



RAILROAD COMMISSION OF TEXAS

OFFICE OF GENERAL COUNSEL

OIL AND GAS DOCKET NO. 09-0260904

COMMISSION CALLED HEARING ON THE COMPLAINT OF DAVID H. ARRINGTON OIL & GAS, INC. THAT COMMERCIAL DISPOSAL WELL PERMIT NO. 12540 FOR THE TEXAS STAR DISPOSALS, L.L.C. - GOSDIN WELL NO. 1W, NEWARK, EAST (BARNETT SHALE) FIELD, SOMERVELL COUNTY, TEXAS, SHOULD BE REVOKED, MODIFIED OR SUSPENDED

Heard By: Donna K. Chandler, Technical Examiner
James M. Doherty, Hearings Examiner

Appearances:

Representing:

COMPLAINANT:

Matthew Baab
Brian Sullivan
Carter Davis
Louis Lint
Danny Ledford
Art Carrasco

REPRESENTING:

David H. Arrington Oil & Gas, Inc.

RESPONDENT:

Stephen Fenoglio
James Lewis
Dale Lovely
Kerry Pollard

Texas Star Disposals, L.L.C.

Procedural History of Case:

Complaint Filed :	February 6, 2009
Notice of Hearing:	February 9, 2009
Hearing Held:	February 23, May 28-29, 2009, January 28, 2010
Interim Order Denied:	August 18, 2009
Record Closed:	March 2, 2010
PFD Issued:	March 30, 2010

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

David H. Arrington Oil & Gas, Inc. ("Arrington") requests that the Commission suspend commercial disposal operations of the Gosdin No. 1W operated by Texas Star Disposal, L.L.C. ("Texas Star") in Somervell County. Arrington alleges that operations of the well have caused waste of Barnett Shale gas by watering out wells on Arrington's Orange Blossom Special lease located approximately one mile from the Gosdin No. 1W well. Arrington believes that fluids injected into the Ellenburger formation in the Gosdin No. 1W are not being confined to the permitted formation and are escaping into the Barnett Shale formation, in violation of the well's permit.

Arrington's request for Interim Order to shut-in the Gosdin No. 1W was presented to the Commission on August 18, 2009. The Commission denied the request to shut-in the well on an interim basis. On January 28, 2010, a hearing was held to consider additional evidence on the merits of the complaint of Arrington.

DISCUSSION OF THE EVIDENCE**Arrington's Evidence**

On January 12, 2007, the Commission issued Commercial Disposal Permit No. 12450 to Texas Star Disposals, L.L.C. for its Gosdin No. 1W well in Somervell County. The permit was issued administratively pursuant to Statewide Rule 9. The permit allowed a maximum of 25,000 BWPD to be injected at a maximum surface injection pressure of 2,000 psig. The permitted injection interval was from 5,900 feet to 6,808 feet in the Ellenburger formation, the top of the Ellenburger being at 5,644 feet. On March 7, 2007, the permitted injection interval was amended to 5,774 feet to 10,000 feet, but the well is only drilled to 6,820 feet. (See Appendix A wellbore diagram). Injection was commenced on about April 20, 2007 and cumulative injection through October 2009 is approximately 14 million BW.

Arrington drilled Well Nos. 1, 2, 3 and 4 on its Orange Blossom Special ("OBS") lease in December 2007, January 2008 and February 2008 (See Appendix B for timeline). The wells were completed in April and May 2008. These four wells are approximately one mile north of the Gosdin No. 1W. (See Appendix C for well locations). The wells are horizontal wells drilled into the Barnett Shale. The horizontal laterals range in length from 3,144 feet to 3,394 feet. The Barnett Shale in this area is approximately 250 feet thick and lies directly above the Ellenburger. Each of the four wells have at least 100 feet of Barnett Shale rock between the wellbore path and the top of the Ellenburger.

The OBS No. 1H began flowing back its frac water in April 2008 and the total frac load was recovered by mid-July. The OBS No. 2H also began flowing back its frac load

in April 2008 and had recovered the frac load by mid July. The OBS No. 3H began flowing back its frac load in April 2008 and had recovered its frac load by mid-July. The OBS No. 4H began flowing back its frac load in May 2008 and the entire frac load was recovered by July 20. For each of the four wells, after the frac loads were recovered, the wells continued to produce at rates of about 3,000 BWPD, with no gas production.

The nearest producing wells to the OBS wells are the Ella Well Nos. 1H, 2H and 3H which were drilled by Quicksilver Resources. These three horizontal wells are about 1,000 feet northeast of the OBS wells and all three started producing prior to any injection into the Gosdin No. 1W. The No. 1H produced a total of 1,789 MCF in March and April 2007, with no production reported since then. The No. 2H produced approximately 29,000 MCF through July 2007, was shut-in until October, then produced approximately 5,400 MCF during November and December 2007, with no production since that time. The No. 3H produced 52,000 MCF through July 2007 and was shut-in until January 2008. The well produced another 22,000 MCF in January through March 2008 and has not produced since.

Well tests for the three Ella wells indicated high volumes of water production (600-1,200 BWPD) just a couple of months after injection into the Gosdin No. 1W began. However, the wells did produce gas from the Barnett Shale. The wells had not yet recovered their frac loads at this time. The Ella No. 1H produced 1,627 MCF in April 2007, the No. 2H produced 17,574 MCF in April 2007 and the No. 3H produced 17,950 MCF in April 2007. Arrington believes that the Barnett Shale in the area of the Ella and OBS wells was certainly capable of producing gas prior to injection into the Gosdin No. 1W. According to Arrington, after injection into the Gosdin No. 1W started, the Barnett Shale became overpressured by invasion of Ellenburger water, resulting in lost gas production in the Ella wells and no gas production in the OBS wells.

There are four other Ellenburger disposal wells within 5 miles of the OBS wells. Quicksilver Resources operates the Officer Club SWD No. 1 in Hood County approximately 2½ miles north of the OBS and Ella wells. About ½ million BW were injected into this well between late 2006 and late 2008. Quicksilver also operates the Cannibal SWD No. 1 in Hood County approximately 2 ½ miles north-northeast of the OBS and Ella wells. From 2006 through late 2008, cumulative injection into this well was 2.6 million BW. Swan Oilfield Services operates the TWJM Services SWD No. 2 about 2½ miles to the southwest of the OBS and Ella wells. Cumulative injection from 2006 to late 2008 was 5.3 million BW. GSI Oil & Gas Inc. operates the George's Creek Ranch SWD No. 1 about 2½ miles to the east of the OBS and Ella wells. Cumulative injection from 2006 to late 2008 was 6.5 million BW. These four disposal wells are injecting into intervals at least 450 feet below the top of the Ellenburger.

Arrington does not believe that any of the other disposal wells in the area could be responsible for the water production experienced by the OBS and Ella wells. Arrington studied the producing wells near three of the other disposal wells. The fourth well, the TWJM disposal, well has no producing wells nearby. No anomalies in production were observed in the producing wells offsetting the other disposal wells.

Arrington presented its seismic interpretation of the area which shows that the Gosdin No. 1W is located approximately 500 feet from a large north-south trending fault which extends into the area of the OBS wells. This fault cuts the Ellenburger, Barnett Shale, Marble Falls and Atoka and is believed to be the conduit for fluids migrating out of the Ellenburger and into the Barnett Shale in the area of the OBS wells. Arrington drilled its OBS wells with the intent to avoid this fault because drilling through the fault would likely result in loss of frac fluids into the fault or water flow from the Ellenburger. The OBS wellbores did not intersect the fault in the Barnett Shale.

Subsequent to the first portion of the hearing, the parties agreed to conduct a pulse interference test between the Gosdin No. 1W and the OBS Nos. 1 and 4 wells. The test consisted of four cycles of shutting in the Gosdin well for 15 hours, followed by 15 hours of injection into the Gosdin well. Pressures were recorded at the wellhead of the Gosdin well and by bottomhole pressure recorders in the OBS wells. After the first 12 hours of shut-in of the Gosdin well, the bottomhole pressures in both the OBS wells began to decrease and continued to decrease throughout the test. Approximately 24 hours after the last shut-in, the bottomhole pressure in the OBS wells began to increase. This test confirms to Arrington that the Gosdin injection directly affects the OBS wells. If there was no communication, the bottomhole pressure in the OBS wells would remain static, as there is no production in the area which would otherwise affect the bottomhole pressure.

Arrington believes that further confirmation of communication is shown when the Gosdin No. 1W was shut-in for 50 hours in late February 2009, just prior to the pulse test. During the 50 hour shut-in, the bottomhole pressure in the OBS No. 4H dropped about 20 psi.

The Barnett Shale is known to be slightly overpressured, with publications indicating hydrostatic gradient of 0.52 psi/ft.¹ Assuming that gradient, the bottomhole pressure in the Barnett Shale matrix is 2,912 psi at 5,600 feet. In July 2008, the OBS No. 4H had a surface pressure of 810 psi, which Arrington believes is reflective of the pressure in the water filled fractures of the Barnett Shale. Based on this surface pressure, Arrington calculates that the bottomhole pressure in the fractures of the Barnett Shale was 3,397 psi. In February 2009, the surface pressure in the OBS No. 4H was 680 psi, which results in a calculated pressure of 3,267 psi in the fractures of the Barnett Shale. In January 2010, the surface pressure at the No. 4H was 350 psi, resulting in a calculated bottomhole pressure of 2,937 psi in the water filled Barnett Shale fractures. Arrington believes these pressures demonstrate that the pressure in the Barnett Shale matrix has always been insufficient to overcome the pressure which existed in the fractures, therefore preventing any gas flow into the OBS wells. This higher pressure in the water filled fractures is believed to be due to invasion by Ellenburger water.

¹Kent A. Bowker, *Barnett Shale Gas Production, Fort Worth Basin: Issues and Discussion*. 2007.

Texas Star had alleged that the water production in the Arrington OBS wells was possibly the result of the OBS wells being frac'd into the Ellenburger. Arrington presented the daily mud reports for all four OBS wells to demonstrate that the OBS wells did not frac into the Ellenburger. Chlorides in the drilling mud for all four wells was increasing during drilling of the Shale laterals, some increasing up to 40,000 ppm. In the No. 4H, chlorides began increasing during drilling of the Marble Falls. The increases in chlorides were not expected while using a freshwater mud system of generally less than 10,000 ppm. Additionally, the No. 4H experienced water flows into the wellbore during drilling in the Barnett Shale. None of the OBS wells had been fracture stimulated when the water flow in the No. 4H occurred or when chlorides increased in the other wells. When the OBS wells were being drilled, the Gosdin well had been injecting for about 10 months. Arrington's position is that the water injected into the Gosdin well had pressured up the Ellenburger in the area of the OBS wells before any of the OBS wells were fracture stimulated.

Injection into the Gosdin No. 1W decreased significantly beginning in June 2009. In prior months, injection had been over 600,000 BWPM. June 2009 injection was only 159,000 BW, followed by 83,000 BW in July, 62,000 BW in August and 75,000 BW in September. From February 2009, the shut-in casing pressure in the OBS No. 4H was monitored. The pressure declined from about 680 psi in February 2009 to about 350 psi in January 2010, corresponding to the decreased volumes of water injected into the Gosdin No. 1W. The correlation further supports communication between the OBS wells and the Gosdin well.

Texas Star's Evidence

Texas Star believes that Barnett Shale wells which are drilled and completed in areas near faults are likely to be high water producers. Texas Star believes that the OBS wells would be poor gas producing wells regardless of whether there was injection into the Gosdin No. 1W because of the proximity of the OBS wells to a fault which Arrington knew existed at the time the wells were drilled. Additionally, it is common knowledge that fracture stimulation of Barnett Shale wells in areas such as this where the Viola Limestone is missing can result in fracturing into the Ellenburger, making wells non-commercial due to high volumes of water production.

The injection interval for the Gosdin No. 1W is from 5,774 feet to 6,820 feet. This is an open hole section from the base of the production casing to the total depth of the well. However, based on an injection profile log for the well, all of the injected fluids are entering the Ellenburger between 6,120 and 6,156 feet. This is 476 feet below the top of the Ellenburger in the well and is within Commission guidelines currently requiring injection to be at least 250 feet below the top of the Ellenburger.

Texas Star performed a step-rate test of the Gosdin No. 1W in November 2006 when the well was being completed. Water was injected into the well at different rates for periods of time. The test demonstrated that injection into the Ellenburger at rates of up to

37,000 BWPD did not fracture the formation. On about April 20, 2007, injection into the well was initiated after an acid stimulation. Another step rate test was performed, injecting at rates of almost 19,000 BWPD. Again, no indications of fracturing the Ellenburger were observed. Texas Star therefore believes that injected fluids are confined to the permitted Ellenburger interval

As previously discussed, the Gosdin No. 1W was shut-in for 50 hours in February 2009. This shut-in was performed to gather information as to whether any boundary effects were seen in the well during the pressure falloff test. Analysis of the pressure data by Texas Star indicated an infinitely acting, homogeneous reservoir, with no indication of a boundary such as a fault.

Texas Star agrees that the pulse test performed on the OBS No. 1 and the Gosdin No. 4H indicate communication between the wells. However, Texas Star believes that the lag time in seeing pressure responses in the No. 4H are an indication that water is not taking an immediate path through a fault to reach the No. 4H, but is traveling a more tortuous path before causing the pressure response in the OBS wells. This is consistent with the Ellenburger being an infinite acting reservoir in the area of the Gosdin No. 1W, with no highly conductive fault present at a distance of 500 feet from the well.

Texas Star notes that during drilling of all four OBS wells, significant increases in chlorides were observed during drilling of the laterals. Texas Star suggests that the increased chlorides in the mud, along with the water flow observed during drilling of the OBS No. 4H, are indications of communication with the Ellenburger, most likely by intersecting a fault connected to the Ellenburger. Texas Star also suggests that Arrington should not have fracture stimulated its wells until the source of the problem was isolated. Arrington knew about the presence of the fault before it drilled its wells, and the fracture stimulations simply made the connection to the water source greater.

In response to Arrington's calculations about pressures in the Barnett Shale fractures and matrix, Texas Star calculated bottomhole pressure in all four OBS wells based on mud weights in the wellbores prior to fracture stimulation. All four wells had been cased and were at static conditions, with mud weights in the wellbores ranging from 9.3 to 9.7 pounds per gallon. The equivalent gradients associated with these mud weights range from 0.4836 to 0.5044 psi/ft. At 5,600 feet, the highest bottomhole pressure was in the No. 3H well, at 2,825 psi. This pressure is less than the pressure of 2,912 psi determined by Arrington to be the matrix pressure. Gas should have been able to flow into the wellbores from the Barnett Shale matrix based on these pressures. Based on these calculations, Texas Star believes that Arrington created the pathway allowing Ellenburger water to enter its wellbores by performing large fracture stimulations on the wells. Texas Star does not believe that its injection operations resulted in lack of gas production from the OBS wells.

EXAMINERS' OPINION

Statewide Rule 9(6)(A)(v) provides as follows:

A permit for saltwater or other oil and gas waste disposal may be modified, suspended, or terminated by the Commission for just cause after notice and opportunity for hearing, if injected fluids are escaping from the permitted disposal zone.

The permit issued for the Gosdin No. 1W well includes the following provision:

Provided, further that, should it be determined that such injection fluid is not confined to the approved strata, then the permission given herein is suspended and the disposal operation must be stopped until the fluid migration from such strata is eliminated.

The examiners believe that the evidence clearly demonstrates that fluids injected into the Gosdin well are escaping the Ellenburger injection interval. It is recommended that the permit for the Gosdin No. 1W be cancelled and that the well be immediately shut-in due to non-confinement of injected fluids.

Though there are very few producing wells in the area, the Barnett Shale is apparently gas productive in the area, as demonstrated by the gas production from the 3 Ella wells. These three wells were fracture stimulated and produced gas from the Barnett Shale prior to injection into the Gosdin No. 1W. By the time the Gosdin well began injecting, the Ella wells had not yet recovered their frac loads and were producing some gas along with flowback water. The No. 3H, the well furthest from the Gosdin well, produced approximately 18 MMCF of gas in April and 21MMCF in May 2007. The other two Ella wells produced less gas than the No. 3. The most recent gas production from any of the Ella wells was March 2008. By this time, the Gosdin well had injected over 4.5 million BW. It was during this same period of time that the OBS wells experienced water flows and increased chlorides during drilling. The examiners believe that the injection into the Gosdin No. 1W escaped the Ellenburger interval through the fault known to exist nearby and invaded the Barnett Shale in the area of the Ella and OBS wells.

There is no evidence that Arrington communicated with the Ellenburger in its OBS wells by fracture stimulation of its wells, as alleged by Texas Star. The water had already invaded the Barnett Shale in the OBS wells prior to any stimulation based on water flow in the OBS No. 4H during drilling and increased chlorides in the drilling fluids of all four wells.

There is no dispute between the parties that the Gosdin No. 1W is in pressure communication with the OBS wells about one mile away. The pulse test confirms this. Regardless of the manner in which the communication occurred, it is apparent that the fluids injected into the Gosdin No. 1 have not been confined to the Ellenburger and have caused a pressure response in the Barnett Shale formation in the OBS wells. To cause a pressure response, Ellenburger fluids must be escaping the zone. The parties agree that there is a large fault approximately 500 feet from the Gosdin No. 1W which cuts the Ellenburger, Barnett Shale, Marble Falls and Atoka. The examiner believe that this fault is the conduit for non-confinement of injected fluids.

FINDINGS OF FACT

1. Notice of the February 23, 2009 hearing on the Interim Order was given to all persons entitled to notice on February 9, 2009. Notice of the January 28, 2010 hearing was given to all persons entitled to notice on October 28, 2009.
2. On February 6, 2009, Arrington filed its complaint and request for hearing to consider an interim order to shut-in the Gosdin No. 1W commercial disposal well.
3. On August 18, 2009, after notice and hearing, the Commission considered the request for interim order and declined to enter an interim order shutting-in the Gosdin No. 1W.
4. On January 28, 2010, a hearing was held to consider additional evidence on the merits of Arrington's request to shut-in the Gosdin No. 1W.
5. Commercial disposal permit No. 12450 for the Gosdin No. 1W was issued to Texas Star Disposal, L.L.C. on January 12, 2007. The permit authorized commercial disposal operations into the Ellenburger in the interval from 5,900 feet to 6,808 feet with a maximum injection volume of 25,000 BWPD and maximum surface injection pressure of 2,000 psig.
6. On March 7, 2007, permit No. 12450 was amended to change the injection interval from 5,774 feet to 10,000 feet.
7. Disposal operations into the Gosdin No. 1W commenced on about April 20, 2007.
8. Cumulative injection into the Gosdin No. 1W is approximately 14 million BW through October 2009.
9. Arrington completed Well Nos. 1, 2, 3 and 4 on its Orange Blossom Special ("OBS") lease in April and May 2008 approximately one mile north of the Gosdin No. 1W.

- a. The OBS wells are horizontal wells drilled into the Barnett Shale with laterals ranging in length from 3,144 feet to 3,394 feet.
 - b. Each of the four OBS wells have at least 100 feet of Barnett Shale rock between the wellbore path and the top of the Ellenburger.
10. The area of the Ella wells located just north of the OBS wells was capable of producing gas prior to injection into the Gosdin No. 1W
- a. When injection into the Gosdin well began on about April 20, 2007, the Ella wells had not yet recovered their frac loads and were producing some gas along with flowback water.
 - b. The No. 3H, the well furthest from the Gosdin well, produced approximately 18 MMCF of gas in April and 21 MMCF in May 2007. The other two Ella wells produced less gas than the No. 3.
 - c. The most recent gas production from any of the Ella wells was March 2008, but production from the all of the Ella wells until that time was very limited and sporadic.
 - d. Through March 2008, the Gosdin well had injected over 4.5 million BW.
11. Water from the Ellenburger had invaded the Barnett Shale in the area of the OBS wells prior to drilling and fracture stimulation of the OBS wells.
- a. During drilling of the OBS No. 4H, a water flow of approximately 110 barrels occurred during drilling in the Barnett Shale. Higher chlorides in the well were observed as the well was drilling in the Marble Falls formation, with continued increases as the well drilled through the Barnett Shale.
 - b. All four OBS wells experienced increases in chlorides in the drilling mud of up to 40,000 ppm. Normal drilling mud would have chlorides less than 10,000 ppm.
 - c. The higher chlorides in the drilling mud are indicative of Ellenburger water.
 - d. All four OBS wells recovered their frac loads by July 2008 and thereafter each well continued to produce water at rates of about 3,000 BWPD, with no gas production.

- e. The OBS wells have been shut-in since frac flowbacks were completed and have never produced gas.
12. Water injected into the Gosdin No. 1W is escaping the permitted Ellenburger injection interval via a fault and has invaded the Barnett Shale in the area of the Ella and OBS wells, as demonstrated by pressure communication between the Gosdin No. 1W and the OBS wells.
 - a. A large fault which cuts the Ellenburger, Barnett Shale, Marble Falls and Atoka exists about 500 feet to the northeast of the Gosdin No. 1W.
 - b. The Gosdin No. 1W and the OBS wells are in pressure communication as demonstrated by a cooperative pulse test conducted in March 2009 between the Gosdin No. 1W and OBS Nos. 1 and 4 wells, During the test, bottomhole pressures in the OBS wells began to decrease only 14 hours after injection into the Gosdin No. 1W ceased. The bottomhole pressures in the wells began to increase after the Gosdin No. 1W was returned to full time injection.
 - c. As injection volumes into the Gosdin No. 1W have decreased over the past eight months, the shut-in casing pressure in the OBS No. 4 has decreased over 500 psi.
 13. The other Ellenburger disposal wells in the area are at least two miles away from the Ella and OBS wells. No anomalies in production were observed in producing wells offsetting the other disposal wells.

CONCLUSIONS OF LAW

1. Proper notice was issued in accordance with the applicable statutory and regulatory requirements.
2. All things necessary to give the Railroad Commission jurisdiction to consider this matter have occurred.
3. Texas Star Disposals, L.L.C. is not in compliance with Commercial Disposal Permit No. 12450 for its Gosdin No. 1W because injected fluids are not being confined to the permitted Ellenburger interval.
4. Permit No. 12450 for the Texas Star Disposals, L.L.C. Gosdin No. 1W should be cancelled because injected fluids are not being confined to the permitted Ellenburger interval.

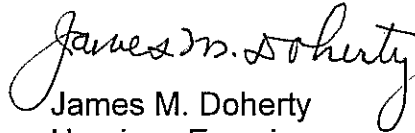
EXAMINERS' RECOMMENDATION

Based on the above findings and conclusions, the examiners recommend that the permit for the Gosdin No. 1W commercial disposal well be cancelled and the well be immediately shut-in.

Respectfully submitted,



Donna K. Chandler
Technical Examiner



James M. Doherty
Hearings Examiner

Texas Star Disposals, LLC.
 Gosdin 1W
 Newark, East Field
 Somervell County, Texas
 Original Completion: 4/20/2007
 PSA ID: 43 KB: 672.5

API: 42-425-30132

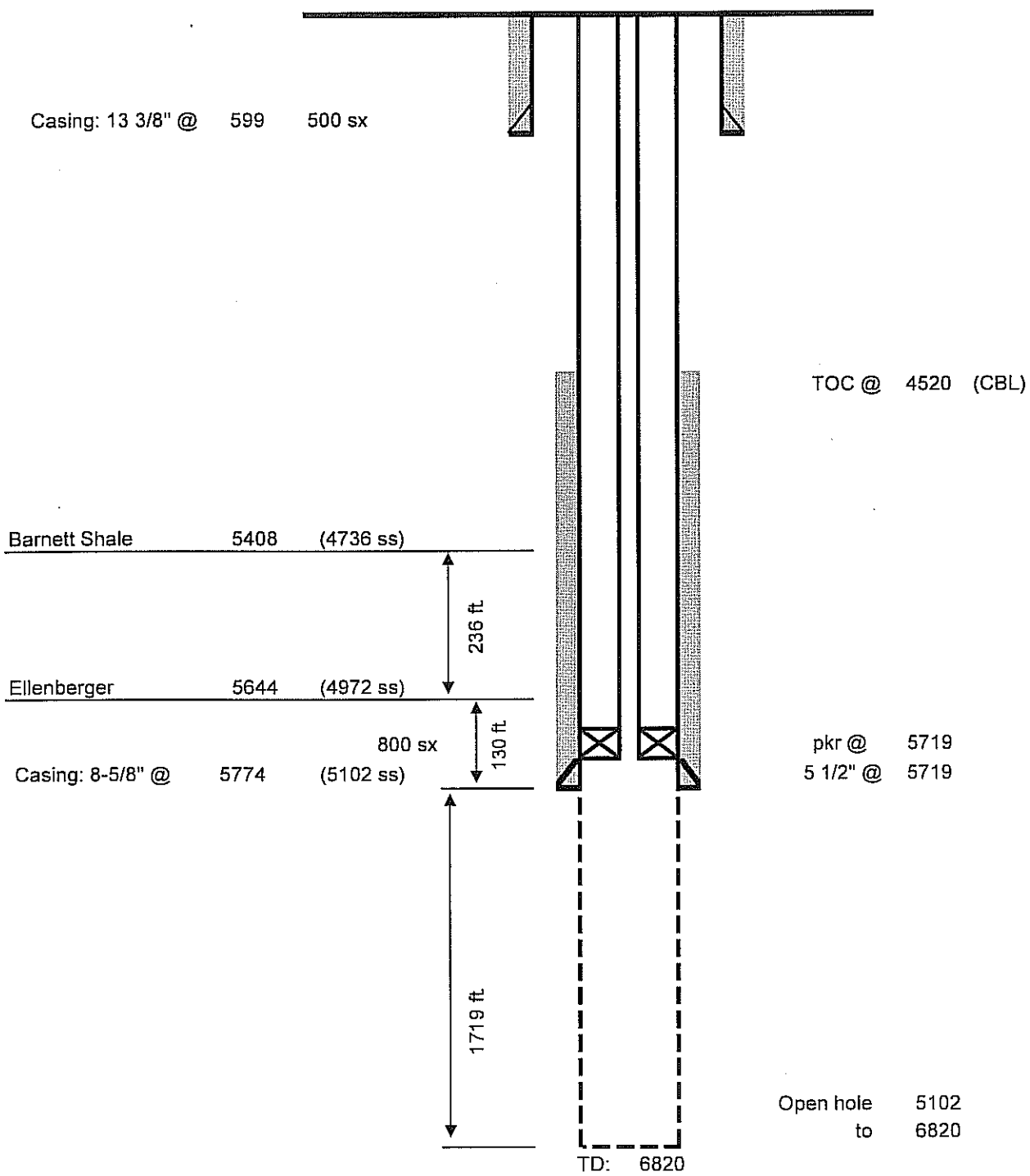
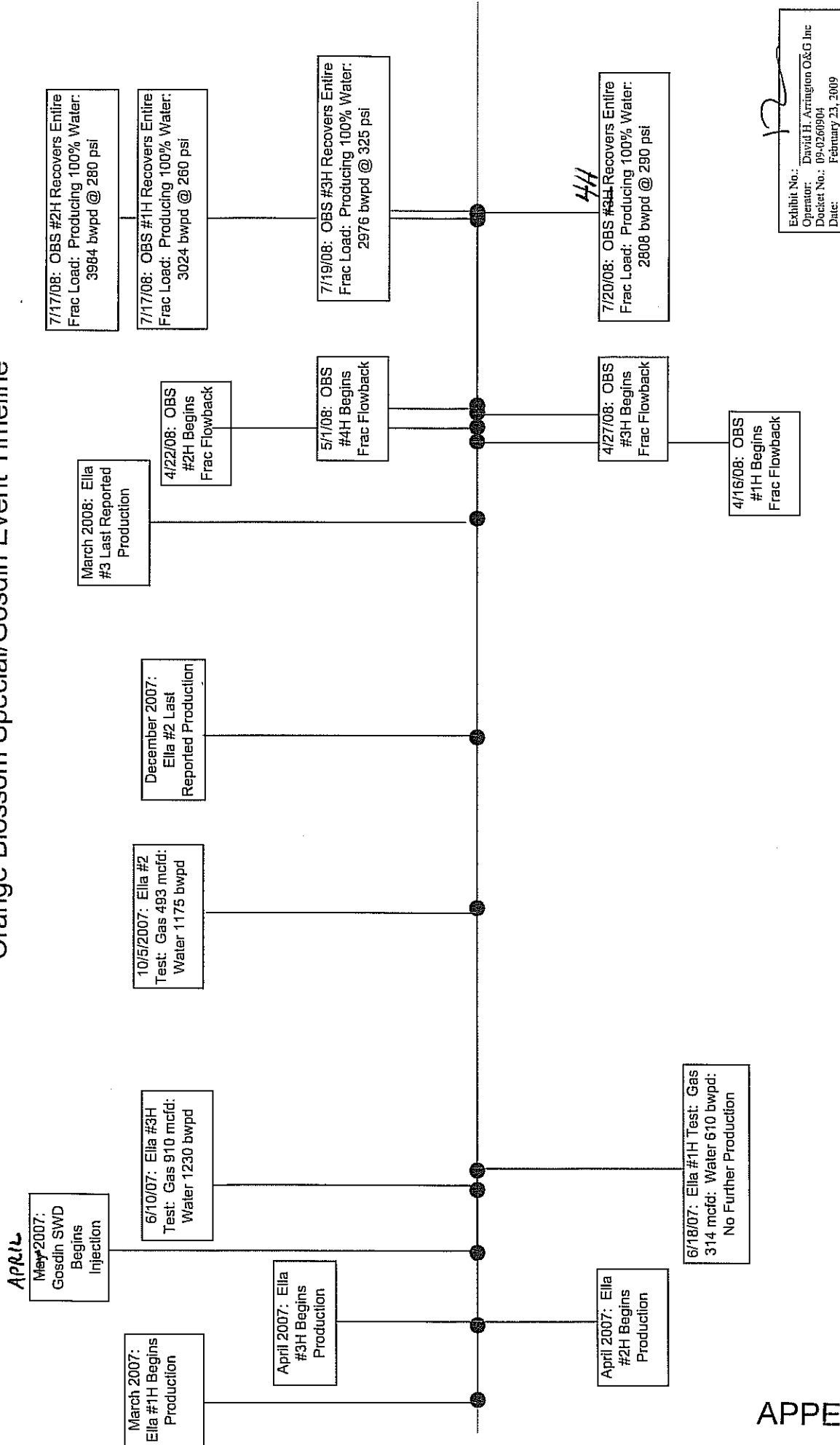
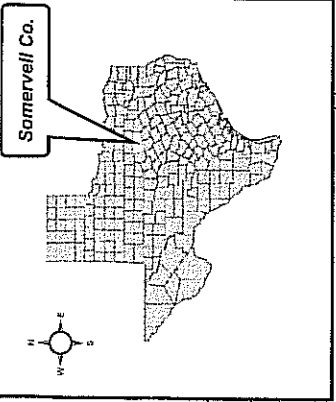
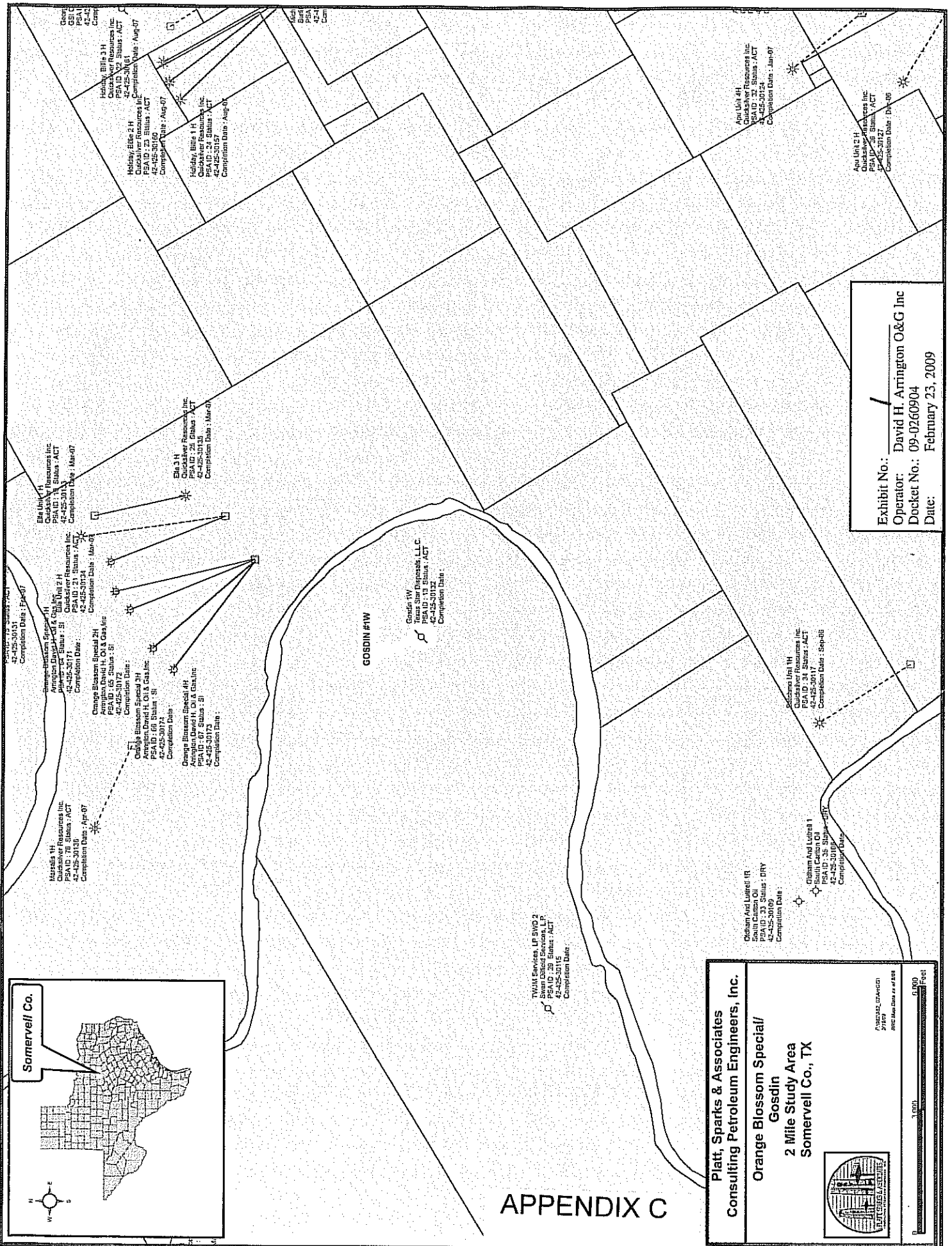


Exhibit No.:	5
Operator:	David H. Arrington O&G
Docket No.:	09-0260904
Date:	February 23, 2009

Orange Blossom Special/Gosdin Event Timeline





APPENDIX C

Exhibit No.: /
 Operator: David H. Arrington O&G Inc
 Docket No.: 09-0260904
 Date: February 23, 2009

Platt, Sparks & Associates
 Consulting Petroleum Engineers, Inc.
**Orange Blossom Special/
 Gosdin**
 2 Mile Study Area
 Somervell Co., TX

PROJECT: ORANGE
 21829
 DATE: March 1, 2009

Scale: 1" = 1000 Feet