

Case 7449

**OIL CONSERVATION COMMISSION**

P. O. BOX 871

SANTA FE, NEW MEXICO

April 16, 1962

**Pan American Petroleum Corporation  
P. O. Box 480  
Farmington, New Mexico**

**Attention: Mr. E. M. Curtis**

**Gentlemen:**

Reference is made to your letter of March 19, 1962, wherein you requested that certain wells be substituted for the water injection wells authorized for your Totah Gallup Pressure Maintenance Project by Order No. R-2162.

No objections have been received from offset operators during the prescribed 20-day waiting period. Pan American is, therefore, hereby authorized to convert to water injection in the Gallup formation the following wells:

Navajo Tribal "H" No. 9, NE/4 NE/4 Section 23  
Navajo Tribal "H" No. 13, NE/4 SW/4 Section 13,  
both in Township 29 North, Range 14 West.

As authorized in Order No. R-2162, Navajo Tribal "H" No. 2, NE/4 NE/4 Section 24, Township 29 North, Range 14 West, will also be used for water injection.

Authority for water injection use of Navajo Tribal "H" No. 4, NE/4 NW/4 of Section 14, and Navajo Tribal "H"

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OIL CONSERVATION COMMISSION

P. O. BOX 871

SANTA FE, NEW MEXICO

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No. 6, SW/4 SW/4 Section 13, Township 29 North, Range 14 West, is hereby rescinded.

Very truly yours,

A. L. PORTER, JR.,  
Secretary-Director

ALP/DSN/eg

cc: Mr. Phil McGrath  
U. S. Geological Survey  
Farmington, New Mexico

Mr. E. C. Arnold  
Oil Conservation Commission  
Aztec, New Mexico

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BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

RE: IN THE MATTER OF THE APPLICATION  
OF PAN AMERICAN PETROLEUM CORPORATION  
FOR A PRESSURE MAINTENANCE PROJECT,  
SAN JUAN COUNTY, NEW MEXICO.

Case No. 2449

ENTRY OF APPEARANCE

Comes now L. C. WHITE of GILBERT, WHITE AND GILBERT, Santa Fe, New Mexico,  
and hereby enters his formal appearance in the above entitled matter as  
resident counsel for Aztec Oil & Gas Company.

  
\_\_\_\_\_  
L. C. WHITE

GILBERT, WHITE AND GILBERT  
ATTORNEYS AT LAW  
SANTA FE, NEW MEXICO

*Handwritten notes:*  
2-20-61  
JL

**(SQUARE LAKE (LOWER GRAYBURG AND UPPER SAN ANDRES WATERFLOOD) POOL—Cont'd.)**

**TOWNSHIP 16 SOUTH, RANGE 31 EAST, NMPM  
EDDY COUNTY, NEW MEXICO**

- Section 19: S/2 SE/4
- Section 28: W/2 SW/4
- Section 29: S/2 N/2 and S/2
- Section 30: NE/4 and E/2 SE/4
- Section 32: N/2
- Section 33: N/2, SE/4 and E/2 SW/4
- Section 34: S/2, W/2 NW/4 and SW/4 NE/4

(2) That all of the above-described acreage which was not included in the previously authorized Square Lake Waterflood Project is hereby designated a legitimate expansion of said project, and shall be exempt from the allowable provisions of Rule 701 E.

(3) That the provisions of Orders Nos. R-1110 and R-1110-A shall remain in full force and effect.

(4) That the waterflood project as expanded by this order shall be operated in accordance with the provisions of Rule 701 E of the Commission Rules and Regulations, except as provided in Paragraph 2 above.

(5) 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.

**HORSESHOE-GALLUP POOL  
(Pan American Pressure Maintenance)  
San Juan County, New Mexico**

Order No. R-2026, Authorizing Pan American Petroleum Corporation to Institute a Pressure Maintenance Project in the Horseshoe-Gallup Pool, San Juan County, New Mexico, July 13, 1961.

*Application of Pan American Petroleum Corporation for a Pressure Maintenance Project in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico, and for special rules governing the operation of said project.*

CASE NO. 2317  
Order No. R-2026

**ORDER OF THE COMMISSION**

BY THE COMMISSION: This cause came on for hearing at 9 o'clock a.m. on June 28, 1961, at Santa Fe, New Mexico, before Elvis A. Utz, Examiner duly appointed by the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission," in accordance with Rule 1214 of the Commission Rules and Regulations.

NOW, on this 13th day of July, 1961, the Commission, a quorum being present, having considered the application, the evidence adduced, and the recommendations of the Examiner, Elvis A. Utz, 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, Pan American Petroleum Corporation, proposes to institute a pressure maintenance project in the Horseshoe-Gallup Oil Pool in Township 30 North, Range 16 West, San Juan County, New Mexico, by the injection of water into the Gallup formation through 20 wells initially, all of which wells are within the proposed project area.

(3) That the proposed pressure maintenance project, to be known as the Northeast Hogback Pressure Maintenance Project, includes lands formerly designated by Order No. R-1494 as part of the Northeast Hogback Unit.

(4) That the applicant proposes that the Special Rules and Regulations to be established for the Northeast Hogback Pressure Maintenance Project be identical with the rules established by Order No. R-1699 for The Atlantic Refining Company Horseshoe-Gallup Pressure Maintenance Project.

(5) That such identical rules should be established in order to prevent conflict in the event the two projects eventually merge.

**IT IS THEREFORE ORDERED:**

(1) That the applicant, Pan American Petroleum Corporation, is hereby authorized to institute a pressure maintenance project in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico, by the injection of water into the Gallup formation through the following-described wells in Township 30 North, Range 16 West:

- PAN AMERICAN PETROLEUM CORPORATION**
- Northeast Hogback Unit Well No. 4, Unit J, Section 14
  - Northeast Hogback Unit Well No. 6, Unit B, Section 15
  - Northeast Hogback Unit Well No. 10, Unit E, Section 14
  - Northeast Hogback Unit Well No. 11, Unit F, Section 14
  - Northeast Hogback Unit Well No. 13, Unit E, Section 13
  - Northeast Hogback Unit Well No. 14, Unit I, Section 14
  - Northeast Hogback Unit Well No. 16, Unit K, Section 13
  - Northeast Hogback Unit Well No. 17, Unit M, Section 13
  - Northeast Hogback Unit Well No. 20, Unit B, Section 24
  - Northeast Hogback Unit Well No. 21, Unit D, Section 15
  - Northeast Hogback Unit Well No. 22, Unit G, Section 15
  - Northeast Hogback Unit Well No. 23, Unit B, Section 10
  - Northeast Hogback Unit Well No. 25, Unit D, Section 11
  - Northeast Hogback Unit Well No. 29, Unit F, Section 11
  - Northeast Hogback Unit Well No. 30, Unit L, Section 10
  - Northeast Hogback Unit Well No. 32, Unit L, Section 11
  - Northeast Hogback Unit Well No. 37, Unit P, Section 10

**EL PASO NATURAL GAS PRODUCTS COMPANY**

- Williams Well No. 2, Unit P, Section 11
- Williams Well No. 3, Unit J, Section 11

**ABRAHAM**

- Federal Well No. 3, Unit B, Section 14

(2) That Special Rules and Regulations governing the operation of the Northeast Hogback Pressure Maintenance Project, San Juan County, New Mexico, are hereby promulgated, as follows:

**SPECIAL RULES AND REGULATIONS**

**FOR THE  
NORTHEAST HOGBACK PRESSURE MAINTENANCE  
PROJECT**

RULE 1. The project area of the Northeast Hogback Pressure Maintenance Project, hereinafter referred to as the Project, shall comprise the following-described acreage in San Juan County, New Mexico:

- TOWNSHIP 30 NORTH, RANGE 16 WEST, NMPM**
- Section 10: E/2 and SW/4
  - Section 11: SW/4 NE/4, W/2 and the SE/4
  - Section 12: W/2 SW/4
  - Section 13: SW/4, W/2 NW/4 and the W/2 SE/4
  - Section 14: N/2, N/2 SW/4 and the SE/4
  - Section 15: NE/4 and the N/2 NW/4
  - Section 23: NE/4 NE/4
  - Section 24: NW/4 NE/4 and the N/2 NW/4

RULE 2. The allowable for the Project shall be the sum of the allowables of the several wells within the project area, including those wells which are shut-in, curtailed, or used as injection wells. Allowables for all wells shall be determined in a manner hereinafter prescribed.

RULE 3. Allowables for injection wells may be transferred to producing wells within the project area, as may the allowables for producing wells which, in the interest of more efficient operation of the Project, are shut-in or curtailed because of high gas-oil ratio or are shut-in for any of the following reasons: pressure regulation, control of pattern or sweep efficiencies, or to observe changes in pressures or changes in characteristics of reservoir liquids or progress of sweep.

RULE 4. The allowable assigned to any well which is shut-in or curtailed shall be identical with the provisions of Rule 3, which allowable is to be transferred to any well or

**BEFORE EXAMINER**

**OIL CONSERVATION COMMISSION**

Pan Am's EXHIBIT NO. 9

CASE NO. 2449

+ 200

(HORSESHOE-GALLUP (PAN AMERICAN PRESSURE MAINTENANCE) POOL—Cont'd.)

wells in the project area for production, shall in no event be greater than its ability to produce during the test prescribed by Rule 6, below, or greater than the current top unit allowable for the pool during the month of transfer, whichever is less.

RULE 5. The allowable assigned to any injection well on a 40-acre proration unit shall be top unit allowable for the Horseshoe-Gallup Oil Pool.

RULE 6. The allowable assigned to any well which is shut-in or curtailed in accordance with Rule 3, shall be determined by a 24-hour test at a stabilized rate of production, which shall be the final 24-hour period of a 72-hour test throughout which the well should be produced in the same manner and at a constant rate. The daily tolerance limitation set forth in Commission Rule 502 I (a) and the limiting gas-oil ratio (2,000 to 1) for the Horseshoe-Gallup Oil Pool shall be waived during such tests. The project operator shall notify all operators offsetting the well, as well as the Commission, of the exact time such tests are to be conducted. Tests may be witnessed by representatives of the offsetting operators and the Commission, if they so desire.

RULE 7. The allowable assigned to each producing well in the Project shall be equal to the well's ability to produce or to top unit allowable for the Horseshoe-Gallup Oil Pool, whichever is less, provided that any producing well in the project area which directly or diagonally offsets a well outside the project area producing from the same common source of supply shall not produce in excess of two times top unit allowable for the pool. Each producing well shall be subject to the limiting gas-oil ratio (2,000 to 1) for the Horseshoe-Gallup Oil Pool, except that any well or wells within the project area producing with a gas-oil ratio in excess of 2,000 cubic feet of gas per barrel of oil may be produced on a "net" gas-oil ratio basis, which net gas-oil ratio shall be determined by applying credit for daily average gas injected, if any, into the Horseshoe-Gallup Oil Pool within the project area to such high gas-oil ratio well. The daily adjusted oil allowable for any well receiving gas injection credit shall be determined in accordance with the following formula:

$$A_{adj} = \frac{TUA \times F_a \times 2,000}{P_g - I_g} \times \frac{1}{P_o}$$

where:

- A<sub>adj</sub> = the well's daily adjusted allowable
- TUA = top unit allowable for the pool
- F<sub>a</sub> = the well's acreage factor
- P<sub>g</sub> = average daily volume of gas produced by the well during the preceding month, cubic feet
- I<sub>g</sub> = the well's allocated share of the daily average gas injected during the preceding month, cubic feet
- P<sub>o</sub> = average daily volume of oil produced by the well during the preceding month, barrels

In no event shall the amount of injected gas being credited to a well be such as to cause the net gas-oil ratio,  $\frac{P_g - I_g}{P_o}$ , to be less than 2,000 cubic feet of gas per barrel of oil produced.

RULE 8. Credit for daily average net water injected into the Horseshoe-Gallup Oil Pool through any injection well located within the project area may be converted to its gas equivalent and applied to any well producing with a gas-oil ratio in excess of two thousand cubic feet of gas per barrel of oil. Total credit for net water injected in the project area shall be the gas equivalent volume of the daily average net water injected during a one-month period. The daily average gas equivalent of net water injected shall be computed in accordance with the following formula:

$$E_g = (V_w \text{ inj} - V_w \text{ prod}) \times 5.61 \times \frac{P_a}{15.025} \times \frac{520^\circ}{T_r} \times \frac{1}{Z}$$

where:

- E<sub>g</sub> = Average daily gas equivalent of net water injected, cubic feet

- V<sub>w inj</sub> = Average daily volume of water injected, barrels
- V<sub>w prod</sub> = Average daily volume of water produced, barrels
- 5.61 = Cubic foot equivalent of one barrel of water
- P<sub>a</sub> = Average reservoir pressure at mid-point of the pay-zones of Horseshoe-Gallup Oil Pool in project area, psig + 12.01 as determined from most recent survey
- 15.025 = Pressure base, psi
- 520° = Temperature base of 60°F expressed as absolute temperature
- T<sub>r</sub> = Reservoir temperature of 87°F expressed as absolute temperature (547°R) *155*
- Z = Compressibility factor from analysis of Horseshoe-Gallup gas at average reservoir pressure, P<sub>a</sub>, interpolated from compressibility tabulation below:

Reservoir Pressure	Z	Reservoir Pressure	Z	Reservoir Pressure	Z
50	.9725	300	.8325	550	.6560
100	.9465	350	.8030	600	.6135
150	.9215	400	.7710	650	.5655
200	.8885	450	.7220	700	.5220
250	.8600	500	.6900	750	.4630
				800	.3935

RULE 9. Each month the project operator shall, within three days after the normal unit allowable for Northwest New Mexico has been established, submit to the Commission a Pressure Maintenance Project Operator's Report, on a form prescribed by the Commission, outlining thereon the data required, and requesting allowables for each of the several wells in the project as well as the total Project allowable. The aforesaid Pressure Maintenance Project Operator's Report shall be filed in lieu of Form C-120 for the Project.

RULE 10. The Commission shall, upon review of the report and after any adjustments deemed necessary, calculate the allowable for each well in the Project for the next succeeding month in accordance with these rules. The sum of the allowables so calculated shall be assigned to the Project and may be produced from the wells in the Project in any proportion except that no well in the Project which directly or diagonally offsets a well outside the Project producing from the same common source of supply shall produce in excess of two times top unit allowable for the Pool.

RULE 11. The conversion of producing wells to injection, the drilling of additional wells for injection, and expansion of the project area shall be accomplished only after approval of the same by the Secretary-Director of the Commission. To obtain such approval, the Project operator shall file proper application with the Commission, which application, if it seeks authorization to convert additional wells to injection or to drill additional injection wells shall include the following:

- (1) A plat showing the location of proposed injection well, all wells within the project area, and offset operators, locating wells which offset the project area.
- (2) A schematic drawing of the proposed injection well which fully describes the casing, tubing, perforated interval, and depth showing that the injection of gas or water will be confined to the Gallup formation.
- (3) A letter stating that all offset operators to the proposed injection well have been furnished a complete copy of the application and the date of notification.

The Secretary-Director may approve the proposed injection well if, within 20 days after receiving the application, no objection to the proposal is received. The Secretary-Director may grant immediate approval, provided waivers of objection are received from all offset operators.

Expansion of the project area may be approved by the Secretary-Director of the Commission administratively when good cause is shown therefor.

(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.

*chg. from 40 to 80 use same attached for Z factors*

PERTINENT DATA SHEET

RESERVOIR ROCK AND RESERVOIR FLUID PROPERTIES  
TOTAH GALLUP FIELD

Original Reservoir Pressure, psig	1623
Reservoir Temperature, °F.	155
Saturation Pressure at 155° F., psig	1463
Estimated Original Solution Gas-Oil Ratio, cu. ft./bbl.	550
Original Formation Volume Factor	1.375
Crude Viscosity, cp	.470
Crude Gravity, °API	41
Producing Mechanism	Solution Gas Drive
Average Porosity, %	14.33
Average Permeability, Md	143.2
Average Water Saturation, %	20
Average Net Pay Thickness, ft.	5.2
Gas-Oil or Water-Oil Contacts	None Indicated
Type Accumulation	Stratigraphic Trap (Sand Bar)

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
<i>Pan Am's</i> EXHIBIT NO. <u>6</u>
CASE NO. <u>2449</u>

CASING AND CEMENTING PROGRAMS  
WATER INJECTION WELLS  
PROJECT AREAS "A" AND "B"  
TOTAH GALLUP FIELD

1. Navajo Tribal "H" No. 2

8-5/8" casing set at 210' with 180 sacks cement.  
4-1/2" casing set at 5211' with 200 sacks cement.

2. Navajo Tribal "H" No. 4

8-5/8" casing set at 209' with 175 sacks cement.  
4-1/2" casing set at 5156' with 200 sacks cement.

3. Navajo Tribal "H" No. 5

8-5/8" casing set at 203' with 190 sacks cement.  
4-1/2" casing set at 5066' in stages. First stage  
cemented with 200 sacks. Second stage with 250  
sacks cement.

4. Gallegos Canyon Unit No. 92

8-5/8" casing set at 210' with 160 sacks cement.  
4-1/2" casing set at 5809' in stages. First stage  
cemented with 200 sacks. Second stage with 150  
sacks cement.

5. Gallegos Canyon Unit No. 100

8-5/8" casing set at 213' with 175 sacks cement.  
4-1/2" casing set at 5545' in stages. First stage  
cemented with 200 sacks. Second stage with 150  
sacks cement.

*1000 Pw/Day*

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
<i>Pan Am's</i> EXHIBIT NO. <u>5</u>
CASE NO. <u>2449</u>

DRILLING AND COMPLETION PROGRAM  
MORRISON WATER SUPPLY WELL  
TOTAH GALLUP AREA

Estimated Top Morrison	6450'
Estimated Total Depth	7150'
Surface Casing	200' 13-3/8" Cemented to surface

**Oil String Casing**

7510' 8-5/8" cemented in two stages. First stage cemented back to top of Gallup. Second stage from 100' below Pictured Cliffs to surface.

**Completion**

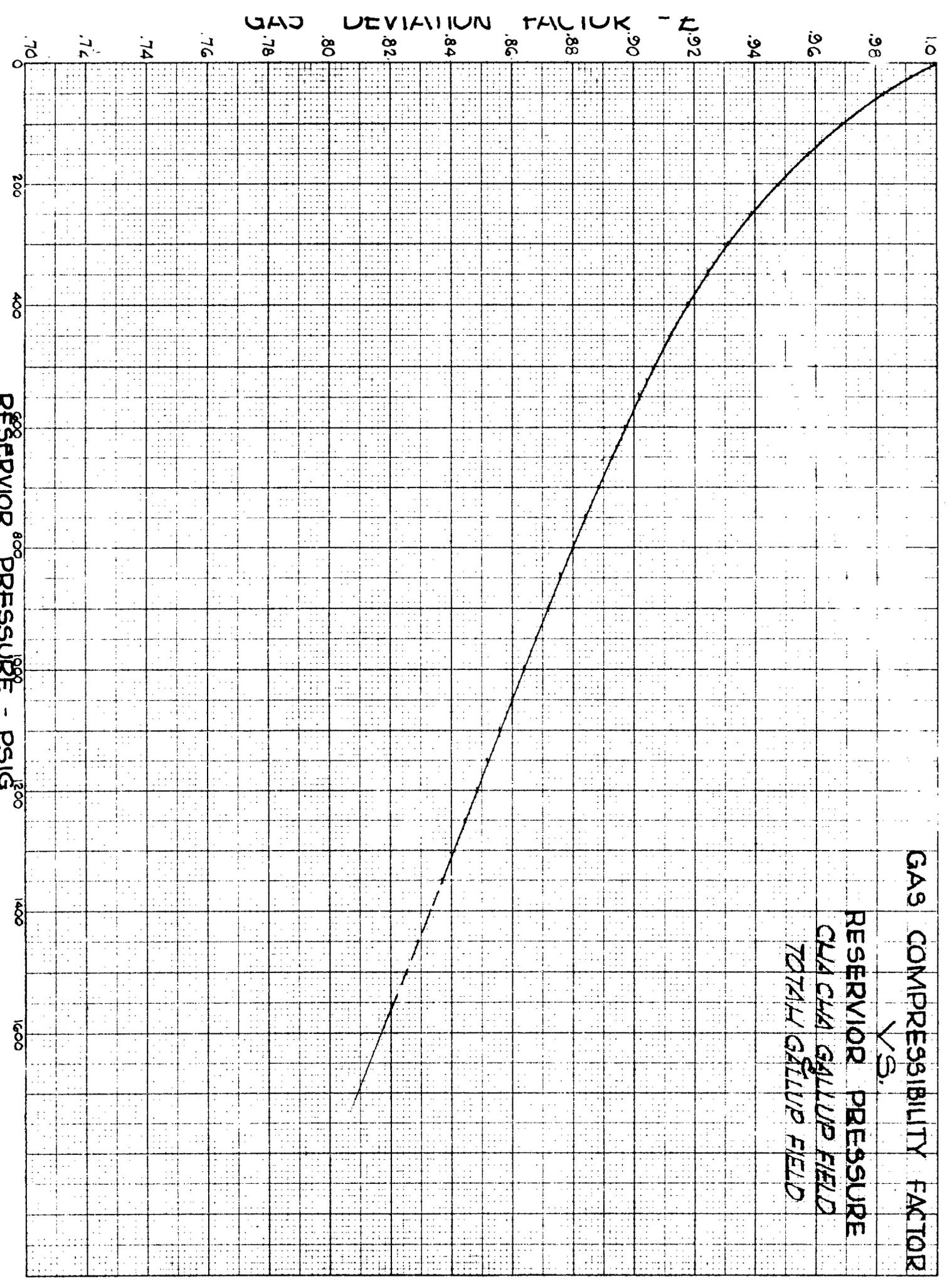
Set-through type completion with Morrison sands jet perforated. The Morrison sands will be fractured with water if necessary to obtain desired productivity.

**Estimated Production Rate**

10,000 barrels of water per day.

BEFORE EXAMINER NUTTER	
OIL CONSERVATION COMMISSION	
<i>Pan Amis</i>	EXHIBIT NO. <u>4</u>
CASE NO.	<u>2449</u>

GAS COMPRESSIBILITY FACTOR  
V.S.  
RESERVOIR PRESSURE  
CHACMA GALLUP FIELD  
TOTALH GALLUP FIELD



LARGE FORMAT  
EXHIBIT HAS  
BEEN REMOVED  
AND IS LOCATED  
IN THE NEXT FILE

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