Geoscience Technologies

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July 18, 2008

Subject: BLM letter re: Mesquite SWD, Inc. #8 Exxon State SWD well dated June 9, 2008

This memo is in rebuttal to the subject BLM letter addressed to the OCD in Santa Fe stating the BLM Carlsbad Field Office (CFO) is desirous of terminating salt water disposal into the subject well. Having completed an extensive geological and hydrogeological examination of the greater area around the Exxon State #8 SWD well, it is believed important to fully comment on statements and representations presented in their letter.

The BLM indicates the CFO became aware of oil surfacing from the abandoned Magnolia #1 State well located 2310' FNL and 330' FWL of Section 14, T21S-R27E, Eddy County, NM in a (undated) conversation with the OCD Artesia office. The BLM indicates the well was plugged in 1957 and also states that the "well needs to be replugged . . " The first serious misunderstanding regarding the purported plugging of the Magnolia well stems from a spot field examination by Mr. Mike Stubblefield of the Artesia OCD on July 14, 1989 in which he noted "Checked status of well. Well is plug & Abadoned (sic)." There is no record of any plugging or abandonment operations on this well prior or subsequent to that field check, therefore it is appropriate that we first address the complete history of the Burgett #1 Magnolia State well (30-015-01082).

The Magnolia well was spudded July 26, 1953 under a valid OCD permit to Robert W. Atha to drill to 700 ft. It was drilled with cable tools. Surface casing, 42' 7" of 10" was set mudded (no cement) on July 28th. Subsequent surface material sluffing into the hole required setting 7" casing at 212 ft. Drilling was completed on August 2, 1953 as report on an undated OCD form entitled Well Record. This form indicates the productive oil zone was from 533 - 538 ft. On the bottom of the form there is an undated handwritten annotation of " 7"/212" and what appears to be " C/80' " added (the C/80 is probably 8" casing mentioned later). A driller's log was filed August 11, 1953 that indicates the total depth (TD) of the well was 538 ft, the first 24 hours of production was 25 bbls of 14-16° oil and 75 bbls of water, with first production on August 3, 1953. The very low gravity of the oil is noteworthy. An August 26th NM OCC Scout Report indicates the well had bailed 2 bbls oil/hour 20% oil and 80% sulphur water from 538 ft.

The owner and operator of the Magnolia #1 State was changed from Atha to Everett D. Burgett on January 20, 1955. In a Miscellaneous Reports dated January 17, 1955 Burgett reported that on January 2nd "the 212 ft. of 7" pipe that was already in the well was cemented with 15 sacks of cement.." Apparently in response to an OCD inquiry Burgett filed a

Miscellaneous Reports dated January 31, 1955 that stated:

> This well had approx. 40 Ft. of 10" pipe. 80 Ft. of 8" pipe was put in to stop caving of surface formation when this failed to stop the caving 212 ft of 7" was put in but not cemented, but it did stop the caving of surface. The well was cleaned out and drilled to 536, then 2 sq. ft of okmum with 100 lbs of lead wool was put in the bottom. to attempt to shut off water

It would appear that Mr. Burgett may have been relating original work before he took over the well because confusion did arise from the last sentence as to the hole's TD. The well had already been drilled to 538 ft. The 2 sq. feet of oakgum with 100 lbs of lead wool going into the uncased hole would have brought considerable wall debris on top of the "plug." Using the bailer he would then have cleaned-out the cavings to the 536 ft depth.

In another C-103 Miscellaneous Report Burgett reported on March 8, 1957:

> Well was cleaned out to a depth of 540 and put back on pump since there has been a lot of junk lost in the hole this well may have to be redrilled

On that same Report Burgett filled-in the TD of the well as: "533 ?" probably intending to indicate the approximate top of the debris in the hole. I question the "cleaned out to a depth of 540" as being inaccurate. Without having moved a rig onto the hole he would not have been able to cut new hole.

On January 24, 1958 another C-103 was filed on this well that added previously unreported information and requested to drill an additional 2 feet - to 540 ft.

> Part of the papers on this well shows the total depth of 533 while others show 538' When this well was cleaned out and shot it was only cleaned out to a depth of 533' My Intentions are to clean this well out or drill deeper but not to excede 540'

NOTE: O.K. TO CLEAN OUT BUT NOT TO DRILL DEEPER MLA

The added information was that on the previous clean-out the hole was shot. This means that a professional "shooter" using nitroglycerin canisters was brought in to fracture the formation opposite the shot. Shooting often created additional debris from wall rock above the shot. Mr. Burgett's hole filled to 533 ft. The bottom of the hole still remained at 538 ft, but it also had the oakgum and lead wool package that apparently failed to cutoff sulphur water influx from the original interval 533 - 538 ft fluid zone within the Magruder pay. The top of the Magruder was reported in the 1956 Roswell Geological Society Symposium of Oil and Gas Fields at +2730 MSL.

All the above seems trivial but does provide facts related to the inference that the Mesquite SWD well is responsible for crude oil bubbling out at the surface around the Magnolia State # 1 located N46°E approximately 2,935 ft (0.56 miles) northeast.

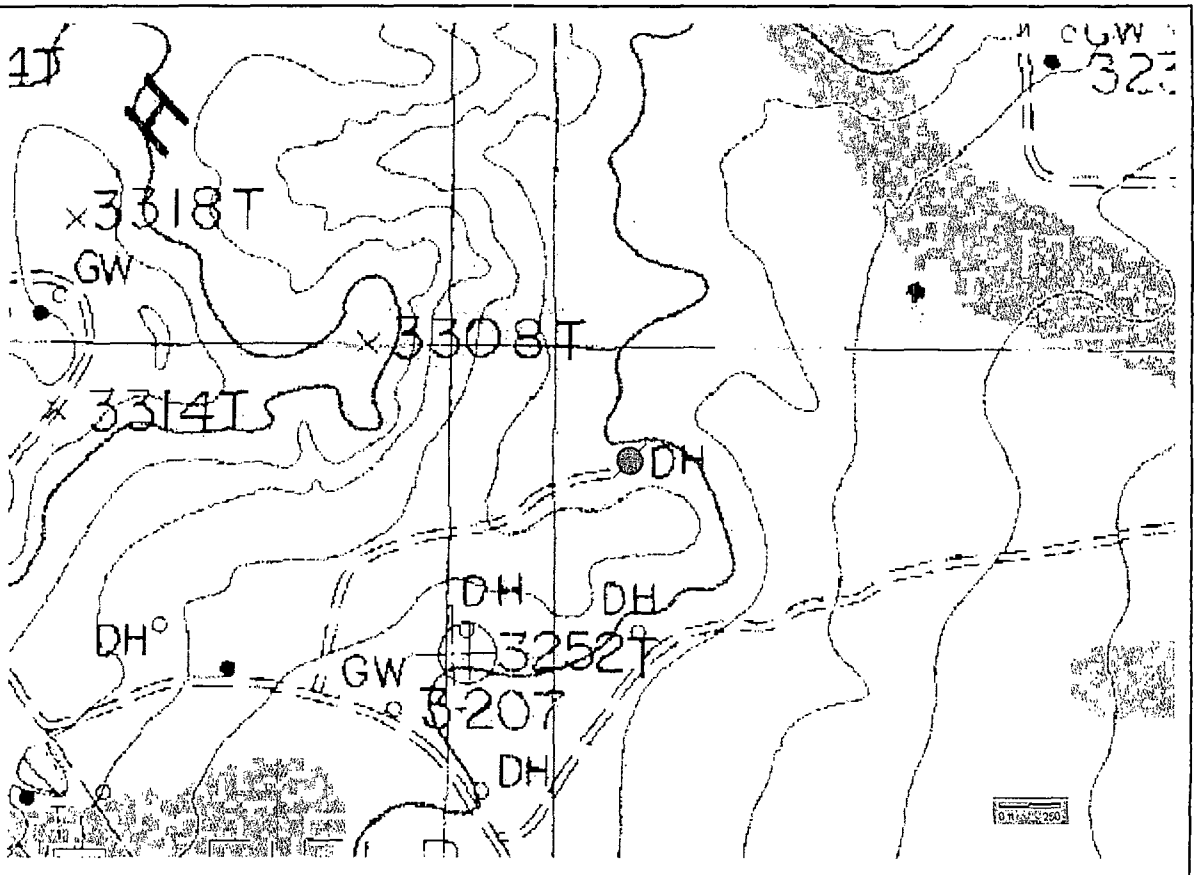

Figure 1 Location Magnolia State #1 USGS topo map DeLorme Xmap elevation.

The top of the Magruder in the Mesquite SWD #8 Exxon is at +2720 MSL, ten feet lower than the Magnolia State #1 at +2730 MSL. The base of the casing cement in the Mesquite SWD well is at 574' (+2707 MSL). The USGS Topo ground surface elevation of the Magnolia State #1 is 3256 ft as shown in Figure 1. The subsurface elevation of the Magnolia's 538' TD is +2718' MSL. The bottom of the cement behind the geophysically logged casing in the Mesquite SWD well is at 574' (+2707' MSL), or 11 feet below the deepest depth drilled in the Magnolia well. Therefore, the same stratigraphic oil and water zone in the Magnolia at 533 - 538' (TD) is cemented behind casing in Mesquite's SWD well. The Magnolia zone is not only over ½ mile away, it is also stratigraphically 11 ft above the uppermost horizon shown on tracer tests in the Mesquite SWD well to be accepting any disposal water.

The problem with the Magnolia State #1 lies in that there is absolutely no evidence that the well was plugged in any manner other than there is apparently enough cement at the surface to hold the marker that Mike Stubblefield probably observed in his 1989 inspection. The above report of cementing the 7" casing with 15 sacks gives an indication of when cementing occurred. It is probable the 15 sacks of cement were pumped into the annulus between the 10" and the 7"

and has only cement the *top* of the 7" inside the 10" casing. That would suggest only the top few feet of surface marker cement may be covering the hole. We only know the well was not plugged and that heavy crude is getting out.

The BLM letter stated that the above concern of needing to replug the Magnolia well, the CFO was "more concerned with what was driving the fluid to the surface." All recognize there is oil and water in the Magruder interval. Because it cannot be economically pumped does not mean the oil has disappeared, the water is somehow not in the reservoir, or the reservoir pressure is dissipated. With a potential of almost 500 ft of hole open it is possible to speculate that crude oil migration from the Magruder pay on top of whatever natural head is present in the original water drive over the past 50 years may be coming from itself or communication with any nearby well. We do not know.

What we do know is that the Magnolia State #1 does not have sufficient depth to penetrate the highest zone into which water is disposed ½ mile away. We also know that the regional structural dip of the Yates Formation is to the southeast and water being taken into the formation under gravity will normally not move up-dip.

The fact that the Exxon State #8 takes water under gravity cannot by rationalized as being a relatively new revelation, unusual, or due of recent disposal. When the well was originally drilled the cable tool hole was virtually empty to TD at 694 ft. The operator, Mr. Rains, reported in a C-103 filed September 20, 1977 setting-up the disposal well, that he ran 565 ft of 2" upset plastic tubing on a packer set at 550 ft, filled the annulus with treated water, acidized the 4-3/4" open hole with 110 gallons and the hole immediately took water on vacuum.

To suggest that the oil in the Magnolia well is slowly seeping onto the surface as a result of lift or drive from water disposed into the Mesquite SWD well is uninformed speculation and not probable based upon the above cited facts readily available for examination and study.

It appears that the BLM gained its information on the relationships of the wells and the nature of the problem through conversations with the OCD rather than examination of the subsurface geology, drilling history, or well data files. That fact is apparent by the BLM stating that 200,000 barrels per month of produced water was being disposed of (in the subject Mesquite well) at a depth of 570'-600' – which the BLM states as "approximately the same depth as the completion interval of the Magnolia" State #1 plugged and abandoned well in 1957. Their facts as to depths, correlations of strata, and plugging are either wrong or also incorrect. It's the detail that matters.

The BLM correctly indicates that Capitan reef water moves "to the east, and it is too saline to warrant protection under New Mexico State regulations." In their further discussion of ground water flow they state that "there are no water wells within 2.5 miles of the Exxon well," which is a true statement, and further indicates that this is because the water quality is bad because of the presence of the Salado Formation. My examination of many drillings – both water and oil/gas – fortunately included many cable tool holes. Cable tool drillers report virtually any water encountered. In the greater area than the 2.5 mile circle, it was found that there simply was no water encountered until they penetrated in the Yates and the Magruder

equivalent horizons.

In the BLM reference to the Salado Formation they state that it is "an evaporite sequence that is primarily salt." Figure 2 is approximately a 9 township cut from the New Mexico Bureau

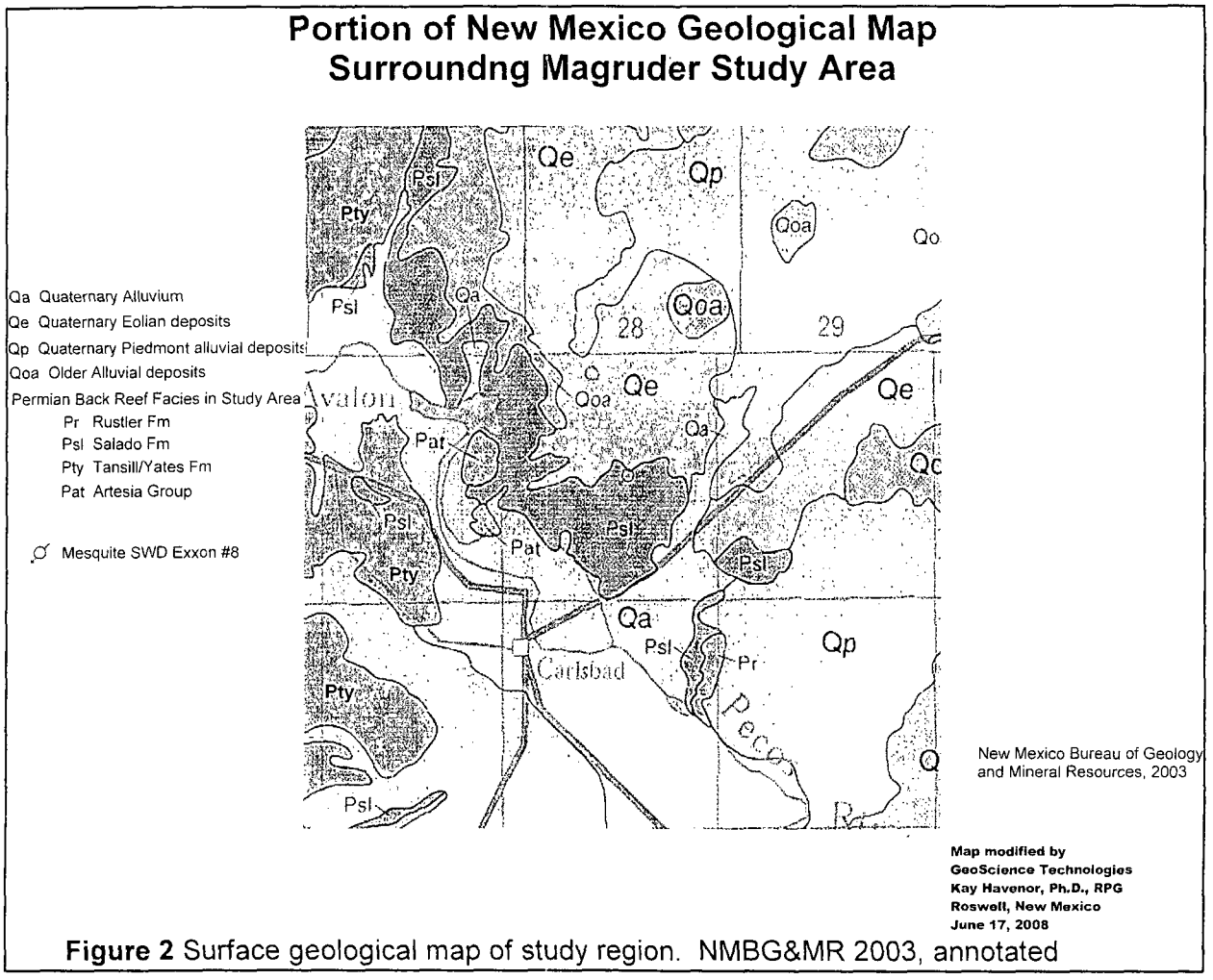

Figure 2 Surface geological map of study region. NMBG&MR 2003, annotated

of Geology and Mineral Resources geologic map of New Mexico (2003).

Figure 2 shows the location of the Mesquite SWD well (approximately in center of map). It is plotted close to the northern edge of the Salado Formation outcrop. We are fortunate in that Mr. Rains, the original operator and driller of the well, kept and reported a detailed sample descriptions during drilling the well. A copy of his driller's log has been included in the C-108 application to which the CFO of the BLM protested. Mr. Rains explicitly reported, on two lines, that no salt was encountered in drilling the hole. Mr. Rains reported redbeds and sand from the surface to 40 ft, gypsum and redbeds from 40 to 75 ft, then hard gray dolomite and anhydrite. The probability is greater that the Magruder Field is predominately on uppermost Artesia Group Tansill outcrops rather than Salado. Salado Formation in this area and north is devoid of salt beds.

The BLM states, "Also, the groundwater in this area (above the Reef) eventually

discharges into the Pecos River." Again, without water being present in the beds above and into the Yates Formation in the area under review and even beyond in the 2-1/2 mile radius mentioned by BLM, the speculation of discharge direction opposite regional structural dip is unfounded. Repeating again, dozens of wells drilled in the study area have not encountered water in the Salado/Tansill or upper Yates Formation. There are possibly one or two stock wells in the greater study area (not permitted by or known to the NM State Engineer) that tap extremely limited and scattered Quaternary eolian/alluvial accumulations at 50 ft or less.

The BLM letter notes that numerous domestic wells are present down-gradient, outside the Salado outcropping, and the CFO is concerned that those waters may be made unusable. Again, the structural gradient is to the southeast, and groundwater in the Capitan reef has an eastern gradient in the high transmissivity zones – none of which are located even near the Mesquite Area of Review, or the 2 mile radius of concern, or the extended area investigated and mapped for Mesquite's C-108 application.

The BLM states the CFO is particularly concerned because of the shallow injection depth of the Exxon State #8 "and its proximity to the Pecos River and the City of Carlsbad." Reference to Figure 2 readily shows that the Exxon State #8 is approximately 6 miles northeast of the City of Carlsbad, and over 5 miles east of the Pecos River. Not only is the distance significant, but the real directions of groundwater gradients are opposed to the BLM's concern as to how water would move–which it cannot. In addition, the Magruder Field is clearly in the back-reef environment whereas the City of Carlsbad is literally on the reef. The lithologies present in the Magruder Field gradually transition southward of the study area into back-reef carbonates that were deposited behind the reef. The sandstones and anhydrites tongue-into the reef about 3 to 5 miles south of the Magruder Field. The back-reef facies are a different world from the reef facies. It is important to also note that the reef facies is where the high transmissivity zones of the Capitan reef occur.

BLM's proposal that a dye tracing campaign be initiated to determine if connectivity between the disposal well and "down-gradient" water can be demonstrated is poorly thought-out. The impetus of the letter first appeared to be concern over the driving force of oil in the Magnolia State #1 that is located northeast (up and across gradient). The concern of possible connection to Capitan reef water (across gradient to the southwest) and the Pecos River (quasi-up-gradient to the west) would not seem logically reasonable for dye testing the Exxon State #8. The oil in the Magnolia State #1 has taken nearly 50 years to surface–and the fluid is apparently moving in a completely unplugged hole. Dye testing would not be logical and would require many years–probably decades–before preordained failure could be accepted.

The report accompanying and contained in the Mesquite submittal of C-108 addresses most of the real and logical concerns of the NM OCD for injection in the Exxon State #8. The BLM and OCD's concerns as to the movement of fluid in the Magnolia State #1, as addressed here in that there is no evidence or reports that indicate the well was ever plugged, and the well is not deep enough to penetrate the highest zone were water is being disposed in the Exxon State #8.. It is my sincere opinion the Magnolia State #1 problem will be completely eliminated when the responsible party physically plugs the hole. But please don't use cable tools.