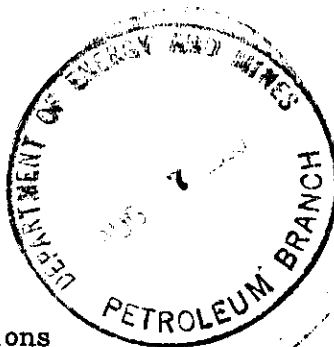


SENT BY FAX

AUG - 3 1990



File:
WASKADA FIELD
NPR APPLN

7-14-2-25

Mr. G.A. Cormack
Manager, Production Operations
Omega Hydrocarbons Ltd.
1300, 112 - 4th Avenue S.W.
Calgary, Alberta
T2P 0H3

Dear Mr. Cormack:

RE: Application for Permission to Over-Produce
Omega Waskada 7-14-2-25 (WPM)

Your application dated July 20, 1990 for permission to over-produce the subject well for the months of July and August, 1990 is hereby acknowledged.

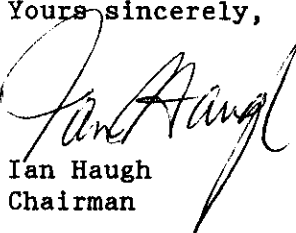
The 7-14-2-25 well has been over-produced in each of the months since being placed on production March 6, 1990. As of July 31, 1990, it is estimated that the well will have accumulated over-production of 850 m³. The accumulated over-production is almost as much as would have been expected if the Board had approved Omega's earlier application for a temporary six (6) month exemption from MPR restrictions.

The Board believes that conservation and equity concerns associated with Omega's previous application, which was denied on June 26, 1990, apply equally to this application. Therefore, this application is denied.

Omega is requested to commence retiring over-production in August, 1990. Accumulated over-production shall be retired at a minimum rate of 100 m³/month. Failure to meet this requirement may result in the well being ordered shut-in until the over-production is retired.

If you have any questions in respect of this decision, please contact Clare Moster at (204) 945-1111 or myself at (204) 945-3130.

Yours sincerely,


Ian Haugh
Chairman

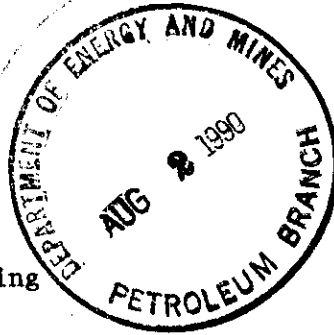
HCM/ibj

Date typed: August 1, 1990

bcc: Petroleum Branch

August 2, 1990

Ian Haugh
Deputy Minister
Energy and Mines
309 Legislative Building



H. Clare Moster
Assistant Deputy Minister
Energy Division

RE: OMEGA'S OVERPRODUCTION APPLICATIONS

1. Attached is copy of letter dated August 1, 1990 sent by me today by mail in response to Omega's July 9th letter expressing concerns with Board denial of first application.
2. Draft letter for your signature related to second application (July 20th).
Note: As Omega has continued to overproduce well since denial (June 26) of first application the well had an "additional" overproduction of 558 m³ in July (cumulative over-production now 860 m³).
Letter more strongly worded to require retirement of over-production by minimum of 100 m³/month or Board may order well "shut-in".
3. Your letter should be faxed (403) 264-5691 so Omega will know requirements ASAP so as to meet August production cut-back requirements.

**ORIGINAL SIGNED BY
H. CLARE MOSTER**

H. Clare Moster

Attachments

1556T

CONFIDENTIAL



1300 SUN LIFE PLAZA III
112 - 4th AVENUE S.W.
CALGARY, ALBERTA, CANADA T2P 0H3
TELEPHONE (403) 261-0743
FAX (403) 264-5691

File
Workman
NPR APPLIN
7-14-2-25

TELECOPIER TRANSMITTAL

DATE: July 20, 1990

TO: Mr. Bob Dubreuil

FAX NO.: 1-204-945-0586

FROM: Gordon Cormack

COMMENTS:

RE: 7-14-2-25 WPM

ATTACHED PLEASE FIND A MAP FOR THE "LAM UPPER SAND TREND" AS PER YOUR CONVERSATION
WITH GORDON CORMACK.

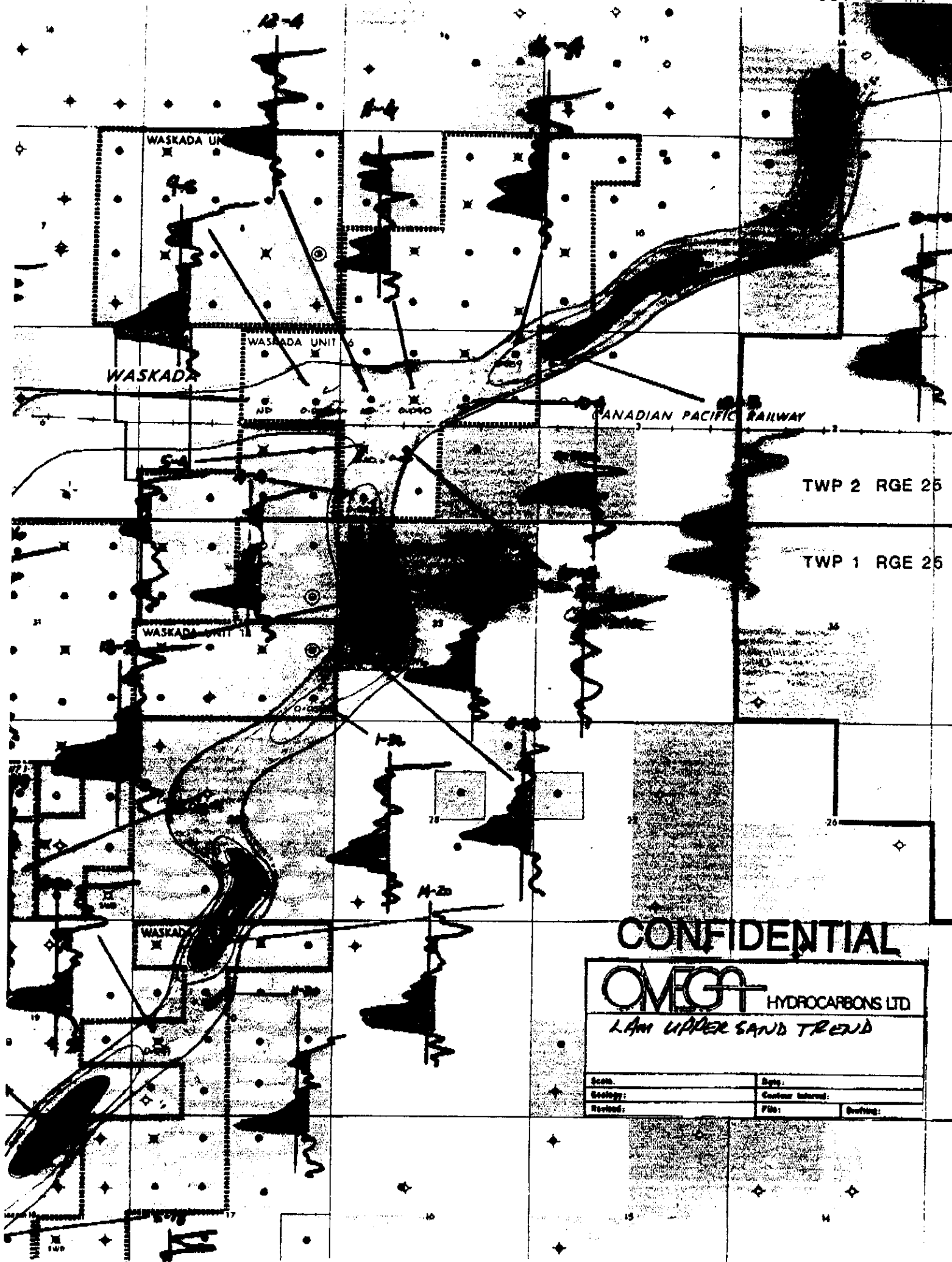
THANK YOU.

Spence

2

Pages (including cover page)

**If you did not receive the above number of pages please call
(403)261-0743 or telecopier no. (403)264-5691. Thank you.**



CONFIDENTIAL

OMEGA HYDROCARBONS LTD
LAM UPPER SAND TREND

Scale:	By:
Geology:	Contour Interval:
Revised:	File:
	Drawing:

August 1, 1990

Mr. G.A. Cormack
Manager, Production Operations
Omega Hydrocarbons Ltd.
1300, 112 - 4th Avenue S.W.
Calgary, Alberta
T2P 0H3

Dear Mr. Cormack:

Re: Application for Exemption for MPR Restrictions
Omega Waskada 7-14-2-25 (WPM)

The Board has received your letter dated July 9, 1990, outlining Omega's concerns with the Board's decision to deny your application for a six (6) month MPR exemption for the subject well.

In reaching its decision the Board has considered both the potential conservation and equity concerns associated with unrestricted production and Omega's desire to accelerate evaluation of the new pool and offset drilling potential.

The Board is of the opinion that the technical evidence filed in support of the application did not adequately address the conservation and equity concerns raised by the Petroleum Branch and offsetting working interest and royalty owners who objected to the application. Furthermore the depletion-dependent nature of the additional technical information required to adequately address such concerns would not be available to Omega for some time. Therefore the Board decided to deny the application.

The following comments directly address the concerns raised by Omega in the July 9, 1990 letter.

- (1) The Board agrees that the appropriate time to gather reservoir information is following the discovery of a new pool. However, the Board believes that additional reservoir information can be gathered without removal of the MPR restrictions. A well's inflow performance can be determined to evaluate the well's optimum producing rate and to size production equipment. Reservoir limits can be determined by an extended pressure drawdown or build-up test.

The Board agrees that accelerating production may help establish an earlier production decline and a more reliable estimate of recoverable reserves. But accelerating production also accelerates depletion which may result in a decrease in ultimate recovery. This concern is compounded by the low reservoir pressure of 6 041 kPa determined from the drill stem test conducted on the new zone. The reservoir pressure at 7-14 is less than 2 000 kPa above the bubble point pressure of the Waskada Lower Amaranth A Pool.

A review of the wells offsetting 7-14-2-25 indicates there are three potential targets in Section 14-2-25 (WPM): the newly discovered sand at the top of the Lower Amaranth, the usual Lower Amaranth producing sands and the MC 1. The combination of potentially productive horizons and the productivity of the newly discovered zone should help reduce the risk of development drilling.

- (2) Based on the Petroleum Branch's estimate of original oil-in-place (OOIP) of 21 450 m³, as of June 1, 1990 the well had produced 4.3% of the OOIP. Omega has stated that the well was capable of producing in excess of 15 m³ OPD. Therefore after 6 months of unrestricted production, the Board estimated that in excess of 17% of the OOIP would have been recovered. This level of recovery could only indicate that drainage of offsetting lands was occurring which was a concern of the parties that objected to the application.
- (3) In removing the daily MPR restrictions for the four month period the Board was allowing Omega the flexibility to production test the well. Without daily MPR restrictions recovery of the monthly MPR could be accelerated thereby allowing Omega to conduct a pressure survey without losing production. Assuming the well was operated at or near its maximum capability for a portion of each month, over the four month period the Board was of the opinion that the maximum capability would begin to show a decline. This decline could be used to estimate the recoverable reserves.
- (4) The Board shares Enron's view that changes in the MPR should ideally be considered on a pool basis rather than well by well. However, in its letter Enron did not request an MPR exemption for the well 3-14-2-25 but rather expressed concerns that unrestricted production at 7-14-2-25 could adversely effect offsetting working interest and royalty owners.
- (5) The Board or the Petroleum Branch had discussions with the three parties who objected to the application either prior to or after receipt of their objections. Though the parties indicated their concern in meeting the Board's deadline, none of the parties indicated that time constraints were a factor in their decision to object to the application.

The Board is prepared to consider a new application for an exemption from an increase in the MPR for the 7-14-2-25 well provided the following information is filed in support of such an application.

- (1) Geological mapping showing the probable extent of the pool.
- (2) Inflow-Performance curve - IPR curve for the well including comments on the rate sensitivity of the GOR and WOR.
- (3) Reservoir pressure survey - preferably of a duration to allow determination of the reservoir limits.
- (4) Fluid analysis.
- (5) If possible consent of the offsetting working interest and royalty owners or as a minimum evidence that Omega has discussed the application with such parties.

If you have any further questions or comments please contact the undersigned at (204) 945-1111.

Yours respectfully,

**ORIGINAL SIGNED BY
H. CLARE MOSTER**

H. Clare Moster
Deputy Chairman

Mr. G.A. Cormack
Manager, Production Operations
Omega Hydrocarbons Ltd.
1300, 112 - 4th Avenue S.W.
Calgary, Alberta
T2P 0H3

Dear Mr. Cormack:

RE: Application for Permission to Over-Produce
Omega Waskada 7-14-2-25 (WPM)

Your application dated July 20, 1990 for permission to over-produce the subject well for the months of July and August, 1990 is hereby acknowledged.

The 7-14-2-25 well has been over-produced in each of the months since being placed on production March 6, 1990. As of July 31, 1990, it is estimated that the well will have accumulated over-production of 850 m³. The accumulated over-production is almost as much as would have been expected if the Board had approved Omega's earlier application for a temporary six (6) month exemption from MPR restrictions.

The Board believes that conservation and equity concerns associated with Omega's previous application, which was denied on June 26, 1990, apply equally to this application. Therefore, this application is denied.

Omega is requested to commence retiring over-production in August, 1990. Accumulated over-production shall be retired at a minimum rate of 100 m³/month. Failure to meet this requirement may result in the well being ordered shut-in until the over-production is retired.

If you have any questions in respect of this decision, please contact Clare Moster at (204) 945-1111 or myself at (204) 945-3130.

Yours sincerely,

Ian Haugh
Chairman

HCM/ibj
Date typed: August 1, 1990

bcc: Petroleum Branch



1300 SUN LIFE PLAZA III
112 - 4TH AVENUE S.W.
CALGARY, ALBERTA, CANADA T2P 0H3
TELEPHONE (403) 261-0743
FAX (403) 264-5691

July 20, 1990

**THE OIL & NATURAL GAS
CONSERVATION BOARD**
Legislative Building
450 Broadway Avenue
Winnipeg, Manitoba
R3C 0V8

Attention: Mr. Ian Haugh
Chairman

Dear Sir:

**Re: Proposal to Reduce Accumulated Overproduction
Omega Waskada 7-14-2-25 WPM**

As of the end of June 1990 the subject well will be approaching an accumulated overproduction volume of 250 m³. Rather than shut the well in at this time to reduce the overproduction Omega Hydrocarbons Ltd. requests authorization for continued production until August 31, 1990. The accumulated overproduction volume will then be reduced to zero in subsequent production months.

Recently, the total fluid production at 7-14-2-25 WPM has increased to above 25 m³/d with a wellhead watercut of 2 percent and no change in operating procedures. In an effort to explain the improved well productivity Omega is in the process of installing temporary satellite testing facilities at the wellsite to monitor gas and fluid production. Our intent is to gather gas/oil ratio and water/oil ratio data during a 1 1/2 month test period to assess reservoir depletion. To obtain the most reliable production data it is essential that the well be allowed to produce on a continuous basis.

Should you have any comments or questions related to this submission contact either Mr. Richard Brekke or Mr. Gordon Cormack at (403) 261-0743. Your earliest attention to this matter would be appreciated.

Yours truly,

OMEGA HYDROCARBONS LTD.

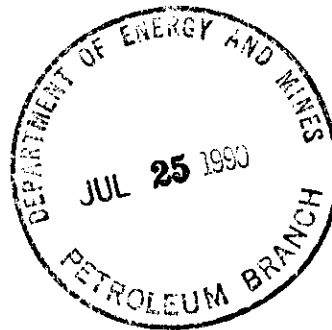


G.A. Cormack
Manager, Production Operations

RAB:jb

c.c.: Department of Energy & Mines
✓ Attn: Mr. L. Robert Dubreuil

Waskada MPR/Allowable File



2215

302 3

531.5

833.9

July 1968 - CONJUGATION OVER-PRODUCTION - 1370 L³

[illegible]

Area 306 / 90 peds. 798.3 m² a. 1

11.8 m/s

semit. over-production to Jan 31, 90 - 860.6 - 3

Produced at the University of Illinois Press

1960

from $40-50 \text{ m}^3/\text{km}^2$

Orak Projects Ltd. - Field Data Gathering System
Field Data Capture System
Monthly Single Well Battery Report

Report Month: Jul/90

Current Time: 07/24/90 14:13:08

SUB: SWB 7-14

UWI: 00/07-14-002-25W1/0

Choke size (mm): 0.0

Zone:

Pool:

Units:

Bat. Codes:

Well Codes:

P R O D U C T I O N																	T R U C K			
Day	Mrs	Oil	Water	Oil	Water	Prod	Allow	Prod	Prod	Prod	Stroke	Pump	TBP	CSP	Casing	Op.	Total	Total	Total	Total
(hr)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(spm)	(cm)	(%)	(kPa)	(kPa)	(m)	Disp.	Disp.	Rec.	Rec.
20		16.6	1.2	0.0	0.0															
1	24.0	34.3	1.6	0.0	0.0	17.9	0.0	0.4	0.0	0.0	0.0	0.0	0	0	0.0	TM	0.0	0.0	0.0	0.0
2	24.0	19.6	1.3	0.0	0.0	14.4	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	TM	29.3	0.6	0.0	0.0
3	24.0	27.8	1.5	0.0	0.0	8.2	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	J6	0.0	0.0	0.0	0.0
4	24.0	25.6	1.6	0.0	0.0	13.4	0.0	0.4	0.0	0.0	0.0	0.0	0	0	0.0	J6	15.6	0.3	0.0	0.0
5	24.0	31.2	1.7	0.0	0.0	21.0	0.0	0.6	0.0	0.0	0.0	0.0	0	0	0.0	J8	15.4	0.5	0.0	0.0
6	24.0	30.3	1.7	0.0	0.0	14.6	0.0	0.4	0.0	0.0	0.0	0.0	0	0	0.0	J8	15.4	0.5	0.0	0.0
7	24.0	32.1	2.7	0.0	0.0	31.8	0.0	1.0	0.0	0.0	0.0	0.0	0	0	0.0	J8	0.0	0.0	0.0	0.0
8	24.0	28.7	1.6	0.0	0.0	27.4	0.0	0.8	0.0	0.0	0.0	0.0	0	0	0.0	J8	60.8	1.9	0.0	0.0
9	24.0	22.9	1.1	0.0	0.0	25.0	0.0	0.5	0.0	0.0	0.0	0.0	0	0	0.0	J8	30.8	1.0	0.0	0.0
10	24.0	56.7	1.6	0.0	0.0	40.5	0.0	0.8	0.0	0.0	0.0	0.0	0	0	0.0	J8	12.7	0.3	0.0	0.0
11	24.0	23.0	1.0	0.0	0.0	24.5	0.0	0.5	0.0	0.0	0.0	0.0	0	0	0.0	J6	52.2	1.1	0.0	0.0
12	24.0	28.0	0.7	0.0	0.0	30.4	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	TM	25.4	0.6	0.0	0.0
13	24.0	27.5	0.7	0.0	0.0	27.1	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	J8	27.6	0.3	0.0	0.0
14	24.0	27.9	0.8	0.0	0.0	26.2	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	J8	25.8	0.2	0.0	0.0
15	24.0	25.1	1.0	0.0	0.0	28.6	0.0	0.6	0.0	0.0	0.0	0.0	0	0	0.0	J6	31.4	0.4	0.0	0.0
16	24.0	25.4	0.7	0.0	0.0	29.9	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	J6	29.6	0.6	0.0	0.0
17	24.0	19.3	0.6	0.0	0.0	15.5	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	J6	21.6	0.3	0.0	0.0
18	24.0	33.9	0.8	0.0	0.0	27.5	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	J8	12.9	0.1	0.0	0.0
19	24.0	23.9	0.7	0.0	0.0	29.4	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	J6	39.4	0.4	0.0	0.0
20	24.0	23.6	1.0	0.0	0.0	28.3	0.0	0.6	0.0	0.0	0.0	0.0	0	0	0.0	J8	28.6	0.3	0.0	0.0
1	24.0	30.3	1.1	0.0	0.0	29.0	0.0	0.6	0.0	0.0	0.0	0.0	0	0	0.0	J6	22.3	0.5	0.0	0.0
2	24.0	30.3	0.5	0.0	0.0	28.3	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	J6	28.3	0.6	0.0	0.0
3	24.0	31.8	0.1	0.0	0.0	32.6	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	J8	31.1	0.4	0.0	0.0
4	No data entered																			
5	No data entered																			
6	No data entered																			
7	No data entered																			
8	No data entered																			
9	No data entered																			
10	No data entered																			
11	No data entered																			

548.0 571.5 9.7 0.0 0.0 554.2 10.9 0.0 0.0

Prod. left to recover 0.0 m3.

(Remarks)

(1) DOWN 4 HRS. FOR PARAFFIN INHIBITING.

ak Projects Ltd. - Field Data Gathering System
Field Data Capture System
Monthly Single Well Battery Report

Report Month: Jun/90

Current Time: 07/03/90 12:33:36

WOB: SWB 7-14

WMI: 00/07-14-002-25W1/0

Choke size (m3): 0.0

one:

Pool:

Unit:

Bat. Code:

Well Codes:

P R O D U C T I O N																	T R U C K			
		Load	Load	Allow	Prod	Prod	Prod	Prod	Prod	Stroke	Pump			Casing			Total	Total	Total	Total
		Inv	Inv	Oil	Water	Oil	Water	Oil	Water	Len	Eff.			Fluid			Oil	Water	Oil	Water
Hrs	Oil	Water	Used	Used	Oil	Left	Water	Oil	Water	Speed		TSP	CSP	Level	Op.		Disp.	Disp.	Rec.	Rec.
(hrs)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(spm)	(cm)	(kPa)	(kPa)	(m)			(m3)	(m3)	(m3)	(m3)
0	21.3	1.7	0.0	0.0																
1	24.0	15.4	1.5	0.0	0.0	6.8	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	TW	12.7	0.3	0.0	0.0
2	24.0	31.1	1.8	0.0	0.0	15.7	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	JE	0.0	0.0	0.0	0.0
3	24.0	27.6	1.7	0.0	0.0	12.1	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	TW	15.6	0.3	0.0	0.0
4	24.0	23.5	1.6	0.0	0.0	11.1	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.2	0.3	0.0	0.0
5	24.0	20.0	1.4	0.0	0.0	12.1	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.6	0.3	0.0	0.0
6	24.0	16.5	1.3	0.0	0.0	12.2	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.7	0.2	0.0	0.0
7	24.0	26.8	1.4	0.0	0.0	10.3	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	JE	0.0	0.0	0.0	0.0
8	24.0	24.0	1.3	0.0	0.0	12.9	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	TW	15.7	0.2	0.0	0.0
9	24.0	21.8	1.2	0.0	0.0	12.8	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	TW	15.0	0.2	0.0	0.0
10	24.0	18.2	1.1	0.0	0.0	12.1	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.7	0.2	0.0	0.0
11	24.0	29.1	1.2	0.0	0.0	10.9	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	JE	0.0	0.0	0.0	0.0
12	24.0	25.0	1.1	0.0	0.0	11.6	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.7	0.2	0.0	0.0
13	24.0	20.9	1.0	0.0	0.0	11.6	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.7	0.2	0.0	0.0
14	24.0	15.8	0.9	0.0	0.0	10.3	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.4	0.2	0.0	0.0
15	24.0	26.4	1.0	0.0	0.0	10.6	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	TW	0.0	0.0	0.0	0.0
16	24.0	15.8	0.9	0.0	0.0	5.1	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	TW	15.7	0.2	0.0	0.0
17	24.0	22.5	1.0	0.0	0.0	6.7	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	TW	0.0	0.0	0.0	0.0
18	24.0	20.9	1.0	0.0	0.0	11.3	0.0	0.1	0.0	0.0	0.0	0.0	0	0	0.0	TW	12.9	0.1	0.0	0.0
19	20.0	24.2	1.1	0.0	0.0	18.2	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	JE	14.9	0.1	0.0	0.0
20	24.0	22.2	1.3	0.0	0.0	12.7	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	JE	14.7	0.1	0.0	0.0
21	24.0	11.9	1.5	0.0	0.0	9.7	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	JE	0.0	0.0	0.0	0.0
22	24.0	29.4	1.4	0.0	0.0	10.2	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	JE	12.7	0.3	0.0	0.0
23	24.0	25.4	1.3	0.0	0.0	11.6	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.6	0.3	0.0	0.0
24	24.0	21.3	1.2	0.0	0.0	11.5	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.6	0.3	0.0	0.0
25	24.0	13.5	1.1	0.0	0.0	7.8	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.6	0.3	0.0	0.0
26	24.0	27.3	1.4	0.0	0.0	13.8	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	JE	0.0	0.0	0.0	0.0
27	24.0	23.3	1.3	0.0	0.0	11.6	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	JE	15.6	0.3	0.0	0.0
28	19.0	19.9	1.2	0.0	0.0	12.2	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	TW	15.6	0.3	0.0	0.0
29	24.0	17.8	1.1	0.0	0.0	13.5	0.0	0.3	0.0	0.0	0.0	0.0	0	0	0.0	TW	15.6	0.3	0.0	0.0
30	24.0	16.6	1.1	0.0	0.0	10.8	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0.0	TW	12.0	0.2	0.0	0.0
210.0					339.8		4.9	0.0	0.0								344.5	5.4	0.0	0.0

Load oil left to recover 0.0 m3. 11.33 1.16

Remarks:

- (9) 5.1 4 HRS. TO CIRCULATE - PARAFFIN INHIBITING.
- (20) 5.1 5 HRS. TO CIRCULATE - PARAFFIN INHIBITING.



1300 SUN LIFE PLAZA III
112 4TH AVENUE S.W.
CALGARY, ALBERTA, CANADA T2P 0H3
TEL: (403) 261-0743
FAX: (403) 264-5691

July 9, 1990

**The Oil & Natural Gas
Conservation Board**
Legislative Building
450 Broadway Avenue
Winnipeg, Manitoba
R3C 0V8

Attention: Mr. H. Clare Moster
Deputy Chairman

Dear Sir:

**Re: Application for Exemption from MPR Restrictions
Omega Waskada 7-14-2-25 WPM**

Omega Hydrocarbons Ltd. just received the written decision by The Oil & Natural Gas Conservation Board to disallow the above noted application and are extremely disappointed with the decision. Although the Board indicates that the application was deficient in specific technical data, Omega was not given an opportunity to correct any deficiencies. We feel that in a short term temporary exemption application of this nature some latitude should be allowed.

After reviewing the concerns presented by the objecting parties and the comments made in the Board's letter dated June 26, 1990, Omega has the following comments,

- 1) The appropriate time to gather data and proceed cautiously with step out drilling in delineating any new pool is immediately following the discovery well. It must be reiterated that the zone in question is a new zone some 10 m above the typical Lower Amaranth producing interval and that there is a very real possibility that the new zone has limited areal extent. The Government and the mineral owners at no time take any risk, however, they can not expect the lessor to drill additional wells without sufficient data, in this case historical pressure data, material balance calculations and production performance have been proposed.



- 2) Given the following well parameters $A = 16$ ha, $\phi = 10\%$, $h = 4.5$ m $Sw = 40\%$, $Bo = 1.155$ m³/m³ the original oil in place is 37,400 m³. Assuming an over production rate of 5m³/d or a total over production volume of 900 m³ during a six month period, this translates to 2.4% of the original oil in place based on 16 ha spacing. It is Omega's feeling that this small over production volume will not result in inequitable drainage. If the pool is larger than 16 ha as suggested by the interveners the impact on drainage and recovery are even less than stated above.
- 3) The Board's proposal to increase the daily MPR while holding the monthly MPR at 240 m³/month does not allow the collection of data to justify carrying on additional work. The intent of temporarily eliminating the MPR at well 7-14-2-25 WPM or any other discovery well is to monitor the well's natural production decline. By restricting production in the proposed manner this cannot be accomplished and the time required to identify a decline curve trend is extended unnecessarily.
- 4) With respect to the well 3-14-2-25 WPM Omega concurs with Enron Oil Canada Ltd. that the new zone found in well 7-14-2-25 WPM is correlatable between wells. This data does not change the questions surrounding the pool size nor the fact that additional reservoir data must be gathered before any further drilling takes place. Omega agrees that well 3-14-2-25 WPM should be given a similar MPR exemption, however, Enron should also be required to obtain pertinent pool data in order to establish the areal extent of the new pool.
- 5) Based on the objection letter put forth by Mr. H.B. Thom and in discussions with Enron it is our understanding that these objections were filed under time duress. Both parties did not receive a copy of the subject application and were given the impression they did not have sufficient time to contact Omega to discuss the application. We are of the opinion that the objections presented could have been addressed and reconciled given an more open approval process by the Board.

In conclusion Omega believes that it has made a responsible technical request for temporary MPR exemption at the subject well. It is difficult for Omega to proceed in an expedient manner with any further development in the NE portion of the Waskada Field without sufficient technical data and the support of the Department of Energy and Mines.

Yours truly,

OMEGA HYDROCARBONS LTD.

A handwritten signature in dark ink, appearing to read 'G.A. Cormack', written in a cursive style.

G.A. Cormack
Manager, Production Operations

GAC:jb

c.c.: T.J. Hall

July 20, 1990

H. Clare Moster
Deputy Chairman
The Oil and Natural
Gas Conservation Board

L.R. Dubreuil
Director

Re: Maximum Permissible Rates

Omega has reacted to the Board's denial of its MPR exemption application for the well Omega Waskada 7-14-2-25 (WPM).

Attached is a letter from Gordon Cormack, Manager, Production Operations taking issue with the disposition of the application. The Petroleum Branch has prepared a proposed response which is also attached. John Fox can provide additional detail and background if necessary.

On July 12, 1990, Jack Hall called for you. Ron Pritchard took the call and advised Jack that I would get back to him. I called Jack on Monday July 16, 1990.

Jack expressed two concerns:

- 1) Omega's inability to obtain an exemption in what it thought was a reasonable request sends a negative message to potential investors in a deep well project. Investment in such a project will be difficult to attract if MPR relief is not guaranteed. Jack suggested that perhaps MPR's should be dispensed with altogether for deep wells.

I feel Jack does have a point that the rules of the game should be established before a deep well is drilled. One approach to recognizing these concerns would be to include a further amendment to the regulatory amendments recently proposed by the Branch. I do not recommend this approach because;

- (a) Delays in approval of the current regulatory amendments would result, reducing the usefulness of the proposed temporary incentives.
- (b) While MPR's for deep wells should probably be covered by regulation, I do not feel we have sufficient information to establish appropriate controls at this time.

Another approach is to develop preliminary guidelines as to how MPR applications for deep wells will be handled by the Board. Such guidelines could suggest that in the absence of unusual circumstances, MPR's would be set in a specific predetermined manner. The guidelines could be communicated as an information letter or policy statement from the Board. I have asked John to develop a proposal. If such an approach is taken, perhaps it could be timed to coincide with the announcement of the horizontal incentives.

- 2) Jack's second concern was that it appeared objections from offsetting royalty or working interest owners appeared to have precluded approval of the 7-14 application. I told Jack that while the objections were undoubtedly a factor, the Branch had expressed serious concerns relating to correlative rights and conservation. I told Jack, however, that we were reviewing Cormack's letter and that the Board would address the individual concerns noted.

L.R. Dubreuil

LRD:cvs

good copy to Cleve

~~July 20, 1990~~

Mr. G.A. Cormack
Manager, Production Operations
Omega Hydrocarbons Ltd.
1300, 112 - 4th Avenue S.W.
Calgary, Alberta
T2P 0H3

Dear Sir:

Re: Application for Exemption for MPR Restrictions
Omega Waskada 7-14-2-25 (WPM)

The Board has received your letter outlining Omega's concerns with the Board's decision to deny your application for a six (6) month MPR exemption for the subject well.

In reaching its decision the Board has considered both the potential conservation and equity concerns associated with unrestricted production and Omega's desire to accelerate evaluation of the new pool and offset drilling potential.

The Board is of the opinion that the technical evidence filed in support of the application did not adequately address the conservation and equity concerns raised by the Petroleum Branch and offsetting working interest and royalty owners who objected to the application. Furthermore the depletion-dependent nature of the additional technical information required to adequately address such concerns would not be available to Omega for some time. Therefore the Board decided to deny the application.

The following comments directly address the concerns raised by Omega in the July 9, 1990 letter.

- (1) The Board agrees that the appropriate time to gather reservoir information is following the discovery of a new pool. However, the Board believes that additional reservoir information can be gathered without removal of the MPR restrictions. A well's inflow performance can be determined to evaluate the well's optimum producing rate and to size production equipment. Reservoir limits can be determined by an extended pressure drawdown or build-up test.

The Board agrees that accelerating production may help establish an earlier production decline and a more reliable estimate of recoverable reserves. But accelerating production also accelerates depletion which may result in a decrease in ultimate recovery. This concern is compounded by the low reservoir pressure of 6 041 kPa determined from the drill stem test conducted on the new zone. The reservoir pressure at 7-14 is less than 2 000 kPa above the bubble point pressure of the Waskada Lower Amaranth A Pool.

A review of the wells offsetting 7-14-2-25 indicates there are three potential targets in Section 14-2-25 (WPM): the newly discovered sand at the top of the Lower Amaranth, the usual Lower Amaranth producing sands and the MC 1. The combination of potentially productive horizons and the productivity of the newly discovered zone should help reduce the risk of development drilling.

- (2) Based on the Petroleum Branch's estimate of original oil-in-place (OOIP) of 21 450 m³, as of June 1, 1990 the well had produced 4.3% of the OOIP. Omega has stated that the well was capable of producing in excess of 15 m³ OPD. Therefore after 6 months of unrestricted production, the Board estimated that in excess of 17% of the OOIP would have been recovered. This level of recovery could only indicate that drainage of offsetting lands was occurring which was a concern of the parties that objected to the application.
- (3) In removing the daily MPR restrictions the Board was allowing Omega the flexibility to production test the well. Without daily MPR restrictions recovery of the monthly MPR could be accelerated thereby allowing Omega to conduct of a pressure survey without losing production. Assuming the well was operated at or near its maximum capability for a portion of each month, over the four months period the Board was of the opinion that the maximum capability would begin to show a decline. This decline could be used to estimate the recoverable reserves.
- (4) The Board shares Enron's view that changes in the MPR should ideally be considered on a pool basis rather than well by well. However, in its letter Enron did not request an MPR exemption for the well 3-14-2-25 but rather expressed concerns that unrestricted production at 7-14-2-25 could adversely effect offsetting working interest and royalty owners.
- (5) The Board or the Petroleum Branch had discussions with the three parties who objected to the application either prior to or after receipt of their objections. Though the parties indicated their concern in meeting the Board's deadline, none of the parties indicated that time constraints were a factor in their decision to object to the application.

The Board is prepared to consider a new application for an exemption from an increase in the MPR for the 7-14-2-25 well provided the following information is filed in support of such an application.

- (1) Geological mapping showing the probable extent of the pool.
- (2) Inflow-Performance curve - IPR curve for the well including comments on the rate sensitivity of the GOR and WOR.
- (3) Reservoir pressure survey - preferably of a duration to allow determination of the reservoir limits.
- (4) Fluid analysis.
- (5) If possible consent of the offsetting working interest and royalty owners or as a minimum evidence that Omega has discussed the application with such parties.

If you have any further questions or comments please ^{contact the} ~~contact H. Clare~~
~~Moster, Deputy Chairman~~ at (204) 945-1111.

^{undersigned}
Yours respectfully,

H Clare Moster
~~Ian Haugh~~
Deputy Chairman

1. AND ON ADVICE OF THE BRANCH MADE SOME
 1. A. HYPOTHESIS IN THE REALITY / UNCERTAINTIES OF
 2. ADDITIONAL DATA AT THIS STAGE OF POOL DEVELOPMENT
 3. PERHAPS SHOULD HAVE DEFERRED DECISION UNTIL CERTAIN
 INFORMATION COLLECTION

well on prod. near 6000

cumul. prod. to Jan 1/90 = 928.6 m³ (11.2 m³/D - May)

DST run to determine initial reservoir pressure - 6047 kPa
 a. After pressure surveys run Bubble Point = 4000

- 3 potential fracture in Sep. 84

1. typically productive LAC sands

2. 1st 2.1 m³/D May/90

recently, increased production during 12. 11

2. PC 2.14 2.2 m³/D Omega approx. 10 m³/D

3. 1st 0.91 m³/D May/90

produced from 1st-1st 1st

3. newly discovered zone present

4. 1st 1st 1st 1st 1st 1st 1st 1st 1st 1st

1st 1st 1st 1st 1st 1st 1st 1st 1st 1st

3. 1st 1st 1st 1st 1st 1st 1st 1st 1st 1st

- 1st 1st 1st 1st 1st 1st 1st 1st 1st 1st

EXACTLY WHAT INFORMATION DOES OMEGA NEED TO
 BRING A STEP-OUT WELL i.e. what is the
 productivity? what level of reserves?

- WHAT ADDITIONAL INFORMATION HAS OMEGA GATHERED?

- WHAT ARE OMEGA'S PLANS FOR DEVELOPMENT

- Additional Information

Board prepared to reconsider application if following elements listed in support of the application

- (1) geological mapping showing probable extent of pool
- (2) Inflow Performance D_{ca} - IPR curve for well including effect of water on IGR & WOR
- (3) Pearson Profile Test - water measure drawn on build-up
- (4) Two dimensions - present in PVT analysis
- (5) discussions with operators - identify withdrawal of obstructions,
- (6) Two well sections or old application from environment for wells 2-12 & 2-14 were all pulled wells to require more evaluation

- 3000 = 37400 m³ (Omea) 2142000 PP noisy sonic recovery to Jan 1/90 - 2.5% OIP trace difficult to accurately determine porosity

recovery after

- Omea assumed 900 m³ additional production over 6 year exemption period
- however application suggested well had productivity in excess of 15 m³ ODP \equiv 1300 m³ additional production over 6 year period
- suggest additional volumes of production 2.4% to 3.5% of OIP are significant in respect of revenue sharing arrangements
- Omea's earlier modified production not result in significant change not shared by all direct working interest & royalty owners
- ENRON - W/2-14 2. Royalty Omea SW/4-14 & NW/4 14 objected to this application

- NOTE. Omea & ENRON ARE 50/50 PARTNERS IN 3-14 YET ENRON STILL OBJECTS TO APPLICATION - OUR ORIGINAL EXPECTATIONS WERE THAT ENRON WOULD ALSO APPLY FOR TDR EXEMPTION

- because of this position that waves of daily new oil not allow identification of production in the
- it will increase at various rate for a period of time over successive months various rate should gradually decrease

1) Omega has provide no geological mapping or predictions
 2. the extent of the new zone

- question why Omega if they cannot work together to gather additional info to new zone (Omega SO2 owner in 2014)

- asking whether Omega is conducting a assessment for a dangerous pressure that which would allow a risk of production in the same time allow Omega to benefit the rest of the pool

3. Board would like to see for a list of locations both Mr. Thom & Mr. Howden placed the Board/Department to express their concerns

1- Equity issues.

Recovery to June 1

- 2.5%

- 2.4%

2 - Pressure on DST

is only 6000 -

1800 hPa over Pb.

- 39%

83% of OOR.

$$P_{bp} = 4200 \text{ mmHg}$$

$\bar{P}_{12} = 86.72 \text{ kPa}$

July 4, 1990

Mr. Harvey B. Thom
Box 125
Goodlands, Manitoba
ROM ORO

Dear Mr. Thom:

RE: Application for Exemption from Maximum Permissible
Production Rate Limitations Omega Waskada 7-14-2-25 (WPM)

Your objection to Omega Hydrocarbons Ltd.'s application for a temporary six (6) month exemption from maximum permissible production rate (MPR) restrictions for the subject well is hereby acknowledged.

The Board has reviewed Omega's application and the concerns regarding conservation and equity issues expressed by the parties that filed objections to the application.

The Board does not believe that Omega has demonstrated the appropriateness of unrestricted MPR's for the subject well. However, the Board recognizes the need to obtain additional data to assist in the development of a depletion strategy. Consequently, the Board has denied the application for unrestricted monthly MPR's. The well will continue to be subject to a maximum monthly production of 240 m³ of clean oil. The Board has, however, exempted the well from daily production restrictions for a period of four months commencing July 1, 1990. This will assist the collection of reservoir data without adversely affecting correlative rights or oil recovery.

Yours respectfully,

H. Clare Moster
Deputy Chairman

July 4, 1990

Howden Homstead Ltd.
Box 17
Waskada, Manitoba
ROM 2E0

Dear Sir:

RE: Application for Exemption from Maximum Permissible
Production Rate Limitations Omega Waskada 7-14-2-25 (WPM)

Your objection to Omega Hydrocarbons Ltd.'s application for a temporary six (6) month exemption from maximum permissible production rate (MPR) restrictions for the subject well is hereby acknowledged.

The Board has reviewed Omega's application and the concerns regarding conservation and equity issues expressed by the parties that filed objections to the application.

The Board does not believe that Omega has demonstrated the appropriateness of unrestricted MPR's for the subject well. However, the Board recognizes the need to obtain additional data to assist in the development of a depletion strategy. Consequently, the Board has denied the application for unrestricted monthly MPR's. The well will continue to be subject to a maximum monthly production of 240 m³ of clean oil. The Board has, however, exempted the well from daily production restrictions for a period of four months commencing July 1, 1990. This will assist the collection of reservoir data without adversely affecting correlative rights or oil recovery.

Yours respectfully,

H. Clare Moster
Deputy Chairman

July 4, 1990

Mr. L.E. Fenwick
Vice-President, Production
Enron Oil Canada Ltd.
1300, 700 - 9 Avenue S.W.
Calgary, Alberta
T2P 3V4

Dear Mr. Fenwick:

RE: Application for Exemption from Maximum Permissible
Production Rate Limitations Omega Waskada 7-14-2-25 (WPM)

Your objection to Omega Hydrocarbons Ltd.'s application for a temporary six (6) month exemption from maximum permissible production rate (MPR) restrictions for the subject well is hereby acknowledged.

The Board has reviewed Omega's application and the concerns regarding conservation and equity issues expressed by the parties that filed objections to the application.

The Board does not believe that Omega has demonstrated the appropriateness of unrestricted MPR's for the subject well. However, the Board recognizes the need to obtain additional data to assist in the development of a depletion strategy. Consequently, the Board has denied the application for unrestricted monthly MPR's. The well will continue to be subject to a maximum monthly production of 240 m³ of clean oil. The Board has, however, exempted the well from daily production restrictions for a period of four months commencing July 1, 1990. This will assist the collection of reservoir data without adversely affecting correlative rights or oil recovery.

The Board has recommended to the Department that the MPR provisions of the Petroleum Drilling and Production Regulation be reviewed with the intent of providing flexibility for new wells to produce in excess of the MPR restrictions for an initial period of time. This producing flexibility should allow operators to obtain additional reservoir information to support applications of this type.

Yours respectfully,

H. Clare Moster
Deputy Chairman

June 26, 1990

The Oil and Natural Gas
Conservation Board
Ian Haugh, Chairman
H. Clare Moster, Deputy Chairman
Wm. McDonald, Member

John N. Fox
Chief Petroleum Engineer
Petroleum Branch

MPR EXEMPTION
OMEGA WASKADA 7-14-2-25 (WPM)

Omega Hydrocarbons made application for a temporary six (6) month exemption from maximum permissible production rate (MPR) restrictions for the well Omega Waskada 7-14-2-25 (WPM). The Board notified the lessors and lessees in Section 14-2-25 (WPM) of the application and a total of three (3) objections to the application were received.

RECOMMENDATIONS

It is recommended that the application be denied but that the daily MPR restriction be waived for a period of four (4) months commencing July 1, 1990. A proposed letter from the Board to Omega is attached. The letter contains a paragraph outlining the Branch's plans to review the MPR provisions of the regulations to allow some flexibility in producing new wells.

DISCUSSION

Objections to Omega's application were received from Enron Oil Canada Ltd. the lessee in the W/2 of Section 14 and the lessors in the SW/4 and NW/4 of Section 14 (Figure 1).

The primary concern expressed by the parties objecting to the application was that approval of an MPR exemption for the well prior to further delineation of the new producing zone would be premature and could result in inequitable drainage and possible loss in ultimate recovery. Enron also suggested that an increase in MPR should not be considered on a well by well basis but rather on a pool basis. The Petroleum Branch shares this view.

The only technical argument put forward by Omega in its application for MPR exemption is the productivity of the well. Omega also contends in its application that a temporary exemption from MPR restrictions is required to gather additional reservoir information to determine, (1) if the zone is of limited size, and (2) if development drilling is warranted.

Reservoir limits determination by an extended pressure drawdown or build-up test can be accurately done without an MPR exemption. If the reservoir is of limited areal extent, accelerated depletion under an MPR exemption will only confirm the results of a reservoir limits test.

The Branch has reviewed the wells in Section 14 and believes there is potential in the N/2 of Section 14 in three zones; the newly discovered sand at the top of the Lower Amaranth, the usual Lower Amaranth productive sands and the MC1. The combination of potentially productive zones and high productivity of the newly discovered sand greatly reduces the risk of development drilling. It is also suggested that development drilling will provide significantly more reservoir information than will producing 7-14-2-25 at higher rates for six months.

It would be premature at this stage of pool development to grant a waiver of the MPR even for a temporary period. Omega has not addressed conservation or equity concerns in its application and until there is enough reservoir information on the new zone to make a determination on such matters, an exemption or increase in the MPR should not be considered.

It is however recommended that the Board grant a waiver of the daily MPR restrictions for a period of four months (the monthly MPR restriction of 240 m³ will remain in effect) to allow Omega the flexibility to conduct a reservoir limits test without the risk of lost production.

Omega's application is one of a number presently before the Board or expected to be filed in the near future requesting an MPR increase or exemption for wells with high initial productivity. The existing MPR restrictions limit an operator's ability to collect the necessary performance and reservoir data required to technically support an application for an MPR increase or exemption.

The Petroleum Branch is presently preparing a regulatory amendment to allow some MPR flexibility during the early life of a well. It is recommended that Omega be informed by the Board of this initiative.

John N. Fox

Encl.

Approved by:

L.R. Dubreuil, Director

June 26, 1990

Omega Hydrocarbons Ltd.
1300 Sun Life Plaza III
112-4th Avenue S.W.
Calgary, Alberta
T2P 0H3

Attention: Mr. R.A. Brekke, P. Eng.
Engineering Supervisor - Manitoba

Dear Sir:

RE: Application for Exemption from MPR Restrictions
Omega Waskada 7-14-2-25 (WPM)

Your application for a temporary six (6) month exemption from maximum permissible production rate (MPR) restrictions for the subject well is hereby acknowledged.

Notice of the application was sent to lessors and lessees in Section 14-2-25 (WPM). Two lessors and one lessee objected to the application. The primary concern expressed by the objecting parties was that approval of the application prior to further delineation of the pool would be premature and could result in inequitable drainage and a possible loss in ultimate recovery.

The purpose of MPR's is to prevent waste that may occur as a result of over-production and to protect correlative rights. MPR's are an interim conservation measure that limit production from individual wells until the optimum depletion strategy for a pool can be determined.

Omega's application does not adequately address conservation or equity concerns in respect of the requested MPR exemption. Nor at this stage of pool development does the Board believe that any strong technical argument regarding the same can be made.

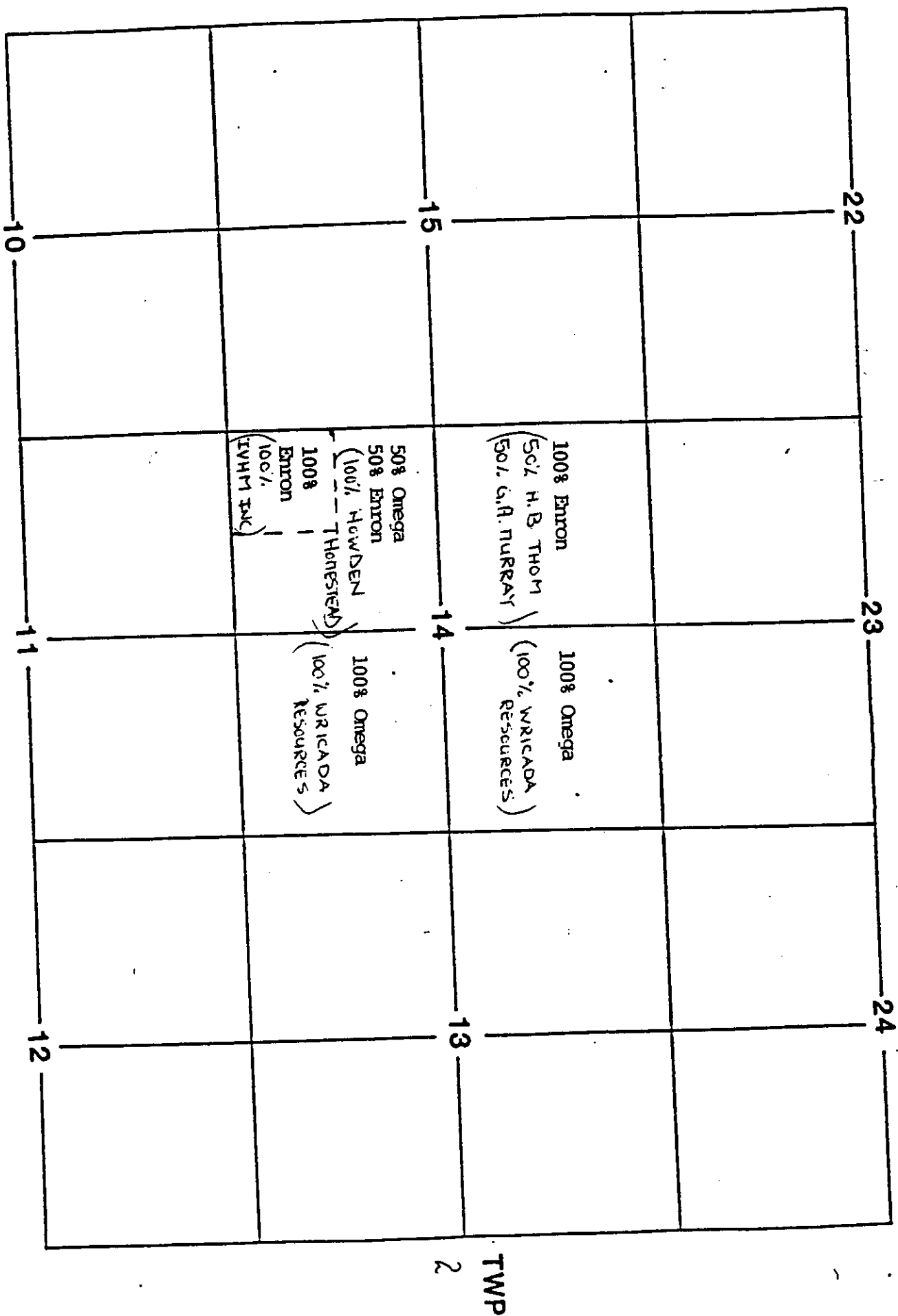
Therefore, the Board finds it premature at this stage of pool development to grant a temporary six month exemption from MPR restrictions for the well Omega Waskada 7-14-2-25 (WPM). However, in order to assist Omega in collecting additional reservoir data, the Board hereby waives the daily MPR restriction of 9.5 m^3 /OPD for a period of four months commencing July 1, 1990. The monthly MPR restriction of 240 m^3 /OPM remains in place.

The Board has recommended to the Department that the MPR provisions of the Petroleum Drilling and Production Regulation be reviewed with the intent of providing flexibility for new wells to produce in excess of the MPR restrictions for a period of time. This producing flexibility should allow operators to obtain additional reservoir information to support applications of this type.

Yours truly,

H. Clare Moster
Deputy Chairman

LESSOR ϕ Lessee Map Surrounding Well 7-14-2-25 WPM



RGE 25 WPM

() ROYALTY OWNER



TELECOPIER NBR. (204) 945-0586

F A X M E S S A G E

DATE:

July 4, 1990

SENT TO:

Omega Hydrocarbons
Attn: Richard Brucke

FROM:

John Fox

MANITOBA ENERGY & MINES

BRANCH/DIVISION:

Petroleum

RE:

TOTAL NUMBER OF PAGES SENT:

3

PLUS COVER

IF YOU HAVE NOT RECEIVED THE SPECIFIED NUMBER OF PAGES, PLEASE CONTACT THE
SENDER AT (204) 945-6577.



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

June 26, 1990

Omega Hydrocarbons Ltd.
1300 Sun Life Plaza III
112-4th Avenue S.W.
Calgary, Alberta
T2P 0H3

Attention: Mr. R.A. Brekke, P. Eng.
Engineering Supervisor - Manitoba

Dear Sir:

RE: Application for Exemption from MPR Restrictions
Omega Waskada 7-14-2-25 (WPM)

Your application for a temporary six (6) month exemption from maximum permissible production rate (MPR) restrictions for the subject well is hereby acknowledged.

Notice of the application was sent to lessors and lessees in Section 14-2-25 (WPM). Two lessors and one lessee objected to the application. The primary concern expressed by the objecting parties was that approval of the application prior to further delineation of the pool would be premature and could result in inequitable drainage and a possible loss in ultimate recovery.

The purpose of MPR's is to prevent waste that may occur as a result of over-production and to protect correlative rights. MPR's are an interim conservation measure that limit production from individual wells until the optimum depletion strategy for a pool can be determined.

Omega's application does not adequately address conservation or equity concerns in respect of the requested MPR exemption. Nor at this stage of pool development does the Board believe that any strong technical argument regarding the same can be made.

Therefore, the Board finds it premature at this stage of pool development to grant a temporary six month exemption from MPR restrictions for the well Omega Waskada 7-14-2-25 (WPM). However, in order to assist Omega in collecting additional reservoir data, the Board hereby waives the daily MPR restriction of 9.5 m^3 /OPD for a period of four months commencing July 1, 1990. The monthly MPR restriction of 240 m^3 /OPM remains in place.

The Board has recommended to the Department that the MPR provisions of the Petroleum Drilling and Production Regulation be reviewed with the intent of providing flexibility for new wells to produce in excess of the MPR restrictions for a period of time. This producing flexibility should allow operators to obtain additional reservoir information to support applications of this type.

Yours truly,

ORIGINAL SIGNED BY
H. CLARE MOSTER

H. Clare Moster
Deputy Chairman



June 18, 1990

Date

FILE

To

Memorandum

From H. Clare Moster
Assistant Deputy Minister
Energy Division

Subject OMEGA APPLICATION FOR MPR EXEMPTION
OMEGA WASKADA 7-14-2-25 WPM
14

Telephone

Received call on June 13, 1990 as Deputy Chairman of the Oil and Natural Gas Conservation Board, from Clare Howden (Howden Homestead Ltd.) a mineral rights owner in SW 1/4-14-2-25 WPM.

Mr. Howden had received the board's notice related to Omega's application. Because of the perceived deadline for submitting a written objection, Mr. Howden asked if a verbal objection was acceptable. I stated that it would be noted and considered by the Board in arriving at its decision.

Mr. Howden's objection was that the 7-14 well was directly offsetting his minerals and that permitting the well to over-produce could affect his minerals. Mr. Howden was aware of the over-production situation of Enron's 3-14-2-25 well and that Enron had not applied for MPR exemption but were working off the over-production. Since his lessee (Enron) had not applied for MPR exemption, he did not feel that Omega's application should be approved.

H.C. Moster

cc: Ian Haugh
Wm. McDonald
L.R. Dubreuil

1489T

First Fold



Date: June 11, 1990

Action / Route Slip

To: Clare Moster

From: Bob Dubreuil

Telephone:

- | | | | | |
|---|---|--|---|--|
| <input type="checkbox"/> Take Action | <input type="checkbox"/> Per Your Request | <input type="checkbox"/> Circulate, Initial and Return | <input type="checkbox"/> For Approval and Signature | <input type="checkbox"/> Make _____ Copies |
| <input type="checkbox"/> May We Discuss | <input type="checkbox"/> For Your Information | <input type="checkbox"/> Return With Comments or Revisions | <input type="checkbox"/> Draft Reply for Signature | <input type="checkbox"/> Please File |

CommentsRE: Omega MPR Application - 7-14-2-25

Spoke with Harvey Thom (50% mineral owner NE 14-2-25). He has sent a letter to the Board objecting to Omega's application. The basis of his objection is that he would like to see his land drilled before the application is approved. His interest is leased to Enron who have 12-14 staked and have plans to drill 11-14. I told him that unless the reservoir was quite limited, a six month exemption should not affect offsets significantly. I told him that he could view a copy of the application at our Waskada Office. He indicated he was going to be talking to Enron today and hoped to have a better understanding of their plans.

Manitoba



Message

To Chas. Rob.

Person calling Harvey Horn

Of from Home office

☒ Telephoned ☐ Will call again ☐ Called to see you
☒ Please call ☐ Returned your call ☐ Will return

Telephone No. <u>658-2515</u>	Time <u>2:00</u>
-------------------------------	------------------

Message Re Omega Hydro-mechanical
inhibitor - Re description
in met. specimens. Blountville -
Lab 7-15-2-25
Upon - N
to Editor

Date June 8 Message taken by MJ

CANADA 39

The Oil & Natural Gas
Conservation Board

Room 309 [H. Clare Master.]

Legislative Bldg.
Winnipeg Man.

R3C 0V8

Goodlands Man

Box 125 Remoro

June 5th/90

H. Clar Morte

Oil & Natural Gas ~~Board~~

Conservation Board.

Dear Sir,

Received your letter dated May 30th but only received it yesterday. I see the date on the envelope was June the 5th. Omega Hydrocarbons Ltd. have made an application for maximum production on well site 7-14-2-35 (W.P.M.).

I am against this at the present time as I understand it will lower the pressure for some distance around. As ~~the~~ Encon Oil

Canada Ltd have a lease on my quarter & are just getting ready to dig. I think Omega should be held off ~~and~~ untill Encon can establish

what is on my quarter before they
lower the pressure if it is only a
small pool. Another thing they have
only dug there wells about 3 months
ago. If Enron should hit the same
thing on my quarter they could
establish some degree of the size of
the pool by that.

At the present time Enron have
~~the~~ staked out L.S.D 12 on my property
& E.S. Burrows Landmen of Enron
said they were almost sure to dig
L.S.D 11 which is only a short ways
from this well No 7 they are talking
about. I expect to write further about
this when I get more information.
However I was afraid my letter
would not get there in time for
the 14 of June so mailed a protest at least.

Yours respectfully -

Harvey B. Thom

what is on my quarter before they lower the pressure if it is only a small pool. Another thing they have only dug three wells about 3 months ago. If Enron should hit the same

thing on my quarter they could establish some degree of the size of the pool by that.

At the present time Enron have ~~the~~ staked out L.S.D 12 on my property & E.S. Burrows Landmen of Enron said they were almost sure to dig L.S.D 11 which is only a short way from there will be 7 they are talking about. I expect to write further about this when I get more information.

However I was afraid my letter would not get there in time for the 14 of June so mailed a protest at least.

Yours respectfully
Harvey B. Thom

Goodland, Man
Box 125 R. Moore
June 8th/90
H. Clay Minter
Oil & Natural Gas
Conservation Board.

Dear Sir,

Received your letter dated May 30th but only received it yesterday. I see the date on the envelope was June the 5th Omega Hydrocarbon Ltd. have made an application for maximum production on well site 7-14-2-35 (W.P.M.).

I am against this at the present time as I understand it will lower the pressure for some distance around. As ~~the~~ Enron Oil Canada Ltd have a lease on my quarter & are just getting ready to dig. I think Enron should be held off ~~and~~ untill Enron can establish

51/1

**ENRON
Oil Canada Ltd.**

(403) 298 2600

VIA PUROLATOR

8 June 1990

Manitoba Energy and Mines
Oil and Natural Gas Conservation Board
Room 309
Legislative Building
Winnipeg, Manitoba
R3C 0V8

Attention: Mr. M. Clare Moster,
Deputy Chairman

Dear Sir:

Re: Application for Exemption from
Maximum Permissible Production Rate Limitations
Omega Waskada 7-14-2-25 WPM

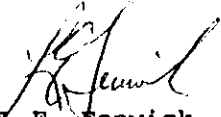
Enron Oil Canada Ltd. hereby formally registers an objection to the Omega Hydrocarbon Application. While some of the points in the Omega application are valid, the rights of the offset owners has not been properly addressed. It is Enron's position that the zone is correlatable through several wells operated by Enron and this sand is presently producing in the offset well Enron Omega Waskada 3-14-2-25 which also has the potential to produce at rates in excess of 15 m³/d of clean oil. The Enron Omega 3-14-2-25 was completed and producing from the referenced new producing zone prior to the drilling of the Omega Waskada 7-14-2-25 WPM.

It is Enron's contention that no one well should be given extended privileges unless this same privilege is extended to all parties within an existing pool. It also should be noted that the mineral owners are different in the east half and the west half of Section 14-2-25 WPM. This action could adversely affect the royalties of the mineral owners.

In support of the above, please find enclosed a copy of the logs, completion profile and production history for Enron Omega 3-14-2-25 WPM. Should you have any questions regarding this matter, please contact the undersigned or Tim McKay at your convenience.

Yours very truly,

ENRON OIL CANADA LTD.


L.E. Fenwick,
Vice-President, Production

TM/LEF:pd
attach

xc: Waskada Field Office,
Attention: C. Turnbull

tm004.ltr

THE OIL AND NATURAL GAS
CONSERVATION BOARD
WINNIPEG, MANITOBA

JUN 11 1990

RECEIVED

DATE			TREATMENT DETAILS
Year	Month	Day	
89	10	28	Ran GR-CBL - CCL logs
			Perforate Spearfish from 860.5-863.0 & 869.0 to 879.0 mKB
		30	Fracture stimulate Spearfish with gelled water and 7 tonnes of 20/40 sand.
		31	Ran BHP and rods
11	02		Place well on production - 4 day avg. 23 m ³ /day oil

3-14

KFS = 195.5
SL = 47.5

00850

866.5

862.5

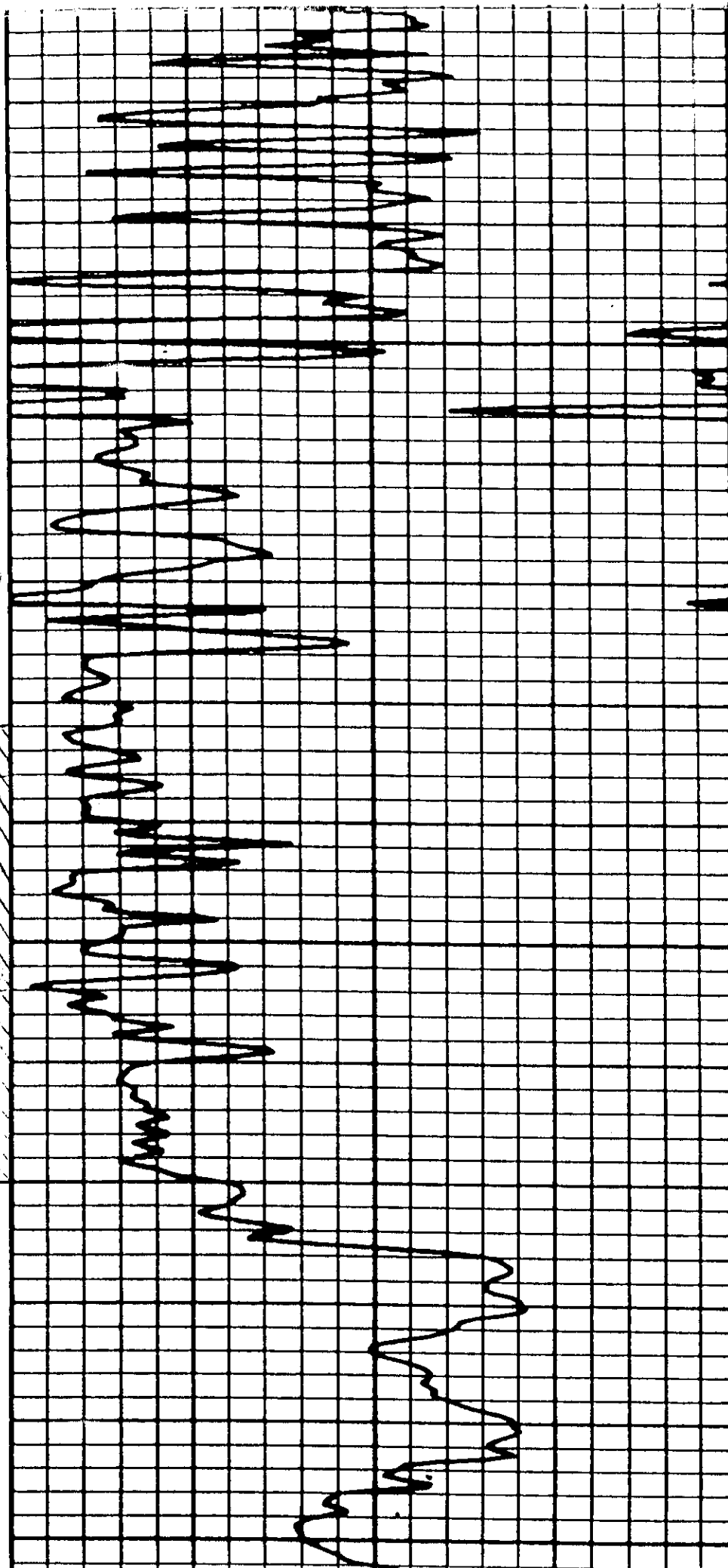
CORED INTERVAL

869

00875

879

00900

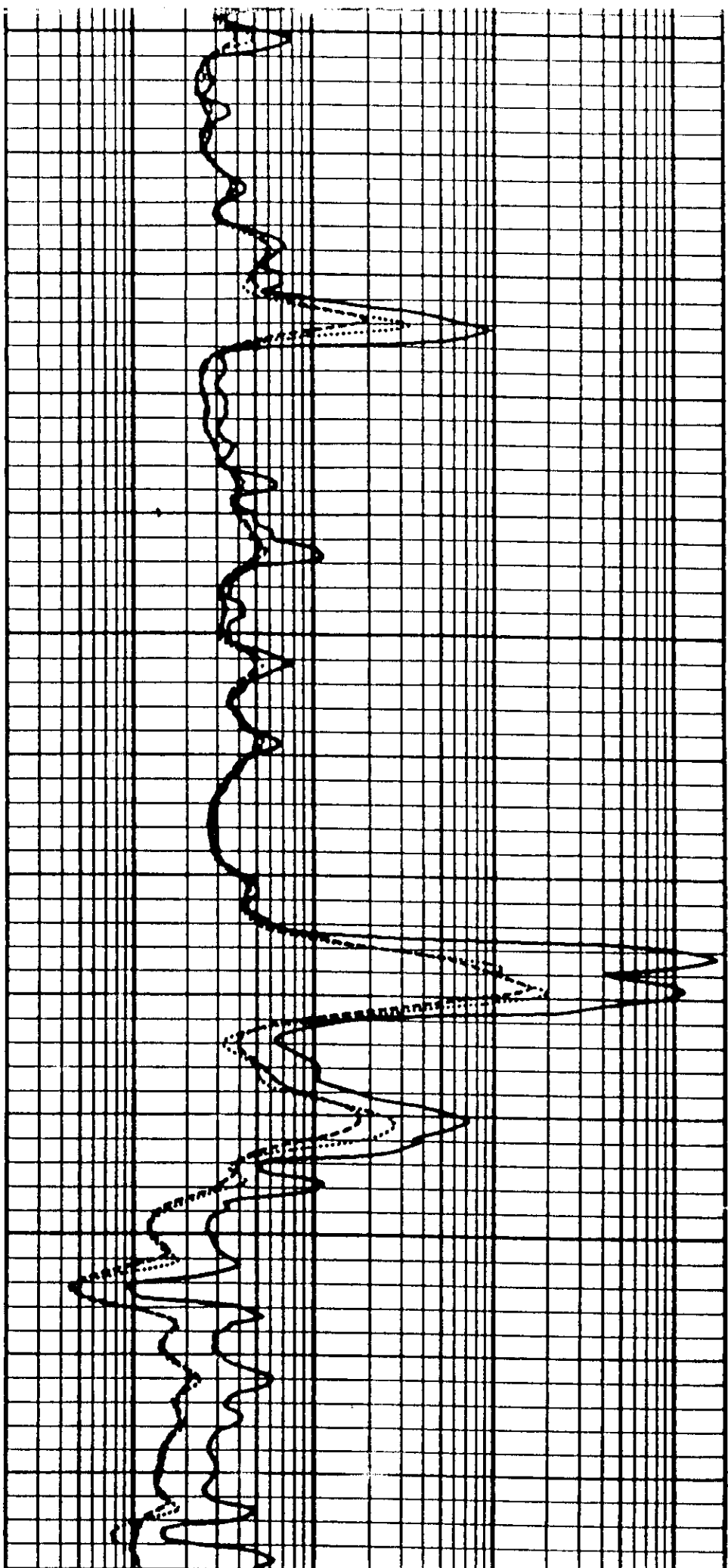
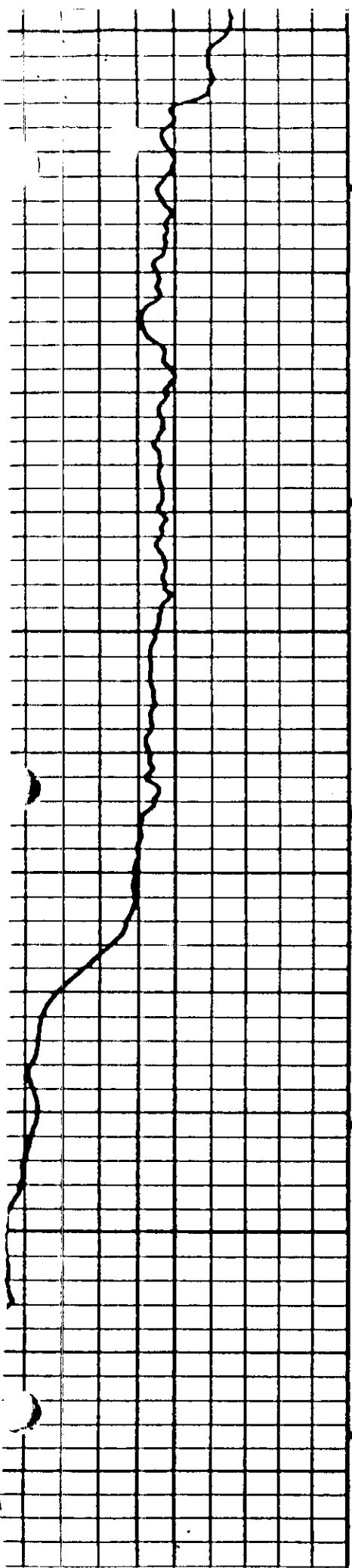


00850

3-141

00875

00900



May 30, 1990

The Oil and Natural Gas
Conservation Board
Ian Haugh, Chairman
H. Clare Moster, Deputy Chairman
Wm. McDonald, Member

John N. Fox
Chief Petroleum Engineer
Petroleum Branch

RE: Application for MPR Exemption
Omega Waskada 7-14-2-25 (WPM)

Omega Hydrocarbons Ltd. has applied pursuant to subsection 51(3) of the Petroleum Drilling and Production Regulation for a temporary 6 month exemption from maximum permissible production rate (MPR) restrictions for the well Omega Waskada 7-14-2-25 (WPM).

Recommendations:

It is recommended that the lessors and lessees in and within 0.5 km of the well Omega Waskada 7-14-2-25 (WPM) be notified directly by the Board of the application. A copy of the proposed letter of notification is attached.

Discussion:

The well Omega Waskada 7-14-2-25 (WPM) encountered a 4 m thick oil-bearing zone at the top of the Lower Amaranth Formation (Figure 1). This zone, which is approximately 9 m above the usual productive sands of the Waskada Lower Amaranth A Pool, is thought to be a tidal channel. Figure 2 is a net pay map of the upper zone. The zone is only present in 3-14-2-25 and 7-14-2-25 and is postulated to extend to the northeast.

The 7-14 well went on production March 6, 1990. During March and April, the well produced an average of 11.6 m³ OPD with a WOR of less than 0.02 m³/m³. The well has the capability to produce in excess of 15 m³ OPD. As of May 1, 1990, the 7-14 well was over-produced 128.1 m³.

The only technical argument put forward by Omega in its application for MPR exemption was the productivity of the well. Omega also indicated in its application that a 6 month waiver of the MPR restrictions will allow the company to gather the necessary reservoir information to determine, (1) if the zone is of limited size, and (2) if development drilling is warranted.

This application and others of a similar type suggest the need for some degree of added flexibility in MPR regulations in the initial production period of a well. Such flexibility would avoid unsupported MPR exemption applications and provide operators with an improved opportunity to obtain reservoir data necessary to better evaluate appropriate MPR levels.

Figure 3 shows the lessors and lessees in and within 0.5 km of the 7-14-2-25 well. Prior to making a decision on the application, the lessors and lessees in Section 14-2-25 (WPM) should be notified of the application and given 14 days to file an objection to or intervention in the application.

ORIGINAL SIGNED BY
JOHN N. FOX

John N. Fox

Att'd.

Original Signed By
L. R. Dubreuil

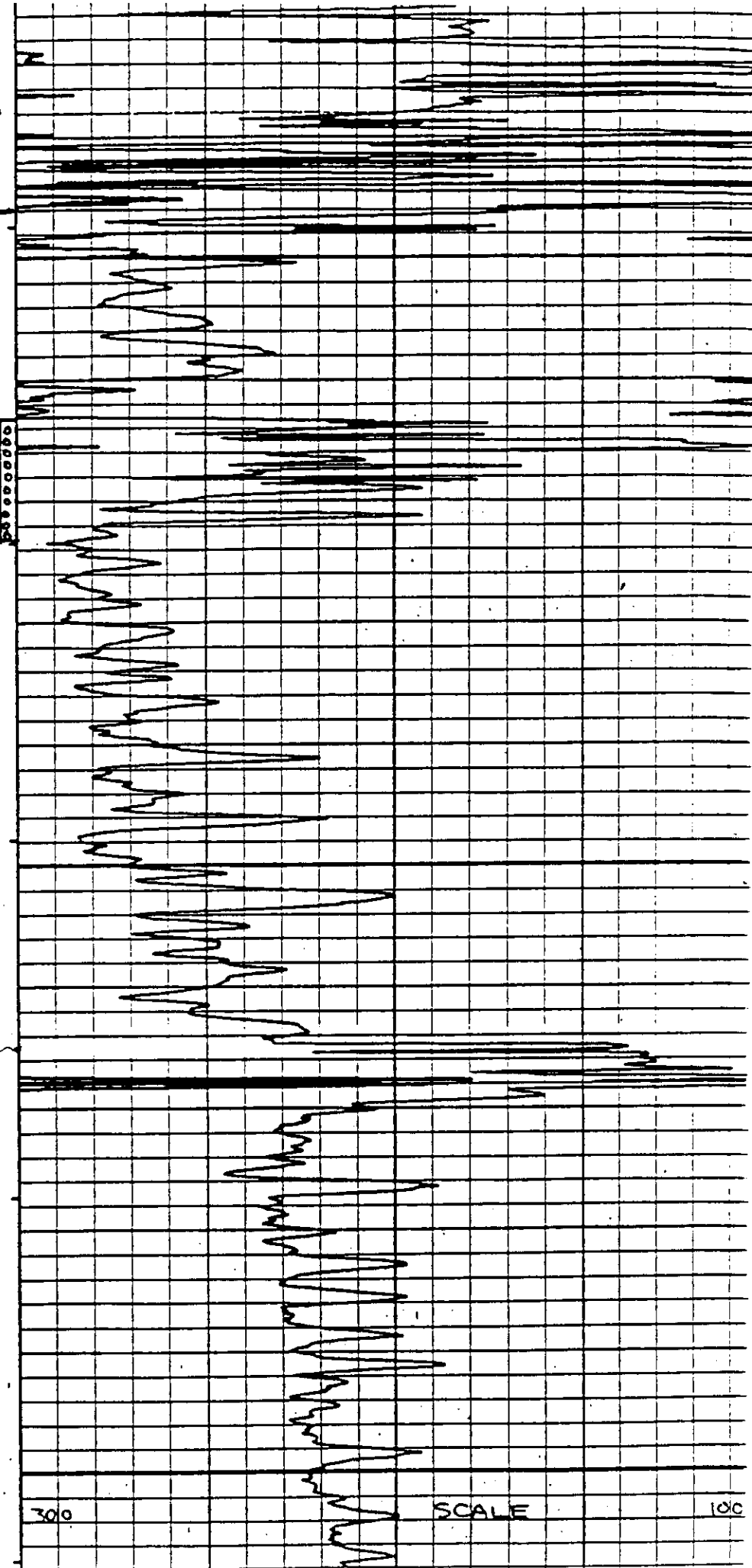
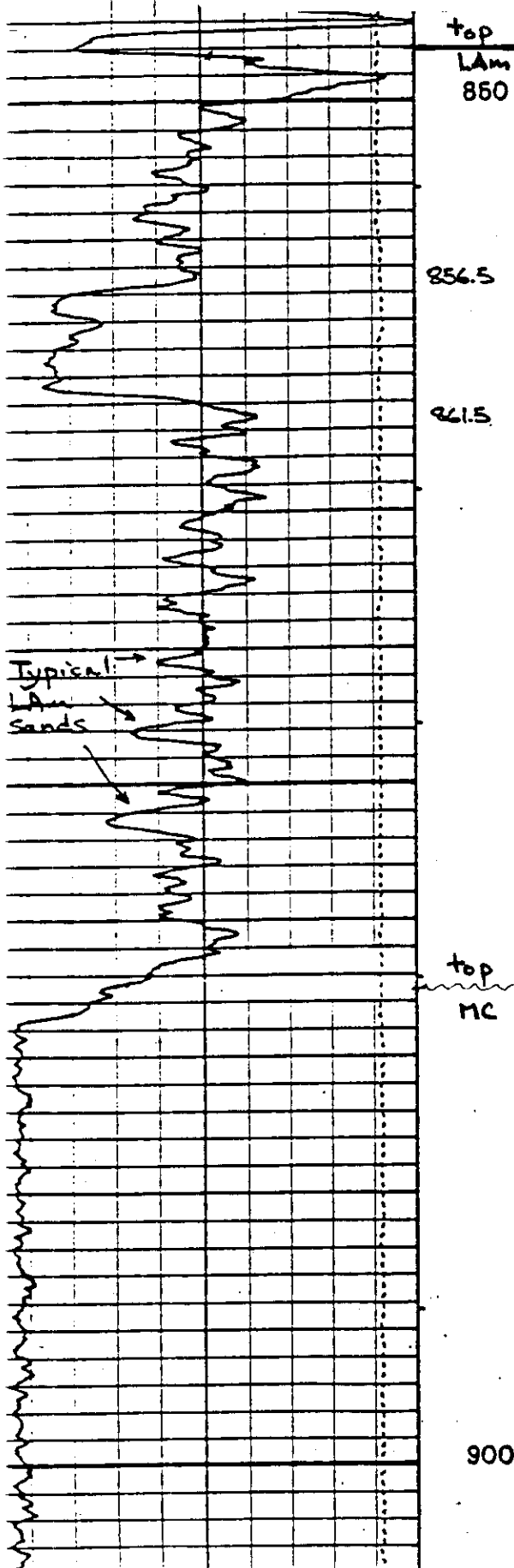
Approved:

L.R. Dubreuil, Director

FIGURE 1

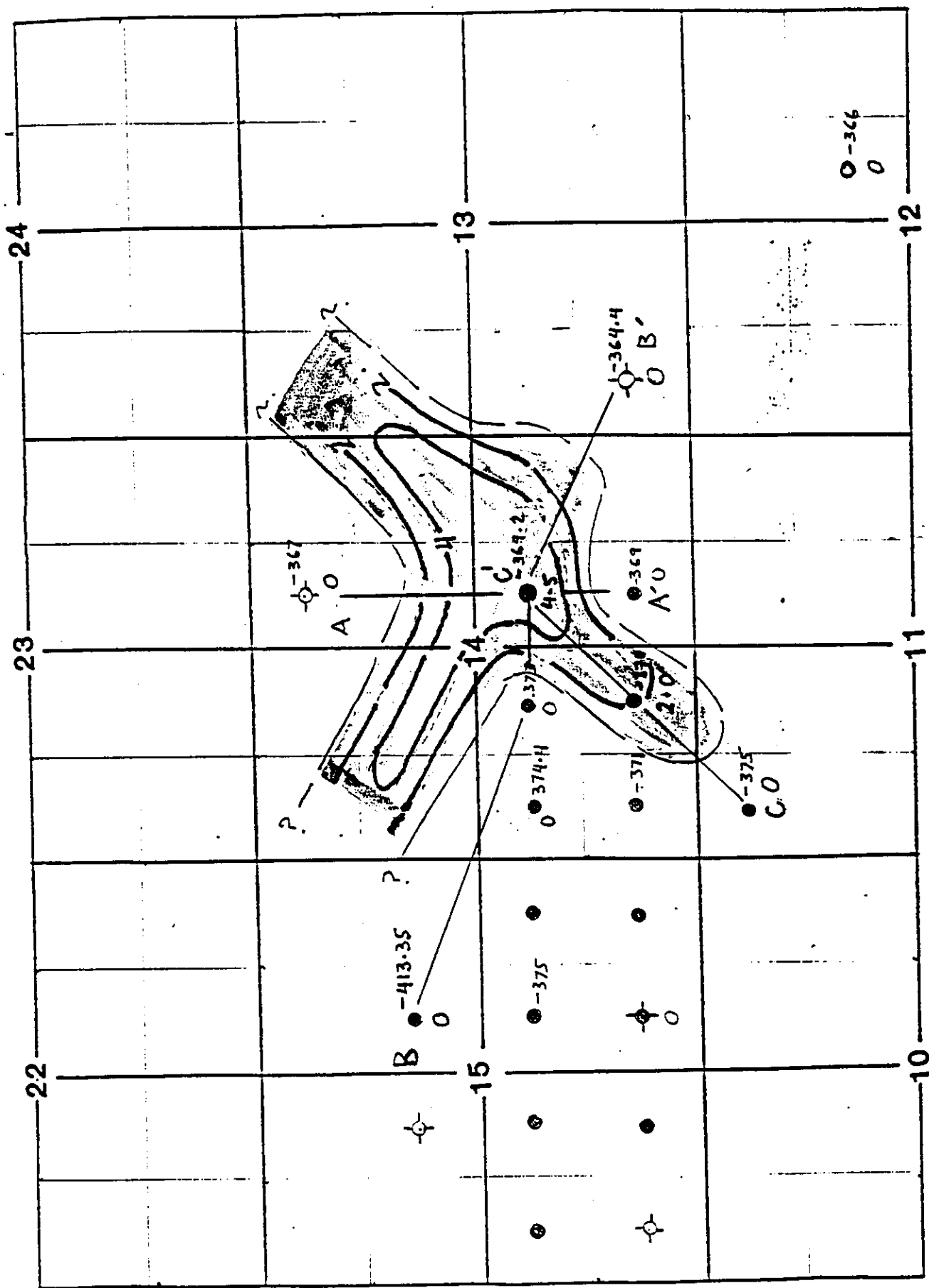
Omega Waskada

7-14-2-25 (WPN)



NET PAY TAP - UPPER SAND - LOWER ANARANTH FT.

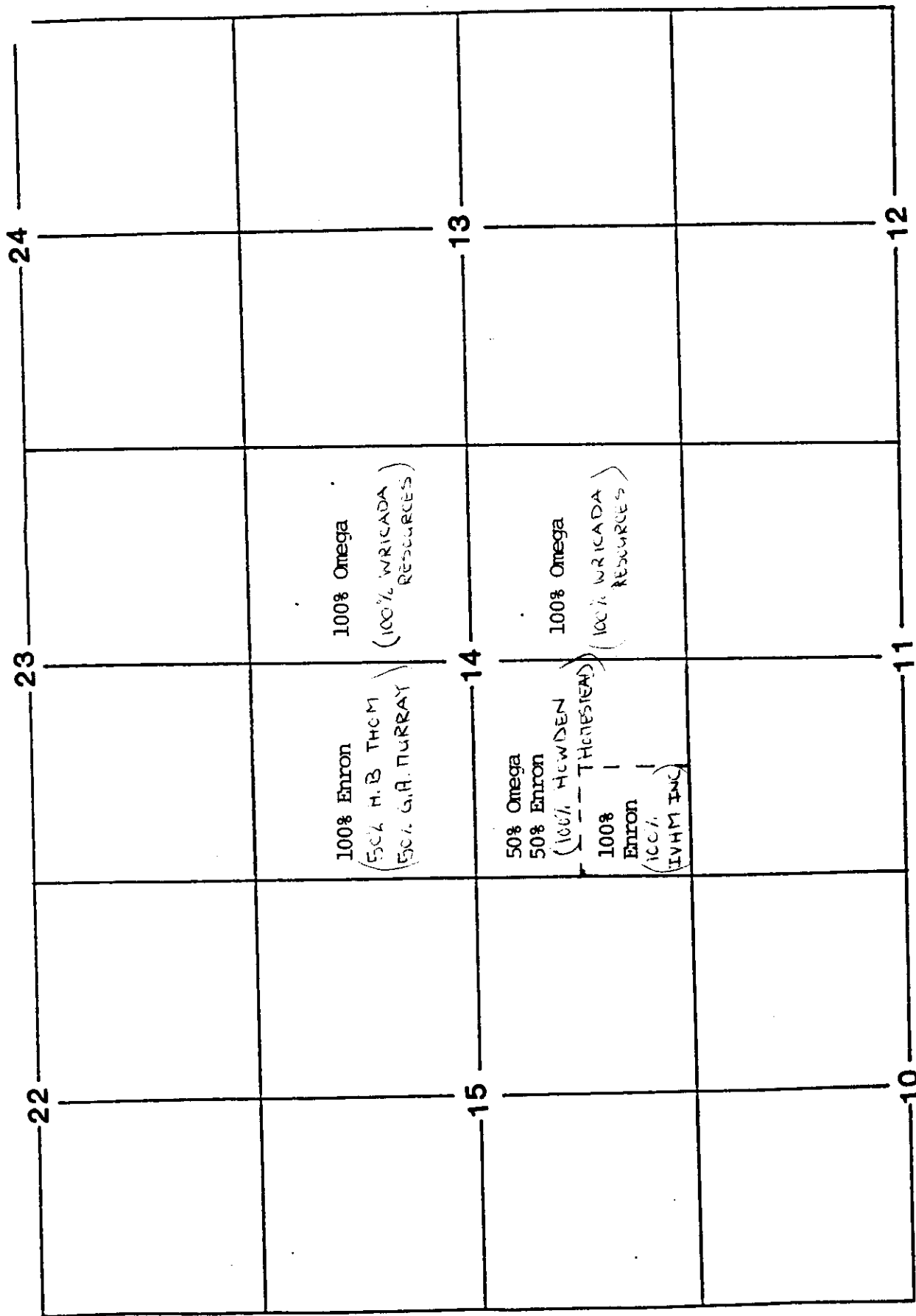
TWP 2



RGE 25 WPM

CI - 2 F

Lessee 2 & Lessee Map Surrounding Well 7-14-2-25 WPM



RGE 25 WPM () ROYALTY OWNER

FIGURE 3

May 30, 1990

Dear Sir/Madam:

RE: Application for Exemption from Maximum
Permissible Production Rate Limitations
Omega Waskada 7-14-2-25 (WPM)

This letter is to notify you that Omega Hydrocarbons Ltd. has made application for a temporary six (6) month exemption from the maximum permissible production rate (MPR) limitations of subsection 51(1) of The Petroleum Drilling and Production Regulation for the well Omega Waskada 7-14-2-25 (WPM).

If no valid objection or intervention in writing is received by the Board at Room 309, Legislative Building, Winnipeg, Manitoba, R3C 0V8, within 14 days of the date of this letter, the Board may approve the application.

Yours respectfully,

H. Clare Moster,
Deputy Chairman

Enron Oil Canada Ltd.
1300, 700 - 9 Avenue S.W.
Calgary, Alberta
T2P 3V4

Attention: Mr. Tim McKay

Harvey Bernard Thom

Box 125

Goodlands, Manitoba

ROM ORO

Howden Homestead Ltd.

Box 17

Waskada, Manitoba

ROM 2EO

IVMH Inc.

Goodlands, Manitoba

ROM ORO

George Alexander Murray

Fairview Home

1351 - 13 Street

Brandon, Manitoba

R7A 4S5

Wricada Resources Ltd.

Deloraine, Manitoba

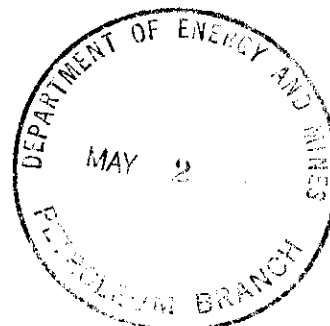
ROM OMO



1300 SUN LIFE PLAZA III
112 - 4th AVENUE S.W.
CALGARY, ALBERTA, CANADA T2P 0H3
TELEPHONE (403) 261-0743

May 1, 1990

**The Oil & Natural Gas
Conservation Board
Legislative Building
450 Broadway Avenue
Winnipeg, Manitoba
R3C 0V8**



**Attention: Mr. Ian Haugh
Chairman**

Dear Sir:

**Re: Application for Exemption from MPR Restrictions
Omega Waskada 7-14-2-25 WPM**

Pursuant to Section 51(3) of the Manitoba Petroleum Drilling and Production Regulations, Omega Hydrocarbons Ltd. hereby applies for an exemption from the maximum permissible production rate limit at well 7-14-2-25 WPM.

The previously mentioned well has encountered a new oil producing zone in the upper portion of the Lower Amaranth sand sequence. On drill stem testing the interval 855.0- 862.0 mKB recovered oil to surface in 40 minutes and has an estimated initial reservoir pressure 6041 kPag. The well was subsequently completed by perforating only and has demonstrated the potential to produce at rates in excess of 15.0 m³/d of clean oil.

Given, the encouraging performance of this well to date the questions which face our company are, 1) is this a zone of limited size and 2) is additional development drilling warranted. With the intent of obtaining the necessary reservoir data in a reasonable time frame Omega proposes that the MPR be temporarily waived at this location until October 31, 1990. At the conclusion of the unrestricted production period bottomhole reservoir pressure data and the well's production decline performance will be evaluated to determine reservoir size. Considering that the MPR exemption being requested is only temporary and that the excess produced volumes will be relatively small it is our position that no detrimental effects to either the correlative rights of offset owners or ultimate oil recovery will be compromised.

In further support of this submission please find attached the following information;

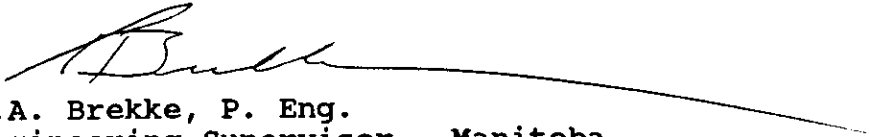
- 1) Lessor Map Surrounding Well 7-14-2-25 WPM
- 2) Lessee Map Surrounding Well 7-14-2-25 WPM
- 3) Production History For Well 7-14-2-25 WPM
- 4) Well Completion Summary
- 5) DST Test Data

Should you have any comments or questions related to this submission contact the undersigned at (403) 261-0743.

Your earliest attention to this matter would be appreciated.

Yours truly,

OMEGA HYDROCARBONS LTD.



R.A. Brekke, P. Eng.
Engineering Supervisor - Manitoba

/jb

c.c.: B. Dubreuil - Petroleum Branch
Waskada MPR/Allowable File

Lessor Map Surrounding Well 7-14-2-25 WPM

22	23	24
	<p>50% H.B. Thom</p> <p>50% G.A. Murray</p>	<p>100% D.M. Saunders</p>
15	14	13
	<p>100% Howden Homestead</p> <p>100% IVMH Inc.</p>	<p>50% D.M. Saunders</p> <p>50% Twin Peaks Petroleum Inc.</p>
	<p>100% Manitoba Dept. of Energy & Mines</p>	<p>100% Wricada Resources</p>
10	11	12
	<p>100% Manitoba Dept. of Energy & Mines</p>	<p>100% Manitoba Dept. of Energy & Mines</p>

TWP 2

RGE 25 WPM

Merak Projects Ltd. - Field Data Gathering System
Field Data Capture System
Monthly Single Well Battery Report

Current Time: 04/02/90 16:45:45

Report Month: Mar 790
WBI SWB 7-14
one:

UWI: 00/07-14-002-25W1/0
Unit:

Rat. Code:

Well Codes

Pools

P R O D U C T I O N																	T R U C K			
Day	Hrs	Inv	Inv	Load	Load	Allow	Prod	Prod	Prod	Strok	Strok	Pump	TSP	CSP	Op.	Total	Total	Total	Total	
		Oil	Water	Oil	Water		Oil	Water	Oil	Water	Speed	Len				Eff.	Oil	Water	Oil	Water
	(hr)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(spm)	(cm)	(%)	(kPa)	(kPa)		Disp.	Disp.	Rec.	Rec.	
																(m3)	(m3)	(m3)	(m3)	
0		0.0	0.0	0.0	0.0										J6	0.0	0.0	0.0	0.0	
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0	
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0	
5	0.0	0.0	0.0	0.0	14.2	0.0	0.0	0.0	3.9	6.9	0.0	0.0	0.0	0	0	J6	3.9	6.9	8.0	14.2
6	14.0	0.0	5.4	0.0	0.0	1.0	0.0	0.0	4.1	6.7	0.0	0.0	0.0	0	0	J6	5.1	1.3	0.0	0.0
7	24.0	3.4	2.0	0.0	0.0	4.8	0.0	1.5	0.0	0.6	0.0	0.0	0.0	0	0	J6	1.4	5.5	0.0	0.0
8	24.0	16.5	1.8	0.0	0.0	33.8	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0	0	J6	20.7	0.5	0.0	0.0
9	24.0	18.0	1.9	0.0	0.0	17.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0	0	VCR	15.7	0.2	0.0	0.0
10	24.0	16.1	1.7	0.0	0.0	13.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	15.6	0.3	0.0	0.0
11	24.0	10.8	1.7	0.0	0.0	9.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	14.7	0.1	0.0	0.0
12	24.0	10.7	1.8	0.0	0.0	11.8	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0	0	J6	11.9	0.1	0.0	0.0
13	24.0	17.4	1.9	0.0	0.0	6.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0
14	24.0	13.3	1.9	0.0	0.0	8.8	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	12.9	0.1	0.0	0.0
15	24.0	8.6	1.9	0.0	0.0	7.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	12.1	0.1	0.0	0.0
16	24.0	15.7	2.1	0.0	0.0	7.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0	0	VCR	0.0	0.0	0.0	0.0
17	24.0	22.8	2.3	0.0	0.0	7.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0	0	VCR	0.0	0.0	0.0	0.0
18	24.0	14.8	1.9	0.0	0.0	7.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	15.4	0.5	0.0	0.0
19	24.0	9.1	1.9	0.0	0.0	7.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	12.9	0.1	0.0	0.0
20	24.0	16.7	2.1	0.0	0.0	7.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0
21	24.0	11.7	1.9	0.0	0.0	10.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	15.5	0.3	0.0	0.0
22	24.0	20.4	2.1	0.0	0.0	8.7	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0
23	24.0	17.8	2.1	0.0	0.0	13.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0	0	J6	15.4	0.3	0.0	0.0
24	24.0	12.7	1.9	0.0	0.0	10.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	15.6	0.3	0.0	0.0
25	24.0	11.7	1.9	0.0	0.0	11.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	12.9	0.1	0.0	0.0
26	24.0	12.7	1.9	0.0	0.0	13.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	12.4	0.1	0.0	0.0
27	24.0	11.7	1.9	0.0	0.0	11.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	12.4	0.1	0.0	0.0
28	24.0	12.0	1.9	0.0	0.0	11.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	11.4	0.1	0.0	0.0
29	24.0	11.2	1.9	0.0	0.0	11.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	11.8	0.1	0.0	0.0
30	24.0	23.1	2.0	0.0	0.0	11.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0
31	24.0	34.5	2.1	0.0	0.0	11.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	J6	0.0	0.0	0.0	0.0
614.0				276.3		5.1		8.0		14.2						249.9		17.1	8.0	14.2

Load oil left to recover 0.0 m3.

10.8 m³/d

Remarks:

6) COMPLETION - STARTED PUMPING.

Marak Projects Ltd. - Field Data Gathering System
Field Data Capture System
Monthly Single Well Battery Report

Report Month: Apr/90

Current Time: 04/30/90 11:29:45

SMB: SMB 7-14

Unit: 00/07-14-002-25W1/0

Zones

Pools

Units

Bat. Codes

Well Codes

P R O D U C T I O N																	T R U C K			
Day	Hrs	Inv	Inv	Load	Load	Prod	Allow	Prod	Prod	Prod	Strok	Strok	Pump	TBP	CSP	Op.	Total	Total	Total	Total
		Oil	Water	Oil	Water		Oil	Left	Water	Oil	Water	Speed	Len				Eff.	Oil	Water	Oil
	(hr)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(spm)	(cm)	(%)	(kPa)	(kPa)		Disp.	Disp.	Rec.	Rec.
C/O		34.5	2.1	0.0	0.0															
1	24.0	44.8	2.2	0.0	0.0	10.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	0.0	0.0	0.0	0.0
2	24.0	29.4	2.0	0.0	0.0	10.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	25.7	0.3	0.0	0.0
3	24.0	28.6	2.0	0.0	0.0	11.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	11.9	0.1	0.0	0.0
4	24.0	16.9	1.9	0.0	0.0	13.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	25.1	0.2	0.0	0.0
5	24.0	18.0	1.9	0.0	0.0	14.8	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	13.7	0.1	0.0	0.0
6	24.0	19.0	1.9	0.0	0.0	13.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	12.9	0.1	0.0	0.0
7	24.0	20.6	1.9	0.0	0.0	14.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	12.9	0.1	0.0	0.0
8	24.0	22.1	1.9	0.0	0.0	14.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	12.9	0.1	0.0	0.0
9	24.0	22.1	1.9	0.0	0.0	12.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	12.9	0.1	0.0	0.0
10	24.0	20.1	1.8	0.0	0.0	13.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	15.7	0.2	0.0	0.0
11	24.0	21.2	1.8	0.0	0.0	14.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	12.9	0.1	0.0	0.0
12	24.0	19.7	1.7	0.0	0.0	14.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	15.7	0.2	0.0	0.0
13	24.0	17.7	1.6	0.0	0.0	13.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	15.7	0.2	0.0	0.0
14	24.0	16.3	1.5	0.0	0.0	13.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	15.3	0.2	0.0	0.0
15	24.0	15.2	1.5	0.0	0.0	13.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	14.7	0.1	0.0	0.0
16	24.0	16.4	1.6	0.0	0.0	15.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0	0	JB	14.4	0.1	0.0	0.0
17	24.0	15.1	1.6	0.0	0.0	11.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	13.2	0.1	0.0	0.0
18	23.0	17.2	1.6	0.0	0.0	13.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	11.8	0.1	0.0	0.0
19	24.0	14.1	1.6	0.0	0.0	10.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	13.4	0.1	0.0	0.0
20	24.0	17.2	1.6	0.0	0.0	13.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	9.9	0.1	0.0	0.0
21	24.0	16.2	1.6	0.0	0.0	11.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	12.9	0.1	0.0	0.0
22	24.0	15.1	1.6	0.0	0.0	10.8	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	11.9	0.1	0.0	0.0
23	24.0	14.1	1.6	0.0	0.0	9.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	10.9	0.1	0.0	0.0
24	24.0	23.4	1.7	0.0	0.0	9.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	0.0	0.0	0.0	0.0
25	24.0	17.2	1.6	0.0	0.0	9.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	JB	15.7	0.2	0.0	0.0
26	24.0	11.3	1.5	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	JB	12.9	0.1	0.0	0.0
27	0.0	11.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	VCR	0.0	0.0	0.0	0.0
28	20.0	12.3	1.5	0.0	0.0	8.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0	0	VCR	7.6	0.1	0.0	0.0
29	4.0	13.7	1.5	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	VCR	0.0	0.0	0.0	0.0
30	No data entered																			
647.0		331.8				2.7		0.0		0.0		352.6		3.3		0.0		0.0		

Load oil left to recover 0.0 m3.

Remarks:

- 18) DOWN 1 HR. TO MOVE TANKS.
- 27) MOTOR DOWN - CARS PROBLEMS
- 29) MOTOR DOWN

1%

CMEGA HYDROCARBONS LTD.
WELL COMPLETION SUMMARY

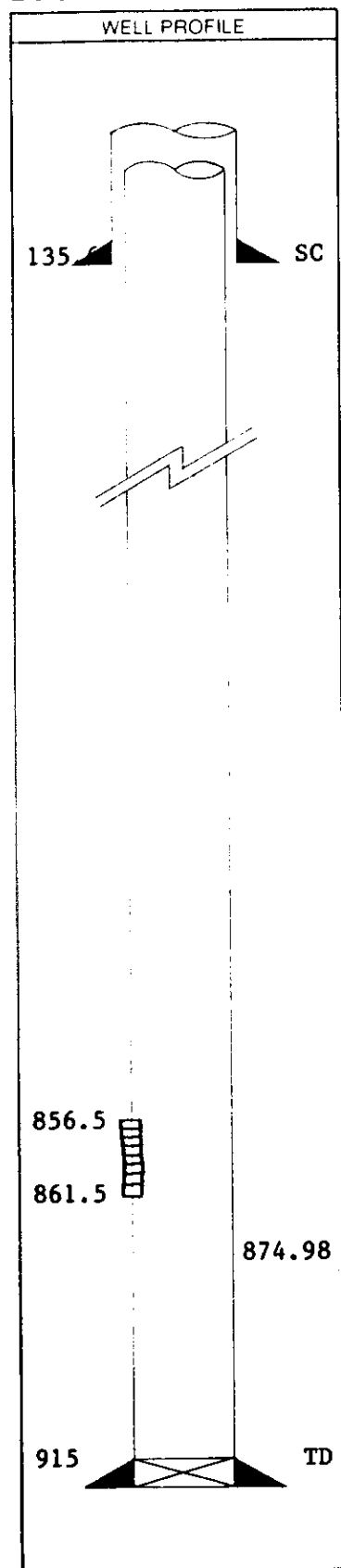
Prepared by Kurt Thomas

Date 90 04 30
Year Month Day

Well Name Omega Waskada Well Status LAM Oilwell

Well Location 7-14-2-25 WPM Rig Release Date 90/02/28

Elevations: KB 478.8 m GL 474.6 m PBDT TD 915.0 mKB



GEOLOGICAL DST and CORE DATA		
FORMATION	DEPTH (mKB)	REMARKS
Spearfish	855-862	DST #1
Spearfish	763-782	DST #2

WELLHEAD ASSEMBLY

CASING AND TUBING REPORT						
SIZE (OD)	WEIGHT (kg m)	DEPTH (mKB)	NO OF JOINTS	GRADE	THREAD	REMARKS
219.1	35.7	135.6	10	J55		11T 0:1:0+3%CaCl ₂
114.1	14.1	915.0	75	J55		20T 2:1:8 w/10T Expando mix

BOTTOM HOLE EQUIPMENT

COMPLETION HISTORY	
DATE Year Month Day	TREATMENT DETAILS
90 02 27	DST#1. PF: Building rapidly to strong. Gas to surface in 5 mins. FF: Strong blow, gas to surface immediately. Fluid to surface in 40 min. (oil). Pressures: IH: 9682, FF: 3224, ISI: 6121 IF: 3424, FF: 4866, FSI: 5943. Total fluid recovered, 390 m of oil
90 02 27	DST #2. PF: Blow building, rapidly to 12 mm of water. No gas to surface. FF: Blow building gradually to 155 mm of water. No gas to surface. Pressures: IH 8881, FF: 360, ISI: 7278, IF: 450, FF: 811, FSI: 7100, FH: 8614. Total fluid recovered, 18 m of oil speckled mud. and 36 m of oil speckled water.

OMEGA HYDROCARBONS LTD.
WELL COMPLETION SUMMARY

Prepared by K. Thomas
Date 90 04 30
Month Day Year

Well Name Omega Waskada Well Status LAm Oilwell
Well Location 7-14-2-25 WPM Rig Release Date 90/02/28
Elevations: KB 478.8 m. GL 474.6 m PBD TD 915 mKB

COMPLETION HISTORY			
DATE			TREATMENT DETAILS
Year	Month	Day	
90	03	05	Perf (LAm) 856.5-861.5 mKB. Run in hole w/cement bond log. Cement over zone of interest looked good. Swabbed fluid to \pm 660.0 mKB. Perforated Spearfish with 16gr. charges w. 90 degree phasing in a 86 mm HSC gun @ 13 spm. All shots fired. Landed tubing @ 874.98 mKB. Ran BHP and partially scraped rod string.

Omega Whiskadee
7-14-7-25 WPM
Sonic Log

850

856.5

861.5

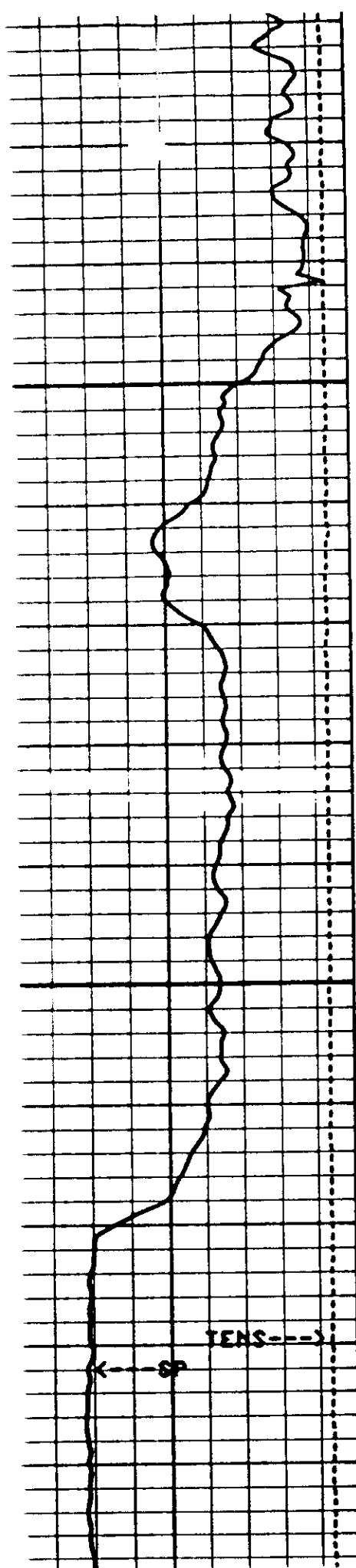
900

Typical
Lam
sands

300

SCALE

100



850

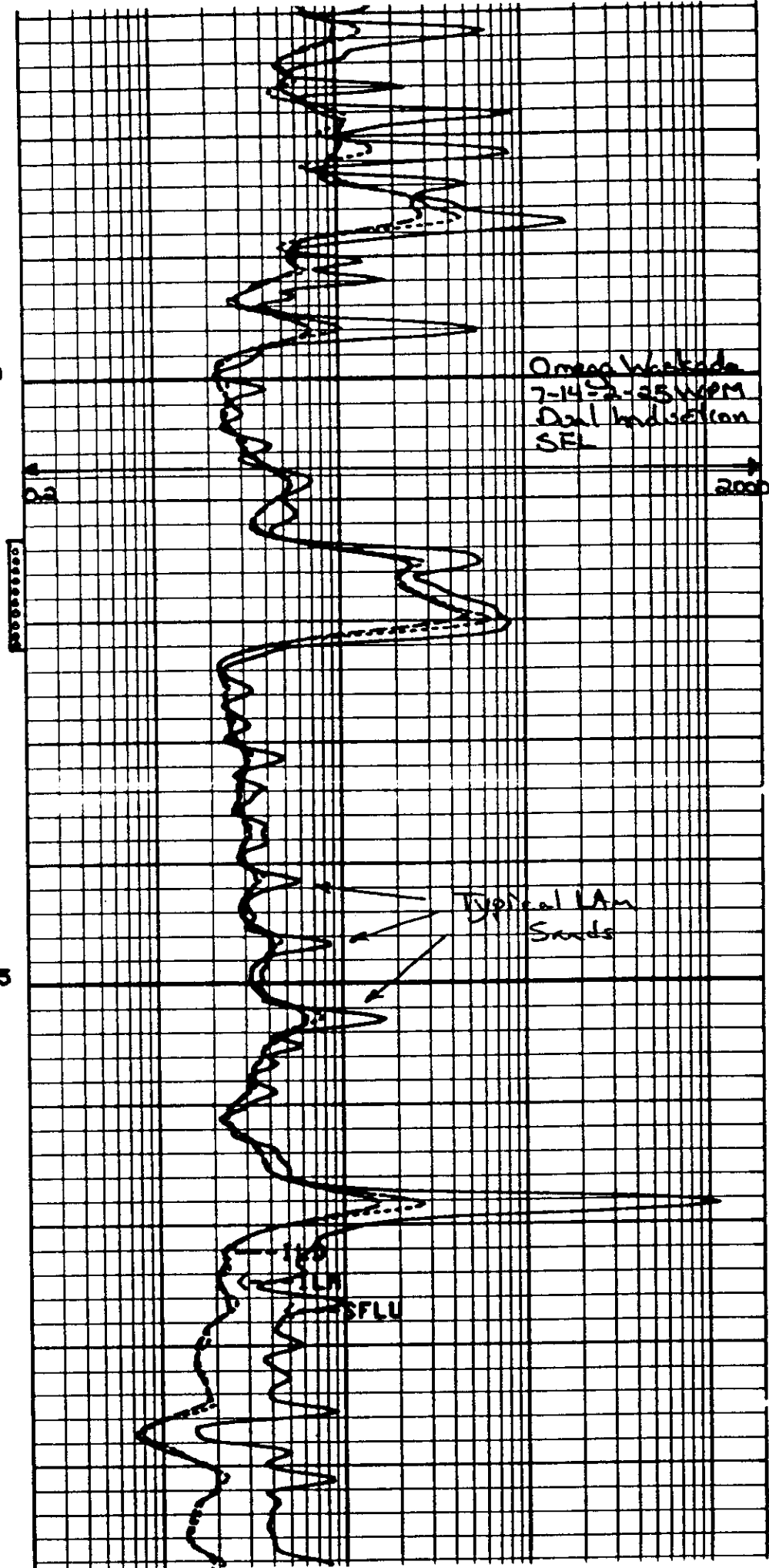
86.5

86.5

875

TENS---

SP



Omeg Wkenda
7-14-2-25 WPM
Dial Indication
SFL

2000

Typical Lam
Sands

SFLU

LLOYD'S DRILLSTEM TESTING LTD.

COMPANY NAME: Omega Hydrocarbons Ltd.

WELL NAME: Omega Waskada

LOCATION: 7-14-2-25-W1

INTERVAL 855.00 m TO 862.00 m TOTAL DEPTH 917.00m

TIME: PF 10 1SI 60, 2FL 45, 2SI 375, 3FL __, 3SI __

KB ELV 478.80m

GR ELV 474.60m

DATE: 90-02-26

T# 481 DST # One

FORMATION: Spearfish

TEST TYPE: Straddle

[CONVENTIONAL]

RECORDER DATA ALL MEASUREMENTS ARE 'SI'

REC.#	3972	10996	2226	2016
RANGE	24132	35853	24476	31576
CLOCK	Hr.	12 Hr.	12 Hr.	24 Hr.
DEPTH	849.91	859.75	864.30	864.30
	KPAG	KPAG	KPAG	KPAG
A IHD	Recorder	9584	9659	9638
B PF		3433		
B1 EPF	malfunction	3343		
C 1SI		6005		
D 2F		3379		
E E2F		4794		
F 2SI		6041	8756	8779
G FHD		9718	9768	9770
D1 3F				
E1 E3F				
F1 3SI				
O/I	FLUID	INSIDE	OUTSIDE	OUTSIDE

HOLE and TEST DESCRIPTION

MUD DATA

T STARTED	20:30 Hr.	HOLE SIZE	200 mm	MUD TYPE	Gel Chem
T ON BTM.	22:30 Hr.	BTM. CHOKE	19.05 mm	WEIGHT	1160
T OPENED	22:52 Hr.	D.COLL ID	63.50 mm	VIS	65
T PULLED	07:00 Hr.	D.PIPE ID	73.00 mm	W.LOSS	10.5
T OUT	12:00 Hr.	D.C.LENG	112.97 m	F.CAKE	1.59
TOOL WT.	2 000 daN	D.P.LENG	741.27 m	MUD DROP	No
WT. SET	20 000 daN	WT. PULLED	32 000 daN	AMT of FILL	NII m
INIT WT	24 000 daN	FINAL WT	28 000 daN	POROSITY	%
HOLE COND	Good	BTM. H. TEMP.	30 C	Fid.CUSHION	m
COMPRESS.RCK.	__	NET PAY	__ m	TYPE	__

SAMPLES TO:

RECOVERY FLUID

TOTAL 390.00m of 112.97 m in D.C. & 247.03 m in D.P.
390.00m of Oil

GAS - Measured with:

TIME	ORIFICE	PRESSURE	RATE
min.	mm	kPa	m ³ /Day

REMARKS:

PREFLOW: Blow building rapidly to strong, gas to surface
in 5 minutes. Too small to measure.

SECONDFLOW: Strong blow, gas to surface immediately, too small
to measure, fluid to surface in 40 minutes.

TEST SUCCESSFUL



PO Sub	.30
XO Sub	.30
Shut-In Tool	1.60
Hydraulic Tool	1.71
Rec. # 3972	1.52
Jars	1.85
Safety Joint	.68
PACKER	1.80
TOTAL TOOL ABOVE	9.76m
INTERVAL	855.00m
STUB	.35
Perfs.	3.35
Rec. # 10996	2.10
Blank sub	.30
STUB	.90
PACKER	1.25
DEPTH	862.00m
TOTAL INTERVAL	7.00m
PACKER	2.10
Rec. # 2226 & # 2016	4.21
Perfs.	.30
XOS	46.24
Drill Pipe	.30
XOS	.60
BULL NOSE	917.00m
TOTAL DEPTH	55.00m
TOTAL TAIL PIPE	25.52m
TOTAL TEST TOOL	
CUSTOMER REP. M. Lamf	
TESTER A. Dubiel /G05	

WELL NAME Omega Waskada 7-14-2-25-W1

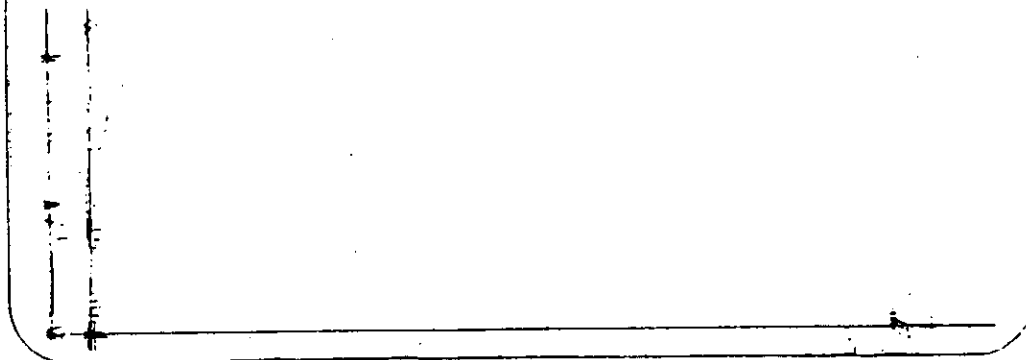
TICKET NO. 481

D.S.T. NO. One

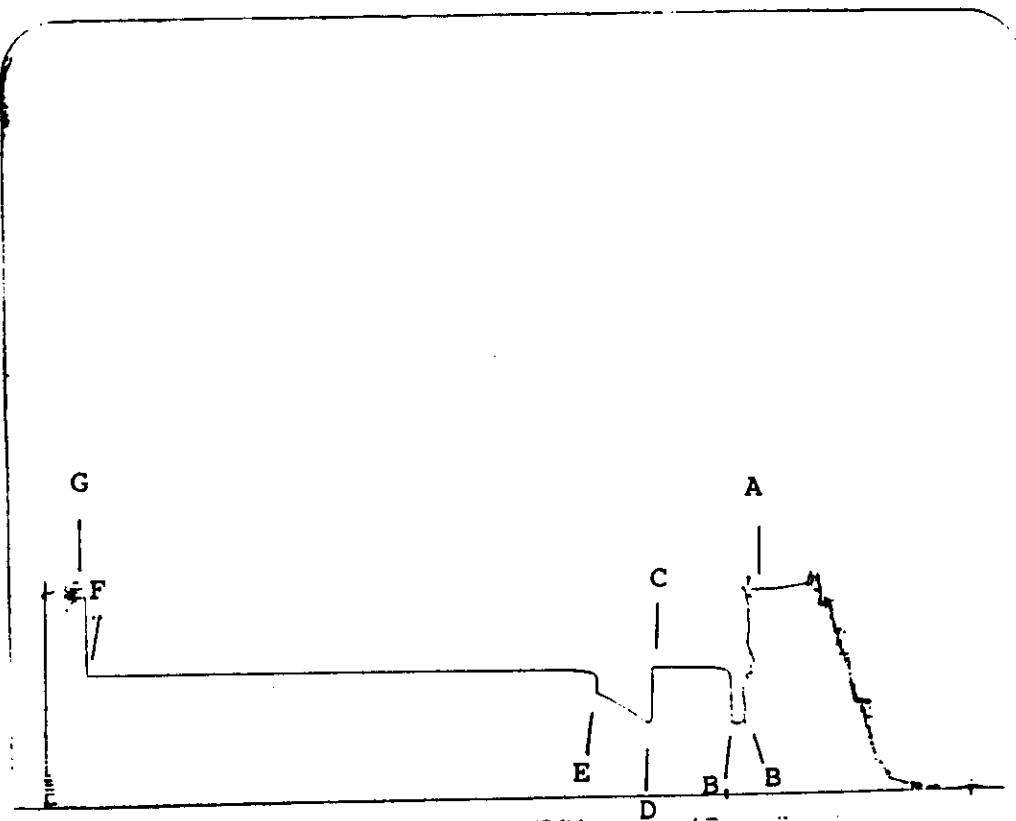
Well Name :Omega Waskada
Location :7-14-2-25-W1

Ticket #:481
DST # :One

Recorder :3972
Depth :849.91
Clock :12 hr.
A IN Hydrostatic : 0.0
B Preflow : 0.0
B1 End Preflow : 0.0
C First Shutin : 0.0
D Second flow : 0.0
E End 2nd flow : 0.0
F Second Shutin : 0.0
G FL Hydrostatic : 0.0
D1 Third flow : 0.0
E1 End third Flow : 0.0
F1 Third Shutin : 0.0



Recorder :10996
Depth :859.75
Clock :12 hr.
A IN Hydrostatic : 9584.0
B Preflow : 3433.0
B1 End Preflow : 3343.0
C First Shutin : 6005.0
D Second flow : 3379.0
E End 2nd flow : 4794.0
F Second Shutin : 6041.0
G FL Hydrostatic : 9718.0
D1 Third flow : 0.0
E1 End third Flow : 0.0
F1 Third Shutin : 0.0

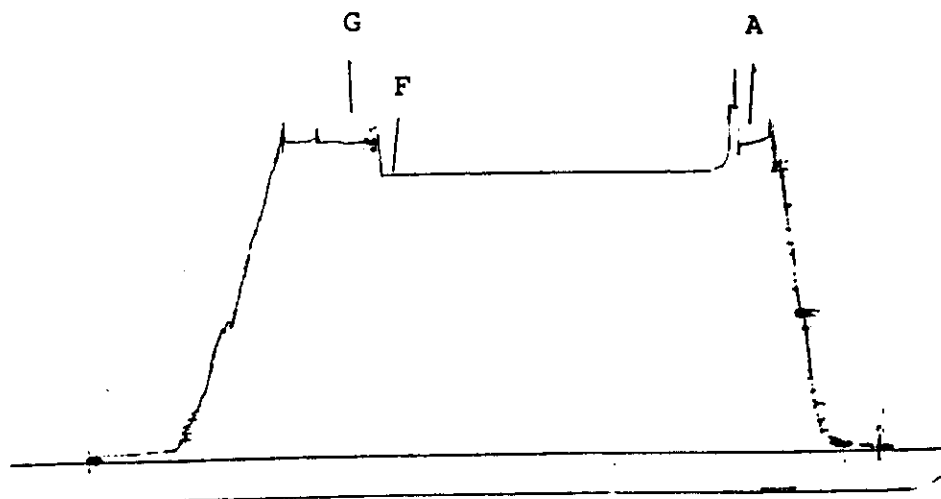


LLOYD'S DRILLSTEM TESTING LTD.

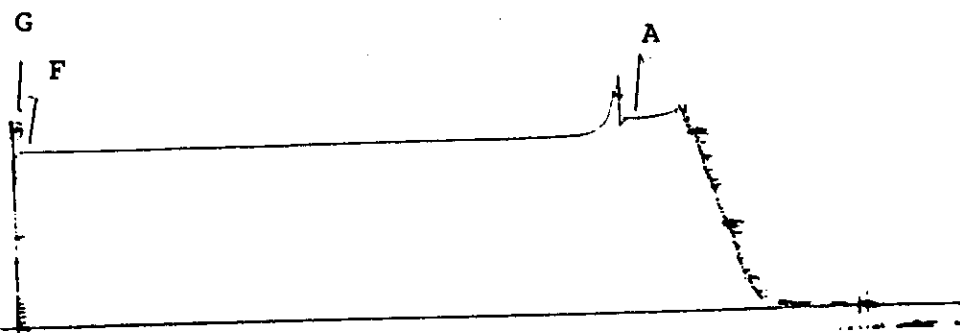
Well Name :Omega Waskada
Location :7-14-2-25-W1

Ticket #:481
DST # :One

Recorder :2226
Depth :864.30
Clock :24 hr.
A IN Hydrostatic : 9659.0
B Preflow : 0.0
B1 End Preflow : 0.0
C First Shutin : 0.0
D Second flow : 0.0
E End 2nd flow : 0.0
F Second Shutin : 8756.0
G FL Hydrostatic : 9768.0
D1 Third flow : 0.0
E1 End third Flow : 0.0
F1 Third Shutin : 0.0



Recorder :2016
Depth :864.30
Clock :12 hr.
A IN Hydrostatic : 9638.0
B Preflow : 0.0
B1 End Preflow : 0.0
C First Shutin : 0.0
D Second flow : 0.0
E End 2nd flow : 0.0
F Second Shutin : 8779.0
G FL Hydrostatic : 9770.0
D1 Third flow : 0.0
E1 End third Flow : 0.0
F1 Third Shutin : 0.0



7-14-2-25 NPR exemption

- new productive sand in Upper portion of LAw.
- well on prod. Mar 6/90 aver. daily rate - 10.8 m³/PD
WOR = 0.02
- Aps - 12.31 m³/PD WOR = 0.01
- over-production @ Apr 30/90 - 128.1 m³
- offset WIO - ENRON - NW/4 - 14
OMEGA E/2 - 14
OMEGA/ENRON S0/S0 LSD's 3, S & 6 - 14
- Omega questions is zone of limited size & is additional development drilling warranted ~ 3 potential targets
- Figure No. 1 shows development in the area.

well's	Finished Date	IP MSOPD	WOR	MARCH 190 PRODUCTION oil WOR
6-14		1.8	2.37	1.8 2.9
5-14 *		4.7	2.4	4.1 3.4
2-14 **		8.1	0.29 *	MC 1.6 0.2 LHM 5.2 0.1
3-14 xxx				13.8 .02
4-14				1.2 .25

- Mission Canyon Products
 - 2-14 also has Mission Canyon potential
- *** 3-14 completed in upper canyon

Enron is reducing OP by U.P. 40-50 m³/m.

3-14 - 498 m³ if U.P. carried forward. 128 m³. (Mar-1)

7-14 128 m³ as of May 1

① ✓ Based on 03 29A MPR, what is the well's over production status?

② ✓ If well un restricted at 15 m³ for six months (15-8) 182 = INCREMENTAL PRODUCTION is 1274 m³

If well ~~was~~ produced at 11 m³ for six months (11-8) 182 = 546 m³ of incremental production.

③ How about ~~restnot~~ removing the daily restriction. This would allow Omega to get additional info to construct a rate vs cum prod. curve and would also make it possible to shut in well for pressure buildup. Can obtain all the same info?

④ ✓ ~~But~~ What is the OP status of 3-14. What are Enron's plans for it

⑤ Drainage concern is in North south west only. (i.e. 3-14) which has different W10 & R10 from 7-14

⑥ Probably no basis in interpreting channel to the NW.

⑦ L.Am (normal zone) in area

✓ 2-14 5.2 / 0.1
6-14 1.8 / 2.9
4-14 1.2 / 0.25

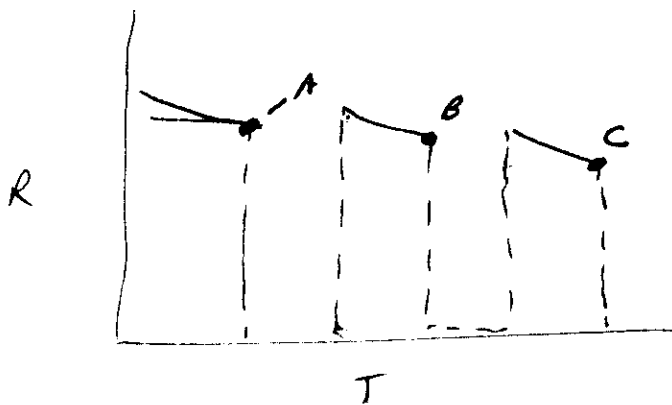
Can we make a ϕ h map?
to demonstrate prospects to the NE
warrant development dir.

- ⑧ Do we have an MCI map of the area. Would you drill a well for MCI alone?
- ⑨ Is Enron aware or have they commented on the application? no!
- ⑩ Is there any fluid level information
- ⑪ How was 3-14 completed? was it stimulated?

- Letter should - suggest dev. drily if other targets reasonable

- provide flex of no max daily rate to permit required ~~reservoir~~ data

(i.e. rate vs cum prod curve



Plot A, B & C against Cum Prod.



Can obtain buildups - R
fluid levels are OK

during any of SI periods
Also ~~flowing~~ ^{prod.} fluid levels

1) Omega 7-14-2-25

Enron 3-14-2-25

Tundra 5-13-10-25

OPTIONS

1 - Deny on tech. grounds.

- sends a neg. message

2. Approve - indicate tech. deficiencies

- 6 mo. period
- data collection
- require devel./depl. strat.
- advertising
- include 3-14 (Enron well)

3. General first year flexibility

- ~~25~~^{up to 50} to over allowable
- regulation
- better long term soln.

ATTACHMENT 1 DEVELOPMENT DRILLING ECONOMICS

A. RESERVOIR PROPERTIES

LOWER AMARANTH

MISSION CANYON

NET PAY (m)	10 - 4.7	1.0 - 1.5
PERMEABILITY (%)	10.3 - 12	11 - 19
WATER SATURATION (%)	45 - 52	46 - 62
COIP m^3	12800 - 36800	10050 - 12450
RECOVERY FACTOR (%)	12	12
RECOVERABLE RESERVES m^3	1536 - 4416	1206 - 1494
INITIAL PRODUCTION (L/D)	2	2

B. DRILLING & OPERATING COSTS

DRILLING, COMPLETION & EQUIPMENT COSTS - \$225 M
OPERATING COSTS FIXED - \$1500/well/month
 VARIABLE - \$15 / m^3
OIL PRICES (\$/m³)
FREEHOLD ROYALTY - 15%

ECONOMICS (AIT)

NET PRESENT VALUE (DCF 10%) (\$M)
RATE OF RETURN (%)
PAY-BACK (YRS)

Rec. RES = 4400 m^3
2.0
15.3
4.9

PETROLEUM ECONOMICS EVALUATION PROGRAM
XI Consultants Ltd.

Version 88-11-18
05/29/90 08:01:20
FILE: MPR1

----- CASE DESCRIPTION -----
OMEGA - MPR APPL'N - 7-14-2-25 (WPM)

DISC RATE (%)	NET PRESENT VALUES (M\$)					
	0.0	12.0	15.0	18.0	20.0	22.0
B.T. OPER INC	407	255	232	213	202	192
B.T. CAP INV.	225	218	216	214	213	212
B.T. CASH FLOW	182	38	16	-1	-11	-20

Royalty Regime: MANITOBA Gas Holiday: NO
Reserve type: Probable Oil Holiday: NO
Royalty Type: Eval/Prod Start: 90- 6/90- 7
Sensitivity: NO Proj/Econ Life: 11.5/11.5 yrs

A.T. OPER INC	351	236	218	202	194	185
A.T. CAP INV.	225	218	216	214	213	212
A.T. CASH FLOW	126	18	2	-12	-20	-27

----- ECONOMIC INDICATORS -----

		B.TAX	A.TAX
ROR	- PCNT	17.8	15.3
PAYOUT PERIOD	- EVAL	4.8	4.9
	- CAPTL	4.5	4.6
UNDISC PIR	- \$/%	0.81	0.56
12.0 PCT PIR	- \$/%	0.17	0.08
15.0 PCT PIR	- \$/%	0.08	0.01
NPV @ 12.0	- \$/M3	8.53	4.07
NPV @ 15.0	- \$/M3	3.72	0.38

----- PRODUCTS RECOVERY -----

		GROSS	WI	ROY	NET
OIL	E3m3	4	4	0	4
GAS-RAW	E6m3	0	0		
GAS-SALES	E6m3	0	0	0	0
ETHANE	E3m3	0	0	0	0
PROPANE	E3m3	0	0	0	0
BUTANE	E3m3	0	0	0	0
CONDENS.	E3m3	0	0	0	0
SULPHUR	E3t	0	0	0	0
OTHER	E3m3	0	0	0	0

----- COMPANY W.I. -----

	Init%	Avr%	Rev%
REVENUE	100.0	100.0	
FIELD CAP	100.0	100.0	
PLANT CAP			
GATH CAP			
ORR-GAS			
ORR-OIL			
ROYALTY	5.5	1.3	

----- WI CASH FLOW SUMMARY -----

YEAR	OIL PRODUCTION---			TOTAL	--ROYALTY--		--OPERATING--		OPERAT	NETBACK	CAPTL	B.TAX	TOTAL	-----AFTER TAX-----		
	RATE	VOL.	PRICE	REV.	WINTAX	%	EXPENSE	INCOME	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM	
	M3/D	E3m3	\$/M3	M\$	M\$	%	M\$	\$/M3	M\$	\$/M3	M\$	M\$	M\$	M\$	M\$	
ZERO											0	0	0	0	0	
1990	2	0	132.09	47	3	5	14	40.43	30	84.45	225	-195	-15	-180	-174	
1991	2	1	132.09	85	4	4	28	42.91	54	83.57	0	54	-1	55	49	
1992	2	1	138.69	79	2	3	28	48.93	49	85.86	0	49	3	46	36	
1993	1	1	145.61	73	1	2	28	56.00	44	87.39	0	44	6	38	27	
1994	1	0	154.17	68	0	0	29	64.29	40	89.26	0	40	7	32	20	
1995	1	0	172.62	68	0	0	29	74.03	39	98.59	0	39	9	29	17	
1996	1	0	188.75	65	0	0	30	85.50	36	103.25	0	36	10	26	13	
1997	1	0	206.83	63	0	0	30	99.00	33	107.83	0	33	10	23	10	
1998	1	0	225.04	61	0	0	31	114.93	30	110.11	0	30	9	20	8	
1999	1	0	236.29	56	0	0	32	133.73	24	102.56	0	24	8	16	6	
2000	1	0	248.11	52	0	0	33	155.94	19	92.17	0	19	6	13	4	
2001	1	0	260.52	32	0	0	22	178.74	10	81.78	0	10	3	7	2	
SUBT		4		750	10		333		407		225	182	56	126	18	
REM.		0		0	0		0		0		0	0	0	0	0	
TOTL		4		750	10		333		407		225	182	56	126	18	
12.0% DISC				447	8		183		255		218	38	20	18		
% OF REV.				100	2		41		57		49	8	4	4		

PETROLEUM ECONOMICS EVALUATION PROGRAM
XI Consultants Ltd.

Version 88-11-18
05/29/90 08:01:29
FILE: MPR1

se Notes

=====

valuation Begins in 1990 6
roduction Begins in 1990 7

parameter File:

MANITOBA ENERGY AND MINES

Discount Method: ANNUAL MID PERIOD

Default Escalation Rates

Revenue	Year	Rate	Oper Costs	Year	Rate	Capital	Year	Rate
	1988	5.00		1988	5.00		1988	5.00
	1990	6.00		1990	6.00		1990	6.00
	1995	6.00		1995	6.00		1995	6.00
	2000	6.00		2000	6.00		2000	6.00

se Parameters:

Probable

roduction:

1 Exponential Decline --- Starting in 1990 : Ini Rate 2.0 : Final Rate 0.5 : Total Volume 4.4 : Decline Pcnt 11.70

oyalties:

berta par price files used

Oil price file: Gas price file

Capital:

ax Data:

1 production is Resource.

ederal surtax of 3.0 % used.

PETROLEUM ECONOMICS EVALUATION PROGRAM
XI Consultants Ltd.

Version 88-11-18
05/29/90 08:01:32
FILE: MPR1
REPORT: peepogip

INPUT DATA SUMMARY

O I L										G A S									
Year	Prod Wells	Prod Rate	Prod Vol	WI Vol	New	Oil Price	Oper Cost	Trans Cost	DRR	Prod Rate	Prod Vol	WI Vol	Shr	New	Price	Oper Cost	Plant/ Bath	Plant/ Bath	DRR
	m3/d	E3m3	E3m3	%	%	\$/m3	\$/m3	\$/m3	%	E3m3/d	E6m3	E6m3	%	%	\$/E3m	\$/E3m	\$/E3m3	M\$/Yr	%
90	1.0	2	0.4	0.4	100	132.1	15.00	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
91	1.0	2	0.6	0.6	100	132.1	15.00	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
92	1.0	2	0.6	0.6	100	138.7	15.75	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
93	1.0	1	0.5	0.5	100	145.6	16.54	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
94	1.0	1	0.4	0.4	100	154.2	17.36	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
95	1.0	1	0.4	0.4	100	172.6	18.23	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
96	1.0	1	0.3	0.3	100	188.8	19.14	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
97	1.0	1	0.3	0.3	100	206.8	20.10	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
98	1.0	1	0.3	0.3	100	225.0	21.11	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
99	1.0	1	0.2	0.2	100	236.3	22.16	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
00	1.0	1	0.2	0.2	100	248.1	23.27	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00
01	1.0	1	0.1	0.1	100	260.5	24.43	0.00	0.00	0.000	0.0	0.0	0.0	100	0.00	0.00	0.00	0	0.00

0.5	4.4	4.4	0.0	0.0	0
1.0	0.0	0.0	0.0	0.0	0
0.5	4.4	4.4	0.0	0.0	0

PETROLEUM ECONOMICS EVALUATION PROGRAM
 XI Consultants Ltd.

Version 88-11-18
 05/29/90 08:01:39
 FILE: MPRI
 REPORT: peepoper

===== WORKING INTEREST OPERATING COST REPORT =====

	\$/BBL		OIL/GAS	\$/MCF		OTHER	\$/MCF		JPF +	
	OIL	OIL	PER	GAS	OIL/GAS	PROD	PL/GATH	PL/GATH	GCA	TOTAL
	OPER	TRUCK	WELL	OPER	OPER	OPER	OPER	OPER	OPER	OPER
	COST	COSTS	OP COST	COST	COST	COST	COST	COSTS	COST	COSTS
Year	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1990	5.3	0.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3
1991	9.7	0.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	27.7
1992	9.0	0.0	18.9	0.0	0.0	0.0	0.0	0.0	0.0	27.9
1993	8.3	0.0	19.8	0.0	0.0	0.0	0.0	0.0	0.0	28.2
1994	7.7	0.0	20.8	0.0	0.0	0.0	0.0	0.0	0.0	28.5
1995	7.1	0.0	21.9	0.0	0.0	0.0	0.0	0.0	0.0	29.0
1996	6.6	0.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	29.6
1997	6.1	0.0	24.1	0.0	0.0	0.0	0.0	0.0	0.0	30.3
1998	5.7	0.0	25.3	0.0	0.0	0.0	0.0	0.0	0.0	31.0
1999	5.3	0.0	26.6	0.0	0.0	0.0	0.0	0.0	0.0	31.9
2000	4.9	0.0	27.9	0.0	0.0	0.0	0.0	0.0	0.0	32.8
2001	3.0	0.0	18.8	0.0	0.0	0.0	0.0	0.0	0.0	21.8
1995	78.8	0.0	254.2	0.0	0.0	0.0	0.0	0.0	0.0	333.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	78.8	0.0	254.2	0.0	0.0	0.0	0.0	0.0	0.0	333.0

PETROLEUM ECONOMICS EVALUATION PROGRAM
 XI Consultants Ltd.

Version 88-11-18

05/29/90 08:02:03

FILE: MPR1

REPORT: peepcap

===== WORKING INTEREST TANGIBLE AND INTANGIBLE INVESTMENT DETAIL =====

	TANGIBLE FIELD CAPITAL M\$	FIELD CAPITAL CCA AFT ITC M\$	TANGIBLE GATH CAPITAL M\$	GATH CAPITAL CCA AFT ITC M\$	TANGIBLE PLANT CAPITAL M\$	PLANT CAPITAL CCA AFT ITC M\$	TANGIBLE OTHER CAPITAL M\$	OTHER CAPITAL CCA AFT ITC M\$	CAN O&G PROP. EXPENSE (COGPE) M\$	COGPE WRITE- OFF M\$	CAN DEVEL EXPENSE (CDE) M\$	CDE WRITE- OFF M\$	CAN EXPLOR EXPENSE (CEE) M\$	CEE WRITE- OFF M\$
Year														
	0.0		0.0		0.0		0.0		0.0		0.0		0.0	
1990	75.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0	45.0	0.0	0.0
1991	0.0	19.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.5	0.0	0.0
1992	0.0	13.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.0	0.0	0.0
1993	0.0	9.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0
1994	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	0.0	0.0
1995	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0
1996	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0
1997	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
1998	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
1999	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
2000	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
2001	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	75.0	73.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0	147.9	0.0	0.0
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	75.0	73.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0	147.9	0.0	0.0

PETROLEUM ECONOMICS EVALUATION PROGRAM
 XI Consultants Ltd.

Version 88-11-18
 05/29/90 08:02:41
 FILE: MPR1
 REPORT: newbtax

===== WORKING INTEREST BEFORE TAX REPORT =====													
Oil Oper Cost \$/m3	INITIAL CROWN/ MANUAL ROYALTY M\$	FINAL CROWN/ MANUAL ROYALTY M\$	ORR/ FRHLD ROYALTY M\$	REVENUE AFTER ROYALTY	OTHER INC & ARTC M\$	TOTAL OPER COST M\$	MINERAL TAX M\$	OTHER EXP & NPI M\$	OPER INCOME M\$	TOTAL INTANG CAPITAL M\$	TOTAL TANG. CAPITAL M\$	TOTAL CAPITAL M\$	CASH FLOW BEFORE TAX M\$
										0	0	0	
90 15.00	0	0	0	47	0	14	3	0	30	150	75	225	-195
91 15.00	0	0	0	85	0	28	4	0	54	0	0	0	54
92 15.75	0	0	0	79	0	28	2	0	49	0	0	0	49
93 16.54	0	0	0	73	0	28	1	0	44	0	0	0	44
94 17.36	0	0	0	68	0	29	0	0	40	0	0	0	40
95 18.23	0	0	0	68	0	29	0	0	39	0	0	0	39
96 19.14	0	0	0	65	0	30	0	0	36	0	0	0	36
97 20.10	0	0	0	63	0	30	0	0	33	0	0	0	33
98 21.11	0	0	0	61	0	31	0	0	30	0	0	0	30
99 22.16	0	0	0	56	0	32	0	0	24	0	0	0	24
00 23.27	0	0	0	52	0	33	0	0	19	0	0	0	19
01 24.43	0	0	0	32	0	22	0	0	10	0	0	0	10
5	0	0	0	750	0	333	10	0	407	150	75	225	182
0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	750	0	333	10	0	407	150	75	225	182

PETROLEUM ECONOMICS EVALUATION PROGRAM
XI Consultants Ltd.

Version 88-11-18
05/29/90 08:03:15
FILE: MPRI
REPORT: peepat

===== WORKING INTEREST AFTER TAX DATA =====																
	Resorc	Resorc	Land&	Land&	Expl	Expl	Tang	Tang	Plant	Plant	Fed	Prov				
Year	Income	Allow	Dev	Dev	Bal	Depr	Bal	Depr	&Gath	&Gath	Taxbl	Fed	Taxbl	Prov	Inv	Total
	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$
'90	21	5	150	45	0	0	75	11	0	0	-29	-10	-29	-5	0	-15
'91	38	10	105	32	0	0	64	19	0	0	-3	-1	-3	-0	0	-1
'92	38	9	74	22	0	0	45	13	0	0	6	2	6	1	0	3
'93	36	9	51	15	0	0	31	9	0	0	11	4	11	2	0	6
'94	33	8	36	11	0	0	22	7	0	0	14	5	14	2	0	7
'95	34	9	25	8	0	0	15	5	0	0	18	6	18	3	0	9
'96	33	8	18	5	0	0	11	3	0	0	19	6	19	3	0	10
'97	31	8	12	4	0	0	8	2	0	0	19	7	19	3	0	10
'98	28	7	9	3	0	0	5	2	0	0	19	6	19	3	0	9
'99	23	6	6	2	0	0	4	1	0	0	16	5	16	3	0	8
00	19	5	4	1	0	0	3	1	0	0	13	4	13	2	0	6
01	9	2	3	1	0	0	2	1	0	0	6	2	6	1	0	3
0.5	343	86		148		0		74		0	109	37	109	19	0	56
1.0	0	0		0		0		0		0	0	0	0	0	0	0
1.5	343	86		148		0		74		0	109	37	109	19	0	56

PETROLEUM ECONOMICS EVALUATION PROGRAM
XI Consultants Ltd.

Version 88-11-18

05/29/90 08:03:45

FILE: MPRI

REPORT: peepry

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====														
CROWN ROYALTIES AND MINERAL TAX										OTHER ROYALTIES				
	OIL CROWN ROYALTY	GAS CROWN ROYALTY	COND CROWN ROYALTY	PROPANE CROWN ROYALTY	BUTANE CROWN ROYALTY	SULPHUR CROWN ROYALTY	ETHANE CROWN ROYALTY	OTHER PROD. CROWN ROYALTY	MAN SCHED CROWN ROYALTY	FRHLD MINERAL TAX	FRHLD ROYALTY	OIL OVER- RIDING ROYALTY	GAS OVER- RIDING ROYALTY	NET PROFIT INTER.
Year	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$

1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0

1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0	0.0	0.0	0.0
2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

2015	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0	0.0	0.0	0.0

PETROLEUM ECONOMICS EVALUATION PROGRAM
XI Consultants Ltd.

Version 88-11-18
05/29/90 08:04:19
FILE: MPR1
REPORT: peepdcf

===== ANNUAL DISCOUNTED B.T. AND A.T. CASH FLOW =====												
	0%	10%	12%	15%	18%	20%	0%	10%	12%	15%	18%	20%
Year	BT Cash Flow M\$	BT Cash Flow M\$	BT Cash Flow M\$	BT Cash Flow M\$	BT Cash Flow M\$	BT Cash Flow M\$	AT Cash Flow M\$	AT Cash Flow M\$	AT Cash Flow M\$	AT Cash Flow M\$	AT Cash Flow M\$	AT Cash Flow M\$

90	-195.1	-189.8	-188.8	-187.3	-185.9	-185.0	-180.3	-175.3	-174.4	-173.1	-171.8	-170.9
91	53.9	48.6	47.7	46.3	45.1	44.2	55.3	49.9	48.9	47.5	46.2	45.4
92	48.9	40.1	38.6	36.5	34.6	33.4	45.7	37.5	36.1	34.2	32.4	31.3
93	43.9	32.8	31.0	28.6	26.4	25.0	38.2	28.4	26.9	24.8	22.9	21.8
94	39.6	26.9	25.0	22.4	20.2	18.8	32.4	21.9	20.4	18.3	16.5	15.4

95	38.7	23.8	21.7	19.0	16.7	15.3	29.5	18.2	16.6	14.5	12.7	11.7
96	35.7	20.0	17.9	15.3	13.1	11.8	26.0	14.6	13.1	11.1	9.5	8.6
97	33.0	16.8	14.8	12.2	10.2	9.1	23.1	11.8	10.4	8.6	7.2	6.4
98	29.7	13.8	11.9	9.6	7.8	6.8	20.3	9.4	8.1	6.6	5.3	4.6
99	24.4	10.3	8.7	6.9	5.4	4.7	16.4	6.9	5.9	4.6	3.7	3.1

00	19.4	7.4	6.2	4.7	3.7	3.1	12.9	4.9	4.1	3.2	2.4	2.1
01	10.0	3.5	2.8	2.1	1.6	1.3	6.8	2.4	1.9	1.4	1.1	0.9
=====												
05	182.2	54.1	37.6	16.4	-1.3	-11.4	126.3	30.5	17.9	1.7	-11.9	-19.8
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
=====												
15	182.2	54.1	37.6	16.4	-1.3	-11.4	126.3	30.5	17.9	1.7	-11.9	-19.8

In the study area (Sections 10, 11, 14, 15 - 2-25 WPM), the Upper Member of the Lower Armaranth produces oil in 3-14 and 7-14. In 3-14, the Lower Member of the Lower Armaranth produces in conjunction with the Upper Member. In 7-14, only the Upper Member has been completed. Quick-look calculations for these two wells yield the following results:

$$3-14: \phi_T = 4.5\%, S_w = 40-45\%$$

$$7-14: * \phi_T = ? ; \text{ if } \phi_T \text{ assumed} = 4\%, S_w = 23\%$$

A one foot sonic was run for 7-14, resulting in a noisy sonic trace which cannot easily be interpreted (my excuse, anyway)

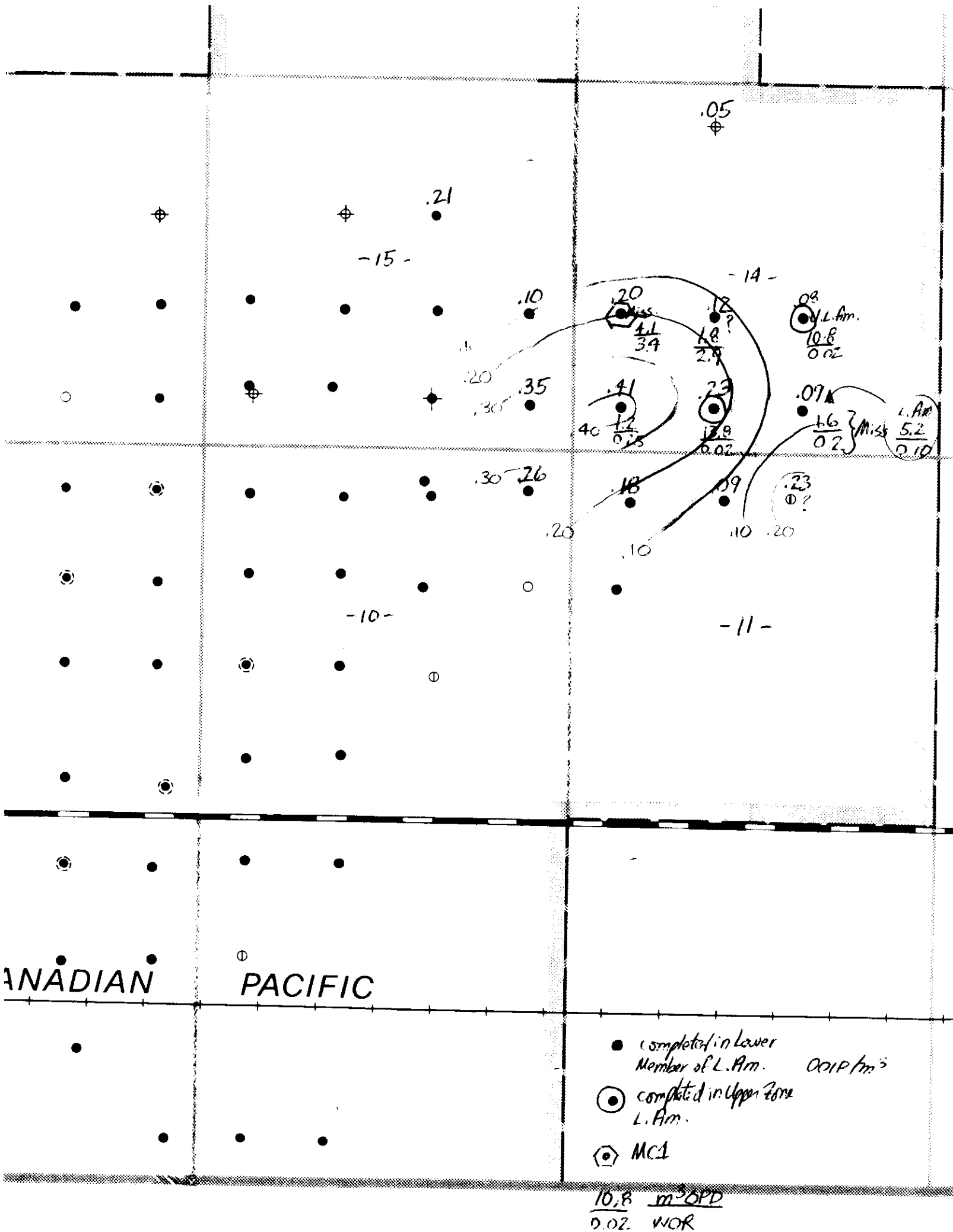
Quick-look calculations were made for a number of other wells in the area, yielding apparent porosities of 14% and water saturations of 45 to 50%.

7-14

*

$$OIP = 10000 \times 16 \times 4 \times .05 \times (1 - .23) \times .87 = 21436 \text{ m}^3$$

$$RoiP = 572$$



$$S_w^2 = \frac{0.62 R_w}{\phi_T^{1.59} R_t} \quad (\text{Figure 8 for } \text{Carvin})$$

$$\phi_T = .238t - 44$$

$$\frac{1}{R_{oi}} = 0.87$$

$$(1 - S_w) \phi_T t \times .87$$

Location	Interval	tt(m)	Δt	R_w	R_t	ϕ_T	S_w	OOIP/m ²
16 11-2-25 comp 706/40	871.6-873	1.4	270	.063	3.1	18	33	.15
	874.5-76.6	2.1	200	.063	10	2	100	-
	871.6-80.0	0.4	210	.063	12	4	60	.01
	880.3-81.1	0.8	232	.063	5	9	46	.03
	871.3-72.0	1.0	243	.063	5	12	37	.07 / (.26)
13 11-2-25 comp	870.0-71.0	1.0	260	.060	2.9	16	39	.08
	871.2-72.2	1.0	260	.060	3.2	16	36	.09
	874.0-75.6	1.6	210	.060	87	4	86	.01 / (.18)
	876.0-77.4	1.4	190	.060	6	title	title	-
14 11-2-25 comp	874.0-75.0	1.0	215	.063	5.5	5	80	.01
	876.0-77.5	1.5	240	.063	6	11	35	.05
	880.3-81.0	1.0	220	.063	5.5	7	54	.03 / (.09)
15 11-2-25 comp	871.0-72.0	1.0	260	.064	4	16	32	.09
	873.0-74.0	1.0	240	.064	4	11	46	.05
	876.0-77.2	1.2	250	.064	4.1	14	37	.09 / (.23)
	873.0-74.0	1.0	197	.064	6	title	title	-
21 4-2-25 comp	866.7-68.0	1.3	215	.063	3.6	12	44	.08
	868.0-69.0	1.0	203	.063	6	3	100	-
	871.0-72.8	1.9	203	.063	11	3	100	-
	873.0-74.0	1.0	215	.063	6	5	76	.01 / (.09)
3 11-2-25 comp 947/30	870.0-72.0	2.0	235	.064	5.1	10	44	.10
	873.7-74.3	0.6	242	.064	3.1	12	51	.03
	875.6-76.7	1.1	239	.064	5	12	38	.07
4 11-2-25 comp	879.0-80.0	1.0	228	.064	5	8	54	.03 / (.23)
	863.0-64.0	1.0	242	.058	2.2	12	62	.04
	865.0-66.0	1.0	260	.058	2.5	16	41	.08
302/72	866.6-67.3	0.7	250	.058	3.2	14	41	.05
	868.0-68.8	0.8	233	.058	3.1	10	57	.03
	869.0-70.0	1.0	260	.058	3.5	16	33	.09
	871.0-72.0	1.0	240	.058	3.6	11	46	.05
	873.5-74.8	1.3	236	.058	5	10	41	.07 / (.41)

Location	Interval	tt(m)	Δt	R_w	R_z	ϕ_z	S_w	$\omega \rho / m^2$
5-4-225 M.S. COOP	867.7-68.7	1.0	238	.058	3.1	11	52	.05
	869.3-70.7	1.4	252	.058	3	14	41	.10
	872.0-73.2	1.2	230	.058	4.9	9	47	.05
	875.0-76.8	1.8	210	.058	5.4	4	100	0.20
6-4-225 COOP	876.5-72.5	2.0	235	.061	3.3	10	58	.07
	872.6-74.7	2.1	239	.064	4.1	11	46	.05
	876.0-77.7	1.7	212	.064	5	5	100	0.12
7-4-225 COOP 1.6m	868.0-69.0	1.0	248	.060	3	13	45	.06
	869.8-71.0	1.2	220	.060	4.1	7	88	.01
	872.7-73.8	1.1	220	.060	4	7	78	.01
	875.7-77.0	1.3	206	.060	6	2	tub	0.08
14-14-225 ABOD	862.1-63.3	0.9	237	.062	3.3	11	54	.04
	867.0-68.0	1.0	218	.062	5	6	74	.01
	870.0-71.0	1.0	198	.062	7	2	tub	0.05
1-5-225 COOP	869.8-70.6	0.8	260	.060	3.1	16	36	.07
	872.0-73.0	1.0	252	.060	3.4	14	37	.08
	873.7-75.3	1.6	252	.060	4.3	14	33	.13
	871.3-79.0	1.7	232	.060	5	9	460	0.07 0.35
8-15-225 COOP	866.0-69.0	3.0	210	.063	6.3	4	100	-
	869.3-70.4	1.1	260	.063	3.2	16	39	.09
	871.0-73.0	2.0	250	.063	4.2	6	86	.01 / 0.10
10-15-225 COOP 2 1/2" / 70	867.8-68.3	0.5	238	.061	3.8	11	48	.02
	869.0-69.8	0.8	226	.061	3.8	7	81	.01
	870.5-72.0	1.5	248	.061	3.3	13	42	.10
	873.0-74.8	1.8	232	.061	5	9	45	0.08 0.21

TWP 2

- 15 -

- 14 -

- 10 -

- 11 -



$\frac{4.1}{3.4}$



$\frac{1.8}{2.9}$



$\frac{10.8}{0.02}$



$\frac{1.2}{0.25}$



$\frac{13.8}{0.02}$



$\frac{1.6}{0.2}$



MCI



UPPER ZONE - LAM



LAM

$\frac{10.8}{0.02}$

$\frac{m^3 OPD}{WOR m^3/m^3}$

NOTES

- 2-14-2-25 recompleted in LAM $\frac{5.2}{0.1}$
- 3-14-2-25 also completed in LAM

ADIAN

PACIFIC

FIGURE 3

STUDY AREA RC EVALUATION

	Thick. (h)	At	Rt	ϕ	SW	ϕh	TOP of (SS) ϕ
<u>13-11-2-25</u>							
KB - 478.60m							
		TITE					
			2	.16	1.55		412.90
			1	.1	1.5		
			1	.1	1.1		

<u>7-14-2-25</u>							
KB - 478.80m							
893 - 894					1.2		414.2
99					1.4		
					1.7		

<u>8-15-2-25</u>							
KB - 476.92m							
					1.5		404.58
					1.1		
					1.1		

<u>14-14-2-25</u>							
KB - 477.10m							
878 - 879.5	1.5	TITE					
880 - 881	1	208	21			.48	402.9
881 - 882	1	TITE					
882 - 883.5	.5	227	8			.29	
883 - 884	1		9	.04	2.10		
884 - 885	1	222	1.6	.14	1.28		
						.71	

	Thick	Δt	Rt	φ	Sw	NET PAM dh	TOT of (SS) φ
<u>3-14-2-25</u>							
KB - 478.83~							
887.5 - 888.5	3	TITE					
891.5 - 892.5	1	200	4	.09	1.3		412.67
894.5 - 896.5	2	TITE					
898 - 900.5	1.5	200	11	.14	1.7		

<u>5-14-2-25</u>							
KB - 476.60~							
882 - 884	2	TITE					
884 - 885	1	231	10	.16	.46	.46	407.4
885 - 886	1	198	11	.09	.83		
886 - 889	3	240	1.9	.18	.99		
889 - 890.5	1.5	210	2.2	.11	1.44	.46	

<u>6-14-2-25</u>							
KB - 478.26~							
883.5 - 887.5	4	TITE					
887.5 - 890.5	3	200	2.5	.09	1.67		409.24
891.0 - 892.5	1.5	251	.55	.20	1.63		
892.5 - 893.0	.5	190	2	.07	2.4		

INTERVAL	THICK (m)	Δt	Rt	ϕ	S_w	ϕh APP	ϕ STRUCTURE TOP
----------	--------------	------------	------	--------	-------	----------------------------	----------------------------

16-10-2-25

KB - 477.80 ~

(TIME)

411.2

(TIME)

13-11-2-25

KB - 477.10 ~

411.9

14-11-2-25

KB - 478.60 ~

414.9

4-14-2-25

KB - 477.00~

dh

Top of ϕ
(SS)

407.5

10-15-2-25

KB - 477.60~

405.9

1-15-2-25

KB - 477.60~

408.4

2-14-2-25

KB - 479.70~

.62

406.8

TOP OF ϕ (S.S.)

\oplus
403.9

\oplus

\oplus

\bullet
405.7

\bullet
404.6

\bullet
406.4

\bullet
409.2

\bullet
414.2

\bullet
408.4

\bullet
409.8

\bullet
412.1

\bullet
417.8

\bullet
411.2

\bullet
416.9

\bullet
414.7

\bullet
422.8

ANADIAN

\oplus
PACIFIC

(ϕh)

\oplus
.77

.46

.62

NADIAN

\oplus
PACIFIC