

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
November 18, 1959
REGULAR HEARING

PHONE CH 3-6691

IN THE MATTER OF:)

Application of Hanson, Waters, and Williamson)
for a hearing de novo before the Oil Conser-)
vation Commission in Case No. 1728, Order)
No. R-1473, which was an application for a)
pilot water flood project in the Coyote-)
Queen Pool, Chaves County, New Mexico, and)
for capacity allowables for 12 wells in said)
project, and for the establishment of an)
administrative procedure for expanding said)
project and for granting capacity allowables)
to wells in said project.)

) Case 1728

BEFORE:

Mr. A. L. Porter, Jr.
Mr. Murray Morgan
Governor John Burroughs

TRANSCRIPT OF HEARING

MR. PORTER: The meeting will come to order. At this time I would like to announce that the Commission has decided that the normal unit allowable for December will be 36 barrels per day for the Southeast, will remain at 52 barrels for the Northwest.

We will take up next Case 1728.

MR. PAYNE: Case 1728: Application of Hanson, Waters, and Williamson for a hearing de novo before the Oil Conservation Commission in Case No. 1728, Order No. R-1473, which was an application for a pilot water flood project in the Coyote-Queen Pool, Chaves County, New Mexico, and for capacity allowables for 12 wells

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in said project, and for the establishment of an administrative procedure for expanding said project and for granting capacity allowables to wells in said project.

MR. KELLAHIN: If the Commission please, Jason Kellahin, Kellahin and Fox, representing the Applicant. Before we start with any testimony in the case, I would like to make a brief statement and kind of review the situation which arose and occasioned our being before the Commission de novo at this time.

The case was first heard before an Examiner on July the 28th, following which the Commission entered its order denying the application for the water flood, and basing the denial on two findings: One, that the proposed producing wells which have been potentialized all were reported as being capable of producing in excess of top unit allowable for the Coyote-Queen Pool; and the other, that the Applicants presented no evidence to show they have an adequate supply of water for said project.

We feel that the findings were based on a misapprehension of our testimony. However, we probably didn't make it as clear as we should have, and at this time we will offer additional testimony on those two points.

The case was originally filed back in July 1959 and well before a / hearing had been called in Case 1787, which resulted in Order No. R-1525; as a matter of information for the Commission, I feel that the Commission should still give full consideration to the fact that this application was based upon an application for

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capacity allowables. I don't know what consideration they will see fit to give to the provision of Order No. R-1525. We are prepared to go ahead with some additional information in connection with the capacity allowable features, by offering to the Commission additional reservoir information which we think is pertinent to the issues.

In connection with the presentation of this testimony I would like to point out that our application for hearing de novo was filed on September 11th of 1959 and under the Statute, the case should have been heard at the hearing in Roswell on October 14th. At the request of the Commission staff, we did not press for hearing at that time and consented to hearing at a later date. Had it been heard at that date, of course, the provisions of this order would not have been in effect, and I think that should be given some consideration by the Commission.

In presenting our case we will have two witnesses, Mr. Schram and Mr. Russell.

MR. PORTER: Will you have your witnesses stand and be sworn, please?

(Witnesses sworn.)

MR. KELLAHIN: My first witness will be Mr. Schram.

HARRY F. SCHRAM

called as a witness, having been first duly sworn on oath, testified as follows:



DIRECT EXAMINATIONBY MR. KELLAHIN:

Q Will you state your name, please?

A My name is Harry F. Schram.

Q By whom are you employed, and in what position?

A As geologist for Ernest A. Hanson.

Q Mr. Schram, have you had any education in the field of geology and experience in that field, and would you outline that education and experience for the Commission?

A I hold a Bachelor of Science degree in Geology from the University of New Mexico, and have been working as a geologist for Mr. Hanson for the past four years.

Q Are you familiar with the geology and reservoir involved in this case in the Coyote-Queen Pool?

A Yes, I've worked as geologist on it since the discovery well was drilled.

MR. KELLAHIN: Are the witness's qualifications acceptable?

MR. PORTER: Yes, sir, they are.

Q (By Mr. Kellahin) Mr. Schram, you heard the statement that I made at the outset of this case. Have you prepared any information based on the production of the wells involved in the proposed water flood project?

A Yes, I have.

Q Has that been prepared in exhibit form?



A Yes. In the beginning, I have available water sources.

(Applicant's Exhibit No. R-1
marked for identification.)

Q Referring to what has been marked as Exhibit No. 1, will you discuss that exhibit, please?

A All right. On the first page, which is a production summary for all of the holdings that Hanson, Waters, Williamson have, and proposed pilot flood in Coyote-Queen Field in Chaves County. The total number of wells in the Field are eleven, and the total field production from August 1st, 1959, to October 31, 1959, was 5,251.34 barrels. The daily field average, which this period is 92 producing days and which are the 11 wells, was 57.08 barrels. For the daily well average for 92 days, 5.19 barrels of oil per day, for that period. The total field production from October 1st to 31st, which during that period those wells were producing as much as they possibly could, we went back the month before and did quite a bit of remedial work in cleaning out the well so that we could get at least a good thirty-day test, and that total was 2,106.52 barrels. The daily average was, for 31 producing days for the 11 wells, was 67.95 barrels, and the daily well average for 31 producing days was 6.18 barrels of oil per day. At the bottom of that page, I put down the tests that were taken on the wells that would be affected by the proposed water flood.

The Hanson State "A" No. 1 on a test which is explained farther in the presentation is 10.95 barrels of oil per day. No.

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2 Hanson State was 1.16 barrels of oil per day. No. 1 Levick State "C" was 5.32 barrels of oil per day; and the No. 2 Levick State "C" was 3.01 barrels of oil per day, for the total daily oil produced by the affected wells would be 20.44 barrels of oil per day. The daily average of the affected wells is 5.09 barrels of oil per day. That would be the area affected by the proposed pilot flood.

Second page is a map of the proposed pilot area, and also will show you where the different well numbers are.

Q Does that also show the lease ownership?

A It also shows the lease ownership of our leases in there.

Q Have you prepared reports on the individual leases involved in this application?

A Yes, I have; not only the individual leases but the individual wells.

Q Without going through the information entirely, could you summarize the information which is shown on Exhibit No. 1 in that regard?

A Well, the main point of this exhibit, of course, is the wells to be affected by the proposed pilot flood, with each lease is an individual test where we have Levick State "A" and Levick State "B" and so forth. We have a ten-day test or a thirty-day test or three-day test which those wells were produced at their maximum during that period. In the case of the Levick State "A",



which only has one -- let's see, Levick State "A" has only just one well on it; for thirty-one day potential test from October 1st to October 31st, 1959, the average was 2.57 barrels of oil per day.

In the case of your Levick State "B", the No. 1 "B" for ten day potential test from November 1st to November 10th, 1959, it was 19.12 barrels of oil per day. The No. 2 Levick State "B" was 8.56 barrels of oil per day for a ten-day test over that same period.

Your Levick State "C", which two of those wells, I believe, are requested in this pilot flood, the No. 1 and the No. 2, the No. 1 for five-day potential test from the 1st to the 5th of November is 5.32 barrels of oil per day. Over that same period the No. 2 "C" averages 3.01 barrels of oil per day. No. 3 "C" was 4.63 barrels of oil per day, and the No. 4 "C" was 10.41 barrels of oil per day.

No. 1 "D", which is the lone well on the "D" lease, the Levick State "D", averaged 9.90 barrels of oil per day.

The Hanson State No. 1-A, which will be affected by the flood, on the nine-day potential test from the 1st of November to the 9th of November averaged 10.95 barrels of oil per day; and the No. 2 averaged 1.16 barrels of oil per day, which two will be affected by your pilot flood.

And your Pan American State "A", for thirty-one day potential test from October 1st to October 31st, 1959, averaged 2.52 barrels of oil per day; and each of these lease summaries

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or production records, you have a day by day production total for that lease for the months of August, September, and October.

Q Now, Mr. Schram, your Levick State "B" lease which shows 19.12 barrels of oil per day, is that inside the proposed project area?

A No, I don't believe it is.

Q Then the best well you would have in the project area potentialized at 10.95 barrels per day?

A That's right.

Q That would be the Hansen State "A"?

A No. 1.

Q No. 1?

A Yes.

Q That is the best well in the project area, is that correct?

A Yes, definitely.

Q You don't have any wells which are top allowable wells?

A No.

Q Now in your opinion, Mr. Schram, has this field reached a stage of stripper operation?

A I would say definitely it is.

Q On the basis of your potential test, do you believe it is ready for water flooding?

A Yes, definitely.

Q Have you prepared any information on the sources of



water?

A Yes, I have.

MR. KELLAHIN: Would you have that marked as Exhibit No. 2?

(Applicant's Exhibit No. R-2 marked for identification.)

Q Referring to what has been marked as Exhibit No. 2, would you discuss that exhibit, please?

A It is a list of available water sources for the pilot injection flood, Coyote-Queen Pool, Chaves County, New Mexico. We have taken tests or have gone back over the records and put down the tests and what we have actually done ourselves in the area, as far as developing an available water source for pilot flood, in this case I took your Devonian formation first, mainly because there are a lot of deep dry holes in the area which we hold the oil and gas lease on these particular leases. Richfield No. 1 Comanche Unit in Section 13, Township 11 South, Range 26 East, was drilled to a total depth of 6129, and the lease is presently owned by Ernest A. Hanson. However, there is no information available as to whether they had tested the Devonian for water or oil or anything else. However, your Richfield No. 2 Comanche Unit, which is directly south, Section 24, Township 11 South, Range 26 East, the well had pipe set on it, was perforated from 6118 to 42 and 6157 to 84; flowed fifteen barrels of salt water per hour, and the lease is presently owned by Ernest A. Hanson.

Your Kewanee No. 1 De Kalb Federal, Section 25,

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11, 26, drill stem tested at 6184 to 6202, open two hours and recovered 2160 feet of salt water.

Honolulu No. 1 State, Section 13, 11, 27, drillstem tested 6692 to 6743, open two hours, recovered 5880 feet of salt and sulphur water.

Texas Company No. 1 State "AM", Section 13, 11, 27, perforated 6583 to 93, flowed 10 barrels of salt water per hour.

Your De Kalb No. 1 Coll in Section 18, 11, 27, was perforated 6315 to 25 and flowed 35 barrels of salt water per hour.

Your Union and De Kalb No. 1 State, Section 27, 11, 27, had a drillstem test from 7400 to 95, open two hours, recovered 1000 feet of slightly gas and mud cut salt water and 4000 feet of salt cut water.

Although these wells, we don't have the leases on these wells, I think it does definitely show that there is adequate water in the Devonian.

Q Now, Mr. Schram, your organization, or Hanson, Waters and Williamson have leases in the area which could be developed as sources of water from the formations you have discussed?

A Yes. We have three leases that have these deep holes on them.

Q Are you familiar with the characteristics of the Devonian formation with regard to the production of water?

A Well, in general, your Devonian water, if you have fairly good drillstem test or you treat the Devonian, if you do



get water generally it will rise pretty close to the surface.

Q Is it generally considered a prolific source of brine where it is not oil productive, is that correct?

A Yes.

Q Do you have adequate water supply available presently for the proposed project area?

A Yes.

Q Would you just discuss where that is coming from and what it consists of?

A On the second page under your heading of "Glorietta" we went back into the De Kalb well in Section 15, 11, 27, which we have designated the No. 2 Levick State "D", we ran pipe, four and a half inch casing as a tubing string and put a pretty fair size pump on that and potentialized that well for 625 barrels of water per day.

Q Do you have adequate water supplies, potential water supplies to carry the project to a completion as you presently anticipate?

A I would say definitely yes. However, it is a matter of developing these supplies more as you go along. They're there, in your Queen you have two wells over to the west which have had, well, really amazing shows of water in them; and then we have one well in the Yates in Section 26, 11, 27, that we have potentialized for 650 barrels of water per day, which between the two wells would certainly take us through our pilot stages of this flood.



Q Do you have any water analysis that has been prepared?

A Yes.

(Applicant's Exhibit No. R-3
marked for identification.)

A On the water analysis run by Russell Engineering, Abilene, Texas, on the water from the No. 2-X Levick State "D", which is the old well we went back into and completed in your Glorietta formation, well, your main point being that your chloride ran 145,000 parts per million, for a total dissolved solids was 238,400 parts per million, which is exceedingly salty water.

MR. PORTER: It wouldn't be fit to drink?

A Definitely not. Now I called in this morning and we had an analysis run on the water from the 1-X Levick State "B", which is the Yates supply that we have developed. It's in Section 26, 11, 27, went into the interval of 120 feet and 170 feet deep, it's out of the Yates formation. It is, the total dissolved solids in that is 2680 parts per million, which is a point between being fresh and salty.

MR. PORTER: That is 170 feet?

A Between 120 and 170 feet deep. That well was 650 barrels of water per day.

Q (By Mr. Kellahin) Were Exhibits R-1, 2 and 3 prepared by you or under your direction and supervision?

A Yes.

MR. KELLAHIN: At this time we would like to offer in



evidence Exhibits R-1, 2 and 3.

MR. PORTER: Without objection the exhibits will be admitted to the record.

MR. KELLAHIN: In order that cross examination can be properly carried on, and for the record at this time, I overlooked offering the record and exhibit from the original hearing in July in this case, and I would like to do so, in order that any further cross examination along that testimony could be brought in at this time.

MR. PORTER: Would there be any objection to the admission of the earlier record in this case? Let the record show that the record at the previous hearing will become a part of this case.

MR. KELLAHIN: Could I ask a further question?

Q (By Mr. Kellahin) Did you give the volumes of water from the shallow well?

A Yes, 650 barrels of water a day, that's with a Reda pump.

MR. KELLAHIN: That's all the questions I have.

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Schram, are all of these water sources you give here either salt water or bordering on salt water?

A Well, all but your Yates; there apparently are shallower zones in there that are somewhat fresh. I doubt whether you would



want to drink them yourself, but they are on that borderline, I would say.

Q Has there any fresh water at all been found in this area which you would deem fresh?

A Well, fresh, for cattle.

Q I mean for human consumption or cattle.

A No, not for human consumption; cattle, yes.

Q With reference to your testimony concerning the potentials of these wells, do you recall the Commission examined quite a few of the potentials which were filed shortly after completion of a number of these wells, several of them, and potentials reported there was, oh, about thirty to forty barrels, something like that, and your performance history indicates that no well in the pool or at least none of these wells, will produce anything like the earlier potential reported. How do you account for this higher potential figure as previously reported, would that be, do you think, a portion of the frack oil was being recovered at that time, or do these wells just decline that rapidly?

A Well, I think there are several reasons for it. The main reason being these wells were potentialized after the frack oil was recovered; however, in the area you have bottomhole pressure that is too slight to measure. Consequently, you get one figure influx of oil which falls off to a stripper well within a matter of two or three months.

Q Would you say that you might get a potential like say

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36 barrels a day on one of these wells today, and tomorrow you would get considerably less?

A Well, if it was a new well, you would probably get top allowable after your frack was back, you would probably get, a top allowable well for possibly thirty to sixty days, and then it just falls right off.

Q Well, apparently production history on these wells indicates that you haven't had any that held up that well?

A Very few.

Q For a period of thirty to sixty days?

A Right after you do frack the wells, and after you do get your load oil back, they would hold up for, oh, several days.

Q Now, going back to the report on the production, well, one example is your Levick State "B" where that well was shut down for some period of time.

A It was shut down for repairs and equipment to be installed on the well.

Q Did it build up again?

A No, it was shut in for thirty days in September, it made 306.85 barrels in October, which would be 9.908 barrels per day average.

Q Would you term this entire field a stripper field, as far as the wells are concerned individually?

A Yes, I would.

MR. PORTER: Does anyone else have a question of the



witness? Mr. Nutter.

BY MR. NUTTER:

Q Mr. Schram, did you give the chloride content on the Yates water?

A Your chloride content on your Yates water is ninety parts per million.

Q Nine?

A Ninety.

Q Ninety. The solids were 2680, correct?

A Right.

Q Now, on the Glorietta water, did I understand that you had 238,000 parts per million of dissolved solids?

A Yes.

Q Was the Glorietta potentialed with the pump in the hole?

A Yes.

Q Was that Reda pump in there?

A No, that was pump jack with a regular four and a half inch pump in the well.

Q You have four formations listed here on this exhibit that could be potential sources of water. What do you expect that you would actually use for your water supply, which of the four?

A For the pilot flood?

Q Yes.

A I think Jim Russell could probably answer that better than I can on the estimates.

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Q Has a study been made for the compatibility of the water of any of the four zones with the natural formation's water in the Queen formation here?

A Not, well, in your Queen formation we make a little bit of water with our wells out there, and of course, it is compatible there; as far as compatibility tests, we -- on the Glorietta water, quote this report of Mr. Russell here: "Special compatibility tests were conducted using the current water sample and a sample of water from a fresh water supply well analyzed in our laboratory, July 13, 1959 and presented as our laboratory No. W-414. Waters from Water Supply Well No. 2-X and from the fresh water supply well were mixed in the ratios of 1 to 3, 1 to 1, and 3 to 1 and checked for formation of precipitates, pH content, alkalinity, and supersaturation. Results of these tests indicated that these waters are compatible in all ratios tested under laboratory conditions."

Q You expect for your water flood you would be using the water from the 2-X and 1-X and mixing them?

A Well, I don't know. I know we have the water available now; however, I'm not sure that we would want to use that. It's kind of hard to develop a water supply without knowing whether you can go on to a pilot flood or not.

Q Whether you need the water or not, you do have a Reda pump installed in the 1-X well, however?

A Yes.



Q Mr. Schram, I notice in these daily production tests that you have conducted, particularly during October, that there is a wide variation in the amount of oil that the well will produce from one day to the next. How do you account for that phenomena?

A Well, in most cases in the field you have one day, you'll have a big slug of water come into the well, anywhere from zero to ten barrels of water, and possibly the next day, which will apparently replace part of your oil in there; you are making a, usually a pretty constant rate of fluid; however, we are pulling these wells pretty hard for the test.

Q Are these all 24-hour tests?

A No, they aren't pumping 24 hours straight in there. They run about 4 hours twice a day, and they are in -- it takes about an hour and a half or so to draw the wells down to nothing.

Q By producing them four hours a day, though, you have, four hours twice a day, I mean, you have withdrawn from the well all the fluids that were coming into the hole?

A Yes, in a matter of an hour or hour and a half.

Q Your total fluid production is relatively constant, it is a variation between the amount of oil and the amount of water?

A Right.

Q Now some days I notice there isn't any oil produced. Is this a day that you are producing one hundred percent water?

A Well, in several cases; however, I think the main



reason for that particularly in the month of October, is that you have to shut the wells down while they pick up oil and they will usually come in and gauge the tanks early in the morning, and sometimes the trucks won't come around and pick it up until the next day.

Q How about the producing history of the various wells? What is the maximum amount of oil that any well has made?

A Well, it would be right after you have recovered your frack oil.

Q I mean the total production, do you have the figures on the total production from any well?

A Not over the entire history of the field, no, I don't, I went back three months where we had accurate gauges in the field to find out mainly what they were doing presently.

Q This production of August through October here, does that represent the total well's production in some cases?

A No, I don't think in any case. Not in any case would cover the entire production of that well.

Q Every well had some production prior to August, then?

A Yes. In fact, I think part of that was presented in that last hearing.

Q I thought maybe some of these were new wells that hadn't been completed.

A No, none of these are new wells since that previous hearing.



MR. NUTTER: I believe that's all.

MR. PORTER: In that connection, are there any new wells completed in the pool?

A No, not right -- well, we haven't any since the first hearing.

MR. PAYNE: Is your next witness going to testify to the proposed injection plan and well completion methods and so forth, or --

MR. KELLAHIN: That testimony is already in the record, Mr. Payne. If you want to supplement it in any way, he will be available to answer any questions.

MR. PAYNE: Your next witness?

MR. KELLAHIN: Yes.

MR. PORTER: Anyone else have a question of this witness? Mr. Irby.

MR. IRBY: Frank Irby, State Engineer's Office.

BY MR. IRBY:

Q Mr. Schram, for my information I would like to have a few things clarified in your Exhibit No. 2, R-2.

A Yes, sir.

Q Under the Richfield No. 2 Well, you have 15 with these five letters following. Now "B" is Barrels --

A Barrels, "X" is salt, "W" water, "P" per, and "H" hour.

Q Now under the Kewannee, that would be 2160 feet of salt water?



A Of salt water, yes, sir.

Q Is that a column in the casing, or what is this?

A That is a column from the total depth of your hole, or if it was a straddle packed test, it would be from the bottom of the bottom packer in the drill pipe.

Q This is merely an indication of pressure, and not quantity of water, right?

A You can, if you had the detailed drillstem test in there, it will also give your pressures and this is actually what the drill pipe filled up in a matter of two hours. The tool was open for two hours for that test, and that 2160 feet of salt water filled up from the bottom into the drill pipe.

Q Now what factor do we have to use there to convert that to quantity volume?

A Well, in your case, in a case like that, or as in an oil well, you don't know until you have treated that well or perforated in a cased hole. Now in the case of other Devonian tests that are listed there where they have set casing and cemented and perforated, such as your De Kalb No. 1 Coll, that was flowing 35 barrels of salt water per hour. There wasn't any, there's hardly any way that you can compare that until you actually set pipe and try to produce that water. All it gives you is an indication that you do have water in there, and of course, the higher it rises over the shorter period, the better your water supply will probably be down there.

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Q Then you couldn't convert this to volume by using the inside diameter of your column pipe?

A No.

Q Then down to your Honolulu No. 1 State --

A Yes.

Q -- explain that "S" in those letters following 5880 feet.

A Salt and sulphur water.

Q Sulphur?

A Yes.

Q And under the Union and De Kalb No. 1 State, those letters following 1000 feet there?

A That's slightly gas and mud cut salt water.

Q Did the exhibit you submitted include chemical analysis on the two wells in the Yates formation, the Whaley Company water well and the Hanson No. 1-X State "B"?

A On the No. 1 State XB, yes. On the other well, no. They are apparently using that water for drilling and mud purposes.

Q Was that analysis in the one case submitted in your original presentation to the Commission, or was it presented today?

A No, it was presented today.

Q Could that be made available to the State Engineer?

A I don't know.

MR. KELLAHIN: I believe it was filed as an exhibit in the other case that was submitted to the Commission.

MR. PORTER: Mr. Irby, if we have a copy of it, we



will be glad to reproduce it and give you a copy.

MR. IRBY: That's all the questions we have.

MR. KELLAHIN: We will be glad to supply one, in any event. I would like to call as our next witness Mr. Jim Russell.

JAMES E. RUSSELL

called as a witness, having been first duly sworn on oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A James E. Russell.

Q Are you the same Mr. Russell who testified in this case at the hearing in July as an expert engineer?

A Yes, sir.

Q With whom are you associated, Mr. Russell?

A Russell Engineering in Abilene, Texas.

Q Were you employed by Hanson, Waters and Williamson to investigate the feasibility of the project which is proposed in this application?

A I was.

MR. KELLAHIN: Are the witness's qualifications acceptable?

MR. PORTER: Yes, sir.

Q (By Mr. Kellahin) Mr. Russell, are you familiar with the provisions of Order No. R-1525 which was recently adopted by



the Commission governing water flood projects?

A I'm familiar with it.

Q In that connection have you made any further study of the reservoir in the Coyote-Queen Pool which is involved in this application?

A Yes, sir, I have given it quite a bit of thought and of course, our original application was prior to the adoption of this rule, and of course, at that time we had applied for two 20-acre five-spots in the Coyote-Queen Pool in this original hearing. The location of these two five-spots, of course, would encompass five 40-acre proration units, and by adopting the rule as set forth, the entire project area would include twenty-one 40-acre proration units, if I interpret the rule correctly.

Of course, at this time all of these 40-acre proration units are not developed and would not be within the area to be affected by the six injection wells.

Q Before you draw any conclusions as to the effect of the new order, Mr. Russell, would you discuss the additional reservoir information which you have prepared?

A We have prepared for illustrative purposes here a cross section prepared from the core analysis data, which might assist in clarifying the data presented in the first hearing with respect to the reservoir itself. I might just put this up here on the board. This illustration shows that in the Coyote-Queen Pool the reservoir actually consists of, in most cases, of about



five separate zones, based on an analysis of cores from each of these wells through which the cross section has been drawn.

In the north part of the reservoir, this is from a southwest to a northeast direction, you will note where we have colored in yellow on this exhibit there is actually a separation between various zones in the Queen formation. For all practical purposes, we have at least four separate reservoirs in this Queen formation. In our original application we applied with the idea of injecting water into each, in all of these formations at the same time. As a consequence, we felt by going to capacity injection rates, that we would flood most economically these five separate zones at the same time.

It is my opinion that if rates have to be restricted, the injection rates have to be restricted, and due to the permeability profiles and the characteristics of this sand, there's a strong possibility that in one or more of these formations or reservoirs that injectivity into those formations would be reduced practically to negligible amount.

At the proposed injection rate that I believe was presented in the prior hearing, 190 barrels per day per well, that is an average of .226 barrels per day per acre foot in each of the 20-acre five-spots. I don't believe that we want to present this cross section as an exhibit, but we do have one prepared using the electrologs, which shows the same pictorial review, that we would like to put into the record.



Q Mr. Russell, you say that curtailing the rates would have an effect on the production of the oil from these five different strata. Would you amplify that and say what effect it would have, in your opinion?

A You will note that in several of these zones that the permeability is quite -- there's quite a spread in the permeability between various zones, and that from my experience in water flooding, that in many cases at low injections rates, there's a phenomenon referred to as a threshold pressure that exists; and that at rates below, injection rates below a certain wellhead pressure, that certain of these formations, we do not know in this case, but from my experience I have seen this many times, that some of these zones will not take water at low pressure, and if we have to restrict our injection rates below the maximum rate, there is a good possibility and a strong possibility that we would actually suffer loss of oil in such a program.

Q Now what would be the alternative to that, Mr. Russell, in the event the injection rates are curtailed?

A Of course, the alternative, if they are curtailed, the alternative would be to perhaps flood each of these zones separately, and if that were done, for example, if we were to flood the bottom zone first, which we have estimated the overall project to take from twelve to fourteen years on the average five-spot to be flooded, as you can see, if we flooded each of them separately, then it would extend the life of this project to such



a long period of time that it would become almost uneconomically feasible to proceed with some of the other zones due to deterioration of equipment, for one thing, additional expense, operating cost, that actually would limit the economic feasibility of such a curtailed type of program.

Q Would a curtailed type of program result in the necessity of buying additional equipment and of reworking wells or other factors which would affect the economics of this project?

A Yes, if we had to flood these zones separately at the present time, the wells in the project are perforated through the entire section, and to flood the zone separately would necessitate either plugging of the zones that are presently perforated, setting packers with tubing strings, and which would add expense to such a project, yes.

Q Now, under the provisions of Order R-1525, as you will recall, an allowable of 42 barrels per proration unit plus a one unit additional allowable on the unit, with certain restrictions, is granted to the operator of a water flood. Have you applied that rule to this project to determine what effect it would have on your injection rates?

A Yes, sir. In the area proposed when it is completely developed with the wells that we had asked for to be drilled and completed, and applying this rule, which would be four wells on a 40-acre tract; in other words, if there are four wells on a 40-acre tract, my interpretation is that it would be an 84 barrel



allowable for that four-acre unit.

When these wells are all completed, there would be a total of twenty wells in this pilot area. The computations on that basis would give us a project allowable of 588 barrels per day. If the entire project area were developed with four wells on each 40 acres, and which would be 84 barrels per day allowable, the total maximum allowable from the project would be 1764 barrels per day. However, the field has not been delineated at this time, we do not know what the limits of the field are; and of course, it is doubtful that we would extend this project to a full completion at this time to the point where we would be entitled to 1764 barrels of oil per day, until at least we know what the pilot project, the results of the pilot.

My calculations indicate that an injection rate of 190 barrels per day per well, that the peak, average peak oil producing rate per well will probably reach 100 to 110 barrels per day, which I think I mentioned earlier that this injection rate, the injection rate would be equivalent to .226 barrels per day per acre foot, which in my opinion is also quite a low rate of injection.

We must keep in mind that we can probably live under this rule if we were to consider this as four or five separate reservoirs and if we were to be granted the 42 barrels per day per well per reservoir, which is the case in most water floods that you get into, that you only have one reservoir that you are flooding



at a time; in that particular case, we would be dealing with ten or eleven feet of sand per reservoir. In this case we have 42 to 50 feet of sand that we're injecting into and producing, so that we in this particular case with 42 barrel a day allowable, it would be a producing rate of one barrel per day per foot of sand; with ten foot section, why we could have four times that.

Q What is your recommendation to the Commission in connection with the injection rates, then, Mr. Russell?

A My recommendation is to grant us permission to inject at capacity injection rates, and to be able to produce these four or five separate reservoirs at their capacity, which each of those reservoirs would be less than the 42 barrels per day as provided by this rule.

I think I mentioned that if we had to reduce the injection rates over the life of this, it would probably amount to about a fifty percent reduction in order to stay within the allowable; and at that rate, the injectivity would be at 0.113 barrels per day per acre foot, or about one-ninth of the magic figure of one barrel per day per acre foot.

Q Would that have an adverse effect on the recovery of oil from this pool?

A In my opinion it would. It would result in economic waste, and with the heterogeneity that exists here, the permeabilities that exist, it would be definitely my opinion that there would be considerable loss.



Q Now you heard Mr. Schram's testimony in regard to production figures on this pool. Are you familiar with the manner in which that production has been achieved?

A Yes. It's my understanding that most of the wells in this area have been fracked with what would be in my opinion a considerably high amount of fracking material. In my opinion, these high rates and high volume frack jobs are not the most desirable for any project in which secondary recovery methods are to be applied.

Q For what reason?

A Because of the possibility of creating artificial pipe lines or permeability within the reservoir too great a distance from the well bore, and that premature water breakthrough could occur, and a loss of production resulting therefrom.

I think it was testified by Mr. Schram that the average producing rate now per well is about five to six barrels per day per well. At this rate, these are not too economical; by the same token, if pressure could be applied to this reservoir and these rates maintained, it would eliminate the necessity of high volume frack jobs, and I believe it would increase the efficiency of the flooding.

Q Now you heard Mr. Schram testify in regard to the available water supply; in connection with that, in your opinion, is there an adequate supply of water available for the pilot project?

A Insofar as I know, there is an adequate water supply.



I think that by using all these available sources, if that is our only source of water, both shallow supply and the deep supply, these waters could be mixed and treated if necessary, and even going into an open system where the water could be treated so that they could all be compatible. In other words, we could correct the compatibilities of these waters if any should develop through a system on the surface, and make it a good clean water prior to injection into the reservoirs.

Q Following that practice, would sufficient supplies of water be available to carry the project through, in the event it is feasible?

A To the best of my knowledge, and from the information at hand, I think that is correct.

Q You said you had a cross section prepared on the basis of electrologs. Would you get that and have it marked as Exhibit R-4?

(Applicant's Exhibit No. R-4
marked for identification.)

Q Mr. Russell, referring to what has been marked as Exhibit No. R-4, have you compared the information contained on that exhibit to the cross section which you prepared upon the basis of core analysis?

A Yes, sir. The information as exhibited from the cross section prepared from these logs correlates very definitely with the results obtained from core analyses, so that the inter-



pretation from one would be the same as the interpretation from the other.

Q In your opinion does that support your conclusion that there are five producing zones involved here which are separated by effective separation?

A A maximum of five, yes. In some cases there are only three, but it is definitely correlatable from well to well and from the logs and core analyses, shows a definite separation between these zones.

MR. KELLAHIN: At this time we would like to offer in evidence Exhibit R-4.

MR. PORTER: Without objection the exhibit will be admitted.

Q (By Mr. Kellahin) Do you have anything further to add, Mr. Russell?

A I don't believe so.

MR. KELLAHIN: That's all the questions I have. Mr. Payne inquired as to whether this witness would testify in regard to well completions, as I understand him; that information was presented at the hearing held in July and we had not contemplated offering anything additional. However, Mr. Russell I'm sure will answer any questions he's able to, and if necessary, Mr. Williamson is present in the hearing room and we will put him on if you want any information that Mr. Russell cannot cover.

MR. PORTER: Mr. Russell -- I think we can work that

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out later, Mr. Kellahin. I have a question or two.

CROSS EXAMINATION

BY MR. PORTER:

Q Now, I believe that you testified that you didn't think these frack jobs under excessive pressures, intense pressures, is desirable in this formation?

A That is correct.

Q To some extent wouldn't you encounter the same danger with high injection rates of water?

A Only if we exceeded the over-burden pressure.

Q Now you also testified, I believe, that you have four zones, four separate reservoirs, I believe you said, in the Queen sand formation?

A Yes, sir.

Q In this pool. Do you find that true throughout the pool?

A Well, from the development to date, and I think this cross section is fairly representative of that.

Q How many wells have you examined for that purpose?

A We have examined all the wells that are completed in the pool.

Q That would be about how many?

A Twelve, eleven or twelve.

MR. SCHRAM: Eleven of ours.

Q (By Mr. Porter) You have just examined your own wells,



nobody else's?

A That's all that I can testify to.

Q You haven't found any instances within the well bore where these separate zones come together?

A Only as depicted by this cross section, sir.

Q I see.

A In this "D"-1, yes, sir; what we have classified here as zone four and five in our opinion do come together.

Q Couldn't that happen in any of the other zones between the well bore?

A It certainly could, but it has not in this area, as far as the information available from the cores.

Q From the well bore?

A From the well bore.

MR. PORTER: Mr. Payne.

BY MR. PAYNE:

Q Do you propose to inject through tubing or through the casing?

A It was our original intention to inject down the casing in a four and a half inch casing by perforation in **each** of the zones.

Q Is this old casing or relatively new?

A So far as I know, it is relatively new.

Q You feel it will adequately protect other waters or --

A The intention was to cement the wells to the surface



for that protection.

Q Are you familiar with the manner in which the wells are completed in this area?

A I haven't been present when these wells were completed. It is only from evidence that I know or have heard to be the case, yes.

Q What I'm interested in is whether the cement is circulated to the surface.

A None of the injection wells have been drilled.

Q I'm talking about the producing wells.

A I do not have first-hand knowledge of this. However, I understand that attempts have been made to circulate cement to the surface by circulating as much as 300 percent more than the amount required to reach surface, and have not been able to do so.

MR. KELLAHIN: In connection with that, we'll put Mr. Williamson on and I believe he can answer the question.

MR. PAYNE: I have one more question of this witness in this regard.

Q (By Mr. Payne) When you run into this kind of problem, it is possible to use some kind of an agent in the cement to lighten it and thereby be able to circulate to the surface?

A I know of certain agents for loss circulation materials and such as that, yes.

Q Now, I believe you testified that you are going to inject or you would propose to inject some 190 barrels of water

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per day per well?

A On the average, yes.

Q On the average. You do feel that you have an adequate water supply for that to inject that amount?

A For the pilot area.

Q Well, yes, pilot area first, yes.

A Yes, sir.

Q And also for the expanded flood?

A To the best of my knowledge, I think we would have enough.

MR. PAYNE: That's all. Thank you.

MR. PORTER: Mr. Nutter.

BY MR. NUTTER:

Q Mr. Russell, you mentioned that you had five sands here. This is a rather common occurrence in the Queen formation, is it not, to have individual stringers of permeability and porosity?

A Yes, I think that you could say that it's an occurrence in the Queen sand, but never have I run into a case where it is so evident as in this particular case.

Q Do you know of any pools in the State of New Mexico where the Oil Conservation Commission has established separate pools for the various stringers in the Queen sand?

A No, sir, I do not have knowledge of it.

Q You wouldn't recommend that the Commission should separate the pools and establish them as different pools and



require dual completion methods before they are completed into a common well bore?

A I'm not recommending dual completion, no, sir. That problem certainly would not in a water flood where we have capacity allowables and capacity injection rates, would not be a problem. It would be under proration, yes.

Q Mr. Russell, when you instituted your study of the feasibility of water flooding the Coyote-Queen area, did you study the feasibility of flooding on a 20-acre pattern as opposed to a 40-acre pattern?

A We studied the feasibility of flooding on patterns varying from one acre to 40 acres each case.

Q How did 20 and 40 compare as far as the effectiveness of the water flood is concerned?

A Of course, our primary study was from, a study of the feasibility based on economics, and the economics of the 40-acre spacing was at least 25 percent less favorable than on the 20-acre spacing.

Q You get a more rapid depletion of the reservoir with the 20-acre than you do the 40, is that correct?

A That's correct.

Q And that gives a more attractive development picture?

A Even though the development costs are higher, the economics are considerably better than the 40-acre spacing.

Q Comparing unrestricted production with restricted



production gives a more attractive economic picture, also?

A Yes, sir.

Q What, Mr. Russell, do you base this fifty percent loss, I think I heard you say something about fifty percent loss of recovery --

A No.

Q -- on the restricted rate?

A No, please don't misinterpret that. I said that under restricted rates of production and to stay below the allowable, I'm estimating that we would have to restrict our injection rate by fifty percent.

MR. NUTTER: I see. I believe that's all. Thank you.

MR. PORTER: Anyone else have a question of Mr. Russell? Mr. Kellahin.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q In connection with the Exhibit R-4 and the other exhibit based upon the core analyses which was not offered in evidence, what area does that cover?

A You mean the areal extent of that?

Q Yes, sir.

A It covers the area from the Levick State "B", which is the extreme southwest developed part of this reservoir, to the Levick State "D"-4 which is the extreme northeast portion of development on these properties.



Q Approximately how far is that?

A Approximately a mile, I would say.

Q Now in regard to drilling the wells on the 20-acre pattern versus a 40-acre pattern, would that have any effect on the ultimate recoveries of oil from the reservoir?

A Yes, when all factors are considered.

Q Which would you recommend?

A The 20-acre or the 40-acre --

Q Yes.

A -- pattern?

Q Yes.

A I would recommend 20-acre patterns now, as I have before.

MR. KELLAHIN: That's all the questions I have.

BY MR. PAYNE:

Q Was it your testimony you would get more oil if you drilled on 20 than you would if you drill on 40's?

A I did not testify to that, sir. I think I could say this, that when economics are considered, that I can say it without doubt that that is the case.

MR. PAYNE: Thank you.

MR. PORTER: Anyone else have a question? The witness may be excused.

(Witness excused.)

MR. PORTER: Mr. Kellahin, I believe we would like



to call Mr. Williamson in regard to the cement casing program.

(Witness sworn.)

MR. PORTER: Mr. Payne, I believe you were concerned in this questioning.

MR. WILLIAMSON

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

BY MR. PAYNE:

Q Could you give us some information on how the producing wells in this proposed pilot area have been completed and the difficulties that you may have encountered?

A Well, in this area we have encountered some loss of circulation in several of the wells, and we have run an excess of 150 percent of cement trying to circulate these wells, and haven't been able to.

Q That's the case in all of them?

A Well, not all of them.

Q Have you attempted to put some agent into the cement and then try circulating to the surface?

A Well, we have used a 50-50 loss mix and cement and tried that and haven't had any success with this.

MR. PORTER: Is this a loss circulation material?

A It is a filling agent, yes.

Q (By Mr. Payne) You feel you have used all reasonable



efforts to attempt to circulate to the surface?

A Yes.

MR. PAYNE: That's all. Thank you.

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Williamson, in that connection, were you aware that some of the other operators, or at least one other operator in the pool has gone back in and squeezed, cemented the casing to the surface?

A Not at the time we cemented our wells, I wasn't.

Q Well, I mean since that time.

A Yes.

Q You are familiar with the field operations?

A Yes.

Q In your opinion, should these -- now as I understand it, you only have one string of casing?

A That's right.

Q And our rules require that the cement be brought to the surface?

A Yes.

Q Would it be your recommendation that a water flood project be carried on unless the cement were circulated to the surface?

A Well, I don't think actually that it has any bearing on it with the amount of cement that we put in per well.



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Q But it still hasn't returned to the surface?

A That's right.

Q Do you know how the other operator in the pool accomplished this circulation of the cement to the surface?

A By going in and re-perforating, in the case that I know of, he went in and re-perforated his casing and squeezed with cement and had quite a job of it.

Q Do you think the same thing might be accomplished in your well?

A Well, it's possible, but on this other operation, they didn't have any loss circulation troubles.

Q How many of your wells have you encountered this trouble in?

A About five.

Q And out of eleven or twelve?

A Yes, out of eleven.

Q In the others you did achieve circulation to the surface?

A No, sir.

Q What was the matter in that case?

A We just didn't seem to be able to get enough cement to circulate.

Q But you still hadn't encountered loss circulation?

A No.

MR. PORTER: Anyone else have a question? Mr. Nutter.



BY MR. NUTTER:

Q Do you have room to run a one-inch pipe on the side of the casing and pump cement down the one inch?

A I doubt that, I don't think we would at this time. When the wells were new we might could have done that, but the locations have been cleaned up, they have been filled in and I very much doubt if you could get a one-inch pipe down the side of it.

MR. KELLAHIN: How much cement have you used in these wells?

A We have run up as high as 250 sacks, which is some 150 percent excess, trying to circulate these wells with cement.

MR. KELLAHIN: You put an excess amount of cement in all of your wells, is that correct?

A Yes.

MR. PORTER: Is that on 1100 foot string of casing?

A Yes, sir, 900 foot, rather.

MR. PORTER: 900?

A 950, somewhere along there.

MR. PORTER: Does anyone else have a question? The witness may be excused.

(Witness excused.)

MR. KELLAHIN: If the Commission please, that's all we have to offer at this time. We urge the Commission to reconsider the order heretofore entered and grant approval of the



water flood project with the capacity allowables as originally requested.

MR. PAYNE: I feel that the record in Case 1787 should most probably be incorporated into this record.

MR. PORTER: Any objection to counsel's motion?

MR. KELLAHIN: If the Commission please, for the sake of the record, we would object on the basis of the situation in which this case was presented and the fact that it was not heard at the time that it should have been heard, when this record would not have been available. However, I'm sure the Commission will want to consider all aspects of it, and we have no serious objection to inclusion of the record in this case.

MR. PORTER: The record in Case 1787 will be made a part of the record in this case.

Does anyone have anything further to offer in this case? If not, we will take the case under advisement, and we're going to recess the hearing.

The hearing will reconvene at 1:30.

(Recess.)

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STATE OF NEW MEXICO)
) ss
 COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing was reported by me in Stenotype, and that the same was reduced to typewritten transcript under my personal supervision and contains a true and correct record of said proceedings, to the best of my knowledge, skill and ability.

DATED this 5th day of December, 1959, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
 NOTARY PUBLIC

My commission expires:

June 19, 1963.

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