OPEN FILE 84-11

ESTIMATED OIL AND GAS RESERVES FOR LA PLATA COUNTY, COLORADO

Compiled by
A. H. Scanlon

Funded by the Department of Local Affairs--
Division of Commerce and Development

Colorado Geological Survey
Department of Natural Resources
State of Colorado
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1984

Acknowledgments

I would like to thank the staff of the Colorado Oil & Gas Conservation Commission (C.O.G.C.C.) who provided considerable assistance during the course of this compilation, and the staff of the Colorado Geological Survey, who assisted in the manuscript preparation.

However, I assume full responsibility for any errors or omissions in these tabulations. Users of this OPEN-FILE REPORT could provide a significant service if they would inform the Colorado Geological Survey of any misinformation or omissions.

This project was completed by the staff of the Colorado Geological Survey as part of a grant from the Department of Local Affairs - Division of Commerce and Development.

A. H. Scanlon
Senior Geologist

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ESTIMATED OIL AND GAS RESERVES FOR LA PLATA COUNTY, COLORADO

Introduction

This report is the ninth* in a series of oil and gas reserve investigations undertaken for those counties in which oil and/or gas is currently being produced.

This study involves La Plata County, located in southwestern Colorado, partly within the northern San Juan Basin. La Plata County covers 1,691 square miles. In this county, oil and/or gas are produced from, in descending order of age, the Kirtland Shale, Fruitland Sandstone, Pictured Cliffs Sandstone, Sanastee Sandstone, Carlile Sandstone, Mancos Shale, Dakota Sandstone, Morrison Sandstone, Ismay Limestone, Paradox Limestone and Hermosa Carbonate.

There are 7 fields considered active producers as of September 30, 1983. Of these, one is classified as an oil field (Red Mesa) (based on cumulative gas-oil ratio (GOR) of <15:1), and 6 are classified as gas fields (based on cumulative GOR >15:1).

* Refer to:
OPEN-FILE REPORT 84-3: Estimated Oil and Gas Reserves for Washington County, Colorado;
OPEN-FILE REPORT 84-4: Estimated Oil and Gas Reserves for Rio Blanco County, Colorado.
OPEN-FILE REPORT 84-5: Estimated Oil and Gas Reserves for Adams County, Colorado;
OPEN-FILE REPORT 84-6: Estimated Oil and Gas Reserves for Weld County, Colorado;
OPEN-FILE REPORT 84-7: Estimated Oil and Gas Reserves for Arapahoe County, Colorado;
OPEN-FILE REPORT 84-8: Estimated Oil and Gas Reserves for Baca County, Colorado.
OPEN-FILE REPORT 84-9: Estimated Oil and Gas Reserves for Cheyenne County, Colorado; and
OPEN-FILE REPORT 84-10: Estimated Oil and Gas Reserves for Garfield County, Colorado.

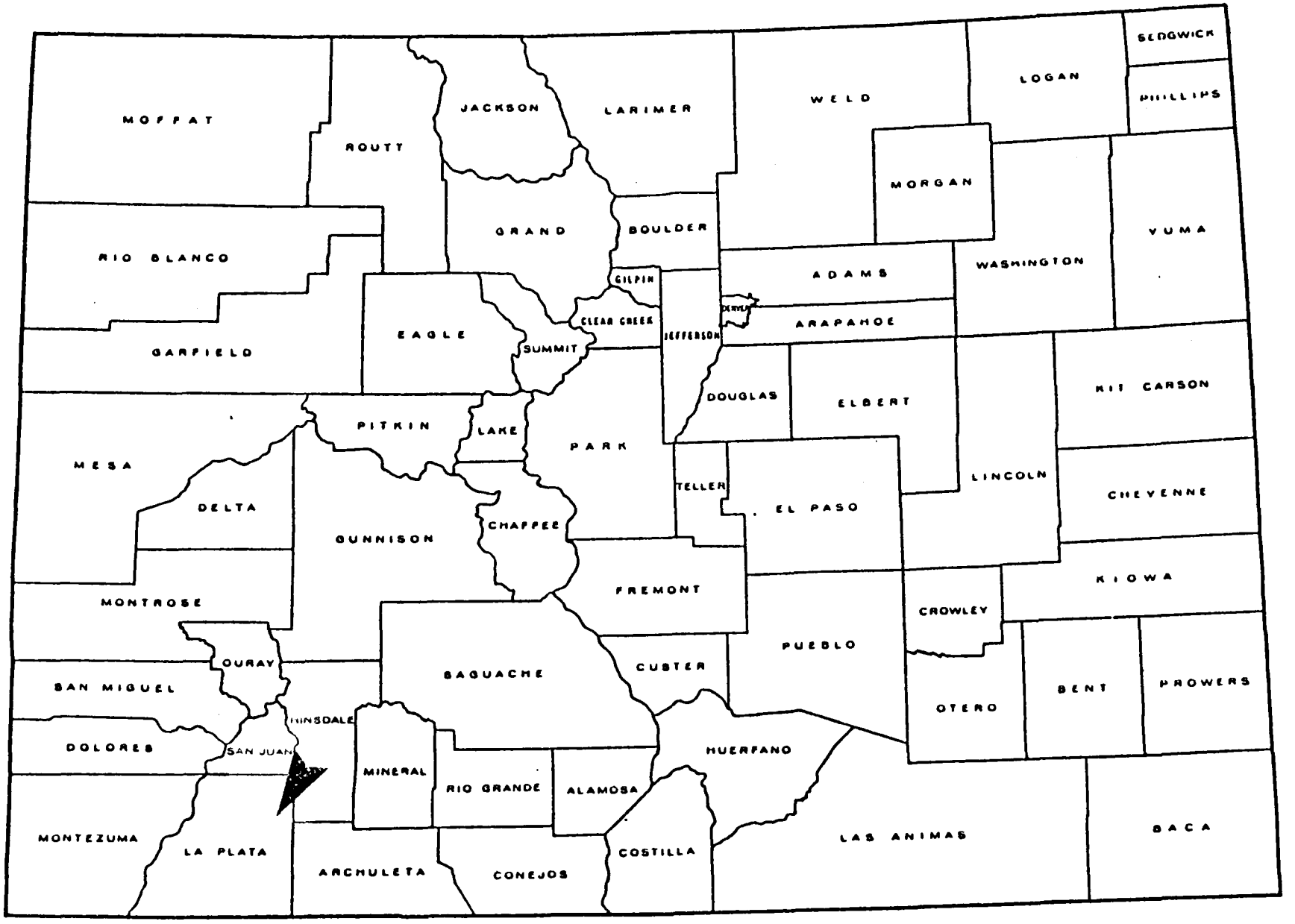

Figure 1. County Location Map

Method of Approach

Production decline curves are plotted for each currently producing horizon within each field, hereafter referred to as a field-horizon. There are 22 production decline curves plotted, one for each field-horizon. Production data were obtained from the C.O.G.C.C. annual production books. These books contain records of yearly production data, dating back to 1952. All production decline curves are plotted as rate (annual production in barrels of oil or MCF of gas) versus time (in years). The rate scale was adjusted to accommodate each field-horizon.

Oil Reserve Calculations

There are 4 oil field-horizons. Production histories have allowed for decline rates to be calculated for 3 of these. The remaining one oil field-horizon has been shut-in recently (9/83), therefore no estimated reserves could be calculated. For the previously mentioned 3 fields, decline rates were determined based on actual past production and recorded, see Table I. These decline rates were then applied to the equation:

$$Rr = \frac{q1 - qf}{-\ln (1-dy)}$$

where: Rr = remaining reserves
q1 = current annual production
qf = final economic production rate (see note below.)
-ln = negative natural log
dy = yearly decline rate (in percent)

The ultimate recoverable was then determined by adding the estimated reserves to the cumulative production. These values are listed in Table I.

Note: the final economic production rate used was one barrel of oil per day per well, for one year; therefore 365 barrels, multiplied by the number of wells needed to keep field production economic. In most cases this was one well. The number of wells used was determined at the discretion of the author.

For associated gas production, estimated reserves were calculated in the same manner as that described in the Gas Reserve Calculations section.

Gas Reserve Calculations

There are 18 gas field-horizons. Production histories have allowed for decline rates to be calculated for 10 of these. The remaining 8 field-horizons have not produced for a long enough time (less than 4 years) to determine a reliable decline rate with the exception of the Red Mesa-Mesaverde field-horizon. This field-horizon displays extremely erratic production, therefore no attempt was made to calculate reserves. Decline rates were determined for the previously mentioned ten field-horizons (see Table II) and applied to the equation:

$$S = \frac{a(1-r^n)}{1-r}$$

Where: S = gas reserves
a = current annual gas production
r = (1-dy) where dy = annual decline rate
n = number of years -- 20 years was used in all cases except where noted in the remarks column of Table II.

Results can be found in Table I.

For the associated oil or condensate production, where this production was significant, the same method to determine estimated oil reserves was used, as discussed in the previous section. Whether oil production was considered significant or not was determined by the author. In all cases, if oil production indicated any kind of trend, reserves were calculated. A few cases arose where oil production, though a trend was indicated, did not exceed the economic limit (as discussed previously) of one barrel of oil per day per year, and therefore no reserve estimate was calculated, or an economic limit of zero was used.

Results

The following figures are for those field-horizons for which reserves could be calculated. Estimated oil reserves for La Plata County totaled 2,165,219 barrels. Estimated gas reserves for La Plata County totaled 400,991,767 MCF. Note that the gas reserve calculations are based on a 20-year projection, therefore they do not account for gas production after the year 2002.

These figures also do not account for production increases due to secondary and/or tertiary recovery not already in progress, or account for undiscovered reserves, nor do they reflect changes in economics or demand.

In 15 to 16 years, roughly half of the estimated oil reserves in La Plata County will have been produced. Roughly one half of the estimated gas reserves for the next 20-year period are expected to be produced in eight to nine years.

In this county there are two classes of field-horizons: I) those with a long enough production history to calculate reserves with confidence, and II) those new field-horizons with essentially no production history, or for other reasons, reserves cannot be calculated.

To be able to calculate total county oil and gas reserves, it was necessary to apply the overall decline rates (4.4 percent per year for oil and 3.05 percent per year for gas) obtained from class I field-horizons to the current production from Class II field-horizons.

Using this approach on current production from Class II field-horizons (132,746 MCF of gas) additional reserves of 2,009,837 MCF of gas were obtained. This gives total county reserves (Class I and II) of 2,165,219 Bbls. of oil and 403,001,604 MCF of gas.

To insure that the reserve figures calculated for Class II are reasonable using this method, a comparison was made between the sources (producing horizons) of the Class I and Class II field-horizons. It was determined that there were differences in the sources of production for the two groups. As the gas production decline rate is quite low for the Class I field-horizons, and the Class II field-horizons are so young, the Class II reserve figure should be considered optimistic.

LIST OF ABBREVIATIONS USED IN TABLE OF RESERVE DATA

'a'	annual gas production
ABD.	abandoned
Approx.	approximate, approximately
Avg.	average, averaged
Bbls.	barrels
B.W.E.	Bottom Water Encrochment
calc.	calculate, calculated
Co.(s)	county (counties)
cond.	condensate
ck.	Creek
Cum.	cumulative
Dak.	Dakota Sandstone
Deplet.	Depletion
dy	annual decline rate
Econ.	Economic
Est.	Estimated
Exp.	Expansion
g	gas
Gas Exp.	Gas Expansion
G.C.E.	Gas Cap Expansion
G.E.	Gas Expansion
GOR	Gas-Oil Ratio
Inc.	Increase, increasing, increased
Inj.	Injection, injected
Lmtd.	Limited
MCF	Thousand cubic feet
Miss.	Mississippian
Mos.	Months
Mtn.	Mountain
N	North
N.P.	New Production or less than five years production, therefore, no reliable annual decline rate could be calculated to apply to the equations to calculate reserves.
No.	number, numbers, North
o	oil
P and A	Plug (ged) and Abandon (ed)
Poss.	Possible
Prod.	Production, produced
Proj.	Projection, projected
q	current annual production of oil
qf	final economic production of oil
react.	reactivated
Rr	Remaining reserves-oil
S	Remaining reserves-gas
S.G.D.	Solution Gas Drive
S.I.(SI)	Shut-in
So	South
W	West
W.D.	Water Drive
Yr or Yrs	Year or years

TABLE I
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RESERVE DATA FOR LA PLATA COUNTY

FIELD NAME/ PRODUCING HORIZON	LOCATION	DATE OF DISCOVERY	TYPE OF DRIVE	Dy	CUMULATIVE PRODUCTION 12/31/82		ESTIMATED RESERVES		ULTIMATE RECOVERABLE		REMARKS
					OIL (Bbls.) ()Condensate (Bbls.)	GAS (MCF)	OIL (Bbls.)	GAS (MCF)	OIL (Bbls.) ()Condensate (Bbls.)	GAS (MCF)	
1.Alkali Gulch/ Paradox	33&34N-12W	1958		6.7 -g		25,506,969	12,630,569			38,137,538	
2.Alkali Gulch West/Ismay	34N-12W	1982			57	46,076					N.P.
3.Barker Dome/ Paradox	32N-14W	1948		11.0 -g	(81,718)	99,045,719	7,362,557		(+81,718)	106,408,276	
4.Barker Dome-Hermosa/Ismay	32N-14W	1975		16.0 -g		248,569	153,536			402,105	
5.Cinder Buttes/ Dakota	32N-12W	1975		9.8 -g	(898)	189,236	113,032		(+898)	302,268	
6.Cinder Buttes/ Gallup	32N-12W	1975		11.7 -g		38,997	13,026			52,023	
7.Ignacio Blanco/ Dakato-Morrison-Dakota	32-34N -	1953				210,292,624	103,035,197			313,327,821	Also prod. in Archuleta Co.
8.Ignacio Blanco/ Fruitland-Pictured Cliffs	32-34N - 6-11W	1954		5.4 -g	(18,081)	45,902,744	34,455,699		(+18,081)	80,358,443	
9.Ignacio Blanco/ Gallup	32-34N - 6-11W	1981				34,326					N.P.
10.IgnacioBlanco/ Kirtland	32-34N - 6-11W	1981				5,160					N.P. SI 9/83
11.IgnacioBlanco/ Lewis	32-34N - 6-11W	1969		17.0 -g		2,590,244	118,052			2,708,296	Used Actual 1983 Prod. thru 9/83 for 'a'.
12.IgnacioBlanco/ Mesaverde	32-34N - 6-11W	1955		2.5 -g	(5,841)	465,634,462	241,176,286		(+5841)	706,810,748	
13.IgnacioBlanco/ Niobrara	32-34N - 6-11W	1982				12,501					N.P.
14.IgnacioBlanco/ Sanastee	32-34N - 6-11W	1983	NOTE: Cumulative Prod. is thru 9/83			1,795					N.P.
15.IgnacioBlanco/ Mesaverde-Dakota	32-34N - 6-11W	1968		7.0 -g		1,725,714	1,609,192			3,334,906	
16.IgnacioBlanco/ Mesaverde-Pictured Cliffs	32-34N - 6-11W	1980			(40)	276,499					N.P.
17.IgnacioBlanco/ Dakota-Sanastee-Mesaverde	32-34N - 6-11W	1983	NOTE: Cumulative Prod. is thru 9/83			2,555					N.P.

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LA PLATA COUNTY

FIELD NAME/ PRODUCING HORIZON	LOCATION	DATE OF DISCOVERY	TYPE OF DRIVE	Dy	CUMULATIVE PRODUCTION 12/31/82 OIL (Bbls.) ()Condensate (Bbls.)	GAS MCF	ESTIMATED RESERVES OIL (Bbls.)	GAS (MCF)	ULTIMATE RECOVERABLE OIL (Bbls.) ()Condensate (Bbls.)	GAS (MCF)	REMARKS
18.Red Mesa/ Carlisle	32&33N - 11&12W	1924			1,403						SI 1953 AND 9/83.
19.Red Mesa/ Dakota	32&33N - 11&12W	1953		4.2 -o 10.5 -g	431,654	532,578	1,663,788	324,073	2,095,442	856,651	Econ.Limit= 11 wells.
20.Red Mesa/ Gallup	32&33N- 11&12W	1958		3.5 -o 4.5 -g	385,371	49,268	452,295	548	837,666	49,816	Econ.Limit= 3 Wells
21.Red Mesa/ Mancos	32&33N- 11&12W	1924		6.9 -o	42,200		49,136		91,336		
22.Red Mesa/ Mesaverde	32&33N- 11&12W	1964				300,095	Production from this field-horizon is erratic throughout its history, therefore no reasonable decline rate can be established. See text.				
COUNTY TOTAL OF ESTIMATED RESERVES							2,165,219 Bbls.	400,991,767 MCF			

Reference List

Colorado Oil and Gas Conservation Commission Production Records and Injected Fluids - Water and/or Gas-File.

Crouch, M.C., III, editor, 1982 Oil and Gas Fields of Colorado, Nebraska and Adjacent Areas: Rocky Mountain Association of Geologists, vols. I and II, 791 pp.

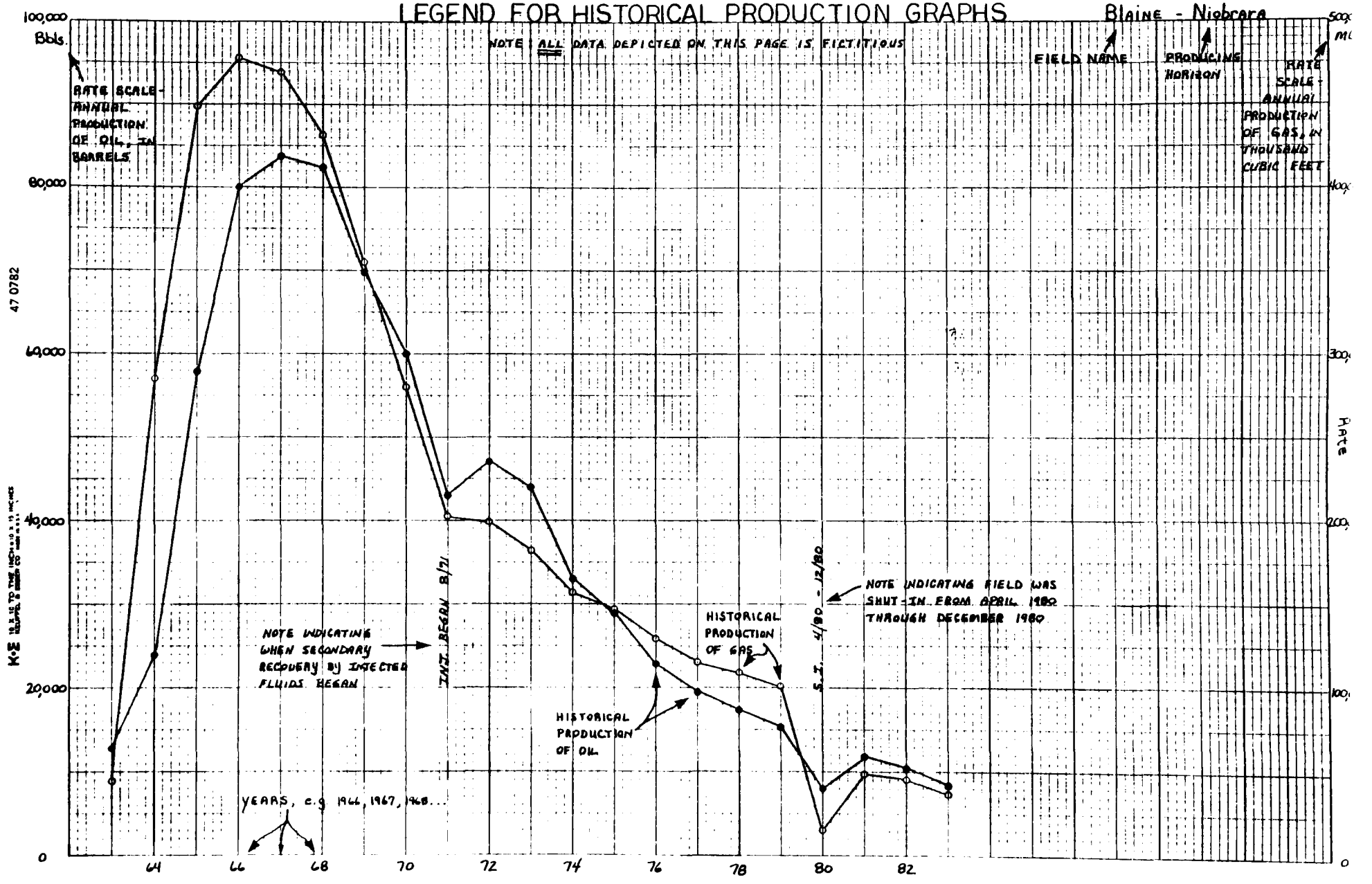
Haun, J.D., Cardwell, A.L., Herrod, W.H. and Cronoble, J.M., 1976. Oil and Gas Reserves of Colorado in Colorado School of Mines Research Institute, Mineral Industries Bulletin, v. 19, #5.

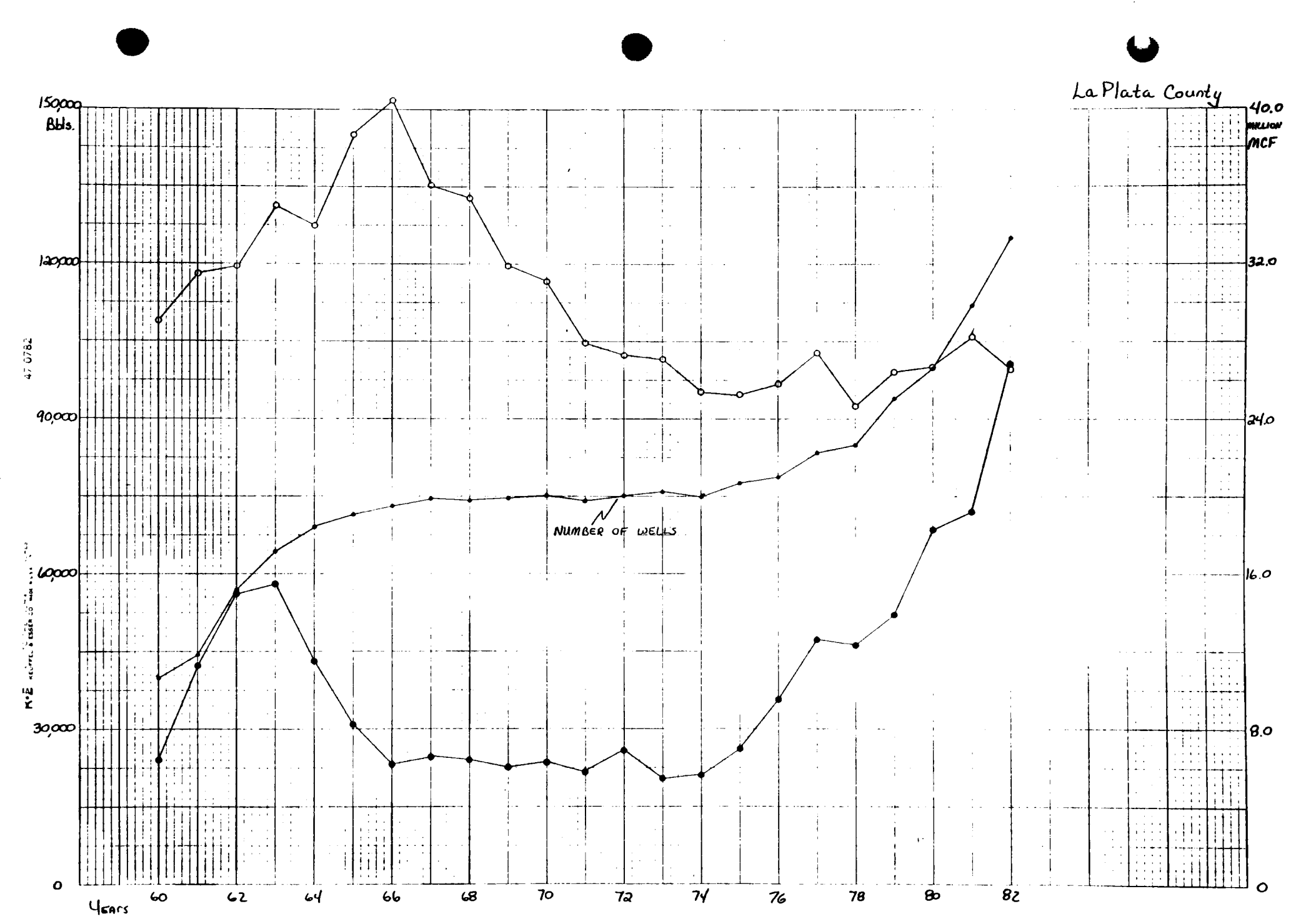
Parker, J.M., editor, 1961 Oil and Gas Field volume: Colorado-Nebraska: Rocky Mountain Association of Geologists, 389 pp.

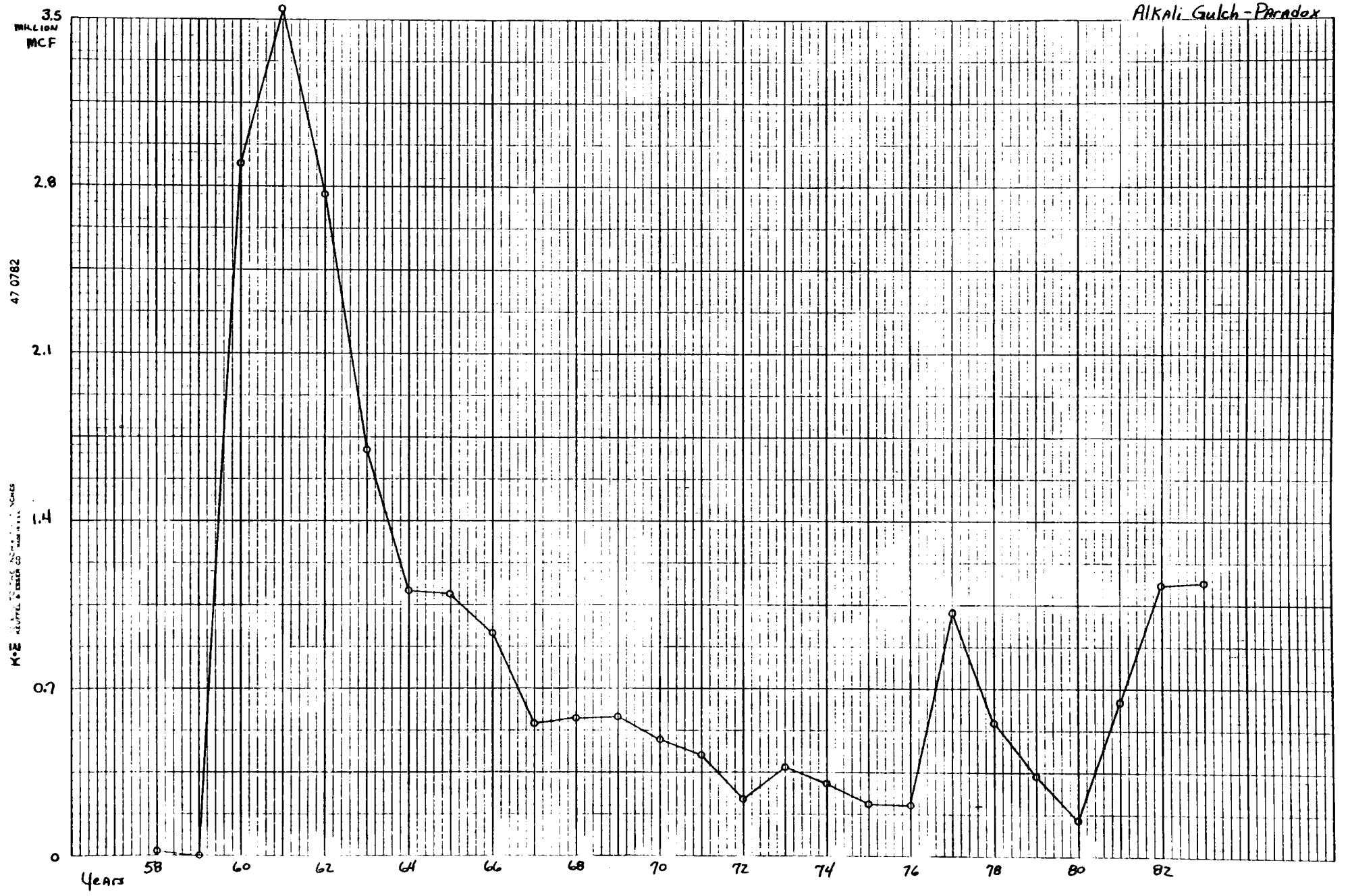
Appendix I

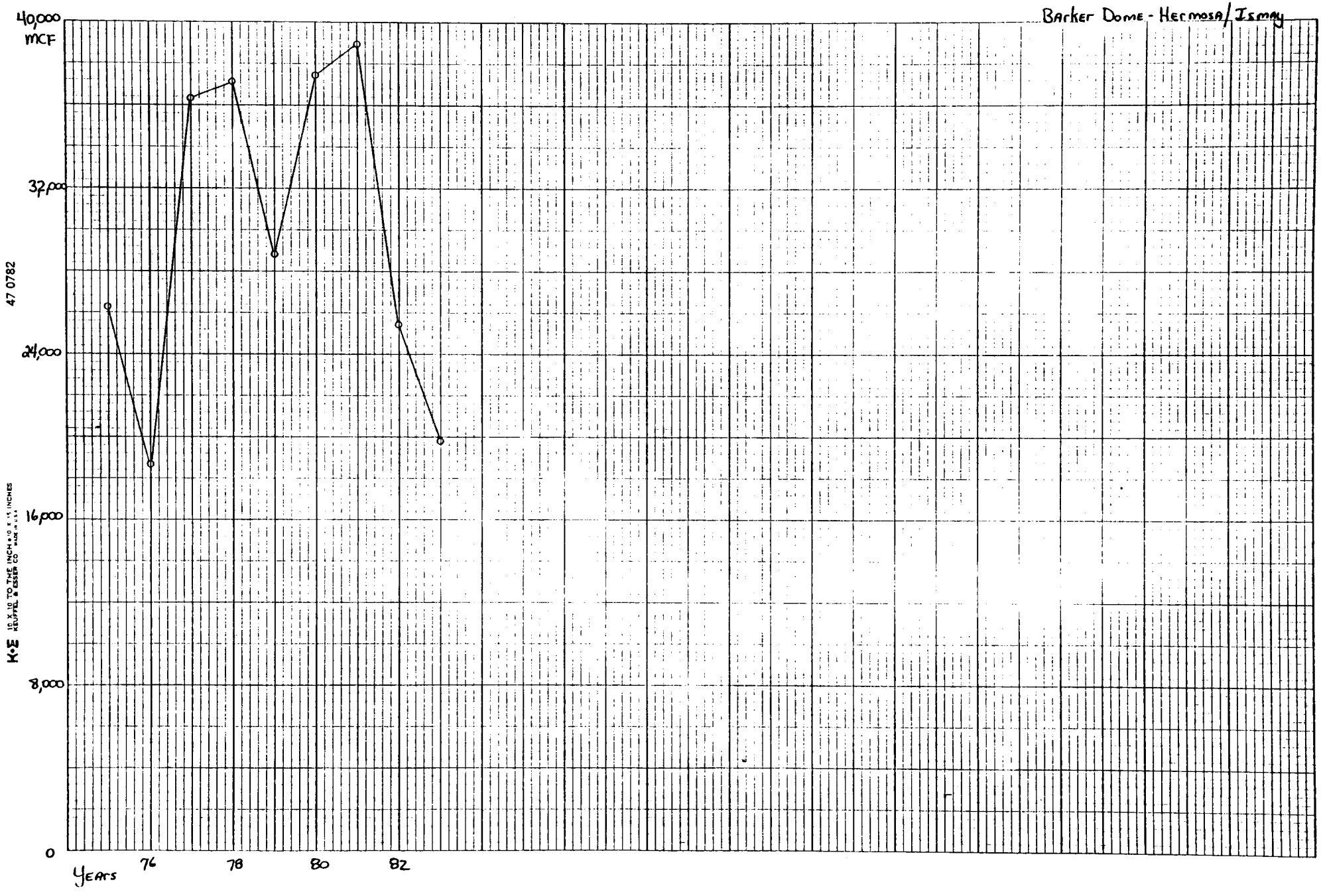
Historical production decline curve graphs for La Plata County. These graphs are presented in alphabetical order by Field name and then by producing horizons within each field.

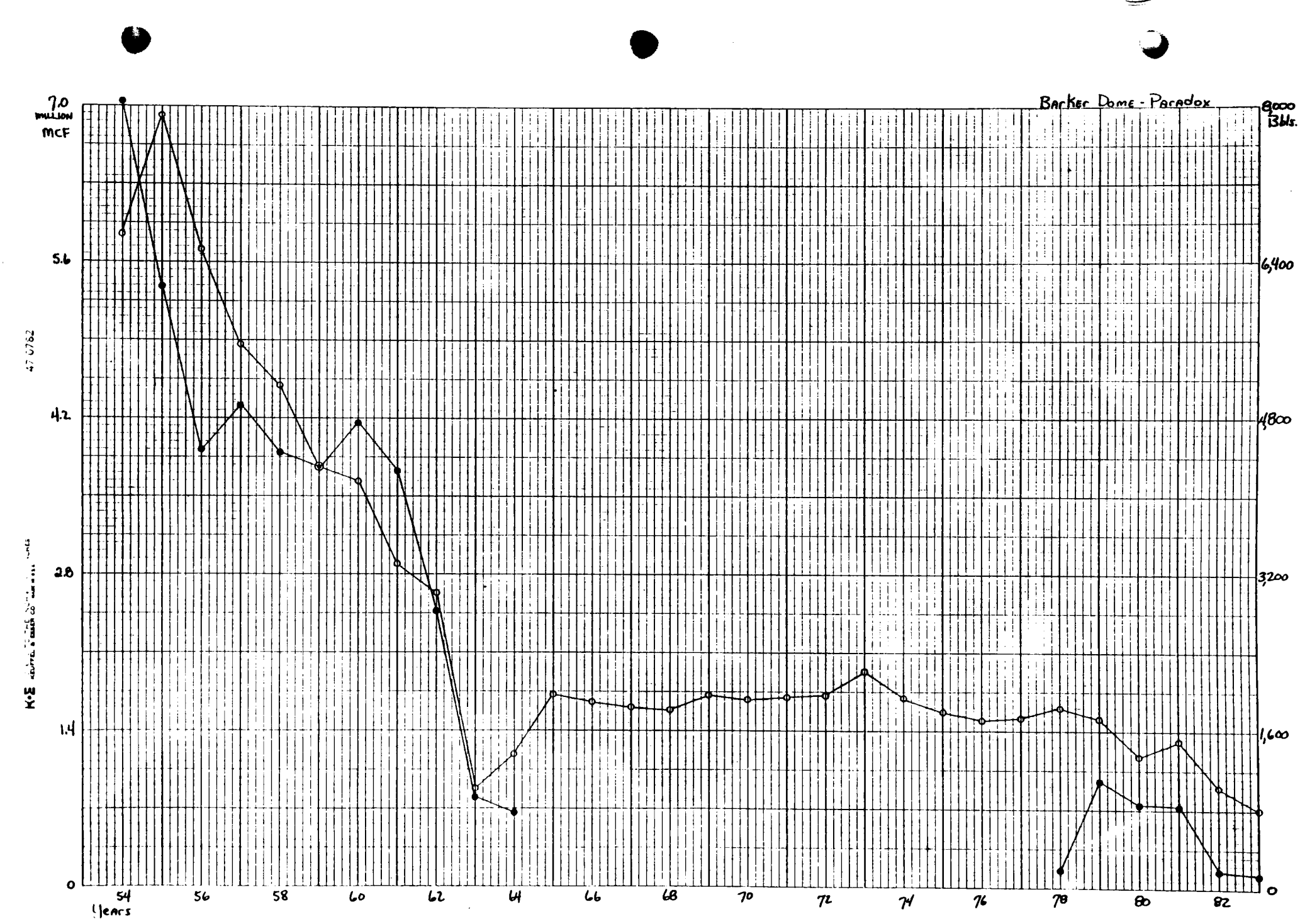
Note that only those fields actively producing as of 9-30-83 are included. Abandoned fields or field-horizons are not included.

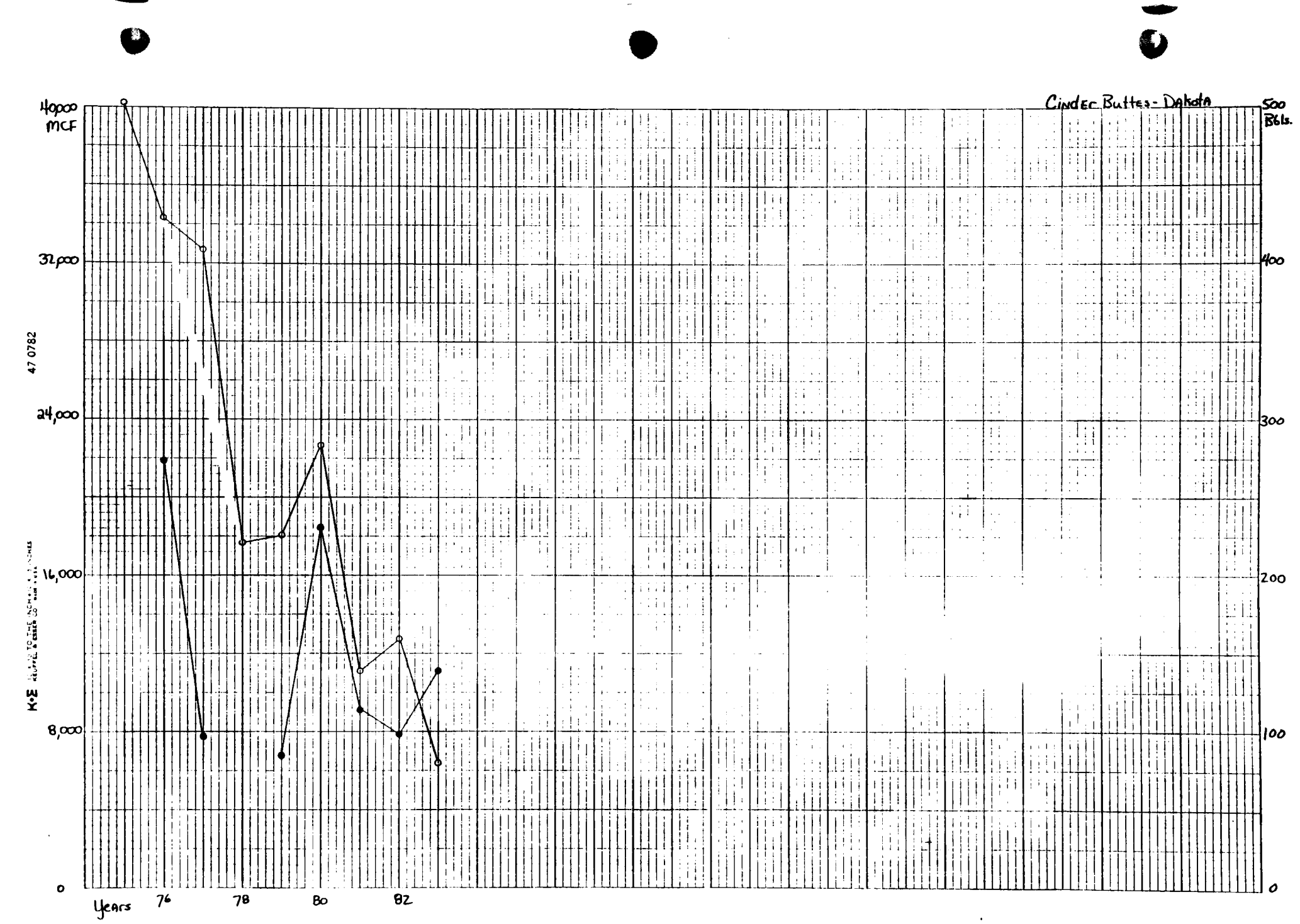

LEGEND FOR HISTORICAL PRODUCTION GRAPHS
Blaine - Niobrara
NOTE: ALL DATA DEPICTED ON THIS PAGE IS FICTITIOUS
FIELD NAME
PRODUCING HORIZON
RATE SCALE - ANNUAL PRODUCTION OF GAS, IN THOUSAND CUBIC FEET
RATE SCALE - ANNUAL PRODUCTION OF OIL, IN BARRELS
100,000 Bbls.
80,000
60,000
40,000
20,000
0
500
400
300
200
100
0
Rate
47 0782
K+E
64
66
68
70
72
74
76
78
80
82
YEARS, e.g. 1966, 1967, 1968...
NOTE INDICATING WHEN SECONDARY RECOVERY BY INJECTED FLUIDS BEGAN
INJ. BEGAN 8/71
HISTORICAL PRODUCTION OF OIL
HISTORICAL PRODUCTION OF GAS
S.I. 4/80 - 12/80
NOTE INDICATING FIELD WAS SHUT-IN FROM APRIL 1980 THROUGH DECEMBER 1980

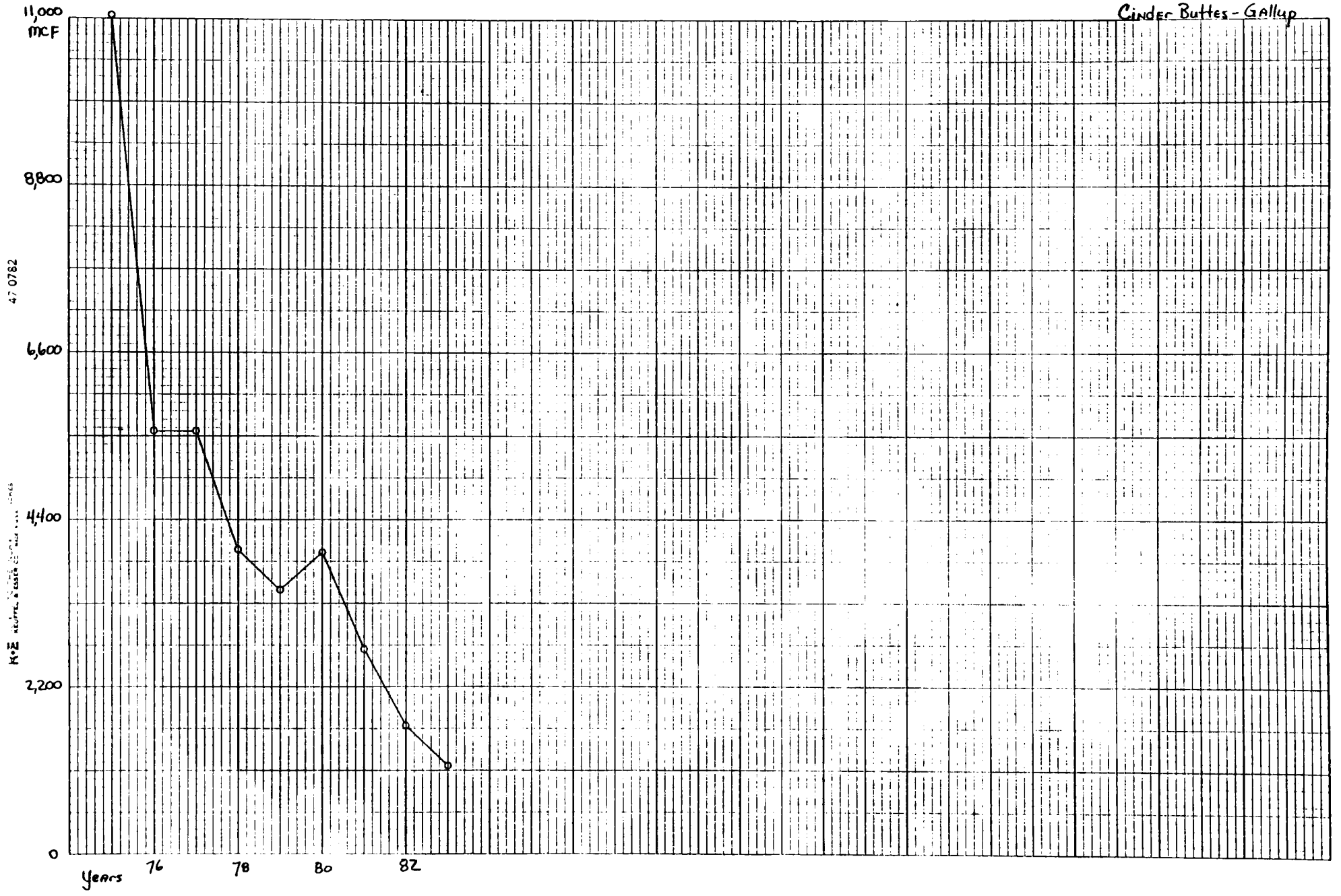

La Plata County
150,000
Bbls.
120,000
90,000
60,000
30,000
0
40.0
MILLION
MCF
32.0
24.0
16.0
8.0
0
NUMBER OF WELLS
YEARS
60
62
64
66
68
70
72
74
76
78
80
82

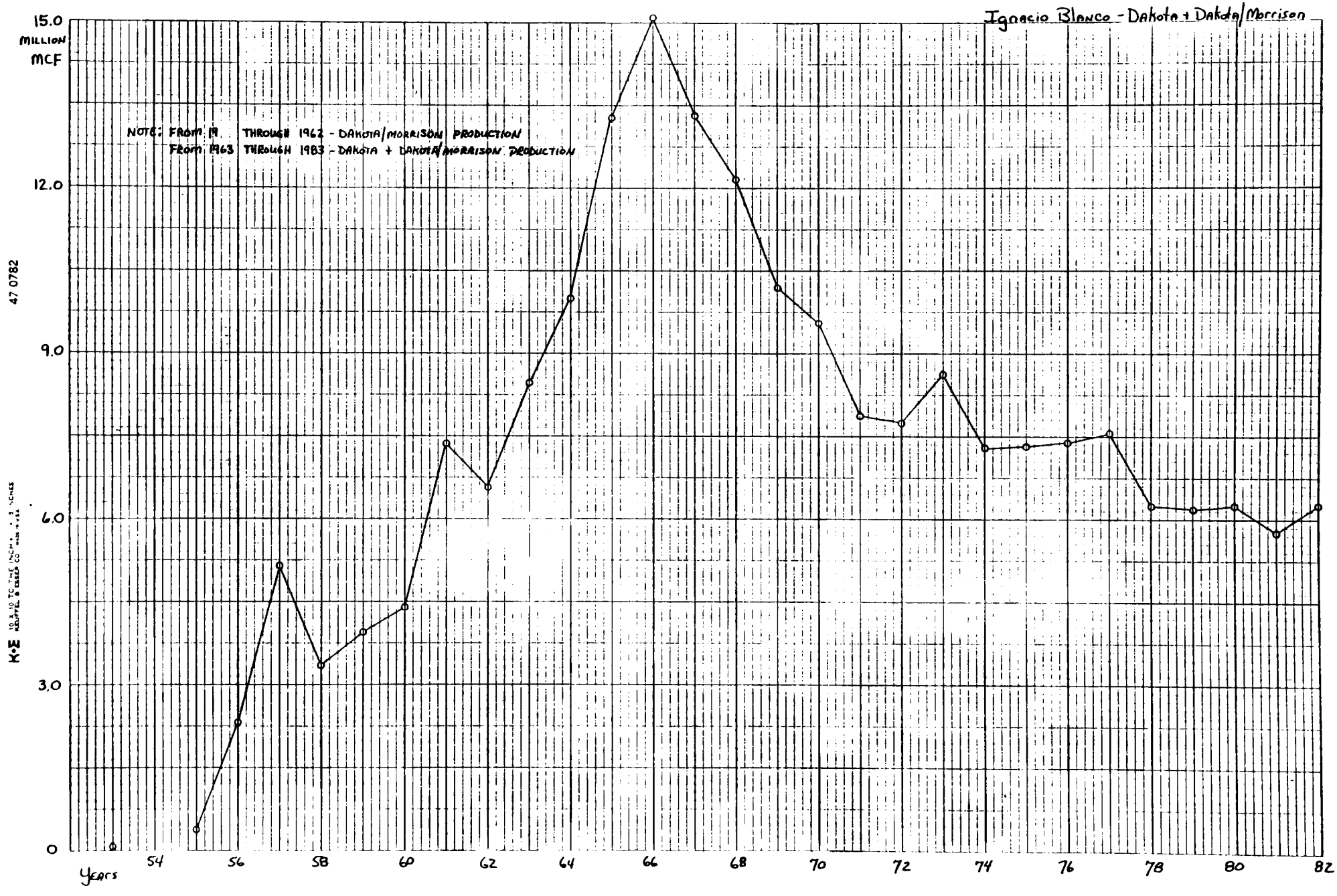

Alkali Gulch - Paradox
3.5
MILLION
MCF
2.8
2.1
1.4
0.7
0
Years
58
60
62
64
66
68
70
72
74
76
78
80
82

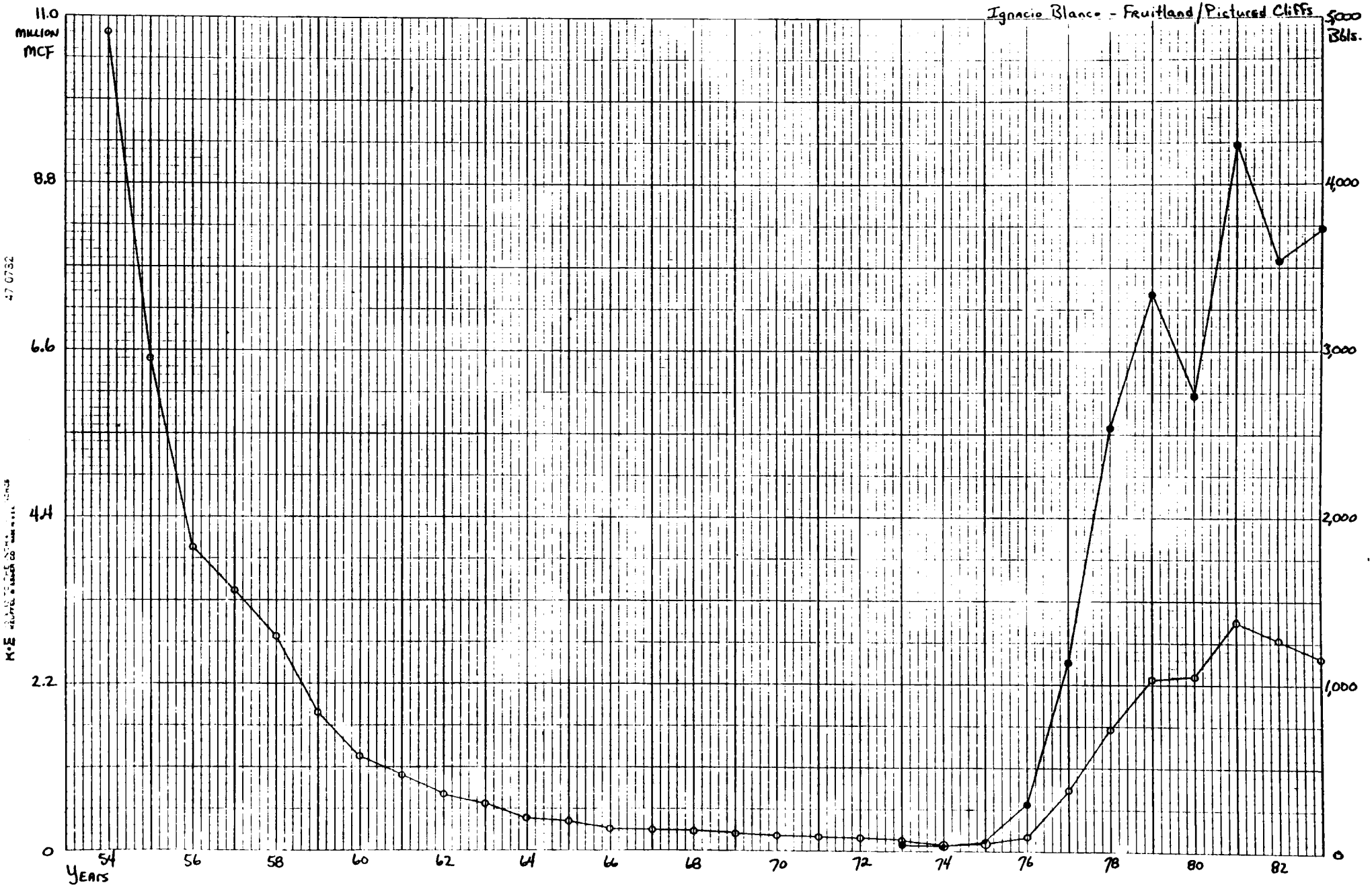

Barker Dome - Hermosa/Ismay
40,000
MCF
32,000
24,000
16,000
8,000
0
Years
76
78
80
82
47 0782
K•E 10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO.


Barker Dome - Paradox
7.0
MILLION
MCF
5.6
4.2
2.8
1.4
0
9000
Bbls.
6,400
4800
3200
1,600
0
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
Years

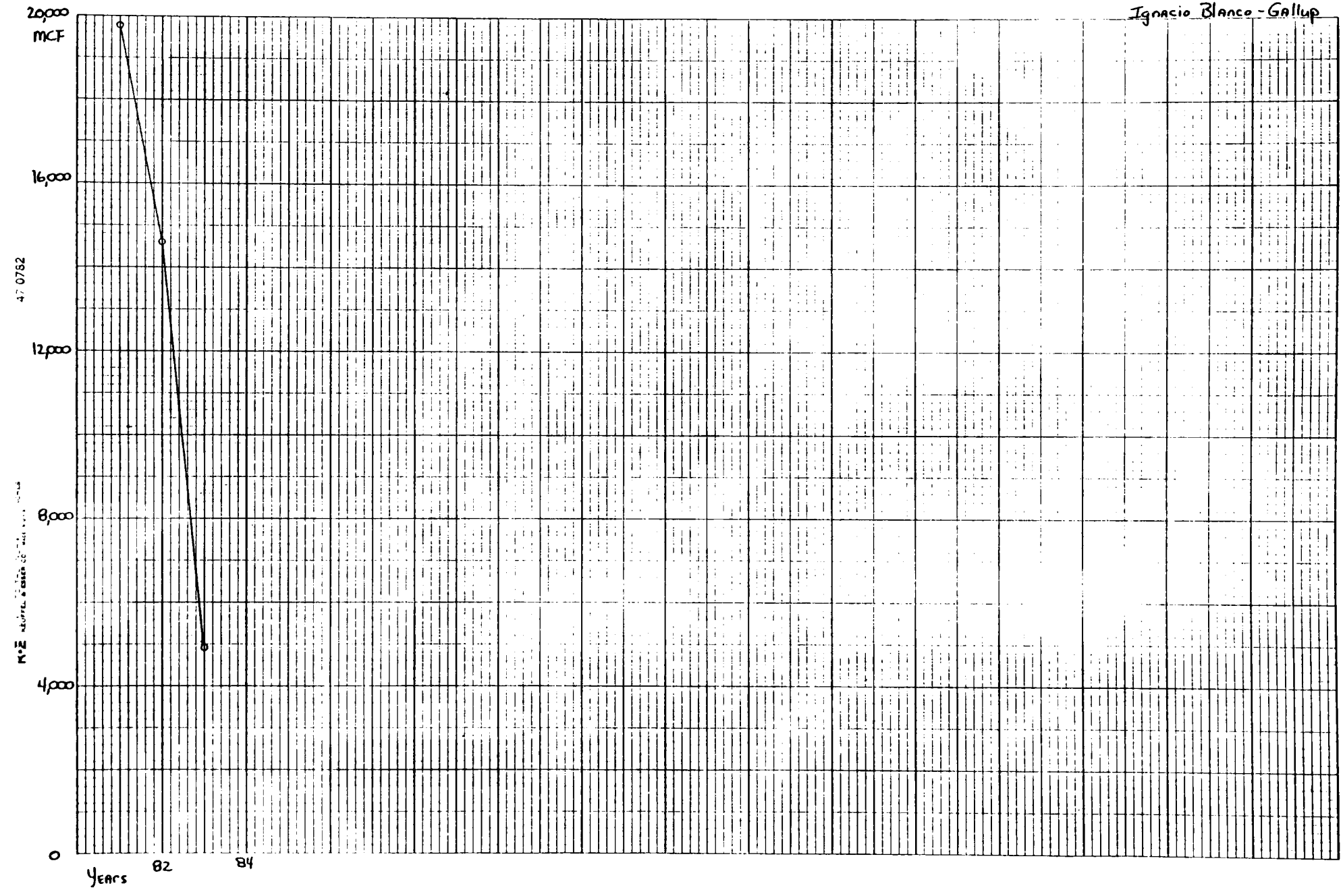

Cinder Buttes - Dakota
40000 MCF
32,000
24,000
16,000
8,000
0
500 Bbls.
400
300
200
100
0
Years
76
78
80
82
47 0782
K&E


Cinder Buttes - Gallup
11,000
MCF
8,800
6,600
4,400
2,200
0
Years
76
78
80
82
47 0782

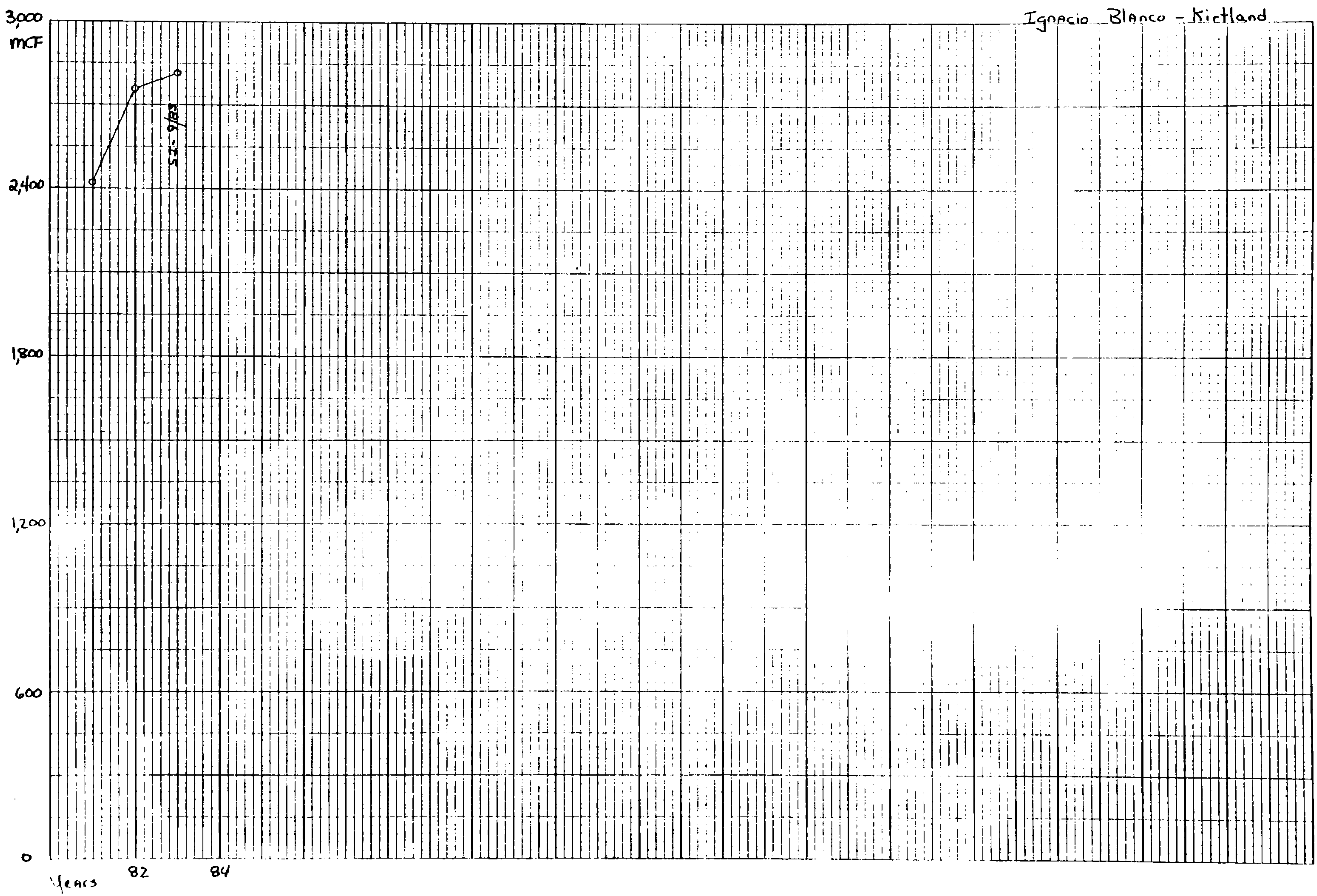

Ignacio Blanco - Dakota + Dakota/Morrison
15.0
MILLION
MCF
12.0
9.0
6.0
3.0
0
NOTE: FROM 19 THROUGH 1962 - DAKOTA/MORRISON PRODUCTION
FROM 1963 THROUGH 1983 - DAKOTA + DAKOTA/MORRISON PRODUCTION
47 0782
K·E
Years
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82

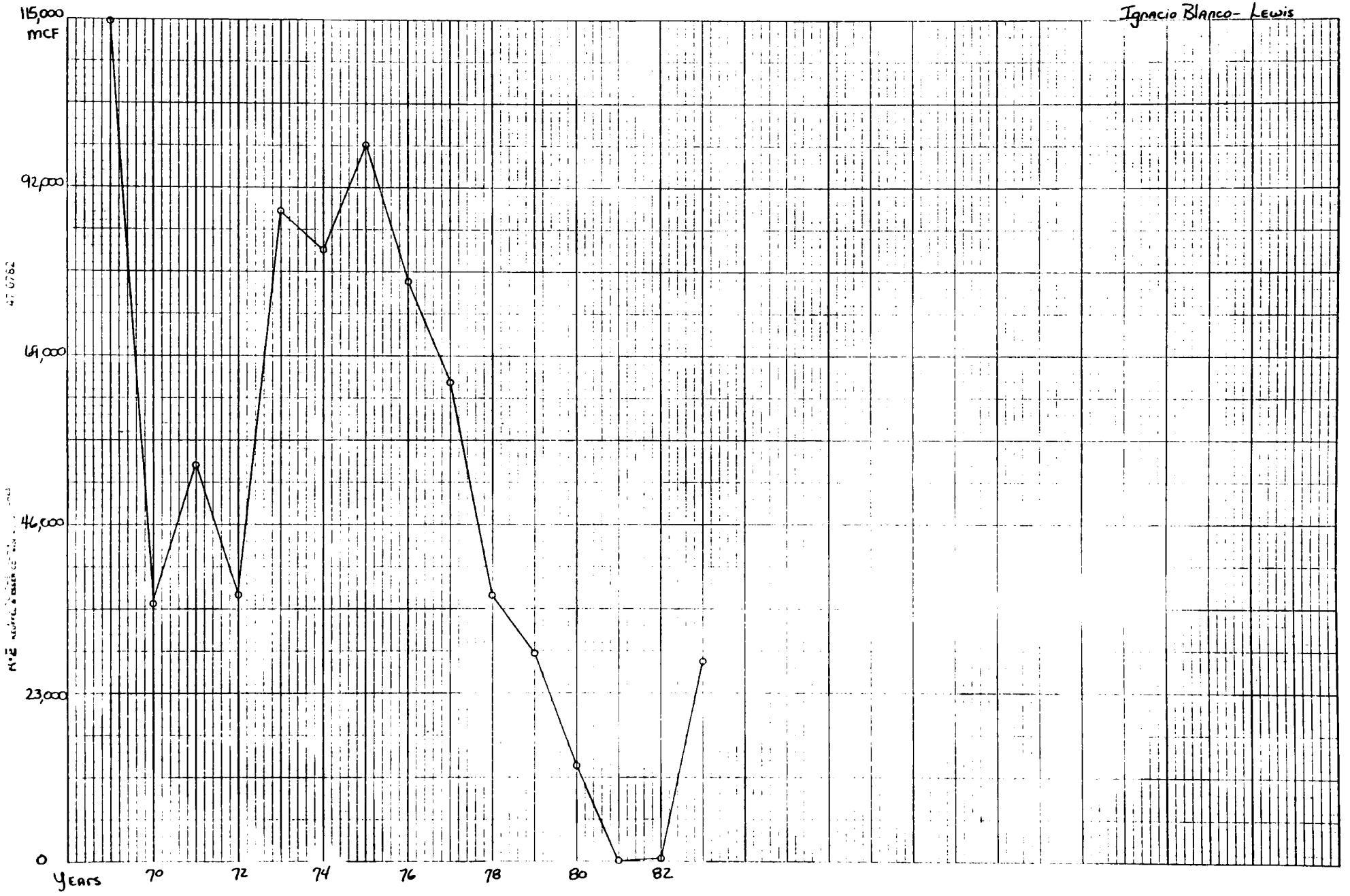

Ignacio Blanco - Fruitland/Pictured Cliffs
11.0
MILLION MCF
8.8
6.6
4.4
2.2
0
5000 Bbls.
4,000
3,000
2,000
1,000
0
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
YEARS

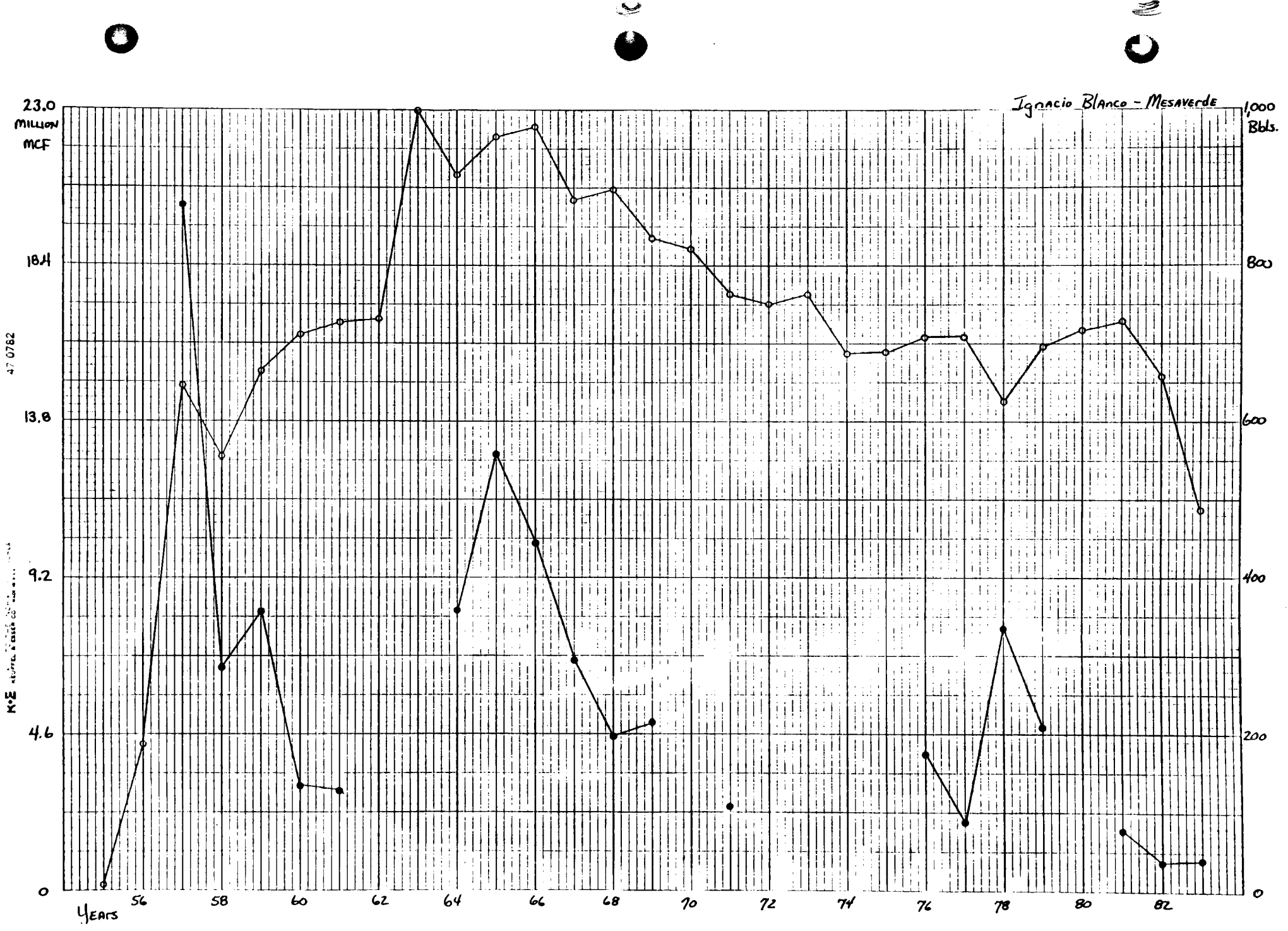
Ignacio Blanco - Gallup



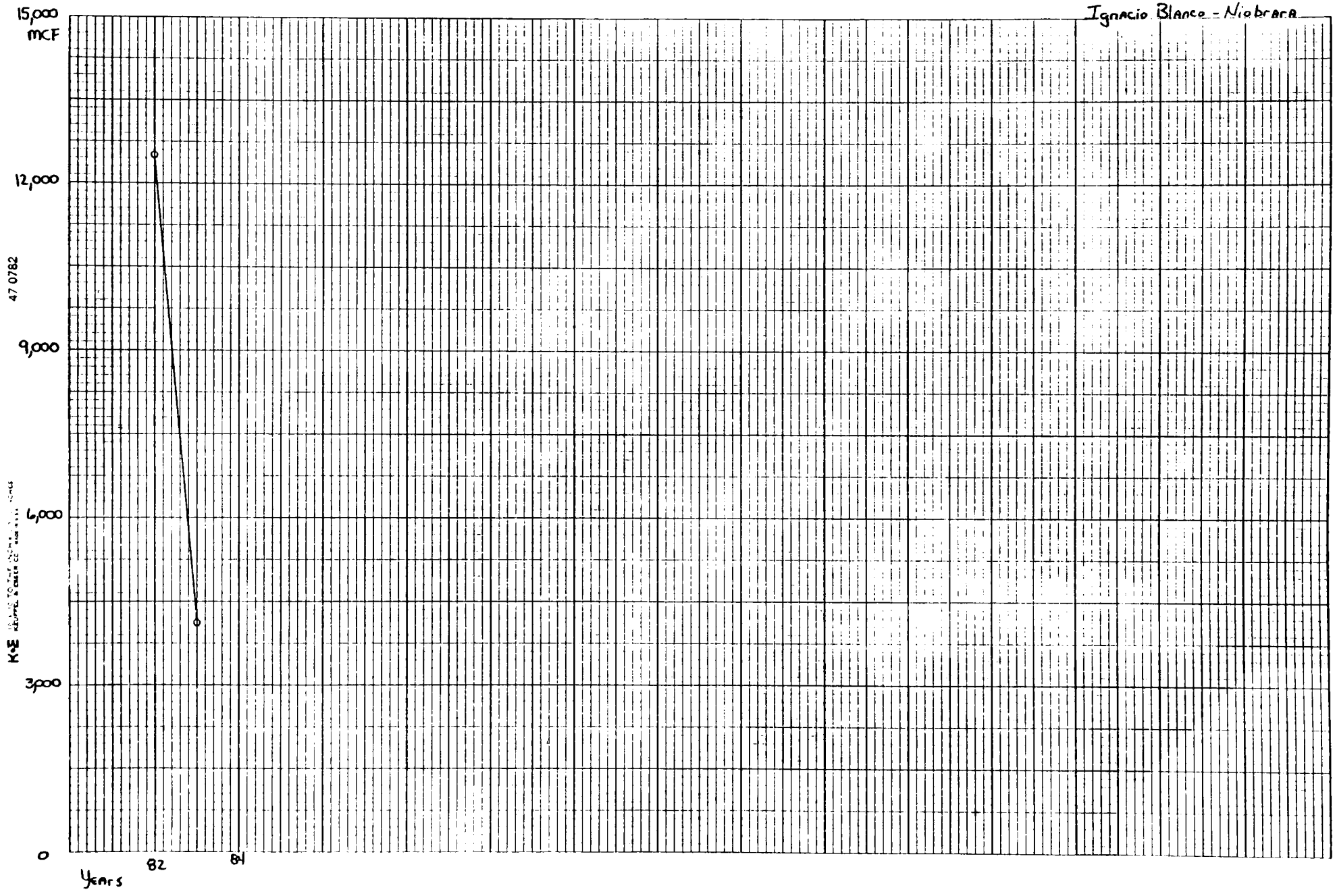
47 0782

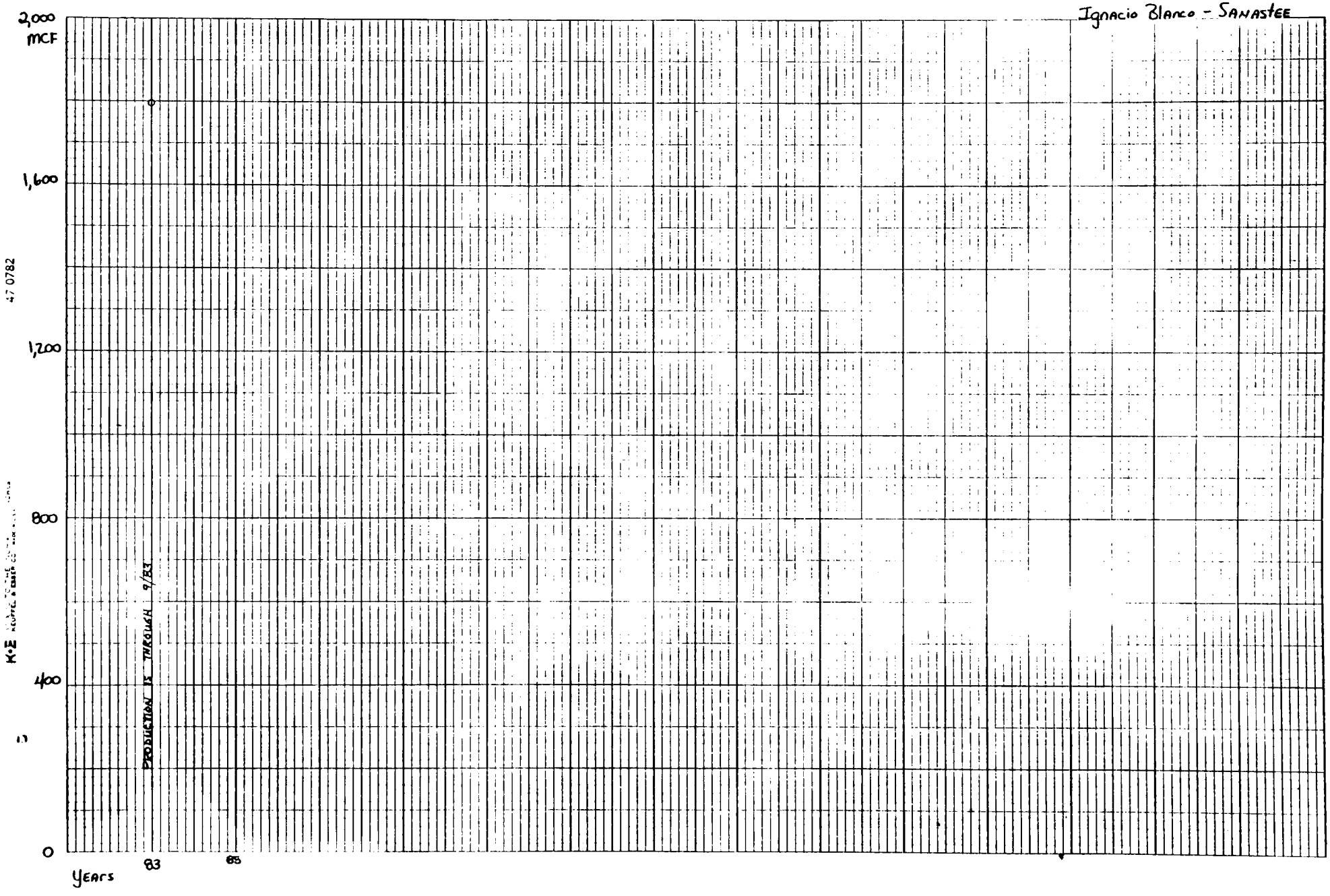

Ignacio Blanco - Kirtland
3,000
MCF
2,400
1,800
1,200
600
0
Years
82
84
SI - 9/83

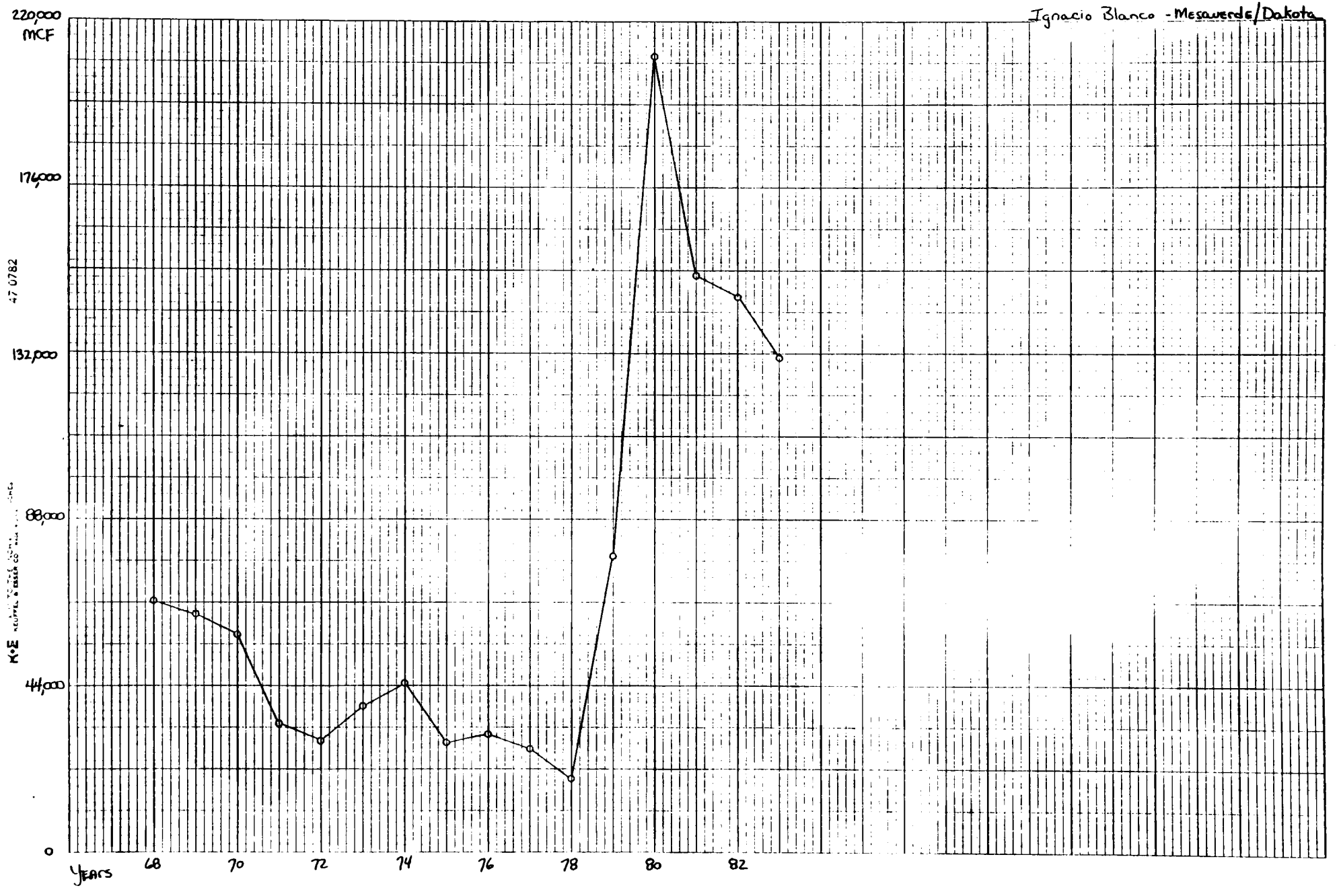

Ignacio Blanco- Lewis
115,000
MCF
92,000
69,000
46,000
23,000
0
Years
70
72
74
76
78
80
82

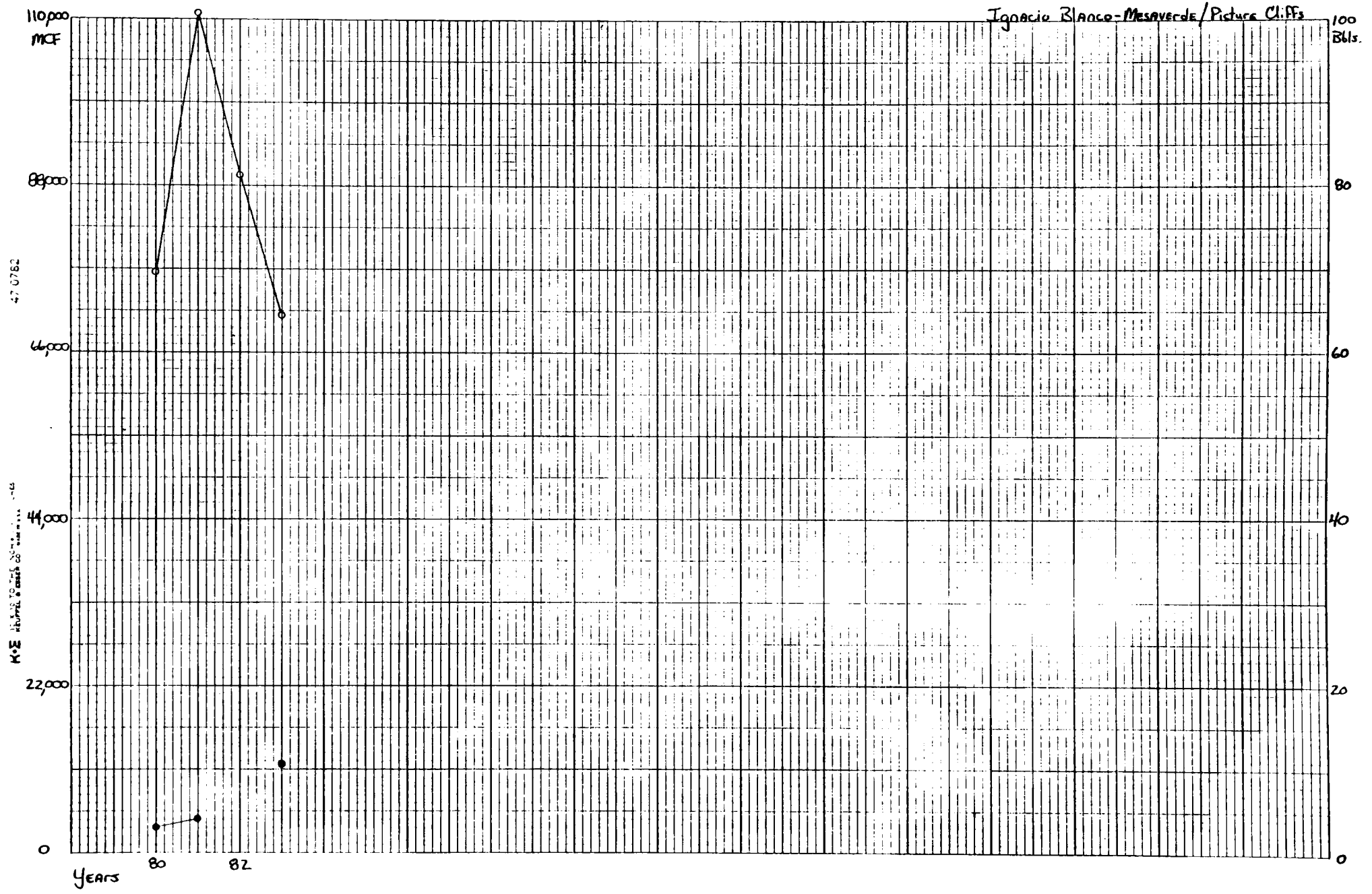

Ignacio Blanco - Mesaverde
23.0
MILLION
MCF
18.4
13.8
9.2
4.6
0
1,000
Bbls.
800
600
400
200
0
YEARS
56
58
60
62
64
66
68
70
72
74
76
78
80
82
47 0762
K·E

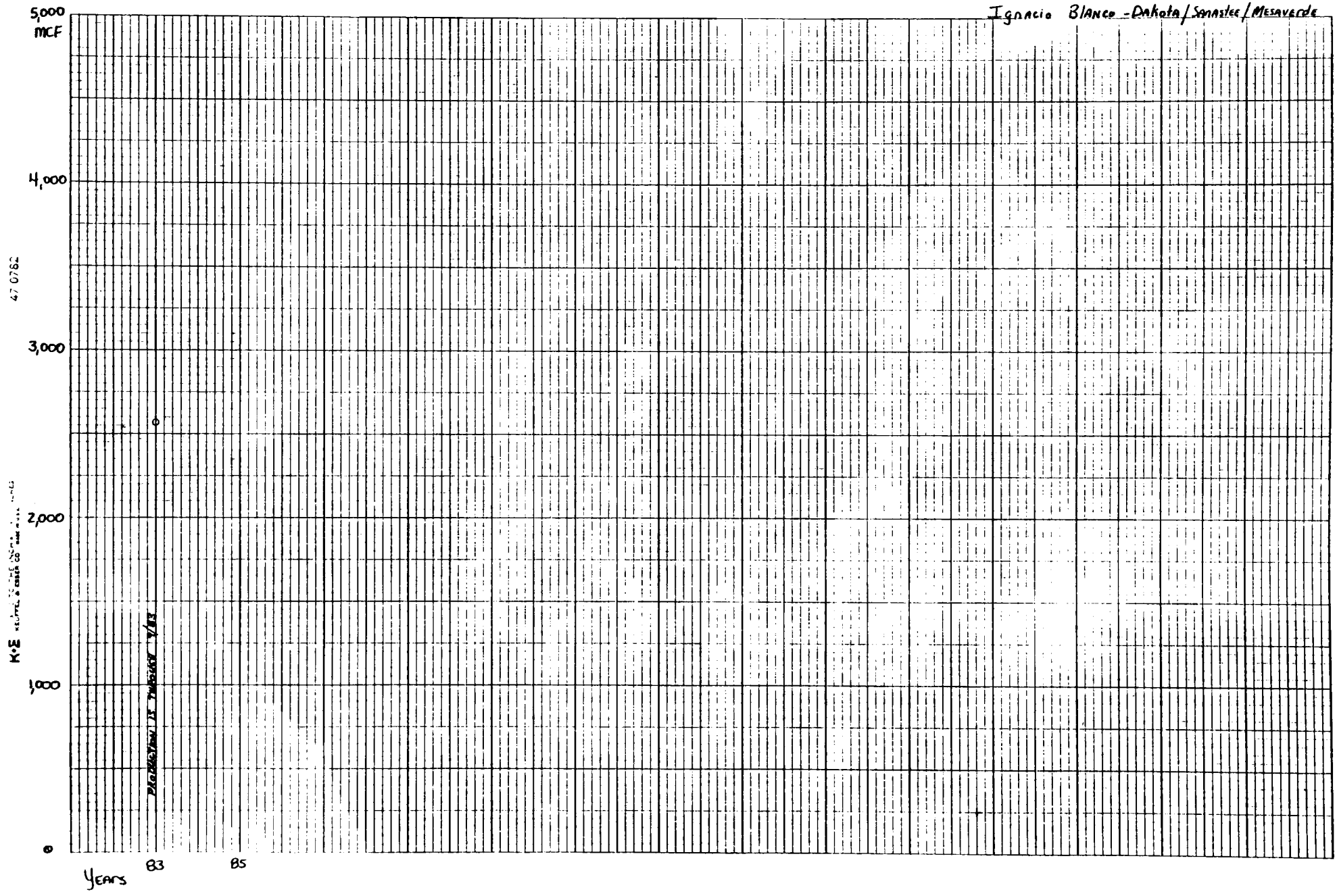
Ignacio Blanco - Niobrara

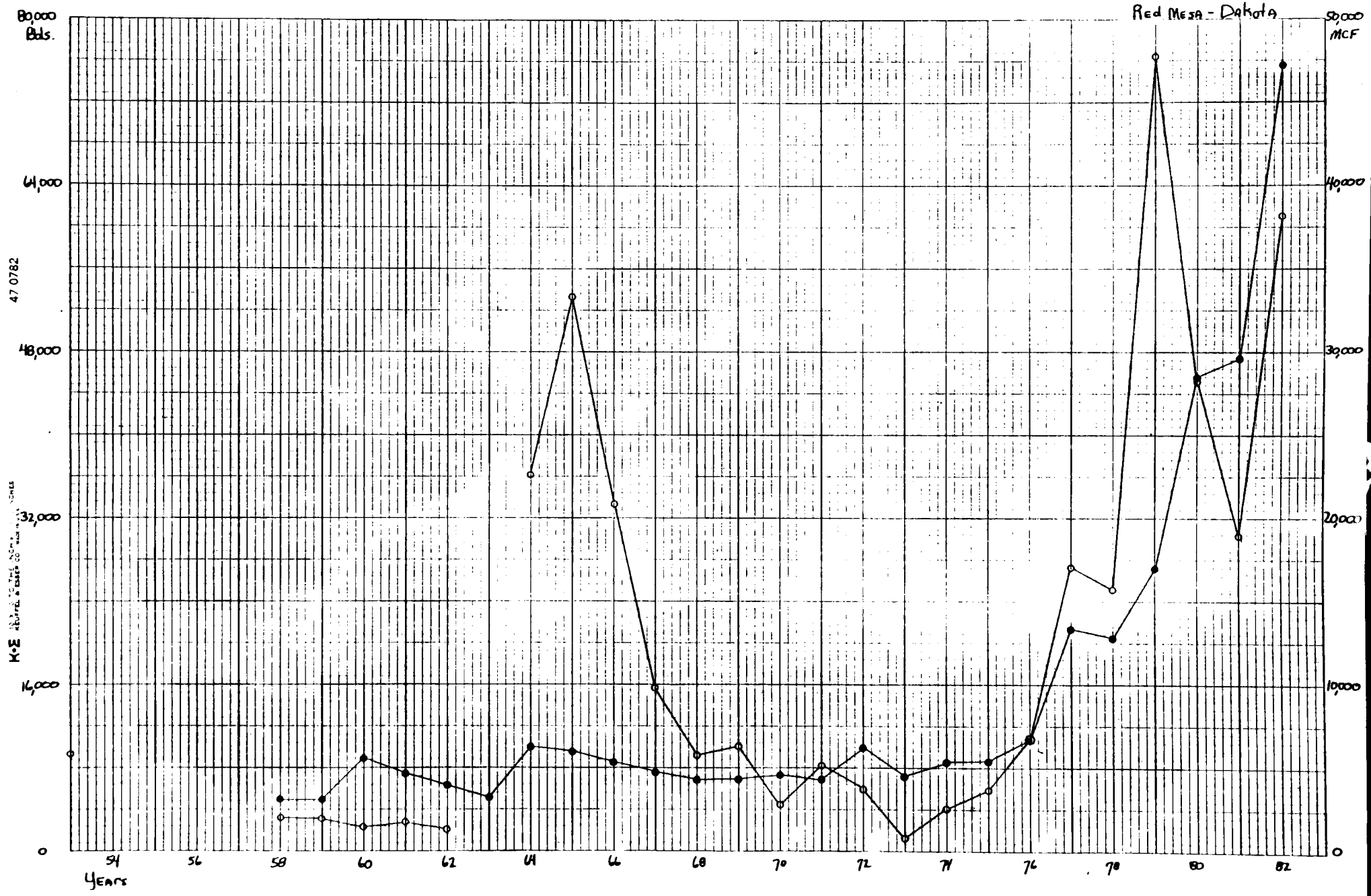


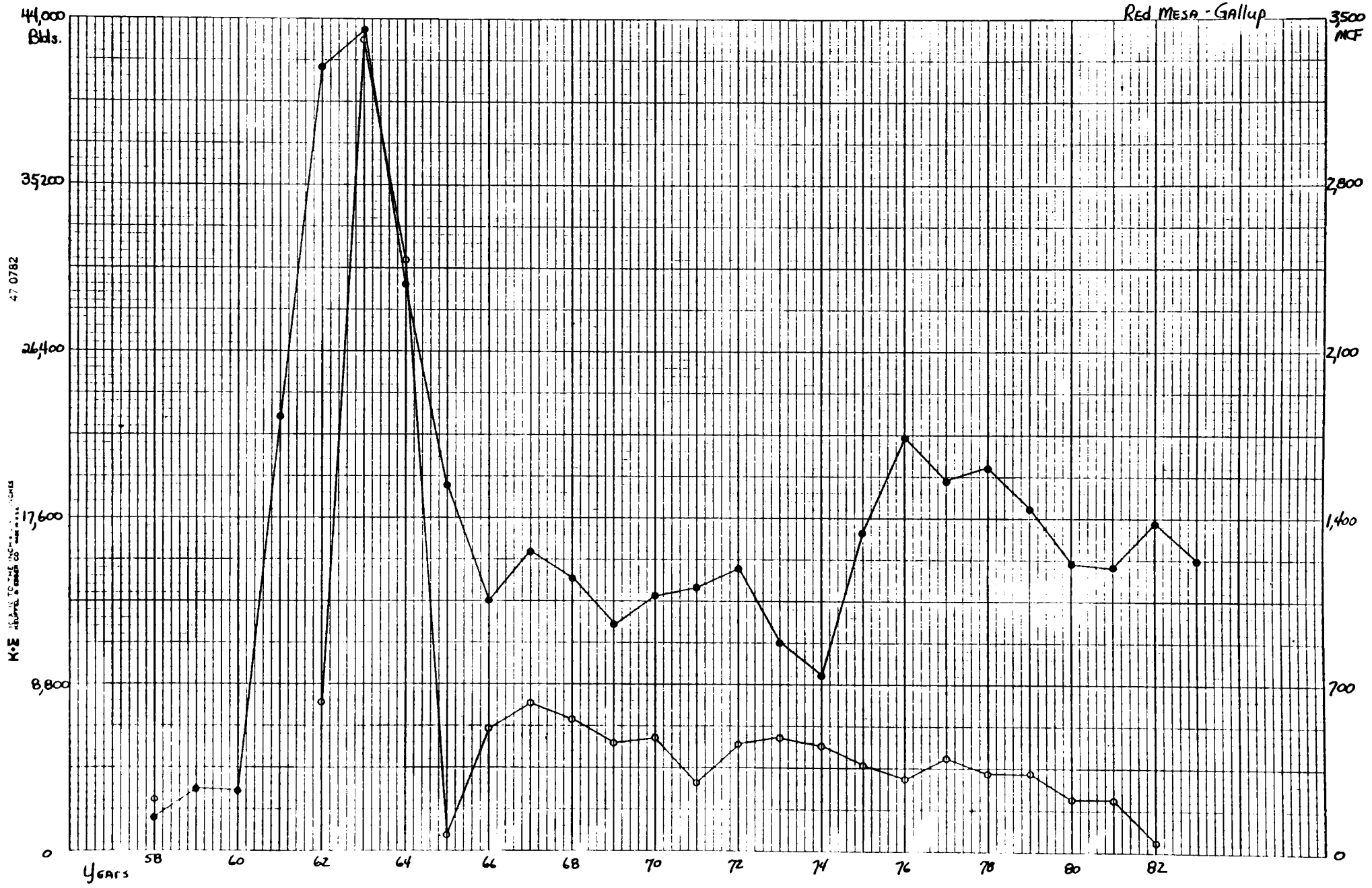

Ignacio Blanco - Sanastee
2,000
MCF
1,600
1,200
800
400
0
PRODUCTION IS THROUGH 9/83
83
85
Years
47 0782
K·E

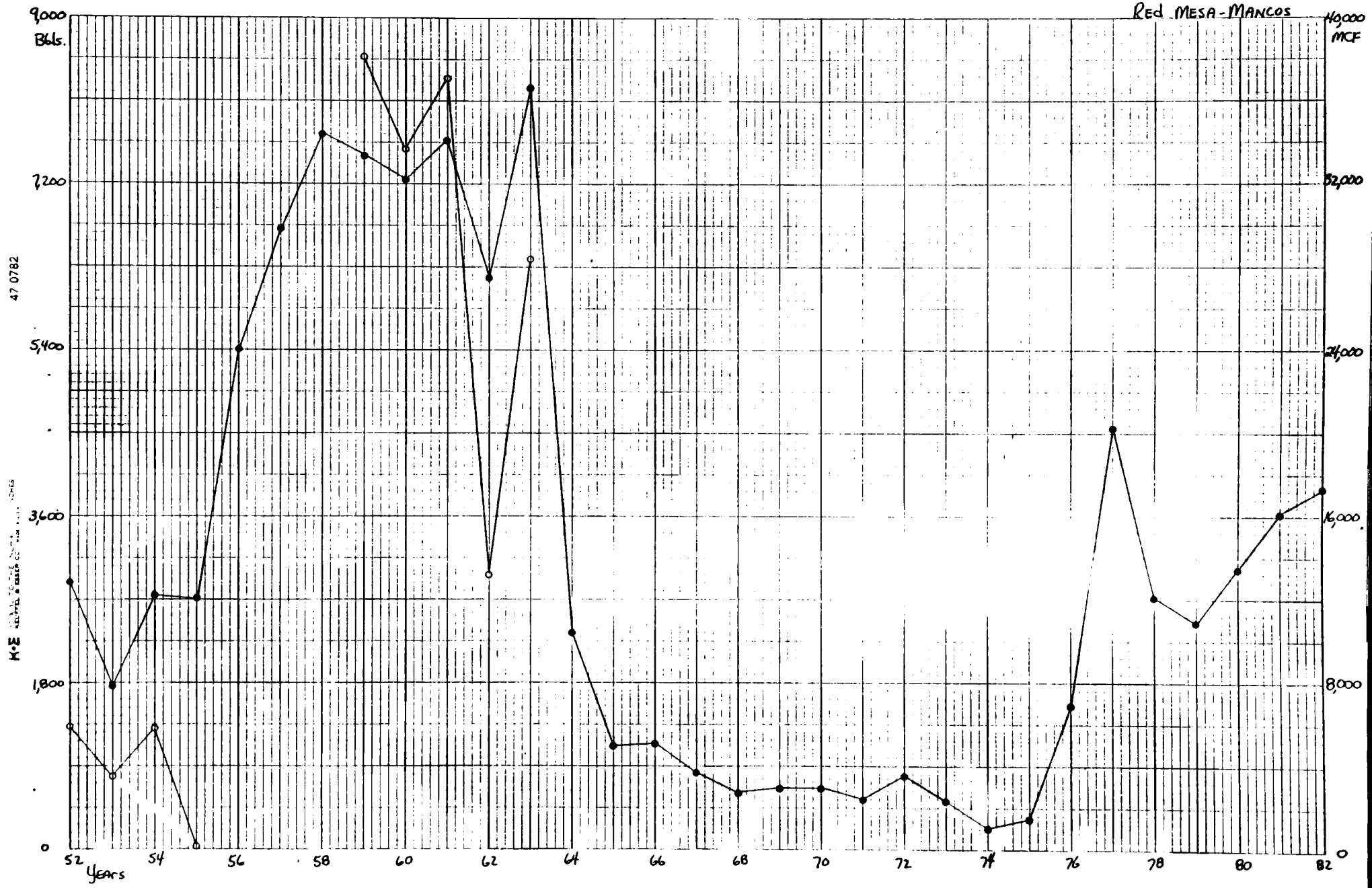

Ignacio Blanco - Mesaverde/Dakota
220,000
MCF
176,000
132,000
88,000
44,000
0
Years
68
70
72
74
76
78
80
82
47 0782
K&E

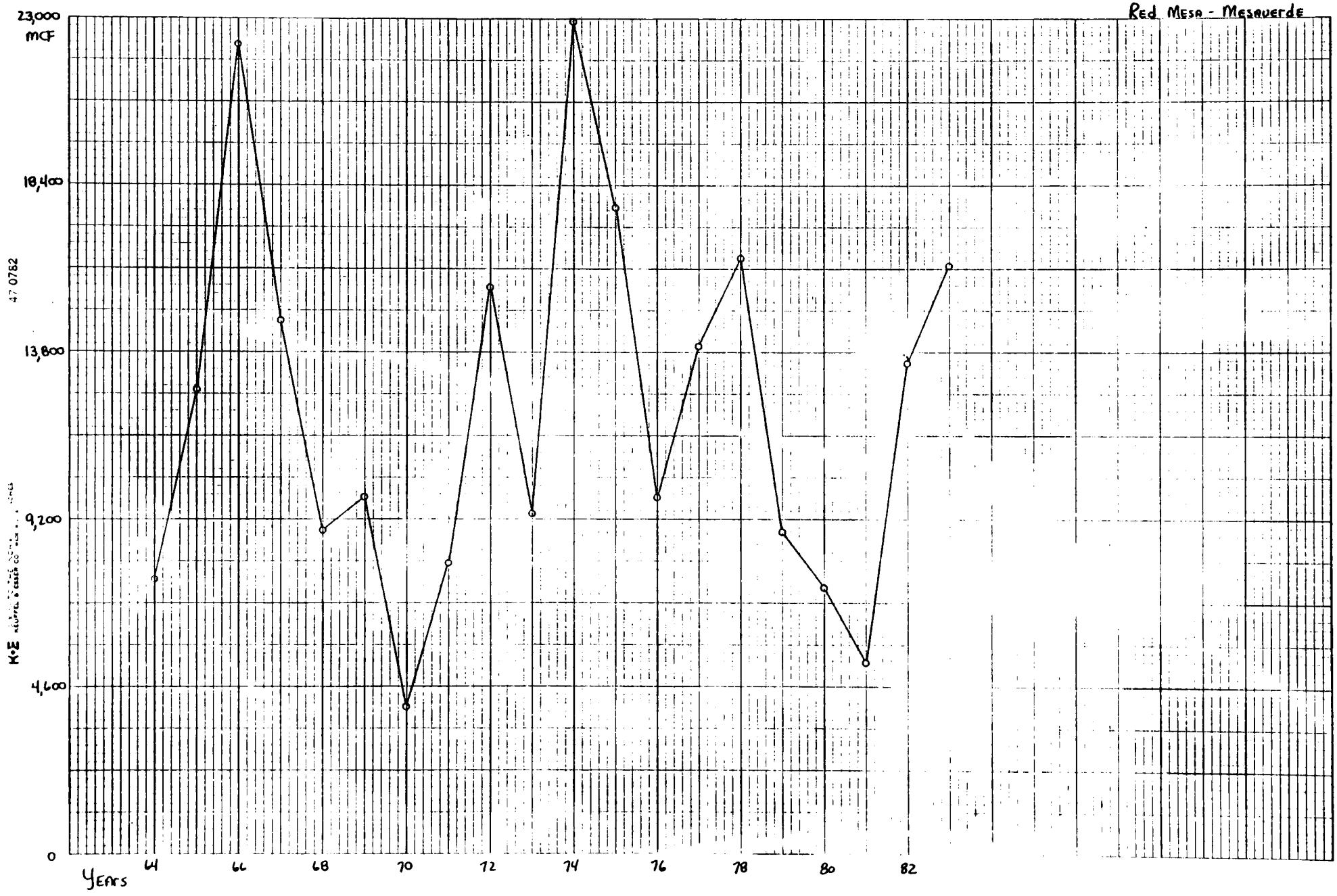

Ignacio Blanco-Mesaverde/Picture Cliffs
110,000
MCF
88,000
66,000
44,000
22,000
0
100
Bbls.
80
60
40
20
0
80
82
Years


Ignacio Blanco - Dakota / Sanastee / Mesaverde
5,000
MCF
4,000
3,000
2,000
1,000
0
Years
83
85
47 0762


Red Mesa - Dakota
80,000 Bbls.
64,000
48,000
32,000
16,000
0
50,000 MCF
40,000
30,000
20,000
10,000
0
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
Years
47 0782
K+E


Red Mesa - Gallup
44,000 Bbls.
35,200
26,400
17,600
8,800
0
3500 MCF
2,800
2,100
1,400
700
0
Years
58
60
62
64
66
68
70
72
74
76
78
80
82
47 0782
K+E


RED MESA-MANCOS
9,000
Bbls.
7,200
5,400
3,600
1,800
0
40,000
MCF
32,000
24,000
16,000
8,000
0
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
Years
47 0782
K&E


Red Mesa - Mesaverde
23,000
MCF
18,400
13,800
9,200
4,600
0
K•E
47 0782
Years
64
66
68
70
72
74
76
78
80
82

Other Publications

INFORMATION SERIES 18--Oil and Gas fields of Colorado: Statistical Data through 1981.
MAP SERIES 22--Oil and Gas fields map of Colorado. 1983, (1:500,000).
OPEN-FILE REPORT 84-3: Estimated Oil and Gas Reserves for Washington County, Colorado;
OPEN-FILE REPORT 84-4: Estimated Oil and Gas Reserves for Rio Blanco County, Colorado.
OPEN-FILE REPORT 84-5: Estimated Oil and Gas Reserves for Adams County, Colorado;
OPEN-FILE REPORT 84-6: Estimated Oil and Gas Reserves for Weld County, Colorado;
OPEN-FILE REPORT 84-7: Estimated Oil and Gas Reserves for Arapahoe County, Colorado;
OPEN-FILE REPORT 84-8: Estimated Oil and Gas Reserves for Bent County, Colorado.
OPEN-FILE REPORT 84-9: Estimated Oil and Gas Reserves for Cheyenne County, Colorado.
OPEN-FILE REPORT 84-10: Estimated Oil and Gas Reserves for Garfield County, Colorado;
OPEN-FILE REPORT 84-11: Estimated Oil and Gas Reserves for La Plata County, Colorado;
OPEN-FILE REPORT 84-12: Estimated Oil and Gas Reserves for Moffat County, Colorado;
OPEN-FILE REPORT 84-13: Estimated Oil and Gas Reserves for Elbert County, Colorado;
OPEN-FILE REPORT 84-14: Estimated Oil and Gas Reserves for Mesa County, Colorado;
OPEN-FILE REPORT 84-15: Estimated Oil and Gas Reserves for Routt County, Colorado;
OPEN-FILE REPORT 84-16: Estimated Oil and Gas Reserves for Yuma County, Colorado.

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