

OPEN FILE 84-13

ESTIMATED OIL AND GAS RESERVES FOR ELBERT 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
Denver, 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 ELBERT COUNTY, COLORADO

Introduction

This report is the eleventh* 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 Elbert County, located approximately 25 miles southeast of Denver, within the south-central portion of the Denver Basin. Elbert County covers 1,864 square miles. In this county, oil and/or gas are produced from, in descending order of age, Ft. Hays Limestone, D sand and J sand.

There are 11 fields considered active producers as of December 31, 1983. Of these, 10 are classified as oil fields (based on cumulative gas-oil ratio (GOR) of <15:1), and one is classified as a gas field (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; and
- OPEN-FILE REPORT 84-12: Estimated Oil and Gas Reserves for Moffat County, Colorado.

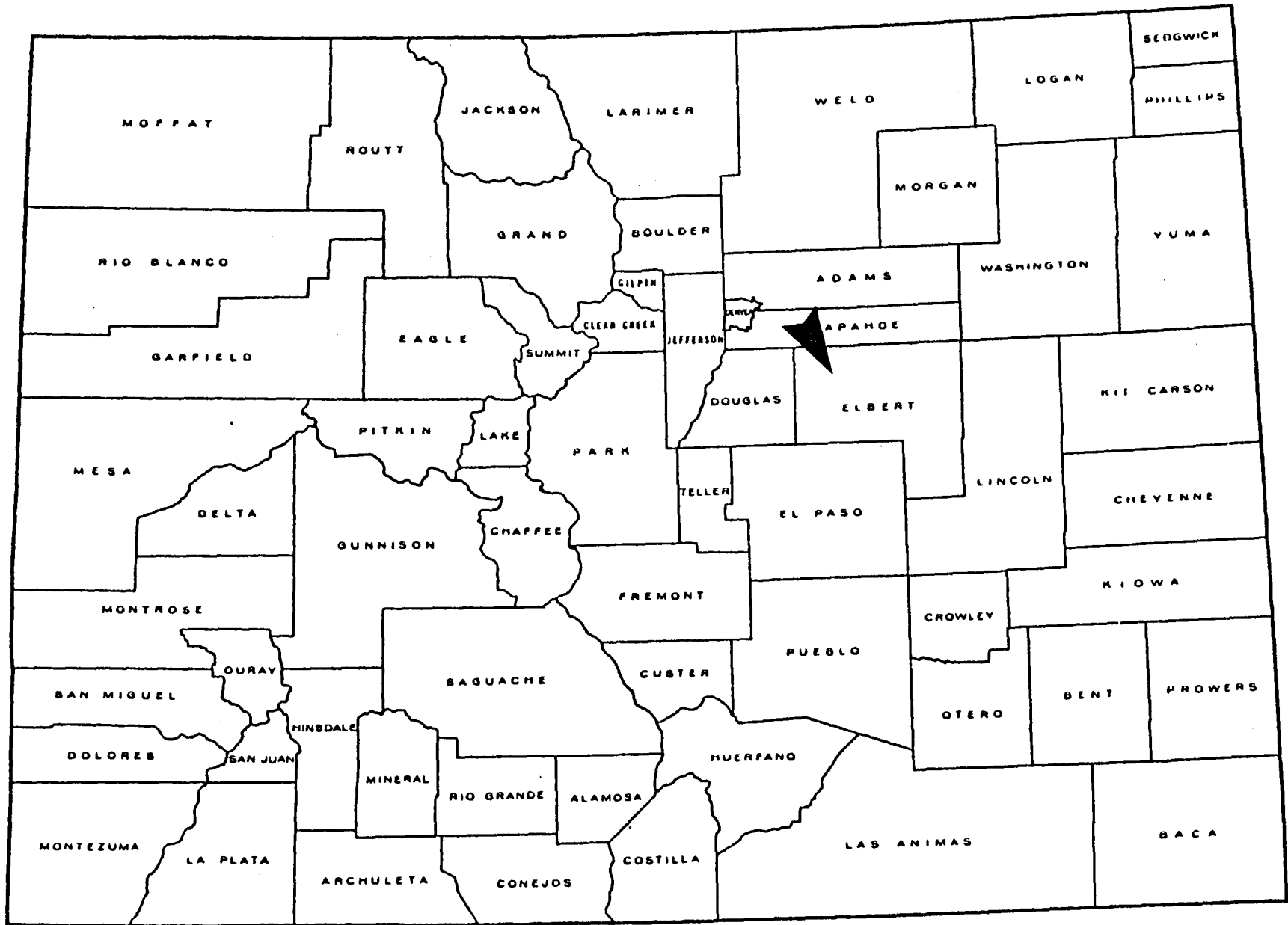


Figure 1. County Location Map

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 20 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 16 oil field-horizons. Production histories have allowed for decline rates to be calculated for 5 of these. The remaining 11 oil field-horizons have not produced for a long enough time (less than 3 years) to determine a reliable decline rate. For the previously mentioned 5 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 4 gas field-horizons. Production histories have allowed for decline rates to be calculated for 2 of these. Of the remaining 2 field-horizons, one has not produced for a long enough time (less than 3 years) to determine a reliable decline rate. The other was shut-in for 11 months in 1983. Decline rates were determined for the previously mentioned 4 gas 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 I.

Results can be found in Table I.

For the associated oil 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 Elbert County totaled 909,386 barrels. Estimated gas reserves for Elbert County totaled 11,773,658 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 three to four years, roughly half of the estimated oil reserves in Elbert 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 (19.8 percent per year for oil and 13.65 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 (82,899 Bbls. of oil and 131,733 MCF of gas) additional reserves of 365,784 Bbls. of oil and 913,813 MCF of gas were obtained. This gives total county reserves (Class I and II) of 1,275,170 Bbls. of oil and 12,687,471 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 84-13
RESERVE DATA FOR ELBERT 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.Caldonia/D	6S-64W	1981			30,835	36,574					N.P.	
2.Caldonia/J	6S-64W	1981			13,025	48,624					N.P.	
3.Coachman/D	6S-65W	1981			909	2,511					N.P.	
4.Comanche Ck/D	6S-62W	1970	S. G. D.	24.4 -o 23.3 -g	1,758,106	5,277,505	420,558	3,932,981	2,178,664	9,210,486	Econ.Limit= 5 wells.	
5.Comanche Ck/J	6S-62W	1970	S. G. D.	8.9 -o 13.8 -g	10,127	1,051,669	27,207	83,946	37,334	1,135,615		
6.Cypress/J	6S-61W	1982			77,856	66,091					N.P.	
7.Deadeye/D	6S-62W	1976		14.6 -o 4.5 -g	801,087	2,939,114	344,124	5,904,858	1,145,211	8,843,972	Econ.Limit= 4 wells; Also Prod. in Arapahoe Co.	
8.Deadeye/J	6S-62W	1981				2,611					N.P. Also Prod. in Arapahoe Co.	
9.Doubletree/D	2S-62W	1981			6,711						N.P. Also prod. in Arapahoe Co.	
10.Doubletree/J	2S-62W	1973		21.5 -o 18.8 -g	33,651 (82,103)	5,102,754	12,550	1,433,019	46,201 (+82,103)	6,535,773	Also Prod. in Arapahoe Co.	
11.Ironhorse/D	7S-63W	1983			1,289	2,285						
12.Ironhorse/J	7S-63W	1969		17.8 -o 9.5 -g	54,365	32,751	37,670	76,739	92,035	109,490		
13.Lowry/J	5S-65W	1972	Volumetric		3,383	34,376					N.P.; Only Prod. '82 & '83.	
14.Running Ck/D	6S-64W	1980	S. G. D.	38.9 -o 8.5 -g	12,251	7,703	2,380	35,959	14,631	43,662		
15.Running Ck/ Ft. Hays	6S-64W	1980			2,698						N.P.	
16.Running Ck/J	6S-64W	1980	S. G. D.		11,447	11,384					N.P.	
17.Song Bird/D	7S-63W	1976		16.0 -o 10.7 -g	202,130	285,233	64,897	306,156	267,027	591,389		
18.Song Bird/J	7S-63W	1976			17,893	491,426					SI 11 mos. in 1983. Very steep decline rate.	
19.Wallbanger/D&J	6S-64W	1983			1,103	425					N.P.	
20.Wallbanger/J	6S-64W	1982			22,083	6,502					N.P.	
COUNTY TOTAL OF ESTIMATED RESERVES							909,386	11,773,658				
							Bbls.	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 Elbert County. These graphs are presented in alphabetical order by Field name and then by producing horizons within each field.

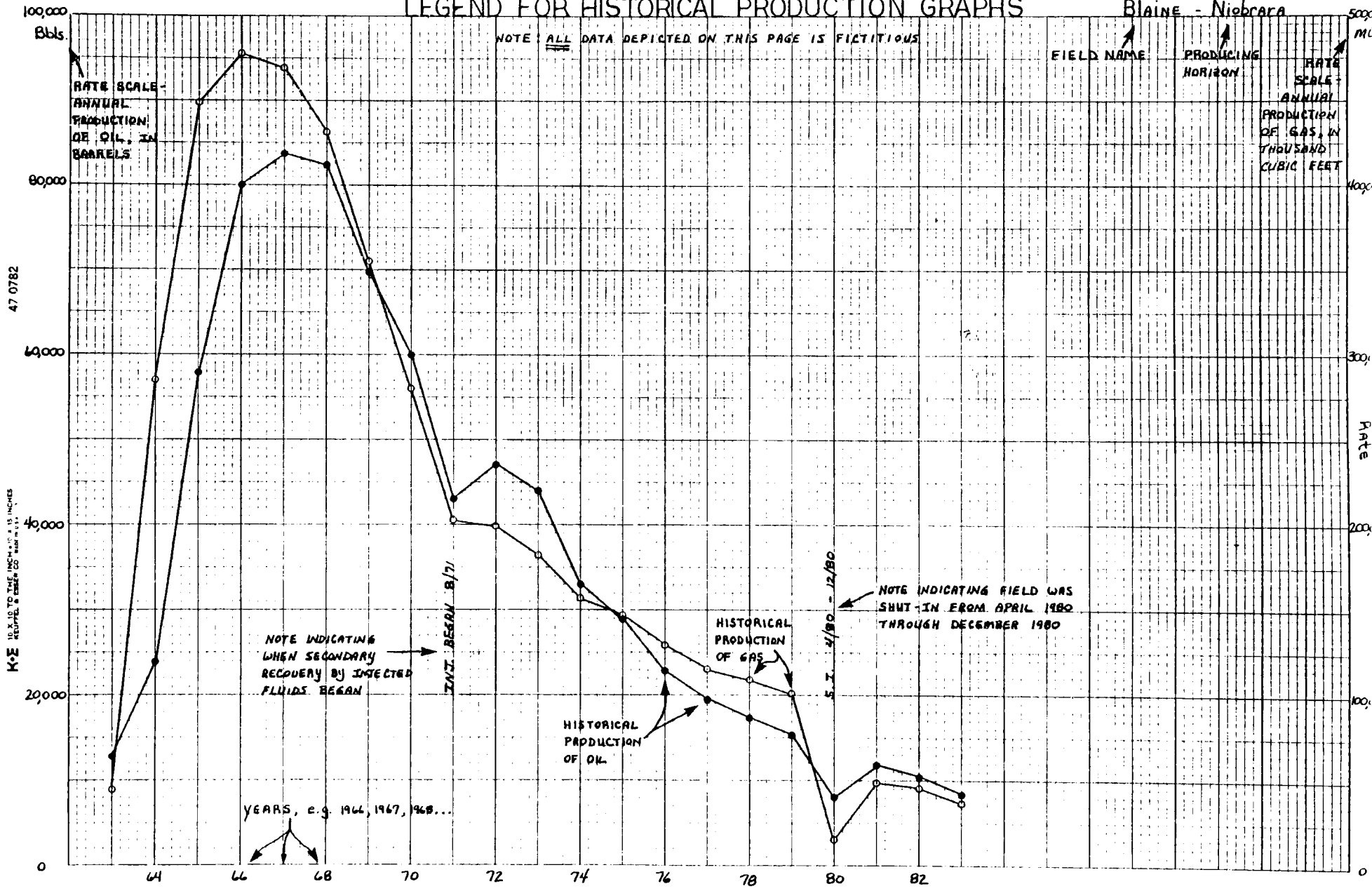
Note that only those fields actively producing as of 12-31-83 are included. Abandoned fields or field-horizons are not included.

LEGEND FOR HISTORICAL PRODUCTION GRAPHS

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



47 0782

K-E 10 X 10 TO THE MC PER 15 INCHES RESERVOIR & 2500 TO 3000 GPD

RATE SCALE - ANNUAL PRODUCTION OF OIL, IN BARRELS

NOTE INDICATING WHEN SECONDARY RECOVERY BY INJECTED FLUIDS BEGAN

INJ. BEGAN 8/71

HISTORICAL PRODUCTION OF OIL

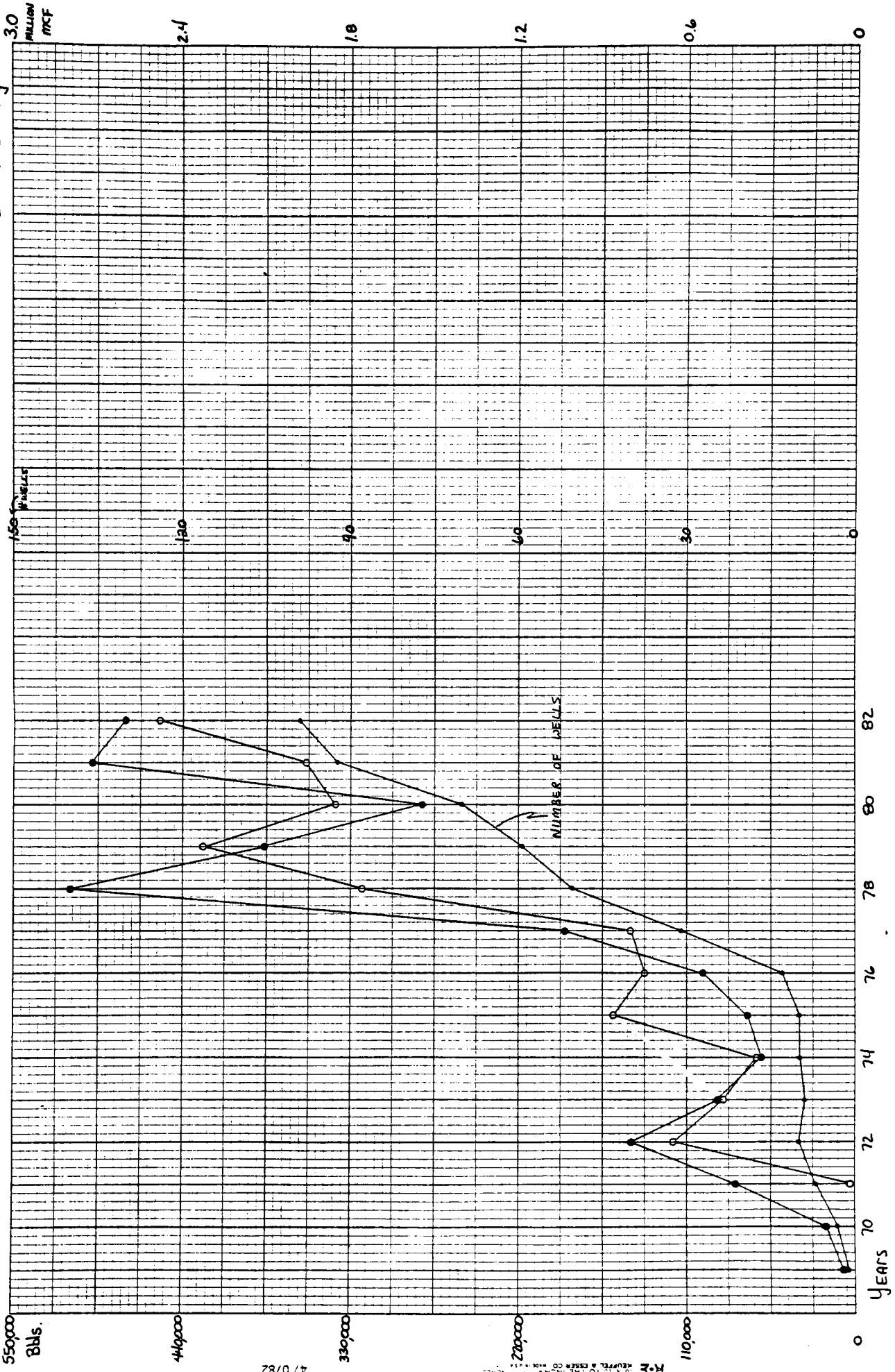
HISTORICAL PRODUCTION OF GAS

NOTE INDICATING FIELD WAS SHUT-IN FROM APRIL 1980 THROUGH DECEMBER 1980

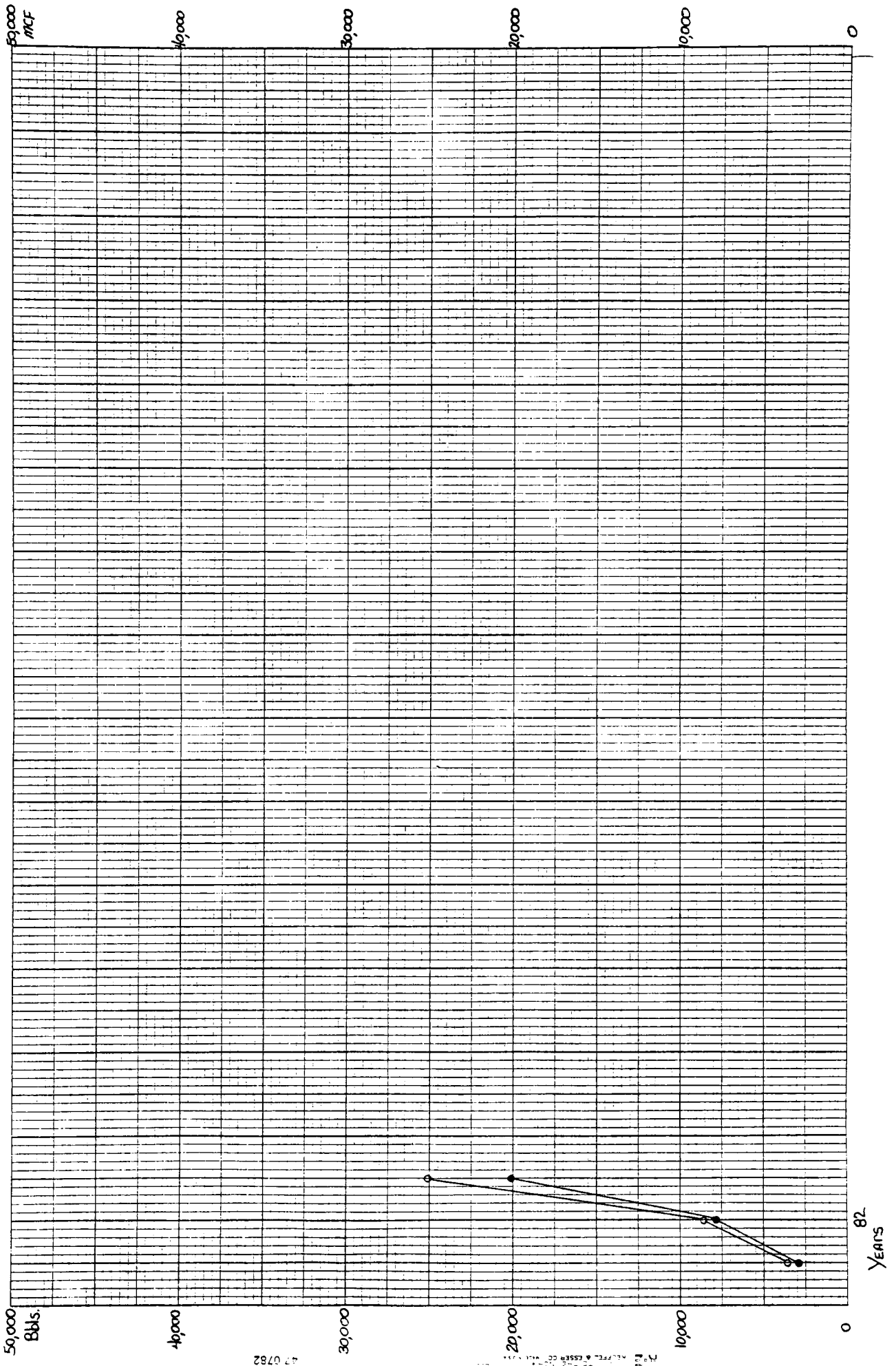
YEARS, e.g. 1966, 1967, 1968...

S.I. 4/80 - 12/80

Elbert County



CALEDONIA - D



47 0782

APRIL 1982

50,000
Bbls.

40,000

30,000

20,000

10,000

0

YEARS

82

50,000
MCF

40,000

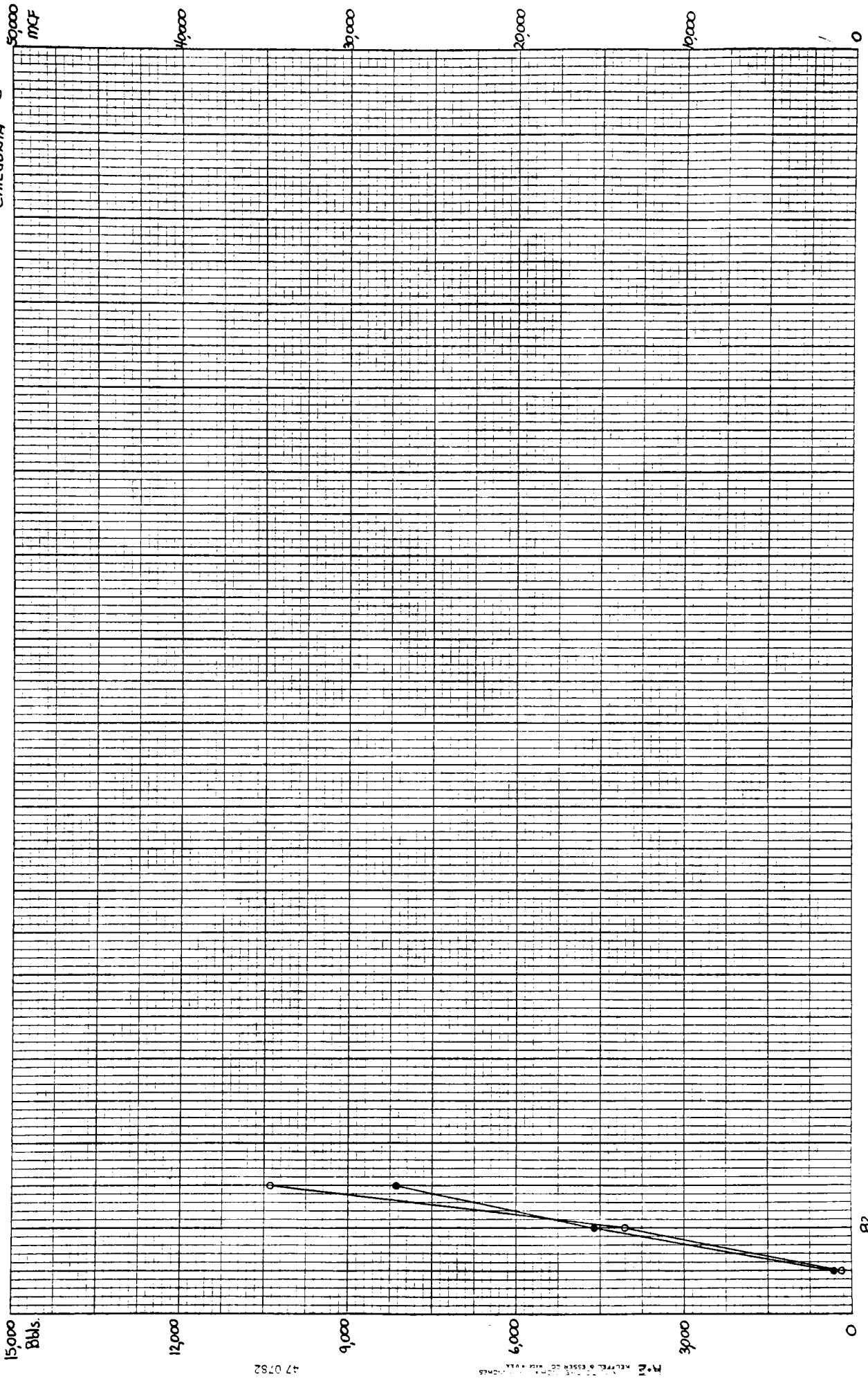
30,000

20,000

10,000

0

CALEDONIA - J



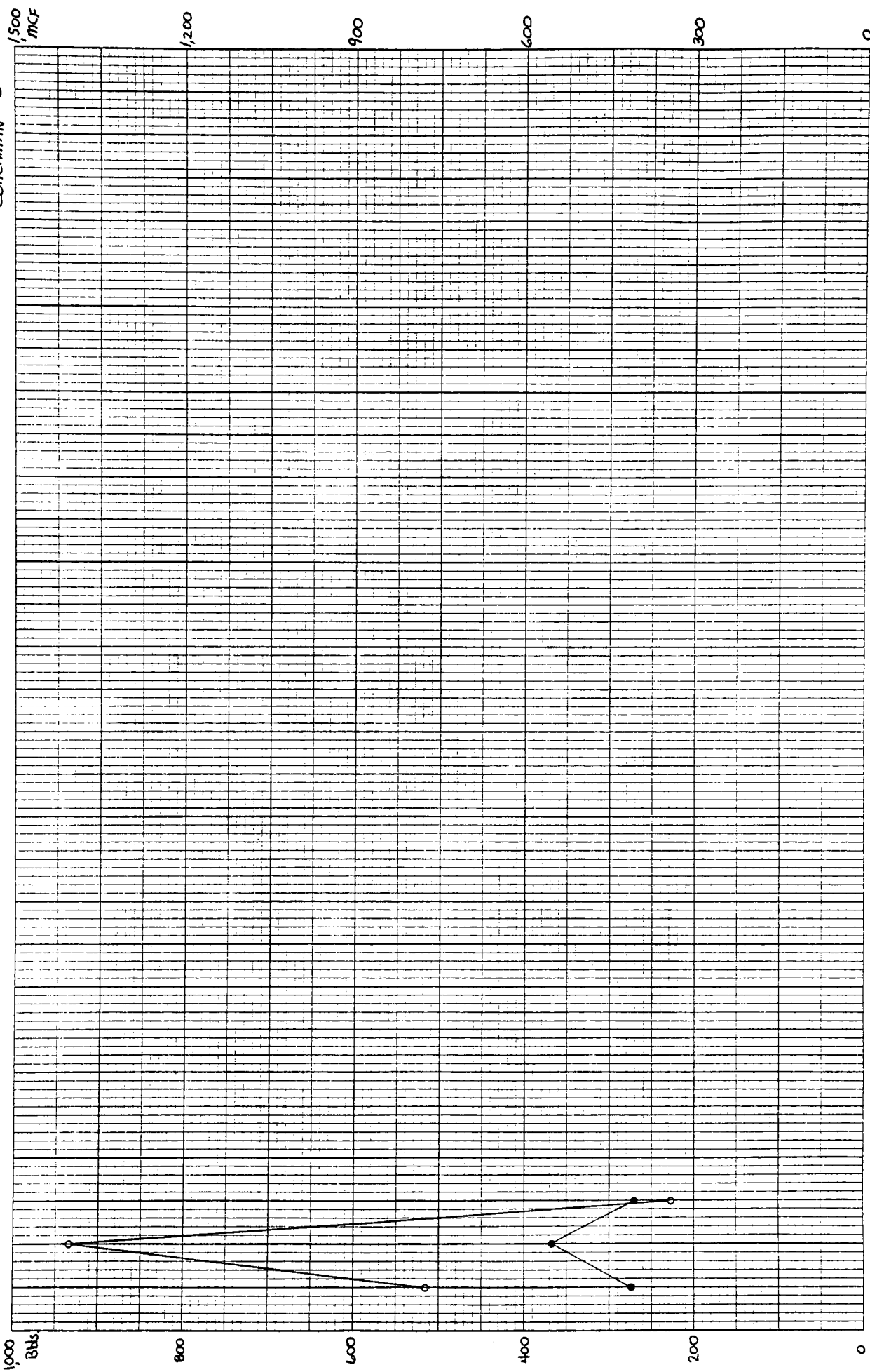
47 0782

M. E. KELFELL & ESSER CO. WASH. D.C.

Years

15,000 Bbls.
12,000
9,000
6,000
3,000
0

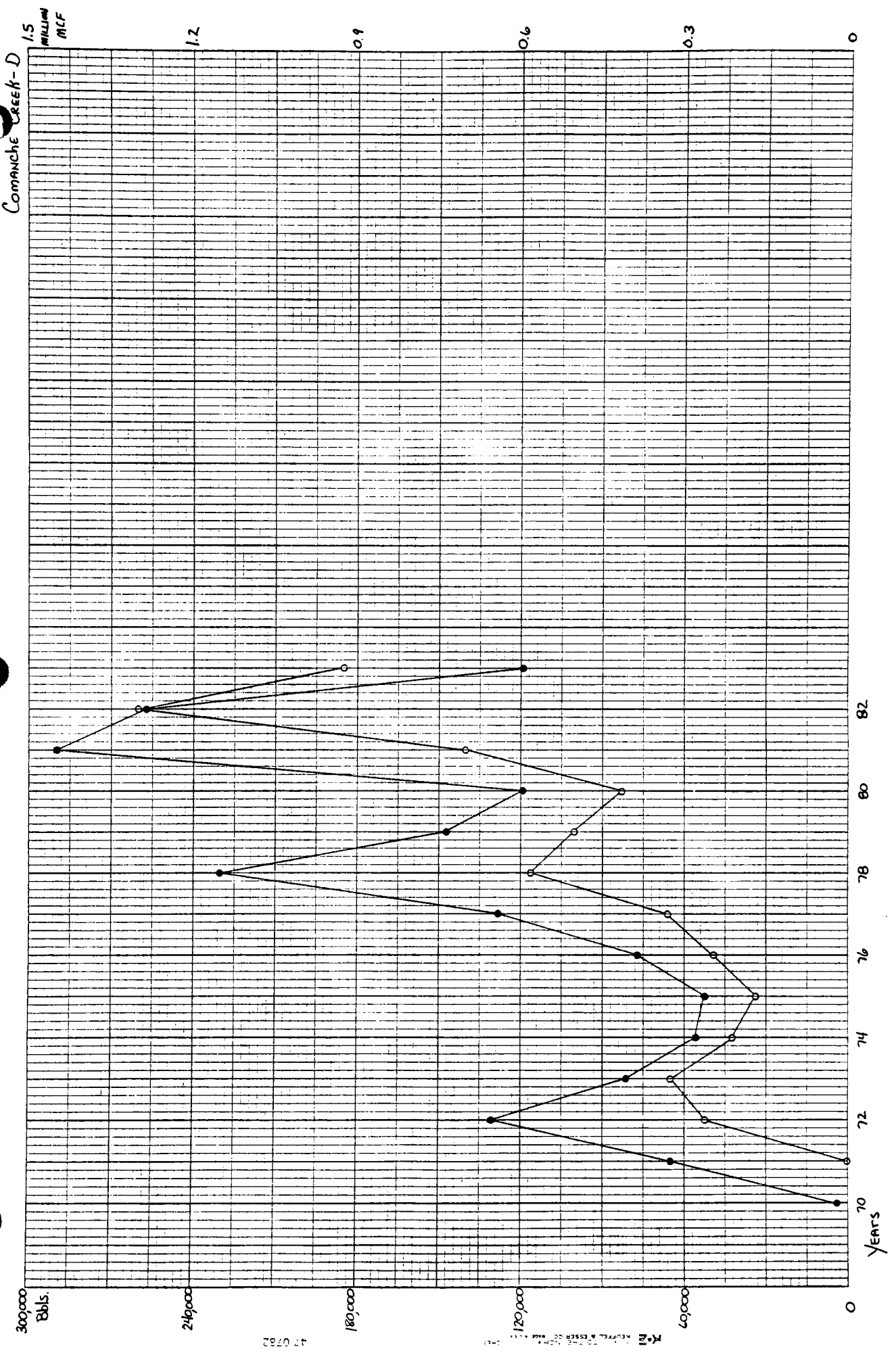
Conchman - D



Years 82

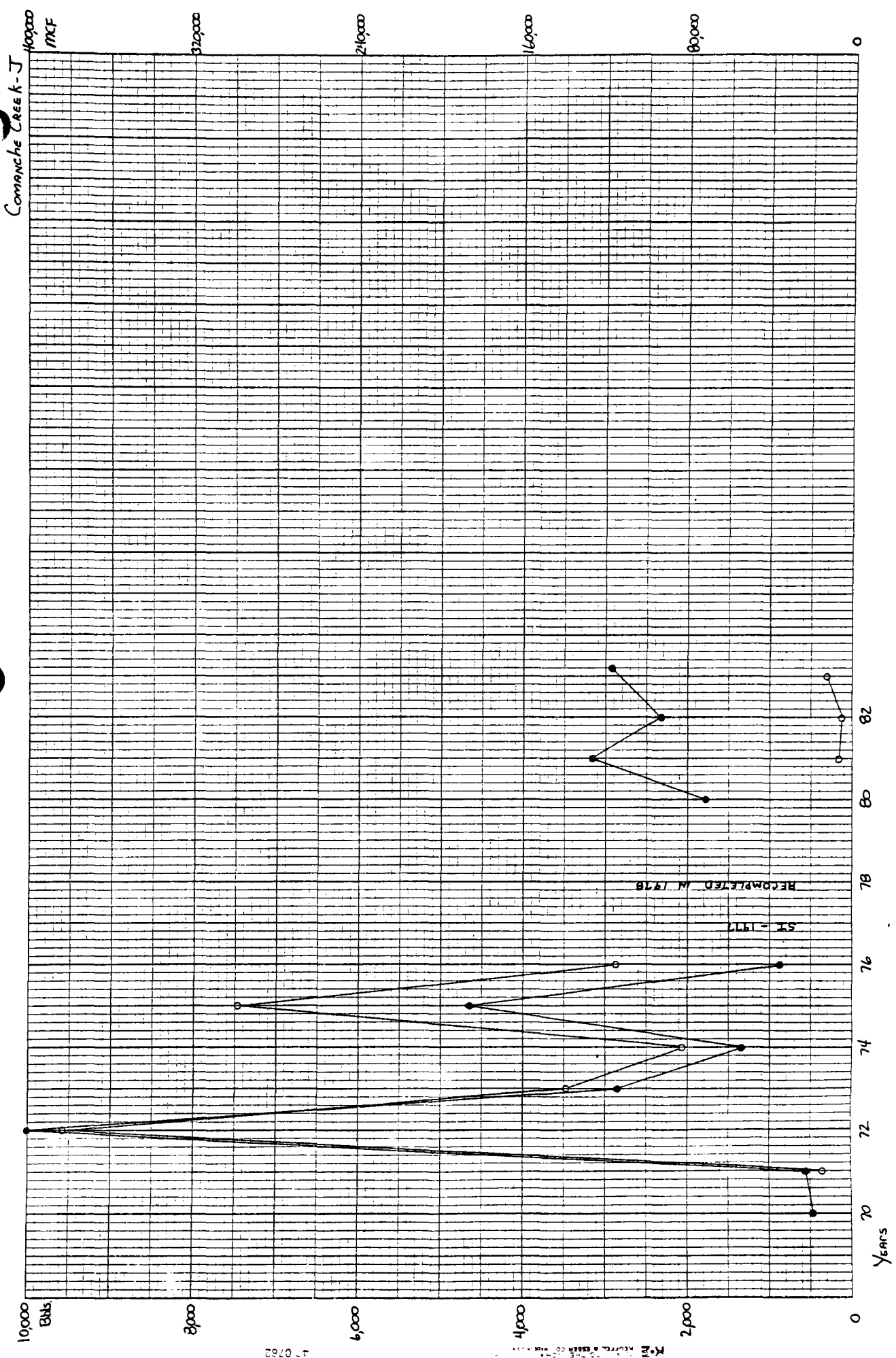
47 0782

1972 KEUFFEL & ESSER CO. "MILWAUKEE" PAPER

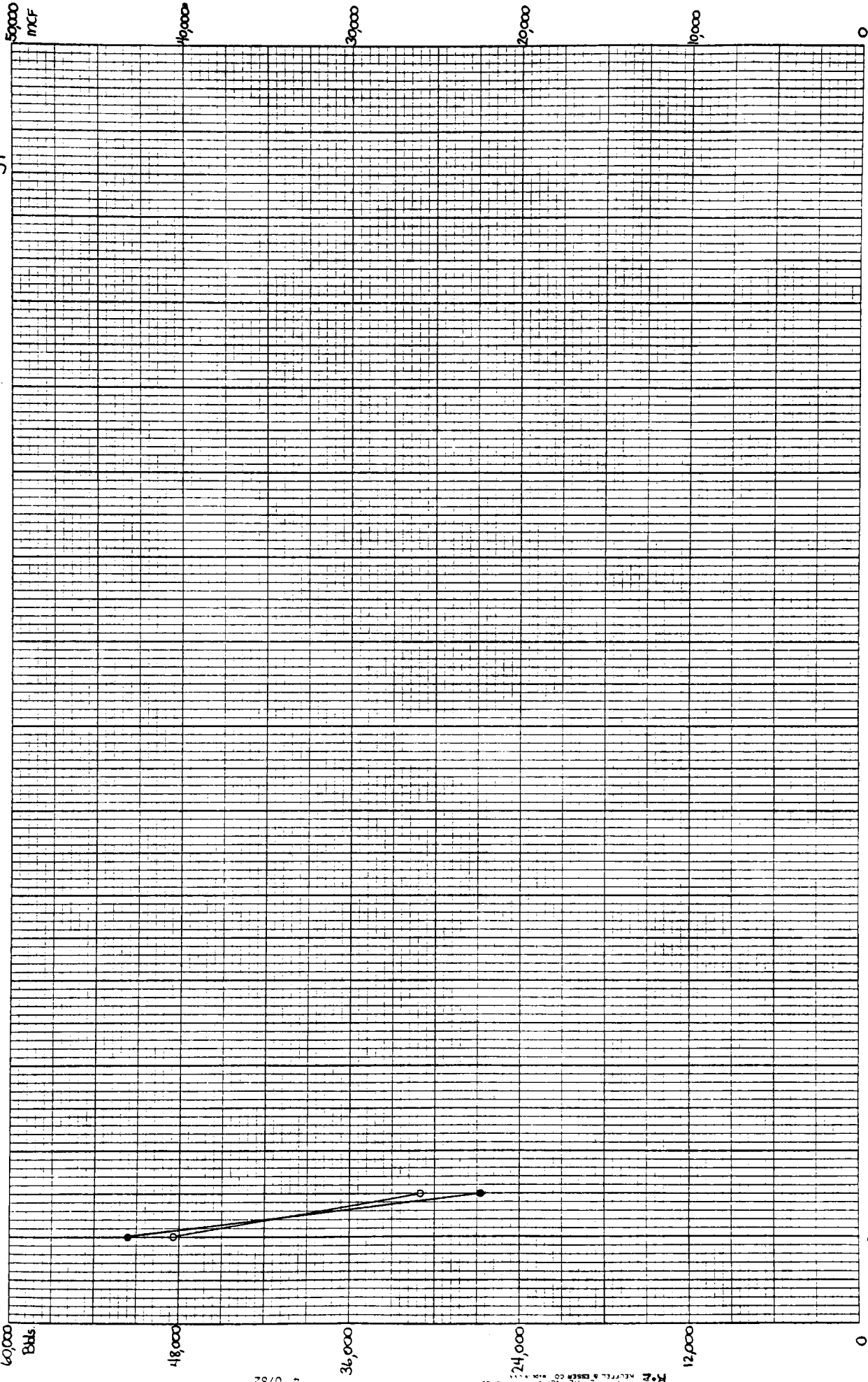


47 0782

REPRODUCED FROM THE ORIGINAL RECORDS OF THE COMPANY

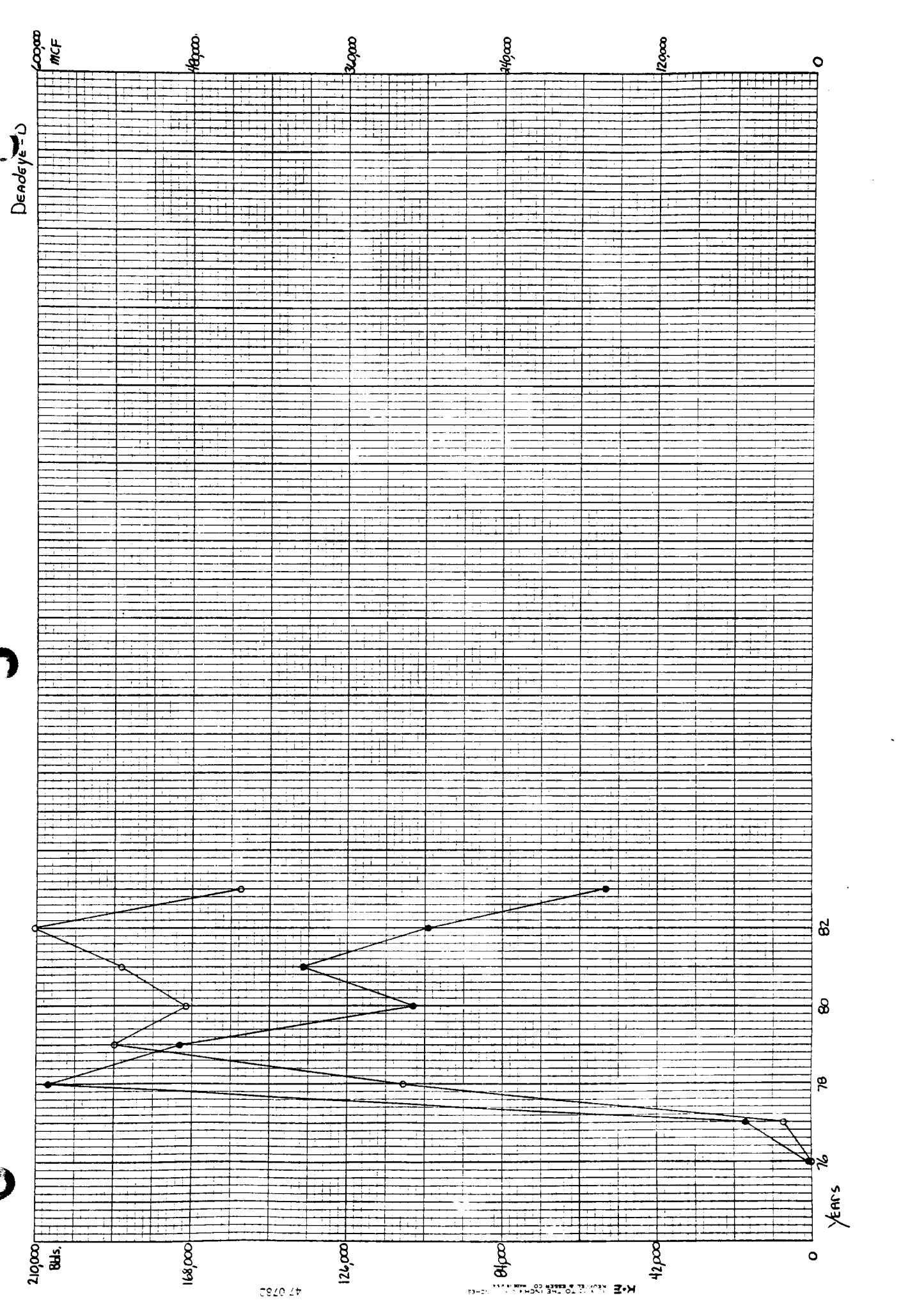


Cypress - J

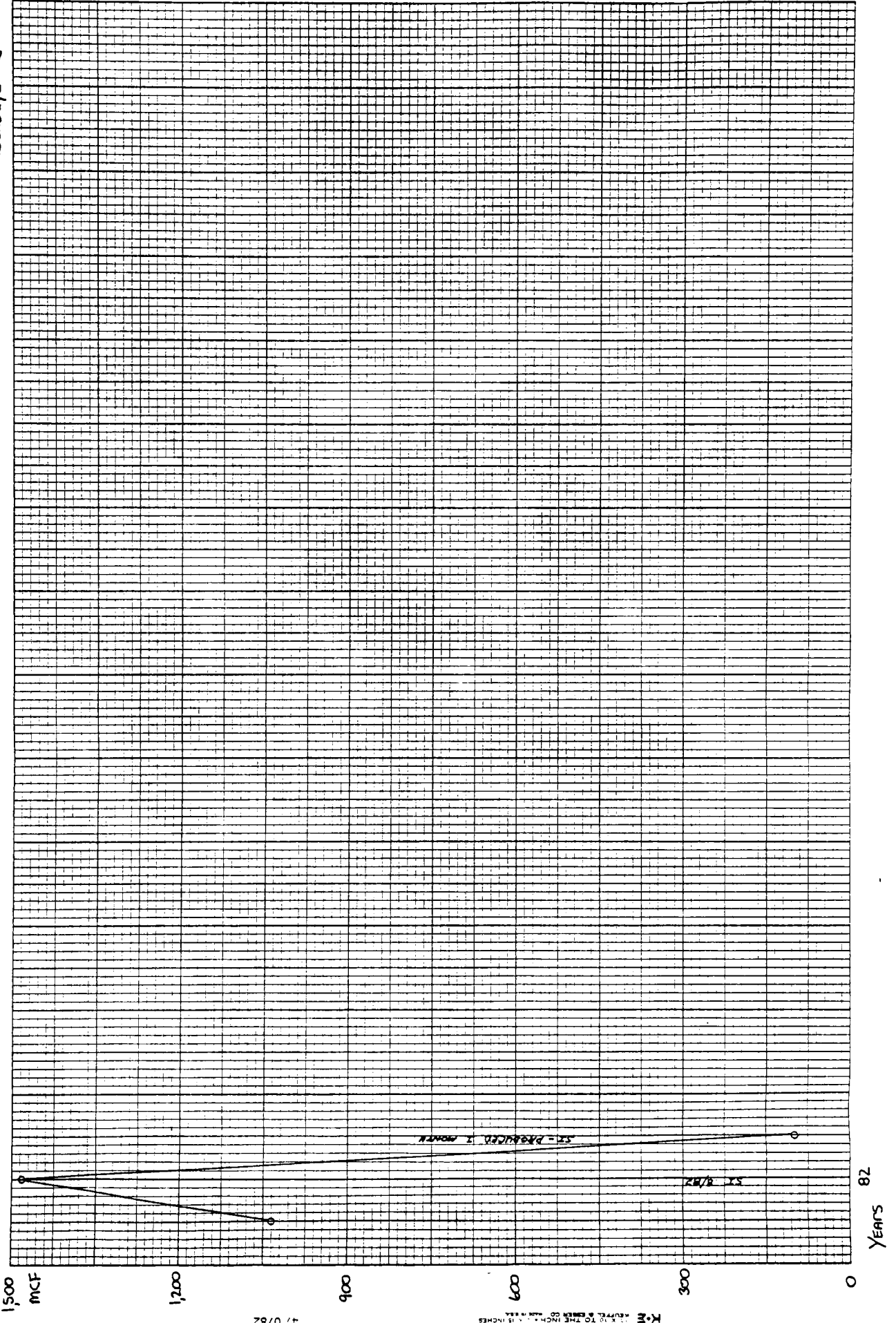


47 0782

H. P. HUFFEL & SONS CO. MINN. S.D.



Deadeye - J

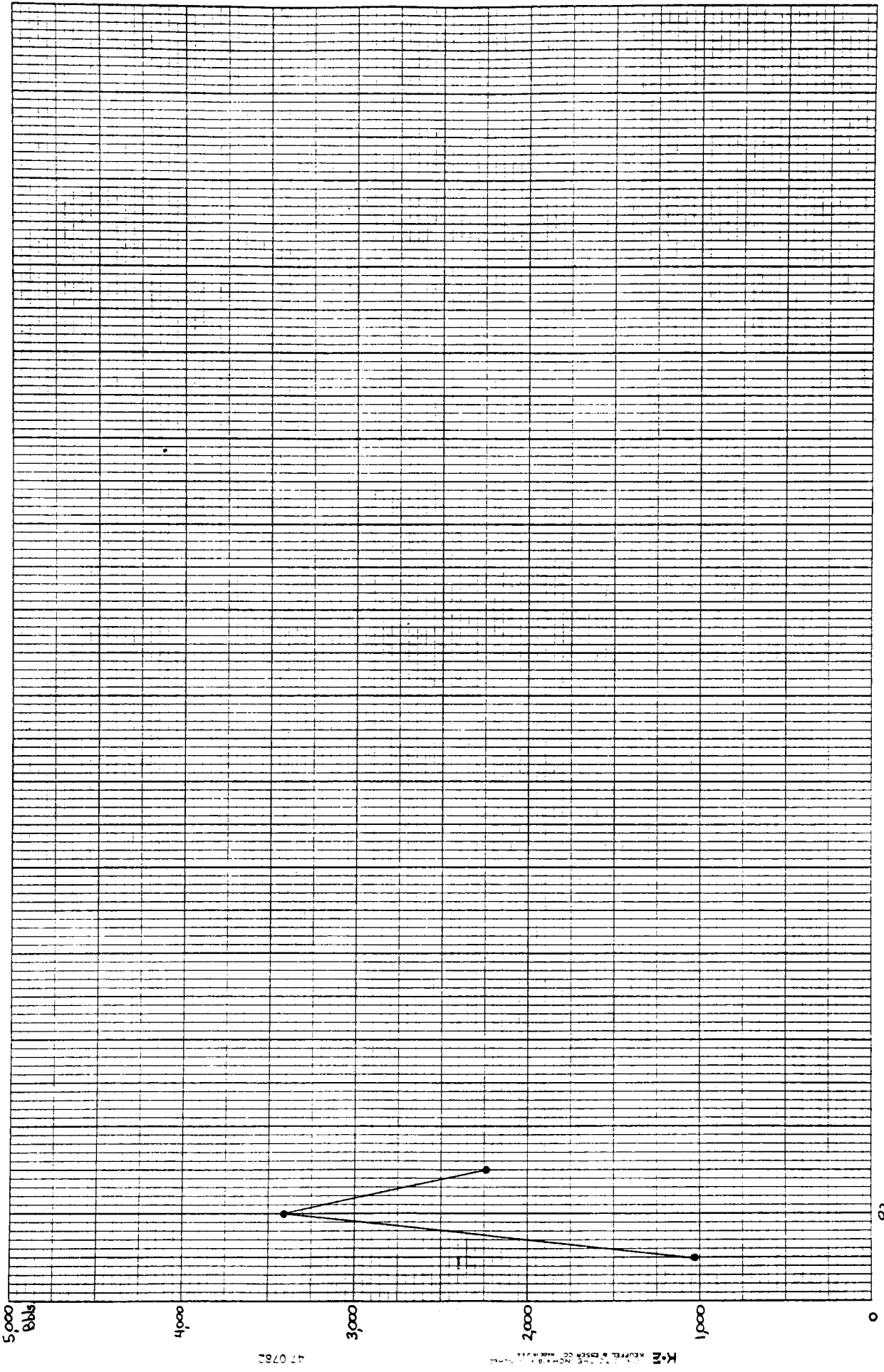


47 0782

SCALE TO THE INCH AS SHOWN

YEARS 82

Doublefr. D



Years

47 0782

MI KUPFER & BROSCH CO. MAPLEWOOD, N.J.

5000

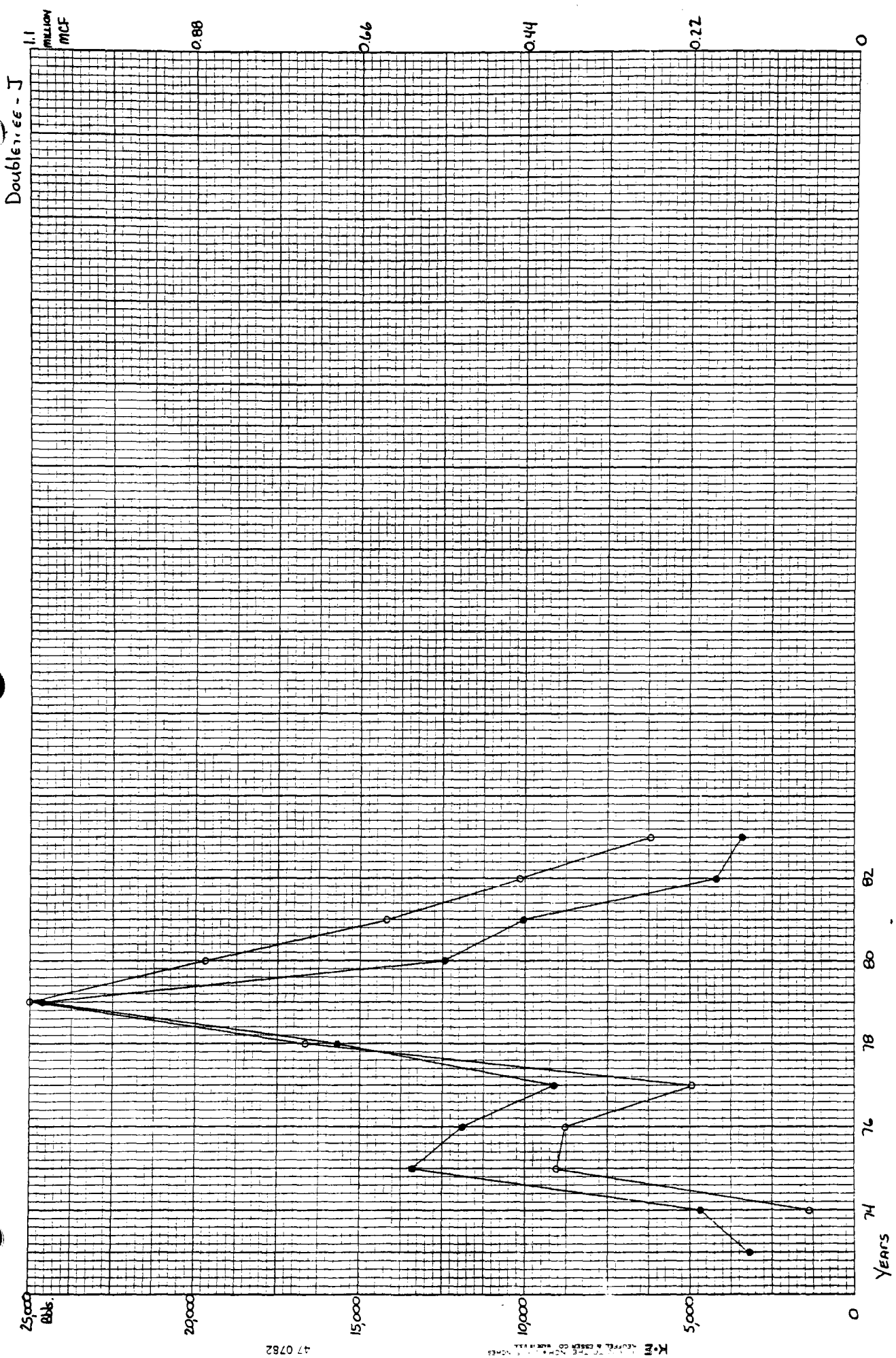
4000

3000

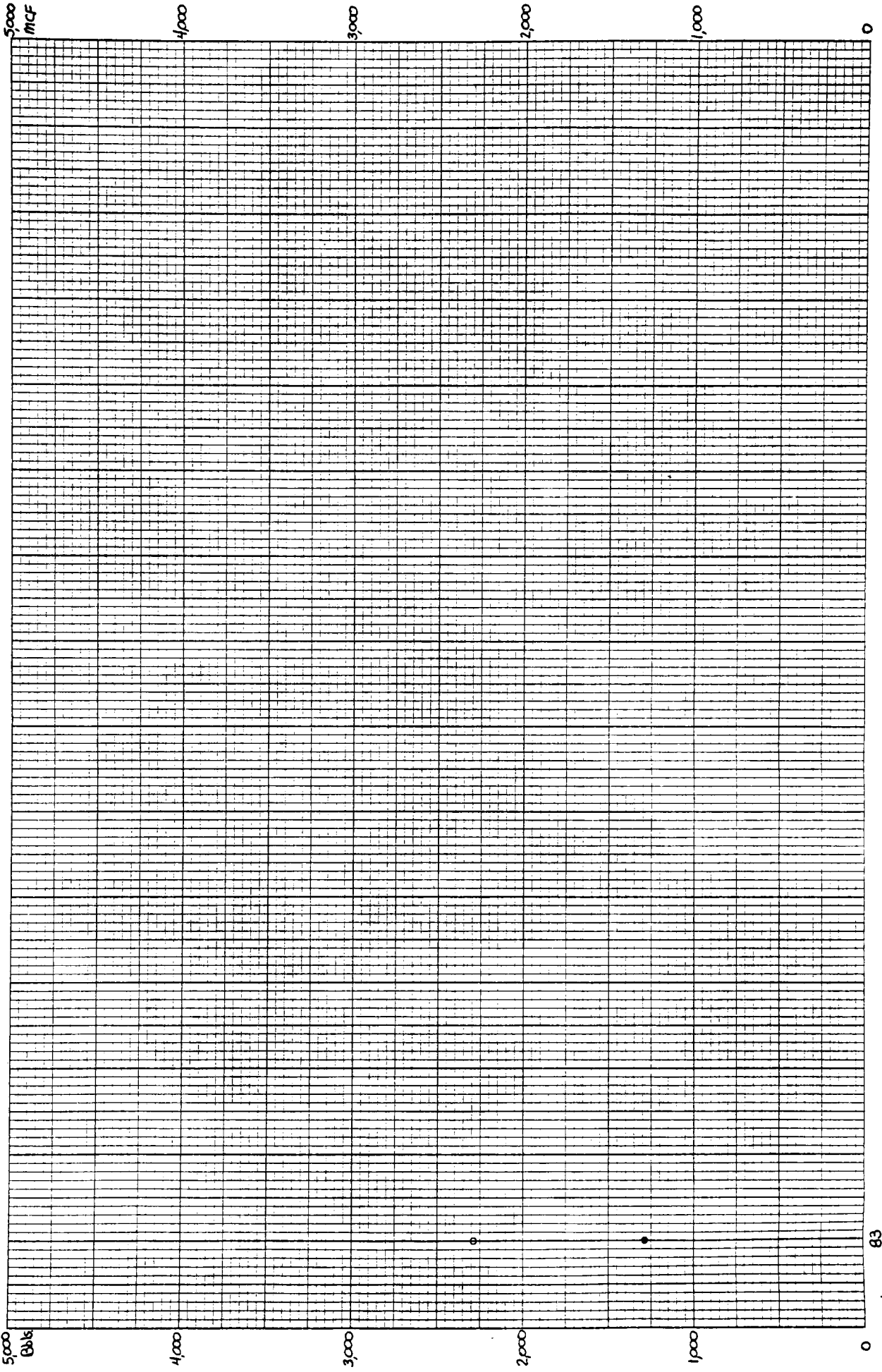
2000

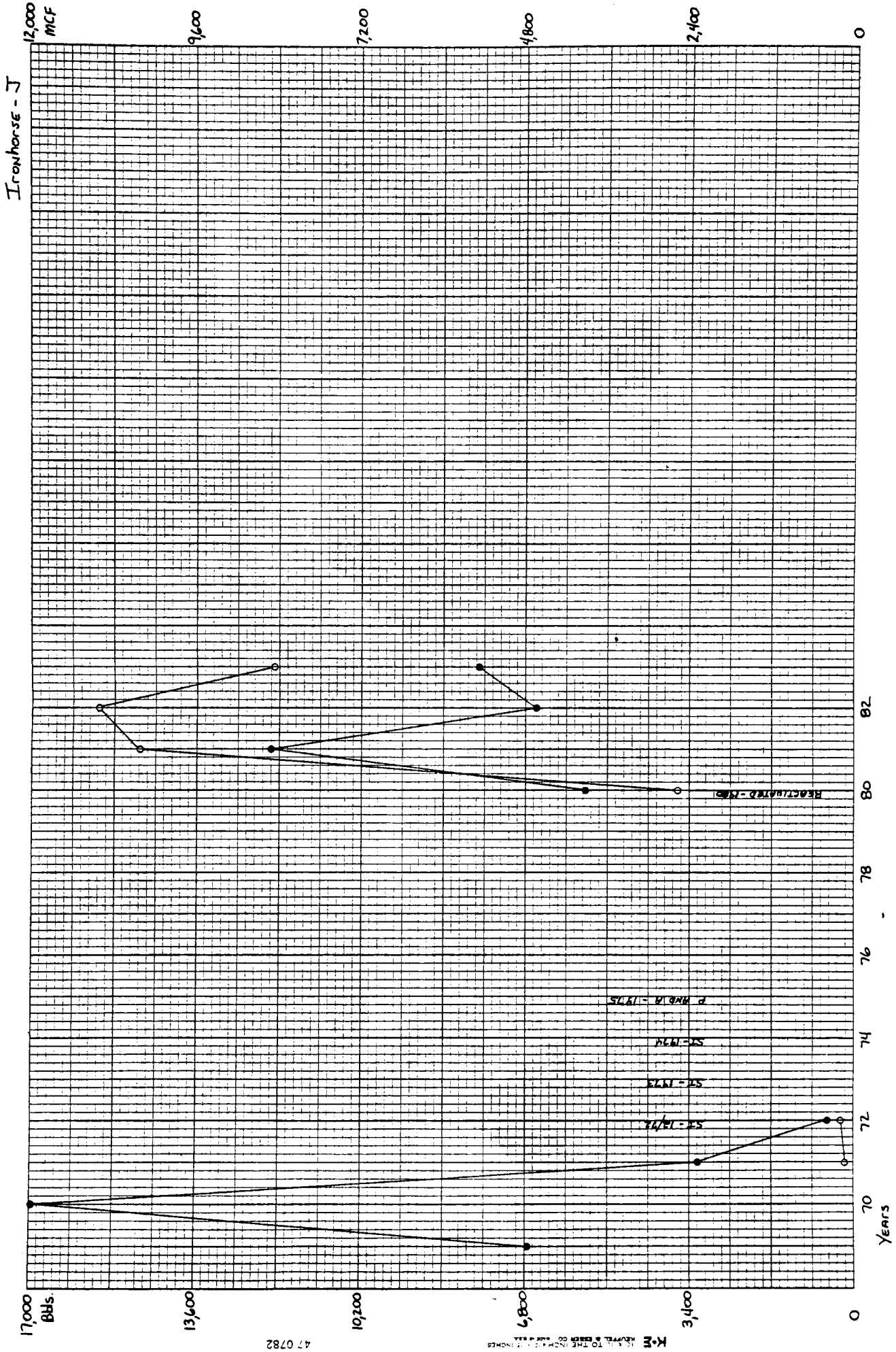
1000

0

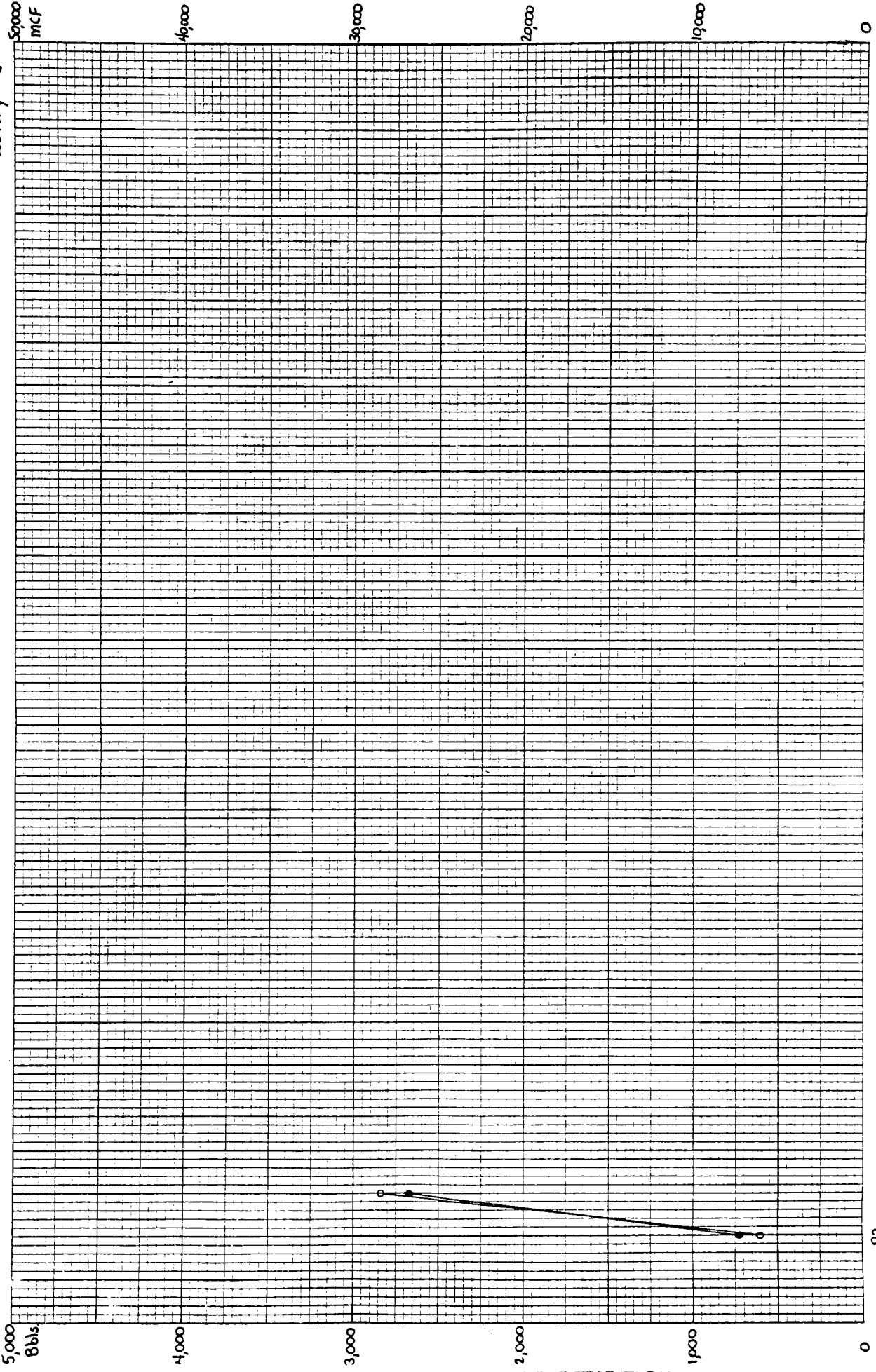


Ironhorse - D





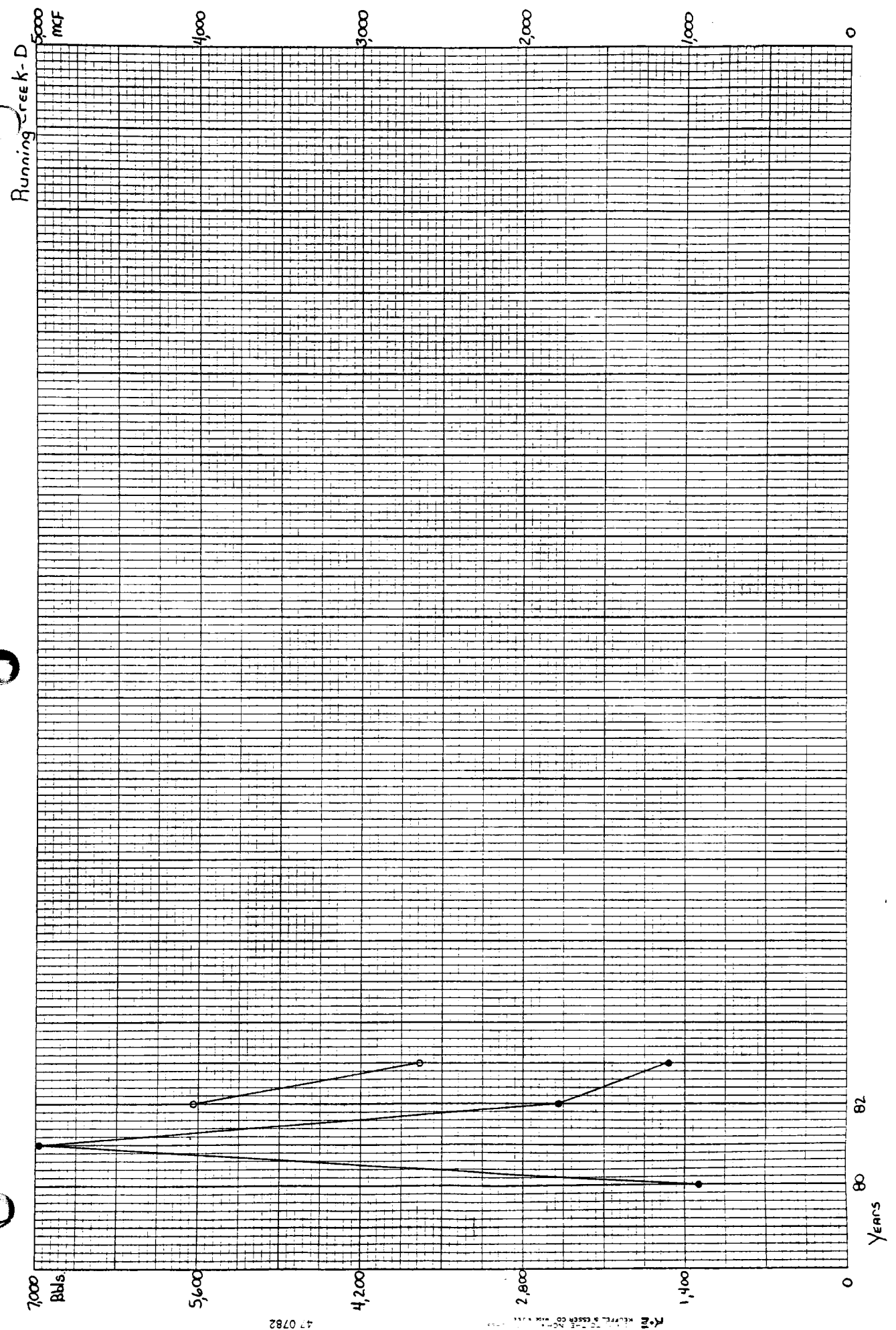
Lowry - J



47 0782

K-M
18 X 10 TO THE INCHES
REPERL & BATH OF INCHES

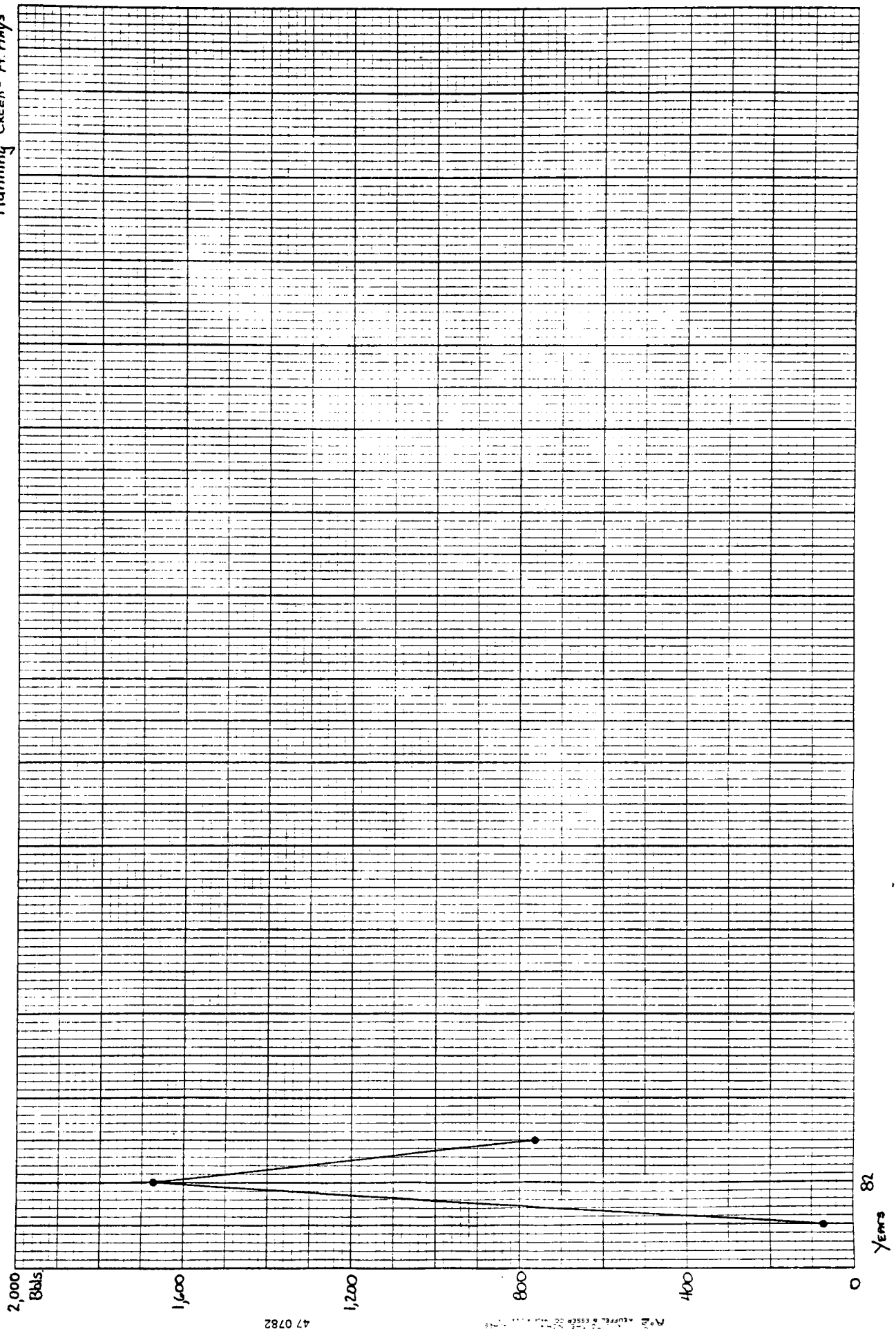
82
Years



47 0782

701 KEUPEL & ESSER CO. INC. ...

Running Creek - Ft Hays



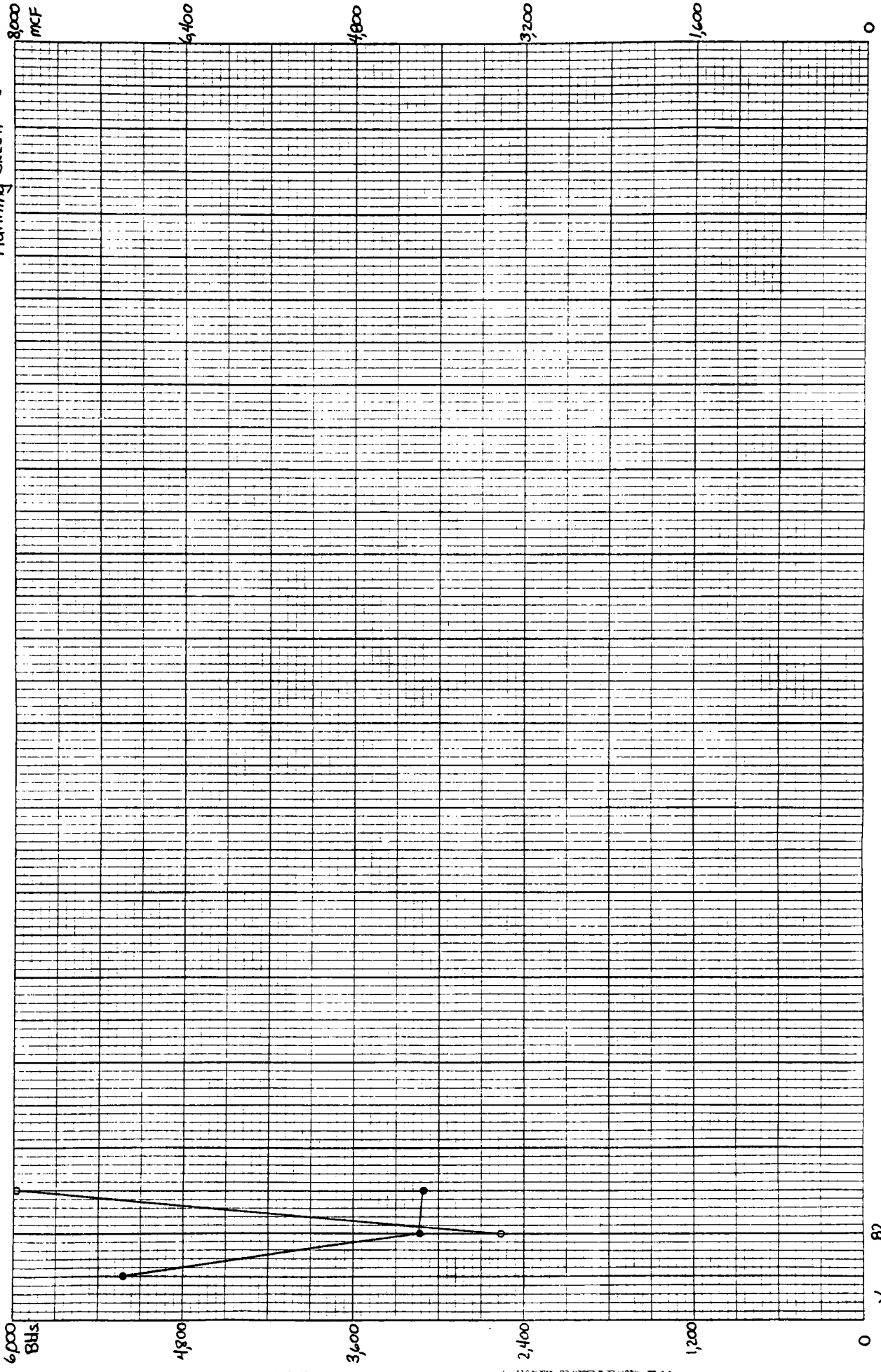
Years

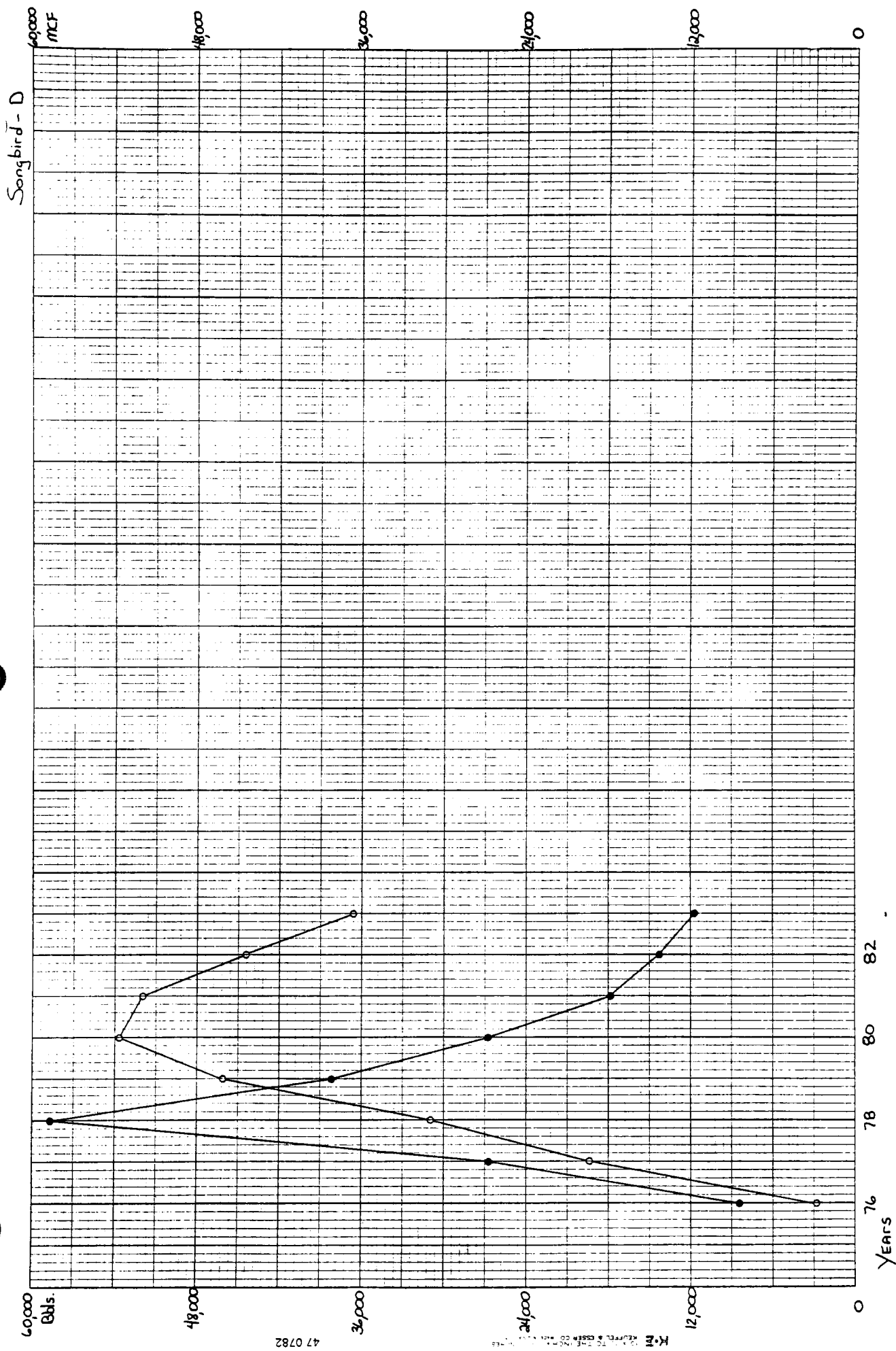
2,000 Bbls
1,000
1,200
800
400
0

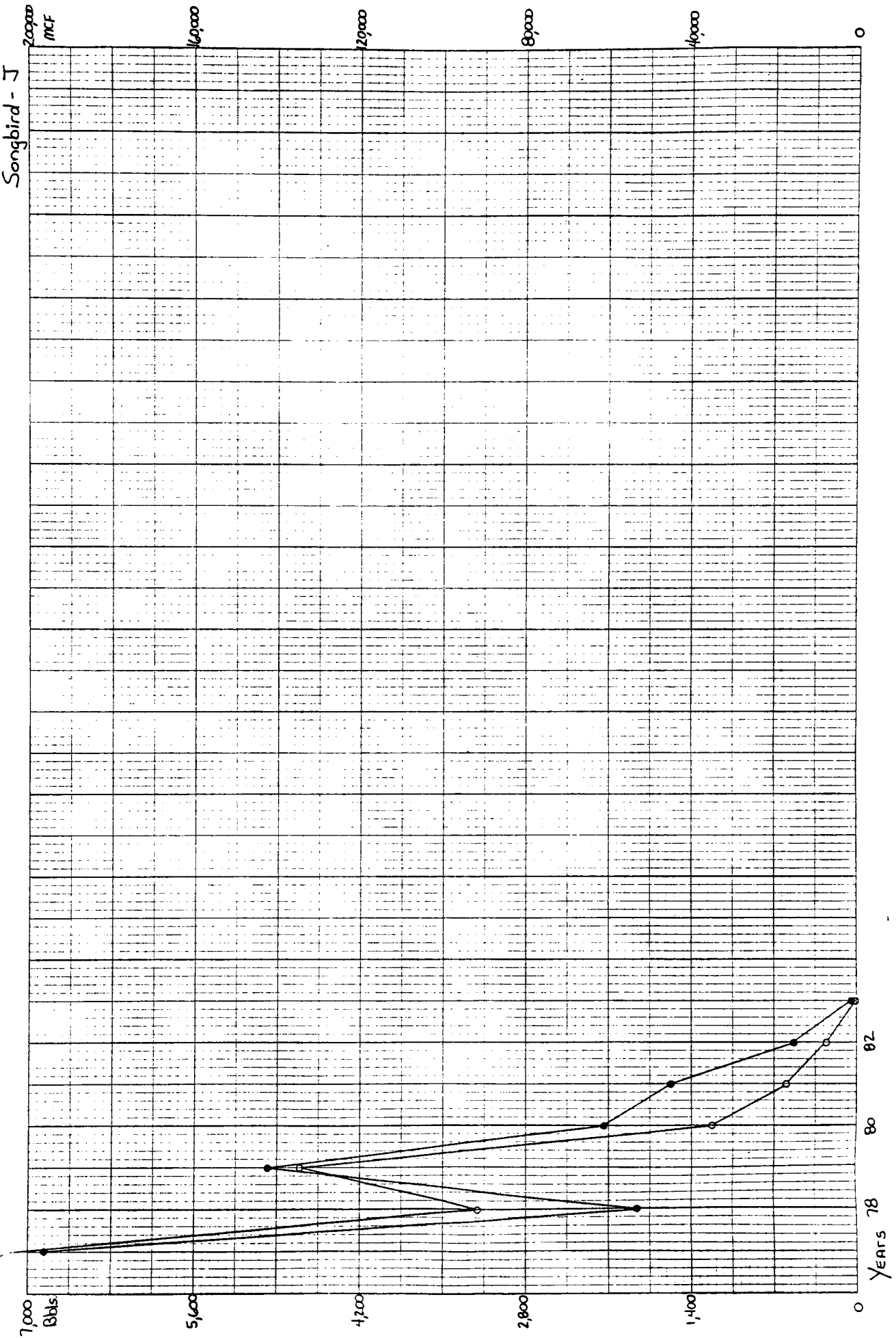
47 0782

PLATE 47 0782

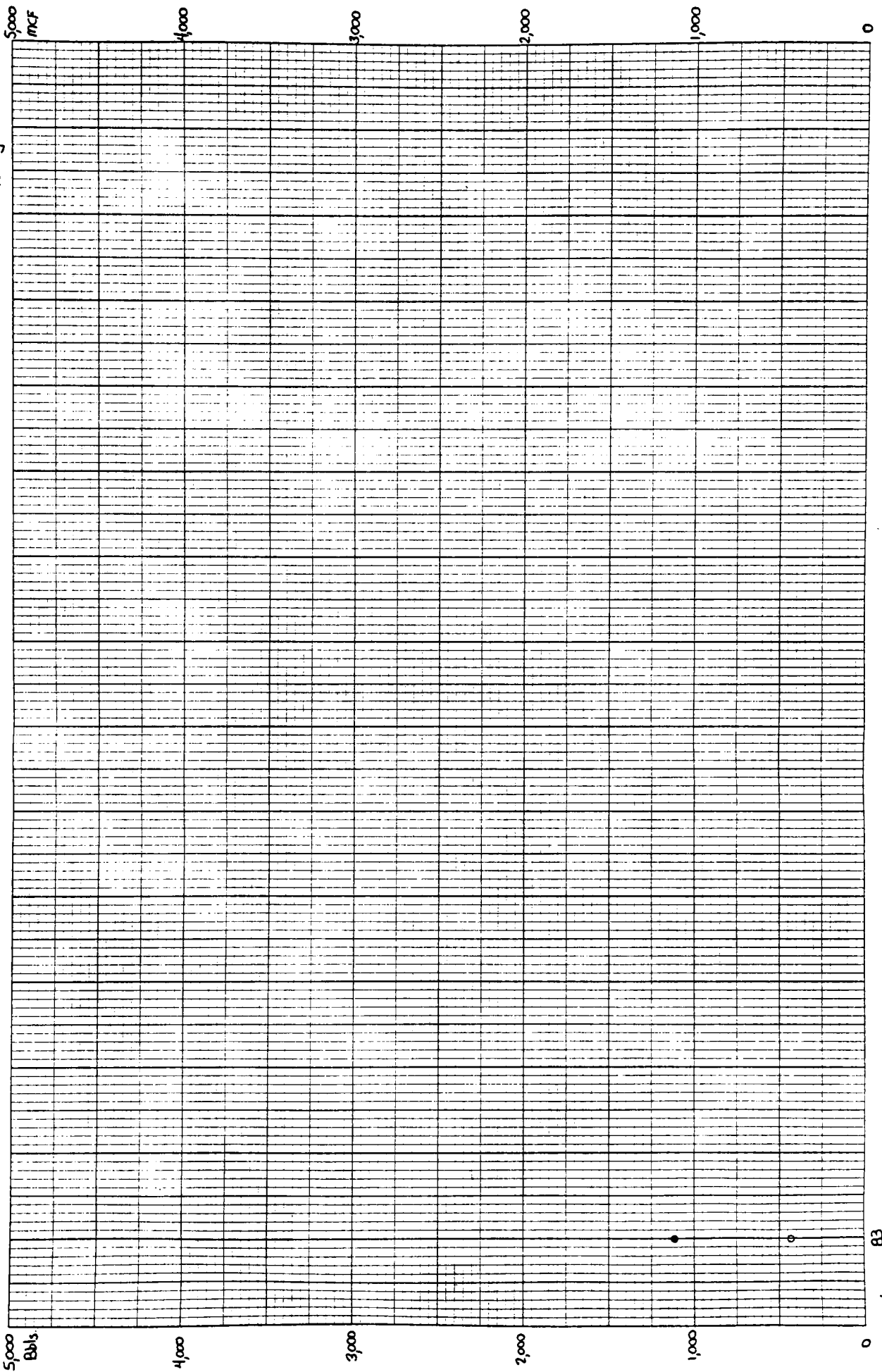
Running Creek - J

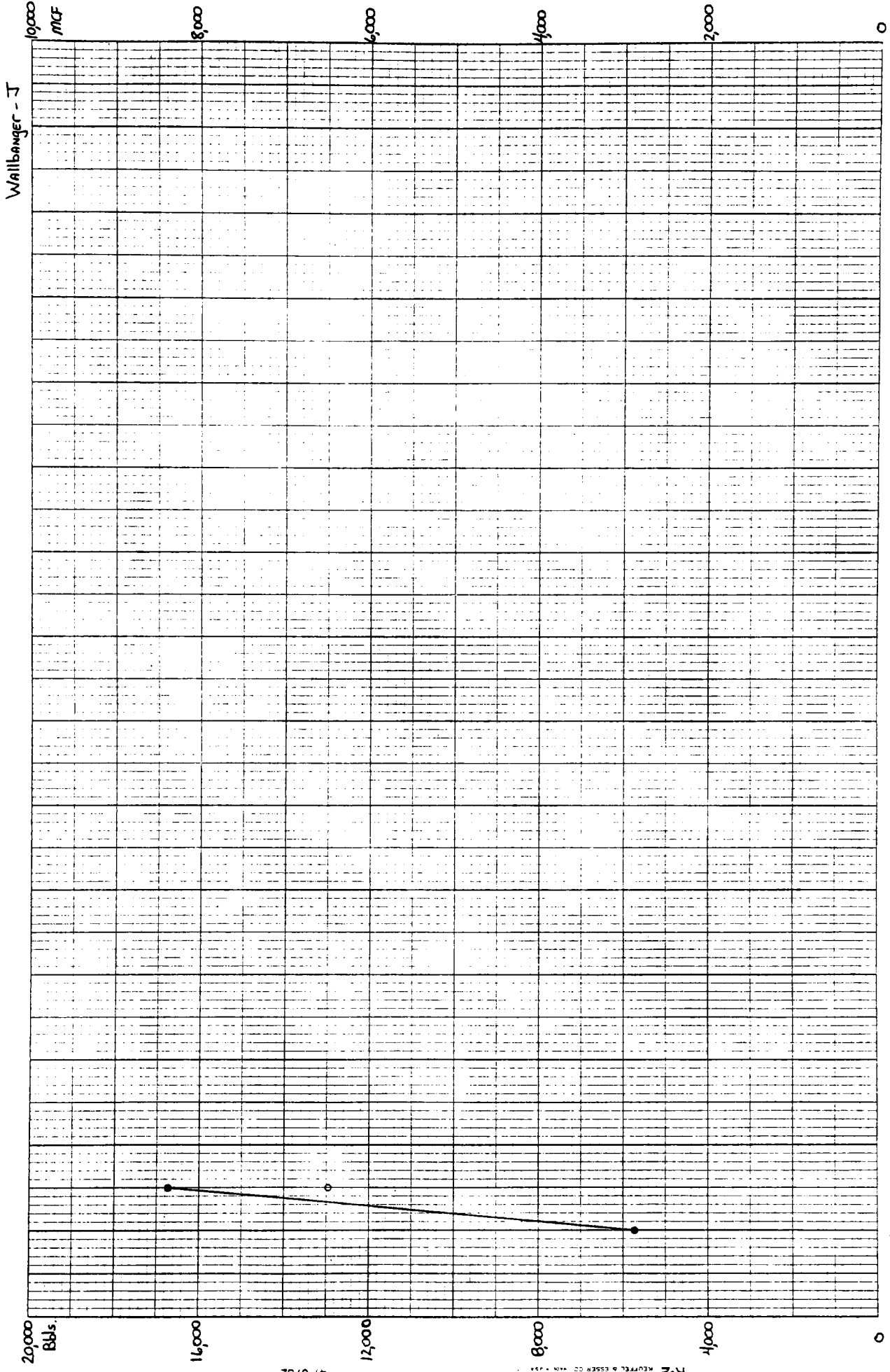






Wallbanger - D + J





47 0782

M. M. KERR & SONS

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;
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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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