

OIL AND GAS DOCKET NO. 09-0259654

THE APPLICATION OF EOG RESOURCES, INC. TO DISPOSE OF OIL AND GAS WASTE BY INJECTION INTO A RESERVOIR NOT PRODUCTIVE OF OIL OR GAS, ERATH COUNTY SWD LEASE WELL NO. 1, NEWARK, EAST (BARNETT SHALE) FIELD, ERATH COUNTY, TEXAS

HEARD BY: Andres J. Trevino P.E., Technical Examiner
Marshall Enquist, Hearings Examiner

APPEARANCES:

APPLICANT:

Philip Whitworth, Attorney
Mark Hanna, Attorney
Bruce Johnson
Robert W. Jenkins, P.E.
David Brunette
Rick Johnston, P.E.

REPRESENTING:

EOG Resources, Inc.

PROTESTANTS:

Barbara Harmon
Jim Harmon
Joe Cooper

Self
Self
Middle Trinity Groundwater Conservation
District

PROCEDURAL HISTORY

Application Filed:	October 20, 2008
Request for Hearing:	October 15, 2008
Notice of Hearing:	October 23, 2008
Date of Hearing:	December 2, 2008
Transcript Received:	December 16, 2008
Proposal For Decision Issued:	May 4, 2009

EXAMINERS' REPORT AND PROPOSAL FOR DECISION**STATEMENT OF THE CASE**

EOG Resources, Inc. ("EOG") requests authority pursuant to Statewide Rule 9 to dispose of oil and gas waste in its Erath County SWD No. 1 in Erath County. The well will be a non commercial disposal well and will be used solely for the disposal of oil and gas waste from EOG's development of Barnett Shale wells in the area.

This application was protested by Barbara and Jim Harmon, adjacent landowners and Joe Cooper, General Manager of the Middle Trinity Ground Water Conservation District. Both parties stated they are representing concerned citizens who reside in the area of the proposed disposal well.

DISCUSSION OF THE EVIDENCE**Applicant's Evidence and Position**

The subject well was drilled in August 2007 as an observation well for a micro seismic project for the surrounding Barnett Shale wells. This micro seismic listening well was used to acquire additional scientific data to allow horizontal wells drilled in the Barnett Shale to be completed in a manner to maximize gas recovery. The location for the proposed well is approximately 1.7 miles east of the town of Morgan Mill. EOG operates 60 to 70 producing wells in Erath County, with additional wells in the process of drilling/completion. Each completion requires a fracture stimulation of 40,000-50,000 barrels of water, the majority of which is produced back to the wellbore, requiring proper disposal.

The proposed Erath County SWD No. 1 is currently drilled to a depth of 5,090 feet, which is 290 feet into the Ellenburger section. The well will be drilled deeper to a depth of approximately 9,000 feet. A 5 inch liner will be run from a depth of 4,840 feet to 9,000 feet. The liner will be cemented from 9,000 feet to the liner hanger at 4,840 feet. The well has 594 feet of 9⁵/₈" surface casing with cement circulated from the casing shoe to the ground surface, and 7" casing set at 5,090 feet, which is approximately 290 feet into the top of the Ellenburger. (See EOG Exh. No. 10 Wellbore Diagram attachment). EOG estimates that the top of cement behind the longstring casing is 3,200 feet, which is above the top of the Barnett Shale. The Texas Commission on Environmental Quality recommends that usable-quality ground water be protected to a depth 20 feet below the base of the Cretaceous-age beds, which is expected to occur at 150 feet. TCEQ therefore recommends that surface casing be set to a depth of at least 170 feet. As noted above, EOG has set casing to a depth of 594 feet.

The nearest well which was drilled into the Ellenburger is the Senter No. 2. This well is also an micro seismic observation well and is approximately 3 miles to the south of the proposed disposal well. The top of the Ellenburger in the Senter No. 2 was found at 4,840 feet and the well penetrated approximately 80 feet of Ellenburger at total depth.

The closest well which penetrated the entire Ellenburger is the Bishop SWD No. 1 approximately 12 miles southeast of the proposed disposal well. This well encountered the top of the Ellenburger at about 4,920 feet. The total Ellenburger thickness in the well is 2,455 feet. The Ellenburger overlies the Granite Wash, which was found at about 7,375 feet in the Bishop SWD No. 1. The log of this well depicts a 463 foot tight limestone interval near the top of the Ellenburger which will provide an impervious barrier to migration of injected fluids from the deeper portion of the Ellenburger into the Barnett Shale, which directly overlies the Ellenburger. Three -D seismic survey of the area establishes that there is no faulting or karst depressions of the Ellenburger in the area. The top of the Ellenburger is "clean" therefore free of vertical faults and fractures which may be detrimental to confining injected fluids in the Ellenburger.

The proposed injection will be through a tapered 3½" and 2⅞" tubing set on a packer at approximately 5,725 feet, but no higher than 100 feet above the top of the injection interval. The proposed injection interval is the lower portion of the Ellenburger formation between 5,800 and 9,000 feet. The base of the Barnett Shale is located approximately at 4,800 feet. Although the base of the Ellenburger is estimated to occur at a depth of 7,550 feet, EOG requested a larger interval to ensure the base of the Ellenburger is included. The proposed maximum injection volume is 8,000 BWPD, with an estimated average of 4,500 BWPD. The proposed maximum injection pressure is 2,500 psig.

EOG plans to have four 500 barrel steel tanks for salt water storage and for separation of the water. The steel storage tanks will be lined internally for corrosion prevention. A 750 barrel fiberglass gun barrel will be on the site to separate the salt water from any small amount of condensate which may be present. The gun barrel tank will collect the condensate. The tanks will be enclosed by berms sufficient to contain 100% of the volume of the largest tank. The entire area including berms will be covered by an impermeable liner. Gravel will be placed over the liner and the tanks will be placed over the gravel. EOG is prohibited, by contract with the landowner, from operating a truck offloading station unless an emergency situation were to arise. Under normal conditions the water will be piped to the disposal well by a water gathering system built to each EOG productive gas well.

There are six wellbores within a ½ mile radius of the proposed disposal well. The wells are EOG's horizontal wells completed in the Barnett Shale. None of the wells have penetrated the Ellenburger. EOG's first Barnett Shale completion was in early 2006. By late 2008, EOG was operating 52 of the 82 active Barnett Shale wells in the county. Currently, EOG hauls about 30% of the produced water from its wells in Erath County to its Bishop SWD No. 1. The well is about 12 miles to the southeast of the current Barnett Shale development in Erath County. For the remainder of the produced water in Erath County, EOG utilizes commercial facilities in surrounding counties. The commercial facilities are about 20 miles away.

A traffic study was conducted on access roads around the proposed disposal well. The volume, classification, direction and speed data were collected to describe the existing traffic characteristics. The study showed that the area traffic is low volume (average of 59 vehicles per day) and relatively low speed (85th percentile speed of 44 mph). Most of the traffic is classified as cars, pick-ups, or single unit trucks with only about 10% of the traffic being classified as heavy trucks. Robert W. Jenkins, P.E. traffic engineer, concluded that using the Erath County SWD No. 1, during emergency situations, the expected truck volumes should not create congestion or endanger public safety.

The proposed Erath County SWD No. 1 is located in the middle of EOG's Barnett Shale development in Erath County. The proposed Erath County SWD No. 1 will gather produced water from surrounding wells through a buried, corrosion proof poly plastic pipeline system. With the current 30 producing wells, the use of the Erath County SWD No. 1 will save an estimated 472,000 miles of hauling per year. Additionally, EOG plans to drill 35 wells in Erath County during 2009. When applied to the combination of 65 existing and proposed wells, the use of the Erath County SWD No. 1 would save an estimated 945,000 truck miles during 2009. It is calculated the trucks would have burned between 78,000 and 135,000 gallons of diesel per year respectively without the disposal well. In addition to the near elimination of truck traffic, the use of the proposed disposal well will result in the recovery of additional reserves as a result of reduced operating expenses associated with the lesser costs of disposing water through a pipeline instead of trucking to a commercial facility. The estimated disposal costs for a barrel of produced saltwater through a pipeline is \$0.40 per barrel. The cost to dispose of that same barrel by trucking to a commercial facility is \$2.25 per barrel. With the average well producing 133 barrels of water per day and assuming \$6.25/MCF (gas price at the time) the economic limit for each well is reduced from 2,158 Mcf/month to 559 Mcf/month. Assuming a 10% decline rate, the reduction in disposal costs will result in the recovery of an additional 192 MMCF per well or 12.4 BCF of gas for 65 wells.

Notice of the subject application was published in *The Stephenville Empire-Tribune*, a newspaper of general circulation in Erath County, on May 14, 2008. A copy of the application was mailed on June 20, 2008 to the Erath County Clerk's Office and the offsetting surface owners. EOG is the only offsetting operator within ½ mile.

Protestants' Evidence and Position

Protestants Barbara and Jim Harmon are concerned that the use of the proposed disposal well will have adverse impacts on fresh water wells in the area, as well as possible run-off from the site and other potential physical hazards due to the well's location. The Harmons presented a petition signed by 100 concerned citizens in the area that are opposed to the disposal well. Barbara Harmon stated the well is located over the Trinity Aquifer recharge zone, the same aquifer that is used for fresh water supply in the area. Her statements also expressed concern regarding the increased heavy truck traffic in the area, the apparent lack of mechanical testing of the well, confinement of the injected fluids, proper notification and general operation and inspection of the facility.

Mrs. Harmon had six main concerns and other general concerns about the disposal

well. Mrs. Harmon is concerned whether the “thin” Barnett Shale of 175 feet was a sufficient barrier to confine the injected fluids. She was concerned that EOG set the surface casing in violation of Rule 3.13(b)(2)(A)(i) which does not allow surface casing to be set deeper than 200 feet below TCEQ’s specified depth without prior approval from the Commission. Mrs. Harmon’s third concern was whether the well was tested to handle injection pressures and whether surrounding Barnett gas wells will be affected by the disposal well. Mrs. Harmon’s fourth concern was whether the well’s casing was pressure tested prior to drilling out the bottom cement plug. Mrs. Harmon’s fifth concern was whether adequate notification was given to adjacent landowners. Mrs. Harmon’s sixth concern was whether the Commission requires saltwater disposal operators to measure bottom hole pressures in potential injection zones to calculate the radius of influence of the injection fluid. Mrs. Harmon raised other concerns including but not limited to other 2008 Barnett Shale accidents/incidents, the infrequent inspection of non-commercial disposal wells by Commission inspectors and groundwater trespassing on to their property.

Joe Cooper, the General Manager of the Middle Trinity Groundwater Conservation District, stated it is a policy of the District to oppose all disposal wells located within the boundaries of the mapped Trinity Aquifer. Mr. Cooper filed a protest letter with the Commission, then sent a letter to EOG Resources informing them of the protest and to request EOG to initiate voluntary groundwater monitoring in exchange for them to withdraw their protest. The voluntary ground water testing would require benchmark testing of four existing water wells located within a one mile radius, two updip and two downdip of the proposed disposal well. The water sampling and testing would continue on an annual basis for the life of the well. Mr. Cooper stated he did not receive any indication EOG would like to take part in the voluntary program.

EXAMINERS’ OPINION

The examiners recommend that this application be approved. The Erath County SWD No. 1 will be completed in a manner which will confine disposal fluids to the proposed disposal interval in the lower portion of the Ellenburger. The longstring liner will be cemented from total depth up to a depth above the top of the Barnett Shale to prevent migration from the injection interval. Additionally, EOG proposes to use only the lower 1000 foot section of the Ellenburger for disposal. With a gross thickness of approximately 2,500 feet in the Ellenburger, more than 1,500 feet of Ellenburger formation will separate the proposed disposal interval from the Barnett Shale. Within the Ellenburger there is a 460 foot tight limestone section near the top that will further prevent migration of disposal fluids out of the Ellenburger. There are no wellbores which penetrate the proposed disposal interval, within one mile of the proposed disposal well. The produced saltwater from area gas wells will be transported to the Erath County SWD No. 1 by a poly plastic pipeline system nearly eliminating truck traffic.

Approval of the requested permit is in the public interest given the number of wells being drilled to the Barnett Shale by EOG in Erath County and that approval of the disposal permit will nearly eliminate truck traffic. An issue over which the Railroad Commission lacks jurisdiction but over which the protestant expressed concerns. With the large fracture

treatments necessary to stimulate production of the Barnett Shale and the accompanying produced frac water, disposal facilities like the proposed well are necessary to fully develop and prevent waste of the natural gas reserves in Erath County. Use of the Erath County SWD No. 1 will nearly eliminate trucking costs, which will reduce the disposal costs for produced water and increase the economic life span of the Barnett Shale wells. This will result in the recovery of additional reserves in Erath County associated with EOG's development of the Barnett Shale of 192 MMCF per well. Applied to the 35 Barnett Shale wells EOG intends to drill in Erath County in 2009, this proposed disposal facility will allow the recovery of an additional 12.4 BCF of natural gas.

The evidence further indicates that the operation of the subject disposal well will not adversely impact useable quality water. Surface casing has been set at 594 feet and cemented to surface. This is approximately 424 feet deeper than the base of useable quality water as recognized by the TCEQ. There are additional shale layers above the Barnett Shale identified on the well's log that will further confine any injected fluids from reaching the protected ground water. The surface facilities will be constructed to minimize the risk of an accidental release to the ground surface. The storage tanks will be internally lined to prevent corrosion and an impermeable liner will be placed under the surface facility.

To address the Harmon's remaining concerns, long surface casings are routinely approved by the Commission's District office personnel provided the drilling mud used is not salt water based or oil based mud. Based on the electric log data, saltwater or oil based mud was not used. Injection wells are tested to 500 psi or to the maximum injection pressure whichever is less prior to commencing service. This test is designed to test for leaks, not to test if the tubing and casing can withstand the maximum injection pressure being applied for. A 3½" and 2⅞" tubing will have internal yield pressures between 3,300 to 26,770 psi and a 5" casing will have internal yield pressures of 4,870 to 20,280 psi depending on the grade. The casing testing results done prior to drilling out the cement shoe in accordance to Rule 3.13(b)(1)(D) is normally kept by the operator with the drilling records at the drilling site and are not normally submitted to the Commission. Application notification was done in accordance to Rule 9(a)(5)(A) for a non-commercial disposal wells. The Commission does not require pressure analysis to be performed to determine if disposal water has "trespassed" off leased property. The other Barnett Shale incidents identified by Mrs. Harmon are not related to EOG's proposed Erath County SWD No. 1 disposal well operations.

EOG noted that its operations will require very little truck traffic due to the use of the poly plastic pipeline system to gather produced salt water from existing and future EOG's Barnett Shale wells in Erath County. EOG has a salt water disposal agreement with the surface owners that prohibits EOG from operating a truck unloading station at the site. EOG is required to eliminate truck traffic used to transport salt water to and from the disposal well, unless an emergency situation arises. The Protestants did not present evidence to counter EOG's statements.

Based on the record in this docket, the examiners recommend adoption of the following Findings of Fact and Conclusions of Law:

FINDINGS OF FACT

1. Notice of this hearing was given to all persons entitled to notice at least ten (10) days prior to the hearing. Notice of the application was published in *The Stephenville Empire-Tribune*, a newspaper of general circulation in Erath County, on May 14, 2008.
2. EOG Resources, Inc. plans to recomplete and deepen the Erath County SWD No. 1 to a maximum depth of approximately 9,000 feet. The top of the Ellenburger occurs at approximately 4,800 feet, based on the well's logs.
3. The maximum requested injection volume is 8,000 barrels of water per day and the maximum requested surface injection pressure is 2,500 psi. The requested disposal interval is the lower portion of the Ellenburger formation between approximately 5,800 and 9,000 feet.
4. The Erath County SWD No. 1 will be cased and cemented in a manner to protect usable quality water.
 - a. The Texas Commission on Environmental Quality recommends that usable-quality water be protected to 170 feet in the area of the proposed well.
 - b. The subject well has 594 feet of 9 $\frac{5}{8}$ " surface casing cemented to surface.
3. Fluids injected into the Erath County SWD No. 1 will be confined to the injection interval.
 - a. Injection will be through tubing set on a packer no higher than 100 feet above the top of the injection interval.
 - b. The subject well has 7" casing set at 5,090 feet, 200 feet below the top of the Ellenburger. The estimated top of cement behind the 7" casing is 3,200 feet, which is above the top of the Barnett Shale.
 - c. The well will be deepened through the Ellenburger to a depth of approximately 9,000 feet. A 5 inch liner will be run from a depth of 4,840 feet to 9,000 feet. The liner will be cemented from 9,000 feet to the liner hanger at 4,840 feet.
 - d. Injection will be in the lower section of the Ellenburger. There is a confining "tight" 460 foot thick limestone section in the upper Ellenburger. Additional confining shale layers exist above the Barnett Shale.

- e. With a maximum surface injection pressure of 2,500 psi, the pressure is below the .5 psi/ft pressure gradient standard.
- 6. The Trinity formation outcrops over approximately 80% of Erath County. The Erath County SWD No. 1 is located over the Trinity Aquifer outcropping/recharge zone.
- 7. Additional surface facility groundwater protection features will be built into the Erath County SWD No. 1 facility to address the recharge zone area.
 - a. The storage tanks will be lined internally to prevent corrosion.
 - b. The entire tank storage area, including the berms will be covered with an impermeable liner.
 - c. The water gathering pipeline system will be composed of poly plastic.
- 8. There are no wellbores within one-quarter mile of the proposed disposal well which penetrate the proposed disposal interval.
- 9. Use of the Erath County SWD No. 1 Well as a disposal well is in the public interest to promote the active development of the Barnett Shale.
 - a. Use of the well will provide a safe, economic means of disposal of the fluids associated with production.
 - b. Use of the well will result in the near elimination of potential spills associated with hauling of disposal fluids from surrounding EOG producing wells to other facilities.
 - c. Use of the well will result in the recovery of an additional 192 MMCF of gas per well operated by EOG due to a lower economic limit for wells.
- 10. The use or installation of the proposed injection well will not endanger or injure any oil, gas, or other mineral formation.
- 11. With proper safeguards, as provided by terms and conditions in the attached final order which are incorporated herein by reference, both ground and surface fresh water will be adequately protected from pollution.

CONCLUSIONS OF LAW

- 1. Proper notice was issued in accordance with the applicable statutory and regulatory requirements.
- 2. All things have occurred to give the Railroad Commission jurisdiction to consider this matter.

3. The use or installation of the proposed injection well is in the public interest.
4. EOG Resources, Inc. has made a satisfactory showing of financial responsibility to the extent required by Section 27.073 of the Texas Water Code.
5. EOG Resources, Inc. has met its burden of proof and satisfied the requirements of Chapter 27 of the Texas Water Code, Section 27.051 and the Railroad Commission's Statewide Rule 9.

EXAMINERS' RECOMMENDATION

Based on the above findings and conclusions, the examiners recommend that the application be approved as set out in the attached Final Order.

Respectfully submitted,

Andres J. Trevino P.E.
Technical Examiner

Marshall Enquist
Hearings Examiner