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

ORIGINAL

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.

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I N D E X

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

* * *

E X H I B I T S

(Continued...)

E X H I B I T S (Continued)

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A P P E A R A N C E S

FOR THE APPLICANT:

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By: W. THOMAS KELLAHIN

* * *

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

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

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

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

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

Call for appearances.

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

(Thereupon, the witnesses were sworn.)

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

Mike Heathington.

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

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

EXAMINER MORROW: Okay.

MIKE S. HEATHINGTON,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

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

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

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

A. Yes, I have.

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

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

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

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

A. That is correct, I was.

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

A. Yes, we did.

Q. And as part of that effort, did you also identify the owners of the surface for which each of the proposed injection wells is to be located or is currently located?

A. Yes, we have.

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

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

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

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

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

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

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

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

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

A. I believe that's correct.

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

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

Q. This unit is identified by what name?

A. The San Andres.

Q. South Carter-San Andres unit?

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

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

A. Exhibit 2 is the proposed second stage of our waterflood project, anticipated -- I'll let the engineers talk more about that, but it is anticipated approximately two years after the first stage is implemented.

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

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

A. Yes.

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

A. That is correct.

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

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

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

It basically shows -- The numbers encompassed by a circle are just the numbers of our tracts within our unit area, the dashed line is the outline of the 624-acre unit area, and then we also show our producer that we plan to drill in this project.

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

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

A. It is Tract Number 2.

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

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

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

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

Great Western, were you dealing with?

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

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

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

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

A. Yes, we have.

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

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

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

The purpose of doing so is to commit the last remaining portion of overriding royalty owners within the unit that have not yet ratified the project; is that your plan?

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

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

A. Yes, sir.

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

A. It is Exhibit Number 4.

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

A. Yes, it does.

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

A. Exhibit 5 is our unit operating agreement.

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

A. Yes, we did.

Q. And that's marked as Exhibit 6?

A. Yes, sir, it is.

Q. Okay. To the best of your knowledge, is that still an accurate, reliable list of those interest owners?

A. Yes, it is.

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

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

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

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

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

A. Yes, I believe it would.

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

We move the introduction of his Exhibits 1 through 7.

EXAMINER MORROW: 1 through 7 are admitted.

EXAMINATION

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 that correct?

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

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

A. In my 96.2 --

Q. In your --

A. -- number --

Q. -- calculation?

A. -- yes, sir.

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

A. It depends --

Q. Or will somebody else talk more about that?

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

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

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

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

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

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

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

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

A. The wedge shown here on Exhibit 2?

Q. Right.

A. I believe that's correct.

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

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

PAT WELCH,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

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

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

Q. Summarize for us your education, sir.

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

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

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

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

A. Yes, sir, I have.

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

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

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

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

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

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

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

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

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

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

A typical completion is drilling with rotary tools to the top of the main porosity in the San Andres, setting a 5-1/2-inch casing, drilling out with cable tools to a depth of about 5200 feet, somewhere above what's considered the water-free completion zone so that no water will be produced from the field.

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

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

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

A. Yes, sir, I believe it is.

Q. What causes you to reach that conclusion?

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

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

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

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

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

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

A. Yes, sir.

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

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

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

A. Uh-huh.

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

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

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

Q. Okay.

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

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

Number 8, identify for us what in fact Exhibit 8 is.
A. This is a structure contour map on the top of the San Andres.
Q. Why would you do this?
A. That's the top of our unitized interval.
Q. And so what significance does the structural component of the reservoir have for you in evaluating the feasibility of a waterflood?
A. It shows reservoir boundaries and our trapping mechanism, or one component of our trapping mechanism.
Q. Does it give you any clue as to where to place or convert injection wells in relation to producing wells?
A. Somewhat. We use structure somewhat, but geologic continuity is another factor.
Q. All right. Let's use this as a basis, then, for having you describe to the Examiner your justification of your boundaries, all right? Let's start with the northern boundary.
Why have you chosen to place the northern unit boundary at that point in the reservoir?
A. If you'll note in Section 6, on the Texas side, in Gaines County, the P.S.L. Block A-6 in Section 6, the Great Western Drilling Company Granberry Number 1-A, that well is down in the transition zone or below the water-free completion zone.

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

A. Yes, sir. And then --

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

A. No, sir, probably not.

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

A. Yes, sir.

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

A. Uh-huh.

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

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

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

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

Q. As you move, then, into Section 6, give us the basis, for example, inclusion of the southeast-southeast --
A. Uh-huh.
Q. -- with the exclusion of the rest of the section.
A. The numerous dry holes can be seen in Section 6. The Johnson 1-A, operated now by DA&S, produced about 26,000 barrels of oil. For protection, that's one reason why we included it.
Q. Well, it contributed San Andres production before it was abandoned, did it not?
A. Yes, sir, about 26,000 barrels.
Q. And you know by log analysis and examination that it's geologically connected to the main portion of the unit?
A. Yes, sir, we feel that that's true.
Q. So that is a tract that has some value to the unit and has had some past contribution to primary production?
A. Yes, sir.
Q. None of the rest of the wells in 6 did that, did they?
A. Well, one well did, but it was only about 1000 barrels. It's the well marked Number 1 that's plugged, and it made approximately 1000 barrels, but it was not considered commercial enough to be included.

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

A. Yes, sir.

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

A. Uh-huh.

Q. Explain to us why it was included.

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

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

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

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

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

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

Q. All right. Finally, the southern boundary of the unit within Section 8 --

A. Uh-huh.

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

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

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

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

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

A. Repeat the question, please.

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

A. Yes, sir.

Q. And did they all agree to this size and shape of the unit?

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

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

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

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

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

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

A. Yes, sir, it is.

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

A. Yes, sir.

Q. With what conclusion?

A. That it's very continuous.

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

A. Yes, sir, it can.

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

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

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

Q. All right, on Exhibit 9?

A. Yes, sir.

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

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

Q. Okay, the Henry McQuein?

A. Number 1, yes, sir.

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

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

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

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

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

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

A. Yes, sir.

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

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

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

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

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

A. Yes, sir.

Q. And what would that be?

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

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

A. No, sir.

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

A. East-west?

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

A. Correct.

Q. Constructed in the same method or manner?

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

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

EXAMINER MORROW: If it was hung on which one?

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

EXAMINER MORROW: Okay.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

A. Yes, sir.

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

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

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

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

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

A. Yes, sir.

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

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

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

We are planning on coring, running modern log suites and pushing that data that we collect back into the data that we do have on the field wells, the current field wells, and optimizing the waterflood in that manner.

MR. KELLAHIN: Mr. Examiner, that concludes my examination of Mr. Welch.

We move the introduction of his Exhibits 8 through 11.

EXAMINER MORROW: 8 through 11 are admitted into the record.

EXAMINATION

BY EXAMINER MORROW:

Q. Mr. Welch, do you know when the phase two part of the project --

A. I'm not --

Q. -- is scheduled to begin, or is that still undecided?

A. I'm not exactly certain. It depends on the performance of the flood. We hope that if the flood performs as we expect, that it will be approximately two years.

The engineer can confirm that when he testifies.

Q. You said you could identify those injection wells on the Texas side there?

A. Yes, sir.

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

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

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

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

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

A. Yes, sir.

Q. Or have been, at least?

A. Yes, sir.

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

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

Q. Four wells, okay.

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

A. Yes, sir.

Q. If you can, I'd appreciate that.
A. All right. It's from a depth of 4820.
Q. The top is 4820?
A. Yes, sir, that's the top.
Q. That's the top of your --
A. -- unitized --
Q. -- unitized interval?
A. Yes, sir. And the base is about 5610.
Q. 5610?
A. Yes, sir.

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

THE WITNESS: Thank you.

EXAMINER MORROW: Appreciate it.

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

<u>DENNIS J. HENDRIX</u>,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Hendrix, for the record, sir, would you please state your name and occupation?
A. Yes, Dennis Hendrix. I'm currently manager of operations for Great Western Drilling in Midland.

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

A. Yes, I have.

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

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

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

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

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

A. Yes, sir, it does.

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

A. Yes, sir, that's correct.

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

EXAMINER MORROW: Fine, we accept Mr. Hendrix.

Q. (By Mr. Kellahin) You're soft-spoken, Dennis. If you'll speak up we'll all --

A. Okay.

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

A. Okay.

Q. Let's talk about the project.

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

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

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

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

A. Exactly, yes.

Q. If you're able to obtain success, have you had an opportunity to try to quantify the magnitude of incremental oil you might recover from a project such as this?

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

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

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

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

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

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

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

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

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

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

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

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

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

A. Yes.

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

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

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

Q. And why did you choose that?

A. There were several reasons. It was similar in development as far as timing. That field was also developed on 40-acre spacing in the mid- to late 1950s. It was similar in size. I believe they had about 16 total wells in that project: eight producers, eight injectors.

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

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

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

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

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

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

Once we had that, we can back into our original in place and get our hydrocarbon pore volume and estimate our fill-up volume from a gas saturation of around 15 percent.

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

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

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

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

A. Yes, sir, I have Exhibit 14.

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

A. Yes, that's correct, Exhibit 14 shows the historical oil production of the Carter-San Andres -- South Carter-San Andres unit, proposed unit, and shows the decline, which is another indication that we don't appear to have any additional support.

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

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

A. Yes, it does.

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

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

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

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

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

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

A. Basically the waterflood case, the curve, the dashed curve on the plot marked Waterflood Case, the initial drop in production shown in the dashed line, that's the expected conversions of our existing producers.

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

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

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

A. Yes, we can. Exhibit --

Q. -- 15?

A. -- 15 shows that relation.

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

A. Exhibit 15 is basically the historical production of the George Allen unit. As I mentioned before, its development was in the late 1950s, early 1960s, and you can see it shows a very similar decline in primary production. That's one reason it was chosen as an analogy.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

A. Yes, they have.

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

A. Yes, we did.

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

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

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

A. The parameters that we're going with, which we show as formula B on this exhibit, are 50 percent based on cumulative production, 45 percent remaining primary, and five percent acreage.

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

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

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

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

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

They'll do two things for us.

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

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

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

A. Yes, they did.

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

A. Yes, it does.

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

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

When you look at 17 and look at the area of review, do each of these circles have a radius of a half mile around each proposed injection well?

A. Yes, they do.

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

A. Yes, there are.

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

A. Yes, we have.

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

A. Yes, I have.

Q. With what conclusion?

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

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

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

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

A. Yes, sir, that's where we got that information.
Q. All right. Are all the existing wells and the new well cased and cemented in such a way that there's a surface casing string from the surface below the total depth of the producing Ogallala?
A. Yes, sir.
Q. And are the producing wells then cased in such a way that that freshwater sand is protected?
A. Yes, they are.
Q. When we look at producing wells which penetrated through the San Andres within the area of review, do you find any problem wells among those producing wells?
A. No, I did not locate or find any problem wells in our area of review.
Q. For each of the producing wells, then, were you able to verify to your own degree of satisfaction that there was adequate cement column protecting casing from the San Andres?
A. Yes, I did.
Q. Let's talk about the operation. You drill your new well, you convert your wells to injection, and you start to achieve fill-up. What volumes or initial rates of water injection are you proposing initially so that you can obtain fill-up within a reasonable period of time?
A. We're going to try to achieve 2500 to 3000

barrels of water a day for the unit total.

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

A. Yes, sir, that's correct.

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

A. Yes, we did.

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

A. Yes, that's correct.

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

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

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

A. Yes, that's correct.

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

A. Yes, sir.

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

A. No, the only compatibility problem noted in our study was due to oxygen, and that was related to the type of well we achieved the sample from, and as long as we maintain a closed system we should eliminate that problem.

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

A. Yes, sir.

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

A. Yes, sir.

Q. Do you understand that?

A. Yes.

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

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

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

Q. Would you like or request the Examiner to include in his order, should he approve your project, an administrative procedure to increase that injection-pressure limitation by the submittal to the agency of step-rate tests or other profile information?

A. Yes, sir, I would.

Q. And we can do that administratively?

A. Yes, sir.

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

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

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

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

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

Q. How did you find out that those existed?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. KELLAHIN: All right, sir.

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

We move the introduction of his Exhibits 12 through 18.

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

EXAMINATION

BY EXAMINER MORROW:

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

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

Q. What channel was that?

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

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

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

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

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

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

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

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

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

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

Q. Which exhibit was that again?

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

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

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

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

And --

Q. Okay.

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

Q. Okay.

A. -- kind of forces us --

Q. Yeah.

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

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

A. Yes, sir.

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

A. Yes, sir, that's correct.

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

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

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

Maybe you could look at Exhibit 2 and we can decide together what there would be any use of ever including.

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

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

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

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

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

Q. Uh-huh.

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

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

A. Yes, sir, that's correct.

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

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

Q. Okay.

A. I don't think the --

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

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

Q. Convert it to injection?

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

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

A. That's correct, yes.

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

A. Yes, from the --

Q. Okay.

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

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

A. Yes, sir.

Q. The -- All of the north half of 8 will be developed either by producers or injectors, with the exception, I'm assuming, 26 acres on the east side of the south half of the north half.

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

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

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

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

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

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

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

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

A. Yes, the --

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

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

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

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

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

A. That's correct.

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

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

Q. And over 95 percent of the other interest?

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

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

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

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

A. Yes, sir.

Q. -- cement plugs?

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

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

A. There are a couple of deeper wells.

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

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

Q. Okay.

A. It's called the Granberry Number 1.

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

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

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

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

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

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

Q. -- would prevent any migration?

A. Uh-huh.

Q. Where is the next one, then?

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

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

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

Q. What was the top of the zone again?

A. The San Andres?

Q. Yes, sir.

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

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

A. Fifty- --

MR. KELLAHIN: -- -six ten.

THE WITNESS: Yeah, I believe it was 5610.

EXAMINER MORROW: 5610, okay.

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

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

A. Yes, sir, maybe deeper than that.

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

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

Q. And that may be fairly distant anyhow --

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

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

A. Section 15.

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

A. Yes, sir.

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

A. Yeah, it may have -- that -- Well, I think that was one we did include, because it was real close, and we thought we'd better be safe than sorry on that one, from the edge.

Q. Where is the base of the Ogallala?

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

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

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

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

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

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

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

Q. So the PVC is glued to the --

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

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

A. That's correct.

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

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

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

A. 2 3/8.

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

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

Q. Okay.

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

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

1.5, so this is somewhere probably above that.

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

A. Yes, sir.

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

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

EXAMINER MORROW: Are they?

MR. KELLAHIN: Yes, sir.

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

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

MR. KELLAHIN: Yes, sir.

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

MR. KELLAHIN: That's all there is.

EXAMINER MORROW: -- an application.

Thank you, sir. Appreciate your testimony.

THE WITNESS: Thank you.

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

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