Copperhead wells

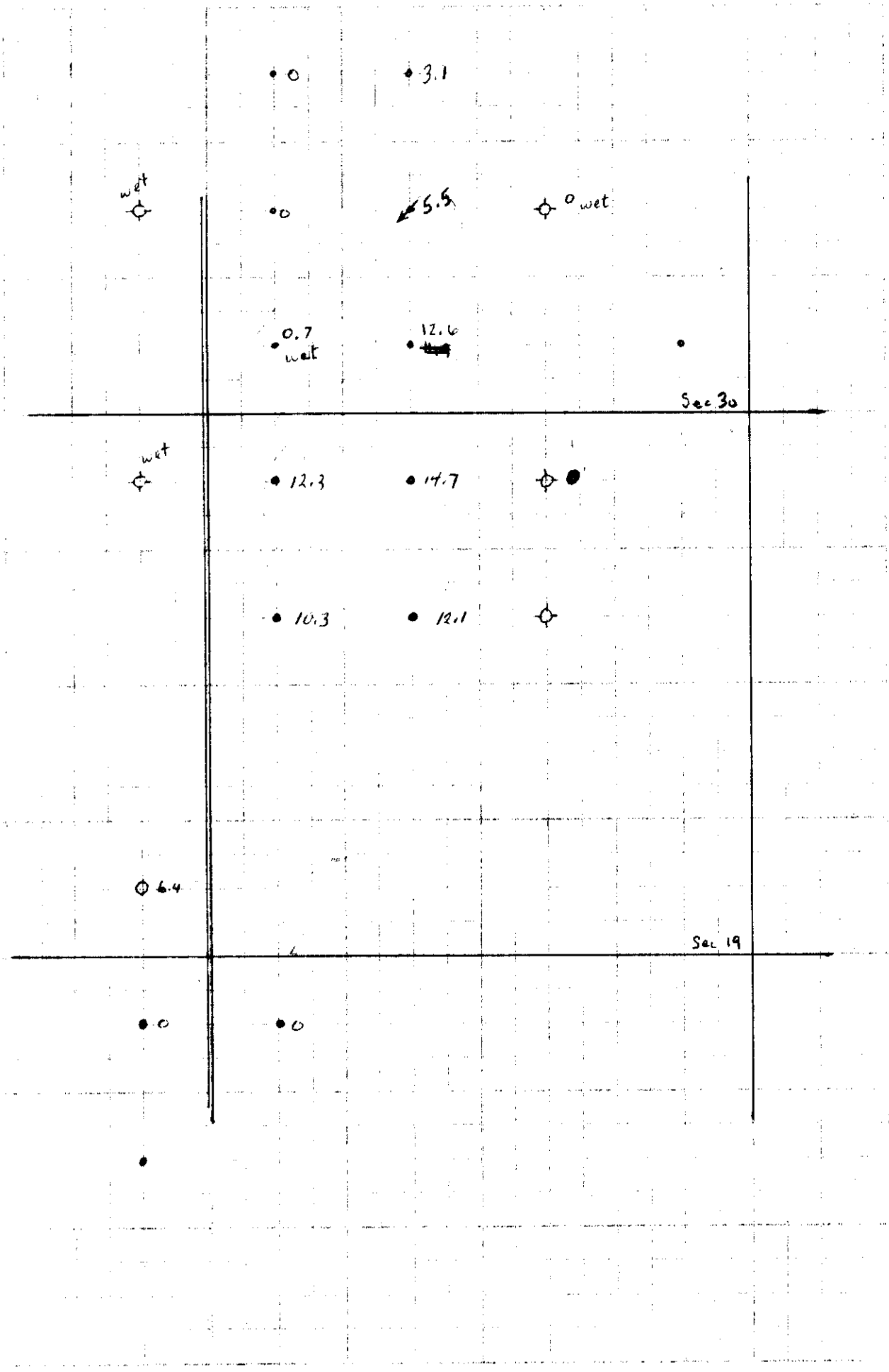
Location	Cum. oil to end of '24 bbls	Cum. oil '25 bbls
11-19-1-25	62,033	3561
12-19-1-25	565	1,703
13-19-1-25	53,363	7,548
14-19-1-25	41,274	1,104

Orange wells

3-30-1-25	42,283	—
4-30-1-25	41,090	—
[illegible]	86,609	—
[illegible]	64,577	—
11-30-1-25	32,345	—
12-30-1-25	44,608	—

[illegible] pressure also [illegible] per month!

cum. production for the pool may/25 is 485,456 bbls of oil.


0
3.1
wet
0
5.5
0 wet
0.7
wet
12.6
Sec 30
wet
12.3
14.7
10.3
12.1
6.4
Sec 19
0
0

LRS
2-2-81

Material Balance

Omega Waskoda

Based on pressures in Omega Wells as follows

Date	Well	P_{ws}	Ave P_{ws}
Oct 76	6-30	251	251
August 76	3-30	73	199
	5-30	482	
	12-30	42	
Oct 76	3-30	124	394
	4-30	544	
	5-30	756	
	12-30	153	
May 77	3-30	551	774
	4-30	1005	
	5-30	1194	
	12-30	346	

Calculations assumed ① R_{si} = 215 SCF/STB and ~~excess~~ gas produced as per solution gas drive reservoir Ref PT Sect. 4.5 UofA Res Eng notes

and

② ~~No excess gas pro~~ Producing GOR equal to original solution GOR

$$N = N_p \frac{[B_t + (R_p - R_{si}) B_{gi}] + W_p - W_i}{B_t - B_{ti}}$$

also

③ No water influx

④ No energy transferred to or from Tundra wells

⑤ PVT properties as in D & S study.

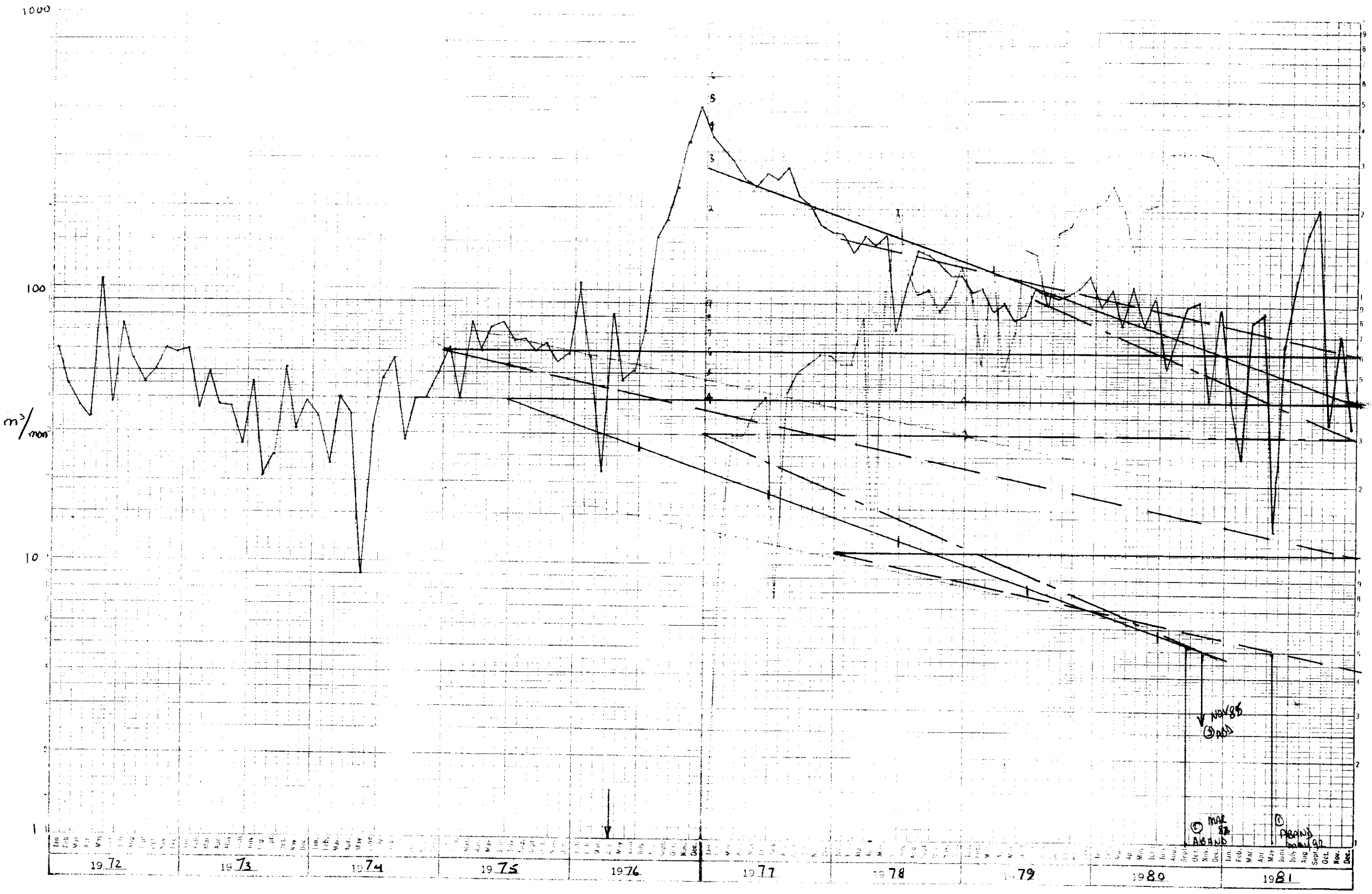
⑥ $B_w = 1.0$

P	B_T	P/P_i	R_p/R_s*	R_p	N_p	$(W_p - W_i)$	N ①	N ②
251	1.035	.217	10.3	2214	235,722	0	20,219,000	3,587,000
199	1.032	.173	10.3	2214	272036	-115,000	19,740,594	2,402,046
394	1.044		9.9	2128	277999	-166436	23,103,241	2,210,624
774	1.071	.67	3.37	724	304550	252232	14,309,522	1,107,876

Results from Assumption ② are much more in line with volumetric estimates. Drop from Oct '76 → May 77 may reflect an efflux of energy to Tundra's wells through the aquifer

* See Assumption ①

4-30-1-25 WPM


1000
100
10
1
m³/mon
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
NOV 85
MAR 82
ABAND
PERMIT MAY 82

WATERFLOOD RESPONSE GRAPH

WELLS 11-19, 13-19, 14-19-1-25 WPM

OIL PROD. - M^3/DAY - (TOTAL 3 WELLS) ——

W-O-R (TOTAL 3 WELLS) ——

10.0

1.0

0.1

10.0

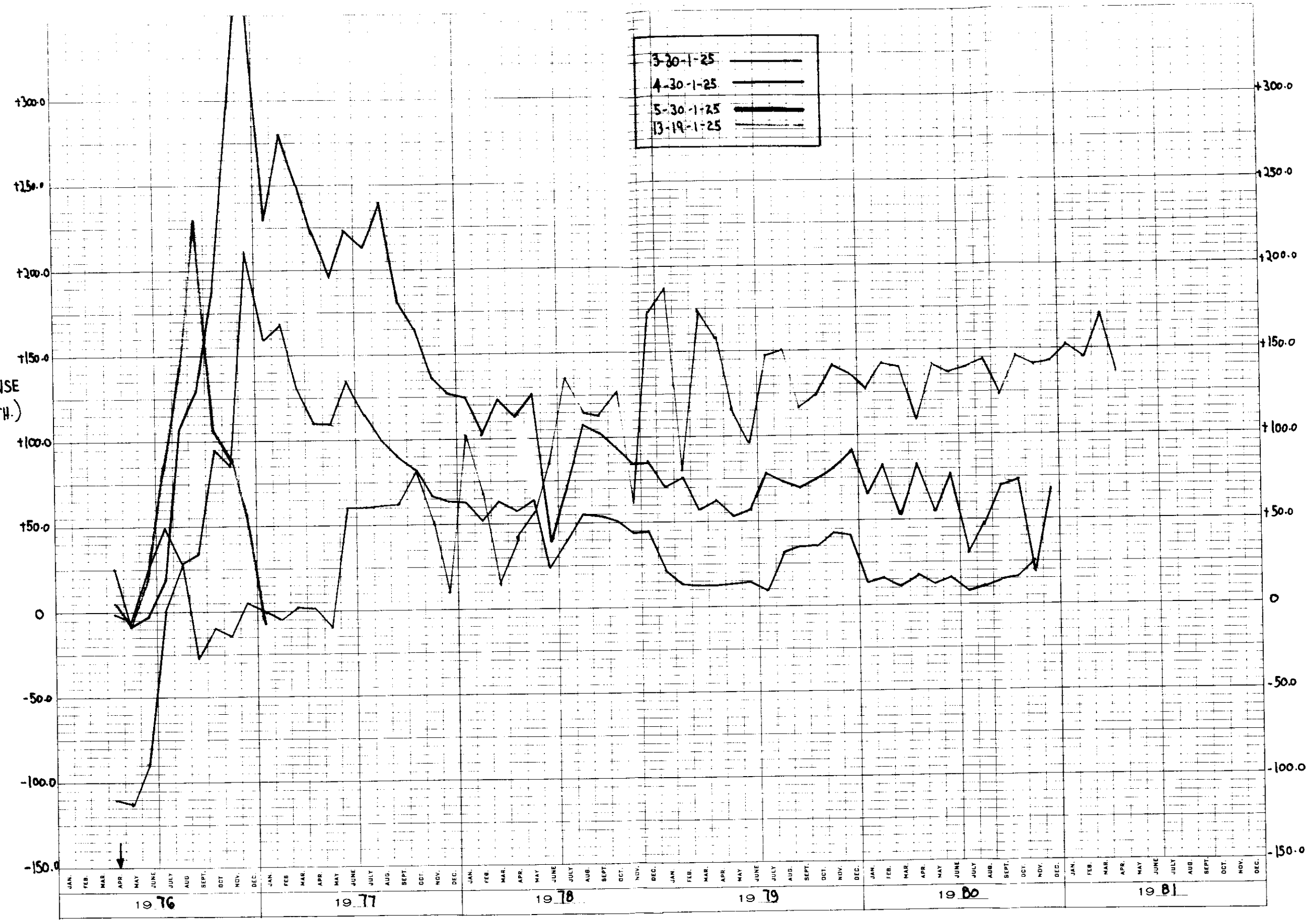
1.0

0.10

INJECTION COMMENCED

19 72 | 19 73 | 19 74 | 19 75 | 19 76 | 19 77 | 19 78 | 19 79 | 19 80 | 19 81

7-23-81 DNS



7-27-81 DA

6-30-1-25

1000

100

m^3/min

10

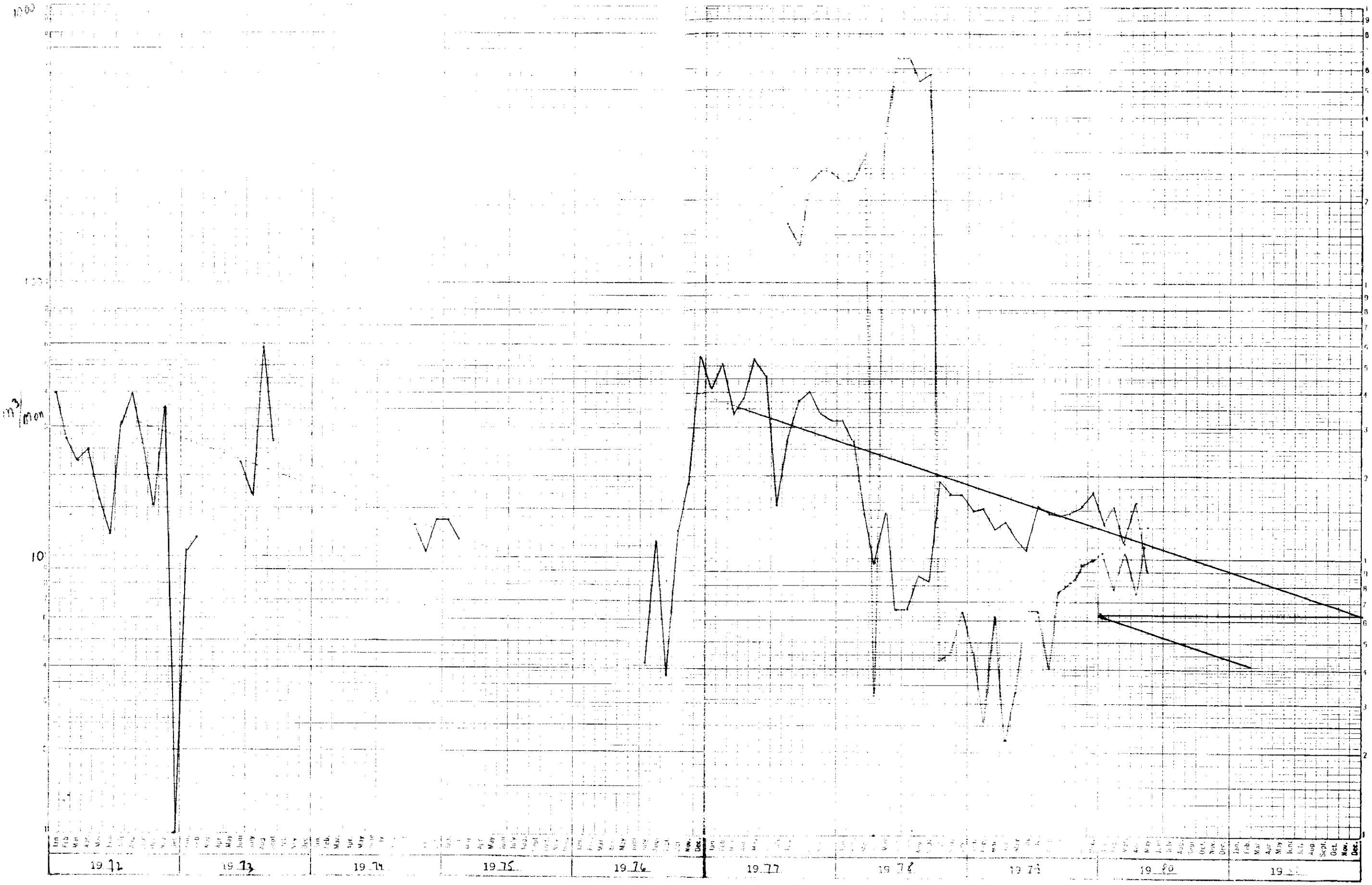
1

Primary Decline

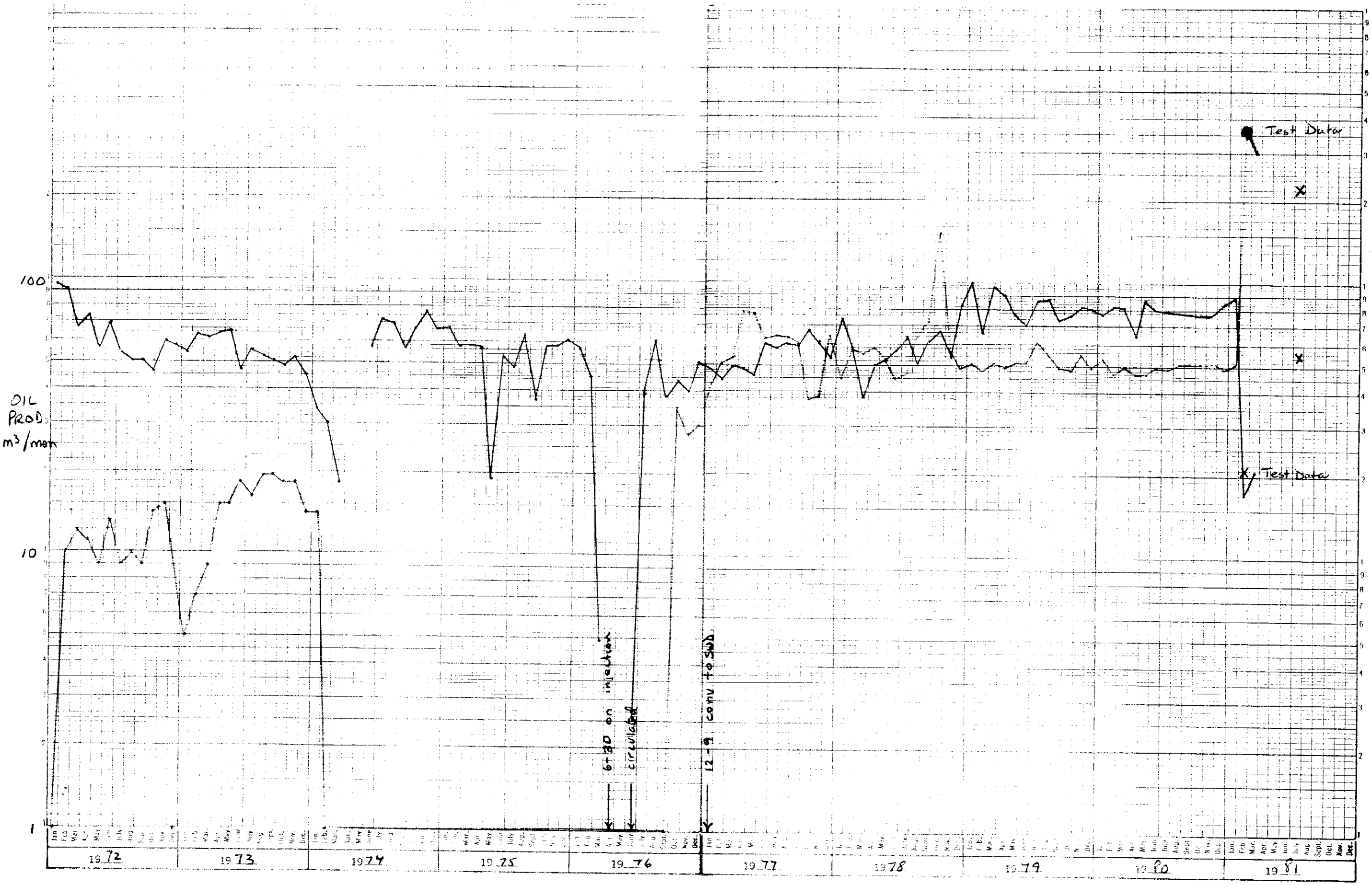
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

19 72 | 19 73 | 19 74 | 19 75 | 19 76 | 19 | 19 | 19 | 19 | 19

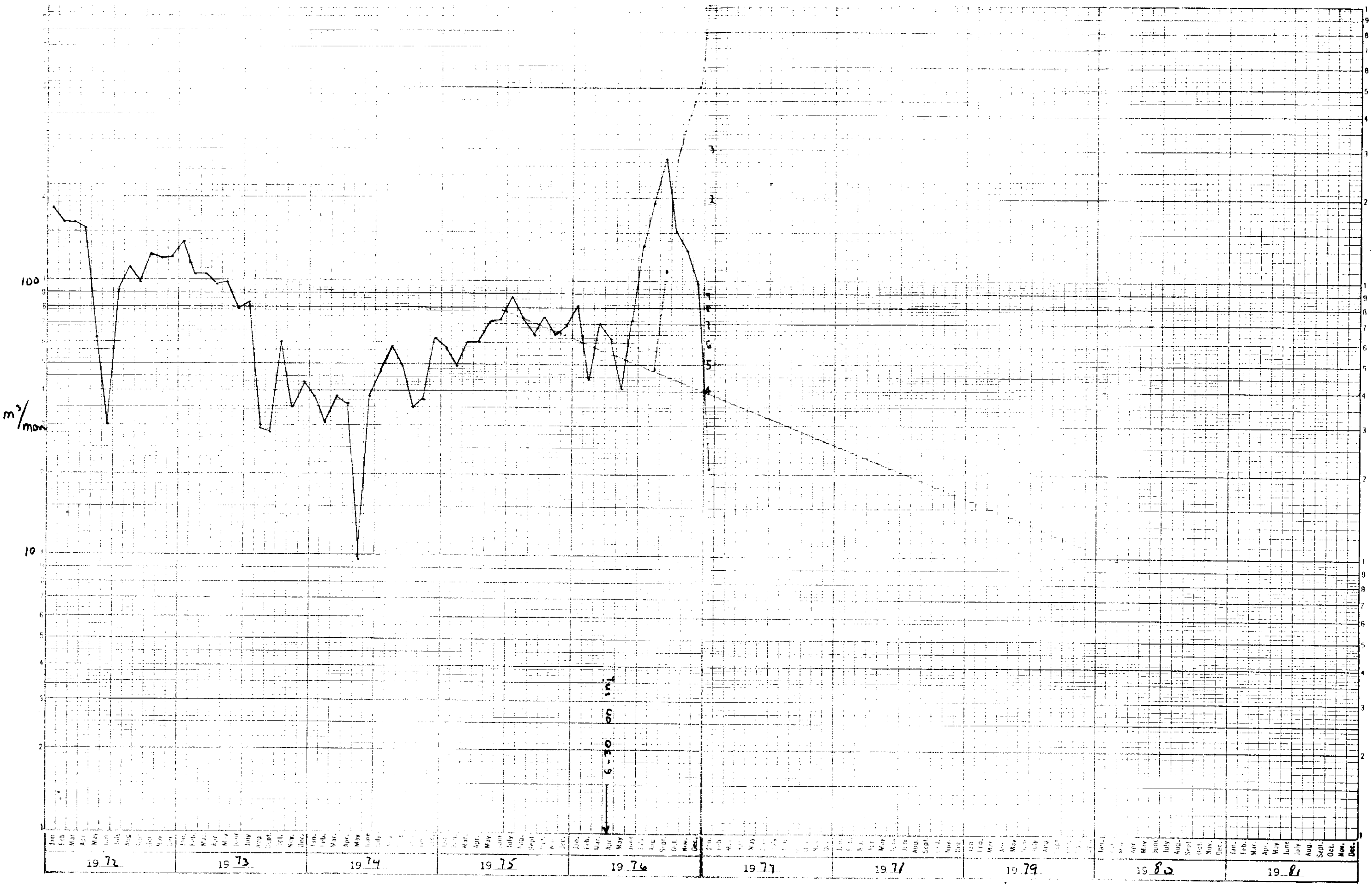
11-30-1-25 wpm


1000
100
10
1
m³/mon
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981

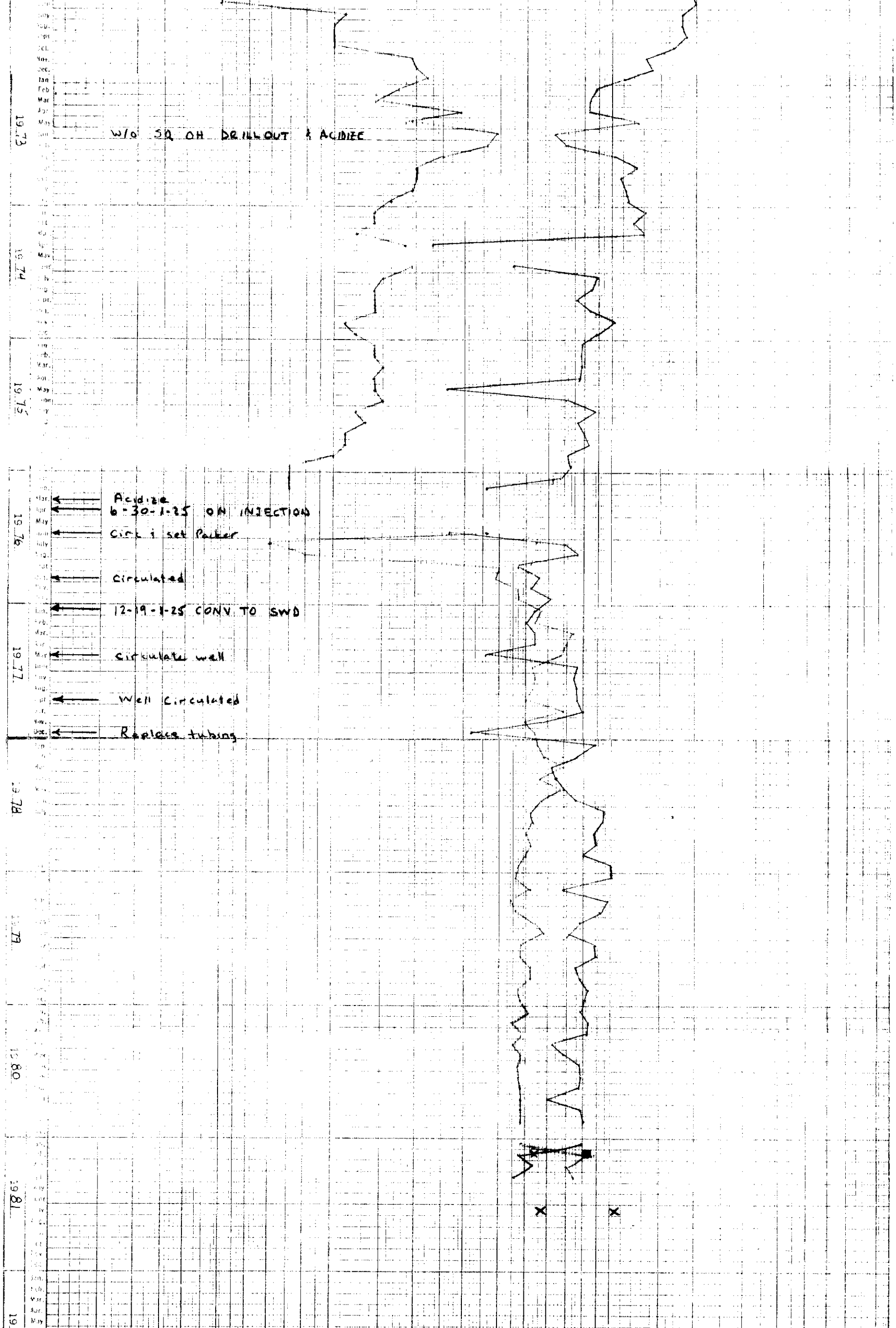
14-19-1-25 WPM


Test Data
100
OIL PROD m³/mon
10
1
Test Data
6-30 on injection
Converted
12-9 conv to Sub
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
19 72
19 73
19 74
19 75
19 76
19 77
19 78
19 79
19 80
19 81

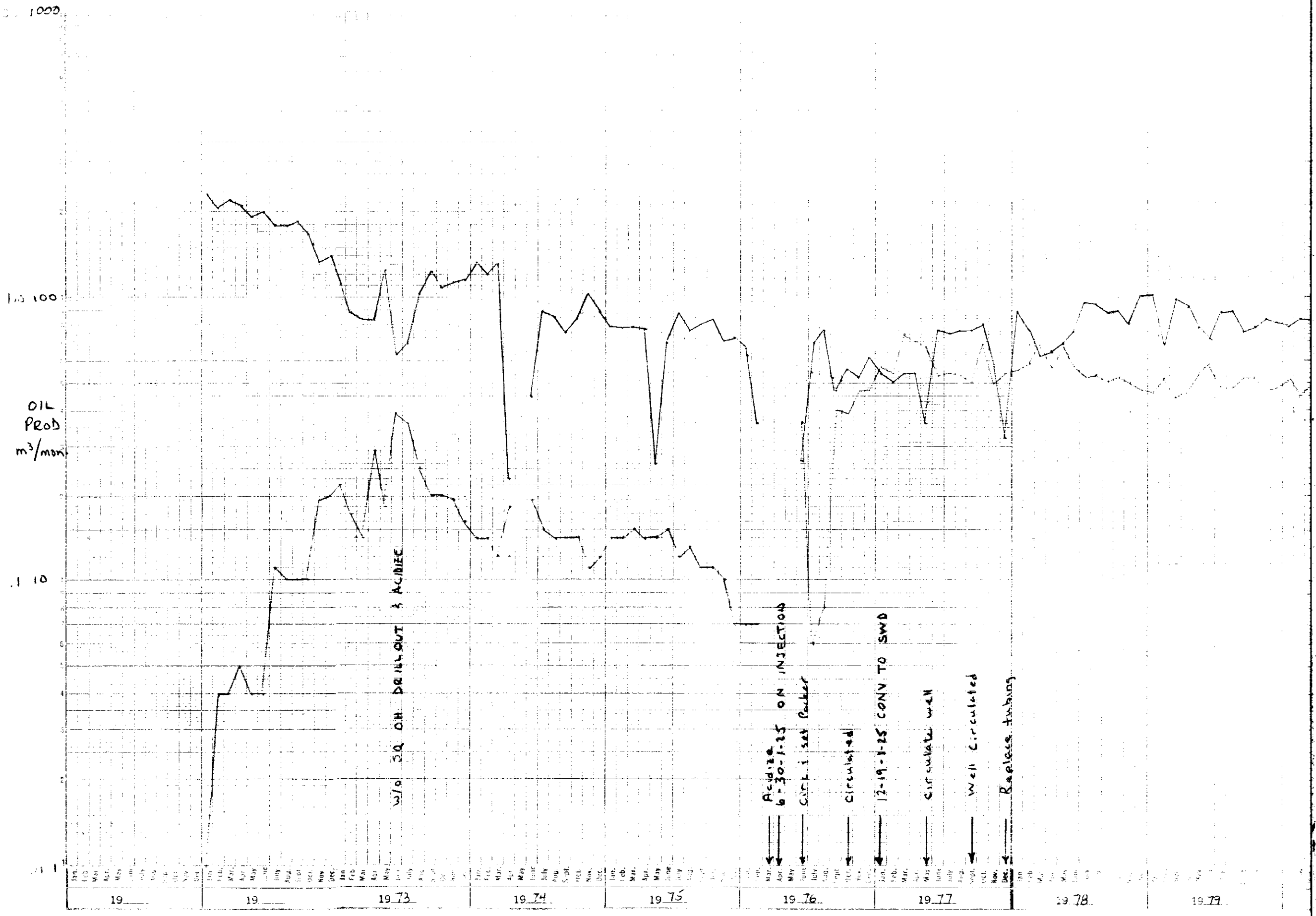
5-30-1-25 WPM



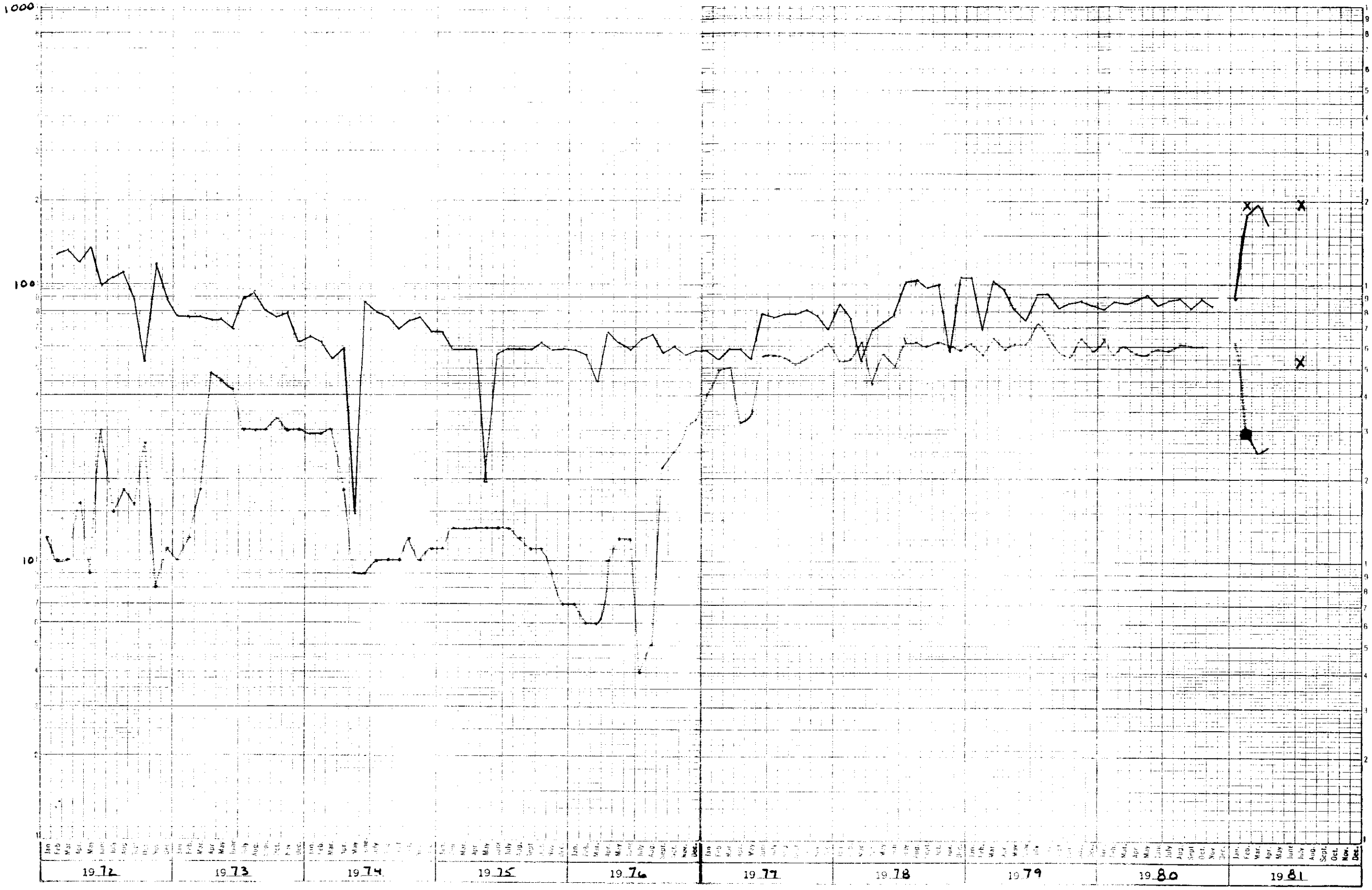
m³/mon
100
10
Tui on 6-30
19 72
19 73
19 74
19 75
19 76
19 77
19 78
19 79
19 80
19 81


W/O SQ OH DRILLOUT & ACIDIZE
Acidize
6-30-1-25 ON INJECTION
Circ & set Packer
Circulated
12-19-1-25 CONV TO SWD
Circulate well
Well Circulated
Replace tubing
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.

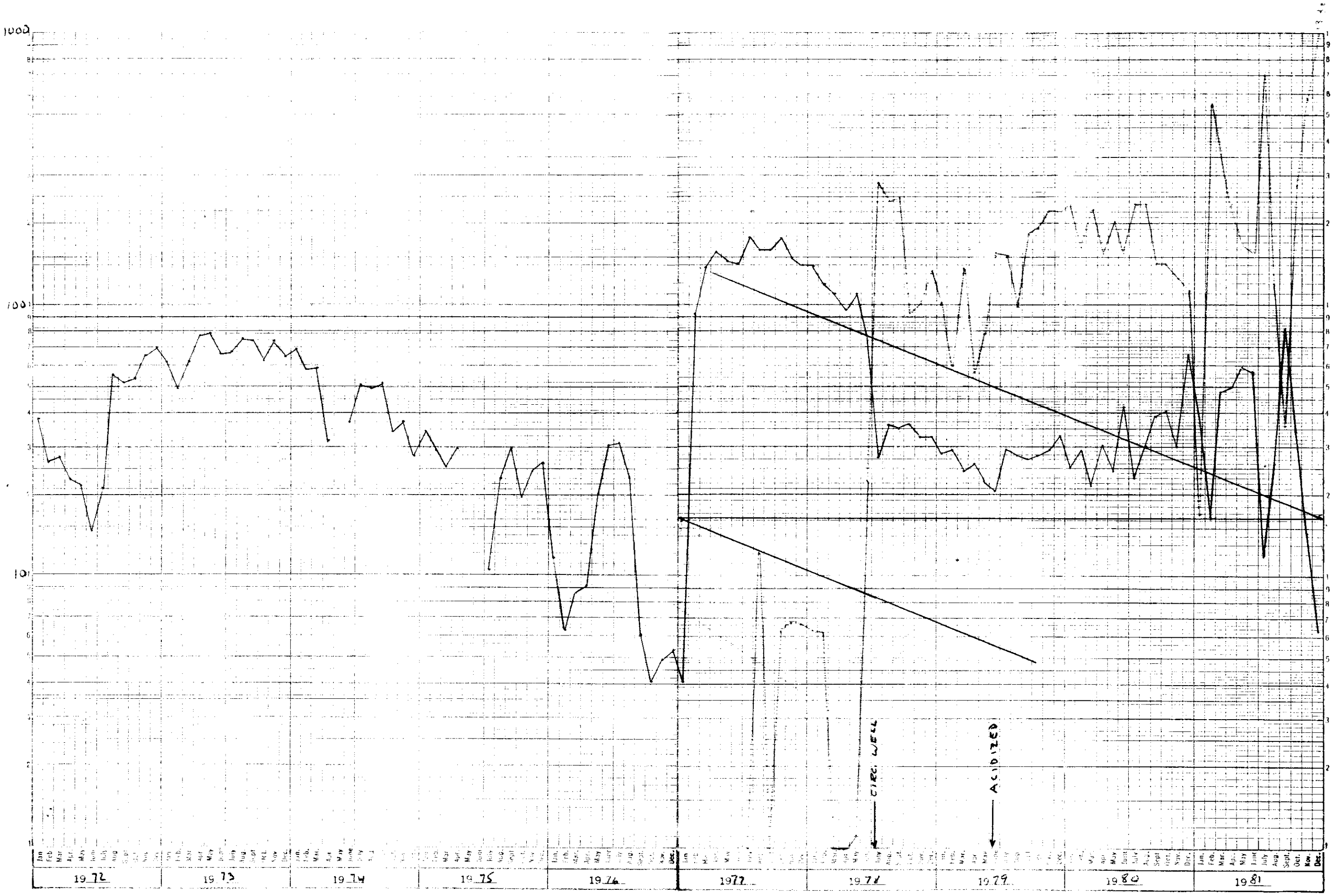
LRD 1-23-81


1000
100
10
1
OIL
Prod
m³/mon
W/O SQ OH DRILLOUT & ACIDIZE
Acidize 6-30-75 ON INJECTION
Circ. & set Packer
Circulated
12-19-75 CONV TO SWD
Circulate well
Well Circulated
Replace tubing
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
19 19 19 73 19 74 19 75 19 76 19 77 19 78 19 79

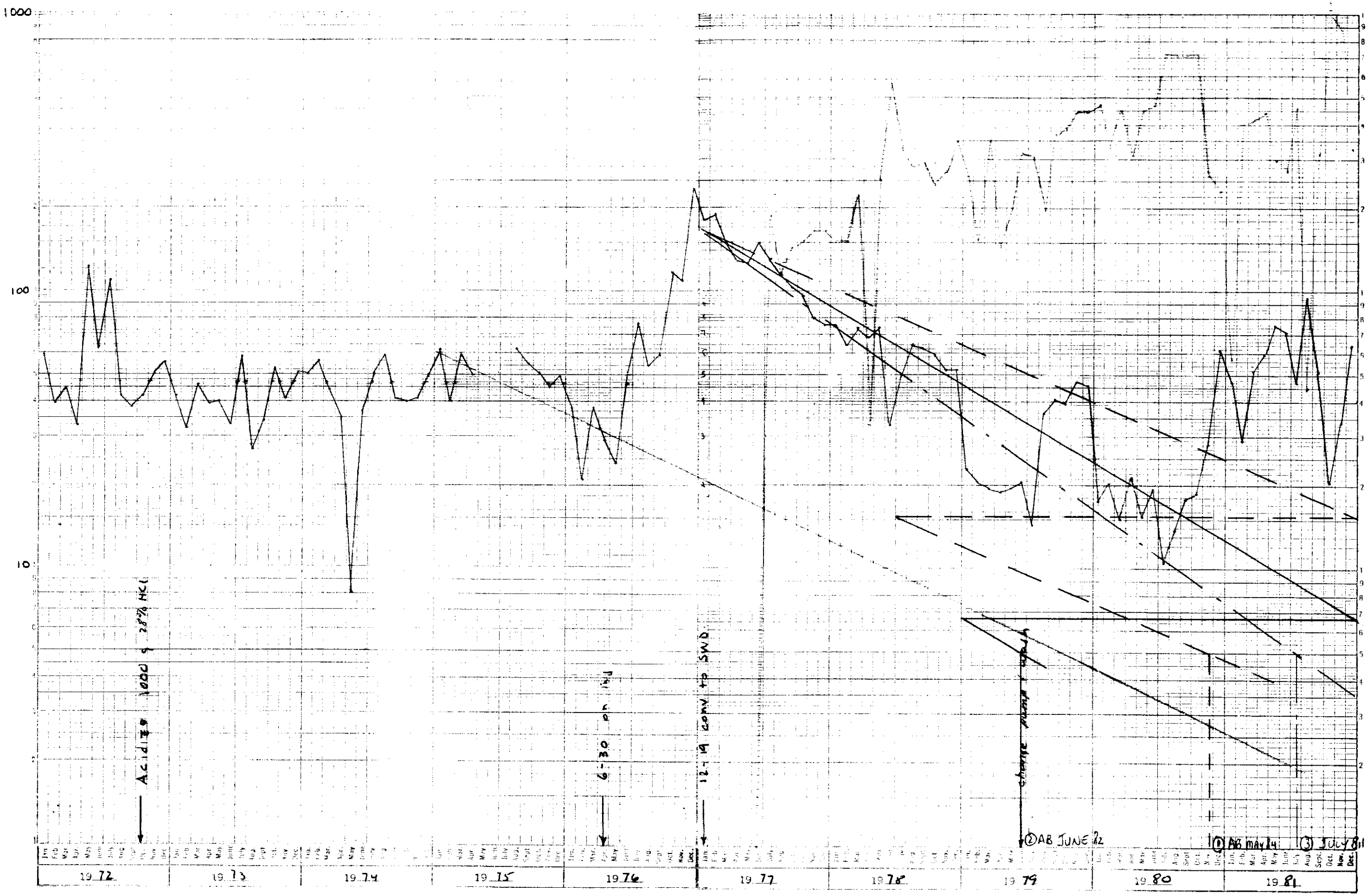
13-19-1-25 WPM

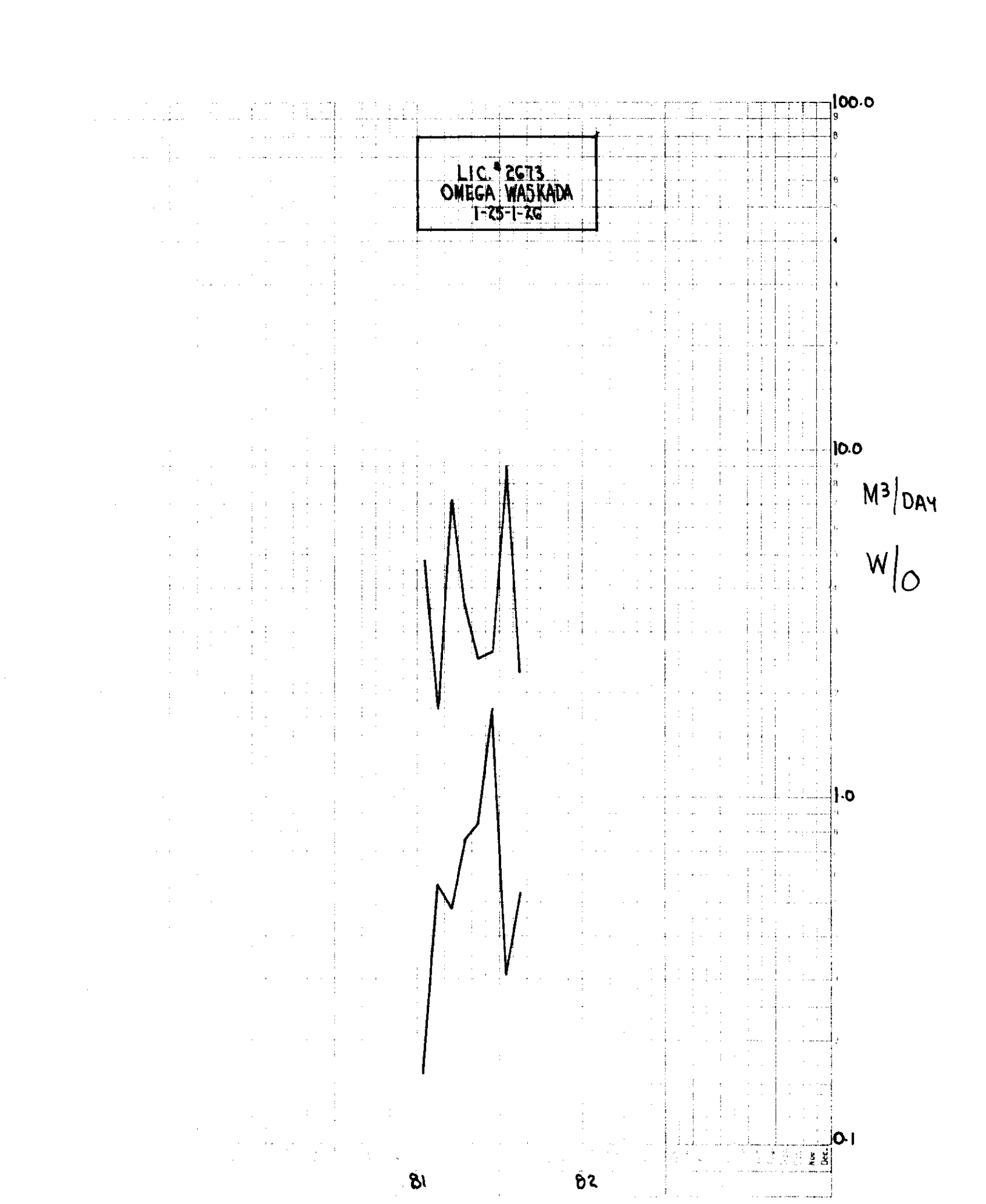

1000
100
10
1
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981

12-30-1-25wPM

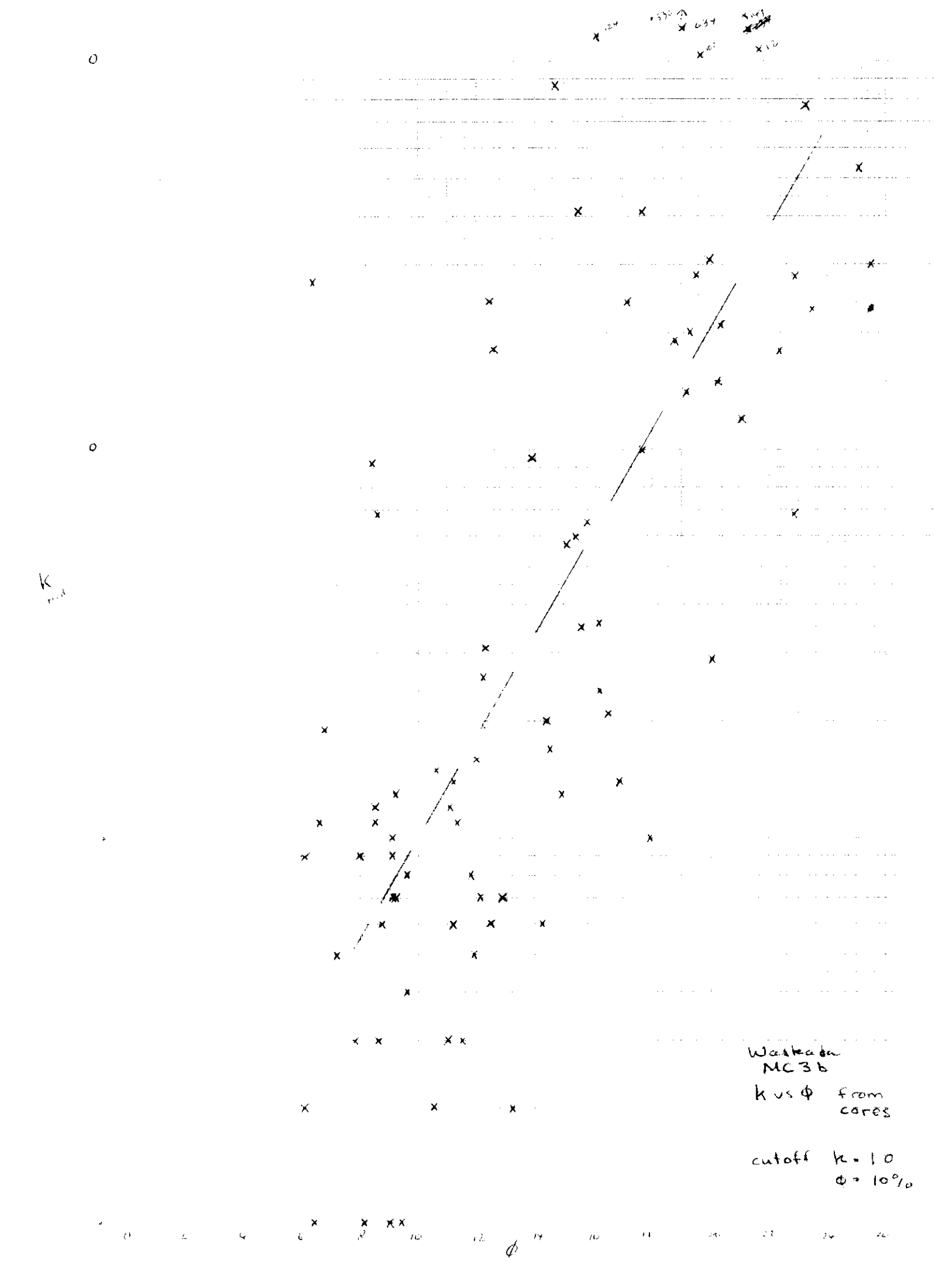

1000
100
10
CIRC. WELL
ACIDIZED
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981

3-30-1-25


1000
100
10
Acidize 1000 g 28% HCl
6-30 on Pkd
12-19 Conv to SWD
Change pump strokes
②AB JUNE 82
①AB may 14
③ July 81
19 72
19 73
19 74
19 75
19 76
19 77
19 78
19 79
19 80
19 81



19-4-82

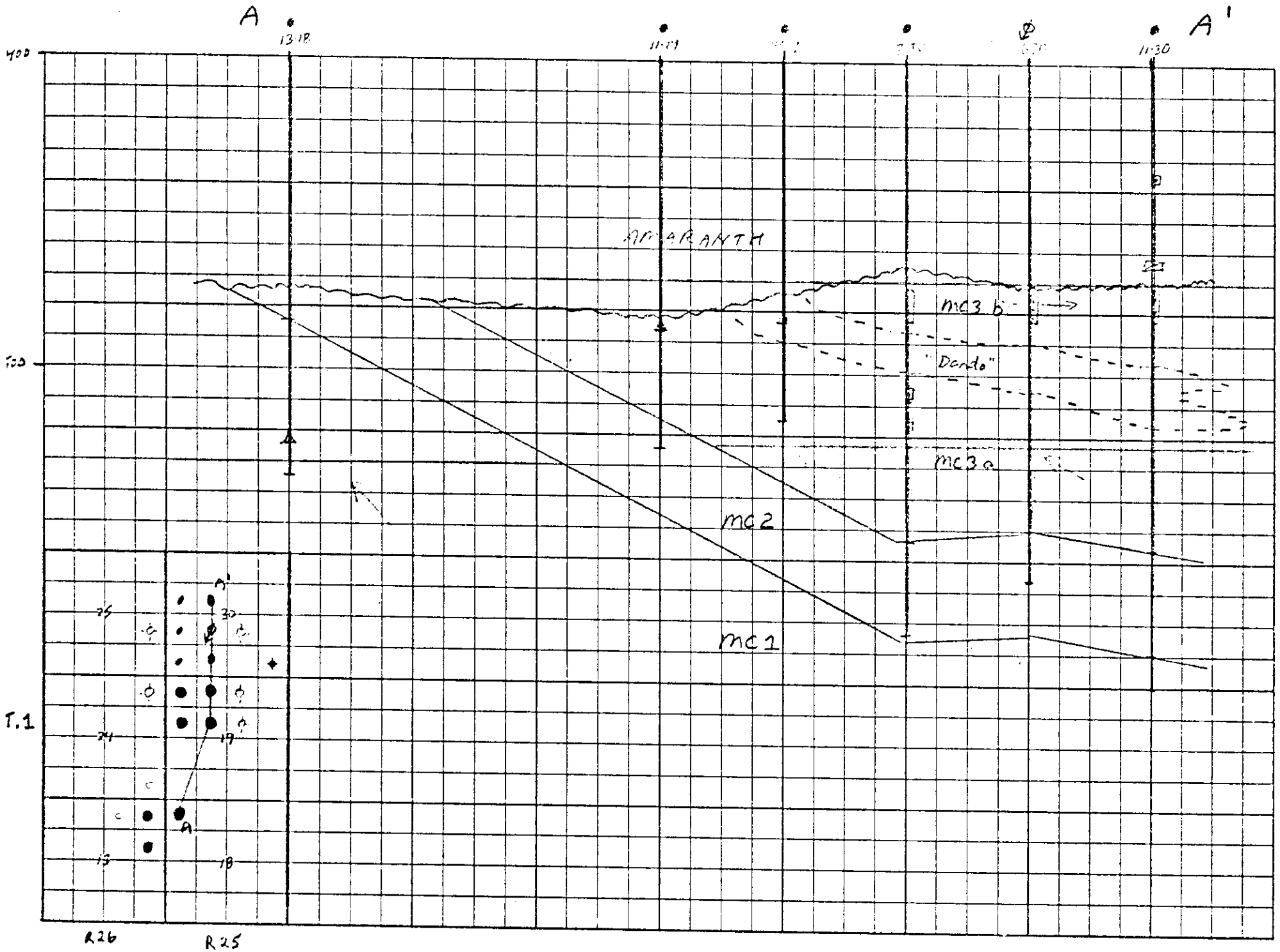

Waskada
MC3b
k vs Φ from cores
cutoff k = 10
Φ = 10%
k
Φ

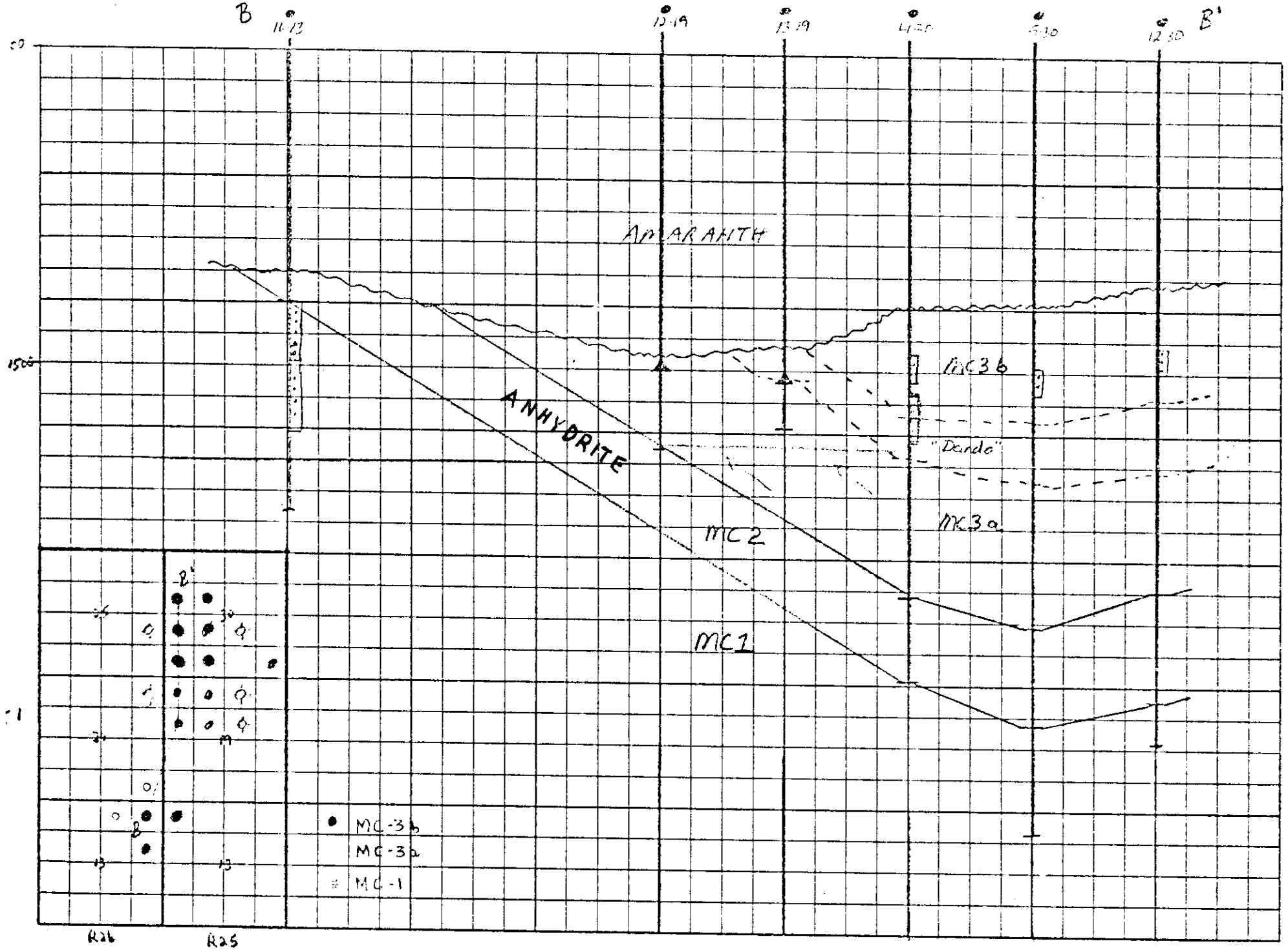
WAIKALA Mesa Net Pay

Well	Pay (ft)	Basis
[illegible]-27	6.7	Logs using 10% cutoff
[illegible]	[illegible]	Net/Gross Ratio
12-19	10.3	Net/Gross ratio from 3-30 and 6-30
13-19	12.3	Partial core + Logs
14-19	17.7	Core and NET/GROSS Ratio from 3 & 6-30
15-19	2.0	GRN Log
3-30	12.6	1md perm c/o Core + OWC @ 1530
[illegible]-30	0.7	[illegible]
6-30	[illegible]	1md perm c/o Core + OWC @ [illegible]530
[illegible]	5.1	[illegible] Ratio [illegible]

Average depth of MC 3 perfs

[illegible]	922.3	925.9
[illegible]	928.4	926.1
[illegible]	928.4	932.7
[illegible]	[illegible]	933 [illegible]
[illegible]	[illegible]	[illegible] 2
[illegible]	926.6	929.0





Waskada Field
Material Balance Calculations

Initial Pressure = 1150 psi
Present Pressure = 200 psi
Assuming there is no initial gas cap, No water production for the ten wells (or water encroachment), Cum. water production to date is about 12,000 bbls.

$$N = \frac{N_p [B_t + (R_p - R_{si}) B_g]}{B_t - B_{ti}}$$

$$B_t = B_o + (R_{si} - R_s) B_g \qquad N_p = 473.06 \times 10^3 \text{ bbl}$$

B_o @ 1150 psi	1.100	bbl/bbl
R_{si}	259	scf/bbl
R_s @ 1150	215	scf/bbl
B_o @ 200	1.032	bbl/bbl
R_s @ 200	34.2	scf/bbl
B_g @ 1150	is .0022	ft^3/scf = .0004 bbl/scf
B_g @ 200	is .0145	ft^3/scf = .0026 bbl/scf

$$B_{ti} = B_o + (R_{si} - R_s) B_g = 1.1 + (259 - 215) .0004$$
$$= 1.1176$$

$$B_t = 1.032 + (259 - 34.3) .0026 = 1.6162$$

R_p (GOR) = 1855 scf/STB

$$N = \frac{473.06 \times 10^3 [1.662 + (300 - 259) .0026]}{1.6162 - 1.1176}$$

$$= \boxed{1.610 \times 10^6} \text{ bbls}$$

Waskada Field
Material Balance Calculations

a - Initial pressure = 1150 psi
Present pressure = 400 psi

Assuming there is no initial gas cap, no water production or encroachment for the ten wells in Waskada, Total cum. water production is 12,000 bbls.

$$N = \frac{N_p [B_t + (R_p - R_{si}) B_g]}{B_t - B_{ti}}$$

$$B_t = B_o + (R_{si} - R_s) B_g \qquad N_p = 473.06 \times 10^3 \text{ bbls}$$

B_o @ 1150 psi — 1.100 bbls/bbls
R_{si} — 259 scf/bbl
R_s @ 1150 psi — 215 scf/bbl
B_o @ 400 psi — 1.0447 bbl/bbl
R_s @ 400 psi — 70.3 scf/bbl
B_g @ 1150 psi is 0.0022 ft^3/scf = .0004 bbl/scf
B_g @ 400 psi is .00708 ft^3/scf = .00126 bbl/scf
$B_{ti} = 1.1176$

$B_t = 1.0447 + (259 - 70.3) \cdot .00126 = 1.2825$

R_p (GOR) = 2149 scf/STB (300 Mscf / 141 STB)

$$N = \frac{473.06 \times 10^3 \left[1.2825 + (\cancel{2149} \; 300/141 - 259) \cdot .00126\right]}{1.2825 - 1.1176}$$

$$= \boxed{3.827 \times 10^6 \text{ bbls}}$$

b. Initial Pressure = 1150 psi
Present Pressure = 314 psi

$B_g = .0088$ cuft/scf $= .00157$ bbls/scf
$R_s = 55$ & $B_o = 1.039$
$B_t = 1.039 + (254-55).00157 = 1.3593$

$$N = \frac{473.06 \times 10^3 [1.3593 + (300-254).00157]}{1.3593 - 1.1176}$$

$$= \boxed{2.786 \times 10^6 \text{ bbls}}$$

Proposed Waskada Unit No. 1
Secondary Recovery Evaluation

1- Primary Recovery:

Rock volume (Isopach) = 4730 acre-ft
Average porosity (Logs) = 10.7 %
Average Water Saturation = 37 % (1)
Formation Volume Factor = 1.115 bbls/bbls

Oil in Place (Volumetric Method)

$$= \frac{7758 \times \text{Rock volume} \times \text{Porosity} \times (1 - Sw)}{Bo}$$

$$= \frac{7758 \times 4730 \times .107 \times .63}{1.115} = \frac{2.219 \times 10^6}{\text{S.T.B.}}$$

Average Pay thickness (calculated from Logs)
= 10.2 feet

Cumulative Oil Production to date for the ten wells (Omega + Copperhead) = 473.06×10^3 bbls
or 21.3 % Recovery Primary

Assuming Ultimate Primary Recovery of 30 %, then, the Ultimate Recovery is 665,700 bbls "Primary Depletion"

(1) Determination of Water Saturations from the logs suggest a value of 40 %, for the purpose of this evaluation it was taken 37 %

2- Secondary Recovery

Calculating Five-spot Recovery by waterflood (1)

Spacing = 40 Acre

porosity = 10.7 %

Formation Volume factor (oil) = 1.115 bbl/bbl

Relative Permeability to Oil k_{ro} = 0.81 (2)

" " " Water k_{rw} = 0.19 (2)

Pay thickness = 10.2 ft

Initial Oil Saturation S_{oi} = 63 %

Residual Oil Saturation S_{or} = 36 % (3)

Viscosity to Oil @ 1852 psi = 4.596 cp (4)

Viscosity to water = .60 cp

Injection Rate = $20 \times 24 = 480$ (1440 bbls/day) (Assumed)

Secondary Recovery Factor from Water oil Relative permeability Curve

$$\text{Recovery} = \frac{\text{Initial Oil Saturation} - \text{Final (residual) Oil Saturation}}{\text{Initial Oil Saturation}}$$

(1) Page 416, Applied Petroleum Reservoir Engineering by C. Craft, Prentice-Hall.

(2) Figure 16, D+S Petroleum Consultant's Study on Waskada, 1974

(3) Table III, Reservoir Study, North Virden Scallion Field, Manitoba, The California Standard Company, August 1961

(4) Table 4, Empirical fluid Properties Analysis D+S Study on Waskada, 1974.

Waskada Proposed Unit No. 1

Fill up time

The gas space in the reservoir must be replaced or filled up by water before the production wells respond fully to the water injection

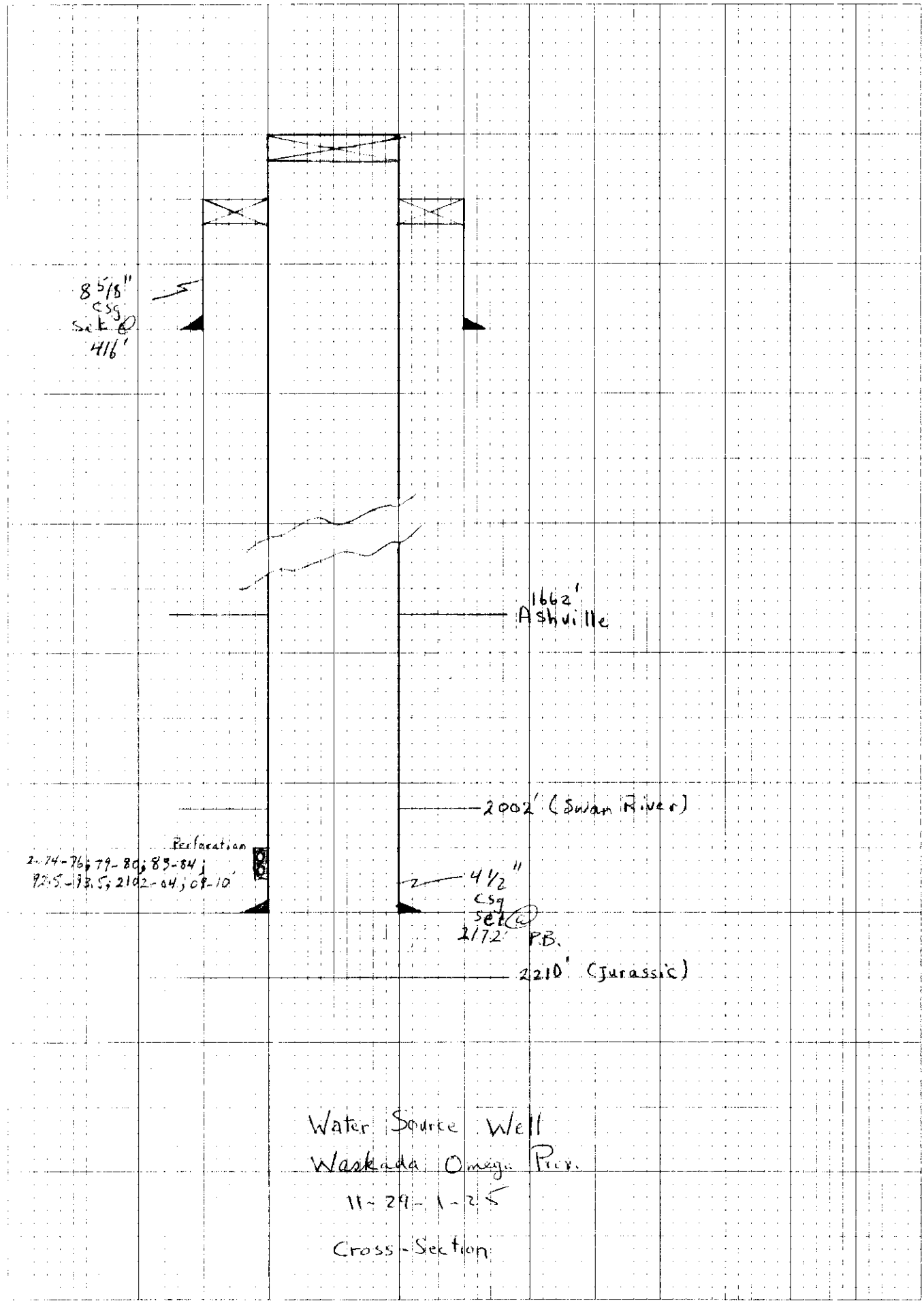
Oil in place = 2.219×10^6 bbls (S.T.)
Gas Saturation = 30 % at 350 psi [1]
Volume of ~~reservoir~~ S.T. bbls occupied by gas
= $2.219 \times 10^6 \times .3 = 665.7 \times 10^3$ S.T.B.
Volume of water required to replace the gas = Vol. of S.T.B. occupied by gas × B.w
Assume B.w = 1.02 bbl/bbl
Volume of water required to replace gas
= $665.7 \times 10^3 \times 1.02 =$

679000 bbls

Assume injection rate 1000 bbls/day
No of days to fill up = $\frac{679000}{1000}$ = 679 days

or 1.86 years

(1) Page 3, Unit Enhanced Waskada Recovery Factor Calculations, D & S Study on Waskada, 1974.



Water Source Well
Waskada Omega Prov.
11-29-1-25
Cross-Section

March 2, 76

Waskada
Injectivity Calculations

① Radial injectivity

Q injection rate BBl/day.

$$Q_r = \frac{0.00707\ k_w h\ \Delta p}{\mu B \left(\ln \frac{R_e}{R_w}\right)}$$

② 5-Spot Injectivity

$$Q_5 = \frac{0.003541\ k_w h\ \Delta p}{\mu B \left(\ln \frac{d}{R_w} - 0.6190\right)}$$

k_w = 20.7 md reservoir perm. to water

h = 13 ft average net pay of 6-30 (Injecto.)

μ = .84 viscosity of water

B = 1.00 formation Volume factor of Inj water

R_e, d = 1320 ft, Radius of Injection extension, distance betw Injector & Producer

R_w = .375 ft, effective wellbore radius

$$Q_r = \frac{.00707 \times 20.7 \times 13\ \Delta p}{.84 \times 1 \left(\ln \frac{1320}{.375}\right)} = \frac{1.9025}{6.8596} = .277\ \Delta p$$

$$Q_5 = \frac{.003541 \times 20.7 \times 13\ \Delta p}{.84 \times 1 \left(\ln \frac{1320}{.375} - .619\right)} = \frac{.953}{6.54} = .1503\ \Delta p$$

Δp = Injection press + hydrostatic press - av. reserv. press.

hydrostatic press = $0.433 \times 3020 = 1308$ psi

av. reservoir press = 400 psi

Δp = Inj. press + 1308 - 400 = Inj press + 908

Reservoir Press 600 psi

$\Delta p = 708 + \text{Inj. Press}$

$Q_r = .277 \times \text{Inj. press.}$

$Q_s = .1503 \times \text{Inj Press}$

Inj 100	$Q_r = 224$	$Q_s = 121$
Inj 300	$Q_r = 280$	$Q_s = 152$
Inj 500	$Q_r = 335$	$Q_s = 182$
Inj 700	$Q_r = 390$	$Q_s = 212$

Res. Press 400 psi

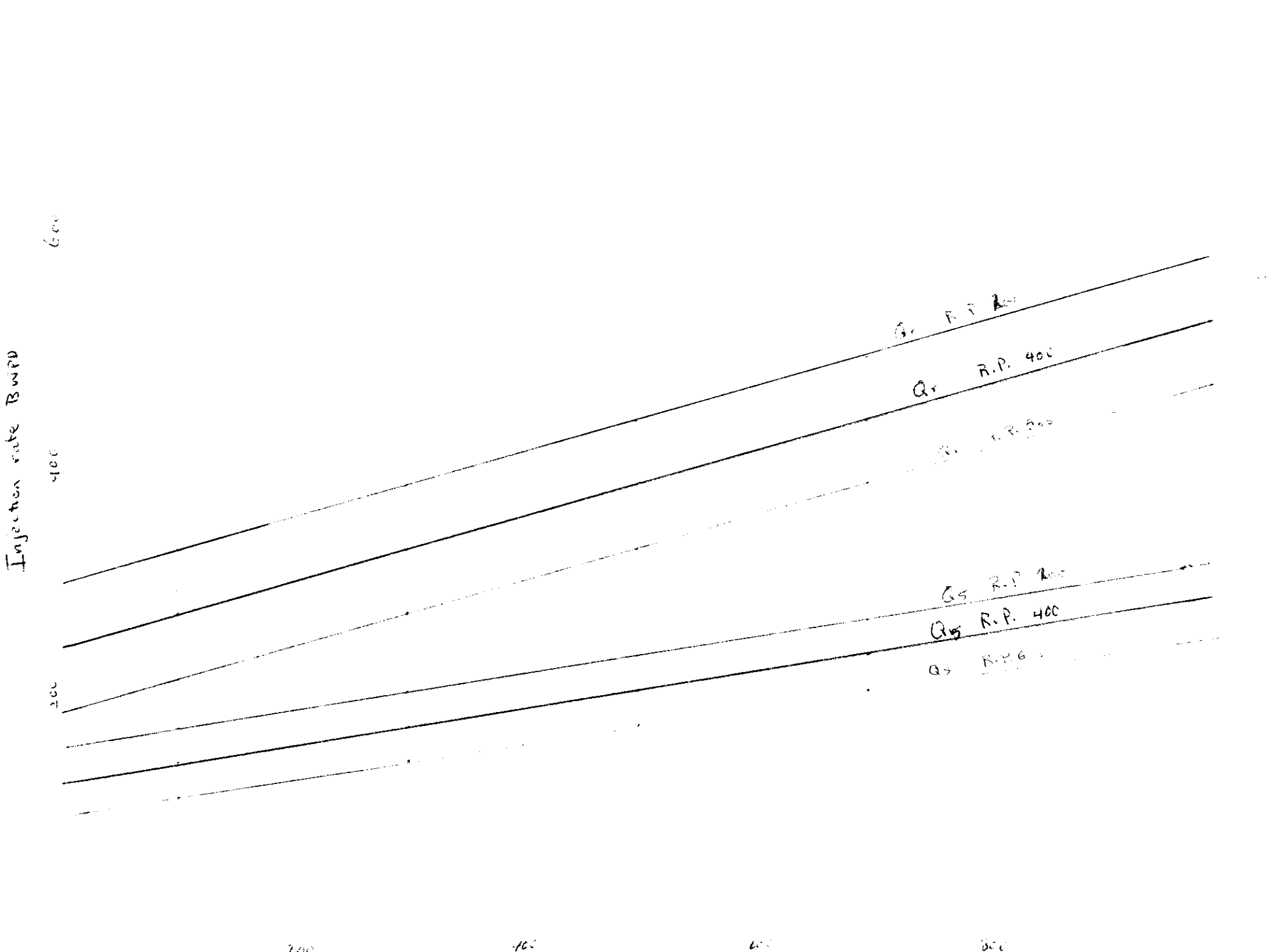
$\Delta p = 408 + \text{Inj. press}$

Inj 300	$Q_r = 335$	$Q_s = 182$
Inj 500	$Q_r = 390$	$Q_s = 212$
Inj 700	$Q_r = 445$	$Q_s = 242$
Inj 100	$Q_r = 280$	$Q_s = 152$

Res. Press 200

$\Delta p = 1108 + \text{Inj press}$

Inj 100	$Q_r = 335$	$Q_s = 182$
Inj 300	$Q_r = 390$	$Q_s = 212$
Inj 500	$Q_r = 445$	$Q_s = 242$
Inj 700	$Q_r = 501$	$Q_s = 272$


Injection rate BWPD
Q R.P. 400
Q R.P. 400
R.P. Reservoir Pressure psi
Injection Pressure psi

Waskada Field
Pilot Waterflooding & Unitization

Unit Agreement

Required changes - refer to your memo to O.N.G.C.B. dated January 29, 1976

Exhibit No. 1 "Unit Proposal and Waterflood Plan"

X 1. down time difinition? Clarification as to the method of calculation submitted by omega Jan. 14, 76 For Down time corrections.

2. Will the well 6-30-1-25 accept water in the range of 1,000 bbls/day on vaccumm as stated "Page 5" What are the supporting evidences? what is the injection press: high

X 3. Will the battery be able to handle production once the field responds favourably to the waterflood? ~~500 bbls~~ 3X capacity of the battery, 290 BPD peak production D+S, 200 BOPD peak production Omega's 1978. based on omega's 6 wells.

4. What are the possibilities for Unit expansion once the waterflood proves successful?
   a) include the 4 copperhead wells in the waterflood
   b) drill more adjacent wells, 13-30

5. If 4-30 and 12-30 are converted to water injection wells at later date. What would be the effect on the 4 copperhead wells?

✓ 6. Are the ten wells in ~~Unit~~ waskada producing from the same pool?

In Waterflood evaluation

3. Waterflooding

1.a. What is the present gas Saturation in the reservoir? 30 % as indicated in D+S ✓

b. Are the ten wells in Waskada producing from the same pool? if yes

c. What are the problems expected from high gas saturation and low pressure ~~if~~ once waterflood starts?

d. In D+S Study Page 6, Second Paragraph, they state "It is evident though, that the flood response will be materially influenced by the presence of a large free gas phase"; and if the ten wells are producing from the same pool, then it means that before getting a visible effect from the waterflood, the free gas saturation has to be reduced materially in all the pool, including the 4 southern wells.

2. What is the estimated life of the Unit?

3. Does Omega have any plans to analyze the injected and produced water for possible breakthrough? How frequent? What method to be used? i.e put dye in injected water and analyze the produced water?

4. Will Omega make any attempts to determine the injected profile and relative positions of waterflood fronts?

5. What is the producing GOR in Waskada?

6. Proper completion on 6-30-1-25 (from Omega)

OMEGA HYDROCARBONS Ltd.

TELEPHONES
ACCOUNTING 263-6161
EXECUTIVE 261-7670

574 - 330 FIFTH AVENUE S.W., CALGARY, ALBERTA T2P OL4

February 20, 1976

Petroleum Branch,
Department of Mines Resources & Energy,
Government of Manitoba,
Winnipeg, Manitoba.

ATTENTION: Mr. Moster

Re: Waskada Production Tests,
December 1, 1975 to February 15, 1976

Further to discussion concerning gas production and gas-oil ratio measurements, we are now able to provide you with such data. These measurements, as indicated below, have been taken over the recent period as shown above. Additional data should be available by the hearing date of March 12, 1976 in which case we will make it available to you prior to the proceedings.

Incidentally, if you have anything in the way of procedures for a hearing where one individual is present on behalf of the applicant, I would appreciate having a copy of a precedent case.

TIME ON TEST DAYS	WELL NO:	GAS MCF	OIL BBLS	GOR CU FT/BBL
7	3-30	54.6	49	1114
5	4-30	21.5	75	286
4	5-30	38.0	108	350
7	12-30	823	12	823
2	(group 4 wells)	32.1	82	391

Yours very truly,

OMEGA HYDROCARBONS LTD.,

T. Jack Hall
President

TJH/eh

OMEGA HYDROCARBONS Ltd.
574 - 330 FIFTH AVENUE S.W., CALGARY, ALBERTA T2P OL4
TELEPHONES
ACCOUNTING 263-6161
EXECUTIVE 261-7670

February 17, 1976

Department of Mines, Resources and
Environmental Management
Petroleum Branch
Mineral Resources Division
993 Century Street
Winnipeg, Manitoba R3H 0W4

Attention: Mr. H. C. Moster

Dear Sir:

Re: Application - Unitization and
Waterflood, Waskada Field

Please be advised that we have discovered a number of typographical errors in Exhibit 1 of our application. They are as follows:

1. Table of Contents
   Delete the word "Discussion" and add the word "Introduction".

2. Page 4, line 2 - Water Injection Facilities
   Delete the Words "Figure No. 5" and add "Figure No. 3"

3. Page 4 the third last line after the word production
   Add "(438 barrels)" including brackets.

4. Page 5 - Second last line of the second paragraph
   After the words - A typical - delete the word "well" and add the word "water".

5. Page 6 - line number 7
   Add the word "Initially" to the sentence so as to read "Initially, the only change anticipated ....."

We trust that you will make these corrections in the copies which were forwarded with the application.

Yours very truly,

OMEGA HYDROCARBONS LTD.

T. Jack Hall,
President

TJH*vs

76 01 29

The Oil and Natural Gas
Conservation Board:
Jas. T. Cawley, P. Eng., Chairman
J. S. Roper, Deputy Chairman
I. Haugh, Member

H. C. Hoster
Director
Petroleum Branch

xxxxx

Subject:

Unitization and Pilot Waterflood Application
Omega Hydrocarbons Ltd.
Waskada Field

Background:

The Waskada Field is located approximately 55 - 60 miles south of Virden and 4 miles north of the Canada - U.S. border. It was discovered in 1967 and to date contains 10 oil wells (Presently 7 producing and 3 suspended wells). The field produces light gravity crude (37 API) from the Mississippian Mission Canyon (MC-3b) formation. No water has been produced from the 6 Northern wells, whereas small amounts of water have been produced from the 4 southern wells. Attachment 1 shows the layout of the wells, their ownership, the portion of the field proposed for unitization and the initial proposed injection well for the pilot waterflood.

The initial pressure of the pool was 1,358 psi (original pressure on the discovery well 11-30-1-25). The present pressure within the pool, or atleast in the northern portion, is very low (approximately 50 psi). The estimated bubble point pressure is 1,535 psig indicating that since discovery, the pool has always been saturated and possibly has a small gas cap. The following are reserve estimates:

	Total Area		Proposed Unitized Area	
	D & S Study	Branch	Omega	Branch
Original Oil-in-Place (bbl.)	2,876,000	2,786,000	1,997,000	1,974,000
Cum. Prod. (Dec. 1/75)(bbl.)	502,422	502,422	325,311	325,311
Recovery to Dec. 1/75 (%)	17.5	18.0	20.4	16.5
Primary Recoverable (bbl.)	719,000	985,500	399,200	664,500
Primary Recovery Factor (%)	25	35	25	33.7
Total Recoverable (Prim. & Waterflood)(bbl.)	1,438,000	1,504,000	798,500	1,085,000
Total Recovery Factor (%)	50	54	50	55

. . . . 2

Discussion:

A. Factors pertaining to the unitization application:

1. Omega in a letter dated October 6, 1975 submitted a draft of a proposed Unitization Agreement for comments as to its acceptability. Because Omega is the only working interest owner in the proposed unitization area, it presented an agreement which did not provide for the normal operating provisions of the plans presently in effect in Manitoba (i.e. excluding organization of the operating committee, powers and duties of unit operator, individual rights and privileges of working interest owners). The Agreement was modelled after the standard model agreement presently used in Alberta. The proposed Agreement was reviewed and suggestions (approved by J. S. Roper) were made to Omega with respect to changes which would provide similar Board controls on operations under this Agreement as are presently contained in existing unitization agreements in Manitoba.

Omega amended the proposed Agreement as suggested by the Branch and submitted the amended agreement entitled "Unit Agreement - Waskada Unit No. 1 Manitoba, Canada" as an application on December 11, 1975. A review of this final draft Agreement has indicated the following changes are required:

(a) The title under Article VIII on Page 12 should read "USE, LOSS AND REINJECTION OF UNITIZED SUBSTANCES".

(b) The heading for 801. on Pg. 12 should read "Use or Loss".

(c) In Exhibit "A" of the Agreement the applicant has divided the proposed unit area into 2 multiwell tracts with a tract participation factor for each tract (not each well). The basis for this is the common royalty ownership in each tract. Because of the method of calculating provincial "Mineral Tax" (on production from or allocated to individual wells), it is required that the tract participation factors for the two (2) wells on freehold minerals be shown individually (namely 11-30 and 12-30). To allow for future similar problems on other wells in or to be included in the Unit, it is suggested that this requirement be placed on all wells (i.e. - single well tracts only).

(d) Exhibit "C" should also indicate the following "Omega Waskada 4-30-1-25 (WPM) - K. B. 1552.4".

2. The method of calculating Interim tract participation factors has required clarification and is presently being checked by the Branch.

3. The Mines Act [Section 74(2)] allows for voluntary unitization without a Board hearing or unitization order (unitization agreement requires Board approval). This alternative is not recommended as it provides little Board control once initiated.

4. This unitization application is for only a portion of the Waskada Field. We believe the D & S Study conducted in 1974 covering the whole pool was jointly financed by both Omega and Copperhead. The overall recommendation of the study was "that the pool should be waterflooded as soon as possible". The application states that Omega "have not been successful in persuading Copperhead Oil Co. and its partners who own three adjoining wells on the south end of the pool to participate in the proposed flood". A major factor therefore in this application is to whether the Board should attempt to exercise its power under Section 76 and 77 of The Mines Act with respect to holding a hearing upon its own motion to consider the advisability or necessity for the operation of a part of a pool or field as a unit (namely the southern 4 wells). Section 77 requires the Board to have consent from 75% of both the working interest owners and the royalty owners before a unitization order may be made. As the present application only covers 6 of 10 wells or 60%, the above requirement would not be met. As the flood is only a pilot at this time, the Board if desirable could act under Section 79(3) at some future date to force enlargement of the new unit.

Copperhead's reasons for not wishing to be part of the unitization and waterflood at this time are not presently known. However, a letter has been sent to Copperhead, dated January 23, 1976, requesting them to state the reasons behind their decision not to participate in this project. It is believed that Copperhead's refusal is mainly due to economic reasons (Attached hereto is a copy of a letter dated January 21, 1976 from Copperhead with respect to other concerns the Branch has with the company). At present there is no royalty or mineral tax reduction on additional production due to secondary recovery. This may be the point on which Copperhead would attempt to justify its not entering the project at this time. Omega has stated verbally that it has considered, and may make, a request for such treatment, but is proceeding with it's application, mainly due to the fact that 4 of its 6 wells are situated on Federal minerals and therefore only subject to a straight 12½% royalty. These 4 wells therefore are not affected by neither the provincial Crown incremental royalty nor the freehold mineral tax. The difference between Federal royalty rates and total freehold royalty and mineral tax rates in Manitoba can amount to as much as an additional 31.65% (off the top) at production rates over 25 BOPD. The maximum provincial crown royalty is 44.2%. Production from freehold minerals is subject to a similar maximum reduction at production rates over 25 BOPD.

. . . . 4

The proposed Unitization Agreement provides for enlargement at a future date.

A list of questions regarding the unitization application shall be prepared prior to the hearing.

B. Factors pertaining to the pilot waterflood application:

The immediate need for commencement of a waterflood scheme in this pool is supported by the extremely low apparent pressure in the reservoir. The reservoir should respond favourably under waterflood with the major potential problem being the free gas saturation expected in the reservoir due to the major pressure drop below the saturation point.

No reasons are evident at this time as to why a pilot waterflood should not be approved.

The D & S Study did not indicate that there was no need for a flood in the southern portion of the pool. An enlargement of the waterflood project to cover the entire pool will be dependent on the results of the proposed pilot. The power given to the Board under Section 62(9)(d) of The Mines Act could be exercised, if required at some future date, once the initial pilot's results are known. The pressure maintenance order covering the pilot could contain a condition requiring a pool wide waterflood scheme be implemented at a future date if in the Board's opinion it was warranted.

The proposed pilot injector is one of the wells proposed by the D & S Study as an injector under a 5 spot pattern. This location appears suitable with respect to this application (an Omega pilot waterflood) and should not create any lease line migration out of the proposed unitized area.

The Branch is continuing to receive and process additional data from the Applicant on the technical items relevant to the application.

A comprehensive list of questions regarding the pilot waterflood shall be compiled for the hearing.

Recommendation:

It is recommended that this dual application be heard at a public hearing.

Original Signed by H. C. Moster

H. C. Moster

HCM/et
Attach.

Copperhead Oil Company Limited

P. O. BOX 1027
415 SEVENTH AVENUE SOUTH
VIRDEN, MANITOBA
ROM 2CO

TEL: 204 - 748-2624

OFFICE OF
THE PRESIDENT

January 21st, 1976

Petroleum Branch,
Dept. of Mines, Resources and Environmental Management,
993 Century Street,
Winnipeg, Manitoba

Attention: H. C. Moster, P.Eng.

Dear Sir:

RE: Suspended Well Operations

We enclose herewith applications to suspend production as per your letter of December 18, 1975 with respect to the following:

Copperhead - Tilston	#9-31-5-29
" "	#10-31-5-29
" "	#11-31-5-29
" "	#15-31-5-29
Copperhead-So.Regent	#6-7-4-21
Copperhead-Waskada	#12-19-1-25

The Tilston wells have not been producing for some time and for reasons given. It is hoped that, as our Company's economic position improves, these wells will again be placed on production by methods and with equipment that will be less costly than the methods used to date, and it is for this reason that we do not wish to permanently abandon the wells. Also, with the high cost of abandonment, at least $3000.00 for each well, our company cannot afford to abandon the wells at this time.

The South-Regent well can only be produced during the summer months, due to the lack of natural gas required for treating purposes, and to overcome severe freezing conditions.

The Waskada well, although it cannot produce on a commercial basis, due to the problem and cost of disposing of the salt water, might be able to produce when a disposal facility becomes available in the immediate area. Another possibility would be to convert this #12-19-1-25 well in to a disposal well to accommodate our own water production if this situation should arise as time goes on.

continued..

With regard to the South-Regent #7-7-4-21 well, we propose to abandon this well as soon as our economic position permits, and an application to abandon will be submitted, hopefully, before October 1, 1976.

We trust the foregoing will meet your requirements.

Very truly yours,

COPPERHEAD OIL COMPANY LIMITED

Steve Hegion, B.A.Sc., P.Eng.,
President

SH/C
encl.

OMEGA HYDROCARBONS Ltd.
574 - 330 FIFTH AVENUE S.W., CALGARY, ALBERTA T2P OL4
TELEPHONES
ACCOUNTING 263-6161
EXECUTIVE 261-7670

January 27, 1976

Department of Mines, Resources and
Environmental Management
Mineral Resources Division
Petroleum Branch
993 Century Street
Winnipeg, Manitoba R3H OW4

Attention: Mr. H. C. Moster, Director

Dear Sir:

Re: Application - Unitization and
Waterflood, Waskada Field

Further to my telephone call of today, we wish to verify our comments with respect to our letter of January 14, 1976 in which we note an error in the year for which down time is considered. In this regard please revise the letter to correspond with the production period referred to in Page 2, Exhibit 1 Under "Interim Period" being September 1, 1974 to August 31, 1975 as follows:

Well 3-30 - Down time is all of May and June, 1975.

Well 6-30 - Down time is during January, 1975. No

Well 11-30 - September 1974 is correct and October and November, 1974 is correct.

Well 12-30 - The period of shut in was May and June, 1975.

With regard to your comments stated in your letter of January 22, 1976 concerning down time credit for 11-30 we provide you with our reasoning as follows:

(a) The production period under consideration relative to calculating the interim participation factor was September 1, 1974 to August 31, 1975. September, 1974 being the first month of such period was credited with 75 barrels which was an estimate of October - November production period.

.... 2

(b) Both 11-30 and 6-30 were reworked in October, 1974 thus providing evidence that 11-30 was in fact capable of such production. It was thought that had the well been reworked in August or September, 1974 such credit would have been verified by production.

(c) An argument could be put forth suggesting that because 11-30 stopped producing in February, 1975 it may have stopped producing one month earlier if in fact the well had been reworked one month earlier thus reducing its production during the 12 month period. However it appears after pulling and rerunning the pump in late 1975 with no further results that the area surrounding the well has become plugged or depleted. The only apparent solution to continued production would appear to be through secondary recovery means.

(d) In our best judgment it would appear that this well should be credited with the down time figure of 75 barrels. However, we remain flexible in the matter of assessing interim and final participation factors.

We trust that the above corrections and comments will be helpful in assessing the matter of participation factors.

Yours very truly,

OMEGA HYDROCARBONS LTD.

T. Jack Hall, P. Eng.
President

TJH*vs

22/1/76

Waskada Field

Reservoir Factors

Average porosity, Percent	10.7	Logs Analysis
" " , "	10.9	Core Analysis
Average Water Saturation, Percent	37	Log
" " " , Core	37.8	Core
Average Formation Volume factor	1.115	bbl/STB
Average Net pay, feet	10.2	Log
Average Residual Oil Saturation	10.4 %	Core
Average permeability	20.7 ~~cp~~ md.	
Rock volume, Acre-ft	4730	
discovery pressure of the Reservoir, Psi	1150	
Present pressure of the Reservoir, Psi	≅ 300	

Original Oil in place, Volumetric method

2.219×10^6 bbls

Original oil in place, Material balance

2.786×10^6 bbls

will be used

Estimated Production
Projected Primary Performance of Omega Wells
(3-30, 4-30, 5-60, 6-30, 11-30 and 12-30)

664,500 bbls

Production
Estimated Primary Performance of 4 southern Wells
(11-19, 12-19, 13-19 and 14-19)

320,500 bbls

Total Primary Production for the Pool 985,500 bbls
or 35% of O.O.I.P. (Recovery Factor)
Assuming 30 bbls/day Economic
limit for the pool
Time of Termination of pool under primary Recovery
Mid 1982

Ultimate Recovery Factor, Percent 54
Secondary Recovery Factor, Percent 19
Primary Recovery Factor, Percent 35

Cumulative Oil production to end of 1975
501,344 bbls or 18% of O.O.I.P.

O'2 6 wells

OOIP	1,974,000 bbls
Prod (Dec 1/75)	325,311 BBls
%)	16.5
Prim Rec. (BBL)	664,500 bbls
" " (%)	33.7
Total Rec (BBL)	1,085,000 bbls
" " (%)	55

S.E.

January 22, 1976

Omega Hydrocarbons Ltd.
574 - 330 Fifth Avenue S. W.
Calgary, Alberta
T2P 0L4

Attention: Mr. T. Jack Hall, President

Dear Sir:

Re: Application for Unitization and
Waterflood - Waskada Field

Further to your letter of January 14, 1976 we still would like to obtain more clarification as to the method used for determining the down time correction shown in Table 1 of Exhibit 1 of your application for Unitization and Waterflood. The results of a review of the production history on the six well in the proposed unit are as follows:

Well 3-30 - Correction of 650 bbls. was used.

A correction figure of 350 bbls. instead of the 650 would appear to be more realistic. The well lost some twenty-five days of production in May and a few days in June of 1974. Multiplying the total days of lost production (35) by the average production rate per day for this well (10) resulted in the 350 bbl. figure.

Wells 4-30 and [illegible]-30 - No correction was made.

Both wells have lost more than twenty days of production in May of 1974. A correction of 200 - 250 bbls. is suggested for each.

Well 6-30 - Correction of 150 bbls.

Our files indicate that in January 1974, the well was operating close to maximum capacity (produced 30 days), however, the No. of producing days in May, 1974 was only 2. Please clarify your statement of the down time correction for this well for January 1974 as mentioned in your letter.

. . . . 2

Well 11-30 - Correction of 75 bbls.

This well did not produce for almost a year (November 1973 - October 1974). Please clarify your statement "The period of shut in was September 1974" and indicate how the correction of 75 bbls. was determined.

Well 12-30 - Correction of 250 bbls.

This figure would appear low by about 100 bbls.

Please advise this office of your views and comments on the above.

Yours sincerely,

Original Signed by H. C. Moster

H. C. Moster, P. Eng.,
Director, Petroleum Branch.

HCM/et

OMEGA HYDROCARBONS Ltd.
TELEPHONES
ACCOUNTING 263-6161
EXECUTIVE 261-7670
574 - 330 FIFTH AVENUE S.W., CALGARY, ALBERTA T2P OL4

January 14, 1976

Department of Mines, Resources and
Environmental Management
Mineral Resources Division
Petroleum Branch
993 Century Street
Winnipeg, Manitoba R3H 0W4

Attention: H. C. Moster, P. Eng.,
Director, Petroleum Branch

Dear Sir:

Re: Application - Unitization
and Waterflood - Waskada Field

In response to your request for information on estimated production during down time as shown in Table 1 of Exhibit 1 of our application for Unitization and Waterflood, we are pleased to provide you with the following:

Well 3-30 - Correction 650 bbls. ✓ 15

Down time is all of May and June, 1974. This resulted from spring flooding of the surface lease. It was estimated that lost production during this period was 650 bbls. based on the capability shown during a normal operating period.

Wells 4-30 and 5-30 - No correction ✓ Aug, 74 - Aug, 75 Sept 1/74 - Sept 1/75

Although these wells were shut in for several days they were able to produce their normal volume of production.

Well 6-30 - Correction 150 bbls. 15

Down time is during January, 1974 which was caused by downhole pumping problems found to be gas locking. Production was estimated from normal operating periods.

Well 11-30 - Correction 75 bbls.

The period of shut in was September 1974 when the well experienced downhole pump problems. Production lost during this month was estimated from October and November, 1974 production.

..... 2

Well 12-30 - Correction 250 bbls. ✓ 5

The period of shut in was May and June, 197X, at a time when spring flooding caused weakness in the surface on which the pump base and pump jack is located. Continued operation could have resulted in serious damage to the pump unit.

If you have any further questions concerning the estimated loss of production we will be pleased to assist you.

Other deficiencies should be forthcoming in a few days.

Yours very truly,

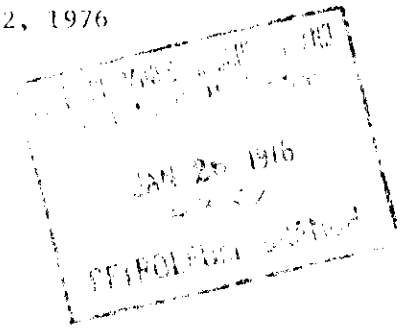
OMEGA HYDROCARBONS LTD.

T. Jack Hall,
President

TJH*vs

HYDROCARBONS Ltd.
TELEPHONES
ACCOUNTING 263-6161
EXECUTIVE 261-7670

January 22, 1976



Department of Mines, Resources and
Environmental Management
Petroleum Branch
993 Century Street
Box 12
Winnipeg, Manitoba R3H 0W4

Attention: Mr. H. C. Moster, Director

Dear Sir:

Re: Waskada Field
Unitization and Waterflood Application

In accordance with your request for information as outlined in your letter dated December 18, 1975 relating to our application we enclose five (5) copies of the following:

Item B(2) Recovery Factor

D. & S. Consultants Ltd. has provided a letter in which they show recoveries relative to water-oil ratio fractions. It should be recognized that this information is based on a five spot pattern when in fact we will have one injector until response dictates otherwise.

Item B(4) Performance Prediction

We have prepared a graphical presentation which includes past production history of Omega's wells including;

(a) A prediction based on Table 3 of the D. & S. Report assuming Omega's share of the pool being 60% of remaining recoverable reserves. Peak production is shown to average 8700 B/M during 1978. The total recoverable oil for this prediction is 561,200 barrels over the remaining life of the pool. This is approximately 100,000 barrels greater than the estimated remaining recoverable oil. Schedule A which is the estimated producing rates is attached.

/2

(b) The cross hatched area is a modified prediction curve which accounts for the over production and the questionable response from the currently shut in 11-30-1-25 well. Therefore, the peak production rate was brought down to correspond with the peak production year of 1968. The recoverable reserve in this instance is approximately 50% of original oil in place as calculated. The estimated annual production rates are shown in the attached Schedule 6.

With regard to individual well predictions, we refer you to Tables **8 to 13 inclusive, showing primary prediction only. It is our feeling that any prediction of individual well performance for a pilot waterflood scheme is of questionable value. In view of the lack of good reservoir information such as gas production and pressure history we would regard the prediction of poor performance under a pilot flood with a great deal of uncertainty. Flood response of a moderate nature will make our efforts worth while.

Please be advised that we have had considerable difficulty with our gas measuring equipment and although we are doing all things possible to rectify the situation we do not yet have individual well measurements of a satisfactory nature.

Yours very truly,

OMEGA HYDROCARBONS LTD.

T. Jack Hall,
President

TJH*vs

Encl.

** Note: D. & S. Petroleum Consultants Ltd. Report
Waskada Alida Beds Oil Pool - Waterflood Potential
dated August 1, 1974

D&S PETROLEUM CONSULTANTS (1974) LTD.
732 Calgary House–550–6 Avenue S.W. Calgary, Alberta T2P 0S2
Telephone: 403–266–1601 Cable: Denescons Calgary

January 19, 1976

Omega Hydrocarbons Ltd.
524, 330 Fifth Avenue S.W.
CALGARY, Alberta.
T2P 0L4.

Attention: Mr. T. Jack Hall

Dear Sir:

As requested, I have enclosed the information you outlined in your letter of January 5th. 1976. I trust this will be sufficient to answer the questions.

1) Bubble Point Pressure

Because there were indications of excess gas production from the commencement of production it was assumed that the reservoir was initially saturated. There are no PVT data to verify this assumption.

2) Waterflood Recovery Factor

The estimated waterflood recovery of 50 percent was based on an evaluation of displacement efficiency, areal conformance factor and vertical conformance factor. The displacement efficiency was based on data obtained from the literature and was believed to be representative of this type of reservoir. The relative permeability curves used in the study are shown on Figure 16 of the August 1, 1974 report. These curves were used to generate a fractional flow curve and the corresponding recovery factor for a homogeneous system.

The areal conformance factor was assumed to be represented by that of a five spot waterflood. A similar result would have occurred if an inverted nine spot pattern was considered.

.....Cont'd.

341 Oxford Street, London W1R 2ED England
Telephone: 01-493-3448/9 Telex: 24360 Cable: Denescons London W1

The vertical conformance accounts for the effects of stratification and was evaluated by a method similar to Pratts et al (Pratts, M. et al - Prediction of Injection Rate and Production History for Multi-fluid Five-Spot Floods - Journal of Petroleum Technology, Vol. 11, No. 5, 1959, P. 98 - 105). This approach divides the section into non-communicating layers of various permeability and assumes they are flooded individually with common pressure at the well. Water injection into the different layers progresses at different rates depending on the permeability of each layer. The total performance at any given time is obtained by a summation of the individual layers.

A summary of the three conformance factors at various water-oil ratios is shown below:

WOR	Areal Conformance	Vertical Conformance	Displacement Efficiency	Total
0.52	0.783	0.690	0.392	0.212
1.04	0.830	0.775	0.410	0.264
5.20	0.950	0.945	0.470	0.422
10.4	0.983	0.983	0.511	0.494
20.8	0.998	0.998	0.560	0.557
52.0	1.000	1.000	0.601	0.601

The total conformance factor indicates the recovery of remaining oil and assumes an initial gas saturation of 28 percent.

3) Performance

The production performance of the total field is divided into Omega and Copperhead wells as shown in the attached tables. Predictions are shown in the economic runs of the August 1, 1974 report.

If you require additional information please do not hesitate to call.

Yours truly,

D&S PETROLEUM CONSULTANTS (1974) LTD.

W. G. Fisher, P. Eng.

WGF:rk

SCHEDULE A

Prediction of Waterflood Response
Omega Properties Waskada, Manitoba

Based on Table 3 - D. & S. Report

Year	60% D. & S. Producing Rate Bbls.	Time Adjusted Rate - Bbls.	Monthly Rate - Bbls.	Cumm. WF Production
1976	11,000	13,200	1,100	13,200
1977	97,400	54,000	4,500	67,200
1978	110,400	104,000	8,670	171,200
1979	67,250	89,000	7,420	260,200
1980	47,600	57,400	4,780	317,600
1981	36,900	42,200	3,516	359,800
1982	30,100	33,500	2,790	393,300
1983	25,400	27,700	2,310	421,000
1984	21,200	23,300	1,940	444,300
1985	17,300	19,200	1,600	463,500
1986	14,600	16,000	1,330	479,500
1987	12,600	13,600	1,130	493,100
1988	11,150	11,900	990	505,000
1989	9,970	10,600	880	515,600
1990	9,000	9,500	790	525,100
1991	8,200	8,600	720	533,700
1992	7,600	7,900	660	541,600
1993	7,000	7,300	610	548,900
1994	6,500	6,700	560	555,600
1995	4,700	5,600	470	561,200
		Production to date		338,000
		Total Primary and W F Recovery		899,200

SCHEDULE B

Predicted Performance (cross hatch area)
Omega Waskada Pool Area
Omega Estimate 50% Total Recovery

Year	Monthly Average	Annual	Waterflood Cummulative
1976	1,400	16,800	16,800
1977	3,500	42,000	58,800
1978	6,000	72,000	130,800
1979	5,000	60,000	190,800
1980	4,000	48,000	238,800
1981	3,000	36,000	274,800
1982	2,500	30,000	304,800
1983	2,000	24,000	328,800
1984	1,800	21,600	350,400
1985	1,500	18,000	368,400
1986	1,300	15,600	384,000
1987	1,100	13,200	397,200
1988	1,000	12,000	409,200
1989	900	10,800	420,000
1990	800	9,600	429,600
1991	700	8,400	438,000
1992	650	7,800	445,800
1993	600	7,200	453,000
1994	550	6,600	459,600
1995	500	6,000	465,600 *
		Production to date	338,000 **
		Total Recovery	803,600

* Note - This value corresponds with 472,527 Bbls. in Column 7, Table 2, Exhibit 1 of our application.

** Corresponds with Cummulative production of Column 6, Table 2 plus estimated production of 1,200 Bbls. for December, 1975.

PRODUCTION BARRELS/MONTH STO

10000 9000 8000 7000 6000 5000 4000 3000 2000 1000

Graph Showing Omega Producing History
and
Predicted Performance under Waterflood
Waskada Oilfield, Manitoba
(January, 1976)

Prediction based on Omega's wells performing at 60% of Rates shown in Table 3 of D. & S. Report on Waterflood Potential.

Prediction based on Omega's estimates corresponding with 50% Recovery Factor

PRODUCTION

PREDICTED WATERFLOOD PERFORMANCE

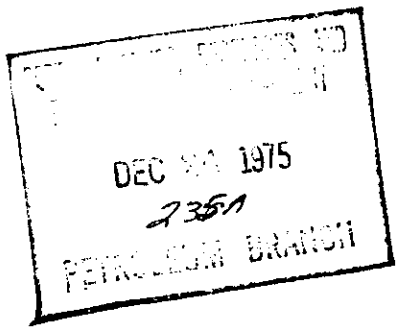
DEC. MAR. JUNE SEPT. DEC.

1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986

material with SAM

OMEGA HYDROCARBONS Ltd.
TELEPHONES
ACCOUNTING 263-6161
EXECUTIVE 261-7670
574 - 330 FIFTH AVENUE S.W., CALGARY, ALBERTA T2P OL4

December 22, 1975



Department of Mines, Resources and
Environmental Management
Petroleum Branch
993 Century Street
Box 12
Winnipeg, Manitoba R3H OW4

Attention: Mr. H. C. Moster, Director

Dear Sir:

Re: Unitization and Waterflood Application
Waskada Field, Manitoba

In accordance with your request we are enclosing the following information:

1. Summary of reservoir factors including estimated primary recovery and original oil in place for each of the six spacing units.

2. A copy of a report prepared by Delta Consultants in October, 1971 referring to fluid level surveys.

3. A summary of shut-in pressure readings taken from drill stem test charts, relating to pressure decline during the development period.

4. A copy of a letter from Omega to D. & S. Consultants relating to a fluid level survey conducted in July, 1974.

5. Reference to the Lasiter Correlation - This article is taken from AIME Transaction, May 1958, and Journal of Petroleum Technology, May 1958. A copy of the article is enclosed for your purposes.

As mentioned to you we have very poor records on pressure history of this pool. Omega ran a fluid level survey in mid summer 1974 and from records presented we could not determine a definitive fluid level on any of the wells. Our best estimates from the sonolog tapes would reflect an operating pressure in the range of 20 - 120 psig.

.... 2

The pool may very well be producing on a gravity mechanism as the up dip wells are not performing as otherwise expected.

We have just recently moved the satellite separator to the main battery and have started taking gas readings. GOR on 12-30 appears to be in the range of 1000 whereas the two wells situated along the down dip side of the pool (4-30 and 5-30) appear to have a very low GOR in the range of 120 - 200. Hopefully, we will have more precise data within the next few weeks.

As for our proposed water injection rates, that will depend on the capability of the water source well and injection pressures. However, our current objective is approximately 1000 barrels per day. This will provide reservoir fill up within an eighteen month period.

Regarding the graphical presentation of past reservoir performance and projected waterflood performance, we have not yet prepared such a graph. However, it is expected that we will attempt to prepare an illustration of our expectations keeping in mind that this is a pilot flood program. Our only reference to projected performance at this time is shown in Table 3 of the D. & S. Consultant's Report, which encompasses the entire pool and two injectors. Our application is intended to cover a portion of the pool and one injector.

Yours very truly,

OMEGA HYDROCARBONS LTD.

T. Jack Hall,
President

TJH*vs

Encl.

ACROLL OIL & GAS LTD.

REPORT ON WELLS IN WASKADA AREA

Prepared by

DELTA CONSULTANTS

CALGARY Alberta

APPOLL OIL & GAS LTD.

REPORT ON WELLS IN WASKADA AREA

October 4, 1971.

Shoot fluid levels on all wells to determine bottom hole pump efficiency and a shut in bottom hole pressure derived from 6-30 which had been shut in approximately 30 days prior to survey.

Obtain oil sample and analyze to determine proper acid stimulation.

Well No.	Jts. Tbg. In Hole	Level from Surface	Pressure Csg.	Pump Submergence
3-30	98	95	13 psig	93'
4-30	98	96	19 psig	65'
5-30	98	97	23 psig	30'
6-30	96	79	62 psig	527'
11-30	96	98.5 ?	20 psig	15'
12-30	104	101	24 psig	93'

ANALYSIS OF FLUID LEVEL DETERMINATION:

3-30 The sonic survey shows a pump submergence of 93'. An attempt to pressure up pump showed a pressure increase on the upstroke but a pressure loss on the downstroke which indicates a leaking standing valve in the bottom hole pump. The pressure remained constant when the pump was stopped, this was done to check the tubing for leaks.

The high annular fluid level proves very low system efficiency.

We recommend the bottom hole pump be repaired.

Continued 2

4-30 The same circumstances exist in this well. The tubing has no leaks, but the bottom hole pump requires repairs.

5-30 The bottom hole pump is operating at maximum efficiency and the tubing has no leaks.

6-30 The survey indicates a surface pressure of 62 PSIG; 527' of fluid at a gradient of .35#/ft or 184.5 PSIG, hydrostatic of fluid; and at gas hydrostatic of 5 psi equals total bottom hole pressure of 62 + 184.5 + 5 = 251.5 PSIG.

The bottom hole pressure determined above may be incorrect due to formation plugging and/or wellhead leaks, but is accurate enough to show a substantial drop due to depletion.

11-30 The bottom hole pump is operating at maximum efficiency and the tubing has no leaks.

12-30 The pressure test indicates the bottom hole pump does not need repairs and the tubing does not leak, but the bottom hole pump is prone to gas locking. This results in poor system efficiency, and explains the high fluid level encountered in the well.

October 5, 1971.

Determination of production capability of each well by recording annular fluid rise in 3, 10 and 30 minute intervals, after shut in.

Well #	Shot #1	Shot #2	Shot #3	Csg. PSIG	Calculated	Prorated
3-30	95	95-	94+	18	12	12
4-30	96	96-	95+	20	12	9
5-30	97	96	95	22	72	50
11-30	98.5	98.5	98+	19	4	3
12-30	101	101-	100+	24	10	7
					110	80

Due to a foaming condition in the annulus the calculated production is high, however an actual production rate of 80 BOPD was used and each well prorated back to this amount to determine more accurately the productivity of each well.

It was assumed that the GOR on each well remained constant.

October 6, 1971.

Order S & S Service No.

Pull pump and rods on 6-30.

Pull pump and rods on 4-30.

Both pumps were taken to Continental Emsco at Winden for repairs.

The 6-30 pump did not require any major repairs, which indicates a formation plugging problem rather than a bottom hole pump failure.

The pump from the 4-30 well required replacement of the standing valve and travelling valve due to wear and corrosion.

Samples of wax and oil were obtained from the bottom hole pumps for further analysis in order to definately determine the proper stimulation treatment.

The 3-30 location was too wet to pull the rods and pump at the present time.

October 7, 1971.

Run in bottom hole pump and rods at 4-30.

6-30

An acid treatment for production stimulation was performed using 1500 gals D.A.D. with 7½, (28% HCl) 30% D.A.D. with Anti-sludge & surfactant added.

A double amount of inhibitor was added to prevent corrosion to bottom hole pump and rods after start up of pump unit.

The retarding effect of this acid emulsion was 4 hours. The acid was spotted on bottom and left for 30 mins. Squeeze 3 bbls at 1/10 BPM, at 200 PSIG. Shut in 30 mins.

Squeeze 3 bbls at 1/10 BPM at 125 PSIG.

Shut in 15 mins.

Squeeze 6 bbls @ 1/5 BPM at 0 pressure (vacuum) at maximum rate of 1/3 BPM. Run in BH pump and rods. Allow acid to remain in formation for 1 3/4 hours prior to start up of pump units. Total time acid in formation = 6 hours.

October 8, 1971.

Pull pump and rods on 3-30.

The standing and travelling valves showed signs of wear and corrosion. The seating cups showed severe wear and were replaced.

The controls on the test separator on 6-30 were dismantled, cleaned and re-adjusted to facilitate testing of wells.

A sonic fluid level on 6-30 indicated a pump submergence of 1020' under pumping conditions at a rate of 60 BOPD, recorded on test separator. This level may be lower than recorded due to foaming, but shows a marked increase in the production rate.

The pump stroke/minute was increased to 12.5/minute which would result in a rate of 91 BOPD at 80% efficiency.

October 9, 1971.

The test separator at 6-30 was functioning normally, however minor adjustments were necessary.

An inspection of the treator at 11-30 showed normal operation.

Fluid levels performed on 6-30 showed 1090' of pump submergence at a rate of 75 BOPD, proving the increase of productivity after the stimulation.

An extended test on 6-30 well to keep a close check on the production rate to determine the effectiveness of the stimulation for sustained production is recommended.

A fluid level on 4-30 showed the fluid on bottom.

October 10, 1971.

Check on well at 8:00 A.M.

Shoot levels at 4-30 and 6-30.

The results were similar.

Check separator operation.

Drive to Calgary.

Bubble Point Pressure Correlation

J. A. LASATER | MAGNOLIA PETROLEUM CO. DALLAS, TEX.

ABSTRACT

A correlation of the bubble point pressure for black oil systems is developed using the standard physical-chemical equations of solutions. The correlation is based on 158 experimentally measured bubble point pressures of 137 independent systems and is expressed in terms of the usually measured field parameters—flash separation gas-oil ratio, tank oil gravity, total gas gravity, and reservoir temperature.

The data were obtained on systems produced in Canada, Western and Mid-Continental United States, and South America. The average error (algebraic) in the representation is 3.8 per cent, and the maximum error encountered is 14.7 per cent.

INTRODUCTION

In the absence of experimentally measured properties of reservoir fluids, it is often necessary for the field engineer to make estimates regarding the fluid properties based on the usually measured producing parameters. To aid in these estimations, various correlations have appeared in the literature in recent years. Among the pertinent properties of interest is the bubble point pressure. A correlation for this parameter has been reported by Standing[1]. However, this correlation was based essentially on California produced crudes and this limitation was pointed out with its presentation. The correlation presented in this paper utilized data on crude oil systems from Canada, Western and Mid-Continental United States, and South America.

Original manuscript received in Society of Petroleum Engineers office Sept. 15, 1957. Revised manuscript received April 3, 1958. Paper presented at Fall Meeting of Southern California Petroleum Section in Los Angeles, Oct. 17-18, 1957.

[1]References given at end of paper.

CORRELATION DEVELOPMENT

The basic assumption used in this development is the same as employed by Standing[1],

$$p_b = f(R, \gamma_o, t, \Gamma). \quad . \quad . \quad . \quad (1)$$

There is a wide variety of ways to combine these parameters; however, in this instance the combination was made on the basis of Henry's law[2]. Accordingly, the relationship proposed is

$$p_b = y_g H'. \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Although Eq. 2 defines an individual system, it is of limited value since H' is a function of gas-phase composition and the system temperature.

It was observed that for the systems where the bubble point was measured at several temperatures that the ratio of the bubble point pressures and the ratio of the corresponding absolute temperatures (°R) were practically identical. Thus, for correlation purposes the bubble point pressure may be taken as a direct function of the absolute temperature. This relation is valid only for those systems that are not near the critical point. Accordingly, this correlation will be inadequate for systems in the region of the critical point.

The solubility of the various hydrocarbons found in the gas phase increases with the molecular weight. Thus, the saturation pressure should be inversely related to the gas gravity.

Applying these principles to Eq. 2 and rearranging terms gives:

$$\frac{(p_b)(\gamma_o)}{T} = y_g H \quad . \quad . \quad (3)$$

The variables on the left side of Eq. 3 were designated as the "bubble point pressure factor".

$$p_t = \frac{n_o}{n_o + n_g} H \quad . \quad . \quad . \quad (4)$$

The number of mols of tank oil per barrel is a function of the "molecular weight" of the tank oil. Although the tank oil is a complex mixture, it was assumed for the purposes of this correlation that a unique molecular weight could be assigned to a given oil. This was designated as the "effective molecular weight", and was related to the oil gravity,

$$M_o = f(\Gamma). \quad . \quad . \quad . \quad . \quad . \quad (5)$$

This empirical relationship was developed simultaneously with the correlation by assuming values of M_o and working to obtain a smooth curve for both the correlation and the effective molecular weight. The relationship between the oil gravity and the effective molecular weight used in this correlation is shown in Fig. 1.

The effective molecular weight is somewhat higher than the molecular weight of the C_7+ fraction. The difference between these values is largest for the low-gravity systems. It is noted that this effective molecular

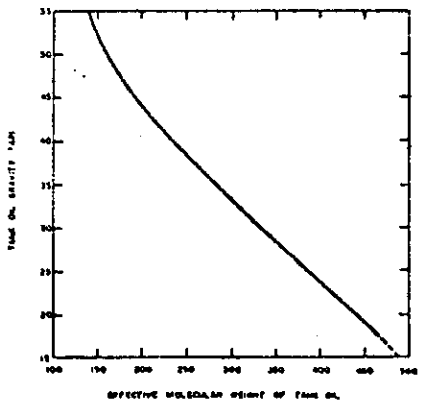


FIG. 1—EFFECTIVE MOLECULAR WEIGHT RELATED TO TANK OIL GRAVITY.

relationship corresponds ly to that given for crude oil s with a UOP characterization factor of 11.8.

The r ionship between the bubble point pressure factors calculated from the experimental data and the gas mol fraction is shown graphically in Fig. 2. Representative values of the curve are given in Table 1. Since the representation of Fig. 2 is not a linear function of the variables, H is not a constant. Thus, a simple analytical expression was not obtained, and it is necessary to rely on the graphical representation of Fig. 2 to obtain p_f from y_s.

The bubble point pressure for a given gas-oil system may be obtained from the correlation by the utilization of Figs. 1 and 2. The effective molecular weight is established from the crude oil gravity, Fig. 1, and the gas mol fraction is obtained from the following equation.

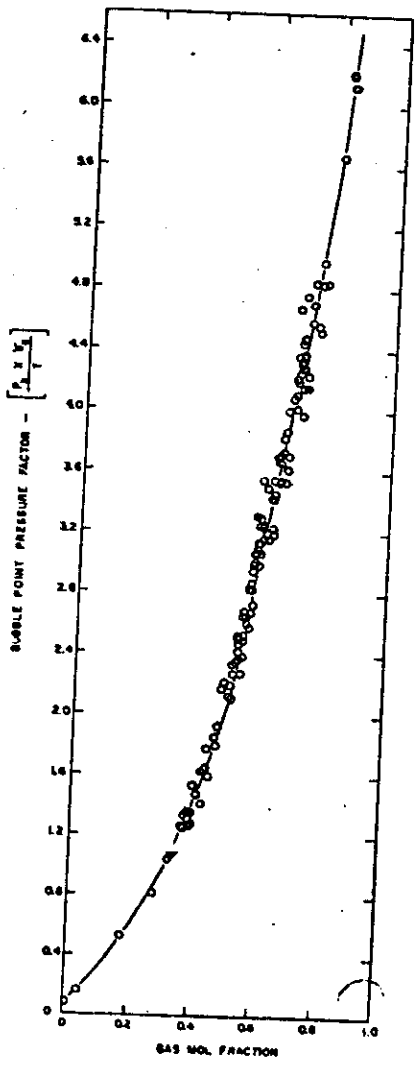


FIG. 2—CORRELATION OF BUBBLE POINT PRESSURE FACTOR.

TABLE 1—SMOOTHED BUBBLE POINT FACTOR FUNCTION

Gas Mol Fraction	Bubble Point Pressure Factor
0.05	0.17
0.100	0.30
0.150	0.43
0.200	0.58
0.250	0.75
0.300	0.94
0.350	1.19
0.400	1.47
0.450	1.74
0.500	2.10
0.550	2.70
0.600	3.29
0.650	3.60
0.700	4.30
0.750	4.90
0.800	5.70
0.850	6.70

$$y_s = \frac{R/379.3}{R/379.3 + \frac{350\,\gamma_o}{M_o}} \quad . \quad . \quad (6)$$

The value of the gas mol fraction is applied in Fig. 2 to obtain the bubble point pressure factor. The bubble point pressure is calculated by use of the following equation

$$p_b = \frac{(p_f)(t + 459.6)}{\gamma_g} \quad . \quad . \quad (7)$$

The 158 experimentally determined bubble point pressures of the 137 independent crude oil systems were compared with the values predicted by the correlation. This comparison showed an algebraic deviation of 3.8 per cent. Approximately 21 per cent of the data points show a deviation of 0.5 per cent, and 80 per cent have a deviation of less than 6.5 per cent. The maximum error encountered was 14.7 per cent.

The ranges of the field measured parameters covered in this correlation were as follows.

Bubble point pressures	48-5780 psia
Flash gas-oil ratios	3-2905 cu ft/bbl
Tank oil gravities	17.9-51.1° API
Total Gas gravities (air = 1.0)	0.574-1.223
Reservoir temperatures	82-272°F
Separator stages (stock tank = 1)	1-3
Separator temperatures	34-106°F
Separator pressures	15-605 psia

This correlation was based on systems essentially free of non-hydrocarbon material. The presence of large amounts of nitrogen, carbon dioxide, hydrogen sulfide, etc., will result in the predicted bubble point being low. The following is given as a guide to the effect of the presence of non-hydrocarbon materials.

Component	Per Cent of Gas	Error in Predicted p_b (Per Cent low)
Carbon dioxide	9.1	5.0
Hydrogen sulfide	3.1	
Carbon dioxide	3.1	1.1
Nitrogen	2.5	
Carbon dioxide	0.3	2.7

A calculation chart has been prepared based on this correlation that permits rapid graphical evaluation of the predicted bubble point. This calculation chart is shown in Fig. 3. The error distribution using the calculation chart is essentially the same as found for the correlation.

CONCLUSION

The correlation is generally applicable to a large number of producing areas and provides a rapid method of estimating the bubble point pressure of crude systems with a reasonable degree of accuracy.

NOMENCLATURE

f = function

γ_g = total gas gravity (air = 1.0)

γ_o = tank oil specific gravity

H' = general Henry's law constant

H = specific Henry's law constant (independent of gas composition and temperature)

M_o = effective molecular weight of tank oil

n_g = mols of gas

n_o = mols of tank oil

y_g = mol fraction of gas

p_b = bubble point pressure, psia

p_f = bubble point pressure, factor

R = total flash separation gas-oil ratio, cu ft/bbl (measured at 60°F)

Γ = tank oil gravity, °API (corrected to 60°F)

t = temperature, °F

T = absolute temperature, °R

ACKNOWLEDGMENT

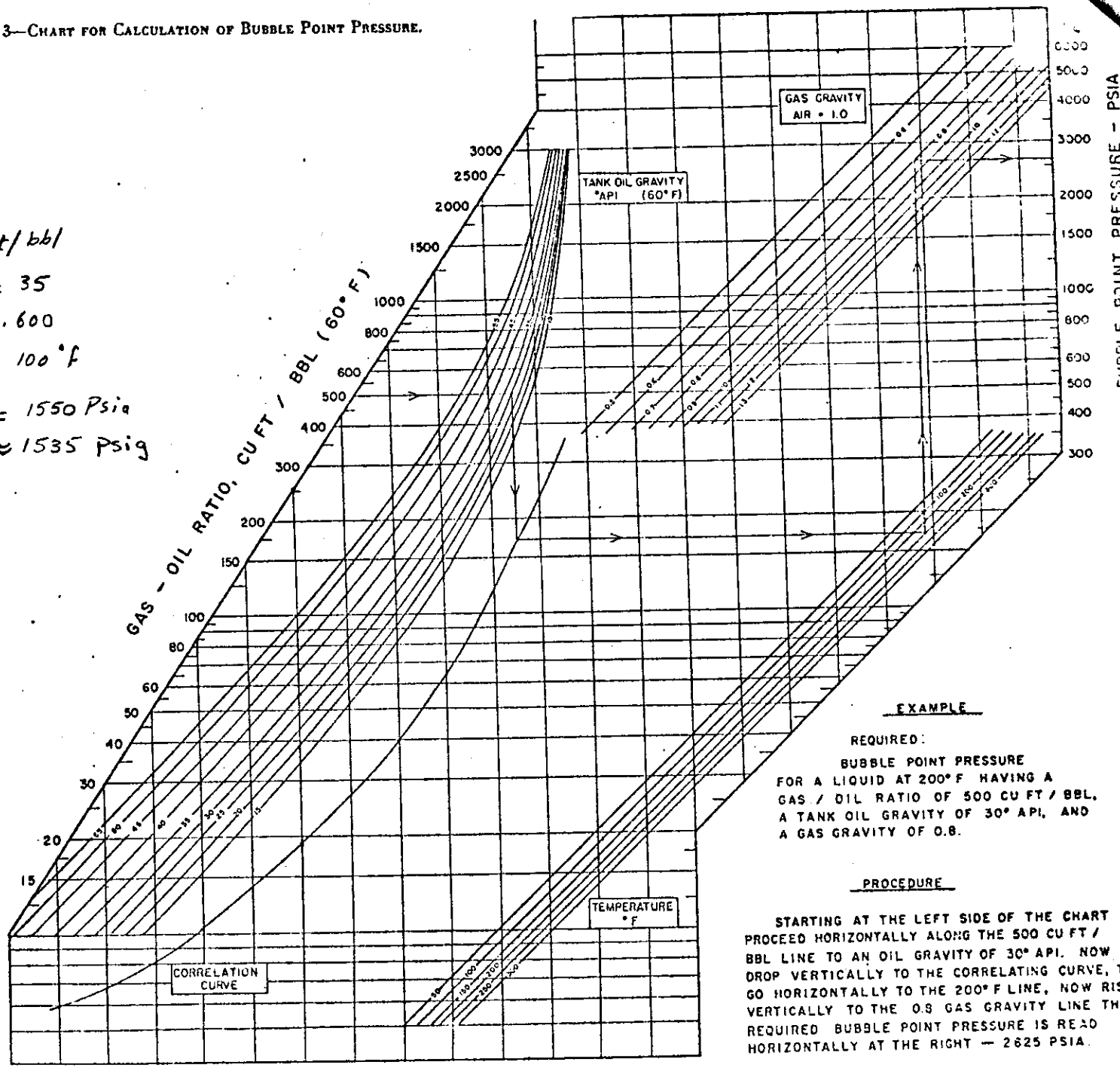
The author is indebted to C. A. Connally and L. G. Sharp for their many helpful suggestions pertaining to the phase behavior of fluids, and to the Magnolia Petroleum Co. for permission to publish this work.

REFERENCES

1. Standing, M. B.: *Drill. and Prod. Prac.*, API (1947) 275.
2. Hougen, O. A., and Watson, K. M.: *Chemical Process Principles*, John Wiley & Sons, Inc., N. Y. (1943) 1, 146.
3. Watson, K. M., and Murphy, C. F.: *Ind. Engr. Chem.* (1935) 27, 1460.

★★★

FIG. 3—CHART FOR CALCULATION OF BUBBLE POINT PRESSURE.



Field:

Waskada

GOR = 300 cuft/bbl

Oil Gravity API° = 35

Gas gravity = .600

Reservoir temp = 100 °f

bubble Point Press. = 1550 Psia

≈ 1535 Psig

EXAMPLE

REQUIRED:

BUBBLE POINT PRESSURE FOR A LIQUID AT 200° F HAVING A GAS / OIL RATIO OF 500 CU FT / BBL, A TANK OIL GRAVITY OF 30° API, AND A GAS GRAVITY OF 0.8.

PROCEDURE

STARTING AT THE LEFT SIDE OF THE CHART PROCEED HORIZONTALLY ALONG THE 500 CU FT / BBL LINE TO AN OIL GRAVITY OF 30° API. NOW DROP VERTICALLY TO THE CORRELATING CURVE, THEN GO HORIZONTALLY TO THE 200° F LINE, NOW RISE VERTICALLY TO THE 0.8 GAS GRAVITY LINE THE REQUIRED BUBBLE POINT PRESSURE IS READ HORIZONTALLY AT THE RIGHT — 2625 PSIA.

xxxxxxx
263-6161

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
#574, 330 - 5th Avenue S.W.,

Omega Corres?

July 29, 1974

D. & S. Consultants Ltd.,
7th Flr., 550 - 6th Ave. S.W.,
Calgary, Alberta.

Attention: Mr. George Misner

Dear Sir:

Enclosed please find two production summary forms, both of which illustrate royalty details on Omega's wells.

Also, we have obtained by telephone the fluid level shots that were mentioned to you by telephone today.

Fluid levels are as follows:

	WELL	TUBING JOINTS TO FLUID	FLUID LEVEL OVER PERFS	CASING PRESSURE	ESTIMATED PRESSURE
	3-30	95	85'	20 PSIG	50
	4330	96	70'	20	45
	5-30	96	60'	20	40
*	6-30	94	100'	80	120
**	11-30	90	220'	0	70
	12-30	99	0	20	20

Production from 4 wells 40-45 bbls/day.

Oil Gradient ≅ .35 psi/ft

* This well has been shut in for about two weeks because of pump problems.

** This well has been shut in for several months following an acid job and has not responded to pumping. It will be reworked in the near term.

We have not been successful in raising Steve Hegion by telephone so I have asked Whistler Petroleums for the royalty details, which will be forwarded to you.

..../2

If we can obtain any other useful information such as operating cost, now estimated to be $350/month, we will forward same to you.

Yours very truly,

OMEGA HYDROCARBONS LTD.

T. J. Hall, P. Eng.

TJE/ml
Enclosures

WASKADA OIL FIELD

Summary of Drill Stem Test, Pressure Data taken from D.S.T., Charts of Waskada wells - indicating reservoir pressure decline over the first year of production.

Waskada Well Number	Date of Test	Initial Shut-in PSIG	Final Shut-in PSIG
*11-30	Jan/67	1358	1358
5-30	March/67	1335	1353
8-25	May/67	1334	1334
6-30	Nov/67	1017	1017
3-30	Nov/67	1109	1109
12-30	Nov/67	1000	951
4-30	Dec/67	-	937

*11-30 was the discovery well indicating an original reservoir pressure of 1358 psig

I. Comments on Material Submitted by Omega in response to our letter of Dec. 18 1975.

A. Pressure Measurements:

Material submitted suggests an average reservoir pressure of about 50 psi (very low) which supports their application for Waterflooding.

An estimate of the bubble point pressure indicates that it is in the order of 1535 psig (1369 psi in D & S study)

The original reservoir pressure is 1358 psi (discovery pressure of 11-30-1-25).

B. Secondary Recovery:

1. Records on Gas measurements are poor. However, We will wait for more precise data from Omega within the next few weeks as mentioned in their letter.

2. We have not received any supporting data as to the estimation of 50% secondary recovery. Awaiting their calculations and graph for predicted performance

C. Tract Participation:

No data has been received as to how the "down time" was used in table I. A possible question at the hearing.

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A - Pressure Measurements:

Material submitted suggests an average reservoir pressure of about 50 psi (very low) which supports their application for Waterflooding.

An estimate of the bubble point pressure indicates that it is in the order of 1535 Psig (1369 psi in D+S study)

The original reservoir pressure is 1358 psi (discovery pressure 11-30-1-25).

B. Secondary Recovery:

1. Records on Gas measurements are poor. However, we will wait for more precise data from Omega within the next few weeks as mentioned in their letter.

2. We have not received any supporting data as to the estimation of 50 % secondary recovery - awaiting their calculations and graph for predicted performance

C. Tract Participation:

No data has been received as to how the "down time" was used in table I. A possible question at the hearing.

D. Proposed Injection Well, Onega Waskada 6-30-1-25

Again, Onega didn't mention anything about any future plans to insure proper completion on the subject well, will send a letter to Omga requesting their plans on the subject well if no answer is received prior to January 15, 1976. "Possible inquiry by phone."

COPY

December 18, 1975

Cargo Hydrocarbons Ltd.
3Z0-350 Fifth Avenue S. W.
Calgary, Alberta
T2P 0L4

Attention: Mr. T.J. Hall, President

Dear Sir:

Re: Waskada Field
Unitization and Waterflood Application

Further to our telephone conversation of December 16, 1975, this is to confirm our request for submission of data supporting the following items:

A. Pressure Measurements

In the third paragraph, Page 1 of D & S Petroleum Consultant's study of Waskada, 1974, it states that "Recent pressure measurements suggest that the reservoir pressure is in the 150 - 350 p.s.i. range." Please submit to this office data supporting this statement. Such data should include:

1. The times and locations these measurements were taken and the results, including the shut-in times.

2. The original "discovery" reservoir pressure, also the reservoir's "bubble-point" pressure.

B. Secondary Recovery and Reservoir Characteristics

Please include in the submission:

1. The results of any measurements of gas production, also the producing Gas-Oil ratios for the wells.

2. Calculations supporting the estimation of 50% ultimate recovery (i.e. - secondary recovery calculations).

3. The proposed water injection rate of the well 6-30-1-25 and also the expected fill-up time.

4. Calculations and graphs (production vs time) indicating the predicted performance of the wells and pool with and without secondary recovery.

G. Tract Participation

1. The submission should also include the calculations used to determine the original oil-in-place for the tracts 3-31, 4-30, 5-30, 6-30, 11-30 and 12-30-1-25 used in Table 2 to Exhibit No. 1 to calculate the Final Tract Participation (%).

2. Also describe how the "down time" production used in [illegible] No. 1 was determined.

[illegible] Well, Omega Haskada 6-30-1-25

[illegible] of our records on the subject well shows that after a [illegible] performed in October 1975 to seal off the leak in the [illegible] pressure bled from 400 p.s.i. to 20 p.s.i. in one [illegible] that there is still a completion problem. [illegible] of your plans to insure the proper completion [illegible] injection purposes.

[illegible] to these items will enable us to process your application [illegible].

Yours sincerely,

E. G. Hester, P. Eng.,
Director, Petroleum Branch.

[illegible]

Waskada Field

Unitization and Waterflood

Application

Pending Questions at Hearing

Item I : Clarification on some items mentioned in their application

a. D & S study.

relevant

- Line No. 6, Page 4, under Geology - The Pay zone is impermeable to the west due to a facies change. To our knowledge, the pay zone is wet to the west but not impermeable. Need further clarification.

- Last sentence, Page 5, under Recovery Factor Calculations - Gas saturation of hydrocarbon pore space is only slightly less than 30 percent. Need further comments.

b. Exhibit No. 1, Unit proposal and Waterflood plan :

- Difinition of "down time". Further explanation to how they apply "down time correction" used in table I.

- There is a rather abnormal difference between Interim and Final participation percent on the wells 3-30 and 4-30-1-25 (23.614% interim and 13.876% final for 3-30 & 26.575% interim and 39.546% final for 4-30). Need royalty holders consent ??

- Need further supporting data as to the statement on the third line, Page 5 "Injection rates indicated that the well 6-30-1-25 would accept water in the range of 1,000 bbls/day with 0 wellhead pressure." We could mention that in our letter.

Item No. II: Waterflooding

- Estimated life of project, at what stage the pool will be considered "Uneconomical to produce". (Question not neccessary if data submitted before hearing).
- If the waterflood is successful, what are the future plans for project expansion?
  i.e. include the 4 southern wells in the waterflood
  i.e. drill a well in 13-30 for evaluation of the extension of the existing pool.
- Will Omega analyze the injected water for possible break through? How frequent? What method to be used? i.e. put dye in injected water and analysis of produced water.
- Will Omega make any attempt to determine the injection profile and relative positions of waterflood fronts?
- What is the predicted max. rate of production? Would production exceed the field allowance?

(60 BH)

- What is the approximate injection pressure ?

  if high

  At high rate of injection pressure and large quantities of injected water, what is the possibility of damaging the reservoir ? i.e. Fracturing, channelling

General:

??? - Reasons behind Copperhead refusal to participate in the project ?

Item III : Unitization

GEOLOGICAL REPORT

and

ESTIMATES OF OIL RESERVES
and
ENGINEERING VALUATION

on the

OMEGA HYDROCARBON WASKADA FIELD ACREAGE

in

TOWNSHIP 1 - RANGE 25 and 26 - WPM

by

J. A. DOCKERY
B. SC. PET. ENG. P. ENG.

Calgary, Alberta
July, 1968

J. A. DOCKERY, B. SC. PET. ENG. P. ENG.

INTRODUCTION

The acreage discussed in this report is located in Township 1 - Ranges 25 and 26 - WPM. The total acreage comprises Sixteen Hundred (1600) acres. The acreage distribution is shown on Maps No. 1 and 2.

Two oil wells, Omega Waskada 11-30-1-25 and Omega Waskada 5-30-1-25 were drilled in January and March of 1967. A third well, Omega Waskada 8-25-1-26 was drilled and abandoned in May of 1967.

Four oil wells, Omega Waskada 3-30-1-25, 4-30-1-25, 6-30-1-25 and 12-30-1-25 were drilled, completed and placed on production during November and the early part of December, 1967. The Omega Waskada 4-31-1-25 well was drilled and abandoned in May of 1968.

The Waskada Oil Field produces light gravity crude (38° API) from the Alida beds. The crude sells at the well head for $2.245 per barrel.

All wells in the Waskada Oil Field are on a Manitoba allowable of 50 barrels of oil per day.

Current production data indicates that the 4-30 and 5-30 wells can exceed this allowable. The 3-30, 6-30 and 12-30 wells can produce near their allowables, with the 11-30 well somewhat below its allowable.

This property is located approximately 50 miles South of the Virden - Roselea Mississippian Oil Fields and approximately 55 miles Southeast of the Cromer Oil Terminal.

INTRODUCTION (continued)

Proven recoverable oil underlying the Omega Hydrocarbon's Waskada Acreage was calculated at 436,100 Barrels.

Probable recoverable oil underlying the Omega Hydrocarbon's Waskada Acreage was estimated at 90,000 Barrels.

Included in this report are Mississippian Topographic Contours (Map No. 2) and Structure Contours on the Base of the Alida Pay Zone.

Also included in this report are tables outlining the "Predicted Future Production from the Omega Waskada Oil Wells", and the "Engineering Valuation of the Remaining Recoverable Oil Reserves for the Omega Waskada Oil Wells".

The present net worth (Discounted at 10%) for the Six (6) drilled Omega Oil Wells was calculated at $458,520.00.

GEOLOGY

Regional

The acreage lies on the Eastern flank of the Williston Basin. Regional strike is Northwest - Southeast - except for local irregularities and dips, which are Southwest at approximately 50 feet per mile.

Stratigraphy

The Omega Hydrocarbon Waskada 5-30-1-25 well encountered the following section:

Formation or Marker	Depth (Feet)	Sub-Sea
Second White Specks	1567	- 17
Base Fish Scales	1800	- 250
Blairmore	1983	- 433
Jurassic	2190	- 640
Watrous	2780	-1230
Red Beds	2910	-1360
Alida (Mississippian)	3025	-1575
Tilston	3130	-1580
Total Depth	3195	-1645

STRUCTURE

Topographic contours drawn on the top of the Mississippian (Map No. 2) indicate a North - South plunging anticlinal nose cutting across Sections 19 and 30 of Township 1 - Range 25 - WPM.

This structure formed is Pre-Mesozoic and could be Tectonic in nature, but is probably due to salt - collapse in the underlying Prairie Evaporite.

ACREAGE DISTRIBUTION

Township 1 - Range 25 - WPM

SW 1/4 of 30 and N 1/2 of 30
SE 1/4 of 31

Township 1 - Range 26 - WPM

E 1/2 of 25 and all of 36

A Total of 1600 Acres

OIL RESERVE DETERMINATION

Well:	- Lsd. 3-30-1-25-WPM
Zone:	- Alida (Interval 3027-3040')
Pay Thickness:	- 11.0'
Average Porosity:	- 11.5%
Porosity Range:	- 9.0 - 15.3%
Recovery Factor:	- 30%
Formation Volume Factor:	- 1.150
Connate Water:	- 35%
Average Permeability:	- 2.2 md.

Based upon the above reservoir factors, the proven - primary recoverable oil in the Alida Formation was calculated at 151.0 Barrels per acre - foot.

Based on a productive area of 440 acre - feet, the proven - primary recoverable Alida oil underlying Lsd. 3-30-1-25 was calculated at 66,500 Barrels.

Oil - place = $\frac{7758 \times \text{Vol.}(\text{acre-ft}) \times \phi(1-S_w)}{B_o}$

$= \frac{7758 \times .115 \times .65}{1.150}$ $\quad 77.58 \times 6.5$

OIL RESERVE DETERMINATION

Well:	- Lsd. 4-30-1-25-WPM
Zone:	- Alida (3046-3064')
Pay Thickness:	- 15.0'
Average Porosity:	- 17.9%
Porosity Range:	- 8.0 - 23.3%
Recovery Factor:	- 25%
Formation Volume Factor:	- 1.150
Connate Water:	- 35%
Average Permeability:	- 45.2 md.

Based upon the above reservoir factors the proven - primary recoverable oil in the Alida Formation was calculated at 195.0 Barrels per acre - foot.

Based upon a productive area of 600 acre - feet, the proven - primary recoverable Alida oil underlying Lsd. 4-30-1-25 was calculated at 117,000 Barrels.

OIL RESERVE DETERMINATION

Well:	- Lsd. 5-30-1-25-WPM
Zone:	- Alida (3046-3062')
Pay Thickness:	- 15.9'
Average Porosity:	- 14.3%
Porosity Range:	- 7.6 - 21.7%
Recovery Factor:	- 25%
Formation Volume Factor:	- 1.150
Connate Water:	- 35%
Average Permeability:	- 41.2 md.

Based upon the above reservoir factors, the proven - primary recoverable oil in the Alida Formation was calculated at 156.0 Barrels per acre - foot.

Based upon a productive area of 636 acre - feet, the proven - primary recoverable Alida oil underlying Lsd. 5-30-1-25 was calculated at 99,200 Barrels.

OIL RESERVE DETERMINATION

Well:	- Lsd. 6-30-1-25-WPM
Zone:	- Alida (3022-3034')
Pay Thickness:	- 12.0'
Average Porosity:	- 9.1%
Porosity Range:	- 6.6 - 15.5%
Recovery Factor:	- 30%
Formation Volume Factor:	- 1.150
Connate Water:	- 35%
Average Permeability:	- 5.4 md.

Based upon the above reservoir factors, the proven - primary recoverable oil in the Alida Formation was calculated at 119.0 Barrels per acre - foot.

Based on a productive area of 480 acre - feet, the proven - primary recoverable Alida oil underlying Lsd. 6-30-1-25 was calculated at 57,000 Barrels.

OIL RESERVE DETERMINATION

Well:	- Lsd. 8-25-1-26-WPM
Zone:	- Alida (3068-3084')

This zone tested water on a drill stem test and the well was abandoned. Electric logs and diamond cores indicate similar characteristics as the 4-30-1-25 and 5-30-1-25 wells.

OIL RESERVE DETERMINATION

Well:	- Lsd. 11-30-1-25-WPM
Zone:	- Alida (3026-3038')
Pay Thickness:	- 6.0'
Average Porosity:	- 9.8%
Porosity Range:	- 6.4 - 14.2%
Recovery Factor:	- 30%
Formation Volume Factor:	- 1.150
Connate Water:	- 35%
Average Permeability:	- 4.85 md.

Based upon the above reservoir factors, the proven - primary recoverable oil in the Alida Formation was calculated at 128.5 Barrels per acre - foot.

Based upon a productive area of 240 acre - feet, the proven - primary recoverable Alida oil underlying Lsd. 11-30-1-25 was calculated at 30,900 Barrels.

OIL RESERVE DETERMINATION

Well:	- Lsd. 12-30-1-25-WPM
Zone:	- Alida (3041-3055')
Pay Thickness:	- 10.5'
Average Porosity:	- 11.9%
Porosity Range:	- 5.8 - 13.9%
Recovery Factor:	- 30%
Formation Volume Factor:	- 1.150
Connate Water:	- 35%
Average Permeability:	- 41.8 md.

Based upon the above reservoir factors, the proven - primary recoverable oil in the Alida Formation was calculated at 156 Barrels per Acre - Foot.

Based upon a productive area of 420 acre - feet, the proven - primary recoverable Alida oil underlying Lsd. 12-30-1-25 was calculated at 65,500 Barrels.

OIL RESERVE DETERMINATION

Well: Lsd. 4-31-1-25-WPM
Zone: Alida (3004-3014')

This zone was tight due to infilling of secondary anhydrite. Some oil stain was observed in the core. This 4-31-1-25 well is close to the zero edge of the Alida porosity, with the probability of the porosity opening up down - dip to the west and southwest.

OIL RESERVE DETERMINATION (PROBABLE)

Lsd. 13-30-1-25-WPM

Based upon projected reservoir factors, the probable primary recoverable Alida oil underlying Lsd. 13-30-1-25 was estimated at 60,000 Barrels.

Lsd. 14-30-1-25-WPM

Based upon projected reservoir factors, the probable primary recoverable Alida oil underlying Lsd. 14-30-1-25 was estimated at 30,000 Barrels.

No proven or probable primary recoverable Alida oil was estimated for the Omega Hydrocarbon acreage underlying the East 1/2 of Section 25 - Township 1 - Range 26 - WPM, the Northeast 1/4 of Section 30 - Township 1 - Range 25 - WPM, and the Southeast 1/4 of Section 31 - Township 1 - Range 25 - WPM.

PROVEN AND PROBABLE OIL

	PROVEN - PRIMARY (Bbls.)	PROBABLE - PRIMARY (Bbls.)
3-30-1-25	66,500	
4-30-1-25	117,000	
5-30-1-25	99,200	
6-30-1-25	57,000	
11-30-1-25	30,900	
12-30-1-25	65,500	
13-30-1-25	--	60,000
14-30-1-25	--	30,000
8-25-1-26	--	--
9-25-1-26	--	--
16-25-1-26	--	--
TOTAL	436,100 (Bbls.)	90,000 (Bbls.)

PRODUCTION DATA

Complete production data up until June 30th, 1968, is listed as follows:

WASKADA PRODUCTION

FROM INCEPTION - JUNE 30, 1968

DATE	11-30	5-30	3-30	4-30	6-30	12-30
January - 1967	279					
February "	461					
March "	677					
April "	194					
May "	366	397				
June "	871	1223				
July "	644	1677				
August "	632	1810				
September "	652	1633				
October "	618	1761				
November "	550	1631				
December "	652	1612	638	583	1378	913
January - 1968	490	1621	1376	894	1587	785
February "	584	1412	948	780	986	1290
March "	705	1430	988	862	1033	1365
April "	592	1365	940	1012	1067	1334
May "	574	1290	801	980	911	1215
June - 1968	564	1325	888	1041	834	1212
July	580	1550	1054	1116	1519	1469

A TOTAL OF 59,033 BARRELS -

ESTIMATES OF OIL RESERVES AND ENGINEERING VALUATION OF THE ACREAGE UNDERLYING THE OMEGA HYDROCARBON'S WASKADA OIL WELLS -

Since no bottom hole pressures or gas production tests have been taken to date on the Omega Oil Wells, the reserve estimates were made by the volumetric method using information obtained from the interpretation of well logs, core analyses and completion reports.

The Omega 11-30-1-25 well has been on continuous production since January of 1967, while the Omega 5-30-1-25 well has been on production since March of 1967. The remaining 3-30, 4-30, 6-30 and 12-30 wells have been on production since early December, 1967.

To date no water has been produced along with the oil from these six wells.

Normally when calculating reserves for a new oil field, it is assumed that the only recovery mechanism operating in the reservoir is a solution gas drive - reserves are therefore calculated using a recovery factor of 20%. In the case of the Waskada wells, the production history is such that a 25 to 30% recovery factor can be readily used in calculating the recoverable oil. Sufficient oil has now been produced from the field (59,033 Bbls.) to indicate that at least a partially, if not completely effective water drive is taking place in the field. If this were not the case, production would be characterized by either an increasing gas/oil ratio or declining production rates, neither of which has occurred.

(Production Data from 5-30 Well)

Further evidence to support a natural water drive is the presence of an excellent down dip aquifer in the Alida beds in the Omega 8-25-1-26-WPM well.

In all likelihood, due to the excellent reservoir characteristics evidenced by the producing wells and the presence of a large down dip water zone, the recovery factor will possibly be higher than the 25 - 30% factor used.

Tables 1 to 6 summarize the production to the end of December, 1967, and the estimated future oil and water production.

Tables 7 to 12 summarize the gross income, operating expenses, royalties, net revenue and present worth discounted at 10 percent.

WASKADA FIELD

		Cum. Prod. to Dec. 31/73	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Total	CUM. TOTAL
COPPERHEAD OIL CO.																
Copperhead Tri-West Waskada 11-19-1-25	OIL	55,891	830	756	824	146		283	560	533	473	526	645	556	6,132	62,023
	WATER	2,714	118	110	100	27		54	84	72	66	72	70	74	847	3,561
Copperhead Tri-West Waskada 12-19-1-25		565														565
		1,703														1,703
Copperhead Tri-West Waskada 13-19-1-25		53,442	410	392	337	374	92	540	496	476	439	465	480	420	4,321	58,363
		6,796	120	114	102	68	8	46	52	48	42	52	50	48	752	7,548
Copperhead Tri-West Waskada 14-19-1-25		37,363	214	191	114			320	456	436	360	420	482	418	3,411	41,[illegible]
		1,075	29												29	1,104
TOTAL -	OIL	147,761	1,454	1,339	1,275	520	92	1,143	1,512	1,445	1,272	1,411	1,607	1,394	14,464	162,[illegible]
	WATER	12,288	267	224	202	95	8	100	136	120	108	124	120	122	1,628	13,916
OMEGA HYDROCARBONS LTD.																
Omega Waskada 3-30-1-25		39,045	313	354	278	232	54	235	317	370	266	250	[illegible]	311	3,238	[illegible]
		-														-
Omega Waskada 4-30-1-25		38,332	216	148	255	220	59	200	299	357	180	255	258	311	2,758	41,090
		-														-
Omega Waskada 5-30-1-25		83,593	239	193	240	228	61	212	297	365	310	219	434	388	3,016	86,609
		-														-
Omega Waskada 6-30-1-25		61,812	350	310	288	280	40	248	259	381	325	30	114	140	2,765	64,577
		-														-
Omega Waskada 11-30-1-25		32,161										82	66	86	234	32,395
		-														-
Omega Waskada 12-30-1-25		41,434	423	364	364	199		235	317	310	323	215	234	175	3,174	44,608
		-														-
TOTAL -	OIL	296,375	1,551	1,369	1,430	1,159	214	1,160	1,491	1,783	1,404	1,051	1,154	1,411	[illegible]	311,562
	WATER	-														-
PREVIOUS PRODUCERS																
Imperial Oil Limited		2,29[illegible]														2,29[illegible]
		2,24[illegible]														2,24[illegible]
WASKADA FIELD - TOTAL	OIL	446,426	3,005	2,708	2,705	1,679	306	2,303	3,003	3,228	2,676	2,462	2,761	2,805	[illegible]	[illegible]
	WATER	14,53[illegible]	267	224	202	95	8	100	136	120	108	124	120	122	1,628	16,16[illegible]

1974

Total Future production for
Omega Waskada oil wells, 1974
is 30,000 bbls (based on
this study)
Actual production for 1974 is
15,187 bbls

TABLE I
PREDICTED FUTURE PRODUCTION
on
OMEGA WASKADA OIL WELLS

WELL 3-30	YEAR	OIL BBLS.	WATER BBLS.	TOTAL FLUID BBLS.	APPROX. WATER %
	1968	14,600	---	14,600	0
	1969	12,400	---	12,400	0
	1970	10,540	600	11,140	5.2
	1971	8,970	1,050	10,200	10.3
	1972	7,625	1,790	9,415	19
	1973	5,485	3,300	8,785	37
	1974	4,600	5,000	9,600	52
		64,220	11,740	76,140	

Cumulative to December 31, 1967 - 638 Bbls.
Total Recoverable Oil - 64,858 Bbls.

TABLE 2
PREDICTED FUTURE PRODUCTION
on
OMEGA WASKADA OIL WELLS

WELL 4-30	YEAR	OIL BBLS.	WATER BBLS.	TOTAL FLUID BBLS.	APPROX. WATER %
	1968	18,250	---	18,250	0
	1969	15,510	---	15,510	0
	1970	13,190	750	13,940	5.4
	1971	11,210	1,200	12,410	9.6
	1972	9,530	1,800	11,330	16
	1973	8,100	2,500	10,600	23.5
	1974	6,880	3,000	9,880	30
	1975	5,850	3,500	9,350	37
	1976	5,000	4,100	9,100	45
	1977	4,250	4,700	8,950	53
	1978	3,600	5,500	9,100	61
		101,370	27,050	128,420	

Cumulative to December 31, 1967 - 583 Bbls.

Total Recoverable Oil - 101,953 Bbls.

TABLE 3
PREDICTED FUTURE PRODUCTION
on
OMEGA WASKADA OIL WELLS

WELL 5-30	YEAR	OIL BBLS.	WATER BBLS.	TOTAL FLUID BBLS.	APPROX. WATER %
	1968	18,250	—	18,250	0
	1969	15,510	780	16,290	5
	1970	13,190	1,750	14,940	11.5
	1971	11,210	3,050	14,260	21.5
	1972	9,530	4,500	14,030	32
	1973	8,100	6,100	14,200	42
	1974	6,880	8,100	14,980	54
	1975	5,850	10,100	15,950	63
	1976	5,000	12,000	17,000	70
		93,520	46,380	139,900	

Cumulative to December 31, 1967 - 11,744 Bbls.

Total Recoverable Oil - 105,264 Bbls.

TABLE 4
PREDICTED FUTURE PRODUCTION
on
OMEGA WASKADA OIL WELLS

WELL 6-30	YEAR	OIL BBLS.	WATER BBLS.	TOTAL FLUID BBLS.	APPROX. WATER %
	1968	14,600	—	14,600	0
	1969	12,400	—	12,400	0
	1970	10,540	600	11,140	5.2
	1971	8,970	1,100	10,070	11
	1972	7,625	1,800	9,425	19
	1973	5,485	3,300	8,785	37
		59,620	6,800	66,420	

Cumulative to December 31, 1967 - 1,378 Bbls.

Total Recoverable Oil - 60,998 Bbls.

TABLE 5
PREDICTED FUTURE PRODUCTION
on
OMEGA WASKADA OIL WELLS

WELL 11-30	YEAR	OIL BBLS.	WATER BBLS.	TOTAL FLUID BBLS.	APPROX. WATER %
	1968	7,300	0	7,300	0
	1969	6,200	0	6,200	0
	1970	5,300	300	5,600	5.4
	1971	4,500	600	5,100	11.5
	1972	3,900	900	4,800	19
	1973	3,300	1,500	4,800	31
		30,500	3,300	33,800	

Cumulative to December 31, 1967 - 6,596 Bbls.

Total Recoverable Oil - 37,096 Bbls.

TABLE 6
PREDICTED FUTURE PRODUCTION
on
OMEGA WASKADA OIL WELLS

WELL 12-30	YEAR	OIL BBLS.	WATER BBLS.	TOTAL FLUID BBLS.	APPROX. WATER %
	1968	14,600	---	14,600	0
	1969	12,400	600	13,000	4.5
	1970	10,540	1,100	11,640	9.5
	1971	8,970	1,800	10,770	17
	1972	7,625	3,400	11,025	31
	1973	5,485	4,000	9,485	42
	1974	4,600	5,400	10,000	54
		64,220	16,300	80,520	

Cumulative to December 31, 1967 - 913 Bbls.

Total Recoverable Oil - 65,133 Bbls.

TABLE 7
ENGINEERING VALUATION
of
REMAINING RECOVERABLE OIL RESERVES
on
OMEGA WASKADA OIL WELLS

YEAR	OIL BBLS.	WATER BBLS.	GROSS INCOME $	CROWN & OVERRIDING ROYALTIES	OPERATING COSTS $	WATER DISPOSAL $	NET INCOME $	PRESENT WORTH (@ 10% DISCOUN FACTOR	AMOU
1968	14,600	--	32,800	8,200	1,500	--	23,100	0.9091	21,0
1969	12,400	--	27,810	6,950	1,500	--	19,360	0.8265	15,9
1970	10,540	600	23,650	5,910	1,500	60	16,180	0.7513	12,1
1971	8,970	1,050	20,200	5,050	1,500	105	13,545	0,6830	9,2
1972	7,625	1,790	17,200	4,300	1,500	179	11,221	0.6209	6,9
1973	5,485	3,300	12,320	3,080	1,500	330	7,410	0.5645	4,
1974	4,600	5,000	10,330	2,590	1,500	500	5,740	0.5132	2,
	64,220	11,740	144,310	36,080	10,500	1,174	96,556		72,

1) Gross Income @ $2.245 per Bbl.
2) Crown Royalty - 25%
3) Operating Costs @ $125.00 per Month
4) Water Disposal Cost @ 10¢ per Bbl.

TABLE 8
ENGINEERING VALUATION
of
REMAINING RECOVERABLE OIL RESERVES
on
OMEGA WASKADA OIL WELLS

YEAR	OIL BBLS.	WATER BBLS.	GROSS INCOME $	CROWN & OVERRIDING ROYALTIES	OPERATING COSTS $	WATER DISPOSAL $	NET INCOME $	PRESENT WORTH (@ 10% DISCOUNT) FACTOR	PRESENT WORTH (@ 10% DISCOUNT) AMOUNT
1968	18,250	--	41,000	10,250	1,500	--	29,250	0.9091	26,60
1969	15,510	--	34,800	8,700	1,500	--	24,600	0.8265	20,30
1970	13,190	750	29,600	7,400	1,500	75	20,625	0.7513	15,50
1971	11,210	1,200	25,200	6,300	1,500	120	17,280	0.6830	11,80
1972	9,530	1,800	21,400	5,350	1,500	180	14,370	0.6209	8,92
1973	8,100	2,500	18,200	4,550	1,500	250	11,900	0.5645	6,71
1974	6,880	3,000	15,450	3,860	1,500	300	9,790	0.5132	5,02
1975	5,850	3,500	13,150	3,290	1,500	350	8,010	0.4665	3,73
1976	5,000	4,100	11,250	2,810	1,500	410	6,530	0.4241	2,77
1977	4,250	4,700	9,550	2,390	1,500	470	5,190	0.3855	2,00
1978	3,600	5,500	8,100	2,015	1,500	550	4,035	0.3505	1,41
	101,370	27,050	227,700	56,915	16,500	2,705	152,080		104,76

1) Gross Income @ $2.245 per Bbl.
2) Crown & Overriding Royalty - 25%
3) Operating Costs @ $125.00 per Month
4) Water Disposal Cost @ 10¢ per Bbl.

TABLE 9
ENGINEERING VALUATION
of
REMAINING RECOVERABLE OIL RESERVES
on
OMEGA WASKADA OIL WELLS

YEAR	OIL BBLS.	WATER BBLS.	GROSS INCOME $	CROWN & OVERRIDING ROYALTIES	OPERATING COSTS $	WATER DISPOSAL $	NET INCOME $	PRESENT WORT (@ 10% DISCOU FACTOR	AMO
1968	18,250	—	41,000	10,250	1,500	—	29,250	0.9091	26,
1969	15,510	780	34,800	8,700	1,500	78	24,522	0.8265	20,
1970	13,190	1,750	29,600	7,400	1,500	175	20,525	0.7513	15,
1971	11,210	3,050	25,200	6,300	1,500	305	17,095	0.6830	11,
1972	9,530	4,500	21,400	5,350	1,500	450	14,100	0.6209	8,
1973	8,100	6,100	18,200	4,550	1,500	610	11,540	0.5645	6,
1974	6,880	8,100	15,450	3,860	1,500	810	9,280	0.5132	4,
1975	5,850	10,100	13,150	3,290	1,500	1,010	7,350	0.4665	3,
1976	5,000	12,000	11,210	2,810	1,500	1,700	5,200	0.4241	2,
	93,520	46,380	210,010	52,510	13,500	5,138	138,862		99,

1) Gross Income @ $2.245 per Bbl.
2) Crown & Overriding Royalty - 25%
3) Operating Costs @ $125.00 per Month
4) Water Disposal Cost @ 10¢ per Bbl.

TABLE 10
ENGINEERING VALUATION
of
REMAINING RECOVERABLE OIL RESERVES
on
OMEGA WASKADA OIL WELLS

YEAR	OIL BBLS.	WATER BBLS.	GROSS INCOME $	CROWN & OVERRIDING ROYALTIES	OPERATING COSTS $	WATER DISPOSAL $	NET INCOME $	PRESENT WORT (@ 10% DISCOU FACTOR	AM
1968	14,600	---	32,800	8,200	1,500	---	23,100	0.9091	21,
1969	12,400	---	27,810	6,950	1,500	---	19,360	0.8265	15,
1970	10,540	600	23,650	5,910	1,500	60	16,180	0.7513	12,
1971	8,970	1,100	20,200	5,050	1,500	110	13,540	0.6830	9,
1972	7,625	1,800	17,200	4,300	1,500	180	11,220	0.6209	6,
1973	5,485	3,300	12,320	3,080	1,500	330	7,410	0.5645	4,
	59,620	6,800	133,980	33,490	9,000	680	90,810		69,

1) Gross Income @ $2.245 per Bbl.
2) Crown & Overriding Royalties @ 25%
3) Operating Costs @ $125.00 per Month
4) Water Disposal @ 10¢ per Bbl.

TABLE 11
ENGINEERING VALUATION
of
REMAINING RECOVERABLE OIL RESERVES
on
OMEGA WASKADA OIL WELLS

YEAR	OIL BBLS.	WATER BBLS.	GROSS INCOME $	CROWN & OVERRIDING ROYALTIES	OPERATING COSTS $	WATER DISPOSAL $	NET INCOME $	PRESENT WORT (@ 10% DISCOU FACTOR	AMO
1968	7,300	--	16,400	3,275	1,500	--	11,625	0.9091	10,
1969	6,200	--	13,930	2,790	1,500	--	9,640	0.8265	7,
1970	5,300	300	11,900	2,380	1,500	30	7,990	0.7513	5,
1971	4,500	600	10,125	2,025	1,500	60	6,540	0.6830	4,
1972	3,900	900	8,760	1,755	1,500	90	5,415	0.6209	3,
1973	3,300	1,500	7,420	1,485	1,500	150	4,285	0.5645	2,
	30,500	3,300	68,535	13,710	9,000	330	45,495		34,

1) Gross Income @ $2.245 per Bbl.
2) Crown & Overriding Royalties - 20%
3) Operating Costs @ $125.00 per Month
4) Water Disposal @ 10¢ per Bbl.

TABLE 12
ENGINEERING VALUATION
of
REMAINING RECOVERABLE OIL RESERVES
on
OMEGA WASKADA OIL WELLS

YEAR	OIL BBLS.	WATER BBLS.	GROSS INCOME $	CROWN & OVERRIDING ROYALTIES	OPERATING COSTS $	WATER DISPOSAL $	NET INCOME $	PRESENT WORTH (@ 10% DISCOUNT FACTOR	PRESENT WORTH (@ 10% DISCOUNT AMOUN
1968	14,600	---	32,800	6,550	1,500	—	24,750	0.9091	22,45
1969	12,400	600	27,800	5,550	1,500	60	20,690	0.8265	17,15
1970	10,540	1,100	23,650	4,725	1,500	110	17,315	0.7513	13,0(
1971	8,970	1,800	20,150	4,025	1,500	180	14,445	0.6830	9,8
1972	7,625	3,400	17,100	3,420	1,500	340	11,840	0.6209	7,3
1973	5,485	4,000	12,320	2,460	1,500	400	7,960	0.5645	4,4
1974	4,600	5,400	10,330	2,065	1,500	540	6,225	0.5132	3,2
	64,220	16,300	144,150	28,795	10,500	1,630	103,225		77,4

1) Gross Income @ $2.245 per Bbl.
2) Crown & Overriding Royalty - 20%
3) Operating Costs @ $125.00 per Month
4) Water Disposal @ 10¢ per Bbl.

TO WHOM IT MAY CONCERN:

The following information is to accompany my report on the Omega - Hydrocarbon Waskada property in Township 1 - Range 25 - WPM (Manitoba)

A) J. A. Dockery, 4820 - 8th Avenue S.E., Calgary, Alberta, Canada.

B) Graduated from the University of Alberta in 1951 as a B. SC. Petroleum Engineering.

C) Ten (10) years (1951-1961) experience in the Petroleum Industry.

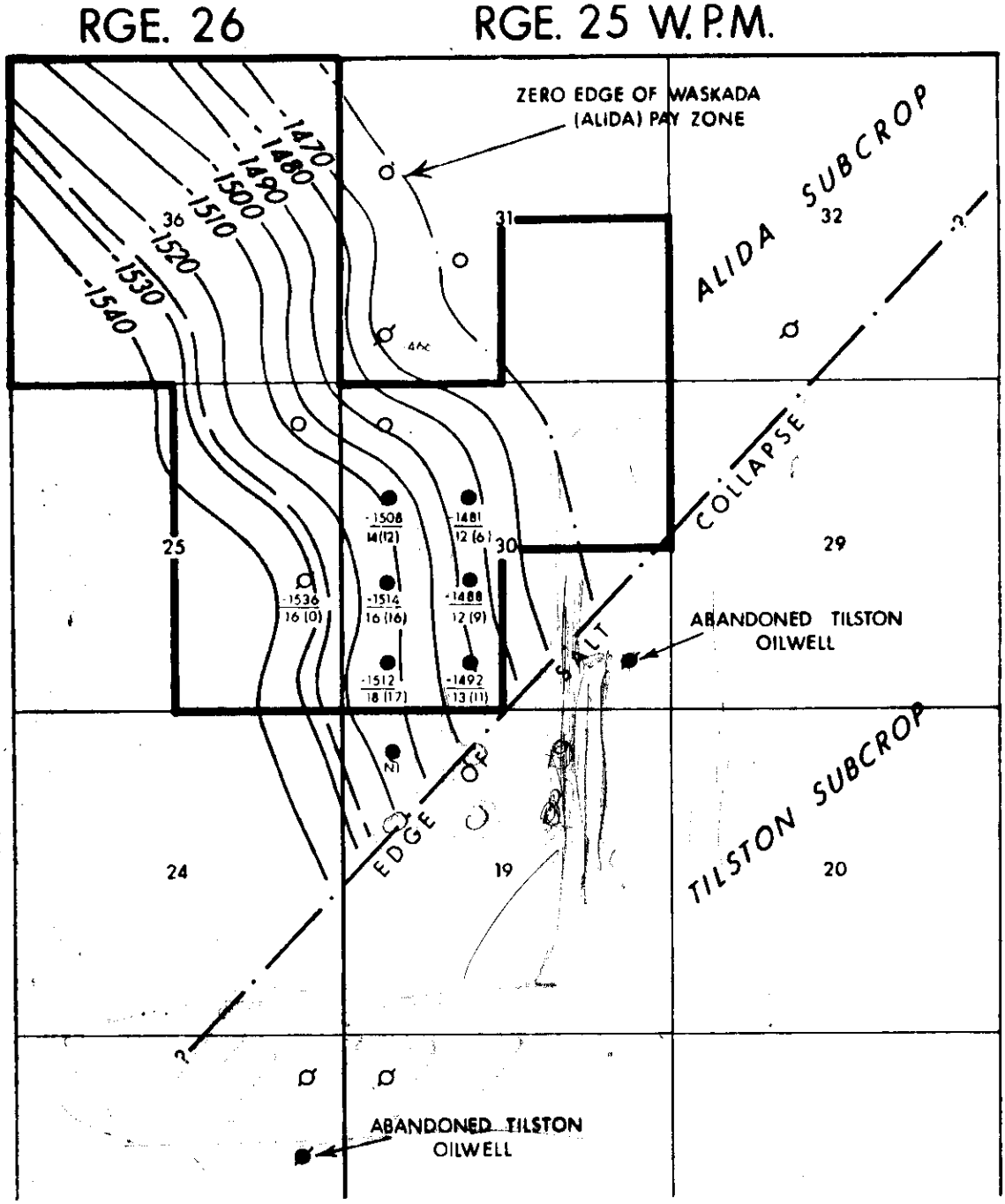
D) Seven (7) years (1961-1968) self employed in Calgary as a Consulting Petroleum Engineer.

E) Member of the Association of Professional Engineers of Alberta.

F) I have no interest in the securities of Omega - Hydrocarbons Ltd.

J. A. Dockery

J. A. Dockery
B. SC. Pet. Eng. P. Eng.



LEGEND

- OILWELL
- ABANDONED WELL
- ABANDONED OILWELL
- OMEGA HYDROCARBON ACREAGE
- NI — NO INFORMATION
- O — OMEGA HYDROCARBON LOCATIONS (PROBABLE)
- EDGE OF SALT COLLAPSE
- -1510 / 18(16) — SUBSEA DATUM BASE ALIDA PAY. GROSS PAY (NET PAY)

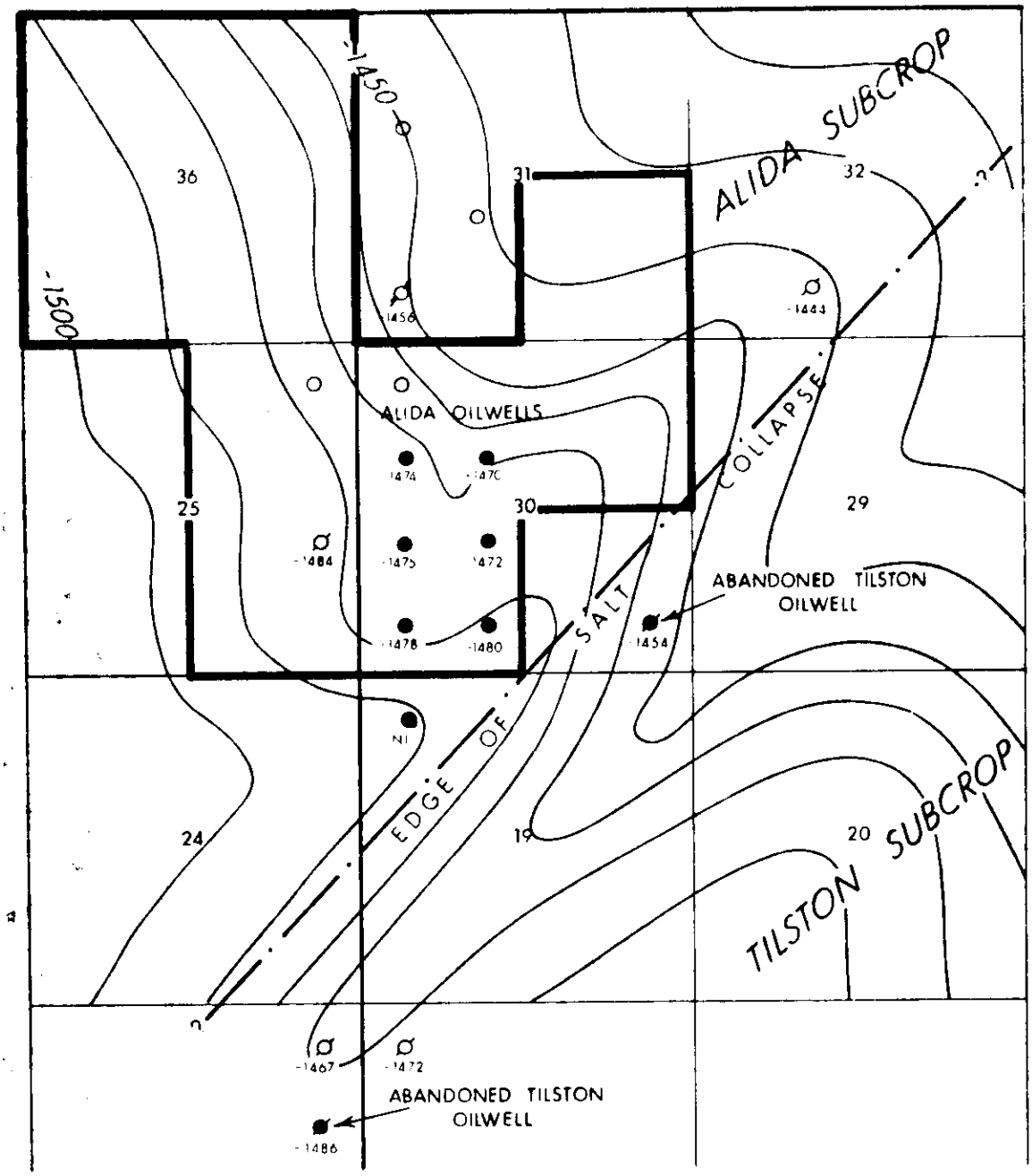
WASKADA AREA

STRUCTURE CONTOURS ON BASE OF ALIDA PAY ZONE

CONTOUR INTERVAL: 10 FEET
SCALE: 2 INCHES = 1 MILE

MAP NO. 1	JULY, 1968

RGE. 26 RGE. 25 W.P.M.



TWP. 1

LEGEND

- ● OILWELL
- ABANDONED WELL
- ABANDONED OILWELL
- OMEGA HYDROCARBON ACREAGE
- NI NO INFORMATION
- O OMEGA HYDROCARBON LOCATIONS (PROBABLE)
- EDGE OF SALT COLLAPSE

WASKADA AREA

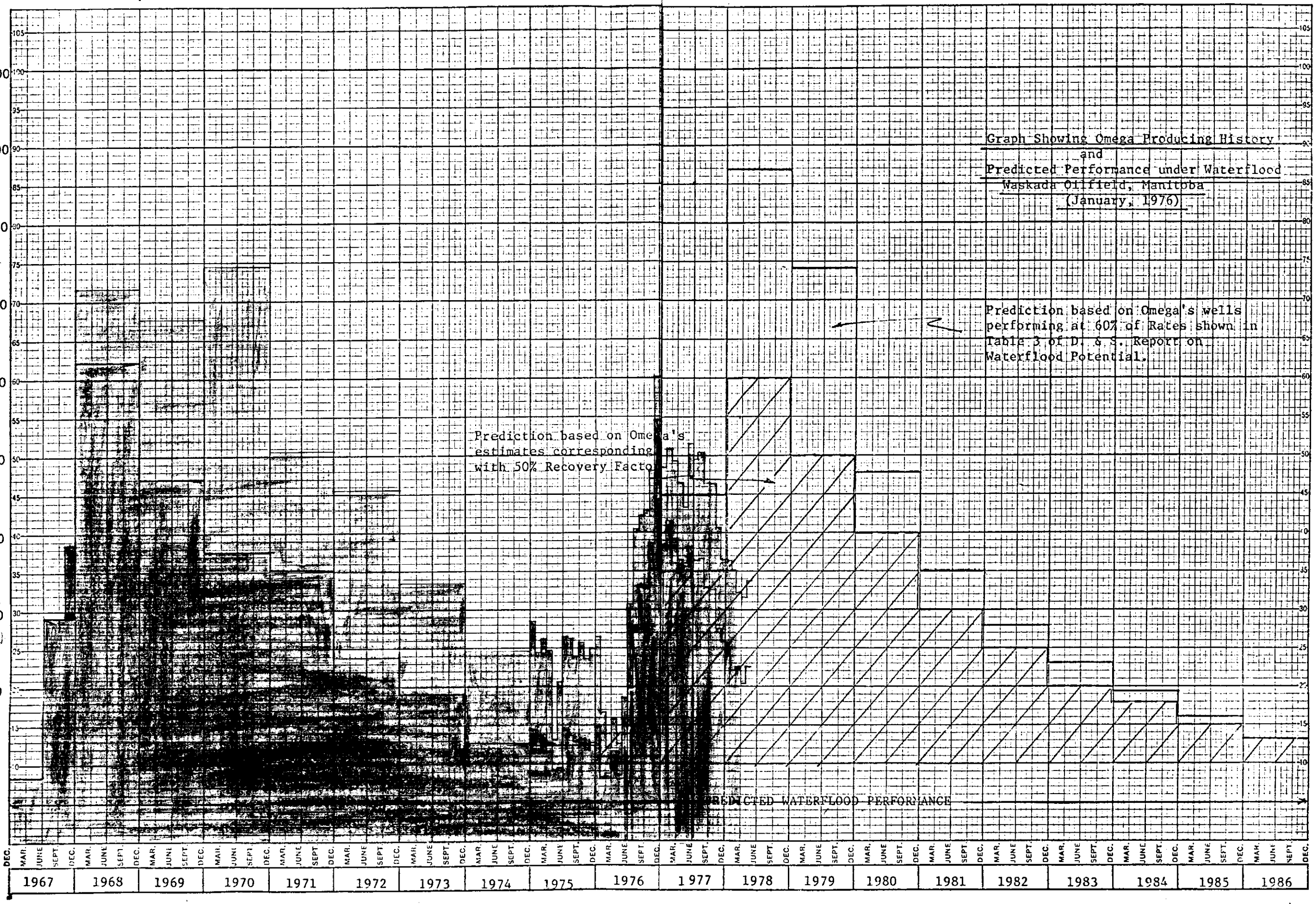
MISSISSIPPIAN
TOPOGRAPHIC CONTOURS

CONTOUR INTERVAL 10 FEET
SCALE: 2 INCHES = 1 MILE

MAP NO. 2	JULY 1968

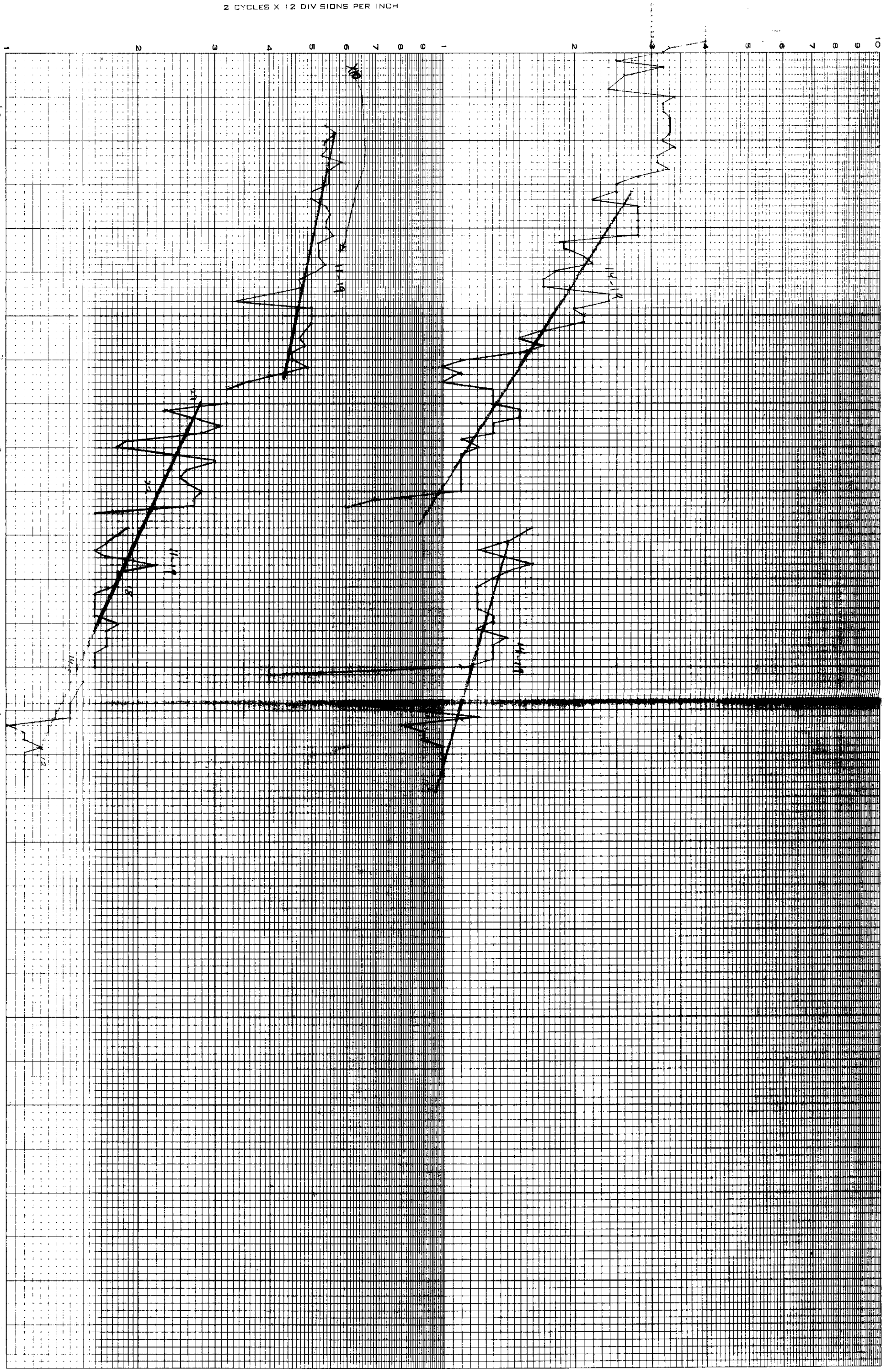
Copperhead Production, Waskada Field

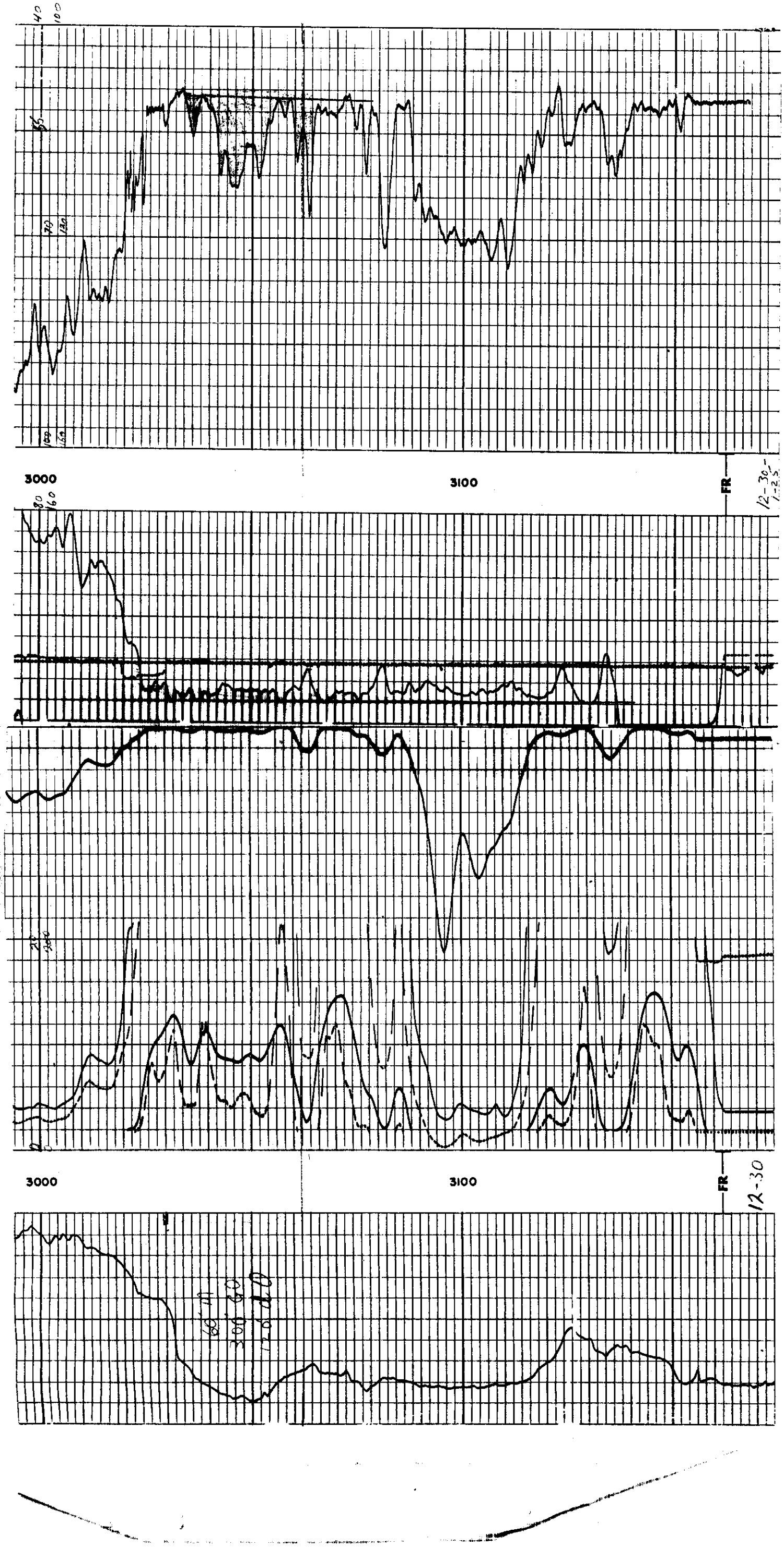
Omega's Production, (Waskada Unit - No. 1).



NO. 340D-L212 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 12 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

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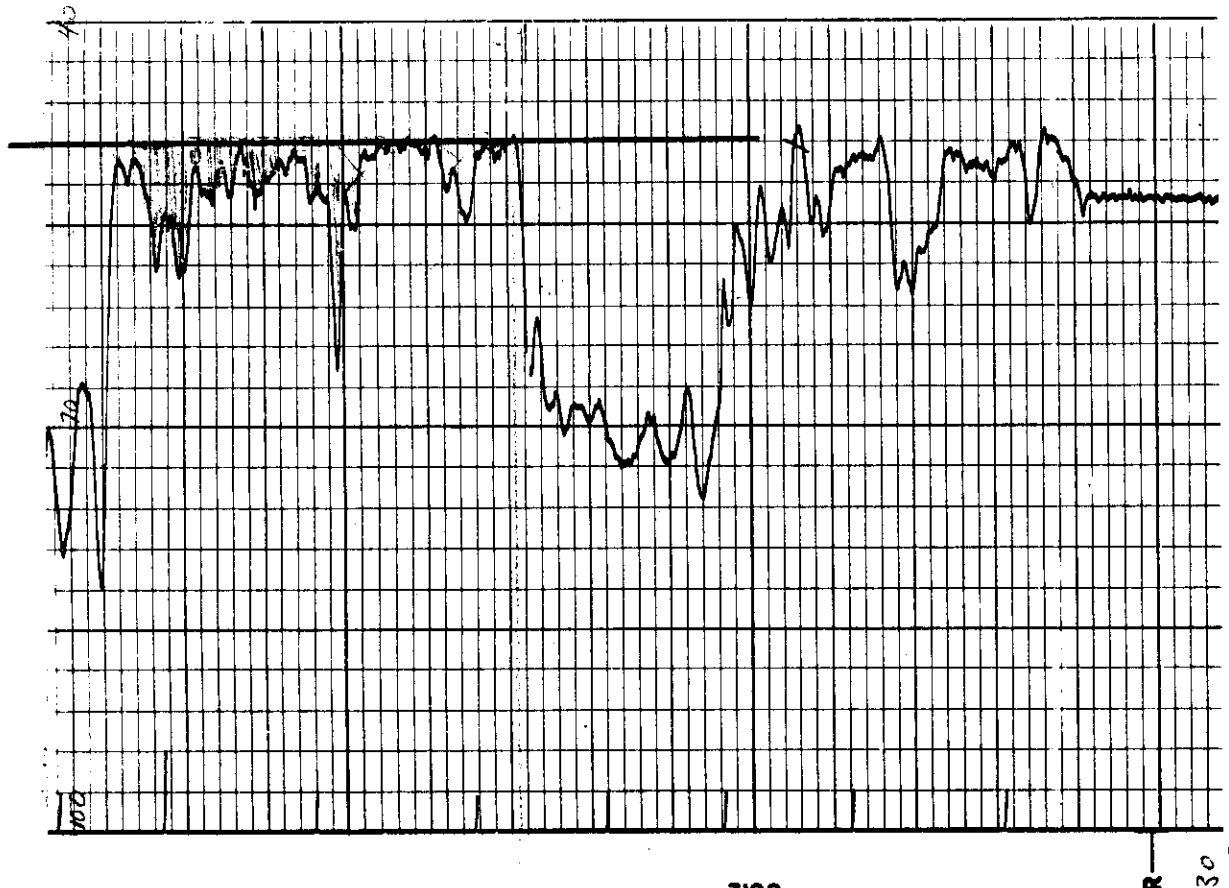
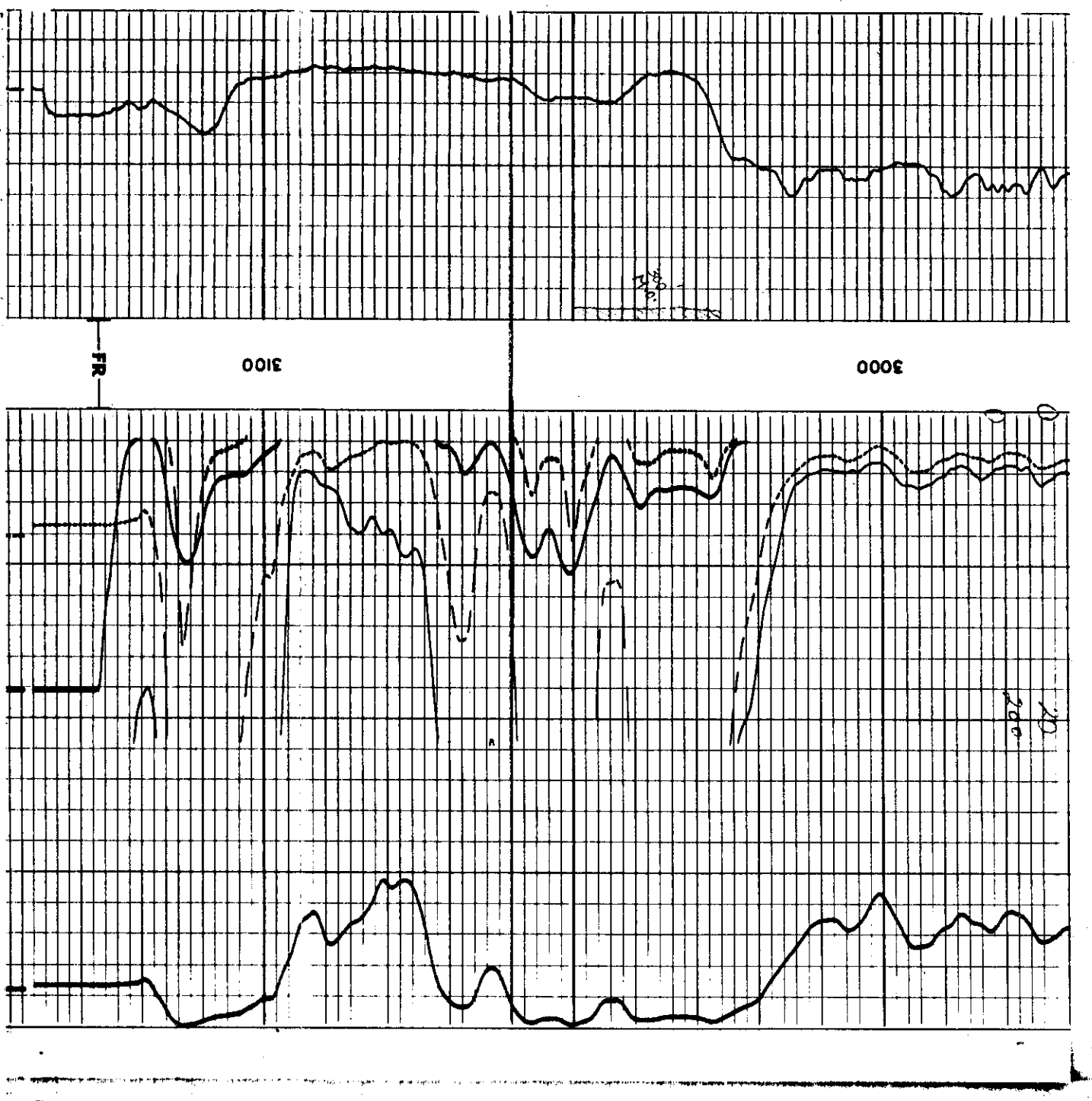
3100
FR
12-30
3000
3100
FR
12-30


3100
FR
11-30
-1-25
K.C. 1549.5
3000
3100
11-30
FR
Elev. Zero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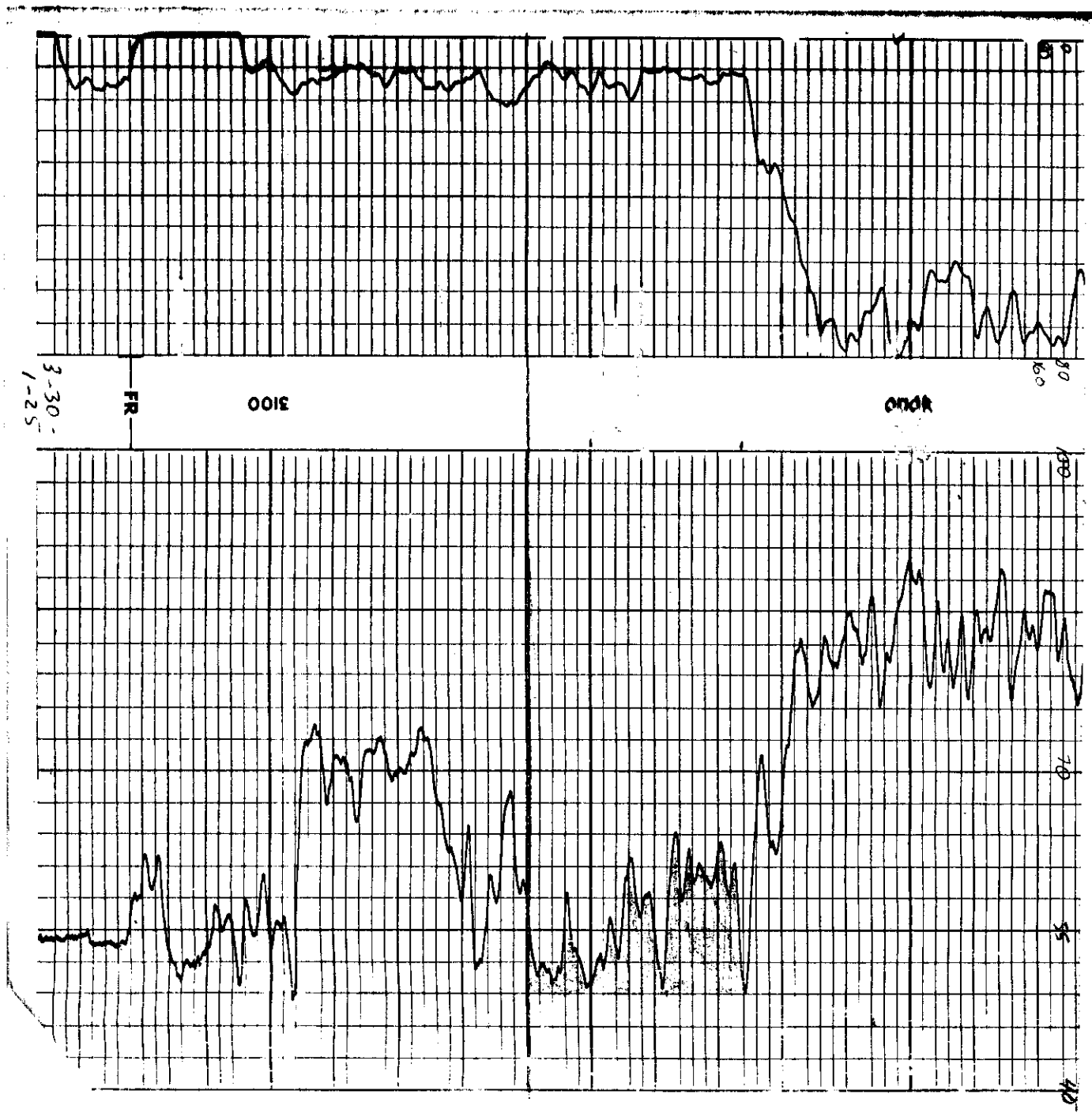
3100
3000


FR
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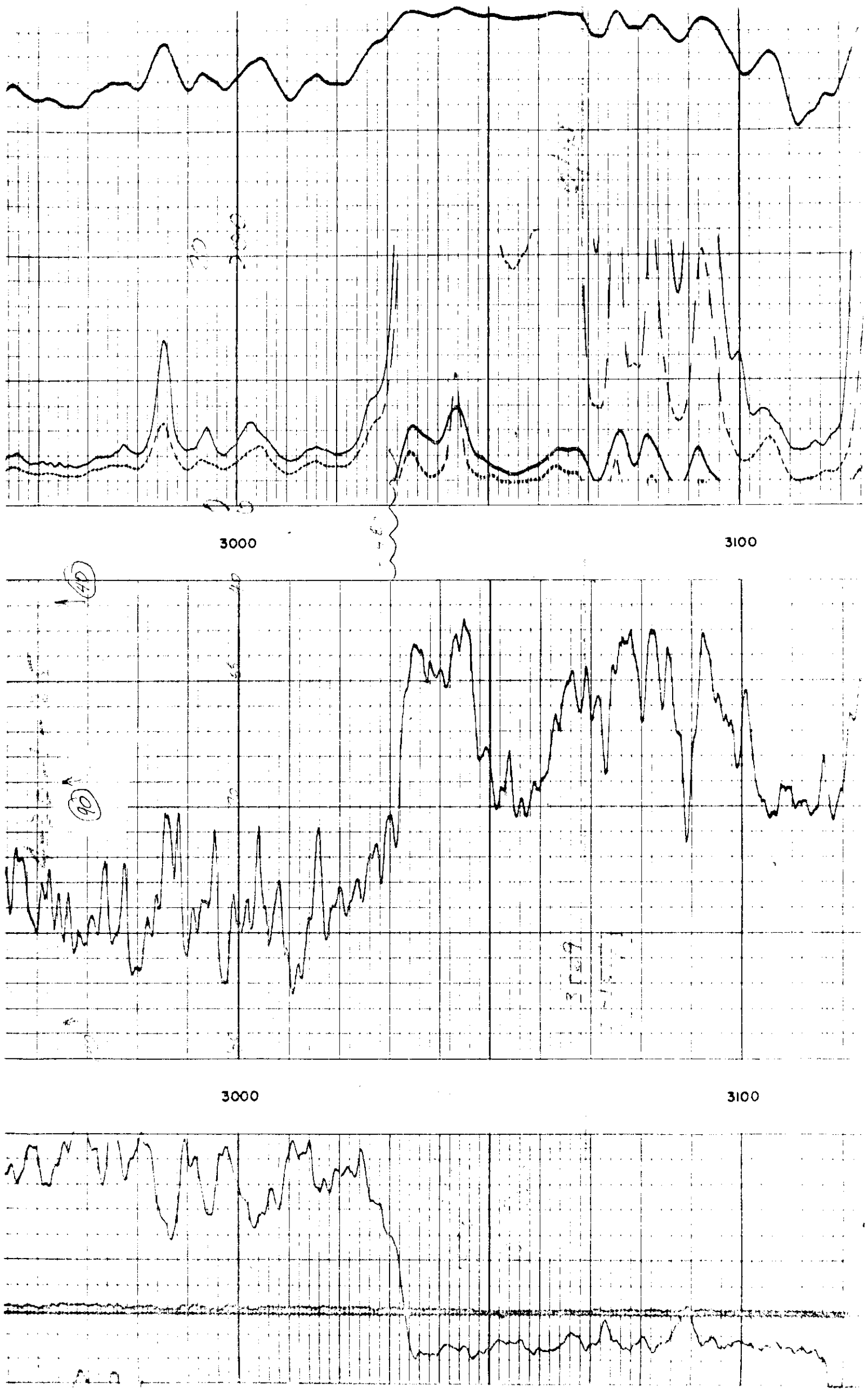
3000
3-30-
1-25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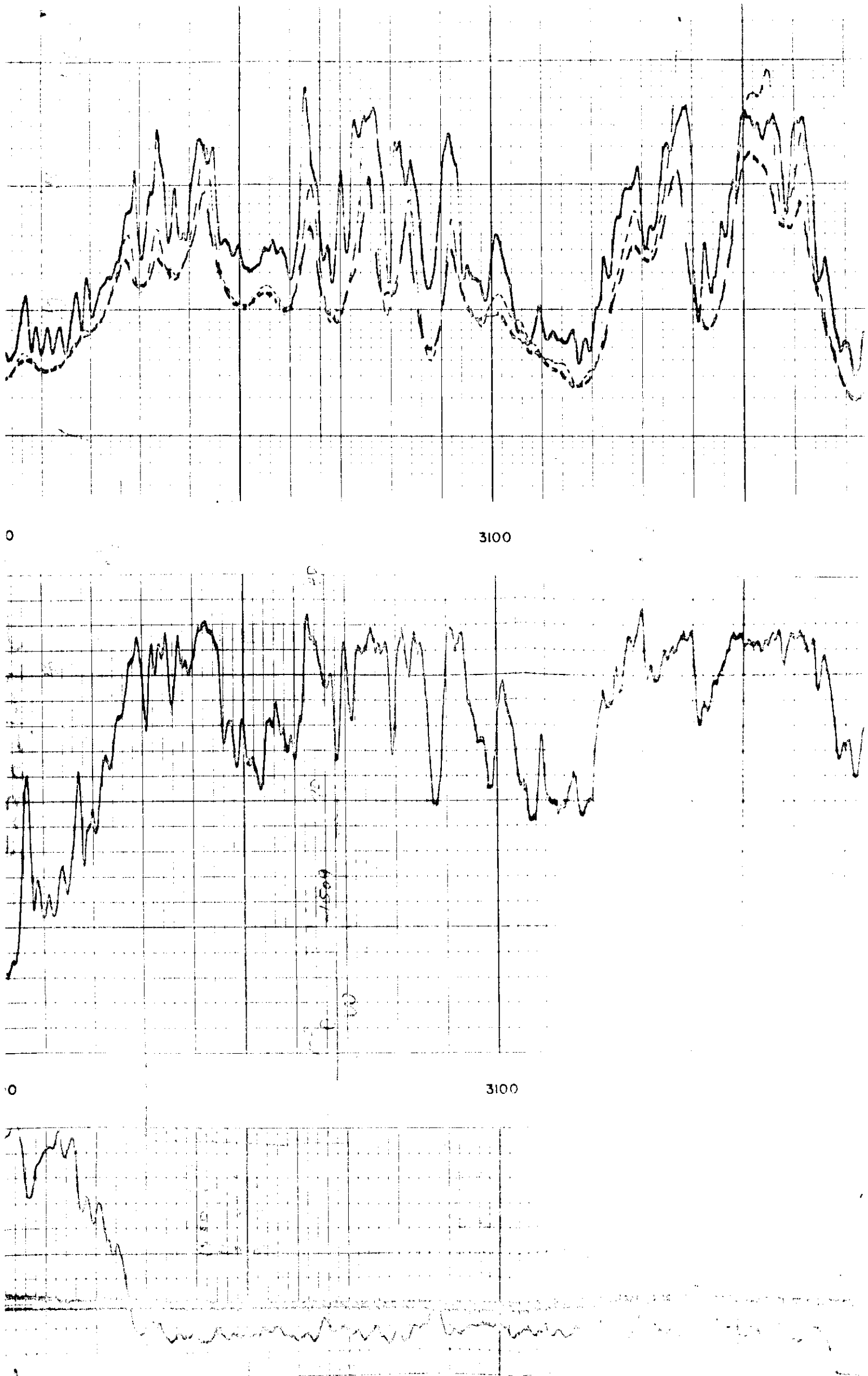
3000
3100


0
3100
0
3100

K.B. 1547.4

0
0
20
200

3000

60 OCAM
110 MCO
120 O

150 O.C.M.

3100

6-30

FR

120
240

3000

140
240
90
190
40
140

3100

FR

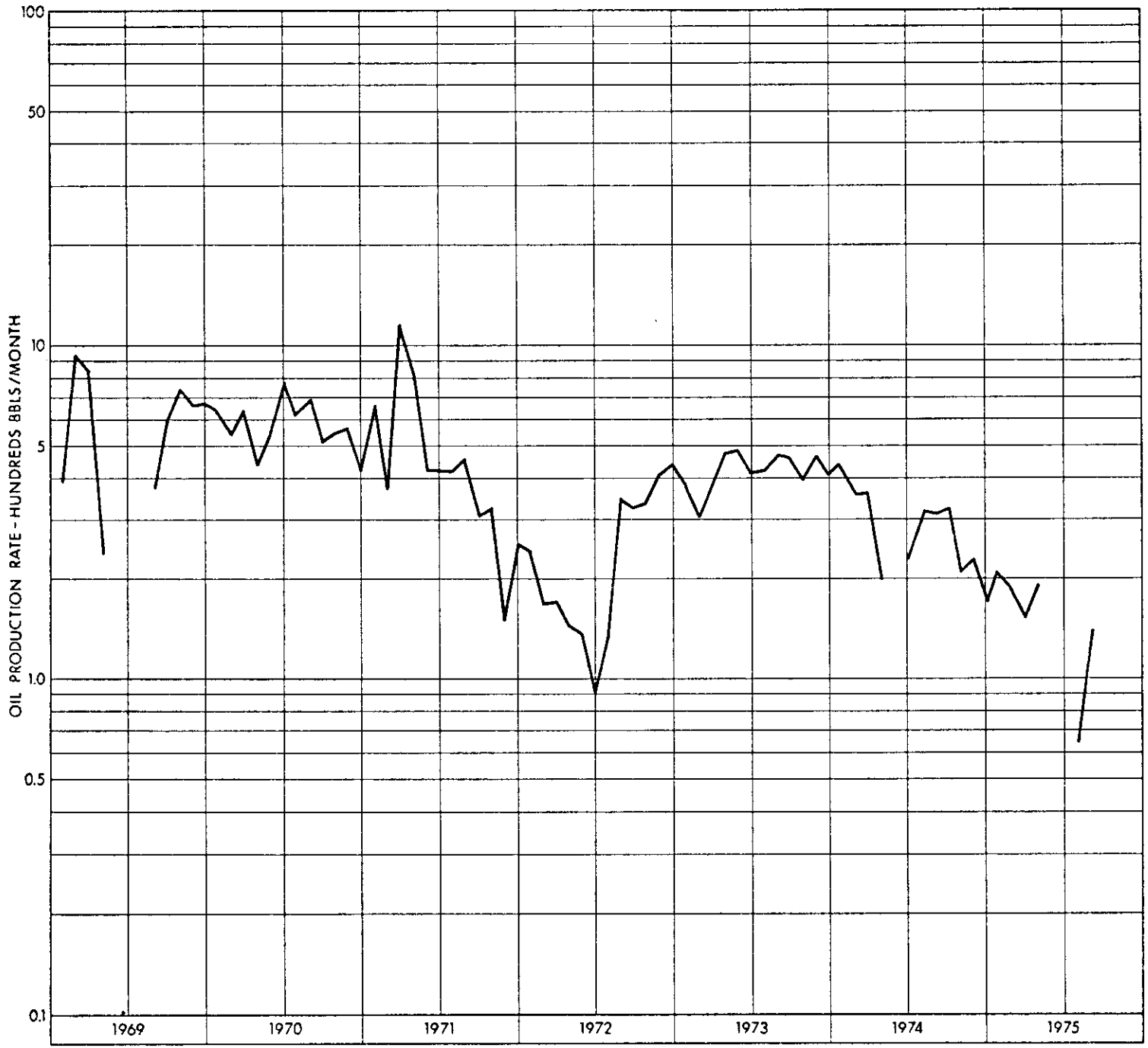
6-30-
1-25

EXHIBIT No. 3

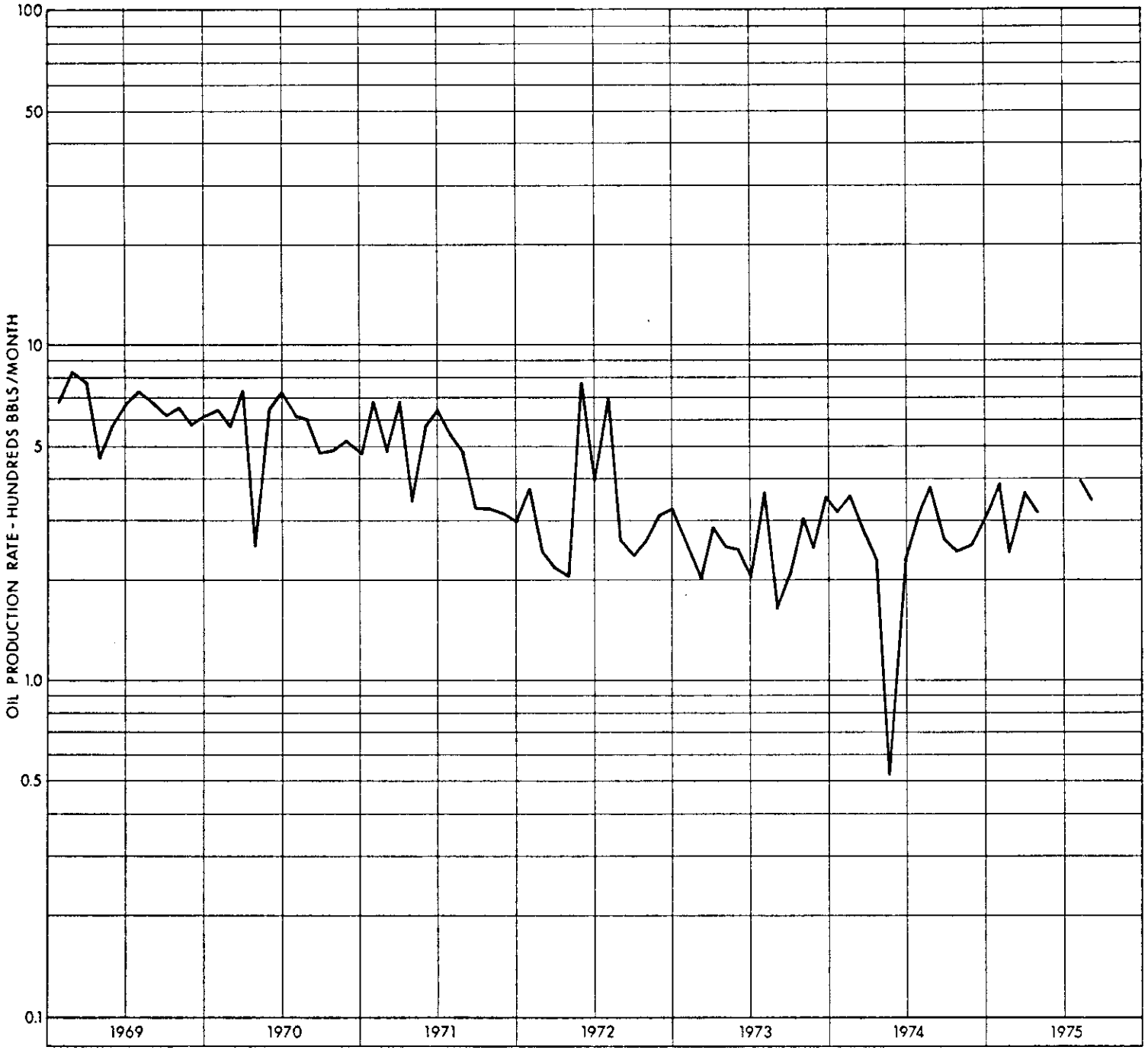
WASKADA POOL

WELL PRODUCTION PERFORMANCE

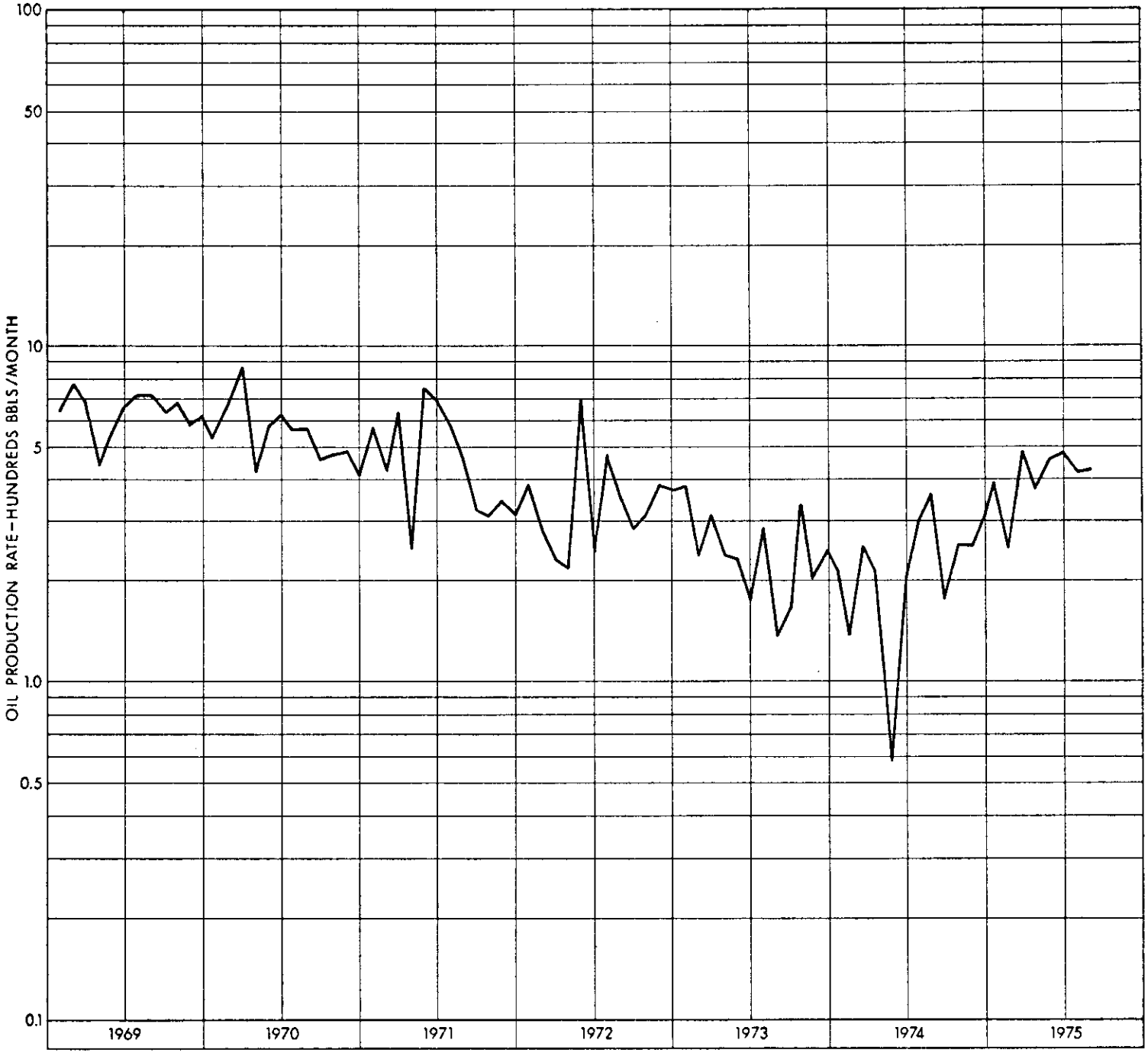
12-30-1-25WPM
PRODUCTION HISTORY
WASKADA



3-30-1-25WPM
PRODUCTION HISTORY
WASKADA

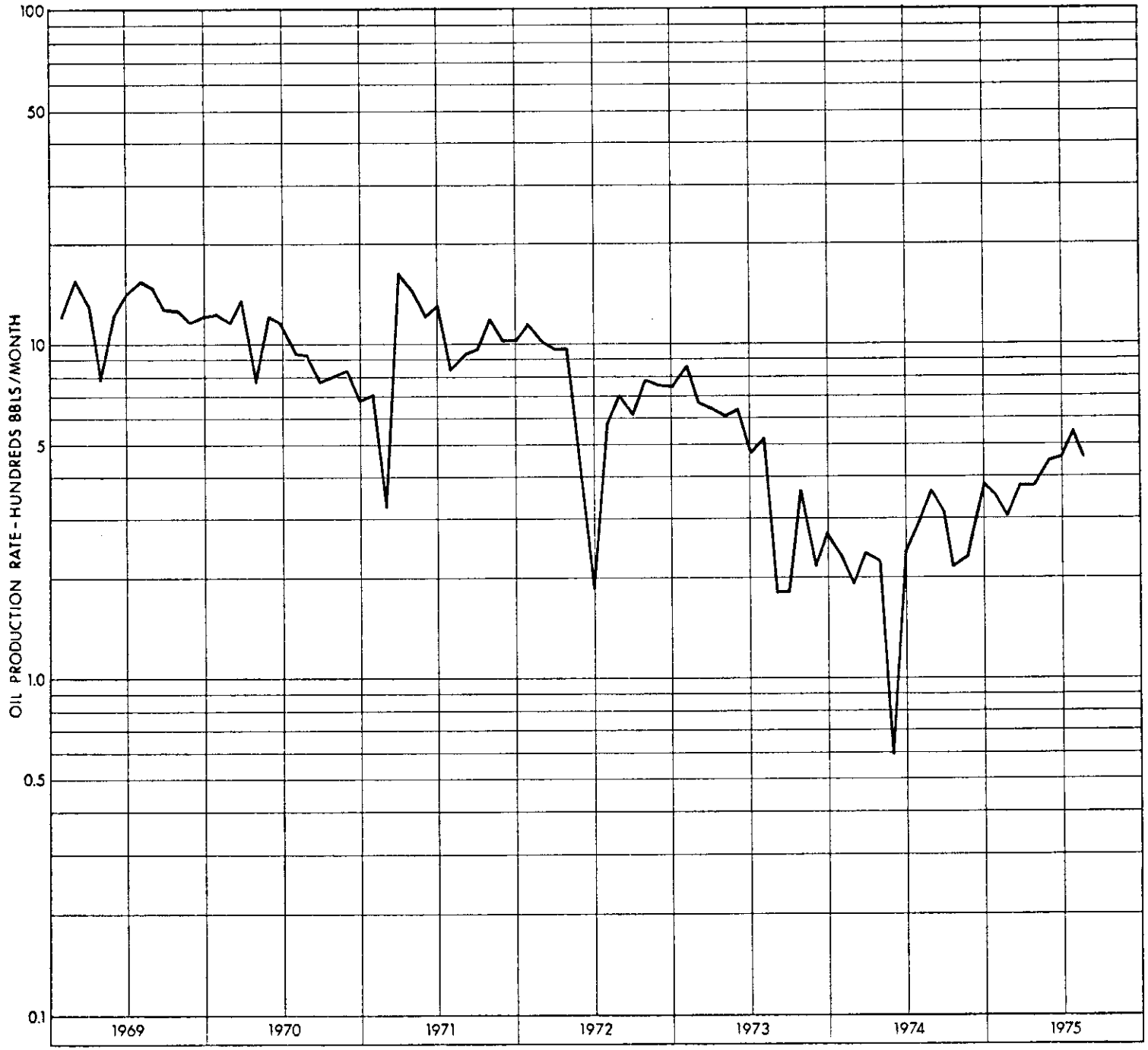


4-30-1-25WPM
PRODUCTION HISTORY
WASKADA

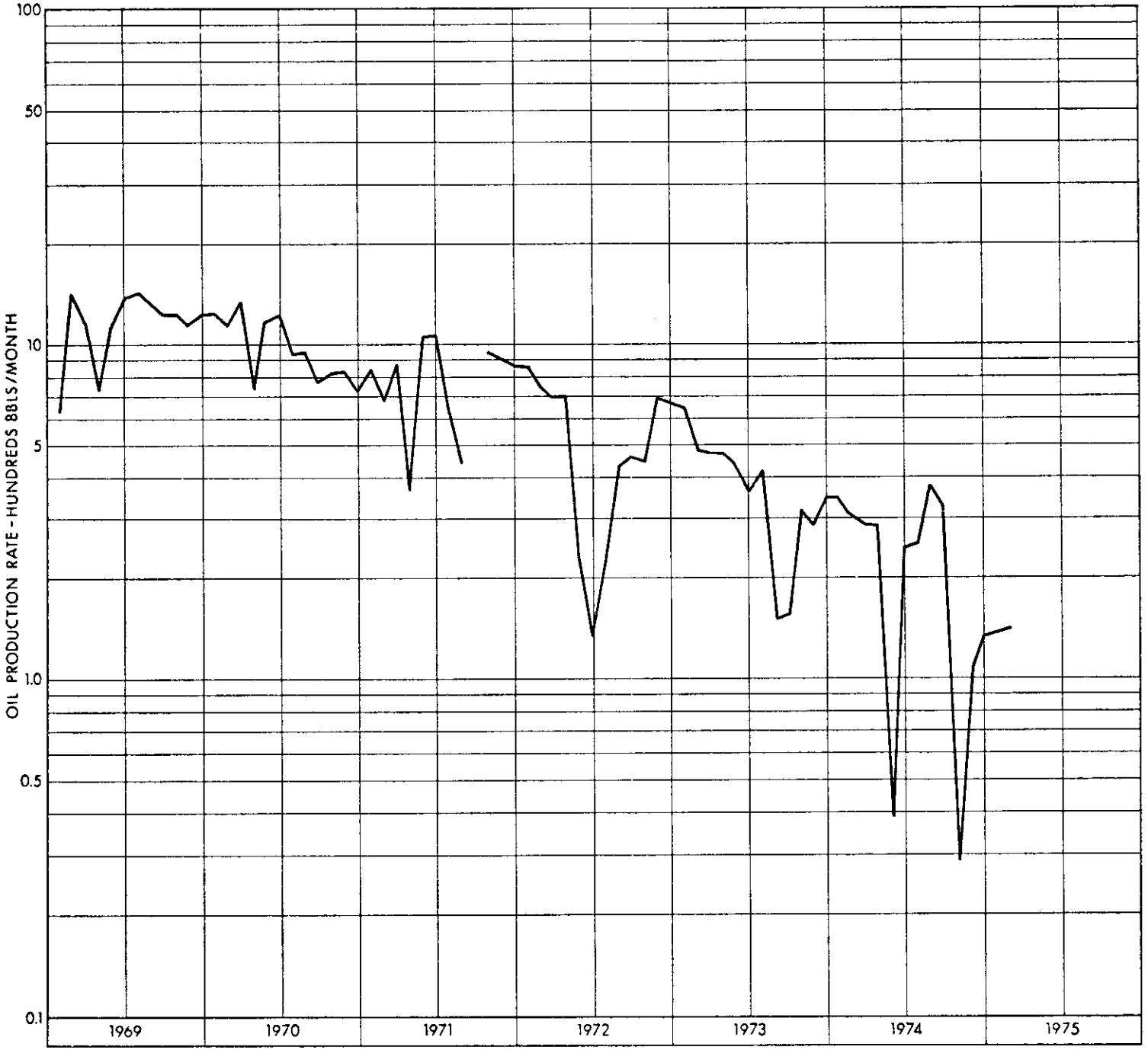


74-2151

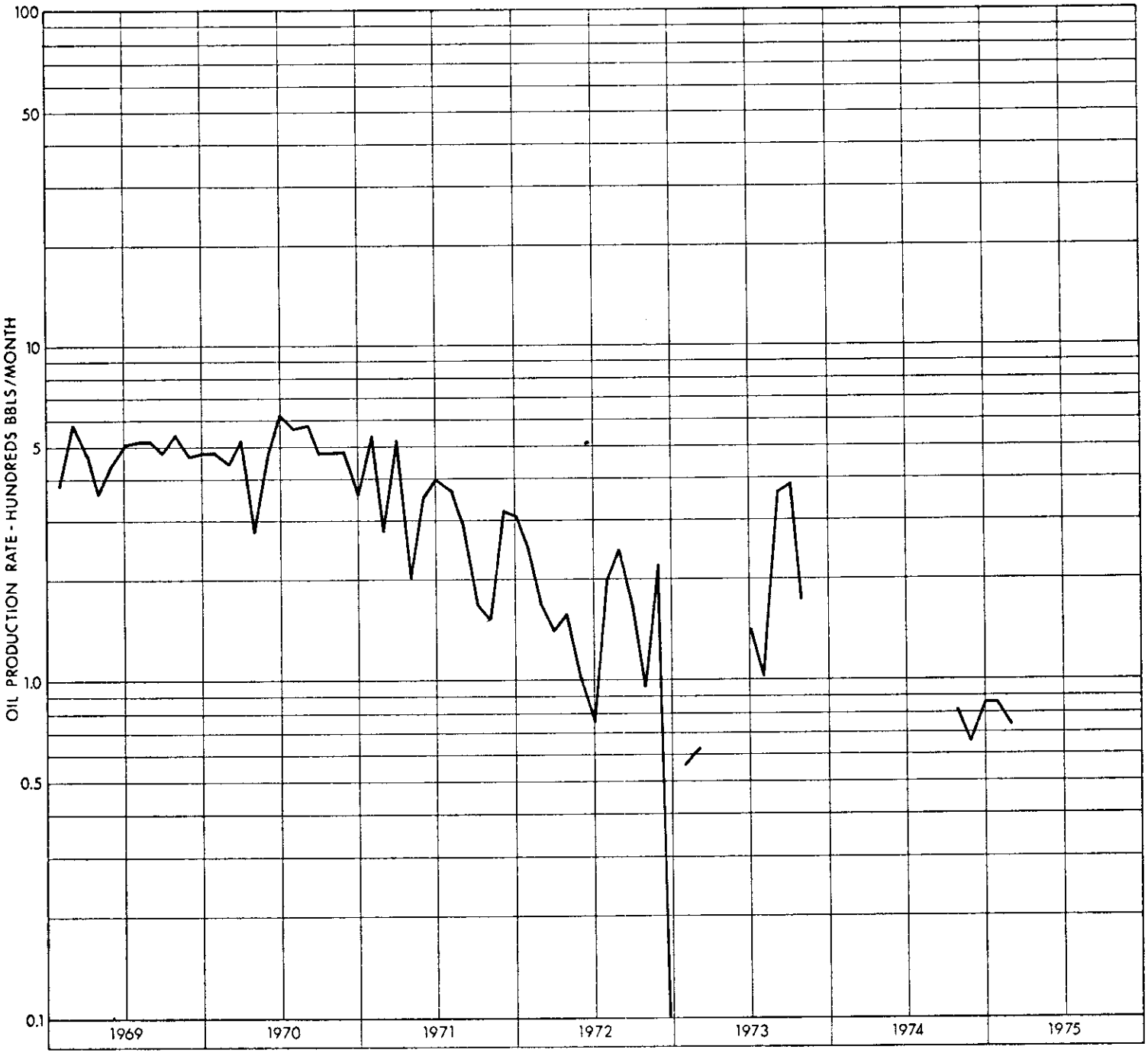
5-30-1-25 WPM
PRODUCTION HISTORY
WASKADA



6-30-1-25 WPM
PRODUCTION HISTORY
WASKADA



11-30-1-25WPM
PRODUCTION HISTORY
WASKADA



WASKADA FIELD - RESERVOIR FACTORS

	3-30-1-25	4-30-1-25	5-30-1-25	6-30-1-25	11-30-1-25	12-30-1-25
Zone	3027 - 3040	3046 - 3064	3046 - 3062	3022 - 3034	3026 - 3038	3041 - 3055
Pay T	11'	15'	15.9'	12.0'	6'	10.5'
Average Porosity	11.5%	17.9%	14.3%	9.1%	9.8%	11.9%
Porosity Range	9.0-15.3%	8-23.3%	7.6-21%	6.6-15.5%	6.4-14.2%	5.8-13.9%
Recovery Factor	30%	25%	25%	30%	30%	30%
F. V. Factor	1.150	1.15	1.15	1.15	1.15	1.15
Connate Water	35%	35%	35%	35%	35%	35%
Ave. Permeability	2.2 md	45.2 md	41.2 md	5.4 md	4.85 md	41.8 md
Estimated Recoverable Oil (bbls.)	66,000	117,000	99,000	57,000	30,000	65,000

59

60

Well 8-25-1-26 - abandoned

Zone tested: 3068' - 3084' (wet)
Core characteristics:-Similar to 4-30 and 5-30-1-25

Well 4-31-1-25 - abandoned

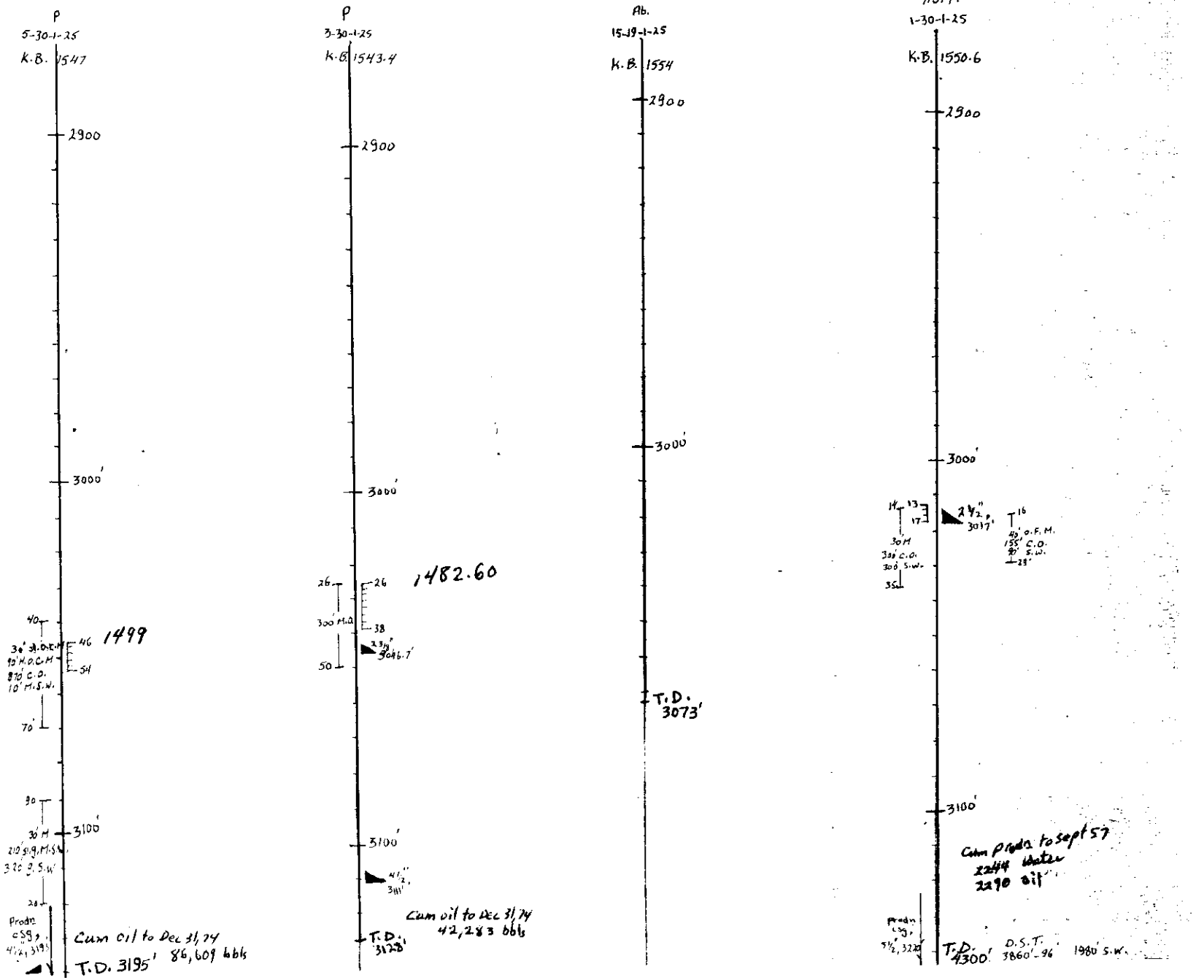
Zone: 3004-3014 (zone infilled with anhydrite)

The average reservoir parameters employed by Omega Hydrocarbons, in the Waskada Field, are as follows:

Porosity	12.6 percent
Net Pay	12.0 feet
Shrinkage	0.87
Water Saturation	35.0%
Recovery Factor	25.0%

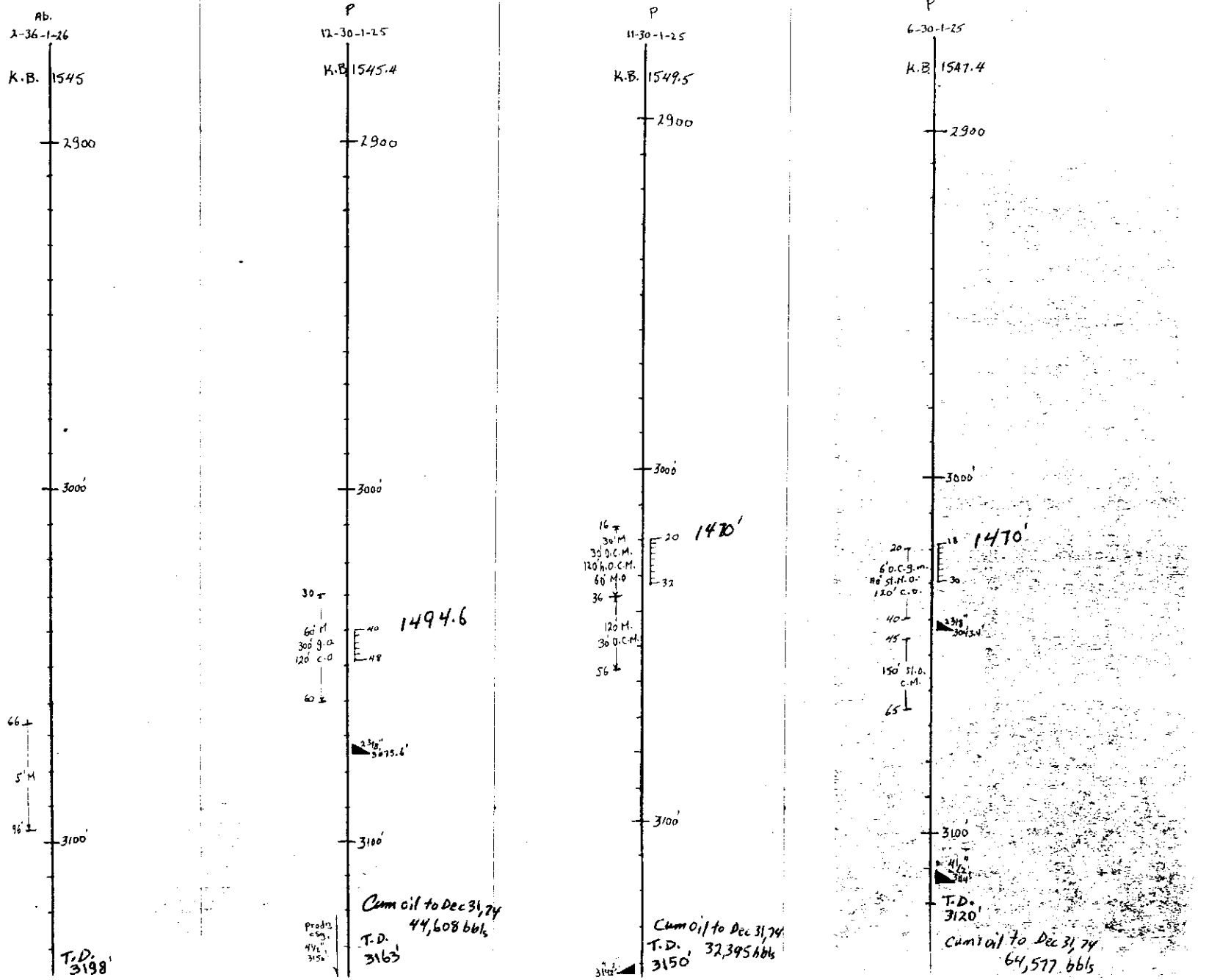
Structural Cross-section, Waskada

(4)



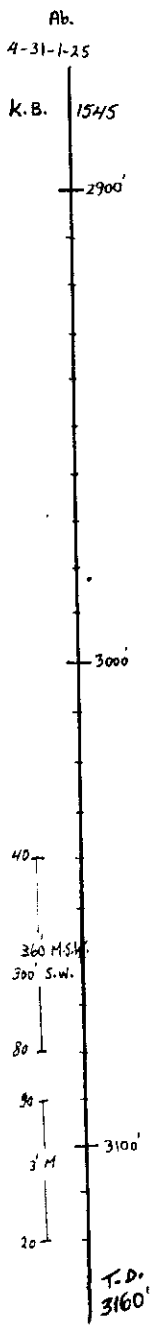
Structural Cross-Section, Waskada

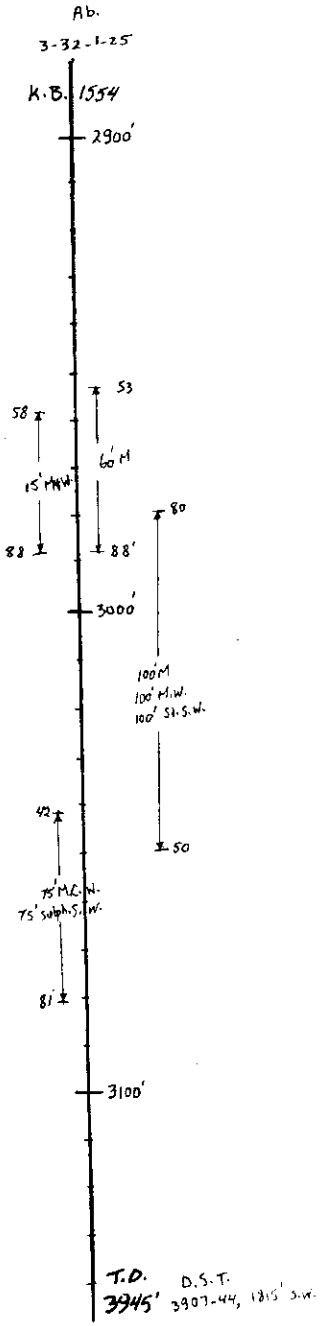
(5)



Structural Cross-Section, Waskada

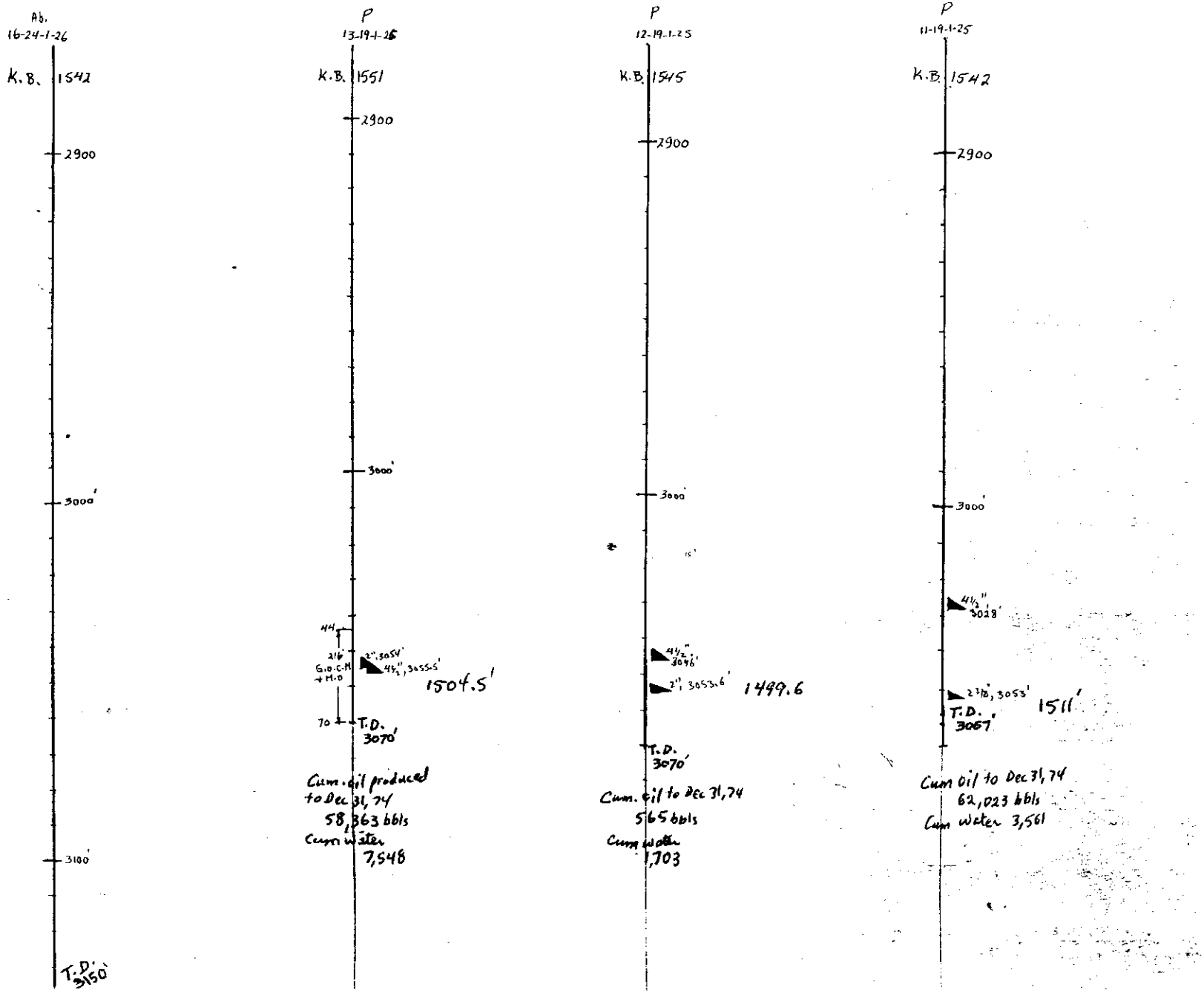
(6)





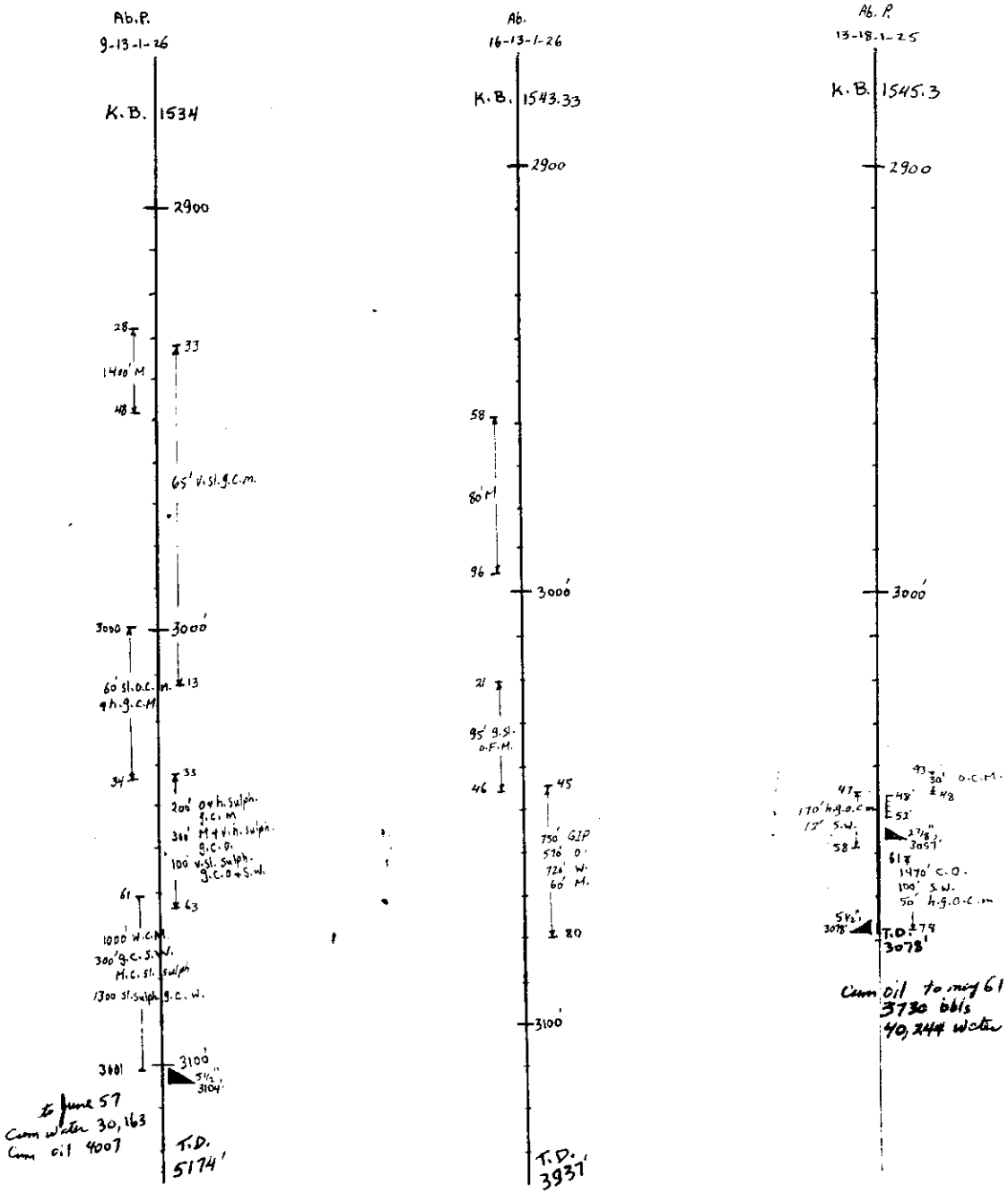
Structural Cross-Section, Waskada

(2)

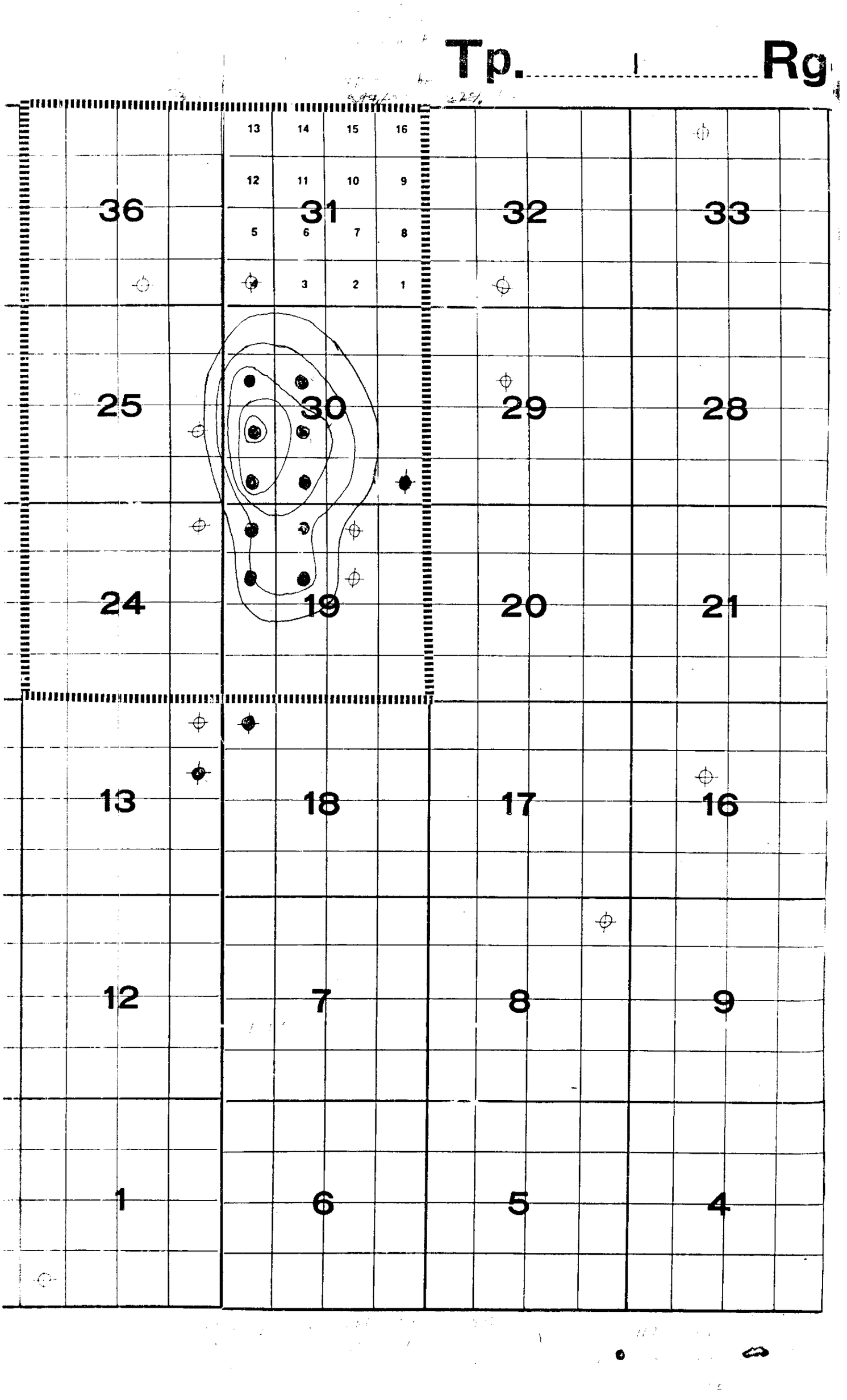


Structural Cross-Section, Waskada

(1)



Tp. 1 Rg


13 14 15 16
12 11 10 9
5 6 7 8
3 2 1
36
31
32
33
25
30
29
28
24
19
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21
13
18
17
16
12
7
8
9
1
6
5
4

WASKADA FIELD.

Field - Waskada
Zone - Mississippian (Mission Canyon)
Spacing - 40 acre
Well OP/can Dec 31/69 = 9.
Area Pool Est acres. - 450 acres
" " Dev. - 360
Pay (Ave.) - 14 ft
Oil Rock Vol (Developed) - 5040 acre ft

Porosity (Ave.) - 10.5 %
Shrinkage - 0.87
Connate water - 35
Recovery est. - 25
Original O-I-P (STB) 2.86 million
Original Recov. (primary) - 715,000 bbls. (approx.)
Production to Dec 31/69 - 191,612. bbls
Remaining Recoverable - 523,000 (approx.)
well MPR = 50
Discovery date - Jan ~~25~~ 4, 1967. on production Jan 25, 1967.
Discovery well - Omega Waskada 11-30-1-25
Location LSD 11 - Sec. 30 - Twp 1 - Rge 25 WPM.
Ave well depth - 3100'
Reservoir Temp °F - 105
Virgin Press PSIG - 1352
Reservoir drive - Sol. Gas & water
Permeability Ave. 24 md.

CORE DESCRIPTION

Core #1 3034 - 3067' Rec. 28.0'

Coring times: 10-7-5-5-5-5-5-5-5-5-4-5-5-6-5-5-6-5-4-4-8-6-7-6-7-7-9-8-9-8-9-7-6.

1.0' Dolomite, buff to light tan, micro-X'lline, anhydrite, dense and tight.

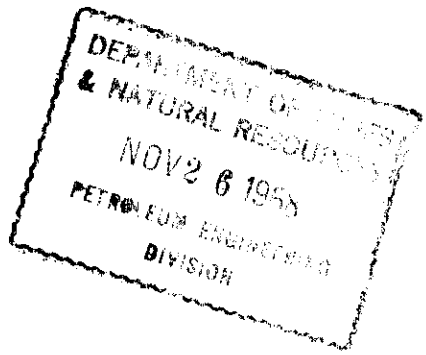
6.0' Limestone, buff tan, fine to medium x'lline, fossiliferous, scattered anhydrite and gypsum crystals throughout, poor to fair scattered porosity with fair oil staining. Some short tension cracks.

8.1' Limestone, tan coarsely x'lline, fossiliferous with numerous crinoid fragments and oolites, fair to locally good porosity with good oil staining throughout. Some scattered small gypsum blebs in upper 4.0'.

2.1' Dolomite, buff to grey, argillaceous, dense and tight with lower 10" being anhydrite.

4.4' Dolomite, pinkish-grey, micro-X'lline argillaceous, anhydritic, dense and tight. Some tight vert, fracts.

6.4' Anhydrite, blue-grey, massive, dense.



COPPERHEAD TRI-WEST WASKADA #14-19-1-25

COPPERHEAD TRI-WEST
WASKADA 14-19-1-25 WPM.

TABLE OF FORMATIONS

Kelly Bushing		
Boyne (First White Specks)	1240	+ 1551
Favel (Second White Specks)	1576	+ 311
Blairmore	1993	- 25
Jurassic - Undifferentiated	2160	- 442
- Watrous Anhydrite	2795	- 609
- Basal Red Beds	2910	- 1244
Mississippian - MC-3	3031	- 1359
- Top of Porosity	3035	- 1480
- Base of Porosity	3049	- 1484
Total Depth	3067	- 1498
		- 1516

Dec 31, 1969

Well		φ	h	S_o	OIP	25% REC	Cum 1969	Remarks
	9	10	30	.65	635,382	159,000		
	1				180,017	45 000		
			11		232,189	58,000		
			11	.65	239,629	60,000		
			18	.65	555,555	139,000		
			17	.65	449 200	112,000		
			11	.65	175,300	49,000		
					82 [illegible]	(40,000) 21.000		
			6		232,368	58.000		
			12	65	2782 87	715 000	192,000	
						235 000		

NO. 4171 TENTH YEARS BY MONTHS X 10 DIVISIONS.

PRODUCTION BARRELS/MONTH STO

8000
7000
6000
5000
4000
3000
2000
1000

Graph Showing Omega Producing History
and
Predicted Performance under Waterflood
Waskada Oilfield, Manitoba
(January, 1976)

Prediction based on Omega's wells performing at 60% of Rates shown in Table 3 of D. & S. Report on Waterflood Potential.

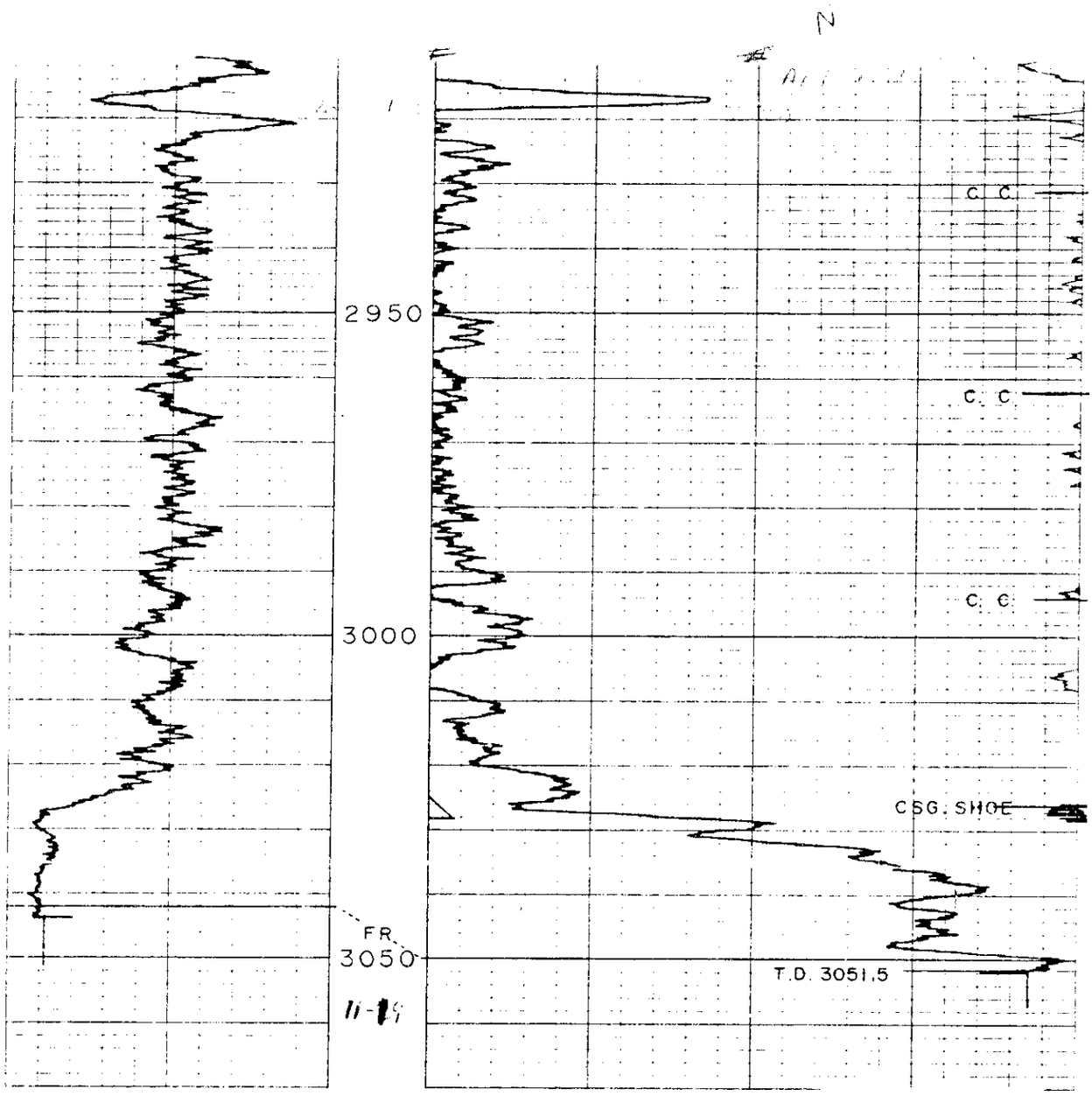
Prediction based on Omega's estimates corresponding with 50% Recovery Factor

PRODUCTION

PREDICTED WATERFLOOD PERFORMANCE

DEC. MAR. JUNE SEPT. DEC.

1967 1968 1969 1970 1971 1972 1973 1974 1975 976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986



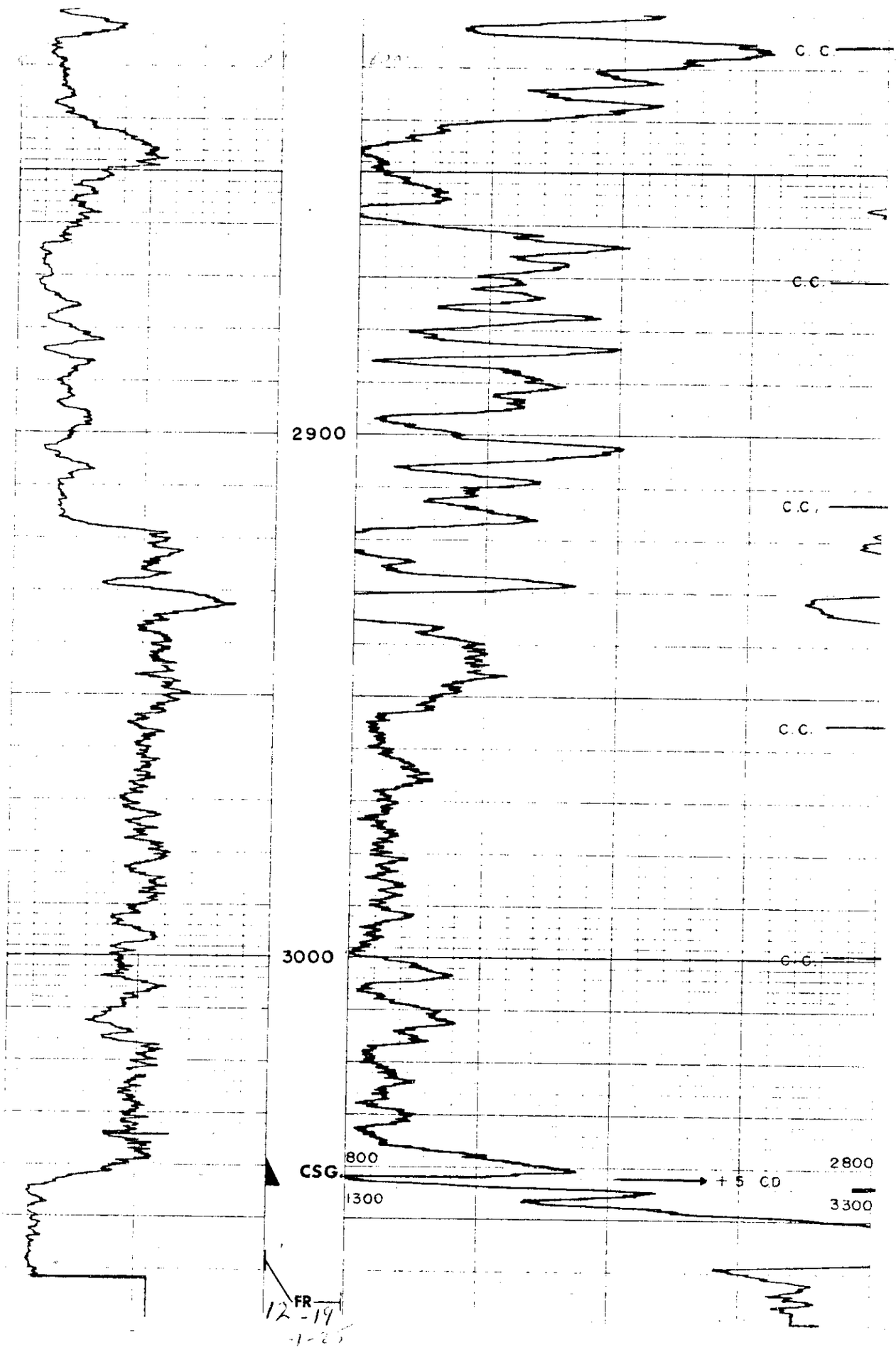
FILE NO. 135519

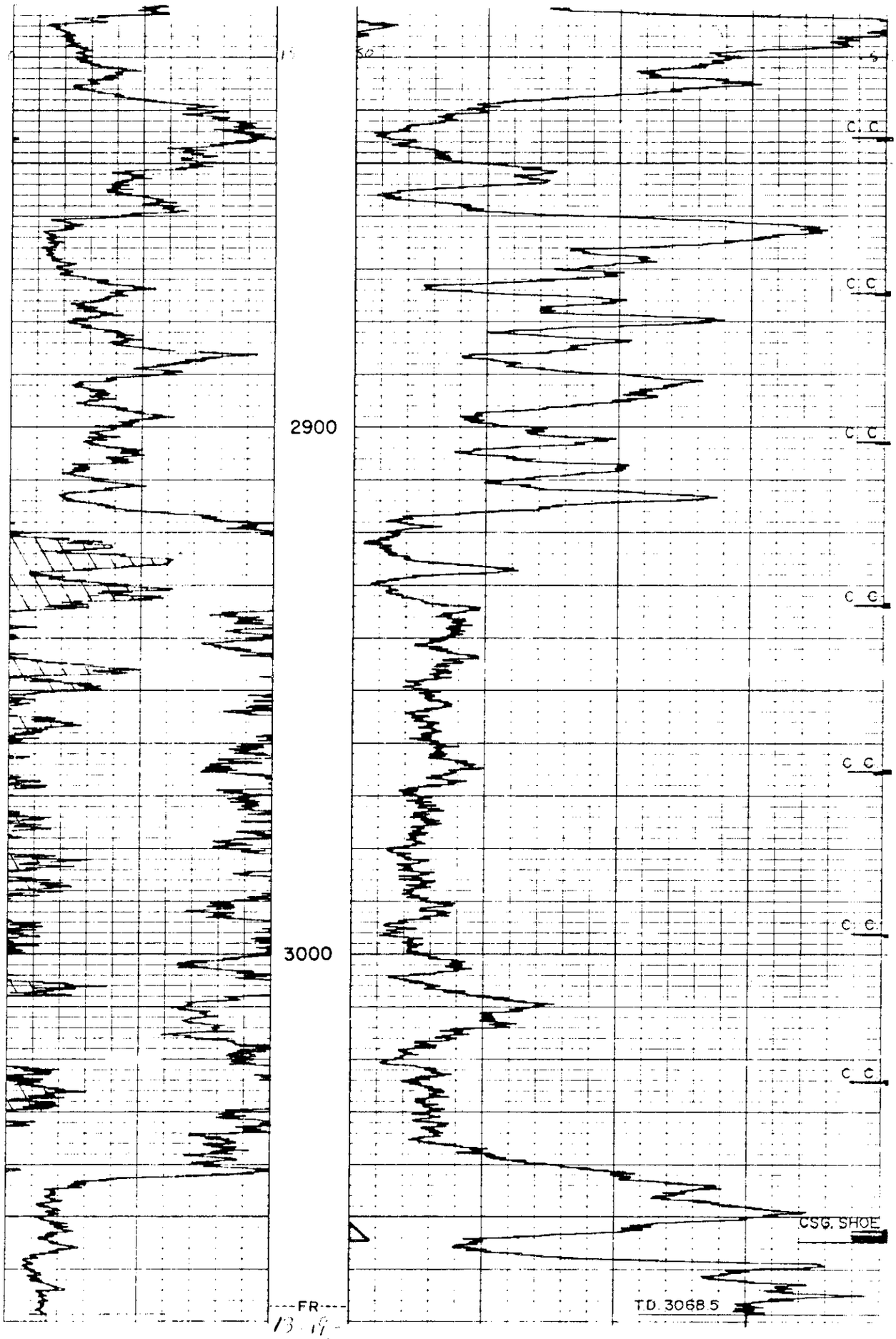
NOTE: Driller depth 3067'.

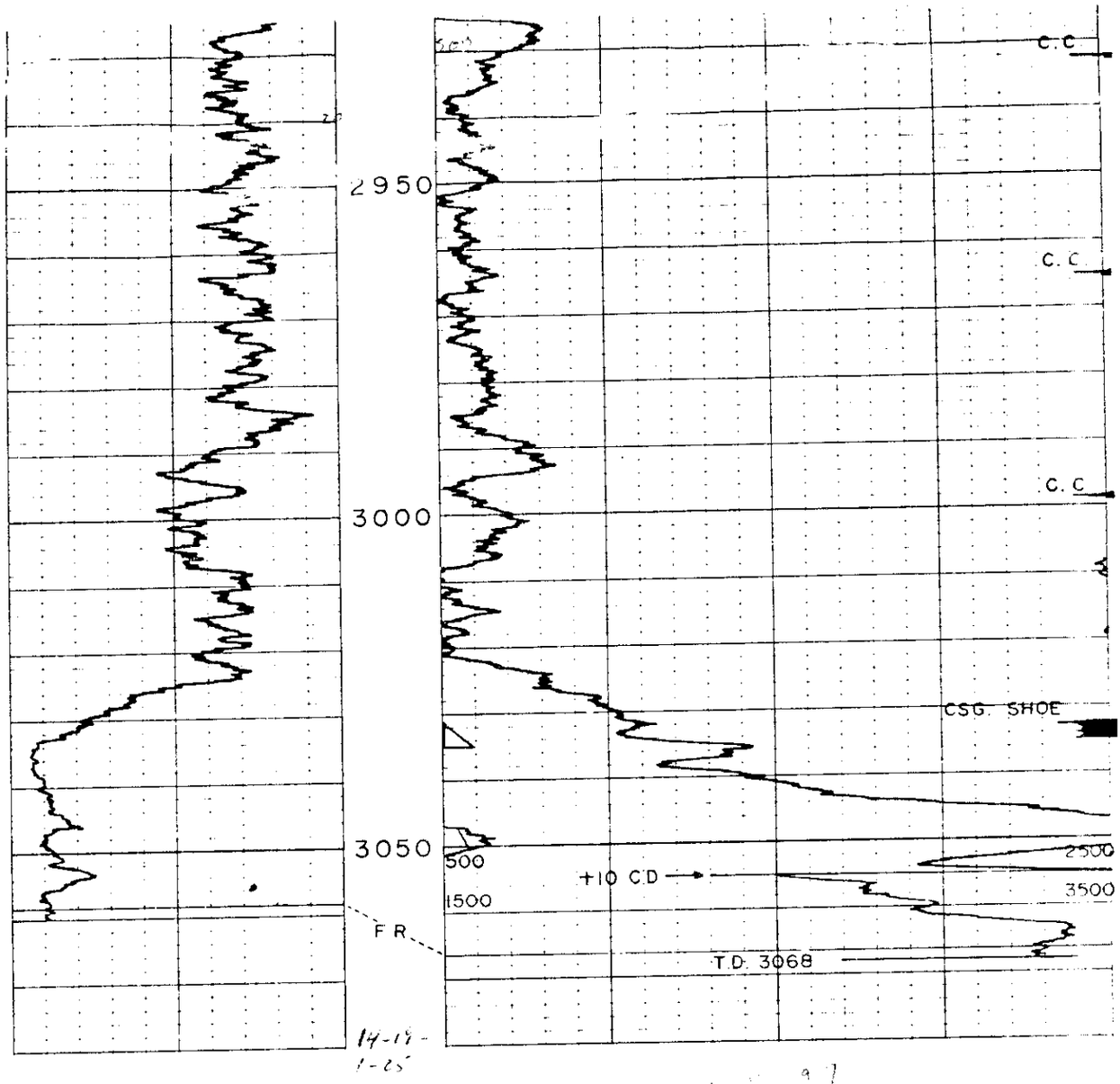
Log could not reach TD due to hole fillup.

Actual cored depth 3032' - 3067'.

Core recovered and analysed 35'.


C. C.
C.C.
2900
C.C.
C.C.
3000
C.C.
800
CSG.
1300
+ 5 CD
2800
3300
FR
12-19


2900
3000
C C
C C
C C
C C
C C
C C
C C
CSG. SHOE
T.D. 3068.5
FR


2950
3000
3050
C. C
C. C
C. C
CSG. SHOE
500
1500
+10 C.D
2500
3500
T.D. 3068
F R
14-19-
1-25

Log Evaluation Sheet

Well Name & Location 3-30-1-25 K.B. 1543.4 Date Dec. 10, 75

K B. By Sam

Formation Alida Pay = 11' Rw @ Form. temp

Source of Rw ✓

Interval	Footage	Lith.	Δt	Δtma	ϕ_s	PB	ϕ_D	ϕ_{ft}	Mud Sample	ϕ_{GR}	Rt	Sw
-1483.6												
(1483.6) 3027 - 3028	1	L.S.	62		10.5			10.5				
3028 - 3031	3	L.S.	65		12.5			37.5				
3031 - 3034	3	L.S.	60		9.0			27.0		ϕ=10.2		
3034 - 3036	2	L.S.	59		8.0			16.0				
3036 - 3038	2	L.S.	62		10.5			21.0				
											112.2	

Log Evaluation Sheet

Well Name & Location 4-30-1-25 K.B. 1551.4 Date Dec. 10, 75

K B. By Sam

Formation Alida R_w @ form. temp

pay = 16' Source of R_w

Interval	Footage	Lith.	Δt	Δt_m	ϕ_s	PB	ϕ_D	ϕ_{ft}	Mud Sep.	ϕ_{GR}	R_t	Sw
(1495.6) 3047 - 3049 (-1495.6)	2	L.S.	63		11.0			22'				
3049 - 3050	1	L.S.	65		12.5			12.5				
3050 - 3052	2	L.S.	69		15			30				
3052 - 3053	1	L.S.	68		14.5			14.5		ϕ=13.2		
3053 - 3054	1	L.S.	64		11.5			11.5				
3054 - 3059	5	L.S.	68		14.5			72.5				
3059 - 3060	1	L.S.	68		14.5			14.5				
3060 - 3063	3	L.S.	63		11.0			33				
3063 - 3064	1	L.S. shale	60	X								

211.2

Log Evaluation Sheet

WELL Name & Location 5-30-1-25 K.B. 1547 Date Dec. 10, 75

K.B. By Sam

Formation Alida R_{wa} @ form. temp 85°F = 0.044

page 21 Source of R_w ✓

Interval	Footage	Lith.	Δt	Δt_m	ϕ_s	R_{wa} / R_B	ϕ_D	ϕ_{ft}	ML Sep.	ϕ_{GR}	R_t	Sw
-1488												
(6488) 3035 - 3037	2	L.S.	58		7.5	.23		15			40	45
3038 - 3040	2	L.S.	53		4	.43		8			25	32
3045 - 3047	2	L.S.	62		10	.20		20			20	48
3047 - 3050	3	L.S.	64		11.5	.23		34.5			15	47
3050 - 3052	2	L.S.	64		11.5	.17		23			12	52
3052 - 3054	2		68		14.5	.24		29		ϕ=10.0	13	
3054 - 3055	1		63		11.0	.15		11			14	
3055 - 3056	1		61		10.0	.12		10			14	
3056 - 3058	2		60		9	.09		18			12	
3058 - 3061	3		63		11	.13		33			11	
3061 - 3062	1		58		7.5	.09		7.5			15	

Log Evaluation Sheet

Well Name & Location 6-30-1-25 K.B. elevation 1547.4 Date

K.B. 1547.4 By

Formation Alida Rw @ form. temp

Net pay = 13' Source of Rw

Interval	Footage	Lith.	Δt	Δtma	ϕ_s	PB	ϕ_D	ϕ_{ft}	Mud Sap.	ϕ_{GR}	Rt	Sw
(-1474.6) 3022-3023	1	L.S.	61		10			10.				
3023-3025	2	L.S.	66		13			26				
3025-3026	1	L.S.	73		18			18				
3026-3029	3	L.S.	61		10			30		ϕ=13.5		
3029-3030	1	L.S.	65		12			12				
3030-3032	2	L.S.	71		16.5			33				
3032-3033	1	L.S.	77		21			21				
3033-3034	1	L.S.	69		15			15				
3034-3035	1	L.S.	62		10			10				
									175.5			

Log Evaluation Sheet

Well Name & Location 11-30-1-25 K.B. elevation 1549.5 Date Dec. 10, 1975

K.B. 1549.5 By Sam

Formation Alida/Net pay = 8 ft Rw @ form. temp R_w = .049 @ 77°C = .044 @ 85°C

Source of Rw

Interval	Footage	Lith.	Δt	Δtm	ϕ_S	R_{wa}/R_t	ϕ_D	ϕ_{fl}	mic. sp.	ϕ_{GR}	R_t	S_w
(1472.5) 3022 - 3024	2	L.S.	51		4	.14		—			80	55 %
3024 - 3026	2	L.S.	52		5	.23		10		6.4	90	44 %
3026 - 3028	2	L.S.	57		7.5	.35		15			60	35 %
3028 - 3030	2	L.S.	56		7	.30		14			60	38 %
3030 - 3032	2	L.S.	54		6	.38		12			110	33 %

average S_w = 41 %

51.2

Log Evaluation Sheet

Well Name & Location 12-30-1-25 K.B. 1545.4 Date Dec. 10, 75

K B. By Sam

Formation A Lida Rw @ form. temp

Pay = 12' Source of Rw

Interval	Footage	Lith.	Δt	Δt_m	ϕ_s	PB	ϕ_D	ϕ_{fl}	ML Sep.	ϕ_{GN}	Rt	Sw
(1496.6) 3042 - 3044	2	Arg. Ls.	60		9			18				
3044 - 3048	4	"	62		10			40				
3048 - 3051	3	"	57		7			21		$\phi = 8.6$		
3051 - 3053	2	"	60		9			18				
3053 - 3054	1	"	56		6			6				

1496.6

103.2

Log Evaluation Sheet

Hole diam. 7 7/8"
Mud wt. 10.6
Formation temp. 85°F

Well Name & Location 11-19-1-25

Date Dec. 10, 75

K B.

By Dan

Formation ALida

R_w @ Form. temp

Source of R_w

Interval	Footage	Lith.	API	Δt_m	ϕ_S	PB	ϕ_D	ϕ_{ft}	Mud Sup.	ϕ_{GA}	R_t	S_w
3032-												

Structural Cross-Section, Waskada

(3)

av. 6 wells 1485 ft Subsea

av. 4 wells 1500 Subsea