

**STATE OF NEW MEXICO
ENERGY, MINERALS, AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION**

**IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
DIVISION TO CONSIDER:**

**CASE NO. 15723
ORDER NO. R-14738**

**THE APPLICATION OF OWL SWD OPERATING, LLC FOR AUTHORIZATION
TO INJECT, LEA COUNTY, NEW MEXICO.**

ORDER OF THE DIVISION

BY THE DIVISION:

This case came on for hearing at 9:00 a.m. on August 1st, 2nd, and 4th, 2017, at Santa Fe, New Mexico and again on August 31st, 2017, before Examiner William V. Jones.

NOW, on this 15th day of June 2018, the Division Director, having considered the testimony, the record, and the recommendations of the Examiners,

FINDS THAT

(1) Due public notice has been given, and the Division has jurisdiction of this case and its subject matter.

(2) The applicant, OWL SWD Operating, LLC (OGRID 308339) ("OWL"), seeks authorization to use the proposed Bobcat SWD Well No. 1 (API No. 30-025-Pending, "Proposed Well") as a disposal well, replacing its existing, nearby disposal well, the Maralo Sholes B Well No. 2 (API No. 30-025-09806). The Bobcat SWD Well No. 1 will be located 740 feet from the South line and 705 feet from the East line, Unit P of Section 25, Township 25 South, Range 36 East, NMPM, Lea County, New Mexico.

(3) The Oil Conservation Division ("OCD") entered an appearance in opposition to the permit for the Proposed Well and presented one technical witness. The State Land Office ("SLO") also entered an appearance and presented one technical witness.

(4) By letter to the Division dated April 28, 2016, the City of Jal ("Jal") had expressed concerns that the high disposal rates into this well would endanger its potential to exploit its proposed water rights in this Section 25. The City of Jal appeared at the hearing through counsel, questioning witnesses and presenting briefs.

(5) OWL provided notice of the proposed disposal well and the hearing to all affected parties and operators of record within the ½ mile Area of Review as required in Rule 19.15.26.12 NMAC. During the hearing, the hearing examiner required the area of review for notice purposes to be extended from one half mile to a one-mile radius from the

proposed disposal well. The case was continued to August 31, 2017 to provide adequate time for the additional notice.

(6) The Division subsequently received a letter from Special Energy Corporation dated August 30, 2017 as one of the noticed (affected) parties stating there was no objection to the application, so long as only one of the wells [subject wells of Cases No. 15723 and 15753] is allowed by the Division to be used for disposal.

(7) No other party entered appearance or otherwise opposed this application.

(8) Case No. 15753, "Application of the New Mexico Oil Conservation Division Compliance and Enforcement OCD for a Compliance Order Against OWL SWD Operating, LLC for the Maralo Sholes B Well No. 2 Operated in Lea County New Mexico." was heard September 15, 2017. The competence of this existing well and its tubulars for use as a high rate commercial disposal well was the subject in Case No. 15753. Case No. 15753 could be considered a companion case because the disposal well permit being proposed in Case No. 15723 would replace the permit for disposal into the Maralo Sholes B Well No. 2; which well is also located in Unit P of Section 25, Township 25 South, Range 36 East, NMPM, Lea County, New Mexico. The parties considered whether to combine the two cases for purposes of testimony but agreed to present the cases separately. A separate order will be issued in Case No. 15753.

(9) OWL had proposed this application administratively by submittal of Form C-108 on May 1 of 2017. The matter was evaluated and referred to an Examiner hearing by the OCD Engineering Bureau.

(10) OWL appeared at the hearing through counsel and presented the following by testimony and exhibits.

- a. The Proposed Well would replace the existing Maralo Sholes B Well No. 2 disposal well which would be plugged and abandoned.
- b. The Proposed Well would have two casing strings. The 9-5/8-inch casing would be set to the top of the Salado formation at 1325 feet and cemented to surface, covering all potential fresh water sources. The 7-inch casing is proposed to be set in the Yates formation, just above the top of the proposed disposal interval at 2915 feet. A 5-7/8-inch open hole would be drilled to 3060 feet and the open hole interval used for disposal through 4-1/2-inch duo-lined tubing set in a 7-inch packer at no higher than 2815 feet.
- c. OWL anticipates a maximum injection rate of 30,000 barrels of water per day. The waste water would be sourced from locally produced water in the Delaware, Bone Spring, Devonian, and Yates-Seven Rivers formations. The maximum anticipated injection pressure would be 580 psi at surface.
- d. The closest fresh water well is located 2328 feet and one other well may be located within one mile. OWL will attempt to supply a fresh water analysis to the Division from these wells.

- e. The affirmative statement in the application says, "Based on the available engineering and geologic data we find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water." The form C-108 application was signed by a consulting engineer and agent for OWL.
- f. The Proposed Well would be part of a series of wells permitted for disposal into either the Yates Seven Rivers or the Devonian formations.
- g. The disposal wells will support a water handling system intended to reliably recycle and dispose of oil field waste water for many years to come. The system is designed to consist of a landfill, two 500,000-barrel water ponds, and be fed from oil field operations located to the west through a 16-inch fiberglass lined water pipeline. The pipeline system is necessary to largely eliminate truck traffic and wear on existing roads and will be much more reliable and much larger in size than a system based on trucking. The system has over a dozen clients and is necessary to the drilling, completion, and production operations near the Red Hills area. OWL intends to continue to scale up the recycling of oil field waste water.
- h. The proposed disposal interval is located geologically in the backreef facies. The well is laterally several miles east of the Capitan Reef. The earlier, older portion of the Capitan Reef extends under the proposed disposal interval below the Seven Rivers formation.
- i. Within the nine-township area surrounding the Proposed Well are three or four hundred Yates-Seven Rivers injection wells within the Langlie Mattix; 7Rvrs-Q-Grayburg Pool (Pool code 37240). There have been numerous other SWD wells permitted by the Division in this area and some in this same Section 25 – all within the same Yates and Seven Rivers formations.
- j. OWL presented an analysis of the Hiss water quality data [report published in 1975] from wells in the surrounding nine-township area of the Proposed Well. Most of the Hiss wells were located to the east of the Proposed Well. The analysis indicated that the waters in the Yates-Seven Rivers formations average above 10,000 TDS of total salinity with a median of 14,650.
- k. Injection into the Proposed Well would be filling up depleted pore space in this reservoir and not harming correlative rights. The Yates and Seven Rivers formations in this area have been produced since the 1920's and by the 1950's had been severely depleted by primary production. In the 1960's injection projects were put in to recover additional oil in place.
- l. The oil reservoir is within the lower Yates and upper Seven Rivers formations which trend roughly north/south and dip gently to the east. Beginning in the west and moving east, the reservoir grades from a free gas phase to oil and then to water in the east. The western edge of Section 25 is near the line at which

the phase changes from gas to oil. The current disposal and the Proposed Well would be disposing just below this contact. There has been significant gas produced from the gas cap of this reservoir.

- m. Original reservoir pressure in the 1920's is estimated to have been 1400 psi or near the bubble point. By the 1950's the gas cap had increased in size and the reservoir pressure had decreased to about 200 psi. The gas cap helped in oil recovery until it was blown down by recompletions up-hole.
- n. The productive rock in this reservoir has been the clean sands with an estimated permeability of at least 350 millidarcies as measured in a core from an adjacent well. The carbonates contain anhydrites which have reduced the permeability. Therefore, the proposed disposal is expected to be contained in the sands and not migrate vertically through the rock.
- o. In the Maralo Sholes B Well No. 2, the initially completed pay interval was above the oil to water contact, therefore the well did not produce any water and only began producing some water after pressure depletion.
- p. Near the Proposed Well, the Yates or Seven Rivers formations would not be a valid source of water for the City of Jal not only due to higher salinity but also due to the initial pay interval not having water.
- q. Within this immediate project area, there is 85 to 90 million barrels of pore space that must be filled before a waterflood would be successful. Other waterflood attempts in this portion of the reservoir have not been successful.
- r. Waterflood operations would not be successful until this reservoir was again restored to original pressures. Small waterfloods have been tried without success. High rate water disposal into the Proposed Well may be positive to surrounding producers and should not be detrimental or cause waste.
- s. The Capitan Reef exists both laterally from and vertically below the Proposed Well. The Capitan Reef trends north/south and the youngest aged, highest portion of the Reef is located several miles to the west where the proposed disposal interval grades into the reef. Older, lower portions of the Capitan Reef are located vertically below the proposed disposal interval anywhere from 250 to 700 feet depending on which estimate was provided.
- t. There are nearby water supply wells and observation wells in the Capitan Reef. The reported water analysis from this area in the Reef indicates waters higher than the 10,000 TDS fresh water limit and dangerous levels of hydrogen sulfide, with a black, corrosive quality.
- u. Disposed waters are not expected to move vertically down due to low permeable dolomites in the lower Seven Rivers formation and the low reservoir pressures in the depleted sand disposal intervals, as compared with the lower intervals.

- v. Disposed waters are not expected to move vertically upward due to the impermeable Salado formation overlying the stratified target disposal interval. The injection survey run in December of 2016 on the Maralo Sholes B Well No. 2 shows that waters are not moving up-hole around the packer and injection water is staying in the permitted disposal interval.
- w. The target disposal interval has been depleted of pressure after years of production; therefore, injected fluids should remain in this interval and not move laterally out of this interval. Any horizontal movement of waste water should be preferentially in an easterly direction because of the lower pressures existing in the east from all the prior oil production. Movement to the west towards the reef is up dip but should not happen due to the higher pressures in the Reef.
- x. The City of Jal currently gets its water from the Pecos Alluvium, the shallowest aquifer in the area. Jal would most likely find additional waters first in the Santa Rosa formation and then in the Rustler formation. The Capitan Aquifer waters would be the third choice and would be expensive to pump and purify.
- y. The State Engineer defines the "Capitan Underground Water Basin" for purposes of administering water rights within that defined extent. This basin includes the Capitan Reef Aquifer and water sources above the Reef but the two sources are not identical in lateral extent.
- z. The Capitan Reef Aquifer is a poor choice for the City of Jal because of its depth and the higher salinity and contaminates in southern Lea County. The newest installed wells in the Capitan Reef in this area were for the Ochoa Mine project. Those wells were pumped for seven days and the final water salinity measured was 70,000 mg/l of TDS.
- aa. The multilayer hydrologic model presented by a hydrologist showed that disposed waste waters would most likely never reach the Capitan Reef. Currently the Capitan water pressures are higher than the pressures in the target disposal interval. In addition, there are layers of low permeability rocks vertically below the target disposal interval. Both factors would prevent or limit movement of injected waters into the Reef.
- bb. The reported rebound in water column in the Capitan monitor wells could be explained by the cessation of large water supply projects both to the north and to the south of this location.
- cc. There has been no evidence of pressure communication or water movement from the higher-pressure Capitan Reef and the depleted Yates-Seven Rivers target disposal reservoir. Therefore, it can be concluded that the two are not in communication and waters introduced back into the depleted reservoir would not contaminate the Capitan Reef Aquifer.

- dd. The flowline installed to this location along with the planned ponds will even-out any injection surges into the Proposed Well. The surface facilities for the Proposed Well are new and designed to Division requirements. The well would be equipped with a SCADA system which monitors rates and pressures and can be used to remotely control the well.
- ee. The injection operation into the Proposed Well can be conducted in a safe and responsible manner without causing waste, impairing correlative rights or endangering fresh water, public health or the environment.

(11) The OCD appeared at the hearing through counsel and presented the following.

- a. The OCD administratively reviewed the permit for disposal in the Proposed Well and referred it to hearing where the matter of commercial disposal into this depleted, low salinity reservoir could be considered. The OCD also reviewed and denied three other proposals for commercial disposal in this area.
- b. The OCD presented maps and a large volume of available data relating to water quality, water availability, water head (or pressure) in the nearby Capitan Reef, and water production in surrounding Area of Review wells.
- c. This reservoir is still producing oil and gas. There are few wells located to the west of the Maralo Sholes B Well No. 2. There are many wells to the east and these are mostly plugged. The remaining producing wells seem to be located to the north or south. Because of the presence of many wells in this same disposal interval, the OCD recommends the one-half mile area of review be expanded to a larger area.
- d. There is a concern that high rate disposal will cause waste in this reservoir. Within the one-half mile area of review is the Fulfer Oil & Cattle, LLC operated Sholes B 25 Well No. 1 (API No. 30-025-09812) located in Unit H of Section 25, Township 25 South, Range 36 East, NMPM, Lea County, New Mexico. This well has reported spikes in water production that may be correlated with injection of high rates of waters into the Maralo Sholes B Well No. 2.
- e. There may be an uncemented well located in the "area of review" that could provide a conduit for high rate disposal waters to move up hole. Within the one-half mile area of review is the Continental Oil Company, Sholes B 30 (API No. 30-025-11839) located in Unit M of Section 30, Township 25 South, Range 37 East, NMPM, Lea County, New Mexico. The well is reported as plugged and abandoned but there are no logs of well file records available in public records to verify depth or plugging method.
- f. The Maralo Sholes B Well No. 2 was originally permitted for handling local waters, but after being taken over for commercial disposal has reported a peak disposal rate of 42,880 barrels of water per day.

- g. Order No's R-14034 and R-9913 were presented by the OCD as examples of proposals for disposal in this area over the years that were denied after notice and hearing. The reason for denial has been cited as a concern over waste of oil and gas and adverse impact on the relatively low salinity waters in the target interval or adverse impact on the Capitan Reef.
- h. The OCD and the Division have received letters from the City of Jal expressing concern over the effects on fresh water supplies of disposal at high rates into the Maralo Sholes B Well No. 2.
- i. The water analysis submitted with the original disposal application for the Maralo Sholes B Well No. 2 reported 8,200 mg/l of TDS. That application was not for commercial disposal of outside waters and the applicant indicated an intention to re-inject those same waters or local waters from local operations back into the Yates and Seven Rivers formations.
- j. The water analysis recently submitted for the application for the Proposed Well is much higher than that submitted with the original application for the Maralo Sholes B Well No. 2.

(12) The State Land Office ("SLO") appeared at the hearing through counsel and presented the following.

- a. SLO explained that the Hiss data confirms a hydrologic model of movement of fresh waters through and near the Capitan Reef. The Artesia group formations near the Proposed Well have clearly been flushed from waters within the Capitan Reef below the original sea water concentrations and are at or below the protectable concentrations.
- b. There has been contamination occurring in this area. The older salt water disposal wells have increased the salt level in waters from surrounding producing wells. This is evidence that disposal waters were being brought into those disposal wells from higher salt yielding formations.
- c. The waters in this Yates, Seven Rivers, Queen formation aquifer to the north of the Proposed Well range from good drinking water to much higher salt content, a complete range of salinities, but many samples are below the 10,000 mg/l of TDS.
- d. There is a well on located to the south of the Proposed Well that had 5800 TDS at one point in time. The salinity in that well degraded over time which has been a pattern for wells in this area.
- e. Looking at the samples taken over time in this back-reef area, it is evident that the waters were clearly fresh and in places have been contaminated by drilling or disposal.

- f. In 2009, the Texas Water Development Board issued a complete report about the waters in this area, updating and expanding on the Hiss work.
- g. From examination of thickness of the Seven Rivers, the Capitan Reef may be within 100 to 300 feet vertically from the open hole, total depth of the Maralo Sholes B Well No. 2. From correlations, the Seven Rivers formation may range in thickness from 100 to 400 feet thick at this location. The lack of deeper wells in this area prevents knowing this thickness precisely.
- h. The permeability in the Capitan Reef can be three to ten times as much as the permeability in the back-reef facies. There is sometimes a low ratio of horizontal to vertical permeability in the Artesia group formations. Therefore, vertical migration can and does occur.
- i. There is some indication of a fault within one mile of the Proposed Well. The faults in the Reef may have resulted in cavernous porosity and points of recharge in the Reef. This cavernous porosity sometimes extends upward into the rocks of the Artesia group overlying the Capitan Reef, as it does above the entrance to the Carlsbad Caverns.
- j. The SLO does not want poor quality water which would be injected into the Proposed Well to migrate under State Trust lands. The SLO has easements for both fresh and naturally brackish water for use by mining companies and oil and gas companies.
- k. The SLO is also concerned about waste and believes there is a residual oil saturation in this reservoir even after depletion. Wells set up to dispose of salt water instead of wells set up in a pattern for injection and waterflooding will result in a waste of State Trust oil resources.
- l. The SLO stated that oil companies are reluctant to install a waterflood or CO₂ flood in this area because of the large liability from poorly plugged wells.

(13) Additional technical details in OWL's submitted form C-108 (application for disposal) and in Division records concerning the Maralo Sholes B Well No. 2 and disposal in this area are pertinent to this case and listed below.

- a. The Maralo Sholes B Well No. 2 (as it is now called) was originally drilled in 1947 for production of oil. The oil pay interval (Yates or Seven Rivers formation dolomite) was initially reported to extend from 2945 feet to 2950 feet. In 1961, the operator reported that the oil interval had "watered out" and applied to recomplete the well up hole as a gas well in the Yates formation. On October 6, 1961 the well tested at 780 Mcf per day from upper Yates formation sands at 2871 feet to 2910 feet. These perforations were cement squeezed and a thicker gas pay interval from 2824 feet to 2933 feet was perforated and fractured on October 21, 1981.

- b. By 1986, the well had reached its economic limit for production of oil and gas and was deepened at least 50 feet and used as a water supply well for the Jalmat Waterflood. The well continued to produce and sell some gas.
- c. After administrative application, on June 1, 2008, the Maralo Sholes B Well No. 2 was permitted by the Division with administrative order SWD-1127 for use as a disposal well into an open hole from 2938 to 3055 in the Lower Yates and Upper Seven Rivers formations. The application for disposal stated the operator's intention to dispose of a maximum of 5,000 barrels of water per day from the same formation and from the operator's own production in the area.
- d. OWL took over as operator of record on July 16, 2014, cleaned out the disposal well, and changed the injection tubing from 3-1/2 inch to 4-1/2 inch in diameter, and connected a produced water flowline to the well. The well has since been used for commercial disposal at rates of approximately 25,000 barrels of water per day ("bwpd"), sometimes peaking at much higher rates.
- e. The Proposed Well would be a new disposal well to be located near and to replace the Maralo Sholes B Well No. 2.
- f. Division records indicate that within one half mile of the Proposed Well are nine (9) plugged and abandoned wells and two (2) other wells that have not yet been plugged, both operated by Fulfer Oil & Cattle, LLC. The producing wells are in the Jalmat; Tansill Yates Seven Rivers (Oil) Pool with Pool Code 33820. All wells located within one-half (1/2) mile of the Proposed Well are reported in the C-108 application submitted by OWL to be cased and cemented adequately to prevent movement of disposal water up-hole and out of interval.
- g. Partially as a check on whether waste will occur, the form C-108 asks for all wells within two miles to be listed in any application for disposal. OWL intends to dispose at relatively high rates over many years into the Proposed Well; therefore, during the hearing the Examiner asked for the radius of notice to be extended from the rule-required one-half mile radius to a one-mile radius, which radius was amended to include all lands in the surrounding four Sections. OWL has done that additional notice. The data indicates that many of the active wells in those Sections are operated by Fulfer Oil & Cattle, LLC and some are operated by Herman L. Loeb, LLC.
- h. Two of the active wells in Section 25 are permitted for disposal and being used for salt water disposal into the same proposed interval as the Proposed Well. Division records for these two disposal wells can be summarized as follows:
 - The Sholes B 25 Well No. 2 (API No. 30-025-09809)
Located in Unit B of Section 25 and currently operated by Fulfer Oil & Cattle, LLC. This well was permitted by SWD-513 on May 20, 1993 for disposal into the Seven Rivers (open hole) from 3061 feet to 3290 feet. The application stated the intention "to inject water from our wells from the

Yates and Seven Rivers formations” at no more than 7000 barrels of water per day.

- The Brown Well No. 5 (API No. 30-025-09807)
Located in Unit E of Section 25 is now operated by OWL SWD Operating, LLC. This well was permitted by Division Order No. R-5196 issued in Case No. 5655 on April 20, 1976 for disposal into the lower Yates and Seven Rivers formations through an open hole from approximately 3289 feet to 3363 feet.

The testimony in this Case No. 5655 presented in 1976 indicated that water from the producing interval of the Yates formation in surrounding wells would be injected in this well into the (lower) Seven Rivers open hole. The applicant submitted a water analysis of these Yates waters (Exhibit No. 5 of Case No. 5655) which showed a TDS of 7302 mg/l with (a lot of) H₂S.

The case file also contains a request submitted relatively recently asking to convert the disposal well from lease-only to Commercial Disposal. The request letter included a water analysis sampled in March of 2000 (titled: Project Owner Fulfer and Project Name Brown SWD near Jal New Mexico) showing waters to be disposed into the well. The Seven Rivers formation water was listed at 8200 TDS and the Queen formation water at 5000 TDS.

The Case file did not contain a reply from the Division granting or denying permission to convert to commercial disposal.

Issues and Conclusions

(14) Waste of Oil or Gas due to Disposal

- a. It was proper that the OCD not approve this disposal application administratively and prudent to require a hearing where the possibility of waste of oil and gas could be further explored.
- b. OWL presented an expert opinion from a Petroleum Engineer that this reservoir cannot be waterflooded until the reservoir pressure is restored, previous waterflood attempts have failed, and disposal into this reservoir will not harm oil reserves but may even help recover additional oil. Prior to the production from gas higher in the reservoir, this reservoir may have had a combination of solution gas and pressure depletion from the gas cap. That may have yielded a higher oil recovery or a faster recovery of the same percent of original oil in place.
- c. Oil reservoirs producing under a pure solution gas drive have a residual oil saturation that can be significant. OWL did talk about reservoir pressures and about permeability as measured on a core and inferred by the rate of disposal,

but did not specifically list other reservoir, rock, or fluid parameters that would support the conclusion about waterflooding.

- d. It does ring true that the reservoir pressure must be restored, and the depleted gas cap would hamper recovery, but waterfloods are often started under depleted conditions where logical patterns of injection and production wells are used to re-pressure and direct the sweep direction.
- e. This application is for commercial disposal into a depleted oil and gas reservoir and was not presented as an application for creation of a pressure maintenance project as is commonly done. The choice to qualify the well as disposal and not injection may be logical considering the large number of plugged wells and the small number of remaining production wells in this vicinity.
- f. Except for the SLO, owners or operators of the minerals did not attend the hearing or otherwise indicate a concern as to waste of oil and gas. The SLO mentioned that waste of oil and gas could occur due to this proposed disposal well but acknowledged that oil companies have been reluctant to install an enhanced recovery project in this area.
- g. The Division has selectively allowed disposal wells into oil productive reservoirs in the past to inexpensively test the waterflooding concept and observe the effect on offsetting production wells. This should not be done administratively, but only after identifying separately owned tracts surrounding the well and providing adequate notice to ALL mineral estate owners of those tracts, and only after convincing testimony from a petroleum engineer. OWL has identified tracts and provided disposal notice to tract owners and presented testimony from a petroleum engineer.
- h. There was no waterflooding study or reservoir simulation and therefore, there is still a question as to the effect of commercial disposal, whether this reservoir has recoverable oil, or whether recoverable oil would be profitable.

(15) Influence of Disposal on the Reef

- a. There was conflicting testimony as to the distance to the reef. It seems there is a lack of well data available to the witnesses as to exactly where the Reef rocks begin vertically underneath the Maralo Sholes B Well No. 2 and even a question as to exactly how far the reef is offsetting to the west.
- b. The low reservoir pressure in the target Yates-Seven Rivers formations is evident by observing the extremely high rate of injection at low surface pressures into the Maralo Sholes B Well No. 2 and the need to use CO2 foam to clean out the fill from the Maralo Sholes B Well No. 2 prior to running the latest injection survey.
- c. The current low reservoir pressure indicates that any strong hydrodynamic connection with the Capitan Reef Aquifer (or waters) does not exist. The area

has been essentially depleted since the 1950's, which was 50 to 60 years ago, and reservoir pressures are still extremely low and dramatically lower than the pressures in the Capitan Reef. If there were a strong connection from the reef, then it seems that pressures would have equalized or shown signs of equalizing.

- d. It is likely that the planned large disposal volumes into this depleted reservoir will eventually fill up the reservoir. At the estimated disposal rate in the C-108 application of 30,000 barrels of water per day, the well will fill up the 90 million barrels of depleted pore space in this project area within less than nine years. These numbers can be considered as estimates, since OWL did not clearly define the project area or estimated area of invasion and as shown above, the vertical injection interval thickness is not precisely known.
- e. As the local reservoir fills up and the pressures rise, injected waters that may be corrosive will migrate somewhere. OWL maintains the waters will migrate to the east where the major depletion has occurred. This is logical; however, there was a slight downward movement of water in the injection survey that was run at only one fifth of the rate that disposal is happening.
- f. There is a lack of well data in this area on the lower Seven Rivers formation and the pore pressures existing vertically below the Proposed Well. Therefore, it is prudent to gather more data and until OWL can provide enough data to show the Division differently, it should consider that fluids may move downward and have an interaction with the Capitan Reef as this reservoir achieves fill up.

(16) The Presence of Water in the Target Interval

- a. OWL's focus in its testimony was on the oil and gas reservoir and concluded that little water was present in this interval or available for use. A specific look at the well records indicates that the target disposal interval or interval slightly deeper in the Seven Rivers formation does have water present. From the SLO presentation, it could be concluded that the connection to the reef and the brackish near reef waters is not too much deeper than the target disposal interval.
- b. The Maralo Sholes B Well No. 2 had produced oil and then reported to have "watered out" prior to recompletion in the gas interval. The well had also been deepened into the water leg of the reservoir [it is not clear as to how far it was deepened] and used as a water supply well for a waterflood.
- c. The question remains as to whether a weak bottom water drive existed and what thickness of interval would be effective for disposal. The thickness, or net pay, of the formation taking water from disposal may not be accurately known and is a critical factor in estimating the invasion radius after many years of injection.
- d. The recently run injection survey on the existing Maralo Sholes B Well No. 2 was run at 6500 barrels of water per day to obtain usable data from the tracer

survey. This survey did not show waters exiting the well and moving down out of the permitted open hole interval, but the survey was not run at the representative rate of 25,000 barrels of water per day, so that is still a possibility.

- e. The conclusion that the sands in the Yates and upper Seven Rivers formations (as those formations are in this backreef lagoonal depositional environment) have dramatically more permeability than the dolomites (which may be filled with anhydrite) would likely still apply to rocks deeper in the water leg.

(17) Yates-Seven Rivers Waters for the City of Jal

- a. The State Engineer did not enter an appearance or otherwise express any support or opposition to this application.
- b. OWL presented testimony that the State Engineer defines the "Capitan Underground Water Basin" for purposes of administering water rights within a defined extent and this basin includes water sources above the Capitan Reef Aquifer so is not laterally limited to the Capitan Reef Aquifer.
- c. OWL opined that the City of Jal would seek waters from many other sources before it would drill wells and produce water from the Capitan Reef Aquifer.

(18) In-Situ Water Quality

- a. This is a reservoir with insitu water salinity considerably lower than the salinity of the proposed disposal waters and therefore has been a consideration for use by business and local municipalities.
- b. As stated by the City of Jal, it is interested in procuring additional water supplies and interested in protecting waters that may someday be of interest. The City of Jal has applied for water rights in this Section 25 and is concerned about the proposed commercial disposal in this area and what effect it would have on fresh waters.
- c. The State Land Office is concerned about waste of oil and gas but also about dilution of potentially valuable waters in the Capitan Reef Aquifer. The State Land Office seems to be taking the position that waters in and around the Capitan Reef even if higher than the protectable limit should be protected from further dilution of waters under State Trust lands by oil field water disposal wells.

(19) Underground Injection Control Program

- a. The State of New Mexico was granted primacy on March 7, 1982 by the US Environmental Protection Agency ("EPA") for administering the federal Underground Injection Control ("UIC") Class II well program within most of the lands in New Mexico. The Oil Conservation Division is the lead agency for administering the program.

- b. The Division is responsible for permitting, inspecting, and monitoring oil field related disposal wells such as the Proposed Well and for reporting such activity quarterly and annually to the EPA.
- c. The following federal definitions are integral with the UIC program:

40 CFR 144.3 - Definitions.

- Aquifer means a geological "formation," group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.
- Total dissolved solids means the total dissolved (filterable) solids as determined by use of the method specified in 40 CFR part 136.
- Underground source of drinking water (USDW) means an aquifer or its portion:
 - (a) Which supplies any public water system; or
Which contains a sufficient quantity of ground water to supply a public water system; and
 - (i) Currently supplies drinking water for human consumption; or
 - (ii) Contains fewer than 10,000 mg/l total dissolved solids; and
 - (b) Which is not an exempted aquifer.
- Even if an aquifer has not been specifically identified by the Director, it is an underground source of drinking water if it meets the definition in § 144.3.

(20) Protectable Waters

- a. The proposal for injection is into a specific well at a specific location and depth, but the presented facts were of a statistical nature over this generally large area. It is evident that the formations, waters, phases of production, and well data change rapidly in an East to West direction and less rapidly from North to South. The available data gets sparse only a short distance to the West because there were less wells drilled for oil and gas. Both sides presented statistics of water salinity showing much variation.
- b. OWL has done a statistical analysis over a nine-township area surrounding this well showing that the median and average water salinities as reported in the 1975 paper by Hiss are both above the protectable level.

- c. The OCD and the SLO cited many examples of water samples showing low, sometimes protectable salinities in Yates, Seven Rivers, and Queen formation wells in this north to south trending reservoir. The SLO showed how salinities have trended over time in selected wells, with many water samples beginning at protectable levels of salinity and some contamination occurring from vertically mixing reservoirs [drilling] or from outside disposal of waters [salt water disposal].
- d. The specific, local water analysis already present in the Division files for previously issued disposal permits in Section 25 [see Brown Well No. 5, API No. 30-025-09807] indicates that the native waters in the Yates, Seven Rivers, and Queen formations are in fact protectable. The Queen formation being equivalent in age to the Capitan Reef, did show lower salinity than the Yates and Seven Rivers formations.
- e. Disposal permits in this area have previously been approved for re-injection of local waters from the same formations. This is allowed under the provisions of Division Rule 19.15.26.8 E(3) NMAC which says, "*...the director may authorize disposal into such zones administratively if the waters to be disposed of are of higher quality than the native water in the disposal zone*".
- f. However, the Division must consider the disposal of outside waters of higher salinity as is being proposed in this case under a higher standard of consideration under Division Rule 19.15.26.8E(2) NMAC which states that "*The division shall not permit disposal into zones containing waters having total dissolved solids concentrations of 10,000 mg/l or less except after public notice and hearing, provided that the division may, by order issued after public notice and hearing, establish exempted aquifers for such zones where the division may administratively approve the injection*".

Summary of Findings

(27) This application for permit to inject should be denied without prejudice to further proceedings. The following facts, conclusions, and remaining questions support this conclusion:

- a. The in-situ waters in this proposed disposal interval of the Yates and Seven Rivers formations within and around Section 25 are protectable and a defined area around the Proposed Well has not yet been declared as an "exempted aquifer" by the Oil Conservation Division and by the US EPA.
- b. The Proposed Well may cause waste of oil or gas. The reservoir is largely depleted, yet there remain active producing wells in the target formation in this immediate area. A rigorous analysis or reservoir simulation or waterflood study has not yet been done to determine the additional recovery capability of this reservoir.

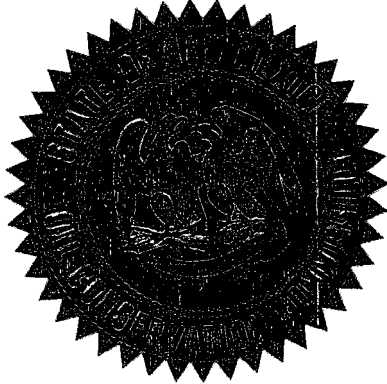
- c. If additional recovery capability exists, then the applicant must further justify the waste of oil with the overreaching need to use this reservoir for commercial disposal. This would involve both facts and legal arguments.
- d. There is a lack of critical data necessary to understand the characteristics of the Yates, Seven Rivers, Capitan Reef, and Queen formations. This data can only come from the drilling, logging, and testing of a nearby well designed to penetrate at least the top of the Capitan Reef. The test well and the location of the test well should be proposed by geologists and engineers and permitted under guidance of the Division.
- e. The Continental Oil Company, Sholes B 30 (API No. 30-025-11839) located in Unit M of Section 30, Township 25 South, Range 37 East, NMPM, Lea County, New Mexico, was reported by the OCD as having no well records, no logs, and no plugging records. Records on offsetting wells indicate wells were plugged with small amounts of cement, but placed at adequate locations. The plugging program used on this well may or may not be similar. Most importantly, because there is likely an open hole through the Salado formation, any attempt to re-enter this well would likely fail and during the work over, would expose shallow fresh water intervals to invasion by salts. Despite these assumptions, OWL should attempt to locate records for this well and supply those records to the Division for further review and guidance.
- f. The extended pressure radius of influence must be determined and presented to the Division. The well construction of all wells within this agreed upon extended radius must then be examined and presented to the Division with a plan for repair of any cementing or casing concerns.
- g. A plan for the periodic monitoring of static reservoir pressures [not just well head injection pressures] near any proposed commercial disposal well must be presented and approved by the Division. Reservoir pressures should rise predictably as disposed water volume increases and the static reservoir pressure should be limited to a pressure that would not cause preferential flow towards the Capitan Reef. And if pressures do NOT rise predictably as water volumes increase, then the confining reservoir and rock assumptions are incorrect, and waste water may be migrating downward and into the Capitan Reef.

IT IS THEREFORE ORDERED THAT

(1) The application of OWL SWD Operating, LLC for permit to inject into the proposed Bobcat SWD Well No. 1 to be located 740 feet from the South line and 705 feet from the East line, Unit P of Section 25, Township 25 South, Range 36 East, NMPM, Lea County, New Mexico, is denied without prejudice.

(2) Jurisdiction is hereby retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.



STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

Heather Riley
HEATHER RILEY
Director

SEAL