OPEN FILE 84-14

ESTIMATED OIL AND GAS RESERVES FOR MESA 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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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.

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A. H. Scanlon
Senior Geologist

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ESTIMATED OIL AND GAS RESERVES FOR MESA COUNTY, COLORADO

Introduction

This report is the twelfth* 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 Mesa County, located on the central western edge of Colorado, partially bordering the Piceance Basin. Mesa County covers 3,334 square miles. In this county, oil and/or gas are produced from, in descending order of age, the Rollins Sandstone, Cozette Sandstone, Corcoran Sandstone, Mesaverde Sandstone, Frontier Sandstone, Mancos Shale, Dakota Sandstone, Buckhorn Sandstone, Cedar Mountain Shale, Morrison Sandstone, Saltwash Sandstone, and Entrada Sandstone.

There are 23 fields considered active producers as of December 31, 1983. Of these, one is classified as an oil field (based on cumulative gas-oil ratio (GOR) of <15:1), and the remaining 22 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.
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; and
OPEN-FILE REPORT 84-13: Estimated Oil and Gas Reserves for Elbert County, Colorado.

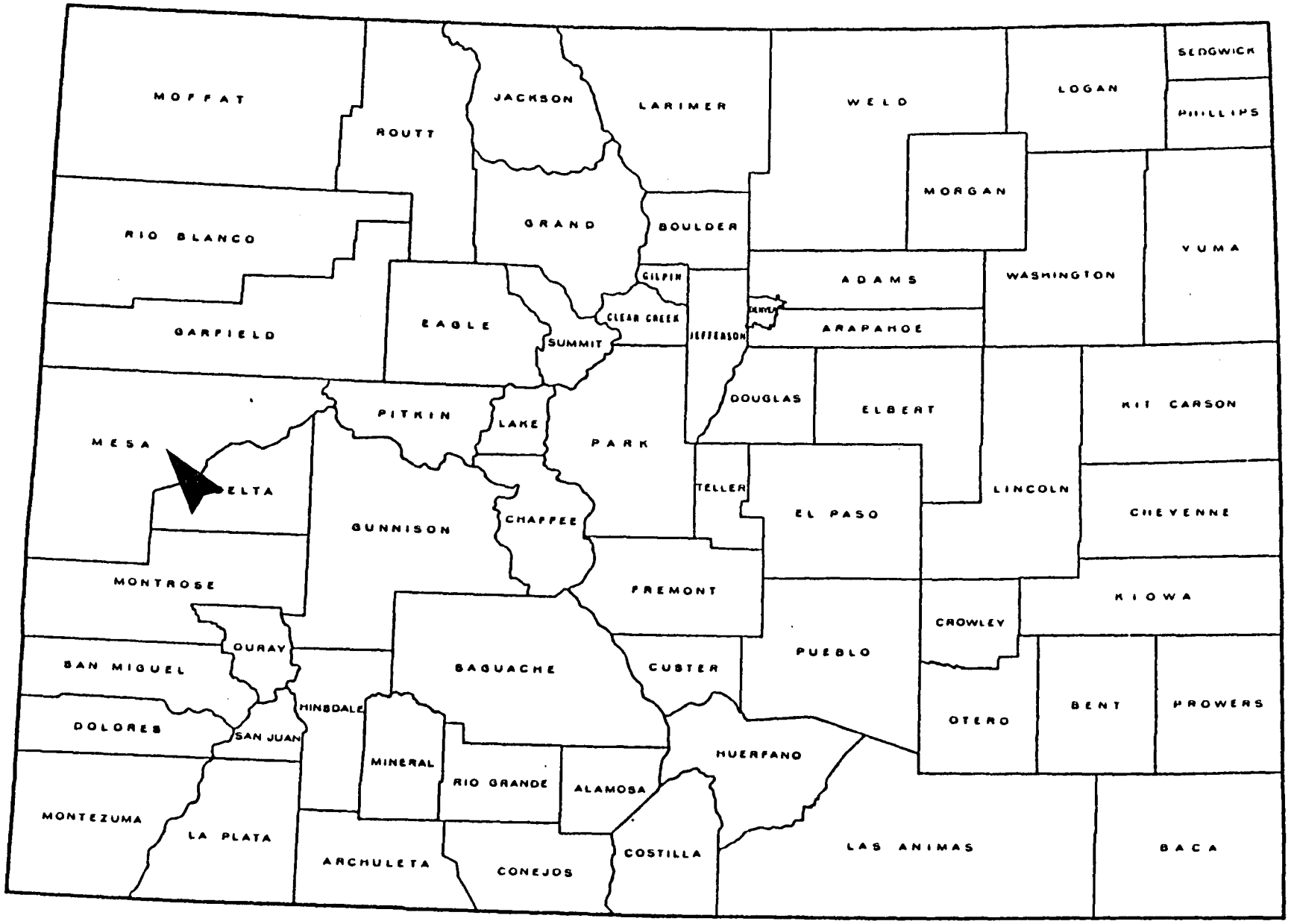

Figure 1. County Location Map

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 36 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 is one oil field-horizon. This field-horizon, the White Water-Dakota, has only produced in 1982 and 1983. This short production history does not allow for a decline rate to be inferred, therefore no reserve estimates were made for this field. Several gas field-horizons have associated oil production. Only one of these (Bar X-Dakota/Morrison/Saltwash) has a long enough production history to obtain a reasonable decline rate. This decline rate was 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 35 gas field-horizons. Production histories have allowed for decline rates to be calculated for 8 of these. The remaining 27 gas field-horizons have not produced for a long enough time (less than 5 years) to determine reliable decline rates. Decline rates were determined for the previously mentioned 8 gas field-horizons (see Table I), 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 I.

Results can be found in Table I.

For the associated oil production, there 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 of 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 Mesa County totaled 4,230 barrels, from Bar X-Dakota/Morrison/Saltwash Production. Estimated gas reserves for Mesa County totaled 46,360,284 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 2003.

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 six to seven years, roughly half of the estimated oil reserves in Mesa 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 seven to eight 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 (11.4 percent per year for oil and 6.1 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 (4,029 Bbls. of oil and 3,208,555 MCF of gas) additional reserves of 33,287 Bbls. of oil and 37,661,295 MCF of gas were obtained. This gives total county reserves (Class I and II) of 37,517 Bbls. of oil and 84,021,579 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 significant differences in the sources of the gas production for the two groups. So many Class II field-horizons began producing within the last five years, it is difficult to apply the Class I decline rate to the Class II production with confidence. The reserve figures for Class II field-horizons are considered quite 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 MESA COUNTY

FIELD NAME/ PRODUCING HORIZON	LOCATION	DATE OF DISCOVERY	TYPE OF DRIVE	Dy	CUMULATIVE PRODUCTION 12/31/83		ESTIMATED RESERVES		ULTIMATE RECOVERABLE		REMARKS
					OIL (Bbls.) ()Condensate (Bbls.)	GAS (MCF)	OIL (Bbls.)	GAS (MCF)	OIL (Bbls.) ()Condensate (Bbls.)	GAS (MCF)	
1.Bar X/Entrada	8S-104W	1953	W. D.		(598)	1,172,527					Prod.'80, '81,'82; SI 1983. N.P.
2.Bar X/Dakota-Morrison-Saltwash	8S-104W	1953	Depletion	11.4 -o 3.8 -g	21,978	4,617,169	4,230	1,224,110	26,208	5,841,279	Econ.Limit=0
3.Bar X/Morrison	8S-104W	1953			1,511	493,513					Prod. '79-'83 N.P.
4.Bronco Flats/ Cedar Mountain	9S-99W	1979				155,919					N.P.
5.Bronco Flats/ Dakota	9S-99W	1979				523,131					N.P.
6.Bronco Flats/ Dakota-Morrison	9S-99W	1979				676,049					N.P.
7.Buzzard/Mesa-verde-Cozette-Corcoran	9S-94W	1958		10.9 -g		1,577,036		451,710		2,028,746	
8.Buzzard Creek/ Cozette-Corcoran	9S-93W	1955	Gas			49,600					Prod. '81-'83. N.P.
9.Buzzard Creek/ Mesaverde	9S-93W	1955	Gas	3.5 -g		4,873,749		2,178,269		7,052,018	
10.Cameo/Dakota	9S-99W	1961	Gas Exp.			143,311					Prod. 1961, 1982-83. N.P.
11.Coal Gulch/ Dakota	8S-101W	1966				33,016					Prod. 1983 N.P.
12.Coal Gulch/ Mesaverde	8S-101W	1966		7.5 -g		139,429		113,443		252,872	
13.Coon Hollow/ Mesaverde	8S-98W	1958	W. D. & Gas Exp.			188,541					Prod. '81-'83. N.P.
14.Coon Hollow/ Rollins-Cozette	8S-98W	1958				135,692					Prod. '82, '83. N.P.
15.Coyote Wash/ Dakota-Morrison	8S-102W	1982				209,415					N.P.
16.DeBeque/ Mesaverde	8S-97W	1902				423,271					Prod. 1980-1983. N.P.
17.Divide Creek/ Mesaverde	8S-91W	1956	Gas Exp.	5.0 -g		46,080,307		13,027,983		59,108,290	Prod. in Garfield Co.
18.Hancock Gulch/ Dakota	8S-99W	1979				5,537					Prod. '82, '83. N.P.

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)	
19.Hunters Canyon/Dakota	8S-100W	1955				371,588					Prod. '81-'83. N.P.
20.HuntersCanyon/ Mesaverde	8S-100W	1955		5.4 -g		2,764,317		4,590,102		7,354,419	
21.Lipan Wash/ Dakota	2N-2W	1973			(79)	175,520					Prod. 1982, '83. N.P.
22.Peachtree/ Dakota-Morrison	9S-103W	1979				825					Tested in 1983. N.P.
23.Persigo Wash/ Buckhorn-Dakota-Morrison-Saltwash	10S-100W	1972			(2)	31,070					Prod. '82, '83. N.P.
24.Plateau/Mesa-verde-Dakota-Cozette-Corcoran	10S-96W	1958	Gas Exp.	6.9 -g	(2,684)	15,374,820		24,376,623		39,751,443	
25.RobertsCanyon/ Dakota	9S-98W	1960		10.5 -g		472,995		272,066		745,061	
26.Sheep Creek/ Cozette-Corcoran	9S-92W	1958				66,680					Prod. 1963. P and A 10/64; Prod. in 1983; N.P.
27.Shire Gulch/ Corcoran	10S-96W	1960	Gas Exp.			984,629					N.P. Prod. 1978-1983.
28.Shire Gulch/ Dakota-Morrison	10S-96W	1960				1,903,371 (Dakota Only)					Prod. 1964-'65; P and A 12-65; Prod. 1981-83; N.P.
29.Shire Gulch/ Dakota-Frontier	10S-96W	1960				89,688					Prod. 1980-'83. N.P.
30.Shire Gulch/ Mancos	10S-96W	1960	Gas Exp.			34,257					Prod. 1981-'83. N.P.
31.Shire Gulch/ Mesaverde	10S-96W	1960				747,366					Prod. 1981-'83. N.P.

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MESA 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)	
32.South Canyon/ Dakota	6S-104W	1957	Gas Exp. & W.D.			14,981					Prod. 1981-'83;Also Prod. in Garfield Co. N.P.
33.South Canyon/ Dakota-Morrison	6S-104W	1957				84,787					Prod.'81-'83;Also Prod. in Garfield Co. N.P.
34.Vega/Cozette	10S-93W	1977		14.4 -g		189,597		125,978		315,575	
35.White Water/ Dakota	12S-98W	1974			1,636	11,637					Prod.'82-'83. N.P.
36.Winter Flats/ Dakota	9S-100W	1982				7,547 (thru 12/82)					Prod. 1982, Book has Est. Prod. for 1983. N.P.
COUNTY TOTAL OF ESTIMATED RESERVES							4,230 Bbls				
							46,360,284 MCF				

Reference List

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

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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.

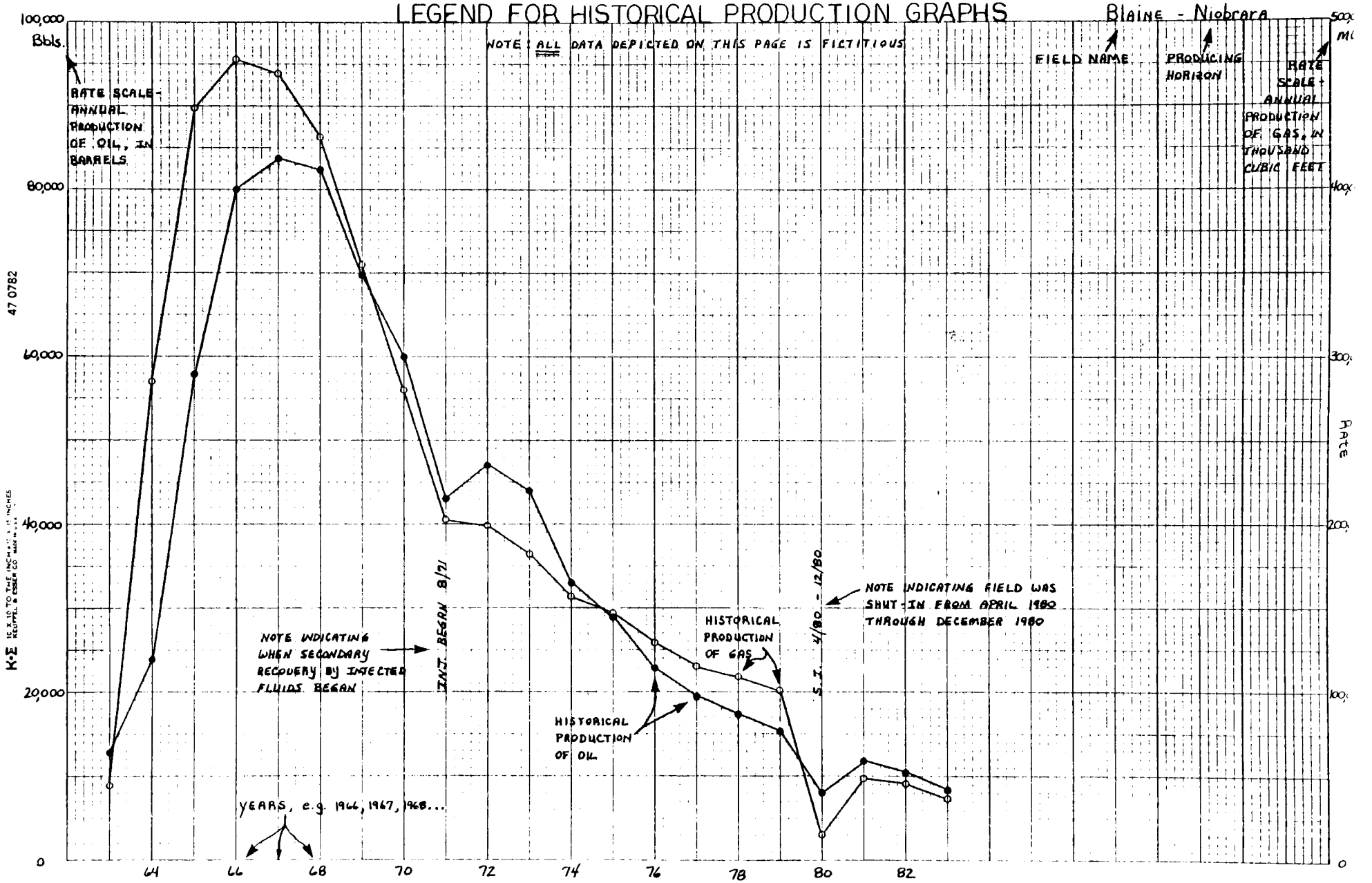
Parker, J.M., editor, 1961 Oil and Gas Field volume: Colorado-Nebraska: Rocky Mountain Association of Geologists, 389 pp.

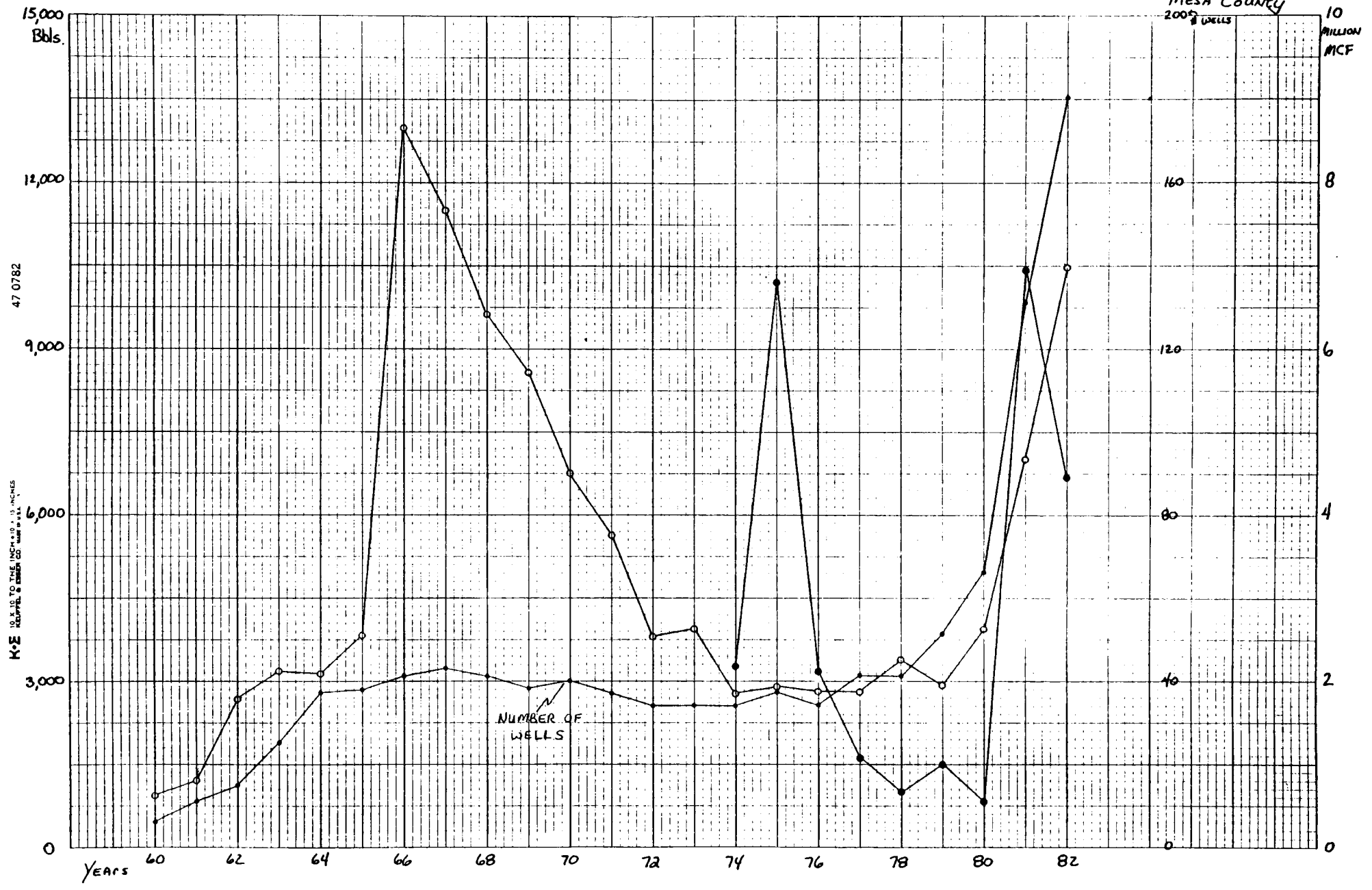
Appendix I

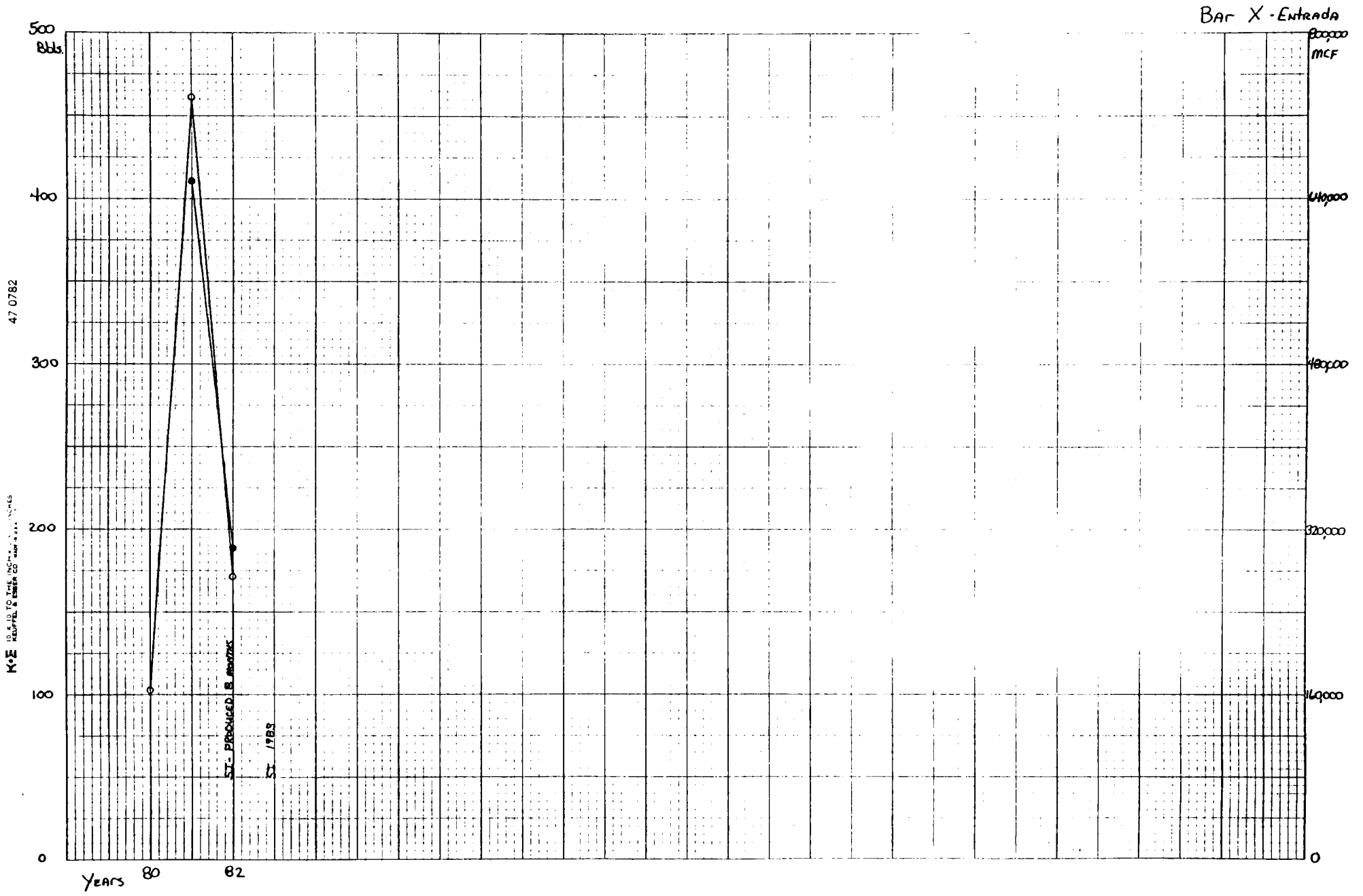
Historical production decline curve graphs for Mesa County. These graphs are presented in alphabetical order by Field name and then by producing horizons within each field.

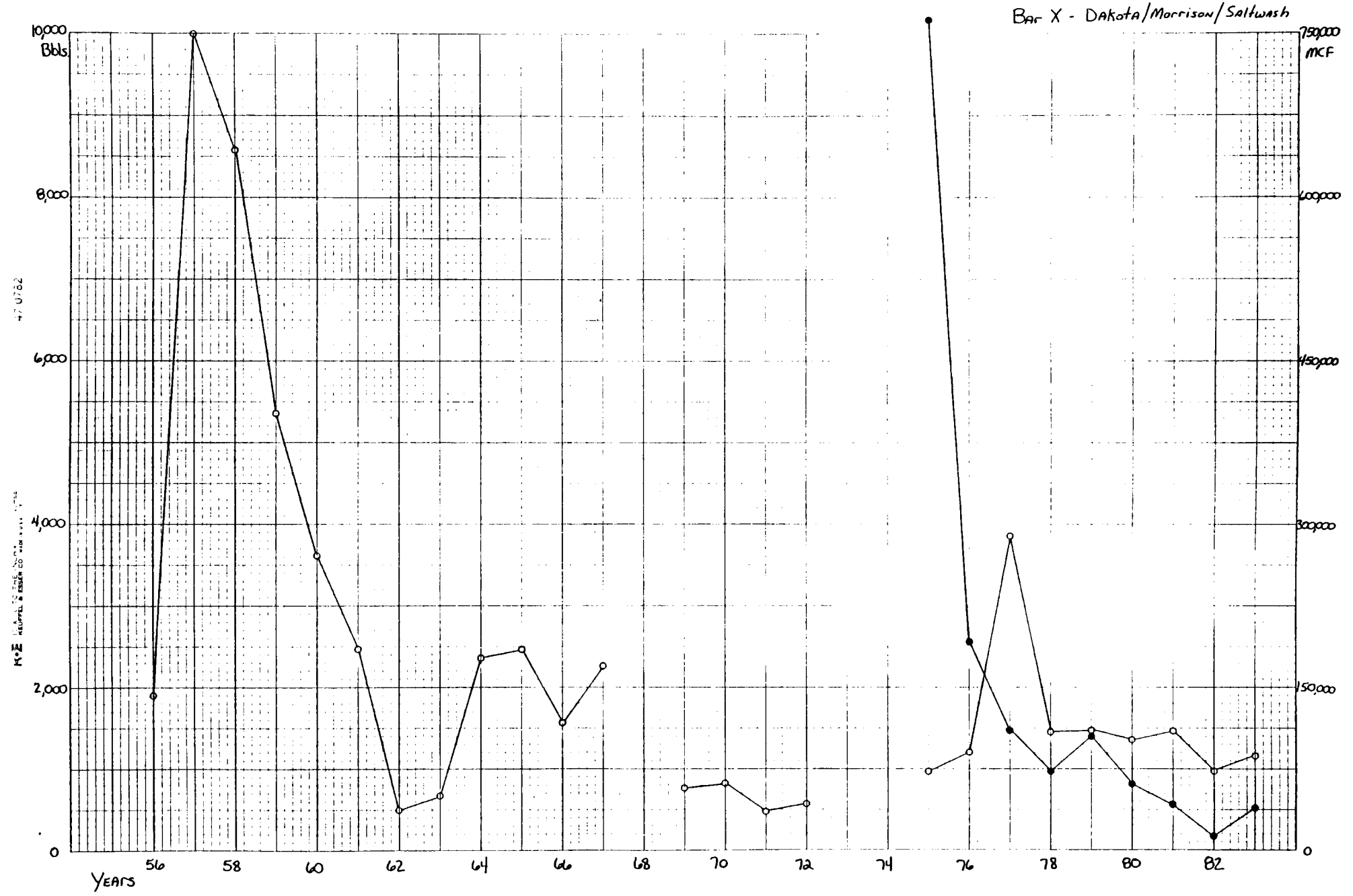
Note that only those fields actively producing as of 12-31-83 are included. Abandoned fields or field-horizons are not included.

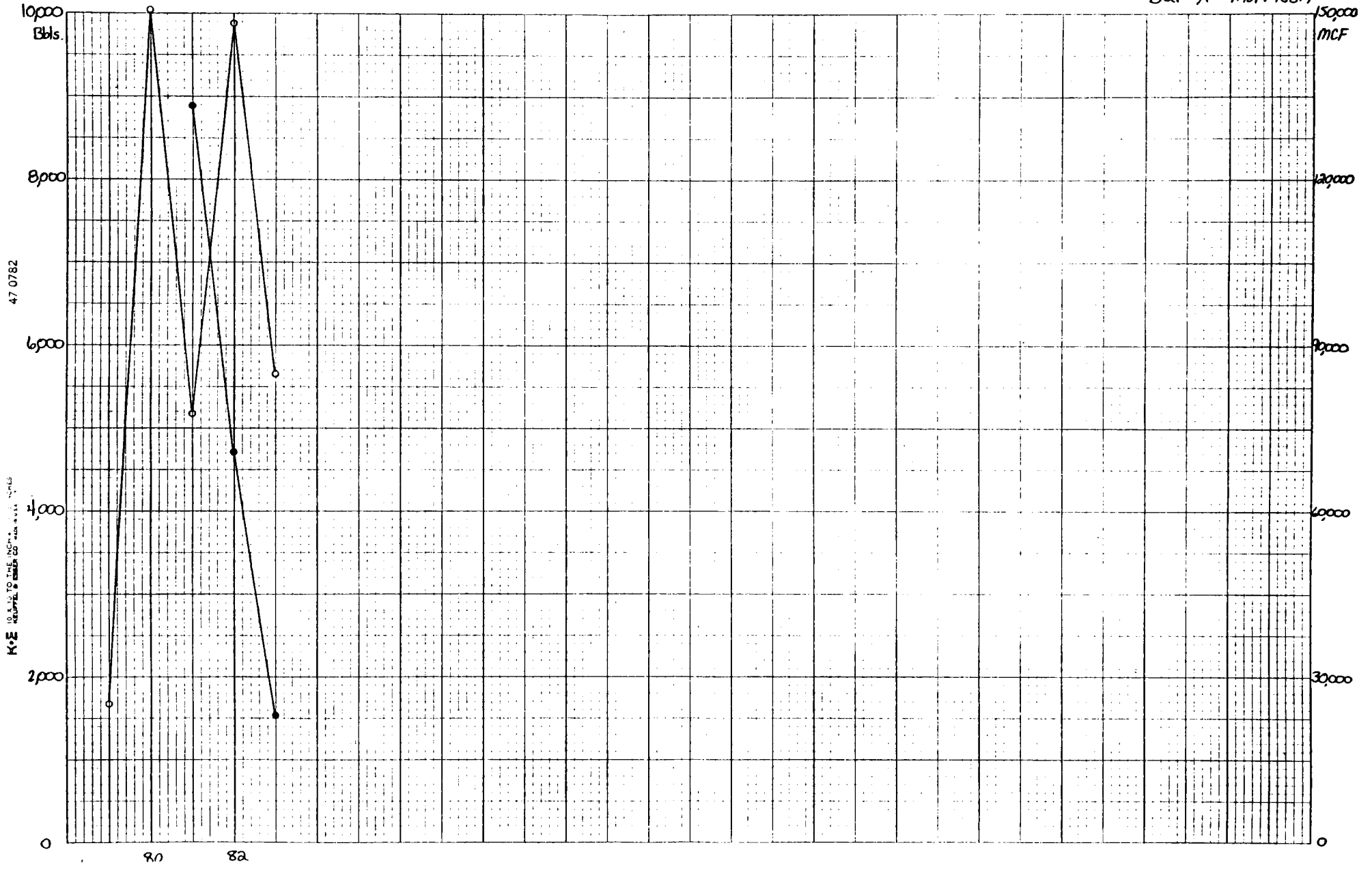
LEGEND FOR HISTORICAL PRODUCTION GRAPHS



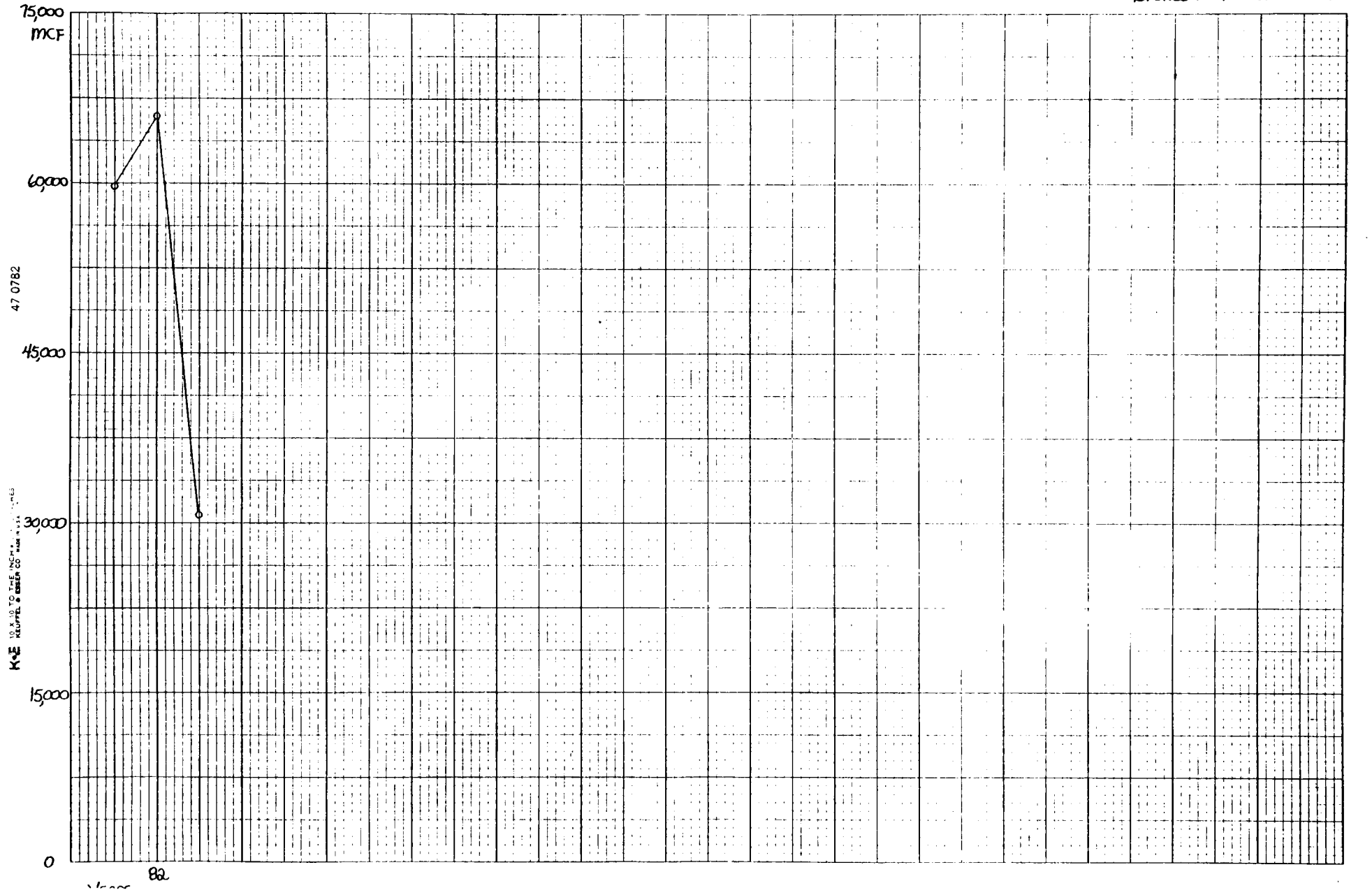

Mesa County
15,000
Bbls.
12,000
9,000
6,000
3,000
0
200
160
120
80
40
0
WELLS
10
8
6
4
2
0
MILLION
MCF
YEARS
60
62
64
66
68
70
72
74
76
78
80
82
NUMBER OF
WELLS
47 0782
K·E


Bar X - Entrada
500
Bbls.
400
300
200
100
0
800,000
MCF
640,000
480,000
320,000
160,000
0
Years
80
82
ST - PRODUCED 8 months
ST 1983
47 0782
K·E


BAR X - DAKOTA/MORRISON/SALTWASH
10,000
Bbls
8,000
6,000
4,000
2,000
0
750,000
MCF
600,000
450,000
300,000
150,000
0
56
58
60
62
64
66
68
70
72
74
76
78
80
82
YEARS

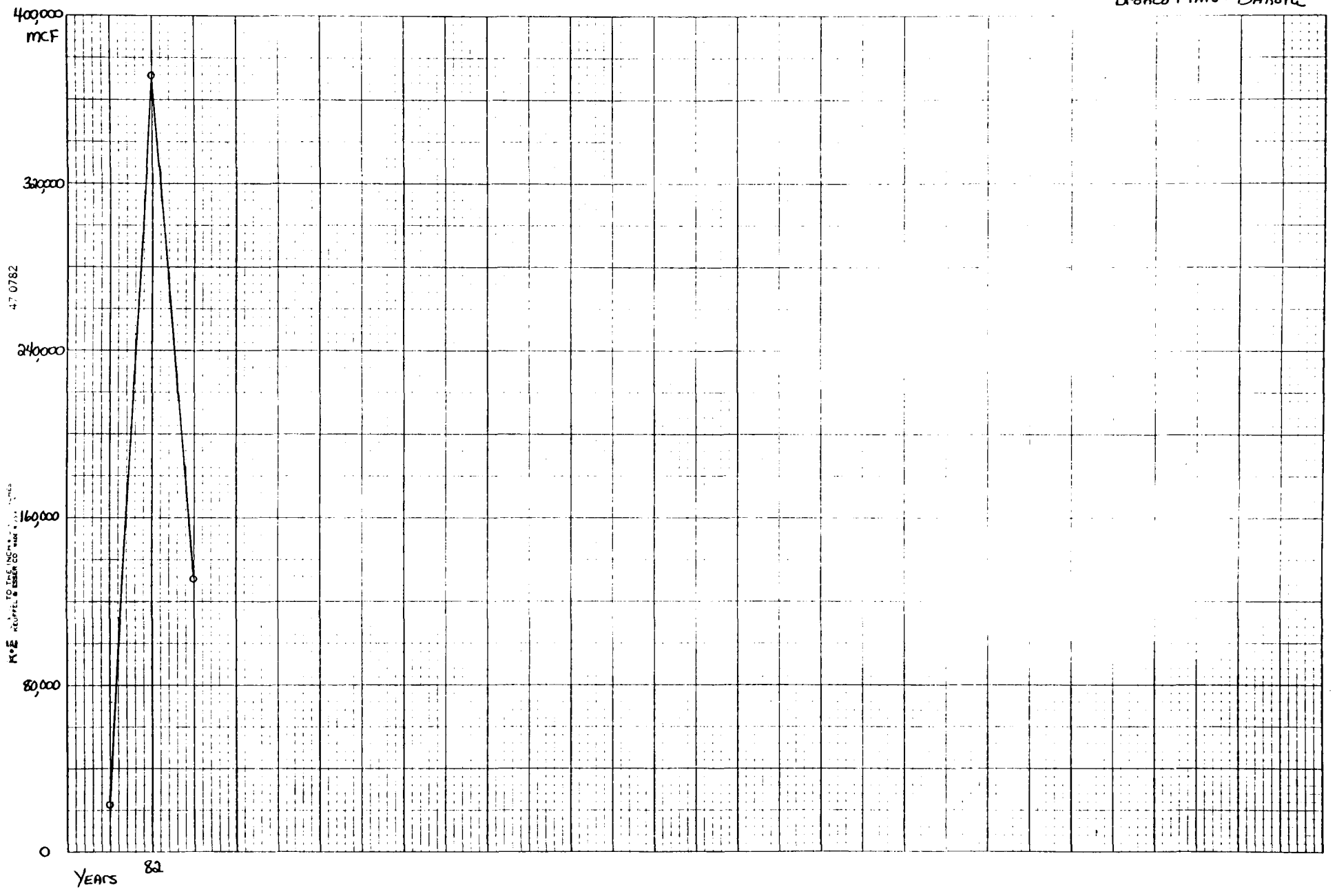

Bar X - Morrison
10,000
Bbls.
8,000
6,000
4,000
2,000
0
50,000
MCF
40,000
30,000
20,000
10,000
0
80
82
47 0782
K+E

Bronco Flats - Cedar Mountain

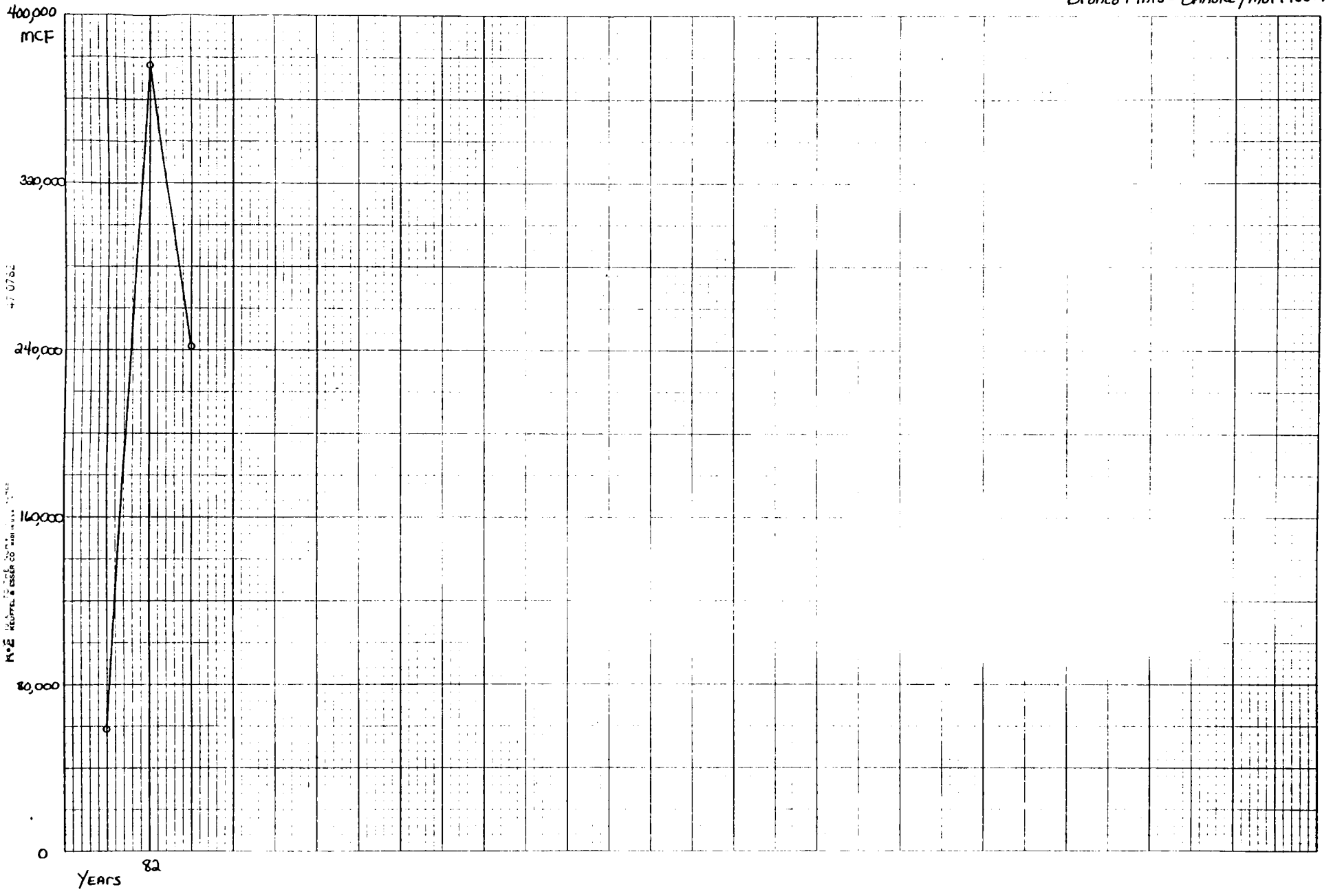


47 0782

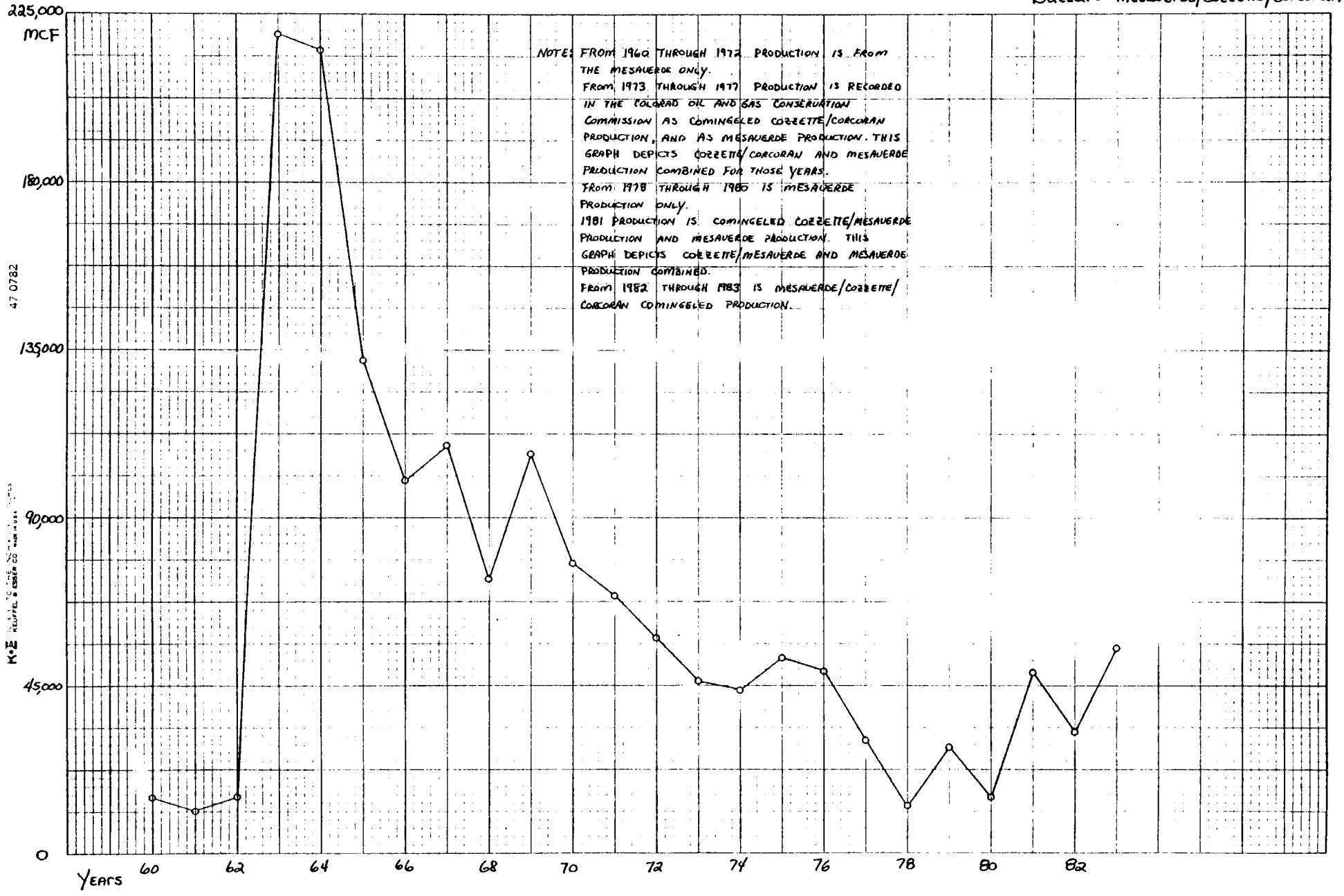
Bronco Flats - DAkota



Bronco Flats - Dakota / Morrison



Buzzard - Mesaverde/Cozzette/Corcoran



47 0782

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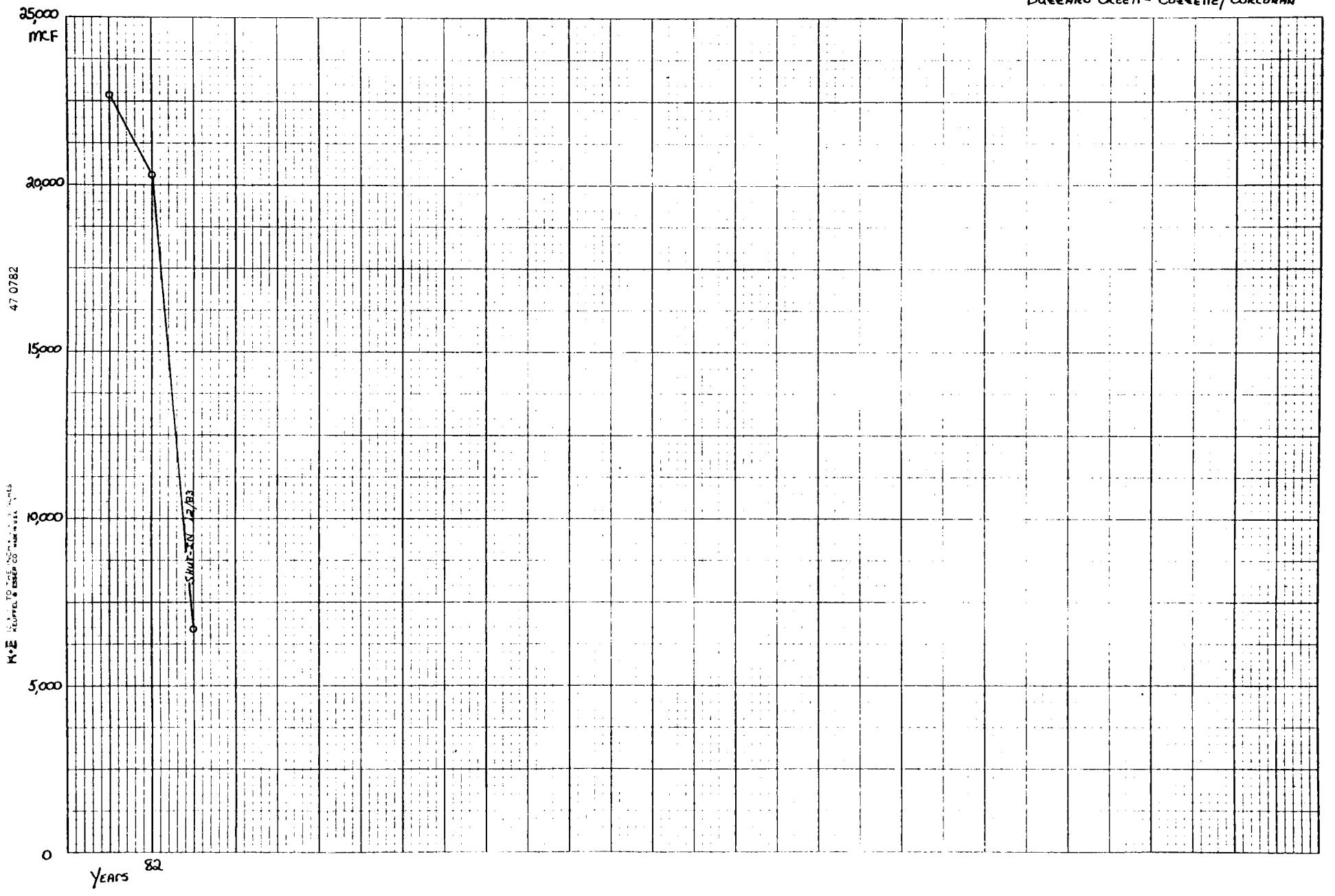
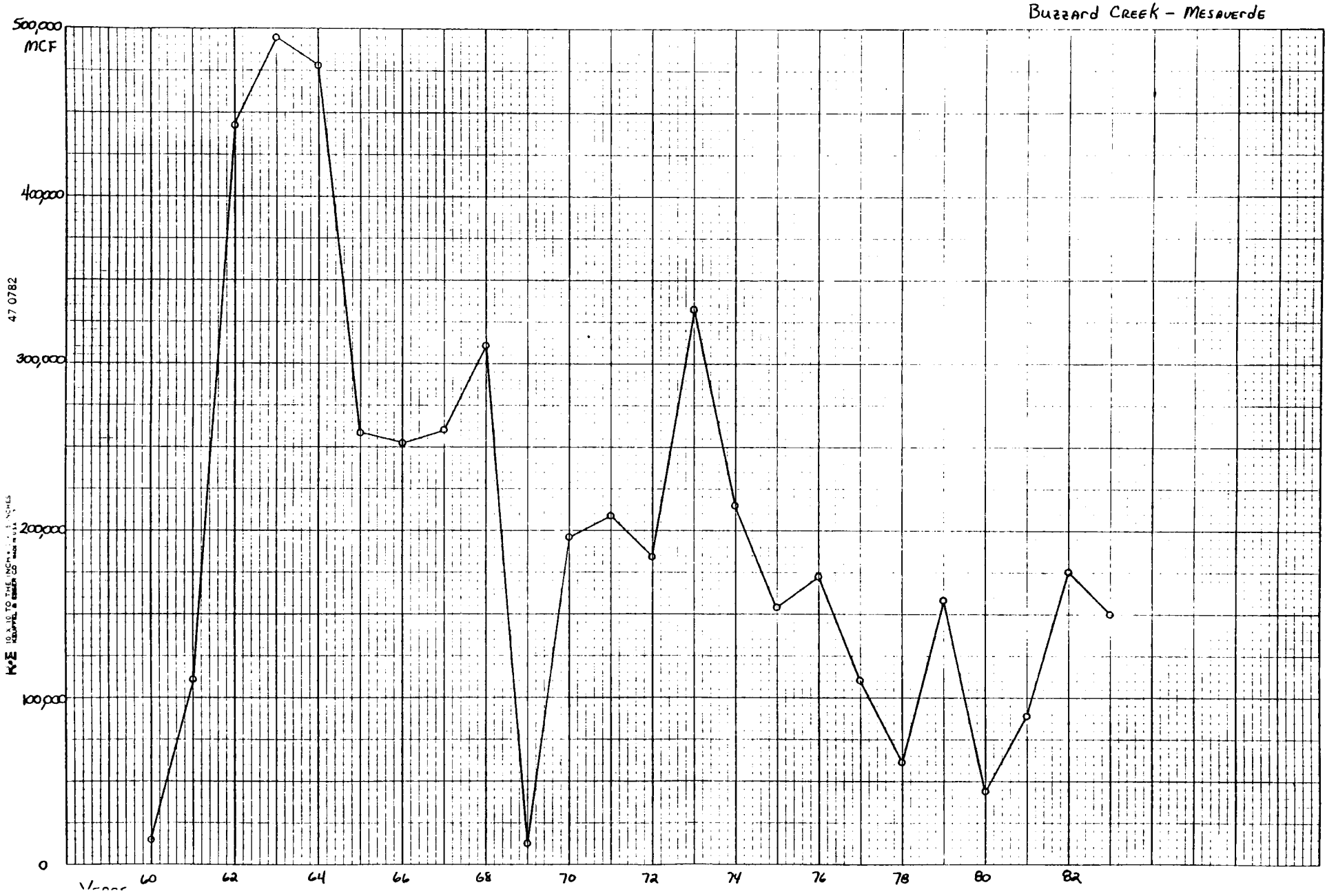
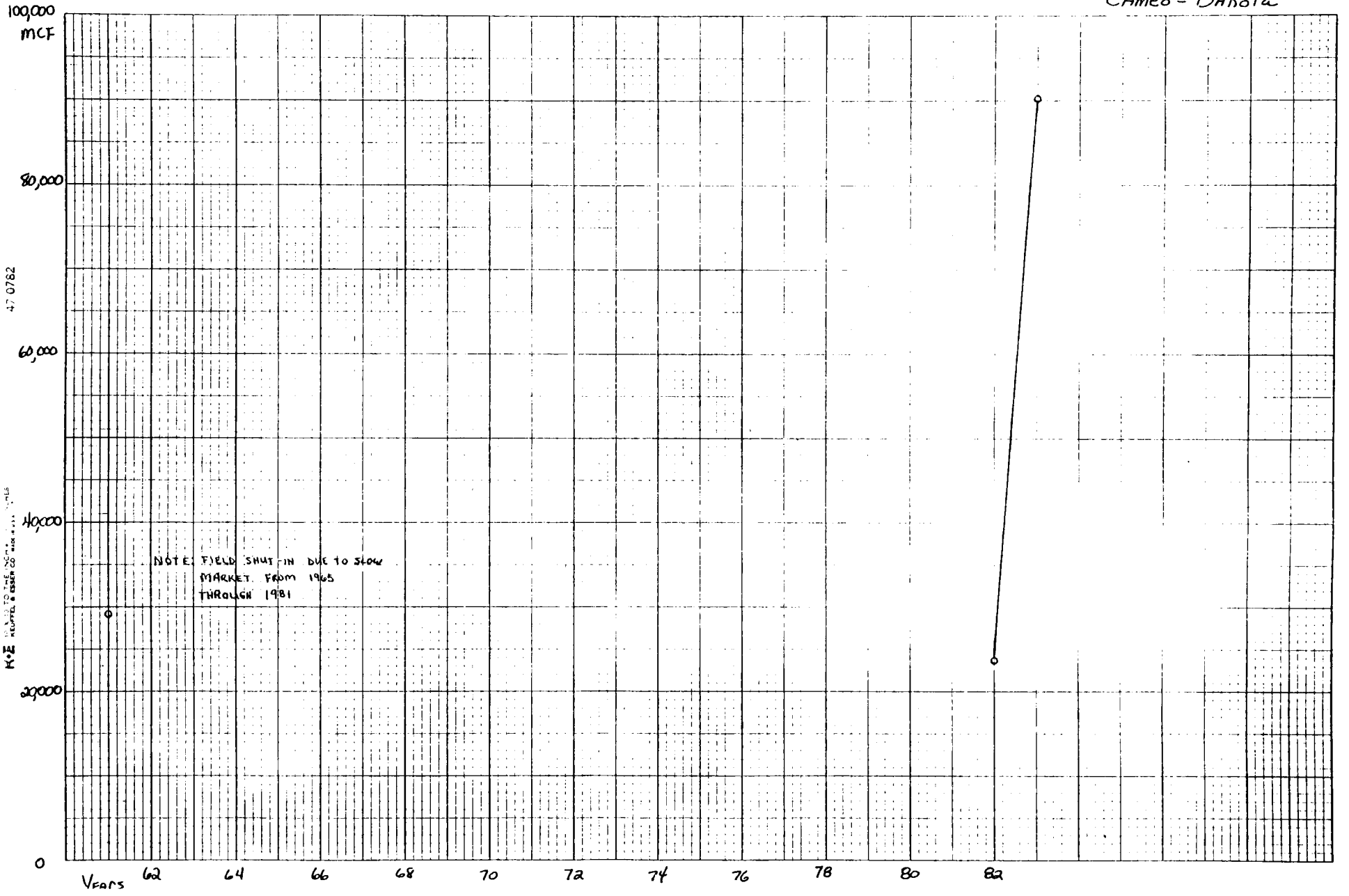
Buzzard Creek - Cozzette/Corcoran

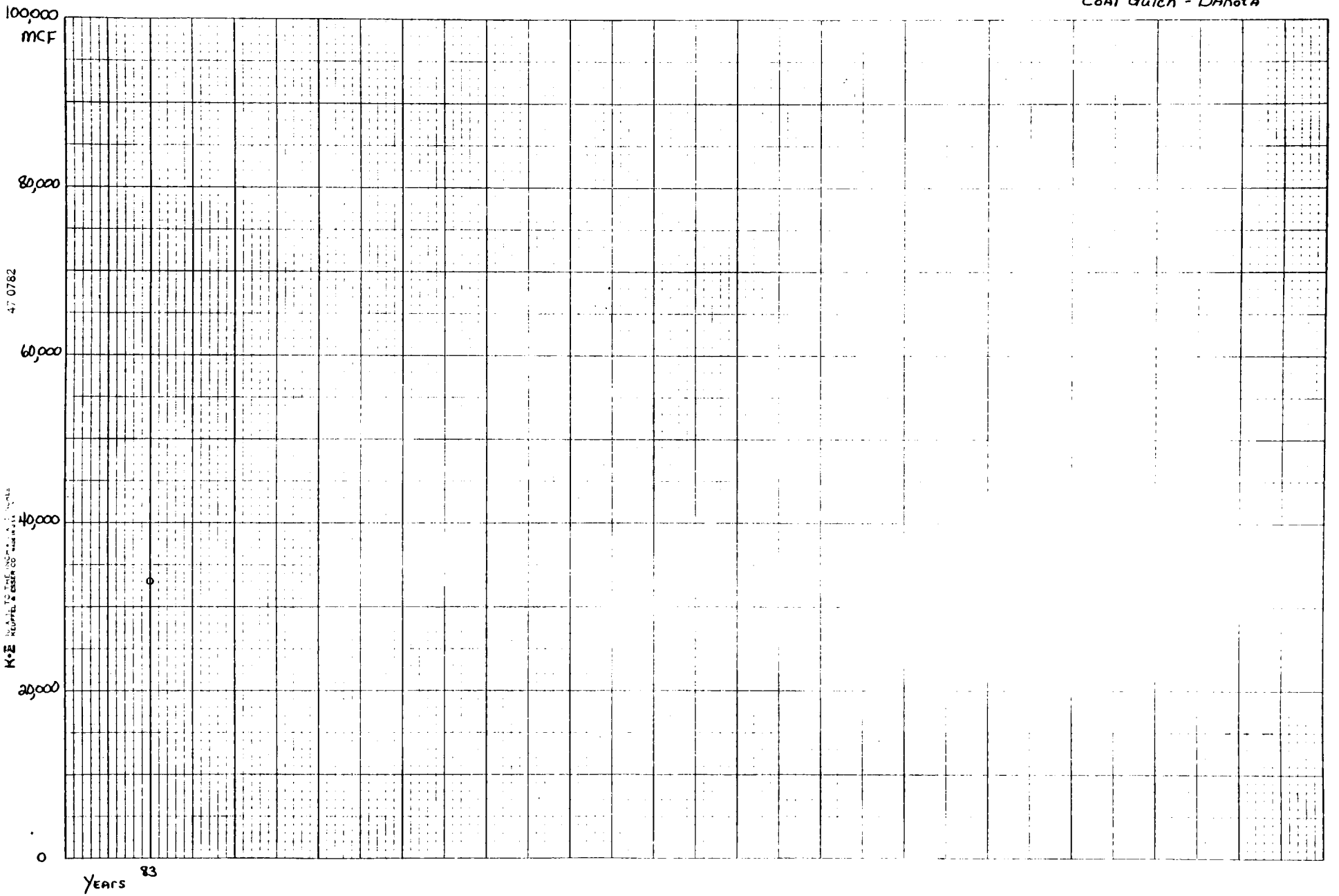



Buzzard Creek - Mesaverde
500,000
MCF
400,000
300,000
200,000
100,000
0
60
62
64
66
68
70
72
74
76
78
80
82
47 0782
K&E

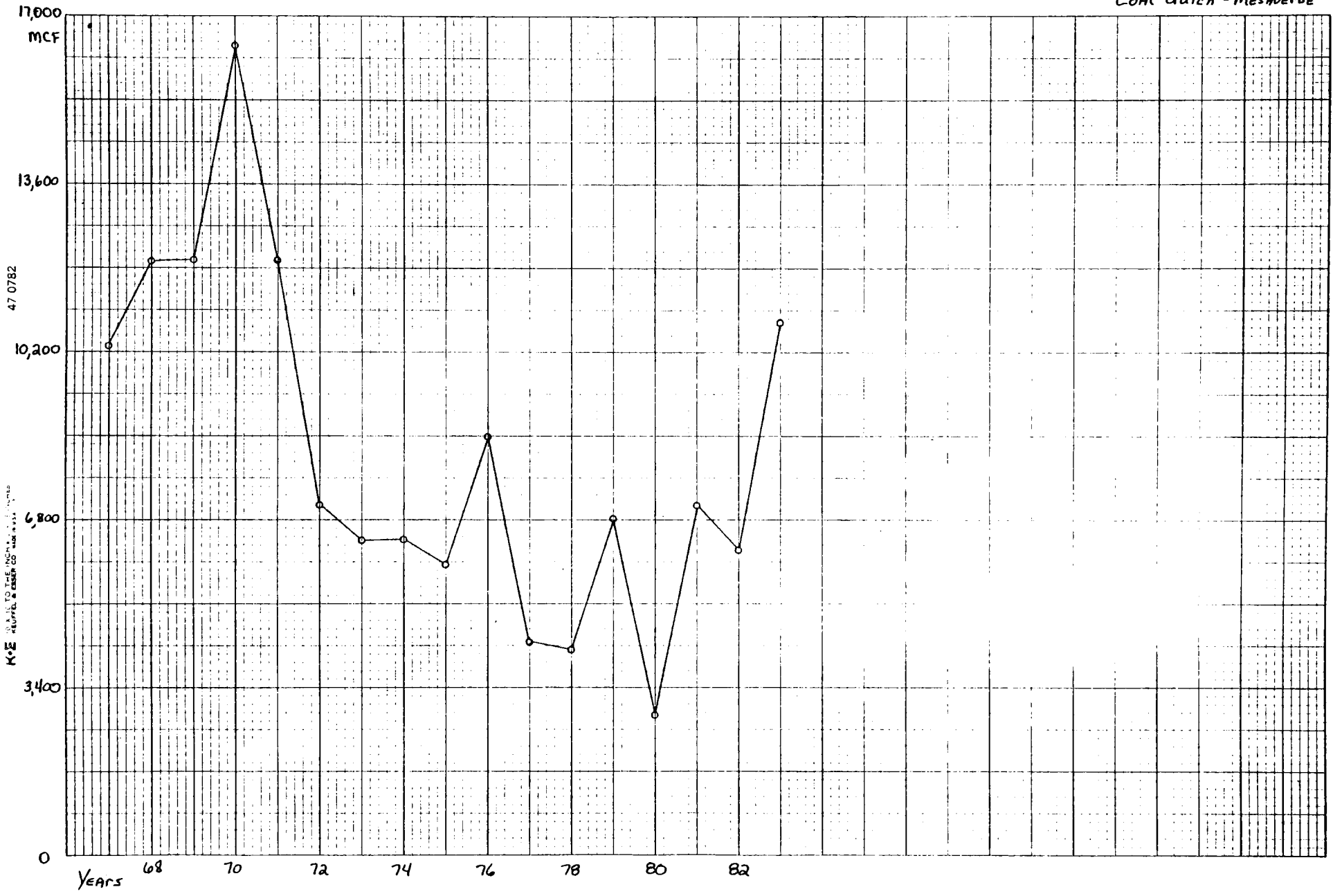
CAMEO - DAKOTA



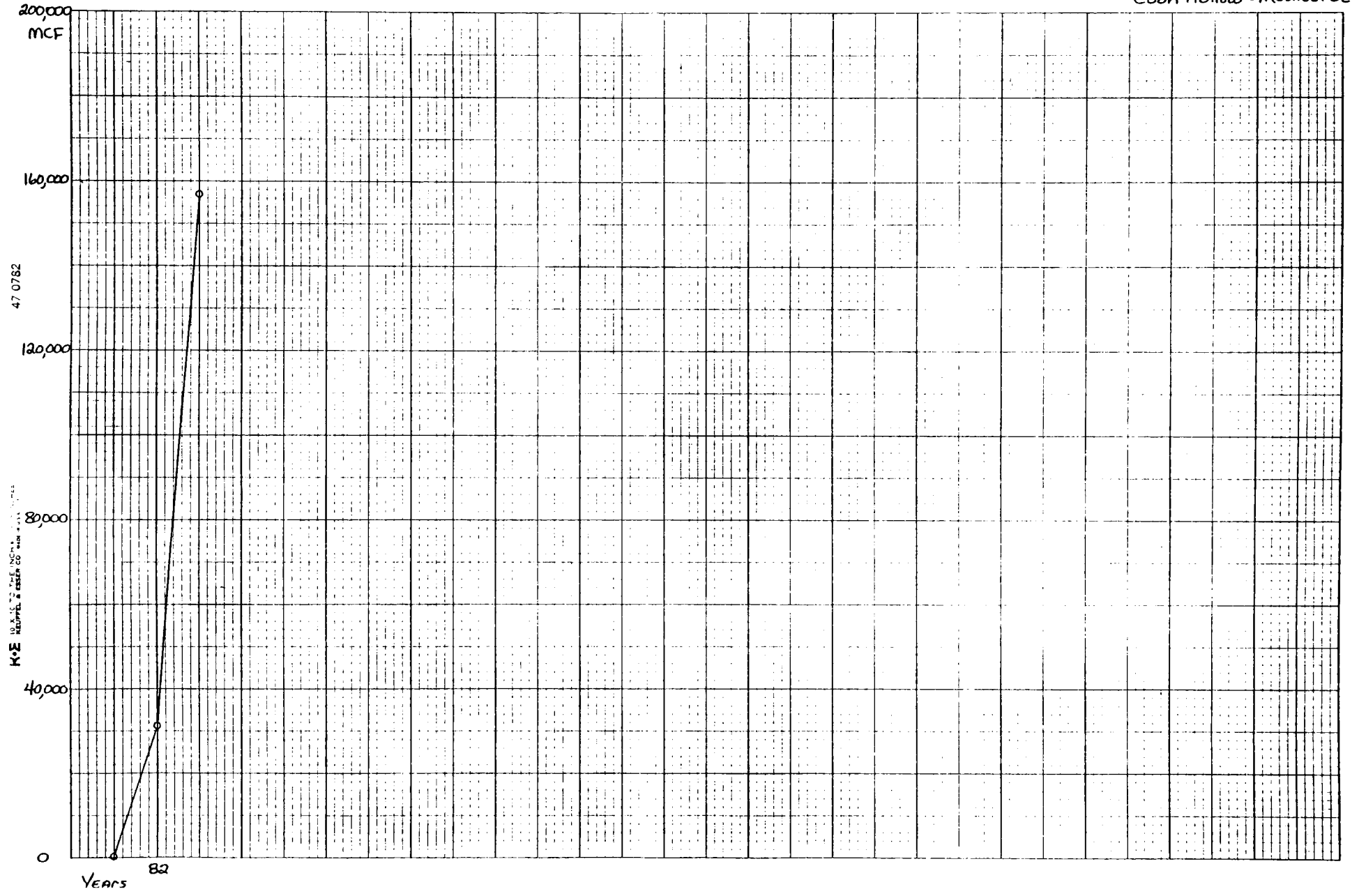
Coal Gulch - Dakota



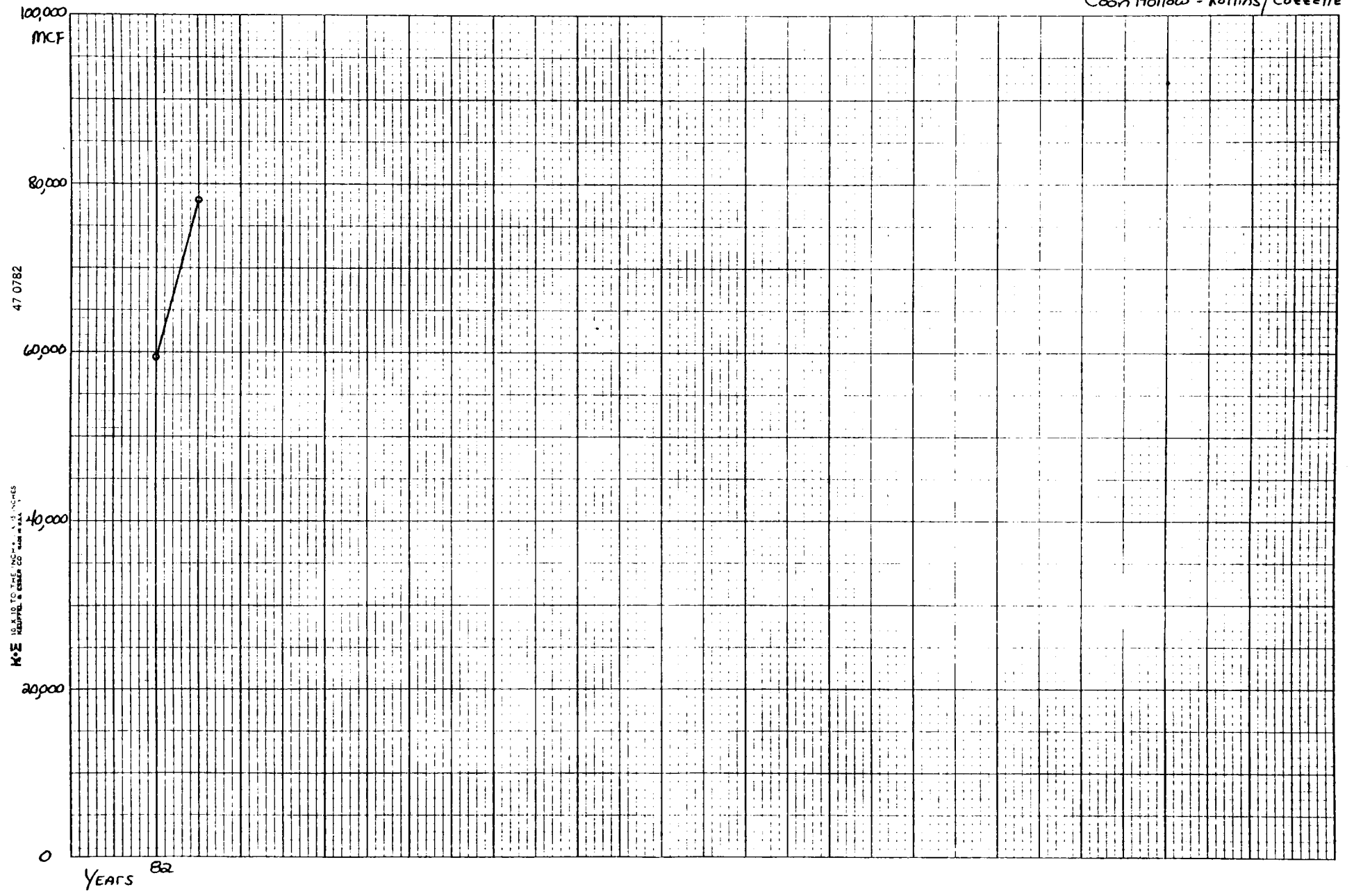
Coal Gulch - Mesaverde



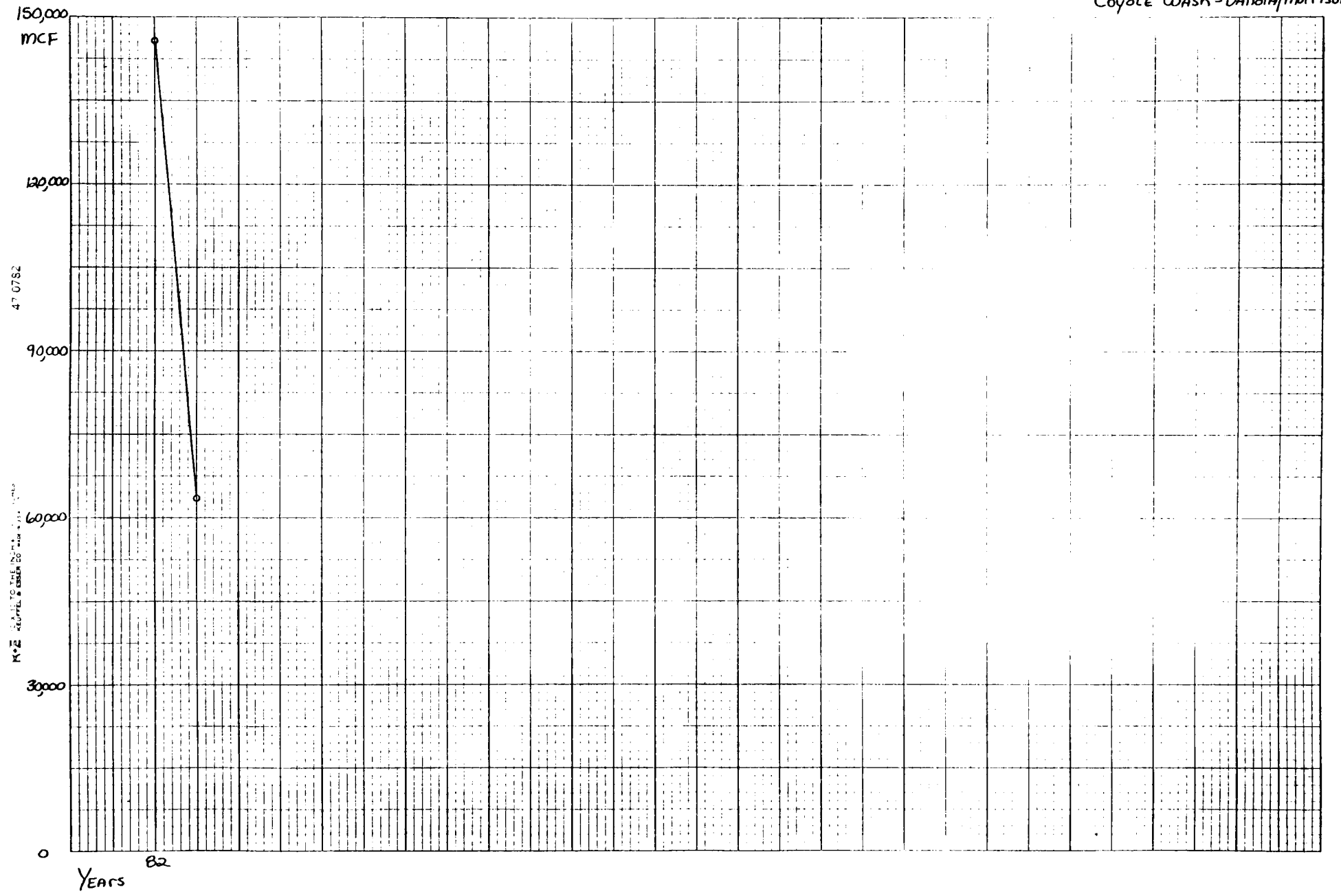
Coon Hollow - Mesaverde

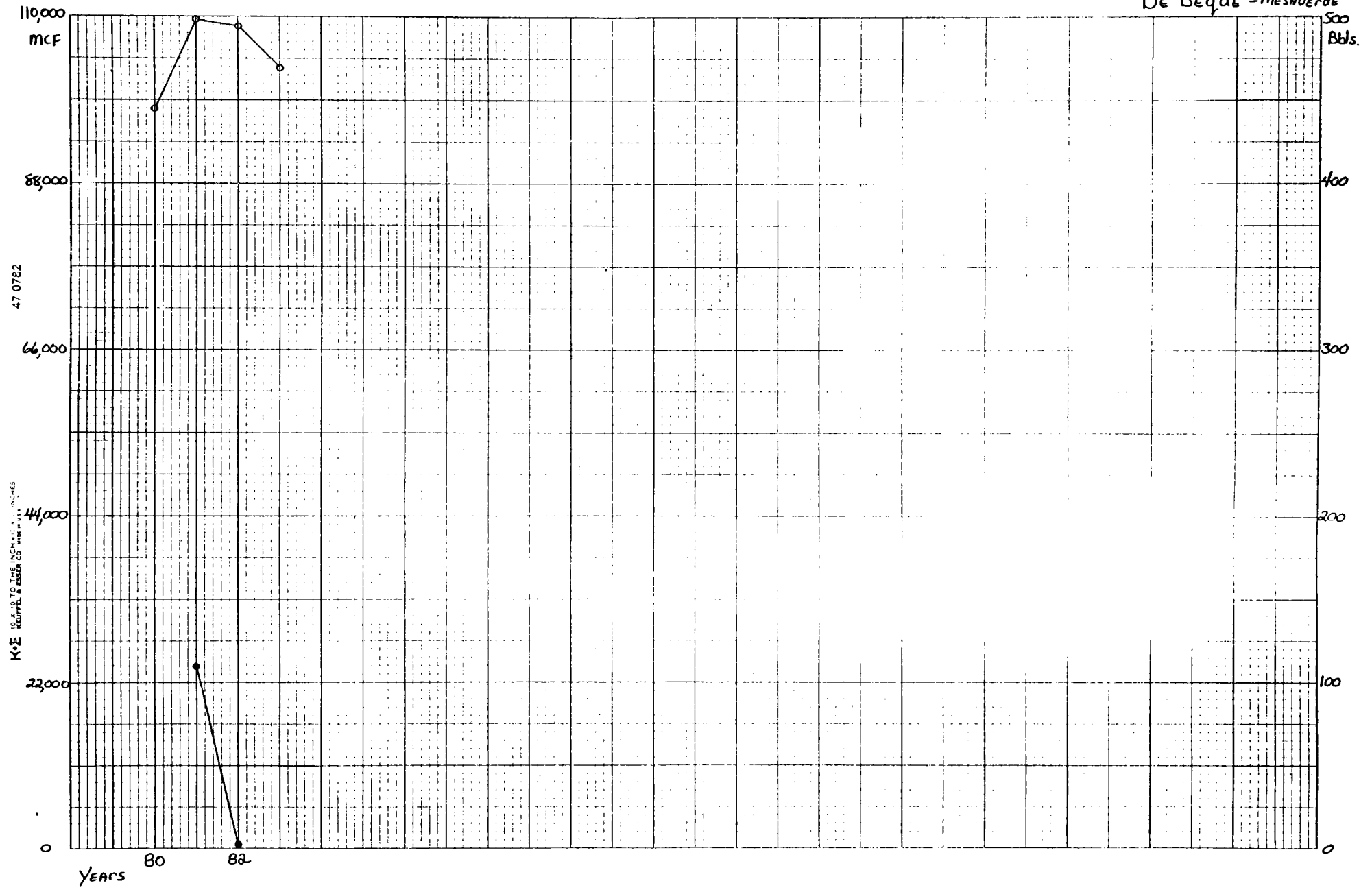


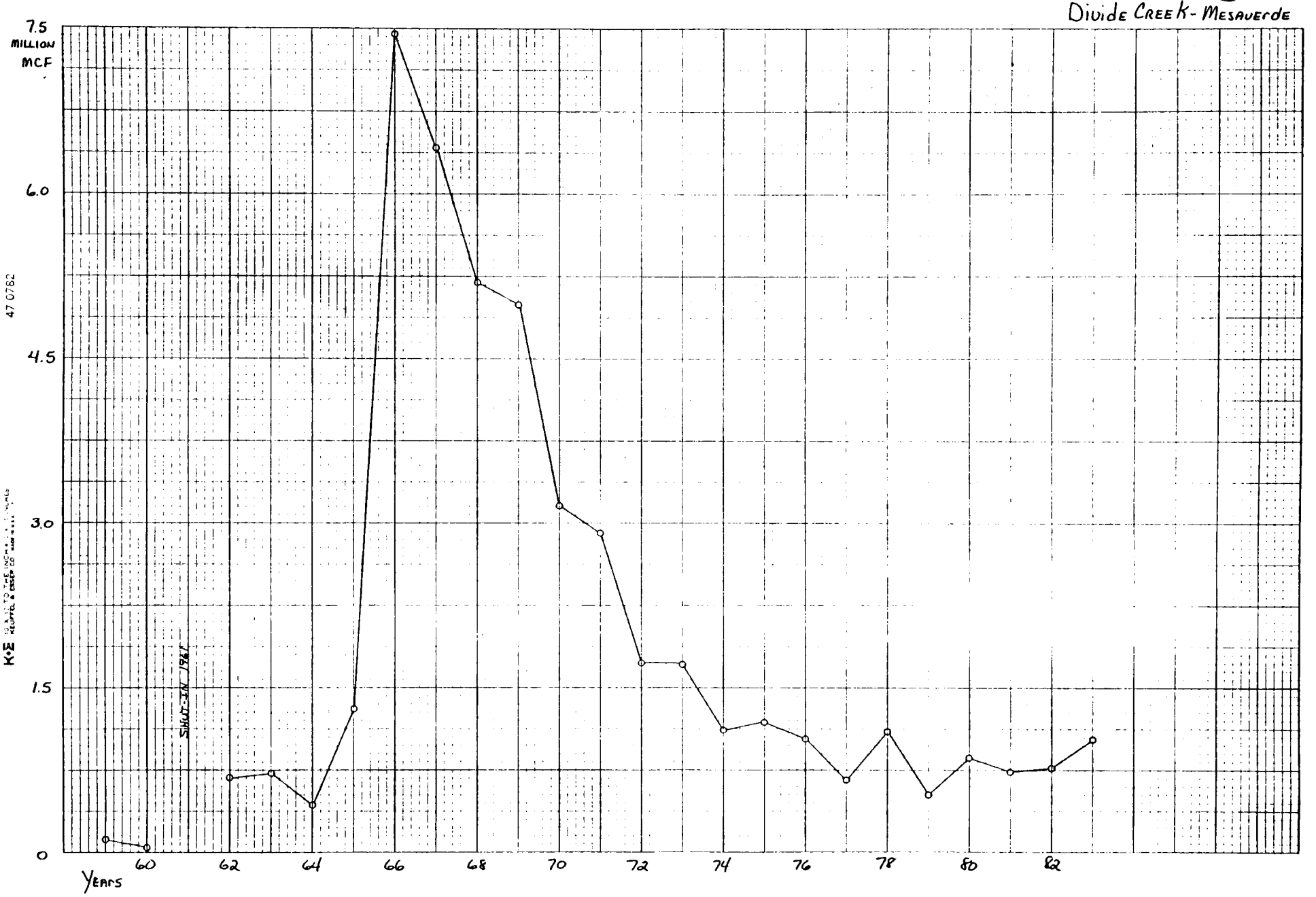
Coon Hollow - Rollins/Cozzette



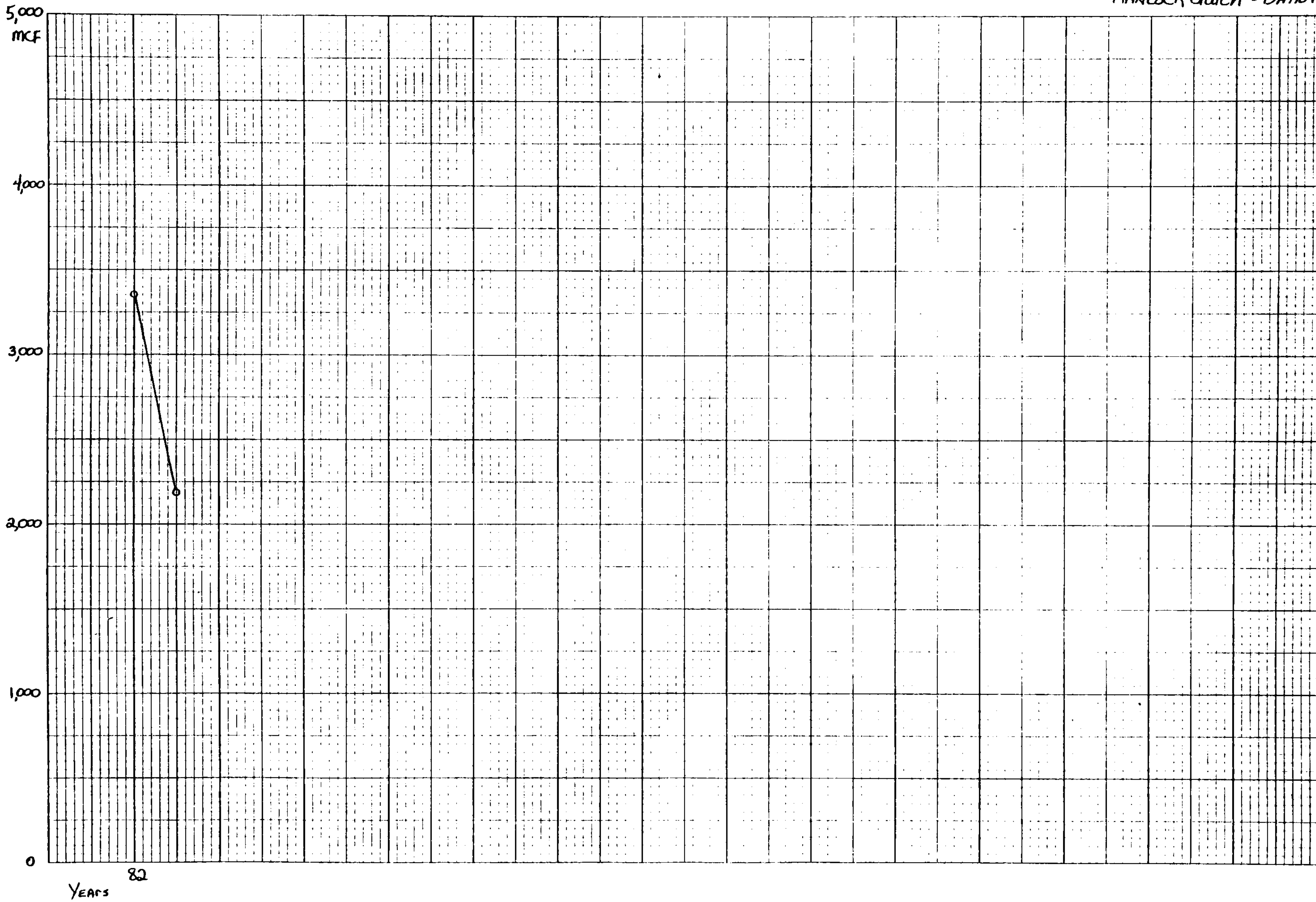
Coyote Wash - Dakota/Morrison



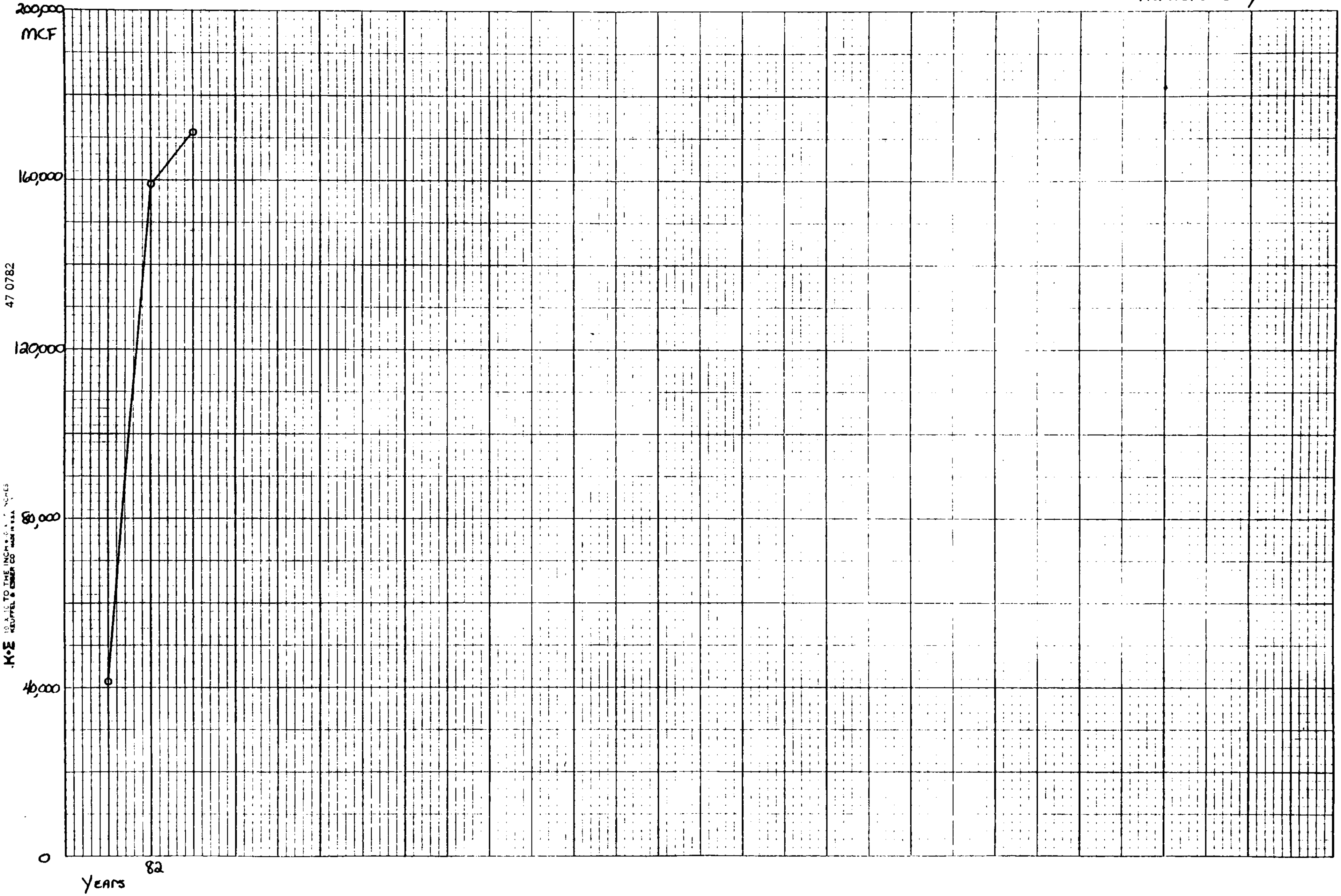

De Beque - Mesaverde
110,000
MCF
88,000
66,000
44,000
22,000
0
500
Bbls.
400
300
200
100
0
80
82
Years
47 0782
K•E

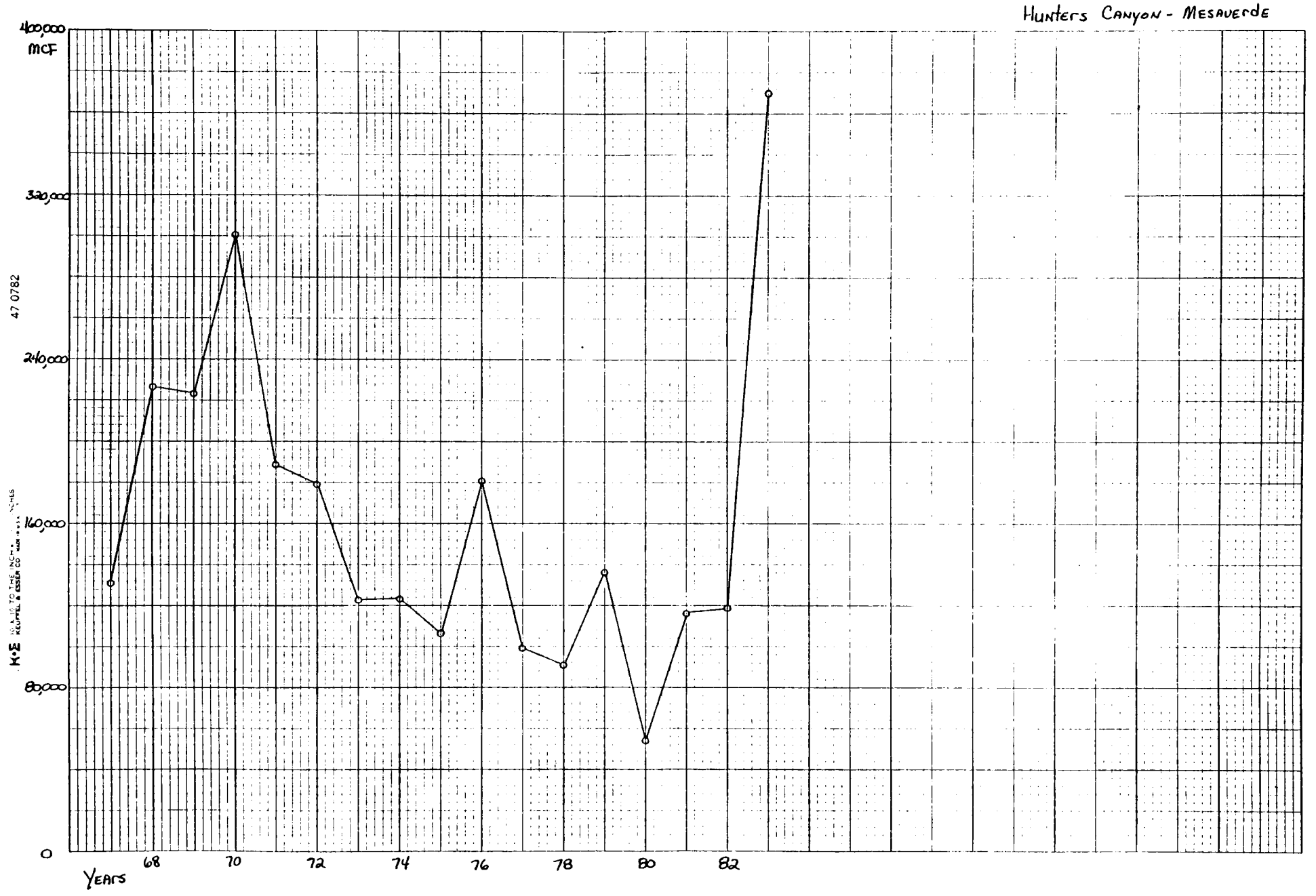

Divide Creek - Mesaverde
7.5
MILLION
MCF
6.0
4.5
3.0
1.5
0
60
62
64
66
68
70
72
74
76
78
80
82
Years
SHUT-IN 1981
47 0782
K&E

Hancock Gulch - Dakota

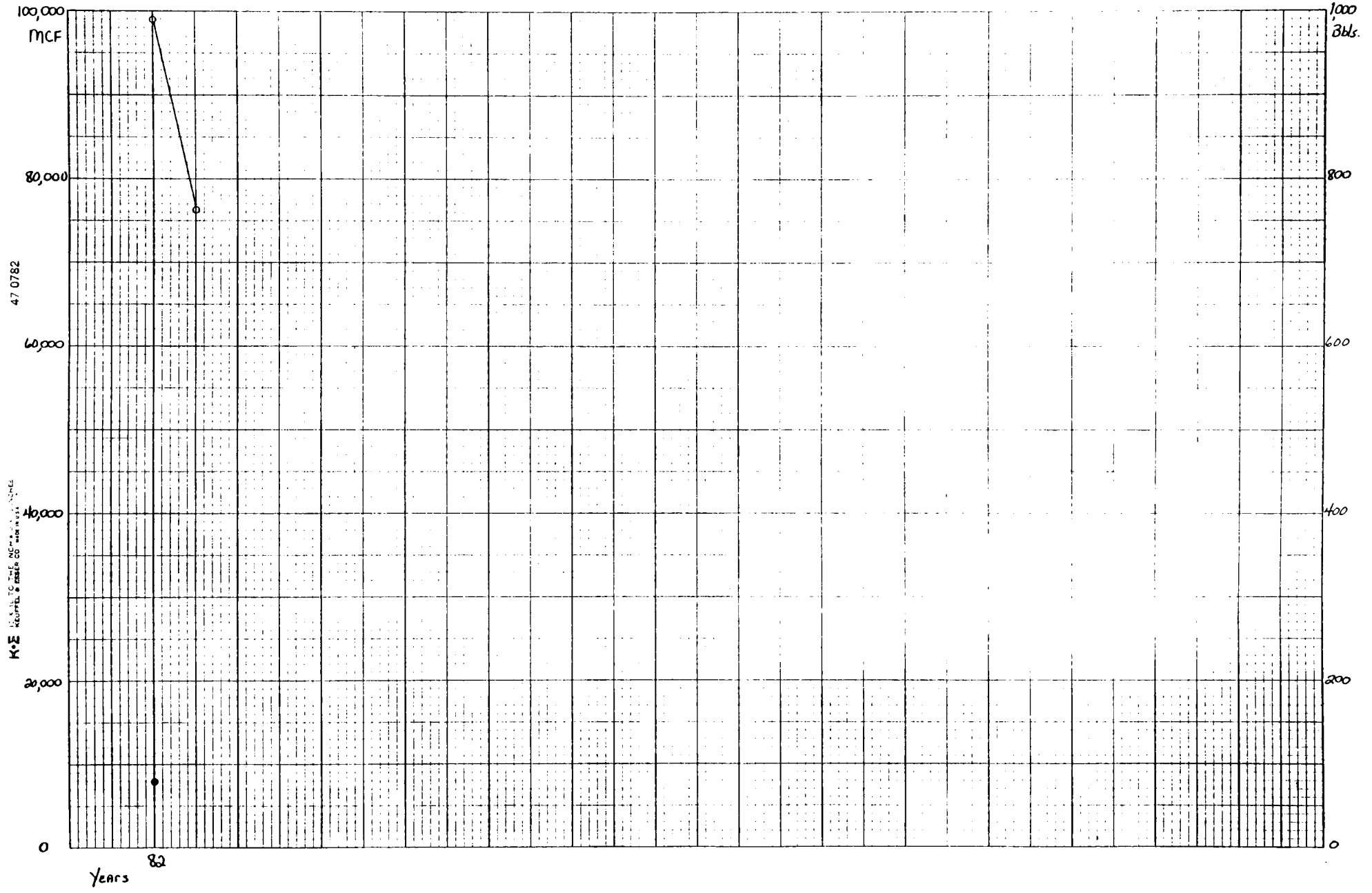


Hunters Canyon - Dakota

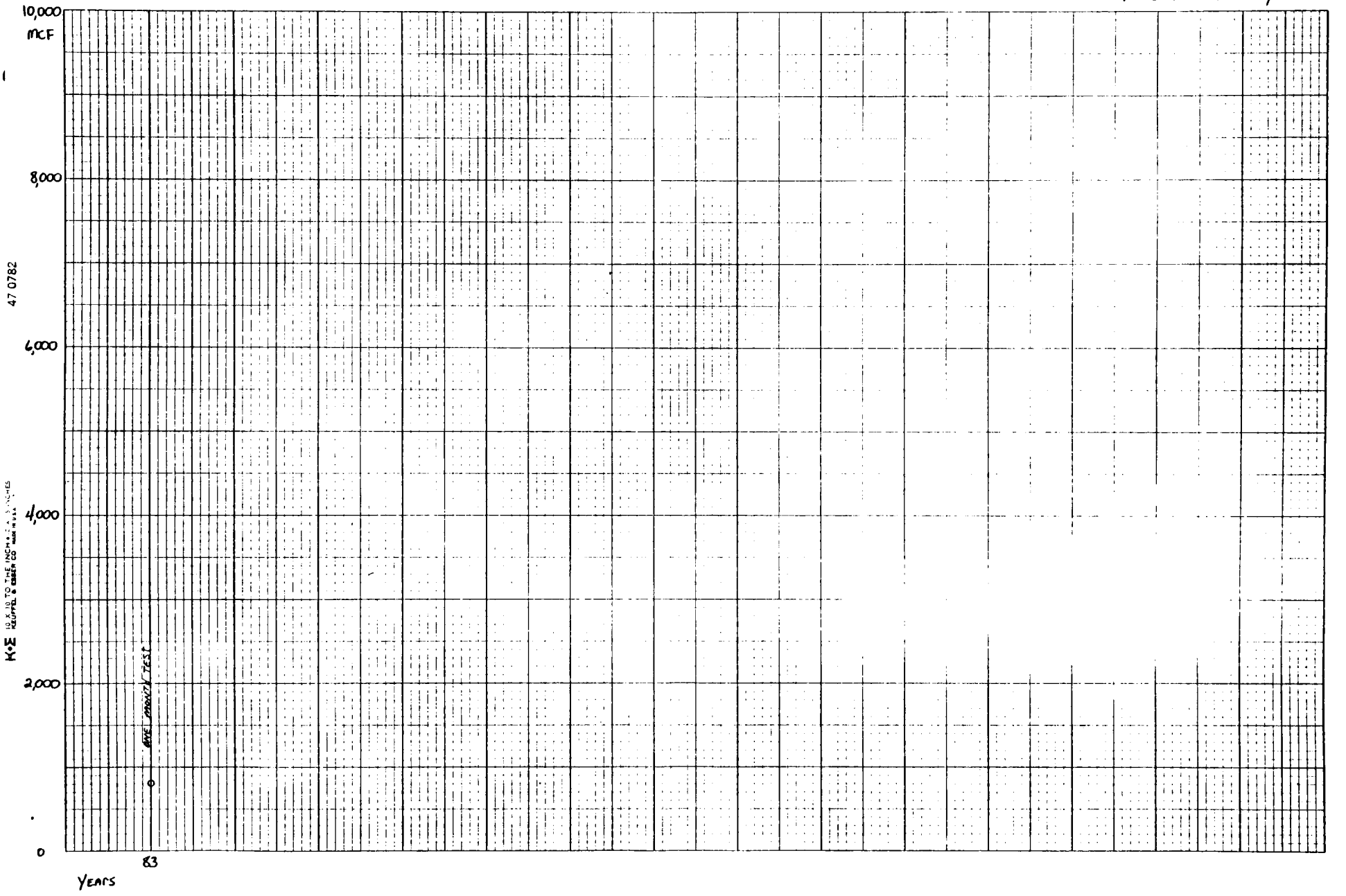



Hunters Canyon - Mesaverde
400,000
MCF
320,000
240,000
160,000
80,000
0
68
70
72
74
76
78
80
82
Years
47 0782
K+E

Lipan Wash - Dakota



Peachtree - Dakota/Morrison



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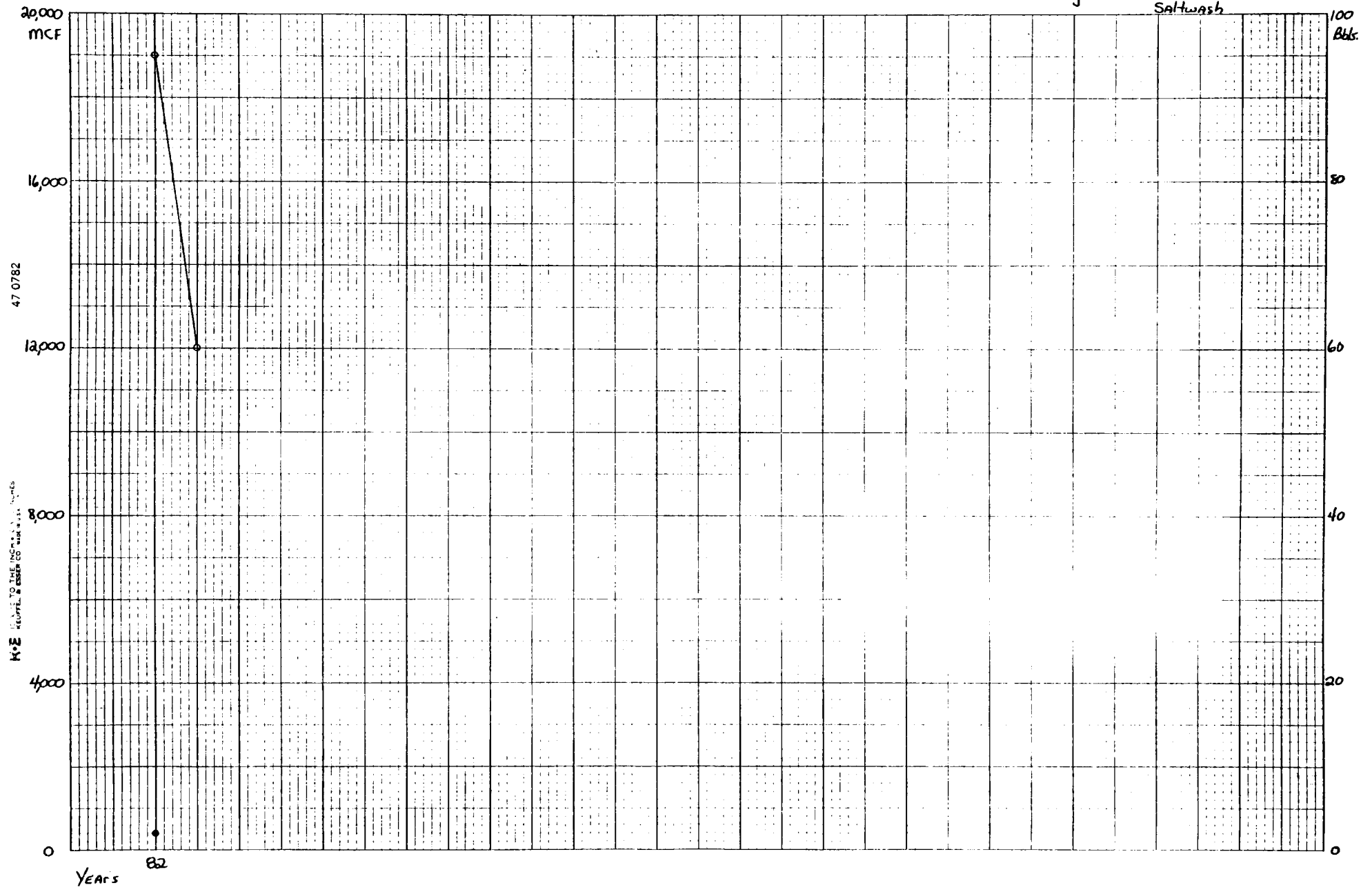
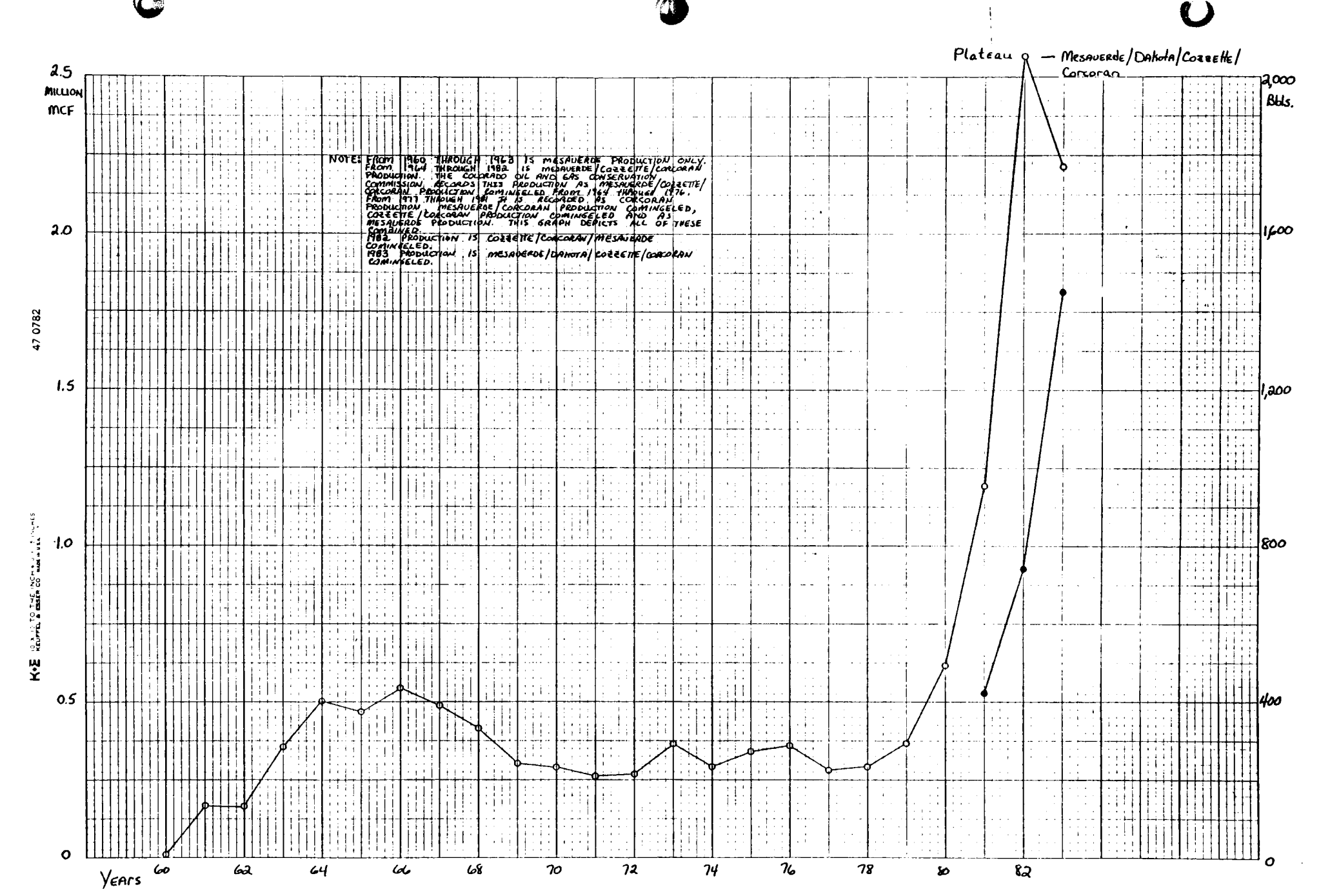
KEUFFEL & ESSER CO. MADE IN U.S.A.

Persigo Wash - Buckhorn/Dakota/Morrison/
Saltwash




Plateau — Mesaverde/Dakota/Cozzette/Corcoran
2.5
MILLION MCF
2.0
1.5
1.0
0.5
0
2,000 Bbls.
1,600
1,200
800
400
0
Years
60
62
64
66
68
70
72
74
76
78
80
82
NOTES: FROM 1960 THROUGH 1963 IS MESAVERDE PRODUCTION ONLY.
FROM 1964 THROUGH 1982 IS MESAVERDE/COZZETTE/CORCORAN PRODUCTION. THE COLORADO OIL AND GAS CONSERVATION COMMISSION RECORDS THIS PRODUCTION AS MESAVERDE/COZZETTE/CORCORAN PRODUCTION COMINGELED FROM 1964 THROUGH 1976.
FROM 1977 THROUGH 1981 IS RECORDED AS CORCORAN PRODUCTION MESAVERDE/CORCORAN PRODUCTION COMINGELED, COZZETTE/CORCORAN PRODUCTION COMINGELED AND AS MESAVERDE PRODUCTION. THIS GRAPH DEPICTS ALL OF THESE COMBINED.
1982 PRODUCTION IS COZZETTE/CORCORAN/MESAVERDE COMINGELED.
1983 PRODUCTION IS MESAVERDE/DAKOTA/COZZETTE/CORCORAN COMINGELED.
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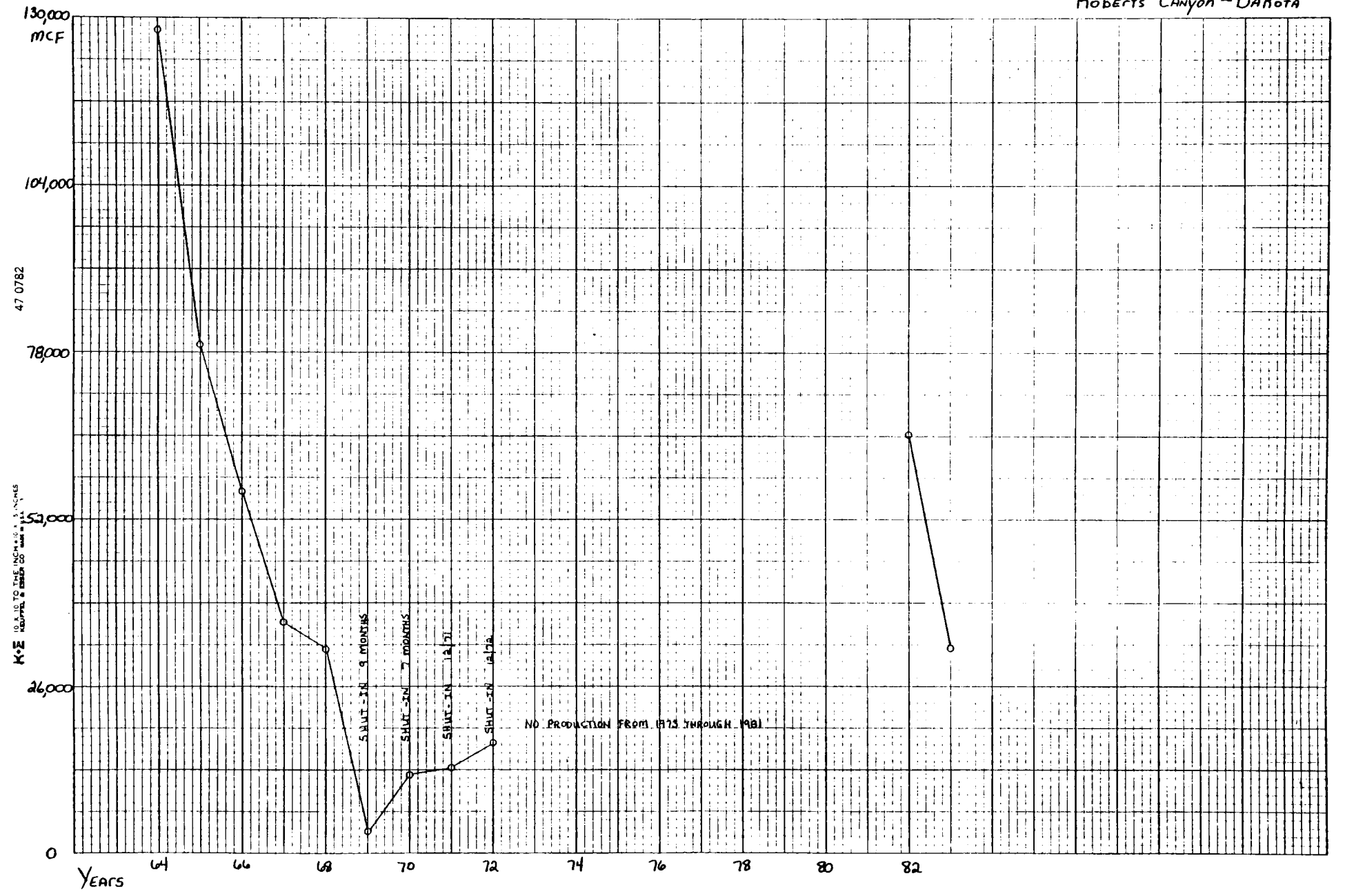
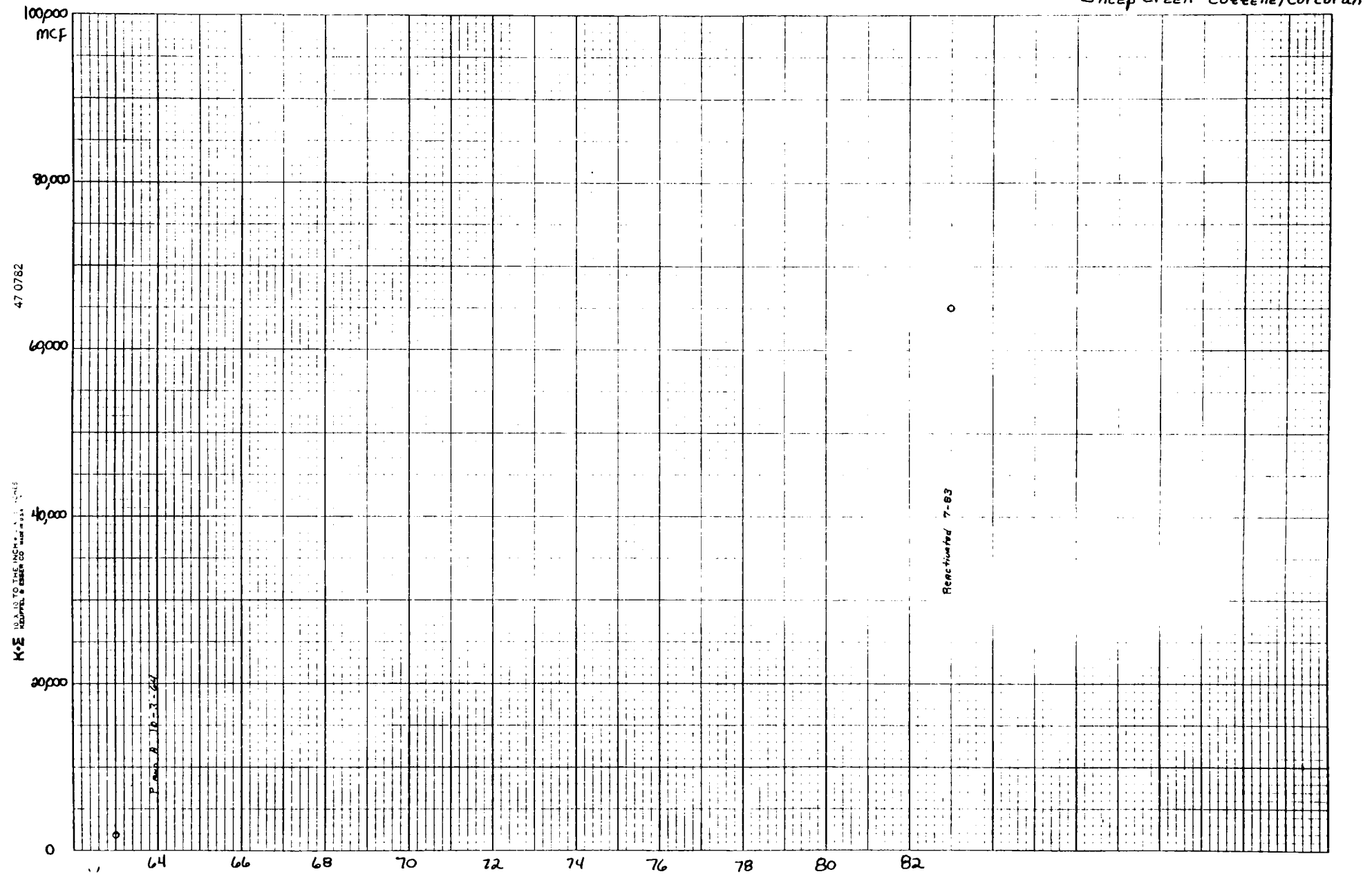
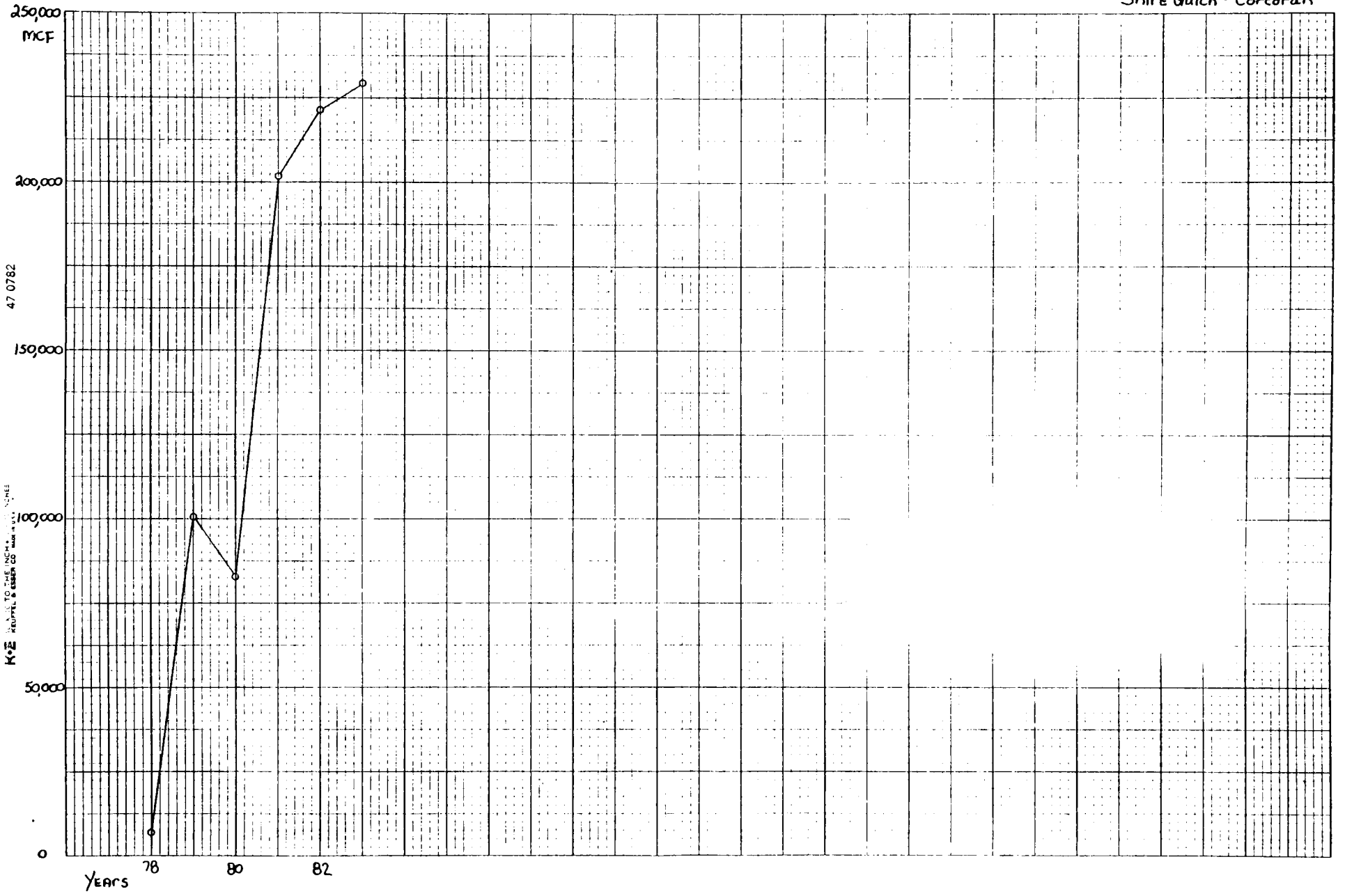
K+E
KEUFFEL & ESSER CO


Roberts Canyon - Dakota
130,000
MCF
104,000
78,000
52,000
26,000
0
47 0782
K·E
10 X 10 TO THE INCH
KEUFFEL & ESSER CO
SHUT-IN 9 MONTHS
SHUT-IN 7 MONTHS
SHUT-IN 1971
SHUT-IN 1972
NO PRODUCTION FROM 1973 THROUGH 1981
64
66
68
70
72
74
76
78
80
82
Years

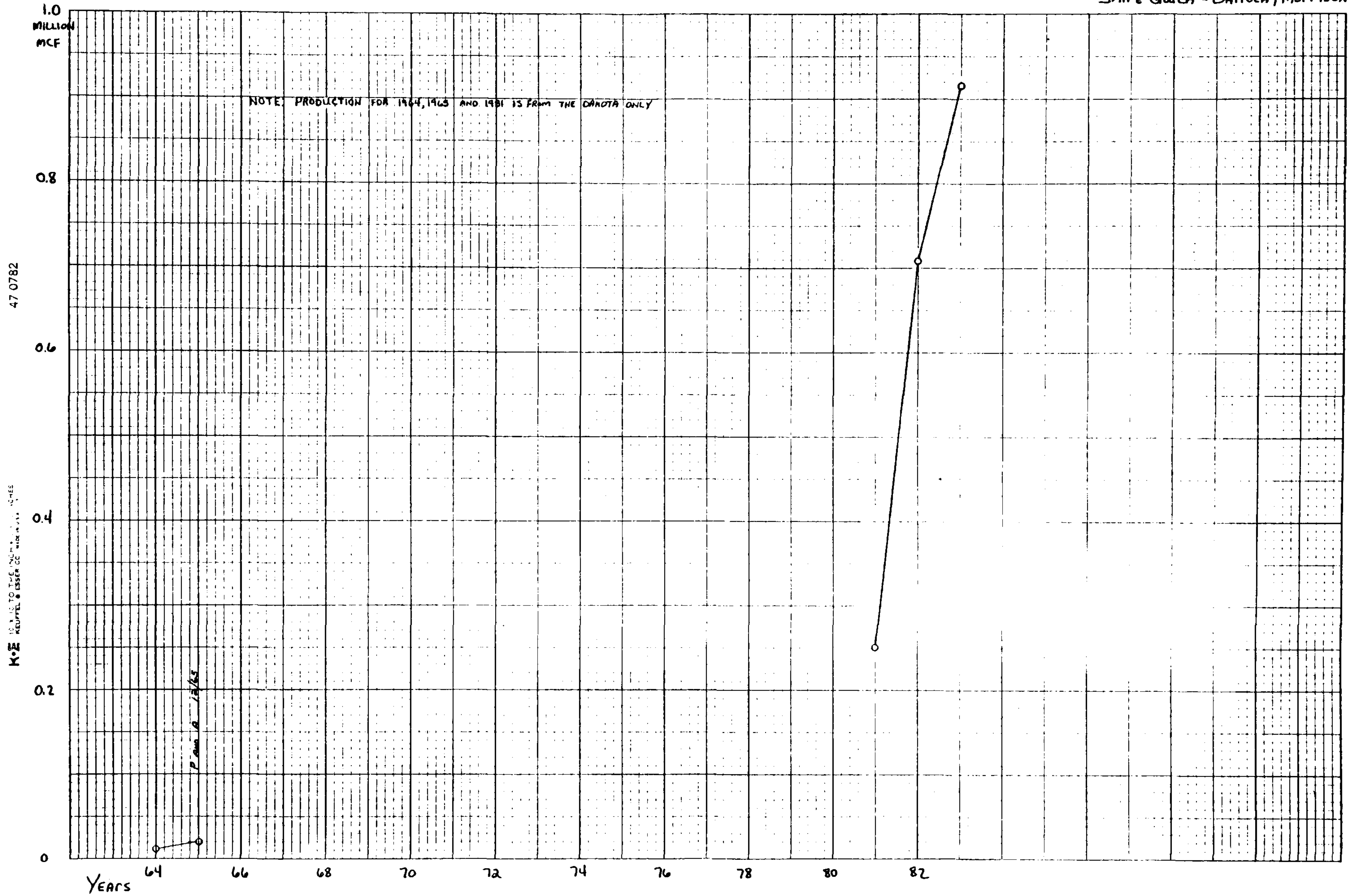
Sheep Creek-Cozzette/Corcoran



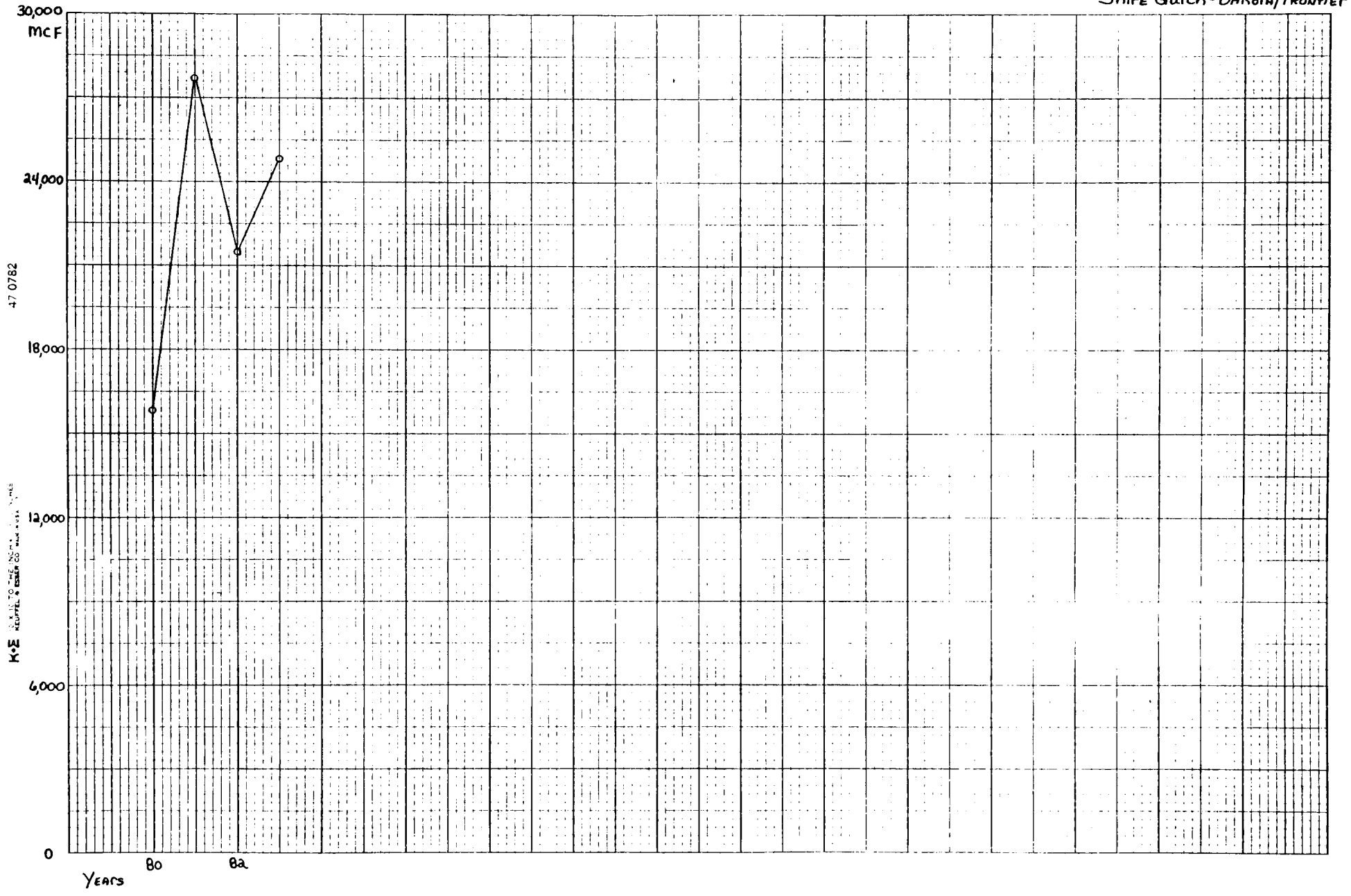
Shire Gulch - Corcoran



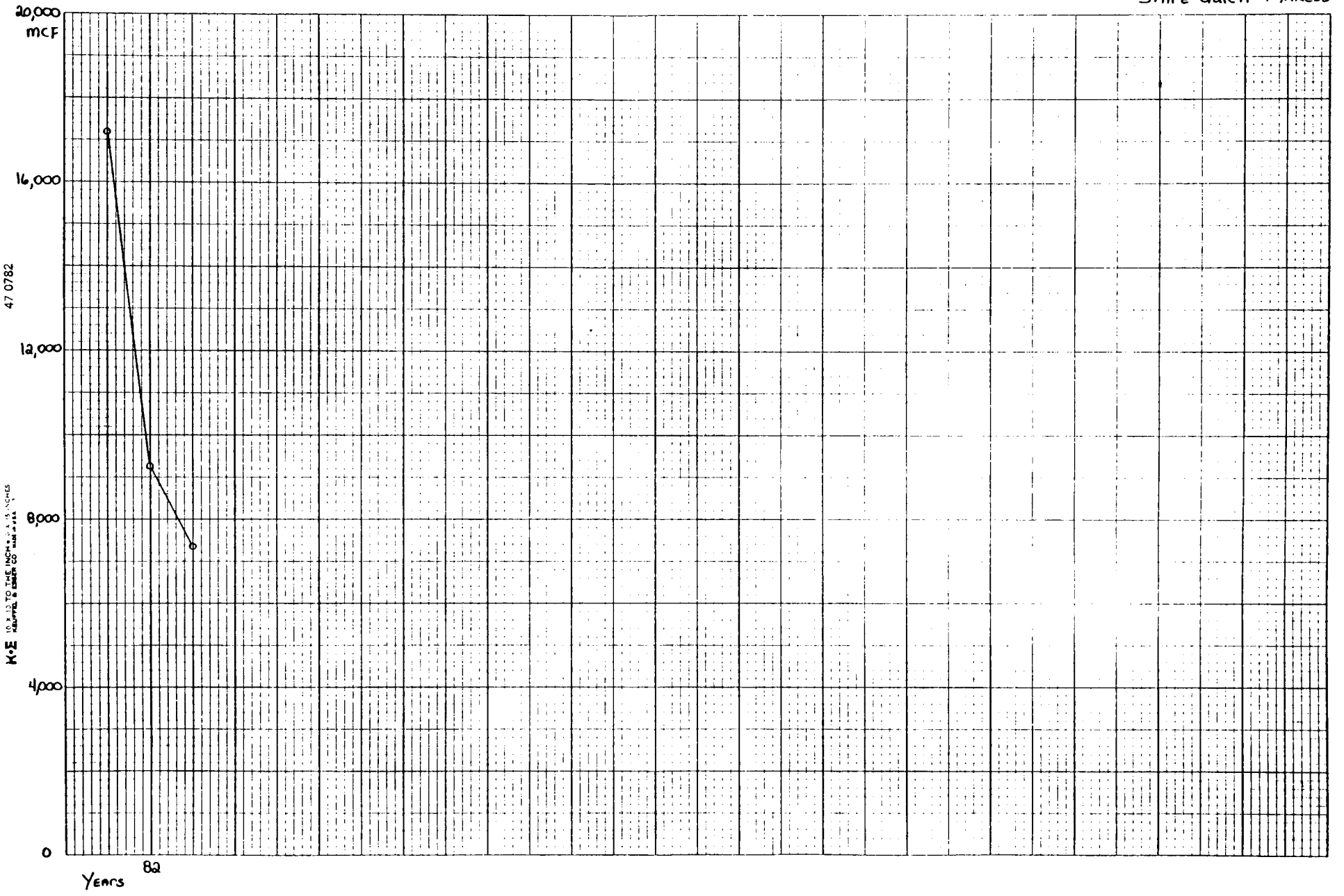
Shire Gulch - Dakota/Morrison



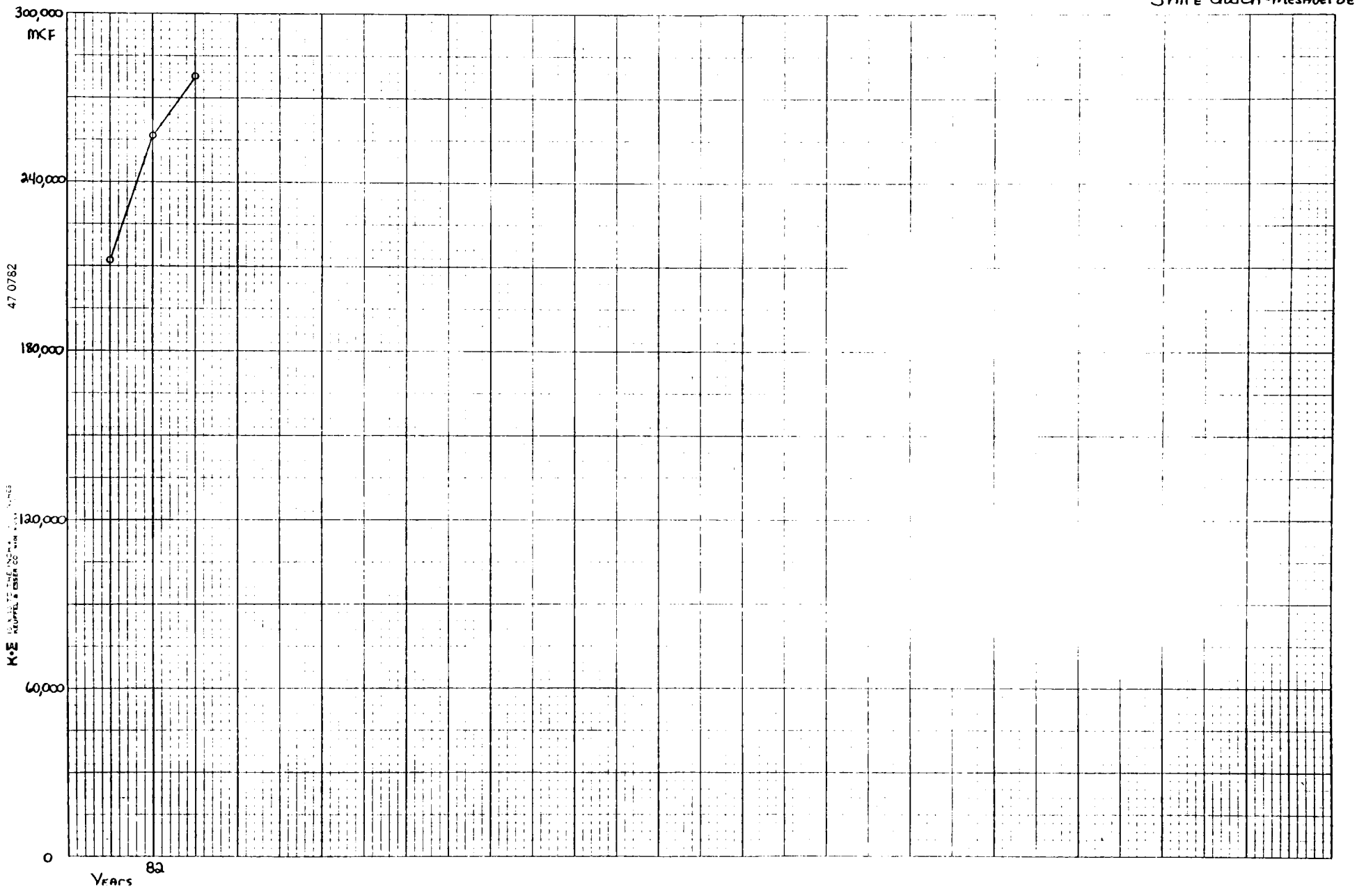
Shire Gulch - DAKota/Frontier



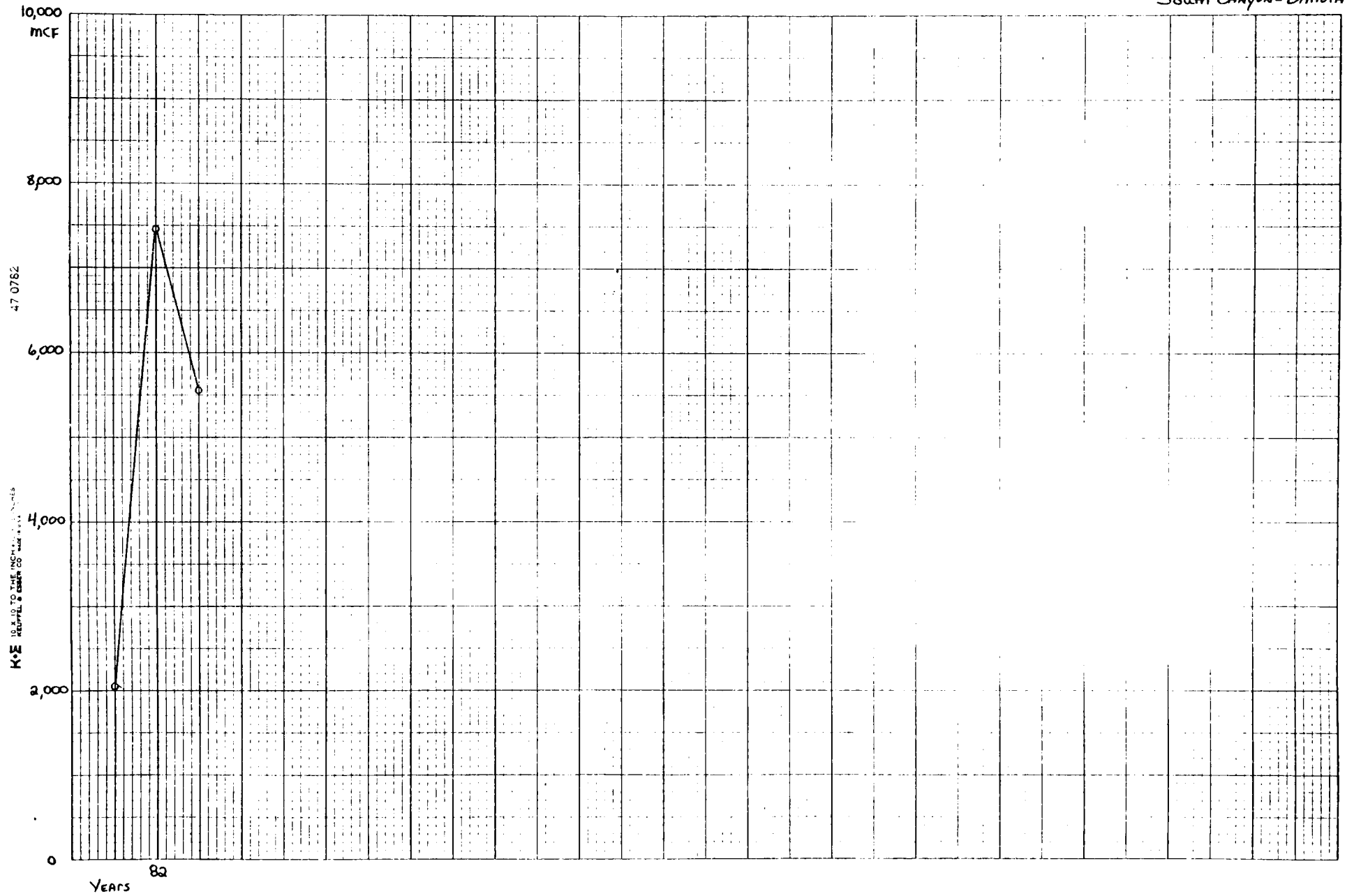
Shire Gulch - Mancos



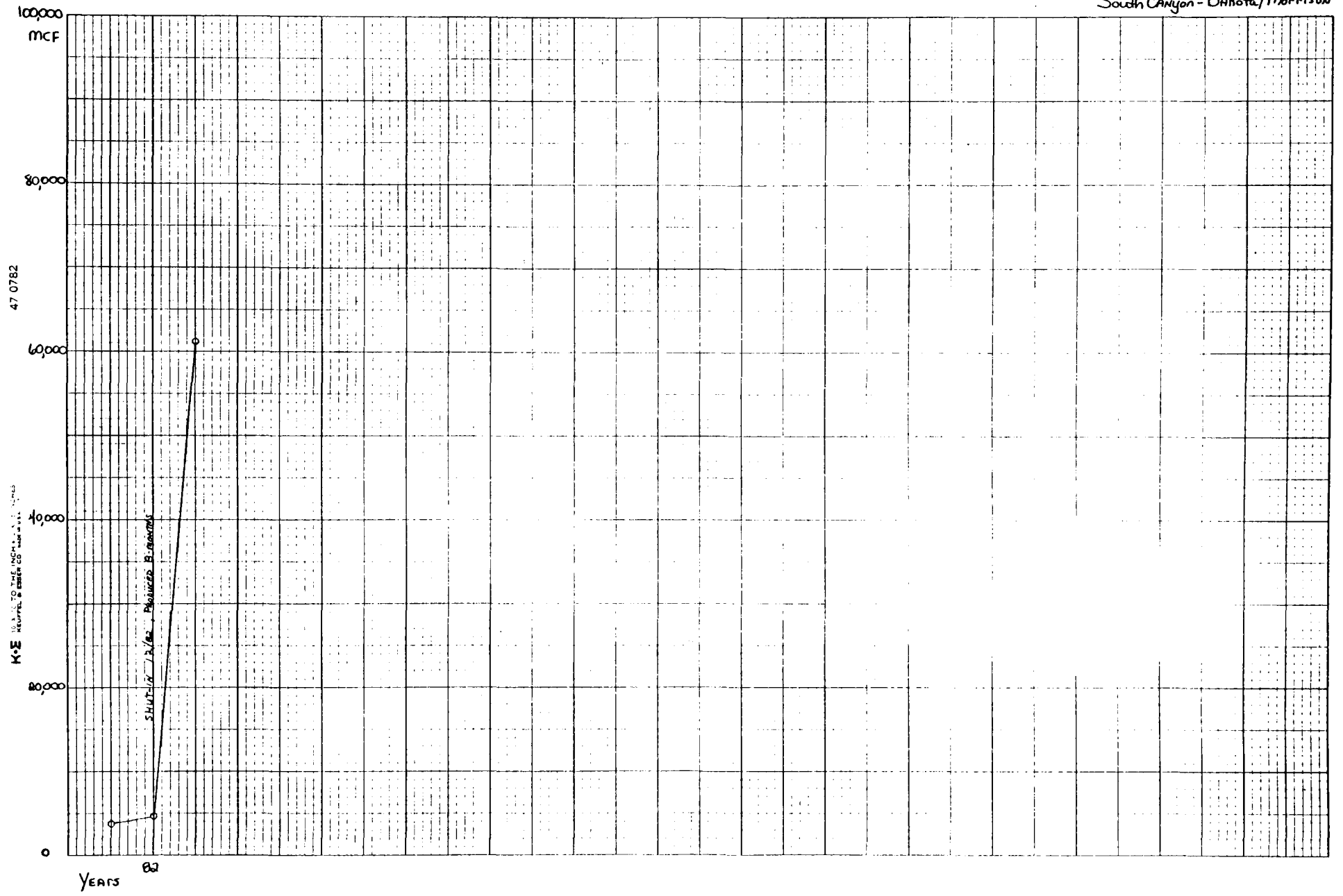
Shire Gulch - Mesaverde



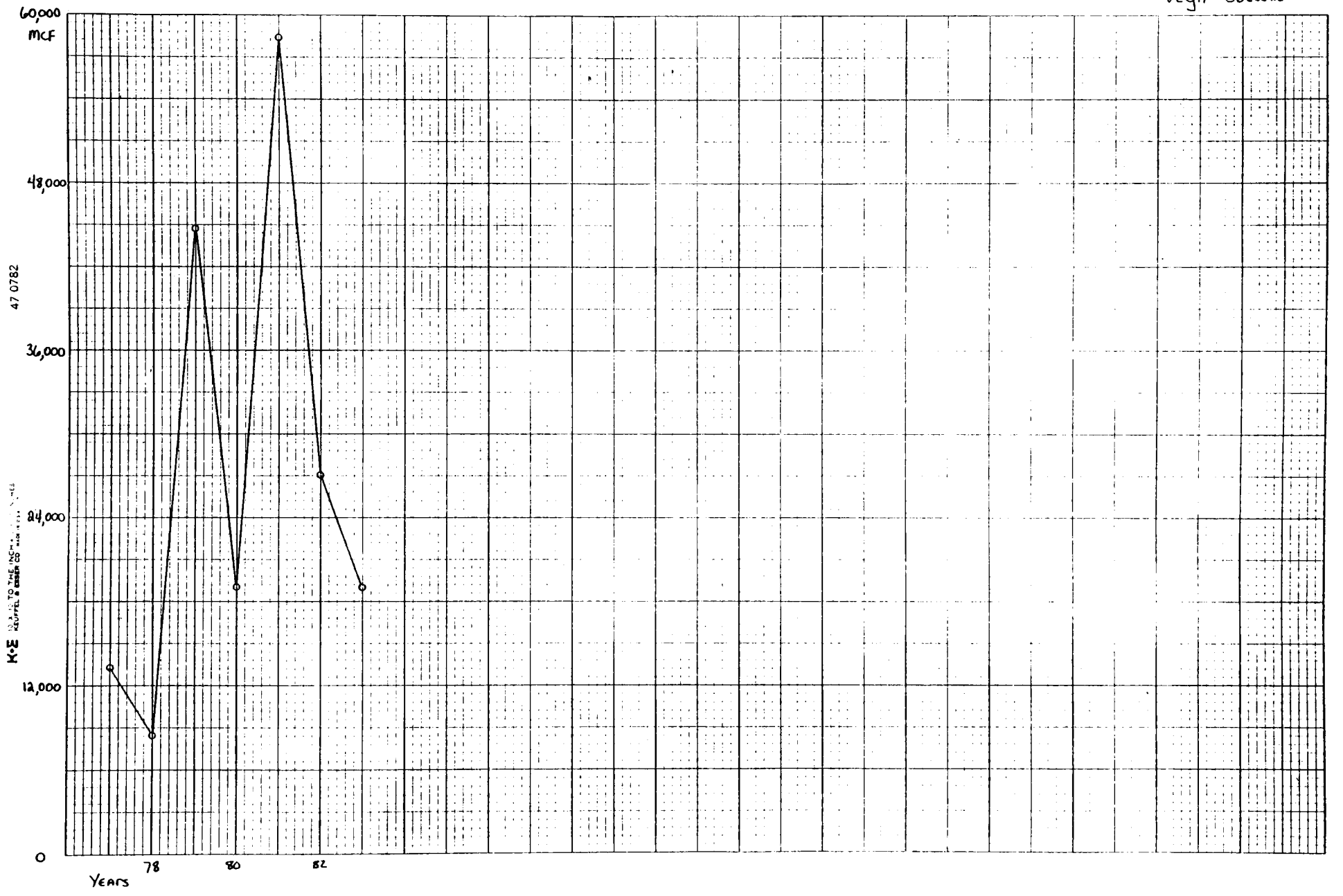
South Canyon - Dakota



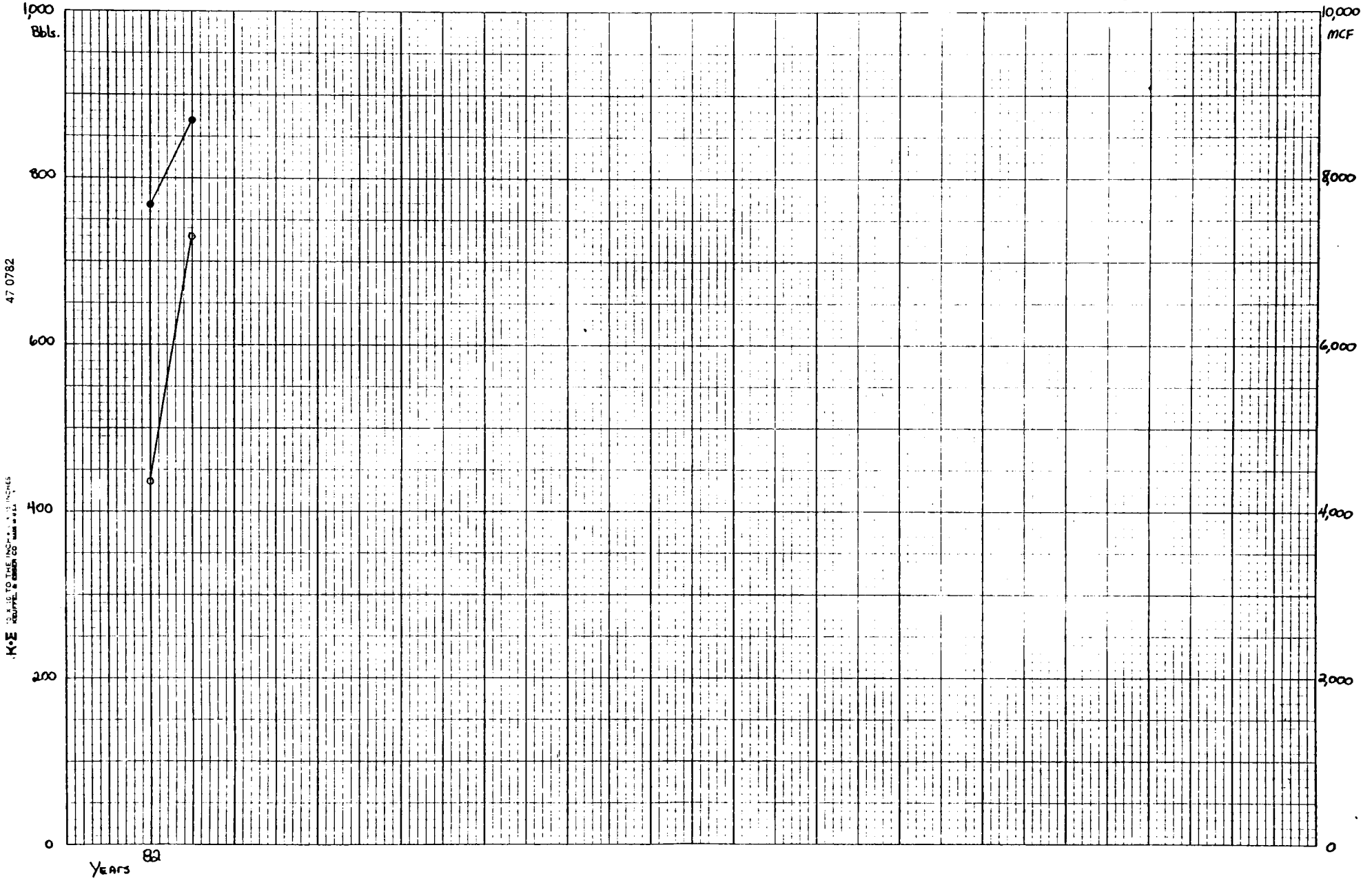
South Canyon - Dakota/Morrison



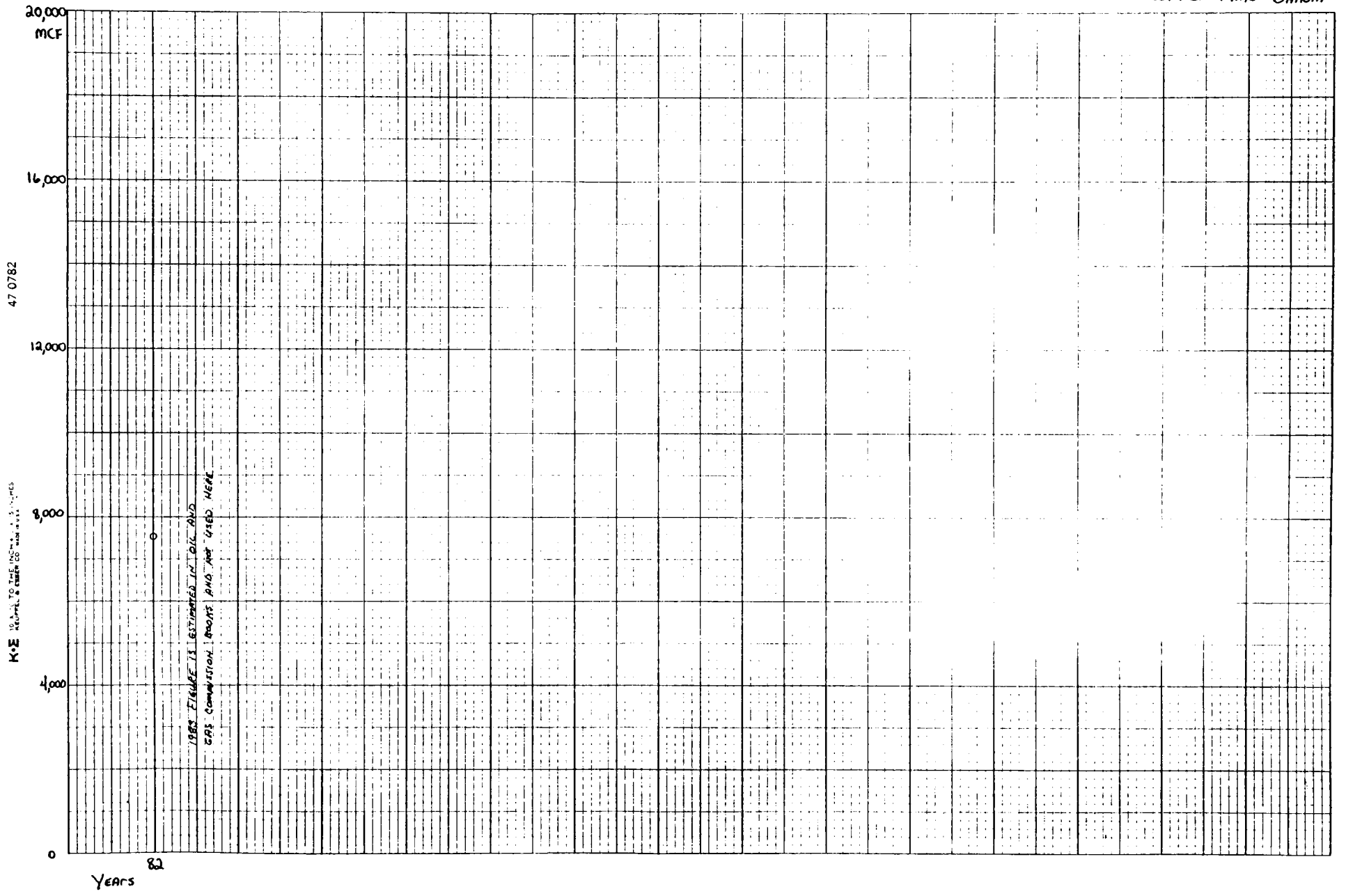
Vega - Cozette



White Water - Dakota



Winter Flats - Dakota



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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 83-6: 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.
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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