BEFORE THE

Oil Conservation Commission

SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE NO. 391

TRANSCRIPT OF PROCEEDINGS

ADA DEARNLEY AND ASSOCIATES
COURT REPORTERS
ROOMS 105, 106, 107 EL CORTEZ BUILDING
TELEPHONE 7-9546
ALBUQUERQUE, NEW MEXICO

BEFORE THE
OIL CONSERVATION COMMISSION
STATE OF NEW MEXICO
Santa Fe, New Mexico

August 18, 1954.

IN THE MATTER OF:

Under terms of Order R-195-A (dated September 17, 1953) the Commission requested that Stanolind Oil and Gas Company appear at this time to show why the Fowler Pool should not be placed on a 40-acre spacing pattern with allowable adjustment to supersede the 80-acre spacing granted for successive one-year periods since October 1, 1952.

Case No. 391 (Continued.)

TRANSCRIPT OF HEARING

MR. MACEY: The next case on the docket is Case 391.

MR. TOWNSEND: My name is Jim Townsend, representing Stanolind Oil and Gas Company, who will also be represented in this case by Mr. J. K. Smith.

Before presenting our testimony I would like to say for the Commission and the record that this is the third hearing on this case. The first being on August 19, 1952 upon the application of Stanolind for 80 acre spacing and proration units in this field, at which time a temporary order was entered until August 20, 1953. At which time a second hearing was had and supplemental testimony and evidence was presented. The testimony and evidence we will present today will be supplemental to the previous testimony and will show that our engineering and geological concepts of this pool are substantially the same as they were at the previous hearings.

We would like at this time to incorporate by reference, the

record of those two previous hearings if there is no objection.

MR. MACEY: Does anyone object to the incorporation in this hearing of the previous testimony in this case?

MR. TOWNSEND: We will have two witnesses.

MR. MACEY: Mr. Townsend, for the purpose of the record, the evidence in the previous case will be incorporated in this case.

T O M L. I N G R A M

having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. TOWNSEND:

Q Will you please state your name?

A Tom L. Ingram.

Q By whom are you employed and in what capacity?

A Stanolind Oil and Gas Company as District Geologist of the Roswell District.

Q Have you previously testified before this Commission, Mr. Ingram?

A I have.

Q Have you previously testified as a geologist in this case?

A I have.

MR. TOWNSEND: We refer to the previous hearings for his qualification.

MR. MACEY: Very well.

Q Mr. Ingram, I will hand you Stanolind's Exhibit No. 1.

(Marked Stanolind's Exhibit No. 1, for identification.)

Q Was this exhibit prepared by you or under your supervision?

A It was.

Q Will you identify the plat which has been marked as

Stanolind's Exhibit No. 1?.

A Exhibit No. 1 is a plat of the Fowler Pool showing the leasehold ownership and the major royalty owners. The outline of the South Mattix unit, the heavy blue outline. The outline in red is that area set aside by the Commission as the Fowler-Ellenburger Pool. Where the green circles are around the 14 producing Ellenburger producing wells, the red circles are around the four Ellenburger dry holes.

Q What development has taken place since the hearing of last June?

A Two wells have been initially potentialed the Stanolind No. 9 and the No. 10 South Mattix unit and the Gulf No. 2 Plains Knight.

Q Have you previously testified as to the type of structure in this pool as reflected by this development?

A I have.

Q What is the general nature of that previous testimony?

A The general structure of the field is a thrusted, elongated, anticlinal structure with the major axis trending in a northwest, southeast direction.

MR. TOWNSEND: I ask that this be marked as Stanolind's Exhibit No. 2, please.

(Marked Stanolind's Exhibit No. 2, for identification.)

Q Have you received any information since the last hearing which would, as a result of the development that you have just testified about, which would affect your testimony and conclusions that you gave at that time?

A We have some additional development with the Gulf No. 2

Plains Knight, located in Section 23 which has been drilled and completed since that date. However, it has not changed our basic concept.

Q Have you prepared an Exhibit to reflect your present interpretation of the faulting conditions that you mentioned awhile ago?

A I have.

Q Directing your attention to the Stanolind's Exhibit No. 2, I will ask you to identify and explain it, if you will.

A Exhibit No. 2 is a continuation, or rather an extension of the Exhibit which was presented last year to incorporate the data obtained from the Gulf No. 2 Plains Knight. This section is the same as the others. It is a prepermian cross section with the lower permian from a datum of minus 3500 to the base of the permian unconformity shown in purple.

The Devonian in brown, the upper Silurian in dark blue, the Fusselman in light blue and Montoya in violet, and Simpson in green, and Ellenburger, yellow, and Precambrian in red.

The upper thrust fault, which is the one shown here, of course, is the most widely recognized in starting on the northwest end in the Humble A, B, it is found within the Simpson, and as you move to the southeast it progresses upward into the section and then the Gulf No. 2 Plains Knight is within the Fusselman. The next we have an intermediate thrust which is shown through here going through the Stanolind No. 5 South Mattix, the Gulf No. 1 and Gulf No. 2 Plains Knight. We also have a third thrust in these same two wells.

Now, this thrust is, one of these two is the same as that

encountered in the Stanolind No. 9 South Mattix unit on the northern edge of the field, and this fault is one of the limiting factors for production on the eastern side.

Q Wherein does this cross section differ from the cross section, the northeast, the northwest southeast cross section which was presented at the last hearing?

A Well, it is an extension, I mean we have added on the data between or out to the Gulf No. 2 Plains Night. We are also forced to add one more fault in the Stanolind No. 5 South Mattix unit. We thought that it was possibly present at the last hearing, but we didn't have definite evidence to put it in. With the drilling of this well, why we are forced to put in the additional fault.

Q Did you prepare and present at the last hearing a cross section from the northeast to the southwest?

A Yes, we presented one at the last hearing. It went from Stanolind No. 1 State A.A. through the South Mattix No. 6, No. 4 and No. 9 South Mattix unit.

Q You have not prepared a new cross section in that direction, for what reason?

A We have no additional data which could in any way change our concept.

Q Do you have anything further in connection with Exhibit 2 to present to the Commission? A No.

MR. TOWNSEND: I would like to have this marked as Exhibit No. 3.

(Marked Stanolind's Exhibit No. 3, for identification.)

Q Directing your attention to the map which has been marked as Stanolind's Exhibit No. 3, I will ask you to identify it, please.

A Exhibit No. 3 is a subsurface structure map contoured on the top of the producing Ellenburger within the Fowler Pool. The fault, the thrust fault on the western side of the map is the upper thrust on Exhibit No. 2. The one on the eastern side of the map is the second fault of Exhibit No. 2. The contour interval is 100 feet and is indicated by a dash line, the water-oil contact.

Q What are the factors that limit the production in this field in your estimation?

A The production is limited by the two major thrust faults and the oil-water contact.

Q What is your estimate of the oil-water contact?

A Subsea of minus 7250.

Q Upon what information do you base that?

A Drill stem test and production data.

Q In your opinion is the Fowler Ellenburger Pool in communication with the major aquiver?

A No, I don't think it is. It is based principally on the fact that we fail to find any large quantities of water.

Q Based on these Exhibits and your study, what are your conclusions as to the nature and extent of that reservoir?

A Well, the production is all coming from one segment and therefore, believed to be one continuous common source of supply.

Q Do you have anything further that you would like to add?

A I believe that is all.

MR. TOWNSEND: We would like to offer Stanolind's Exhibits 1, 2 and 3 into evidence.

MR. MACEY: Is there objection to the Exhibits? If not they will be received.

MR. TOWNSEND: That is all the questions we have of the witness at this time.

MR. MACEY: Any questions of the witness? If not, the witness may be excused.

(Witness excused.)

R O B E R T G. H I L T Z

having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. TOWNSEND:

Q Will you please state your name for the Commission?

A My name is Robert G. Hiltz.

Q By whom are you employed and in what capacity?

A I am employed by the Stanolind Oil and Gas Company as a Petroleum Engineer in their North Texas-New Mexico Division office in Ft. Worth, Texas.

Q Have you previously testified before the Commission in this case? A Yes, I have.

Q You have been qualified by the Commission and your qualifications have been accepted? A Yes, sir.

Q Would you please summarize for the Commission and those present, briefly the results of the previous hearings in this case?

A This matter was first heard on August 19, 1952, on Stanolind's application for the establishment of a uniform 80-acre spacing pattern and the adoption of 80 acre proportional allocation factors in this pool. As a result of that hearing the Commission issued its Order No. R-195 dated September 23, 1952, in which it ordered among other things, that 80 acre proration units be established in the Fowler-Ellenburger Pool. The order required, however, that the operators again appear at the regular statewide hearing on

August 20, 1953, to show cause why this field should not be placed on a 40 acre spacing pattern with appropriate allowable adjustment based on testimony presented at that hearing. The Commission issued its Order No. R-195-A dated September 17, 1953, continuing in effect for a period of one year the 80 acre spacing and proration unit order.

This order also, however, required that the operators again appear at the August 1954 hearing to again show cause why this field should not be placed on a 40 acre spacing pattern with appropriate allowable adjustment.

Q Was there any opposition by any operator to the application which was filed for 80 acre spacing in this pool at either of the previous hearings?

A No, at each of the two previous hearings all interested parties who made appearance indicated their agreement with our recommendations. At no time has anyone indicated any opposition to this plan of proration for the Fowler Pool.

Q What development has taken place in the pool since the date of the last hearing?

A As Mr. Ingram has previously testified, three wells have been officially completed subsequent to the last hearing. The South Mattix unit Wells No. 9 and 10 were officially completed although information on them was available at the time of the last hearing and Gulf has completed their Plains Night No. 2 Well as a dry hole.

Q Have you prepared an up-to-date completion schedule of all the wells in the Fowler Pool? A Yes, I have.

MR. TOWNSEND: We will ask that this be marked as Exhibit

No. 4, Stanolind's Exhibit No. 4.

(Marked Stanolind's Exhibit No. 4, for identification.)

Q Will you please state briefly what this exhibit shows?

A It is simply a tabulation of pertinent completion data on all 14 of the producing wells completed to date. The information reflected by this exhibit is the ownership of the well, the elevation, the top of the Ellenburger for each well, the total depth to which it was drilled, the oil string casing set, the original completion interval of the well, the type and amount of stimulation, the date the well was completed, and pertinent data from the initial potential test.

Q Since the last hearing has additional data relative to the performance of this reservoir been obtained?

A Yes, it has. We have prepared this information in graphical form to be submitted to the Commission.

MR. TOWNSEND: I ask that this be marked as Stanolind's Exhibit No. 5.

(Marked Stanolind's Exhibit No. 5, for identification.)

Q Will you please state for the record what this exhibit reflects?

A This exhibit is simply a graphical illustration of reservoir performance as a function of time since the discovery of the field. We have indicated on the graph first at the top, the curve outlined in yellow, the fieldwide bottomhole pressure as determined from periodic bottomhole pressure surveys.

These data indicate that the pressure at the time of the last survey in April of this year, was on an order of about 2650 pounds. I should like to point out that this exhibit differs in

one respect from other exhibits previously presented to the Commission, and that is in reference to the datum plain to which all pressures are corrected. Previously we had been using a datum of minus 6359 feet. That was a datum selected early in the life of the field before there was a great deal of development. We didn't desire to change the datum plain until sufficient information was developed on the configration of the reservoir to select a suitable datum near the mid pay.. We have now changed the datum from minus 6980 feet as indicated on the curve. All bottomhole pressure that we will testify to today has been corrected to the new datum near the mid part of the pay. The second curve simply reflects the number of producing wells as a function of time. The blue curve simply illustrates the solution gas-oil ratio of the crude in this field as obtained from bottomhole samples and analysis.

The solution at the saturation pressure was 1020 cubic feet per barrel. Gas-oil ratios as measured on the latest Commission survey indicates that the average field gas-oil ratio is considerably below the solution ratio. So we have simply indicated what the theoretically correct gas-oil ratio should be at this time. The red curve reflects cumulative withdrawals as a function of time to date. It indicates that total production to this time has been on the order of 2,150 barrels. The green curve reflects oil producing rates by months.

The lower green curve indicates the water production in the field as a function of time to date. I would like to comment there that the water production has not been significant to this time in the reservoir. One other comment I would like to make is that to date the reservoir is still producing at a pressure above the

saturation pressure.

Q What was the basis for this pressure information?

A The pressures were obtained from periodic surveys that were required by the Commission in the orders previously issued on this Pool.

Q Have you prepared in tabular form the results of these pressure surveys?

A Yes, we have prepared the available pressures in tabular form to be submitted to the Commission.

MR. TOWNSEND: We would like to have this marked as Stanolind's Exhibit 6.

(Marked Stanolind's Exhibit No. 6, for identification.)

Q Based upon your analysis, Mr. Hiltz, of the reservoir performance to date, have you reached any conclusions?

A Yes, based on the analysis of all the information that is available to me, I have concluded that this reservoir is producing essential under volumetric control. Since the average field pressure is still above the saturation pressure, it is apparent that all the production to date has been as a result of the expansion of the liquid in the reservoir.

Q Has any information been acquired since the last hearing which would alter or modify your previous conclusions or concepts regarding this reservoir? A There has not.

Q Directing your attention to Order No. R-185-A, dated September 17, 1953 about which you previously testified, such order provides for 80 acre proration units and in effect, for the spacing of wells on an 80 acre spacing pattern. Would it be your recommendation that the establishment of 80 acre spacing and 80

acre proration units be made permanent?

A Yes, and I should like to comment that all development in the field to date has conformed to the spacing and proration unit pattern established by those orders.

Q What was the nature of the testimony presented at the previous hearings to support an order for 80 acre spacing and for 80 acre proration units?

A We put considerable testimony in the record to show that there would be no significant difference in the ultimate recovery from this reservoir whether it be developed on a 40 acre or 80 acre spacing pattern.

Q In your opinion will one well in the Fowler-Ellenburger Pool efficiently and economically drain 80 acres?

A Yes, it will.

Q Briefly, what testimony did you present or has been presented to support that conclusion?

A Well, at the original hearing held in August of '52 we presented data to show that using well known and generally accepted principles governing the flow of viscous fluids through permeable media, it is possible to calculate the effect of well density on ultimate recovery and utilizing this procedure and all of the physical factors available for the Fowler-Ellenburger Pool, it was demonstrated that there would be no significant difference in the ultimate recovery in this particular field whether it be developed on 40 or 80 acres. In making these calculations, however, we pointed out that there was only one critical assumption, that being that the permeability development or communication throughout the reservoir did exist. That it was one continuous reservoir.

Q What information was submitted to the Commission to validate that assumption?

A In order to determine whether or not this condition existed, an interference test was initiated in March of 1951. The results of this test as presented in previous hearings clearly indicated that there was good communication between wells in this field and that one well would efficiently and adequately drain 80 acres.

Q What other information do you have to demonstrate the fact that there was a, is continuous permeability development in this reservoir?

A Well, we have previously presented information to show that in addition to this particular interference test, that the initial pressures on wells drilled in the field were almost identical to the existing average field pressure at the time they were completed and prior to the time that any significant amounts of production were taken from these new wells. Since these initial pressures were indicated to be approximately equal on the average reservoir pressure, we felt that they offered additional confirmation of the fact that the area in the vicinity of the wells was being efficiently and adequately drained.

Q What is the cumulative result of all these data?

A It is that excellent communication does exist throughout the reservoir and one well will efficiently drain 80 acres.

Q Has the interference test been continued since the last hearing? A Yes.

Q Have you prepared or caused to be prepared an exhibit reflecting the results of that test down to the present time?

A Yes, I have.

MR. TOWNSEND: I would like to ask that this be marked Stanolind's Exhibit No. 7.

(Marked Stanolind's Exhibit No. 7, for identification.)

Q Directing your attention to Exhibit 7, will you please explain to the Commission what it shows?

A This is a graph as a function of time showing the complete results of this interference test to which we have referred since its initiation in March of 1951. To orient the Commission, I should like to point out that we have a key map of the Fowler-Ellenburger Pool showing the well which has been utilized in the test. That is a South Mattix unit No. 3 well at this location. Under Commission order we were permitted to shut this well in in March of 1951 and transfer and distribute its allowable to other wells within the field. Periodically bottomhole pressures were taken in that interference well. These pressures as measured in the interference test well are reflected by the green curve shown here. The individual black dots represent the actual pressure measurements while the solid line, of course, represents the best trend through those points.

At the same time we have been taking periodic complete field wide surveys on all wells in the field. The data obtained from these surveys is shown by the small x's indicated as I am pointing out here. The best trend through those points is indicated by the yellow line shown here. I should like to point out that we have very significant results from that test in that the pressures measured on the interference test conformed as a function of time

almost identically to the average field pressures measured on the other wells in the field, very clearly showing that the area in the vicinity of the interference test well was drained at almost identically the same rate as the remainder of the field, demonstrating there was excellent communication and no question about continuous permeability development.

Another thing which we observed to extrapolate that line of thinking to the line of the field, was to determine the initial pressures on new wells in the field. These pressures are shown by the red dots. It is readily apparent that the initial pressures on the new wells conform almost identically to the average field pressures existing at that time. In all probability, the deviations can be attributed to minor errors or differences in measurements on the different bottomhole pressure devices used. So we have these factors to indicate clearly that the communication certainly is there. As a matter of fact, I consider this one of the best indications of complete communication which I have ever seen.

Q What does the blue curve show?

A The blue curve reflects the cumulative withdrawals from the field from the time at which the test was started to date.

Q What is the cumulative withdrawals as of today, the present time?

A From the time the interference test begun to date, the cumulative withdrawals have been on the order of almost two million barrels, which represent a large portion of the production from the field to date.

Q Have you had prepared another exhibit in connection with the bottomhole pressures as against these cumulative withdrawals?

A Yes. I would like to point out what our objective is in showing the additional exhibit. That is some confusion or misunderstanding might result from the fact that we are indicated to have during the latter part of 1952 a sharper or accelerated rate of pressure decline in the field, and since this field is producing above the bubble point, I would like to illustrate when you plot the pressure data as a function of cumulative withdrawals, that this apparent acceleration of pressure decline is due to additional development and increased rate of withdrawals.

MR. TOWNSEND: I would like to have this marked as Stanolind's Exhibit 8.

(Marked Stanolind's Exhibit No. 8, for identification.)

Q Would you identify and explain this graph please?

A This is a graph bottomhole pressure versus cumulative withdrawals. Reminding you that the other curve is a function of time, when you plot the interference test well pressure as indicated in orange along with the average field pressure as indicated by the green squares, it is apparent there is a straight line decline in bottomhole pressure throughout the producing life of the field when plotted as a function of the cumulative withdrawals.

From this we can conclude that this reservoir is performing exactly as it would be expected to above its saturation pressure.

Q Based on your study of this pool and the data about which you testified, what are your general conclusions?

A Well, I have concluded that this is a single common source of supply with good communication throughout. I think that the data that we have presented conclusively show that one well in this field will efficiently, adequately drain an area of at least

80 acres.

Q What has been the average cost of wells drilled in this field to date by Stanolind Oil and Gas Company?

A Of the 14 completed producing wells in the field, Stanolind has drilled ten at approximately cost of $230,000 each.

Q Do you believe then, that the drilling of additional wells is necessary?

A No. In my opinion the drilling of additional wells on a closer spacing pattern in this field is completely unnecessary. The investment which would be required to drill those wells would be a complete economic loss.

Q If an order were issued by the Commission requiring that this field be developed on a pattern of 40 acres per well, approximately how much additional investment would be required by the operator?

A Recognizing the fact there are now 14 producing wells and assuming that 14 additional wells could be drilled on 40 acre spacing pattern, it is estimated that an additional investment in this field would be on the order of three million dollars to drill those 14 wells. In my opinion, that is unnecessary and a loss.

Q Based upon these conclusions that you have mentioned, what are your recommendations to the Commission as to a permanent spacing and proration order for the Fowler Pool?

A Well, it is my recommendation that the Commission issue a permanent order providing for 80 acre proration unit and the spacing of wells on an 80 acre pattern.

Q Have you had prepared a proposed permanent order which you recommend that the Commission enter?

A Yes, I have.

MR. TOWNSEND: I ask that it be marked as Stanolind's Exhibit No. 9.

(Marked Stanolind's Exhibit No. 9, for identification.)

Q Will you briefly review the recommendations which are made in this order?

A I should like to point out first that I believe on Stanolind's Exhibit No. 1 we had indicated the currently accepted field limit as designated by the Commission. In light of the fact that there currently is another well drilling in the field, we felt that perhaps it would be advisable at this time to enlarge the field limits to include two additional quarter sections in the field. If I may refer to Stanolind's Exhibit 1, I would like to identify that acreage. It would be our recommendation that in view of the fact that this well is now being drilled here, that the field limits be enlarged to include the northeast quarter of Section 27, and the northwest quarter of Section 26.

Q What do you mean by this well? Where is that located?

A That is the Stanolind South Mattix Unit No. 12 drilling in the southeast quarter of the southeast quarter Section 22. This order essentially is identical to the previous orders that have been issued by the Commission. It would require that all wells drilled in this pool be located in the center of either the northwest quarter or the southeast quarter of each governmental quarter section with a permissible tolerance of 150 feet to avoid surface obstructions.

I should like to again comment that all of the development in this field to date has conformed to that development pattern.

It would also require that, or permit the operator to designate at his own discretion the proration for each well as being either the north half or the south half or the east half and west half, governmental quarter section on which the well is located. It provides that no well would be drilled in this field except in conformance with the spacing and proration unit pattern set out without special order of the Commission after due notice and hearing, so the order does provide that exceptions may be granted after hearing.

It also provides that individual well allowables drilled in conformity with this spacing pattern should be established in accordance with the 80 acre proportional allocation factors which are provided for in the Commission's Rules and Regulations.

Q What is the last provision?

A The last provision is that a bottomhole pressure survey would be taken in May of each year and the results submitted to the Commission by the 5th of June each year.

Q Do you recommend to the Commission that this order be entered?

A Yes, I do.

Q As a permanent order for the Fowler-Ellenburger Pool?

A Yes.

MR. TOWNSEND: That is all the evidence we have. We would like to offer the Exhibits No. 4 through 9 inclusively.

MR. MACEY: Is there objection to the introduction of these Exhibits? If not they will be received. Any questions of the witness?

By MR. MACEY:

Q How many operators are there in the Pool?

A In the Pool there are three. Stanolind Oil and Gas Company as operator of the South Mattix and the Gulf and Humble.

Q Has Stanolind or any of the other operators in this Pool considered the feasibility of secondary recovery program?

A Stanolind, as operator of the South Mattix Unit, has recently completed a preliminary investigation which will lead to a determination of the desireability of secondary recovery in this field. This report has very recently been submitted to the other operators in the South Mattix Unit for their consideration and their comments, and should they reach a conclusion that further study is warranted or that secondary recovery should be initiated, steps would then be taken to see that such a program is initiated.

MR. MACEY: Are there any further questions? If not the witness may be excused.

(Witness excused.)

MR. HINKLE: If the Commission please, Clarence Hinkle representing Humble Oil and Refining Company.

The Humble has one well, I believe, in the Fowler Pool. The Humble would like the record in this case to show that they are in accord with the showing that has been made here by the Stanolind and their recommendations that this field be continued on an 80 acre spacing and proration basis.

MR. MACEY: Are you through with your case?

MR. TOWNSEND: That is all we have at this time.

MR. WALKER: Don Walker with Gulf.

We are the operator of the other three wells and we would like to concur with Stanolind in asking for a permanent order for 80 acre spacing.

MR. ADAMS: M. R. Adams with Continental.

We would like to concur with Stanolind in their request today.

MR. TOMLINSON: W. P. Tomlinson with Atlantic.

Atlantic concurs with Stanolind's recommendations.

MR. MACEY: Anyone else?

MR. SMITH: I have a brief statement. J. K. Smith with Stanolind.

This is a third hearing on this matter and each of the hearings has substantiated the initial conclusions that we have made. We think that enough evidence has been submitted to definitely warrant the issuance of a permanent order. There has been no opposition at any of the hearings to the proration pattern or spacing pattern, and it is our considered opinion that the field has been substantially developed, that there will be no necessity for any further testimony to change the spacing or proration pattern. If, in the event additional evidence is developed which would warrant some exceptions, why that could be taken care of easily by the operator calling a special hearing and after notice and hearing, the appropriate order can be entered.

MR. MACEY: Does anyone have anything further in this case? If not the case will be taken under advisement.

C E R T I F I C A T E

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings in the matter of Case No. 391 were taken by me on August 18, 1954, that the same is a true and correct record to the best of my knowledge, skill and ability.

Ada Dearnley
Reporter

BEFORE THE
OIL CONSERVATION COMMISSION
STATE OF NEW MEXICO

CASE 391: (Continuation) Under the terms of Order R-195, the Oil Conservation Commission requested Stanolind to appear at this time to show cause why the Fowler Pool should not be placed on a 40-acre spacing pattern with allowable adjustment to supersede the 80-acre spacing granted by the order for a period of one year.

TRANSCRIPT OF HEARING

August 20, 1953

BEFORE: Honorable Ed. L. Mechem, Governor
Honorable E. S. Walker, Land Commissioner
Honorable R. R. Spurrier, Director, OCC

STATE OF NEW MEXICO)
) ss.
COUNTY OF LOS ALAMOS)

I hereby certify that the within transcript of proceedings before the Oil Conservation Commission is a true record of the same to the best of my knowledge, skill and ability.

TRANSCRIBED at Los Alamos, New Mexico this 21st day of August, 1953.

Audrey M. Henrickson
Notary Public

My Commission Expires September 22, 1955.

NEW MEXICO OIL CONSERVATION COMMISSION

Regular Hearing

9:00 a.m., August 20, 1953

MR. SMITH: J. K. Smith, Stanolind Oil and Gas Company. At this time, I should like to inquire of the Commission if they will consider this a continuation of the meeting - - hearing held one year ago and we offer in evidence at this time, all of the testimony and documentary evidence submitted at that hearing.

I will submit the additional testimony and evidence showing the physical facts that have occurred since the date of the last hearing. Will the Commission accept our proffer of the evidence at the earlier hearing?

MR. SPURRIER: Certainly.

MR. SMITH: All right. I have two witnesses, Mr. Ingram and Mr. Hiltz, both of whom testified at the previous hearing.

TOM L. INGRAM,

having been first duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. SMITH:

Q. Will you state your name, please?

A. Tom L. Ingram.

Q. Mr. Ingram, I believe you testified for Stanolind Oil and Gas Company at the hearing a year ago involving application by Stanolind Oil and Gas Company for 80-acre spacing in the Fowler field.

A. I did.

Q. What is your present position with Stanolind Oil and Gas Company?

A. District geologist at Roswell.

Q. That's the same position you occupied at the time of your earlier testimony?

A. That's correct.

Q. Now, Mr. Ingram, since the last hearing, how many additional wells have been drilled in the Fowler field?

A. Six additional wells have been completed from the Ellenberger and two have indicated production and are now in the process of being completed and three others have been dry holes in that formation.

Q. From these additional wells you have acquired additional geological information, isn't that correct?

A. We have.

Q. Do you have any exhibits which reflect the information that has been developed?

A. We have here a large plat which shows the development that has taken place within the last year. Those wells that have been completed as producers are circled in red, with a solid red center; the two that are in process of being completed are circled in red and the three dry holes are indicated with the appropriate symbols.

MR. SMITH: I would like to have this marked as Exhibit 1 and offer it in evidence at this time.

MR. SPURRIER: Is there objection? Without objection, it will be admitted.

Q. Stanolind's Exhibit 1, as you have testified, indicates the additional wells and dry holes that have been drilled since the last hearing. What is the - - is significant with reference to the pattern as developed as a result - - -

A. To determine the area of the field.?

Q. Yes.

A. Well, the additional data that we have now we are better able to define the two major factors which control the field. Namely, two major thrust faults and the oil-water contact. In arriving at the solution of this problem, we have prepared three cross-sections of the field.

Q. Do you have those with you?

A. I do.

Q. If you will hand them to me, we will have them marked as Exhibit 2, 3 and 4.

(The exhibits were then marked for identification)

Q. Mr. Ingram, I am going to ask you to refer to Exhibit 2 and explain the - - what this exhibit identifies?

A. Exhibit No. 2 is an extension of the exhibit that was presented at the previous hearing, with the additional wells that we now have;on all of the sections we have shown Permian from a datum of minus 3500 feet to the basal Permian unconformity which is the violet color, the Devonian in brown, Upper Silurian in dark blue, Fusselman in light blue, the Montoya in lavender, Simpson in green, Ellenberger in yellow, and the pre-Cambrian in red.

This section extends in a northeast-southwest direction through the Humble No. 1 State "AB", the Stanolind No. 6, 2, 3 and 5 and the - - number 3 and 5 South Mattix and the Gulf No. 1 Plains Knight.

From this section as shown in the preceeding hearing, we showed two major thrust faults. The upper one, shown in the "AB", in the Simpson, progesses upward through all of the wells in the Gulf to the Fusselman. The lower fault is shown as having penetrated in only two wells, the Stanolind No. 5 South Mattix and the Gulf No.1Knight - - Plains Knight. This fault is important in that it does remove the lower part of the regular converted in the field. In the Stanolind well, we went back into the Simpson and then penetrated the Ellenberger and in the Gulf well, there was actually no separation in the Ellenberger. However, the production from this entire Ellenberger in all of the wells is from a continuous common source.

Q. Do I understand that the Stanolind No. 5 was completed at the time of the last hearing?

A. Yes. That is correct.

Q. And you encountered water from the Ellenberger, is that correct?

A. In the Ellenberger, in the base portion. In the second Ellenberger.

Q. Now, in the Gulf No. 1, you found no intervening evidence as to the faulting condition which indicates that you have continuous communication all the way through the entire Ellenberger. Is that correct?

A. That is correct.

Q. Do you know where the Gulf was completed - both in the Upper and basal Ellenberger or in one of the other?

A. They have perforations in both the upper section and in the upper part of the lower section.

Q. All right. I'd like to refer you now to Stanolind's Exhibit No. 3 and ask you to explain what this exhibit identifies.

A. Exhibit No. 2 extends in a northeast-southwest direction and includes the Stanolind No. 6 South Mattix and is at right angles to the previous exhibit. This section includes the Stanolind No. 1 State "AA", No. 6 South Mattix, No. 4 and No. 9 South Mattix. From this section, the upper fault was encountered in the Stanolind No. 1 State "aa" about 40 feet below the top of the first Ellenberger. Now this Ellenberger is not that - - A small portion of Simpson was repeated before reaching the regular Ellenburger. Water was recovered on the first drill stem test taken from this usual pay.

The fault then progresses on upward through the No. 6 and No. 4 South Mattix Units and is truncated at the base of the Permian before reaching the No. 9 South Mattix. The lower fault was cut in only the No. 9 South Mattix Unit and is shown in that unit and while it was not in any of these other wells, if they had been drilled sufficiently deep they would have been encountered . However, its presence, as mentioned regarding the previous section, would probably be found in the granite in the other wells. The pay in the No. 9 was found in the upper-most segment of Ellenburger immediately above the fault. Thus the limits of production as found on this section are controlled on the southwest

by water in the No. 1 State "AA" and on the northeast by the fault in the No. 9 Mattix.

Q. From this have you come to any conclusions as to the limits of the - - of production? Or will it be necessary to refer to Exhibit No. 4?

A. I think it would be better to look at Exhibit No. 4.

Q. Will you explain Exhibit No. 4.

A. The third section is parallel to the first and passes through the Gulf No. 5 Carr, Stanolind Nos. 5 and 10 South Mattix and Humble No. 1 Knight. The Gulf well was the first one in the field to obtain water on a drillstem test from the regular producing formation. Its water was encountered on a drillstem test from 10510 to 10570 feet. This interval laps the now established water level of minus 7315 feet. The upper faults on this exhibit are shown only in the Gulf No. 5 Carr, and then it is truncated at the base of the Permian before reaching the other three wells.

The lower fault would have probably been penetrated in the Gulf well in the lower part of the Ellenberger had it been deepened to this point. Its relationship to the Stanolind No. 9 South Mattix Unit is the same as was discussed in the preceeding exhibit. It would probably have been penetrated in the No. 10 South Mattix the same as in the Gulf No. 5 Carr. While drillstem tests indicated the upper portion of the Ellenberger in the Humble No. 1 Plains Knight to be devoid of porosity, later production tests proved this section to contain water. Thus the lack of production in this well may be

attributed to encountering the Ellenberger pay below the water-oil contact.

Q. Now, Mr. Ingram, from the cross-section which you have just exhibited to the Commission or testified about, are you able to come to a conclusion as to the source of production in the Fowler Field - Ellenberger?

A. From the three sections, it may be concluded that the production in the Fowler Field is coming from an Ellenberger which is one continuous, common source of supply.

Q. There is communication throughout the entire field?

A. That is correct.

Q. Now, have you any conclusions to offer to the Commission as to the relative limits of the field at this time?

A. We have.

Q. I would like you to refer to that which has just been marked as Stanolind's Exhibit 5 and ask you to explain this exhibit to the Commission.

A. Exhibit No. 5 is a sub-surface structure map which is contoured on the top of the Ellenberger that is producing in the field. In those instances where the first and third Ellenbergers have been penetrated are omitted. The fault shown on the western side of the map represents the upper fault to the point where, we believe, separates the pay-producing Ellenbergers. Its trace is indicated where the top of the Ellenberger would be cut by this fault, assuming that the dip of the fault and beds remained constant. The fault on the eastern

edge is the anticipated innersection of the lower fault with the same pay.

We believe that the productive limits of the Ellenberger pay will be found between these two faults where the top of the Ellenberger is encountered above the water table. Otherwise, it would be controlled by the water table. Subsequent drilling will give us the additional data to define the field.

Q. Now those fault lines are identified on the map as UD on the west and CD on the east, is that correct?

A. Well, the UD stands for the upper side of the fault - -

Q. But it's the line UD - - -

A. That's right.

Q. Now, what about the situation with respect to the north end of the field?

A. From the standpoint of possible future production?

Q. From the standpoint of possible future production.

A. We believe that the data is fairly well established on the northwestern end. The producing section on that por tion is becoming increasingly thin. We believe that there might possibly be one more well.

Q. What is the situation with respect to the south of the field?

A. Well the southwestern end has two dry holes and the only possibility would be with reference to extreme southern end of the field. Information there is still incomplete at this time. The western end is pretty well defined and we believe that in the

future, additional development will give us further data.

MR. SMITH: I have no further questions.

MR. SPURRIER: Does anyone have any questions of the witness?

MR. MACEY: You said that you established oil-water contact in the Carr?

A. Yes.

MR. MACEY: Will you tell me what that is with respect subseepage?

A. Somewhere between a minus 7010 and 7300. That is based on Gulf No. 5 Carr and the Humble and the No. 7 South Mattix. On the tests, they began to make some water

MR. MACEY: On the Humble Knight , did it encounter the Ellengerger at the Oil-water contact?

A. Yes. On tests that were taken down through the Ellenberger, no water was encountered. But they ran a pipe and perforated it and found that the entire section had water.

MR. SMIT H: Is there any production of water in the field at this time?

A. To my knowledge, no.

MR. SPURRIER: Are these top allowable wells?

A. Yes, they are. - - I guess so. I shouldn't be testifying.

MR. SMITH: Mr. Hiltz, do you know?

MR. HILTZ: Yes, all the wells in the field are capable of making top allowable.

MR. SPURRIER: Does anyone else have a question of this witness? If not, the witness may be excused.

R. G. HILTZ,

having been first duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. SMITH:

Q. Will you state your name, please?

A. R. G. Hiltz.

Q. Are you the same R. G. Hiltz who testified at the earlier hearing?

A. Yes, I am.

Q. What is your position?

A. I am a petroleum engineer for Stanolind Oil and Gas Company, in the north Texas-New Mexico field stationed in Fort Worth.

Q. You are familiar with the testimony formerly advanced and I would ask you to refer to what is marked for iddntification as Stanolind Exhibit No. 6.

A. This exhibit was previously introduced by Stanolind at the previous hearing held in August, 1952. We refer to it at this time in order to tie the two hearings together in the interest of continuity. At the hearing held in August, 1952, in considering at that time 80-acre spacing, to demonstrate to the Commission that if this field were developed on 80-acres, there would be no significant difference in the recovery than could be expected if the field were drilled on 40-acre spacing.

Now the basic approach that we use to demonstrate that was the fact that through well-known principles, we can calculate the effect of the density of drilling on the recovery. Now in the Fowler

Field, we had reliable analyseson certain characteristics - rock characteristics and utilizing this data, we were able to show that the range of productivity of the wells that had been completed in the Fowler Field that there would be no significant variation in recovery.

Now, at that time, wells had been completed - six to be exact, which Stanolind had conducted these tests on. The range of productivity of those wells was from 1 to 10. And we demonstrate by this exhibit that ger that range of productivity that the alternate recoveries on the two spacing patterns, 40 vs. 80, would be very small. As a matter of fact, a range of productivity of ten barrels per day between the 40 and 80 acres would only have been 8/100ths of 1 per cent of the original oil. Now this difference, we consider insignificant and would in so way justify the drilling of an additional well.

Q. Now, additional wells have been completed in the field since the last hearing and I believe that interference tests have been completed too, isn't that right?

A. Yes. Over a period of a year, subsequent to the last hearing, we have continued to observe and record water preformance and conducted a series of tests which we feel confirm our previous conclusion.

Q. I show you what has been marked for identification as Stanolind's Exhibit No. 7 and ask you to explain to the Commission what itidentifies.

A. I would like to point out prior to discussing this exhibit that additional data has been compiled which in every sense corroborates the characteristics of the rock itself which was previously observed,

through core data, sample analysis, and Pi tests. So we can assume looking at this exhibit and the next one that there is no difference in the rock characteristics that would have any significant effect. Our objective here is to supplement the previous data with additional information to show how we confirmed the conclusion which we reached based on these calculations.

Now, on this exhibit, we have shown here the number of wells completed and the six additional wells completed in the field, as reflected by this graph. In addition, we have shown on this graph the monthly producing rate of all wells in the field. At the time of the last hearing, the monthly producing rate in the field was approximately 30,000 barrels per month. With the completion of six additional wells doubling the number of wells in the field, an increase in the allowable put into effect October 1st, 1952, the allowable was increased to 170 barrels per day to conform with the state-wide rule of 80-acre spacing which would be 215 barrels per day. The combination of those two factors resulted in the increase of the rate of withdrawal from 30,000 barrels per month to 70,000 barrels per month. That is also reflected in the recovery curve as shown, that the increase has been more rapid than last year.

We have also indicated on here the bottom hole pressure performance tests as recorded up to the last hearing and subsequent to that time.

Q. What part indicates up to the last hearing?

A. This is exactly the same - except that it has been continued and there is no change in the - - - At the time of the last hearing,

we had bottom hole pressures through approximately June of that year. Subsequent to that time, at the direction of the Commission, field bottom hole pressures surveys were conducted in November, 1952 and of April, 1953. The results of this survey as shown by these two points on the curve. It will be noted that they show what would appear to be an accelerated rate of decline of pressure. However, in order to understand the decline in bottom hole pressure, we have to take into consideration the fact, of course, that the rate of withdrawal has virtually doubled. So that the actual relationship between withdrawal from the field and the bottom hole pressure decline is exactly what you would expect at present. This can be further illustrated by cumulative recovery versus bottom hole pressure. When you see that, you get a perfectly straight line. And that is exactly what you would expect.

Q. From these figures then, there would be complete communication throughout?

A. Yes. But perhaps to express it a bit more clearly, the bottom hole pressure information should clarify that point. I would like to point out one other curve on here. The gas ratio performance continues to follow the same pattern. The bottom hole pressure, as of the last survey, done in April, indicates that the pressure was 3170 pounds. Now that is still well above the pressure for the field which is 2406 pounds, and in conjunction with the fact that we are producing well above the margin. The gas-oil ratio has followed what you would normally expect. The gas-oil ratio as measured in the tests has continued to be at or below the solution rate.

We have also noted on here water production in the field to date. There has been very little water produced in the field and only attributed to two wells. Upon initial completion of the Humble AT No. 1, it did not produce water. But I understand that soon after completion, it began to make water at the rate of approximately one to two thousand barrels per month. We have also illustrated on here the oil production history to date. That information is introduced today as part of this hearing, since order granting this temporary 80-acre spacing order required the operators to submit a complete record which is reflected by this exhibit. However, I understand that in February of this year, Humble completed work operations, plugged the well back and were successful in completely shutting off the water in that well. Other water production is attributable to South Mattix well No. 7 which upon completion produced a small quantity of water. However in June of this year, they also completed work-over operations, plugged back the well, and that well is not now producing water. So as, Mr. Ingram said, there are no wells producing water.

At this time, I would like to bring out another point with reference to this plat and that is the bottom hole pressure performance history to date leads us to the conclusion that there is no water drive in the field.

Q. Now, Mr. Hiltz, I show you that which has been marked for identification as Stanolind's Exhibit 8 and as k that you refer to it and explain the various curves appearing on this graph.

A. Well, referring briefly again to Exhibit No. 10 which shows the relationship between wells and recovery, inmaking those

calculations, that were necessary, there was only one assumption that had to be made which had any effect whatsoever and that was the fact that we had continuous porosity and permeability throughout the productive limits of the field. In order to validate that assumption, we initiated in March, 1951, with the Commission's approval, interference tests. At that time, the South Mattix Unit well No. 3 was making allowables transferred to other wells in the field. Pressures were measured periodically on the shut-in well and they were recorded, on this exhibit. At the time of the last hearing, we had information through July, 1952. The data at that time clearly indicated that the vicinity of the No. 3 well was being adequately drained by withdrawals from other portions of the field. It showed that very distinctly by the bottom hole pressure.

Now, we have added to that/this curve year, for clarification purposes, and superimposed the actual field bottom hole pressures on that curve. The field bottom hole pressures are in red and the interference well pressures are the blue curve. It will be noted that where field withdrawals are relatively small, the two curves coincided almost identically. The scale on this graph is very small. Each one of these represents only 50 pounds pressure. So here is the proof that the area at that time was adequately drained.

Q. Will you explain the point of deviation between your red and your blue lines which indicates that there is more pressure on your red line than there is for your blue line?

A. I would like to first point out that subsequent to that time, we had continued that interference test. At the same time, we

have made a field bottom hole pressure survey. The great curve here reflects the identical information shown in a previous exhibit. I point out the superimposed on this curve to illustrate the fact that information obtained from the interference well and the actual field average test, that the two curves virtually coincide. Now, the small difference between the curves can be attributed principally to the fact that the interference test has virtually been at stabalized, equalized pressure area and that pressure conducted on the other wells in the field during the regular bottom hole pressure survey may not have reached a complete build-up. The tests were conducted over a period of 48 hours, whereas data obtained from productivity tests conducted on several wells indicated that not all the wells reached the peak during a 48-hour period. However, the information is conclusive enough to show that even where you do have slight differences in build-up , there is an average pressure for all the wells in the field.

Now, supplementing that, we also obtained from four wells that have been completed in the last year , initial pressures and those pressures are shown here in Gulf Lilli No. 1, the South Mattix Unit No. 7, the Gulf Carr No. 5 and the South Mattix Unit No. 8.

Now, in each case, it will be noted that pressures, the initial pressures on these wells, is reflected in the withdrawals on the curve, and conform exactly to the field average pressure at the time. The only significant difference would be attributed to the amount of withdrawals taken from the wells. This would indicate that the areas of the new wells could be adequately drained prior to the time they were drilled, illustrating clearly that the entire reservoir is being adequately drained by the

present spacing pattern.

Q. In other words, to point up your testimony here, the very last well was completed falls almost exactly upon the curve of your interference well?

A. That is correct.

Q. And that the bottom hole pressure there and as well as other wells in the field is almost the same as the date of completion of the last well?

A. Yes. That is correct.

Q. I ask you to refer to Stanolind's Exhibit No. 9, which is entitled Bottom Hole Pressures, 1952 Survey and 1953 Survey.

A. Yes, these are the tabulated results of bottom hole pressure surveys which have been conducted on all wells in the field that were completed at the time of the survey. This is in accordance with the Commission's request, which is encorporated in the graphs presented.

Q. I show you what has been marked for identification as Stanolind's Exhibit No. 10, entitled List of Completed Pressures, Fowler Field which the Commission has also indicated they would like to have.

A. This is presented at this hearing, although the Commission did not require it, we feel it is very valuable in pointing out the fact that the area was being adequately drained prior to the time of completion. These are all the data on the wells.

Q. Mr. Hiltz, based upon your testimony at the previous hearing and this hearing too, is it your conclusion that the Fowler Ellenberger Field is one of complete communication and that the amount of

ultimate recovery as reflected by 40-acre spacing as against 80-acre spacing is of such an amount as to be relatively insignificant?

A. Yes. I think this is one continuous reservoir and that all the wells completed to date are producing from a common source. The reservoir is being adequately drained by the present wells on an 80-acre spacing pattern, and that the bottom hole pressures will not justify the drilling of additional wells.

Q. Has the data more or less established that the order of magnitude as reflected by the respective productivity is consistent with the actual facts that exist?

A. Yes, that's true. The interference test data and all reservoir and rock characteristics corroborate our previous conclusion.

MR. SMITH: I have not further questions.

MR. SPURRIER: Does anyone have a question of the witness?

MR. MACEY: Mr. Hiltz, you have not completed your No. 9 and No. 10 wells, yet?

A. They are now in the process of completion. I believe the No. 9 well is actually starting production.

MR. RHODES: I think the Commission would like some permeability information.

A. At the hearing held in August 1952, we introduced all the information that we had relative to permeability at that time. I believe that information was illustrated on Stanolind's Exhibit, I believe it was Stanolind's Exhibit No. 9. I could get that exhibit out for you, but I believe you will find, if you refer to that exhibit, that you will find the figures of the actual permeability measurements

and the core analysis as well as permeability value as calculated from productivity tests. Subsequent to that time, all the information that we have obtained indicates that the rock characteristics as learned from the new wells are equally comparable to that which we observed previously.

MR. SPURRIER: Anyone else? Do you have anymore witnesses, Mr. Smith?

MR. SMITH: No, sir.

MR. SPURRIER: Mr. Macey would like to ask Mr. Ingram some questions and I think perhaps of Mr. Hiltz. But I suggest that we take a ten minute break before we continue.

(TEN MINUTE RECESS)

MR. MACEY: Mr. Ingram, with reference to your Exhibit 1, you identified that exhibit as a lease ownership and land status plat. That exhibit shows the working interest holders only, is that correct?

MR. INGRAM: It shows those that own the deep rights.

MR. MACEY: Now, what I would like to ask you first of all is who is the owner of the $S\frac{1}{2}$ of the $S\frac{1}{2}$ of the $SW\frac{1}{4}$ of Section 14?

MR. INGRAM: I believe that that is Humble.

MR. MACEY: Now, with respect to the spacing pattern that you're operating under in the Fowler Pool, the wells are located in the NW and SE quarter of each quarter section, is that correct?

MR. INGRAM: That is correct.

MR. MACEY: There has been a dry hole drilled in the NW quarter of the SW quarter of Section 14, is that correct?

MR. INGRAM: Yes.

MR. MACEY: And the only well under the spacing pattern which could be drilled in the SW¼ of Section 14, would be in the SE¼SW¼, is that correct?

MR. INGRAM: That is correct.

MR. MACEY: Would you normally expect that well to be productive?

MR. INGRAM: Based on my information, the controlling limits on that fault are somewhat indefinite on the field to the south.

MR. MACEY: According to your interpretation, would the SW¼ SW¼ of Section 14 be productive?

MR. INGRAM: Quite possibly. You would have a diagonal off-set. The well to the NW is productive and the well to the south is productive.

MR. MACEY: You said the northwest. I believe you meant a direct west off-set, didn't you? Isn't your No. 8 a direct west off-set and the Gulf No. 1 Lilli is a direct south off-set?

MR. INGRAM: Yes.

MR. MACEY: Therefore, under a normal 80-acre program, according to your interpretation, it would not be possible for a productive well to be drilled on the S½ of the SW¼ of Section 14?

MR. INGRAM: Using the spacing that we have now - is that the question?

MR. MACEY: Yes, sir.

MR. INGRAM: I would say no.

MR. MACEY: Now the - - therefore, there is a part of that

lease that is productive, is there not?

MR. INGRAM: Well, - - -

MR. MACEY: Is it your thought that there is a part of that lease that is productive?

MR. INGRAM: That is true.

MR. MACEY: Is it over half of that 80 acres? Or would you say it was about half?

MR. INGRAM: I would say that it would be less than half or quite possibly 40 acres.

MR. MACEY: That's all the questions I have for Mr. Ingram. Mr. Hiltz, in connection with your bottom hole pressures, you indicated that there was the possibility the pressures had not reached static conditions in the reservoir when they were taken. Is that correct?

MR. HILTZ: In some instances in some of the wells, they had not reached a static condition within 48 hours.

MR. MACEY: Why, in a reservoir where the permeability is supposedly pretty high, - - would you say that the permability was pretty high as evidenced by your previous Pi test?

MR. HILTZ: Yes. There were indicated variations in permeability and porosity throughout the reservoir which is a characteristic of Ellenberger reservoirs throughout the entire State. You have variations in permeability - some may be low and some may be high in others. This is a charactertistic which is similar in Ellenberger reservoirs.

MR. MACEY: I have one last question with respect to your No. 8 and 9 wells. You have no core information or reservoir information

on those wells?

MR. HILTZ: We did not core either the No. 8 well or the No. 9 or 10 well, so there is no core data available on those wells. A productivity test was conducted on No. 8, I believe. I don't have the complete information but I believe that the Pi was approximately 4 and putting it in a range proximating the other 6 wells on which we had conducted Pi tests.

MR. MACEY: I believe that at the hearing a year ago that one of the witnesses, it might have been you, testified that there was evidence that there was a possibility that one well would drain 160 acres, is that correct?

MR. HILTZ: Well I would say very definitely one well in that field can drain in excess of 160 acres.

MR. MACEY: Therefore, would you say that the Gulf No. 1 Lilli and your No. 8 South Mattix Unit were draining or could drain the SW¼SW¼ of Section 14?

MR. HILTZ: Very definitely. Yes. We have continuous communication throughout the reservoir as was stated at the last hearing.

MR. MACEY: That's all I have.

MR. SPURRIER: Does anyone else have a question of either of these witnesses?

MR. SMITH: Mr. Hiltz, you are familiar with the fact that this white area contained herein in your south Mattix Unit - - -

MR. HILTZ: That is correct.

MR. SMITH: Is some of the acreage around here is fee-owned

acreage?

MR. HILTZ: That is correct.

MR. SMITH: Are you also familiar with the fact - - - Is Humble fully apprised of the situation with respect to the dry hole they drilled and the possibility of additional production in the S½ of the SW¼ of Section 14?

MR. HILTZ: Yes, sir. I'm certain the operator fully recognizes that point.

MR. SMITH: Was the Humble Knight a dry hole? Mr. Ingram?

MR. INGRAM: That is correct.

MR. SMITH: And it is shown on your map as being inside the fault?

MR. INGRAM: Yes, sir.

MR. SMITH: Is the reason for it being dry, the fact that the fault has shifted forward to the west?

MR. INGRAM: No, sir. It encountered the Ellenberger below the oil-water contact.

MR. SMITH: In other words, that is a definite possibility insofar as the SW¼ of Section 14 is concerned - that it could likewise be dry because of encountering water in the Ellenberger - is that right?

MR. INGRAM: Part of the SW¼.

MR. SMITH: Well, the part that is shown in the - - west of the fault line?

MR. INGRAM: Well, assuming the present water-oil contact is minus 7240 or 7300, there could be a small portion in the SW¼ of

SW¼ portion which could be productive.

MR. SMITH: In other words, you're not sure, based on information based on Humble's Knight well at which point on the contour level the water will be encountered?

MR. INGRAM: That is correct. It could be further over to west.

MR. SMITH: Mr. Ingram, with respect to the enlargement or possible enlargement of the unit, it is anticipated to continue on an 80-acre spacing. Isn't that right?

MR. INGRAM: That is correct.

MR. SMITH: Upon the establishment of a more productive limit and inclusion of additional parties into the unit, based on an agreement as to the possibility of probability of production in this area?

MR. INGRAM: That is true.

MR. SMITH: So that if the unit is enlarged and in view of the Humble Knight well No. 1 and the additional information from other wells, that participation will probably be enlarged despite the fact that there will be no wells drilled upon the SW¼ of the SW¼ of Section 14?

MR. INGRAM: True.

MR. SMITH: Now, Mr. Hiltz, with respect to the variations in pressure build up which you testified to a while ago, I would like you to answer whether there are any of those practices which must be taken into consideration in order to explain the variations, as shown

on your exhibit?

MR. HILTZ: Well, there is one other thing which we have previously indicated at the last hearing and that is that both the Pi tests and the bottom hole pressure tests which had been conducted were effected by the fact that there were in most cases limited producing intervals which were open to the well bore. Either by the virtue of the amount of penetration there or the perforations, made in the pipe. The fact that you actually strip the producing intervals like that will have some effect on the rate at which you are - - a well will produce or a bottom hole pressure will build up. I would like to emphasize the fact though that pressures as recorded - - the differences are relatively small. As a matter of fact, a large portion of that can actually be attributed to the air in the instruments themselves. We simply pointed out that there seems to be no doubt in anyone's mind about the fact that these would be the normal variations that you would expect in conducting a test, that the pressure on the interference well and the pressure on the average in the field actually conform so closely, it would almost be, you might say, astonding, in their near accuracy.

MR. SMITH: Mr. Hiltz, I would like to ask you one further question. I assume that Stanolind Oil & Gas Company is conducting some studies with respect to the possibility of recovery in the south here.

MR. HILTZ: Yes, sir. We have a dual responsibility there, both as an operator and an operator of the South Mattix Unit. And we constantly have that field under surveillance and study by our engineers to determine the feasibility of recovery and consideration will certainly

be given to conducting the proper type 7-year recovery program. However, you need considerable time to determine what the proper type of program is.

MR. SMITH: And development on an 80-acre basis lends itself better to acquire that information quicker than it would on a 40-acre spacing pattern?

MR. HILTZ: Yes, sir.

MR. SMITH: No further questions.

MR. SPURRIER: Mr. Macey?

MR. MACEY: Mr. Ingram, with respect to Mr. Smith's remark about your continuing efforts to unitize the pool, - approximately - - have you made any effort - - estimate of approximately what the total number of productive acres are in the pool?

MR. INGRAM: No, sir.

MR. MACEY: Would it be too difficult for you to determine how much acreage is productive in each section?

MR. INGRAM: No.

MR. MACEY: Let's take Section 10 to start with. Approximately how much do you think is productive up there?

MR. INGRAM: Possibly 80 acres.

MR. MACEY: How about Section 14?

MR. INGRAM: One hundred twenty acres.

MR. MACEY: Section 15?

MR. INGRAM: About six hundred acres.

MR. MACEY: How about Section 16?

MR. INGRAM: One hundred twenty.

MR. MACEY: Section 22?

MR. INGRAM: Could be forty. It could be more than that.

MR. MACEY: All right. How about Section 23?

MR. INGRAM: One hundred sixty.

MR. MACEY: Now, of the total 1,120 acres - I make it 1,120 but I could be wrong in my hasty mathematics. The Stanolind after they complete the No. 9 and No - - I believe it's No. 9. Is your No. 9 well in the northwest quarter northwest quarter of Section 15?

MR. INGRAM: That is right.

MR. MACEY: After you complete your No. 9 and No. 10 wells, you will have completed 8 wells in Section 15, would you not?

MR. INGRAM: Yes.

MR. MACEY: And you have already completed two wells in Section 22?

MR. INGRAM: That is correct.

MR. MACEY: So that you will have - - you will be producing ten top allowable wells, provided your No. 9 and 10 are top allowable wells, from the acreage under consideration. Is that correct?

MR. INGRAM: That is correct.

MR. MACEY: Now, outside of your unit area, which is not unitized with your South Mattix Unit, there are four producing wells. Is that correct?

MR. INGRAM: That is correct.

MR. MACEY: Do you think that under the provisions of the withdrawals of eight of the four of the producing wells - - you have two-thirds of the wells in the pool, do you think that two-thirds of

of your acreage - - that your acreage is two-thirds of the total productive area?

MR. INGRAM: I believe that's right.

MR. MACEY: In other words, it's your - - you're testifying that based on the proven limits of the pool that you can best determine and from your knowledge of the reservoir that Stanolind's getting their fair share of the oil from that pool and that everybody else is?

MR. INGRAM: Yes. That's true.

MR. MACEY: Well, - - -

MR. INGRAM: Of course, we have application in to the U. S. Geodetical Survey now to enlarge the area and as soon as that can be approved, then the participating area will be set up around each of the four wells that are outside of the unit.

MR. MACEY: Doesn't that unit enlargement envolve some state acreage in Section 16?

MR. INGRAM: Yes.

MR. MACEY: And has it been submitted to Mr. Walker's office, do you know?

MR. INGRAM: I don't know.

MR. SMITH: I would like to answer Mr. Macey and say that those matters are handled by our Land Department and that is the reason Mr. Ingram is not familiar with this. I do know that it will be submitted to them if it has not already been presented.

MR. MACEY: Mr. Ingram, how long has that Humble "AB" well been completed?

MR. INGRAM: September of 1952.

MR. MACEY: Mr. Ingram, in connection with your statement about the acreage that's productive and how much is in each section, your Mattix Unit wells represent the total productive acreage in Section 15 and 22 - is that correct?

MR. INGRAM: That is correct.

MR. MACEY: You estimated that there was six hundred acres productive in Section 15 and two hundred forty in Section 22. Is that right?

MR. INGRAM: That is right.

MR. MACEY: Now that total of eight hundred and forty, the pool total according to your estimate being 1,120 - when your No. 9 and 10 wells are completed you will have completed and be producing 10 of the 14 wells in the pool. Is that in respect - - in the same relationship to your acreage holdings in the pool?

MR. INGRAM: As you speaking of "your acreage" as being the South Mattix - - -

MR. MACEY: Yes, sir. I meant the South Mattix Unit Area. That you operate.

MR. INGRAM: I don't understand the question.

MR. MACEY: Well, you've got 840 acres of productive acreage in Section 15 and 22 - all represented by the South Mattix Unit. The total pool productive acreage which you estimated was 1,120 acres. Therefore, your - - the relationship - - the purportion that your acreage bears to 1,120 is 840/1120ths. You produce - or will produce as soon as you complete these two wells in the near future - you will

be producing ten of the fourteen wells. You will be getting 10/14th of the total oil withdrawal from the reservoir. I haven't figured out what that percentage is - - -

MR. SMITH: Isn't that a mathematical answer, Mr. Macey?

MR. MACEY: Well yes, that's what I'm trying to determine.

MR. SMITH: Well, do you want Mr. Hiltz to figure this?

MR. MACEY: Yes, sir.

MR. HILTZ: Does anyone have a slide rule? - - Based on the acreage of 840 acres - the percentage is 75% and 10 of 14 wells is 71.3%.

MR. MACEY: So that proportion is a little bit higher on withdrawals than it is on productive acreage. Is that correct?

MR. SMITH: It's the reverse of that, isn't it Mr. Macey?

MR. MACEY: Yes, that's right.

MR. HILTZ: The withdrawals would be approximately 71.3% as against the amount of productive acres which is 75%.

MR. MACEY: All right now, in connection with that you assign 240 acres productive in Section 22, you have only two producing wells in that section - is that correct?

MR. SMITH: That's correct. But these two wells are included in here.

MR. MACEY: Are you intending to drill another well in Section 22?

(MR. INGRAM) (Laughter) I'm not in a position to answer that question.

MR. HILTZ: I would like to point out that we would like to get allowables for the two wells.

MR. MACEY: And similarly in Section 16, the Humble only gets one allowable for 120 acres proven acreage, is that correct?

MR. INGRAM: That happens to be state acreage.

VOICE: It's not 120 acres.

MR. MACEY: That's what he testified it was.

MR. INGRAM: Just possible productive limits.

MR. MACEY: That's all I have.

MR. SPURRIER: Does anyone else have a question of this witness? Mr. Hinkle?

MR. HINKLE: I have no questions, I would just like to make a statement. I'm Clarence Hinkle of Hervey, Dow and Hinkle, Roswell, New Mexico representing the Humble Oil and Refining Company.

The testimony in this case 391 shows that the Humble is an operator in the Fowler Pool. It is the operater of one well and the Humble would like for the record to show in this case that it is in accord with the position taken by the Stanolind in favoring the development of this pool on an 80-acre spacing basis.

MR. SPURRIER: Anyone else?

MR. GORDON: Joseph C. Gordon with the Three States Natural Gas Company. We have an interest in the South Mattix Unit and we are in accord with the request of Stanolind.

MR. VICKERY: J. H. Vickery with the Atlantic Refining Company. We have an interest in the South Mattix Unit Area and we are in accord

with Stanolind's request for 80-acre spacing.

MR. SPURRIER: Would you give us your name again, please?

MR. VICKERY: J. H. Vickery,

MR. SPURRIER: Mr. Walker?

MR. WALKER: Don Walker with Gulf. Gulf has three wells in the Fowler Pool and we'd like to urge the Commission to adopt another extension for a one year period under provision of Rule 195 which, of course, provides for 80-acre spacing and 80-acre allowable.

MR. SPURRIER: Anyone else?

MR. SMITH: May it please the Commission, at this time, Stanolind Oil & Gas Company would like to urge the Commission to extend the 80-acre spacing rule for one year to permit the completion in the field and additional data so that a proper compilation may be made as to the proper spacing pattern.

MR. SPURRIER: Anyone else? If there is nothing further in this case, we will take it under advisement and move on to case 521.

BEFORE THE

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO

*****

TRANSCRIPT OF HEARING

August 19, 1952

Case No. 391

BEFORE THE
OIL CONSERVATION COMMISSION
STATE OF NEW MEXICO

***

In the matter of the application of Stanolind Oil and Gas Company for the establishment of a uniform 80-acre spacing pattern and adoption of 80-acre proportional allocation factor in the common source of supply known as the Fowler Pool, Township 24 South, Range 37 East, NMPM, Lea County, New Mexico.	)	Case No. 391

TRANSCRIPT OF HEARING

August 19, 1952

(See transcript in Case entitled, "Allowable," for register of attendance and appearances.)

MR. SPURRIER: The next case on the docket will be Case 391.

(Mr. Graham reads the Notice of Publication.)

MR. SMITH: We have certain testimony that we would like to put on for the Commission's consideration this morning. I should like to make a summarizing statement to the effect that we are going to show under the testimony that there is no significant variation in ultimate recovery for well density of forty and eighty acres in the Fowler Field Ellenburger. We have some engineering and geological testimony and a little bit of economics on the matter. I would like to call Mr. Tom Ingram as our first witness.

MR. GRAHAM: Do you have other witnesses?

MR. SMITH: Yes. Mr. Leibrock and Mr. Hiltz.

(All witnesses were sworn.)

MR. SMITH: We have taken the liberty to prepare for your consideration the proposed rules that may be entered if the Commission sees fit, to agree with our conclusions in the matter; and if you care to have me do so, I should like to hand copies of the proposed rules to the Commission at this time. (Done.)

TOM L. INGRAM

having been first duly sworn, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. SMITH:

Q Will you state your name, please?

A Tom L. Ingram.

Q You are employed by Stanolind Oil and Gas Company?

A I am.

Q In what capacity?

A District Geologist.

Q And where are you stationed?

A In Roswell.

Q And how long have you been stationed there?

A For seven months.

MR. SPURRIER: He has been qualified.

MR. SMITH: Will you accept his qualifications?

MR. SPURRIER: Certainly.

Q In your capacity as District Geologist at Roswell, have you had occasion to make a study of the geological structures in the Permian Basin?

A I have.

Q You are fully familiar with the production in the various zones in the Permian Basin, including the Ellenburger?

A Yes.

Q Have you made a study of the geology in the Fowler Field?

A I have.

Q First, do you have an exhibit showing the land ownership?

A I do.

(Plat marked "Stanolind's Exhibit No. 1.)

MR. SMITH: I would like to offer as Exhibit 1, the Lease Ownership for the Deep Rights.

Q Mr. Ingram, I would like for you to explain the significance of this line here. I note an area which appears to be checked, or dotted, rather, outlined in blue. What is that area?

A Well, the map itself represents, I mean, the names indicated here, represent the leasehold ownership of the deep rights, in other words, below approximately 4,000 feet. The various types here--this is State acreage.

Q When you say "this", you mean what?

A Well, the cross-hatched area here is State acreage. The stippled acreage is Federal acreage; and the one with vertical lines is fee acreage. The heavy blue line in the center of the map represents the present South Mattix Unit.

Q Is that a Federal type unit?

A Yes, it is.

Q What is the area included in the red line?

A The area included in the red line represents the area in which we would like to have the 80-acre spacing.

Q And this is the Fowler Pool Ellenburger that we are talking about so far as your testimony is concerned?

A Yes, sir, only the Ellenburger.

Q Now, Mr. Ingram, what was the discovery well for the Ellenburger production in the Fowler Field?

A Ellenburger production was discovered in South Mattix Unit No. 1, Section 15, Township 24 South, Range 37 East.

Q When was it discovered?

A It was completed in May of 1949, by open hole completion from 9505 feet to 9705 feet. That is the Ellenburger pay that is open.

Q What was the potential of that well at the time of completion?

A Three hundred eighty-three barrels.

Q And how many wells have been completed to date in the Ellenburger in the Fowler Field?

A Six wells. They are all located in Sections 15 and 22.

Q Can you state generally the type of sedimentary deposits encountered in the area, and whether or not they were typical of sedimentary deposits found in wells in the Permian Basin?

A Well, the pre-Permian are typical of those zones found in the pre-Permian of Southern New Mexico and Western Texas. Below the Permian conformity, we have in descending order, the Upper Silurian, the Fusselman, Montoya, Simpson, and Ellenburger. The Devonian is also present in the No. 4 and No. 6 South Mattix wells, and it has been reported to be present in the Humble No. 1 State AB, and the No. 7 South Mattix Unit.

Q Are these wells drilling now?

A They are currently drilling-wells.

Q Now, have you prepared any cross-sections that reflect the type of strata encountered near the Ellenburger?

A I have.

Q Will you produce them?

(Plats marked "Stanolind's Exhibits 2 and 3.")

Q Will you please refer to the cross-section maps which have been marked for identification Exhibits Nos. 2 and 3, and explain what they purport to reflect?

A Exhibit No. 2 is a pre-Permian cross-section extending through wells 5, 3, 2, and 6 in a northwest and southeast direction. Exhibit No. 3 is also a pre-Permian cross-section extended through wells 1 and 2 in a northeast-southwest direction.

Q Refer to the key map indicated in the lower lefthand corner. Does that explain the surface direction of the cross-sections?

A Yes, sir, the location of the wells and direction of cross-section. The various beds encountered here are shown in different colors. Since we are dealing primarily with the pre-Permian, we have omitted the upper part of the section and started in the basal part of the Permian. This is the Permo-Pennsylvanian unconformity. In other words, on Exhibit No. 2, we have two thrust faults, one, the upper one, extending through wells 5, 3, and 6, and

in this well we have a repetition of the section. In the No. 5, we go out of the Montoya and back to Fusselman; and in the No. 3, the same situations, Montoya to Fusselman. In No. 2, we have a normal sequence down to the Simpson, then the Montoya, and back to the Simpson. In the No. 6, it was cut in the Simpson itself. However, we do have a repetition of the section. This fault is such that in the presently completed well, the only formations affected are the Fusselman, Montoya and Simpson, with no effect upon the Ellenburger. The same situation is true in Exhibit No. 3.

Q Is this fault indicated on Exhibit No. 3 the same fault exhibited at a higher level on No. 2?

A That is the same fault actually in Exhibit No. 3. The northeast-southwest section would be extended off the No. 2 well shown on Exhibit No. 2.

Q Now, you might explain the depths that are shown in the righthand margin on Exhibits 2 and 3.

A The depths are subsea elevations. In other words, the upper mark, the horizontal line, is 3500 below sea level, and so on down.

Q Where were these respective wells completed, and at what depths?

A All of the wells were completed in the upper yellow shown on Exhibit 2. In other words, the Ellenburger formation.

The actual completed depths varied in the formation. In No. 5, it was toward the basal part of the Ellenburger. In the No. 3, it was up near the top, and for 2 and 6, it was near the mid-section.

Q Now, I direct your attention to well No. 5, which apparently has gone from the Ellenburger through the Simpson, and back into the Ellenburger. Is there any significance attached to that?

A Those are the faults I referred to. In the Ellenburger, the faults--the second one, is so far down that it only appears in the No. 5 well and is located near the base of the Ellenburger, goes out of the Ellenburger through the Simpson, then back to the Ellenburger, and then encounters the pre-Cambrian; and the only water found so far in the Ellenburgef, Fowler Field, is located below this fault in the basal part of the repeated Ellenburger.

Q Have you found, or encountered any water in the Ellenburger located at a higher level in any wells that have been drilled in the field?

A No, we haven't.

Q Was well No. 5 completed back up the hole, and at what level?

A It was completed between minus 6500 and 7,000 feet, indicated on the righthand side, but in the lower basal Ellenburger.

Q Is there any indication of, or known water in the producing zone in the Ellenburger in the Fowler Field?

A No, sir, there isn't any indication of water in the pay section. The Ellenburger is tan to buff, white to light gray, medium to coarsely crystalline dolomite, with traces of intergranular porosity and some vuggy porosity. The thickness of the formation varies on the top of the structure to around 480 feet thick and on the flanks about 585 feet. In the basal part it may be extremely sandy with large square grains, and the producing depths vary from the top of the pay in the No. 1 well, 9505, to the base of the pay in the No. 6 well, 10,430 feet, or approximately 925 feet.

Q Do you have the data on the depths at which test wells were completed from the surface of the ground?

A Yes, sir.

Q I wonder if you might give the depth for each of the six wells that have been completed so far?

A In the No. 1 South Mattix Unit, top of the pay, 9505, total depth 9705. In the No. 2, the top of the pay, 9942, total depth 10,305. In the No. 3, top of the pay, 9906, total depth 10,085. In the No. 4, top of pay, 9805, total depth 10,270. In the No. 5, top of pay, 9730, total depth, plug-back depth, 10,320. In the No. 6, top of pay 10,045, total plug-back depth, 10,480.

Q Is Stanolind's No. 7 well drilling now?

A Yes, sir.

Q At what depth? Do you have that information?

A Yes, sir. Stanolind's No. 7 is drilling at a depth of 9995.

Q That was as of what date?

A As of yesterday, the 18th.

Q Now, have you prepared a contour map, indicating the relative location, or the relative elevation of the Ellenburger in the Fowler Field?

A I have.

Q Will you produce it, please?

(Contour map marked "Stanolind's Exhibit No. 4.")

Q Mr. Ingram, what type of field is this considered to be, looking at the sub-surface structure map that you contoured on top of the Ellenburger?

A Exhibit No. 4 is a subsurface structure map, contoured to the top of the Ellenburger, but--anyway, we have the Fowler Field pictured as an elongated anticlinal structure with the long axis extending northwest-southeast.

Q How did you determine your datum points as used in the contour?

A The datum points shown under the well numbers, the minus figures, were obtained from detailed microscopic sample analyses in conjunction with Schlumberger electrical logs,

and also, using data prepared by the Residue Research Laboratory in Midland, Texas.

Q From this data, and also interpreting your Exhibit No. 4, what conclusions, if any, do you come to with respect to this Field and its possibilities?

A Well, we appear to have one structure with no log separations; and based on drill stem tests that were run on each of the wells, they recovered either oil, or oil and gas--cut mud from the entire Ellenburger section, with the exception of the bottom 70 feet, which would indicate to us that we do have a continuous pay throughout the whole field.

Q You mean by that, that in your opinion there is a continuous source of supply through the Ellenburger as found in South Mattix No. 1 well, and in the other wells?

A Yes, sir, and this structure at the present standing is unaffected by the faults which were shown on Exhibits Nos. 2 and 3.

Q Now, referring again to those faults that were shown on Exhibits 2 and 3, have you any opinion with respect to whether or not the water found in the repeated Ellenburger reflected on Exhibit No. 2, has been sealed off from the productive zone?

A Well, we have no definite evidence as of now. This is from a geological standpoint. I think the engineering

data will be available a little later. But I assume the lower fault on Exhibit 2, and possibly the upper fault shown on Exhibits 2 and 3, has separated the pay section from the main aquifer.

Q Now, referring back to Exhibit 1, the land ownership map, and particularly with reference to the red line which outlines the area which we are asking be included in our application for field rules; in your opinion does that reasonably outline the possible area of the field, based on your present geological information?

A Yes, based on my present geological information, I would say that it does.

MR. SMITH: At this time, I would like to offer Exhibits 1, 2, 3 and 4, which have been marked for identification purposes only up to now.

MR. SPURRIER: Without objection, they will be received.

MR. SMITH: I have no further questions.

MR. SPURRIER: Does anyone have a question of this witness?

MR. FOSTER: Mr. Chairman, I am a little confused here about the use of some of the language here. This proposal says that it has to do with establishing a uniform 80-acre spacing pattern. Are you talking there, Mr. Ingram, about establishing 80-acre proration units?

That is what you are talking about, isn't it?

MR. SMITH: I don't believe Mr. Ingram is qualified to answer the question, but I will: yes.

MR. FOSTER: Eighty-acre proration units. In other words, it is all on a proration basis in the field?

MR. SMITH: Well, now, the regular spacing pattern in this field is on an 80-acre basis, isn't that true?

MR. FOSTER: Now, the spacing pattern--what I am trying to get at, a spacing pattern to me has to do with distances between wells, and from lease lines. Now, that is not what you are talking about when you use the term "spacing pattern"?

MR. SMITH: Well, in this particular instance, yes, sir. If you will read the copy of the proposed rules I handed to you awhile ago. The location of the wells is specified for the regular political subdivisions in New Mexico. Ordinarily, we speak in terms of government survey, which has the effect of establishing distance in locating the wells, on established political subdivisions in New Mexico, as distinguished from West Texas, where you have a different survey system. Does that answer your question?

MR. FOSTER: Well, now, of course, that is just generally the establishment of an 80-acre proration unit,

isn't it?

MR. SMITH: Well, Judge, I think our discussion should be deferred until after the testimony is in. I believe after the testimony is in, you will have a better picture of what we are asking for.

MR. FOSTER: Very well. You mean, I can come back and ask some more questions?

MR. SMITH: Yes, sir.

MR. SPURRIER: Any further questions of this witness? If not, the witness may be excused.

(Witness excused.)

MR. SPURRIER: Mr. Smith, do you have another witness?

MR. SMITH: Yes, sir. Mr. R. M. Leibrock.

R. M. LEIBROCK

being first duly sworn, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. SMITH:

Q Will you state your name, please?

A R. M. Leibrock.

Q Where are you employed, Mr. Leibrock?

A Stanolind Oil and Gas Company, Fort Worth, Texas.

Q In what capacity?

A Division Reservoir Engineer.

Q How long have you been so employed?

A Approximately twenty-two months.

Q Do you have any degrees in petroleum engineering?

A I have the degree of Bachelor of Science in Petroleum Engineering from the University of Texas.

Q When did you receive that degree?

A September, 1943.

Q Have you done any special research, or investigation into petroleum engineering problems since receiving that degree?

A I was employed for approximately two years in Stanolind Research Laboratory in Tulsa, Oklahoma.

Q And since that time, you have been employed by Stanolind at what locations and in what capacities?

A I worked in the Reservoir Section, General Office, in Tulsa; in the Reservoir Section, District Office, in Lubbock, Texas; and in the Division Reservoir Section in Fort Worth, Texas.

MR. SMITH: I would like to ask the Commission whether it will accept Mr. Leibrock's qualifications as an expert?

MR. SPURRIER: They will.

Q Now, Mr. Leibrock, in your capacity as Division Engineer at Fort Worth, the Fowler Field is within the purview of your jurisdiction, is it not?

A Yes, that is correct.

Q Have you made any studies or analyses of reservoir performance in the Fowler Field?

A Yes, I have.

Q Have actual tests been performed in the field as well as analyses? Have there been actual interference and other tests made in the field, to show its reservoir performance?

A Yes, there were.

Q Now, you have prepared certain exhibits with reference to the performance. Do you have those with you?

A Yes, I do.

(Map, Cross Section A-A, Fowler Field, marked "Stanolind's Exhibit No. 5.)

Q Will you please refer to cross-section A-A prime, Fowler Field, Lea County, New Mexico, which has been marked as Exhibit 5.

MR. SMITH: At this time, I would like to offer Exhibit 5 in evidence.

MR. SPURRIER: Without objection, it will be received.

Q Will you explain this cross-section map, Mr. Leibrock?

A Exhibit A-A prime, which has been designated Exhibit No. 5, is a cross-section through the Fowler Field, Lea County, New Mexico, the trace of which is indicated on the map on the lower lefthand corner of the Exhibit.

This section begins with South Mattix Unit No. 6, which is the lowest well drilled to date on top of the Ellenburger, and continues up-structure through South Mattix Unit No. 2, South Mattix Unit No. 3 and South Mattix Unit No. 5.

In preparing this cross-section, we have made use of electric logs and available core data in the field. It will be observed that core data were available for South Mattix No. 3 and South Mattix No. 5. For these two wells porosity and permeability values are plotted versus depth.

Q I will ask you to refer to the scale shown under South Mattix No. 3. Do those figures reflect the porosity and permeability throughout the field, or what is that scale?

A The scale indicates the porosity and permeability development for a particular well. In the case of well No. 3, the porosity varies between 1 and 7 percent and is of the order of magnitude found throughout the Ellenburger section in the Fowler Field. The average porosity is somewhere between two and three percent. As indicated on the exhibit, the permeability varies over an appreciable range. This is typical of the majority of the Ellenburger reservoirs in the area considered.

Q When you talk about "area considered", what area do you mean?

A I have in mind the New Mexico-West Texas areas of the Permian Basin.

Q Now, you mentioned awhile ago that certain tests have been made. Has there been an interference test run in the field?

A Yes, an interference test has been conducted in the Fowler Field. It was initiated in March, 1951, and is still in progress.

Q You might explain what an interference test is.

A Briefly, an interference test involves the shutting in of one or more wells in a field, and transferring the allowable from the shut-in well to the remaining wells on the lease or the unit. In this particular case, we used South Mattix No. 3 for the shut-in well and transferred the allowable from this well to the remaining wells in the South Mattix Unit. During the course of the test, we obtained periodic bottom hole pressure measurements with a calibrated bomb in South Mattix Unit No. 3.

Q At the same time, were tests of bottom hole pressure made in other wells?

A Yes, bottom hole pressure tests have been made in other wells in the field. This information will be shown on a subsequent exhibit.

(Map, Cross-Section BB, Fowler Field, marked as"Stanolind's Exhibit No. 6.")

Q All right. You have before you a map entitled, "Cross-Section B-B Prime, Fowler Field, Lea County, New Mexico, which has been marked Exhibit 6.

MR. SMITH: I would like to offer this exhibit in evidence.

MR. SPURRIER: Without objec tion, it will be received.

Q Will you please refer to Exhibit 6, and explain this map?

A Exhibit 6, labeled, "Cross-Section B-B Prime, Fowler Field, Lea County, New Mexico," is similar to the preceding exhibit, but is a trace through a different part of the field and includes Unit Well No. 4, Unit Well No. 1, and Unit Well No. 3. Well No. 3 is the only well that appears in both cross-sections. Our primary purpose in presenting this exhibit as well as the preceding exhibit was to point out that there is no reason to believe that permeability is not continuous throughout that portion of the Ellenburger section developed to date.

In this exhibit we have also used electric logs and core data in preparing the cross-section. In this particular case, all three wells included in the cross-section were cored. It will be observed that we have about the same order of magnitude of porosity variation as was indicated on the preceding exhibit.

Q Does that exhibit indicate the context or top of pay

throughout the field?

A That is correct.

Q Now, are there any dense sections that have been noted as a result of the tests that have been run through here? In other words, are there dense sections in the Ellenburger pay?

A There are sections which might be termed relatively dense. However, there is no indication that we have dense intervals between wells from the interference test data.

Q Are there any indications of vertical communication up and down, within the pay?

A Yes, there is vertical communication within the Ellenburger section. This will be demonstrated by a subsequent exhibit.

Q All right, we will proceed to the next exhibit.

(Graph, Reservoir Fluid Characteristics, marked "Stanolind's Exhibit No. 7".)

Q We have on the board a graph, showing reservoir fluid characteristics, Fowler Field, Lea County, New Mexico, which has been marked as Exhibit No. 7.

MR. SMITH: At this time, I would like to offer Exhibit 7 in evidence.

MR. SPURRIER: Without objection, it will be received.

Q Will you please explain the significance of Exhibit No. 7,

Mr. Leibrock?

A Exhibit No. 7, which is offered at this time, labeled, "Reservoir Fluid Characteristics, Fowler Field," is a composite graph which indicates the relative volume factor as a function of reservoir pressure; gas solubility as a function of pressure; and finally oil viscosity as a function of pressure.

Returning to the uppermost curve which is shown in red, the relative volume factor simply indicates the volume which one stock tank barrel of oil on the surface occupies in the reservoir. For example, at the initial reservoir pressure of 4300 pounds, the relative factor was approximately 1.51. The crude is under saturated with a bubble point pressure of 2482 pounds per square inch absolute, as compared to the initial pressure of 4300 psia. Accordingly, with a reduction in reservoir pressure, the relative volume factor increases slightly to a maximum value at the bubble point. At this point, the relative volume factor is 1.56. That simply indicates that one barrel of stock tank oil on the surface would occupy 1.56 barrels in the reservoir. Below the bubble point the relative volume factor decreases along the trend indicated, with a reduction in pressure.

The green curve indicates the gas solubility as a function of pressure. Initially, the crude contained

1020 cubic feet per barrel of oil. With a reduction in pressure, the gas solubility follows the trend indicated on the graph.

The oil viscosity curve, which is shown in black, indicates that at the original reservoir pressure of 4300 pounds, the crude viscosity is approximately 33 millipoise, and it decreases slightly to a value of 30 millipoise at the bubble point. With a further reduction in pressure, the oil viscosity, of course, increases along the trend indicated on the graph, as gas comes out of solution.

Q What is the significance of your oil viscosity with respect to reservoir performance?

A I might point out that oil viscosity in this particular field is unusually low. I indicated previously that at the initial pressure of 4300 pounds, the viscosity is approximately 33 millipoise. For that reason, regardless of the type of reservoir control, recovery will be substantially higher than would have been the case if the crude were more viscous.

(Map, Fowler Field Performance History, marked "Stanolind's Exhibit No. 8".)

Q I would like to direct your attention to Exhibit No. 8, which is the Fowler Field Performance History.

MR. SMITH: And at this time, I would like to

offer Exhibit 8 in evidence.

MR. SPURRIER: Without objection, it will be received.

Q Will you please explain the various factors that are reflected upon Exhibit 8?

A Exhibit No. 8 is a composite graph, which indicates performance history for the Fowler Field. The upper curve which is shown in red traces the bottom hole pressure history from the time of discovery of the field in May, 1949, up to the first of June, 1952.

The initial pressure was 4300 pounds per square inch. Since discovery of the field, the pressure has declined along the trend indicated, and as of the middle of May, was approximately 3670 pounds per square inch. As pointed out in the preceding exhibit, the bubble point pressure is 2482 psia., so the reservoir pressure still is approximately 1200 pounds above the bubble point. For that reason, recovery to date has been due entirely to expansibility of crude in the reservoir. Pressure decline as a function of cumulative oil recovery is expected to continue along the presently established trend until the bubble point pressure of 2482 psia. is reached. At that point, the pressure-recovery relationship will flatten out appreciably.

The curve shown in green is simply a plot of the

number of wells. Wells have been completed as shown on the graph and at the present time, there are six completed wells in the South Mattix Unit.

The next curve, which is shown in orange, is the gas-oil ratio relationship as a function of time. Inasmuch as the reservoir pressure is still above the bubble point, we have not observed any increase in the gas-oil ratio, and we do not expect to observe any increase in the gas-oil ratio until the pressure declines below the bubble point. For that reason, we have simply drawn in the dashed line to reflect a gas-oil ratio equal to the solution gas-oil ratio of 1020 cubic feet per barrel.

The curve in black simply indicates cumulative recovery as a function of time. Up to June, 1952, the unit had recovered approximately 590,000 barrels of oil from the Ellenburger reservoir.

Q Now, explain the bottom curve, will you?

A The lower curve simply indicates the producing rate expressed in thousands of barrels per month as a function of time. You will note that with continued development, the producing rate increased along the trend shown on the graph and reached a maximum value of approximately 31,000 barrels during the month of March, 1952. The sharp reduction shown for the month of May is associated with the oil strike.

Q All right, you have an exhibit showing the summary of productivity tests?

A Yes, we have that exhibit. We have only one copy. (Map, Summary of Productivity Index Tests, Fowler Field, Lea County, N.M., marked "Stanolind's Exhibit No. 9.")

MR. SMITH: At this time, I would like to offer in evidence Exhibit No. 9, which is a Summary of Productivity Index Tests, Fowler Field, Lea County, New Mexico.

MR. SPURRIER: Without objection, it will be received.

Q Explain Exhibit No. 9, if you will, please.

A Exhibit No. 9, offered at this time, is a summary of productivity index tests in the Fowler Field. During the course of developing the Fowler Field, Stanolind Oil and Gas Company has conducted P.I. tests on all wells with the exception of Unit No. 3, which is the control well in the interference test program.

Beginning on the lefthand side of the Exhibit, we have indicated the unit well number, the oil string casing point, and so forth. For example, in unit Well No. 1, 7-inch casing is set at 9486 feet. The third column indicates the producing interval and whether or not it is producing from open hole, or through a perforated interval in the casing. Column four indicates the length of producing interval, and varies from a min-

imum of 40 feet to a maximum of 100 feet in Unit Well No. 1.

The estimated formation thickness is shown in the next column and varies from a minimum value of 400mfeet to a maximum of 585 feet in Unit Well No. 5.

Q At this time, Mr. Leibrock, why is it necessary to make an estimate on the first three wells, Wells Nos. 1, 2, and 3?

A Wells 1, 2, and 3 did not penetrate the entire section, and it is necessary to project these wells to an estimated top of Granite in order to estimate the total thickness of the Ellenburger section.

The next column indicates the percent of pay exposed to well bore. It will be observed that the percent of pay exposed varies from a minimum of 9 percent in Well No. 6, to a maximum of 50 percent in Well No. 1.

The next column indicates P.I. values measured in the field. These values vary from a minimum of 0.4 barrel per day per P.S.I. in Unit Well No. 5, to a maximum of 10 barrels per day per P.S.I. in Unit Well No. 4.

Q Mr. Leibrock, will you explain briefly the procedure followed in obtaining a P.I. on a well?

A A P.I. test involves producing a well at a constant rate of flow under stabalized pressure conditions, and measuring the pressure at the sand face. Upon completion of

the flowing portion of the test, the well is shut in for a sufficient period of time to obtain the true reservoir pressure. With these data available the P.I. can be calculated and is expressed in terms of barrels/day/psi.

It might be well to point out that the variation in P.I. between wells is traceable to two things: 1. A certain amount of variation in permeability development within the reservoir; and 2. variation in the length of producing interval exposed to the well bore.

Continuing with the summary, we have applied a correction factor in order to obtain some idea of what the P.I.'s would have been for the five wells tested if the entire pay section had been exposed in the well bore. This involves the use of a proportionality correction factor, which is simply the ratio of the producing capacity of a completely penetrating well, to the producing capacity of a partially penetrating well. By applying this correction factor, we have estimated the P.I. values assuming the full section had been exposed. These calculated values are, of course, appreciably higher and vary from a minimum of 2.1 bbls./day/psi. to a maximum of 31 bbls./day/psi.

Our purpose in obtaining these corrected P.I. values was to compare permeabilities as measured in the

laboratory with values calculated from P.I. tests in the field. Unfortunately, in the final analysis, we were able to compare only two wells. For example, in Well No. 1, only nine feet of pay were cored and subsequently analyzed, and we didn't consider it representative of the 400 feet of formation above Granite. In Well No. 2, we did not obtain a core analysis. In Well No. 3, we obtained a core analysis which we considered representative, but due to the fact that we had an interference test in progress, did not obtain a P.I. test on this well. That brings us down to Wells 4 and 5 where we considered the core data to be representative of the entire section. In these two instances, you will note that the permeability from P.I. tests compare favorably with permeability measured in the laborabory.

Q No. 6, what was the reason for not making a comparison there?

A In Well No. 6, we did not have a core analysis. We only had a P.I. test. I might point out that our final objective was to obtain some idea of vertical permeability development in the Ellenburger [illegible]on; that is, to find out whether wells which penetrated only a portion of the pay could be expected to drain the undrilled or unperforated section. Inasmuch as we obtained good permeability checks on Wells 4 and 5, we can conclude that we have

excellent vertical communication within the Ellenburger. A subsequent exhibit will indicate the existence of good horizontal communication.

(Map, Calculated Differences in Recovery, 40 versus 80-acre Spacing, marked "Stanolind's Exhibit No. 10.")

Q Mr. Leibrock, I would like to direct your attention to what has been marked for identification as Exhibit No. 10, Calculated Differences in Recovery, forty versus eighty-acre Spacing, in the Fowler Field, Lea County, New Mexico, in the producing zone.

MR. SMITH: At this time, I would like to offer this Exhibit in evidence.

MR. SPURRIER: Without objection, it will be received.

Q Will you please explain what this Exhibit 10 reflects?

A Exhibit 10 offered at this time indicates oil saturation distribution at abandonment conditions in the Fowler Field, Lea County, New Mexico.

As we stated previously, the type of reservoir control has not been definitely established from the performance history observed to date. However, there are two developments to date which suggest that this reservoir is subject to volumetric control. First, the geological data submitted by Mr. Ingram gives some indication that the fault situation is such that the oil reservoir

in the Fowler Field will be isolated from the Ellenburger aquifer, which extends over a tremendous area in New Mexico. Secondly, the performance history to date tends to substantiate a volumetric reservoir. You will recall from an earlier exhibit that the reservoir pressure decline suggests the absence of any water influx.

With this in mind, we have made certain calculations which assume that solution gas will be the principal source of energy contributing to the expulsion of oil from the Fowler Field reservoir.

The method of attack utilized in handling this problem is general, and is not limited to any particular volumetric reservoir. However, the pertinent variables used in these calculations have been selected so as to be of the order of magnitude of those found in the Fowler Field. Accordingly, the quantitative values which we will exhibit here, will apply only to a field in which the reservoir and fluid characteristics are similar to those in the Fowler Field.

As I indicated previously, this graph shows the calculated oil saturation distribution in the area surrounding the wells. The problem is set up on a key map in the upper righthand corner of the Exhibit, and involves Unit Well No. 6, a hypothetical 40-acre location, and South Mattix Unit Well No. 1. We have considered the

saturation distribution that would exist throughout the reservoir in the case of the two wells drilled on an 80-acre spacing pattern, as compared to the satuaation distribution which would exist if we were to drill an in-fill well on a 40-acre location.

I would like to point out that initially, prior to withdrawal of any oil from the Ellenburger, the Ellenburger is 100 percent saturated with oil; that is to say, the fracture and vug system is 100 percent oil saturated. This statement is based on past research which indicates that all water in the Ellenburger section is contained in the Mattix porosity and that only oil is contained in the fracture and vug system.

With production from the reservoir, the oil saturation will, of course, be lowered to some value appreciably below 100 percent. We have calculated that at the time of abandonment, that is, when these wells are no longer capable of producing at economic rates, the liquid saturation on an 80-acre location will be as we have indicated by the solid blue line on the Exhibit. The sharp reduction in saturation in the vicinity of the well bore is typical of a radial system.

Q You are speaking at this time of an 80-acre radial basis?

A Yes, sir, 80-acre radial locations. The solid blue line indicates the saturation condition which would exist at

abandonment for wells drilled to a density of 80 acres.

The position of a 40-acre well is represented by the dashed red line. Employing the same procedure previously followed, we have calculated the saturation distribution which would exist throughout the reservoir for 40-acre spacing. This indicates that the only change in saturation distribution would occur in the vicinity of this 40-acre location, as indicated by the red dashed area on the Exhibit.

Q What causes this condition, Mr. Leibrock?

A This is characteristic of fluid flow in a radial system where you have a sharp pressure reduction in the vicinity of the well bore and an attendant reduction in liquid saturation. I want to emphasize the fact that the only increase in recovery resulting from drilling to twice the density we now have, would be this slight reduction in liquid saturation, indicated by the red cross-hatched area on the Exhibit. You can see that the difference between 40- and 80-acre spacing would not be appreciable.

The results of these calculations are, perhaps, more effectively summarized in the tabulation shown at the base of the Exhibit. This tabulation compares the calculated difference in recovery for well densities of 40 and 80 acres over a P.I. range of 1 to 10 bbls./day/psi. This indicates that for a well having a P.I. of

1 bbl/day/psi. on a 40-acre location, we expect to recover 31.82 percent of the original oil in place; whereas, on 80-acre spacing we would recover 31.18 percent, a difference of only 0.64 of 1 percent. For a P.I. of 10 bbls/day/psi. on 80-acre spacing, we have calculated a recovery of 35.34 percent of oil originally in place, as compared to 35.42 of the oil originally in place on 40 acres. In other words, by drilling to 40-acre density in this particular case, the increased recovery would be only 0.61 of 1 percent.

Q That is assuming that you have a P.I. of 10 constant throughout the reservoir?

A Yes.

Q Now, you have previously testified with respect to the P.I. in this field and on an average throughout, where does the average fall? Somewhere between the 1 and the 10 that you have?

A Our purpose in selecting the range of 1 to 10 was in the belief that the average for the Fowler Field would fall somewhere between these two.

In concluding the discussion on this particular Exhibit, I might add that while we have considered the effect of well density on ultimate recovery in a reservoir in which the solution of gas is the principal source of energy, it should be pointed out that even if the

reservoir develops a water drive, or if gravity drainage plays an important part in the recovery mechanism, the effect of well spacing on ultimate recovery will be essentially the same as we have indicated on this Exhibit. In other words, if we have an effective water drive, it is reasonable to expect that the liquid saturation will be reduced below the value we have calculated for a volumetric reservoir. However, the spread between the recovery for 40- and 80-acre densities still would not be appreciable.

Q Now, all of your testimony with respect to recovery from exhibit 10 is based upon primary recovery in the initial stage, is that correct, Mr. Leibrock?

A That is correct.

(Map, Interference Test Data, Fowler Field, marked "Stanolind's Exhibit No. 11.")

MR. SMITH: At this time, we would like to offer in evidence Exhibit No. 11, entitled, "Interference Test Data, Fowler Field, Lea County, New Mexico.

MR. SPURRIER: Without objection, it will be received.

Q Will you explain the significance of Exhibit No. 11, Mr. Leibrock?

A Yes. Prior to the direct comment on Exhibit No. 11, I would like to point out that up to this point, we have

considered the effect of well density on ultimate recovery as determined from the application of certain basic physical principles which govern the flow of fluids in reservoirs having continuous permeability development. I might further point out that opponents of wide spacing frequently contend that the assumption of continuous permeability development in an oil reservoir is unrealistic.

MR. FOSTER: Mr. Smith, may I break in and make a suggestion? I am not against you; I am for you. But the witness talks of wide well spacing as related to the establishment of 80-acre proration units. There just isn't any relationship between spacing and how much territory one well will drain. We keep confusing ourselves in this Commission, I think, in talking about those things.

MR. SMITH: Well, Judge Foster, I appreciate that. Of course, the use of the words--the words he did select are fairly relative terms; and I think subsequent testimony will clearly demonstrate what he has in mind.

MR. FOSTER: They are not relative. The spacing pattern, in terms of distance and 80-acre proration units just do not have any relation one to the other.

MR. SMITH: I think you are probably right, but I believe subsequent testimony will clear up the point

if you are patient.

MR. FOSTER: I have been very patient. I've been sitting here for several years.

MR. SMITH: We will take that into consideration, Judge Foster. I appreciate it, but I think we are a little out of order here, and we ought to wait until all the testimony is in.

MR. FOSTER: Frequently engineers or geologists, in attempting to support close spacing take the position that there exists a lenticular condition within the producing horizon, whereby lenses of porous and permeable oil-saturated rock are isolated from other permeable beds. The method of analysis utilized in calculating ultimate recovery such as we have had presented here does not reach this argument.

MR. SMITH: I believe that subsequent testimony will answer the question you raise.

THE WITNESS: Continuing with my previous discussion, it should be pointed out, however, that situations of this type are not to be anticipated in dolomitic limestone beds due to the manner in which porosity was developed in these formations. This is demonstrated by the performance data in numerous fields in the New Mexico-West Texas area.

Q Now, Mr. Leibrock, what do each of those dots on the Ex-

hibit No. 11 reflect that you have drawn down on the line?

A We have indicated here the pressures measured in South Mattix Unit No. 3, the control well, in the interference test program. As I stated previously, the interference test was initiated on March 5, 1951, and is still in progress. After shutting in South Mattix Unit No. 3, pressure measurements were made with no decline in pressure detected for approximately fifty days. At that time the pressure began to decline and continued to drop off along the trend indicated on the graph. Each of these black dots represents pressures measured in South Mattix Unit No. 3 as a function of shut-in time.

We have also indicated actual dates to provide a better idea of the time involved. The green curve indicates the cumulative recovery from the reservoir since the test was initiated.

Q Now, what is the significance of the pressures taken in the test well?

A As a result of the pressure behavior in South Mattix Unit No. 3 over a period of sixteen months that the test has been in progress, we have definite indication of interference between wells, thus establishing continuity of permeability development between wells on an 80-acre spacing pattern.

Q Now, the present field development has been on an 80-acre

spacing basis, has it not, Mr. Leibrock?

A That is correct.

Q Will you give us any final conclusion you have?

A As exhibited on the graph, we have obtained a completion pressure on Unit Well No. 6, the last well completed in the reservoir. This pressure measurement was obtained before the well had produced an appreciable volume of oil. The pressure measured was approximately 3650 pounds, a value which is very close to the pressure measured in the control well, the small difference observed being well within the limits of accuracy of a bottom hold pressure bomb operating at this depth.

Q What is the percent of deviation between the test taken in the key well and in the Unit Well No. 6?

A Approximately 1 percent deviation in pressure difference here, which as I stated previously, is within accepted limit of accuracy for a pressure bomb. The important thing to realize is that the pressure recorded in this well is approximately 600 pounds below the original reservoir pressure of 4300 pounds and that this value was recorded before the well had produced an appreciable volume of oil

Q Do you have another exhibit relating to bottom hold pressure in other wells as of a date the pressume was taken in a test well?

A Yes.

(Map, relating to Fowler Field, Lea County, N.M., Bottom Hole Pressure, Survey May 12 to 15, 1952, marked "Stanolind's Exhibit No. 12.")

MR. SMITH: I would like to offer in evidence as Exhibit 12, a map relating to Fowler Field, Lea County, New Mexico, bottom hole pressure survey, May 12 to 15, 1952.

MR. SPURRIER: Without objection, it will be received.

Q Mr. Leibrock, will you please explain the significance of Exhibit No. 12?

A Exhibit No. 12, offered at this time and labeled, Fowler Field, Lea County, New Mexico, Bottom Hole Pressure Survey, indicates the results obtained from a pressure survey conducted during the period May 12 to 15, 1952. All pressure measurements were made at the same datum of minus 3759 feet.

The important thing shown by this Exhibit is the fact that wells completed at different periods of time have essentially the same pressures recorded on each well, the variation being around 30 pounds. The pressure throughout the reservoir has declined approximately 600 pounds below the original reservoir pressure of 4300 pounds. In other words, the close grouping of the pres-

sures recorded in this survey gives added support to the contention of good horizontal permeability development within the reservoir, and further establishes the adequacy of 80-acre spacing in this field.

Q In your opinion, Mr. Leibrock, then, what would you say as to the difference, if any, between developing on a 40-, or on an 80-acre basis with respect to ultimate recovery to be expected?

A From the information which we have presented in this Exhibit and preceding exhibits, it has been definitely demonstrated that there is no significant variation in ultimate recovery for well densities of 40 and 80 acres.

Q As a matter of fact, Mr. Leibrock, your testimony would support even wider spacing?

A That is correct.

MR. SMITH: That's all.

MR. SPURRIER: Does anyone have a question of this witness?

CROSS EXAMINATION

BY MR. WHITE:

Q Mr. Leibrock, do you consider the porosity and permeability in the pay structure as being high or low?

A High. Let me qualify that. I consider the permeability development to be relatively high. The porosity development is relatively low, as is the case in all Ellenburger

reservoirs.

Q That is a characteristic observed in practically all Ellenburger reservoirs?

A Yes.

Q And as a matter of fact in all dolomitic lime reservoirs?

A There is no way of predicting the extent of variation in porosity development from one well to another. It varies between wells and from one limestone reservoir to another.

Q What is the variation in permeability between Wells 4 and 5?

A The average permeability development for Well No. 4 from core analyses is 4.1 millidarcys. The average permeability development for Well No. 5 from core analyses is 37.6 millidarcys.

Q I judge from your testimony, if I am correct, that the bottom hole pressures as to all the wells vary less than 30 pounds, is that correct?

A That is correct.

Q Now, is the P.I. the same as to all the wells?

A No. The P.I. varies over an appreciable range. The actual measured P.I.s vary from a minimum of .4 to a maximum of 10.

Q Now, your Exhibit No. 10 is based on averages, is it not?

A That is correct.

Q And that is based upon the assumption that the P.I. is

constant?

A In running out the calculations, it is based upon the assumption that the P.I. is constant. However, the only important assumption associated with these calculations is the assumption of continuous permeability development. The order of magnitude of variation in permeability development is not important in determing the variation in ultimate oil recovery for different well densities. In other words, once we establish continuous permeability development, we have satisfied the only really important assumption associated with the calculated variation in oil recovery for various spacing patterns.

Q Now, is that also based upon the assumption that the porosity would be the same?

A No, it doesn't necessarily assume equal porosity development throughout.

REDIRECT EXAMINATION

BY MR. SMITH:

Q Is there any differential in time with respect to the flow of fluids in the reservoir as based on the P.I.s, the productivity indices? In other words, would it take longer for a situation to level off?

A Well, of course, it will take longer to deplete a well having a P.I. of 1 than it would a well having a P.I. of 10.

Q But the important factor is that you must have continuous permeability development throughout the reservoir?

A That is correct.

RECROSS EXAMINATION

BY MR. CHRISTIE:

Q I would like to ask one question. I believe you said you were able to maintain your static conditions under P.I. test, is that correct?

A That is correct.

Q Does that mean that you did not have a declining P.I.?

A That is correct.

Q What is your shut-in time for your bottom hole pressure, your survey period?

A They vary. I believe it is forty-eight hours, but some of the wells might not have been shut in over twenty-four hours. All wells exhibit a quick build-up and were left shut in for a sufficient period of time to definitely establish that we had a complete build-up.

BY MR. MACEY:

Q Mr. Leibrock, on your Exhibit 9, you based your average permeability based on your core analysis on No. 1, No. 3, No. 4, and the No. 5 wells, is that correct?

A That is correct. We have core analyses on the Unit Wells 1, 3, 4, and 5, and the values indicated are the averages of these analyses.

Q Now, did you core the entire section?

A No, sir, we have not cored the entire section in any well drilled today.

Q In your coring, what type of recoveries did you get?

A We got recoveries which approximated 100 percent; 90 to 100 percent, I believe will cover them all.

Q Now, in Well No. 3, what was the permeability, complete core analysis in No. 3?

A Well, No. 3 exhibited a permeability of 408 millidarcys.

Q That is considerably higher than any other?

A That is appreciably higher than any other well cored.

Q Do you have a complete tabulation of all your bottom hole tests taken since completion of your first test well?

A I don't have them with me, but they are available and I can get them.

MR. SMITH: Would you like us to supply that information for you?

MR. MACEY: Very definitely.

MR. SPURRIER: Any further questions of this witness? If not, the witness may be excused and we will recess until one fifteen.

(Witness excused.)

(Whereupon, at eleven forty o'clock, A.M., a recess was taken, the hearing being resumed at one thirty o'clock, P.M.)

MR. SPURRIER: The meeting will come to order, please, and we will continue with testimony in Case 391.

MR. SMITH: I believe that Mr. Hiltz has been qualified as an expert witness before the Commission heretofore. Will you accept his qualifications as an expert again?

MR. SPURRIER: We will.

ROBERT G. HILTZ

being first duly sworn, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. SMITH:

Q Your name is Robert G. Hiltz?

A Yes, sir.

Q You are employed by Stanolind Oil and Gas Company?

A Yes, sir.

Q In what capacity?

A I am Division Proration Engineer in Stanolind's North Texas-Nexico Division office in Fort Worth, Texas.

Q Mr. Hiltz, you have had occasion in your capacity as Division Proration Engineer to make certain analyses in the Ellenburger Field?

A That is true.

Q Have you made any studies with respect to cost of drilling each of the wells?

A Yes, I have. Stanolind Oil and Gas Company as operator

of the South Mattix Unit has completed six wells to date on which complete cost data are available. The average cost per well has been approximately $252,000.

Q How much steel is involved in completing the wells?

A The average amount of steel required to complete each of the six wells was 210 tons.

Q That includes the casing and tubing?

A Yes, sir.

Q And wellhead equipment?

A Yes, sir.

Q It does not include tank batteries and items of that sort?

A That is correct.

MR. SMITH: If I could ask the Commission--does the Commission judicially recognize the fact that there is a critical shortage of steel, or would you rather have testimony on it?

MR. SPURRIER: We don't have a quorum, Mr. Smith. We can't decide. Excuse me, go ahead.

Q Mr. Hiltz, in your knowledge of the oil and gas business and proration practices, is there any scarcity or shortage of steel at present?

A With the information that has been made available to me, and in consideration of the information appearing in periodicals and newspapers, there apparently is a short-

age of steel.

MR. SPURRIER: Does that include tubular steel?

THE WITNESS: That includes tubular steel, that is correct.

Q In your opinion, is it a critical shortage?

A At this time, I believe the shortage would still be considered critical.

Q Of course, steel is used in defense activities?

A Yes, that is true.

Q And for re-arming the country and for items of that sort, where it is essential to be used elsewhere at this time?

A Yes, sir.

Q Now, Mr. Hiltz, we have submitted to the Commission's consideration proposed rules and primarily they are designed for location of wells on a uniform basis. I will ask you if you have any comments to make about the location of the wells?

A Yes, sir, I have. We would like to enter this as our next Exhibit, Exhibit No. 13.

(Map indicating locations completed to date, marked "Stanolind's Exhibit No. 13.")

A (Continuing): Now, on this map, we have indicated with red dots the locations which have been completed to date. You will note that six wells have been completed to date.

The blue dots here, here, and here, represent wells

currently drilling and which have not been completed.

Now, assuming that the entire area within the red line, which area we would ask that this order be designed to cover, would be productive, we have indicated by green dots the additional development which would represent complete development of this area on the spacing pattern we would ask the Commission to adopt, that is, one well to the equivalent of each 80 acres, with the wells being located in the center of the northwest and southeast quarters of the section. We would also ask that the wells be located in the center of the quarter quarter section, but we would provide 150 feet clearance for surface obstructions where necessary.

Q Is provision made for the Commission's granting exceptions to the rules?

A Yes, sir, that is correct. We would like to ask the Commission to make provision for exceptions in cases where they are believed to be necessary, after due notice and hearing.

Q Do you have any other comments to make with respect to the rules?

A In our proposed rule, we are asking, in effect, that 80-acre proration units be established in this field, which conforms to the type of proration units you would have for 80-acre spacing in this case. As I have stated,

the red line represents the area we would initially request the Commission to declare, or designate be covered by this order.

I would also like to point out that the area within the red line does not necessarily represent the maximum productive limits of the field; and at the appropriate time, they undoubtedly will have to be extended.

Q Would those extensions be accomplished after notice and hearing in a manner similar to that which we have today?

A That is correct. As far as the proration unit itself is concerned, it would be comprised of 80 acres and this rule would permit the operator to designate either the north half of the quarter section, the south half, the east half, or the west half, as being the 80 acres for a given proration unit.

Inasmuch as we are speaking of 80-acre proration units here, we would ask the Commission to adopt the 80-acre proportional allocation factors recently ordered effective, I believe, July 1 in Order No. R-98-A.

I believe those are all the comments I have.

MR. SPURRIER: Are there any questions of this witness?

CROSS EXAMINATION

BY MR. MACEY:

Q Mr. Hiltz, you have a well off pattern drilling now, is that right?

A Yes. You will note in our proposed order, however, that we are asking that the specific requirements for spacing be applicable only to wells to be drilled in the future. We recognize the fact that the well drilled by Gulf is on a 330-foot location, which conforms to state-wide rules; but we couldn't ask them to move that location physically.

MR. SPURRIER: Any other questions? If not, the witness may be excused.

(Witness excused.)

MR. SMITH: That is all the testimony we have to offer.

MR. SPURRIER: Do you want to offer this exhibit?

MR. SMITH: Oh, yes. I would like to offer that Exhibit in evidence.

MR. SPURRIER: Without objection, Exhibit 13 will be received.

Does anyone else have a witness, or a comment to make?

MR. HOUSE: We feel that the engineering and geological data presented by Stanolind is reasonable and can be accepted. And we would like to contribute, with Stanolind in asking that this 80-acre spacing be authorized.

MR. ROGERS: We have an 80-acre lease in the proposed unit, this lease being described as the West Half of the Northwest Quarter of Section 22. We also are in agreement with Stanolind on their proposed spacing.

MR. CHRISTIE: We have a one hundred sixty-acre tract within the confines of this proposed unit. And we would like to concur in Stanolind's application for 80-acre spacing for this Fowler Ellenburger Field.

I would like to point out that this isn't a field all of its own. There are a number of similar fields with similar characteristics; and I have in mind particularly one field that we operate in, that is, the Barnhart Field in Texas, which is an Ellenburger fracture type reservoir. We have been operating there for approximately ten years, and have a ten-year history on it. The viscosity of the oil is very similar. The formation volume factor is high, a little bit higher than in this particular field. The type of reservoir is solution type, and we also conducted interference tests when the field was drilled, to an approximate density of 160 acres.

We had three wells shut in at that time, and we noted that after a certain length of time, pressures declined along with the rest of the field, although not quite in the same magnitude; which indicated to us that in this field, which is similar to the Fowler Field, that we had drainage

on at least 160 acres.

I think most of you are also familiar with the Spraberry Sands in West Texas; and it is also a fracture type reservoir, most of the oil coming through the fracture system. And one company in that field has carried on a very stiff interference test setting in approximately half their wells in a section. And they have also noted in this type of reservoir that one well would drain at least 80 acres, and the indications are that it would drain greater than 80 acres.

So you have a history back of these types of reservoir which will support 80-acre spacing. And we urgently wish that the Commission would adopt this order as applied for by the Stanolind Company.

MR. TAYLOR: In the evidence presented by Stanolind, it satisfies the Gulf Oil Corporation that one well will drain at least 80 acres in the Fowler Field; and Gulf wishes to concur with Stanolind's application for a uniform 80-acre spacing pattern and the adoption of an 80-acre proportional allocation factor.

Gulf has in the past requested that its locations not be fixed for either 40 acres or the 80-acre unit. And we urge that the Commission approve this application, provided it is ordered that the well in each unit may be drilled in either 40-acre tract.

MR. SPURRIER: Anyone else?

MR. RAY: We believe that Stanolind's application has been well substantiated, with excellent engineering information; and we wish to concur in the application.

MR. SPURRIER: Anyone else?

If not, this case will be taken under advisement and we will go on to Case 392.

STATE OF NEW MEXICO)
) SS.
COUNTY OF SAN MIGUEL)

I hereby certify that the foregoing and attached transcript of proceedings in Case No. 391, before the Oil Conservation Commission, is a true and correct record of the same to the best of my knowledge, skill and ability.

Dated at Las Vegas, New Mexico, this 1st day of September, A.D. 1952.

Ruth Warden
Reporter