CASE 5189: Application of CRAIG FOLSON FOR AN UNORTHODOX OIL WELL LOCATION, CHAVES COUNTY, N. M.

CASE No. 5189

Application,

Transcripts,

Small Exhibits

ETC.

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
March 13, 1974

EXAMINER HEARING

IN THE MATTER OF:

Application of Craig Folson for an unorthodox oil well location, Chaves County, New Mexico.

Case No. 5189

BEFORE: Richard L. Stamets, Examiner.

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the New Mexico Oil Conservation Commission

William Carr, Esq.
Legal Counsel for the Commission
State Land Office Bldg.
Santa Fe, New Mexico

For the Applicant:

W. Thomas Kellahin, Esq.
Kellahin & Fox
500 Don Gaspar
Santa Fe, New Mexico

I N D E X

E X H I B I T S

	Marked	Admitted
Applicant's Exhibits Nos. 1 through 9	--	10

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386

MR. STAMETS: We will take the next case, 5189.

MR. CARR: Case 5189. Application of Craig Folson for an unorthodox oil well location, Chaves County, New Mexico.

(Whereupon, a discussion was held off the record.)

MR. KELLAHIN: Tom Kellahin of Kellahin & Fox, Santa Fe, New Mexico, appearing on behalf of the Applicant, Craig Folson, and I have one witness to be sworn.

(Witness sworn.)

CRAIG FOLSON

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you please state your name and occupation, Mr. Folson?

A My name's Craig Folson, from Dallas, Texas, and I'm an Attorney and Independent Oil Operator.

Q Are you the Applicant in this Case?

A Yes, I am.

MR. KELLAHIN: I apologize to the Examiner for the quality of our plat as Exhibit 1; it is difficult to

read, but we have additional Exhibits that will clarify the nonreadability of that.

BY MR. KELLAHIN:

Q Mr. Folson, would you please refer to Exhibit No. 1 and explain briefly to the Examiner what you are seeking to do by way of this Application?

A Exhibit 1 is a plot of Township 13, 31 East in Chaves County, and I intend to reenter an old abandoned field hoping to find some original oil and some secondary oil that I feel has not been swept by secondary flood procedures.

Q Let's stop right there and refer to what has been marked as Exhibit No. 2, and that might give us a little background. Would you please identify this and explain to the Examiner what information it contains.

A This is a map of the Ambassador operated North Queen Unit No. 1 which is now abandoned as of about August of '71. It was given to me by Mr. Don Layton who is employed by Anadarko Petroleum who was the gentlemen who was in charge of all the secondary recovery procedures in this area.

Q Is my understanding correct that this water-flood secondary recovery has been completed and that the

unit has been abandoned?

A Their unit has been abandoned and plugged at this time, to my knowledge.

Q Please refer to what has been marked as Exhibit No. 3 and identify it.

A Exhibit No. 3 is a plot of Section 12, 13 S. 31 E. which shows the amount of barrels that has been produced over the life of these properties, both primary and secondary.

Q All right. In discussing Exhibit 3, would you now refer to Exhibit No. 4.

A Exhibit 4 shows the southeast quarter specifically of Section 12 and I intend to drill a well as close to the center as possible in the southeast quarter, once again, to hopefully recover primary oil in place and unswept oil that was not swept by secondary cover procedures.

Q At this point, for purposes of the unorthodox well location, is it your desire to dedicate the northeast quarter of the southeast quarter, that 40 acre tract to this particular well?

A That's correct, and I would subsequently like to form a 40-acre unit, nonstandard unit, which will take in 10 acres from each of those 40 acres.

MR. KELLAHIN: If the Examiner please, that Application, or that request for a nonstandard unit is in the process of being filed and will be final today. At this point, for purposes of the unorthodox-well location, though, we would dedicate the acreage, the 40-acre tract, indicated in the red, and at a subsequent hearing, come back to get the nonstandard --

MR. STAMETS: Mine is not red.

MR. KELLAHIN: I'm sorry.

MR. STAMETS: We'll just switch and let me "red" this one in here. So you will be dedicating the northeast quarter of the southeast quarter of the Section?

MR. FOLSON: That's correct, but I wanted to point out to you that we immediately intend to come back and form a 40-acre tract composed of 10 acres out of each of the quarter sections there.

MR. STAMETS: All right.

BY MR. KELLAHIN:

Q As they exist now, Mr. Folson, would you identify for us the location of the injection wells in this quarter section.

A The injection wells were in the northwest quarter and in the southeast quarter of the southeast quarter of 12.

Q And where were the two producing wells located?

A In the northeast quarter and the southwest quarter of 12.

Q Would you please refer to what has been marked as Exhibit No. 5 and identify it?

A It is a letter from a Mr. Hollingshead, Jr., at Pennzoil Company, whom I have been working with inasmuch as Pennzoil owns 40 acres of this proposed drilling site. They request that I form a nonstandard unit whereby they will designate 10 acres of their 40 acres to the unit for the well.

Q So you have a farm-out from Pennzoil for the southeast quarter of the southeast quarter?

A That's correct. I have a verbal agreement with them and they are ready to commit that to writing upon the formation of the nonstandard unit. I also have a verbal agreement with the other owners with the exception of the northwest quarter--I've tried numerous times to contact this lease owner and all the mail which I have been sending certified comes back unanswered, so this lease owner is just unapproachable.

Q This is the main individual in the pending forced pooling application?

A Correct.

Q Please refer to what has been marked as Applicant's Exhibit No. 6?

A That's a letter from James Davidson, also at Pennzoil, which basically states the same thing as the letter from Mr. Hollingshead, only it is of a current date, February 11th of this year, stating that they would once again dedicate 10 acres toward this 40 acre unit I desire to form at a subsequent date.

Q Please refer to what has been marked as Exhibit No. 7?

A This is a farm-out from the owner of the southwest quarter and the northeast quarter, John Crandall, Trustee, giving me the rights to drill in that area.

Q Would you please refer to what has been marked as Exhibit No. 8?

A Exhibit 8 is a letter from Paul White, who is a Vice President of Summit Energy Incorporated with his offices in Artesia, New Mexico. He originally submitted this to me as a very viable prospect with very little risk, with potential of recovering up to 150,000 barrels per well. With the price of oil being what it is today, it has a lot more merit than it did a year ago and I feel

that the potential of recovering 60 to 70 barrels a day is viable and has merit inasmuch as Thunderbird Oil of Midland, Texas, has drilled a well exactly on this type configuration; one and a quarter miles to the east, and it has produced in excess of 60 barrels a day since August, 1972. They have subsequently staked three locations to the west so they are within a mile of what I desire to do with the same concept.

Q You are talking about the Thunderbird well in Section 8 I guess -- it's off my plat here.

A It's the section adjacent to the Section 12 I intend to drill in Lea County. This is on the Chaves-Lea County line. It's called their 85-Y Well.

Q So a similar type project has been completed and it has proved successful for Thunderbird Oil?

A That's correct.

Q Would you please refer to what has been marked as Exhibit No. 9 and identify it?

A Exhibit No. 9 is additional evidence written by Don Layton, with Anadarko whom I visited with on numerous occasions as to my ideas in undertaking this project. It is his belief also that it does, in fact, have merit, and with the price of oil being what it is

he feels that it will be a commercial success and has given me aid and will help me in the drilling of it subsequently.

Q In your opinion, Mr. Folson, will approval of this Application prevent waste, result in the recovery of hydrocarbons that otherwise would not be recovered, and not impair the correlative rights of others?

A Yes, it will.

MR. KELLAHIN: We move the introduction of Applicant's Exhibits Nos. 1 through 9.

MR. STAMETS: Applicant's Exhibits 1 through 9 will be admitted into evidence.

(Whereupon, Applicant's Exhibits Nos. 1 through 9 were admitted into evidence.)

MR. KELLAHIN: That concludes our direct examination.

CROSS EXAMINATION

BY MR. STAMETS:

Q Mr. Folson, how much acreage do you now control and have the rights to, or pending to having the rights to in this area?

A In excess of 320 acres.

Q Is this all in Section 12?

A Section 12 and Section 1, directly north of Section 12.

Q The only acreage you don't control is the Spurck acreage?

A That's correct.

Q It certainly would be helpful, Mr. Folson, if you would submit a plat outlining the acreage that you do control in this area.

MR. KELLAHIN: May we submit that to you by mail, Mr. Examiner?

MR. STAMETS: That will be fine.

MR. KELLAHIN: We will supply you with a new plat.

MR. STAMETS: Right.

MR. FOLSON: In Section 1 also?

MR. STAMETS: Yes, right.

Are there any other questions of the Witness? If not, we'll take the Case under advisement and adjourn the Hearing until 1:15 P.M.

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

I, RICHARD L. NYE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me, and the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

Richard L. Nye
RICHARD L. NYE, Court Reporter

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 5163, heard by me on 3/13, 1974.

D. Richard L. Stamets, Examiner
New Mexico Oil Conservation Commission

THE NYE REPORTING SERVICE
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225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386

Docket No. 6-74

DOCKET: EXAMINER HEARING - WEDNESDAY - MARCH 13, 1974

9 A.M. - OIL CONSERVATION COMMISSION CONFERENCE ROOM,
STATE LAND OFFICE BUILDING - SANTA FE, NEW MEXICO

The following cases will be heard before Richard L. Stamets, Examiner, or Daniel S. Nutter, Alternate Examiner:

ALLOWABLE: (1) Consideration of the allowable production of gas for April, 1974, from seventeen prorated pools in Lea, Eddy, Roosevelt and Chaves Counties, New Mexico;

(2) Consideration of the allowable production of gas from five prorated pools in San Juan, Rio Arriba, and Sandoval Counties, New Mexico, for April, 1974.

CASE 5179: Application of HNG Oil Company for a unit agreement, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval for the Dogie Draw Unit Area comprising 5,122 acres, more or less of State, Federal, and fee lands in Township 26 South, Range 36 East, Lea County, New Mexico.

CASE 5180: Application of Amoco Production Company for a unit agreement, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval of the Rock Lake Unit Area comprising 5760 acres, more or less, of State and fee lands in Township 22 South, Range 35 East, Lea County, New Mexico.

CASE 5181: Application of Amoco Production Company for a unit agreement, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval of the Trail Canyon Unit Area comprising 5758 acres, more or less, of State, Federal and fee lands in Township 24 South, Range 23 East, Eddy County, New Mexico.

CASE 5182: Application of Perry R. Bass for compulsory pooling, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Pennsylvanian formation underlying the W/2 of Section 15, Township 21 South, Range 27 East, adjacent to the Burton Flats Field, Eddy County, New Mexico, to be dedicated to a well to be drilled at a standard location in the W/2 of said Section 15. Also to be considered will be the cost of drilling and completing said well and the allocation of such costs, as well as actual operating costs and charges for supervision. Also to be considered is the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 5183: Application of Amini Oil Company for an unorthodox oil well location, Lea County, New Mexico. Applicant, in the above-styled cause, seeks, as an exception to the North Vacuum Abo Pool rules, authority to drill its Pennzoil State Well No. 2 at an unorthodox location for said pool 1780 feet from the South line and 460 feet from the West line of Section 36, Township 16 South, Range 34 East, Lea County, New Mexico.

CASE 5184: Application of Mountain States Petroleum Corporation for an unorthodox gas well location, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks, as an exception to the Buffalo Valley-Pennsylvanian Pool rules, approval for an unorthodox gas well location for a well to be drilled at a point 990 feet from the South and West lines of Section 36, Township 14 South, Range 27 East, Chaves County, New Mexico.

CASE 5185: Application of Rice Engineering & Operating, Inc. for salt water disposal, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to dispose of produced salt water into the Abo formation in the open-hole and perforated interval from 8442 feet to 9150 feet in its Abo SWD Well No. 2 located in Unit C of Section 2, Township 17 South, Range 36 East, Lovington Abo Pool, Lea County, New Mexico.

CASE 5186: Application of Amerada Hess Corporation for an unorthodox oil well location and two non-standard oil proration units, Lea County, New Mexico. Applicant, in the above-styled cause, seeks, as an exception to the Bagley Siluro-Devonian Pool rules, the formation of two non-standard proration units in Section 35, Township 11 South, Range 33 East, Lea County, New Mexico, the first being a 40-acre unit comprising the NW/4 SE/4 to be dedicated to applicant's State BTD Well No. 2, and the second being an 80-acre unit comprising the SE/4 SW/4 and the SW/4 SE/4 to be dedicated to applicant's State BTD Well No. 1, proposed to be drilled at an unorthodox location for said pool 660 feet from the South line and 1900 feet from the East line of said Section 35.

CASE 5187: Application of Inexco Oil Company for compulsory pooling, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Pennsylvanian formation underlying Section 17, Township 21 South, Range 26 East, Eddy County, New Mexico, adjacent to the Catclaw Draw-Morrow Gas Pool, to be dedicated to a well to be drilled at a standard location for said pool. Also to be considered will be the cost of drilling and completing said well and the allocation of such costs, as well as actual operating costs and charges for supervision. Also to be considered is the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 5188: Application of Continental Oil Company for downhole commingling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to commingle Drinkard and Blinebry production in the wellbore of its Lockhart B-1 Well No. 8 located in Unit H of Section 1, Township 22 South, Range 36 East, Lea County, New Mexico.

CASE 5189: Application of Craig Folson for an unorthodox oil well location, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of a well proposed to be drilled at a point 1340 feet from the South line and 1300 feet from the East line of Section 12, Township 13 South, Range 31 East, Caprock-Queen Pool, Chaves County, New Mexico.

CASE 5190: Application of Union Oil Company of California for pool creation and special rules, Lea County, New Mexico. Applicant, in the above-styled cause, seeks the creation of a new Morrow gas pool for its Pipeline Deep Unit Well No. 1 located in Unit J of Section 17, Township 19 South, Range 34 East, Lea County, New Mexico, and for the promulgation of special rules therefor including a provision for 640-acre spacing.

CASE 5191: Application of Murphy Minerals Corporation for a waterflood project, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project by the injection of water through two wells into the Grayburg-San Andres formation on its Gissler "B" lease in Sections 11 and 12, Township 17 South, Range 30 East, Square Lake Pool, Eddy County, New Mexico.

CASE 5192: In the matter of the application of the Oil Conservation Commission of New Mexico upon its own motion for the extension of the following pools in Lea County:

Antelope Ridge-Morrow Gas Pool
EK Yates-Seven Rivers-Queen Pool
House-San Andres Pool
Humble City-Atoka Pool
North Shoe Bar-Wolfcamp Pool
Tres Papalotes-Pennsylvanian Pool
Wantz-Granite Wash Pool

CASE 5124: (Continued from the February 13, 1974 Examiner Hearing)

Application of Belco Petroleum Corporation for compulsory pooling and an unorthodox gas well location, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests underlying the S/2 of Section 30, Township 20 South, Range 33 East, South Salt Lake-Morrow Gas Pool, Lea County, New Mexico, to be dedicated to a well to be drilled at an unorthodox location 660 feet from the South line and 1300 feet from the East line of said Section 30. Also to be considered will be the cost of drilling and completing said well and the allocation of such costs, as well as actual operating costs and charges for supervision. Also to be considered is the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 5140: (Continued from the February 13, 1974, Examiner Hearing)

Application of Pierce & Dehlinger for compulsory pooling, Vada-Pennsylvanian Pool, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Vada-Pennsylvanian Pool underlying the NW/4 of Section 24, Township 9 South, Range 33 East, Lea County, New Mexico, to be dedicated to the King Resources Sheridan Well No. 1-A located in Unit C of said Section 24. Also to be considered is designation of the applicant as operator of the NW/4 of said Section 24 and the well located thereon, provision for allocation of actual operating costs and charges for supervision, and allocation of costs for reworking said well including a 200% charge attributable to any non-consenting working interest owner's pro rata share of said workover costs, for the risk involved in said workover.

CASE 4956: (Reopened) (Continued from the February 13, 1974 Examiner Hearing

Application of Pierce & Dehlinger for a determination of well costs, Lea County, New Mexico. Applicant, as operator of the Sheridan Well No. 1 located in Unit M of Section 13, Township 9 South, Range 33 East, Lea County, New Mexico, to which well is dedicated the SW/4 of said Section 13, all mineral interests in the Vada-Pennsylvanian Pool thereunder having been pooled by Commission Order No. R-4560, seeks the determination of reasonable well costs attributable to applicant and to King Resources, including, but not limited to, the costs of reworking and placing said Sheridan Well No. 1 back on production and attorneys fees in connection therewith. Applicant further seeks an order assessing, as a charge for the risk involved in the reworking of the well, 120% of the pro rata share of the reasonable well costs attributable to the working interest of King Resources.

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

March 18, 1974

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

Mr. Tom Kellahin
Kellahin & Fox
Attorneys at Law
Post Office Box 1769
Santa Fe, New Mexico

Re: CASE NO. 5189
ORDER NO. R-4750

Applicant:
Craig Folson

Dear Sir:

Enclosed herewith are two copies of the above-referenced Commission order recently entered in the subject case.

Very truly yours,

A. L. Porter, Jr.

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

Copy of order also sent to:

Hobbs OCC x
Artesia OCC x
Aztec OCC

Other

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5189
Order No. R-4750

APPLICATION OF CRAIG FOLSON
FOR AN UNORTHODOX OIL WELL
LOCATION, CHAVES COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on March 13, 1974, at Santa Fe, New Mexico, before Examiner Richard L. Stamets.

NOW, on this 15th day of March, 1974, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Craig Folson, seeks approval for an unorthodox oil well location at a point 1340 feet from the South line and 1300 feet from the East line of Section 12, Township 13 South, Range 31 East, NMPM, Caprock-Queen Pool, Chaves County, New Mexico.

(3) That the NE/4 SE/4 of said Section 12 is to be dedicated to the well.

(4) That no offset operator objected to the proposed unorthodox location.

(5) That the proposed well is to be drilled in a depleted abandoned waterflood project.

(6) That a well drilled to the Queen formation at the proposed unorthodox location may produce oil which would otherwise not be recovered.

(7) That approval of the subject application will afford the applicant the opportunity to produce his just and equitable share of the oil in the Caprock-Queen Pool, and will otherwise prevent economic waste and protect correlative rights.

IT IS THEREFORE ORDERED:

(1) That the applicant, Craig Folson, is hereby authorized to drill a well at an unorthodox oil well location 1340 feet from the South line and 1300 feet from the East line of Section 12, Township 13 South, Range 31 East, Caprock-Queen Pool, Chaves County, New Mexico.

(2) That the NE/4 SE/4 of said Section 12 shall be dedicated to the well.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

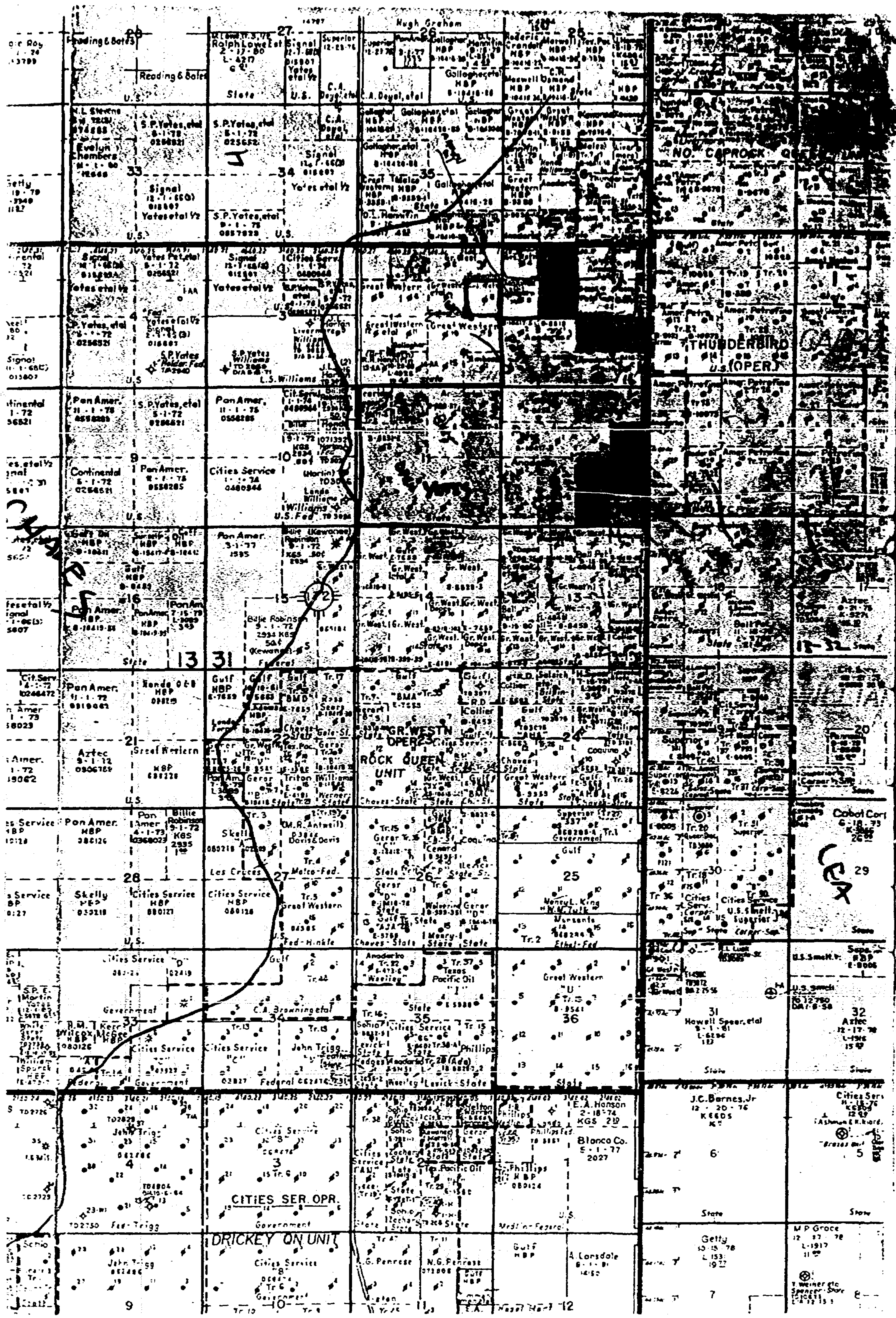
I. R. TRUJILLO, Chairman

ALEX J. ARMIJO, Member

A. L. PORTER, JR., Member & Secretary

S E A L

jr/



Hugh Graham
Reading & Bates
Ralph Lowe Est
Signal
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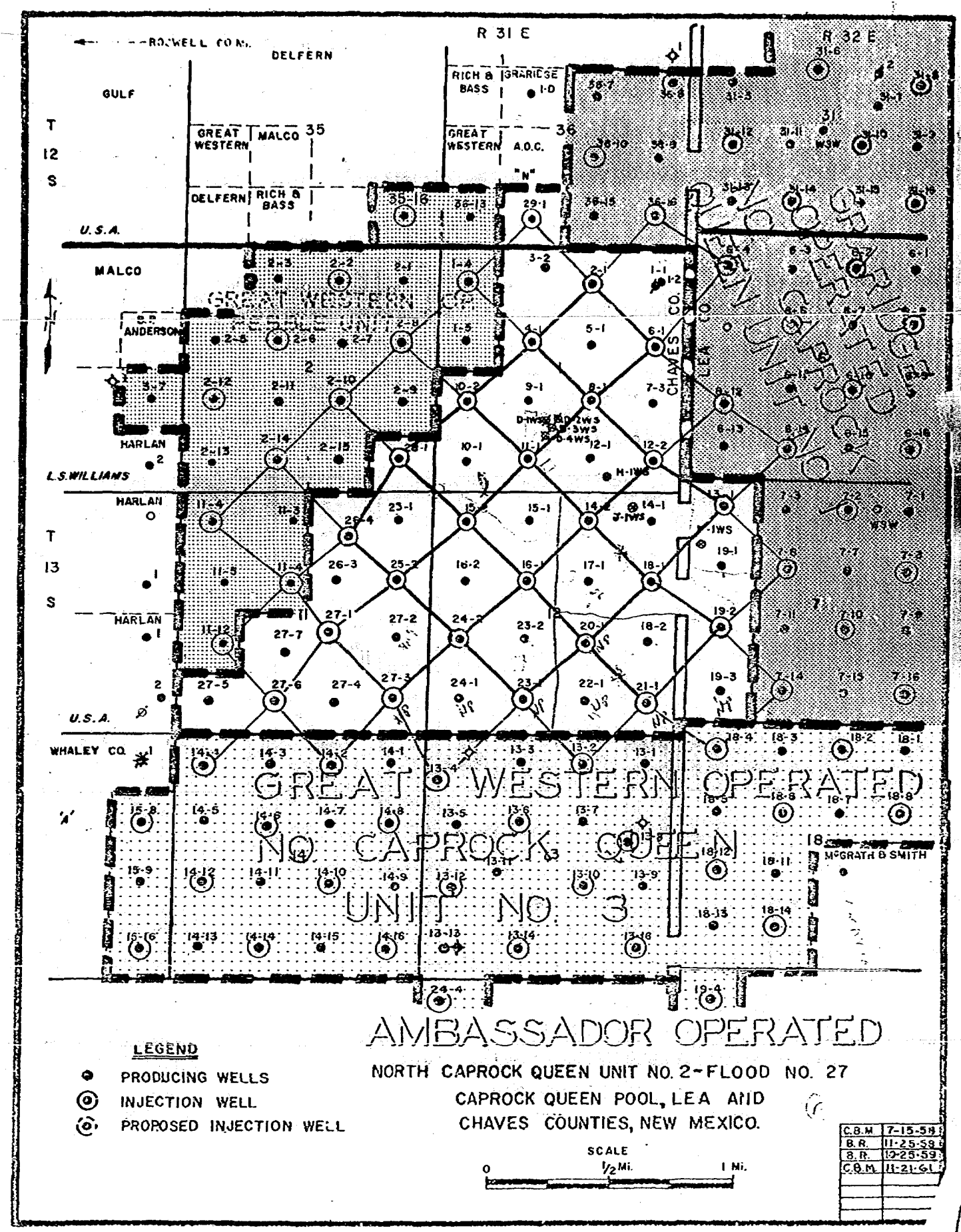
Gallagher etal
C.A. Doyel, etal
Maxwell
Roderic Crandell
S.P. Yates, etal
Evelyn Chambers
Yates etal ½
Great Western
NO. CAPROCK QUEEN UNIT
Thunderbird Oil
THUNDERBIRD
U.S.(OPER.)
Amer. Petrofina
Yates Pet., etal
Cities Service
L.S. Williams
Pan Amer.
Continental
Landa Williams
U.S. Fed.
Gulf
Billie Robinson
Kewanee
Gr. West.
Bell Pet.
Aztec
State
Federal
GR. WESTN OPER.
ROCK QUEEN UNIT
Chaves-State
Triton
Williams
Werner State
Superior
Coquina
Collier
Great Western
Skelly
Les Cruces
Melco-Fed.
M.R. Antweil
Davis & Davis
Nancy L. King
Monsanto
Ethel-Fed
Fed-Hinkle
Cabot Corp
Cities Service
U.S. Smelt.
Anadarko
Texas Pacific Oil
C.A. Browning etal
Government
John Trigg
Phillips
Levick-State
Howell Speer, etal
J.C. Barnes, Jr
E.A. Hanson
Blanco Co.
CITIES SER. OPR.
Fed-Trigg
DRICKEY QN UNIT
N.G. Penrose
A. Lonsdale
Getty
M.P. Grace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L.S.WILLIAMS
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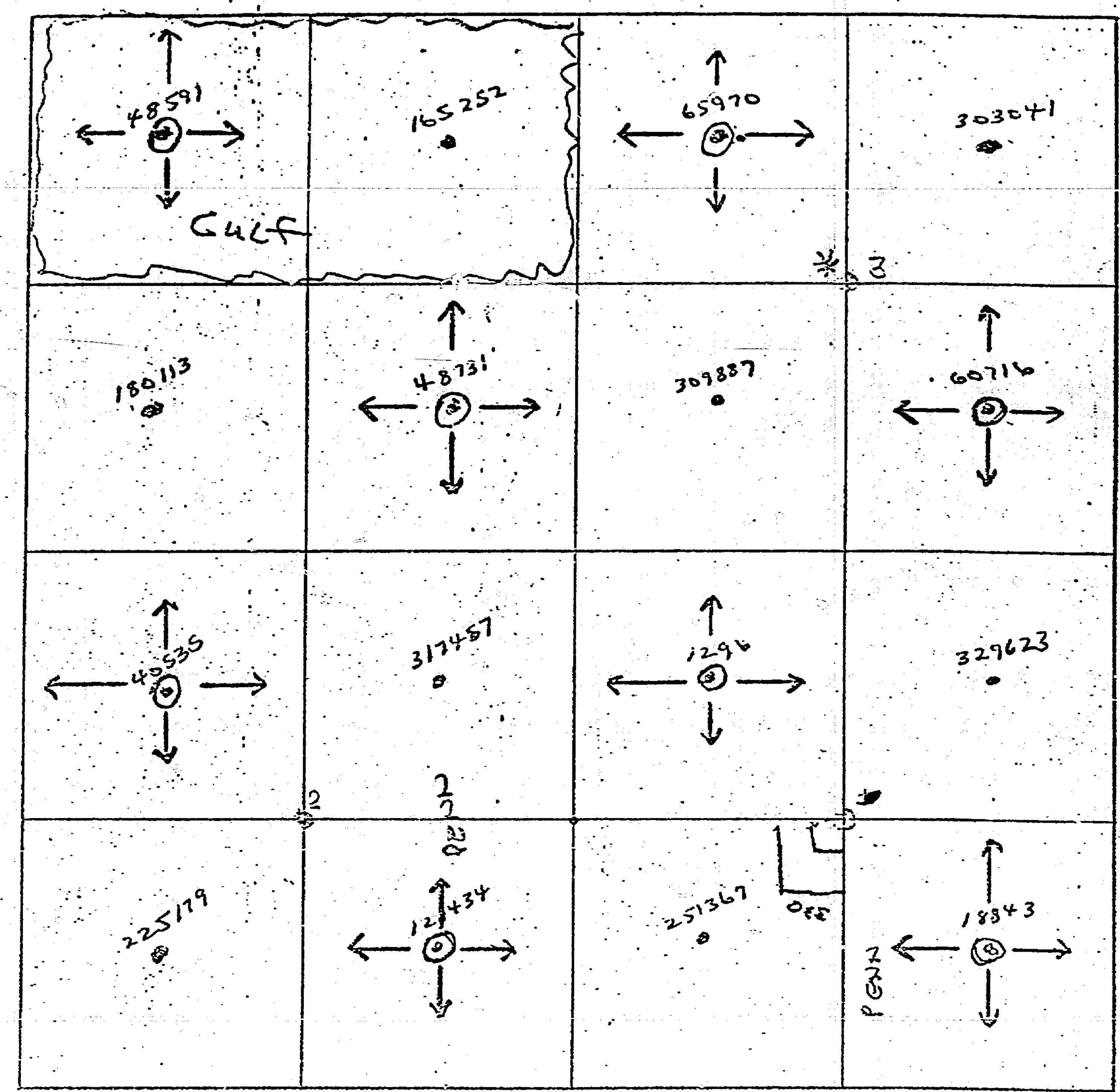
U.S.A.
WHALEY CO.
LEA CO.
CHAVES CO.
GREAT WESTERN OPERATED
NO. CAPROCK QUEEN
UNIT NO. 3
McGRATH & SMITH
AMBASSADOR OPERATED
LEGEND
PRODUCING WELLS
INJECTION WELL
PROPOSED INJECTION WELL
NORTH CAPROCK QUEEN UNIT NO. 2-FLOOD NO. 27
CAPROCK QUEEN POOL, LEA AND
CHAVES COUNTIES, NEW MEXICO.
SCALE
0
1/2 Mi.
1 Mi.
C.B.M. 7-15-58
B.R. 11-25-58
B.R. 12-25-59
C.B.M. 11-21-61

EACH OF THE NUMBERS BELOW REPRESENTS BARRELS OF OIL PRODUCED OVER THE LIFE OF THESE PROPERTIES

(1 MI.) ONE-SECTION PLAT

SECTION 12 TOWNSHIP 13 S RANGE 31 E COUNTY Chaves STATE N.M.



(·) Injection wells
• Producers
→ Pressure lines toward withdrawal

BEFORE EXAMINER STAMETS
OIL CONSERVATION COMMISSION
Folsom EXHIBIT NO. 3
CASE NO. 5189
Submitted by Folsom
Hearing Date 13 MAR 74

SCALE FOR SECTION, 660 Ft.—1 Inch. { Each side large blue squares = 20 chains, 80 rods, 1320 feet; area of square 40 acres. Each side small red squares = 5 chains, 20 rods, 330 feet; area of square 2½ acres.

N

Section 12, Township 13 South Range 31 East, N.M.P.M.
Chaves County, New Mexico

E

NW/4SE/4
Spruck

NE/4SE/4
Crandall/Folson

20' out of corner
proposed unorthodox
location

SW/4SE/4
Crandall/Folson

SE/4SE/4
Folson/Pennzoil

S

SCALE FOR QUARTER SECTION, 330 Ft. - 1 Inch. { Each side large blue squares = 10 chains, 40 rods, 660 feet; area of square 10 acres. Each side small red squares = 2½ chains, 10 rods, 165 feet; area of square .625 of 1 acre.

PRONTO LAND MEASURE 660-330 MAP SHEET PRONTO LAND MEASURE

BEFORE EXAMINER STAMETS
OIL CONSERVATION COMMISSION
Folson EXHIBIT NO. 4
CASE NO. 5189
Submitted by Folson
Hearing Date 13 MAR 74

PENNZOIL COMPANY

WESTERN DIVISION OFFICE • WALL TOWERS WEST - MIDLAND, TEXAS • PHONE (915) 682-7316
MAILING ADDRESS: P. O. DRAWER 1828 MIDLAND, TEXAS 79701

H. W. HOLLINGSHEAD, JR.
DIVISION EXPLORATION MANAGER

December 7, 1972

Mr. C. Craig Folson
1925 Mercantile Dallas Building
Dallas, Texas 75201

Re: Caprock Area
Chaves County, New Mexico

Dear Mr. Folson:

Mr. Davidson is out of the office on vacation and since you are quite anxious to arrive at a solution in the above area, I am answering your last letter.

Pennzoil would like to see a well drilled to the Queen formation at your suggested location, however, we cannot agree to a well at this location under the present terms, nor are we willing to sell our lease on the terms offered. We would like to suggest that you consider forming a 40 acre proration unit around your location. It would seem to us that the best proration unit would consist of 10 acres from each of the quarter/quarter sections surrounding your location. This would appear to be an equitable solution and also allow additional 40 acre proration units to be formed around similar locations should the in-fill drilling prove profitable.

If you will form the above discussed 40 acre proration unit as suggested, Pennzoil will either join for its interest in the drilling of this well or will farmout on reasonable terms. At this time I feel that Pennzoil would farmout.

We realize that you have time and money invested in this venture and we hope that we can arrive at a solution equitable to all parties involved. Give this some consideration and we will be glad to discuss any alternate suggestions.

Very truly yours,

H. W. Hollingshead, Jr.

H. W. Hollingshead, Jr.

BEFORE EXAMINER STAMETS
OIL CONSERVATION COMMISSION
Folson EXHIBIT NO. 5
CASE NO. 5189
Submitted by Folson
Hearing Date 13 MAR 74

PENNZOIL COMPANY
POST OFFICE DRAWER 1828 • MIDLAND, TEXAS 79701 • PHONE (915) 682-7316

February 11, 1974

Mr. C. Craig Folson
Suite 2805
2001 Bryan Tower
Dallas, Texas 75201

Re: Farmout Request
Chaves County, New Mexico

Dear Sir:

Reference is made to your letter of February 7, 1974. We are authorized to farmout to you our interest in the NW/4 of the SE/4 of the SE/4 Section 12, T-13-S, R-31-E, on the following basis:

(1) Operator to form a 40 acre communitized unit including the above described acreage, and commence a 3,200' Queen Sand test within 90 days from date.

(2) Commercial production to earn rights in our lease from the surface to 50' below the deepest productive perforation in the well.

(3) Pennzoil to retain 1/8 of 8/8 override, proportionately reduced to our interest in the 40 acre communitized unit.

As soon as your hearing before the New Mexico Oil Conservation Commission is completed, please advise whether you want our usual form farmout letter to be written to cover this trade.

Very truly yours,

James A. Davidson

JAD/mlm

BEFORE EXAMINER STAMETS
OIL CONSERVATION COMMISSION
Folson EXHIBIT NO. 6
CASE NO. 5189
Submitted by Folson
Hearing Date 13 MAR 74

A G R E E M E N T

This Agreement, made and entered into as of this 7th day of November, 1972, by and between JOHN R. CRANDALL, TRUSTEE, 721 Ourlane Circle, Houston, Texas 77024, hereinafter referred to as Assignor, and C. CRAIG FOLSON, 1925 Mercantile Dallas Building, Dallas, Texas 75201, hereinafter referred to as Operator.

WITNESSETH:

John R. Crandall, Trustee, has assigned to C. Craig Folson under date of October 25, 1972, that certain Oil and Gas Lease embracing lands owned by the State of New Mexico and covered by New Mexico State Lease No. B-10416 dated July 3, 1943, originally issued to J. C. Maxwell, Inc., and Charles H. Osmond, and only insofar as said lease covered the following described land situated in Chaves County, New Mexico, to-wit:

Township 13 South, Range 31 East, N.M.P.M.
Section 1: SE¼NW¼, NE¼SE¼, and NW¼SE¼;
Section 12: NE¼SE¼, SE¼NE¼, and SW¼SE¼,
containing 240 acres, more or less; said assigned lands being referred to herein as "said lease."

The foregoing Assignment was made subject to certain terms and conditions, all of which have been agreed upon by the parties hereto, which terms and conditions are as follows:

1. Assignor reserves all rights under said lease as to oil, gas and other minerals below a depth of 3,500 feet, together with full right of ingress and egress for the purpose of developing, operating and producing any and all oil, gas and other minerals below said 3,500 feet.

2. C. Craig Folson (Operator) has purchased said lease only insofar as it covers oil, gas and other mineral rights together with the exclusive right to explore the same above a depth of 3,500 feet and has acquired no other rights under said lease.

3. In the event of production from said oil and gas lease above said depth, Operator agrees to pay and Assignor hereby reserves an overriding royalty of 1/16 of 7/8ths of all oil, gas and other minerals produced, saved and marketed from said lands above said depth. Said overriding royalty shall be computed and paid at the same time and in the same manner as royalties payable to the State of New Mexico under the terms of said lease are computed and paid, and Assignor shall be responsible for Assignor's proportionate part of all taxes and assessments levied upon or against or measured by the production of oil or gas from said lands. The 1/16 of 7/8 overriding royalty is a reserved interest and shall be paid directly in the following proportions to the parties hereinafter named by the pipeline company or companies purchasing oil, gas or other minerals from said lease until otherwise notified in writing:

Maxwell Oil Company - 1/2 of 1/16 of 7/8
Charles H. Osmond, Trustee - 1/4 of 1/16 of 7/8
John R. Crandall, Trustee - 1/4 of 1/16 of 7/8.

BEFORE EXAMINER STAMETS
OIL CONSERVATION COMMISSION
Folson EXHIBIT NO. 7
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Submitted by Folson
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4. This Agreement shall terminate and all rights hereunder shall be relinquished and reassigned to Assignor including the assignment of said official title to said Lease unless Operator, on or before 360 days from the date hereof, completes operations so as to restore the production of oil or gas from said lands above a depth of 3,500 feet. Operations carried on by Operator on said lands shall be conducted with due diligence and in a good and workmanlike manner, subject to the provisions hereinafter contained. In the event production of oil or gas is re-established by Operator on said lands, then and in that event this Agreement shall continue for so long thereafter as said oil or gas is produced from said lands under the terms of said Lease.

5. In connection with the drilling of any wells by Operator upon said lands, it is agreed that Operator shall furnish to Assignor all information obtained with respect to said drilling operations, including copies of oil well logs, electrical logs or well surveys, core analysis and samples of cuttings from all formations penetrated, the latter to be furnished only upon request in containers supplied by Assignor at the well location. Operator shall furnish owner with daily drilling reports by mail and shall notify Assignor of all wells drilled or recompleted on the Lease acreage. In conducting operations hereunder, Operator agrees to conduct producing and injection operations in the vicinity of the leased acreage in a manner such as to prevent reasonably avoidable uncompensated drainage of oil. Operator for himself and his successors and assigns agrees to furnish to Assignor completion reports and reports of production and injection volume for all wells operated by Operator or his successors on or within one-half mile of the Lease acreage above described.

6. In the event Operator acquires rights-of-way for roads, pipelines or other purposes, it is agreed that such rights-of-way shall be acquired for the mutual benefit and advantage of both the parties hereto and both of the parties hereto may use the same.

7. All operations carried on by Operator upon said land shall be in conformity with the terms of said Oil and Gas Lease, and any extensions or renewals thereof and all applicable laws and regulations. Operations conducted by Operator on said lands shall be at Operator's sole cost, risk and expense and Operator expressly agrees to protect the leasehold estate from claims of any nature which might arise out of Operator's drilling, producing or abandonment operations upon said lands or the acts of his contractors, agents or assigns, and in this connection Operator agrees to indemnify and save Assignor harmless from any and all claims and demands.

8. In connection with rentals that shall become due and payable under the terms of said Lease, Operator shall pay the same and shall promptly notify Assignor that the said rentals have been timely paid, furnishing to the Assignor the receipt or copy thereof reflecting the said rental payment. There shall be no apportionment of rentals hereunder notwithstanding the fact that Assignor owns the leasehold operating rights below a depth of 3,500 feet. In the event oil or gas is produced, saved and marketed from said lands, Operator shall pay to the State of New Mexico all royalties accruing on account thereof and shall save, hold and protect Assignor from all liability on account of obligations accruing to the State of New Mexico or to others on account of the production of oil and gas from said lands as to the depth hereinabove specifie-

Assignor shall be notified of all changes in the official title to said Lease.

9. Operator shall use only so much of the surface of said lands as may be necessary or required to carry on operations in developing and producing oil or gas from the rights herein granted to Operator, and Assignor shall have the right to use so much of the surface as may be necessary or required to develop Assignor's rights, and in the event any wells for such purposes are drilled by either Assignor or Operator, Assignor and Operator agree to conduct their operations in such a manner so as to interfere as little as possible with the operations of the other. Assignor shall be responsible for all royalties which may become due and payable on account of production of oil or gas obtained by Assignor in developing any rights not acquired by Operator hereunder.

10. Operator shall satisfy himself as to the title of Assignor to said lands embraced in the above described Lease. It is expressly understood that Assignor does not warrant, either expressly or impliedly, that said Lease is valid and subsisting or that the same is held by production.

11. Operator shall not relinquish or surrender said Lease as to said lands nor shall Operator do or perform any act or thing which might cause said Lease to be forfeited as to said lands without the consent in writing of Assignor. Operator shall promptly furnish to Assignor copies of all notices or other communications received from the State of New Mexico or any representative or office thereof pertaining to said Oil and Gas Lease.

In the event Operator should desire to relieve himself of the obligation to pay the rentals apportionable to said Lease or as to a portion thereof, he may give notice thereof to Assignor and Assignor shall have sixty (60) days from the receipt of such notice within which to notify Operator of Assignor's desire to receive a reassignment of said lands (including the official title) and Lease. In the event Assignor elects to have a reassignment, all wells located on the acreage to be reassigned shall have been plugged and abandoned to the entire and complete satisfaction of the Commissioner of Public Lands and the New Mexico Oil Conservation Commission, and appropriate evidence thereof shall be furnished to Assignor. In the event Assignor elects not to receive a reassignment, Operator may relinquish the lands described in the said notice to the State of New Mexico, thereby terminating shallow and deep rights of the respective parties to this contract.

Any assignment of rights granted under the terms of this contract shall be made subject to the terms and conditions of this Agreement, and a copy thereof shall be delivered to any assignee of rights hereunder or of the official title conveyed to Operator.

12. All notices that are required are authorized to be given hereunder except as otherwise specifically provided herein shall be given in writing by United States mail, postage and charges prepaid and addressed to the party to whom such notice is to be given as follows:

ASSIGNOR: John R. Crandall, Trustee
721 Ourlane Circle
Houston, Texas 7702[illegible]

OPERATOR: C. Craig Folson
1925 Mercantile Dallas Building
Dallas, Texas 75201

For the purposes of this paragraph, the address of either party may be changed by giving written notice to the other party.

13. The rights and liabilities of the parties hereto shall be individual and not joint or collective, and this Agreement shall not be construed as creating a co-partnership, joint venture or mining partnership. This Agreement shall be binding upon the parties hereto, their heirs, personal representatives, successors and assigns, and the covenants herein contained shall be construed as covenants running with the ownership of said lease as to the acreage herein specifically described and shall remain in full force and effect during the life of said oil and gas lease as to said acreage and any and all extensions or renewals thereof.

IN WITNESS WHEREOF, this Agreement is executed in duplicate as of the day and year first hereinabove written.

John R. Crandall
John R. Crandall, Trustee,
"Assignor"

C. Craig Folson
C. Craig Folson,
"Operator"

STATE OF TEXAS)
) ss.
COUNTY OF HARRIS)

The foregoing instrument was acknowledged before me this 7th day of November, 1972, by John R. Crandall.

My commission expires:

Notary Public

VIRGINIA MARSH
Notary Public in and for Harris County, Texas
My Commission Expires June 1, 1973

STATE OF TEXAS)
) ss.
COUNTY OF DALLAS)

The foregoing instrument was acknowledged before me this 2nd day of January, 1973, by C. Craig Folson.

My commission expires:
June 1, 1973

Notary Public

PAUL G. WHITE
Vice President - Production

SE

SUMMIT ENERGY, INC.

112 NORTH FIRST STREET
ARTESIA, NEW MEXICO 88210

June 26, 1972

Summit Energy, Inc.
1925 Mercantile Dallas Building
Dallas, Texas 75201

Attn: Mr. Craig Folson

Re: Caprock Queen Prospect

Dear Craig:

Since it appears that this deal might have some merit I have worked up the economics on the prospect.

The objective would be to drill and test a Queen Sand well at an approximate depth of 3000'. The reasons for drilling the experimental well include (1) the fact that recoveries of up to 300,000 barrels of oil per well have been experienced in the area (2) cheap lease acquisition (3) failure of cross-flooding.

For sometime it has been felt by engineers that in certain waterflood areas a parabolic design of oil "banking" might occur in good five spot flood prospects. The physical affect of high center spot withdrawal from four pressure points would set up very efficient flow systems in the sand body but because of this very success there could be large deposits of oil in the areas of pressurization where no withdrawal is occurring.

SUMMIT ENERGY, INC.

I have prepared the economics as follows:

I. TO DRILL AND TEST 3000' QUEEN SAND WELL

Drilling Footage 3000' @ $4.75	$14,250
Day Work Rig	2,000
Drilling Mud and Fluids	1,500
8 5/8" Surface Casing 300'	900
Cementing 8 5/8" Surface Pipe	1,150
2 7/8" EUE J55S Test String	3,600
Lynes Open Hole Test Packer	2,000
1-8 5/8" Weldon by 6"-600 Ser Flange w/ 2-2" Side Outlets	250
Welding Services	100
Tank Rental and Trucking	500
5 Days Service Unit Time	2,500
Dirt Work and Location	2,000
Sub Total	$30,750
	300
II. TO COMPLETE A COMMERCIAL QUEEN SAND WELL	31050
5 1/2" Casing @ 3000'	$ 4,500
Cementing 5 1/2" Casing	1,234
Perforating 5 1/2" Casing	1,500
Wellhead 8 5/8 x 5 1/2 x 2 7/8	500
228 Pumping Unit and Base	6,000
25 HP Electric Motor	500
Control Box	500
Rods and Pump	1,700
Stuffing Box- P. Tee- Polish Rod	300
2-500 barrel Tanks	2,500
Flowline and Battery Connections	500
Heater-Treater	2,000
Well Service Unit	2,500
General Labor	500
Sub Total	$24,734

III. TOTAL COST FOR COMPLETED QUEEN SAND WELL

Drill and Test	$30,750
Complete	24,734
Total	$55,484

Based on a $55,484 well cost payout would be expected in 7½ months for a 100 BOPD producer.

100 BOPD @ $3.25 per barrel	$325.00
Gross Revenue to 7/8ths Interest	284.38
Lease Operating Expense and Taxes	40.00
Net Revenue Per Day to 7/8ths Interest	244.38

Reserves for the well should approximate the reserves experienced in the waterflood area on a well basis. For example, in Section 12-T13S-R31E, total oil recovery has been 2,488,035 barrels. Each 40 acre tract produced 155,502 barrels of oil.

155,502 barrels @ $3.25 per barrel	$505,382
Gross Revenue to 7/8ths Interest	442,209
Lease Operating Expense and Taxes	194,378
Net Revenue to 7/8ths Interest	247,831

The NRI would be 4½ to 1.

The very nature of the experiment would require the drilling of a minimum number of wells. The most attractive situation would be for one completion to hold large acreage until performance prompted further development.

The unknown factor in the entire experiment would be whether the injected water bank affect would deplete rapidly or sustain good rates of oil withdrawal in the parabola.

SUMMIT ENERGY, INC.

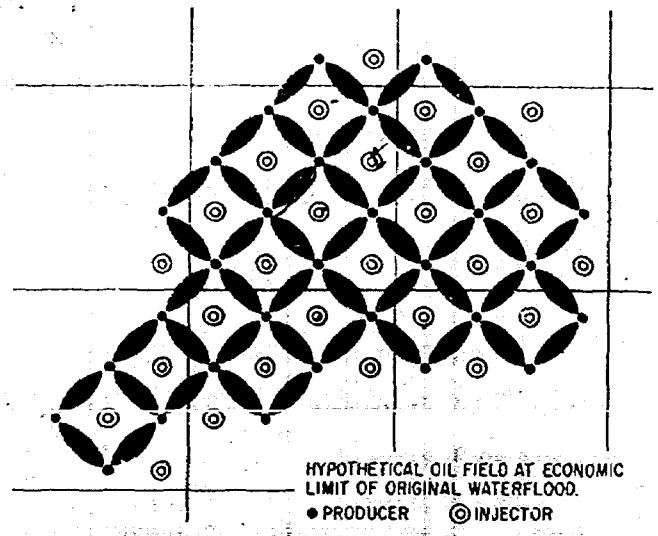
I feel this preparation of economics is adequate until we can discuss this further. However, if you think we need more information, please let me know.

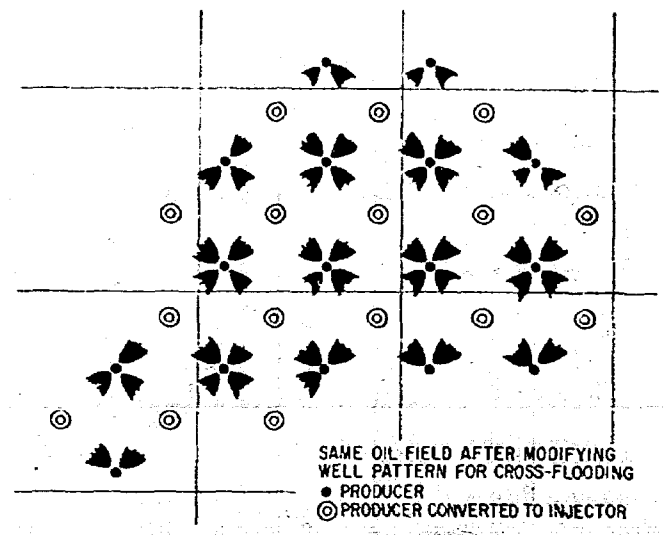
Sincerely yours,

Paul G White

Paul G. White
Vice President-Production

PGW/gs
cc: Mr. Jack Knox - President





HOW CROSS-FLOODING WORKS. Hypothetical oil field is completely controlled by 5-spot waterflood. Colored areas represent zones swept by floods. At left: field had 60 wells, 32 injectors and 28 producers, at time of economic limit of waterflood. Dark segments represent 30% of the area containing mobile oil which is unswept due to normal flood behavior. At right: same field after complete revamping for cross-flood. Field now has 28 wells, 13 injectors and 15 producers. Well count has been reduced by 53% for lower operating expense and remaining wells will recover mobile oil from unswept areas shown in drawing at left.

How to get additional oil from a watered-out flood

Some practical minded operators are making money with cross-flooding in spite of pessimistic lab predictions

20-second summary

Bypassed crude remaining after completion of a conventional 5-spot waterflood is being economically recovered by "cross-flooding", a technique which involves simple modification of the injection pattern. With pre-planning, the method requires a small investment and it can recover almost half as much oil as the original injection project.

D. R. Layton, District Superintendent,
Anadarko Production Co., Lovington, N. M.

When a waterflood has reached the economic limit, cross-flooding offers a way to continue producing and even increase production without drilling new wells.

As much as 30 percent of recoverable reserves remaining after primary recovery is trapped in unswept areas by conventional waterfloods. By rearranging existing wells and selective abandonment, cross-flooding can:

- Recover 43 percent as much oil as the original waterflood.
- Permit continued operation with minimal investment.
- Reduce active well count and lower operating costs.

Waterflooding easily outperforms all other of secondary recovery methods. But even these floods are often inefficient when recovery is compared to total volume of mobile oil originally in place.

Case histories indicate that most waterflood projects are less efficient than lab tests, and volume of oil remaining at abandonment is significant. Unswept areas can represent 30 percent of total area.

The natural sweep pattern of a 5-spot waterflood follows a definite course. At water breakthrough, a pattern of fairly well defined geometry exists. There is evidence that unswept areas tend to remain intact and that this remaining oil can be recovered with a program of pattern distortion. →

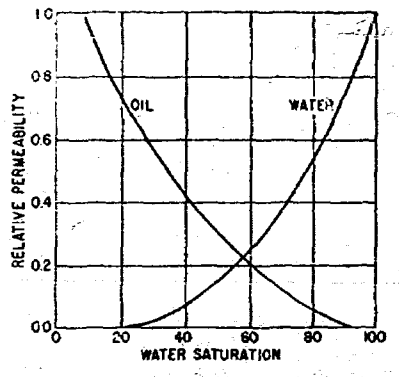


FIG. 1—Relative permeability curves show how permeability to water increases with water saturation. Formation will reach a point where oil will not flow. The same principle will help prevent cross-flood oil from moving into areas already swept by water.

WATERFLOOD EFFICIENCY

Mobility ratio of displacing and displaced fluids significantly affects flood performance and efficiency. This factor is influenced by fluid viscosities, relative permeabilities and reservoir heterogeneity.

Efficiency of a project, usually referred to as sweep efficiency, is total percentage of the reservoir, both areal and vertical, from which mobile oil has been swept by displacing fluid.

There is a definite relation between mobility ratio and sweep efficiency although investigators are not in agreement in their descriptions.[1-5] However, it is generally concluded that areal sweep efficiency declines as mobility ratio increases.

Early attempts at secondary recovery by injection of gas or air exemplify the adverse effect of high mobility ratio. These projects were mostly inefficient, showing early breakthrough of injected gas with poor areal coverage. Basic principles of this phenomena are revealed in curves showing relative permeability of oil and water with varying values of water saturation.

In Fig. 1, relative permeability to water increases rapidly with increasing water saturation and mobility ratio is accelerated. Most important, mobility of oil rapidly decreases with increased water saturation. This validates the assumption that a distinct oil-water interface exists in the reservoir.[6,7] That is, only water is mobile in the region behind the interface (water zone) and only oil is mobile in the region ahead of the interface (oil zone).

Effect of patterns. Potentiometric, X-ray shadowgraph, fluid mapper and electrolytic models have been used to find sweep pattern and efficiency of injected fluids.[1,3-6,8-10] Mathematical analysis supports model studies which, on the average, indicate areal sweep efficiency at water breakthrough slightly above 70 percent. Others with less favorable mobility ratios indicate efficiencies down to 50 percent.

The sweep pattern of a 5-spot waterflood used throughout this article has been well established by model studies.

Field-lab comparison. Because reservoir conditions are less than ideal, 70 percent sweep efficiency may not be realistic. Much research data was derived from conditions approaching ideal. In most cases, reservoir models are homogeneous and often unconsolidated, reflecting favorable porosity and permeability.

Displacement was simulated many times using fluids with a mobility ratio of 1.0. In a few cases displacing media was miscible fluid. Significantly, most discrepancies among findings of investigators occur when mobility ratio departs from unity.

Formations are normally stratified to some extent, and breakthrough occurs at different times within various layers. This complicates any volumetric calculation approach to determine areal sweep efficiency at time of initial breakthrough. However, *ultimate* efficiency can be estimated volumetrically with normal data.

Using this approach, many successful projects attained sweep efficiencies of 70 percent. This figure could be greater if projects continued indefinitely, as the sweep pattern would gradually expand. However, economics do not permit this extension.

Therefore, it is assumed that water breakthrough occurs with a sweep efficiency of 50 to 70 percent and that ultimate sweep will not exceed 70 percent on most projects.

It is also assumed that stratification occurs in most consolidated sandstone reservoirs and that these strata flood-out more or less individually. Thus, water breakthrough probably occurs in some strata at a high relative sweep efficiency, nearly ultimate for that particular layer, and only a small percentage of total oil is produced after breakthrough.

Research does not support this theory. However, it is consistent with the concepts of relative permeability curves explained earlier.

Some pattern expansion may continue, but as water saturation builds within strata around the well bore and mobility to oil decreases, expansion will subside and production from this strata will approach 100 percent water. Other layers will follow the same pattern until economic limit is reached.

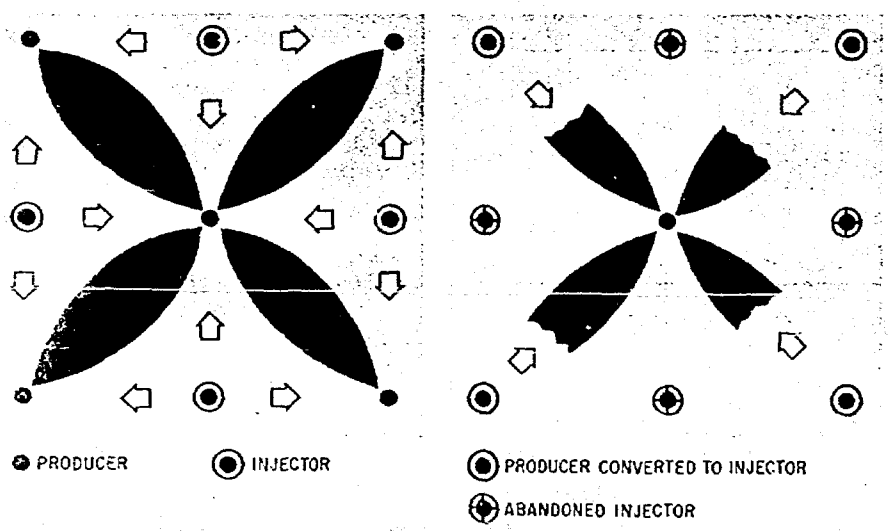


FIG. 2—Cross-flood design for maximum recovery of mobile oil. At left, watered out 5-spot pattern at point of abandonment has 30% of area unswept, dark areas. At right, pattern is converted to cross-flood by abandoning original injectors and converting alternate producers to new injectors. If cross-flooding is anticipated, little additional well work and no drilling are required.

CROSS-FLOOD PATTERN

A watered-out 5-spot pattern is shown in Fig. 2. Unswept areas are assumed to equal 30 percent of total area. After modification for cross-flooding, original injection wells are plugged and alternate producing wells are converted to injection placing unswept areas in a direct line between injection and producing well for additional sweepout.

Assuming a recovery efficiency equivalent to the original flooded area, this new area represents potentially 43 percent additional waterflood recovery.

For example, assume a hypothetical reservoir had 1,430,000 barrels of oil recoverable by waterflooding and the secondary flood recovered 1,000,000 barrels with an efficiency of 70 percent. There then would be 430,000 barrels of remaining recoverable oil. The remaining oil, if recovered by cross-flooding, would be 43 percent of secondary recovery.

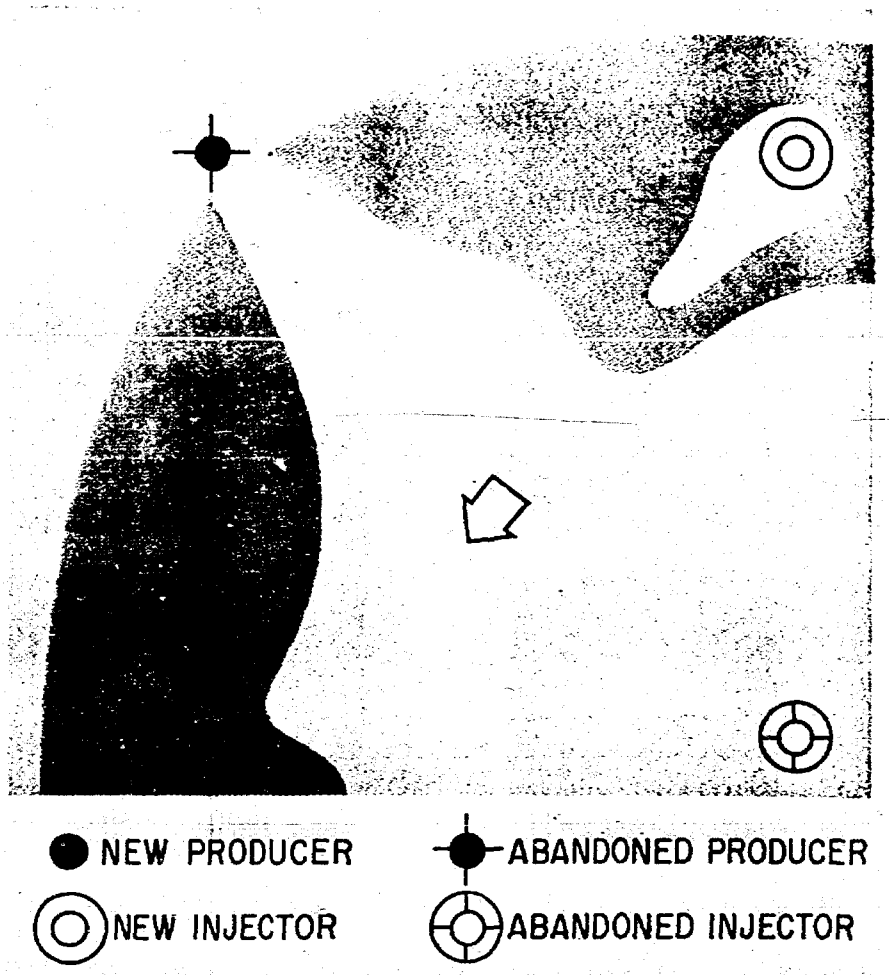


FIG. 3—Poor cross-flood pattern proposed in some research. System requires additional drilling. Mobile oil has to move across watered-out area to reach producer.

Performance. The cross-flood process has not been tried in most areas. However, one operator in Nowata County, Okla., has cross-flooded shallow Pennsylvanian sands with much success. It is now a standard practice to convert all waterfloods as they reach economic limit. Profits have been extended on all projects.

Minimum results have been to maintain the same production rate with one-half the previous active well count. Good production increases have been recorded on better projects.

Coring in unswept areas has shown high oil saturation surprisingly near old watered out producing wells. Infill drilling in similar areas by two major companies in the Permian Basin has resulted in recovery of significant amounts of oil. These results support the theory that trapped oil areas of sizable extent do exist.

Lab studies. Little research has been done on cross-flooding. One investigation indicated that additional recovery of only 3 percent could be expected.[11] This study assumed that it would be necessary to drill new wells, both injection and producing, for the tertiary phase. Fig. 3 shows the proposed 5-spot pattern.

This pattern would sweep across the old flooded area and recover bypassed oil. But it is *not* the proper pattern to move oil from unswept areas containing most of the remaining recoverable reserves. The new producing well would recover *some* oil from the immediate area, but rapid water breakthrough would occur on the flanks and again leave a trapped oil area.

Most oil around the injection well would not be recovered. Injected fluids would break through rapidly and only a small portion of oil would be moved towards the producer before it would have to migrate across the original watered out area.

In practice, most projects will not justify additional drilling. If the project will support new wells, they should be producing wells drilled in the center of unswept areas with all original producing wells converted to injection. This would provide maximum possible recovery from a cross-flood pattern.

Design problems. Primary consideration for a successful cross-flood is effective movement of an oil bank through the narrow unswept area. There will be a strong tendency for injected fluids to migrate into the watered out zone.

Pressure potential from injector to producer has some characteristics which are favorable for cross-flooding. Fig. 4 shows distribution of pressure gradient by equipotential lines. About 80 percent of pressure drop occurs in 4 percent of volume around injection and producing wells. Distribution shows that the large swept area with high relative permeability to water has a low potential drop which would help prevent fluid movement. However, injected fluid may still preferentially follow the water saturated route.

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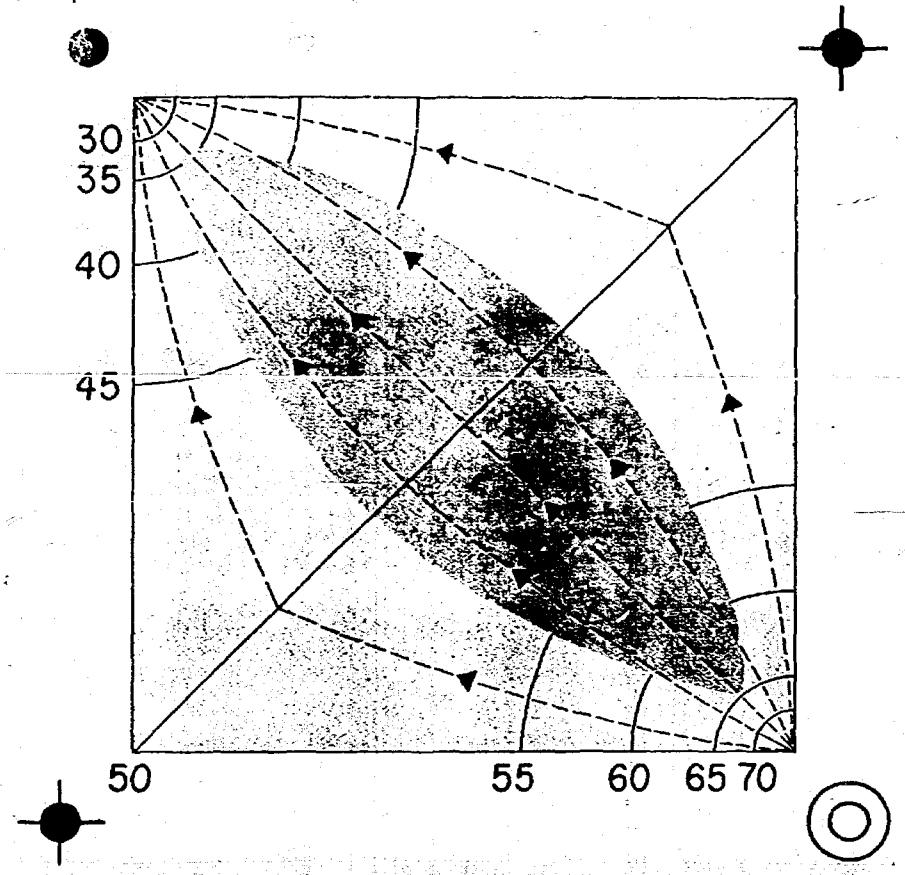

FIG. 4—Pressure distribution and stream lines from converted injector to producer. Solid equipotential lines show 80% of pressure drop in immediate area around well bores. Injected water would tend to follow watered-out area but shortest distance is directly across unswept area. Low permeability to oil in wet areas would help move mobile oil toward producer.

The shortest distance from injector to producer is a straight line through the unswept area as shown by stream lines. This also represents greatest pressure drop per unit distance to aid fluid migration. If fluid travel is governed to some extent by distance, then travel will be a function of distance and mobility ratio. This may justify the additional cost of using polymers.

In the narrow unswept area, oil will move because of the good relative permeability to oil, except for the small area around the producing well bore. For oil to move in a direction away from the producer, it would have to pass through high water saturation. Relative permeability concepts (Fig. 1) make this movement unlikely.

Lenticular pay zone stringers with local pinch outs adversely affect cross-flooding. If this problem existed in the original flood, it could be a major consideration in a cross-flood. However, by changing the pattern, some areas that were isolated in the original flood could produce in the cross-flood.

If cross-flooding is going to be tried, an entire project or at least a very large area, should be converted initially. Partial attempts or small pilot areas will likely give disappointing results. Highest practical injection rates should be maintained to create maximum pressure differential across the 5-spot area. This will help offset the preferential advance of injected fluid across swept areas.

Economics. A cross-flood project will usually require modest development cost. Existing equipment will normally suffice for the tertiary phase. Major costs will be for rearrangement of the injection system and well work. If all wells were new or worked-over during the original flood, little work may be necessary. If the project were anticipated originally, the injection system could be designed so that minimum change would be required.

An immediate economic benefit is fewer wells for lower operating costs. This would simultaneously extend economic limit and add to operating profits.

Cross-flooding should be considered for extended profits from waterflood projects. Potential is high enough to justify risk of capital expenditure. Each project requires a separate study, as any secondary project does, but justification may not be confined to better secondary projects. Many less successful projects contain a great amount of recoverable oil and knowledge gained during the secondary phase may be used to design efficient tertiary projects.

About the author

DONALD R. LAYTON *is district superintendent for Anadarko Production Co. in the Loco Hills, N. M., district, secondary recovery division. He started working in the eastern Kansas oil fields before graduating from high school. In 1947, he returned from the Army and continued working on a waterflood project with an independent operator. In 1955, he joined Ambassador Oil Corp. as waterflood project supervisor and was transferred to New Mexico in 1957. He was appointed to his present position in 1965 when Ambassador was acquired by Anadarko. Mr. Layton is a petroleum engineering graduate, a member of AIME, API and the New Mexico Waterflood Association.*

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10 Muskat, M., Flow of Homogeneous Fluids through Porous Media, McGraw-Hill Book Co., Inc., (1937)

11 Still, Gerald R., and Crawford, Paul B., Laboratory Evaluation of Oil Recovery By Cross Flooding," Producers Monthly, February 1963, pp. 12-19.

Case No. 5189

BEFORE THE

OIL CONSERVATION COMMISIION OF NEW MEXICO

IN THE MATTER OF THE APPLICATION
OF CRAIG FOLSON FOR APPROVAL OF
AN UNORTHODOX WELL LOCATION,
CAPROCK-QUEEN POOL, CHAVES COUNTY,
NEW MEXICO

A P P L I C A T I O N

Comes now Craig Folson and applies to the Oil Conservation Commission of New Mexico for approval of an unorthodox well location in the Caprock-Queen Pool, Chaves County, New Mexico, and in support thereof would show the Commission:

1. Applicant is the owner of the right to drill and develop the oil and gas minerals in the area involved in this application.

2. Applicant proposes to drill a well to test the Queen formation at a depth of approximately 3.100 feet, at a location 1340 feet from the South line and 1300 feet from the East line of Section 12, Township 13 South, Range 31 East, N.M.P.M., Chaves County, New Mexico.

3. A well located as proposed will recover oil and gas that would not otherwise be recovered, is in the interests of conservation, and the correlative rights of no offset operator will be impaired.

WHEREFORE applicant prays that this application be set for hearing before the Commission of the Commission's duly appointed examiner, and that after notice and hearing as required by law the Commission enter its order approving the location as prayed for.

Respectfully submitted,

CRAIG FOLSON

BY Jason W. Kellahin

KELLAHIN & FOX
P.O. Box 1769
Santa Fe, New Mexico 87501

ATTORNEYS FOR APPLICANT

DRAFT

Expedite

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5189

Order No. R-4750

APPLICATION OF CRAIG FOLSON
FOR AN UNORTHODOX OIL WELL
LOCATION, CHAVES COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on March 13, 1974, at Santa Fe, New Mexico, before Examiner Richard L. Stamets.

NOW, on this _____ day of March, 1974, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Craig Folson, seeks approval for an unorthodox oil well location at a point 1340 feet from the South line and 1300 feet from the East line of Section 12, Township 13 South, Range 31 East, NMPM, Caprock-Queen Pool, Chaves County, New Mexico.

(6) That a well drilled to the Queen formation at the proposed unorthodox location may produce oil which would otherwise not be recovered.

(5) That the proposed well is to be drilled in a depleted abandoned waterflood project.

(3) That the NE/4 SE/4 of said Section 12 is to be dedicated to the well.

(4) That the NE/4 SE/4 of said Section 12 can be efficiently and economically drained and developed by said well.

(5) That no offset operator objected to the proposed unorthodox location.

(7) That approval of the subject application will afford the applicant the opportunity to produce his just and equitable share of the oil in the Caprock-Queen Pool, and will otherwise prevent economic waste and protect correlative rights.

IT IS THEREFORE ORDERED:

(1) That the applicant, Craig Folson, is hereby authorized to drill a well at an unorthodox oil well location 1340 feet from the South line and 1300 feet from the East line of Section 12, Township 13 South, Range 31 East, Caprock-Queen Pool, Chaves County, New Mexico.

(2) That the NE/4 SE/4 of said Section 12 shall be dedicated to the well.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.