

OPEN FILE 84-10

ESTIMATED OIL AND GAS RESERVES FOR GARFIELD COUNTY, COLORADO

Compiled by  
A. H. Scanlon

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



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Colorado Geological Survey  
Department of Natural Resources  
State of Colorado  
Denver, Colorado  
1984

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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.

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 GARFIELD COUNTY, COLORADO

## Introduction

This report is the eighth\* 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 Garfield County, located in northwestern Colorado, approximately 20 miles north of Grand Junction, within the Piceance Basin. Garfield County covers 3,000 square miles. In this county, oil and/or gas are produced from, in descending order of age, the Wasatch Sandstone, Rollins Sandstone, Cozette Sandstone, Corcoran Sandstone, Mesaverde Sandstone, Niobrara Limestone, Mancos Shale, Dakota Sandstone, Buckhorn Sandstone, Morrison Sandstone, and Entrada Sandstone.

There are 20 fields considered active producers as of September 30, 1983. All 20 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; and
- OPEN-FILE REPORT 84-9: Estimated Oil and Gas Reserves for Cheyenne County, Colorado.

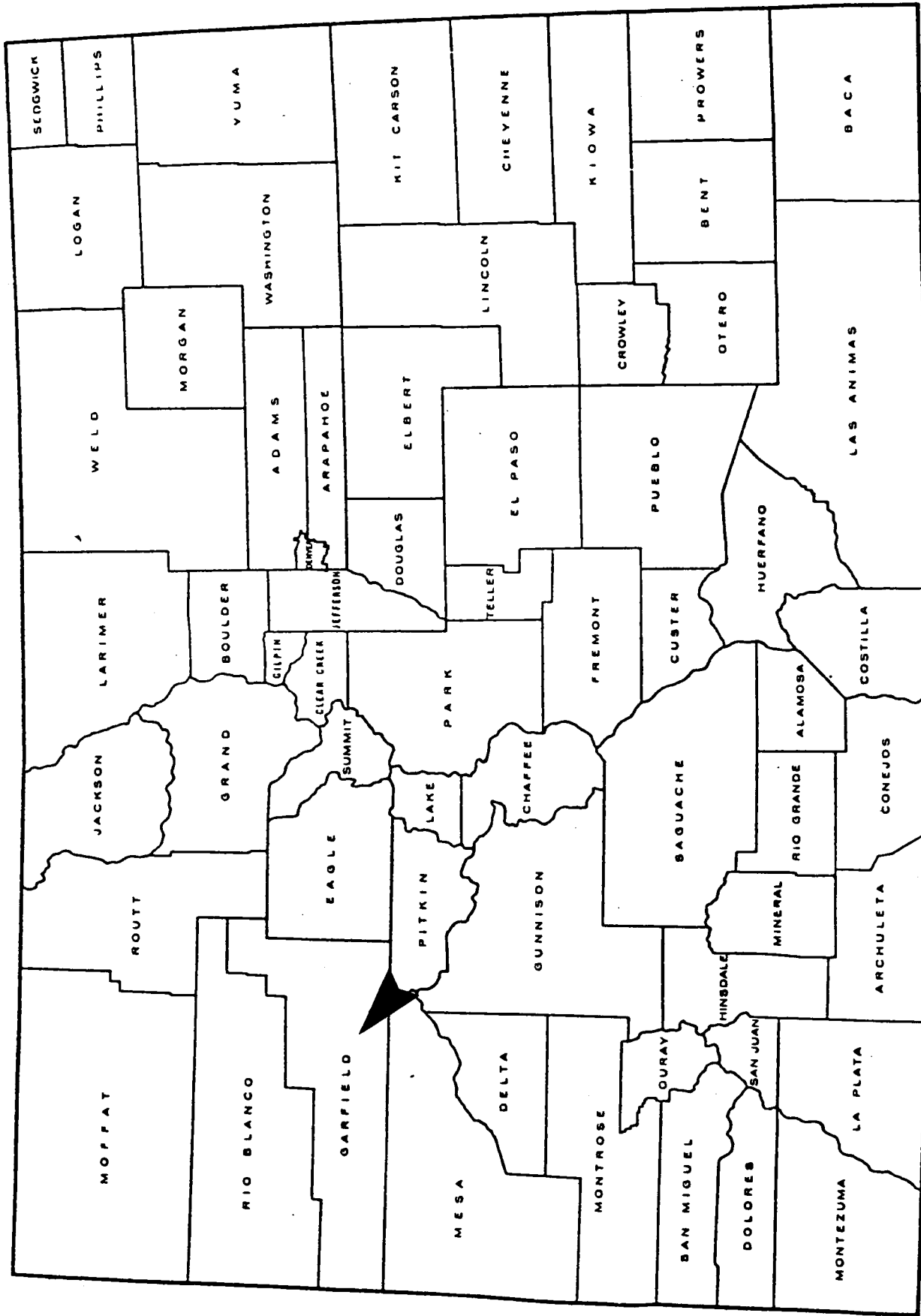


Figure 1. County Location Map

## 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 35 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, Bridle-Entrada. Its production history has allowed for a decline rate to be calculated. This decline rate was 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 34 gas field-horizons. Production histories have allowed for decline rates to be calculated for 17 of these. The remaining 17 gas field-horizons have not produced for a long enough time (less than 4 years) to determine a reliable decline rate. Decline rates were determined for the previously mentioned 17 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.

Only one gas field-horizon, South Canyon-Dakota/Morrison, had "associated" condensate production. In this case a decline rate was determined and applied to the oil reserve equation previously discussed. An economic limit of zero was used in this case as the condensate production is 'secondary' with respect to the gas production.

## Results

The following figures are for those field-horizons for which reserves could be calculated. Estimated oil reserves for Garfield County totaled 17,047 barrels. Estimated gas reserves for Garfield County totaled 51,330,082 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 four to five years, roughly half of the estimated oil reserves in Garfield 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 five to six 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 (15.65 percent per year for oil and 12.45 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 (804 Bbls. of oil and 1,567,717 MCF of gas) additional reserves of 4,724 Bbls. of oil and 11,710,606 MCF of gas were obtained. This gives total county reserves (Class I and II) of 21,771 Bbls. of oil and 63,040,688 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 no significant differences in the sources of production for the two groups. Therefore, it is concluded that the overall decline rates can be applied with confidence.



## 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 Encroachment
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  
OPEN FILE 84-10  
RESERVE DATA FOR GARFIELD 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.) ( )Condensate (Bbls.)	GAS (MCF)	OIL (Bbls.) ( )Condensate (Bbls.)	GAS (MCF)	
1. Baldy Creek/ Cozette	7S-90W	1980		50.0	-0	305,390	718	306,108			NOTE: Used Proj. '83 value to calc. S. N.P. Also Prod. in Rio Blanco Co. Also Prod. in Rio Blanco Co. N.P. N.P. Prod. '77, '82 & '83. SI 12/82; Also prod. in Rio Blanco Co. SI-1983
2. Baxter Pass/ Dakota	4S-103W	1982	Gas Exp.			(804)					
3. Baxter Pass/ Mancos B	4S-103W	1980				9,404					
4. Baxter Pass/ Morrison	4S-103W	1977	Gas Exp.			17,898					
5. Baxter Pass So./5S-102W Morrison	5S-102W	1978	Gas Exp.			282,924					
6. Bridle/Entrada	8S-104W	1980		9.9	-0	5,483	12,432	17,915			
7. Bridle/Dakota- Morrison	8S-104W	1976		13.0	-9	(68)	9,749,475	(+68)	16,609,265		
8. Calf Canyon/ Dakota	6S-102W	1982				53,172					N.P.
9. Calf Canyon/ Dakota-Morrison	6S-102W	1982				38,694					N.P.
10. Calf Canyon/ Mesaverde	6S-102W	1982				47,401					N.P.
11. Calf Canyon/ Niobrara	6S-102W	1982				136					N.P.
12. Carbonera/ Dakota	7S-104W	1959		6.4	-9	(121)	150,104	(+121)	907,769		NOTE: No Gas Prod. from 1965 thru 1971. NOTE: No Gas Prod. from 1972 thru 1981. N.P. Also Prod. in Mesa Co.
13. Carbonera/ Dakota-Morrison	7S-104W	1959		6.0	-9	321,400	159,572		480,972		
14. Divide Creek/ Cozette-Rollins- Corcoran	7&8S-91W	1980				85,144					

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GARFIELD 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.) GAS (MCF)	(-)Condensate (Bbls.)		
15. Divide Creek/ Mesa Verde	7&8S-91W	1962		3.2 -g	1,290,009		155,070	1,445,079		NOTE: No Gas Prod. 1963, '64, '73 thru 1977, Also Prod. in Mesa Co. SI 12/82, & 9/83. N.P.	
16. Douglas Pass/ Dakota-Morrison	5S-102W	1978		(123)	991,050					N.P.	
17. Douglas Pass/ Dakota	5S-102W	1978			850,278					N.P.;	
18. DryFork/Dakota	7S-99W	1982			105,774					SI 12/82 & 9/83. Also	
19. Evacuation Creek/Dakota	4S-102W	1981	Gas Exp.		63,324					Prod. in Rio Blanco Co.	
20. Foundation Ck/ Mancos B	4S-102W	1977	Gas Exp.	8.5 -g	66,757		73,051	139,808		Also Prod. in Rio Blanco Co. N.P.	
21. Logan Wash/ Cozette-Corcoran	8S-97W	1982			16,460					N.P.	
22. Logan Wash/ Mesa Verde	8S-97W	1982			133,005						
23. Mam Creek/ Mesa Verde	6S-93W	1965		(443)	771,707		69,932	841,639	(+443)		
24. Prairie Canyon/ Dakota-Dakota- Morrison	7S-104W	1959		11.6 -g	2,337,990		783,274	3,121,264		NOTE: Field SI 9/83.	
25. Rock Canyon/ Dakota	5S-102W	1975		3.4 -g	242,023					Erratic and Inc. Gas Prod.	

OPEN FILE 84-10  
GARFIELD 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.) ( )Condensate (Bbls.)	GAS (MCF)	OIL (Bbls.) ( )Condensate (Bbls.)	GAS (MCF)	
26. Rulison/ Mesaverde	6&7S-93- 95 W	1959	Gas Exp.	2.8 -g	(6,723)	5,564,594	9,866,297	(+6,723)	15,430,891		
27. Rulison/ Wasatch	6&7S-93- 95W	1973	Gas Exp.	10.2 -g		3,235,073	9,995,283		13,230,356		
28. Soldier Can/ Dakota	4S-100W	1977	Gas Exp.	50.0 -g		69,446	52,206		121,652		Also Prod. in Rio Blanco Co. Used Actual 1983 Prod. thru 9/83 for 'a'; Also prod. in Rio Blanco Co.
29. Soldier Can/ Mancos 'B'	4S-100W	1978		21.5 -g	200	11,702	6,751	+200	18,453		Econ. Limit -0- wells; Also prod. in Mesa Co. Also Prod. in Mesa Co. Also prod. in Rio Blanco Co.
30. South Canyon/ Dakota-Morrison	6&7S-102- 104W	1978		25.7 -0 25.0 -g	(5,104)	7,149,139	5,320,881	(9,719)	12,470,020		
31. South Canyon/ Dakota-Buckhorn	6&7S-102- 104W	1959		12.0 -g	(802)	21,335,891	14,393,426		35,729,317		
32. Trail Canyon/ Dakota	4S-101W	1975	Gas Exp.	18.7 -g	(35)	285,442	279,817	(35)	565,259		
33. Twin Buttes/ Dakota	5S-102W	1978		40.0 -g		225,364	145,000		370,364		
34. Twin Buttes/ Morrison	5S-102W	1951		18.2 -g	(61)	3,469,105	129,943		3,599,048		NOTE: No Gas Prod. 1966 thru 1975.
COUNTY TOTAL OF ESTIMATED RESERVES					17,047 Bbls.		51,330,082 MCF				

## Reference List

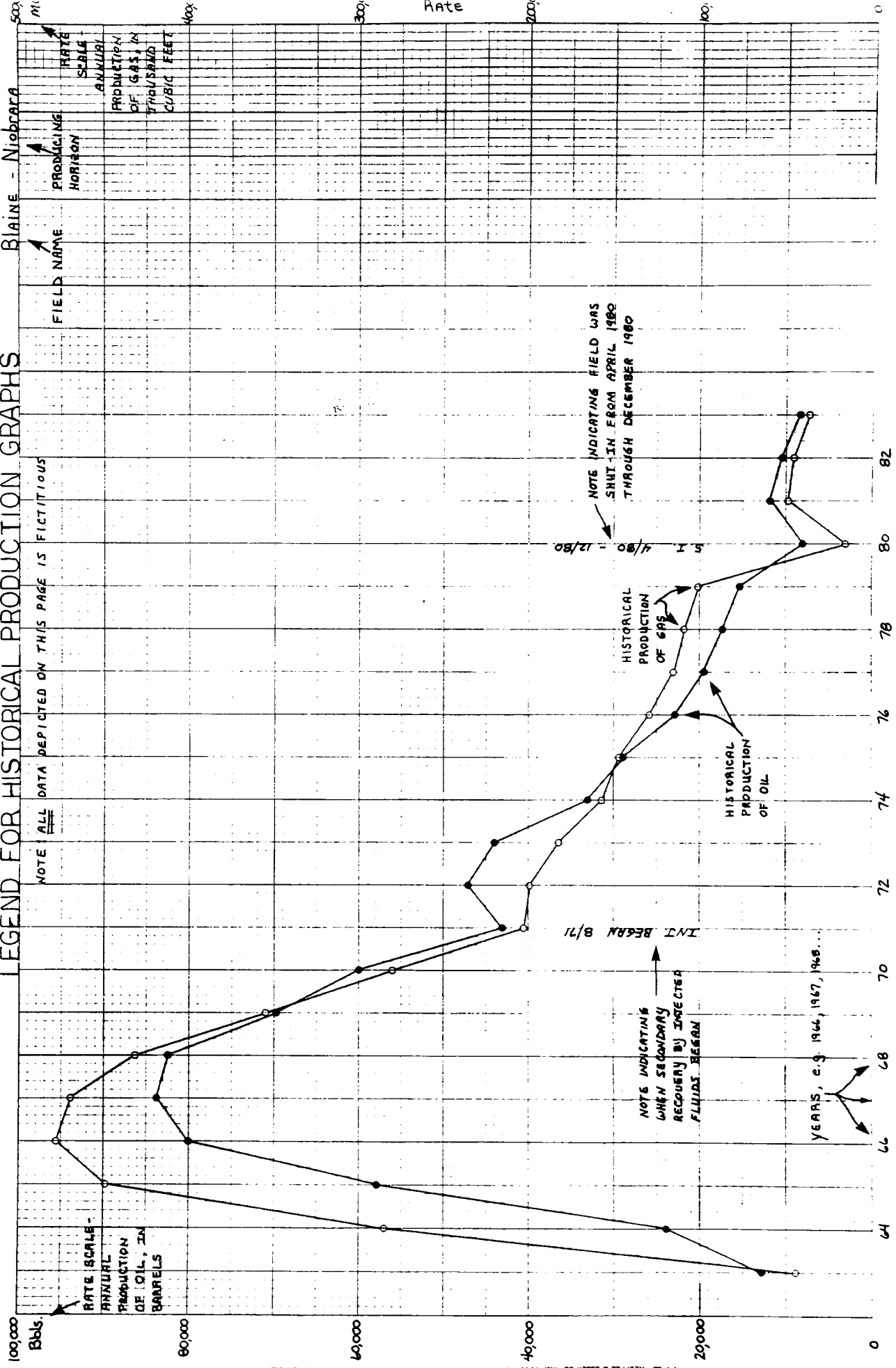
- Colorado Oil and Gas Conservation Commission Production Records and Injected Fluids - Water and/or Gas-File.
- Crouch, M.C., III, editor, 1982 Oil and Gas Fields of Colorado, Nebraska and Adjacent Areas: Rocky Mountain Association of Geologists, vols. I and II, 791 pp.
- Haun, J.D., Cardwell, A.L., 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 Garfield County. These graphs are presented in alphabetical order by Field name and then by producing horizons within each field.

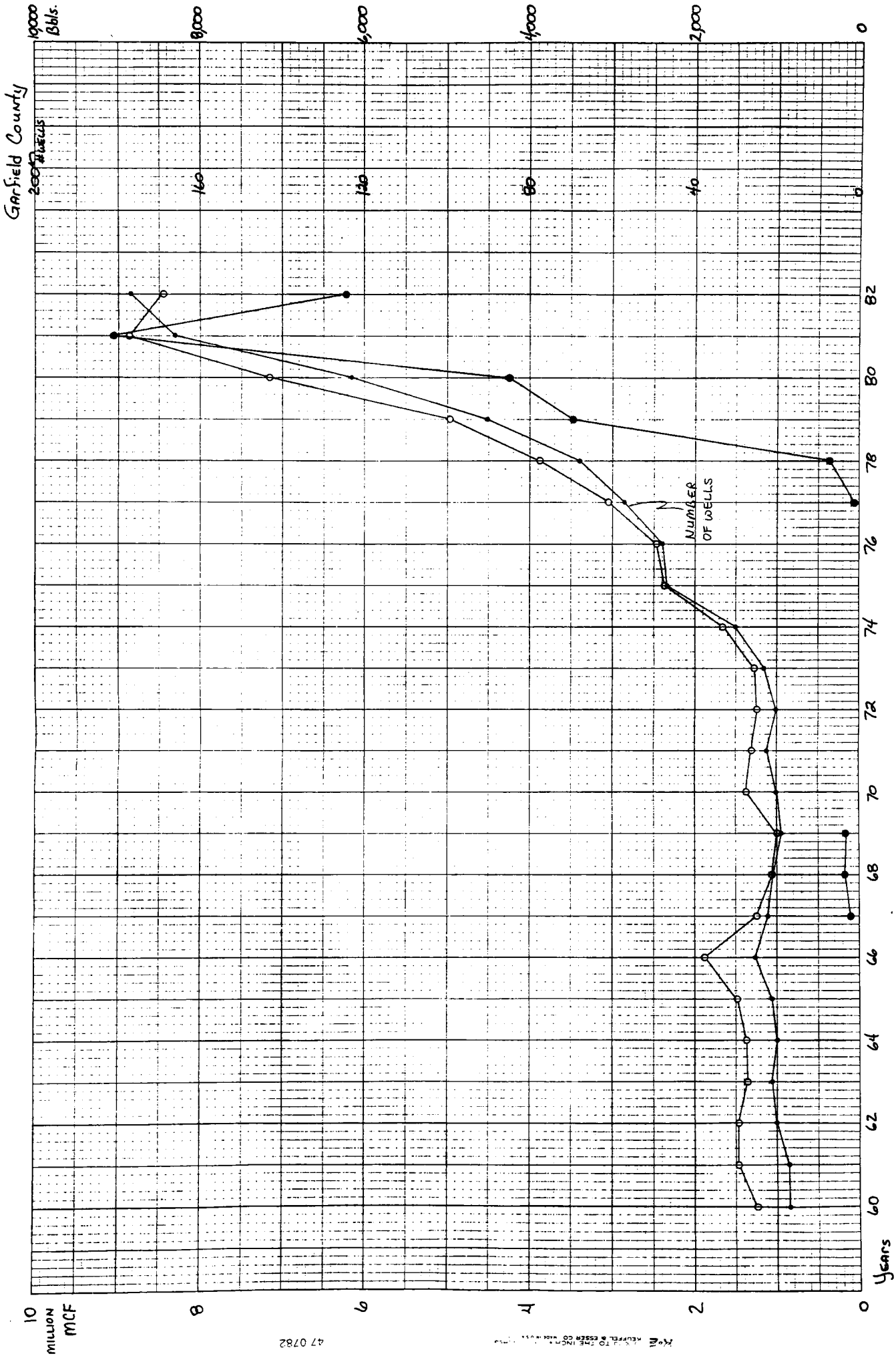
Note that only those fields actively producing as of 9-30-83 are included. Abandoned fields or field-horizons are not included.

# LEGEND FOR HISTORICAL PRODUCTION GRAPHS



Blaine - Niobrara  
 FIELD NAME  
 PRODUCING HORIZON  
 RATE SCALE  
 ANNUAL PRODUCTION OF GAS, IN CUBIC FEET  
 ANNUAL PRODUCTION OF OIL, IN BARRELS

NOTE: ALL DATA DEPICTED ON THIS PAGE IS FICTITIOUS

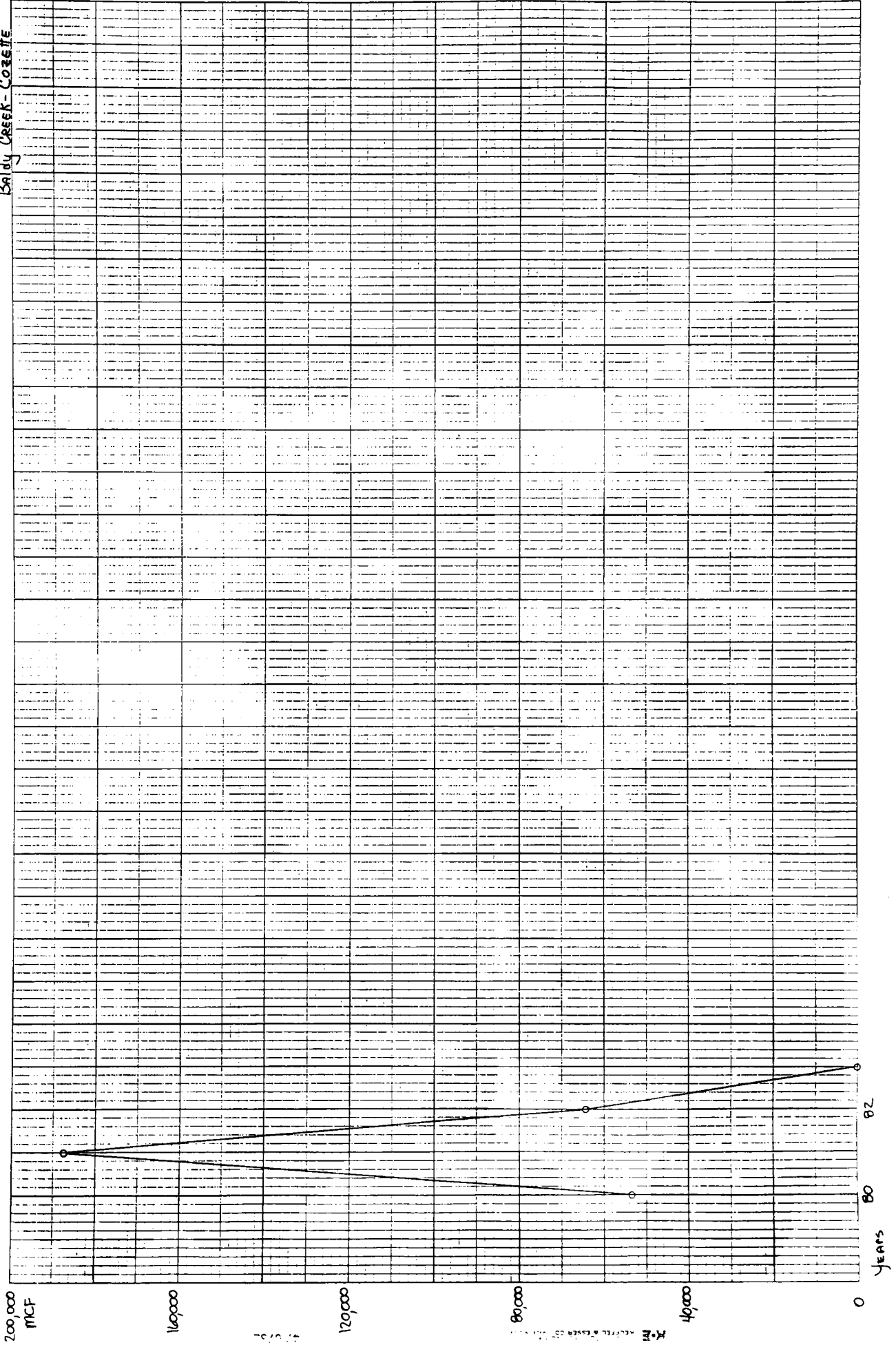


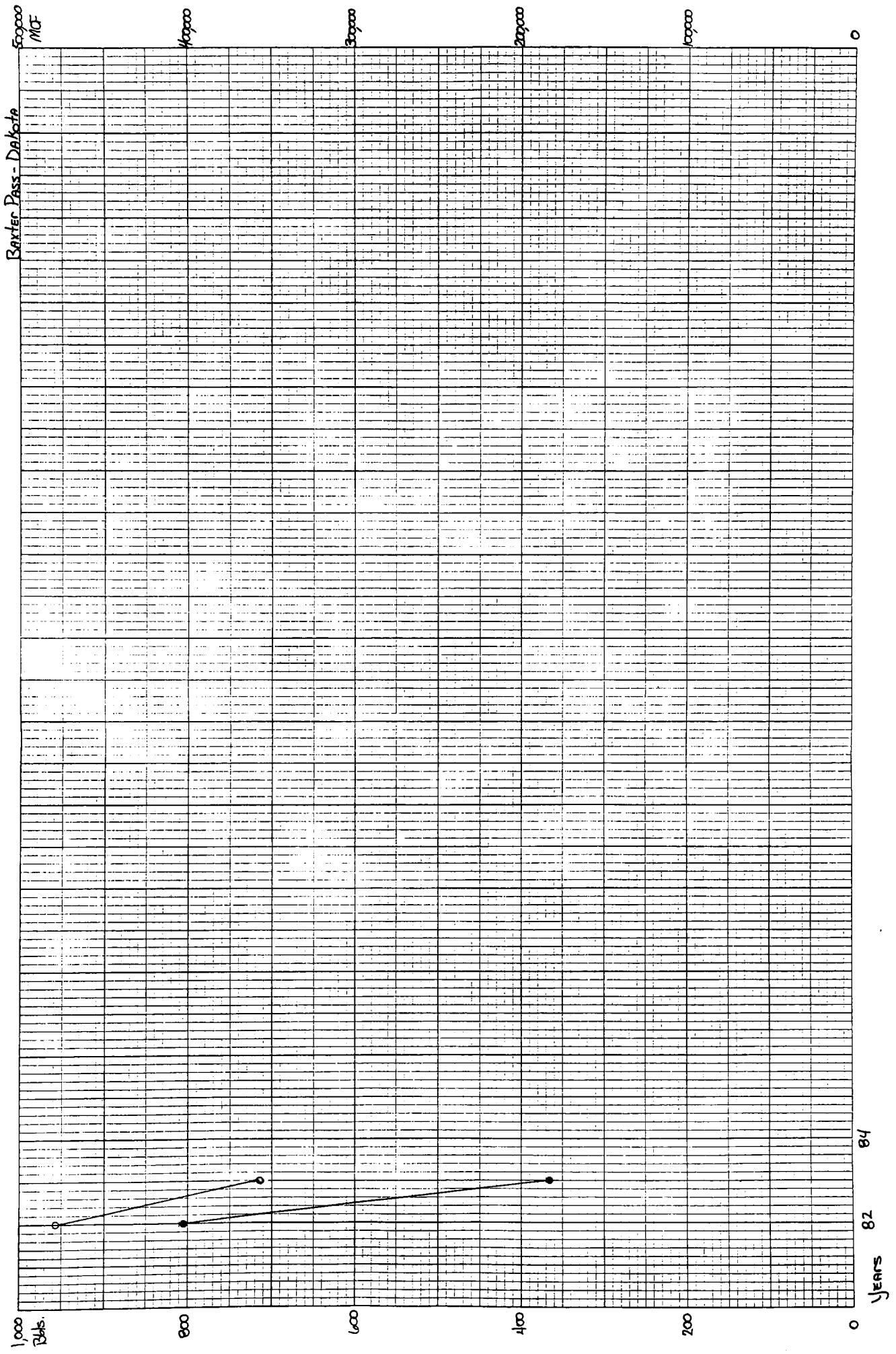
47 0782

Prepared by the INMCA

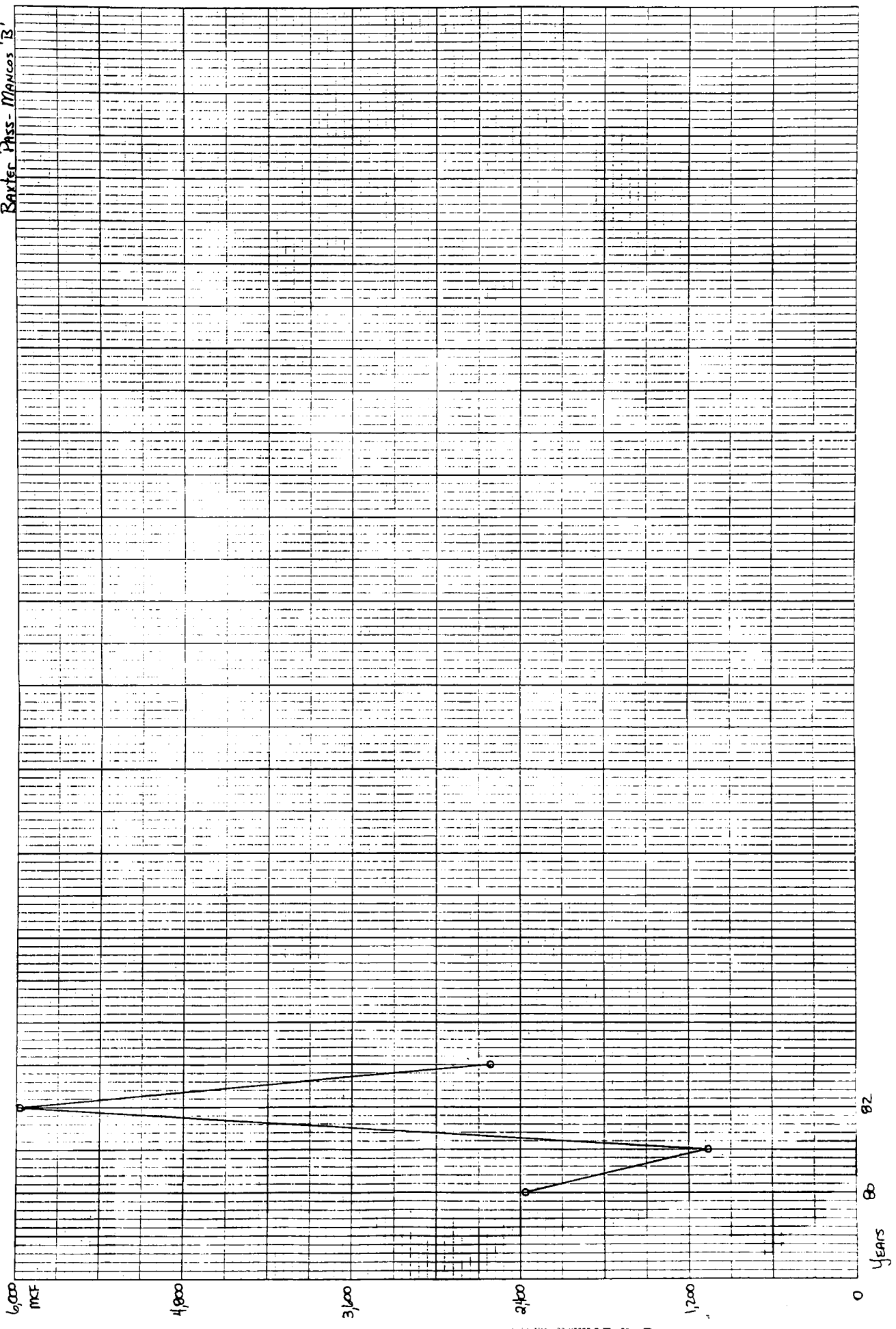


Baldy Creek - Cozette





Baxter Pass - Mancos 'B'



6000  
MCF

4800

3600

2400

1200

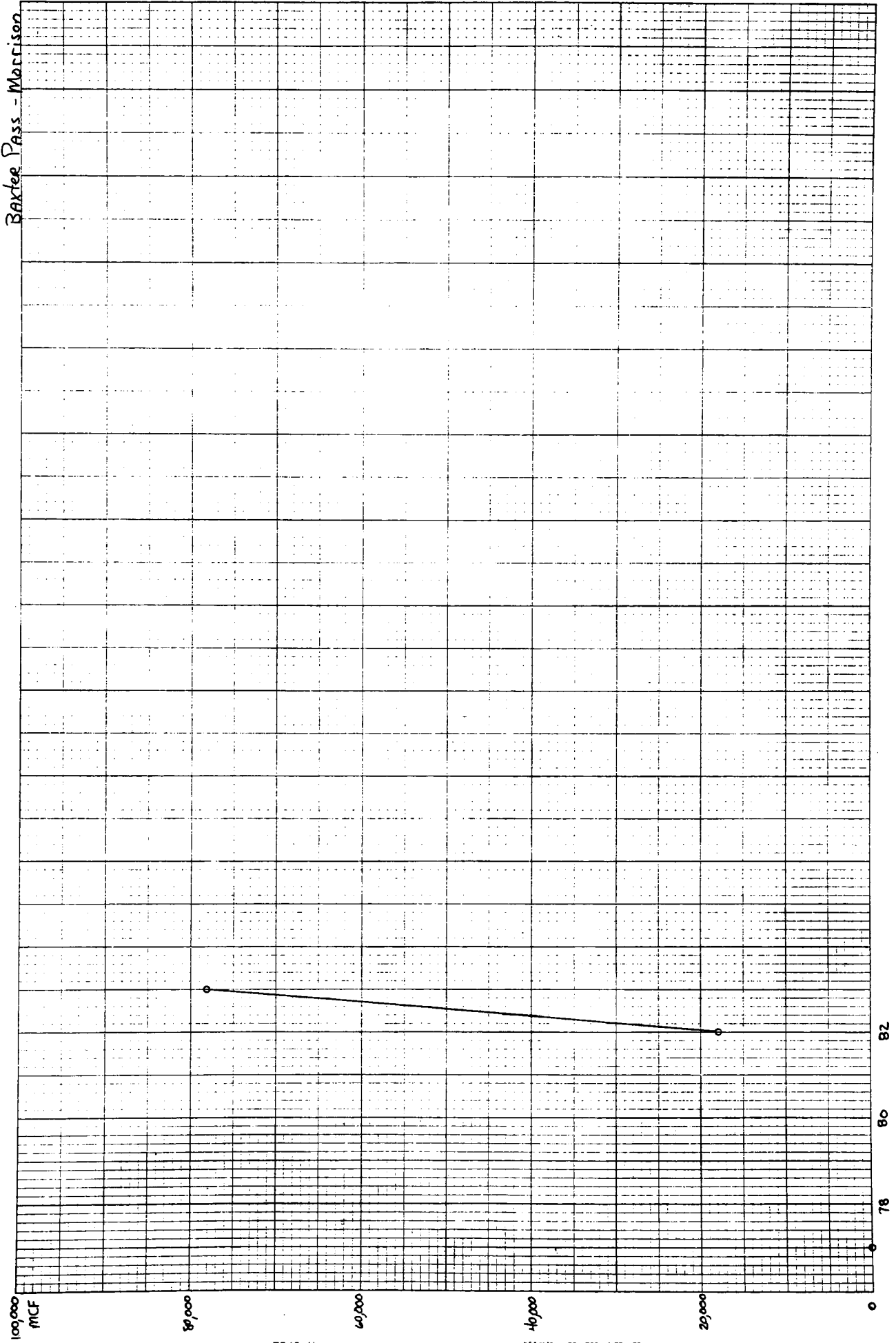
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82

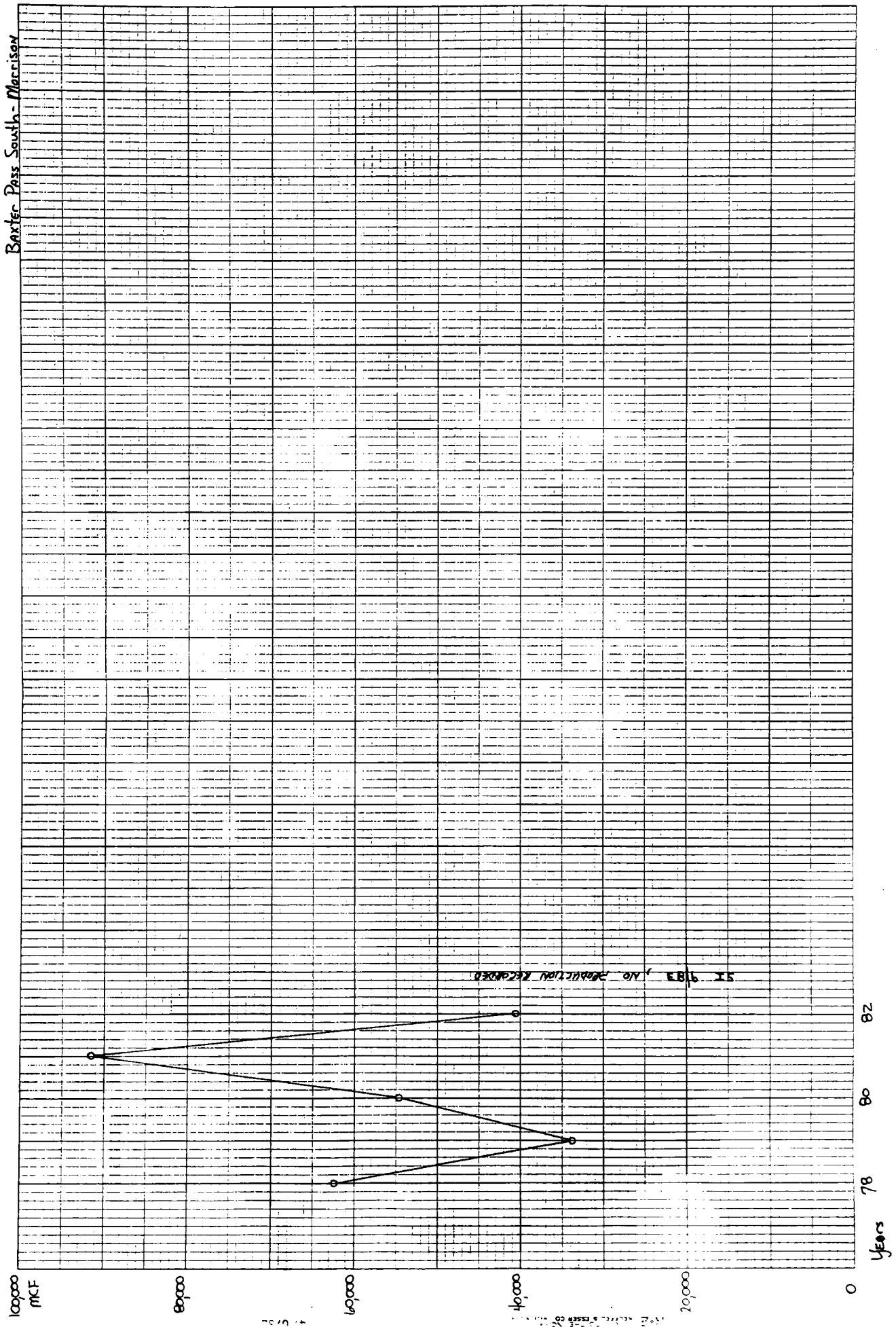
80

Years

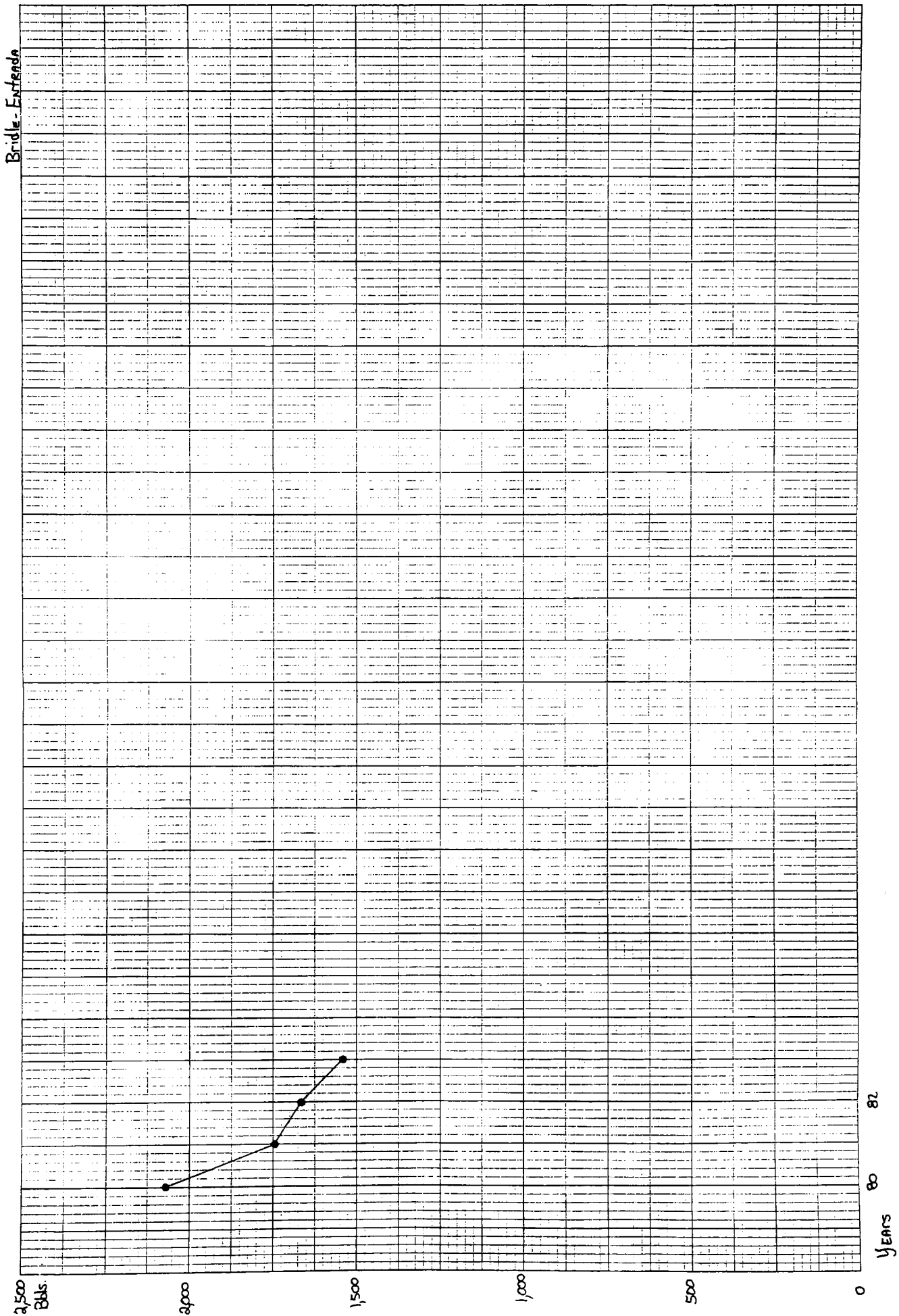
Baxter Pass - Morrison



Baxter Pass South - Morrison



Bridle - Entenda



2.0  
MILLION  
MCF

Bridle - Dakota/Morrison

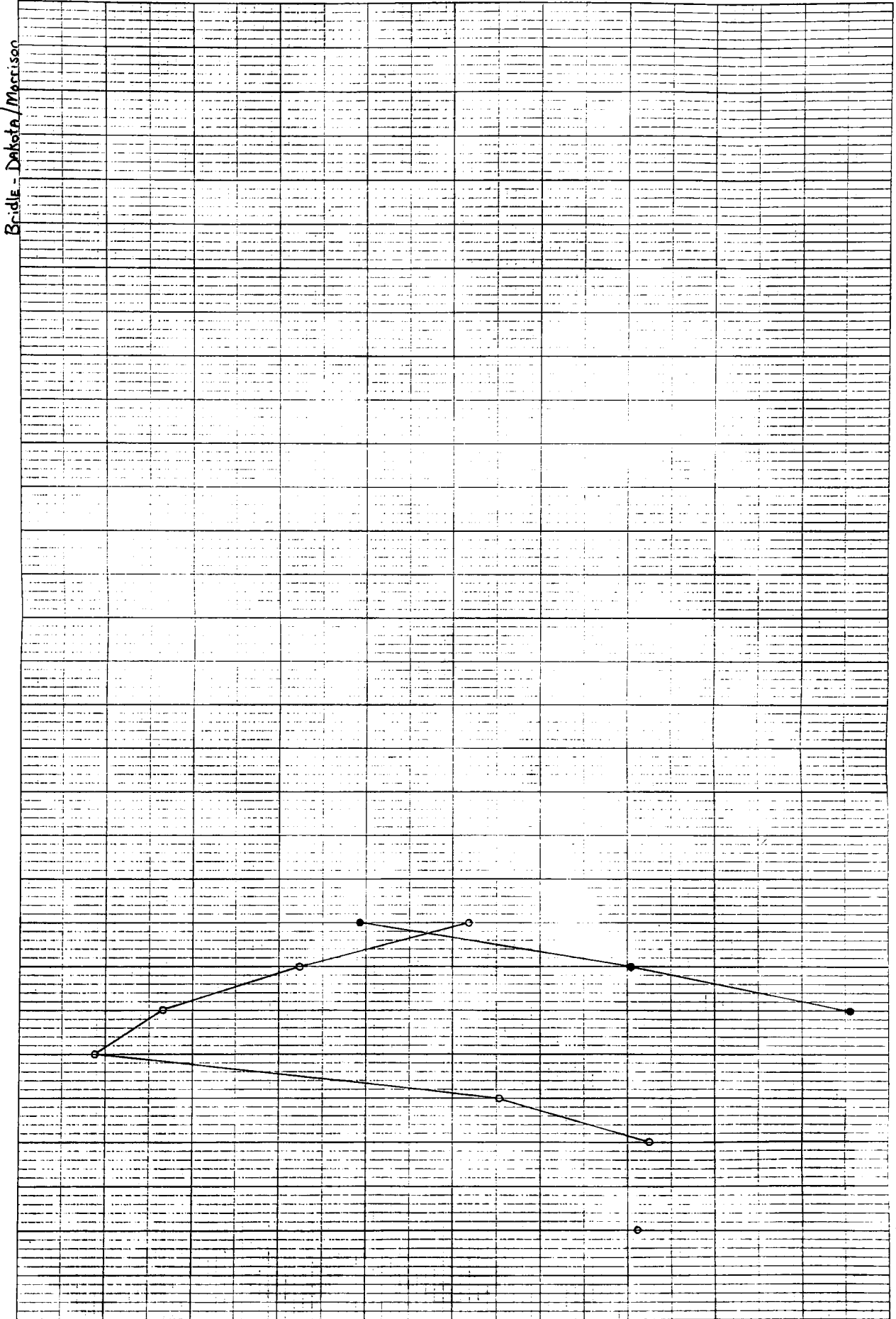
1.6

1.2

0.8

0.4

0



200  
Bbls.

160

120

80

40

0

Years  
76 78 80 82

CALF CANYON - DAKOTA

500  
Bbls

400

300

200

100

0

100,000  
MCF

80,000

60,000

40,000

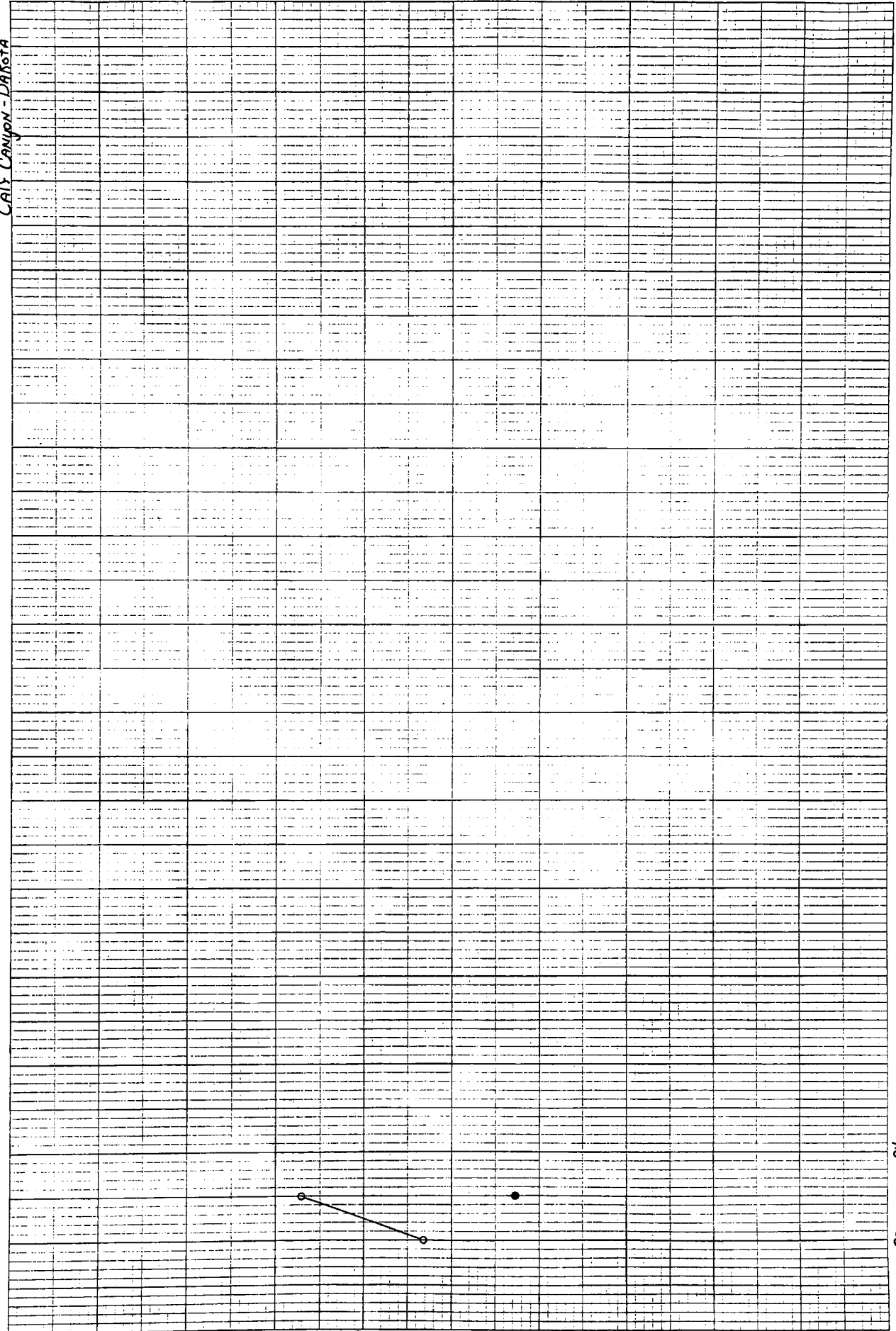
20,000

0

78

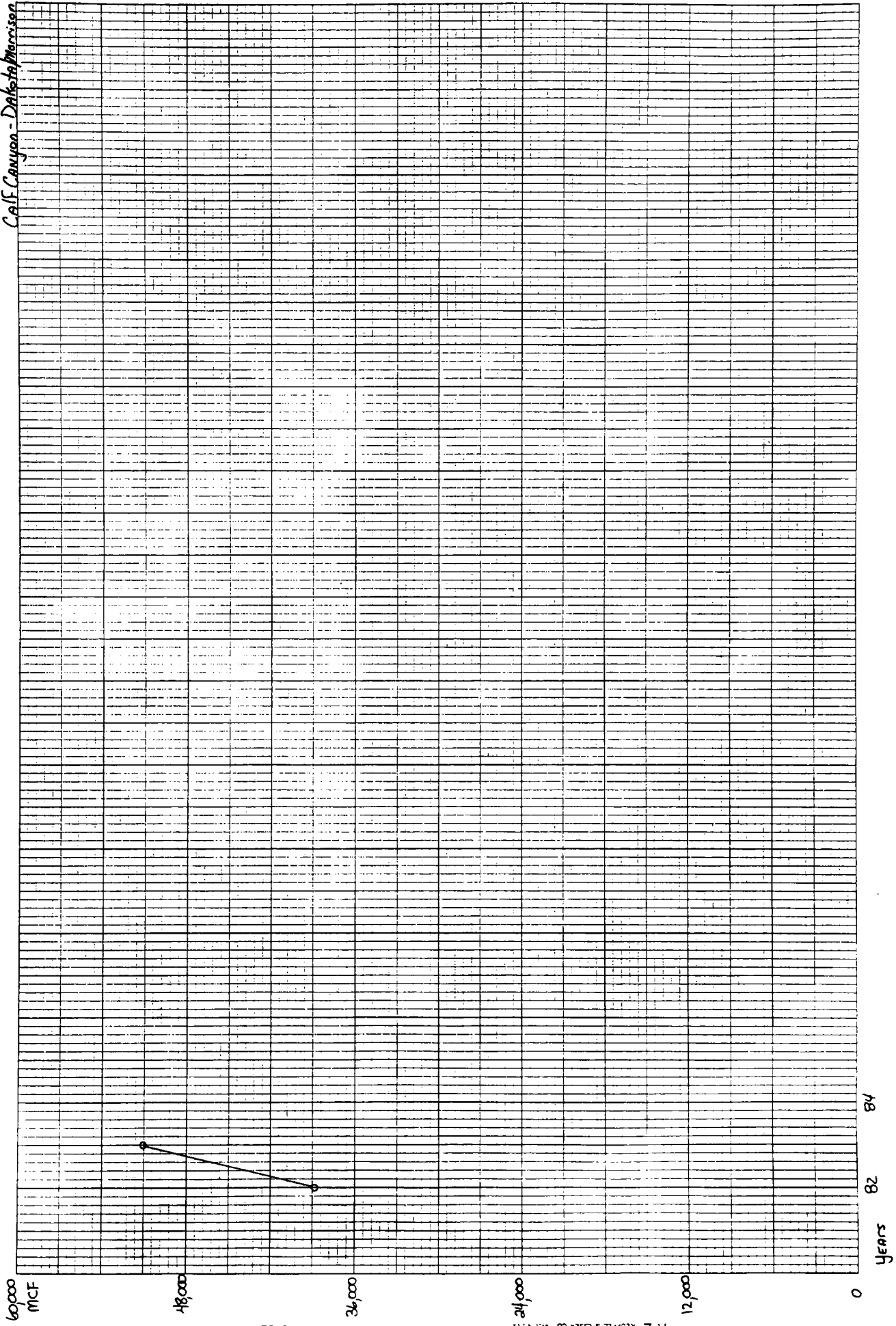
79

years



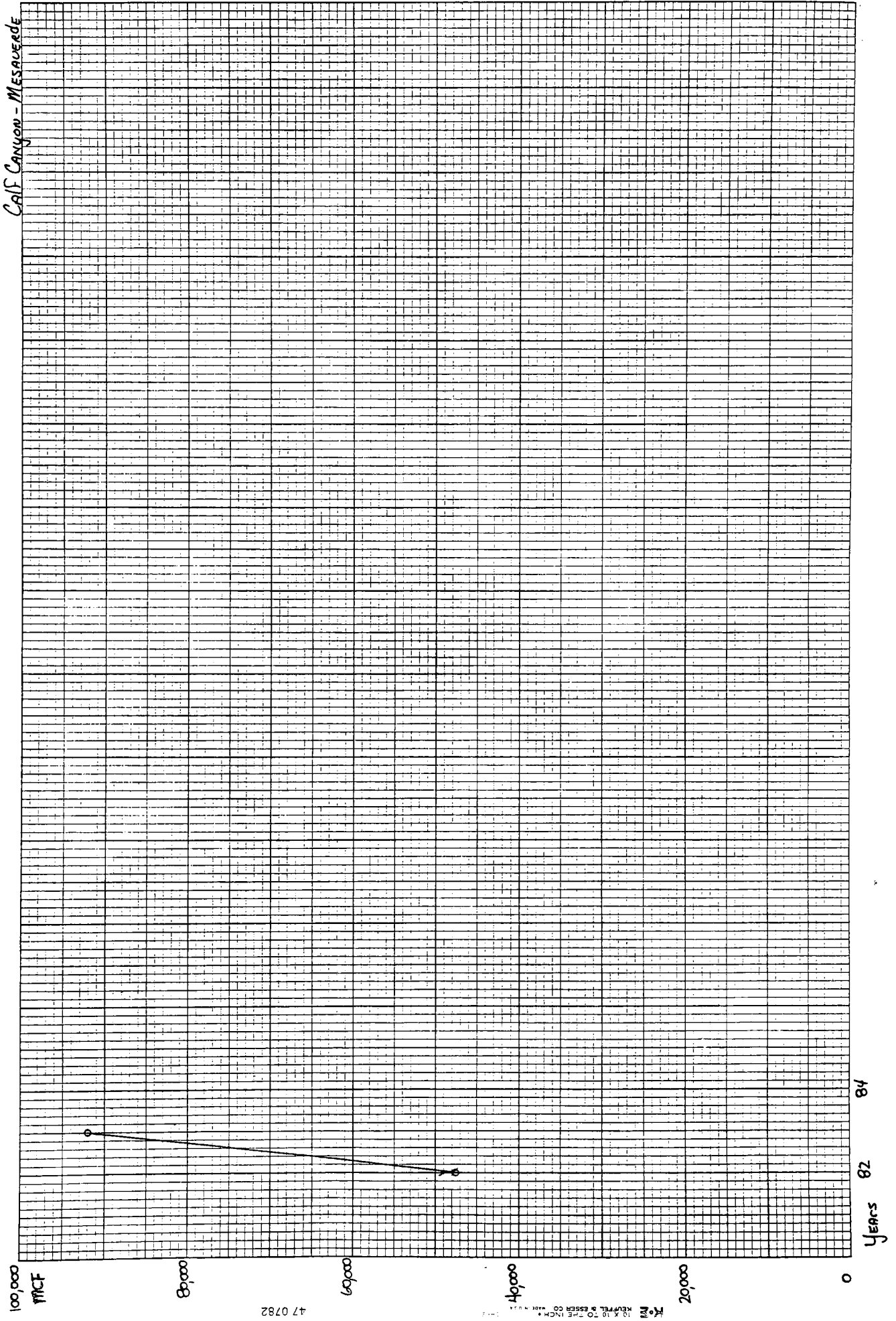


Calf Canyon - Dakota Division



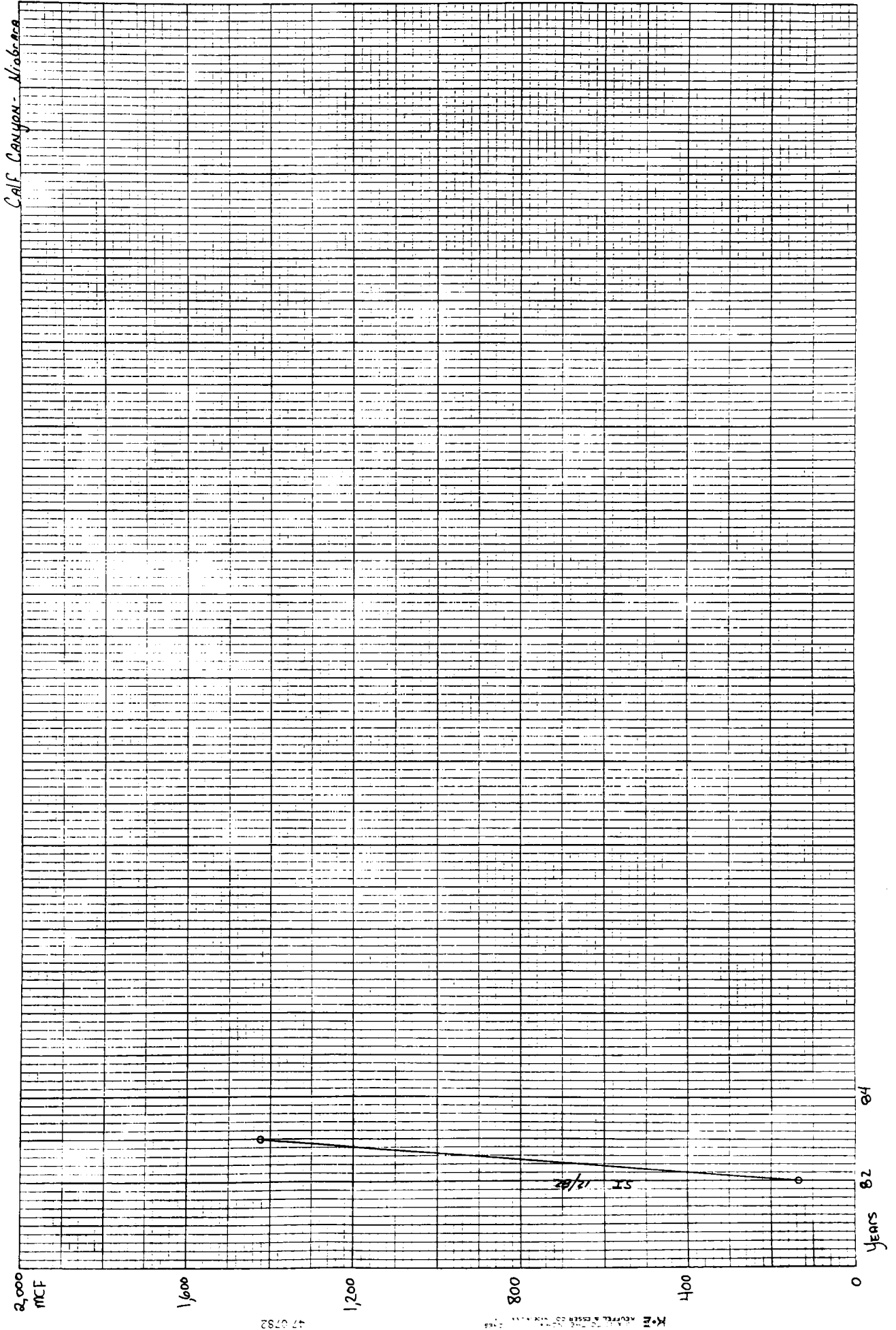
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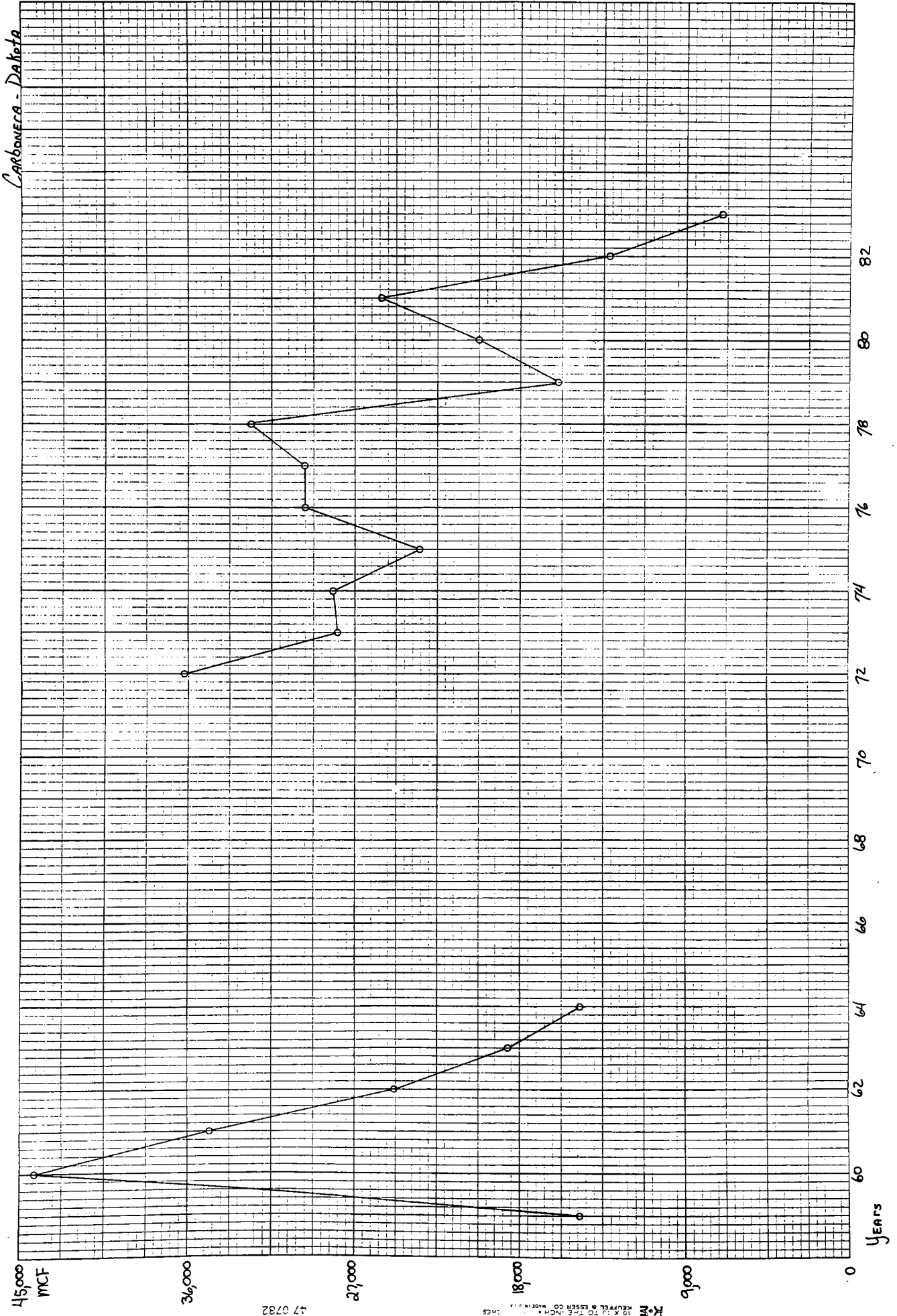
1072 KOPPEL 3/25/82



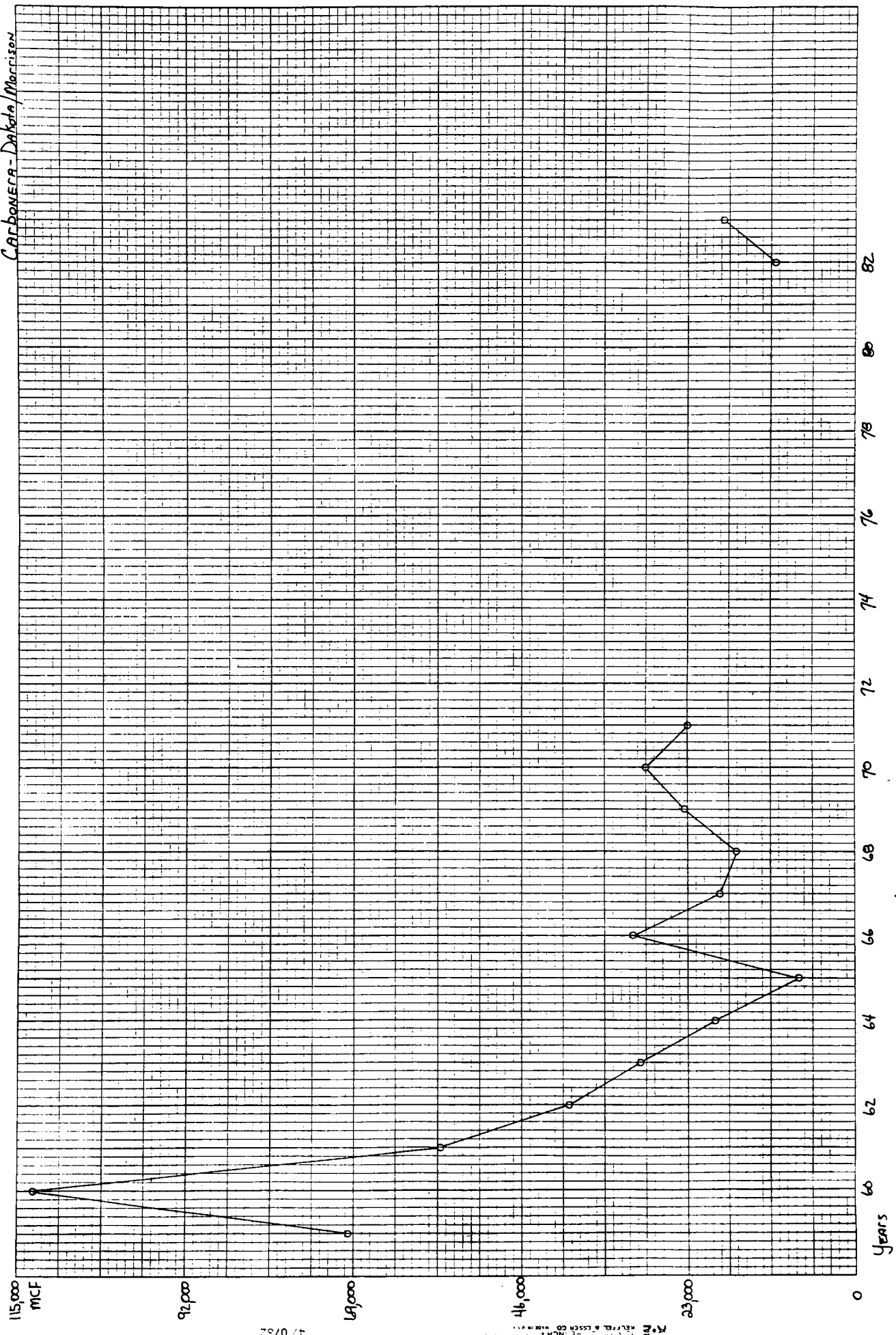
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Mc  
K 10 20 THE INC.  
KUPTEL, B 5558 CO. SAN JOSE, CA





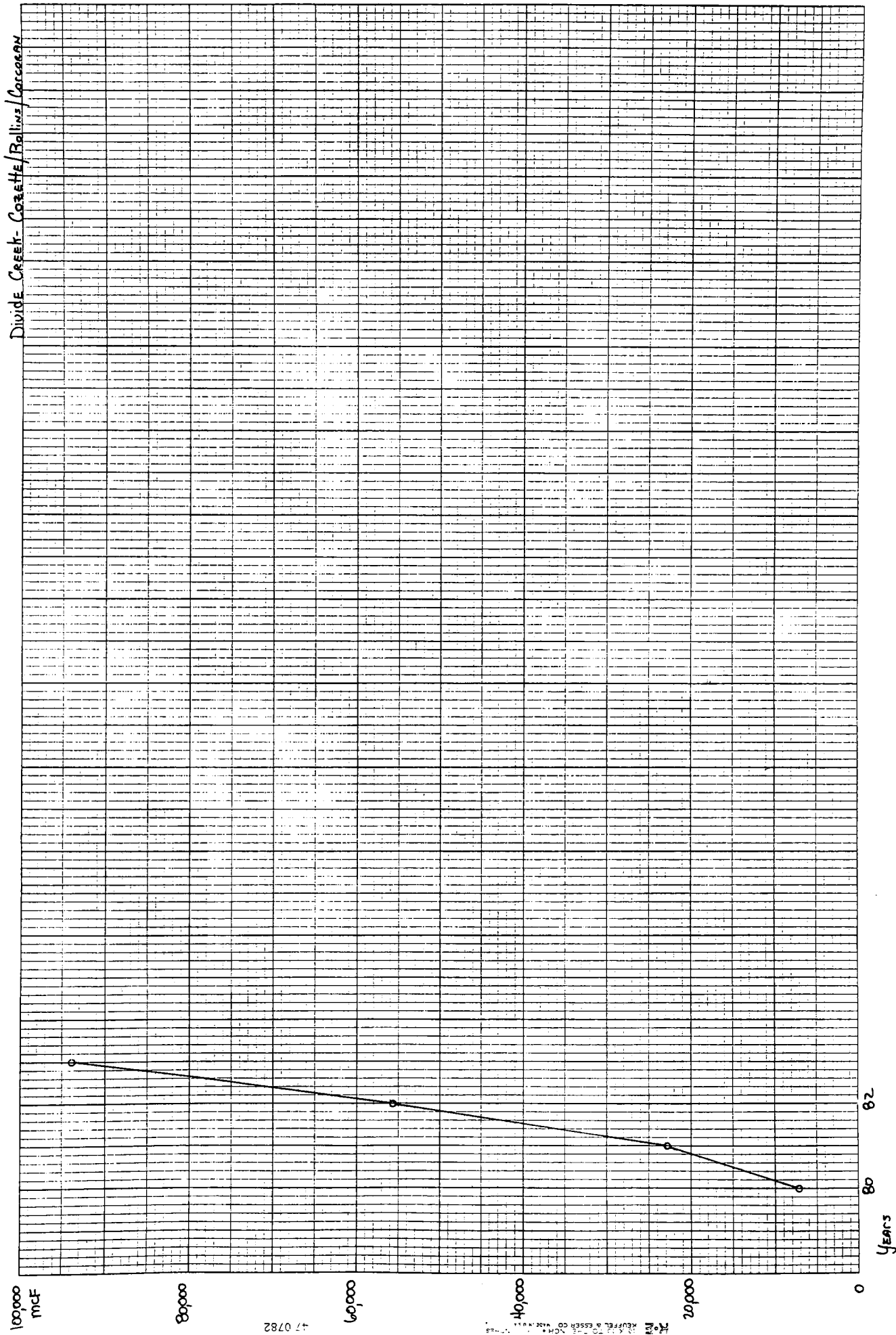
CARBONERA - Dakota / Morrison



47 0732

REPRODUCED FROM THE CARBONERA - Dakota / Morrison

Divide Creek-Cosette/Rollins/Concepcion



100,000  
mcf

80,000

47 0782

60,000

40,000

20,000

0

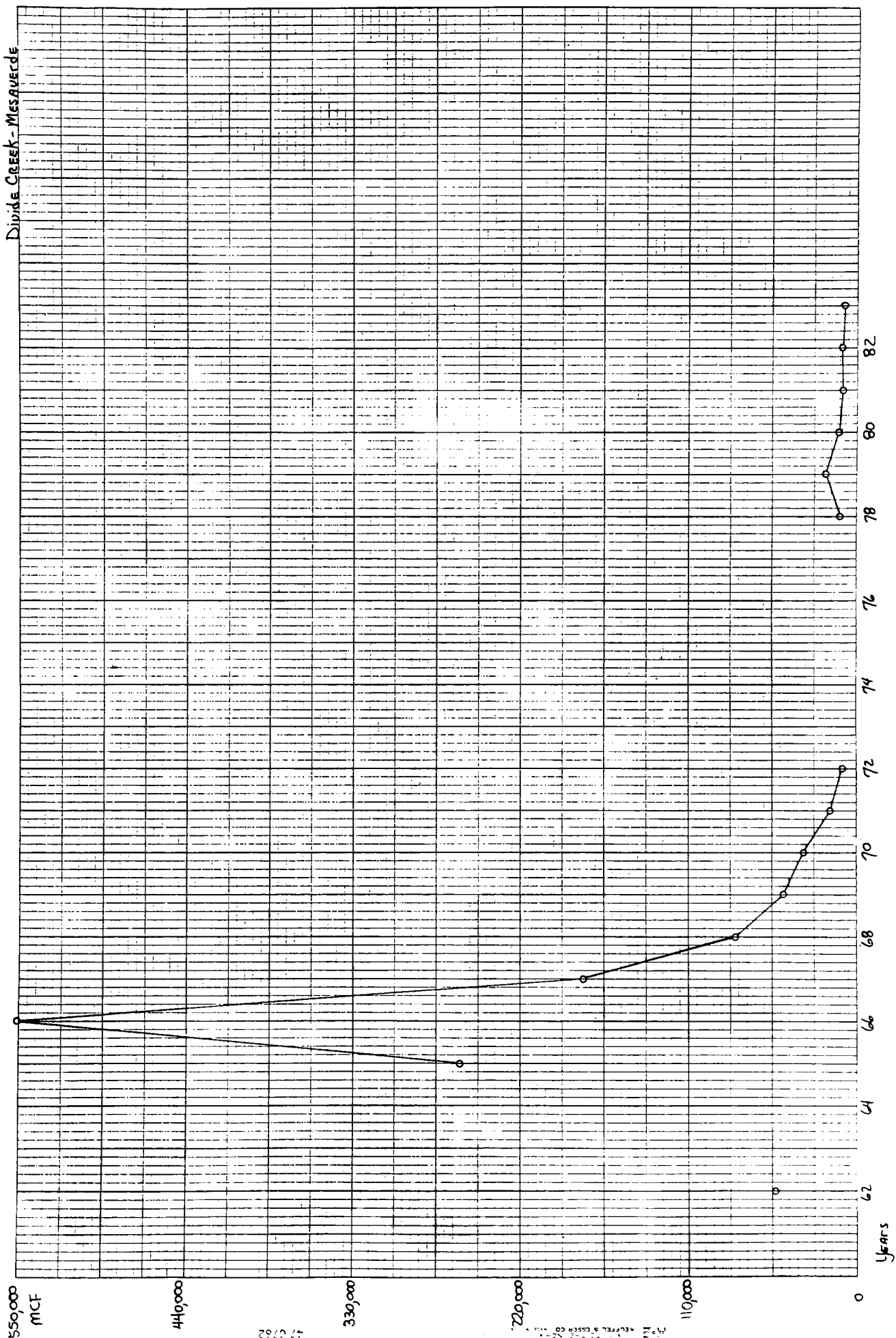
KEUFFEL & ESSER CO. MADE IN U.S.A.

78

80

Years

Divide Creek - Mesaverde



550,000  
MCF

440,000

330,000

220,000

110,000

0

YEARS

82

80

78

76

74

72

70

68

66

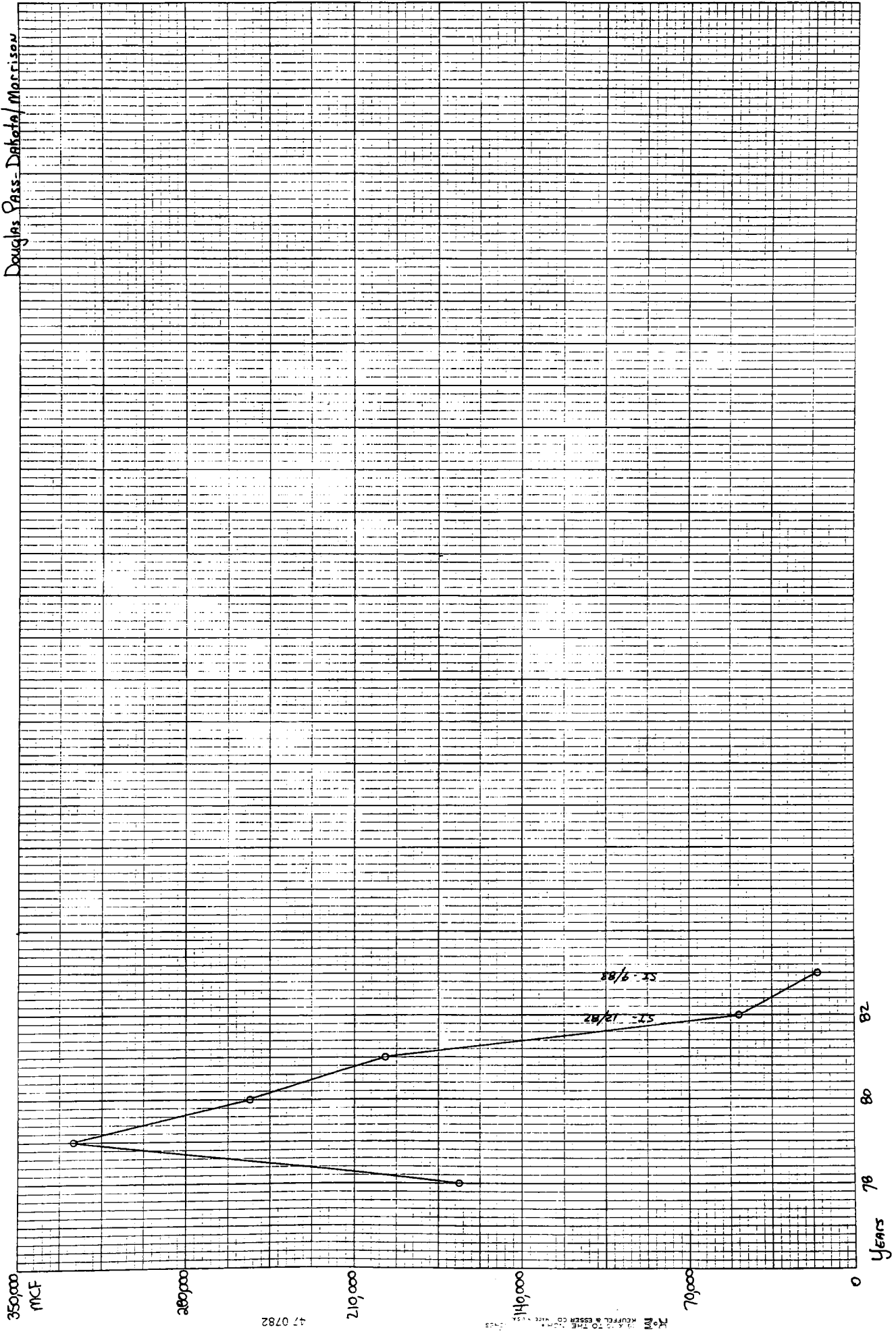
64

62

47 0782

RED WELLS & CASB CO. INC.

Douglas Pass - Dakota Morrison



350,000  
MCF

200,000

47 0782

210,000

140,000

70,000

0

Years

82

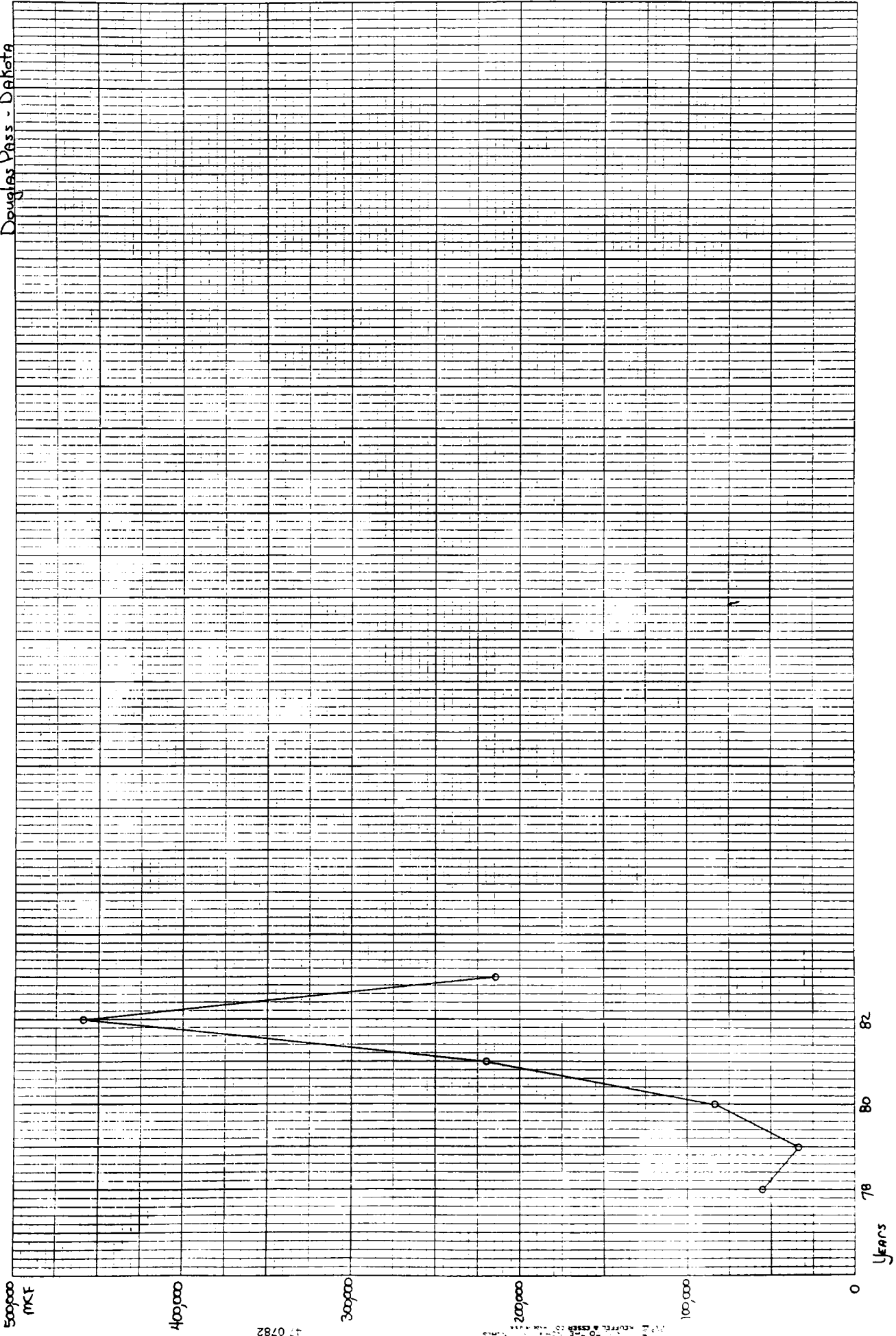
80

78

Plot by KUFFEL & ESSER CO. INC. 12/82



Douglas Pass - Dakota



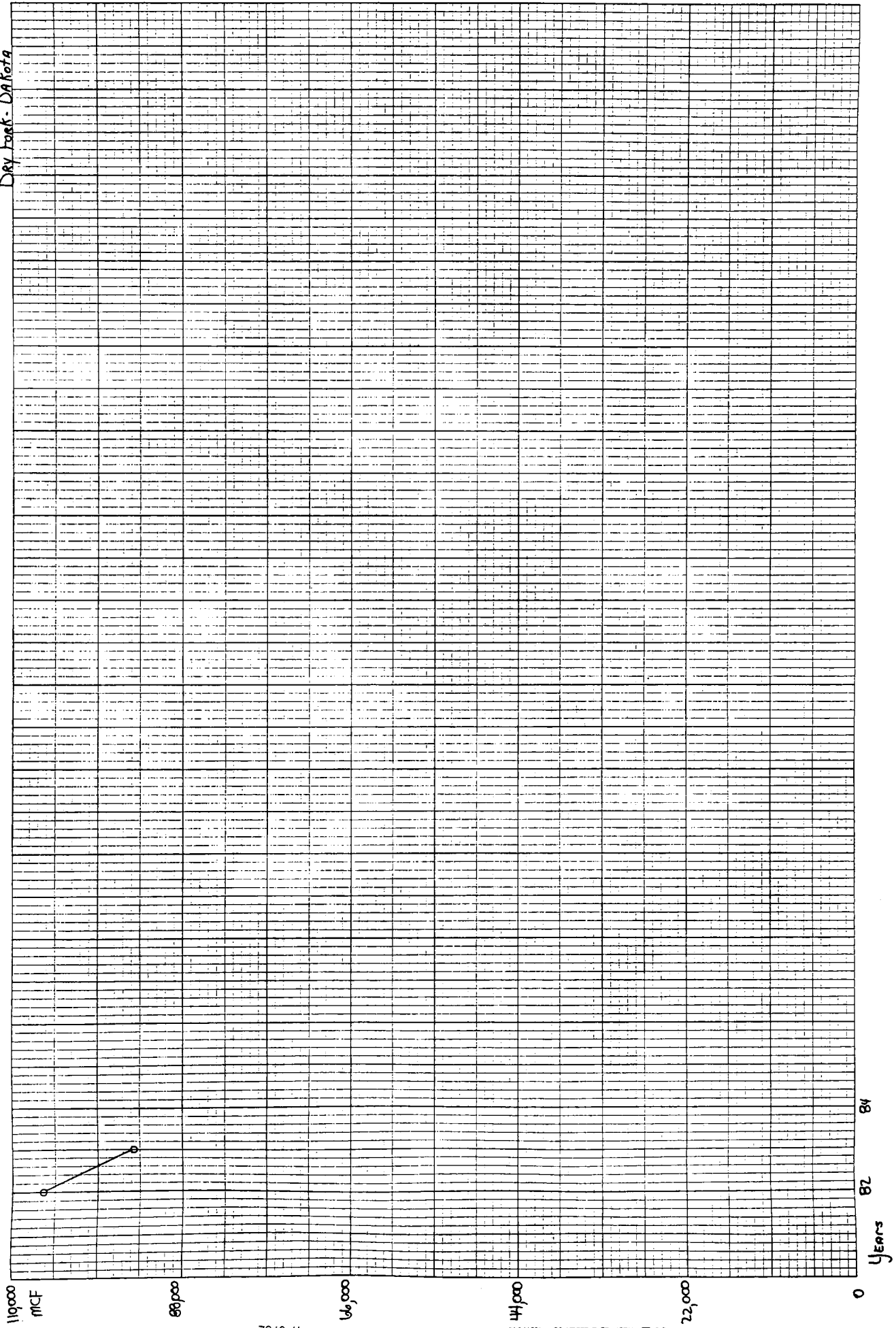
500,000 MCF  
400,000  
300,000  
200,000  
100,000  
0

Years  
82  
80  
78

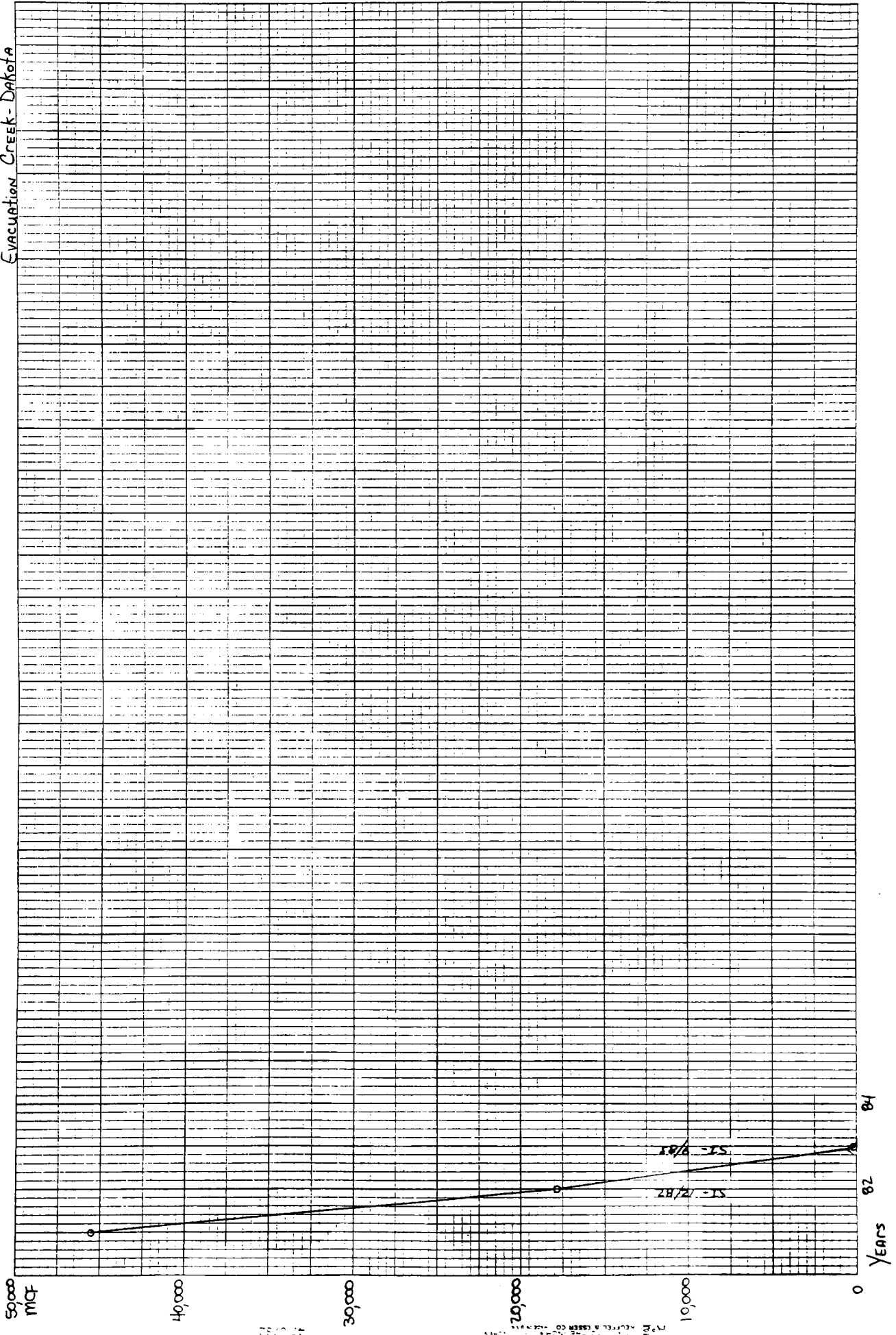
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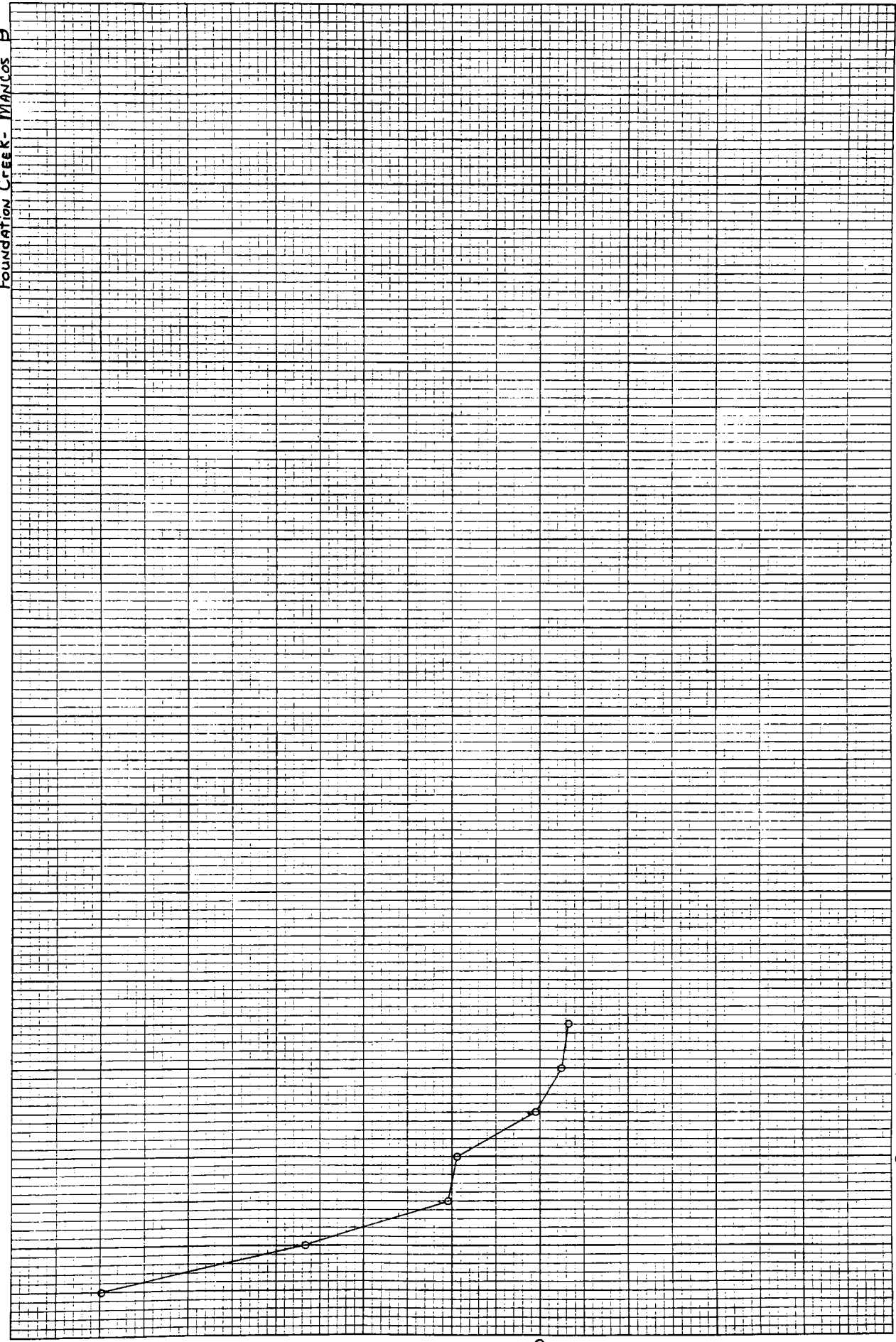
Dry Fork - Dakota



EVACUATION CREEK - DAKOTA



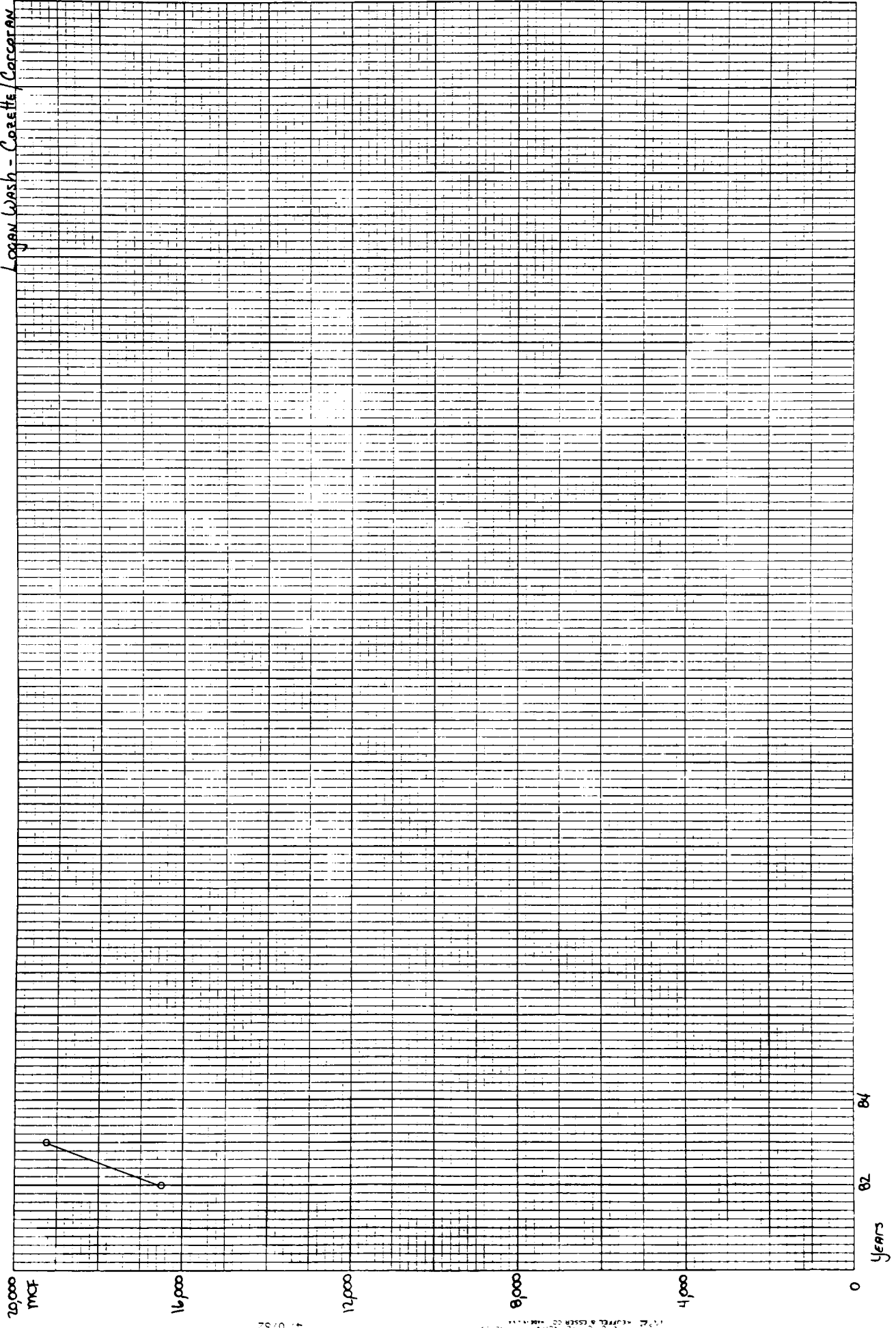
FOUNDATION CREEK - MANLOS 'B'



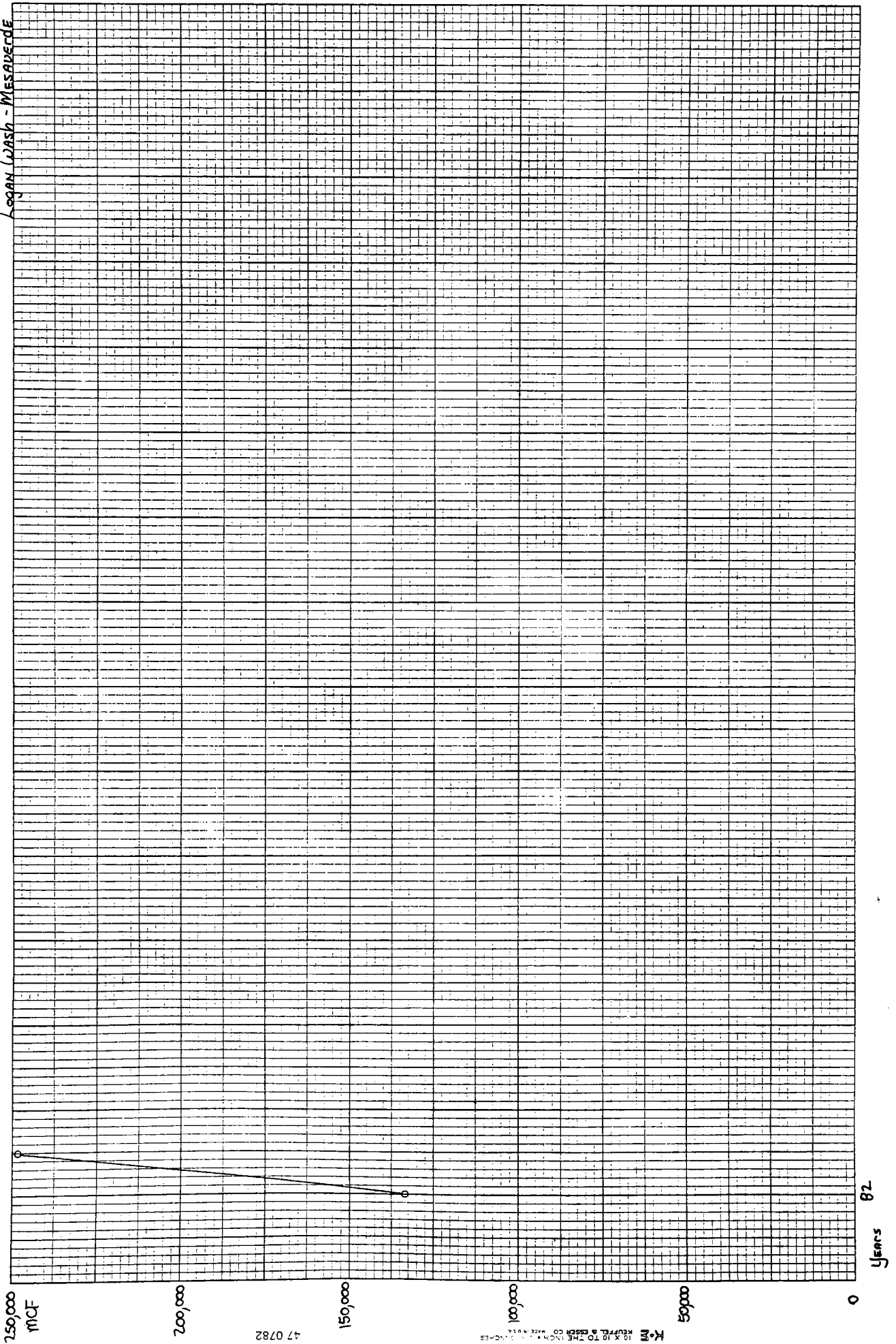
20,000 MCF  
000'91  
000'82  
000'72  
000'8  
000'4  
0

Years  
76  
78  
80  
82

Logan Wash - Corbette / Carcagan



Logan Wash - Mesaverde

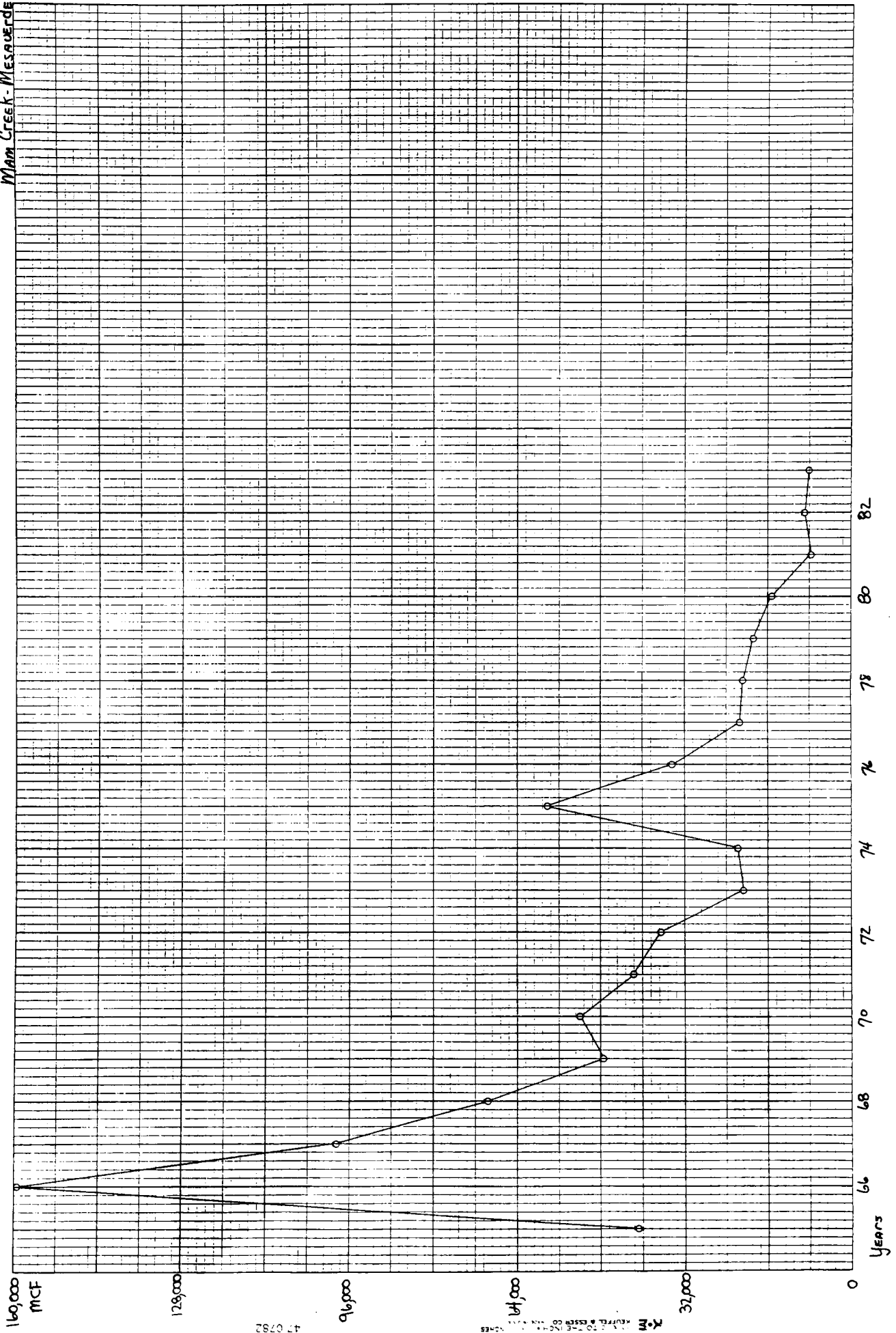


47 0782

K. M. RUFFEL & SONS CO. MINNAPOLIS, MINN. U.S.A.

78

MAM CREEK - MESQUERDE



300,000  
MCF

200,000

100,000

0

YEARS

69

70

71

72

73

74

75

76

77

78

79

80

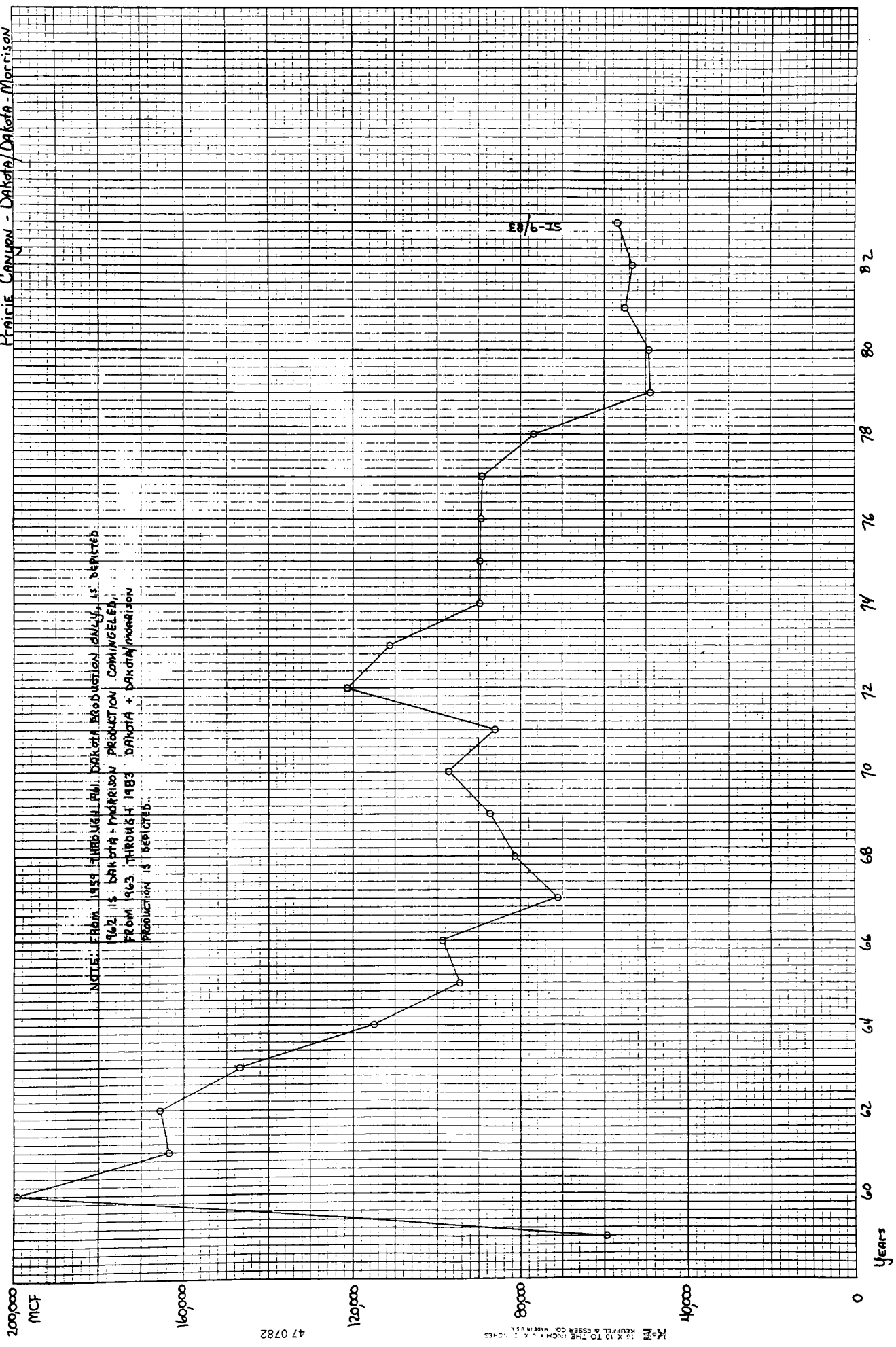
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82

47 0782

7. M  
APRIL 1982  
MAM CREEK - MESQUERDE

Prairie Canyon - Dakota/Dakota-Morrison



NOTE: FROM 1959 THROUGH 1961 DAKOTA PRODUCTION ONLY IS DEPICTED.  
 1962 IS DAKOTA + MORRISON PRODUCTION COMINGLED.  
 FROM 1963 THROUGH 1983 DAKOTA + DAKOTA/MORRISON  
 PRODUCTION IS DEPICTED.

88/6-15

200,000  
MCF

160,000

120,000

80,000

40,000

0

Years

82

80

78

76

74

72

70

68

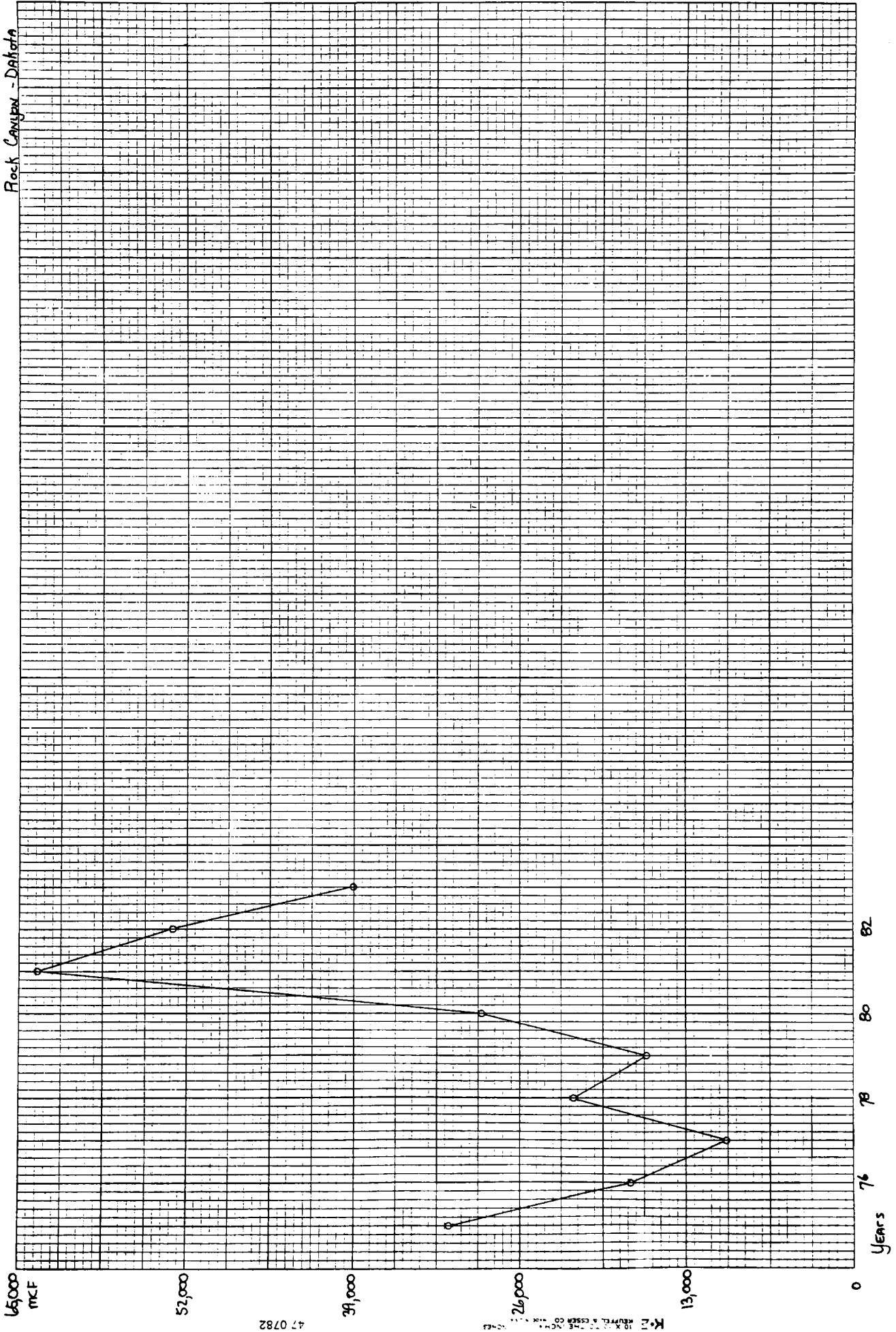
66

64

62

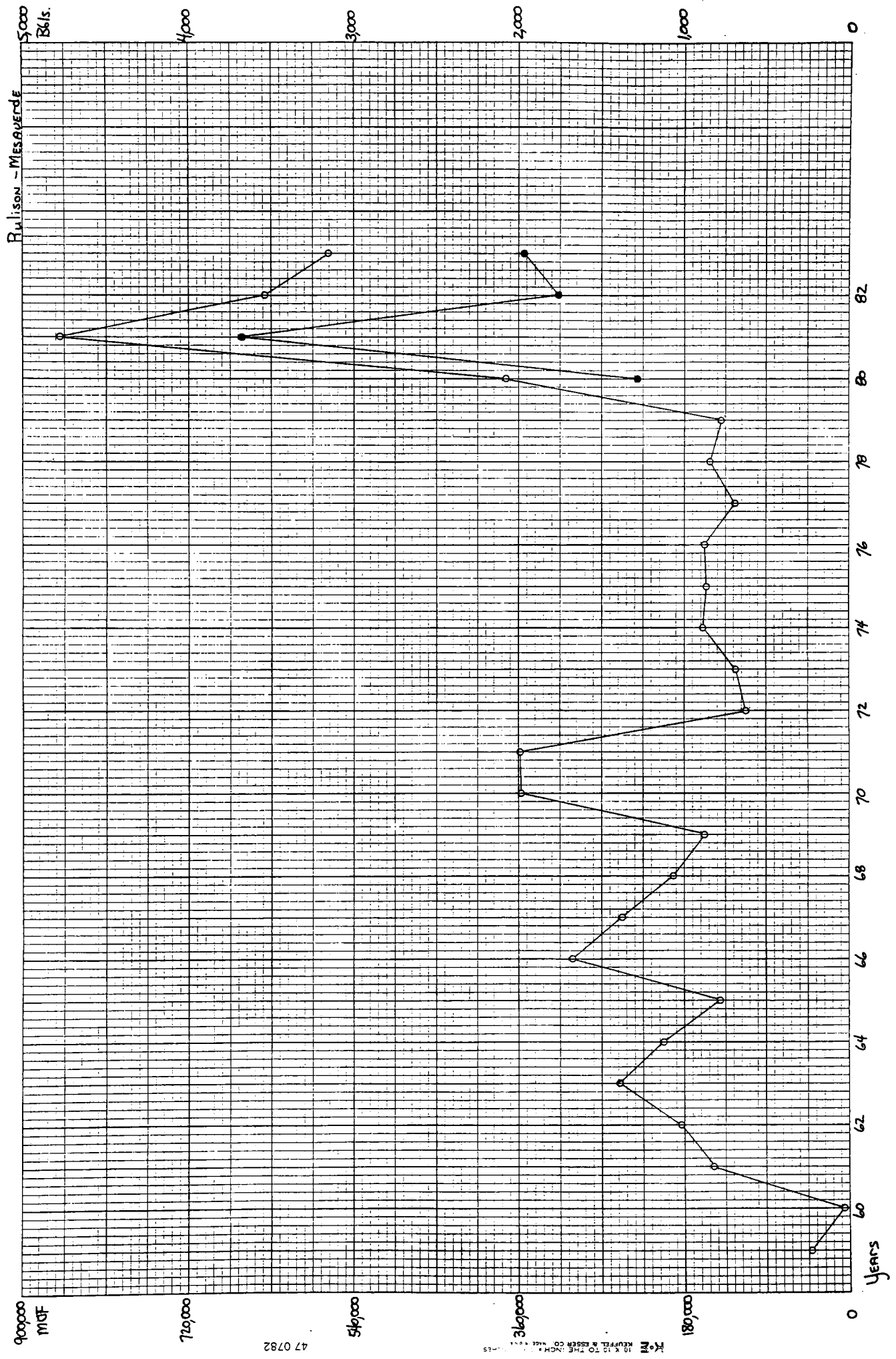
60





47 0782

K. E. 10 X 10 THE ROCK CANYON

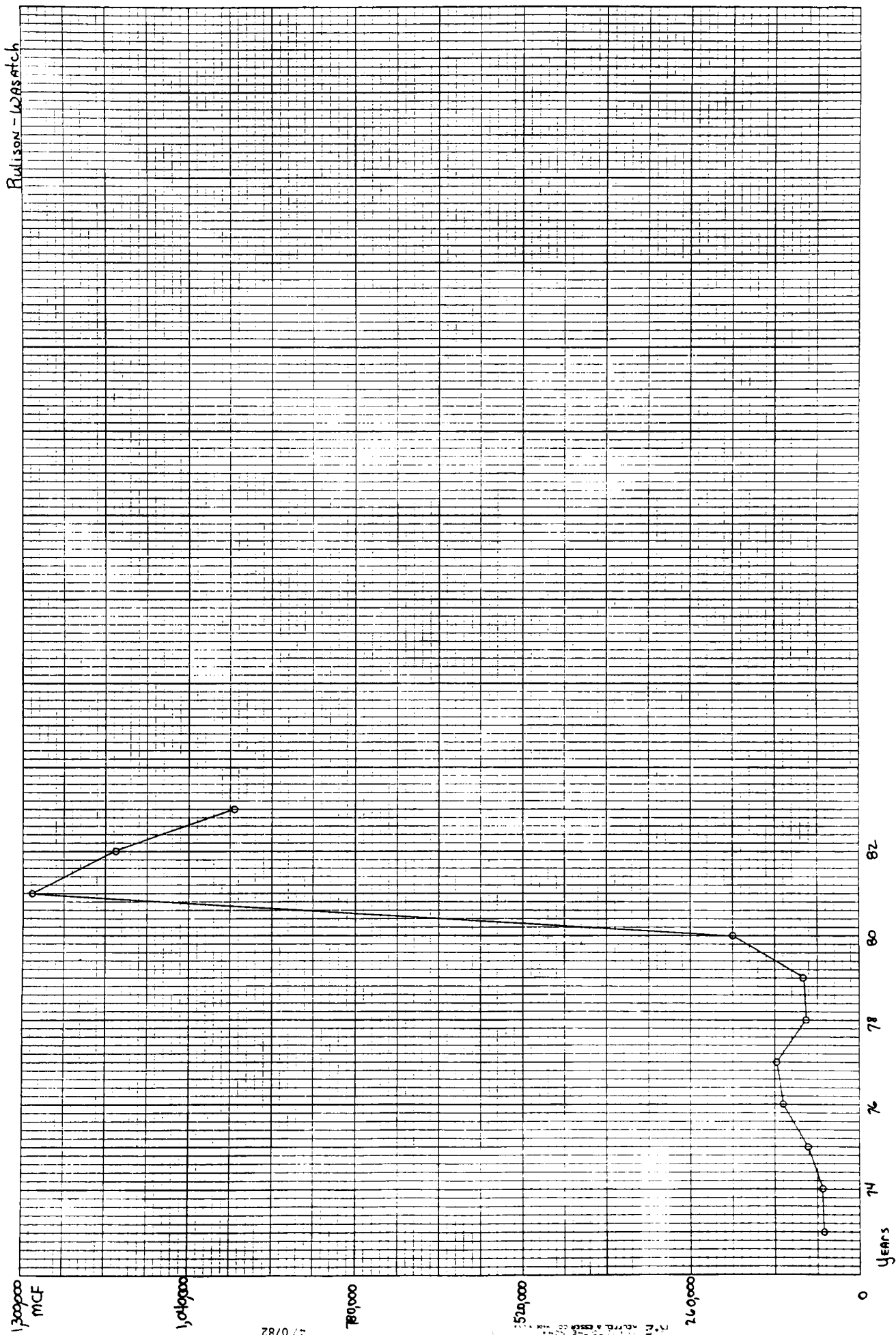


47 0782

10 X 10 TO THE INCH  
 REUFEL & BERN CO. MAP CO.

000000  
 000071  
 000072  
 000073  
 000074  
 000075  
 000076  
 000077  
 000078  
 000079  
 000080  
 000081

Rulison - 6288atch



1,300,000  
MCF

1,000,000

47 0782

700,000

500,000

200,000

0

Years

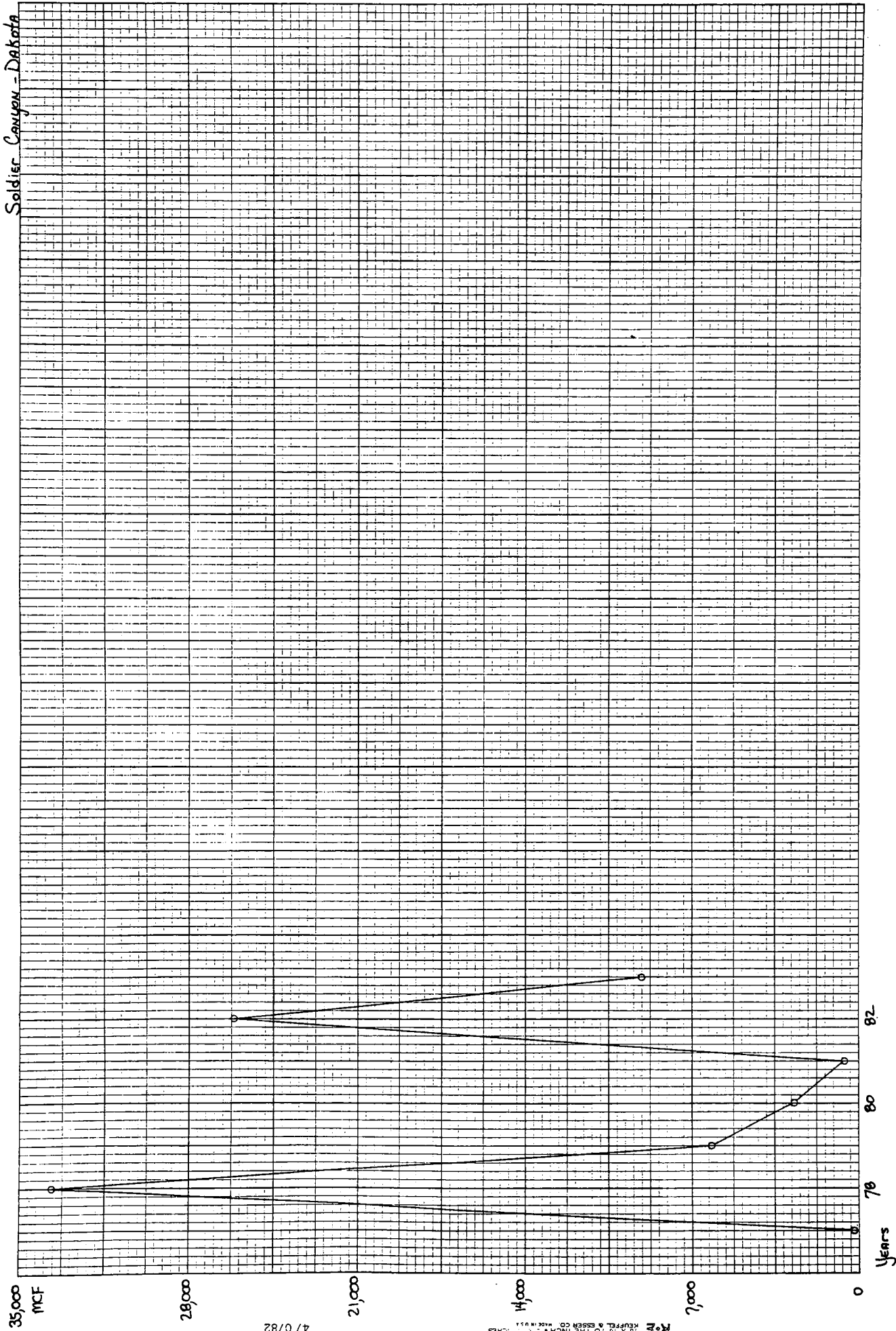
82

80

78

76

74



47 0782

K & B 10 X 10 TO THE INCH • RUPPEL & BASS CO. MADISON, WI

Soldier Canyon - Mancos 'B'

500  
Bbls.

400

300

200

100

0

5,000  
MCF

4,000

3,000

2,000

1,000

0

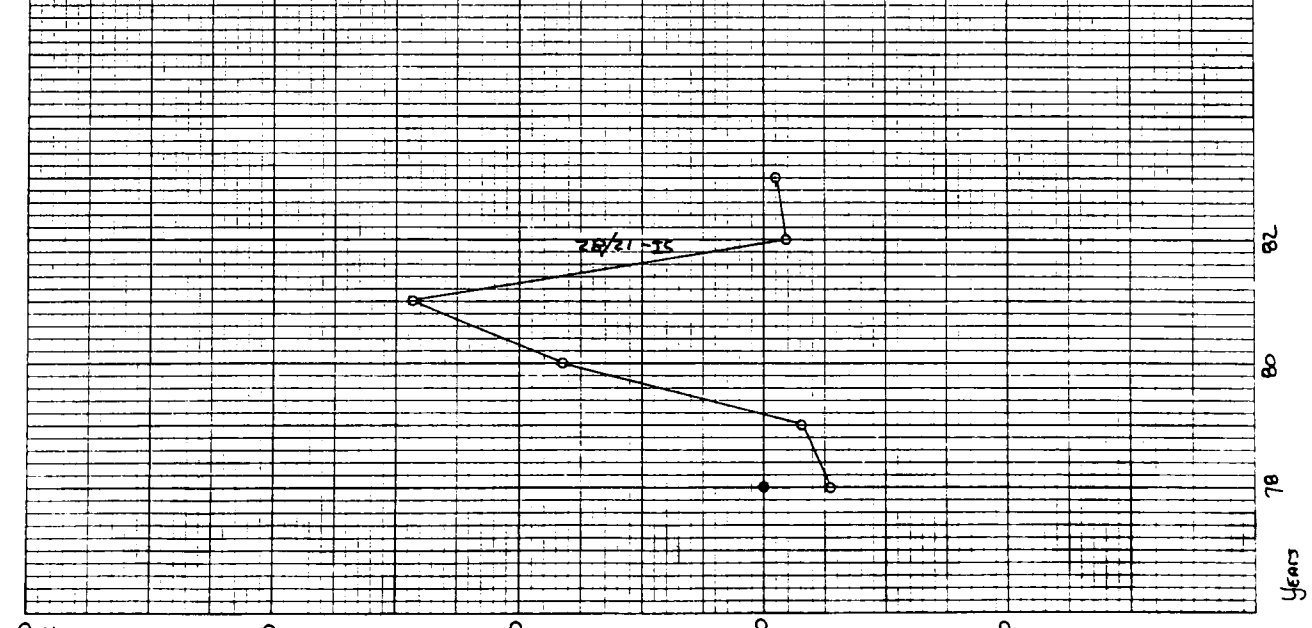
82

80

78

76

Years



56-12/82

3000  
Bbls.

2400

1800

1200

600

0

South Canyon - Dakota/Morrison

2.0  
million  
MCF

1.6

1.2

0.8

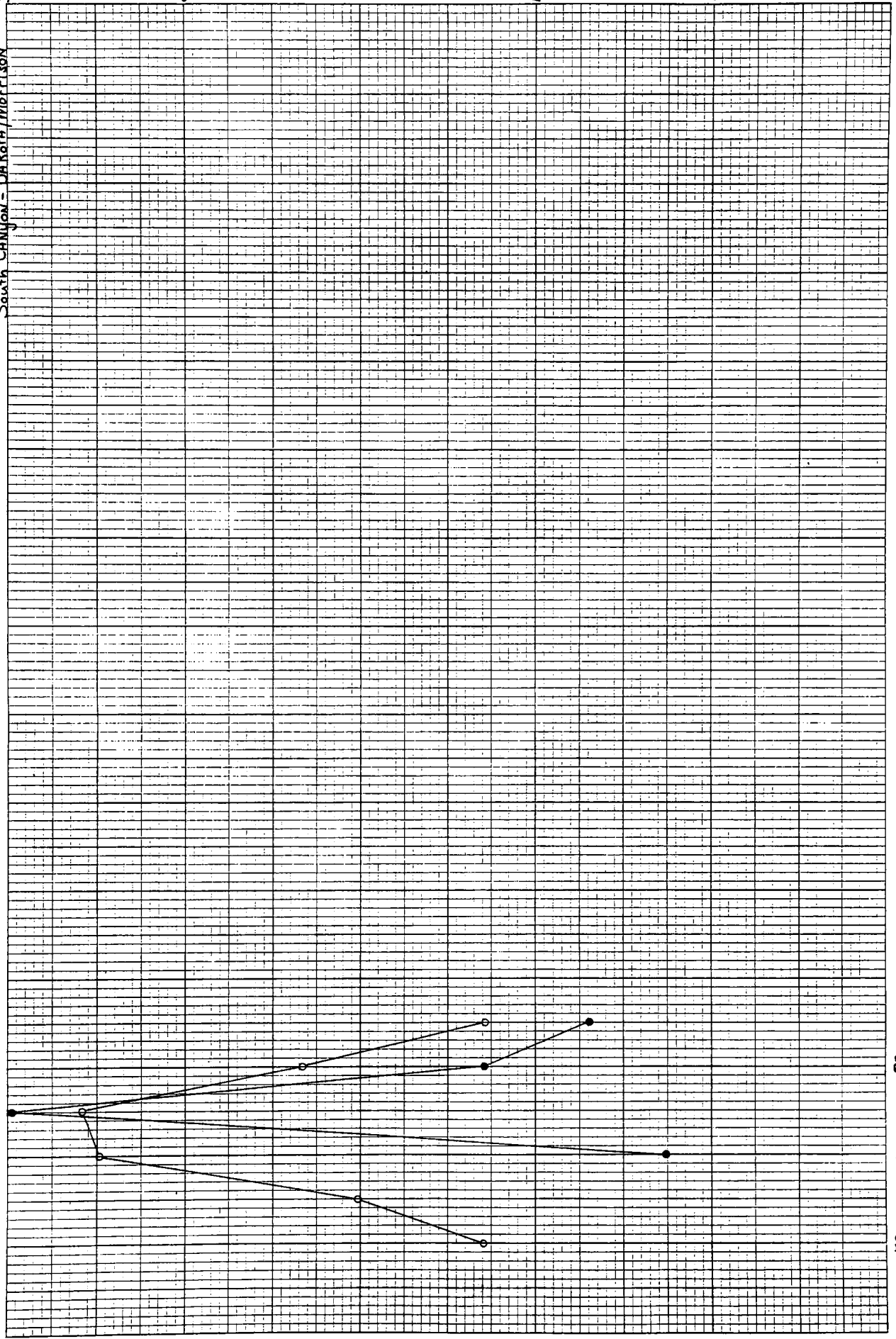
0.4

0

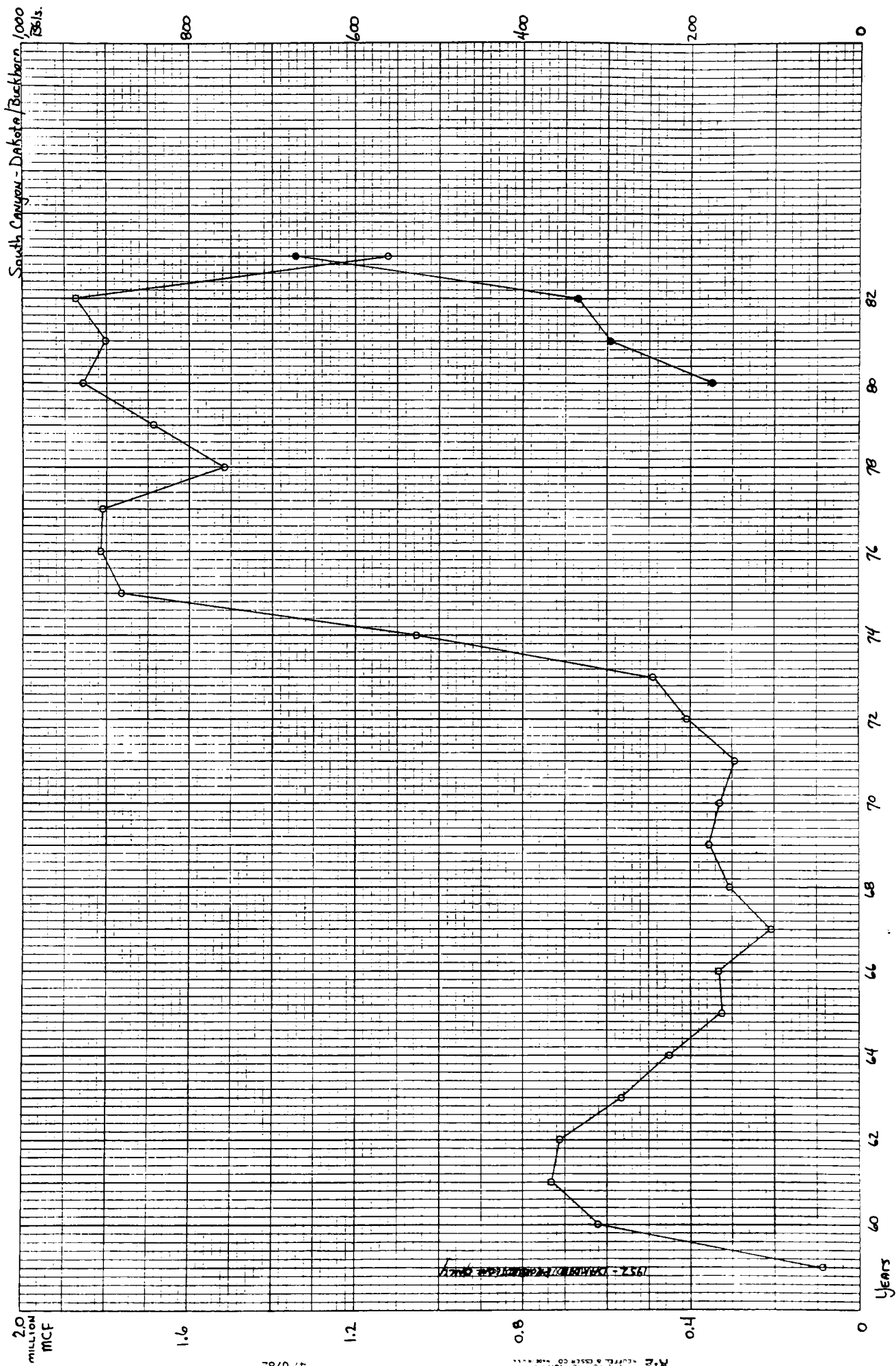
47 0782

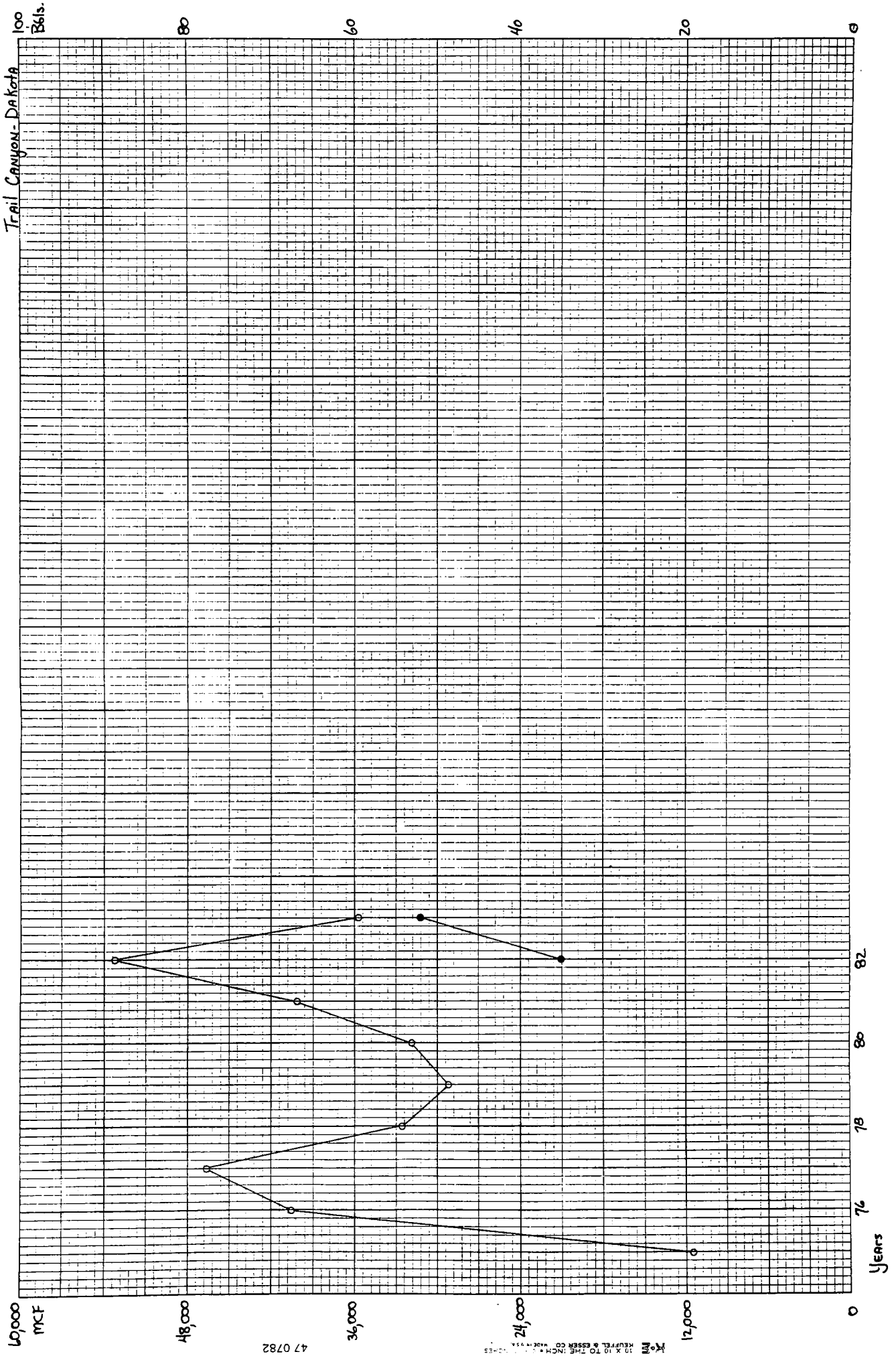
K&M  
10 X 10 TO THE INCH  
KUEPPEL & ESSER CO. MADE IN U.S.A.

Years  
78 80 82



South Canyon - Dakota/Buckhorn 1000  
1961s.



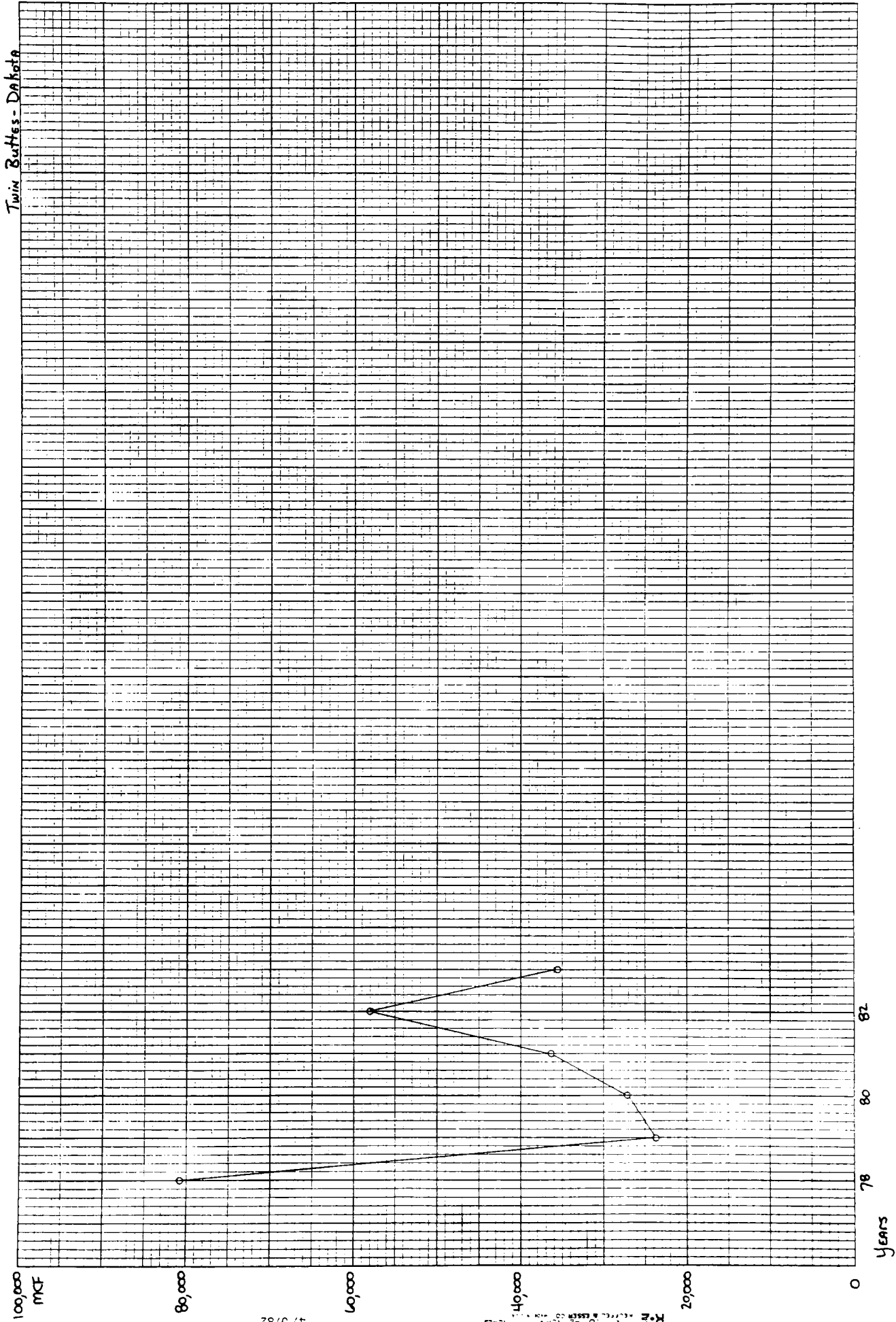


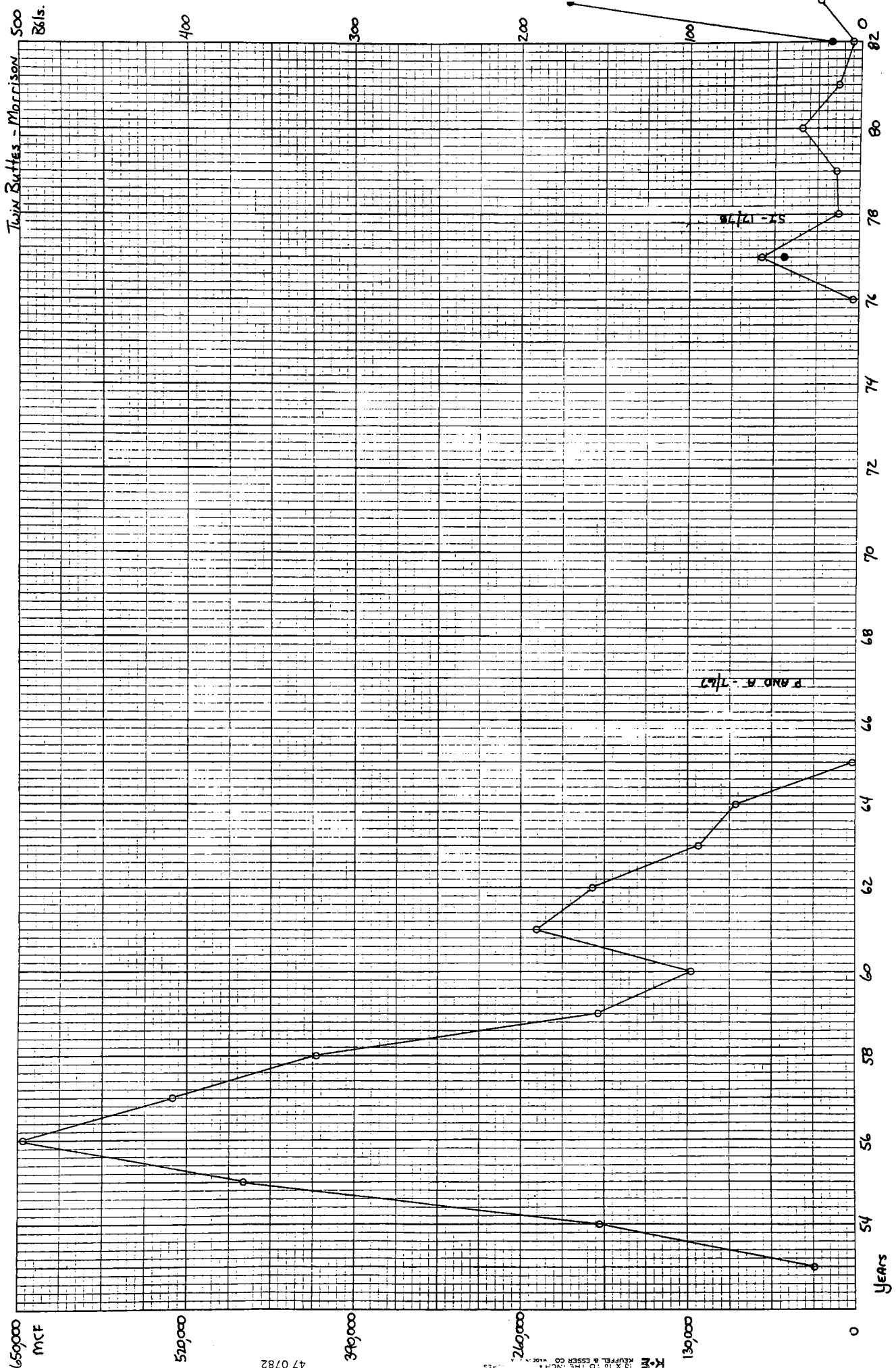
47 0782

McKENZIE & ASSOCIATES  
 19 X 10 TO THE NCH  
 KUPFL & ESSER CO. MADE IN U.S.A.



Twin Buttes - Dakota





## 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 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.

The Colorado Geological Survey has other publications covering topics in mineral fuels, minerals, groundwater, geothermal, and engineering and environmental geology. For a current publication list please contact:

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