Case No.

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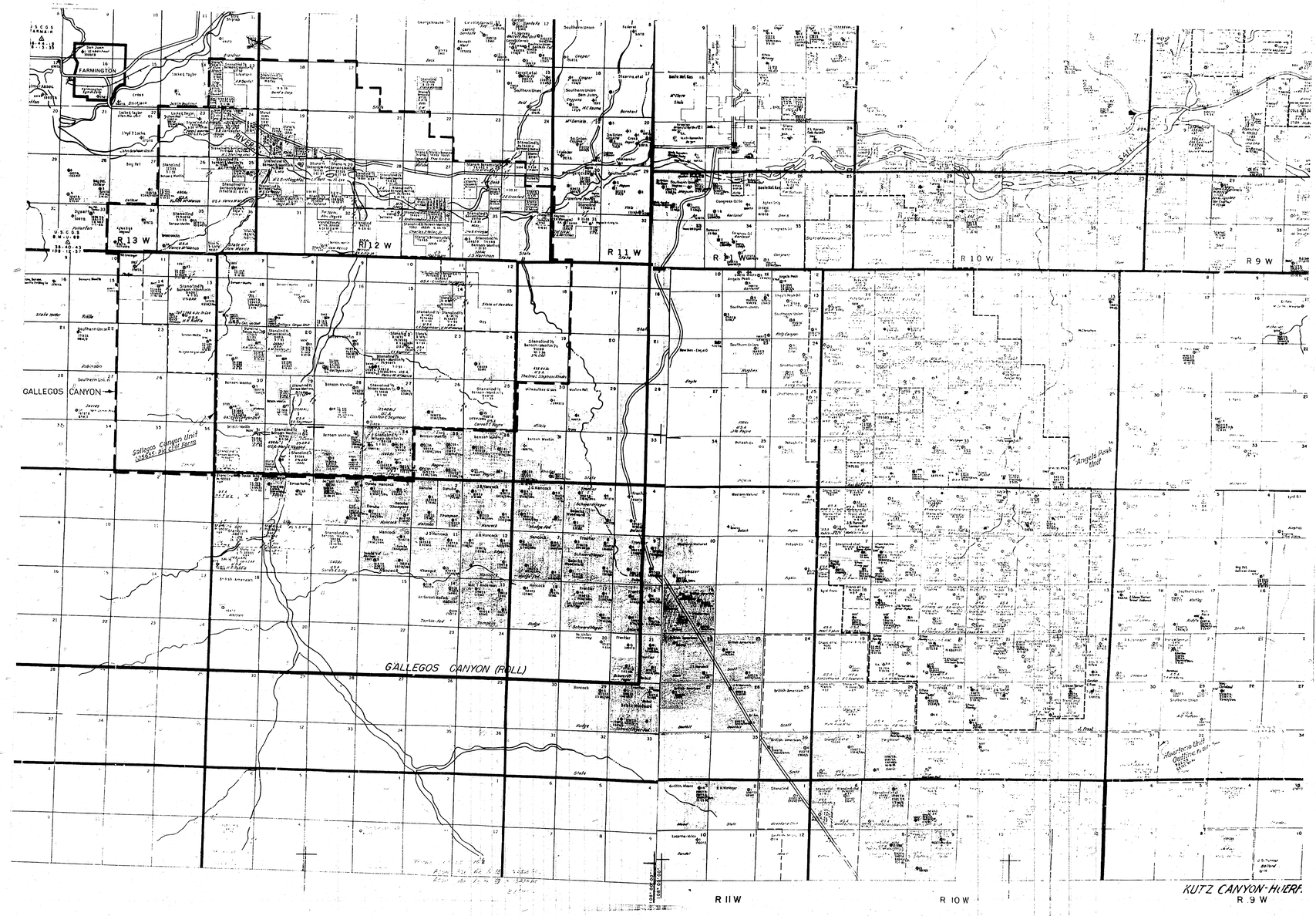
Large Exhibits


FARMINGTON
GALLEGOS CANYON
GALLEGOS CANYON (FOLL)
R 13 W
R 12 W
R 11 W
R 10 W
R 9 W
R11W
R 10W
KUTZ CANYON-HUERF.
R 9 W

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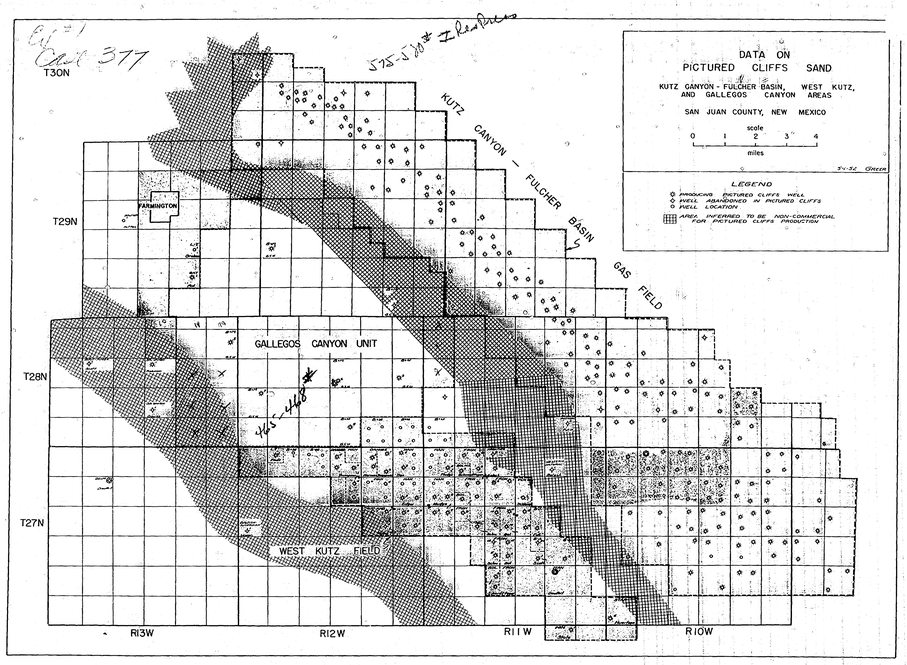

DATA ON
PICTURED CLIFFS SAND
OF
KUTZ CANYON - FULCHER BASIN, WEST KUTZ, AND GALLEGOS CANYON AREAS

SAN JUAN COUNTY, NEW MEXICO

scale
0 1 2 3 4
miles

S-32 Green

LEGEND

- PRODUCING PICTURED CLIFFS WELL
- WELL ABANDONED IN PICTURED CLIFFS
- WELL LOCATION
- AREA INFERRED TO BE NON-COMMERCIAL FOR PICTURED CLIFFS PRODUCTION

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Ex. 5
Case 377

PRODUCTION RESEARCH TESTS

GALLEGOS CANYON UNITS NO. 2, 3, 4, 5 AND 7

WEST KUTZ FIELD

SAN JUAN COUNTY, NEW MEXICO

FOR

BENSON AND MONTIN

DALLAS, TEXAS

CORE

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

April 29, 1952

Benson and Montin
502 Continental Building
Dallas, Texas

Attention: Mr. A. R Greer, Jr.

Subject: Production Research Tests
Gallegos Canyon Units No. 2, 3, 4, 5 and 7
West Kutz Field
San Juan County, New Mexico
Our File No. PR-5209 CP

Gentlemen:

We submit herewith results of special production research measurements on core samples from five wells, listed above, in the West Kutz Field, New Mexico. Included are data on capillary pressure tests, formation resistivities, and porosity and permeability tests. A discussion is given in regard to comparisons of these data with data from conventional and special (large core) analysis on the wells.

Table 1 shows the results of single point capillary pressure measurements, sometimes called restored state tests, on fifteen samples. These samples were permeability plugs from the conventional core analysis. The permeabilities measured in the conventional core analysis are also shown in this table; these values were checked to within a few per cent by this laboratory.

The capillary pressure data were obtained in the conventional manner by displacing brine from the saturated samples on a porous plate with air at 30 PSI. The connate water saturations thus obtained showed satisfactory agreement with permeability; the average relationship is shown in Table 2 where values of connate water are given for varying permeabilities.

The samples used in the above tests were prepared, after extraction, by evacuating and then saturating with a brine of approximately 68,000 parts

per million sodium chloride. The porosities of these samples were obtained from the difference of the dry weights and saturated weights, and these porosities are shown in Table 3. It was noted that the average porosity, 17.7 per cent, was in excellent agreement with the average porosity obtained by large core analysis on the five wells; this point will be discussed in more detail subsequently.

The formation resistivity factors, also shown in Table 3, were obtained by measuring the electrical resistance of the saturated samples, correcting for length and area to obtain unit resistivity in ohm-meters, and dividing by the resistivity of the saturating brine. The resistivities of eight of the samples were also obtained after their water saturation had been reduced to connate water saturation. The resistivity ratio, i.e. the ratio of R_o, the resistivity at 100 per cent brine saturation to R_s, the resistivity at connate water saturation S, is shown in Table 3.

The resistivity measurements were measured in case it is desired to obtain an independent check on connate water saturations in the formation by utilizing electrical log data. For this purpose the correlation of formation factor with porosity, shown in Table 4, may be used if it is desired to make detailed calculations; otherwise, the average formation factor, 23, may be used. In this connection it is necessary to know also the exponent n in the equation $R_o/R_s = S^n$. From the resistivity ratios shown in Table 3 the best value of n was found to be 1.95.

The resistivity of a water sample from Gallegos Canyon Unit No. 7 well was measured and found to correspond to a sodium chloride concentration of 68,000 parts per million. A water sample from Unit No. 6 well showed 73,000 parts per million. If these are representative samples, the formation water would have an electrical resistivity corresponding to an average 70,500 parts per million sodium chloride. This brine resistivity would be 0.1031 ohm-meters at 70° F., 0.0921 at 80° F., and 0.0832 at 90° F., based on data from the International Critical Tables.

When the five subject wells were cored, spot samples were selected (from all except Unit No. 3) and sent to our Farmington, New Mexico, laboratory for conventional core analysis. The remainder of the cores were sent

$S = \left(\frac{R_o}{R_t}\right)^{\frac{1}{1.95}} = \left(\frac{R_o}{R_t}\right)^{.513}$

to our Worland, Wyoming, laboratory for large-core analysis. A summary of average data obtained on these analyses is shown in Table 5.

It may be noted that the average permeability obtained by large-core analysis was less than 0.1 millidarcys on each well. It was suspected that the procedure involved in the special analysis had altered the samples due to their clay content. Three perm plugs were subsequently drilled from the large cores on each of the five wells and sent to Dallas for checking of permeability. Twelve out of the fifteen plugs showed 0.000 millidarcys, and the other three had only a low permeability. This confirmed our belief that the analysis procedure had lowered the permeability of the samples. In this procedure fresh water is introduced into the cores by a vacuum-pressure treatment and the cores subsequently stay under hot toluene at 230° F. for one to two weeks. Such alteration of permeability had never been previously observed in this special analysis which is nearly always used only for limestone and dolomite samples and only rarely for sands. It is believed therefore that the permeabilities obtained in the conventional analyses are most representative of the true formation permeabilities.

Before proceeding to a discussion of further comparison of conventional and special analyses, a brief description of these analysis procedures is given as follows. In the conventional analysis, a representative portion of the core sample, usually 100 grams, is retorted to obtain the oil and water content in terms of per cent bulk volume of the rock, i.e. cubic centimeters of oil and of water per 100 cubic centimeters of rock. A separate portion is taken and subjected to mercury under 750 PSI pressure to measure the mercury penetration and thereby determine the gas content of this sample. The oil, water and gas contents are then added to obtain the porosity. A separate plug is drilled and tested for permeability. In the special or large-core analysis used on these samples, the entire core, in lengths up to about one and one half feet, is subjected to vacuum for a brief period to remove essentially all the gas, and is then saturated with water under pressure, up to 100 per cent liquid saturation. The sample is then placed under toluene and a modified Dean-Stark distillation carried out wherein the toluene is refluxed and carries the water out of the sample over a period of usually a week or two, or until all the water is removed. The amount of water collected, less the amount introduced to

replace the gas, gives the amount originally in the sample. The oil content is obtained from the weight difference of the saturated and extracted sample, less the weight of water removed. Permeability is obtained in two directions diametrically across the whole sample after placing the sample in a special holder.

As these are two entirely different types of core analysis, each has its own inherent experimental errors. Previous research has indicated that the conventional analysis may give porosity values that are too high in bentonitic sands or sands of high clay content. The large-core analysis, on the other hand, may give porosities that are slightly on the low side, but which in general are considered to be closer to the true porosities than the values obtained by conventional analysis. The total water content shown by large-core analysis is very exact, and includes only the free water or water not chemically bound to the clay content.

In view of the above observations, plus the excellent agreement between the average porosity shown by the large-core analysis and the average porosity obtained on the fifteen samples used for capillary pressure tests, it is concluded that the porosities obtained by large-core analysis are the more correct values, and closer to the true porosities than the ones obtained by conventional analysis.

If it is desired to obtain point-by-point permeabilities from the large-core analysis data, it is suggested that Table 6 be used, which is a correlation of the permeabilities vs. porosities measured on the fifteen samples used for the capillary pressure tests.

One more point of comparison between the core analysis data and the data obtained during these production research tests is worth noting. In Table 5 the average total water content of the cores analyzed from each well is shown, expressed as a percentage of total bulk volume of the rock. This is obtained by multiplying the porosity by the per cent total water saturation. Also shown expressed in the same units is the calculated connate water from the core analysis data. This calculated connate water is obtained by the method which we have used for years to obtain a first approximation of connate water in the absence of direct data. It is based on an empirical formula, and is not claimed to possess any high accuracy.

However, it would seem significant that the values from the conventional and the large-core analysis are in reasonable agreement with each other and with the average value, 10.3 per cent, from the capillary pressure data. The latter figure is not shown in the tables, but is the average of the individual values obtained by multiplying the porosity of each of the fifteen samples (Table 3) by the corresponding connate water saturation (Table 1).

We trust these data will be useful in the evaluation of this field.

Very truly yours,

Core Laboratories, Inc.

Frank C. Kelton

Frank C. Kelton,
Manager of Research

FCK:ma

Table 1

Water Saturations at 30 PSI
Single Point Capillary Pressure Tests

Gallegos Canyon Units, West Kutz Field

Sample No.	Well: Unit No.:	Depth, Feet	Permeability, Millidarcys	Water Saturation at 30 PSI, % Pore Space
1	2	1338.0	1.8	69.0
2	2	1350.0	4.3	55.5
3	2	1354.0	8.7	38.5
4	2	1440.0	1.1	65.0
5	2	1445.0	5.3	50.3
6	4	1604.5	2.8	70.0
7	5	1395.5	33	44.4
8	5	1403.5	10	53.8
9	5	1435.5	2.5	60.1
10	7	1406.5	21	49.2
11	7	1408.0	5.9	55.9
12	7	1414.5	1.3	80.5
13	7	1433.5	1.3	88.7
14	7	1465.5	11	47.8
15	7	1475.5	6.1	55.6
Average			7.7	59.0

Table 2

Connate Water Saturation vs. Permeability

Gallegos Canyon Units, West Kutz Field

Permeability, Millidarcys	Connate Water Saturations, Per Cent Pore Space
1	71.8
2	64.5
3	60.4
4	57.6
6	53.8
8	51.0
10	49.1
15	45.7
20	43.3
30	40.4
40	38.7

Table 3

Resistivity Measurements

Gallegos Canyon Units, West Kutz Field

Sample No.	Porosity, Per Cent	Formation Resistivity Factor, R_o/R_w	Resistivity Ratio* at Connate Water, R_o/R_s
1	15.9	30.3	0.494
2	17.3	31.2	.378
3	15.1	16.0	.245
4	17.8	28.6	.303
5	17.5	21.5	.340
6	16.1	25.0	.460
7	21.1	18.4	.208
8	19.1	18.6	.345
9	18.3	23.6	-
10	21.2	17.3	-
11	18.8	19.1	-
12	15.3	24.7	-
13	16.1	29.6	-
14	17.7	22.0	-
15	17.6	21.5	-
Average	17.7	23.0	

*Best fit of data is to equation $R_o/R_s = S^{1.95}$
where R_o = Resistivity at 100 % water saturation
R_s = Resistivity at connate water saturation
S = Connate water saturation (as fraction of pore space)

Table 4

Formation Resistivity Factors vs. Porosity

Gallegos Canyon Units, West Kutz Field

Porosity, Per Cent	Formation Resistivity Factor
15	32.6
16	28.7
17	25.3
18	22.6
19	20.3
20	18.3
21	16.6
22	15.1

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Table 5

Summary of Conventional and Special Core Analyses

Gallegos Canyon Units, West Kutz Field

Well: Unit:	Number of Samples	Porosity, Per Cent	Perm. Md.	Average Water Saturations: Total, % Pore	Calc. Connate, % Pore	Total, % Bulk	Calc. Connate, % Bulk
Conventional Analysis:							
2	15	20.9	2.5*	58.8	49.8	12.3	10.4
4	5	22.4	9.5*	49.7	37.2	11.1	8.3
5	12	22.1	6.1*	66.2	55.7	14.6	12.3
7	12	21.8	5.4*	57.5	45.4	12.5	9.9
Average		21.8	5.9*			12.6	10.2**
Special Analysis:							
2	42	17.0***	<0.1	61.5	61.5	10.4	10.4
3	21	16.6***	<0.1	68.9	68.9	11.4	11.4
4	56	17.9***	<0.1	62.5	58	11.2	10.4
5	75	17.8***	<0.1	72.9	71	13.0	12.6
7	86	18.1***	<0.1	74.8	73	13.5	13.2
Average		17.5***				11.9	11.6**

* Considered most accurate permeability values, for reasons outlined in report

** Note that the average connate water from capillary pressure tests is 10.3 per cent bulk volume

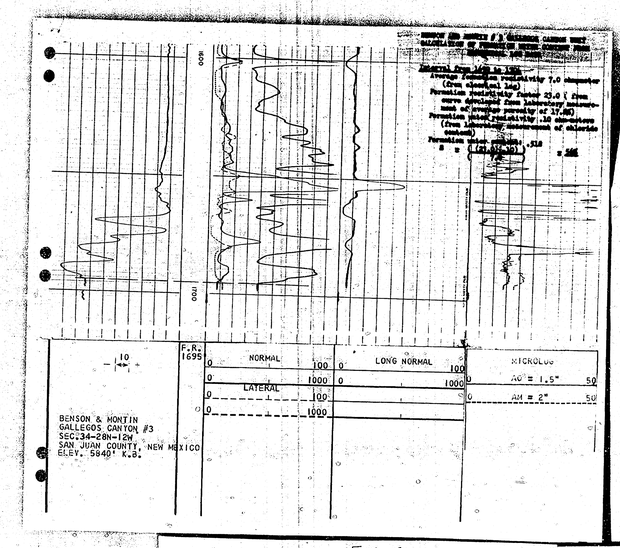
*** Considered the most accurate porosity values, for reasons outlined in report

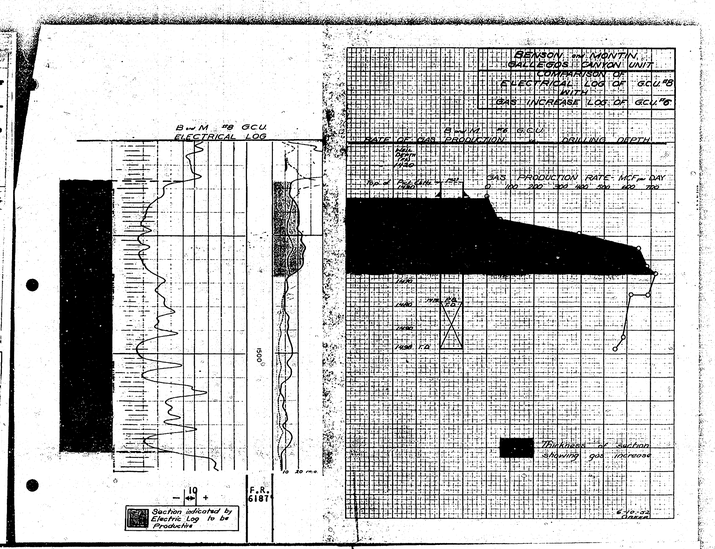
Table 6

Correlation of Permeability vs. Porosity of Perm Plugs
Taken From Average Curve

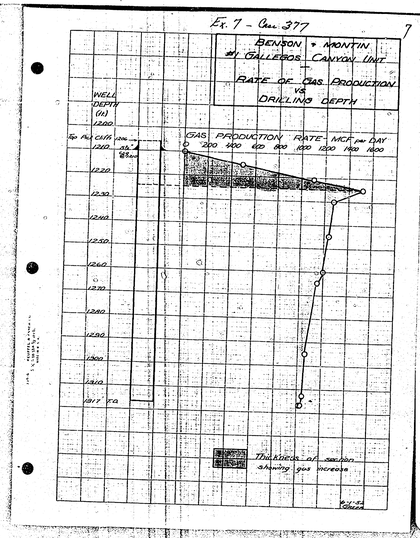
Gallegos Canyon Units, West Kutz Field

Porosity, Per Cent	Permeability, Millidarcys
13.0	0.4
14.0	0.8
15.0	1.1
16.0	1.9
17.0	3.4
18.0	5.9
19.0	10
20.0	18
21.0	31
22.0	51
23.0	88





Ex. 7 - Case 377



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DETERMINATION OF FORMATION WATER CONTENT (Interstitial Water)

Well	CONVENTIONAL ANALYSIS: Conventional Core Analysis (Total Water) (%)	SPECIAL CORE ANALYSIS: Total Water (%)	Calculated Connate Water by Core Lab Standard Method (%)	Interstitial Connate Water by Reducing "Total" Water According to Chloride Concentration (%)	Electric Log Data	Capillary Pressure	Average of Last Three Methods
B & M #3 G.C.U.	Not run	68.9	68.9	68.9	56.0	54.8	59.9
" #4 "	49.7	62.5	58.0	52.8	49.6	54.8	47.8
" #5 "	62.7	63.1	58.6	39.0	34.0	50.8	41.8
" #7 "	57.8	69.2	67.4	40.7			
Averages				50.3	46.6	53.6	50.1

Brockman Unit
Case 377
9-17-53

EXHIBIT I — MEMORANDUM (See attached tabulations)

INFORMAL STUDY WEST KUTZ CANYON PICTURED CLIFFS POOL
MAY 1, 1952 to OCTOBER 31, 1952 and JANUARY 1, 1953 to MAY 31, 1953

(The figures for the Gallegos Canyon Unit for the months of November and December 1952 are listed but remain uncomputed in the summaries.)

1. EXPLANATION OF COLUMNAR FIGURES

COLUMN A - is the month in which the production took place.

COLUMN B - is the number of wells producing during that month. There is no guarantee that the wells were producing during the entire month.

COLUMN C - Average production per well is computed by taking the total production and dividing it by the number of wells shown in Column "B".

COLUMN D - Average production per acre is Column "C" (Average Production Per Well) divided by the number of acres in the spacing unit, for instance, for the Gallegos Canyon Unit it is Column "C" divided by 320 acres. For the area outside, it is Column "C" divided by 160 acres.

COLUMN E - is the total production respectively for the Gallegos Canyon Unit and for the total area outside the Unit as received from the statistical reports named.

SUMMARIES on the bottom of each sheet and for the whole pool are computed in the same manner as the columns just mentioned.

2. TOTAL PRODUCTION

Year	Gallegos Canyon Unit North Half of Pool	South Half of Pool
1952 (May thru October)	430,035 MCF	2,921,723 MCF
1953 (January thru May)	1,112,035 MCF	2,209,266 MCF

3. AVERAGE NUMBER OF PRODUCING WELLS PER MONTH

1952 (May thru October)	4.67	72.67
1953 (January thru May)	16.2	65.80*

*(This figure is actually higher but has been reduced in the computation by approximately 40 wells not being reported in for production during the month of May.)

4. NUMBER OF ACRES PER WELL OF PRODUCING AREA

May 31, 1952	7667	288
December 31, 1952	2555	226
April 30, 1953	1100*	200

*(Assuming that the drainage area of each of the 21 wells in the Unit is 320 acres, the total acreage drained is 7,187 acres out of a total of 23,000.)

-2-

EXHIBIT I - TABULATION SHOWING PRODUCTION

(a) To date the production from the South Half of the West Kutz Canyon Pool is more than three times the production from the North Half of the Pool (Gallegos Canyon Unit) from beginning through June 1953.

(b) There are approximately four and a half times as many wells in the South Half of the West Kutz Canyon Pool as there are in the North Half (Gallegos Canyon Unit) June 30, 1953.

(c) The number of acres per producing well is approximately 200 acres per well in the South Half of the Pool and 1100 acres in the North Half of the Pool (Gallegos Canyon Unit) June 30, 1953.

INFORMATION FROM - 1952 - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT
1953 - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT

PROJECTED PRODUCING AREA - 23,000 ACRES
320 ACRE PER WELL SPACING

WEST KUTZ CANYON-PICTURED CLIFFS POOL
GALLEGOS CANYON UNIT (320 ACRE SPACING SUMMARY SHOWN BELOW)
(ALL VOLUMES IN MCF)
ALL PRODUCTION - MAY 1952 THROUGH MAY 1953

- A - MONTH	- B - NUMBER OF PRODUCING WELLS	- C - AVERAGE PRODUCTION PER WELL	- D - AVERAGE PRODUCTION PER ACRE (DRILLED 320 ACRE SPACING)	- E - TOTAL PRODUCTION FOR MONTH
MAY	3	15796.00	49.36	47388
JUNE	3	13109.00	40.97	39327
JULY	3	14230.33	44.47	42691
AUGUST	6	14299.50	44.68	85797
SEPTEMBER	7	15377.86	48.05	107651
OCTOBER	9	16459.00	51.43	148113
NOVEMBER (DID NOT REPORT)	10	13346.10	41.71	133461
DECEMBER (DID NOT REPORT)	10	16737.30	47.30	167373
JANUARY	10	14439.20	45.12	144392
FEBRUARY	10	11844.50	37.01	118445
MARCH	14	11381.14	35.58	227622
APRIL	21	13822.10	43.26	283964
MAY	21 (ESTIMATED)	16704.76	52.21	350800
TOTAL	30			3071346

MAY 1952 THROUGH OCTOBER 1952						JANUARY 1953 THROUGH MAY 1953					
AVERAGE NUMBER OF PRODUCING WELLS	AVERAGE MONTHLY PRODUCTION PER WELL	TOTAL PRODUCTION FOR PERIOD	AVERAGE DAILY PRODUCTION PER WELL	TOTAL DAILY RATE (ESTIMATED)	AVERAGE DAILY PRODUCTION PER ACRE	AVERAGE NUMBER OF PRODUCING WELLS	AVERAGE MONTHLY PRODUCTION PER WELL	TOTAL PRODUCTION	AVERAGE DAILY PRODUCTION PER WELL	TOTAL DAILY RATE (ESTIMATED)	AVERAGE DAILY PRODUCTION PER ACRE
4.67	15274.66	430035	502.47	2351.07	1.62	16.2	13677.74	1112815	441.73	7155.15	44.73222

WEST KUTZ CANYON-PICTURED CLIFFS POOL
COMPARATIVE SUMMARY - GAS PRODUCTION EACH - MAY 1952 THROUGH MAY 1953 (11 months - Brockman Unit Case)

INFORMATION FROM - 1952 - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT
1953 - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT

		AVERAGE NUMBER PRODUCING WELLS	AVERAGE PRODUCTION PER MONTH	AVERAGE PRODUCTION PER WELL	TOTAL PRODUCTION FOR PERIOD	AVERAGE PRODUCTION PER ACRE	AVERAGE PRODUCTION PER WELL PER MONTH	TOTAL	
GALLEGOS CANYON UNIT (320 ACRE SPACING)		16.2 (3,240 ACRES)	14,648.34	158,971.32	45.16	49.79	1.	1,582,884	
REMAINDER OF POOL (160 ACRE SPACING)		73.72 (11,792 ACRES)	6,243.57	85,476.61	37.70	44.80	✓	5,130,759	

WEST KUTZ CANYON POOL
GAS PRODUCTION PERIOD - JANUARY 1953 TO JUNE 1953
(ALL VOLUMES IN MCF)

INFORMATION FROM - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT

OWNER, LEASE, WELL & LOCATION		S.T.R.	JAN.	FEB.	MAR.	APR.	MAY	TOTAL PER WELL PRODUCTION JAN. TO JUNE 53		AVERAGE PER MONTH PRODUCTION PER WELL - JAN. TO JUNE 53		AVERAGE PRODUCTION PER MONTH - PER WELL
ANDERSON, M.T.												
TOWNUS	13 K	13-27-12	1279	683	701	853	693	4109		857.80		525
"	3 C	"	820	932	965	1022	892	4671		958.20		586
"	4 K	"	691	496	1153	685	391	3416		647.40		3564
"	5-1A	14-27-12	252	522	164	183	164	991		195.20		124
	TOTAL		3031	2633	2982	2553	1930					
BENGAL & MARTIN												
GALLEGOS CANYON	24	26-28-12	3614	2615	2940	2870	3078	15117		3023.40		944
"	4G	34-28-12	20791	19900	19630	16991	20861	98173		19634.80		6139
"	3 H	13-28-12	39263	35863	37969	33972	39064	185931		37186.20		11620
"	6K	22-28-12	2780	2409	2933	2781	1710	13613		2722.60		3410
"	7 D	30-28-12	5314	2823	2713	2188	2463	15501		3100.20		1938
"	9K	32-28-12			4720	1548	5191	21459		4291.80		2110
"	8K	33-28-12			13710	13201	12885	67796		13559.20		4238
"	1A	34-28-12	5929	4340	5210	4914	5210	25603		5120.60		3199
"	10A	33-28-12			13789	12368	14285	70742		14148.40		4420
"	15H	27-28-12			17852	16395	20048	89295		17859.00		5581
"	14H	26-28-12	12682	9340	9136	14233	10029	55420		11084.00		3463
"	16B	27-28-12	12128	10997	14805	12429	12671	63030		12606.00		3939
"	17H	28-28-12	45003	38410	38972	36353	37804	196542		39308.40		12278
"	18H	21-28-12				29945	30262	60207		12041.40		3763
"	20H	17-28-12				12380	16787	29167		14583.50		4557
"	21H	18-28-12			8191	14277	20002	42470		14156.67		4423
"	22G	11-28-12			7158	19800	18589	45547		15182.33		4744
"	23K	12-28-12			1287	4494	12758	18539		4634.75		1448
"	24K	36-28-12			16282	20445	20243	56970		18990.00		5934
LILLY	1A	4-27-12	5774	4514	5333	27250	5651	48522		9704.40		3032
"	2E	"	20220	18768	17545	12729	23835	93097		18619.40		5818
"	3G	5-27-12	1532	1734	1808	1687	3030	9791		1958.20		1224
"	4K	4-27-12		27443	14633	9557	12456	64089		12817.80		4005
GALLEGOS CANYON UNIT	2H	32-28-12	2482	2662	47	2031	2748	9970		1994.00		177
RHODES	2H	31-28-11	9272	7600	10219	6838	8412	42341		8468.20		2646
"	3G	"	4447	3482	5180	3541	2778	19428		3885.60		861
PAINE	1G	36-28-12	9082	7529	5602	4080	5004	31297		6259.40		2043
"	2E	"	7280	1951	1671	1445	1953	8700		1740.00		1094
"	5B	35-28-12	16090	8308	8093	9035	11420	52946		10589.20		6545
"	6K	"	6794	7240	8440	2832	9280	34586		6917.20		5111
"	7H	"	4328	4729	4629	5134	6677	25497		5099.40		3475
"	8D	"	8760	4285	4368	6827	7466	31706		6341.20		4585
	TOTAL		281066	209392	308228	354890	435689					

WEST KUTZ CANYON POOL (CONT.)

INFORMATION FROM - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT

ACTUAL PRODUCING AREA - 19,000 ACRES
160 ACRE PER WELL SPACING

WEST KUTZ CANYON-PICTURED CLIFFS POOL
ALL PRODUCTION BELOW GALLEGOS CANYON UNIT (160 ACRE SPACING)
(ALL VOLUMES IN MCF)
ALL PRODUCTION - MAY 1952 THROUGH MAY 1953

INFORMATION FROM - 1952 - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT
1953 - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT

- A - MONTH	- B - NUMBER OF PRODUCING WELLS	- C - AVERAGE PRODUCTION PER WELL	- D - AVERAGE PRODUCTION PER ACRE (DRILLED 160 ACRE SPACING)	- E - TOTAL PRODUCTION FOR MONTH
MAY	49	3096.00	20.40	534376
JUNE	46	4477.91	29.80	513568
JULY	41	7020.54	43.88	498458
AUGUST	72	5964.11	37.21	423096
SEPTEMBER	76	5390.40	34.03	409730
OCTOBER	84	5911.96	36.95	496615
NOVEMBER				
DECEMBER				
JANUARY	84	6257.17	36.41	474,826
FEBRUARY	96	5279.63	31.75	487,644
MARCH	96	4701.57	29.88	459,031
APRIL	96 (15 WELLS + 1 WELL = 1/2 WELL)	4.564.78	28.46	437,203
MAY	102 (ESTIMATED)	5218.80	32.86	533,256
JUNE	92			374,246

MAY 1952 THROUGH OCTOBER 1952						JANUARY 1953 THROUGH JUNE 1953					
AVERAGE NUMBER OF PRODUCING WELLS	MONTHLY AVERAGES			TOTALS		AVERAGE NUMBER OF PRODUCING WELLS	MONTHLY AVERAGES			TOTALS	
	AVERAGE MONTHLY PRODUCTION PER WELL	AVERAGE DAILY PRODUCTION PER WELL	TOTAL PRODUCTION FOR PERIOD	TOTAL DAILY RATE (ESTIMATED)	AVERAGE DAILY PRODUCTION PER ACRE		AVERAGE MONTHLY PRODUCTION PER WELL	AVERAGE DAILY PRODUCTION PER WELL	TOTAL PRODUCTION	TOTAL DAILY RATE (ESTIMATED)	AVERAGE DAILY PRODUCTION PER ACRE
72.67	4742.86	47.18	2,921,723	10,537.16	258.62	85.80	5224.89	52.65	2,209,266	26,221.45	164.26

WEST MITZ CANYON POOL (CONT.)

INFORMATION FROM - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT

OWNER, LEASE, WELL # & LOCATION	S.T.R.	JAN.	FEB.	MAR.	APR.	MAY	TOTAL PER WELL PRODUCTION JAN. TO JUNE/63		ARENAC PER MONTH PRODUCTION PER WELL - JAN. TO JUNE/63	AVERAGE PRODUCTION PER MONTH PER WELL PER DAY BASIS	AVERAGE PRODUCTION PER WELL
L. SCOTT 6E	30-27-11	744	1500	2887	1939		6040		1810.00	7	1141
TOTAL		185088	185281	191067	186771						
LOCKHART & LOCKHART DRILLING CO.											
TOUT 1D	5-27-12										
SAN JUAN GAS COMPANY											
WHITTEN 1A	17-27-11	255	279	348	202	124	1211		242.20		151
THE FRONTIER REFINING CO.											
BOACH 1	28-27-11	2405	1636	1901	1441	1775	9158		1833.20	11.46	
" 2	21-27-11	511	662	616	620	829	3578		715.60	450	
" 4	4-27-11	1225	977	1008	930	905	5106		1021.20	638	
" 5	9-27-11	9764	7758	7962	7546	9022	42032		8406.40	5254	
" 6	"	6788	6893	8565	7151	8856	38633		7726.60	4829	
" 7	"	989	1106	1030	901	1102	5128		1025.60	641	
" 8	"	7631	8709	8100	5439	6858	34737		6947.40	4342	
" 11	16-27-11	17902	11012	14308	12486	14452	72200		14440.00	9025	
" 12	15-27-11	7169	4991	6089	5091	6120	29460		5892.00	3683	
" 13	"	8106	9776	10021	8965	11680	48608		9721.60	6076	
" 14	14-27-11	12061	8977	9911	9127	10922	49198		9839.60	6035	
" 15	21-27-11	161	37	142	4	55	399		79.80	49	
SCHNEIDTFEGER 1	5-27-11	7411	5805	6048	6831	6335	31648		6329.60	3956	
" 2	"	5846	4101	4285	3792	7991	26015		5203.00	3252	
" 3	8-27-11	1943	1075	1154	1327	1490	7189		1437.80	899	
" 4	"	1295	1527	1319	1795	1686	7622		1524.40	953	
" 5	21-27-11	23471	4603	4648	4116	5286	17780		3556.00	2215	
" 6	28-27-11	1922	1569	1743	1659	1224	8721		1744.20	1090	
" 7	8-27-11	12515	10544	9468	9651	12184	54368		10873.60	6794	
" 8	5-27-11	-0-	-0-	-0-	-0-	-0-	-0-		-0-		
" 9	17-27-11	908	556	1095	1129	1590	5078		1015.60	635	
" 10	18-27-11	8397	6411	9777	5676	6902	33163		6632.60	4158	
" 11	17-27-11	9482	9044	9811	9733	11457	49177		9835.40	6185	
" 12	16-27-11	3460	2858	2831	2682	3573	15404		3080.80	1877	
TOTAL		132716	107567	115478	105615	134250					
WESTERN NAT. GAS CO.											
SCHLOSSER 1	10-27-11	2083	2224	1770	2735	1836	10648		2129.60	1325	
STANOLIND O&G CO.											
NEBFRAD UNIT H.M.	31-27-10			2154	503	843	976	3876	969.00	606	
" 1-G	1-28-11			4202	982	1423	-0-	6657	1414.25	884	
" 1-H	6-28-10			4204	985	1473	953	6613	1465.25	908	
" 1-A	36-27-11			4202	982	1473	1924	7361	1879.25	1182	

WEST MITZ CANYON POOL (CONT.)

INFORMATION FROM - SAN JUAN BASIN OPERATORS COMMITTEE MONTHLY STATISTICAL REPORT

OWNER, LEASE, WELL # & LOCATION	S.T.R.	JAN	FEB.	MAR.	APR.	MAY	TOTAL PER WELL PRODUCTION JAN. TO JUNE/63		ARENAC PER MONTH PRODUCTION PER WELL - JAN. TO JUNE/63	AVERAGE PRODUCTION PER MONTH PER WELL PER DAY BASIS
NEBFRAD UNIT H.M.	31-27-11	1154	203	243			2900		966.67	604
" 1-G	30-27-10	4203	982	473	950	640B	14248		1472.00	1035
" 1-H	6-28-10	-0-	-0-	-0-	-0-	-0-	-0-		-0-	
" 1-A	5-28-10	2105	442	231	952	3786	9426		941.50	592
" 1-B	A	2105	492	231	-0-	3836	7088		708.50	443
" 1-12	H	2102	491	231	476	3506	8260		826.50	515
" 1-15	G	2143	1705	711	1844	12807	3201.75			2001
TOTAL		36574	2513	4006	3055					
WOODWARD OIL INC. &										
T. BOACH										
SCHNEIDTFEGER 1M	8-27-11	344	301	243		886	29600			186
" 2C	28-27-11	1413	1301	1104		3678	1272.67			808
" 3M	5-27-11	1875	1217	1471		10266	3422.00			2138
TOTAL		6632	2819	5581						
POOL TOTAL		637625	606089	664203	721167	684225				

TOTAL PRODUCTION - WELLS OUTSIDE UNIT — 2,295,444 MCF (AVERAGE 8.5.8 WELLS)
TOTAL PRODUCTION - WELLS WITHIN UNIT — 1,906,282 MCF
AVERAGE PRODUCTION - PER WELL - JAN. TO JUNE — 1,906,282 MCF / AVERAGE 14.2 WELLS
AVERAGE PRODUCTION - PER WELL - JAN. TO JUNE - " - " — 134,337 MCF

AVERAGE MONTHLY PRODUCTION PER WELL
- WELLS OUTSIDE UNIT — 2,813,333 MCF
- WELLS WITHIN UNIT — 5,026,632 MCF
- 18,647.74 MCF

228

- UNIT -

NO.	WELL	LOCATION	TOTAL DEPTH	DATE	BHP #	DATE	PRESSURE DECLINE IN 24 HRS.	TOTAL PRODUCTION IN MMCF	PRESSURE DECLINE IN PSI PER MMCF GAS PRODUCED	
#1	GALLEGOS CANYON UNIT #3	SW/4 NW/4 24-28-13	4178 ft	11-1-51	1027#	9-13-53	61#	79.52	.72 #	
#4	GALLEGOS CANYON UNIT #4	SW/4 NE/4 34-28-13	4161 ft	11-1-51	1069#	9-13-53	72#	136.88	.21 #	
#6	GALLEGOS CANYON UNIT #6	SE/4 NE/4 18-28-12	4141 ft	11-1-51	1092#	9-12-53	68#	574.072	.12 #	
#11	GALLEGOS CANYON UNIT #11	NE/4 NE/4 33-29-13	4134 ft	1-23-52	1178#	9-12-53	73#	163.826	.70 #	
#12	GALLEGOS CANYON UNIT #11	SW/4 NW/4 34-28-13	4174 ft	10-28-52	1169#	9-12-53	78#	79,783	.98 #	
#13	GALLEGOS CANYON UNIT #13	SW/4 NW/4 27-28-13	4184 ft	11-13-52	1177#	9-12-53	93#	170,080	.25 #	
#9	GALLEGOS CANYON UNIT #9	NE/4 NE/4 30-28-12	4098 ft	11-1-51	1125#	9-13-53	24#	42,870	.54 #	
#15	GALLEGOS CANYON UNIT #10	NW/4 NW/4 31-28-13	4150 ft	1-23-53	1101 #	9-12-53	48 #	125,532	.39 #	
#16	GALLEGOS CANYON UNIT #22	SW/4 NE/4 12-28-12	4098 ft	3-5-53	1176#	9-12-53	52#	146,496	.36 #	
#17	GALLEGOS CANYON UNIT #26	SW/4 NW/4 21-28-13	4171 ft	10-27-52	1182#	9-12-53	65 #	139,596	.43 #	
#10	GALLEGOS CANYON UNIT #24	NW/4 SE/4 34-28-13	4135 ft	1-24-53	1158#	9-12-53	75#	182,908	.41 #	

- OUTSIDE UNIT - Border Unit

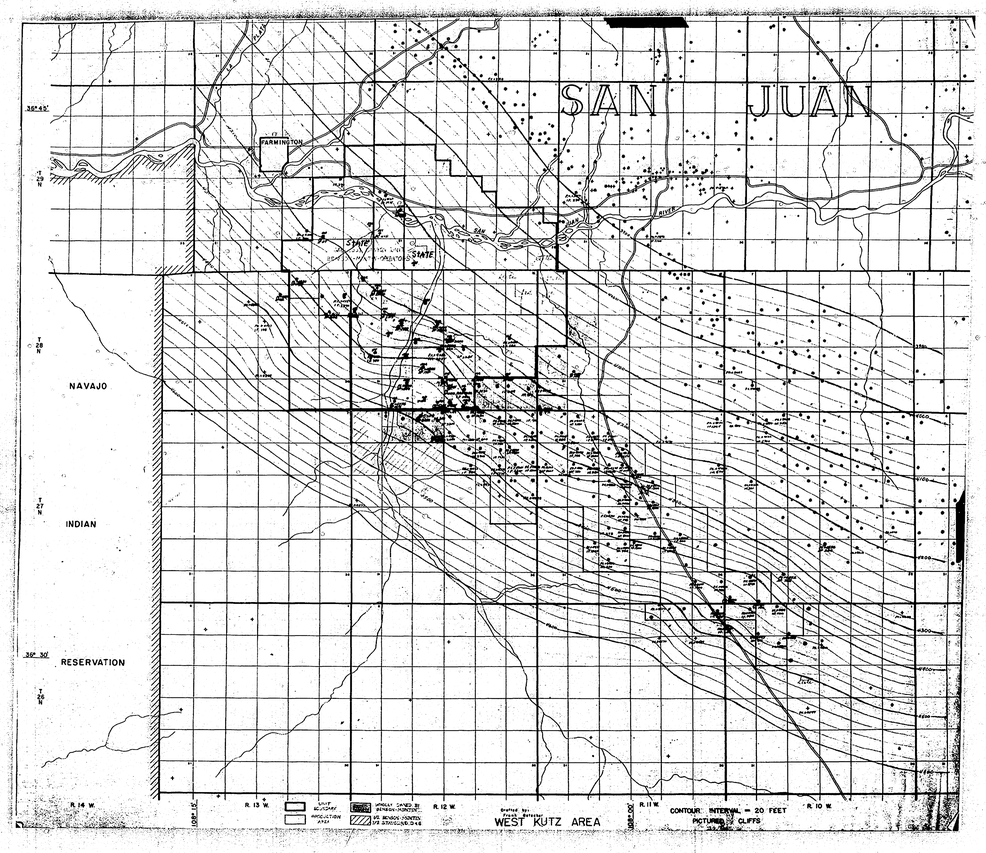
NO.	WELL	LOCATION	TOTAL DEPTH	DATE	BHP #	DATE	PRESSURE DECLINE IN 24 HRS.	TOTAL PRODUCTION IN MMCF	PRESSURE DECLINE IN PSI PER MMCF GAS PRODUCED	
#B	BRITAIN-AMERICAN FEDERATION #1	SW/4 SE/4 23-27-11	4154 ft	1-17-52	1283 #	9-5-53	82 #	187,114	.93 #	South end
#7	BRITAIN - AMERICAN FEDERATION #2	SW/4 NE/4 15-27-11	4161 ft	5-15-52	1098 #	9-5-53	57 #	90,707	.82 #	South end
#10	J.D. HARPER DOUTHIT #3	SE/4 SE/4 26-27-11	4160 ft	2-16-52	1226 #	9-5-53	34 #	96,038	.35 #	South end
#1	RELIANCE-HUNTON #1 PAYNE	UNIT M 35-28-12	4150 ft	8-24-52	1391 #	9-13-53	77 #	67,282	1.17 #	Border
#2	LOCKE-TAYLOR #1 HUNT	UNIT E 27-28	4152 ft	10-20-51	1281 #	9-12-53	46 #	69,085	.64 #	
#3	RELIANCE-HUNTON #1 ALLEN	NE/4 9-27-12	4146 ft	11-13-52	1394 #	9-12-53	52 #	43,202	1.20 #	Border
#4	RELIANCE-HUNTON #5 PAYNE	SW/4 NE/4 25-28-12	4158 ft	10-13-52	1372 #	9-13-53	82 #	76,124	1.20 #	Border
#5	RELIANCE-HUNTON #6 PAYNE	UNIT N 35-28-12	4164 ft	9-21-52	1394 #	9-13-53	70 #	98,580	.71 #	Border
#6	RELIANCE-HUNTON #5 PAYNE	UNIT E 35-28-12	4148 ft	10-10-52	1369 #	9-13-53	44 #	124,439	.36 #	Border
#7	J.D. MUNCH #7 MUNCH	UNIT N 2-27-12	4122 ft	4-20-52	1263 #	9-5-53	59 #	91,945	.64 #	

229

EXHIBIT III - TABULATION SHOWING THE DECLINE IN PRESSURE PER MILLION CUBIC FEET OF PRODUCTION FROM INITIAL BOTTOM HOLE PRESSURE TO SHUT-IN PRESSURE SEPTEMBER 1953.

This shows that generally speaking, the decline in pressures per million feet of gas produced is greater for the Unit than for the south half of the Pool. This means that gas is escaping to the south half of the Pool or that the wells are being produced so hard that it is waste. I am inclined to believe that both escape of gas to the south end of the Pool and also waste is taking place.

230


SAN JUAN
FARMINGTON
NAVAJO
INDIAN
RESERVATION
36° 45'
36° 30'
T. 28 N.
T. 27 N.
T. 29 N.
R. 14 W.
R. 13 W.
R. 12 W.
R. 11 W.
R. 10 W.
STATE
STATE
WEST KUTZ AREA
CONTOUR INTERVAL = 20 FEET
PICTURED CLIFFS

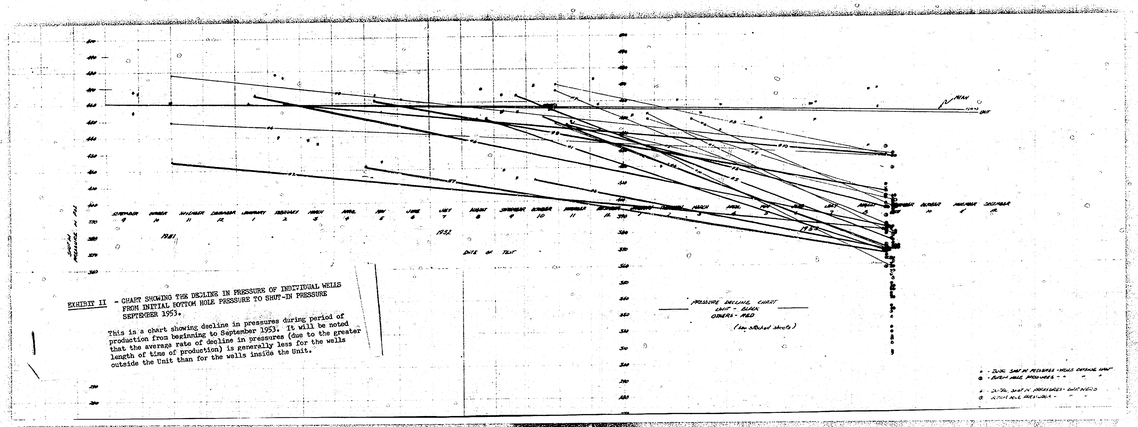
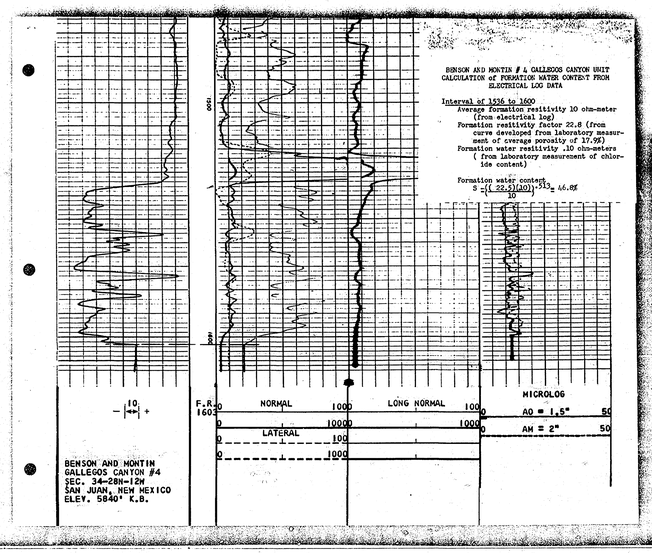
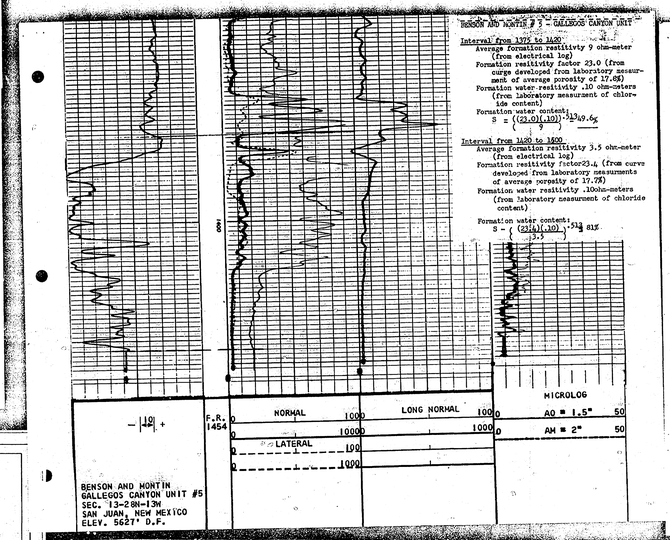


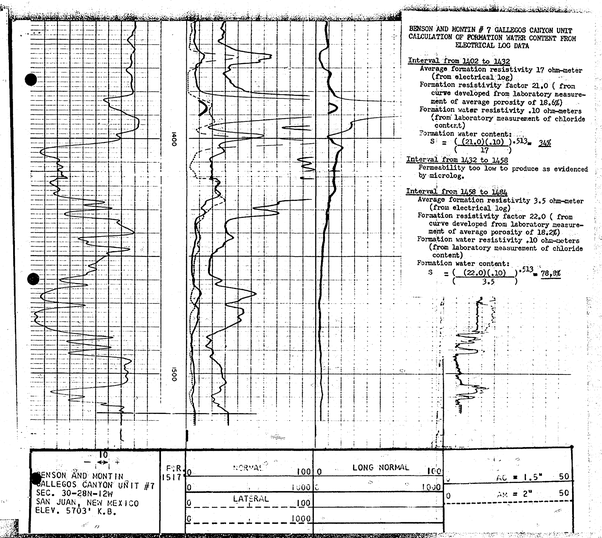
EXHIBIT II - CHART SHOWING THE DECLINE IN PRESSURE OF INDIVIDUAL WELLS FROM INITIAL BOTTOM HOLE PRESSURE TO SHUT-IN PRESSURE SEPTEMBER 1953.

This is a chart showing decline in pressures during period of production from beginning to September 1953. It will be noted that the average rate of decline in pressure (due to the greater length of time of production) is generally less for the wells outside the Unit than for the wells inside the Unit.

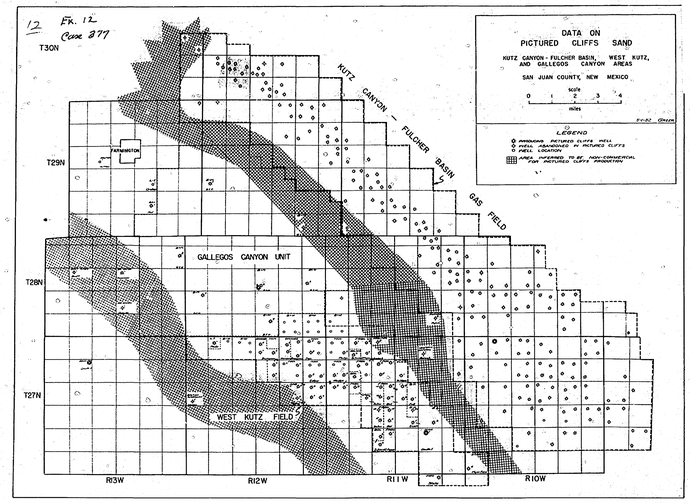
231



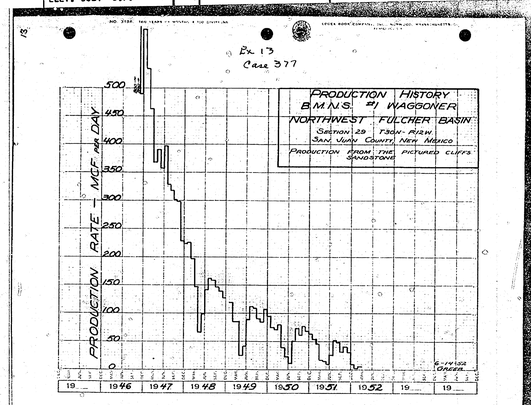




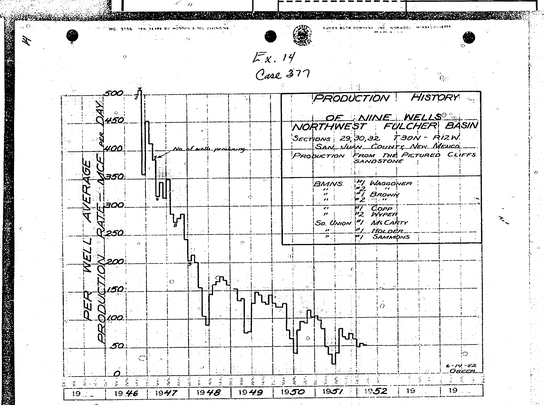
12 Ex. 12
Case 377



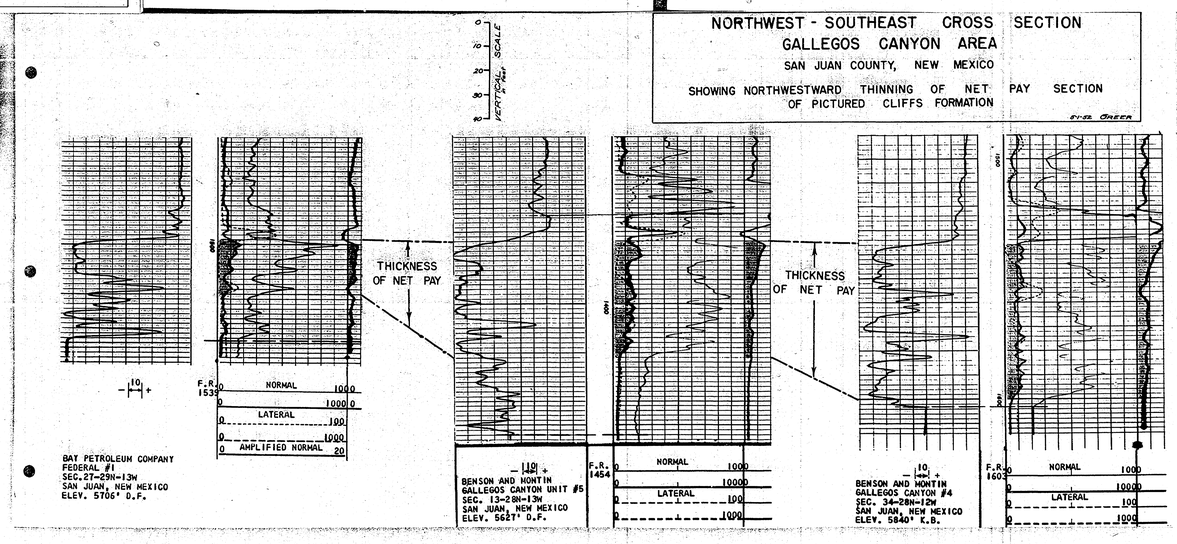
13
Ex. 13
Case 377

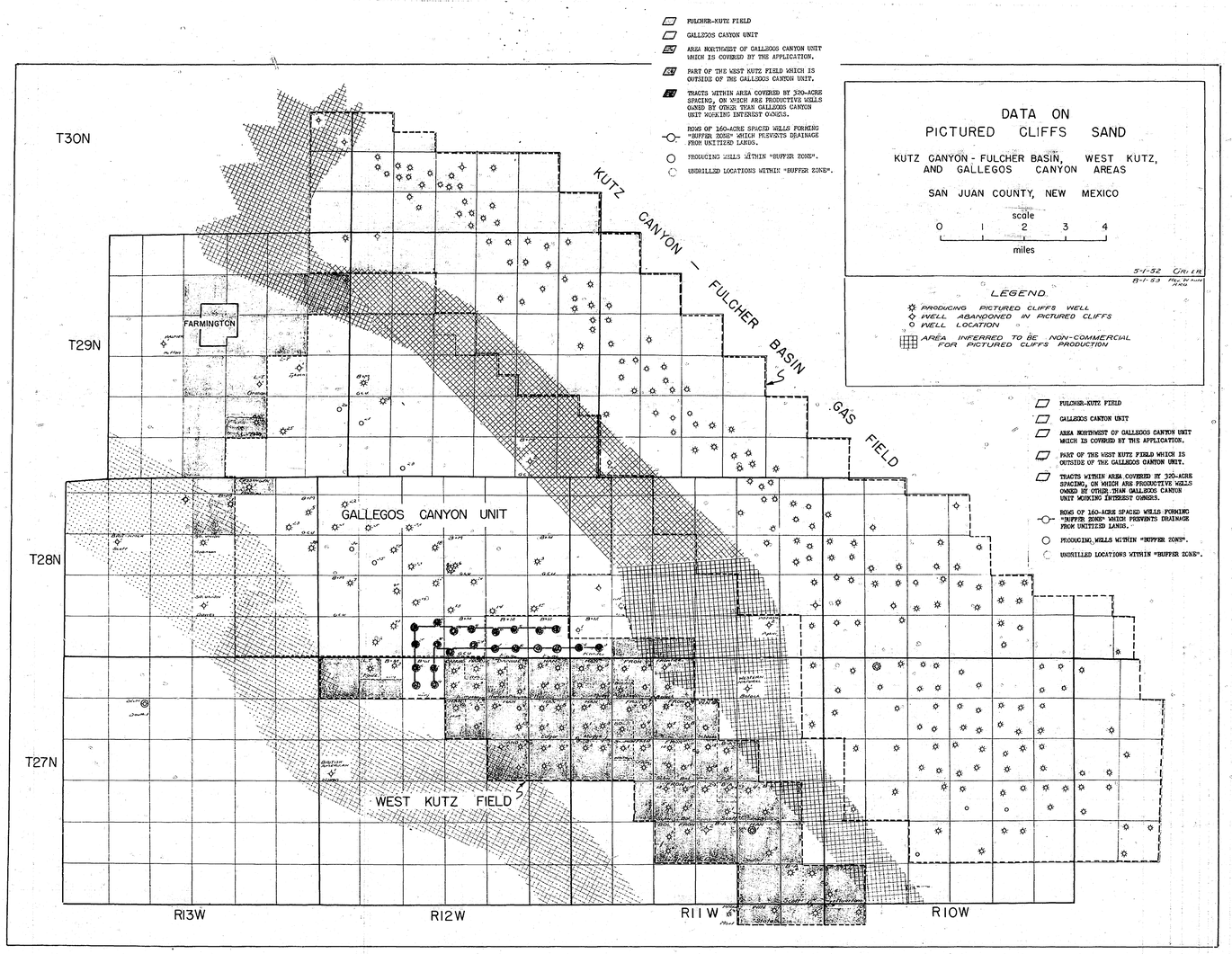


14
Ex. 14
Case 377



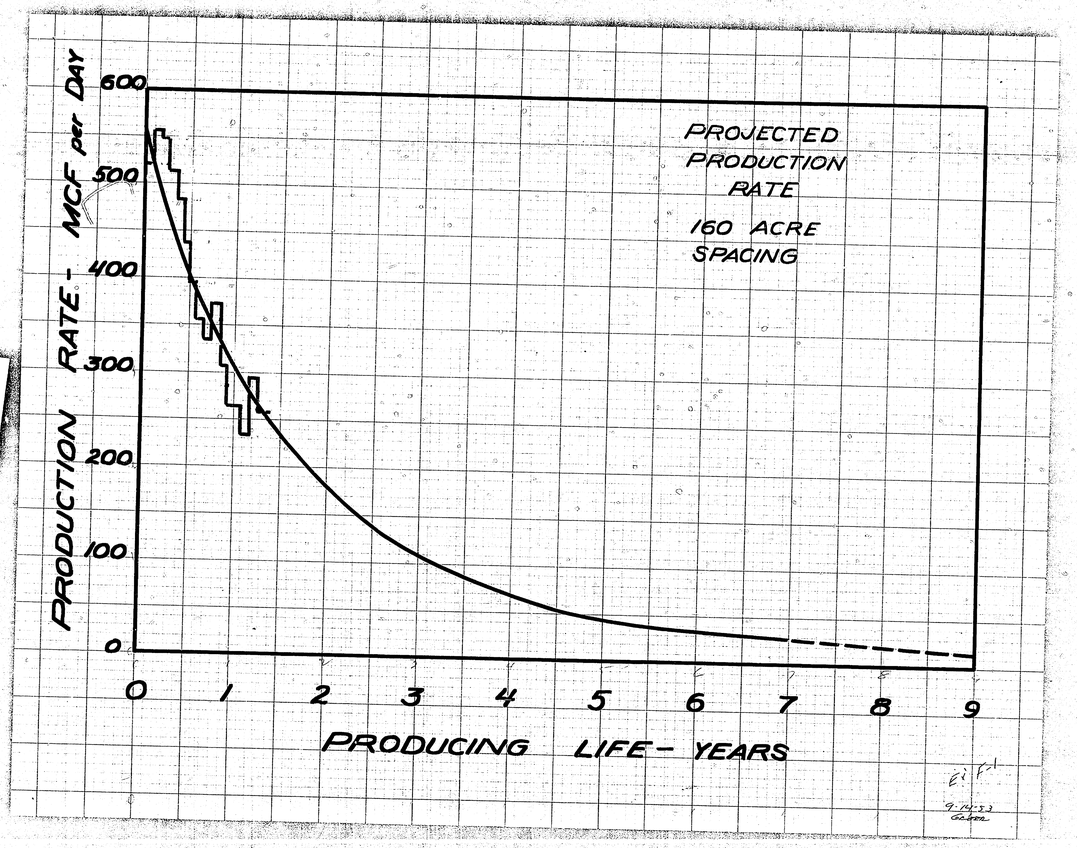
232




T30N
T29N
T28N
T27N
R13W
R12W
R11W
R10W
FARMINGTON
KUTZ CANYON — FULCHER BASIN GAS FIELD
GALLEGOS CANYON UNIT
WEST KUTZ FIELD
FULCHER-KUTZ FIELD
GALLEGOS CANYON UNIT
AREA NORTHWEST OF GALLEGOS CANYON UNIT WHICH IS COVERED BY THE APPLICATION.
PART OF THE WEST KUTZ FIELD WHICH IS OUTSIDE OF THE GALLEGOS CANYON UNIT.
TRACTS WITHIN AREA COVERED BY 320-ACRE SPACING, ON WHICH ARE PRODUCTIVE WELLS OWNED BY OTHER THAN GALLEGOS CANYON UNIT WORKING INTEREST OWNERS.
ROWS OF 160-ACRE SPACED WELLS FORMING "BUFFER ZONE" WHICH PREVENTS DRAINAGE FROM UNITIZED LANDS.
PRODUCING WELLS WITHIN "BUFFER ZONE".
UNDRILLED LOCATIONS WITHIN "BUFFER ZONE".
DATA ON
PICTURED CLIFFS SAND
KUTZ CANYON - FULCHER BASIN, WEST KUTZ, AND GALLEGOS CANYON AREAS
SAN JUAN COUNTY, NEW MEXICO
scale
0 1 2 3 4
miles
5-1-52
8-1-53
LEGEND
PRODUCING PICTURED CLIFFS WELL
WELL ABANDONED IN PICTURED CLIFFS
WELL LOCATION
AREA INFERRED TO BE NON-COMMERCIAL FOR PICTURED CLIFFS PRODUCTION
FULCHER-KUTZ FIELD
GALLEGOS CANYON UNIT
AREA NORTHWEST OF GALLEGOS CANYON UNIT WHICH IS COVERED BY THIS APPLICATION.
PART OF THE WEST KUTZ FIELD WHICH IS OUTSIDE OF THE GALLEGOS CANYON UNIT.
TRACTS WITHIN AREA COVERED BY 320-ACRE SPACING, ON WHICH ARE PRODUCTIVE WELLS OWNED BY OTHER THAN GALLEGOS CANYON UNIT WORKING INTEREST OWNERS.
ROWS OF 160-ACRE SPACED WELLS FORMING "BUFFER ZONE" WHICH PREVENTS DRAINAGE FROM UNITIZED LANDS.
PRODUCING WELLS WITHIN "BUFFER ZONE".
UNDRILLED LOCATIONS WITHIN "BUFFER ZONE".

233

234


PROJECTED
PRODUCTION
RATE
160 ACRE
SPACING
PRODUCTION RATE - MCF per DAY
600
500
400
300
200
100
0
0 1 2 3 4 5 6 7 8 9
PRODUCING LIFE - YEARS

235

DATA ON PICTURED CLIFFS SAND

KUTZ CANYON - FULCHER BASIN, WEST KUTZ, AND GALLEGOS CANYON AREAS

SAN JUAN COUNTY, NEW MEXICO

scale

0 1 2 3 4

miles

5-1-52 GREER

8-1-53 Rev. M. Rice

LEGEND

- PRODUCING PICTURED CLIFFS WELL
- WELL ABANDONED IN PICTURED CLIFFS
- WELL LOCATION
- AREA INFERRED TO BE NON-COMMERCIAL FOR PICTURED CLIFFS PRODUCTION

LEGEND REGARDING INTERFERENCE TEST

- AREA COVERED BY TEST.
- SUBJECT SHUT-IN WELL.
- WELLS PRODUCING DURING PERIOD OF TEST. (ALL O'DIER WELLS SHOWN IN TEST AREA WERE NOT COMPLETED AS OF TIME OF INTERFERNCE TEST.)

T30N

T29N

T28N

T27N

FARMINGTON

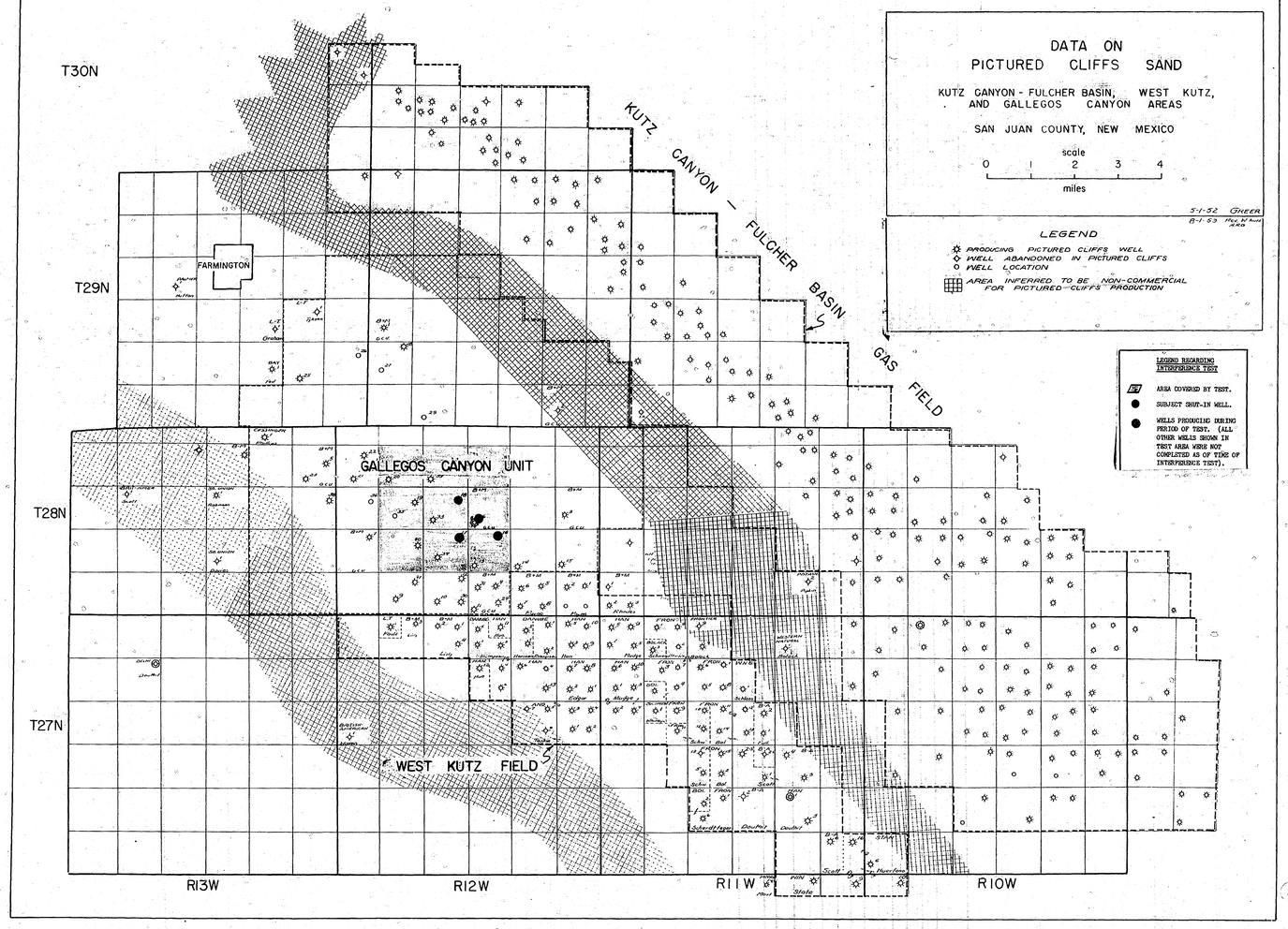
KUTZ CANYON — FULCHER BASIN GAS FIELD

GALLEGOS CANYON UNIT

WEST KUTZ FIELD

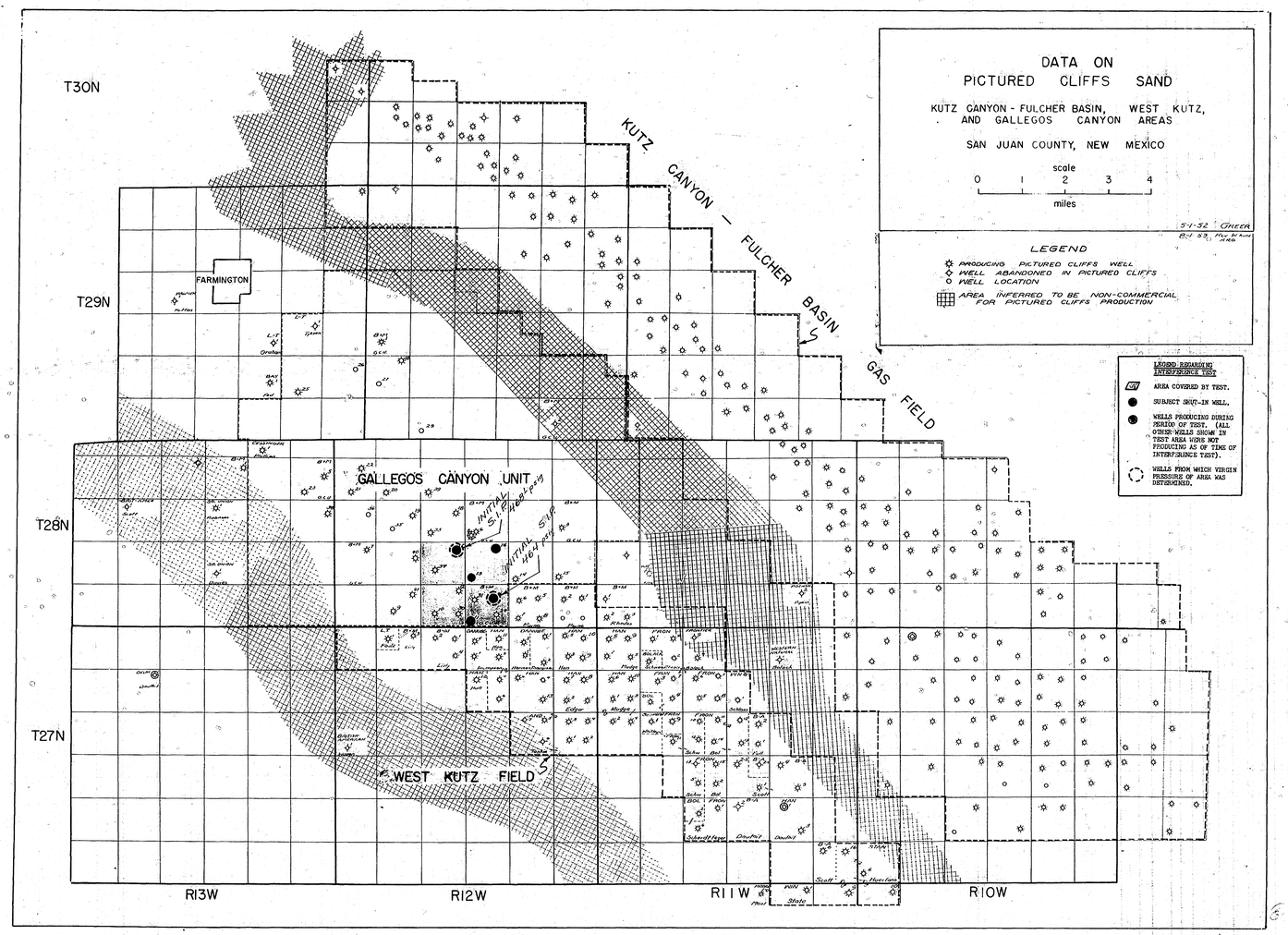
R13W R12W R11W R10W

Ex. A-1


T30N
T29N
T28N
T27N
R13W
R12W
R11W
R10W
FARMINGTON
KUTZ CANYON — FULCHER BASIN GAS FIELD
GALLEGOS CANYON UNIT
WEST KUTZ FIELD
DATA ON
PICTURED CLIFFS SAND
KUTZ CANYON - FULCHER BASIN, WEST KUTZ, AND GALLEGOS CANYON AREAS
SAN JUAN COUNTY, NEW MEXICO
scale
0 1 2 3 4
miles
5-1-52 GHEER
8-1-53 Rev. to base
LEGEND
PRODUCING PICTURED CLIFFS WELL
WELL ABANDONED IN PICTURED CLIFFS
WELL LOCATION
AREA INFERRED TO BE NON-COMMERCIAL FOR PICTURED-CLIFFS PRODUCTION
LEGEND REGARDING INTERFERENCE TEST
AREA COVERED BY TEST.
SUBJECT SHUT-IN WELL.
WELLS PRODUCING DURING PERIOD OF TEST. (ALL OTHER WELLS SHOWN IN TEST AREA WERE NOT COMPLETED AS OF TIME OF INTERFERENCE TEST).

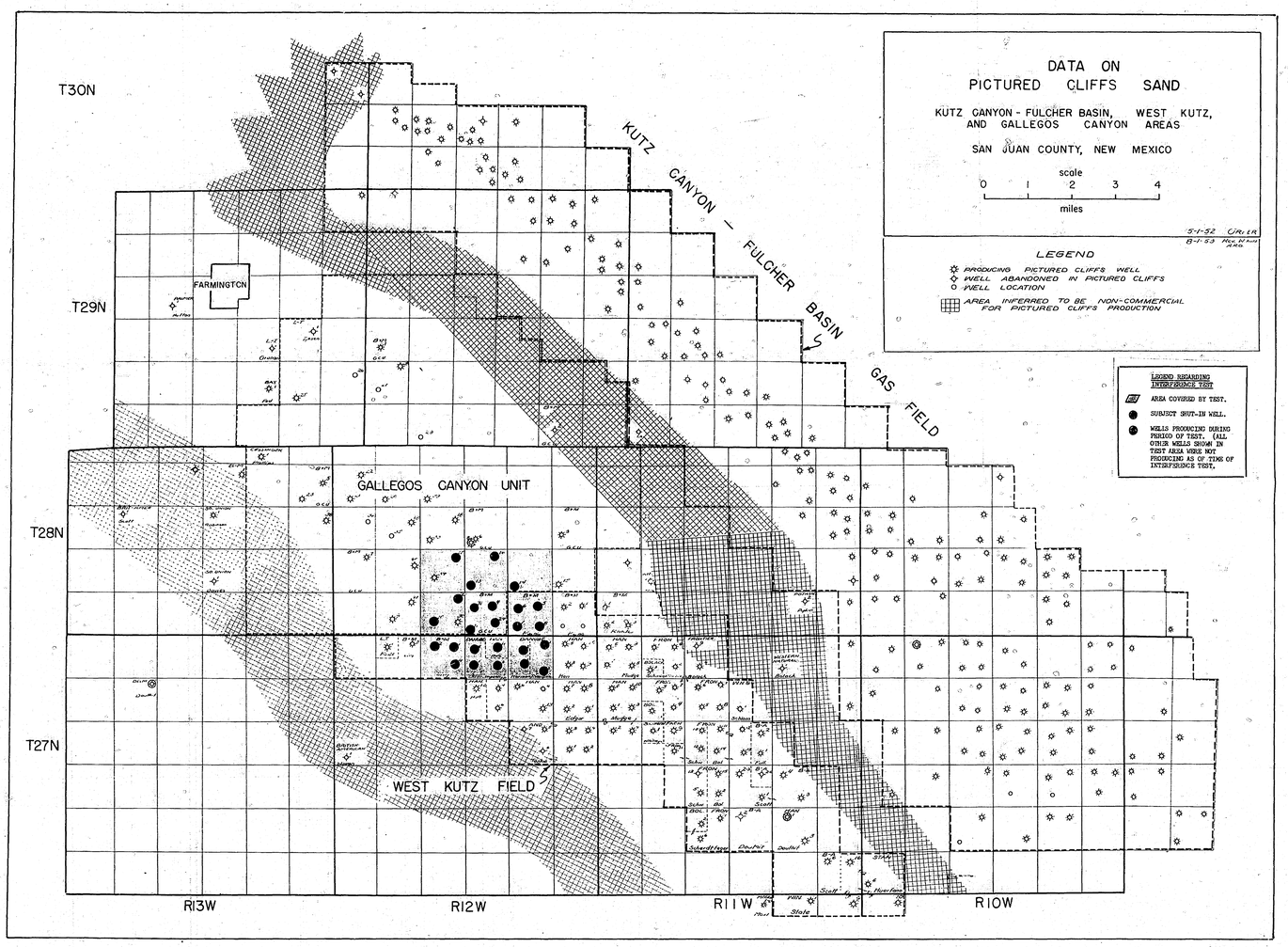
Ex H-1

236


T30N
T29N
T28N
T27N
R13W
R12W
R11W
R10W
FARMINGTON
KUTZ CANYON — FULCHER BASIN GAS FIELD
GALLEGOS CANYON UNIT
WEST KUTZ FIELD
DATA ON
PICTURED CLIFFS SAND
KUTZ CANYON - FULCHER BASIN, WEST KUTZ, AND GALLEGOS CANYON AREAS
SAN JUAN COUNTY, NEW MEXICO
scale
0 1 2 3 4
miles
5-1-52 GREER
LEGEND
PRODUCING PICTURED CLIFFS WELL
WELL ABANDONED IN PICTURED CLIFFS
WELL LOCATION
AREA INFERRED TO BE NON-COMMERCIAL FOR PICTURED CLIFFS PRODUCTION
LEGEND REGARDING INTERFERENCE TEST
AREA COVERED BY TEST.
SUBJECT SHUT-IN WELL.
WELLS PRODUCING DURING PERIOD OF TEST. (ALL OTHER WELLS SHOWN IN TEST AREA WERE NOT PRODUCING AS OF TIME OF INTERFERENCE TEST).
WELLS FROM WHICH VIRGIN PRESSURE OF AREA WAS DETERMINED.

Ex I-1

237


T30N
T29N
T28N
T27N
FARMINGTON
KUTZ CANYON — FULCHER BASIN GAS FIELD
GALLEGOS CANYON UNIT
WEST KUTZ FIELD
R13W
R12W
R11W
R10W
DATA ON
PICTURED CLIFFS SAND
KUTZ CANYON - FULCHER BASIN, WEST KUTZ, AND GALLEGOS CANYON AREAS
SAN JUAN COUNTY, NEW MEXICO
scale
0 1 2 3 4
miles
5-1-52 GR.ER
8-1-53 Rev. H.H.M. Area
LEGEND
PRODUCING PICTURED CLIFFS WELL
WELL ABANDONED IN PICTURED CLIFFS
WELL LOCATION
AREA INFERRED TO BE NON-COMMERCIAL FOR PICTURED CLIFFS PRODUCTION
LEGEND REGARDING INTERFERENCE TEST
AREA COVERED BY TEST.
SUBJECT SHUT-IN WELL.
WELLS PRODUCING DURING PERIOD OF TEST. (ALL OTHER WELLS SHOWN IN TEST AREA WERE NOT PRODUCING AS OF TIME OF INTERFERENCE TEST.

(4)

Ex. J-1

238

DATA ON PICTURED CLIFFS SAND

KUTZ CANYON - FULCHER BASIN, WEST KUTZ, AND GALLEGOS CANYON AREAS

SAN JUAN COUNTY, NEW MEXICO

scale

0 1 2 3 4

miles

5-1-52 GREER

8-1-53 Rev. W.Hunt

LEGEND

- PRODUCING PICTURED CLIFFS WELL
- WELL ABANDONED IN PICTURED CLIFFS
- WELL LOCATION
- AREA INFERRED TO BE NON-COMMERCIAL FOR PICTURED CLIFFS PRODUCTION

LEGEND REGARDING INTERFERENCE TEST

- AREA COVERED BY TEST.
- SUBJECT SHUT-IN WELL.
- WELLS PRODUCING DURING PERIOD OF TEST. (ALL OTHER WELLS SHOWN IN TEST AREA WERE NOT PRODUCING AS OF TIME OF INTERFERENCE TEST).
- WELLS FROM WHICH VIRGIN PRESSURES OF AREA WAS DETERMINED.

T30N

T29N

T28N

T27N

FARMINGTON

KUTZ CANYON — FULCHER BASIN GAS FIELD

GALLEGOS CANYON UNIT S.J.P.

INITIAL PA

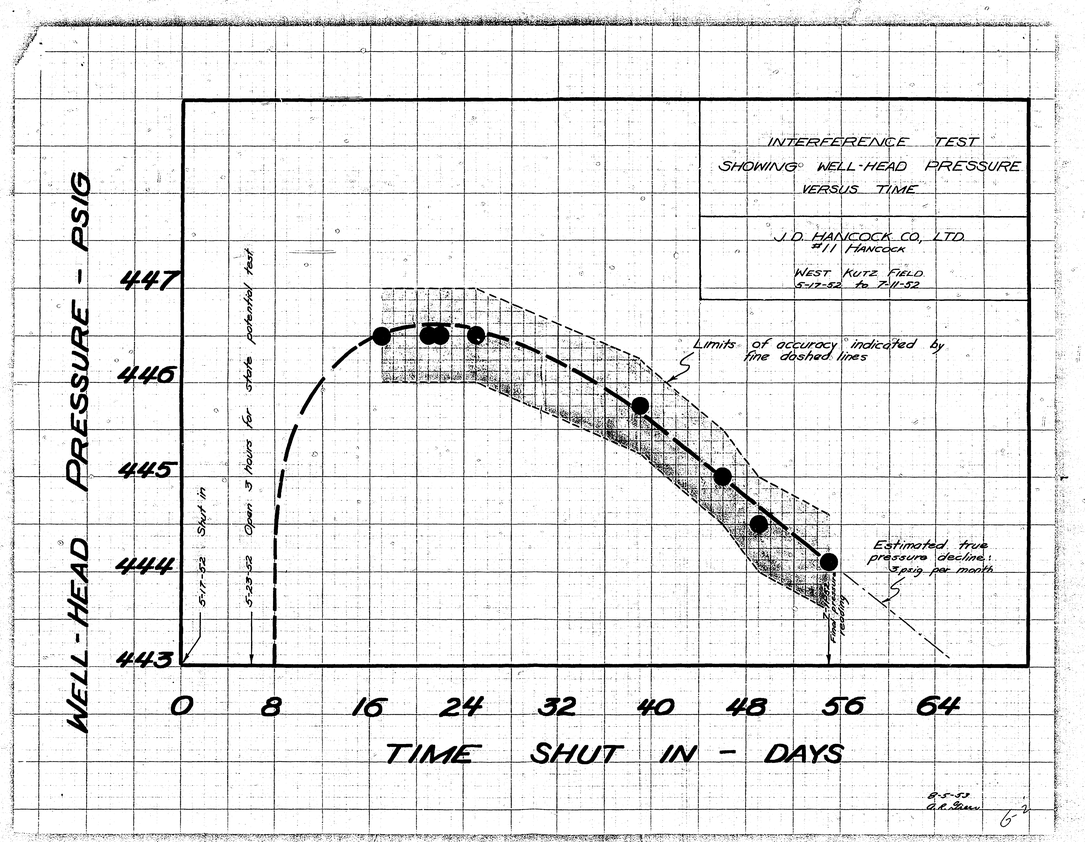
INITIAL PA

WEST KUTZ FIELD

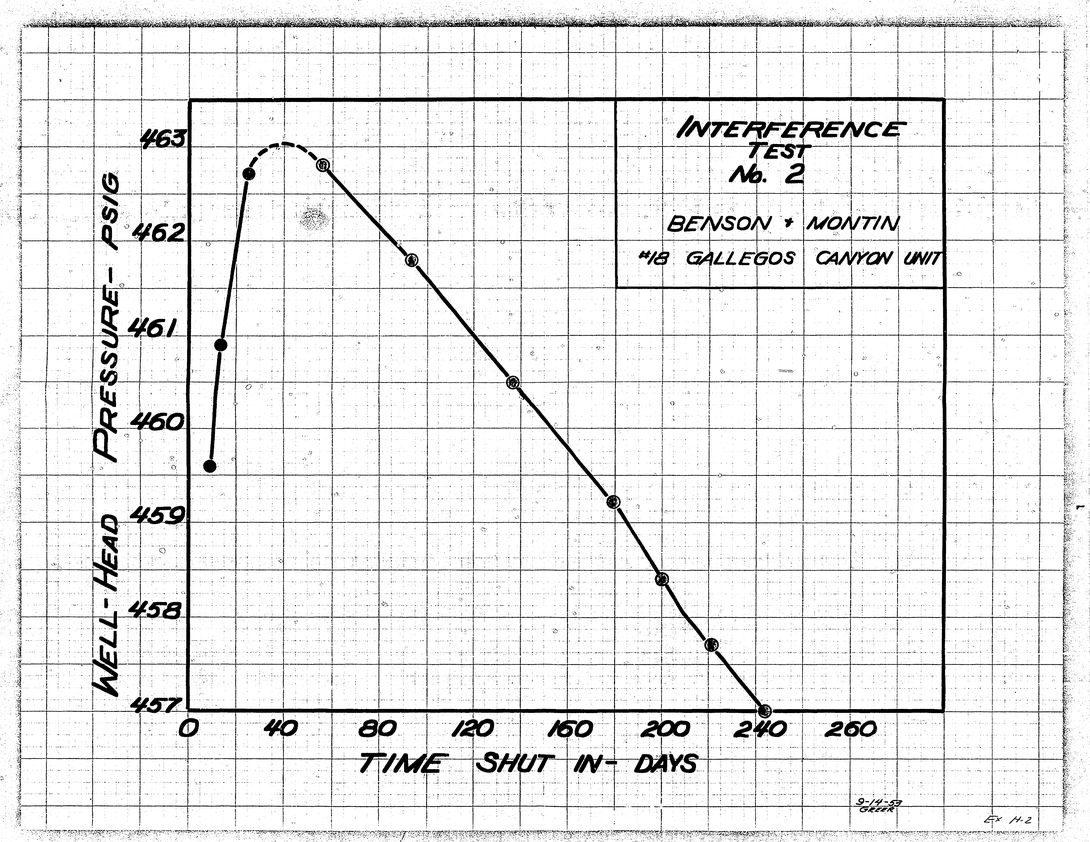
R13W R12W R11W R10W

Ex F-1

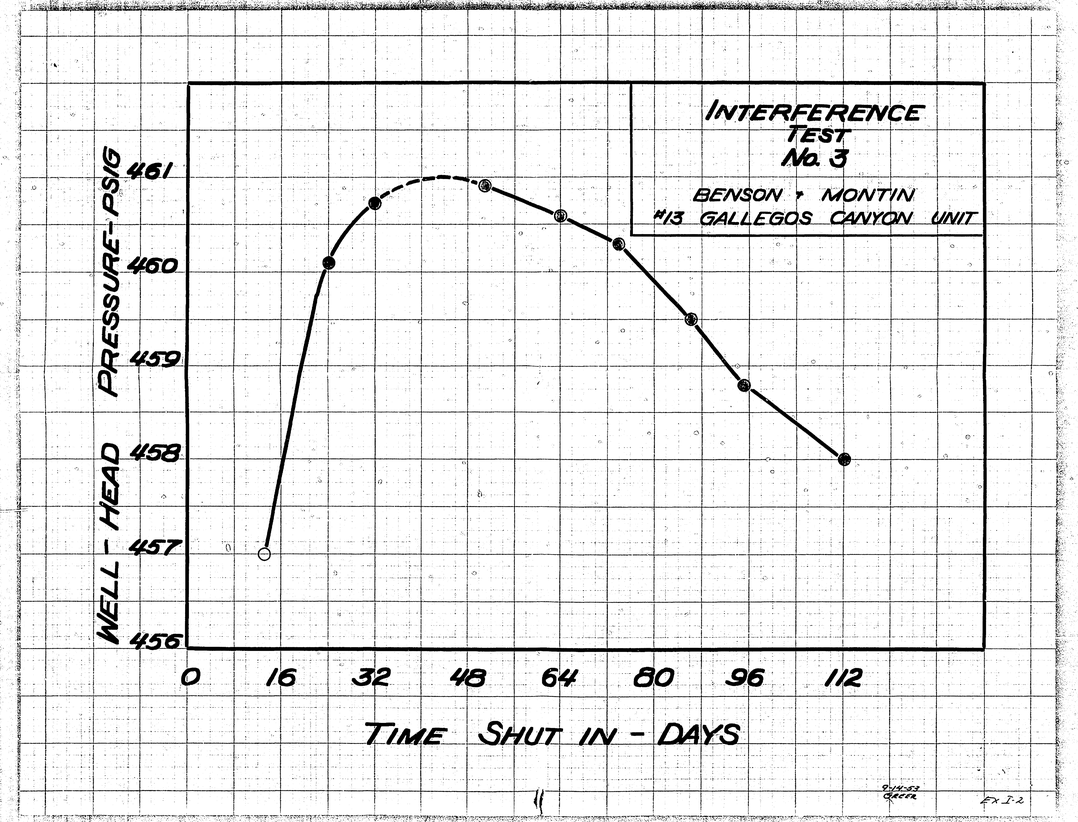
239


INTERFERENCE TEST
SHOWING WELL-HEAD PRESSURE
VERSUS TIME
J.D. HANCOCK CO, LTD.
#11 HANCOCK
WEST KUTZ FIELD
5-12-52 to 7-11-52
WELL-HEAD PRESSURE - PSIG
447
446
445
444
443
0
8
16
24
32
40
48
56
64
TIME SHUT IN - DAYS
5-17-52 Shut in
5-28-52 Open 3 hours for start potential test
Limits of accuracy indicated by fine dashed lines
Estimated true pressure decline: 4 psig per month
6-5-52
A.R. Gunn

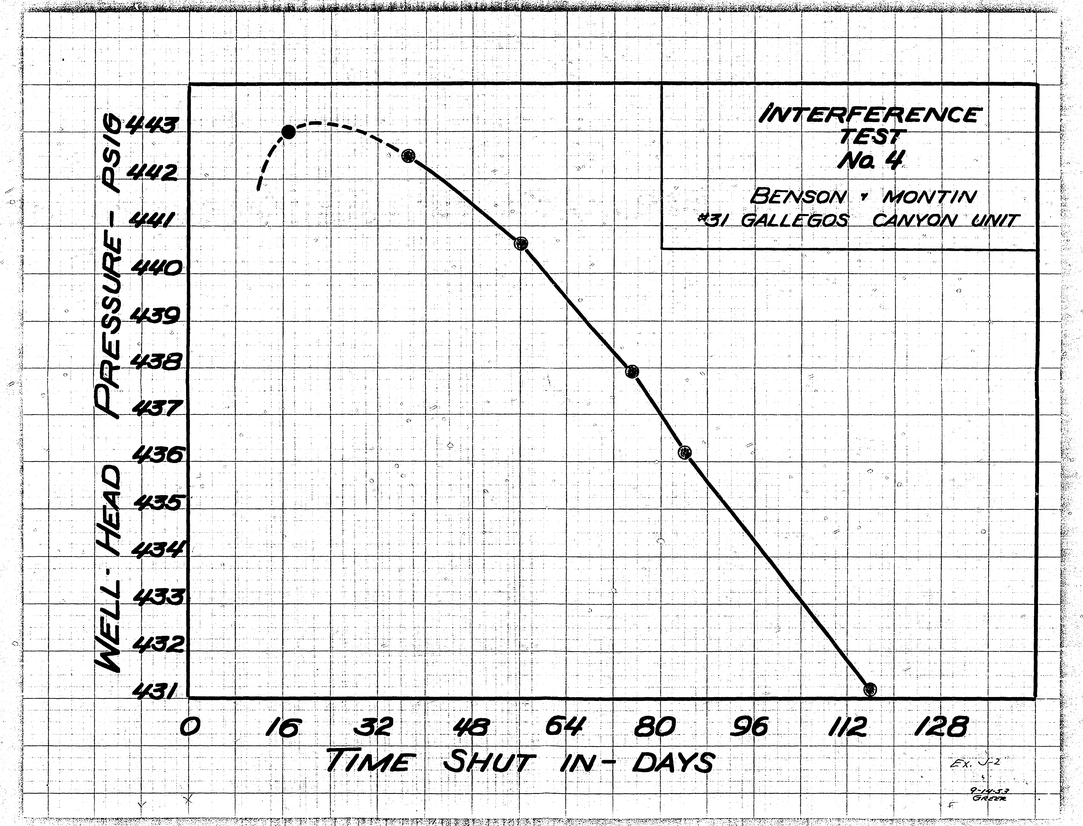
240


INTERFERENCE
TEST
No. 2
BENSON + MONTIN
#18 GALLEGOS CANYON UNIT
WELL-HEAD PRESSURE- PSIG
463
462
461
460
459
458
457
0
40
80
120
160
200
240
260
TIME SHUT IN- DAYS
9-14-53
GREER
EX 14-2

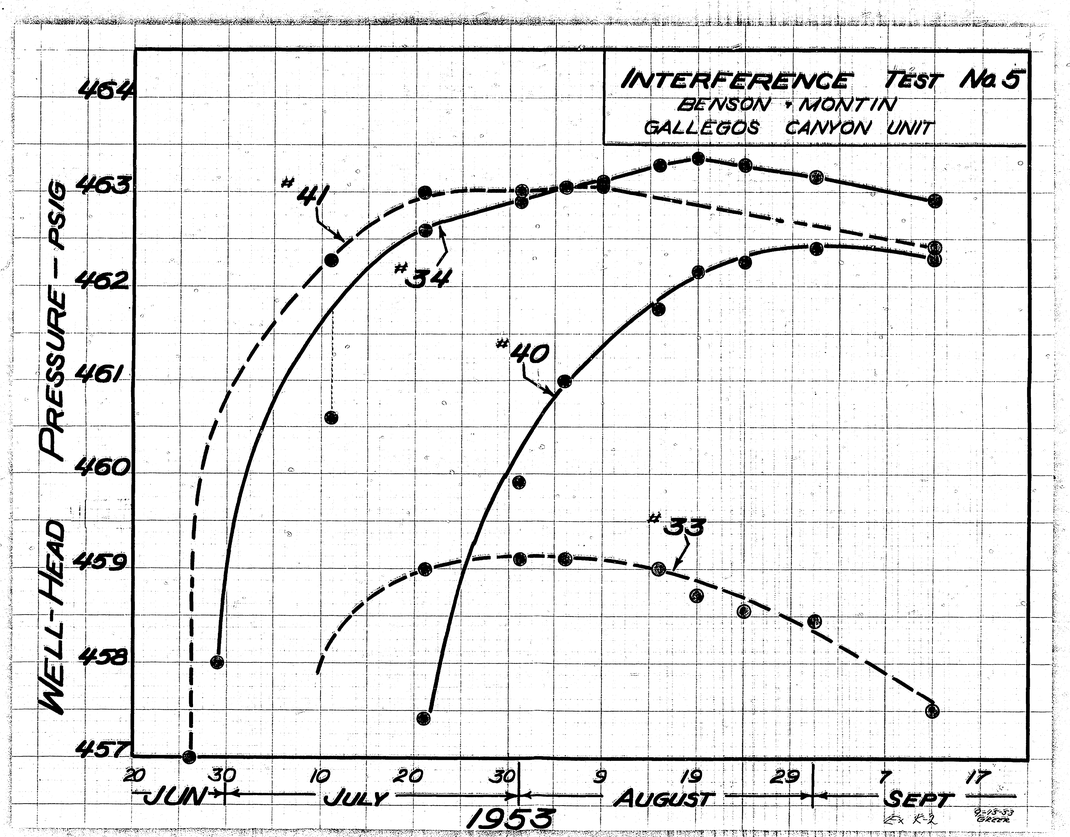
241


INTERFERENCE
TEST
No. 3
BENSON - MONTIN
#13 GALLEGOS CANYON UNIT
PRESSURE-PSIG
WELL-HEAD
461
460
459
458
457
456
0
16
32
48
64
80
96
112
TIME SHUT IN - DAYS
EX I-2

242


INTERFERENCE
TEST
No. 4
BENSON - MONTIN
#31 GALLEGOS CANYON UNIT
WELL-HEAD PRESSURE - PSIG
443
442
441
440
439
438
437
436
435
434
433
432
431
0
16
32
48
64
80
96
112
128
TIME SHUT IN - DAYS
Ex. J-2
9-14-53
GREER

243


INTERFERENCE TEST No. 5
BENSON - MONTIN
GALLEGOS CANYON UNIT
WELL-HEAD PRESSURE - PSIG
464
463
462
461
460
459
458
457
#41
#34
#40
#33
20
30
10
20
30
9
19
29
7
17
JUN
JULY
AUGUST
SEPT
1953
Ex. K-2

244