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ESTIMATED OIL AND GAS RESERVES: KRAUTHEAD-BASELINE FIELDS AREA,  
WELD AND ADAMS COUNTIES, COLORADO

Compiled by  
A. H. Scanlon

Funded by the Colorado Oil and Gas Conservation Commission



Colorado Geological Survey  
Department of Natural Resources  
State of Colorado  
Denver, Colorado  
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ESTIMATED OIL AND GAS RESERVES: KRAUTHEAD-BASELINE FIELDS AREA,  
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INTRODUCTION

The area under study comprises six designated fields: Krauthead (1S-64W), Baseline (1S-63W), Banner Lakes (1N & 1S-64W), Fence Post (1S-64W), Horse Creek (1N-64W), and Sloan (1N-63W). The study area lies approximately 20 miles northeast of Denver, within the Denver Basin (Fig. 1). The area is classified as a stratigraphic trap with updip reduction of porosity, under a solution-gas drive. All production from these fields, excluding Sloan, is from the D sand of Cretaceous age at an average depth of 7,500 feet. A net porous sand isopach map (Plate 1) was constructed using sand thickness greater than 8% porosity (using a 2.68 grain density). A contour map on the top of the 'D' Sand was also constructed (Plate 2). The D sand averages 13.5 feet in thickness, with a maximum thickness of 30 feet. An east-west (A-A') and a northwest-southeast (B-B') cross section were also constructed (Plate 3). The cross sections and isopach map indicate this area was an elongate northeast-southwest-trending channel sand, bordered by thin, narrow levee deposits and splay deposits.

It has been documented that the D sand throughout this area is fractured. This fracturing can be directly related to the quantity of production, as well as to the permeability of the sand. Where producing wells have no D sand porosity greater than 8%, production is credited to the fracture system.

Development of this area has been rapid due to economics and recent frac treatment improvements. Most producers in this area consider all six fields to be of common source and supply, and are therefore commonly combined as a one-field area for reservoir and other related studies.

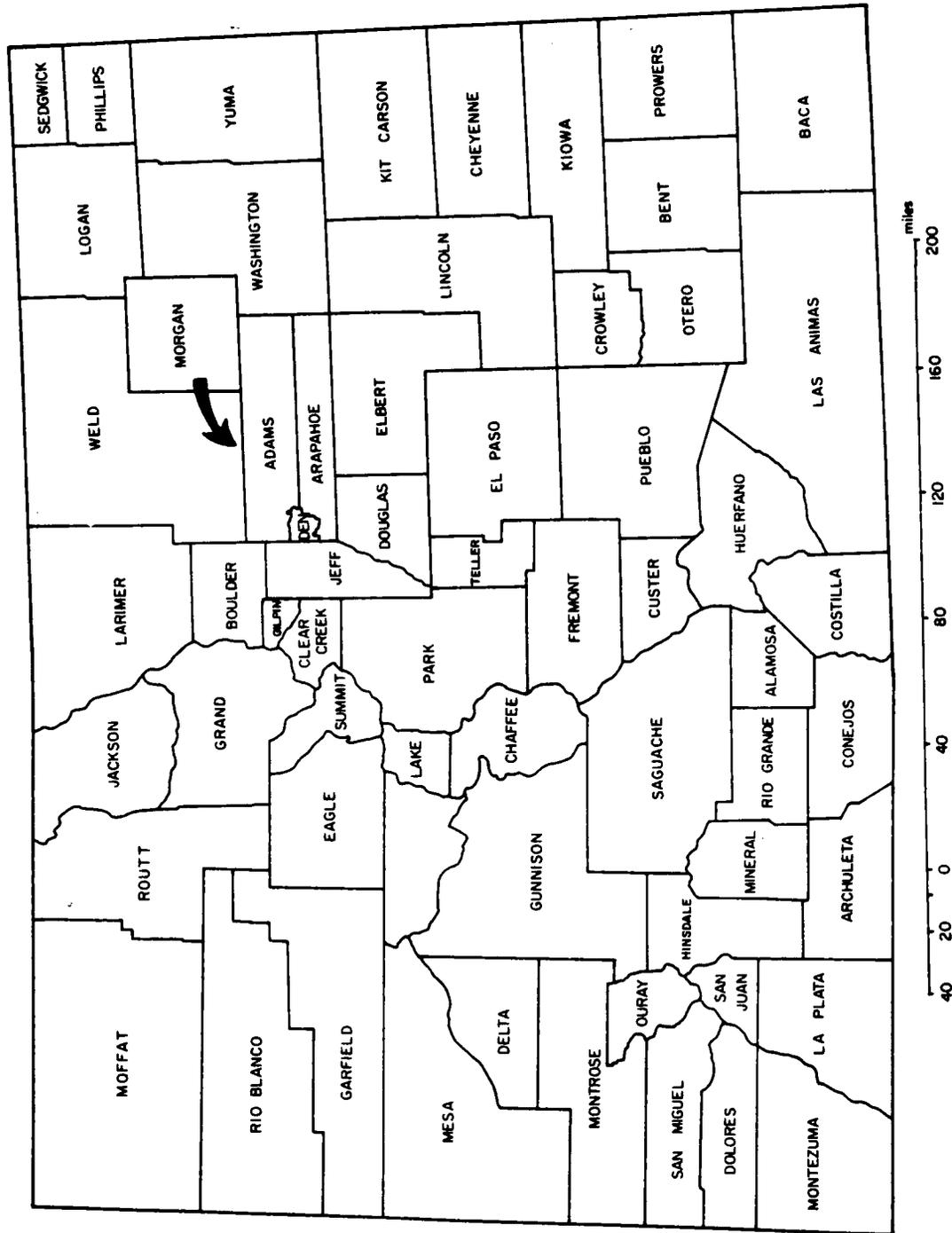


Figure 1. Location Map.

In addition to production from the D sand, the J sand often proves to be economic. Within the study area to date, only one well produces from the J sand, in Sloan Field.

#### TECHNIQUES USED IN THIS STUDY

Two methods of approach have been used to determine oil reserve estimates in this area: 1) based on case history studies, several relationships have been drawn and are used to predict reserves for other geologically similar situations, and 2) decline curve analysis.

The first method is taken from the American Petroleum Institute (API) publication A Statistical Study of Recovery Efficiency and the Society of Petroleum Engineers (SPE) study Correlation for Fluid Physical Property Prediction. By means of studying case histories on oil and gas reservoirs in the United States and abroad, several parameters which are normally measured by PVT Laboratory Analysis can be calculated by using the following equations. The solution gas-oil ratio is calculated using equation 1:

Equation 1:

$$R_s = \frac{(\delta_g)(P)^{1.187}}{56.06} 10^{10.393 \left( \frac{API}{T + 460} \right)}$$

Where:  $R_s$  = solution gas-oil ratio

$\delta_g$  = specific gravity of gas

$P$  = Reservoir pressure at bubble point

API = API oil gravity

$T$  = formation temperature, °F

The formation volume factor for API gravity greater than 30° is calculated using equation 2:

Equation 2:

$$Bo = 1 + 4.67 (Rs) 10^{-4} + 0.11 (T-60) \frac{API}{\delta g} 10^{-4} + 0.1337 (Rs)(T-60) \left( \frac{API}{\delta g} \right) 10^{-8}$$

where Bo = oil Formation Volume Factor

Rs, T, API, and  $\delta g$  = as above

Barrels per acre-foot can then be arrived at using equation 3:

Equation 3:

$$BAF = (3244) \left( \frac{\phi(1-S_w)}{Bo_b} \right)^{1.1611} \left( \frac{K}{\mu_{ob}} \right)^{0.0979} (S_w)^{0.3722} \left( \frac{P_b}{P_a} \right)^{0.1741}$$

Where: BAF = Barrels per Acre Foot

$\phi$  = porosity

S<sub>w</sub> = water saturation

Bo<sub>b</sub> = oil Formation Volume Factor at bubble point

K = permeability

$\mu_{ob}$  = viscosity of oil at bubble point

P<sub>b</sub> = reservoir bubble point pressure

P<sub>a</sub> = reservoir abandonment pressure

Finally, the recovery efficiency is calculated using equation 4.

Equation 4:

$$R.E. = 41.815 \left( \frac{\phi(1-S_w)}{Bo_b} \right)^{0.1611} \left( \frac{K}{\mu_{ob}} \right)^{0.0979} S_w^{0.3722} \left( \frac{P_b}{P_a} \right)^{0.1741} \text{ (in percent)}$$

Where:  $\phi$ , S<sub>w</sub>, Bo<sub>b</sub>, K,  $\mu_{ob}$ , S<sub>w</sub>, P<sub>b</sub>, P<sub>a</sub> = as above

R.E. = Recovery Efficiency

Using the values calculated from the above equations in conjunction with the values of acre-feet determined by planimetering the D sand isopach map, a value of the total recoverable oil was obtained. Using these data, a percent recovery efficiency was calculated. Values used for each field in these equations can be found in Table I. It should be noted that the accuracy of estimates using these equations will not be better than the reliability of the input data.

The second method of approach used is based on decline curve analysis and the associated relationships to arrive at the values for remaining reserves and ultimate recoverable reserves. The rate of yearly decline is calculated using equation 5.

Equation 5:

$$dy = \frac{q1 - q2}{q1}$$

Where:  $dy$  = yearly decline rate, in percent

$q1$  = production rate at time 1

$q2$  = production rate at time 2

Two types of curves are plotted: 1) a rate versus cumulative, (Figures 2-6), and 2) a rate versus time (Figures 7-12). The first case is a simple linear relationship and best results (closest approximation to a straight line, therefore a constant percentage decline) are obtained by plotting this data on regular coordinate paper. The second case is one of exponential decline (assuming a constant percentage decline) and can best be expressed as a straight line on semi-log paper. From equation 6 the remaining reserves can be calculated.

TABLE I

Values Used

Baseline 12-1S-64W	Krauthed 11-1S-64W	Banner Lakes 4-1S-64W	Fence Post 24-1S-64W	Horse Creek 36-1N-64W	Sloan 30-1N-63W
0.8788	0.89				
spec. grav. gas -----use-----0.88-----					
P -----2890-----					
Tfm -----178-----					
38 -40	38 -42	40	40	40	39.8
-----use 40 as average-----					
Sw(Min/Avg)	14.6/19.2	14.7/18.4	-----18.8-----		
K(Max/Avg)	4.1/0.79	61/10.7	-----80 &.10-----		
ob (visc. oil@bub.pt.) -----0.35-----					
O(Max/Avg)	11.9/8.7 C	18.2/10.8 C	10 avg	12/8.6 L	12/8.3 L
C - core	19/8.5 L	18/9.6 L			
L - log					
Proven Prod. Ac.	1400	720	240	200	40
Net Pay(Max/Avg)	22/6.2	13/6.5		13/6.7	6/3
					6/3.2

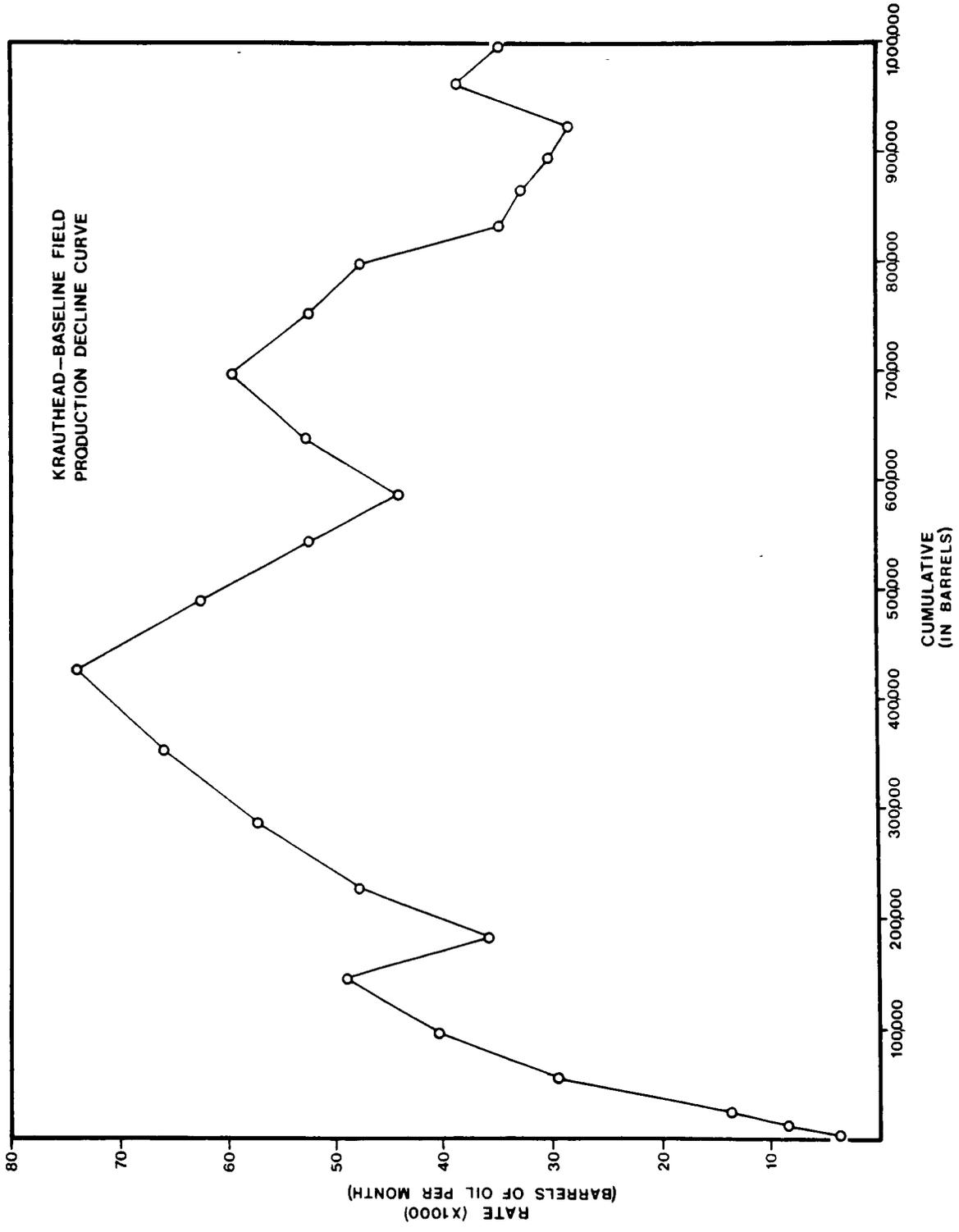


Figure 2.

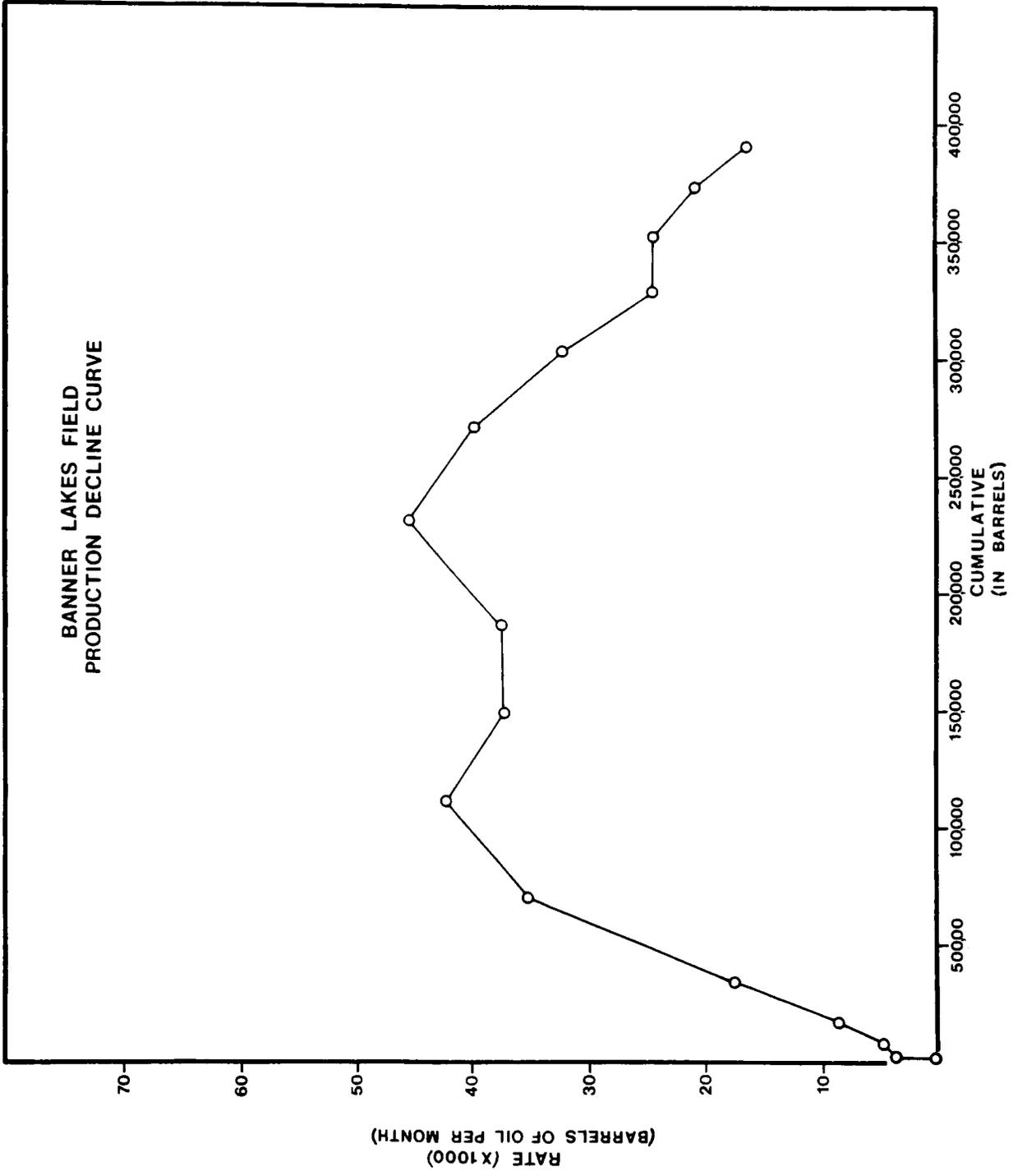
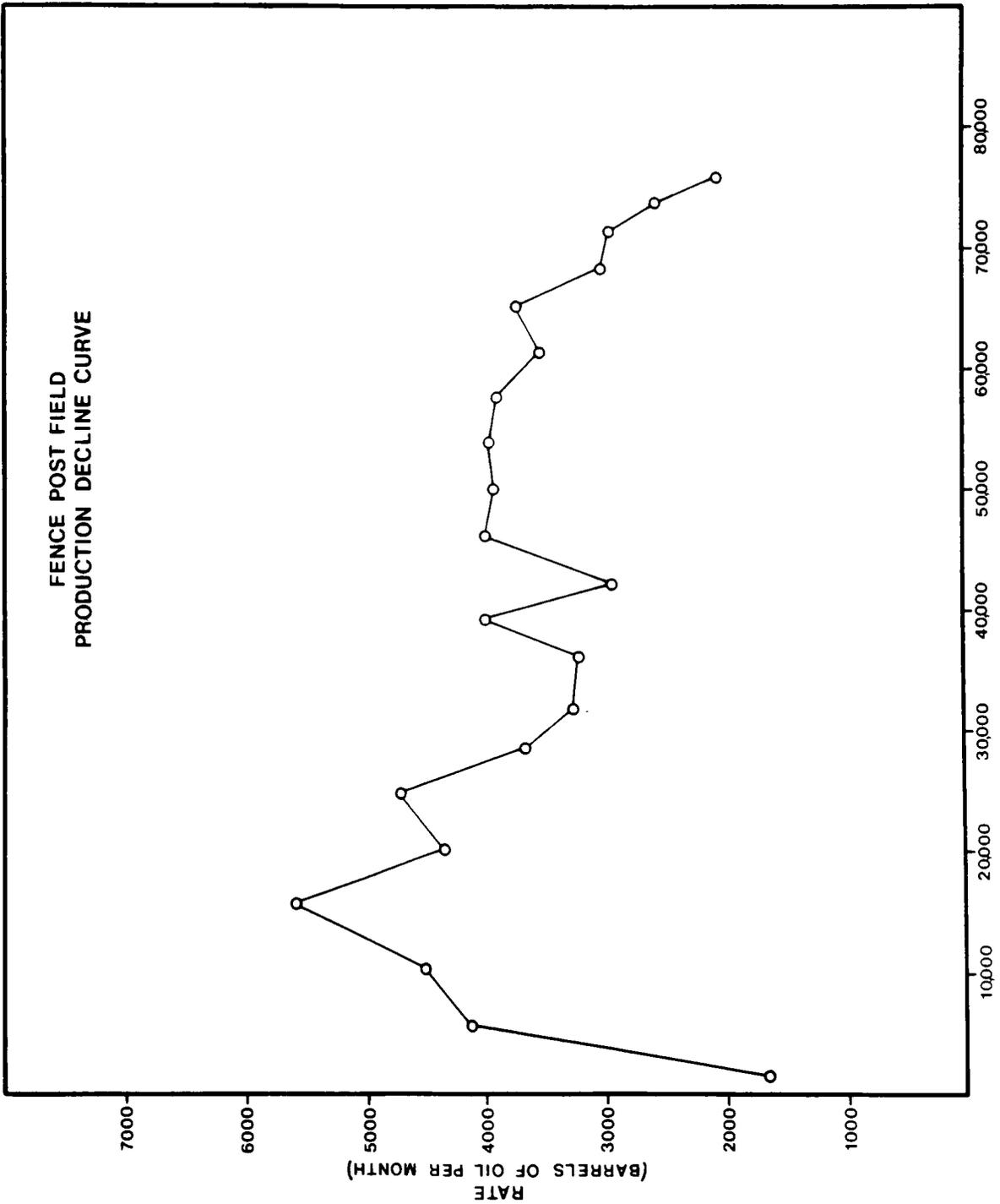


Figure 3.

FENCE POST FIELD  
PRODUCTION DECLINE CURVE



CUMULATIVE  
(IN BARRELS)

Figure 4.

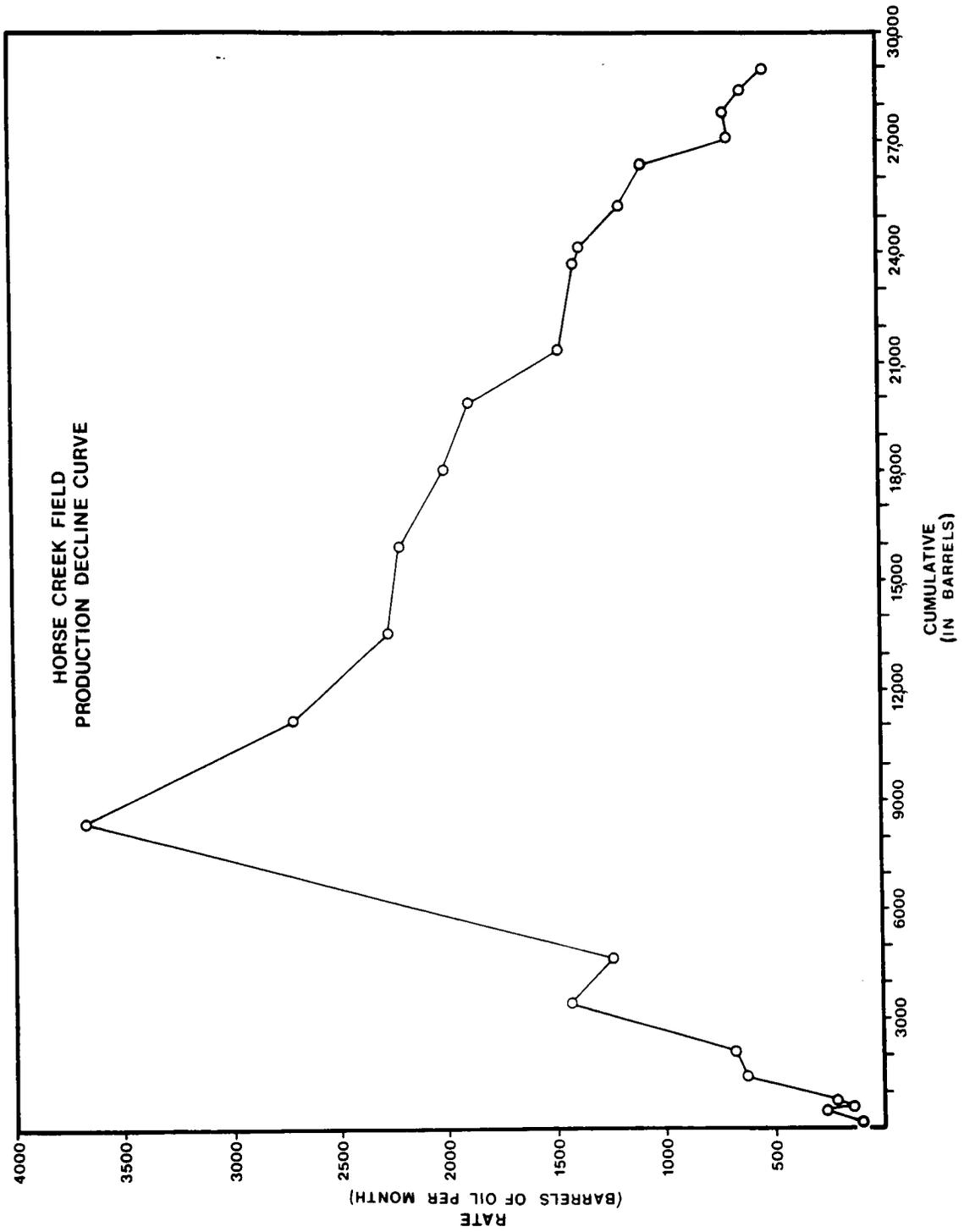


Figure 5.

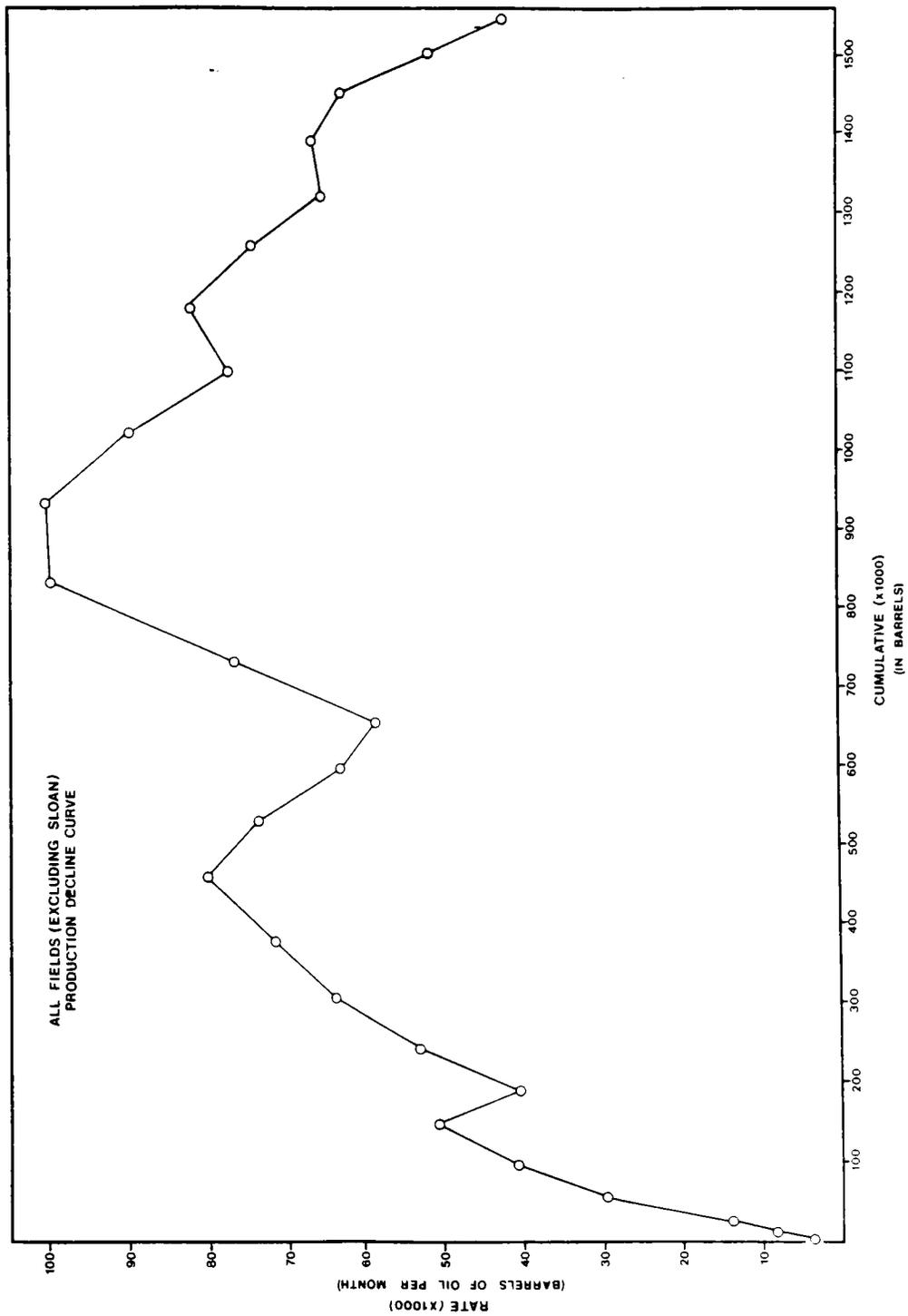


Figure 6.

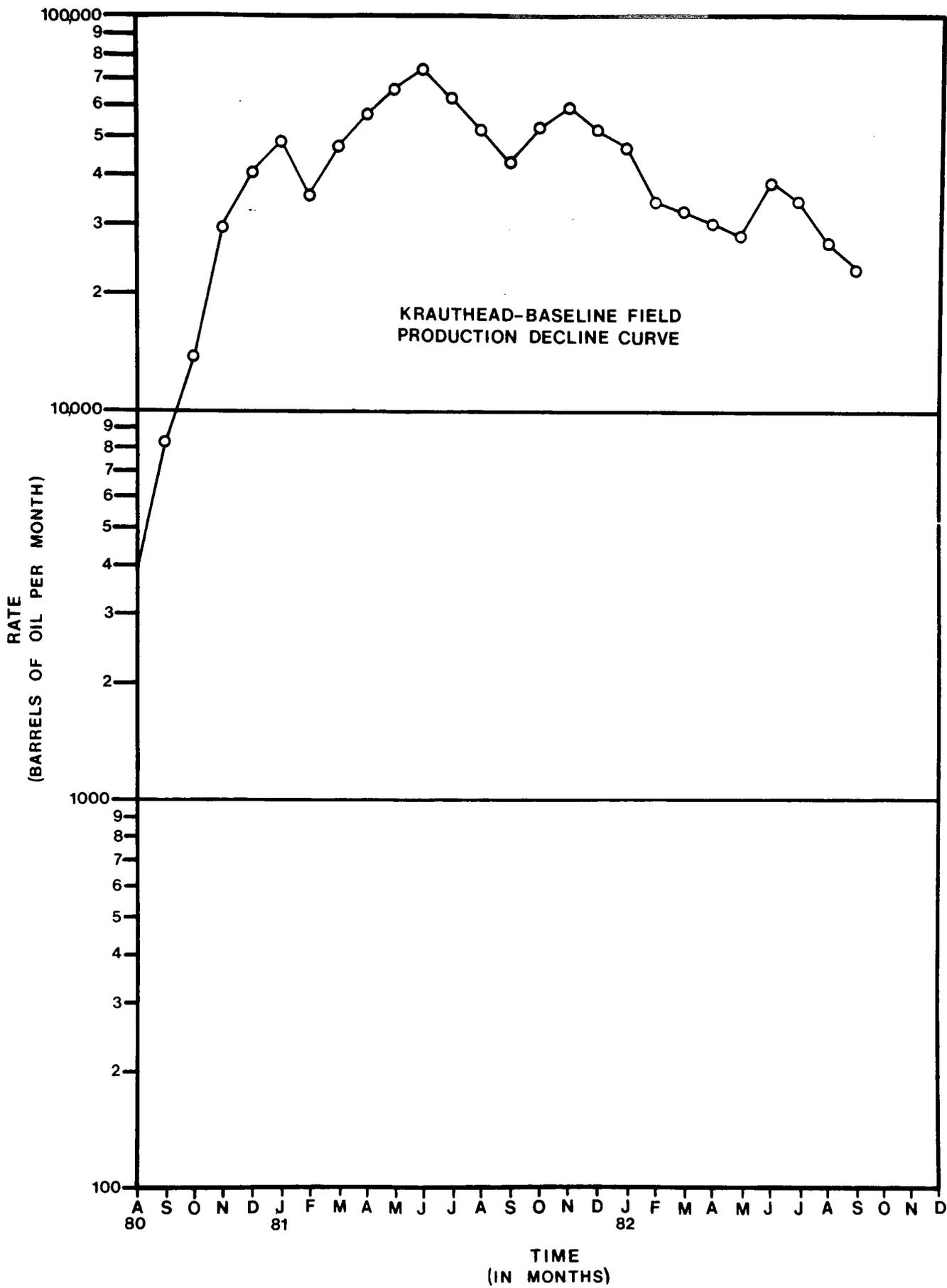


Figure 7.

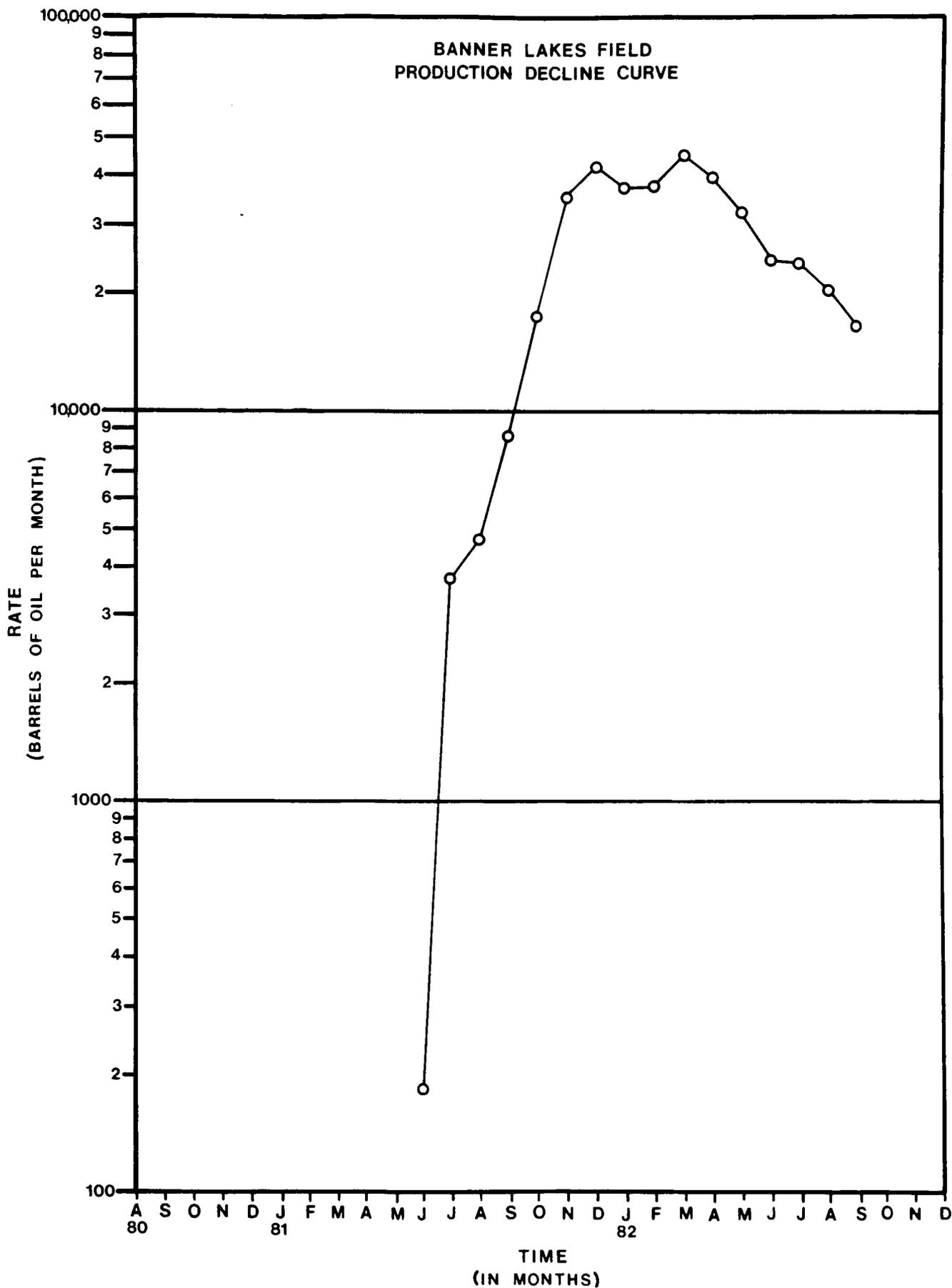
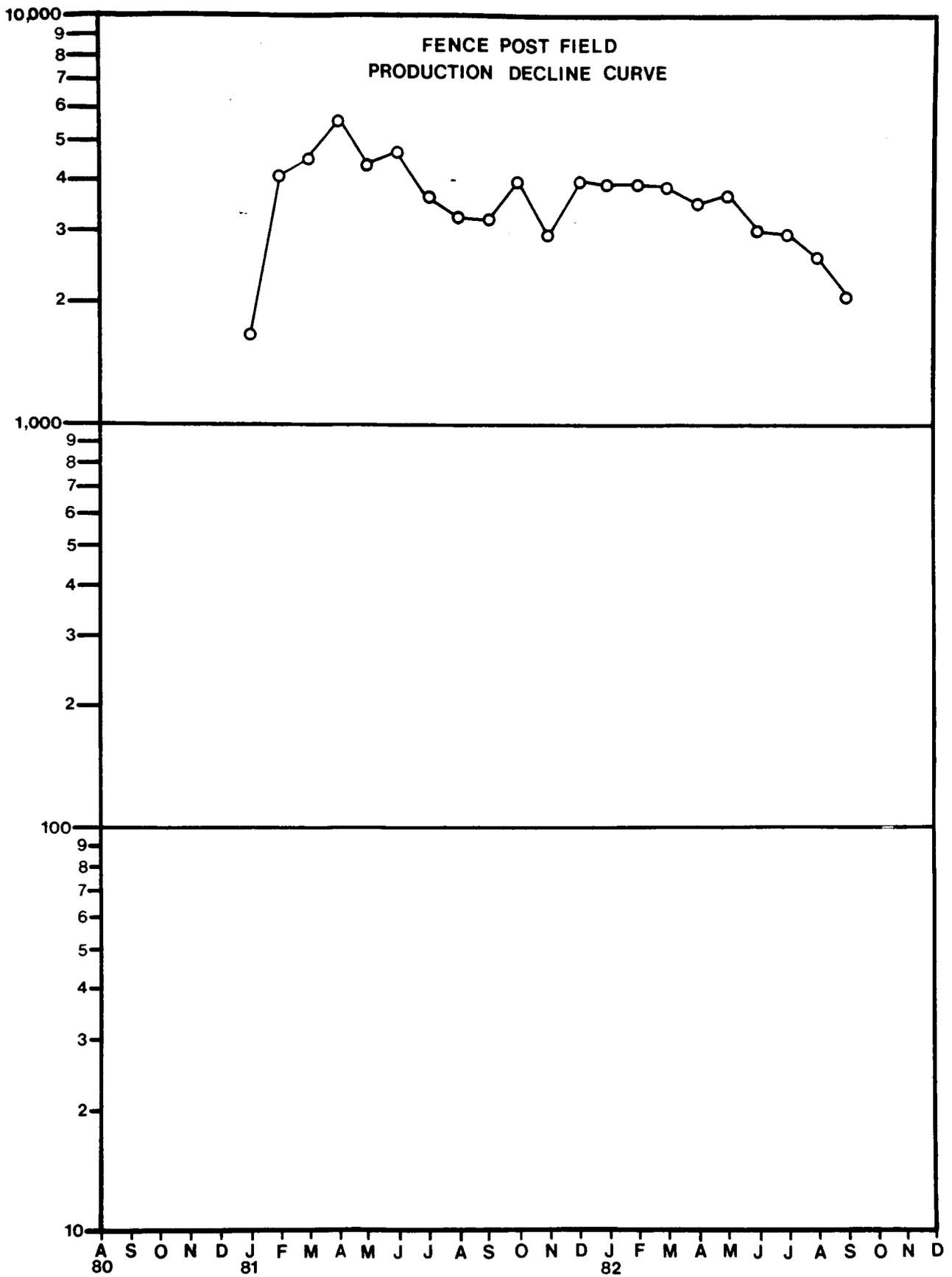


Figure 8.



TIME  
(IN MONTHS)  
Figure 9.

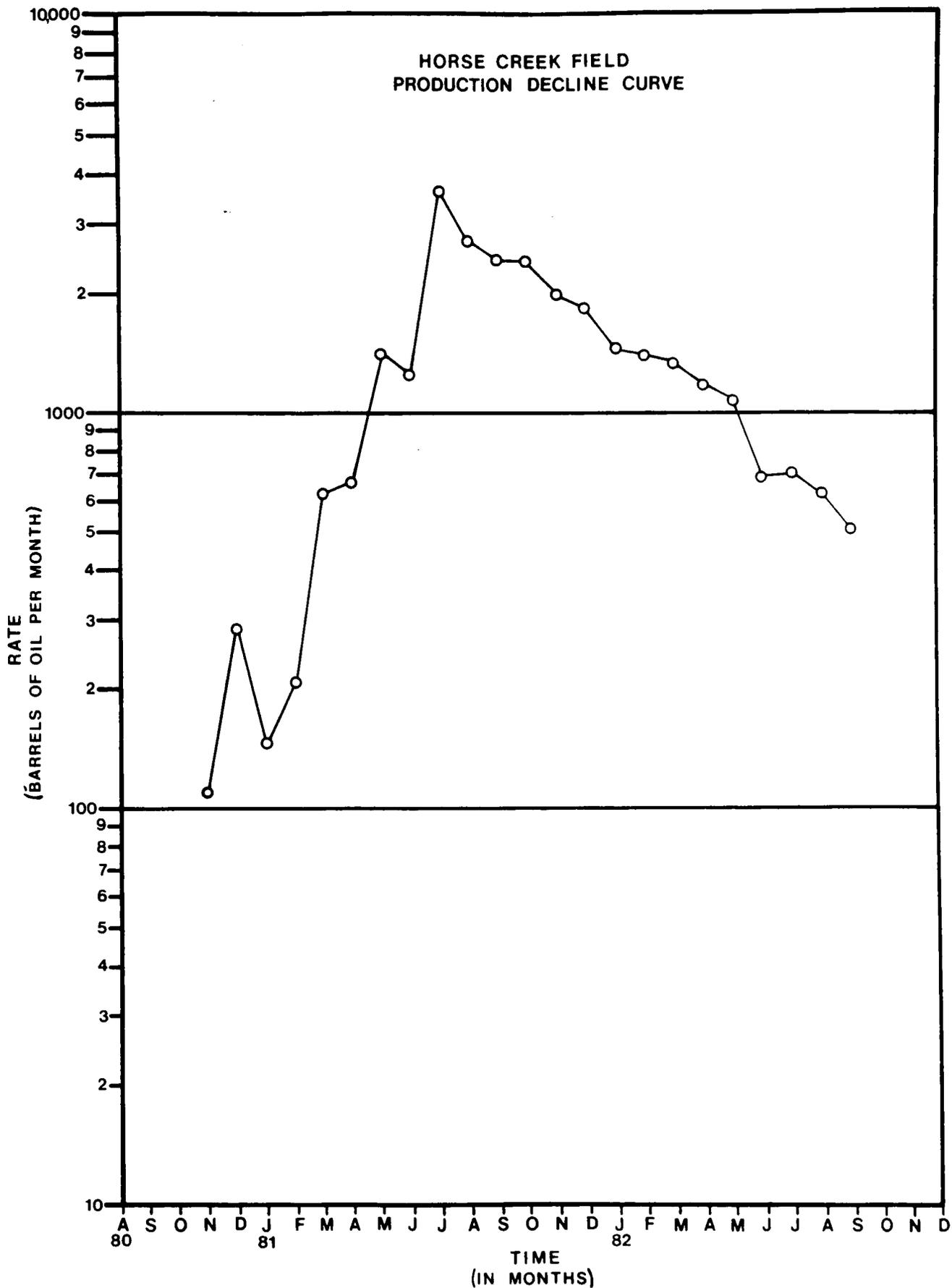
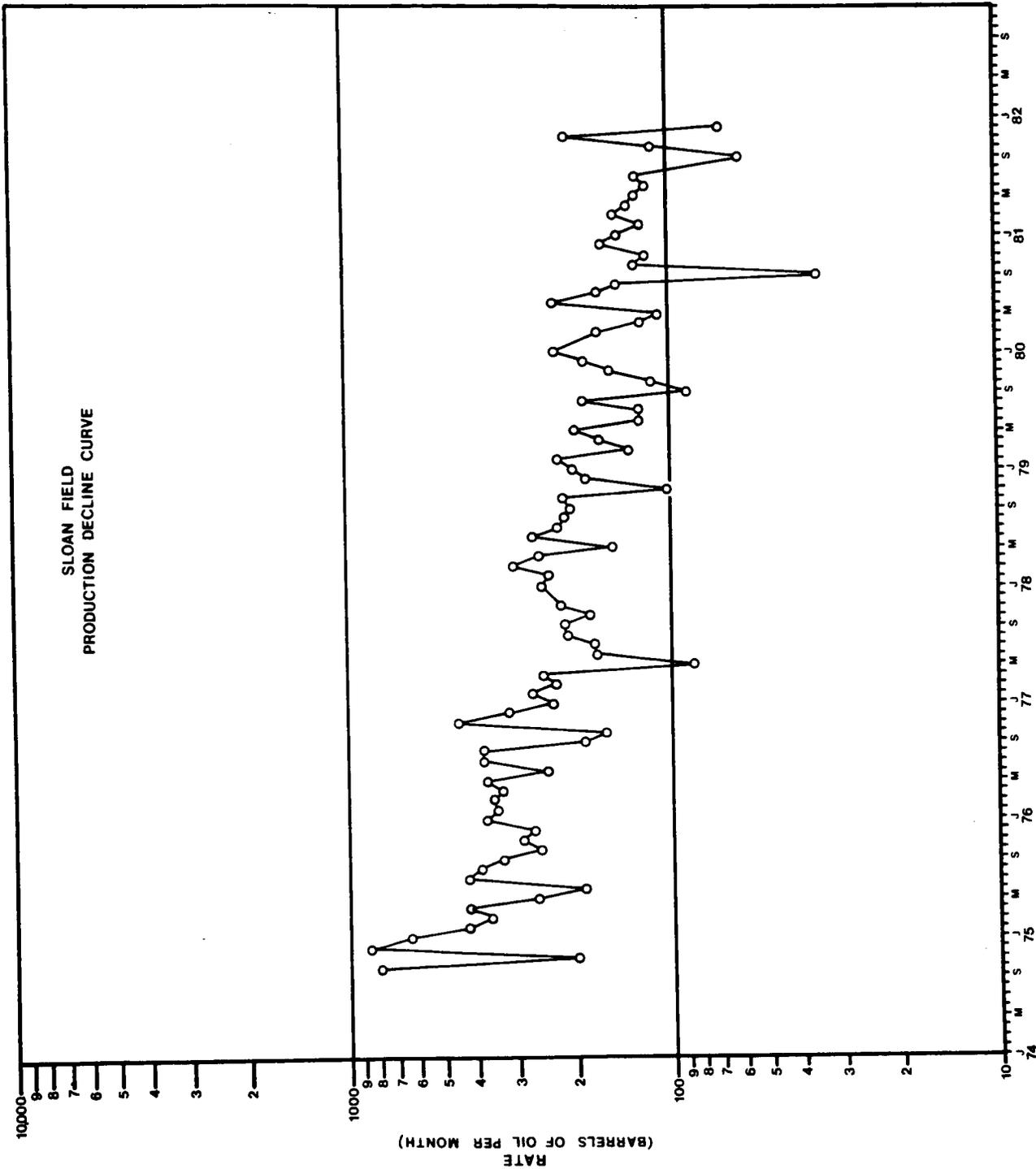
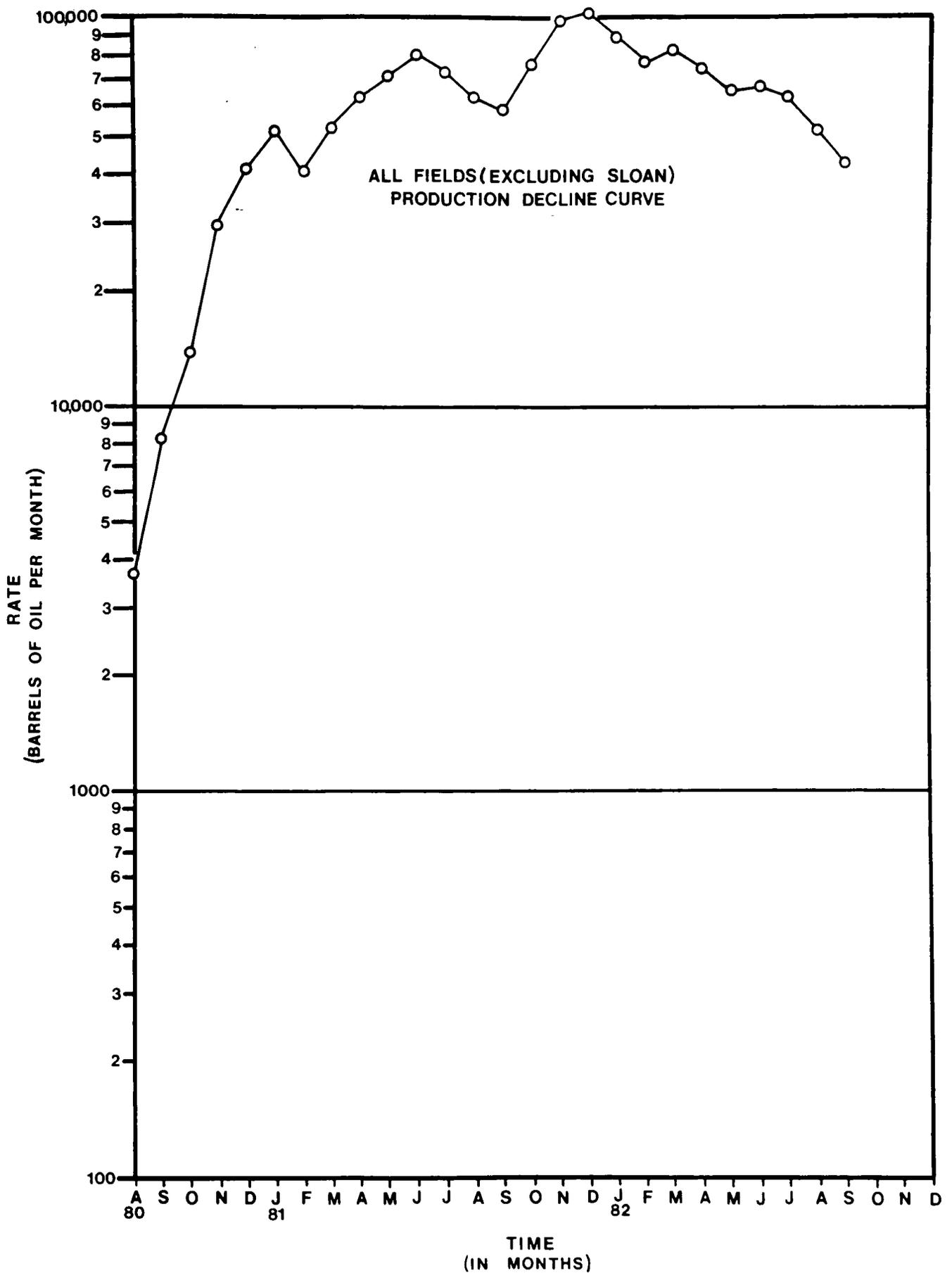


Figure 10.



TIME  
(IN MONTHS)  
Figure 11.



TIME  
(IN MONTHS)

Figure 12.

Equation 6:

$$Rr = \frac{q - qf}{-\text{Ln}(1-dy)} \times 12 \text{ months}$$

Where: Rr = remaining reserves

q = production rate

qf = final economic production rate

Ln = natural log

dy = yearly decline rate, in percent

Several assumptions must be made to obtain this value. A reasonable number of producing wells must be used at the time of field "abandonment" for the field to still be considered economic. In addition, an economic amount of production for each of those wells must be arrived at. At present crude oil prices, it is commonly accepted that a one- to two-BOPD value per well is considered economically feasible. The ultimate recoverable oil is calculated by adding the cumulative production and remaining reserves. The original oil in-place is volumetrically calculated by equation 7.

Equation 7:

$$\frac{\text{BAF}}{\text{R.E.}} \times \text{A.F.} = \text{O.O.I.P.}$$

where: BAF = Barrels per acre feet

R.E.= Recovery Efficiency

A.F.= acre-feet

O.O.I.P.= Original oil in place

Then, the actual recovery efficiency is calculated by equation 8.

Equation 8:

$$R.E._A = \frac{U.R.}{O.O.I.P.}$$

where:  $R.E._A$  = actual recovery efficiency

U.R. = ultimate recovery

O.O.I.P. = original oil in place

## RESULTS

As previously stated, the quality with which the outcome can be relied upon is only as good as the quality of input data. All data used in this study is taken from production reports, logs, and well files received by the Colorado Oil and Gas Conservation Commission. Any data which did not fit well with the surrounding data was either not used or was checked for errors in reporting. The problem of bad data was rarely encountered, and with the abundance of data available, no major problems developed.

In general, several rules can be followed in interpreting the resulting information. The following quote from J. J. Arps, 1956, gives some insight into the discrepancies seen using the two methods discussed previously. "Oftentimes it is difficult to fit the projected performance to the volumetric estimate. If both types of estimates are based on good, reliable information, but cannot be reconciled, some important conclusions may be drawn from this discrepancy. If the performance indicates a substantially lower ultimate recovery than the volumetric calculation would indicate, this may mean that

there is something fundamentally wrong with the production practices used. Possibly more drainage points are needed or the wells need stimulation treatments or cleanout jobs.

"On the other hand, if the well performance projection indicates an ultimate recovery well in excess of the volumetric estimate, it would mean that the subsurface interpretation used may be in error and that there may be a larger oil reservoir on hand than current subsurface interpretation indicates. In that case, it may be highly desirable to look for a possible extension to such an oil reservoir."

Table 2 summarizes the results of two methods used in this study. The reserves calculated for the study area was done for each field with the exception of Krauthead and Baseline fields. These two fields are considered one reservoir by the author and most operators in the area. In addition, reserves were calculated for all fields combined, excluding Sloan field.

In general, the results obtained using a decline curve analysis indicate a slightly below average value of recovery as compared to the recovery results calculated using the volumetric method. The latter indicate values within an acceptable range as predicted by API, "A Statistical Study of Recovery Efficiency."

There are numerous possible explanations as to why the actual production (decline curve analysis) does not approach the expected production (volumetric analysis).

One factor which should be considered is the short production time for the

Table II. Summary of Results

Field Name/ Discovery Date	Rate- Cum.	Rate- Time	Rs	Bo	P 100, 200, ..500	R.E.	Acre-feet	Total Recoverable	% of OOIP	% of cum.	Production	Remaining Reserves	Ultimate Recoverable Reserves	O.O.I.P.	Actual R.E. (in %)
Krauthed- Basel line August 1980/ October 1980	.49	.62	890	1.48	132 117 109 103 99	33 29 27 26 25	25,615 [61,610]	3,381,180 2,996,955 2,792,035 2,638,345 2,535,885	33 29 27 26 25	31 35 37 40 41	1,046,626	15 wells @ 30 BOPM 24,643 R/T 38,316 R/C	1,071,269 1,088,942	10,246,000 10,334,328 10,340,870 10,147,481 10,143,540	10.5 10.4 10.4 10.6 10.6
Banner Lakes March 1981	.713	.615	903	1.47	118 105 98 93 89	28 25 23 22 21	10,300 [31,910]	1,215,400 1,081,500 1,009,400 957,900 916,700	28 25 23 22 21	35 39 42 45 47	426,273	4 wells @ 30 BOPM 249,932 R/T 171,896 R/C	676,205 598,169	4,340,714 4,326,000 4,388,696 4,354,091 4,365,238	16 16 15 16 15
Fence Post December 1980	.564	.640	903	1.49	96 85 80 76 73	27 24 22 21 20	2,645 [9,305]	253,920 224,825 211,600 201,020 193,085	27 24 22 21 20	30 33 36 38 39	75,795	2 wells @ 30 BOPM 269,460 R/T 363,426 R/C	345,255 439,221	940,444 936,771 961,818 957,238 965,425	37 37 36 36 36
Horse Creek December 1980	.732	.79	903	1.49	98 87 81 77 74	27 24 23 21 20	1,500 [2,715]	147,000 130,500 121,500 115,500 111,000	27 24 23 22 20	20 22 24 25 26	28,972	1 well @ 30 BOPM 3,922 R/T 5,194 R/C	32,894 34,166	544,444 543,750 528,261 550,000 555,000	6 6 6 6 6
Sloan October 1974	--	.160	896	1.48	94 84 78 74 71	27 24 22 21 20	570 [2,770]	53,580 47,880 44,460 42,180 40,470	27 24 22 21 20	22,478	5164 R/T	27,642	198,444 199,500 202,091 200,857 202,350	14 14 14 14 14	
All fields (except Sloan)	.610	.616	903	1.49	103 91 85 81 78	27 24 23 22 21	40,060 [105,540]	4,126,180 3,645,460 3,405,100 3,244,860 3,124,680	27 24 23 22 21	38 43 46 48 50	1,577,666	20 wells @ 30 BOPM 588,026 R/T 563,297 R/C	2,165,692 2,240,963	15,282,148 15,189,417 14,804,783 14,749,364 14,879,429	14 14 15 15 15

fields in this area. If this area is in the early stages of production, it can be inferred that the decline rates have not yet leveled off. It is difficult to obtain a one-well decline curve due to the methods used by the Colorado Oil and Gas Conservation Commission in keeping production records. The author is presently attempting to obtain one-well decline curves for the various fields to be able to get a more reasonable decline rate. The straight line extrapolation used for these fields assumes a constant percentage decline. This assumption generally provides results which are too conservative. This is normally corrected by graphically flattening out the decline slope in the latter stages of development. By using a field production decline curve, the decline rate has been influenced by the additional drilling of wells throughout the field history. There also appears to be several 40-acre tracts where new wells can be drilled. This additional infilling will influence the production rate for these fields, and therefore the reserve estimates based on these production rates.

A second factor to be considered are the various field characteristics, example: varying permeability, porosity, sand quality, etc. These characteristics, considered individually or when combined, may be influencing the production rates. One characteristic which is playing a significant part in influencing the production rate in this area is permeability. This value is usually low when compared to other geologically similar fields. The core analyses, which are few in this area, indicate a permeability between 0.1 and 10 millidarcies. API studies indicate values of 6, 51, and 940 millidarcies as minimum, medium, and maximum values, respectively. Core analyses for the Rocky Mountain area, as displayed in Frick, (Petroleum Production Handbook, Fig. 13) show a range of permeability of 0 to 900 millidarcies for the D sand, with an average value of 192 millidarcies. In this area, when a well produces at

Formation	Fluid prod.	Range of prod. depth, ft.	Avg. prod. depth, ft.	Range of prod. thickness, ft.	Avg. prod. thickness, ft.	Range of perm. K mid	Avg. perm. K mid	Range of perm. A w mid	Avg. perm. A w mid	Range of porosity, %	Avg. porosity, %	Range of oil satn., %	Avg. oil satn., %	Range of total water satn., %	Avg. total water satn., %	Range of calc. nat. water satn., %	Avg. calc. nat. water satn., %	Range of grav. 'API	Avg. grav. 'API	
Aneth	O	5,100-5,300	5,200	3 8-23 1	14 0	0 7-34	9 35	0 2-23	6 10	4 4-10 5	8 1	14 5-35 9	25 0	12 5-30 5	23 6	13-31	24	41	41	
Boundary	O	5,500-5,600	5,600	8 -27 2 0	17 5	0 -2 0	1 05	0 2-33	12 5	4 3-6 5	4 7	4 7	4 7	23 8-35 0	29 4	23-35	29	41	41.1	
Butte	O	5,400-5,900	5,600	2 -68 13 7	13 3	0 -114	13 3	0 94	12 5	5 4-21 6	11 0	4 8-26 7	4 5	9 3-48 8	28 3	7-45	27	40-41	41.1	
Cliffhouse	O	3,600-5,800	4,800	2 -36 13 7	13 3	0 -114	13 3	0 94	12 5	7 0-16 2	11 3	0 -19 8	4 5	10 2-60 3	36 9	10-59	36	36	-42	38
D head	O	4,350-5,050	4,800	2 -33 15 0	19 2	0 -900	0 08	0 08	0 08	6 6-29 5	21 3	8 4-39 5	13 2	14 8-55 3	40 6	15-32	28	38	-43	40
D tail	O	3,500-7,100	5,700	2 -24 9 5	22 3	0 -186	22 3	33 0	33	7 3-19 6	11 2	0 -7 8	3 5	14 8-44 5	31 0	1-25	19	41	41	41
Dakota	O	3,400-7,200	5,600	4 -19 14 9	22 3	0 -186	22 3	33 0	33	5 0-23 3	11 2	13 8-16 8	15 2	14 8-24 7	19 2	1-25	19	31	39	39
Desert	O	5,400-5,500	5,500	11 6-18 3	14 9	0 -11	4 4	0 4-2 4	1 13	11 9-13 8	12 7	7 6-37 6	14 9	20 7-59 2	40 0	28-54	37	36	-42	39
Frontier sands	O	2,65-8,295	2,950	8 -100 5	105	0 -534	10 2	0 3-20	10 2	6 3-29 8	20 0	0 -23 6	3 7	17 2-76 3	35 7	20-54	34	36	-42	39
Gallup	O	1,500-6,900	5,000	5 -25 11 6	26 5	0 -324	26 5	0 3-20	10 2	8 5-20 8	13 3	0 -23 6	3 7	17 2-76 3	35 7	20-54	34	36	-42	39
Hermoda	O	5,000-6,400	4,600	2 -43 12 4	48 2	0 -1-3 2	0 7	0 1-3 2	0 7	6 9-23 1	12 5	8 5-43 7	23 3	14 2-45 2	32 0	12-45	32	41	41	41
Hermoda	O	4,900-7,700	5,600	5 -30 14 1	18 6	0 -91	45 0	45 0	45 0	5 5-16 5	10 2	0 -6 3	3 8	18 7-40 9	38 0	12-45	32	41	41	41
Hermoda	O	5,300-6,000	5,600	3 -38 2 15 0	7 32	0 -26	4 26	0 -26	4 26	2 7-17 9	10 3	3 9-29 1	10 8	18 7-40 9	38 0	12-45	32	41	41	41
Hoopa	O	4,800-7,100	5,500	3 -17 10 5	7 32	0 -26	4 26	0 -26	4 26	7 4-11 9	10 3	20 4-29 8	25 0	32 3-44 6	36 0	31-45	35	40	40	40
J sand	O	4,600-5,100	4,800	6 -18 13 3	8 63	0 -25	8 63	0 -25	8 63	6 6-14 8	19 6	8 8-46 5	13 9	14 5-45 1	27 5	6-42	20	36	-42	38
Madison lime	O	4,470-5,460	4,900	15 -62 25 0	17 95	0 -1,795	33 0	0 -25	8 63	8 9-32 7	19 6	8 8-46 5	13 9	14 5-45 1	27 5	6-42	20	36	-42	38
Menifee	O	3,400-6,200	4,900	41 -450 18 6	13	0 -1,400	13	0 -25	8 63	1 8-26 4	11 9	6 0-43 5	17 4	14 5-45 1	27 5	6-42	20	36	-42	38
Mesa Verde	O	5,200-5,700	5,400	7 -25 12 7	5 04	0 -1-20	5 04	0 -1-28	4 43	8 7-13 5	11 2	0 -3 5	3 3	14 5-68 4	42 0	15-43	27	21	6-30	26
Mesa Verde	O	1,500-6,100	4,700	2 -22 10 0	3 57	0 -1-17	3 57	0 -57	4 57	10 0-19 8	14 6	0 -6 8	3 3	14 5-68 4	42 0	15-43	27	21	6-30	26
Morrison	O	1,600-6,900	4,500	24 -54 4 0	60	0 -1,250	60	0 -57	4 57	9 9-25 5	17 5	5 0-26 0	13 1	14 5-68 4	42 0	15-43	27	21	6-30	26
Muddy	O	910-8,747	1,845	7 -75 20 0	173	0 -2,150	173	0 -57	4 57	2 3-32 9	22 3	7 6-48 5	30 8	14 5-68 4	42 0	15-43	27	21	6-30	26
Paradox	O	5,100-9,500	6,900	4 -44 2 12 2	11 6	0 -2-42	11 6	0 -57	4 57	1 4-19 4	7 4	0 -10 1	3 1	9 9-57 9	34 7	10-56	34	40	-43	41
Phosphoria (formerly Embury)	O	5,300-6,100	5,700	2 -66 14 8	10 4	0 -119	10 4	0 -57	4 57	3 3-21 8	10 5	3 6-38 7	12 4	10 8-60 5	33 6	10-61	33	40	-43	41
Picture Cliffs	O	700-10,500	4,600	5 -100 64	3 7	0 -126	3 7	0 -57	4 57	2 0-25 0	8 9	3 0-40 0	22 5	23 6-67 5	46 7	5-30	21	15	-42.3	25.4
Point Lookout	O	1,800-5,800	3,400	3 -43 16 8	1 12	0 -7 68	1 12	0 -57	4 57	8 5-25 5	15 7	0 -21 1	2 6	23 6-67 5	49 1	23-63	43	55	55	55
Point Lookout	O	4,300-6,500	5,500	2 -101 23 0	0 5	0 -16	0 5	0 -57	4 57	5 6-21 6	10 9	0 -9 1	2 9	11 9-55 6	36 7	12-55	49	39	39	39
Point Lookout	O	1,100-6,860	3,100	5 -100 44	2 90	0 -2,950	2 90	0 -57	4 57	15 0-25 0	19 0	8 0-25 0	17 0	20 4-9	25 7	20-49	35	22	-43	39
Sundance	O	600-11,800	4,700	10 -200 11 8	120	0 -2,950	120	0 -57	4 57	5 0-27 0	13 6	6 0-30 0	23 3	7 0-59	25 7	5-50	19	17	-58.5	26.2
Tensleep	O	1,400-5,100	4,600	4 -58 17 3	3 36	0 -31	3 36	0 -57	4 57	12 8-17 8	14 7	11 9-26 6	21 3	40 8-55	46 3	40-55	46	36	36	36
Toledo	O	1,400-5,100	4,600	4 -58 17 3	3 36	0 -31	3 36	0 -57	4 57	12 8-17 8	14 7	11 9-26 6	21 3	40 8-55	46 3	40-55	46	36	36	36

\* Not enough wells to justify range of variations.  
† Data limited to Big Horn Basin.

Figure 13. Rocky Mountain Area Typical Core Analysis of Different Formations (from Frick, pg. 24-13, Table 24-9). Reprinted with permission from the Society of Petroleum Engineers of A. I. M. E., copyright 1962, Dallas, Texas.

greater rates than surrounding wells or produces where there is 0 net feet of sand greater than 8% porosity, the production is attributed to fracturing. Due to the lack of core data, and therefore a lack of permeability data, it is difficult to determine whether the latter may be attributed to differences in the expected and actual production.

A third factor to be considered is based on Arp's conclusions as stated earlier. Being that the present production techniques are not adequate for the conservation of oil from this area.

There are many other factors that can be attributed to the large differences seen in the expected versus the actual production from this area.

#### CONCLUSIONS AND SUGGESTIONS

At the present time, the author proposes that the more conservative values, those determined by declined curve analysis, be assumed correct until either future production records can be incorporated and/or when a one-well decline curve can be analyzed or until additional production technique studies can be undertaken.

With reference to secondary and tertiary recovery, it is the author's belief that until more reasonable values are assigned, it would be futile to assess those values. At present, it appears that some type of secondary gas injection project would be best suited to enhance the future recovery in this area. As new production techniques are adapted, and more efficient secondary and tertiary recovery projects are established, this approach may change. Reasonable values for tax revenue expected from this area are also not feasible

at this time for the same reason stated above.

It has been proposed to the Colorado Oil and Gas Conservation Commission that the production for Krauthead, Baseline, and Horse Creek fields be combined, as they are all considered one reservoir. This will aid the production staff and also any future studies for these fields. Finally, the author proposes to suspend further study into this area for a period of six months, at which time an update will be undertaken to determine if more reasonable values can be assigned at that time.

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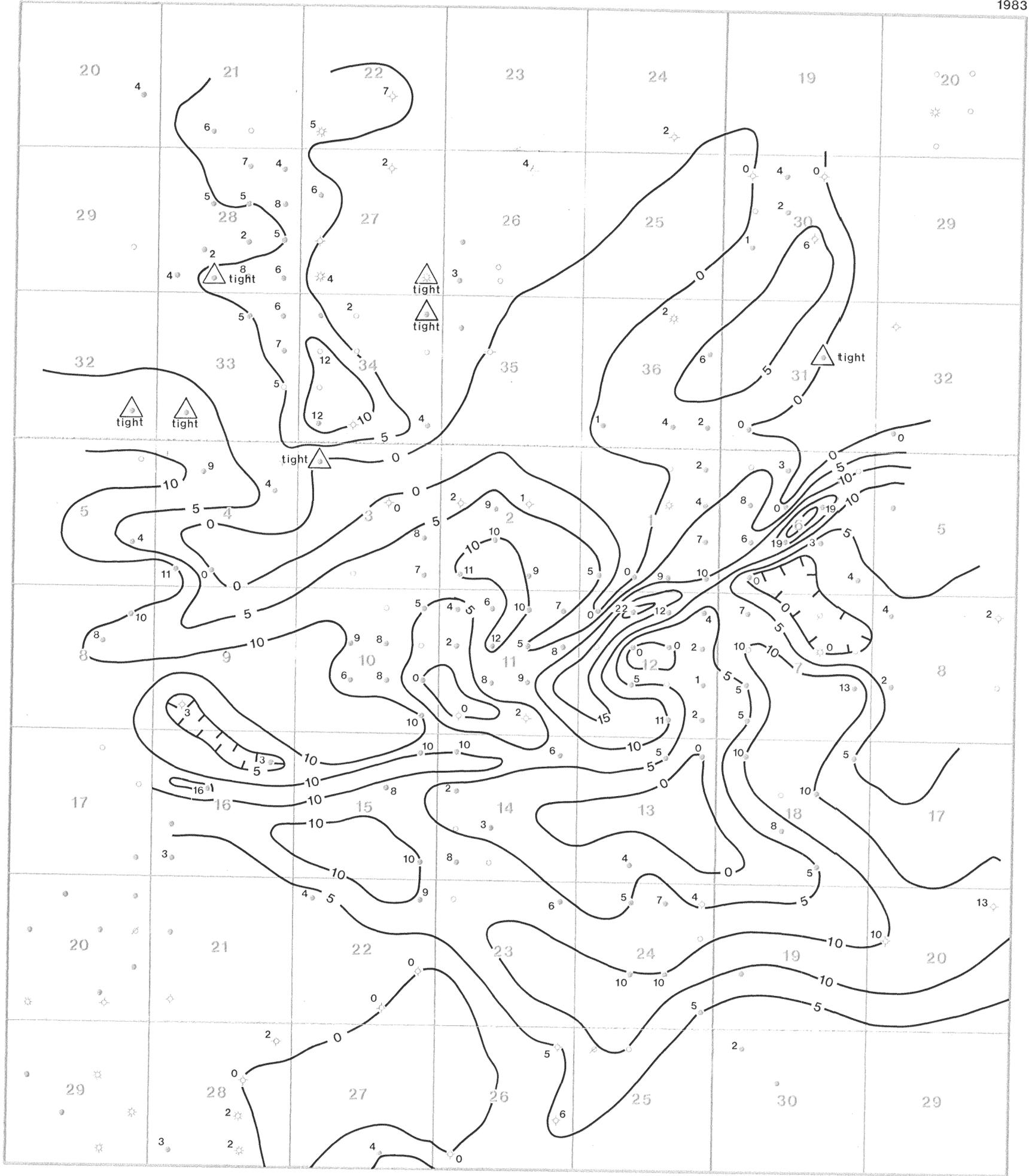
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ISOPACH MAP OF NET POROUS "D" SAND OF KRAUTHEAD-BASELINE FIELD AREA  
 (>8% POROSITY USING 2.68 GRAIN DENSITY)

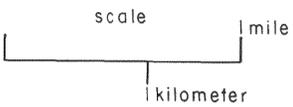
BY ANN SCANLON

COLORADO GEOLOGICAL SURVEY  
 DEPARTMENT OF NATURAL RESOURCES  
 JOHN W. ROLD, DIRECTOR

OPENFILE 83-3  
 PLATE I  
 1983



drafted by Anne Magee



EXPLANATION

- |                             |                    |
|-----------------------------|--------------------|
| 8 net porosity<br>(in feet) | ● oil well         |
| ● oil well location         | ☆ gas well         |
| — Isopach                   | ◇ dry hole         |
| C.I. 5'                     | ○ location         |
| △ confidential information  | ✕ abandon location |
| tight                       |                    |



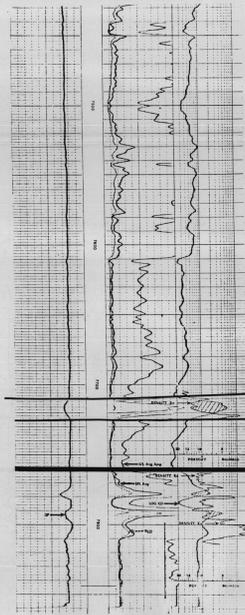
# KRAUTHEAD-BASELINE FIELD AREA, ADAMS AND WELD COUNTIES, COLORADO

STRATIGRAPHIC CROSS SECTION  
DATUM: J SILT

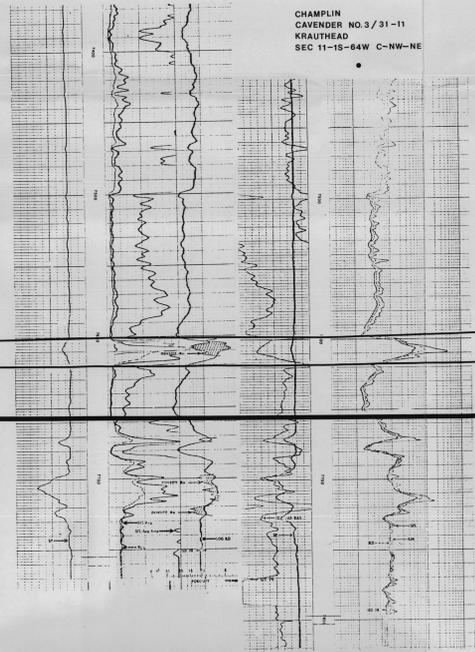
VERTICAL SCALE: 1" = APPROX. 40' HORIZONTAL SCALE: 8" = APPROX. 1 MILE

A

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KRAUTHEAD  
SEC. 10-15-64W C-SE-NW

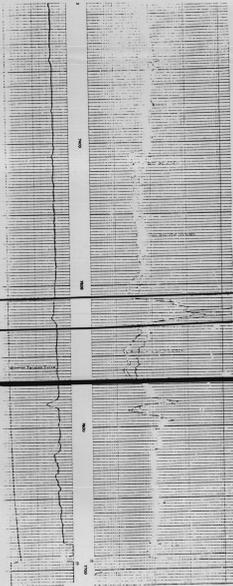


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SEC. 11-15-64W C-NW-NW

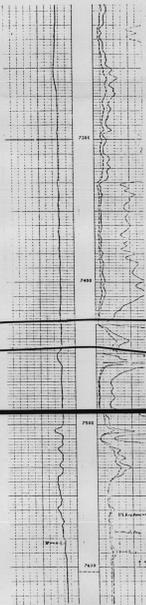


CHAMPLIN  
CAVENDER NO. 3/31-11  
KRAUTHEAD  
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AMOCO  
UPRR 60 PAN AM NO. 3C  
BASELINE  
SEC. 1-15 64W C-SE-SW



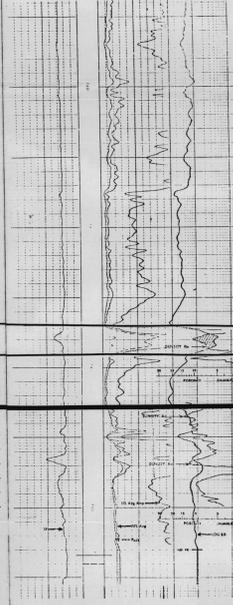
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FRANCES NO. 1  
BASELINE  
SEC. 6-15-63W C-NW-SW



M.G.F. CO.  
RIKA NO. 1  
BASELINE  
SEC. 6-15-63W C-NE-SW



HOUY CO.  
MAY 44-6  
BASELINE  
SEC. 6-15-63W C-SE-SE



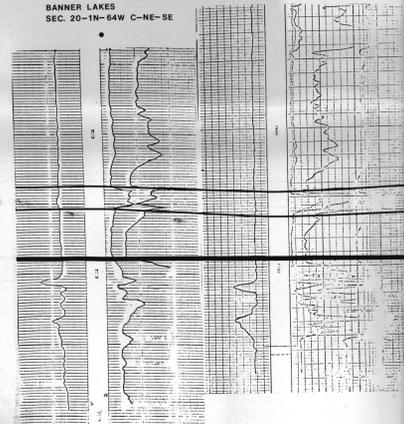
TOM VESSELS  
SAUTER NO. 1  
WILDCAT  
SEC. 8-15-63W C-NE-NE



TOP D SAND  
BASE D SAND  
J SILT MARKER

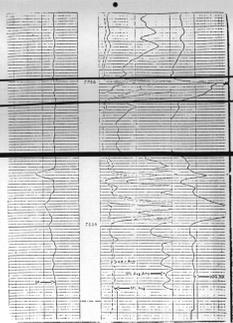
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DUNCAN  
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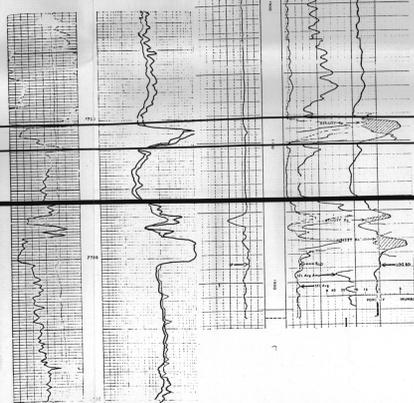


HOUY CO.  
UPRR AMBER NO. 24-21  
BANNER LAKES  
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GLORIA NO. 1  
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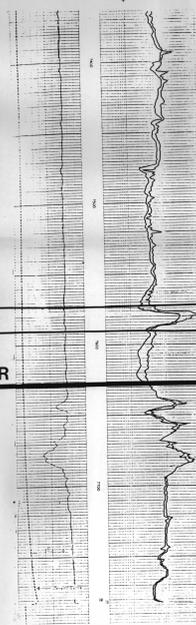
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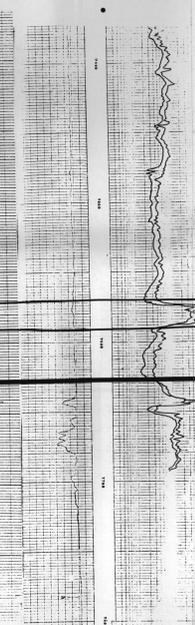
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OPAL NO. 1  
BANNER LAKES  
SEC. 34-1N-64W C-SW-SW



AMOCO  
VERNON RANDALL NO. 1  
KRAUTHEAD  
SEC. 2-15-64W C-SW-NW



AMOCO  
ABBOTT FARMS NO. 1  
KRAUTHEAD  
SEC. 2-15-64W C-SW-SE



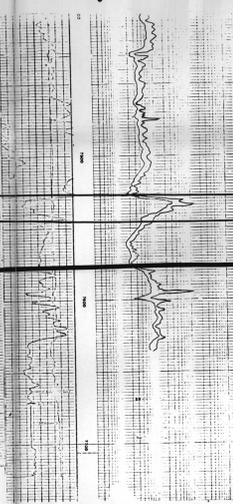
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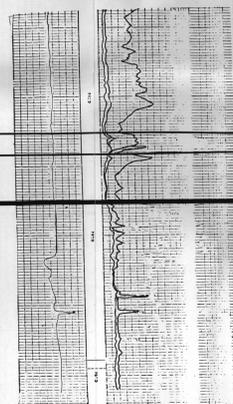
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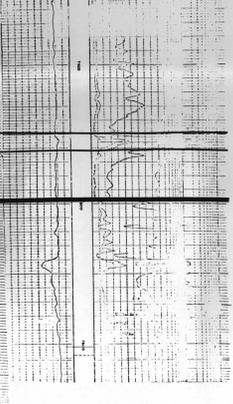
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HERBERT NO. 34-15  
BASELINE  
SEC. 18-15-63W C-SW-SE



WONDERLY CORP.  
ZEILER NO. 12 20  
WILDCAT  
SEC. 20-15-63W C-SW-NW



TOP D SAND  
BASE D SAND  
J SILT MARKER

A'

B'