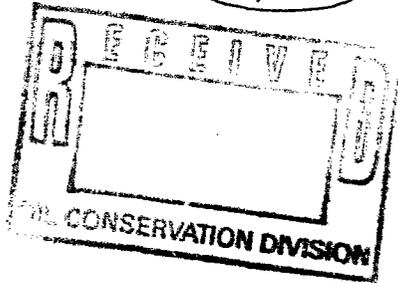


STATE OF NEW MEXICO  
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT  
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING )  
CALLED BY THE OIL CONSERVATION )  
DIVISION FOR THE PURPOSE OF )  
CONSIDERING: )  
 )  
APPLICATIONS OF GREAT WESTERN )  
DRILLING COMPANY )  
\_\_\_\_\_ )

CASE NOS. 11,113  
11,114



REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

BEFORE: JIM MORROW, Hearing Examiner

October 13th, 1994

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Division on Thursday, October 13th, 1994, at Morgan Hall, State Land Office Building, 310 Old Santa Fe Trail, Santa Fe, New Mexico, before Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

\* \* \*

## I N D E X

October 13th, 1994  
 Examiner Hearing  
 CASE NOS. 11,113 and 11,114

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## A P P E A R A N C E S

FOR THE APPLICANT:

KELLAHIN & KELLAHIN  
 117 N. Guadalupe  
 P.O. Box 2265  
 Santa Fe, New Mexico 87504-2265  
 By: W. THOMAS KELLAHIN

\* \* \*

1           WHEREUPON, the following proceedings were had at  
2   9:47 a.m.:

3           EXAMINER MORROW: At this time we'll call the  
4   hearing back to order and call Case 11,113, which is the  
5   Application of Great Western Drilling Company for a  
6   waterflood project and to qualify said project for the  
7   recovered oil tax rate pursuant to the New Mexico Enhanced  
8   Oil Recovery Act.

9           And I assume you'll want that consolidated  
10   with --

11          MR. KELLAHIN: Yes, Mr. Examiner, if you would  
12   also call the next case, we'd like to consolidate both  
13   those cases for purposes of presenting the testimony today.

14          EXAMINER MORROW: All right, at this time we'll  
15   call Case 11,114, which is the Application of Great Western  
16   Drilling Company for statutory unitization, Lea County, New  
17   Mexico.

18          Call for appearances.

19          MR. KELLAHIN: Mr. Examiner, I'm Tom Kellahin of  
20   the Santa Fe law firm of Kellahin and Kellahin, appearing  
21   on behalf of the Applicant, and I have three witnesses to  
22   be sworn.

23          (Thereupon, the witnesses were sworn.)

24          MR. KELLAHIN: Mr. Examiner, our first witness  
25   this morning is a petroleum landman with the Applicant, Mr.

1 Mike Heathington.

2 We have provided for you, Mr. Examiner a set of  
3 exhibits on the table in front of you. Some of those  
4 exhibits are simply a duplication of the documents already  
5 filed with the Application.

6 You may recall that both the statutory  
7 unitization Application as well as the enhanced oil  
8 recovery Application require the prefiling of certain  
9 exhibits, and so you'll find some of that information  
10 already in the case file. But for convenience this  
11 morning, we have simply duplicated as a single entire  
12 package all those exhibits that we thought might be  
13 relevant to your decision.

14 EXAMINER MORROW: Okay.

15 MIKE S. HEATHINGTON,

16 the witness herein, after having been first duly sworn upon  
17 his oath, was examined and testified as follows:

18 DIRECT EXAMINATION

19 BY MR. KELLAHIN:

20 Q. Mr. Heathington, for the record, sir, would you  
21 please state your name and occupation?

22 A. Mike Heathington. I'm the land manager of Great  
23 Western Drilling Company in Midland, Texas.

24 Q. On prior occasions, Mr. Heathington, have you  
25 testified before this agency?

1           A.    Yes, I have.

2           Q.    Describe for us what your particular duties have  
3 been as a land manager concerning this project by your  
4 company.

5           A.    My duties have primarily been to coordinate the  
6 effort of preparing a unit agreement and unit operating  
7 agreement for the purposes of securing approvals of all of  
8 the interest owners in our project outline, 624-acre unit  
9 that you see on Exhibit 1, our proposed project.

10           I helped draft those agreements, worked with the  
11 working interest owners in getting agreement and  
12 ratification of those instruments, and of course was  
13 involved in securing all the joinders we needed from the  
14 royalty owners also.

15           Q.    As part of that effort, were you responsible for  
16 determining a list of the owners, their most current  
17 addresses and to identify what percentage interest they  
18 might have within the unit area?

19           A.    That is correct, I was.

20           Q.    In addition, as part of the engineering staff's  
21 processing of the C-108 for approval of the injection  
22 wells, did you or others under your direction or control  
23 identify offsetting operators to the project area?

24           A.    Yes, we did.

25           Q.    And as part of that effort, did you also identify

1 the owners of the surface for which each of the proposed  
2 injection wells is to be located or is currently located?

3 A. Yes, we have.

4 MR. KELLAHIN: We tender Mr. Heathington as an  
5 expert petroleum landman.

6 EXAMINER MORROW: Fine, we accept Mr.  
7 Heathington's qualifications.

8 Q. (By Mr. Kellahin) Let's turn to Exhibit 1 that  
9 you've referenced. Identify for us, Mr. Heathington, the  
10 significance to you of the area that's outlined by the  
11 yellow line.

12 A. The yellow outline is the seven -- is comprised  
13 of primarily fee land. There are seven tracts within the  
14 yellow outlines, in other words, seven different leases  
15 that we have outlined here as our 624-acre proposed unit.  
16 It basically is all in Lea County, New Mexico. It is on  
17 the state line.

18 Q. How would we find the state line between the  
19 State of New Mexico and the State of Texas?

20 A. It is the darkest blue line on the east boundary  
21 of our yellow line, where you see the "Gaines County", and  
22 also Gaines County is a Texas county that adjoins.

23 Q. When you identify this as being all fee tracts  
24 except for one federal tract, show us which tract is the  
25 federal tract.

1           A.    Okay, it's located in Section 5.  It is the small  
2 irregular-shaped 26-acre tract with the one well in the  
3 southeast corner of Section 5.  It's 26-acre federal tract  
4 right up against the state line.

5           Q.    All right.  Sir, both Sections 5 and 8 are  
6 irregular-shaped sections of irregular size because of the  
7 boundary with Texas, I assume, by governmental survey?

8           A.    I believe that's correct.

9           Q.    What is your understanding of what the technical  
10 personnel for your company are seeking in terms of the  
11 unitized interval?  What do they want to unitize?

12          A.    We want to unitize, as I understand it, the top  
13 of the San Andres formation all the way to the base on that  
14 San Andres formation, for purposes of that becoming a  
15 common interval so we can conduct our unit operations.

16          Q.    This unit is identified by what name?

17          A.    The San Andres.

18          Q.    South Carter-San Andres unit?

19          A.    Oh, excuse me, yes, the South Carter-San Andres  
20 unit.

21          Q.    Let's turn to Exhibit 2 and have you identify  
22 that for us.

23          A.    Exhibit 2 is the proposed second stage of our  
24 waterflood project, anticipated -- I'll let the engineers  
25 talk more about that, but it is anticipated approximately

1 two years after the first stage is implemented.

2 It shows additional injectors and wells that we  
3 plan to drill if we're successful in phase one of our  
4 project. And what it ultimately does, of course, is  
5 increase oil recoveries by getting better patterns  
6 available to us.

7 Q. As you understand it, then, the initial unit area  
8 conforms to the project area as conceptualized by the  
9 technical staff, including stages one and two?

10 A. Yes.

11 Q. This boundary is in fact the initial boundary of  
12 the unit and is to be the boundary of the waterflood  
13 project?

14 A. That is correct.

15 Q. Let's turn now to Exhibit Number 3. You made  
16 reference a while ago to the tracts within the unit area  
17 containing specific tract numbers so that they could be  
18 identified.

19 When we look at Exhibit Number 3, show us or  
20 describe for us what we're looking at.

21 A. Okay. Exhibit Number 3 is our actual Exhibit B  
22 to the unit agreement that we have secured approval from  
23 our owners of.

24 It basically shows -- The numbers encompassed by  
25 a circle are just the numbers of our tracts within our unit

1 area, the dashed line is the outline of the 624-acre unit  
2 area, and then we also show our producer that we plan to  
3 drill in this project.

4 The triangles are the injectors, proposed  
5 injectors. We also show one plugged producer within the  
6 outline, also one T-and-A'd well that we plan to make a  
7 producer -- or P-and-A'd.

8 Q. What's the -- When we refer to the federal tract,  
9 then, this contains what tract number within the unit?

10 A. It is Tract Number 2.

11 Q. Okay. Have you met with the Bureau of Land  
12 Management concerning obtaining their approval for the  
13 inclusion of the federal tract within the unit and the  
14 waterflood project?

15 A. We have notified them of this proposed project,  
16 sent them all of the information that they requested from  
17 us, basically received -- What we tried to do was get a  
18 preliminary approval from them.

19 We were notified by BLM in Roswell that since the  
20 federal participation in this project was so small, that  
21 preliminary approval was not required, and we did have  
22 copies of those letters in our files.

23 Q. As to your efforts to consolidate the working  
24 interest ownership within the unit for the project,  
25 approximately how many working interest owners, other than

1 Great Western, were you dealing with?

2 A. We were dealing with twelve other working  
3 interest owners in this unit outline.

4 Q. What is the current status of your efforts to  
5 obtain voluntary commitment of the working interest owners  
6 to the unit and to the waterflood project?

7 A. We currently have 100 percent of the interest  
8 owners that do own working interest within this outline  
9 signatory to our agreements.

10 Q. When we deal with the second category of  
11 ownership, that being royalty and overriding royalty  
12 owners, have you notified and attempted to obtain  
13 commitment of all the royalty and overriding royalty  
14 interest owners?

15 A. Yes, we have.

16 Q. And what is the status of that effort in terms of  
17 a percentage committed to the project?

18 A. We are currently setting at 96.2 percent of their  
19 approval to do this project. We anticipate that going up  
20 higher, you know, anticipate that going around 99 percent  
21 or in excess of that eventually.

22 Q. We've asked the Examiner to consider issuing us  
23 an order under the Statutory Unitization Act.

24 The purpose of doing so is to commit the last  
25 remaining portion of overriding royalty owners within the

1 unit that have not yet ratified the project; is that your  
2 plan?

3 A. Yes, yes, I believe we will require that.

4 Q. In addition to obtaining approval of the unit,  
5 have you also obtained approval of the working interest  
6 owners to commit their interest to an operating agreement?

7 A. Yes, sir.

8 Q. And how is the unit agreement identified for  
9 purposes of this hearing?

10 A. It is Exhibit Number 4.

11 Q. And this still represents the form as well as the  
12 substance of that unit agreement that you're using for this  
13 project?

14 A. Yes, it does.

15 Q. All right. And Exhibit 5, what is that, sir?

16 A. Exhibit 5 is our unit operating agreement.

17 Q. You made reference just now to a certain group of  
18 interest owners that had not yet ratified the project, and  
19 at the time the Application was filed did you have a  
20 tabulation of those interest owners as well as the last  
21 known available address?

22 A. Yes, we did.

23 Q. And that's marked as Exhibit 6?

24 A. Yes, sir, it is.

25 Q. Okay. To the best of your knowledge, is that

1 still an accurate, reliable list of those interest owners?

2 A. Yes, it is.

3 Q. All right. When we look at Exhibit 7, Exhibit 7  
4 is what, sir?

5 A. Exhibit 7 is the surface ownership of all the  
6 lands within our proposed project, the individual owners of  
7 all tracts within our unit outline.

8 Q. As a petroleum landman, do you have an opinion,  
9 or have you formed a conclusion concerning the necessity of  
10 having the Division approve this project area in order for  
11 your company to go ahead with the project?

12 A. Yes, I do have an opinion. I think that would be  
13 required in order to properly commence the secondary  
14 recovery project.

15 Q. And if the Examiner were to approve your  
16 Application, then, do you have an opinion as to whether or  
17 not his approval would constitute approval that would  
18 protect correlative rights and avoid the waste of  
19 hydrocarbons?

20 A. Yes, I believe it would.

21 MR. KELLAHIN: That concludes my examination of  
22 Mr. Heathington.

23 We move the introduction of his Exhibits 1  
24 through 7.

25 EXAMINER MORROW: 1 through 7 are admitted.

## EXAMINATION

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BY EXAMINER MORROW:

Q. Mr. Heathington, the 96.2 percent that is signed up, does that include both the overriding and royalty interest owners?

A. Yes, it does, Mr. Morrow.

Q. And that -- The list, one not signed up, is on Exhibit 6; is that correct?

A. That is correct.

Q. And that -- So let's see. The BLM, you've got them on that list, I believe --

A. Well --

Q. -- and the Department of the Interior, at least; is that --

A. Right. As I understand it, since we have notified them and have been working with the Roswell office, they probably should not be, I guess, on that list, technically.

Q. Okay. So you expect that they are committed, more or less, verbally at least?

A. Yes, sir.

Q. So all these interests here add up to about -- nearly four percent of the unit interest, I assume? Or maybe you haven't totaled it. I guess you don't.

Since these -- These are the unsigned ones; is

1 that correct?

2 A. These are the unsigned ones, and they do -- this  
3 was sent, I believe, to Tom two or three weeks -- We do  
4 have probably one large owner in here that has come in.  
5 Yes, we do, on page 3. I guess Meridian Oil Production is  
6 now a signatory to the project. So you take Meridian and  
7 the BLM off of here, they should add up to roughly 3.8  
8 percent.

9 Q. Oh, I see. You've already taken them out?

10 A. In my 96.2 --

11 Q. In your --

12 A. -- number --

13 Q. -- calculation?

14 A. -- yes, sir.

15 Q. Do you know when that phase two will start?

16 A. It depends --

17 Q. Or will somebody else talk more about that?

18 A. Well, probably the engineers need to discuss that  
19 more. They would be able to lend more information through  
20 that, Mr. Morrow.

21 Q. On the Exhibit Number 2, do you know if there are  
22 plans to re-enter those abandoned wells that are marked  
23 with a slash through them and produce them?

24 Like in Section 6 and Section 8, there's at least  
25 one well in each section within the unit boundary that --

1           A.     Currently, I don't believe in Section 6 and 8  
2 we'll be re-entering any of those wellbores.

3                     I believe up in 5 we do plan to attempt some of  
4 those, on the west half, southwest of 5.

5           Q.     So that 1-A, it won't ever produce as far as you  
6 know?

7           A.     It's kind of -- It has produced out of the San  
8 Andres formation, but currently, and as a matter of  
9 protection, mainly, we have included it in the boundary.

10          Q.     All right. And there's no development plan for  
11 what looks like about the north 300 -- or 120 acres in  
12 Section 5?

13          A.     The wedge shown here on Exhibit 2?

14          Q.     Right.

15          A.     I believe that's correct.

16                     EXAMINER MORROW:   Okay. Thank you, Mr.  
17 Heathington. Appreciate it.

18                     MR. KELLAHIN:   Mr. Examiner, at this time we  
19 would call Great Western's geologic witness, Pat Welch.

20                                     PAT WELCH,

21 the witness herein, after having been first duly sworn upon  
22 his oath, was examined and testified as follows:

23                                     DIRECT EXAMINATION

24                     BY MR. KELLAHIN:

25           Q.     Mr. Welch, would you please state your name and

1 occupation?

2 A. My name is Pat Welch. I'm a development and  
3 acquisitions geologist for Great Western Drilling Company  
4 in Midland, Texas.

5 Q. Summarize for us your education, sir.

6 A. I earned a bachelor of science in geology from  
7 Midwestern State University in Wichita Falls, Texas, in  
8 1984.

9 Q. Subsequent to graduation, summarize your  
10 employment as a geologist.

11 A. I was employed as a -- for a short time as a  
12 special core analyst, and then I've been employed with  
13 Great Western Drilling Company for the past ten years.

14 Q. As part of your duties, were you assigned the  
15 responsibility as the geologist to examine what we've  
16 identified as the South Carter-San Andres unit and  
17 waterflood project area?

18 A. Yes, sir, I have.

19 Q. As part of your duties, did you have available to  
20 you log information to show you geologic data for the San  
21 Andres by which you could commence your analysis?

22 A. We had some data. The field was developed and  
23 drilled in the late Fifties, and much of the log data is of  
24 poor quality because of the completion techniques. There  
25 were not proper log sweeps run.

1           We can make correlations, geologic correlations,  
2 from well to well, but quantitative well analysis has been  
3 impossible.

4           Q.    Were you able to utilize that existing although  
5 limited data by which to form geologic opinions concerning  
6 not only the vertical limits for the project but the  
7 horizontal boundary?

8           A.    Yes, sir, we do have sample data from the drill  
9 cuttings, and we were able to use those in conjunction with  
10 the log data to show the geologic continuity.

11           MR. KELLAHIN:  We tender Mr. Welch as an expert  
12 petroleum geologist, Mr. Morrow.

13           EXAMINER MORROW:  We accept Mr. Welch's  
14 qualifications.

15           Q.    (By Mr. Kellahin)  Let's talk about the history  
16 of the San Andres development in this particular area.

17                    When we talk about the South Carter-San Andres  
18 Pool, describe for us in a summary fashion the history of  
19 that pool.

20           A.    The field was discovered in the mid-1950s.  Great  
21 Western was the operator on many of the completions or most  
22 of the completions.  The field was fully developed by 1960.

23                    A typical completion is drilling with rotary  
24 tools to the top of the main porosity in the San Andres,  
25 setting a 5-1/2-inch casing, drilling out with cable tools

1 to a depth of about 5200 feet, somewhere above what's  
2 considered the water-free completion zone so that no water  
3 will be produced from the field.

4 Q. The wells that were drilled and produced were  
5 produced as open-hole completions in the San Andres  
6 interval?

7 A. Yes, sir, most all of the wells are open-hole  
8 completed. There have been perforations added subsequently  
9 to that in additional porosity zones.

10 Q. What has caused -- Do you have an opinion as to  
11 whether or not it is geologically feasible to introduce  
12 waterflooding into this portion of the San Andres at this  
13 time?

14 A. Yes, sir, I believe it is.

15 Q. What causes you to reach that conclusion?

16 A. Primarily the performance of the wells, the  
17 production performance. The wells have produced on average  
18 probably 200,000, 250,000 barrels each.

19 Q. What kind of current rate do you have on average  
20 for your producing oil wells?

21 A. Current rate is down to about 60 barrels of oil  
22 per day for all of the wells that are currently producing.

23 Q. All right. How many wells do you currently have  
24 producing in the project?

25 A. I'll have to count them. Eight producing wells,

1 I believe, sir.

2 Q. And out of the eight wells, you're getting about  
3 60 barrels of oil a day?

4 A. Yes, sir.

5 Q. How much water are you producing out of the  
6 project area?

7 A. A similar amount, about 60 barrels a day.

8 Q. Mr. Heathington demonstrated to us the project  
9 area's eastern boundary is contiguous with the state line  
10 of New Mexico and it meets Texas.

11 A. Uh-huh.

12 Q. What's happening on the Texas side with regards  
13 to the production in the San Andres?

14 A. The operator there is American Exploration.  
15 They've been notified. They haven't shown any interest in  
16 the unitization. Their wells are of a poor performance, as  
17 evidenced by their production.

18 They have attempted a waterflood there. They are  
19 currently injecting water, and those wells are marked on  
20 Exhibit 8.

21 Q. Okay.

22 A. I can point them out, if you would like to see  
23 them.

24 Q. Let's go to your geologic displays, now, Mr.  
25 Welch. If you'll turn to what we've marked as Exhibit

1 Number 8, identify for us what in fact Exhibit 8 is.

2 A. This is a structure contour map on the top of the  
3 San Andres.

4 Q. Why would you do this?

5 A. That's the top of our unitized interval.

6 Q. And so what significance does the structural  
7 component of the reservoir have for you in evaluating the  
8 feasibility of a waterflood?

9 A. It shows reservoir boundaries and our trapping  
10 mechanism, or one component of our trapping mechanism.

11 Q. Does it give you any clue as to where to place or  
12 convert injection wells in relation to producing wells?

13 A. Somewhat. We use structure somewhat, but  
14 geologic continuity is another factor.

15 Q. All right. Let's use this as a basis, then, for  
16 having you describe to the Examiner your justification of  
17 your boundaries, all right? Let's start with the northern  
18 boundary.

19 Why have you chosen to place the northern unit  
20 boundary at that point in the reservoir?

21 A. If you'll note in Section 6, on the Texas side,  
22 in Gaines County, the P.S.L. Block A-6 in Section 6, the  
23 Great Western Drilling Company Granberry Number 1-A, that  
24 well is down in the transition zone or below the water-free  
25 completion zone.

1 Q. So we're going to get water at a certain point on  
2 structure, approximately at that interval?

3 A. Yes, sir. And then --

4 Q. Is there any opportunity below, say, minus 1350  
5 on this structure by which you might have San Andres oil  
6 production?

7 A. No, sir, probably not.

8 Q. So that's the basis for excluding the northern  
9 portion of 5?

10 A. Yes, sir.

11 Q. As you move counterclockwise going to the west --

12 A. Uh-huh.

13 Q. -- take us around the western boundary and  
14 explain to us why you've chosen the boundary.

15 A. The well you'll note in Section 5, it's  
16 approximately -- I'm not sure exactly the location, but  
17 it's the well that has the N. It's the most northerly well  
18 in our north-south cross-section. It's a minus 1325.

19 That well had numerous DSTs in the San Andres,  
20 and it proved noncommercial. It actually -- They produced  
21 1000 or 2000 barrels of oil from the San Andres in a lower  
22 part of the reservoir.

23 I'm sorry, that completion was in the Glorieta.  
24 The well DST'd the San Andres, and there was no commercial  
25 production established.

1 Q. As you move, then, into Section 6, give us the  
2 basis, for example, inclusion of the southeast-southeast --

3 A. Uh-huh.

4 Q. -- with the exclusion of the rest of the section.

5 A. The numerous dry holes can be seen in Section 6.  
6 The Johnson 1-A, operated now by DA&S, produced about  
7 26,000 barrels of oil. For protection, that's one reason  
8 why we included it.

9 Q. Well, it contributed San Andres production before  
10 it was abandoned, did it not?

11 A. Yes, sir, about 26,000 barrels.

12 Q. And you know by log analysis and examination that  
13 it's geologically connected to the main portion of the  
14 unit?

15 A. Yes, sir, we feel that that's true.

16 Q. So that is a tract that has some value to the  
17 unit and has had some past contribution to primary  
18 production?

19 A. Yes, sir.

20 Q. None of the rest of the wells in 6 did that, did  
21 they?

22 A. Well, one well did, but it was only about 1000  
23 barrels. It's the well marked Number 1 that's plugged, and  
24 it made approximately 1000 barrels, but it was not  
25 considered commercial enough to be included.

1 Q. All right. The other wells are dry holes, having  
2 tested adequately the San Andres?

3 A. Yes, sir.

4 Q. Let's move into 7. You've picked the northeast-  
5 northwest for a 40-acre tract to be included.

6 A. Uh-huh.

7 Q. Explain to us why it was included.

8 A. That's the Carter Number 1-A, operated by  
9 Marshall R. Young. That well has produced about 59,000  
10 barrels.

11 We feel like that well in the future could be a  
12 good potentially injection location, if not a good  
13 production location.

14 Q. And historically it's contributed oil out of the  
15 San Andres, and it's geologically connected to the rest of  
16 the unit?

17 A. Yes, sir. The cross-section that we'll get to  
18 that's Exhibit, I believe, 10, will show it's on the east-  
19 west cross-section.

20 Q. All right, sir, and why have you now excluded the  
21 rest of 7?

22 A. Mainly because all of the other locations have  
23 been drilled around the unit, and they've all been dry  
24 holes.

25 Q. All right. Finally, the southern boundary of the

1 unit within Section 8 --

2 A. Uh-huh.

3 Q. -- the inclusion versus the exclusion of acreage  
4 in 8.

5 A. The inclusion in section 8, in the middle  
6 portion, the Henry McQuein Number 2, has produced a  
7 considerable amount of oil.

8 The Henry McQuein Number 1, which is -- on the  
9 north-south cross-section it's the most southerly well on  
10 that cross-section that we'll get to -- produced only about  
11 5000 barrels of oil. But we feel like there are completion  
12 targets in that well or in that area that could prove  
13 valuable to the unit.

14 In the south half of 8, we feel like the data in  
15 Section 7 to the west and in Section 15 to the east show  
16 that that tract probably would not contribute anything to  
17 the unit.

18 Q. Were the other working interest owners that are  
19 involved in the unit provided the opportunity to analyze  
20 your unit boundary?

21 A. Repeat the question, please.

22 Q. Yes, sir. Were the other working interest owners  
23 provided the opportunity to look at this unit boundary?

24 A. Yes, sir.

25 Q. And did they all agree to this size and shape of

1 the unit?

2 A. Yes, sir, they have, a hundred percent.

3 Q. Let's turn to your north-south cross-section, if  
4 you will. It's marked as Exhibit 9. The line of that  
5 cross-section is displayed on Exhibit 8, is it not?

6 A. Yes, sir, north-south cross-section.

7 Q. Give us the marker or the datum point at which  
8 you've hung all the logs on the stratigraphic cross-  
9 section.

10 A. I've marked -- I've hung these cross-sections on  
11 a stratigraphic datum, being the top of the detrital zone  
12 that separates the San Andres from the Grayburg.

13 Q. Is that detrital zone a readily identifiable  
14 marker on these logs?

15 A. Yes, sir, it is.

16 Q. Having made that correlation, then, do you find  
17 when you look north to south through the unit area that you  
18 can correlate from log to log the pay interval in the San  
19 Andres Pool?

20 A. Yes, sir.

21 Q. With what conclusion?

22 A. That it's very continuous.

23 Q. Geologically, does it appear to be feasible to  
24 you that this portion of the San Andres could be utilized  
25 for secondary recovery by waterflooding?

1 A. Yes, sir, it can.

2 Q. Let's go the other dimension. If we go east-  
3 west, do you have a cross-section that will do that?

4 A. Yes, sir, I sure do, our next exhibit, Number 10.

5 By the way, I might mention, the most southerly  
6 log on this cross-section is -- The Henry McQuein Number 1  
7 is the type log for our flood.

8 Q. All right, on Exhibit 9?

9 A. Yes, sir.

10 Q. All right. Well, let's do that right now. We're  
11 still on your --

12 A. The type log, it's the well on the far left.

13 Q. Okay, the Henry McQuein?

14 A. Number 1, yes, sir.

15 Q. Q-u-e-i-n.

16 Let's use that log to have you show me the  
17 vertical limits.

18 A. All right. If you notice, from the top of the  
19 detrital you come down and you come to the top of the San  
20 Andres 1. From the top of the San Andres 1 to the top of  
21 the San Andres 2 is for the most part tight anhydritic  
22 dolomite, providing part of the seal for the trap.

23 Then you move into the top of the San Andres 2,  
24 is the main porosity. There are some porosity streaks up  
25 in the San Andres 1, but the main porosity is marked by the

1 top of the San Andres 2.

2 Then as you move down in this type log, down to a  
3 depth of about 5600 feet, is the base of the dolomite which  
4 marks the base of the porosity. All of that interval is  
5 considered porous and potential. At the base it's more  
6 than likely wet, but there is a transition zone, more than  
7 likely, between the base of the dolomite and the top of the  
8 San Andres.

9 Q. So the potential portion of the pool that would  
10 contribute hydrocarbons as a result of the waterflood could  
11 be any interval or portion from the top of the San Andres 1  
12 to the base of the dolomite?

13 A. Yes, sir.

14 Q. Within that interval, do you have vertical  
15 containment of hydrocarbons and any injected fluids?

16 A. Yes, sir, we have vertical containment, with our  
17 casing being protected -- or being cemented --

18 Q. No, I'm talking about reservoir conditions. The  
19 dolomite would seal the bottom of the reservoir, would it  
20 not?

21 A. Oh, yes, sir. Yes, sir, you move into a  
22 nonporous interval.

23 Q. All right. And above the top of the San Andres 2  
24 is there some geologic barrier to vertical flow?

25 A. Yes, sir.

1 Q. And what would that be?

2 A. The top anhydritic dolomite of the SA-1, and then  
3 even the detrital could be considered a potential trap.

4 Q. Do you see any evidence of faulting or any  
5 hydrologic connections that would communicate fluids from  
6 the San Andres to any shallow freshwater sands?

7 A. No, sir.

8 Q. All right. Let's turn and look at the north-  
9 south cross-section.

10 A. East-west?

11 Q. Yeah. We already did north-south, didn't we?  
12 East-west. You're looking at east-west, it's Exhibit 10?

13 A. Correct.

14 Q. Constructed in the same method or manner?

15 A. Yes, sir, same manner. It's a stratigraphic  
16 cross-section hung on the top of the detrital zone that  
17 separates the Grayburg and the San Andres, basically done  
18 for correlation purposes, but it does show that even at the  
19 time of the San Andres, the field wells were in a  
20 structurally advantageous position.

21 And also I've marked on there -- The dashed line  
22 would be considered a structural datum or a sea-level  
23 datum, and if it was hung on that the structure would be  
24 even more pronounced.

25 EXAMINER MORROW: If it was hung on which one?

1 THE WITNESS: This one is hung on the top of the  
2 detrital.

3 EXAMINER MORROW: Okay.

4 THE WITNESS: But I've marked the subsea datum as  
5 minus 1000 feet, what it would look if it was hung there.

6 Basically, it shows that the wells on the flanks  
7 east and west would be lower than they are right now on  
8 this cross-section, or at present they are lower than they  
9 show to be on this cross-section.

10 Q. (By Mr. Kellahin) What's your conclusion, having  
11 utilized the east-west cross-section?

12 A. That there's good reservoir continuity from well  
13 to well, the correlation is not difficult.

14 The cross-section shows the structural advantage  
15 of the field wells.

16 Q. Have you also prepared a map to show us the  
17 productivity of the wells that have produced in this area  
18 out of the San Andres Pool?

19 A. Yes, sir, I have. Typically, we would like to  
20 construct an isopach map, but in lieu of that, since we  
21 don't have the -- the entire section hasn't been drilled,  
22 and we have poor log quality, we would like to submit an  
23 Exhibit Number 11, and it's an iso-cum production map.

24 Q. All right, just a minute. Let's get one folded  
25 out here.

1           Before you describe what it means to you and the  
2 conclusions, tell us how you went about constructing it.

3           A.     We gathered all of the cum production data from  
4 all of the wells in the area and then contoured it using a  
5 100,000-barrel contour interval.

6           Q.     What's the objective or purpose of constructing a  
7 map like this?

8           A.     Cum production is probably the best indicator of  
9 reservoir quality.

10          Q.     Having constructed the map, what conclusion do  
11 you reach?

12          A.     That the wells in Section 5 -- or the portions  
13 outlined in yellow in our unit, constitute the primary part  
14 of the field that would be a target for waterflood.

15          Q.     Are the results of the iso-cumulative production  
16 map consistent with the structural interpretation of the  
17 reservoir that you've shown us earlier?

18          A.     Yes, sir. There's a slight bit of offset, but  
19 for the most part that is true.

20          Q.     What kind of values have you put on your contour  
21 lines?

22          A.     The contours are in 100,000-barrel increments,  
23 and it shows the production from none up to about the best  
24 well in the field, the Carter Number 2, which is 337,000  
25 barrels of oil.

1 Q. When you look at the proposed development plan on  
2 Exhibit Number 1 --

3 A. Yes, sir.

4 Q. -- and look at the location of the new producer  
5 well to be drilled as part of the project, is there any  
6 relationship to the location of that well as you look at  
7 the iso-cumulative production map?

8 A. Yes, sir, that well should be in the best part of  
9 the reservoir, or one of the better parts of the reservoir.

10 Q. Geologically, if you use that wellbore as the  
11 producing well and offset it with some injection wells,  
12 what is the likely result?

13 A. You should get excellent injection support and  
14 flood and basically bank oil and produce from that  
15 location.

16 Q. And geologically, that in fact is the initial  
17 plan or concept, is it not?

18 A. Yes, sir.

19 Q. Summarize for us your conclusions, Mr. Welch,  
20 about the geology.

21 A. We conclude that the reservoir is continuous  
22 throughout the unitized tracts, that we have an excellent  
23 target for waterflood.

24 We do plan to drill one infill well to collect  
25 additional data for reservoir characterization.



1 Q. If you would go ahead and do that, just --

2 A. Yes, sir. The wells that are marked with a W are  
3 all the water injection wells. There's approximately five  
4 of them.

5 Q. Some of them are marked like 4-W up there in  
6 the --

7 A. Yes, sir, they're dryhole symbols with a W after  
8 the number.

9 Q. That still means they're active injection wells?

10 A. Yes, sir.

11 Q. Or have been, at least?

12 A. Yes, sir.

13 Q. All right, I see two on there. Is that -- Here's  
14 a third one.

15 A. Just 1 through 5. There's the number 4 at the  
16 top of Section 15, the Number 1 is due south of that  
17 approximately 1000 feet, the Number 2 is about another 1000  
18 feet south of that. Due east of that is the Number 5-W,  
19 and then I guess they have a Number 3, so I guess there's  
20 four.

21 Q. Four wells, okay.

22 On the type log, would you please give me the  
23 exact depths that you propose? You know, pick them off the  
24 logs there.

25 A. Yes, sir.

1 Q. If you can, I'd appreciate that.

2 A. All right. It's from a depth of 4820.

3 Q. The top is 4820?

4 A. Yes, sir, that's the top.

5 Q. That's the top of your --

6 A. -- unitized --

7 Q. -- unitized interval?

8 A. Yes, sir. And the base is about 5610.

9 Q. 5610?

10 A. Yes, sir.

11 EXAMINER MORROW: Okay. Thank you, Mr. Welch.

12 THE WITNESS: Thank you.

13 EXAMINER MORROW: Appreciate it.

14 MR. KELLAHIN: Mr. Examiner, we'll call the  
15 Applicant's reservoir engineer and project engineer, Dennis  
16 Hendrix.

17 DENNIS J. HENDRIX,

18 the witness herein, after having been first duly sworn upon  
19 his oath, was examined and testified as follows:

20 DIRECT EXAMINATION

21 BY MR. KELLAHIN:

22 Q. Mr. Hendrix, for the record, sir, would you  
23 please state your name and occupation?

24 A. Yes, Dennis Hendrix. I'm currently manager of  
25 operations for Great Western Drilling in Midland.

1 Q. On past occasions have you testified before the  
2 Division as a petroleum engineer?

3 A. Yes, I have.

4 Q. For purposes of this Examiner, summarize for us  
5 your education.

6 A. I graduated in 1981 from Oklahoma State with a BS  
7 in petroleum.

8 After school I went to work for Chevron in  
9 Midland, and I held several engineering capacities in  
10 drilling and production and reservoir and a stint in  
11 operations.

12 In 1992 I started work for Great Western Drilling  
13 as a reservoir engineer and have been in those type of  
14 capacities up until recently, and went into manager of  
15 operations.

16 Q. As part of your duties of manager of operations,  
17 do they cover and include this proposed project in the  
18 South Carter-San Andres unit?

19 A. Yes, sir, it does.

20 Q. In addition, were you responsible for preparing  
21 the Division Form C-108 for compliance with the underground  
22 injection control regulations?

23 A. Yes, sir, that's correct.

24 MR. KELLAHIN: We tender Mr. Hendrix as an expert  
25 petroleum engineer.

1 EXAMINER MORROW: Fine, we accept Mr. Hendrix.

2 Q. (By Mr. Kellahin) You're soft-spoken, Dennis.

3 If you'll speak up we'll all --

4 A. Okay.

5 Q. -- hear you. The microphone is not going to help  
6 you.

7 A. Okay.

8 Q. Let's talk about the project.

9 What are your conclusions as a reservoir engineer  
10 concerning the feasibility of a waterflood project in an  
11 old area of the San Andres that is substantially depleted?

12 A. We have reviewed the unitized area for a  
13 potential waterflood. It's been reviewed twice, once  
14 several years ago and again recently after I came on board.

15 It's a very typical solution gas drive San Andres  
16 reservoir that has got numerous analogies. We saw it as  
17 having limited primary recovery or existing primary lift,  
18 and it was time to try to restimulate the reservoir,  
19 repressurize the reservoir and try to sweep some secondary  
20 oil into the producers.

21 Q. You've reached an ultimate conclusion that this  
22 project, if approved by the Division, is feasible?

23 A. Exactly, yes.

24 Q. If you're able to obtain success, have you had an  
25 opportunity to try to quantify the magnitude of incremental

1 oil you might recover from a project such as this?

2 A. Yes, we used the combination of analogy and  
3 existing cum production to come up with what we think is  
4 our secondary target.

5 Due to the lack of good log quality, these two  
6 methods are commonly used in these old waterfloods to try  
7 to quantify what secondary oil target you're going after.

8 Q. What volume of oil have you projected or  
9 forecasted to be the additional incremental oil that may be  
10 recovered from the project?

11 A. We're predicting through stage one and stage two  
12 development to recover approximately 1.3 million barrels of  
13 secondary.

14 Q. Have you estimated for your project the capital  
15 costs of the additional facilities, the amount of money to  
16 be spent on the project?

17 A. Yes, we have. We've done a detailed look at the  
18 facilities needed, required to do the flood, both stage one  
19 and stage two, and have done numerous economic analysis  
20 runs to make sure of the economic viability also of the  
21 project.

22 Q. Can you share with us the summary and conclusions  
23 concerning what the capital cost for the additional  
24 facilities would be?

25 A. Yes, the initial costs are estimated to be around

1 \$955,000 at the -- in 100 percent for the unit.

2 Q. And have you forecasted a total net value of the  
3 additional oil that might be recovered in terms of present  
4 value?

5 A. Yes, we did. The undiscounted present value for  
6 the project of 1.3 million barrels is in the range of \$5.7  
7 million.

8 Q. Let's talk about the analogies that you have  
9 examined by which, then, to judge the feasibility of your  
10 project.

11 If you'll turn to Exhibit 12, it's an area map.

12 A. Yes.

13 Q. Can you show us what is of significance to you on  
14 this map?

15 A. Exhibit 12 shows a lot of the fields that are in  
16 the general area. It's -- locates the South Carter Unit,  
17 which is highlighted in the middle of the map, shown just  
18 outside Hobbs.

19 Also across the San Simon Channel, you see  
20 another highlight of the George Allen unit, which is a San  
21 Andres that we chose as a good analogy to carry on with our  
22 feasibility study.

23 Q. And why did you choose that?

24 A. There were several reasons. It was similar in  
25 development as far as timing. That field was also

1 developed on 40-acre spacing in the mid- to late 1950s. It  
2 was similar in size. I believe they had about 16 total  
3 wells in that project: eight producers, eight injectors.

4 It was also similar in water cut, fairly low  
5 water cut reservoir, and also a similarly low GOR  
6 reservoir. And the decline-curve analysis showed very --  
7 characteristics very much like the Carter-San Andres in  
8 primary.

9 Q. Based upon your study, have you compiled  
10 reservoir data and some parameters that you intend to apply  
11 to your project?

12 A. Yes, we have. We had some reservoir data.

13 Q. Let's turn to Exhibit 13 and have you identify  
14 for us what you've tabulated on that display.

15 A. Exhibit 13 is basically a listing of the fill-up  
16 calculations I went through. It's a combination of  
17 information we had from fluid studies done back on the  
18 Carter Number 1, on the unit back in 1957, and also some  
19 information that we got from analogous fluids in the area.

20 Basically what I did here is go through the idea  
21 that the cum production date is somewhere in the 20 percent  
22 of original in place, which is a value without any  
23 assistance, with -- any additional assistance in reservoir  
24 pressure, is a pretty typical primary San Andres recovery.

25 Once we had that, we can back into our original

1 in place and get our hydrocarbon pore volume and estimate  
2 our fill-up volume from a gas saturation of around 15  
3 percent.

4 And at the bottom of the page is basically just a  
5 secondary schedule that shows first response occurring at  
6 around 55 percent of fill-up of our gas pore volume, with  
7 peak occurring around 100 percent of fill-up.

8 These numbers are derived from just a lot of  
9 empirical data from a lot of San Andres floods, and that's  
10 how that's scheduled out.

11 It also matches closely to the type of response  
12 and peak that was seen on the George Allen unit, which is  
13 our analogy.

14 Q. Mr. Hendrix have you provided a plot or a graph  
15 showing production from those oil wells within the proposed  
16 unit area?

17 A. Yes, sir, I have Exhibit 14.

18 Q. All right, sir. Let's turn to Exhibit 14 then.  
19 In addition to the production information, have you also  
20 utilized this display to forecast the potential effect of  
21 the waterflood?

22 A. Yes, that's correct, Exhibit 14 shows the  
23 historical oil production of the Carter-San Andres -- South  
24 Carter-San Andres unit, proposed unit, and shows the  
25 decline, which is another indication that we don't appear

1 to have any additional support.

2 At the end of the primary production, you see the  
3 dashed line come in. That is the waterflood -- expected  
4 waterflood case, secondary, that was shown on the  
5 calculations on Exhibit 13.

6 Q. This appears to be a typical solution gas drive  
7 reservoir?

8 A. Yes, it does.

9 Q. Where are you in terms of pressure relationships  
10 in your depletion of the reservoir?

11 A. The original reservoir pressure of the field was  
12 around 1300 to 1400 p.s.i. and a bubble-point pressure of  
13 about 841.

14 We did run some bottomhole pressure surveys  
15 during our feasibility study, and it indicated an average  
16 reservoir pressure of about 450 pounds. That was as low as  
17 214 and as high as a little over 500.

18 Q. Give us a summary of your gas-oil ratio.

19 A. Gas-oil ratio has been fairly consistent. It's  
20 averaging around 400 SCF per barrel at this point.

21 Q. When you use your production data, describe for  
22 us what information you then considered to change the curve  
23 so that you were forecasting the effects of the waterflood  
24 project?

25 A. Basically the waterflood case, the curve, the

1 dashed curve on the plot marked Waterflood Case, the  
2 initial drop in production shown in the dashed line, that's  
3 the expected conversions of our existing producers.

4 At that point we expect it to fall back on its  
5 normal decline of around four percent, until first response  
6 is indicated, and that goes back to Exhibit 13, at around  
7 1.9 years.

8 If we do get first response, that's going to sort  
9 of key our stage-two development plans. At that point,  
10 once we get first response, we expect to see, based on our  
11 expected injection rates, it would take on a positive  
12 incline up to our peak production of around 300 barrels a  
13 day. Once it reaches that, we expect it to remain flat for  
14 several years and then follow a normal decline of around 15  
15 percent.

16 Q. Can you compare this forecast for your project  
17 with what has occurred in the George Allen unit?

18 A. Yes, we can. Exhibit --

19 Q. -- 15?

20 A. -- 15 shows that relation.

21 Q. All right. Show us Exhibit 15 and describe its  
22 significance to you.

23 A. Exhibit 15 is basically the historical production  
24 of the George Allen unit. As I mentioned before, its  
25 development was in the late 1950s, early 1960s, and you can

1 see it shows a very similar decline in primary production.  
2 That's one reason it was chosen as an analogy.

3 They decided to go ahead and start waterflood  
4 operations in 1988, and you can see their first response  
5 was in a similar one-and-a-half to two-year period that  
6 they were expecting. At that point, it took on a fairly  
7 severe incline and then peaked out.

8 Q. All right, sir. Let's turn now to Exhibits 1 and  
9 2. Let's go back to the project stages one and two.

10 Within the project area, there's a code of well  
11 symbols. The plan is to do what, sir? You've got existing  
12 oil wells; you're going to take five of those and convert  
13 them to injection?

14 A. Yes, sir, that's correct. We've got five planned  
15 conversions.

16 Q. And then you're going to drill another producer  
17 in the center of the -- of that configuration of injection  
18 wells in Section 5?

19 A. That's correct, in the south central portion of  
20 Section 5, where the open circles are, that's a planned 20-  
21 acre infill producer.

22 Q. Within the geologic description Mr. Welch has  
23 provided us, describe for us why you as the project manager  
24 have selected this particular injection pattern for the  
25 project.

1           A.    There's a couple of reasons.  One of them, we  
2 feel like that it's shown because of the production cums to  
3 be a very repetitive part of the best part of our  
4 reservoir, which will give us some valuable information  
5 when we core and test it for a pressure depletion and so  
6 forth.

7                    Another reason is because of the skewed nature of  
8 the locations of these wells, it leaves a fairly sizeable  
9 hole, and we thought that to efficiently drain that part of  
10 the reservoir, you needed to have an infill location there.

11           Q.    What kind of information will you receive from  
12 the new producer that you intend to drill that you don't  
13 already have about the reservoir?

14           A.    Well, we don't currently have any core data at  
15 all on the wells in the central part of the unit, the main  
16 part of the unit.  We've got some core data on the edges  
17 that aren't very helpful.

18                    We plan on running a full modern log suite, we  
19 plan on running this -- or drilling this well into the  
20 transition zone of the San Andres below the water-free  
21 contact to see if there is additional pay that we might be  
22 flooding.

23                    And we'll also probably be taking some pressure  
24 samples.  It will give us an indication of what the  
25 pressure is like at an infill position in the reservoir.

1 Q. If that initial stage of the project is  
2 successful, do you have an estimate of the period of time  
3 that you'll be in stage one?

4 A. We expect to be in stage one for one and a half  
5 to two years.

6 Where that number comes from is basically back to  
7 our first response, which was at 1.9. We feel like at the  
8 point we had first response on our producers we had  
9 sufficient pressure to go in and possibly develop this a  
10 little better.

11 Q. Under the concept that you have, if stage one is  
12 successful, do you move into a second stage?

13 A. Yes, we will. If stage one is successful, we  
14 feel like there's additional potential that we would want  
15 to pursue at that point.

16 Q. Let's look at Exhibit Number 2 and have you  
17 describe for the Examiner your concept of what happens if  
18 you get to stage two.

19 A. Stage two development is basically a continuation  
20 of a tightening of the patterns, and again what we're  
21 trying to do with this continuous development is maximize  
22 our efficiency of recovery.

23 It's especially important, we feel, in this  
24 field, because of the skewed nature of the locations of the  
25 existing wells.

1           It is at this point mostly a concept. We tried  
2 to look for developing some better patterns, and also  
3 filling some gaps as well as extending the reservoir where  
4 we don't feel we've got a good delineation to the north and  
5 the south.

6           Included in the stage two development, you might  
7 note, is a proposed lease line injector on the Texas border  
8 there, and that will allow us to recover the secondary  
9 between the existing producers in the corner of Section 5  
10 and 8 that would otherwise go unrecovered.

11           Q. Did the other working interest owners that would  
12 participate with Great Western approve the plan of  
13 operation for this unit?

14           A. Yes, they have.

15           Q. As part of that plan, did the working interest  
16 owners agree and negotiate a participation formula?

17           A. Yes, we did.

18           Q. Describe for us the parameters that you selected  
19 to use in the participation formula and then describe for  
20 us the formula.

21           A. Okay. If you'll reference Exhibit 16, see our  
22 participation formula that we selected.

23           Q. All right, sir. Give us the parameters that you  
24 used.

25           A. The parameters that we're going with, which we

1 show as formula B on this exhibit, are 50 percent based on  
2 cumulative production, 45 percent remaining primary, and  
3 five percent acreage.

4 Q. When we look at the seven tracts, I believe they  
5 were -- Under Mr. Heathington's presentation, Exhibit  
6 Number 3, there are seven individual tracts that would  
7 share under this participation formula.

8 Do you as an engineer have an opinion as to  
9 whether or not each of those tracts is receiving a fair and  
10 appropriate share of any secondary oil that might be  
11 recovered under this formula?

12 A. Yes, that was our intent when we entered into the  
13 participation formula, was to come up with one that's fair  
14 and equitable to all tracts, and I believe we have done  
15 that.

16 Q. Describe -- We've heard the geologic explanation  
17 for the inclusion of these various tracts. Describe as an  
18 engineer why you have recommended the inclusion of the  
19 tracts within the unit, particularly those in Section 6 and  
20 7.

21 A. The tracts in 6 and 7, basically, are -- again,  
22 we feel like we're continuous -- the reservoir continued  
23 into both of those areas. They did produce sufficient  
24 amounts of oil out of the San Andres to indicate that  
25 they're part of the reservoir.

1           They'll do two things for us.

2           It will give us some protection if we do go into  
3 this latter stages of development.

4           And, as you might note in the stage two  
5 development plan, there is a concept, anyway, of converting  
6 the Marshall R. Young well that's shown in Section 7.

7           Q.   Did all the working interest owners agree to the  
8 inclusion of all these tracts within the unit and the  
9 project area?

10          A.   Yes, they did.

11          Q.   Okay.  When we look at the participation formula,  
12 is the application of that formula to each of the  
13 individual tracts such that each tract has a positive value  
14 if it participates in the unit?

15          A.   Yes, it does.

16          Q.   Let's turn to the C-108 information.  Let's do  
17 underground injection control.  There are two displays for  
18 you to consider, Mr. Hendrix.

19                If you'll look at Exhibit 17, which is the area-  
20 of-review circle map, and then if you'll also look at 18,  
21 18 is the C-108.  And at the bottom right corner of the  
22 C-108, each individual page is numbered.  So we'll use  
23 those two, and let me take you through the analysis.

24                When you look at 17 and look at the area of  
25 review, do each of these circles have a radius of a half

1 mile around each proposed injection well?

2 A. Yes, they do.

3 Q. When we look at that area, then, as the area of  
4 review, do you find any plugged or abandoned wells that had  
5 penetrated the San Andres Pool?

6 A. Yes, there are.

7 Q. As a result of that activity, have you included  
8 in the C-108 schematics of those plugged and abandoned  
9 wells?

10 A. Yes, we have.

11 Q. And as an engineer, have you examined the  
12 plugging protocol for each of those plugged wells?

13 A. Yes, I have.

14 Q. With what conclusion?

15 A. They all seem to be properly plugged. There  
16 seems to be sufficient protection from fresh water in all  
17 the wells.

18 Q. When we look at the deepest known source of fresh  
19 water in this area, what is your understanding of that  
20 deepest source?

21 A. The deepest and only source of fresh water is the  
22 Ogallala. It occurs at a depth of around 125 to 140 feet.

23 Q. Have you confirmed with the Oil Conservation  
24 Division's District Office what they believe to be the  
25 deepest point of produced water out of the Ogallala?

1 A. Yes, sir, that's where we got that information.

2 Q. All right. Are all the existing wells and the  
3 new well cased and cemented in such a way that there's a  
4 surface casing string from the surface below the total  
5 depth of the producing Ogallala?

6 A. Yes, sir.

7 Q. And are the producing wells then cased in such a  
8 way that that freshwater sand is protected?

9 A. Yes, they are.

10 Q. When we look at producing wells which penetrated  
11 through the San Andres within the area of review, do you  
12 find any problem wells among those producing wells?

13 A. No, I did not locate or find any problem wells in  
14 our area of review.

15 Q. For each of the producing wells, then, were you  
16 able to verify to your own degree of satisfaction that  
17 there was adequate cement column protecting casing from the  
18 San Andres?

19 A. Yes, I did.

20 Q. Let's talk about the operation. You drill your  
21 new well, you convert your wells to injection, and you  
22 start to achieve fill-up. What volumes or initial rates of  
23 water injection are you proposing initially so that you can  
24 obtain fill-up within a reasonable period of time?

25 A. We're going to try to achieve 2500 to 3000

1 barrels of water a day for the unit total.

2 Q. Utilizing these five injection wells, then you'll  
3 try to achieve fill-up, and then you'll go into later  
4 development if that proves successful?

5 A. Yes, sir, that's correct.

6 Q. As part of your study, have you obtained an  
7 analysis of the water produced out of the San Andres?

8 A. Yes, we did.

9 Q. Your make-up water is going to be produced San  
10 Andres water and water from another source?

11 A. Yes, that's correct.

12 Q. All right. What's your other source?

13 A. We're going to have -- We've got existing water  
14 supply well which will be our make-up water source.

15 Q. You have your own water supply well for the  
16 project?

17 A. Yes, that's correct.

18 Q. And have you provided the Examiner in the C-108  
19 package an analysis of that supply water source?

20 A. Yes, sir.

21 Q. Do you see any incompatibility problems with  
22 combining those injection waters with formation water?

23 A. No, the only compatibility problem noted in our  
24 study was due to oxygen, and that was related to the type  
25 of well we achieved the sample from, and as long as we

1 maintain a closed system we should eliminate that problem.

2 Q. Okay. One of the items of responsibility for the  
3 Examiner is to maintain a control on the surface injection  
4 pressure.

5 A. Yes, sir.

6 Q. Initially the Division has a guideline that says  
7 that you'll maintain a surface injection pressure of not  
8 greater than .2 p.s.i. per foot of depth to the top  
9 perforation?

10 A. Yes, sir.

11 Q. Do you understand that?

12 A. Yes.

13 Q. All right. What do you propose to do?

14 A. We propose, at least initially, to maintain our  
15 injection, our maximum pressure, at .2 p.s.i. per foot.  
16 That will be calculated on a per-well basis, based on where  
17 the perforations or open hole interval would be in the  
18 injector.

19 After injection is established, if we aren't able  
20 to achieve our target injection rates, we would probably be  
21 running injection profiles as soon as we could stabilize  
22 rate, and probably be looking at running step-rate tests to  
23 try to verify we need additional -- we can handle  
24 additional volumes, pressure.

25 Q. Would you like or request the Examiner to include

1 in his order, should he approve your project, an  
2 administrative procedure to increase that injection-  
3 pressure limitation by the submittal to the agency of step-  
4 rate tests or other profile information?

5 A. Yes, sir, I would.

6 Q. And we can do that administratively?

7 A. Yes, sir.

8 Q. All right. Do you have information by which we  
9 could show the location of those freshwater sources that  
10 you have determined may exist in the area?

11 A. Yes, we do, on Exhibit 18, on the very back page,  
12 page 30.

13 Q. All right, sir, let's look at page 30. Page 30  
14 should be the last page of the C-108, Mr. Examiner, very  
15 last page of that.

16 You've got three arrows. What do those show?

17 A. The arrows denote the freshwater wells that are  
18 active in the area that we did sample.

19 Q. How did you find out that those existed?

20 A. It was a combination of information we received  
21 from the State Engineer's office and our own field foremen  
22 going into the area and looking for windmills or any  
23 indication of fresh water.

24 Q. Did you find any freshwater sources within the  
25 area of review, to half-mile radiuses?

1           A.    We located one freshwater source that is in the  
2 area of review.  It's been inactive, plugged out for some  
3 time, it appears.

4           Q.    So it's not shown on this map?

5           A.    And it's not shown on this map, that's correct.

6           Q.    Do you -- For purposes of the record, do you have  
7 a location for that well?

8           A.    Yes, it's down in the -- It's an offset to the  
9 Johnson A, which is the 40-acre tract in the corner of  
10 Section 6.

11          Q.    Let's turn to the C-108 and find a schematic of  
12 an injection well, after it's been converted.  Do you have  
13 one that will illustrate that for us?

14          A.    Yes, we just picked this first one, which is page  
15 4.

16          Q.    All right.  Let's look at page 4.  Give us an  
17 example of how you're going to take these producers and  
18 convert them to injection.

19          A.    Okay, this sample well, the Carter Number 2,  
20 would be a typical well.  It's on production now, the  
21 standard setup with 2 3/8 tubing and an anchor.

22                That equipment will be pulled out of the hole.  
23 We'll probably be running a packer down above the open hole  
24 section, doing a light stimulation, just to remove any  
25 damage that might have occurred in the last few years.

1           Then we'll go ahead and run 2 3/8 Duoline -- it's  
2 a PVC-lined tubing -- with an injection packer. And the  
3 packer will be set within 100 feet of the casing shoe in  
4 this instance, above the open-hole interval, and it will be  
5 set for injection.

6           Q. Do you have a method by which to monitor the  
7 annular space between the casing and the tubing?

8           A. Yes, sir, we'll -- Typically, on the wells of  
9 this age, what we'll do is we will put a valve on the  
10 casing string, on the annular string, so if there is any  
11 tubing leak or anything, it will be indicated either by a  
12 pressure reading or by a bleeder valve.

13                   And that will be monitored on a daily basis by  
14 our pumpers on the lease.

15           Q. When you look back at your project area, can you  
16 estimate for us what has been the cumulative primary  
17 production to some approximate date?

18           A. Yes, as of 1-1-94, our cumulative production was  
19 slightly over 2.2 million barrels in the unit area.

20           Q. If the waterflood project is not approved, do you  
21 have an estimate for us of the remaining primary oil  
22 production?

23           A. Yes, sir, from the same relative date, the  
24 primary remaining is estimated from decline-curve analysis  
25 to be about 378,000 barrels.

1 Q. And if your project is successful, then you could  
2 be looking at an estimated 1.3 million barrels of oil?

3 A. Yes, in addition to the 378,000, that's correct.

4 MR. KELLAHIN: All right, sir.

5 Mr. Examiner, that concludes my examination of  
6 Mr. Hendrix.

7 We move the introduction of his Exhibits 12  
8 through 18.

9 EXAMINER MORROW: All right, 12 through 18 are  
10 admitted into the record.

11 EXAMINATION

12 BY EXAMINER MORROW:

13 Q. On Exhibit 12, what does the channel across there  
14 mean? What was the significance of that?

15 A. It's basically just a relational map showing the  
16 location of the central basin platform and where we think  
17 that's -- that's -- key is that the analogy field, which is  
18 on the other side of the San Simon Channel --

19 Q. What channel was that?

20 A. San Simon Channel. It's just a geologic  
21 province, and it's used as sort of a way of characterizing  
22 the type of reservoir you expect to find in that position  
23 related to the channel.

24 The George Allen unit, being on the other side of  
25 the channel, on the -- I believe that's the northwest shelf

1 -- since it's also a San Andres reservoir that's being  
2 deposited toward the channel it again supports the fact  
3 that it's a good analogy for us.

4 Q. Does the channel represent some better type of  
5 production or worse or --

6 A. No, it's typically -- Well, I don't know if it's  
7 any better or worse. It's usually worse, I guess, yeah.

8 Q. It looked like the peak response would probably  
9 be, on your plot there, it would be sooner than the 3.9  
10 years. It looks like maybe you shaved some off the top of  
11 that thing or something.

12 A. Yeah, the plot's a little bit deceiving because  
13 it jumps around.

14 Q. It looks more like 1.9 years to peak response.

15 A. Well, actually the way the plot reads there, the  
16 end of 1994 -- which of course everything is kind of  
17 shifted because it's taken a little longer -- the end of  
18 1994 is where we begin injection. And the peak is shown,  
19 according to the plot, in 1998. So it's right at four  
20 years.

21 It's just -- the scale along the bottom is a  
22 little --

23 Q. Which exhibit was that again?

24 A. It's Exhibit 14, Mr. Morrow.

25 Q. Oh, yeah, I've got it here.

1 Well, I guess peak is that flat part; is that  
2 right?

3 A. Right, that's the peak produc- -- The first  
4 response is due to occur, if we get our target rates, about  
5 1.9 years.

6 And --

7 Q. Okay.

8 A. -- the scale, because of the long history --

9 Q. Okay.

10 A. -- kind of forces us --

11 Q. Yeah.

12 A. -- to string the scale on the bottom.

13 Q. Let's see, are you the last witness?

14 A. Yes, sir.

15 Q. Part of the Application was a certification for  
16 an enhanced oil recovery tax credit.

17 A. Yes, sir, that's correct.

18 Q. What area do you propose be included for that?  
19 What area would you like to have included?

20 A. Well, we propose to have the entire unit area  
21 included in the Application.

22 Q. I think normally what's included is a developed  
23 portion of the reservoir, or at least no more than what is  
24 planned for development.

25 Maybe you could look at Exhibit 2 and we can

1 decide together what there would be any use of ever  
2 including.

3 And I'd ask you kind of a subquestion here. Are  
4 those -- that -- Are these more or less two-thirds of a  
5 section wide or three-fourths, or what is the acreage, say,  
6 included in Section 8?

7 A. It's actually -- it's actually -- there -- from  
8 the left side that says Section 8, the section line between  
9 7 and 8, there's two standard 40-acre proration units, and  
10 you're left with about 26 to 27 acres.

11 Q. So that 26 that BLM had is added to a half  
12 section along the east boundary there?

13 A. Yeah, they did it -- The proration units are set  
14 up two different ways.

15 Some of them were set up as 26- or 27-acre  
16 proration units and given a .65 factor for the allowable.

17 Q. Uh-huh.

18 A. And then in some cases they were set up as a 40-  
19 acre. In the case of the Johnson 1 in Section 8, it's a --  
20 I think they call it a nonstandard 40-acre proration unit,  
21 which took the well to the west of it down to about 26- or  
22 27-acre proration unit.

23 Q. Okay. So I guess in Section 5, if you're going  
24 to include an area there all of the -- say the south half,  
25 would eventually be developed by either producers or

1 injection?

2 A. Yes, sir, that's correct.

3 Q. And no development is ever planned in Section 6;  
4 is that correct?

5 A. Not at this point, I don't believe so, no.

6 Q. Okay.

7 A. I don't think the --

8 Q. And you wouldn't develop the 40 acres in Section  
9 7?

10 A. Section 7 probably wouldn't be any further  
11 development. Just the one well is a conversion --

12 Q. Convert it to injection?

13 A. -- down the road. That's correct.

14 Q. Okay. But it -- Now, it will initially be a  
15 producer, I believe, is --

16 A. That's correct, yes.

17 Q. So it might get some response in the initial --

18 A. Yes, from the --

19 Q. Okay.

20 A. -- from the conversion of the Johnson 3, it  
21 could get some response.

22 Q. So that could logically be included, I believe.

23 A. Yes, sir.

24 Q. The -- All of the north half of 8 will be  
25 developed either by producers or injectors, with the

1 exception, I'm assuming, 26 acres on the east side of the  
2 south half of the north half.

3 A. Yes, sir, I believe that would be right.

4 Q. Okay. The participation formulas that you  
5 discussed are -- there are two sets of those. Is that --  
6 What's the significance of the two?

7 A. The reason I included this, our original  
8 participation formula was formula A, and we did send that  
9 out to working interest owners, and I wasn't real sure if  
10 you had gotten that initially. And then you saw a second  
11 one come in, which is formula B.

12 So I went ahead and included both of them just in  
13 case it came up.

14 Formula A was what we started with but the ten-  
15 percent acreage factor was not acceptable to the BLM, and  
16 so we had some conversations with the BLM engineer. And  
17 they've convinced us that a five-percent acreage is all  
18 they really allow.

19 And what it does to the working interest owners  
20 is, it really improves about 94 or -5 percent of the  
21 working interest owners' unit interest.

22 So we felt like that was a fair compromise, and  
23 we ended up with formula B.

24 Q. It cut down on those tracts that hadn't produced  
25 much? Was that the situation?

1 A. Yes, the --

2 Q. Or that had very little remaining primary, I  
3 guess.

4 A. Right. And their opinion too was, they felt like  
5 that the cum and remain was a much better indicator of  
6 secondary recovery and worth than undeveloped acreage that  
7 may or may not add to the value.

8 Q. So you gave more weight to remaining primary and  
9 less to cum oil?

10 A. No, actually cum oil stayed the same. The only  
11 thing that changed was more to remaining primary and five  
12 percent less to acreage.

13 Q. Oh, it's 50 percent cum oil, five percent  
14 acreage?

15 A. That's correct.

16 Q. Okay. And 100 percent of the working interest  
17 owners have agreed to that?

18 A. They've agreed to it, yes, sir.

19 Q. And over 95 percent of the other interest?

20 A. Right, 96 percent of the royalty and 100 percent  
21 of the working interest owners have.

22 Q. On the data you provided in the 108, are all the  
23 wells -- is a schematic included there for each well within  
24 the half-mile radius?

25 A. Yes, sir, it sure is, that's correct.

1 Q. And you believe the San Andres is covered in each  
2 of those with cement or --

3 A. Yes, sir.

4 Q. -- cement plugs?

5 A. Yes, sir. We used a combination of -- to get the  
6 50-percent washout factor recommended by the OCD to  
7 calculate tops, if we didn't have a top of cement denoted  
8 through a log or such, and we didn't see anything that  
9 didn't look like it was sufficiently covered.

10 Q. Are all the wells San Andres wells, or are some  
11 of them to a deeper horizon?

12 A. There are a couple of deeper wells.

13 Q. If you could find those, point out which pages  
14 they're on, I'd appreciate it.

15 A. Okay, the -- Let me start at the front here. The  
16 wells that are deeper are located on the Texas side, and in  
17 that one well that Pat alluded to that's up in the north  
18 part of Section 5 -- The first one in order is page 15 in  
19 the C-108 package.

20 Q. Okay.

21 A. It's called the Granberry Number 1.

22 Q. But it was completed in the San Andres and pack-  
23 cemented through -- across the San Andres; is that --

24 A. Yes, that's correct. They tried a San Andres  
25 completion and -- before, and then they plugged it out.

1 Q. Let's see, in that particular well it looks like  
2 probably San Andres is open to the Grayburg there. Would  
3 you agree with that?

4 A. The -- Oh, yes, yes. The top of the cement in  
5 this well calculated out at 4963.

6 Q. Of course you do have pipe through there, so  
7 that --

8 A. We have pipe through there, that's correct.

9 Q. -- would prevent any migration?

10 A. Uh-huh.

11 Q. Where is the next one, then?

12 A. The next deep well is going to be page 17, and  
13 it's a recently drilled well. It was test into the Clear  
14 Fork called the Taylor Number 4, and it was drilled and  
15 abandoned.

16 We felt like they did a sufficient job with their  
17 cement plugs there to...

18 And one that's probably of interest is the plug  
19 they set at 4800 feet.

20 Q. What was the top of the zone again?

21 A. The San Andres?

22 Q. Yes, sir.

23 A. Approximately 4950. We could probably pull a  
24 nearby log to get closer than that. It's going to be --

25 Q. And on a type log the base was where?

1 A. Fifty- --

2 MR. KELLAHIN: -- -six ten.

3 THE WITNESS: Yeah, I believe it was 5610.

4 EXAMINER MORROW: 5610, okay.

5 THE WITNESS: The top may be lower than 4950,  
6 because we're getting over on the edge, so there is some  
7 dip on that side.

8 Q. (By Examiner Morrow) Maybe lower than that?

9 A. Yes, sir, maybe deeper than that.

10 Q. So there's a possibility there that the Grayburg  
11 and San Andres could be open together, I guess, in this  
12 well?

13 A. Yeah, it's possible, I think, on that one, with  
14 the plug at --

15 Q. And that may be fairly distant anyhow --

16 A. Yeah, you've got forty-eight hundred feet to  
17 sixty-nine. I'd have to look at that --

18 Q. Let's see, that well is in section what, now?  
19 Section 15?

20 A. Section 15.

21 Q. Oh, it's right on -- right out -- It looks like  
22 it's right outside the --

23 A. Yes, sir.

24 Q. -- half-mile radius, or right on the edge?

25 A. Yeah, it may have -- that -- Well, I think that

1 was one we did include, because it was real close, and we  
2 thought we'd better be safe than sorry on that one, from  
3 the edge.

4 Q. Where is the base of the Ogallala?

5 A. We were given a depth of 125 to 140 feet. We  
6 have talked to some other people that said it might occur  
7 as deep as 200 feet, but that wasn't verified.

8 Q. And surface pipe was set at least that deep in  
9 all of the --

10 A. Yes, sir. I believe the shallowest surface side  
11 I noticed going through here was about 297, in that range,  
12 about a hundred feet below what potentially could be the  
13 deepest.

14 Q. The PVC-lined tubing, how -- What process did you  
15 use to install that lining?

16 A. Well, what they do is, they take -- they can take  
17 used tubing, which is what we try to do so we can utilize  
18 our current tubing string. They take it in to the  
19 company -- it's called Rice -- and they set it up. And  
20 they basically have -- Their liner slips in. It's just  
21 a -- They have PVC or fiberglass liner.

22 And then they put this -- It's like an epoxy-  
23 cement material that will go between the tubing wall and  
24 the liner. And they pump that in there, and that spins it.  
25 And so it coats the -- It keeps the liner in the middle,

1 and it spins this cement along the outside of it.

2           Once that's done, then they have some ends, some  
3 plastic ends that they snap in, and --

4           Q.    So the PVC is glued to the --

5           A.    Yeah, it's just an insert, really, into the steel  
6 tubing with --

7           Q.    But it's -- Some adhesive is put in there to  
8 attach it --

9           A.    That's correct.

10          Q.    -- to the steel; is that correct?

11          A.    Yes. It's sort of like a thin cement that's in  
12 between the outside of that plastic liner and the tubing  
13 wall. It provides a real -- a very long-term protection of  
14 the injection string.

15          Q.    Are you using 2 3/8 or 2 7/8?

16          A.    2 3/8.

17          Q.    How much does that leave you in your i.d. there?  
18 Is that --

19          A.    I believe on -- 2 3/8 is typically about a 1.99,  
20 and I believe this cuts you down to about a 1.58 or  
21 somewhere in that range --

22          Q.    Okay.

23          A.    -- maybe even a little more than that.

24                   Cement-lined actually cuts your i.d. down further  
25 than this liner does. I think the cement-lined is about

1 1.5, so this is somewhere probably above that.

2 Q. Okay. Are all the recoveries that you cited near  
3 the end of your testimony, are those on that reservoir data  
4 sheet? Two-point-some million barrels of --

5 A. Yes, sir.

6 Q. -- primary and the 300,000 barrels remaining,  
7 plus or minus?

8 MR. KELLAHIN: If not, Mr. Examiner, they're  
9 stated in the Application.

10 EXAMINER MORROW: Are they?

11 MR. KELLAHIN: Yes, sir.

12 THE WITNESS: Yeah, that's where they are. I  
13 don't -- They're not on the fill-up calculation sheet;  
14 that's probably what you're alluding to. No, they're not  
15 on that.

16 EXAMINER MORROW: Well, is that all we've got to  
17 talk about?

18 MR. KELLAHIN: Yes, sir.

19 EXAMINER MORROW: Doesn't seem like enough for --

20 MR. KELLAHIN: That's all there is.

21 EXAMINER MORROW: -- an application.

22 Thank you, sir. Appreciate your testimony.

23 THE WITNESS: Thank you.

24 MR. KELLAHIN: We have a certificate of notice  
25 for the hearing, Mr. Examiner. It should be in your

1 package as Exhibit 19, and we would move its introduction  
2 at this time.

3 EXAMINER MORROW: Okay. Accept it into the  
4 record.

5 MR. KELLAHIN: That concludes our presentation.

6 EXAMINER MORROW: Cases 11,113 and 11,114 are  
7 taken under advisement.

8 (Thereupon, these proceedings were concluded at  
9 11:17 a.m.)

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## CERTIFICATE OF REPORTER

STATE OF NEW MEXICO )  
 ) ss.  
 COUNTY OF SANTA FE )

I, Steven T. Brenner, Certified Court Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Division was reported by me; that I transcribed my notes; and that the foregoing is a true and accurate record of the proceedings.

I FURTHER CERTIFY that I am not a relative or employee of any of the parties or attorneys involved in this matter and that I have no personal interest in the final disposition of this matter.

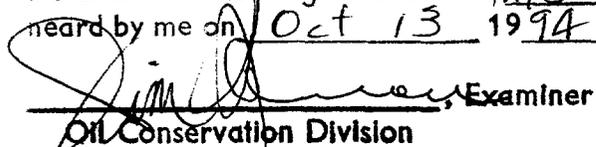
WITNESS MY HAND AND SEAL October 16th, 1994.



STEVEN T. BRENNER  
 CCR No. 7

My commission expires: October 14, 1998

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 1113 + 1114 heard by me on Oct 13 1994.



Examiner  
 Oil Conservation Division