Vaca Tar Sand.

The Oxnard Oil Field was discovered in 1937 with the drilling of Vaca Oil Exploration well No.1 (API 11101341). The well cored more than 300 feet of massive Pleistocene sand from approximately 1850 feet to 2170 feet that was saturated with gassy tar. The gravity of the tar was later estimated to be 6-8° API. The tar sand, with host sand referred to as the Vaca Sand, became known as the Vaca Tar Sand. With subsequent drilling of over 200 wells, the Vaca Tar Sand accumulation has become well defined and can be described as a northeast-southwest trending continuous form which is approximately 2.8 miles long with an average width of approximately 0.75 miles. The thickness of Vaca Tar Sand varies from zero at its outer limits to more than 500 feet in gross thickness in the central portion of its accumulation. Development of the Vaca Tar Sand has been largely concentrated in the central portion of the mapped area of the Vaca Tar Sand.

Renaissance Petroleum, LLC (RenPet) operates the Cabrillo Oil Field, which is located approximately 4000 feet south of the southwestern most extent of the Vaca Tar Sand. RenPet produces high gravity, 38° API, light crude oil and natural gas from deeper Miocene sandstone reservoirs. RenPet and others have drilled 13 wells within the DOGGR administration boundary of the Cabrillo Oil Field targeting the deeper Cabrillo Sand and other formations. The Vaca Sand is present in the Cabrillo Oil Field and is 300-600 feet structurally higher than the nearest wells in the Oxnard Oil Field. Except for a minor mudlog tar trace in well VR-1 (5'@2203'), all available information confirms no shows, no logged oil, and 100% water in the Vaca Sand in Cabrillo Oil Field wells. The high density of the Vaca Tar, which is heavier than water under natural conditions, does not allow for the Vaca Tar to migrate up structure in the Vaca Sand to the area of the Cabrillo Oil Field. Therefore, future RenPet development wells in the Cabrillo Field are expected to encounter 100% water in the Vaca Sand. The Vaca Sand is not an objective for Cabrillo.

Executive Summary

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1. Introduction

In April of 2019, the Ventura County Board of Supervisors voted to enact an emergency moratorium to prohibit the drilling of new wells and the re-drilling of existing wells (sidetracks) located in an area defined by the known occurrence of the Pleistocene Vaca Tar Sand of the Oxnard Oil Field where steam injection has been used to help increase recovery of this ultra-heavy hydrocarbon resource. The prohibition was put in place in response to a preliminary ground water study by the United States Geological Survey (USGS) in late 2018 which found traces of thermogenic methane in ground water in the vicinity of where steam injection was being used to develop the Vaca Tar Sand. Further research is ongoing to better understand the origin of the gas. A map showing the areal extent of the new/re-drill well prohibition area as established by the resolution mentioned above is provided as **Figure 1**.

Renaissance Petroleum, LLC (RenPet) operates the Cabrillo Oil Field (Cabrillo) which is located south-southwest of that portion of the Oxnard Oil Field that involves Vaca Tar Sand production operations. RenPet produces high gravity, 38° API, light crude oil and natural gas from Miocene sandstone reservoirs situated in that group of rocks that are referred to as the Topanga Group which consists dominantly of interbedded Miocene volcanics rocks. The scope of this report is the Pleistocene section of the Oxnard Oil Field and its relation to the Cabrillo Oil Field.

2. Methods

This study involved a review of more than 150 wells associated with the Oxnard Oil Field the majority of which were concentrated in the area where the Vaca Tar Sand is defined. Sufficient wells beyond the limits of the Vaca Tar Sand were reviewed to establish a high level of confidence as to the extent of the Vaca Tar Sand. All mudlogs and electric logs of wells associated with the Cabrillo Oil Field were reviewed. The principal data base for the review of well data was the Division of Oil and Gas and Geothermal Resources (DOGGR). In addition, well files, maps, and cross-sections were provided by RenPet. All of the published literature involving the Oxnard Oil Field and the Vaca Tar Sand was reviewed. The principal literature sources are listed in Section 7 of this report.

3. Geology

The area of study is located in the central portion of the Oxnard Plain of Ventura County California and it encompasses portions of T1N R21W, T1N R22W, T2N R21W and T2N R22W as part of the San Bernardino Base Meridian (SBBM). The area of study is shown on **Figure 2** which also shows the DOGGR administrative boundaries for both the Oxnard Oil Field and the Cabrillo Oil Field.

The surface of the study area is flat with a slight south-southwest gradient towards the coastline. The average surface elevation is from 20-50 feet above sea level. Agricultural operations dominant the surface use of the study area. The dominant crops are strawberries.

The Oxnard Oil Field was discovered in 1937 with the drilling of Vaca Oil Exploration well No.1 (API 11101341). The well cored more than 326 feet of massive Pleistocene sand from approximately 1850 feet to 2170 feet that was saturated with gassy tar. The gravity of the tar was later estimated to be 6-8° API. The discovery well bottomed in Miocene volcanic rocks of the Topanga Formation. The location of the discovery well is indicated on **Figure 2** as the magenta “callout” box labeled “19” on **Figure 2**. The wells that are associated with magenta boxes on **Figure 2** correspond to the pertinent individual wells that are a part of this study and which are listed in **Table 1**.

The host sand for the Vaca Tar Sand is termed the Vaca Sand. The age of the Vaca Sand has been reported as old as late Pliocene but is now recognized as being Pleistocene in age. The Pleistocene stratigraphic section in the vicinity of the Oxnard Oil Field progressively thins to the southeast by onlap onto an unconformity surface. The unconformity represents the northwest dipping structural ramp that was active in the early Pliocene following structural activity on the northeast-southwest striking Livingston Fault system. The Livingston Fault has been inactive since the late Pliocene. The Vaca Sand is one of several Pleistocene shallow marine sands that onlaps the Miocene rocks that form the northwest dipping structural ramp. The onlap and progressive thinning of the Vaca Sand onto the unconformity surface is shown on **Figure 3**, a north-south cross section that links the Cabrillo Oil Field area with the south-central portion of the Oxnard Oil Field. The location of N-S cross section Figure 3 is shown on **Figure 2** as a dashed red line bracketed with an “N” at its north end and a corresponding “S” at its south end. The Vaca Sand is massive with few interbeds of shale or shaly material and has a poorly defined top that corresponds to a sandy unit with increasing amounts of shale interbeds. The Vaca Sand is typically more than 400 feet thick with thickness increasing towards the northwest. As seen on the cross-section, the Vaca Sand and other Pleistocene sands such as the Fox Canyon and San Pedro gently dip to the northwest. This area has been structurally quiet throughout the late Pliocene and Pleistocene. This is in contrast to the area to the north associated with the Camarillo Hills where these same rocks have experienced recent uplift and folding.

4. Vaca Tar Sand

The Vaca Tar Sand, the tar unit that occurs within the host Vaca Sand, has been encountered in approximately 200 wells that have been drilled as part of the Oxnard Oil Field. From these penetrations the Vaca Tar Sand can be defined as a northeast-southwest trending continuous form which is approximately 2.8 miles long with an average width of approximately 0.75 miles. The tar sand is a continuous body laterally and a massive unit vertically. Not all of the wells drilled to exploit the Vaca Tar Sand fully penetrate this unit. Fifty wells that fully penetrate the Vaca Sand interval that have electric logs to allow the definition of the top and bottom of the Vaca Tar Sand have been used to generate a gross thickness map for the Vaca Tar Sand. The distribution of the Vaca Tar Sand is shown by the green contours on **Figure 2**. The gross thickness values that were used to generate the contours are shown on the map as yellow

“callout” boxes. This map is in substantial agreement with other published versions of the Vaca Tar Sand unit (Dosh, 1965; Yeates, 1983).

The limit of the Vaca Tar Sand to the southwest and south is defined by well penetrations where no measurable amount of Vaca Tar Sand has been encountered. These wells are noted on **Figure 2**. The magenta “callout” boxes on **Figure 2** correspond to the individual wells that are listed in **Table 1** and include show and tops information. These include all of the wells that have been drilled within the DOGGR administrative boundary of the Cabrillo Oil Field and all of the wells immediately beyond the southwestern extent of the Vaca Tar Sand mapped extent. The area to the south of the southwestern extent of the Vaca Tar Sand mapped extent corresponds to the area of Cabrillo. As shown on **Figure 3**, it is up structure several hundred feet from the nearest known penetrations of the Vaca Tar Sand. The fact that the tar sand is significantly heavier than water prohibits the tar from migrating upwards in the freshwater resources of the Pleistocene.

The origin of the Vaca Tar is associated with the vertical migration upwards of oil along the Livingston Fault into the overlying Pleistocene sands (Vaca Sand) where the oil is rapidly biodegraded by aerobic bacteria that are present in the relatively cold freshwater. Stray amounts of “tar” may be found in areas of the Vaca Sand outside of the defined units of the Vaca Tar Sand accumulation and may represent a minor volume of originally light oil that entered the Vaca Sand and migrated a short distance in the sand before biodegradation transformed it to tar and left it heavier than water.

On **Figure 3**, the Vaca Tar Sand is shown to thin towards the outer limits of its mapped form. It is noted that the Vaca Tar Sand thins from the top towards its base. It also is found to occupy structural lows. Both of these observations support the conclusion that the Vaca Tar Sand will not be found up structure south of its mapped accumulation in any volume that would render it to be commercial. Its natural tendency is to “sink” if to move at all after being transformed into tar.

5. Vaca Tar Sand Resource Development

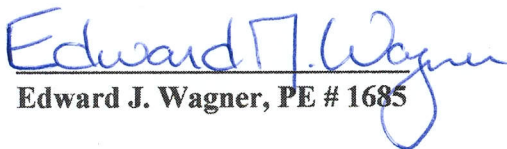
The Vaca Tar Sand of the Oxnard Oil Field is a well-known and established resource. Producing this resource presents operators with multiple technical, mechanical, and financial challenges. All of the development of this resource has been concentrated in the areas where the Vaca Tar Sand is thickest. There is an excellent correspondence between the known extent of the Vaca Tar Sand resource and the Prohibition Area established by Ventura County. Both boundaries are shown on **Figure 2**.

Since there is no proven tar accumulation in the Vaca Sand in the Cabrillo Oil Field area, it is believed that any commercial resource development will be in the Oxnard Oil Field area as presently defined.

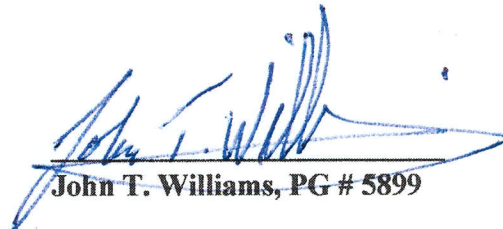
6. Conclusions

- 6.1 The Vaca Tar Sand of the Oxnard Oil Field is a well-known and established resource.
- 6.2 The mapped extent of the Vaca Tar Sand is well defined by over 200 wells. The tar accumulation does not extend to the southwest or south of its known extent.
- 6.3 There is an excellent correspondence between the known extent of the Vaca Tar Sand resource and the Prohibition Area established by Ventura County.
- 6.4 The Vaca Sand is typically greater than 400 feet thick.
- 6.5 The Vaca Sand at Cabrillo Oil Field is greater than 300 feet structurally higher to the southern-most known occurrence of the Vaca Tar sand that is part of the Oxnard Oil Field.
- 6.6 Other than a minor trace of tar in the VR-1 mudlog, all available well information confirms 100% water being present in the Vaca Sand in the area of the Cabrillo oil Field.
- 6.7 The Vaca Tar Sand is heavier than water and cannot migrate laterally under natural existing conditions.
- 6.8 The original source of the oil that was subsequently converted to tar was oil that had migrated up the Livingston Fault where it became emplaced in the Pleistocene Vaca Sand where it was biodegraded in an aerobic environment of cold fresh water.

With the information and conclusions provided in this document, it is our belief that the defined Vaca Tar Sand prohibition area in the Oxnard Oil Field should not impact the Cabrillo Oil Field and future development wells.


Edward J. Wagner, PE # 1685

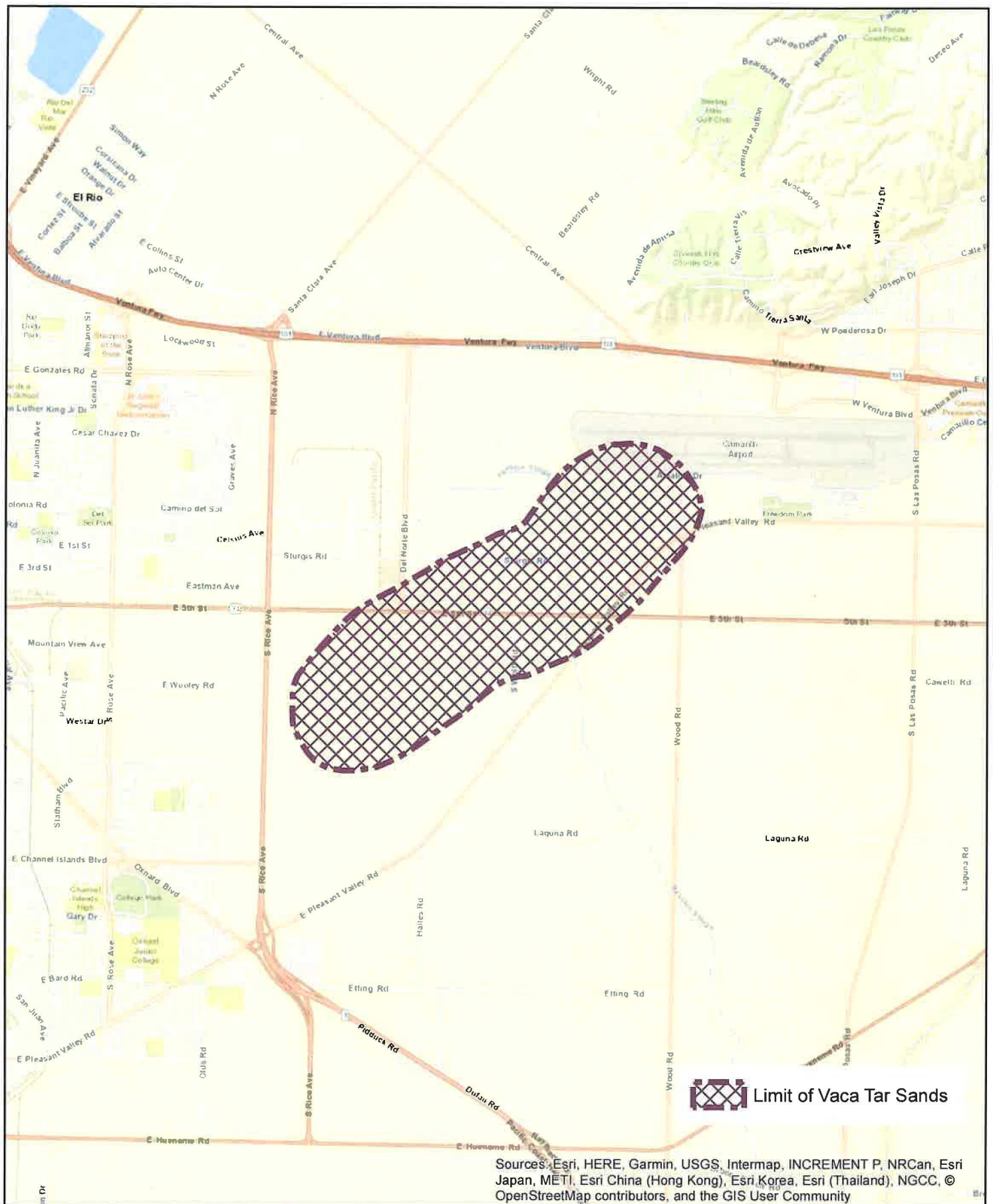
7/12/2019
Date


John T. Williams, PG # 5899

7-12-2019
Date

7. References

1. Yeates, R.S., 1983, Heavy Oil Accumulations in the Oxnard Field, Ventura Basin, California, pp. 85-98, in Petroleum Generation and Occurrence in the Miocene Monterey Formation, California, Pacific Section SEPM special publication, Caroline M. Isaacs et al. editor.
2. Kaplow, E.J., 1947, Oxnard Oil Field; California Division of Oil and Gas, Summary of Operations- California Oil Fields, Vol. 44, No.2.
3. Dosch, M.W. and Mitchell, W.S., 1964, Oxnard Oil Field; California Division of Oil and Gas, Summary of Operations- California Oil Fields, Vol. 50, No.1.
4. Dosch, M.W., 1965, Pliocene Tar Sands in Oxnard oil Field; California Division of Oil and Gas, Summary of Operations- California Oil Fields, Vol. 51, No.2.
5. Rosecrans, Celia Z., Landon, Matthew K., and McMahon, Peter B., 2019, Groundwater quality results from the Regional Monitoring Program study of the Oxnard Oil Filed, presented at California State Water resources Control Board Stakeholder Meeting, February 25, 2019.



Ventura County
Resource Management Agency
Information Systems GIS Services
Map created on 4/15/2019

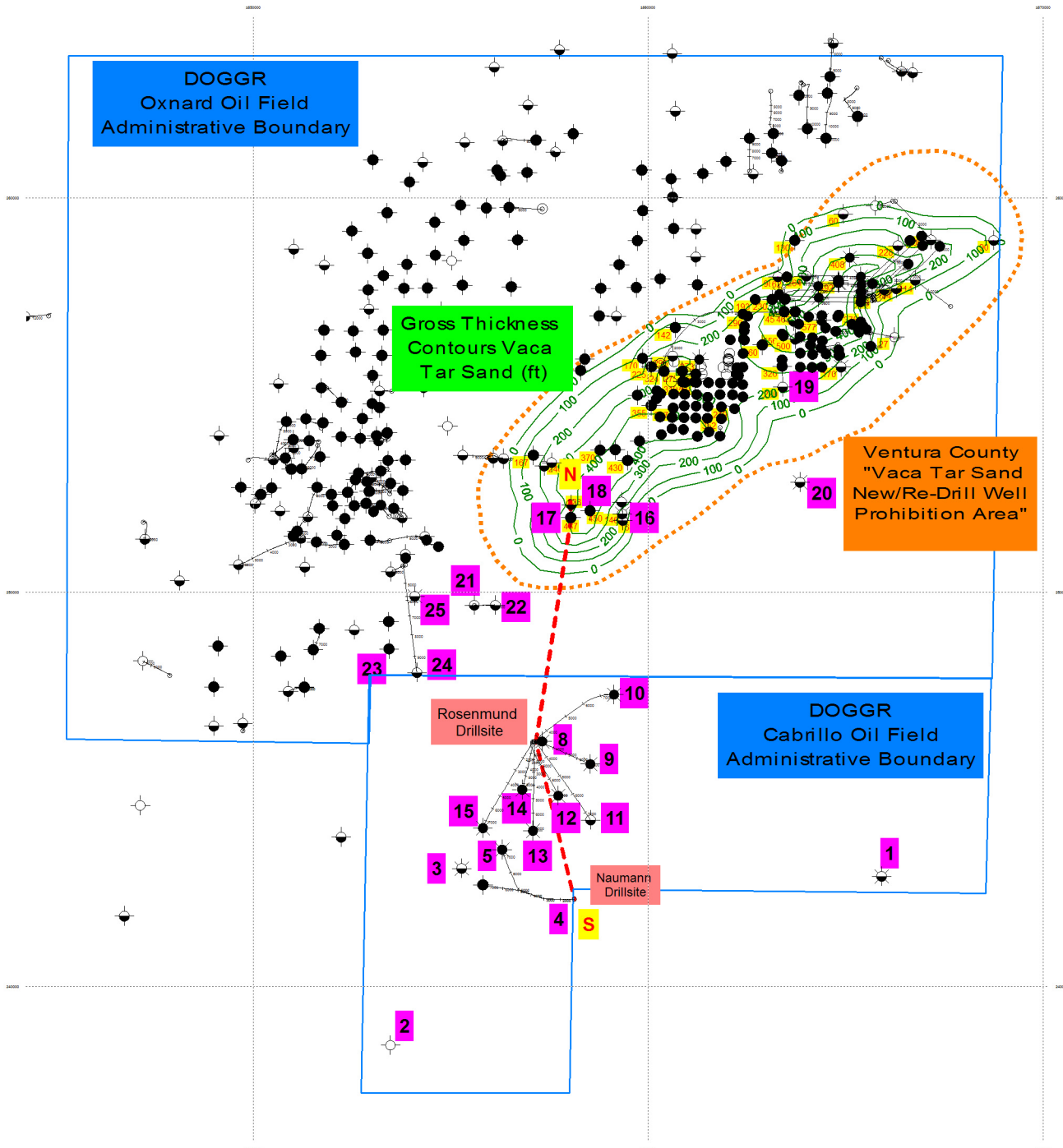


New/Re-Drill Well Prohibition Area County of Ventura, April 2019

0 1,500 3,000 5,000 Feet
Disclaimer: this map was created by the Ventura County Resource Management Agency Information Systems GIS, which is designed and operated solely for the convenience of the County and related public agencies. The County does not warrant the accuracy of this map and no decision involving a risk of economic loss or physical injury should be made in reliance therein.



Figure 1

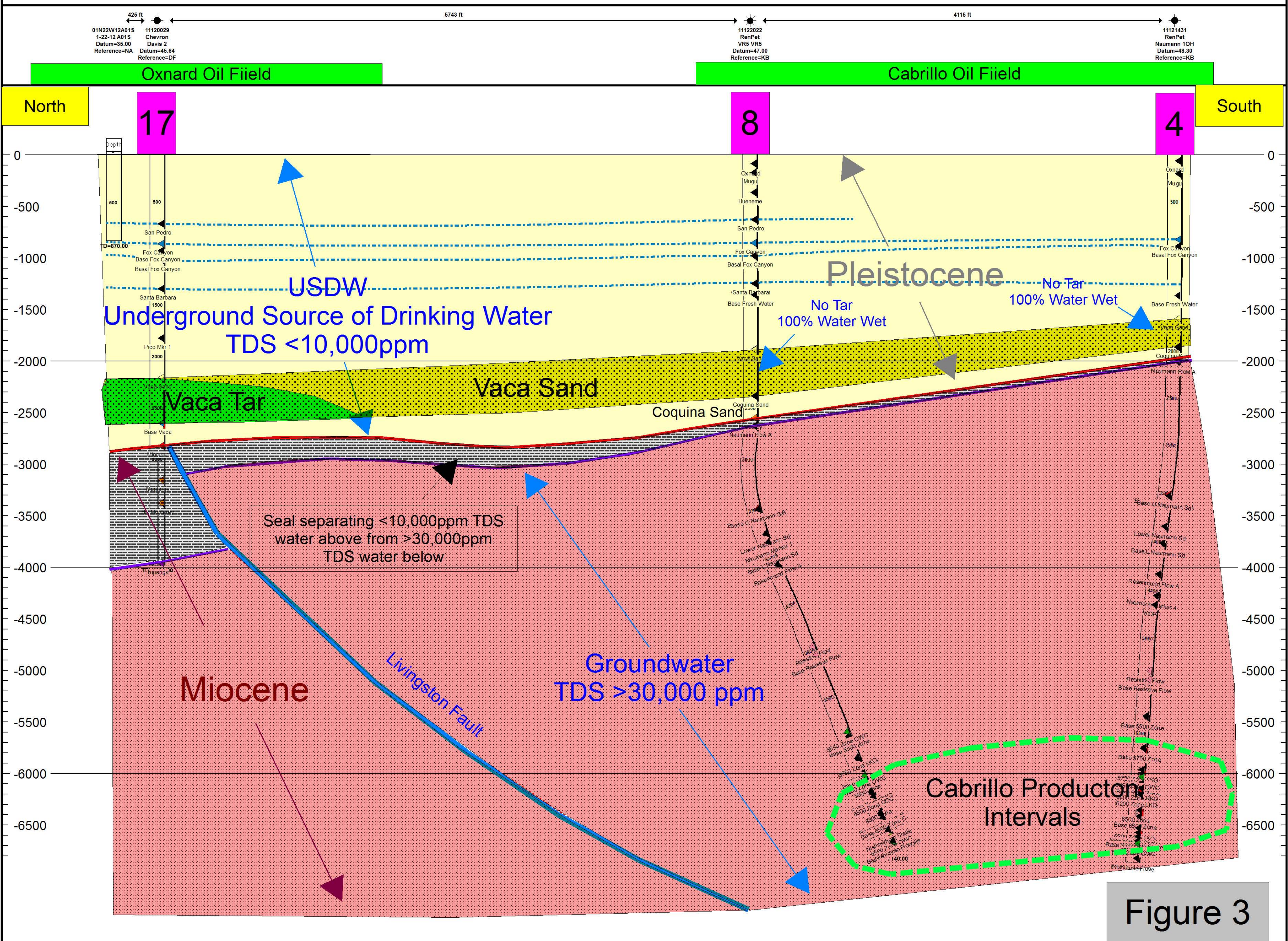


Cabrillo & Oxnard Oil Fields		
Oxnard Plain Ventura County, California		
Author: <ETW>	Scale: <as shown>	Date: June, 2019

Figure 2

North-South Geologic Cross Section Oxnard Oil Field to Cabrillo Oil Field

Distribution of Vaca Sand



Ref							Vaca Sand		Coquina Sand	Miocene									
No.	Operator	Field	Well Name	Number	Status	API	Top (md)	Base (md)	Top (md)	Base (md)	Top (md)	Comments							
1	Magu Syndicate Inc., Ltd	Cabrillo	Utt	1	P	11105598					1907	No elog, reviewed drillers logs, no post-Mio hydrocarbon shows							
2	Texaco	Cabrillo	Eastwood	1	P	11105615					1589	No elog, reviewed drillers logs, no post-Mio hydrocarbon shows							
3	Sun Exploration & Prod. Co.	Cabrillo	Nishimoto	1	P	11121337	1714	2094	2094	2190	2190	Reviewed elog and mudlog, no shows of any kind in Vaca Sand							
4	Cities Service Oil & Gas Corp.	Cabrillo	Naumann	1	P	11121431	1668	1961	1961	2084	2084	Reviewed elog and mudlog, no shows of any kind in Vaca Sand							
5	Renaissance Petroleum, LLC	Cabrillo	Naumann	1RD1	A	11121431	1668	1961	1961	2084	2084	Reviewed elog and mudlog, no shows of any kind in Vaca Sand							
6	Decalta International Corp.	Cabrillo	Naumann	2	C	11121539						Never drilled							
7	Decalta International Corp.	Cabrillo	Naumann	3	C	11121540						Never drilled							
8	Renaissance Petroleum, LLC	Cabrillo	Vivian Rosenmund	1	I	11121912	1975	2378	2378	2603	2603	Reviewed elog and mudlog across Vaca Sand, trace tar reported @2203', no Vaca Tar Sand on elog							
9	Renaissance Petroleum, LLC	Cabrillo	Vivian Rosenmund	2	A	11121913		2378	2378	2606	2606	No elog across Vaca Sand, mudlog start @ 2008', no shows in Vaca Sand							
10	Renaissance Petroleum, LLC	Cabrillo	Vivian Rosenmund	3	I	11121914	1895	2378	2378	2605	2605	No elog across Vaca Sand, mudlog start @ 1000', no shows in Vaca Sand							
11	Renaissance Petroleum, LLC	Cabrillo	Vivian Rosenmund	4	A	11121934	1965	2378			2602	No elog across Vaca Sand, mudlog start @ 1000', no shows in Vaca Sand							
12	Renaissance Petroleum, LLC	Cabrillo	Vivian Rosenmund	5	A	11122022	1935	2383	2383	2598	2598	Reviewed elog and mudlog across Vaca Sand, no shows of any kind in Vaca Sand							
13	Renaissance Petroleum, LLC	Cabrillo	Vivian Rosenmund	6	A	11122085		2405	2405	2523	2523	No elog across Vaca Sand, mudlog start @ 2650', first driller's sample @2270', no shows in Vaca Sand							
14	Renaissance Petroleum, LLC	Cabrillo	Vivian Rosenmund	7	A	11122135		2367	2367	2554	2554	No elog across Vaca Sand, mudlog start @ 2660', first driller's sample @2170', no shows in Vaca Sand							
15	Renaissance Petroleum, LLC	Cabrillo	Vivian Rosenmund	8	A	11122136		2434	2434	2626	2626	No elog across Vaca Sand, mudlog start @ 2770', first driller's sample @2170', no shows in Vaca Sand							
16	Chevron	Oxnard	Davis	1	P	11105521	2081	2311	Absent	Absent	2311	146' gross Vaca Tar Sand							
17	Chevron	Oxnard	Davis	2	P	11120029	2210	2648	Absent	Absent	2869	437' gross Vaca Tar Sand							
18	Chevron	Oxnard	Davis	3	P	11106207	2078	2528	Absent	Absent	2607	450' gross Vaca Tar Sand							
19	Vaca Oil Exploation	Oxnard	Vaca	1	p	11101341	1847	2173	Absent	Absent	2173	326' gross Vaca Tar Sand, discovery well Oxnard Oil Field (1937)							
20	Texaco	Oxnard	Capital-Silva	1	p	11101327	1952	2120	Absent	Absent	2120	Reviewed elog, no mud log, no shows reported in Vaca Sand							
21	Chevron	Oxnard	EM Pfeiler	1	p	11100264	2720	3069	3069	3216	3216	Reviewed elog and mudlog, no shows of any kind in Vaca Sand							
22	Chevron	Oxnard	EM Pfeiler	1RD1	p	11100264	N/A	N/A	N/A	N/A	N/A	Redrilled OH from below Vaca Sand							
23	Chevron	Oxnard	Daily	2	p	11101164	3034	3412	3412	3602	3602	Reviewed elog, no mud log, no shows reported in Vaca Sand							
24	ABA	Oxnard	DEA	1	p	11122131	3117	3540	3540	3691	3691	Reviewed elog, no mud log, no shows reported in Vaca Sand							
25	Chevron	Oxnard	Hooker-Daily	1	p	11101275	3138	3454	3454	3610	3610	Reviewed elog, no mud log, no shows reported in Vaca Sand							
					</														

Status: P= plugged & abandoned, A= active, I= idle, C= cancelled