

September 23, 1985

Chevron Canada Resources Limited  
Box 100  
VIRDEN, MB ROM 2C0

Attention: K.G. Matieshin, P. Eng.  
Area Supervisor

Re: New Scope S. Waskada 13-6-1-25 (WPM)  
New Scope et al Waskada 5-7LAM-1-25 (WPM)  
New Scope et al Waskada 13-7LAM-1-25 (WPM)  
Chevron Newscope Waskada 15-7-1-25 (WPM)  
Chevron Waskada 5-18-1-25 (WPM)  
Chevron Waskada 7-1-1-26 (WPM)  
Chevron Waskada 515-1-1-26 (WPM)  
Chevron Waskada Prov. 5-12-1-26 (WPM)  
Chevron Waskada 7-12-1-26 (WPM)  
Newscope S. Waskada 15-12-1-26 (WPM)

Enclosed are approved applications to recomplete the subject wells as water injection wells. Please note that injection should not be commenced until the Waskada Unit No. 6 Unit Agreement has been approved by The Oil and Natural Gas Conservation Board.

Yours sincerely,

L.R. Dubreuil  
Chief Petroleum Engineer  
Petroleum Branch

LRD:dah

encl

cc: Waskada Office

Attached are applications to recomplete the following wells to water injectors. Same wells as approved by Board Order PM 44. Only recompletion to be approved.

5-18-1-25 ✓

7-1-1-26 ✓

15-1-1-26 ✓

7-12-1-26 ✓

5-12-1-26 ✓

13-6-1-25 ✓

15-7-1-25 ✓

15-12-1-26 ✓

13-7 LA m-1-25 ✓

5-7 LA m-1-25 ✓

All wells will be recompleted in the same manner using cement lined tubing and a tension packer set 5-10m above the perfs. The annuli are to be circulated to inhibited water.

For the 15-1 well which was formerly completed in the MC3, these perfs will be cement squeezed through the existing cement retainer

In currently producing wells, injection should not occur until after Unitization is effective. Wells currently shut in (5-12, 13-6) could go on injection before Unitization.



MANITOBA

THE OIL AND NATURAL GAS CONSERVATION BOARD  
309 LEGISLATIVE BUILDING  
WINNIPEG, MANITOBA  
R3C 0V8

May 17, 1985

Chevron Canada Resources Limited  
Box 100  
Viriden, Manitoba  
ROM 2C0

Attention: Mr. C. G. Folden,  
Area Supervisor

Dear Sirs:

Re: Board Order No. PM 44  
Waskada Lower Amaranth A Pool

Enclosed is Board Order No. PM 44 authorizing pressure maintenance by waterflooding in a portion of the Waskada Lower Amaranth A Pool. Please note specific provisions of this Order relating to pressure surveys (PM rule 3), to a program to monitor communication between the Lower Amaranth and the Mississippian (PM rule 4) and reporting requirements (PM rules 7 and 8).

Also note that water injection should not be commenced until an appropriate Unit Agreement has been agreed to and approved.

Yours sincerely,

THE OIL AND NATURAL GAS  
CONSERVATION BOARD

ORIGINAL SIGNED BY  
WM. M. McDONALD, P. ENG

Wm. McDonald  
Deputy Chairman

LRD/HCM/lk

c.c. Petroleum Branch

Manitoba Regulation /85

Being

THE OIL AND NATURAL GAS CONSERVATION BOARD

ORDER NO. PM 44

An Order Pertaining to Pressure Maintenance by Water Flooding  
WASKADA LOWER AMARANTH A POOL

Made and Passed Pursuant to "The Mines Act", Cap. M160, of the  
Continuing Consolidation of the Statutes of Manitoba, and  
Amendments Thereto, by The Oil and Natural Gas  
Conservation Board of Manitoba

(Filed: )

WHEREAS, subsection (9)(d) of Section 62 of "The Mines Act", being Chapter M160 of the Continuing Consolidation of the statutes of Manitoba, provides as follows:

"62(9) Without restricting the generality of subsection (8) the board, with the approval of the minister, may make orders

(d) requiring the repressuring, recycling, or pressure maintenance, of any pool or portion thereof where it is economical to do so, and for that purpose where necessary requiring the introduction or injection into any pool or portion thereof of gas, air, water or other substance;"

AND WHEREAS, the Board received an application dated November 29, 1984 from Chevron Canada Resources Limited for approval of a project to inject water into the Waskada Lower Amaranth A Pool ("the Pool") in Manitoba.

AND WHEREAS, the Board has received letters from Chevron Canada Resources Limited dated January 3, 1985 and March 29, 1985 incorporating modifications to the project and providing additional information requested by the Board.

AND WHEREAS, Chevron Canada Resources Limited is the interim Unit Operator ("the Operator") of the proposed Waskada Unit No. 6;

NOW THEREFORE, the Board Orders that:

1. The Operator shall conduct pressure maintenance operations by the injection of water into the Pool underlying the area of the proposed Waskada Unit No. 6 ("the Unit Area").
2. The pressure maintenance operations shall be in accordance with, and subject to, the following rules:

PRESSURE MAINTENANCE RULES

1. (1) Water shall be injected into the Lower Amaranth Formation through the wells:

New Scope Waskada WIW 13-6-1-25 (WPM)  
New Scope et al Waskada WIW 5-7LAm-1-25 (WPM)  
New Scope et al Waskada WIW 13-7LAm-1-25 (WPM)  
Chevron Newscope Waskada WIW 15-7-1-25 (WPM)  
Chevron Waskada WIW 5-18-1-25 (WPM)  
Chevron Waskada WIW 7-1-1-26 (WPM)  
Chevron Waskada WIW 15-1-1-26 (WPM)  
Chevron Waskada Prov. WIW 5-12-1-26 (WPM)  
Chevron Waskada WIW 7-12-1-26 (WPM)  
New Scope Waskada WIW 15-12-1-26 (WPM)

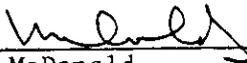
and such other wells in the Unit Area as the Board may approve.

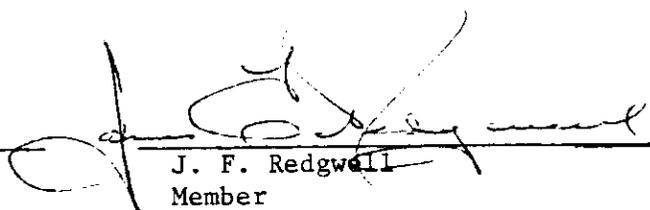
- (2) After the commencement of injection, the Operator shall, subject to any remedial work required to be performed on the wells referred to in subclause (1) of this clause, endeavour to maintain continuous injection.
  - (3) Notwithstanding the provisions of subclause (2), the Board may, upon application by the Operator, approve the suspension of water injection into any well or wells, provided that the Board is satisfied that pressure maintenance operations in the Unit Area will not be adversely affected.
  - (4) The completion of the wells referred to in subclause (1) will be as prescribed by the Director of the Petroleum Branch.
2. The Operator, upon the request of the Board, shall satisfy the Board as to the source, suitability and method of treatment of the water to be injected.
3. (1) Before injection of water is commenced, the Operator shall submit to the Board results of a survey conducted to determine the static reservoir pressure in a minimum of five wells in the Unit Area.
  - (2) The Operator shall, not less than six months nor more than 12 months after the commencement of injection, and at yearly intervals thereafter, conduct a survey to determine the static reservoir pressure in a minimum of one well in each injection pattern within the Unit Area.
  - (3) The Operator shall submit the details of the surveys described in subclauses (1) and (2) of this clause to the Petroleum Branch, including a list of the wells to be surveyed, the measurement technique to be used, and the intended shut-in periods for each well, and approval shall be obtained from the Director of the Petroleum Branch before the program is carried out. Within 30 days of the completion date of the surveys, a report shall be submitted to the Petroleum Branch including:

- (a) the static reservoir pressure data obtained from the survey, corrected to a common datum;
  - (b) an isobaric map of the Pool within the Unit Area based on the data obtained; and
  - (c) a discussion of the survey results and pressure distribution within the Pool.
- (4) The Board may, at any time, require the Operator to carry out such additional reservoir pressure surveys as it deems necessary.
4. The Operator shall, within 30 days of the commencement of injection, submit to the Board the plan of a comprehensive program designed to monitor the extent of communication between the Lower Amaranth and Mission Canyon Formations in the Unit Area and the effect of such communication upon production performance and ultimate recovery in each Formation.
5. The Operator shall immediately report to the Board any indication of channelling or break-through of injected water to producing wells or any indication of other detrimental effects that may be attributable to the pressure maintenance operations.
6. The maximum wellhead pressure at which water is injected into the wells referred to in subclause (1) of clause 1 hereof shall not exceed 10 000 kPa or such other maximum pressure as the Board may prescribe. The Board may, from time to time, prescribe a maximum or minimum rate at which water shall be injected into any well in the Unit Area.
7. (1) The Unit Operator shall, not later than the last day of each month file with the Petroleum Branch, a report of the quantity, source and pressure of water injected during the preceding month into each well referred to in clause 1 hereof.
- (2) The Unit Operator shall, not later than the last day of each month, file with the Petroleum Branch a summary report of production and injection operations during the preceding month. This report shall include:
- (a) the monthly oil, gas and water production for the Unit Area and for each well;
  - (b) the percentage of voidage replaced by injection for each injection pattern; and
  - (c) a summary of any remedial operations carried out on any well in the Unit area.

8. The Operator, shall, within 60 days of the end of each calendar year, file with the Petroleum Branch a report of the pressure maintenance program, setting out graphically such interpretive information necessary to evaluate the efficacy of the waterflood.

Oil and Natural Gas Order No. PM 44,  
made and passed this *13* day of  
*MAY* A.D., 1985, at the City  
of Winnipeg, in the Province of  
Manitoba, by The Oil and Natural  
Gas Conservation Board.

  
\_\_\_\_\_  
Wm. McDonald  
Deputy Chairman  
The Oil and Natural Gas  
Conservation Board

  
\_\_\_\_\_  
J. F. Redgwell  
Member  
The Oil and Natural Gas  
Conservation Board

Approved:

  
\_\_\_\_\_  
Wilson D. Parasiuk  
Minister of Energy and Mines

Memorandum from THE DESK OF L. R. DUBREUIL

Date \_\_\_\_\_

To :

This list is of surface and mineral owners offsetting the project area.

Chevron is preparing and will be submitting a further list of ownership within the scheme area.

WIO on the attached list that have not been notified are

- 1) Shell (NW $\frac{1}{4}$  -1-1-26)
- 2) Dome (LSD 2+7 -6-1-25)
- 3) Troy/Pag (LSD 9+16 -2-1-26)

THINK POSITIVE



**Chevron Canada Resources Limited**

300 - 7th Avenue, Calgary, Alberta T2P 0L7

K E Gode  
Chief Eng

Bob

1985-04-29

*Does this info differ from records used to recommend passing PM order to Board?*

*Any further notification of possible interested parties required? *DM**



Addition to the  
Waskada Lower Amaranth "A" Pool  
Waterflood Application Dated 1984-11-29

The Oil and Natural Gas Conservation Board  
309 Legislative Building  
Winnipeg, Manitoba  
R3C 0V8

Attention: Mr. R. B. Chenier

Gentlemen:

Attached is a table containing the Lessors, Owners and Lessees of lands surrounding the proposed Waskada Unit No. 6. This table is part of Figure 2 in the Waterflood Application.

Any questions regarding this matter should be directed to Doug Schierman at (403) 234-5167.

Sincerely

R. A. FILGATE, P.Eng.  
Supervising Engineer  
Reservoir

DS/ds  
Attach.

# Memorandum

1985-04-23

Proposed Waskada Unit No. 6  
Legal File No. 59,293

MESSRS. D. G. GUEST:  
D. N. SCHIERMAN:

Attached hereto please find a schedule of all Lessors, Owners and Lessees of lands surrounding proposed Waskada Unit No. 6 as per your request. This schedule was compiled from our land records and titles from the Boissevain Land Titles Office. As stated before, the Land Titles Office will not guarantee the accuracy of an abstract of title. Therefore, because we have had to extrapolate our information from abstracts in certain instances, we cannot guarantee our advice is absolutely accurate. In addition, we have shown the Lessees of the lands as being the Caveators of the interests as shown on the titles and abstracts to the lands. There may be assignments of leases, or surrenders of leases of which we are not aware. Therefore, our advice as to the Lessees is subject to any information not registered against the title to the subject lands. As well, where we have stated the Lessee is "unknown", it may be that there are no leases issued in respect of the lands, or it may be unclear as to which party is the proper Lessee. A star beside the name of the Lessor indicates Chevron has leased the lands.

Lastly, this schedule contains several amendments to our memo of 1985-04-17. The information in this schedule is therefore more accurate, and should be that which is used from this point on.

Please advise us should you require any further assistance from us.

Yours very truly,



T. M. DOUGALL

NJS/sme  
attachment

Interest	Legal Description	Min/Surf	Owner/Lessor	Lessee
	<u>Twp. 1, Rge. 25 WPM</u>			
All	SW-1/4, Sec. 6	surface	Francis Hedley Lawrence	Newscope Resources
U-1/2	" "	minerals	Prudential Trust Co Ltd.	Dome Petroleum
U-1/2	" "	minerals	Elm American Minerals Inc	Omega Hydrocarbons
All	Lsd's 7 & 2, Sec. 6	surface	Francis Hedley Lawrence	Newscope Resources
U-1/4	" "	minerals	Curtis Wilbur Crane	Unknown
U-1/2	" "	minerals	Prudential Trust Co. Ltd.	Dome Petroleum
U-1/8	" "	minerals	Carroll Reid Pope*	
U-1/8	" "	minerals	Ben Wilson Harnon*	
All	Lsd's, 11 & 14, Sec. 6	surface	Francis Hedley Lawrence	Newscope Resources
U-1/2	" "	minerals	Dome Petroleum Ltd.	N/A
U-1/2	" "	minerals	Daisy May Lawrence	
All	Lsd's 10 & 15, Sec. 6	surface	Herbert Joseph Lawrence*	
All	" "	minerals	Manitoba Crown	Unknown
All	SE-1/4, Sec. 7	surface	Robert Donald McGregor	Newscope Resources
All	" "	minerals	59643 Manitoba Ltd.*	
All	SW-1/4, Sec. 7	surface	Leslie James McGregor	Newscope Resources
U-3/4	" "	minerals	59643 Manitoba Ltd.*	
U-1/4	" "	minerals	Roy Ovey Young*	
All	NW-1/4, Sec. 7	surface	Robert Donald MacGregor	Newscope Resources
U-1/2	" "	minerals	Glen Temple Rushton*	
U-1/2	" "	minerals	PanCanadian Petroleum	N/A
All ?	NE-1/4 Sec. 7	surface	PanCanadian Petroleum	N/A
U-1/2	" "	minerals	Rushton Resources Ltd *	
U-1/2	" "	minerals	PanCanadian Petroleum	N/A
All	Lsd's 10 & 15, Sec. 8	surface	George Howard McMillan	Unknown
U-1/2	" "	minerals	59837 Manitoba Ltd.	Omega Hydrocarbons
U-1/2	" "	minerals	Millbridge Oil Ltd.	Omega Hydrocarbons
All	Lsd's 4 & 5, Sec. 17	surface	John Lloyd Millions and Kathlyn Dorothy Millions	Unknown
U-1/2	" "	minerals	Central Leduc Oils Ltd.	Unknown
U-1/4	" "	minerals	James Forbes Trewin	Omega Hydrocarbons
U-1/4	" "	minerals	John Lloyd Millions and Kathlyn Dorothy Millions	Unknown
All	E-1/2, Sec. 18	surface	Theodore Norman McGregor	Omega Hydrocarbons
U-1/10	" "	minerals	Howard Glover Lee	Omega Hydrocarbons
U-4/10	" "	minerals	Millbridge Oil Ltd.	Omega Hydrocarbons
U-1/2	" "	minerals	Jacob Symons Brown	Omega Hydrocarbons
All	NW-1/4, Sec. 18	surface	Melvin James Lee	Unknown
All	" "	minerals	Manitoba Crown	Unknown
	<u>Twp. 1, Rge. 26 WPM</u>			
All	Lsd's 1 & 2, Sec. 1	surface	Franklin Ewald Smart*	
All	" "	minerals	Smart Oils Ltd.*	
All	SW-1/4, Sec. 1	surface	Franklin Ewald Smart*	

Interest	Legal Description	Min/Surf	Owner/Lessor	Lessee
All	SW-1/4, Sec. 1	minerals	Smart Oils Ltd.	Omega Hydrocarbons
All	NW-1/4, Sec. 1	surface	Franklin Ewald Smart	Omega Hydrocarbons
U-1/2	" "	minerals	Smart Oils Ltd.	Omega Hydrocarbons
U-1/4	" "	minerals	William Creighton Pearson	Shell Canada
U-1/4	" "	minerals	Agnes Muriel MacKay and Arthur MacDonald Pearson	Voyageur Petroleum
All	Lsd's 9 & 16, Sec. 2	surface	Franklin Ewald Smart	Unknown
U-1/8	" "	minerals	Andrew Murray Gardiner	Troy Oils
U-1/16	" "	minerals	Joyce Adelaide Barber	Unknown
U-1/16	" "	minerals	Donna Muriel Boyle	Unknown
U-1/2	" "	minerals	Alfred Heinzeg	Troy Oils/Page Petroleum
U-1/4	" "	minerals	Orland Malray Gardiner	Troy Oils
U-1/8	" "	minerals	Harry Andrew Gardiner	Troy Oils
All	E-1/2, Sec. 11	surface	William Lloyd McKinney	Omega Hydrocarbons
All	" "	minerals	Manitoba Crown	Unknown
All	Lsd's 4, Sec. 12	surface	Melvin James Lee*	
	" "	minerals	Manitoba Crown*	
All	NW-1/4, Sec. 12	surface	Melvin James Lee	Omega Hydrocarbons
All	" "	minerals	The Canada Trust Company	Omega Hydrocarbons
All	SE-1/4, Sec. 13	surface	Theodore Norman McGregor	Omega Hydrocarbons
U-1/2	" "	minerals	Canadian Gridoil Limited	Omega Hydrocarbons
U-1/4	" "	minerals	Cda Perm. Trust	Omega Hydrocarbons
U-1/4	" "	minerals	Edmund Albert McGregor and Mary Elizabeth McGregor	Omega Hydrocarbons
All	SW-1/4, Sec. 13	surface	Theodore Norman McGregor	Omega Hydrocarbons
U-1/2	" "	minerals	Canadian Gridoil Limited	Omega Hydrocarbons
U-1/2	" "	minerals	Edmund Albert McGregor and Mary Elizabeth McGregor	Omega Hydrocarbons
All	NW-1/4, Sec. 13	surface	Jack George McGregor	Omega Hydrocarbons
U-1/2	" "	minerals	Canadian Gridoil Limited	Omega Hydrocarbons
U-1/2	" "	minerals	Edmund Albert McGregor and Mary Elizabeth McGregor	Omega Hydrocarbons
All	NE-1/4, Sec. 13	surface	Jack George McGregor	Omega Hydrocarbons
U-1/2	" "	minerals	Canadian Gridoil Limited	Omega Hydrocarbons
U-1/4	" "	minerals	Cda. Perm Trust	Omega Hydrocarbons
U-1/4	" "	minerals	Edmund Albert McGregor and Mary Elizabeth McGregor	Omega Hydrocarbons



**Chevron Canada Resources Limited**  
500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7



1985-06-19

J.M. Taylor  
Coordinator  
Units & Joint Ventures  
Producing Department

Waskada Unit No. 6  
Unitization and Waterflood Proposal

TO: ALL ROYALTY OWNERS  
PROPOSED WASKADA UNIT NO. 6  
(Addressee List Attached)

Gentlemen:

Attached for your information is a discussion of the unitization and waterflood proposal for Waskada Unit No. 6. Chevron, as proposed operator of this unit, has received approval from the Manitoba Oil and Natural Gas Conservation Board to implement a waterflood in the subject area. This waterflood cannot be implemented until a Unit is formed. We feel that the attached summary of the project will explain to you the basics and merits of a unit and waterflood and would then enable an expeditious execution of a forthcoming Unit Agreement. (The Unit Agreement must be signed by all Working Interest and Royalty Owners.) If you have any questions on this matter please call Mr. Cal Folden at Chevron's Virden office at (204) 748-1334, Mr. Bob Wier at Newscope's Calgary office at (403) 266-1101 or Mr. Todd Ballantyne at Great American's Rancho Mirage office at (619) 340-3102. If felt necessary by the Royalty Owners, we are prepared to hold a meeting to further discuss this matter.

Yours very truly,

*J.M. Taylor*  
J. M. TAYLOR

KGM/db  
Attach.

cc: Newscope Resources Limited  
Attention: Mr. R. D. Weir

Great American Energy, Inc.  
Attention: Mr. T. Ballantyne

ADDRESSEE LIST

Manitoba Energy & Mines  
Eaton Place  
555, 330 Graham Avenue  
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R3C 4E3

Hernefield Enterprises Ltd.  
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Waskada, Manitoba  
ROM 2E0

Rushton Resources Ltd.  
Box 1213  
Virden, Manitoba  
ROM 2C0

59643 Manitoba Ltd.  
Box 1717  
The Pas, Manitoba  
R9A 1L5

Daisey MacLawrence  
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ROM 2E0

PanCanadian Petroleum Limited  
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Calgary, Alberta  
T2P 2S5

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Mr. Roy Ovey Young  
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POT 1W0

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Calgary, Alberta  
T2P 2T8

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Pitca, AK 99835  
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U & N Witteman  
Wohall, ND 58761  
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Winot, ND 58702  
R.S.A.

H & M Boyle  
Pohall, ND 58761  
M.S.A.

William J. Hill Estate  
General Delivery  
Westhope, ND 58793  
U.S.A.

PROPOSED WASKADA UNIT NO. 6  
UNITIZATION AND WATERFLOOD PROPOSAL

INTRODUCTION

The Waskada Lower Amaranth "A" (Spearfish) Pool was discovered in 1981. Since then, many wells have been drilled and waterflood and gas flood schemes are currently operating in portions of the pool. The proposed Waskada Unit No. 6 area is in the south end of the Pool and contains wells currently operated by Chevron Canada Resources Limited and Newscope Resources Limited.

The area proposed for unitization and waterflooding (see Figure 1) has 31 wells completed in the Lower Amaranth formation at an average depth of 920 m. It is expected that unit expansions will take place shortly after initial unitization to include additional wells that have or may be completed. The peak production for this area was reached in 1984-09 at 91 m<sup>3</sup>/d. Since that time production has steadily declined. At the end of 1984-12, 45 250 m<sup>3</sup> of oil had been produced and the daily rate was 79 m<sup>3</sup>/d. The daily production rate will continue to decline if this area remains under the present method of operation.

WATERFLOODING

It is anticipated that the area's ultimate oil recovery and producing rate can both be improved by waterflooding. The Waskada Unit No. 1 waterflood in the same formation has been in operation for approximately two years, with preliminary results indicating that oil recovery will be increased.

Waterflooding is a process whereby water is forced into the rock containing the oil in order to flush the oil from the rock into the well bore (see Figure 2). Water injection is accomplished by converting selected wells and injecting the water through these wells into the reservoir rock. Studies have been conducted during the past year which indicate that this technique can be employed successfully in the Waskada field. The studies indicate that waterflooding could increase the ultimate recovery for the Unit area to approximately 177 000 m<sup>3</sup> of oil. This is almost double the presently anticipated 89 000 m<sup>3</sup> which is expected under natural depletion. Figure 3 is a graph showing the production which is anticipated from the proposed Waskada Unit No. 6 area under the present method of operation compared with that which is expected from waterflooding. This increase in production represents extra income for the Royalty Owners and the operators. Royalty owners do not contribute any money for the installation of the waterflood.

The technique of waterflooding has been successfully employed in many fields in Western Canada. A few examples of waterfloods in Manitoba that have proven their value are North Virden Scallion Unit No. 1, Virden-Roselea Unit Nos. 1, 2 and 3 and Daly Unit No. 3.

PROPOSED WASKADA UNIT NO. 6  
UNITIZATION AND WATERFLOOD PROPOSAL  
(Continued)

UNITIZATION

In order to implement the most efficient waterflood for the proposed Waskada Unit No. 6 area, it is necessary that this part of the Waskada field be unitized. Unitization is a method whereby all interests in an oil field are merged and the reservoir is developed and operated as a single property. Working Interest and Royalty Owners no longer receive a portion of the production from a specific well or group of wells but share in the Unit's total production. They share in the Unit production on the basis of a participation formula agreed upon by the Working Interest Owners. It must be pointed out that each Working Interest and Royalty Owners will share to the extent of their participating interest until complete abandonment of the Unit, whether their well or wells are producing, injecting, suspended, or abandoned.

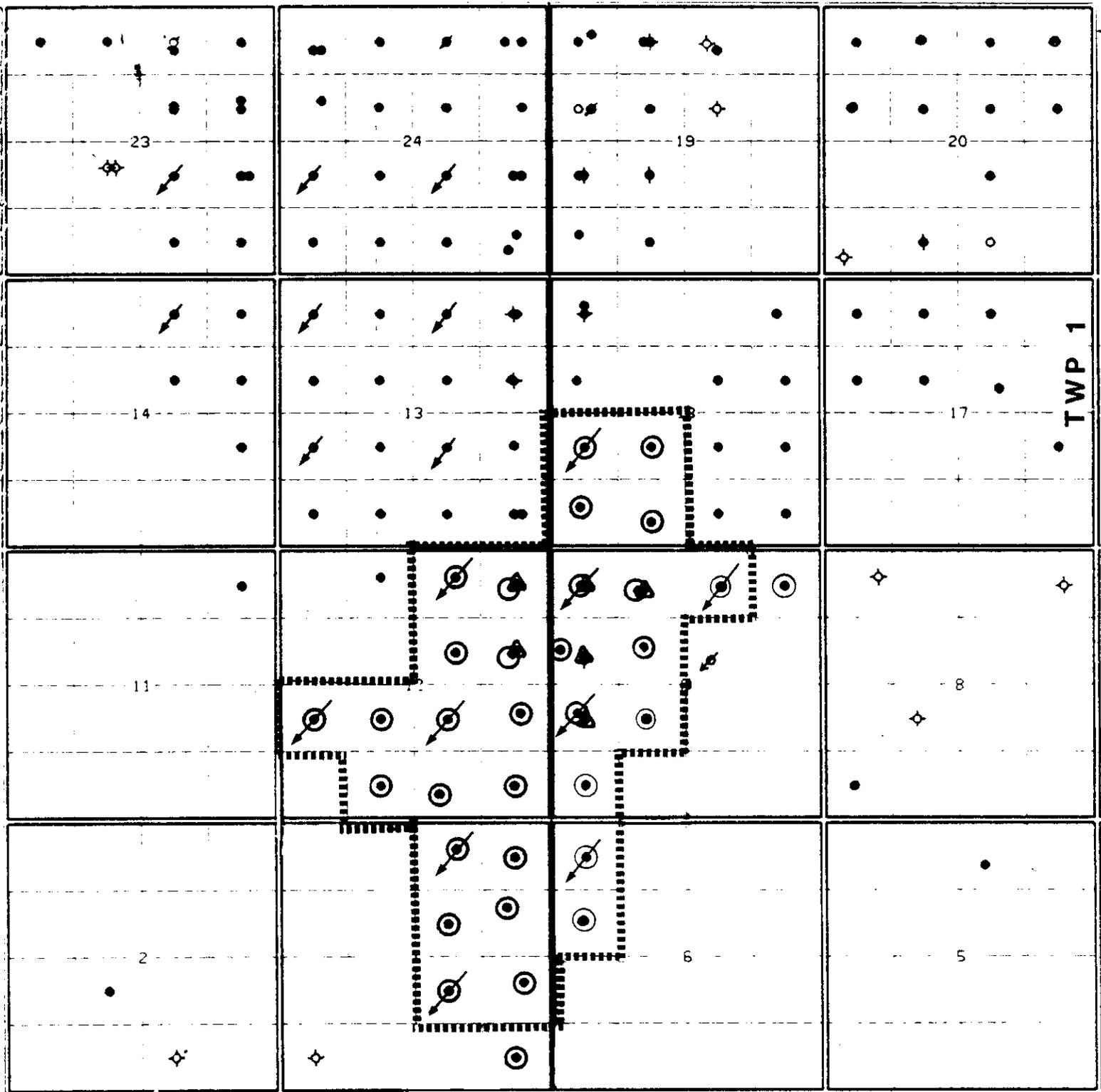
Commonly used factors to determine participation are oil production, water cut and various oil-in-place factors. In this pool, production history not only gives the present and past value of each well but also indicates the future worth of each well. Each well's decline rate, current rate, oil cut, and porosity-footage (used to calculate oil-in-place) represent the present and future worth of that well. These factors have been combined in the following formula which the Working Interest Owners feel represents the total value for each well and the fairest means of participating within this Unit:

Tract Participation Factor =  $0.3 \times \text{current oil rate factor} + 0.1 \times \text{current oil cut factor} + 0.3 \times \text{initial oil rate factor} + 0.1 \times \text{initial oil cut} + 0.2 \times \text{porosity-metre factor}$ .

The porosity-metre term has been given a low weighting due to the difficulty in assigning oil-in-place or oil reserves to each well. However, it is felt this term was necessary to help represent the future value of each well.

Chevron Canada Resources Limited has been selected as Interim and Final Operator for the Unit. Chevron is the largest Working Interest Owner of the Unit area and has many years of experience operating waterfloods in Western Canada.

A Unit Agreement will be developed which will set down the terms and conditions of the Unit, the tract participation factors and the Working Interest and Royalty Owners.



26 W 1

25 W 1

LEGEND

-  SPEARFISH
-  MC-3
-  PROPOSED INJECTORS
-  DISPOSAL WELL
-  PROPOSED UNIT AREA



Chevron Canada Resources Limited

WASKADA AREA  
PROPOSED UNIT 6

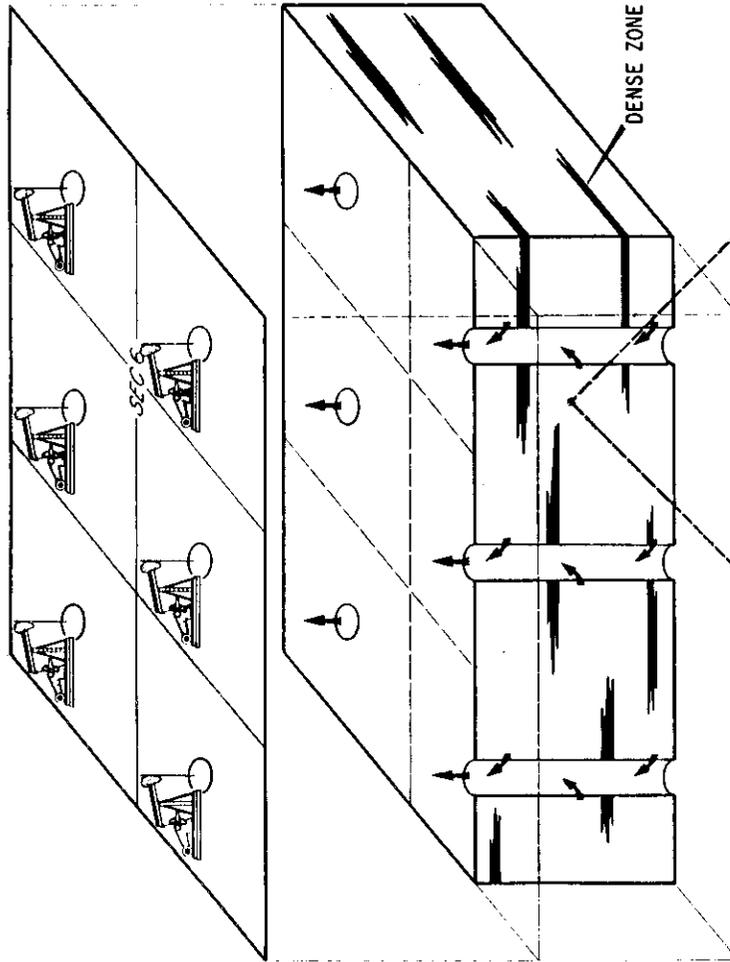
FIGURE 1

PROPERTY	WASKADA	CLIENT	WEYS
FIELD/AREA	WASKADA	OWNER	W. HUBBARD
FILE	WASKADA	DESIGN	L. CAMPBELL
PREPARED BY		DOCUMENT NO.	INTERPRETATION OVERLAY NO.
DATE		A-10780	
		FILE NO. 1058361	FILE NO. FC-01
		ACC. NO.	ACC. NO.

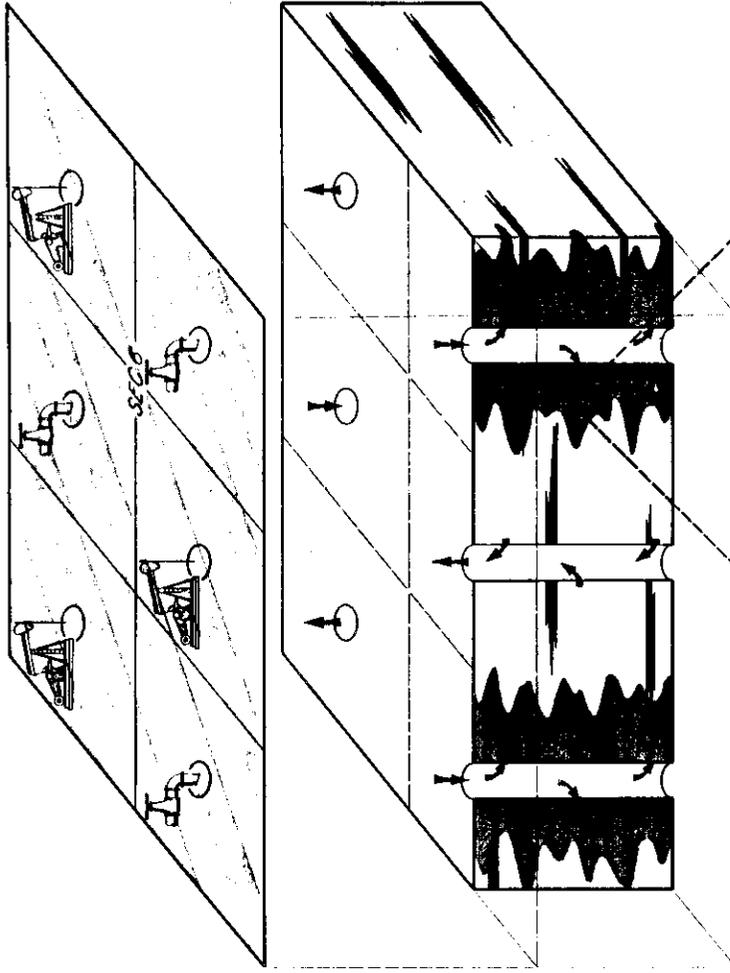
FIGURE 2

SCHEMATIC SECTION OF TYPICAL SANDSTONE RESERVOIR

BEFORE FLOODING



AFTER FLOODING



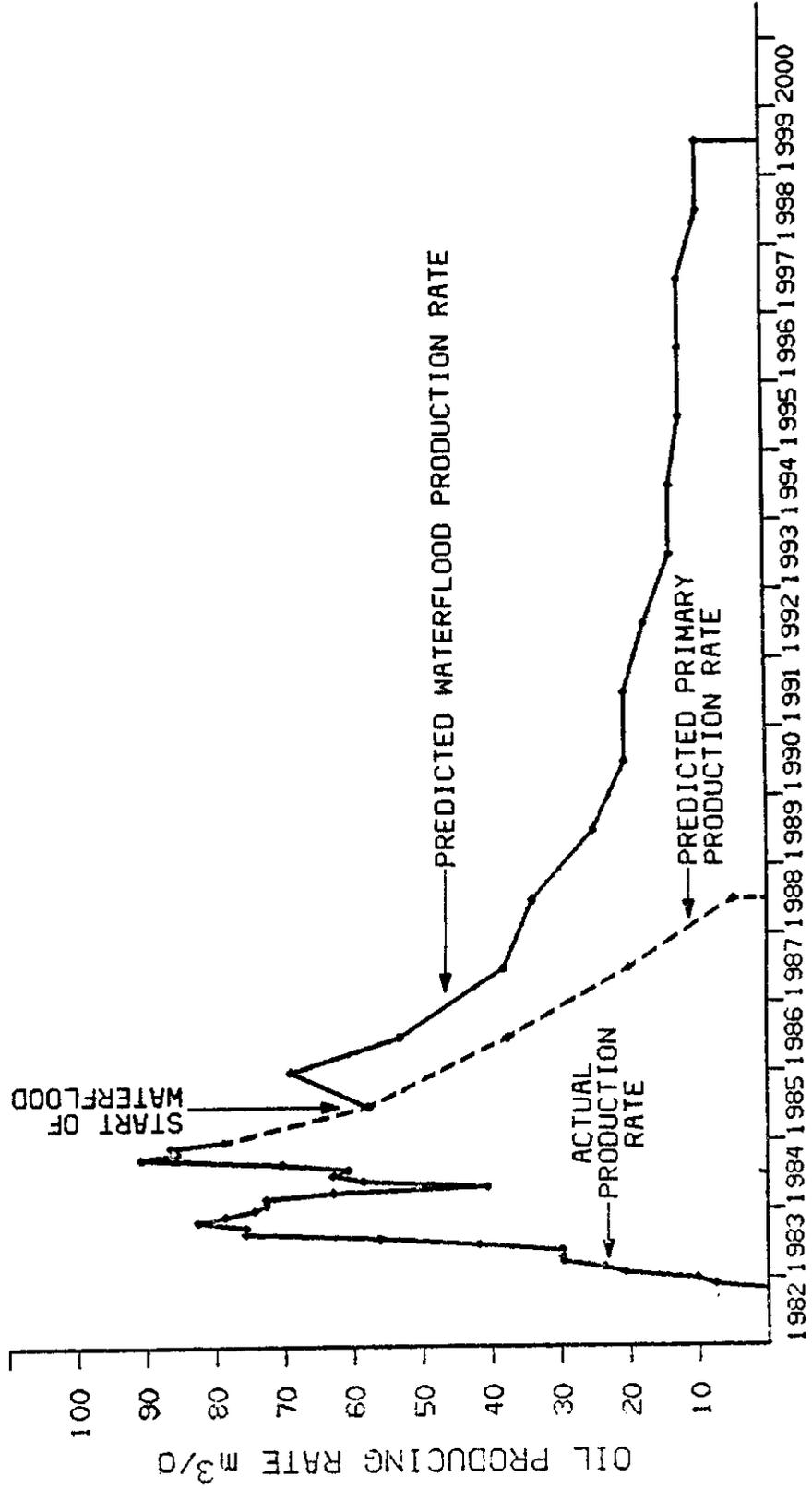
LEGEND

- PUMPING OIL WELL
- WATER INJECTION WELL
- OIL
- WATER

MAGNIFIED X100

MAGNIFIED X100

**FIGURE 3**  
**WASKADA UNIT NO. 6**  
**PREDICTED WATERFLOOD PERFORMANCE**



DATE: April 23, 1985

→ Bob

MANIT  BA

TO: J. F. Redgwell

COMMENTS:

Re: Board Order No. PM 44

FROM: H. Clare Moster

Attached is the subject Order  
for your approval and signature.

Dept.:

Branch:

Address:

Please forward to Wm. McDonald  
when signed.

Telephone:

Thanks!

- |  |  |
|--|--|
| <input type="radio"/> Take action                                | <input type="radio"/> Circulate                        |
| <input type="radio"/> Per your request                           | <input type="radio"/> See me re attached               |
| <input type="radio"/> Call me on this matter                     | <input type="radio"/> For your information             |
| <input type="radio"/> Investigate and report                     | <input type="radio"/> Supply data for my reply         |
| <input type="radio"/> For your revision<br>or approval           | <input type="radio"/> Reply direct<br>with copy to me  |
| <input type="radio"/> Return with comments<br>or recommendations | <input type="radio"/> Draft reply<br>for signature of: |



## Inter-Departmental Memo

Date April 22, 1985

To The Oil and Natural Gas  
Conservation Board

Wm. McDonald, Deputy Chairman  
J. F. Redgwell, Member

From H. Clare Moster  
Director, Petroleum Branch

Subject Waskada Lower Amaranth A Pool

Telephone

Pressure Maintenance by Waterflooding  
Chevron - Newscope

Chevron Canada Resources Limited, on behalf of itself and Newscope Resources Limited, has made application, dated November 29, 1984, for approval to conduct waterflood operations in a portion of the subject Pool. Notice of the initial application was published in the Manitoba Gazette (December 22, 1984) and the Melita New Era (December 20, 1984). Copies of the notice were also sent to all working interest owners within and adjacent to the project area and to all royalty interest owners in the project area. No interventions or objections have been received.

In its letter of January 17, 1985, the Board requested that Chevron submit a list of mineral rights owners and lessees and surface owners prior to final processing of the application.

Chevron has submitted a letter dated March 29, 1985 including the required lists and summarizing a number of changes in the application. The proposed changes result in exclusion of several undrilled or non-productive tracts, inclusion of two additional tracts in Section 6-1-25 (WPM) and conversion of two additional wells to water injection. Figure No. 1 shows the current project area outlining these changes.

Recommendations:

It is recommended that the application be approved and that Board Order No. PM 44, authorizing pressure maintenance operations, be issued. A copy of the proposed Board Order is attached.

Discussion:

A review of the list of royalty owners provided by Chevron indicates that all parties except those in Section 6-1-25 have received notice of the application. In that the proposed operation in Section 6-1-25 (WPM) involves conversion of a currently non-productive well to water injection, a valid objection is not anticipated. Further, royalty owners in this Section will have to become parties to the Unit agreement prior to injection.

Inclusion of Chevron Newscope 15-7-1-25 as an injector could potentially affect wells operated by Omega Hydrocarbons Ltd. in Section 18-1-25 (WPM). Omega has been contacted (phone call Bob Dubreuil to George Patey - April 17, 1985) and have indicated no concerns regarding inclusion of this well as an injector.

The proposed Board Order is quite similar to Orders authorizing injection in other parts of the Pool. Included are normal provisions regarding pressure surveys, maximum injection pressures and monitoring the effect of communication with the Mississippian on ultimate oil recovery from the area.

H. Clare Moster

LRD/lk

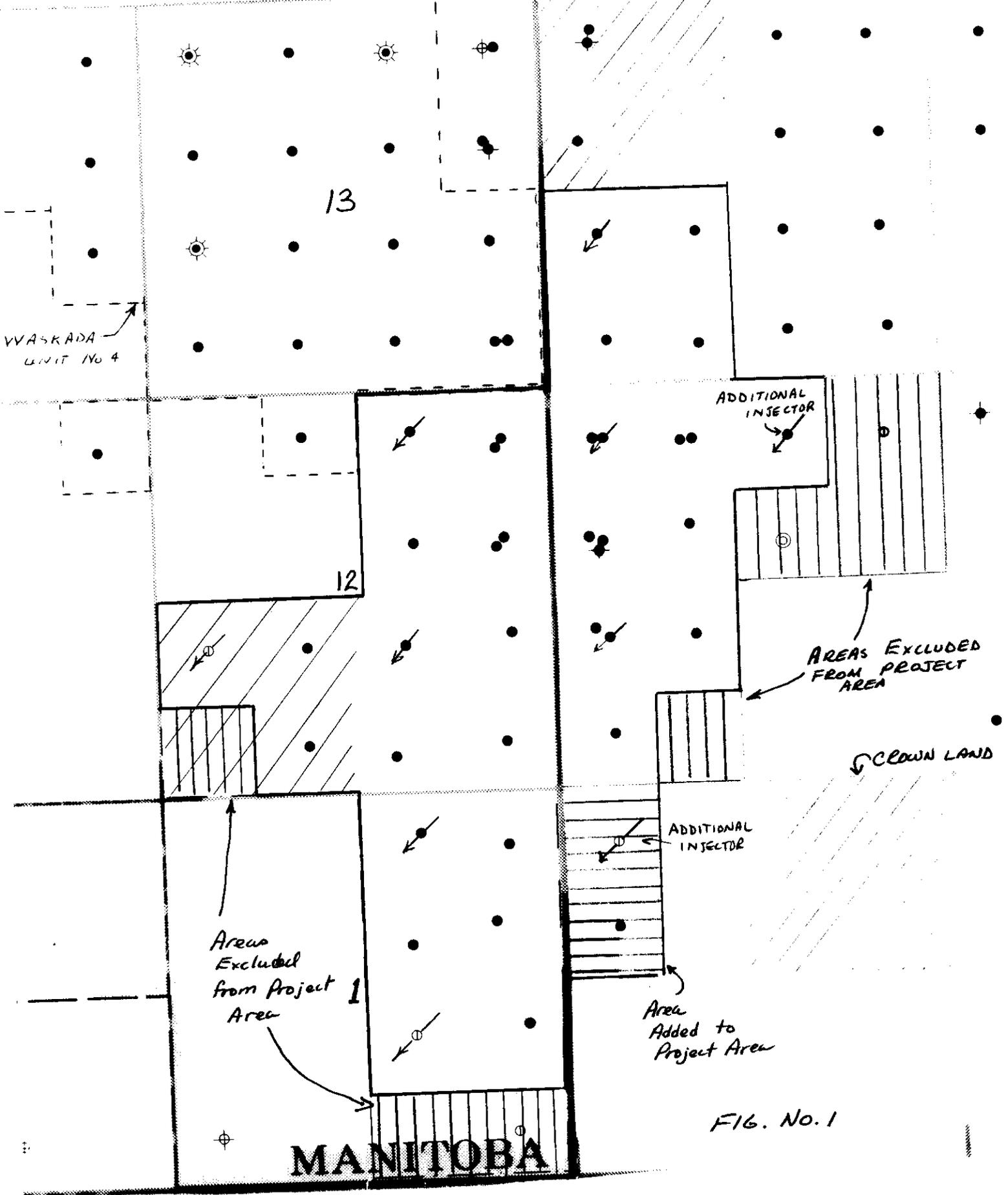


FIG. No. 1

Manitoba Regulation /85

Being

THE OIL AND NATURAL GAS CONSERVATION BOARD

ORDER NO. PM 44

An Order Pertaining to Pressure Maintenance by Water Flooding

WASKADA LOWER AMARANTH A POOL

Made and Passed Pursuant to "The Mines Act", Cap. M160, of the Continuing Consolidation of the Statutes of Manitoba, and Amendments Thereto, by The Oil and Natural Gas Conservation Board of Manitoba

(Filed: )

WHEREAS, subsection (9)(d) of Section 62 of "The Mines Act", being Chapter M160 of the Continuing Consolidation of the statutes of Manitoba, provides as follows:

"62(9) Without restricting the generality of subsection (8) the board, with the approval of the minister, may make orders

(d) requiring the repressuring, recycling, or pressure maintenance, of any pool or portion thereof where it is economical to do so, and for that purpose where necessary requiring the introduction or injection into any pool or portion thereof of gas, air, water or other substance;"

AND WHEREAS, the Board received an application dated November 29, 1984 from Chevron Canada Resources Limited for approval of a project to inject water into the Waskada Lower Amaranth A Pool ("the Pool") in Manitoba.

AND WHEREAS, the Board has received letters from Chevron Canada Resources Limited dated January 3, 1985 and March 29, 1985 incorporating modifications to the project and providing additional information requested by the Board.

AND WHEREAS, Chevron Canada Resources Limited is the interim Unit Operator ("the Operator") of the proposed Waskada Unit No. 6;

NOW THEREFORE, the Board Orders that:

1. The Operator shall conduct pressure maintenance operations by the injection of water into the Pool underlying the area of the proposed Waskada Unit No. 6 ("the Unit Area").
2. The pressure maintenance operations shall be in accordance with, and subject to, the following rules:

PRESSURE MAINTENANCE RULES

1. (1) Water shall be injected into the Lower Amaranth Formation through the wells:

New Scope Waskada WIW 13-6-1-25 (WPM)  
New Scope et al Waskada WIW 5-7LAm-1-25 (WPM)  
New Scope et al Waskada WIW 13-7LAm-1-25 (WPM)  
Chevron Newscope Waskada WIW 15-7-1-25 (WPM)  
Chevron Waskada WIW 5-18-1-25 (WPM)  
Chevron Waskada WIW 7-1-1-26 (WPM)  
Chevron Waskada WIW 15-1-1-26 (WPM)  
Chevron Waskada Prov. WIW 5-12-1-26 (WPM)  
Chevron Waskada WIW 7-12-1-26 (WPM)  
New Scope Waskada WIW 15-12-1-26 (WPM)

and such other wells in the Unit Area as the Board may approve.

- (2) After the commencement of injection, the Operator shall, subject to any remedial work required to be performed on the wells referred to in subclause (1) of this clause, endeavour to maintain continuous injection.
- (3) Notwithstanding the provisions of subclause (2), the Board may, upon application by the Operator, approve the suspension of water injection into any well or wells, provided that the Board is satisfied that pressure maintenance operations in the Unit Area will not be adversely affected.
- (4) The completion of the wells referred to in subclause (1) will be as prescribed by the Director of the Petroleum Branch.
2. The Operator, upon the request of the Board, shall satisfy the Board as to the source, suitability and method of treatment of the water to be injected.
3. (1) Before injection of water is commenced, the Operator shall submit to the Board results of a survey conducted to determine the static reservoir pressure in a minimum of five wells in the Unit Area.
- (2) The Operator shall, not less than six months nor more than 12 months after the commencement of injection, and at yearly intervals thereafter, conduct a survey to determine the static reservoir pressure in a minimum of one well in each injection pattern within the Unit Area.
- (3) The Operator shall submit the details of the surveys described in subclauses (1) and (2) of this clause to the Petroleum Branch, including a list of the wells to be surveyed, the measurement technique to be used, and the intended shut-in periods for each well, and approval shall be obtained from the Director of the Petroleum Branch before the program is carried out. Within 30 days of the completion date of the surveys, a report shall be submitted to the Petroleum Branch including:

- (a) the static reservoir pressure data obtained from the survey, corrected to a common datum;
  - (b) an isobaric map of the Pool within the Unit Area based on the data obtained; and
  - (c) a discussion of the survey results and pressure distribution within the Pool.
- (4) The Board may, at any time, require the Operator to carry out such additional reservoir pressure surveys as it deems necessary.
4. The Operator shall, within 30 days of the commencement of injection, submit to the Board the plan of a comprehensive program designed to monitor the extent of communication between the Lower Amaranth and Mission Canyon Formations in the Unit Area and the effect of such communication upon production performance and ultimate recovery in each Formation.
5. The Operator shall immediately report to the Board any indication of channelling or break-through of injected water to producing wells or any indication of other detrimental effects that may be attributable to the pressure maintenance operations.
6. The maximum wellhead pressure at which water is injected into the wells referred to in subclause (1) of clause 1 hereof shall not exceed 10 000 kPa or such other maximum pressure as the Board may prescribe. The Board may, from time to time, prescribe a maximum or minimum rate at which water shall be injected into any well in the Unit Area.
7. (1) The Unit Operator shall, not later than the last day of each month file with the Petroleum Branch, a report of the quantity, source and pressure of water injected during the preceding month into each well referred to in clause 1 hereof.
- (2) The Unit Operator shall, not later than the last day of each month, file with the Petroleum Branch a summary report of production and injection operations during the preceding month. This report shall include:
- (a) the monthly oil, gas and water production for the Unit Area and for each well;
  - (b) the percentage of voidage replaced by injection for each injection pattern; and
  - (c) a summary of any remedial operations carried out on any well in the Unit area.

8. The Operator, shall, within 60 days of the end of each calendar year, file with the Petroleum Branch a report of the pressure maintenance program, setting out graphically such interpretive information necessary to evaluate the efficacy of the waterflood.

Oil and Natural Gas Order No. PM 44,  
made and passed this        day of  
   A.D., 1985, at the City  
of Winnipeg, in the Province of  
Manitoba, by The Oil and Natural  
Gas Conservation Board.

---

Wm. McDonald  
Deputy Chairman  
The Oil and Natural Gas  
Conservation Board

---

J. F. Redgwell  
Member  
The Oil and Natural Gas  
Conservation Board

Approved:

---

Wilson D. Parasiuk  
Minister of Energy and Mines



## Chevron Canada Resources Limited

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

K.E. Godard  
Chief Engineer

1985-03-29

Summary of Changes to the  
Waskada Lower Amaranth "A" Pool  
Waterflood Application dated 1984-11-29

The Oil and Natural Gas Conservation Board  
309 Legislative Building  
Winnipeg, Manitoba  
R3C 0V8

Attention: Mr. R. B. Chenier

Gentlemen:

With the recent development drilling, the Waterflood Project area has changed from the area included in the Waskada Lower Amaranth "A" Pool Waterflood Application dated 1984-11-29. A summary of the changes is:

1. The following tracts have been added to the proposed Unit:

LSD 12 and 13-06-01-25 WPM

LSD 06 and 15-07-01-25 WPM

See the attached map which is an updated version of Figure 1 of the Waterflood Application. This map shows the initial boundary of the proposed Unit.

2. Two additional wells will be converted to water injection service. They are:

13-06-01-25 WPM

15-07-01-25 WPM

See the attached table that is an updated version of Table 1 in the Waterflood Application. This table shows the injector geologic properties and the expected injection rates. The completion and stimulation summary for the two additional injectors is contained in the updated version of Appendix B in the Waterflood Application.

3. An update of the surface facilities map (Figure 7 in the Waterflood Application) is also attached.

Also attached are three tables with the preliminary lists of the working interest, mineral rights, and surface owners of the proposed Unit. These tables take the place of Figure 2 in the Waterflood Application, which was deficient. A final version of these tables will be forwarded when the Title Search Committee for the proposed Waskada Unit No. 6 has completed its work.

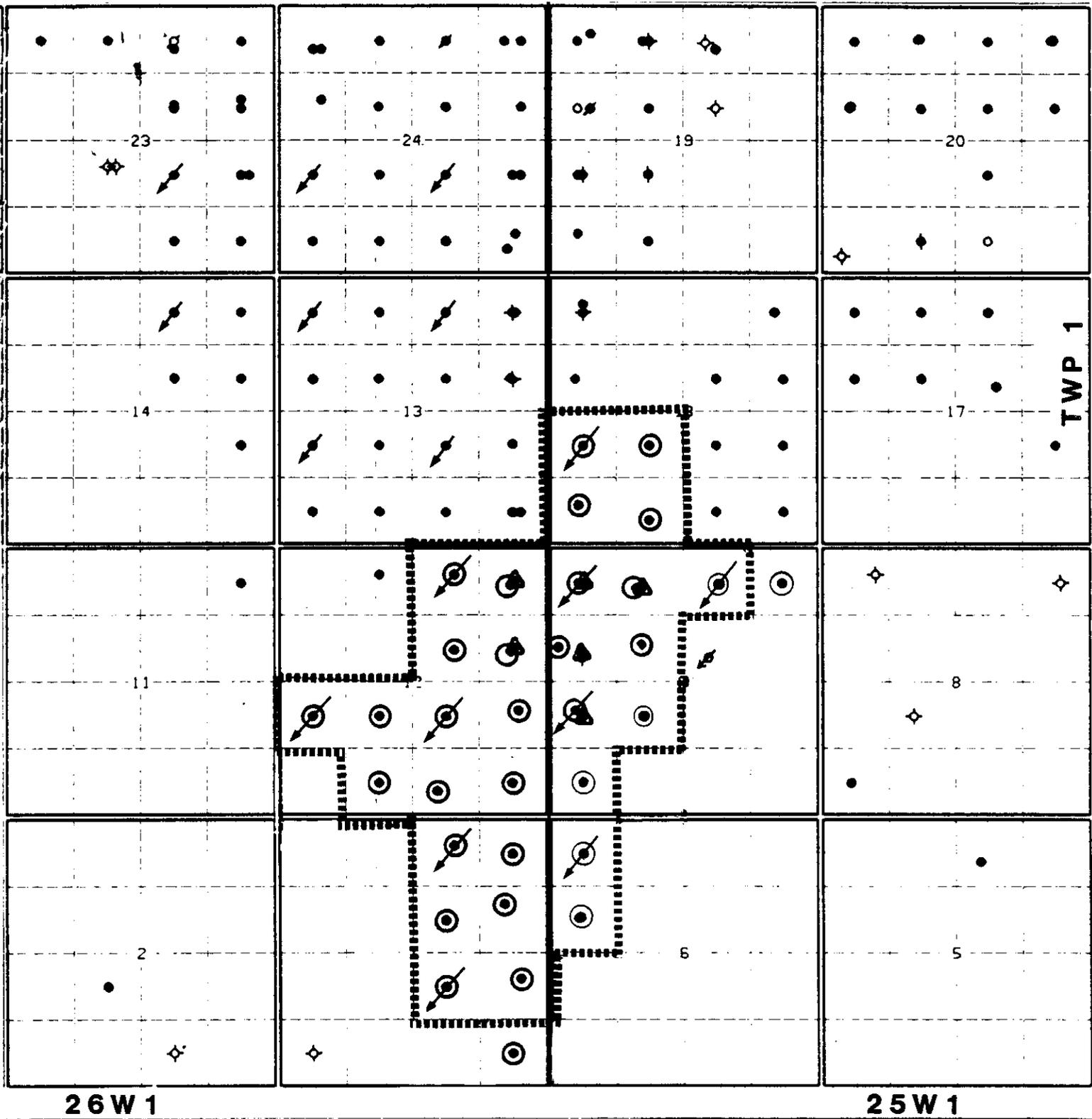
Any questions regarding this matter should be directed to D. Schierman at (403) 234-5167.

Sincerely,



R. A. FILGATE, P.Eng.  
Supervising Engineer  
Reservoir

DS/lgs  
Attach.



26 W 1

25 W 1

LEGEND

- ⊙ SPEARFISH
- ▲ MC-3
- ⊙ with arrow PROPOSED INJECTORS
- ⊙ with arrow and dot DISPOSAL WELL
- PROPOSED UNIT AREA



Chevron Canada Resources Limited

WASKADA AREA  
PROPOSED UNIT

FIGURE 1

PREPARED BY H. HUBBARD	SCALE	DATE
FILED BY H. HUBBARD	APPROVED BY H. HUBBARD	DATE
PROJECT WASKADA	DRAWN BY L. CAMPBELL	CAD NUMBER
DESCRIPTION WASKADA	DOCUMENT NO. A-10780	INTERPRETATION OVERLAY NO.
FILE NO. 2058261	FILE NO. FC-01	FILE NO.
REV. NO.	REV. NO.	REV. NO.

TABLE 1

Waskada Lower Amaranth "A" Pool  
Proposed Waterflood Project  
Injector Geologic Properties and Expected  
Injection Rates

---

<u>Injector</u>	<u>h</u> m	<u>Øh</u> m	<u>kh</u> <sup>1</sup> mdm	Predicted Injection <u>Rate</u> <sup>2</sup> m <sup>3</sup> /d
13- 6- 1-25	4.0	.64		150
5- 7- 1-25	1.2	.20		80
13- 7- 1-25	1.0	.17	2.0	100
15- 7- 1-25	5.2	.83	11.4	70
5-18- 1-25	3.4	.54	5.4	40
7- 1- 1-26	4.4	.70	8.8	60
15- 1- 1-26	7.2	1.10	18.7	100
5-12- 1-26	1.3	.26		80
7-12- 1-26	3.9	.62		30
15-12- 1-26	2.0	.30		60

1. Wells without kh data were not cored.
2. Estimated from Unit 1 injection well production and injection data.



## A P P E N D I X B

### Waskada Injection Well Candidates Well Completion and Stimulation Summary

#### Newscope S. Waskada 13- 6- 1-25 WPM

114 mm casing, landed at 985.0 m KB.  
Plug back total depth: 980.0 m KB  
Perforations: Lower Amaranth From 913.0 - 916.0, 919.0 - 923.0 and  
924.0 - 926.5 m KB  
Stimulation: Fracced with 27 tonne sand.

#### Newscope et al Waskada 5-7LAM-1-25-WPM

114 mm casing, landed at 930.5 m KB. Cemented to surface.  
Plug back total depth: 926.0 m KB.  
Perforations: Lower Amaranth from 916.0 to 924.0 m KB.  
Stimulation: Fracced with 27 tonne sand.

#### Newscope et al Waskada 13-7LAM-1-25-WPM

140 mm casing, landed at 935.5 m KB. Cemented to surface.  
Plug back total depth: 931.4 m KB.  
Perforations: Lower Amaranth 913.5 - 926.0 m KB.  
Stimulation: Fracced with 30.0 tonne sand.

#### Chevron Newscope Waskada 15-7-1-25 WPM

140 mm casing, landed at 954.8 m KB.  
Plug back total depth: 940.7 m KB (by electric wireline).  
Perforations: Lower Amaranth from 912.0 to 924.0 m KB.  
Stimulation: Fracced with 27 tonne sand.

#### Chevron Waskada 5-18-1-25-WPM

140 mm casing, landed at 963.5 m KB. Cemented to surface.  
Plug back total depth: 949.0 m KB.  
Perforations: Lower Amaranth from 913.0 - 922.5 m KB.  
Stimulation: Fracced with 16 tonne sand (Sanded Off)

#### Chevron Waskada 7-1-1-26-WPM

140 mm casing, landed at 968.5 m KB. Cemented to surface.  
Plug back total depth: 955.0 m KB.  
Perforations: Lower Amaranth from 914.0 to 925.0 m KB.  
Stimulation: Fracced with 27.0 tonne sand.

Chevron Waskada 15-1-1-26-WPM

140 mm casing, landed at 959.5 m KB. Cemented to surface.  
Plug back total depth: 946.5 m KB initially.  
Perforations: Mission Canyon from 936.0 to 938.0 m KB  
(Temporarily Abandoned)  
New Plug Back Total Depth: 931.0 m KB (Cement Retainer)  
New Perforations: Lower Amaranth from 915.0 to 929.0 m KB.  
Stimulation: Fraced with 7.7 tonne sand (Sanded Off).

Chevron Waskada 5-12-1-26-WPM

140 mm casing, landed at 979.5 m KB.  
Plug back total depth: 963.6 m KB.  
Perforations: Lower Amaranth from 927.0 to 936.0 m KB.  
Stimulation: Fraced with 27.0 tonne sand.  
Remedial: Cement squeezed top of MC-3 to shut off excessive water  
production - only partially successful.

Chevron Waskada 7-12-1-26-WPM

140 mm casing, landed at 955.0 m KB. Cemented to surface.  
Plug back total depth: 939.3 m KB.  
Perforations: Lower Amaranth 910.5 - 923.0 m KB.  
Stimulation: Fraced with 11.0 tonne sand (Sanded Off).

Newscope S. Waskada 15-12-1-26-WPM

114 mm casing, landed at 958.5 m KB.  
Plug back total depth: 953.2 m KB.  
Perforations: Lower Amaranth from 909.0 - 921.0 m KB.  
Stimulation: Fraced with 27.0 tonne sand

PROPOSED WASKADA UNIT NO. 6  
WORKING INTEREST OWNERS

Well	Participation - %					
	Chevron	Newscope	PanCanadian	Great American	Colenco	New McManus
12- 6- 1-25	25.00	30.00	-	-	25.00	10.00
13- 6- 1-25	25.00	30.00	-	-	25.00	10.00
4- 7- 1-25	50.00	27.50	-	-	12.50	5.00
5- 7- 1-25	50.00	27.50	-	-	12.50	5.00
6- 7- 1-25	50.00	27.50	-	-	10.00	7.50
11- 7- 1-25	25.00	27.50	25.00	-	10.00	7.50
12- 7- 1-25	25.00	27.50	25.00	-	12.50	5.00
13- 7- 1-25	-	55.00	-	-	25.00	10.00
14- 7- 1-25	25.00	27.50	25.00	-	10.00	7.50
15- 7- 1-25	50.00	50.00	-	-	-	-
3-18- 1-25	100.00	-	-	-	-	-
4-18- 1-25	100.00	-	-	-	-	-
5-18- 1-25	100.00	-	-	-	-	-
6-18- 1-25	100.00	-	-	-	-	-
7- 1- 1-26	100.00	-	-	-	-	-
8- 1- 1-26	100.00	-	-	-	-	-
9- 1- 1-26	100.00	-	-	-	-	-
10- 1- 1-26	100.00	-	-	-	-	-
15- 1- 1-26	100.00	-	-	-	-	-
16- 1- 1-26	100.00	-	-	-	-	-
1-12- 1-26	31.25	25.00	-	43.75	-	-
2-12- 1-26	31.25	25.00	-	43.75	-	-
3-12- 1-26	100.00	-	-	-	-	-
5-12- 1-26	100.00	-	-	-	-	-
6-12- 1-26	100.00	-	-	-	-	-
7-12- 1-26	31.25	25.00	-	43.75	-	-
8-12- 1-26	31.25	25.00	-	43.75	-	-
9-12- 1-26	50.00	27.50	-	-	10.00	7.50
10-12- 1-26	50.00	27.50	-	-	10.00	7.50
15-12- 1-26	50.00	27.50	-	-	10.00	7.50
16-12- 1-26	50.00	27.50	-	-	12.50	5.00

Abbreviations:

Chevron	- Chevron Canada Resources Limited
Newscope	- Newscope Resources Limited
PanCanadian	- PanCanadian Petroleum Limited
Great American	- Great American Energy, Inc.
Colenco	- Colenco Petroleum Ltd.
Can-Am	- Can-Am Drilling Ltd.
New McManus	- New McManus Red Lake Gold Mines

PROPOSED WASKADA UNIT NO. 6  
MINERAL RIGHTS OWNERS

<u>Lands</u>	<u>Lessor</u>
NW-1/4 6- 1-25 WPM	Daisy May Lawrence Dome Petroleum Limited
SW-1/4 7- 1-25 WPM	59643 Manitoba Ltd. Roy Ovey Young
NE-1/4 7- 1-25 WPM	Joyce A. Rushton PanCanadian Petroleum Limited
NW-1/4 7- 1-25 WPM	Glen T. Rushton PanCanadian Petroleum Limited
SW-1/4 18- 1-25 WPM	Hernefield Enterprises Ltd.
E-1/2 1- 1-26 WPM	Frank R. Smart & Robert Smart
SE-1/4 12- 1-26 WPM	Hernefield Enterprises Ltd. William J. Hill Estate Robert Stead Witteman (W & N) M. Westlie (beneficiary of Weinhandle) Smith (Estate) Boyle (P&M) P. Boyle Westlie Estate M. Ballantine
SW-1/4 12- 1-26 WPM	Crown (Manitoba)
NE-1/4 12- 1-26 WPM	Hernefield Enterprises Ltd.

PROPOSED WASKADA UNIT NO. 6  
SURFACE OWNERS

<u>Lands</u>	<u>Surface Owners</u>
NW-1/4 6- 1-25 WPM	Francis H. Lawrence
SW-1/4 7- 1-25 WPM	Leslie J. McGregor
NE-1/4 7- 1-25 WPM	Leslie J. McGregor
NW-1/4 7- 1-25 WPM	Robert D. McGregor
SW-1/4 18- 1-25 WPM	Melvin Lee
E-1/2 1- 1-26 WPM	Franklin Smart
SE-1/4 12- 1-26 WPM	Melvin Lee
SW-1/4 12- 1-26 WPM	Melvin Lee
NE-1/4 12- 1-26 WPM	Ronald W. Lee (Owner) Melvin Lee (Occupant)



POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To E.R. Radcliffe  
A Box 1717  
W. Pus, Man R9A1L5

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To E.R. Smart  
A Waskada  
Manitoba R9M 2E0

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To J.A. & C.T. Rushton  
A Box 1213  
Warden Man R0M 2C0

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To Pan. Canadian Petroleum  
A 150 - 9th Ave S.W.  
Calgary, Alta T2P 2S5

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To Don Black Lee  
A 7-1st Ave S.W.  
Calgary, Man R0G 0T0

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To W. & M. Hef  
A Westhope  
North Dakota 58793

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To Carl & Joan White  
A 41 Woodland Dr  
Fargo, N.D. 58130

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To W. & N. Witterman  
A Westhope, N.D.  
58793

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To Melvin Balaunyne  
A 1000 West Central  
Minot N.D. 58701

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To D.E. Smith  
A Box 4302  
Mount Edgecomb, Alaska 99835

FEE  c. No.   
DROIT  c. No.

P.M. Initials  
Initiales du m. de p. \_\_\_\_\_

Timbre à date

*Not recommended*

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To *M. R. Westlie*  
A *135 16th St. N.W.*  
*Minot, N.D. 58701*

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To *Charles Westlie*  
A *Traverse Country Club Village*  
*Minot, N.D. 58701*

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOM  
Date Stamp

To *Paul + Margaret Boyce*  
A *Minot, N.D. 58761*

FEE  c. No.  **5877**  
DROIT

P.M. Initials  
Initiales du m. de p.

*Apr 18. (Post off)*  
*The trace is on!*  
*They'll call us*  
*with the results*  
*S.*

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOM  
Date Stamp

To *Robert Stead*  
A *Route 1, Box 66*  
*Westhope, N.D. 58793*

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

*Sent*  
*Dec 17/84*

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECO...  
Date Stamp

To *M. J. Lee*  
A *Box 136*  
*Waskada, Man SPM 2EO*

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To  
A

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

Timbre à date

POSTES CANADA POST  
REGISTRATION RECEIPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To  
A

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

Timbre à date

POSTES CANADA POST  
T - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To  
A

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

Timbre à date

POSTES CANADA POST  
PT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To  
A

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

Timbre à date

POSTES CANADA POST  
IPT - RÉCÉPISSÉ DE RECOMMANDATION  
Date Stamp

To  
A

FEE  c. No.   
DROIT

P.M. Initials  
Initiales du m. de p.

Timbre à date



MANITOBA

THE OIL AND NATURAL GAS CONSERVATION BOARD  
309 LEGISLATIVE BUILDING  
WINNIPEG, MANITOBA  
R3C 0V8

NOTICE UNDER THE MINES ACT

WASKADA OIL FIELD

Chevron Canada Resources Limited, on behalf of itself and Newscope Resources Limited, has made application under The Mines Act to conduct a waterflood pressure maintenance project in the Lower Amaranth Formation in that portion of the Waskada Field described as follows:

W<sup>1</sup>/<sub>2</sub> and NE<sup>1</sup>/<sub>4</sub> of Section 7-1-25 (WPM)  
SW<sup>1</sup>/<sub>4</sub> of Section 18-1-25 (WPM)  
E<sup>1</sup>/<sub>2</sub> of Section 1-1-26 (WPM)  
E<sup>1</sup>/<sub>2</sub> and SW<sup>1</sup>/<sub>4</sub> of Section 12-1-26 (WPM)

It is proposed to convert the following wells to water injection:

New Scope et al Waskada 5-7LAm-1-25 (WPM)  
New Scope et al Waskada 13-7LAm-1-25 (WPM)  
Chevron Waskada 5-18-1-25 (WPM)  
Chevron Waskada 7-1-1-26 (WPM)  
Chevron Waskada 15-1-1-26 (WPM)  
Chevron Waskada Prov. 5-12-1-26 (WPM)  
Chevron Waskada 7-12-1-26 (WPM)  
New Scope S. Waskada 15-12-1-26 (WPM)

If no valid objection or intervention in writing is received by the Board at 555 - 330 Graham Avenue, Winnipeg, Manitoba, R3C 4E3 within 14 days of the publication of this notice, the Board may approve the application.

Copies of the application may be obtained from Chevron Canada Resources Limited, 500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7 or viewed at the offices of the Manitoba Petroleum Branch, 555 - 330 Graham Avenue, Winnipeg, Manitoba.

THE OIL AND NATURAL GAS  
CONSERVATION BOARD



Ian Haugh  
Deputy Chairman

Dated December 7<sup>th</sup>, 1984.

February 6, 1985

**Chevron Canada Resources Limited**  
500 Fifth Avenue S.W.  
Calgary, Alberta  
T2P 0L7

**Attention: Mr. R. A. Filgate, P. Eng.**  
Supervising Engineer, Reservoir

Dear Sirs:

Re: Proposed Waskada Unit No. 6 - Minutes

Your letter of January 28, 1985 with attached minutes of your recent meeting to commence unitization proceedings for the subject proposed Unit is acknowledged.

The Board wishes to reiterate its desire to have a pressure maintenance scheme initiated as soon as possible in this area and urges the Interim Operating Committee to take whatever steps are necessary to accelerate unitization and implementation.

Please keep the Board informed of all further developments in this matter.

Yours sincerely,

**THE OIL AND NATURAL GAS  
CONSERVATION BOARD**

**Wm. McDonald**  
Deputy Chairman

LRD/lk

b.c. Dick Chenier  
Jim Redgwell  
Petroleum Branch ✓

DATE: February 1, 1985

FROM: Office of the Deputy Minister  
Department of Energy and Mines  
309 Legislative Building  
Winnipeg, Manitoba R3C 0V8

COMMENTS:

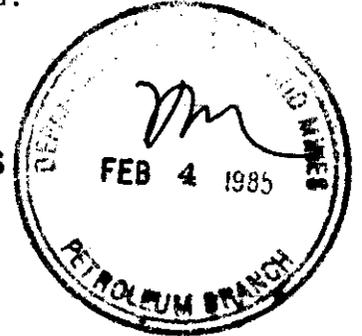
Please have Clare draft letter or notification to be circulated on changes to Board.

*in progress*

TO: Bill McDonald

*Clare Moster*

DEPT. OF ENERGY & MINES



FEB 0 1 1985

Conservation & Renewable Energy Br.

Dick Chenier

Telephone:

- Take action
- Per your request
- Call me on this matter
- Investigate and report
- For your revision or approval
- Return with comments or recommendations
- Circulate
- See me re attached
- For your information
- Supply data for my reply
- Reply direct with copy to me
- Draft reply for signature of:



*Bob*

*Draft letter of acknowledgment to Filgate from Dep. Chairman of Board.*

*ie - Bill McDonald*



**Chevron Canada Resources Limited**  
500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

K.E. Godard  
Chief Engineer

1985-01-28

Minutes - Waskada Unit No. 6

The Oil and Natural Gas Conservation Board  
309 Legislative Building  
Winnipeg, Manitoba  
R3C 0V8

Attention: Dr. Ian Haugh

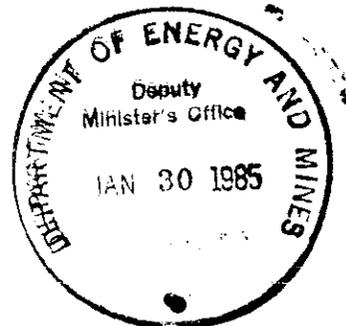
Gentlemen:

Attached are copies of the Minutes from the proposed Waskada Unit No. 6  
Operating and Technical Committee Meetings.

Sincerely,

*for* R. A. FILGATE, P.Eng.  
Supervising Engineer  
Reservoir

DS/ds  
Attach.





## Chevron Canada Resources Limited

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

1985-01-21

Proposed Waskada Unit No. 6  
Waterflood Project  
Minutes of Meeting 1985-01-17

TO: ALL WORKING INTEREST OWNERS  
PROPOSED WASKADA UNIT NO. 6

Gentlemen:

Chevron Canada Resources Limited called a meeting to commence unitization proceedings and discuss a waterflood project in the Chevron and Newscope operated portion of the Waskada Lower Amaranth "A" Pool. The people who attended are listed in Attachment No. 1. Mr. K. G. Matieshin of Chevron chaired the meeting.

1. There were no comments on the minutes of the 1984-12-17 meeting.
2. The following is a discussion of the resolutions voted on:

- (a) Resolution No. 1: "BE IT RESOLVED, that the Waskada Unit No. 6 Interim Operating Committee be established this 17th day of 1985-01 and this committee be chaired by a representative of Chevron Canada Resources Limited which will be designated as the Interim Unit Operator."

Newscope noted a problem exists in the NE-1/4 12-1-26 in that the mineral rights owner is presently against Chevron being operator of that land. Newscope further noted that the selection of Chevron as Interim Operator would not necessarily reflect on the selection of the Final Operator.

This resolution was moved by Chevron, seconded by PanCanadian and approved unanimously.

The following representatives were named to the Interim Operating Committee:

Chevron:	K. Matieshin (Chairman)
Newscope:	B. Weir
PanCanadian:	A. Khan
Great American:	T. Ballantyne
Colenco:	P. Cole
New McManus:	M. Watson (also representing Can-Am)

- (b) Resolution No. 2: "BE IT RESOLVED, that the Interim Unit Participation for the Proposed Waskada Unit No. 6 be based upon well count as shown in Attachment No. 3, as revised 1985-01-17."

The revision made was to include the recently drilled and completed producing well, 15-7-1-25. This Interim Unit Participation is included with these minutes as Attachment No. 2. This resolution was moved by Chevron, seconded by Great American and approved unanimously.

- (c) Resolution No. 3: "BE IT RESOLVED, that each party shall have a voting interest equal to its Interim Unit Participation and all matters prior to unitization, except those of participation interest and equalization of investment, shall be determined by an affirmative vote of 85% of the voting interest."

This resolution was moved by Chevron, seconded by New McManus and approved unanimously.

- (d) Resolution No. 4: "BE IT RESOLVED, that pre-unitization cost sharing be based on the Interim Unit Participation for each of the parties and that these charges will be redistributed on the basis of final Unit participation when the Unit becomes effective. BE IT FURTHER RESOLVED, that any expenditure prior to 1985-01-17 not be considered a pre-unit expense."

This resolution was moved by Chevron, seconded by Great American and approved unanimously.

- (e) Resolution No. 5: "BE IT RESOLVED, that a Titles Committee be established this 17th day of 1985-01, chaired by a representative of Chevron and reporting to the Interim Operating Committee, and be charged with the following:

- (i) Recommend an independent outside law firm to perform the titles work.
- (ii) Assist and supervise this outside law firm."

This resolution was amended from a previous motion to include Chevron as chairman. The resolution was moved by Chevron, seconded by Colenco and approved unanimously.

The following representatives were named to the Titles Committee:

Chevron:	G. Sveinson (Chairman)
Newscope:	D. Eskesen

Chevron agreed with the previous suggestion of Newscope's to use the firm of Bennett Jones to conduct the titles work. Chevron and Newscope will further discuss this matter and Chevron will issue an AFE for the title search work.

- (f) Resolution No. 6: "BE IT RESOLVED, that a Technical Committee be established this 17th day of 1985-01, chaired by a representative of Chevron and reporting to the Interim Operating Committee, and be charged with developing production related factors and geological factors that could be used in the tract factor calculations."

This resolution was moved by Chevron, seconded by Newscope and approved unanimously.

The following representatives were named to the Technical Committee:

Chevron:	D. Schierman (Chairman)
Newscope:	B. Weir & D. Krill (Alternate)
Great American:	T. Ballantyne
Colenco:	P. Cole
New McManus:	M. Watson (also representing Can-Am)
PanCanadian:	Representative to be named later

3. The agenda item concerning production related factors and geological factors was left for discussion at the Technical Committee level. The first Technical Committee meeting was later scheduled for 1985-01-18-09:00 in Room 1161 of the Chevron building.
4. The waterflood cost estimate of \$710 000 presented by Chevron was noted to be only a preliminary estimate. Final design and the drilling of additional wells could change the final cost.
5. Other Business

It was noted there was some urgency in putting the waterflood and unit in place. The timing of a summer 1985 start-up is reasonable with the Board. Chevron stated that they are meeting with Omega on another matter and will bring up the possibility of expansion of this project to the NE. Chevron will informally check with the Board concerning an incentive extension.

It was agreed by all parties that the minutes of this meeting should be sent to the Manitoba Board.

The meeting was adjourned on a motion by Chevron that was seconded by Great American.

Yours very truly,



K. G. MATIESHIN, Chairman  
Interim Operating Committee  
Proposed Waskada Unit No. 6

KGM/db  
Attach.

bcc: D. M. Forbes  
K. E. Godard  
R. A. Filgate  
C. G. Folden  
D. B. Taylor  
D. G. Guest  
TIS

ATTACHMENT NO. 1

ATTENDANCE LIST - 1985-01-17 MEETING  
PROPOSED WASKADA UNIT NO. 6

<u>Company</u>	<u>Name</u>
Chevron Canada Resources Limited	Kevin Matieshin Don Guest Doug Schierman Kathleen Arthur Mark Haughey Doug McCallum Chester Holmlund Cal Folden
Colenco Petroleum Ltd.	Percy Cole
Great American Energy, Inc.	Todd Ballantyne
New McManus Red Lake Gold Mines (also representing Can-Am Drilling Ltd.)	Mike Watson
Newscope Resources Limited	Dave Eskesen Bob Weir Don Krill
PanCanadian Petroleum Limited	Ash Khan

ATTACHMENT NO. 2

REVISED 1985-01-17

INTERIM UNIT PARTICIPATION  
PROPOSED WASKADA UNIT NO. 6

Well	Participation - %						
	Chevron	Newscope	PanCanadian	Great American	Colenco	Can-Am	New McManus
4- 7- 1-25	50.00	27.50	-	-	12.50	5.00	5.00
5- 7- 1-25	50.00	27.50	-	-	12.50	5.00	5.00
11- 7- 1-25	25.00	27.50	25.00	-	10.00	5.00	7.50
12- 7- 1-25	25.00	27.50	25.00	-	12.50	5.00	5.00
13- 7- 1-25	-	55.00	-	-	25.00	10.00	10.00
14- 7- 1-25	25.00	27.50	25.00	-	10.00	5.00	7.50
15- 7- 1-25	50.00	50.00	-	-	-	-	-
3-18- 1-25	100.00	-	-	-	-	-	-
4-18- 1-25	100.00	-	-	-	-	-	-
5-18- 1-25	100.00	-	-	-	-	-	-
6-18- 1-25	100.00	-	-	-	-	-	-
7- 1- 1-26	100.00	-	-	-	-	-	-
8- 1- 1-26	100.00	-	-	-	-	-	-
9- 1- 1-26	100.00	-	-	-	-	-	-
10- 1- 1-26	100.00	-	-	-	-	-	-
15- 1- 1-26	100.00	-	-	-	-	-	-
16- 1- 1-26	100.00	-	-	-	-	-	-
1-12- 1-26	31.25	25.00	-	43.75	-	-	-
2-12- 1-26	31.25	25.00	-	43.75	-	-	-
3-12- 1-26	100.00	-	-	-	-	-	-
5-12- 1-26	100.00	-	-	-	-	-	-
6-12- 1-26	100.00	-	-	-	-	-	-
7-12- 1-26	31.25	25.00	-	43.75	-	-	-
8-12- 1-26	31.25	25.00	-	43.75	-	-	-
9-12- 1-26	50.00	27.50	-	-	10.00	5.00	7.50
10-12- 1-26	50.00	27.50	-	-	10.00	5.00	7.50
15-12- 1-26	50.00	27.50	-	-	10.00	5.00	7.50
16-12- 1-26	50.00	27.50	-	-	12.50	5.00	5.00
TOTAL WELL COUNT	1 850.00	452.50	75.00	175.00	125.00	55.00	67.50
PARTICIPATION INTEREST	66.071	16.161	2.679	6.250	4.464	1.964	2.411

ADDRESSEE LIST  
PROPOSED WASKADA UNIT NO. 6

PanCanadian Petroleum Limited  
PanCanadian Plaza  
150 - 9th Avenue S.W.  
Calgary, Alberta  
T2P 3H9

Attention: Mr. J. F. Kelly

Great American Energy, Inc.  
Suite 7, 71321 Highway 111  
Rancho Mirage, California  
92270

Attention: Mr. T. Ballantyne

Can-Am Drilling Ltd.  
Box 26, Group 10  
RR1  
Dugald, Manitoba  
ROE OKO

Attention: Mr. J. Frieson

Newscope Resources Limited  
Suite 1600, 700 - 9th Avenue S.W.  
Calgary, Alberta  
T2P 3V4

Attention: Mr. R. D. Weir

Colenco Petroleum Ltd.  
200, 409 - 8th Avenue S.W.  
Calgary, Alberta  
T2P 1E3

Attention: Mr. C. P. Cole

New McManus Red Lake Gold Mines  
205 - 52 Donald Street  
Winnipeg, Manitoba  
R3C 3Z6

Attention: Mr. M. K. Watson



January 17, 1985

**Chevron Canada Resources Limited**  
300 Fifth Avenue S.W.  
Calgary, Alberta  
T2P 6L7

**Attention: Mr. E. A. Filgate, P. Eng.**  
**Supervising Engineer, Reservoir**

**Dear Sir:**

**Re: Nisku Lower Anasazi A Pool - Waterflood Project**

Thank you for your letter of January 3, 1985. The Board will require a table listing mineral rights owners, leases and surface owners in the project area before final processing of your application can proceed. You will also be aware that prior to commencing injection operations, it will be necessary to have a Unit agreement in place.

Further to discussions between your Mr. Felder and the Petroleum Branch, it is recommended that the initial Unit area be defined to include only those spacing units for which well bore data and sufficient initial production data are available to permit calculation of final water participation factors at this time. Normal provisions for Unit expansion could then be used to include additional lands at a later date. We are of the opinion that this approach will expedite formation of the Unit and establishment of pressure maintenance operations.

...2

We also note your plans, outlined by Mr. Folden, to initiate discussion with offset operators (i.e. Omega and Petro Canada) and ask that you keep the Board informed of any developments in this regard.

Yours sincerely

**THE OIL AND NATURAL GAS  
CONSERVATION BOARD**

ORIGINAL SIGNED BY  
IAN HAUGH

**Ian Haugh  
Deputy Chairman**

cc: Marc Eliason  
J. F. Redgwell  
Petroleum Branch

HCM/IH/bb

DATE: 09 January 1985

TO: ~~H. C. Mester~~ → BOB

COMMENTS:

FROM: Ian Haugh

Dept.:

Branch:

Address:

Telephone:



- Take action
- Per your request
- Call me on this matter
- Investigate and report
- For your revision or approval
- Return with comments or recommendations
- Circulate
- See me re attached
- For your information
- Supply data for my reply
- Reply direct with copy to me
- Draft reply for signature of: Ian Haugh please



**Chevron Canada Resources Limited**  
500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

K.E. Godard  
Chief Engineer

1985-01-03



Waskada Lower Amaranth A Pool  
Proposed Waterflood Project

The Oil and Natural Gas Conservation Board  
309 Legislative Building  
Winnipeg, Manitoba  
R3C 0V8

Attention: Dr. Ian Haugh

Gentlemen:

On 1984-12-04, The Manitoba Conservation Board requested the following additional information from Chevron Canada Resources Limited regarding the proposed Waskada Lower Amaranth A Pool Waterflood Project.

- The proposed Waterflood Project area has been revised (see attached map). The proposed Project area includes a number of undrilled spacing units. A tentative drilling schedule is as follows:

<u>LOCATION</u>		<u>DRILLING SCHEDULE</u>
12-6-1-25 WPM	NOT IN AREA	1985 - First Quarter
3-7-1-25 WPM	NOT DRILLED	1985 - First Quarter
6-7-1-25 WPM	NOT ON PROD YET	Rig Release 1984-12-23
9-7-1-25 WPM	NOT IN AREA	1985 - Third Quarter
10-7-1-25 WPM	NOT PRODUCTIVE	Depends on results of 15-7
15-7-1-25 WPM	ON PROD 300-100	Rig Release 1984-12-09
16-7-1-25 WPM	NOT DRILLED	1985 - First Quarter
2-1-1-26 WPM		No plans for drilling
4-12-1-26 WPM		No plans for drilling

- Consideration has be given to including the N-1/2-17-1-25 WPM and the E-1/2-18-1-25 WPM in the proposed Project. However, Chevron proposes obtain an agreement for the proposed Project, before additional lands are brought into the Waterflood Project.

*Has any contact been made with Omega / Petro Canada etc why not*

*to / should make more sense to bring this area in now as opposed to bring in individual tracts in 1*

Ian Haugh's office-09Jan85

pc: H. C. Moster

3. A preliminary Unitization meeting was held on 1984-12-17. The next Unitization meeting will be held during 1985-01, at which time committees will be set up to deal with title searches and tract participation factors.

Any questions regarding the subject Waterflood Project should be directed to D. Schierman at (403) 234-5167.

Sincerely,

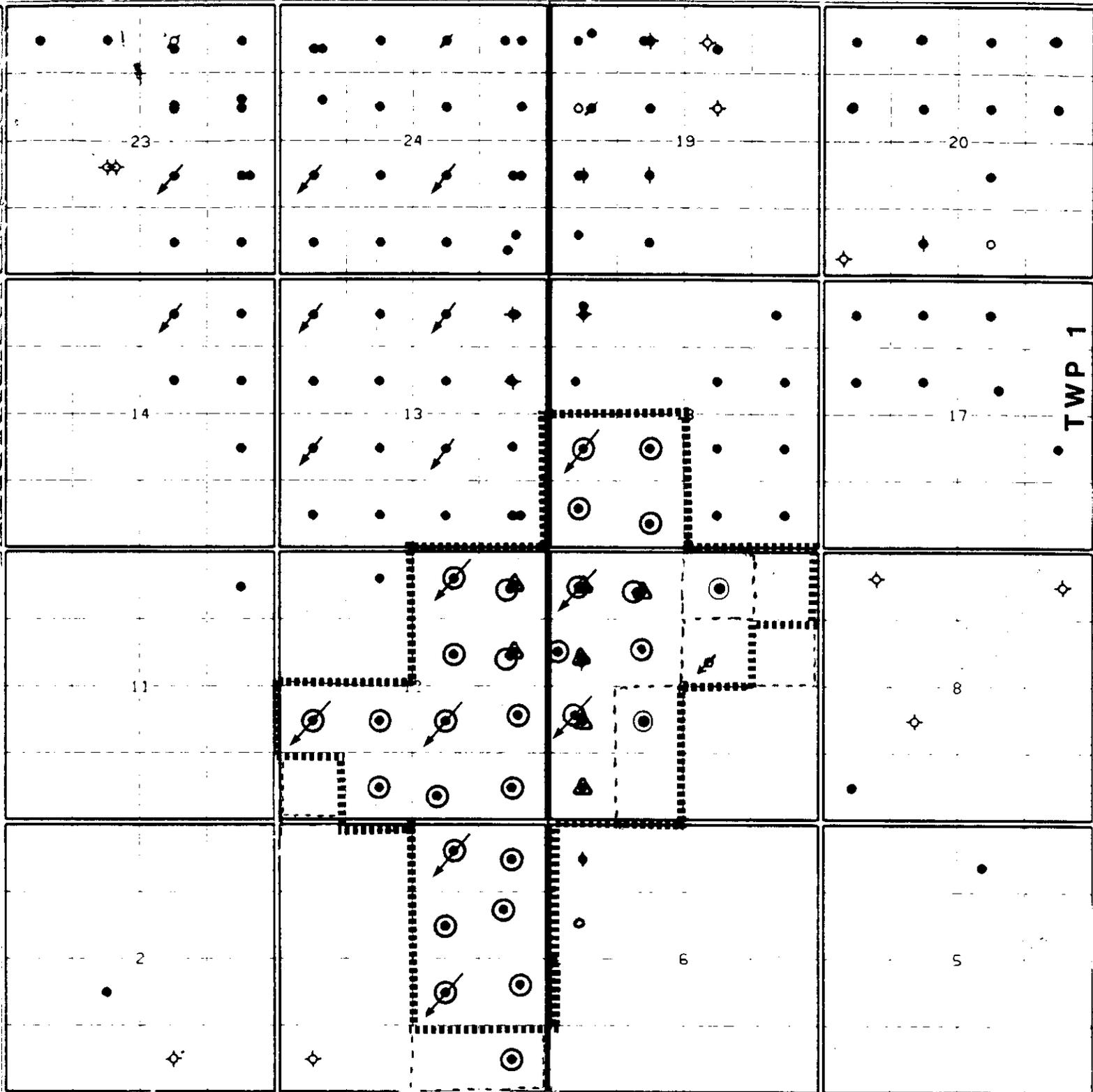


for

R. A. FILGATE, P.Eng.  
Supervising Engineer  
Reservoir

DS/lgs  
Attach.

cc: Can-Am Drilling Ltd.  
Colenco Petroleum Ltd.  
Great American Energy Inc.  
New McManus Red Lake Gold Mines  
Newscope Resources Limited  
PanCanadian Petroleum Limited



26W 1

25W 1

LEGEND

- SPEARFISH
- ▲ MC-3
- ⊙ PROPOSED INJECTORS
- ⚡ DISPOSAL WELL
- ▬▬▬▬ PROPOSED UNIT AREA



Chevron Canada Resources Limited

WASKADA AREA  
PROPOSED UNIT

FIGURE 1

PROPERTY	WASKADA	SECTION	14	DATE	
PROJECT	WASKADA	ACTIVITY	H. HALLIDAY	DATE	
PREPARED BY		REVISION	L. CHAMBERLAIN	DATE	
APPROVED BY		DOCUMENT NO.	A-10780	INTERPRETATION OVERLAY NO.	FC-01
DATE		FILE NO.		FILE NO.	

Mailing Address: Box 45, Tilston, Manitoba, R0M 2B0.  
23-51

Woods Housing Co-op Ltd.  
November 16, 1984  
Registered Office: c/o Mr. Len Wilson, 1204  
St. Avenue, Winnipeg, Manitoba, R3M  
1-51

E. HARBOTTLE,  
Registrar.

**TRAFFIC ACT**

Application for the transportation of general merchandise, usually household goods, from various points within an area of a 160 km. radius of La Broquerie, Manitoba, including the City of Winnipeg.

Docket 12324  
Earl E. Stairs,  
Winnipeg, Alberta.  
Application for Public Service Vehicle Certificate for the transportation of those duties which Earl E. Stairs may perform through the Manitoba/Saskatchewan boundary through the Province of Ontario, on a corridor operation, to the Manitoba/Ontario boundary, and the Manitoba/International boundary, for furtherance and vice versa. No pick ups or drop offs in the Province of Manitoba.

19/84  
Moving & Storage Ltd.,  
Winnipeg, Ontario.  
Application for Public Service Vehicle Certificate for the transportation of household goods and personal effects as defined in the Motor Vehicle Act, R.S.C. (1985), Chapter M101, from all provinces in Canada and from various points in Manitoba, by arrangements made by Transfer Ltd., Winnipeg, Manitoba, pursuant to Board Order No. 11/66.

Application for extension of Public Service Vehicle Certificate for the transportation of products manufactured by Dycks Containers Ltd. and Forest Products Ltd. from various points in the Province of Ontario, and return of damaged products from various points in the United States of America to various points in the Province of Manitoba for

Dycks Containers Ltd. and Forest Products Ltd.  
Docket 12306  
Gaulco Ltd.,  
Winnipeg, Manitoba.

Application for extension of Public Service Vehicle Certificate for the transportation of linoleums, carpets, underlay, adhesives, related floorcovering and wallcovering and related accessories for installation purposes:

1. from various points in Ontario and Quebec for furtherance to various points in the Province of Manitoba.

2. from various points in the United States of America to various points in the Province of Manitoba.

3. from the Manitoba/Ontario boundary and the Manitoba/International boundary, through the Province of Manitoba, on a corridor operation, to the Manitoba/Saskatchewan boundary for furtherance as authorized and vice versa. No pick ups or drop offs in the Province of Manitoba.

Docket 12311  
Transx Ltd.,  
Winnipeg, Manitoba.

Application for extension of Public Service Vehicle Certificate for the transportation of goods to and from points in the Province of Manitoba, to and from points in the Province of Ontario as presently authorized by the Province of Manitoba and the Province of Ontario via the alternate routes of the Manitoba/United States and the Ontario/United States boundary:

Provided that this Certificate of Authority shall be an alternate route authority only to serve points in Manitoba and Ontario as presently authorized.

Docket 12310  
Kooistra Trucking Ltd.,  
Swan River, Manitoba.

Application for extension of Public Ser-

vice Vehicle Certificate for the transportation of lumber from various points in British Columbia to various points in the Province of Manitoba and vice versa.

Docket 12275  
Edwards Sales & Service Ltd.,  
Medora, Manitoba.

Application for extension of Public Service Vehicle Certificate for the transportation of grain and fertilizer to and from Deloraine, Medora, Goodlands and Waskada to and from Brandon, Winnipeg, Carman, Harrowby, Altona and Portage la Prairie, Manitoba.

Docket 12307  
Frank J. Laba, Jr., o/a  
Whitemouth Transfer,  
Whitemouth, Manitoba.

Application for extension of Public Service Vehicle Certificate for the transportation of the following:

1. general merchandise to and from Winnipeg, Manitoba to and from Seddon's Corner and district.

2. peat moss from the plant at Moss Spur to various points in the Province of Manitoba.

Anyone wishing to make representation or oppose the granting of the above applications must file such notice with the Secretary of the Board, 200-301 Weston Street, Winnipeg, Manitoba, either by mail or personal filing, prior to 4:30 P.M., Thursday, January 10, 1985. Notices received after this date will not be accepted.

Subsequent to the above date the applications will be scheduled for Public Hearing and the Applicants and anyone who opposed will be notified as to the date, time and place of the Hearing.

L. G. OLIJNEK,  
Secretary.  
THE MANITOBA MOTOR  
TRANSPORT BOARD.

-51

**UNDER THE MINES ACT**

**Waskada Oil Field**  
Chevron Canada Resources Limited, on behalf of itself and Newscope Resources Limited, has made application under The Mines Act to conduct a waterflood pressure maintenance project in the Lower Amaranth Formation in that portion of the Waskada Field described as follows:  
W $\frac{1}{2}$  and NE $\frac{1}{4}$  of Section 7-1-25 (WPM)  
SW $\frac{1}{4}$  of Section 18-1-25 (WPM)  
E $\frac{1}{2}$  of Section 1-1-26 (WPM)  
E $\frac{1}{2}$  and SW $\frac{1}{4}$  of Section 12-1-26 (WPM)  
It is proposed to convert the following wells to water injection:

- New Scope et al Waskada 5-7LAm-1-25 (WPM)
  - New Scope et al Waskada 13-7LAm-1-25 (WPM)
  - Chevron Waskada 5-18-1-25 (WPM)
  - Chevron Waskada 7-1-1-26 (WPM)
  - Chevron Waskada 15-1-1-26 (WPM)
  - Chevron Waskada Prov. 5-12-1-26 (WPM)
  - Chevron Waskada 7-12-1-26 (WPM)
  - New Scope S. Waskada 15-12-1-26 (WPM)
- If no valid objection or intervention in writing is received by the Board at 555-330 Graham Avenue, Winnipeg, Manitoba, R3C 4E3, within 14 days of the publication of this

notice, the Board may approve the application.

Copies of the application may be obtained from Chevron Canada Resources Limited, 500-Fifth Avenue S.W., Calgary, Alberta, T2P 0L7, or viewed at the offices of the Manitoba Petroleum Branch, 555-330 Graham

Avenue, Winnipeg, Manitoba.

THE OIL AND NATURAL GAS  
CONSERVATION BOARD,  
IAN HAUGH,  
Deputy Chairman.

Dated December 7th, 1984.  
—51

#### UNDER APPLICATION TO THE LEGISLATURE

Applicants for Private Bills properly the subject of legislation by the Legislative Assembly of Manitoba should take notice of the following rules:

108 (1) Every petitioner for a Private Act shall publish, between the close of the next preceding session of the Legislature and the time of the consideration of the petition,

(a) in one issue of The Manitoba Gazette; and

(b) at least once in each week during two weeks, in an issue of a newspaper published in English, and having a wide circulation in the Province;

a notice, clearly and distinctly specifying the nature and object of the application signed by or on behalf of the applicants.

(2) Prior to presentation of the petition in the House, the petitioner shall file with the Clerk a statutory declaration proving to the satisfaction of the Clerk the due publication of the notices mentioned in sub-rule (1).

109. Three copies of the proposed Bill, typewritten on standard letter-size paper and double spaced, shall be placed by the petitioner in the hands of the Law Officer at least two weeks, if possible, before the presentation of the petition in the House.

110. (1) Before any Private Bill is considered by the committee to which it may be referred, a report shall first be submitted to the committee by the Law Officer or the Deputy Law Officer stating that he has examined the Bill, and has noted by section in the report any exceptional power sought and any other provisions of the Bill requiring special consideration.

(2) Every Private Bill for an Act of incorporation or in amendment of any such Act shall be drawn in accordance with the Model Bill in Appendix B, with such variations and additions as may be approved by the Law Officer.

(3) Any exceptional provisions that it may be proposed to insert in any Bill shall be clearly specified in the notice of application therefor.

(4) Every Private Bill for an Act of incorporation shall be so framed as to incorporate by reference the clauses of the general Act or Acts relating to the details to be provided for by the Bill.

(5) Special grounds shall be established for any proposed departure from this principle, or for the introduction of other provisions as to any such details; and a note shall be appended to the Bill, indicating the provisions thereof, in which it is proposed to depart from the general Act or Acts.

(6) Bills that are not framed in accordance with this rule shall be recast by the promoters, and re-printed at their expense, before any committee passes upon the clauses thereof.

(7) Sub-rule (4) does not apply to those provisions of The Companies Act that, by virtue of that Act, are deemed to be included in any Private Act incorporating a company.

For further particulars apply to the Clerk of the Legislative Assembly, Legislative Building, Winnipeg, Manitoba. (R3C 0V8)

—TF

#### RURAL SALE OF

By virtue of a Warrant issued by the Province of Manitoba, under the Municipality of Ethelbert, to me on December 13, 1984, commanding me to levy a rate thereon with cost, I do hereby give notice that a period of one year or more for the purpose of imposing and the proportion of the rate imposed on Thursday, December 13, 1984 at the council chambers of the Rural Municipality of Ethelbert, said lands for the said arrears of rate.

Further take notice that the right to bid up to the amount due on the purchase of all said lands even if the same is offered by another bidder.

Descriptive list of lands:  
Pt. of the NE¼ 2-28-21W C.T. D3  
Pt. of the SW¼ 25-29-22W C.T. 10  
SE¼ N½ of 17-31-21W C.T. 11448

Dated this 1st day of November 1984.  
Manitoba.

15089—51

#### UNDE

Notice is hereby given that on the 14th day of January, 1985, unless the contrary be shown, I will, upon the application of the Registrar of Land Titles, in the name of Francis Leonard, CPR Trainman, and Violet Elizabeth Leonard, his wife, both of the City of Winnipeg, in Manitoba, (as joint tenants and tenants in common), as registered in the following land:

In the City of Winnipeg, in the Province of Manitoba, being in accordance with the Special Survey of said City, and being Eleven, excepting thereout the most Westerly Sixteen feet in width thereof, Twelve, which lots are shown on a survey of part of Lot Twenty-five, Parish of Saint Boniface, registered in the Winnipeg Land Titles Office as No. 11448, which certificate it is alleged has been destroyed, or I will upon request

# Classifieds

## HELP WANTED

**HELP WANTED—Administrator Wanted**—Applications are invited for the position of administrator at the Souris Hospital District No. 11, Souris, Manitoba. This is a modern 73 bed facility offering a range of health care services, acute and personal care.

The hospital is located in a town of 1,800 people, and services a district of approximately 7,500. Souris boasts a variety of recreation facilities, and is a 30 minute drive from the city of Brandon.

The successful candidate will be responsible to the Board of Governors for the overall operation and management of the Souris District Hospital, including the Souris District Personal Care Home, the Hartney Medical Nursing Unit, and the Souris Ambulance Service.

The position requires a minimum of five (5) years recent senior management experience in health care delivery and recognized academic training; a degree is desirable. The successful applicant will have demonstrated ability in financial management, labour relations and a multi-disciplinary approach. It is expected that the applicant will have experience in strategic planning, quality assurance and accreditation. Residence in Souris and active membership in C.C.H.S.E. are necessary.

Interested persons send written applications, including resume detailing education, experience and references to: Chairman, Recruitment Committee, Souris District Hospital, Box 10, Souris, Man. R0K 2C0.

Closing date for applications is January 30, 1985. 18-1c

## MISCELLANEOUS

**LIGHT DUTY TRUCK FOR SALE**—1983 S15 GMC Sierra Classic long box V6 Automatic, O.D. Air, Tilt, Cruise, New Condition used as car one owner 42,000 KM. \$8,900. OBO will consider trade Recreational

## NOTICE

### NOTICE UNDER THE MINES ACT WASKADA OIL FIELD

Chevron Canada Resources Limited, on behalf of itself and Newscope Resources Limited, has made application under The Mines Act to conduct a water-flood pressure maintenance project in the Lower Ameranth Formation in that portion of the Waskada Field described as follows:

W $\frac{1}{2}$  and NE $\frac{1}{4}$  of Section 7-1-25 (WPM)

SW $\frac{1}{4}$  of Section 18-1-25 (WPM)

E $\frac{1}{2}$  of Section 1-1-26 (WPM)

E $\frac{1}{2}$  and SW $\frac{1}{4}$  of Section 12-1-26 (WPM)

It is proposed to convert the following wells to water injection:

New Scope et al Waskada 5-7LAm-1-25 (WPM)

New Scope et al Waskada 13-7LAm-1-25 (WPM)

Chevron Waskada 5-18-1-25 (WPM)

Chevron Waskada 7-1-1-26 (WPM)

Chevron Waskada 15-1-1-26 (WPM)

Chevron Waskada Prov. 5-12-1-26 (WPM)

Chevron Waskada 7-12-1-26 (WPM)

New Scope S. Waskada 15-12-1-26 (WPM)

If no valid objection or intervention in writing is received by the Board at 555-330 Graham Avenue, Winnipeg, Manitoba, R3C 4E3 within 14 days of the publication of this notice, the Board may approve the application.

Copies of the application may be obtained from Chevron Canada Resources Limited, 500-Fifth Avenue S.W., Calgary, Alberta T2P 0L7 or viewed at the offices of the Manitoba Petroleum Branch, 555-330 Graham Avenue, Winnipeg, Manitoba.

The Oil and Natural Gas Conservation Board  
—Ian Haugh  
Deputy Chairman  
Dated December 7th, 1984.

## MISCELLANEOUS

**Inter-Departmental Memo**

To The Oil and Natural Gas  
Conservation Board  
Marc Eliesen, Chairman  
Dr. I. Haugh, Deputy Chairman  
J. F. Redgwell, Member

Date December 6, 1984  
From H. Clare Moster  
Director, Petroleum Branch

Subject Waskada Lower Amaranth A Pool - Pressure Maintenance - Chevron

Chevron Canada Resources Limited, on behalf of itself and Newscope Resources Limited, has made application for approval to initiate waterflood operations in the southern portion of the subject Pool. The "scheme area" is shown on Figure No. 1.

Recommendations:

It is recommended that notice of the application be published in the Manitoba Gazette and the Melita New Era and sent to mineral interest owners within the scheme area and working interest owners within and adjoining the scheme area. A copy of the proposed Notice is attached.

A decision on approval of the application should be withheld until certain concerns, outlined in the Board's letter of December 5th, 1984, are addressed by Chevron/Newscope.

Discussion:

Figure No. 1 shows the area of the subject Pool which has been jointly developed by Chevron and Newscope over the past 2½ years. Three productive horizons, the Lower Amaranth, the Mission Canyon 3b and the Mission Canyon 3a have been developed in the area.

Figure No. 2 shows the Lower Amaranth Red Beds structure in the area. There is a structurally high area through the East half of Section 12-1-26 and the Northeast quarter of Section 1-1-26 with lower structure to the east and west. Production and pressure data from the area indicates that aquifer support is limited and is confined to the structurally lower areas.

The results of pressure surveys conducted in the Spring of 1984 as interpreted by the Branch are presented on Figure No. 3. Note that while Chevron has presented reservoir pressures based on extrapolation of pressure buildup data to infinite shut-in, the Branch has applied generally accepted methods of estimating average reservoir pressure from build-up data. As a result, the data presented on Figure No. 3 shows somewhat lower pressures than shown by Chevron, but it is felt that these pressures are more realistic.

Review of the data presented on Figure No. 3 indicates that substantial pressure drops have occurred in the central part of the area, and that at the time of the survey, some areas were likely below the bubble point. With continued production since the pressure survey, it is likely that the area of the reservoir below the bubble point has increased.

Based on declining reservoir pressure, and production rates as well as the observed success of the existing waterflood projects in the Field, the Branch concurs with Chevron that waterflooding is necessary to ensure maximum recovery from this part of the Pool.

Chevron proposes to continue the nine spot pattern established by Omega in the areas currently being pressure maintained. This will ensure maximum areal sweep efficiency although there is some potential for sweeping oil out of the scheme area to Omega's wells to the north. In view of this, it is not likely that Omega will object to the proposal by Chevron.

The pressure maintenance program in Waskada Unit No. 4 to the north of the scheme area involves gas injection. Reservoir simulation work conducted by Omega indicates that mixing of injected gas and water in the reservoir will not be detrimental to ultimate recovery and could result in an increase in waterflood oil recovery through a trapped gas saturation.

Several concerns have been expressed to Chevron in the Board's letter of December 5, 1984.

First, the proposed scheme area includes a number of undrilled spacing units. This adds a degree of uncertainty in the technical aspects of the proposal, but more importantly, would make unitization virtually impossible.

Second, the East Half of Section 18-1-25 and the North Half of Section 17-1-25 are adjacent to the scheme area and have been developed by Omega and Petro Canada. In that the configuration and size of this development would make formation of a separate Unit difficult, consideration should be given to including the area in the proposed scheme.

Third, Chevron's application provides no information regarding unitization, a necessary pre-requisite for the proposed operation. In view of numerous royalty and conflicting working interest owners, it is likely that Unit negotiations will be lengthy and could jeopardize maximum recovery (if pressures continue to decline).

Although the application raises some concerns, it is recommended that public notice of the application be made at this time to minimize future delays. It is proposed to send the Notice to all royalty owners within the scheme area and all working interest owners within and adjacent to the scheme area. Table No. 1 provides

a list of these parties. The Notice should also be published in the Manitoba Gazette and the Melita New Era.

*Original Signed by H. C. Moster*

H. Clare Moster

LRD/lk

TABLE NO. 1

## A. ROYALTY OWNERS - PROPOSED SCHEME AREA

<u>Royalty Owners</u>	<u>Area</u>	<u>Interest</u>
Provincial Crown	SW $\frac{1}{4}$ -12-1-26	100%
F. R. Smart	E $\frac{1}{2}$ -1-1-26	100%
M. J. Lee	SE $\frac{1}{4}$ -12-1-26	25%
W. H. Hill		25% ✓ TITLE PROBLEM.
R. Stead		6.25%
P. Boyle		6.25%
C. Westlie		12.5%
M. R. Westlie		6.25%
D. E. Smith		6.25%
M. Ballantyne		6.25%
W. Witterman		3.125%
P. & M. Boyle		1.5625%
C & J. White		1.5625%
Hernfield Enterprises	NE $\frac{1}{4}$ -12-1-26	100%
R. O. Young	SW $\frac{1}{4}$ -7-1-25	25%
R. R. Radcliffe		75%
G. T. Rushton	NW $\frac{1}{4}$ -7-1-25	50%
Pan Canadian Petroleum		50%
J. A. Rushton	NE $\frac{1}{4}$ -7-1-25	
Pan Canadian		
M. J. Lee	SW $\frac{1}{4}$ -18-1-25	100%

B. WORKING INTEREST OWNERS (within scheme area)

Chevron Canada Resources Limited	all lands	variable
Newscope Resources Limited	W $\frac{1}{2}$ -7-1-25	variable
	NE $\frac{1}{4}$ -12-1-26	
Pan Canadian Petroleum Ltd.	N $\frac{1}{2}$ -7-1-25	50%
Great American Eagle Inc.	SE $\frac{1}{4}$ -12-1-26	

C. WORKING INTEREST OWNERS (adjacent to scheme area)

Omega Hydrocarbons Ltd.	All Section 13-1-26
	E $\frac{1}{2}$ -14-1-26
	NW $\frac{1}{4}$ -12-1-26
	NE $\frac{1}{4}$ -11-1-26
	E $\frac{1}{2}$ -18-1-25
	NW $\frac{1}{4}$ -17-1-25
	NW $\frac{1}{4}$ -8-1-25
Tundra Oil & Gas	NW $\frac{1}{4}$ -18-1-25
Petro Canada Inc.	E $\frac{1}{2}$ -17-1-25
Voyager Petroleum Ltd.	SW $\frac{1}{4}$ -8-1-25



MANITOBA

THE OIL AND NATURAL GAS CONSERVATION BOARD  
309 LEGISLATIVE BUILDING  
WINNIPEG, MANITOBA  
R3C 0V8

NOTICE UNDER THE MINES ACT

WASKADA OIL FIELD

Chevron Canada Resources Limited, on behalf of itself and Newscope Resources Limited, has made application under The Mines Act to conduct a waterflood pressure maintenance project in the Lower Amaranth Formation in that portion of the Waskada Field described as follows:

W<sup>1</sup>/<sub>2</sub> and NE<sup>1</sup>/<sub>4</sub> of Section 7-1-25 (WPM)  
SW<sup>1</sup>/<sub>4</sub> of Section 18-1-25 (WPM)  
E<sup>1</sup>/<sub>2</sub> of Section 1-1-26 (WPM)  
E<sup>1</sup>/<sub>2</sub> and SW<sup>1</sup>/<sub>4</sub> of Section 12-1-26 (WPM)

It is proposed to convert the following wells to water injection:

New Scope et al Waskada 5-7LAm-1-25 (WPM)  
New Scope et al Waskada 13-7LAm-1-25 (WPM)  
Chevron Waskada 5-18-1-25 (WPM)  
Chevron Waskada 7-1-1-26 (WPM)  
Chevron Waskada 15-1-1-26 (WPM)  
Chevron Waskada Prov. 5-12-1-26 (WPM)  
Chevron Waskada 7-12-1-26 (WPM)  
New Scope S. Waskada 15-12-1-26 (WPM)

If no valid objection or intervention in writing is received by the Board at 555 - 330 Graham Avenue, Winnipeg, Manitoba, R3C 4E3 within 14 days of the publication of this notice, the Board may approve the application.

Copies of the application may be obtained from Chevron Canada Resources Limited, 500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7 or viewed at the offices of the Manitoba Petroleum Branch, 555 - 330 Graham Avenue, Winnipeg, Manitoba.

THE OIL AND NATURAL GAS  
CONSERVATION BOARD



Ian Haugh  
Deputy Chairman

Dated December <sup>7<sup>th</sup></sup>, 1984.

Possible extension to  
Scheme Area

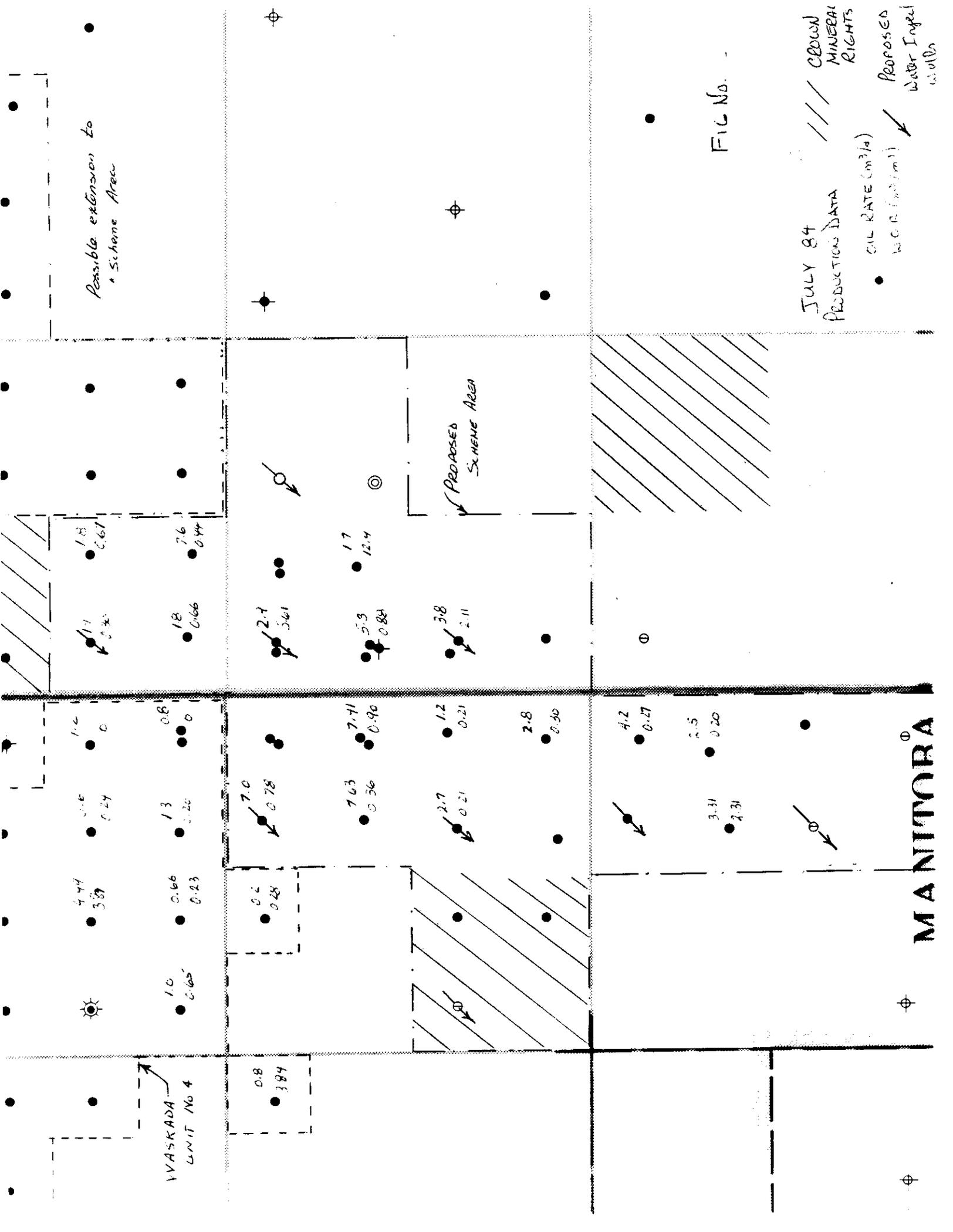
FIG No. -

JULY 84  
PRODUCTION DATA

CEYLON  
MINERAL  
RIGHTS

OIL RATE (m<sup>3</sup>/d)  
W.C. (m<sup>3</sup>/m)

PROPOSED  
Water Inject  
Wells



VASKADA  
UNIT No 4

PROPOSED  
SCHEME AREA

MANITORA

FIG No. 2

STRUCTURE  
LOWER AMARANTH  
RED BEDS  
(m - ss)

CEYLON  
MINERAL  
RIGHTS

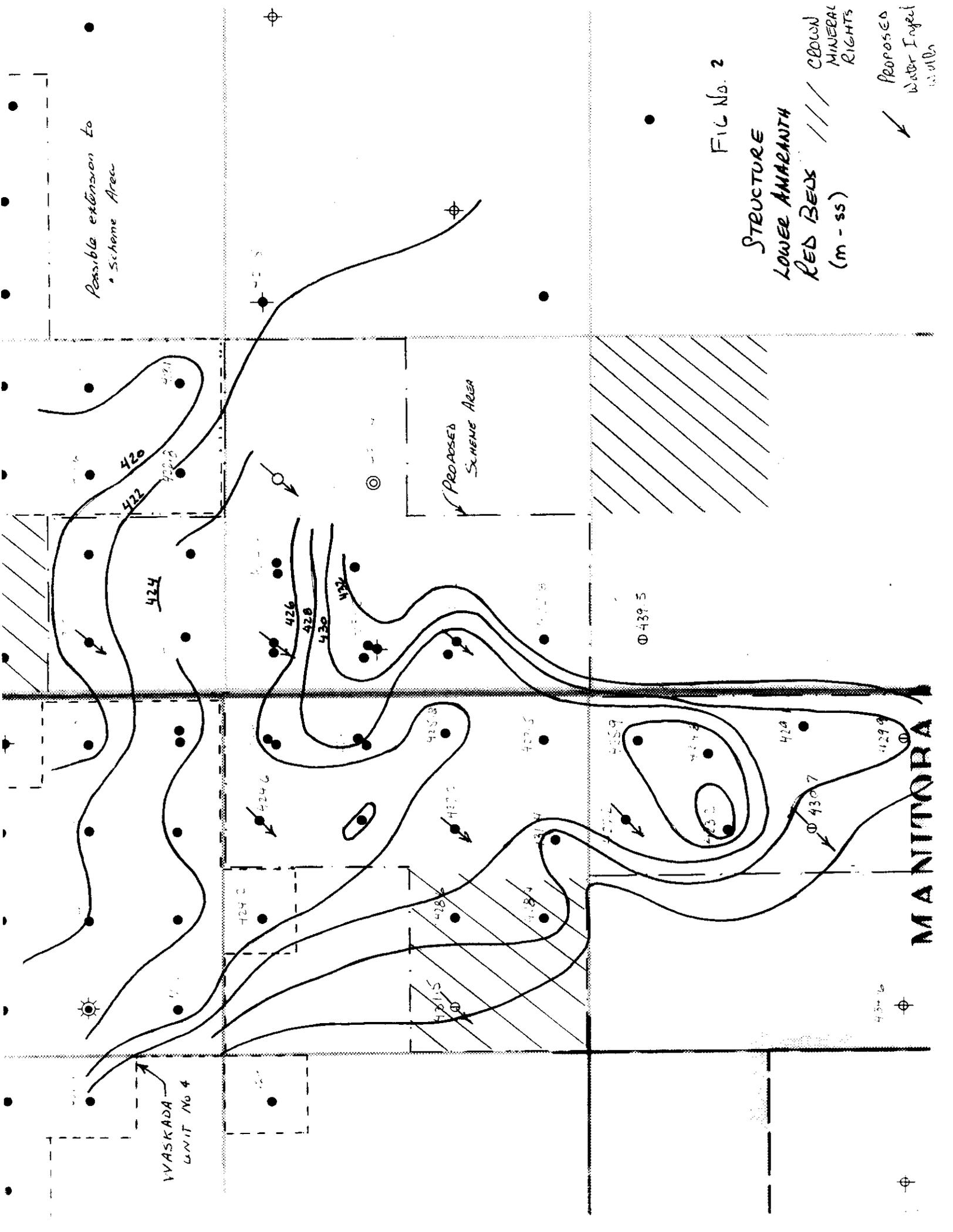
PROPOSED  
Water Inject  
Wells

Possible extension to  
Scheme Area

PROPOSED  
SCHEME AREA

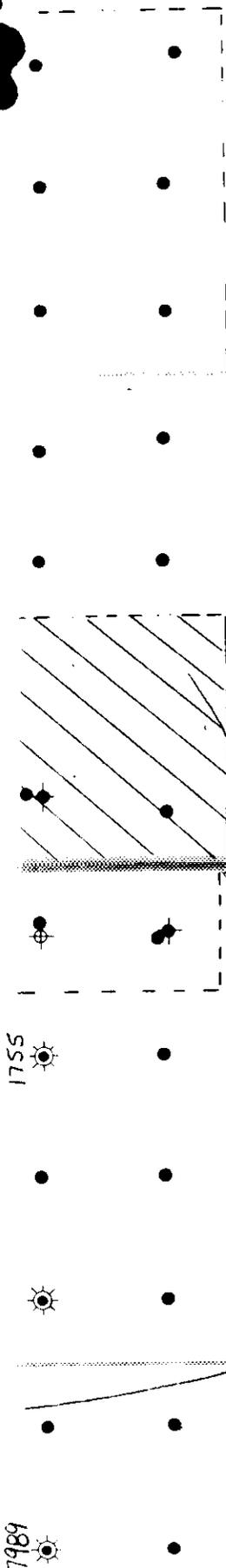
VVASKADA  
UNIT No 4

MANITORA



7989

1755



2932

3000 kPa

4724

44931

WASKADA UNIT No. 4

Possible extension to Scheme Area.

4000 kPa

5695

6035

7673

5937

5904

6076

7673

4077

6385

2893

5000

5000

5000

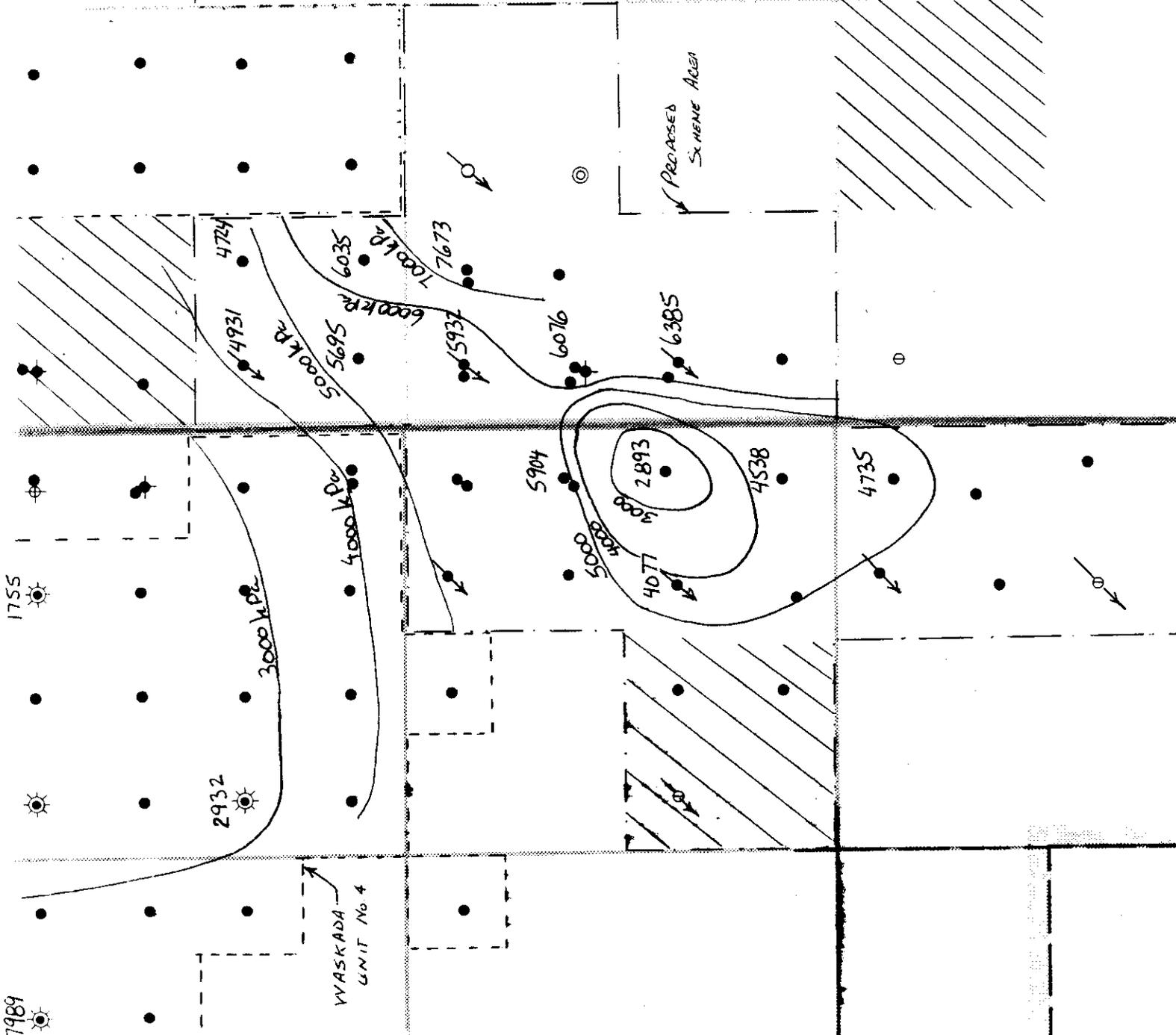
4538

4735

PROPOSED SCHEME AREA

FIG No. 3  
 Reservoir Pressure @  
 Datum (-440m)

/// CROWN  
 MINERAL  
 RIGHTS  
 / PROPOSED





MANITOBA

THE OIL AND NATURAL GAS CONSERVATION BOARD  
309 LEGISLATIVE BUILDING  
WINNIPEG, MANITOBA  
R3C 0V8

December 4, 1984

Chevron Canada Resources Limited  
500 - 5th Avenue S.W.  
Calgary, Alberta  
T2P 0L7

Attention: Mr. R. A. Filgate,  
Supervising Engineer, Reservoir



Dear Sirs:

Re: Waskada Lower Amaranth A Pool - Waterflood Project

Your application dated November 29, 1984 for approval to conduct an enhanced recovery project by waterflooding in the subject pool is acknowledged.

A preliminary review of the application indicates it to be complete except as you have noted. Please note that the application should be made pursuant to Section 64 of The Petroleum Drilling and Production Regulations, 1984 and not Section 739.

To assist in the processing of the application, we request your comments on the following:

1. The waterflood scheme area, which appears to be coincident with the proposed Unit area includes a number of undrilled spacing units. Will these areas be developed prior to unitization of the area and commencement of injection?
2. Has there been any consideration given to extending the scheme area to the Northeast to incorporate the developed area in the East half of Section 18 and the North half of Section 17-1-25 (WPM)?
3. What is the current status of Unit negotiations in the scheme area?

Your application is being reviewed in detail and you will be advised in due course of any further comments or deficiencies.

Enclosed for your use are complimentary copies of large scale maps (1:20 000) covering the scheme area. These maps reflect updated well status. Additional copies of these maps can be obtained from the Petroleum Branch at a cost of \$5.00 per copy.

Yours sincerely,

THE OIL AND NATURAL GAS  
CONSERVATION BOARD

**ORIGINAL SIGNED BY  
IAN HAUGH**

Ian Haugh  
Deputy Chairman

LRD/lk

c.c. Marc Eliesen  
J. F. Redgwell  
Petroleum Branch



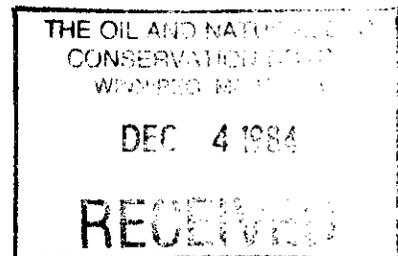
**Chevron Canada Resources Limited**  
500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

1984-11-29

Waskada Lower Amaranth A Pool  
Application For Enhanced Recovery  
By Water Injection

Manitoba  
The Oil and Natural Gas Conservation Board  
309 Legislative Building  
Winnipeg, Manitoba  
R3C 0N8

Attention: Dr. Ian Haugh



Gentlemen:

Pursuant to Section 739 of the Manitoba Oil and Gas Regulations, Chevron Canada Resources Limited and Newscope Resources Limited, as present operators in the Waskada area, jointly submit an application for approval of a scheme to enhance oil recovery from the Waskada Lower Amaranth "A" Pool by water injection.

1. The waterflood scheme area is shown on Figure 1 and includes the following tracts:

SW-1/4 7- 1-25 WPM  
NW-1/4 7- 1-25 WPM  
NE-1/4 7- 1-25 WPM  
SW-1/4 18- 1-25 WPM  
SE-1/4 1- 1-26 WPM  
NE-1/4 1- 1-26 WPM  
SE-1/4 12- 1-26 WPM  
SW-1/4 12- 1-26 WPM  
NE-1/4 12- 1-26 WPM

2. The mineral rights' owners, lessees and surface owners within and adjoining the waterflood scheme area are shown on Figure 2 (this Figure is deficient and will be forwarded when completed).
3. The Lower Amaranth "A" Pool (LAM) boundaries are shown on a net pay map (Figure 3).

4. The status of each LAM and MC3 well within and adjoining the waterflood scheme area is shown on Figure 1.
5. Pore volume and permeability capacity maps for the Lower Amaranth "A" Pool are attached as Figures 4 and 5.
6. The following eight LAM wells will be converted to water injection service:

Newscope et al Waskada	5- 7LAM- 1-25 WPM
Newscope et al Waskada	13- 7LAM- 1-25 WPM
Chevron Waskada	5-18- 1-25 WPM
Chevron Waskada	7- 1- 1-26 WPM
Chevron Waskada	15- 1- 1-26 WPM
Chevron Waskada	5-12- 1-26 WPM
Chevron Waskada	7-12- 1-26 WPM
Newscope S. Waskada	15-12LAM- 1-26 WPM

The geologic properties and expected injection rates at these wells are shown on Table 1. The method used to estimate the injection rates is described in Appendix A. Figure 6 is a schematic of a typical injection well. Completion summaries for the proposed injectors are contained in Appendix B. Maximum wellhead injection pressure will be 6.5 MPa.

7. These eight wells were chosen to develop a 9-spot pattern. After examining the injection rates experienced at Waskada Unit 1 injectors, it was determined that a 9-spot pattern will have enough injection capacity to replace voidage. A 9-spot pattern also reduces the number of injectors so less primary production will be lost until waterflood response occurs.
8. In the interest of maximizing oil recovery from the LAM Pool, Chevron is proposing to maintain continuity with the Waskada Unit 1 9-spot pattern.
9. A schematic of the surface production and injection facilities is contained in Figure 7. A comprehensive schematic showing pipe sizes, working pressures, etc., will be developed when the facility design has been finalized. This schematic will be forwarded when completed.
10. Injection water sources will be produced water from the LAM and MC3 Pools and MC3 water from well 10-7-1-25 WPM. This well is currently used as a disposal well for produced water. The average injection rate over a 13 day period was 190 m<sup>3</sup>/d with a wellhead pressure of 0 kPa (see Appendix E). The deliverability of 10-7 should be at least 200 m<sup>3</sup>/d which is similar to the predicted oil voidage. Produced water will be treated and filtered before being injected. Water from the 10-7 well will just require filtering. Measurement of injected water will be done by individual well positive displacement meters.

11. Analyses of the LAM and MC3 waters are very similar, and tests performed by Chevron and other area operators indicate that these waters are compatible (see Appendix C). Also, a water sensitivity test was done by Omega on core samples from a Waskada Unit 5 well (2-2-2-26). This test indicated that the core permeability did not change when low salinity water was injected (see Appendix C).
12. Volumetric calculations indicate the OOIP for the waterflood scheme area to be  $830 \cdot 10^3 \text{ m}^3$  while the original solution gas-in-place is  $37 \cdot 10^6 \text{ m}^3$ . Cumulative oil production to 1984-06-30 is  $30.5 \cdot 10^3 \text{ m}^3$  which is 3.7% of OOIP. Cumulative water production to 1984-06-30 is  $23.3 \cdot 10^3 \text{ m}^3$ . Figure 8 shows the monthly oil production and well count for the project area.
13. A reservoir pressure survey was conducted during 1984-03 and 04. The average reservoir pressure on a pore volume basis is about 6000 kPa. Figure 9 is a map showing the pressure contours in the project area. This map shows that the reservoir pressure has not dropped below the bubble point pressure (4220 kPa). A summary of the pressure survey results and build up analyses is contained in Appendix D. The survey results indicate that seven wells have pressures below the bubble point. The pressures used on the pressure map were obtained by extrapolation of the available data. Comparison with pressures at adjacent wells indicates that the extrapolated pressures are reasonable. Also, all the questionable data was obtained by acoustic well sounder which is not as accurate as a bottomhole recorder.
14. Material balance calculations were used to demonstrate the existence of aquifer support in the project area. With the cumulative oil and water production to 1984-04-30, the reservoir pressure was calculated to be 3 800 kPa, assuming no aquifer support. As the actual reservoir pressure was about 6 000 kPa, the difference can be attributed to limited aquifer support from the down dip west edge of the reservoir.
15. Production forecasts for primary and secondary recovery are shown in Table 2 (The waterflood production forecast was developed assuming water injection would commence in 1984-11). Figure 10 shows the forecasted cumulative oil production for primary and secondary recovery. Figure 11 shows the forecasted WOR for the waterflood. Primary recovery is estimated at  $89 \cdot 10^3 \text{ m}^3$  or 11% of OOIP. Oil recovery from the proposed waterflood scheme is estimated at  $177 \cdot 10^3 \text{ m}^3$  or 21% of OOIP after 15 years. The proposed waterflood scheme will result in about  $88 \cdot 10^3 \text{ m}^3$  of incremental oil. Appendix A contains a description of the method used to calculate primary and secondary recovery.
16. Water injection is planned to commence during 1985-06. Injection rates will be adjusted to maximize oil recovery from the LAM reservoir while replacing voidage and maintaining reservoir pressure.

Any questions regarding the application should be directed to Cal Folden at (204) 748-1334 or Doug Schierman at (403) 234-5167.

Sincerely,



R. A. FILGATE, P.Eng.  
Supervising Engineer  
Reservoir

DS/ds  
Attach.

cc: Newscope Resources

TABLE 1  
 Waskada Lower Amaranth "A" Pool  
 Proposed Waterflood Project  
 Injector Geologic Properties and Expected  
 Injection Rates

---

<u>Injector</u>	<u>h</u> m	<u>Øh</u> m	<u>kh</u> <sup>1</sup> mdm	<u>Predicted Injection Rate</u> <sup>2</sup> m <sup>3</sup> /d
5- 7- 1-25	1.2	.20		80
13- 7- 1-25	1.0	.16	2.0	100
5-18- 1-25	3.4	.54	5.6	40
7- 1- 1-26	4.3	.69	8.6	60
15- 1- 1-26	6.6	.99	17.1	100
5-12- 1-26	1.3	.26		80
7-12- 1-26	3.0	.39	4.5	30
15-12- 1-26	2.0	.30		60

1. Wells without kh data were not cored.
2. Estimated from Unit 1 injection well production and injection data.

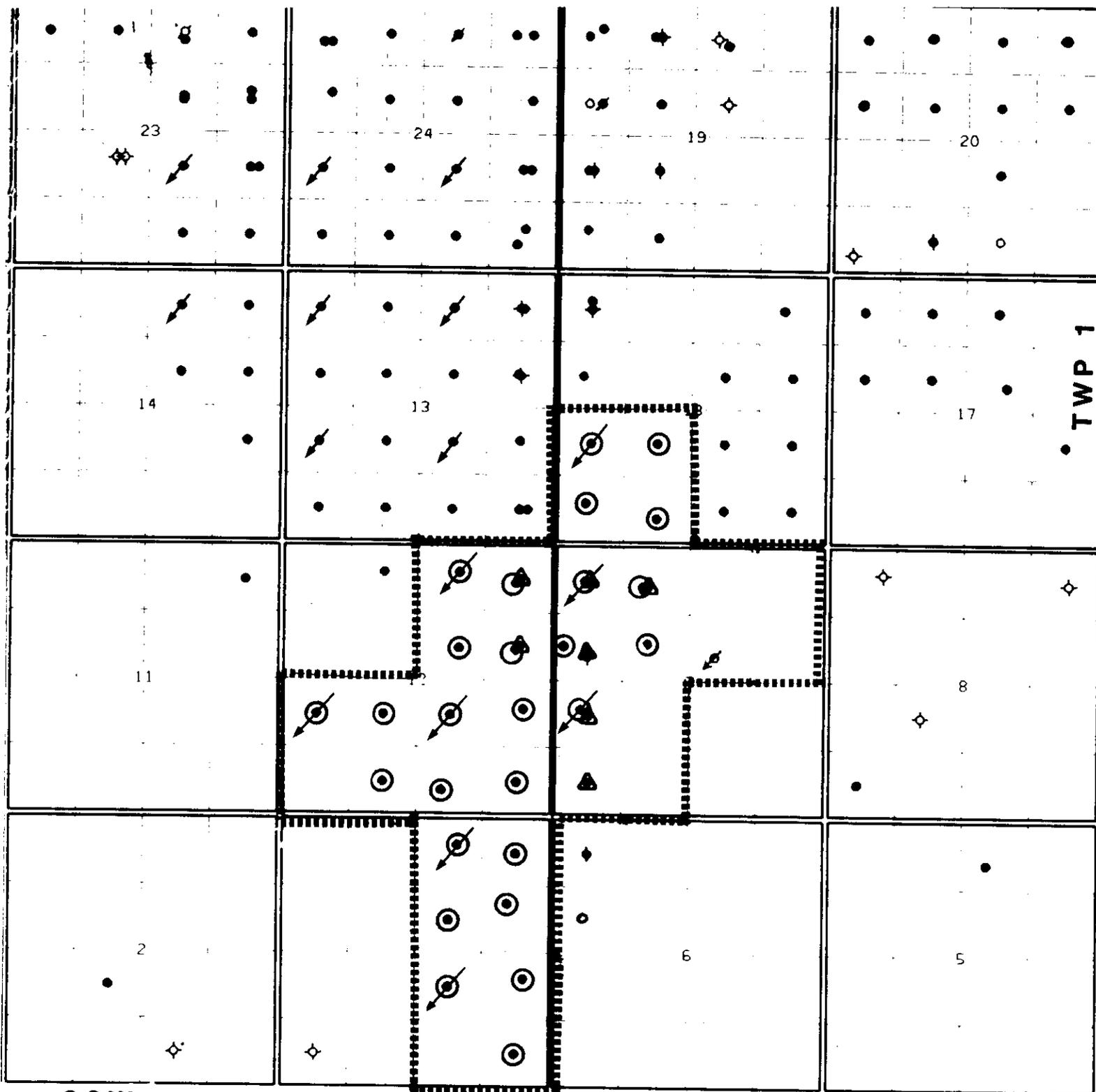
1984-07-30

TABLE 2

Waskada Lower Amaranth "A" Pool  
Proposed Waterflood Project  
Production Forecasts For Primary and Secondary Recovery

Year	Primary		Secondary <sup>1</sup>	
	Oil Production $10^3 \text{ m}^3$	Cumulative Oil $10^3 \text{ m}^3$	Oil Production $10^3 \text{ m}^3$	Cumulative Oil $10^3 \text{ m}^3$
1982	.5	.5		
1983	18.7	19.3		
1984	26.1	45.4	25.8	45.1
1985	21.0	66.4	25.2	70.3
1986	13.7	80.1	19.4	89.7
1987	7.3	87.4	13.9	103.6
1988	1.8	89.2	12.4	116.0
1989			9.2	125.2
1990			7.5	132.7
1991			7.5	140.2
1992			6.4	146.6
1993			5.0	151.6
1994			5.0	156.6
1995			4.4	161.0
1996			4.4	165.4
1997			4.4	169.8
1998			3.4	173.2
1999			3.4	176.6

<sup>1</sup>Assumed waterflood would commence 1984-11



26W 1

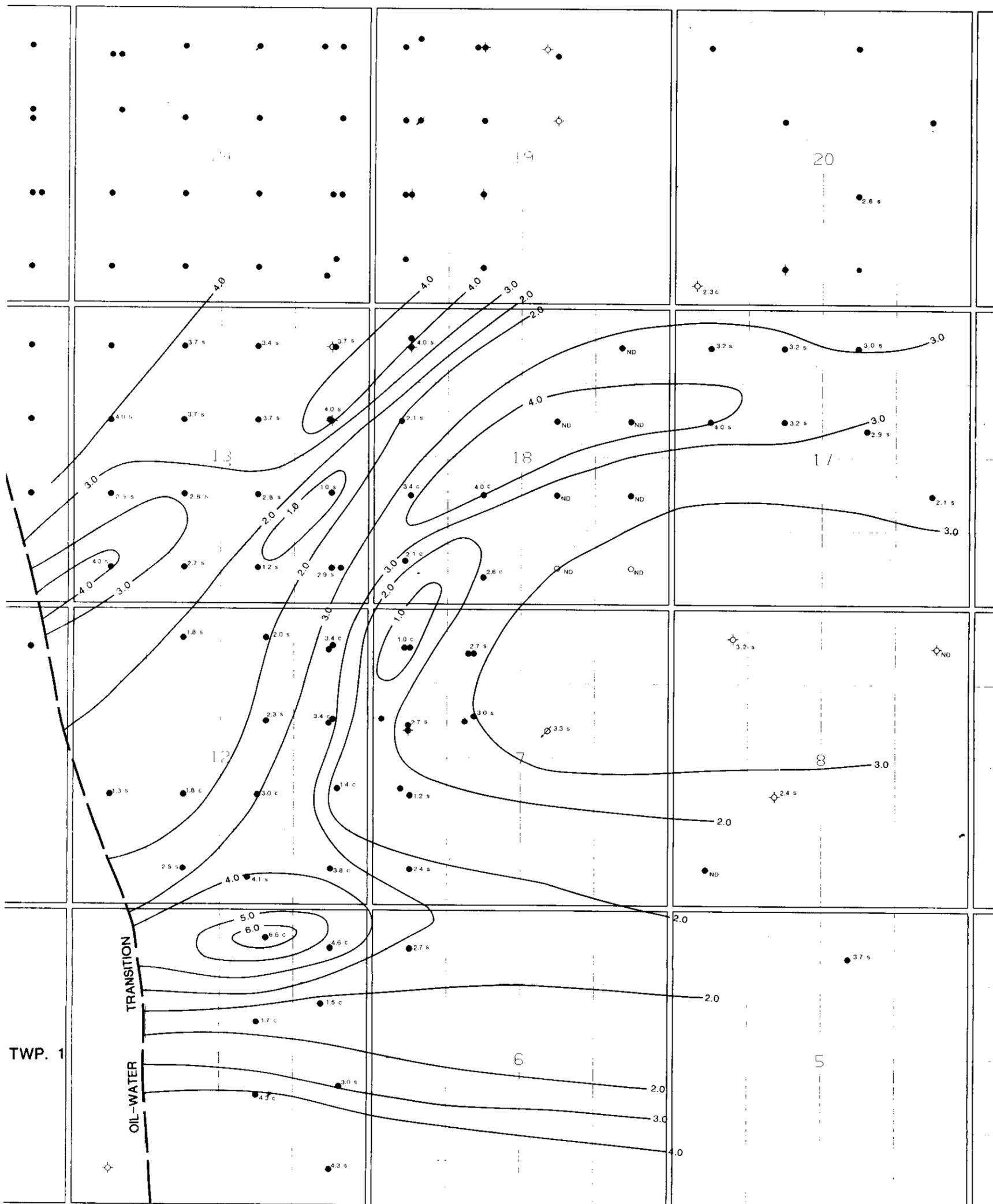
25W 1

LEGEND

-  SPEARFISH
-  MC-3
-  PROPOSED INJECTORS
-  DISPOSAL WELL
-  PROPOSED UNIT AREA

 <b>Chevron Canada Resources Limited</b>		
<b>WASKADA AREA PROPOSED UNIT</b>		
FIGURE 1		
PROJECT: _____ TITLE SHEET: _____ PLAN: _____ PROPERTY: _____ DRAWING NO.: _____ DATE: _____	SCALE: _____ AUTHOR: _____ DRAWN: _____ CHECKED: _____ DOCUMENT NO.: _____ FILE NO.: _____ REC. NO.: _____	DATE: _____ CAD NUMBER: _____ INTERPRETATION OVERLAY NO.: _____ FILE NO.: <b>FC-01</b> REC. NO.: _____

TWP. 25



TWP. 1

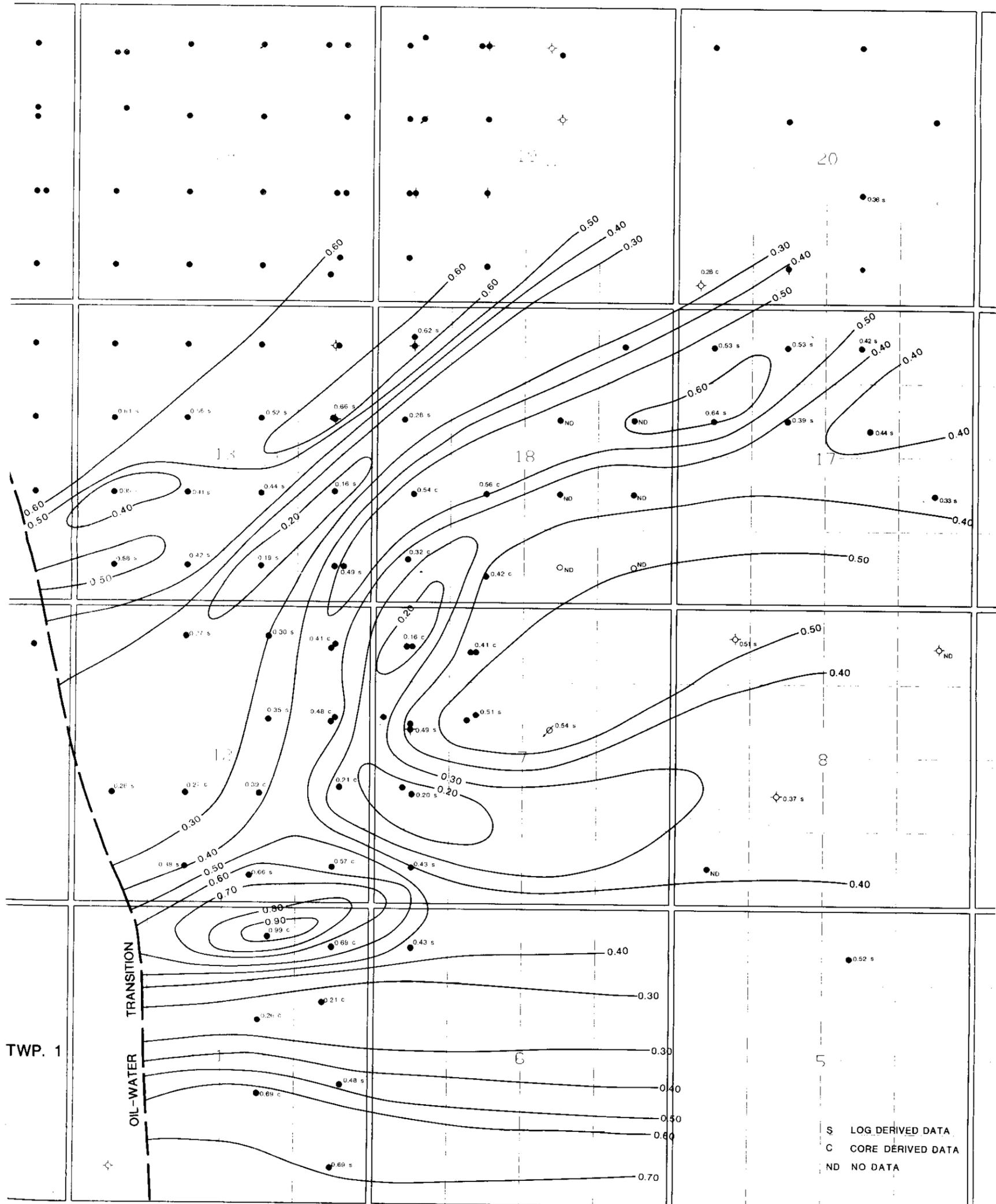
OIL-WATER  
TRANSITION

**Environ**  
Chevron Canada Resources Limited

**SOUTH WASKADA  
SPEARFISH FORMATION  
NET PAY (h)  
(m)  
FIGURE 3**

PROVINCE	MUNICIPALITY	SECTION	DATE
ALBERTA	WINDSOR	11-1-11	1988

TWP. 25



S LOG DERIVED DATA  
C CORE DERIVED DATA  
ND NO DATA

 **Chevron Canada Resources Limited**

**SOUTH WASKADA**  
SPEARFISH FORMATION  
 $\phi_h$  (m)

FIGURE 4

PROV. ALBERTA SCALE 1:50,000 GRID

TWP.25



TWP. 1

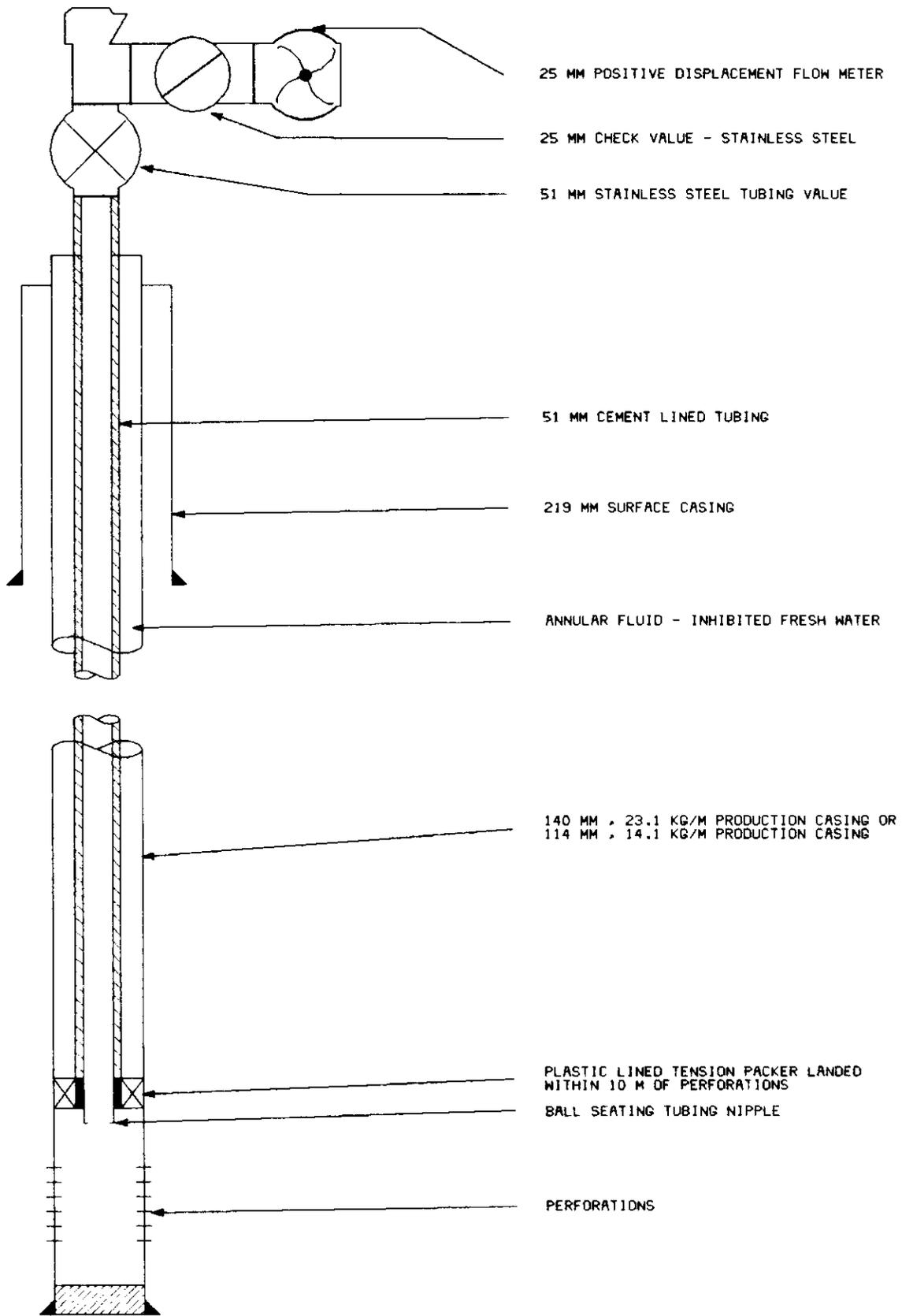
OIL-WATER  
TRANSITION

 Chevron Canada Resources Limited

**SOUTH WASKADA**  
SPEARFISH FORMATION  
K.h (md. m)  
1.0 md PERMEABILITY CUTOFF  
FIGURE 5

PROVINCE	COUNTY	SCALE	DATE
ALBERTA	WASKADA	1" = 1 MILE	84-06

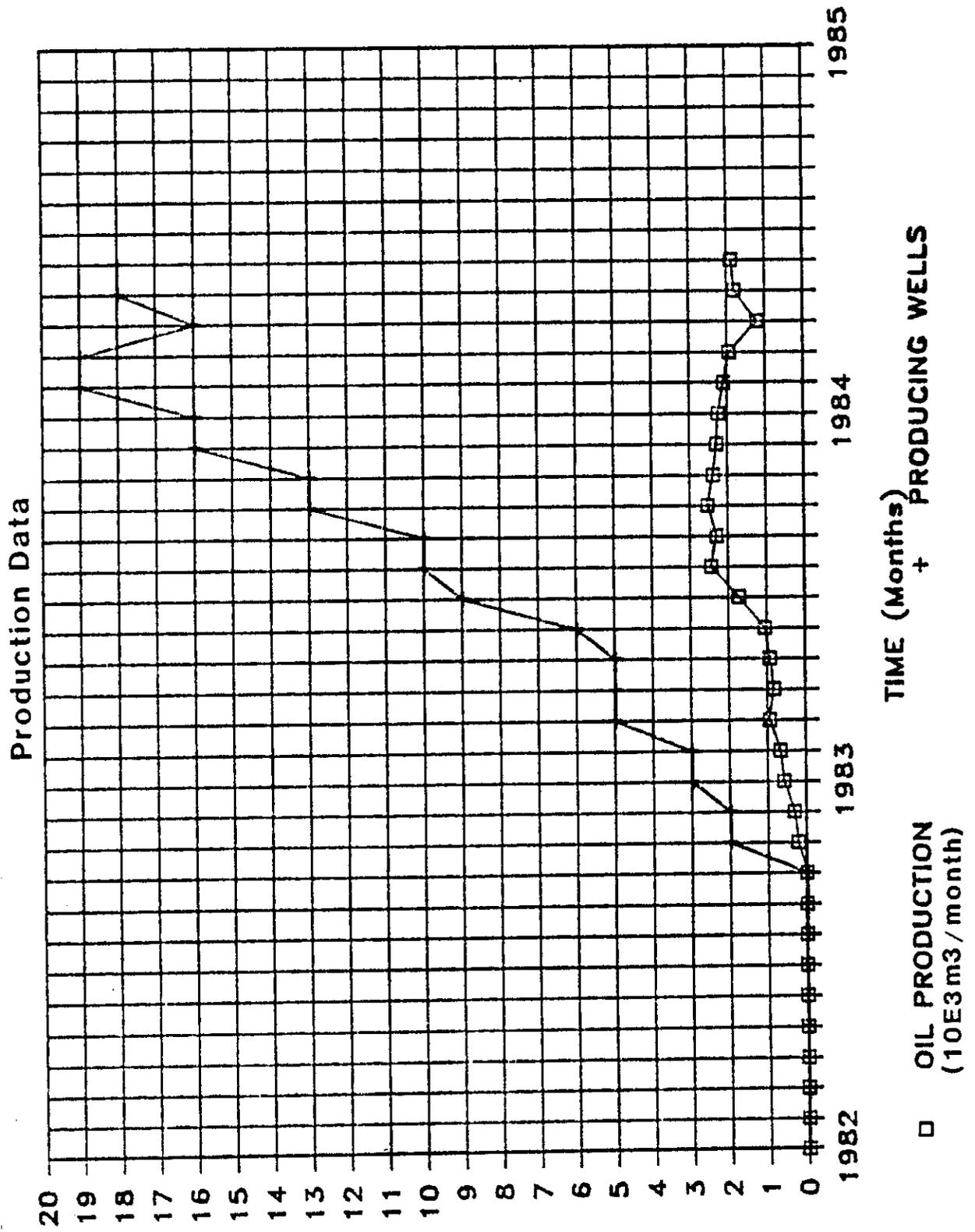
SCHEMATIC OF A TYPICAL INJECTION WELL

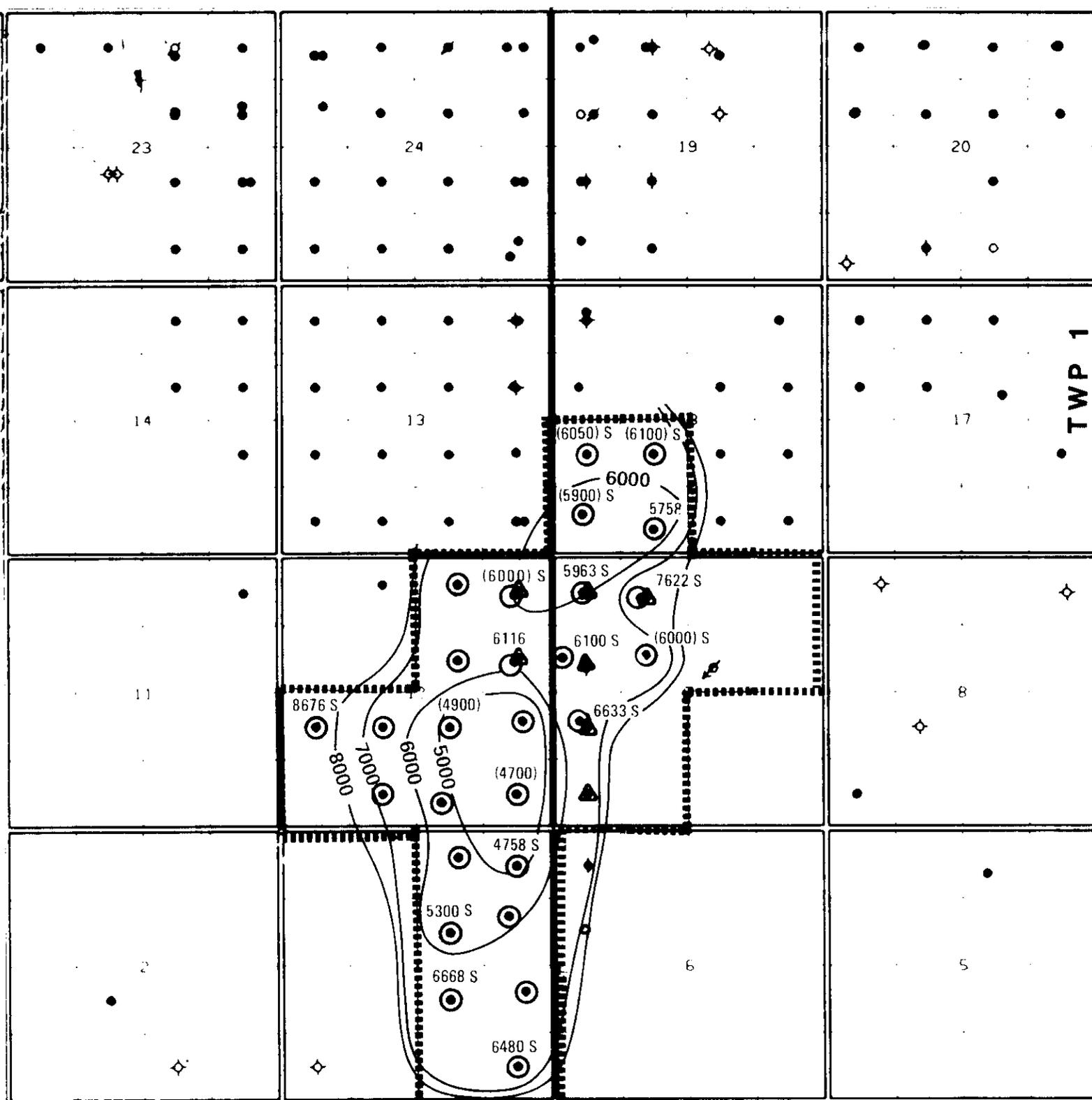




# WASKADA LOWER AMARANTH "A" POOL PROPOSED WATERFLOOD PROJECT

FIGURE 8





26 W 1

25 W 1

LEGEND

- PROPOSED WATER FLOOD AREA
- SPEARFISH (DATUM -440 m)
- ▲ MC-3
- S SONIC SURVEY

PRESSURE IN kPa UNITS  
 PRESSURES IN BRACKETS INDICATE  
 INCOMPLETE DATA TO DETERMINE  
 ACCURATE BUILDUPS. PRESSURES  
 ARE EXTRAPOLATED FROM LAST  
 DATA POINTS AND REPRESENT  
 MINIMUM EXPECTED PRESSURES.



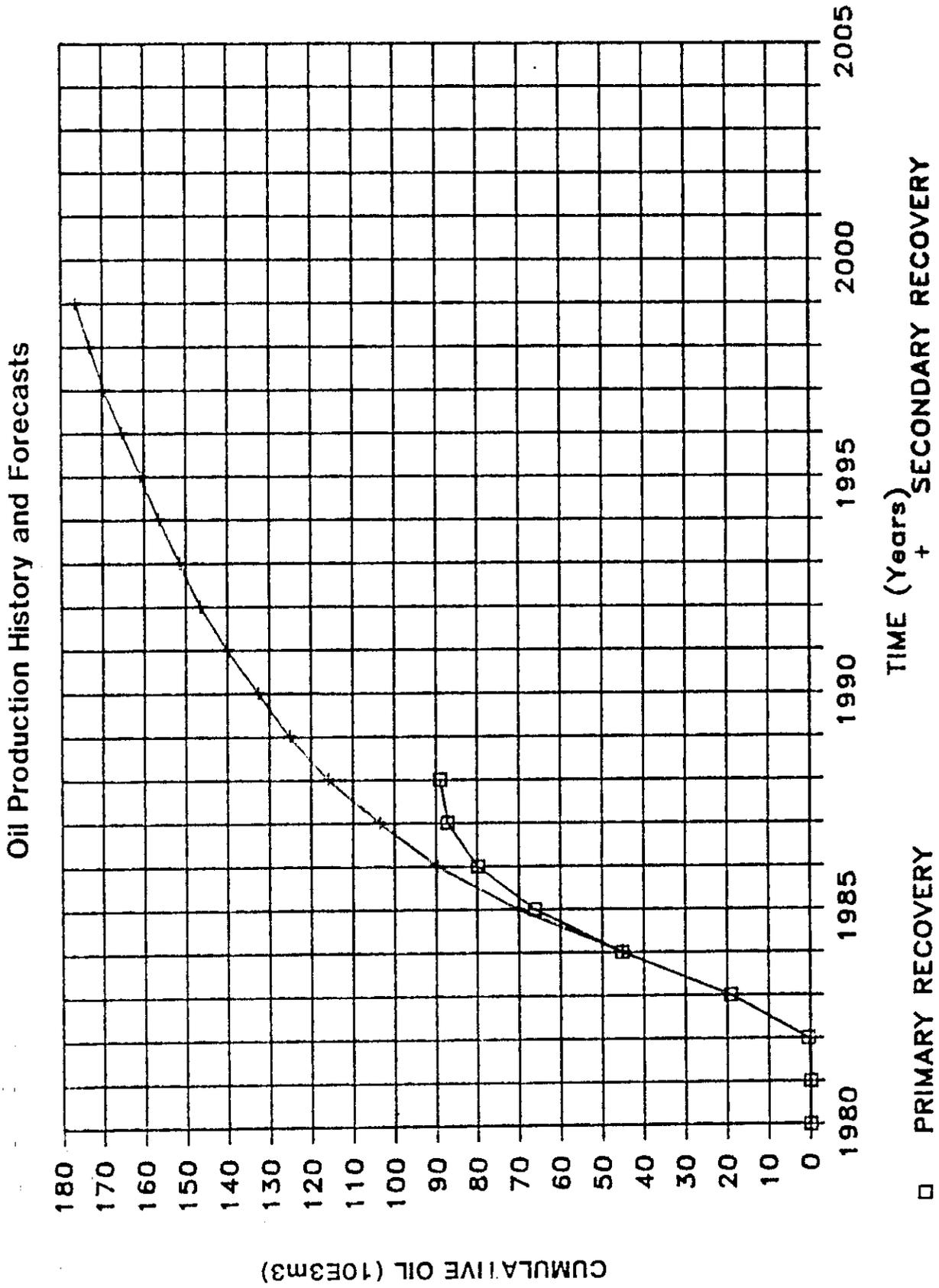
Chevron Canada Resources Limited

WASKADA AREA  
 PROPOSED WATERFLOOD  
 SPEARFISH PRESSURE SURVEY  
 1984-04  
 FIGURE 9

PROPERTY	WASKADA	SECTION	WASKADA	DATE	1984-04
FILE NO.	WASKADA	APPROVED BY	H. HILDREY	DATE	1984-04
PROJECT	WASKADA	PREPARED BY	C. CHAMBERLAIN	INTERPRETATION OVERLAY NO.	FC-01
FIGURE NO.		DOCUMENT NO.	A-10780-1	FILE NO.	FC-01
DATE		FILE NO.	80058062	DATE	

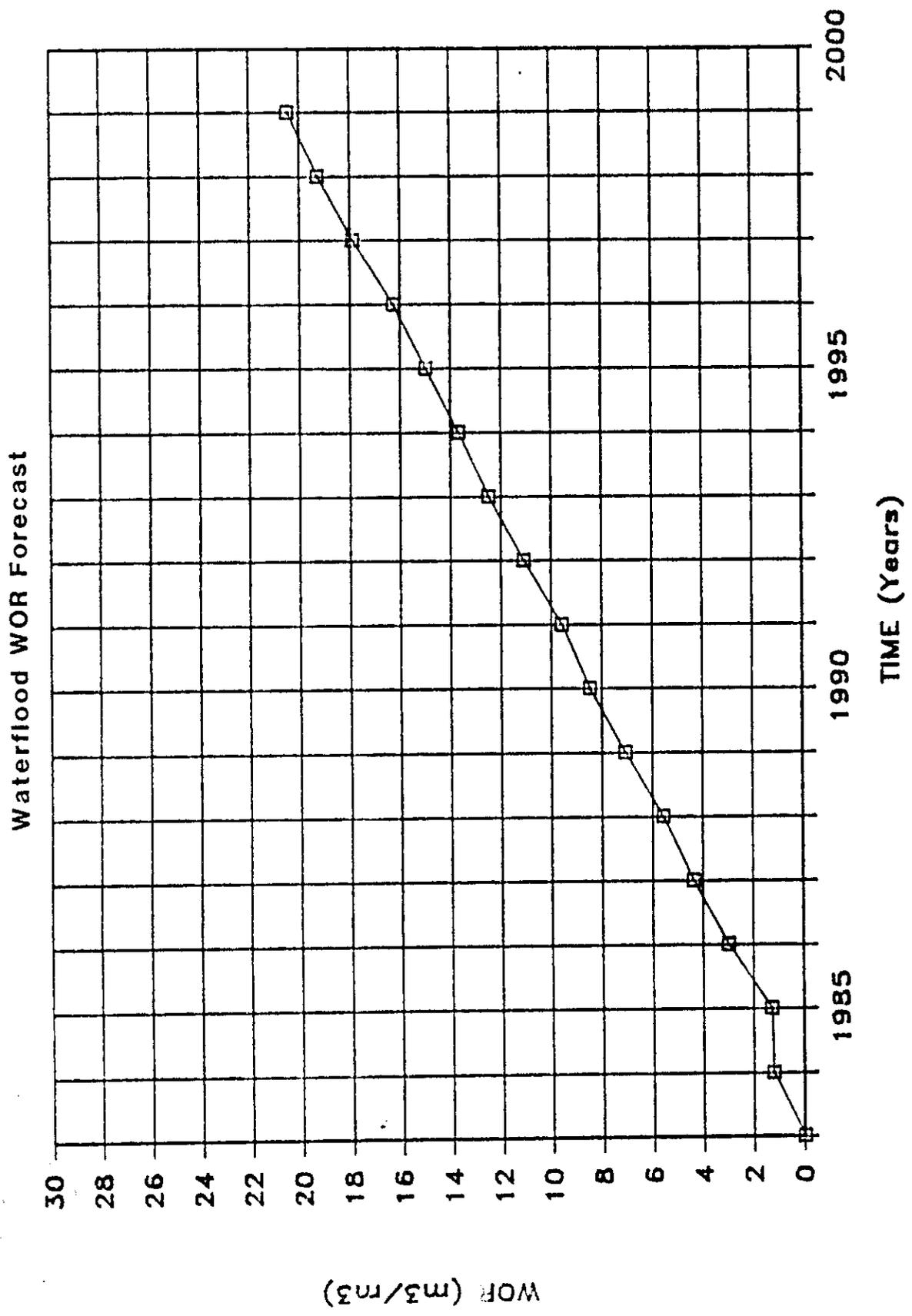
# WASKADA LOWER AMARANTH "A" POOL PROPOSED WATERFLOOD PROJECT

FIGURE 10



# WASKADA LOWER AMARANTH "A" POOL PROPOSED WATERFLOOD PROJECT

FIGURE 11



## References

1. Pelib User's Guide Volume III, Chevron Geosciences Company.
2. Special Core Analysis Study, Omega Waskada Prov 16-22-1-26,  
Omega Waskada 3-25MC3A-1-26 1982. Core Laboratories - Canada Ltd.
3. J. Flores and W. Laurila, Waskada Model Study - Lower Amaranth Pool  
1983.
4. Reservoir Fluid Study, Omega Waskada 8-26-1-26, 1982.  
Core Laboratories - Canada Ltd.

## A P P E N D I X A

### A. Primary Production Forecast

A primary production forecast was generated as follows:

1. Average well production was plotted on a normalized time basis (See Figure A1).
2. This decline curve was extrapolated to determine the expected life of an average well (6 years).
3. A conventional production plot (see Figure A2) was then extrapolated to 1990.
4. A primary oil production forecast was calculated using the Figure 2A decline curve and a yearly well count.
5. This production forecast gives a primary recovery of  $89 \times 10^3 \text{ m}^3$  or 11% of OOIP. The Unit 1 Model Study estimated primary recovery from the LAM to be 12% of OOIP.

### B. Waterflood Performance Prediction

1. Oil production and WOR for the LAM waterflood scheme were obtained from a Chevron Computer Program called Laysim. 'Laysim computes pattern waterflood performance in a layered reservoir flooded with a repetitive well pattern. Laysim accounts for non-unit mobility ratio displacements, areal sweep efficiency, vertical sweep efficiency and reservoir fill-up of free gas saturations. The model assumes no cross flow between model layers and incompressible flow. Buckley - Leverett two-phase flow theory is used to compute saturation movement within pairs of steamlines and accumulates results of these individual streamtube calculations to obtain total pattern performance.'<sup>(1)</sup>

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(1) Pelib User's Guide Volume III Chevron Geosciences Company

2. The Laysim Model was calibrated by matching the pore volume, the WOR, and the total liquid production rate for one layer.
3. Geologic, PVT, pressure, well, and waterflood pattern data were input to make an initial run.
4. The pore volume calculated by Laysim for 1/8 of a 9-spot pattern was compared with an average pore volume from similar pattern elements on the  $\emptyset h$  map. Pay thickness was adjusted to get the pore volumes to match. The end result was a pay thickness of 3.1 m. The average pay thickness and porosity from core and log data was 2.9 m and 15% respectively.
5. A water saturation of 0.55 was required for Laysim to match the current WOR of 1. Geologic data indicates the initial water saturation to be between 0.45 and 0.60.
6. A permeability of 89 md was required for Laysim to match the current total liquid production rate of 10 m<sup>3</sup>/d. Measured permeability from cores is about 1 - 3 md but natural fractures have been observed in the cores, and all wells are fracture stimulated. Pressure buildup analyses indicated  $k_0$ 's of 1.9 to 379 md and  $k_w$ 's of 1.7 to 272 md (single phase permeability would be greater).
7. Once the Laysim Model was calibrated, the Dykstra-Parsons Method was used to obtain permeabilities for 10 equal thickness layers. A permeability variation of 0.8 was used to obtain the initial permeability for the 10 layers (see Figure A3). These initial  $k$ 's were adjusted so the total  $kh$  of the ten layers equals the  $kh$  of the one layer used in the calibration (see Table A1).
8. Using several layers rather than one layer spreads out the water breakthrough times, which represent the waterflood mechanism more accurately. The high permeability layers help to model the affects of the natural fracturing in the LAM more accurately. Predicted oil recovery is less using several layers compared to one layer.

9. Laysim predicts pattern element and individual well production. The individual wells are a direct offset from the injector and a diagonal offset. The well production data was used with a well count to generate a waterflood production forecast.
10. Waterflood recovery is estimated at  $177 \times 10^3 \text{ m}^3$  or 21% of OOIP after 15 years. Incremental recovery over primary is  $88 \times 10^3 \text{ m}^3$ . The Unit 1 Model Study predicted a recovery of 22% of OOIP after 10 years.

C. Reservoir Fluid Properties

Reservoir fluid properties were taken from a PVT analysis of an oil sample from the well Omega Waskada 8-26-1-26 WPM. Table A2 contains the reservoir fluid properties at various pressures. Chevron plans to confirm the saturation pressure obtained from the 8-26 sample when MC3 producers in the subject area are recompleted as LAM producers or a new well is drilled. If the saturation pressure cannot be confirmed a full PVT analysis will be done on the LAM oil sample.

D. Injection Rate Calculation

The production and injection history of the Waskada Unit 1 injectors was used to calculate a stabilized injection rate/stabilized liquid production rate ratio. The average ratio for the four Unit 1 injectors is 8. Maximum injection rates for the subject injectors were estimated using this ratio (8) and liquid production rates from the subject injectors.

TABLE A1

1984-07-30

Waskada Lower Amaranth "A" Pool  
 Proposed Waterflood Project  
 Properties of 10 Equal Thickness Layers Having  
 Permeability Variation of .8 (k = 89 md & h = 3.1 m)

Layer	Dykstra-Parsons k md	h m	kh md-m	Adjust <sup>1</sup> kh md-m	Adjust k md	Laysim k $10^{-9} \text{ m}^2$
1	1 250	.31	387.5	141.9	458.0	.000452
2	470	.31	145.7	53.3	172.0	.000170
3	262	.31	81.2	29.7	95.9	.0000946
4	166	.31	51.5	18.8	60.8	.0000600
5	108	.31	33.5	12.3	40.0	.000039
6	73	.31	22.6	8.3	26.7	.0000263
7	48	.31	14.9	5.5	17.6	.0000174
8	30	.31	9.3	3.4	11.0	.0000108
9	17	.31	5.3	1.9	6.3	.00000618
10	6.4	.31	<u>2.0</u>	<u>.7</u>	2.4	.00000233
			753.5	275.8		
Composite	89	3.1	276.0			

1. Adjust kh = Dykstra - Parsons kn x  $\frac{276}{753.5}$

TABLE A2

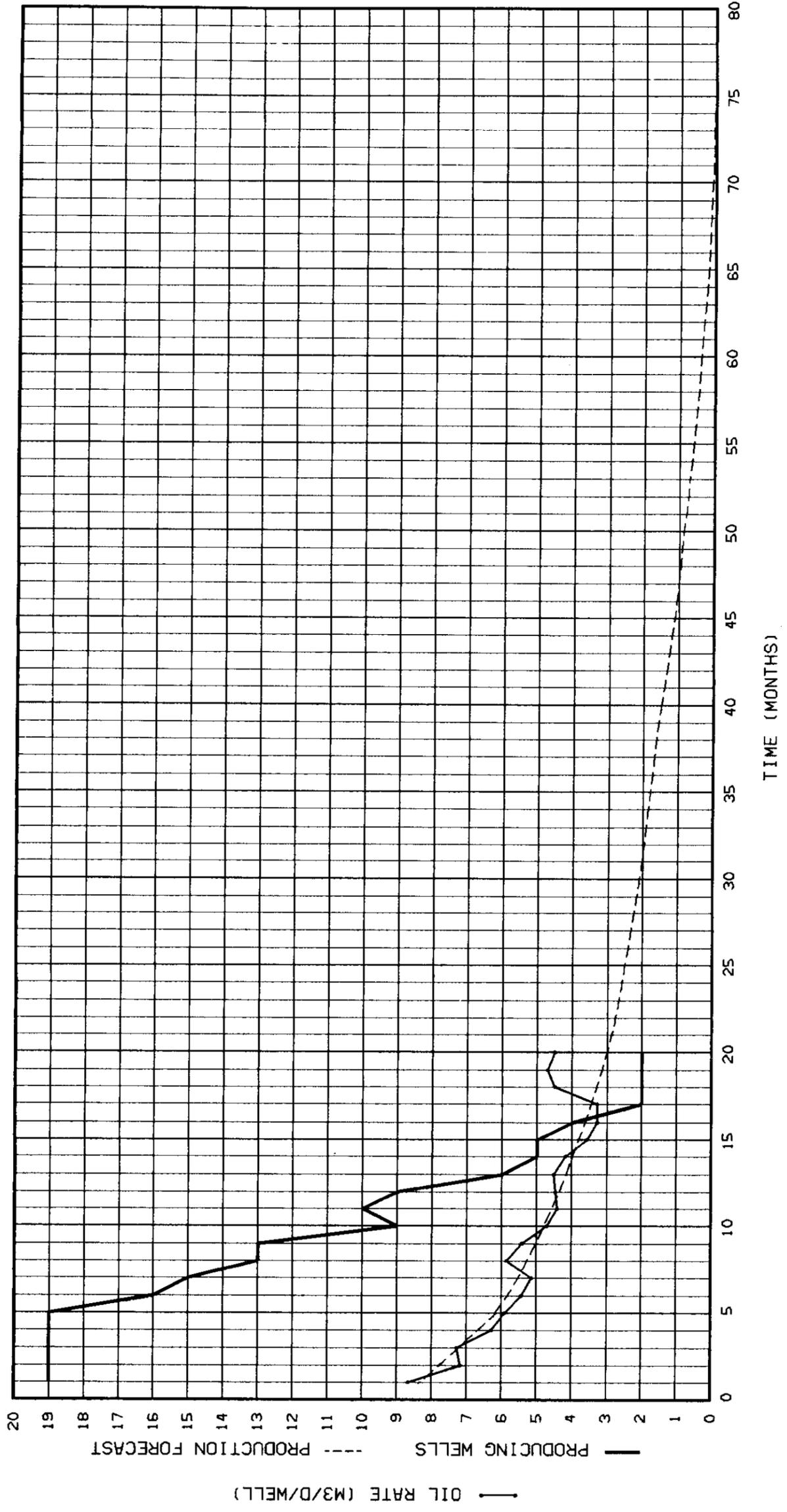
Waskada Lower Amaranth Pool  
Reservoir Fluid PVT Properties

<u>Pressure</u> kPa (GA)	<u>Oil Formation Volume Factor</u> R m <sup>3</sup> /S m <sup>3</sup>	<u>Soln GOR</u> m <sup>3</sup> /m <sup>3</sup>	<u>Oil Visc.</u> cp	<u>Gas Visc.</u> 10 <sup>-3</sup> cp	<u>Z</u>	<u>Water Visc.</u> cp
1000.0	1.1125	25	1.92	8.78	0.9769	0.758
1500.0	1.1225	29	1.74	9.15	0.9681	0.758
2000.0	1.1306	32	1.62	9.54	0.9610	0.758
2500.0	1.1373	35	1.53	9.94	0.9549	0.758
3000.0	1.1432	38	1.47	10.30	0.9501	0.758
3500.0	1.1484	41	1.42	10.80	0.9465	0.758
4000.0	1.1531	43	1.38	11.20	0.9442	0.758
4220.0	1.1550	44	1.29	11.40	0.9437	0.758
4500.0	1.1546		1.29			0.758
5000.0	1.1538		1.30			0.758
5500.0	1.1531		1.31			0.758
6000.0	1.1523		1.32			0.758
6500.0	1.1516		1.33			0.758
7000.0	1.1509		1.34			0.758
7500.0	1.1502		1.35			0.758
8000.0	1.1495		1.36			0.758
8500.0	1.1488		1.37			0.758

1. Sample from Well Omega Waskada 8-26-1-26 WPM
2. Reservoir Temperature 45°C
3. Saturation Pressure 4 220 kPa

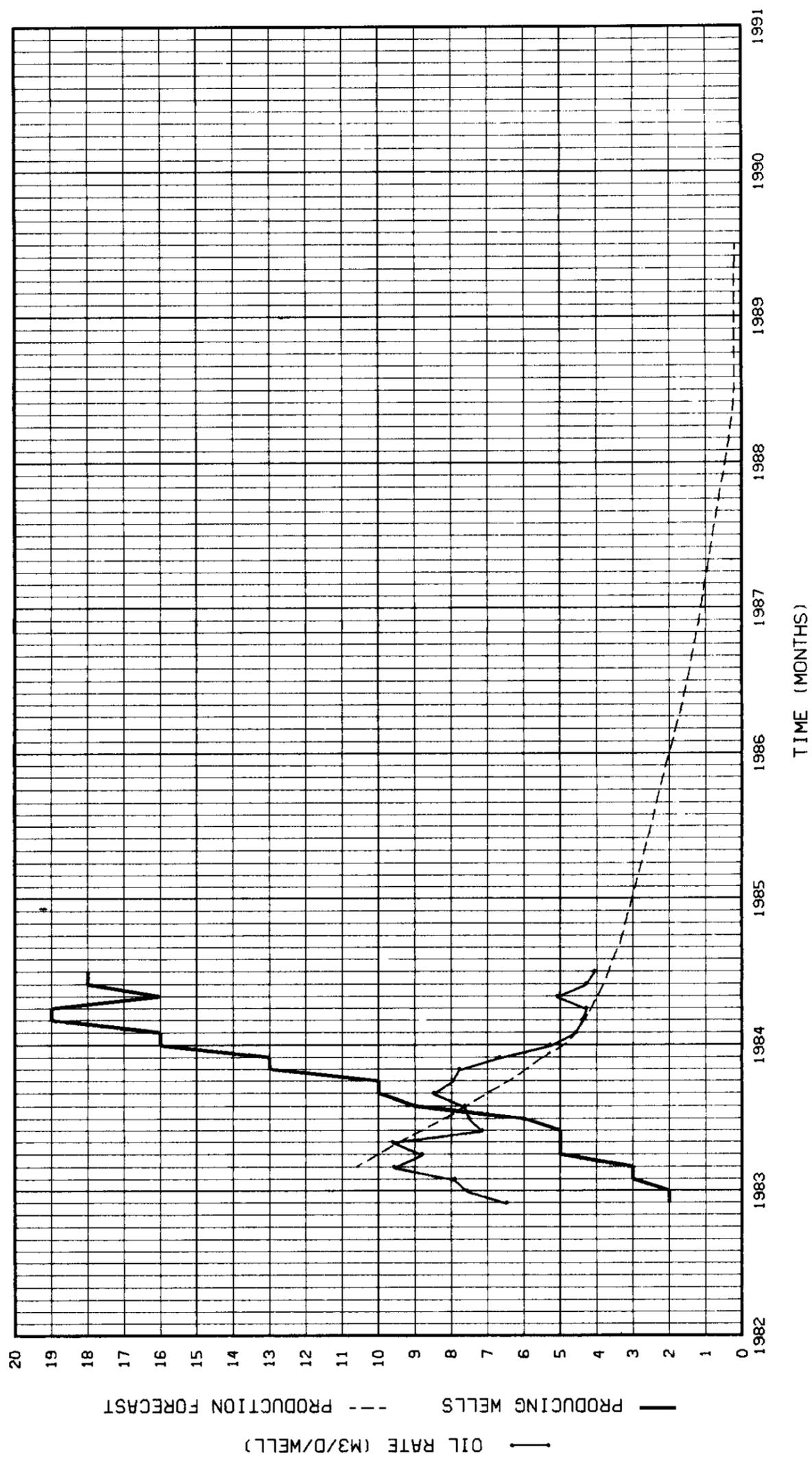
1984-08-23

FIGURE A1 WASKADA LOWER AMARANTH 'A' POOL  
PROPOSED WATERFLOOD PROJECT  
PRIMARY PRODUCTION DATA AND FORECAST

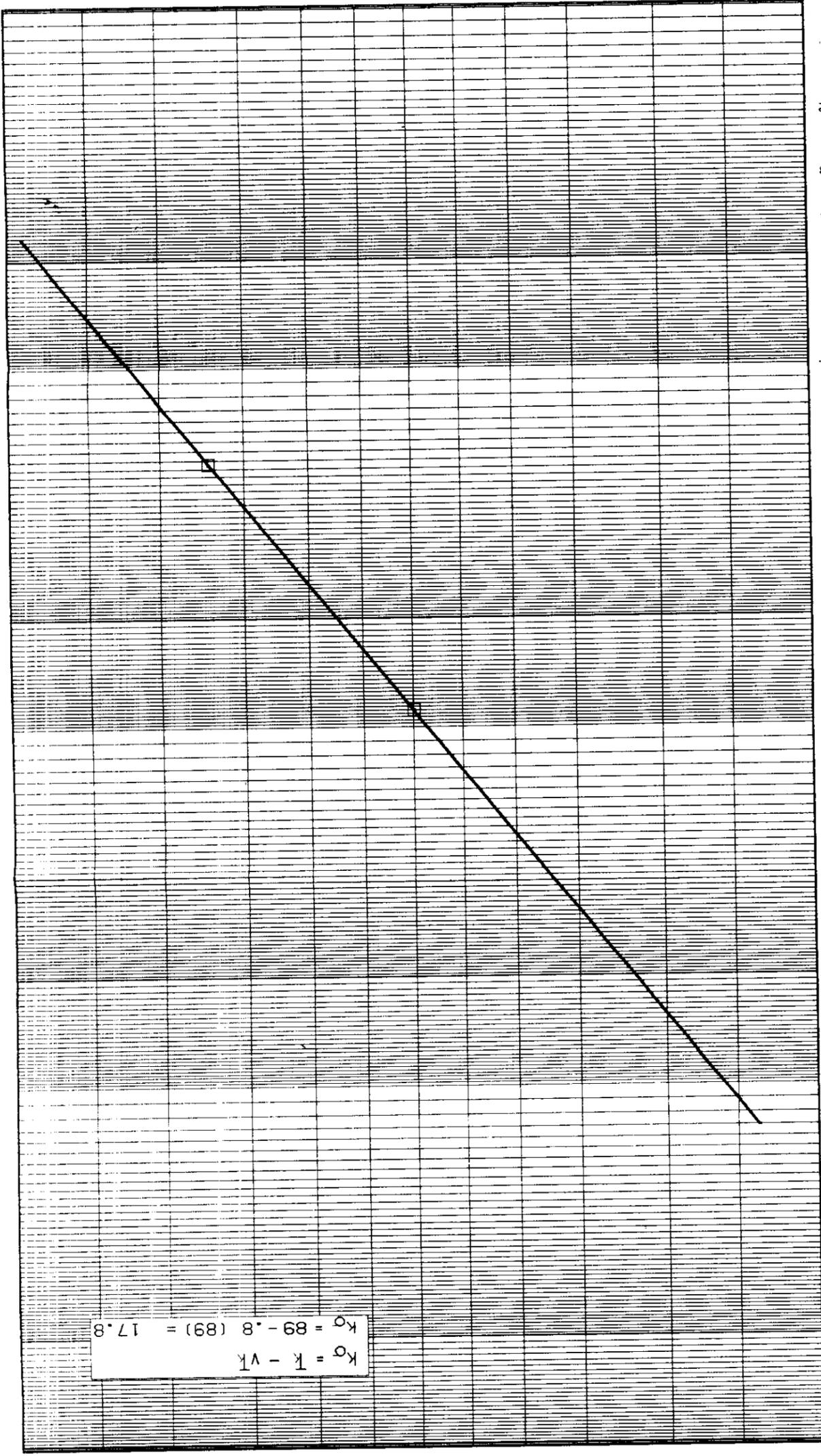


1984-08-23

FIGURE A2 WASKADA LOWER AMARANTH 'A' POOL  
PROPOSED WATERFLOOD PROJECT  
PRIMARY PRODUCTION DATA AND FORECAST



PERCENTAGE  
2 5 10 20 30 40 50 60 70 80 90 95 98



PERMEABILITY (md)

$$k_D = k - v k$$

$$k_D = 89 - .8 (89) = 17.8$$

MASKADA LOWER AMARANTH 'A' POOL  
 PROPOSED WATERFLOOD PROJECT  
 NORMAL PERMEABILITY DISTRIBUTION

FIGURE A3

1984-08-14

## A P P E N D I X B

### Waskada Injection Well Candidates Well Completion and Stimulation Summary

#### Newscope et al Waskada 5-7LAM-1-25-WPM

114 mm casing, landed at 930.5 m KB. Cemented to surface.  
Plug back total depth: 926.0 m KB.  
Perforations: Lower Amaranth from 916.0 to 924.0 m KB.  
Stimulation: Fraced with 27 tonne sand.

#### Newscope et al Waskada 13-7LAM-1-25-WPM

140 mm casing, landed at 935.5 m KB. Cemented to surface.  
Plug back total depth: 931.4 m KB.  
Perforations: Lower Amaranth 913.5 - 926.0 m KB.  
Stimulation: Fraced with 30.0 tonne sand.

#### Chevron Waskada 5-18-1-25-WPM

140 mm casing, landed at 963.5 m KB. Cemented to surface.  
Plug back total depth: 949.0 m KB.  
Perforations: Lower Amaranth from 913.0 - 922.5 m KB.  
Stimulation: Fraced with 16 tonne sand (Sanded Off)

#### Chevron Waskada 7-1-1-26-WPM

140 mm casing, landed at 968.5 m KB. Cemented to surface.  
Plug back total depth: 955.0 m KB.  
Perforations: Lower Amaranth from 914.0 to 925.0 m KB.  
Stimulation: Fraced with 27.0 tonne sand.

#### Chevron Waskada 15-1-1-26-WPM

140 mm casing, landed at 959.5 m KB. Cemented to surface.  
Plug back total depth: 946.5 m KB initially.  
Perforations: Mission Canyon from 936.0 to 938.0 m KB  
(Temporarily Abandoned)  
New Plug Back Total Depth: 931.0 m KB (Cement Retainer)  
New Perforations: Lower Amaranth from 915.0 to 929.0 m KB.  
Stimulation: Fraced with 7.7 tonne sand (Sanded Off).

#### Chevron Waskada 5-12-1-26-WPM

140 mm casing, landed at 979.5 m KB.  
Plug back total depth: 963.6 m KB.  
Perforations: Lower Amaranth from 927.0 to 936.0 m KB.  
Stimulation: Fraced with 27.0 tonne sand.  
Remedial: Cement squeezed top of MC-3 to shut off excessive water  
production - only partially successful.

Chevron Waskada 7-12-1-26-WPM

140 mm casing, landed at 955.0 m KB. Cemented to surface.  
Plug back total depth: 939.3 m KB.  
Perforations: Lower Amaranth 910.5 - 923.0 m KB.  
Stimulation: Fracced with 11.0 tonne sand (Sanded Off).

Newscope S. Waskada 15-12-1-26-WPM

114 mm casing, landed at 958.5 m KB.  
Plug back total depth: 953.2 m KB.  
Perforations: Lower Amaranth from 909.0 - 921.0 m KB.  
Stimulation: Fracced with 27.0 tonne sand

A P P E N D I X C



CORE LABORATORIES - CANADA LTD.  
Petroleum Reservoir Engineering  
CALGARY ALBERTA



WATER ANALYSIS

7021-83-730

Plastic  
CONTAINER IDENTITY

LABORATORY NUMBER

Chevron Canada Resources Limited

1 of 1

OPERATOR

PAGE

LSD 10-1-1-26 WPM

Chevron Waskada 10-1-1-26

LOCATION

WELL OR SAMPLE LOCATION NAME

MB. ELEV.

GRD. ELEV.

Waskada, Manitoba

Spearfish

FIELD OR AREA

POOL OR ZONE

SAMPLER

TEST TYPE & NO.

TEST RECOVERY

Wellhead

POINT OF SAMPLE

AMT. & TYPE CUSHION

MUD RESISTIVITY @ °C

PUMPING

FLOWING

GAS LIFT

SWAB

WATER

m<sup>3</sup>/d

OIL

m<sup>3</sup>/d

GAS

m<sup>3</sup>/d

TEST INTERVALS OR PERFS.

SEPARATOR RESERVOIR

CONTAINER WHEN SAMPLED @ °C

CONTAINER WHEN RECEIVED @ °C

SEPARATOR

PRESSURES, kPa

TEMPERATURES, °C

83 12 15

83 12 16

LS

DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

ION	mg/L	mg Fraction	MEQ/L
Na	37500.	0.3589	1631.1
K	272.	0.0026	7.0
Ca	2383.	0.0228	118.9
Mg	276.	0.0026	22.7
Ba			
Sr			
Fe	NOT DETECTED		

ION	mg/L	mg Fraction	MEQ/L
Cl	59942.	0.5736	1690.7
Br			
I			
HCO <sub>3</sub>	131.	0.0013	2.1
SO <sub>4</sub>	3992.	0.0382	83.2
CO <sub>3</sub>	0.	0.0000	0.0
OH	0.	0.0000	0.0
H <sub>2</sub> S	NOT DETECTED		

TOTAL SOLIDS mg/L

BY EVAPORATION @ 110°C

BY EVAPORATION @ 180°C

104495.

AT IGNITION

CALCULATED

1.0755 @ 15.4°C

1.3490 @ 20.

SPECIFIC GRAVITY

REFRACTIVE INDEX

7.3

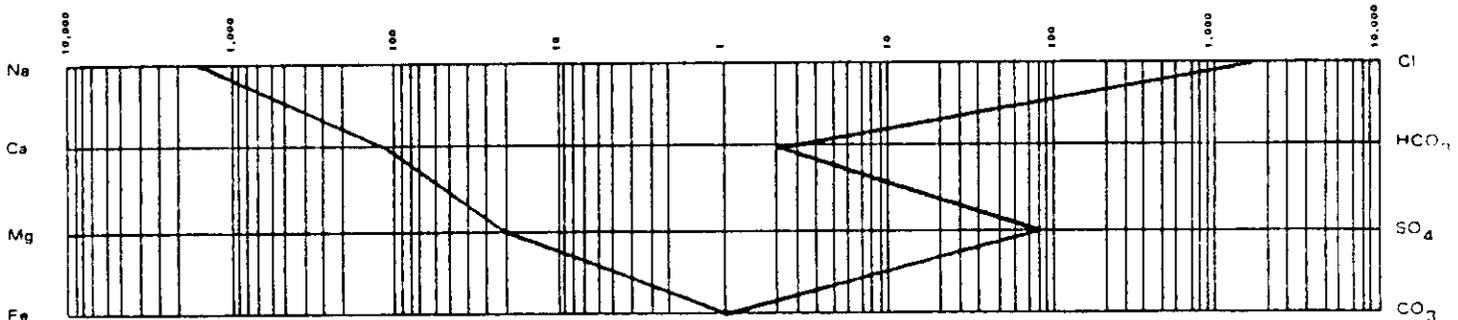
0.073

@ 25°C

pH

RESISTIVITY (OHM/METERS)

LOGARITHMIC PATTERN MEQ PER LITRE



REMARKS NaCl equiv. 102561.



CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST. JOHN CALGARY



WATER ANALYSIS

CB4-4008

LICENCE NUMBER

OPERATOR NAME

CHEVRON CANADA RESOURCES LIMITED

2-12-1-26 W1

Chevron Waskada 2-12-1-26

FIELD OR AREA

POOL OR ZONE

NAME OF SAMPLER

COMPANY

mc3

TEST TYPE NO

TEST RECOVERY

MULTIPLE RECOVERY

SAMPLING POINT

AMT. & TYPE OF CUSHION

MUD RESISTIVITY

Well Head

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

WATER

m<sup>3</sup>/d OIL

m<sup>3</sup>/d GAS

10<sup>3</sup> m<sup>3</sup>/d

SEPARATOR

TREATER

RESERVOIR

SOURCE

GAUGE PRESSURE kPa

SEPARATOR

TREATER

RESERVOIR

SOURCE

TEMPERATURE °C

DATE SAMPLED (Y M D)

DATE RECEIVED (Y M D)

DATE REPORTED (Y M D)

ANALYST

OTHER INFORMATION

1984-01-19

1984-02-07

1984-02-20

S. Sargious

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

TOTAL SOLIDS  $\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Na

38 330

0.3670

1667.36

Cl

58 500

0.5601

1649.70

EVAPORATED @ 110°C

EVAPORATED @ 100°C

K

258

0.0025

6.60

Br

109 200

AT IGNITION

CALCULATED

Ca

2 042

0.0195

50.95

I

103 800

104 454

Mg

510

0.0049

20.96

HCO<sub>3</sub>

366

0.0035

6.00

ORGANICS: TRACE

RELATIVE DENSITY

REFRACTIVE INDEX

Ba

SO<sub>4</sub>

4 448

0.0425

46.26

1.074 @ 20°C

1.3501 @ 20°C

Sr

CO<sub>3</sub>

0 0.0000

0.00

OBSERVED pH

RESISTIVITY (OHM·m)

Fe PRESENT

OH

0 0.0000

0.00

7.8 @ 23°C

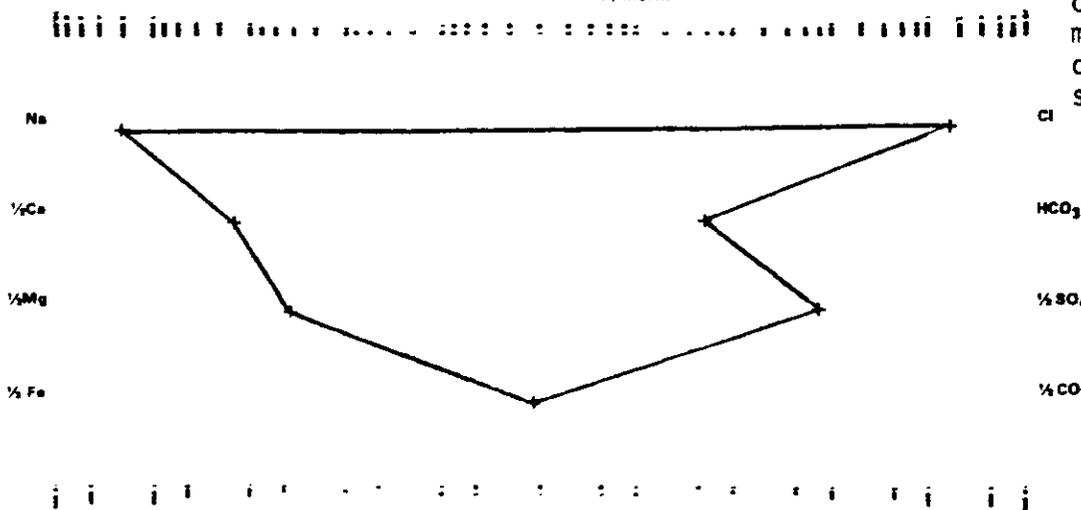
0.076 @ 23°C

H<sub>2</sub>S PRESENT

REMARKS

Clear, colorless filtrate recovered from a sample containing a trace sediment, a trace of hydrocarbons and hydrogen sulfide.

LOGARITHMIC PATTERN  $c/mol \cdot m^{-3}$





CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST JOHN CALGARY



WATER ANALYSIS

CB4-4007-1

CONTAINER NUMBER

OPERATOR NAME

CHEVRON CANADA RESOURCES LIMITED

5-7-1-25 W1

WELL NAME

Chevron Waskada 5-7-1-25

FIELD OR AREA

POOL OR ZONE

NAME OF SAMPLER

COMPANY

Spearfish

TEST TYPE NO

TEST RECOVERY

MULTIPLE RECOVERY Y/N

SAMPLING POINT

AMT & TYPE OF CUSHION

MUD RESISTIVITY

Well Head

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

WATER

m<sup>3</sup>/d OIL

m<sup>3</sup>/d GAS

10<sup>3</sup> m<sup>3</sup>/d

SEPARATOR

TREATER

RESERVOIR

SOURCE

GAUGE PRESSURE

MPa

SEPARATOR

TREATER

RESERVOIR

SOURCE

TEMPERATURE C

DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

DATE REPORTED (Y/M/D)

ANALYST

OTHER INFORMATION

1984-01-19

1984-02-07

1984-02-20

S. Sargious

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

TOTAL SOLIDS

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Na 38 330 0.3666 1667.36

Cl 58 500 0.5595 1649.70

EVAPORATED @ 110°C

EVAPORATED @ 130°C

K 328 0.0031 8.40

Br

107 300

AT IGNITION

CALCULATED

Ca 2 042 0.0195 50.95

I

102 700

104 587

Mg 486 0.0046 19.98

HCO<sub>3</sub> 275 0.0026 4.51

ORGANICS: TRACE

RELATIVE DENSITY

REFRACTIVE INDEX

Ba

SO<sub>4</sub> 4 596 0.0441 47.80

1.068 @ 20°C

1.3498 @ 20°C

Sr

CO<sub>3</sub> 0 0.0000 0.00

OBSERVED pH

RESISTIVITY (Ω-cm)

Fe PRESENT

OH 0 0.0000 0.00

7.6 @ 23°C

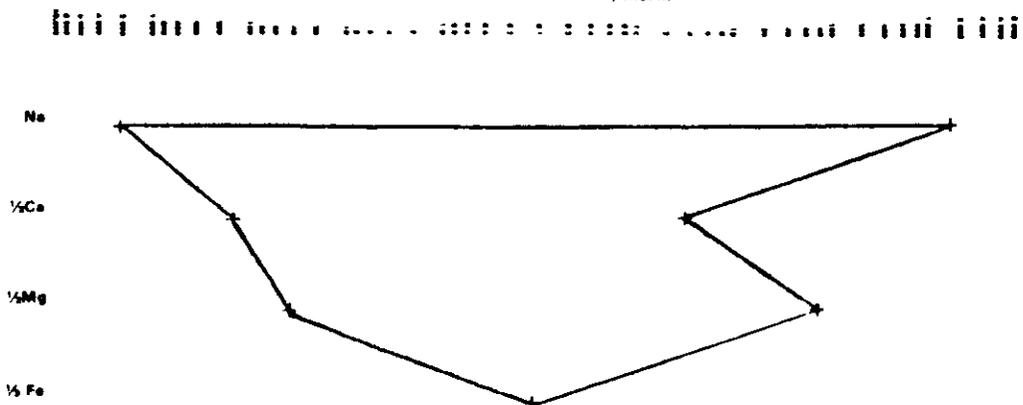
0.077 @ 23°C

H<sub>2</sub>S NIL

REMARKS

Clear, colorless filtrate recovered from a sample containing a trace sediment and a trace of hydrocarbons.

LOGARITHMIC PATTERN c/mol.m<sup>-3</sup>





CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST. JOHN CALGARY



WATER ANALYSIS

CB4-1007-2

REFERENCE NUMBER

OPERATOR NAME

5-7-1-25 W1

CHEVRON CANADA RESOURCES LIMITED

WELL NAME

Chevron Waskada 5-7-1-25

ELEVATIONS

FIELD OR AREA

POOL OR ZONE

NAME OF SAMPLER

COMPANY

MC3

TEST TYPE NO

TEST RECOVERY

MULTIPLE RECOVERY

SAMPLING POINT

AMT & TYPE OF CUSHION

MUD RESISTIVITY

Well Head

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

WATER

SEPARATOR

TREATER

RESERVOIR

GAS

10<sup>3</sup>m<sup>3</sup>/d

GAUGE PRESSURE

IPs

SEPARATOR

TREATER

RESERVOIR

SOURCE

TEMPERATURE

C

DATE SAMPLED (Y M D)

DATE RECEIVED (Y M D)

DATE REPORTED (Y M D)

ANALYST

OTHER INFORMATION

1984-01-19

1984-02-07

1984-02-20

S. Sargious

ION	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$	Mass Fraction	$\frac{c}{mol \cdot m^{-3}}$	ION	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$	Mass Fraction	$\frac{c}{mol \cdot m^{-3}}$
Na	38 190	0.3674	1661.27	Cl	58 000	0.5579	1635.60
K	282	0.0027	7.22	Br			
Ca	1 962	0.0189	48.95	I			
Mg	632	0.0061	25.98	HCO <sub>3</sub>	336	0.0032	5.51
Ba				SO <sub>4</sub>	4 555	0.0438	47.37
Sr				CO <sub>3</sub>	0	0.0000	0.00
Fe	PRESENT			OH	0	0.0000	0.00

TOTAL SOLIDS  $\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

EVAPORATED @ 110°C

EVAPORATED @ 180°C

108 700

AT IGNITION

AT IGNITION

102 900

103 957

ORGANICS: TRACE

RELATIVE DENSITY

REFRACTIVE INDEX

1.070 @ 20°C

1.3500 @ 20°C

OBSERVED pH

RESISTIVITY (25°C)

7.8 @ 23°C

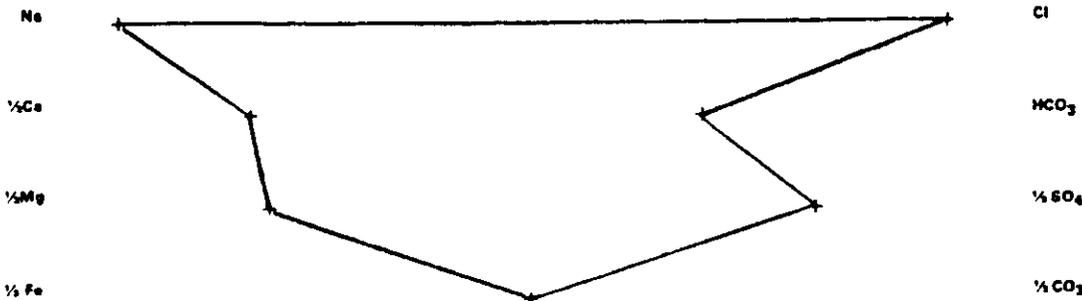
0.076 @ 25°C

H<sub>2</sub>S NIL

REMARKS

Clear, colorless filtrate recovered from a sample containing a trace sediment and a trace of hydrocarbons.

LOGARITHMIC PATTERN  $c/mol \cdot m^{-3}$



CHEMICAL & GEOLOGICAL LABORATORIES LIMITED

OPERATOR: CHEVRON CANADA RESOURCES LIMITED

REPORT NUMBER: C84-4007

DATE SAMPLED: 1984-01-19

DATE RECEIVED: 1984-02-07

DATE REPORTED: 1984-02-20

C84-4007-1 5-7-1-25 Waskada - Spearfish

C84-4007-2 5-7-1-25 Waskada - MC3

COMPATIBILITY

The filtered samples were mixed in 10% increments with 100% of each sample retained to observe effect of exposure to air and to act as controls.

The test was conducted on an open system basis at room temperature over a 24 hour period.

Results are as follows:

<u>MIXTURES</u>		<u>PRECIPITATION</u>				
<u>C84-4007-1</u> %	<u>C84-4007-2</u> %	<u>IMMEDIATE</u>	<u>1 HOUR</u>	<u>4 HOURS</u>	<u>8 HOURS</u>	<u>24 HOURS</u>
100	0	NIL	NIL	NIL	NIL	NIL
90	10					
80	20					
70	30					
60	40					
50	50					
40	60					
30	70					
20	80					
10	90					
0	100					

REMARKS & CONCLUSIONS

No precipitation was observed in any of the mixtures of the Waskada - spearfish water and the Waskada - MC3 water, nor in the 100% samples of these waters, during the test period. These waters are compatible under test conditions.



CORE LABORATORIES - CANADA LTD.  
Petroleum Reservoir Engineering  
CALGARY ALBERTA



Plastic

WATER ANALYSIS

7021-83-730

CONTAINER IDENTITY

LABORATORY NUMBER

Chevron Canada Resources Limited

1 of 1

OPERATOR

PAGE

LSD 10-1-1-26 WPM

Chevron Waskada 10-1-1-26

LOCATION

WELL OR SAMPLE LOCATION NAME

KB ELEV.

GRD. ELEV.

Waskada, Manitoba

Spearfish

FIELD OR AREA

POOL OR ZONE

SAMPLER

TEST TYPE & NO.

TEST RECOVERY

Wellhead

@ °C

POINT OF SAMPLE

AMT. & TYPE CUSHION

MUD RESISTIVITY

PUMPING

FLOWING

GAS LIFT

SWAB

WATER

m<sup>3</sup>/d

OIL

m<sup>3</sup>/d

GAS

m<sup>3</sup>/d

TEST INTERVAL<sup>1</sup> OR PERFS.

SEPARATOR RESERVOIR

@ °C  
CONTAINER  
WHEN SAMPLED

@ °C  
CONTAINER  
WHEN RECEIVED

SEPARATOR

PRESSURES, kPa

TEMPERATURES, °C

83 12 15

83 12 16

LS

DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

ION	mg/L	mg Fraction	MEQ/L
Na	37500.	0.3589	1631.1
K	272.	0.0026	7.0
Ca	2383.	0.0228	118.9
Mg	276.	0.0026	22.7
Ba			
Sr			
Fe	NOT DETECTED		

ION	mg/L	mg Fraction	MEQ/L
Cl	59942.	0.5736	1690.7
Br			
I			
HCO <sub>3</sub>	131.	0.0013	2.1
SO <sub>4</sub>	3992.	0.0382	83.2
CO <sub>3</sub>	0.	0.0000	0.0
OH	0.	0.0000	0.0
H <sub>2</sub> S	NOT DETECTED		

TOTAL SOLIDS mg/L

BY EVAPORATION @ 110°C

BY EVAPORATION @ 150°C

104495.

AT IGNITION

CALCULATED

1.0755 @ 15.4°C

1.3490 @ 20.

SPECIFIC GRAVITY

REFRACTIVE INDEX

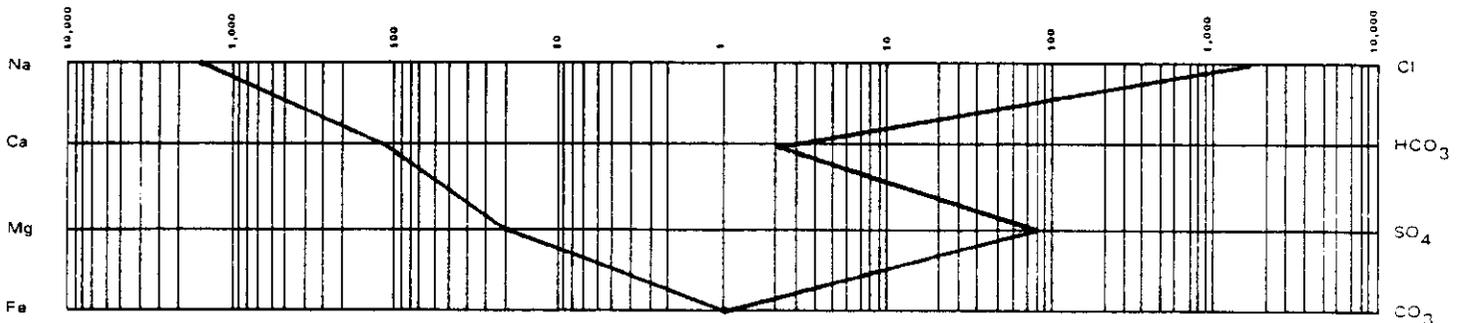
7.3

pH

0.073

RESISTIVITY (OHM/METERS) @ 25°C

LOGARITHMIC PATTERN MEQ PER LITRE



REMARKS NaCl equiv. 102561.



CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST. JOHN CALGARY



WATER ANALYSIS

LABORATORY NUMBER  
C84-6045

LICENCE NUMBER

OPERATOR NAME

CHEVRON CANADA RESOURCES LIMITED

LOCATION  
5-18-1-26 W1

WELL NAME

Chevron Waskada 5-18-1-26

ELEVATIONS  
N.B. (meters) GRD  
470.2 466

FIELD OR AREA  
Waskada

POOL OR ZONE

Spearfish

NAME OF SAMPLER

D. Spencer

COMPANY

TEST TYPE NO

TEST RECOVERY

MULTIPLE RECOVERY Y/N

SAMPLING POINT

AMT. & TYPE OF CUSHION

MUD RESISTIVITY @ 25°C

Lease Production Tank

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

WATER

m<sup>3</sup> d OIL

m<sup>3</sup> d GAS

10<sup>3</sup> m<sup>3</sup> d

SEPARATOR

TREATER

RESERVOIR

SOURCE

GAUGE PRESSURE

MPa

SEPARATOR

TREATER

RESERVOIR

SOURCE

913 - 922.5

TEMPERATURE °C

DATE SAMPLED (Y M D)

DATE RECEIVED (Y M D)

DATE REPORTED (Y M D)

ANALYST

OTHER INFORMATION

1984-07-10

1984-07-26

1984-07-30

S. Sargious

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

Na

37 780

0.3662

1643.43

Cl

59 000

0.5719

1663.80

K

25

0.0002

0.64

Br

Ca

1 506

0.0146

37.58

I

Mg

535

0.0052

21.99

HCO<sub>3</sub>

195

0.0019

3.20

Ba

SO<sub>4</sub>

4 127

0.0400

42.92

Sr

CO<sub>3</sub>

0

0.0000

0.00

Fe

PRESENT

OH

0

0.0000

0.00

TOTAL SOLIDS  $\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

EVAPORATED @ 110°C

EVAPORATED @ 180°C

103 100

AT IGNITION

CALCULATED

95 200

103 168

ORGANICS: TRACE

RELATIVE DENSITY

REFRACTIVE INDEX

1.068 @ 25°C

1.3485 @ 25°C

OBSERVED pH

RESISTIVITY (Ohm.m)

7.8 @ 24°C

0.075 @ 25°C

H<sub>2</sub>S NIL

REMARKS

Clear, colorless filtrate recovered from a sample containing a trace sediment and a trace of hydrocarbons.

LOGARITHMIC PATTERN  $c/mol \cdot m^{-3}$



Na

1/2 Ca

1/2 Mg

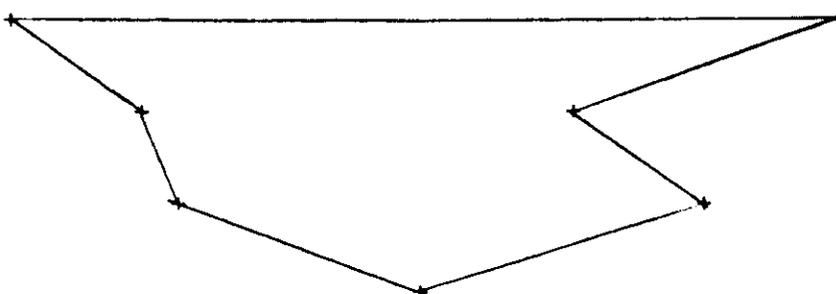
1/2 Fe

Cl

HCO<sub>3</sub>

1/2 SO<sub>4</sub>

1/2 CO<sub>3</sub>





CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST. JOHN CALGARY



WATER ANALYSIS

LABORATORY NUMBER

CB4-6046-2

LICENCE NUMBER

OPERATOR NAME

CHEVRON CANADA RESOURCES LIMITED

8-1-1-26 W1

Chevron Waskada 8-1-1-26

ELEVATIONS  
K.B. (metres) G.R.D. 466.9 462.3

FIELD OR AREA  
Waskada

POOL OR ZONE  
MC3

NAME OF SAMPLER  
D. Spencer

TEST TYPE NO.

TEST RECOVERY

MULTIPLE RECOVERY

Y/N

SAMPLING POINT

AMT. & TYPE OF CUSHION

MUD RESISTIVITY

Lease Production Tank

Test Interval (metres)

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

WATER

m<sup>3</sup> d OIL

m<sup>3</sup> d GAS

10<sup>3</sup> m<sup>3</sup> d

SEPARATOR

TREATER

RESERVOIR

SOURCE

GAUGE PRESSURE

kPa

SEPARATOR

TREATER

RESERVOIR

SOURCE

931.5 - 933

TEMPERATURE °C

DATE SAMPLED (Y M D)

DATE RECEIVED (Y M D)

DATE REPORTED (Y M D)

ANALYST

OTHER INFORMATION

1984-07-11

1984-07-26

1984-07-30

S. Sargious

ION	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$	Mass Fraction	$\frac{c}{mol \cdot m^{-3}}$	ION	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$	Mass Fraction	$\frac{c}{mol \cdot m^{-3}}$
Na	40 130	0.3601	1745.66	Cl	64 250	0.5765	1811.85
K	25	0.0002	0.64	Br			
Ca	2 026	0.0182	50.55	I			
Mg	496	0.0045	20.39	HCO <sub>3</sub>	38	0.0003	0.62
Ba				SO <sub>4</sub>	4 485	0.0402	46.65
Sr				CO <sub>3</sub>	0	0.0000	0.00
Fe	PRESENT			OH	0	0.0000	0.00

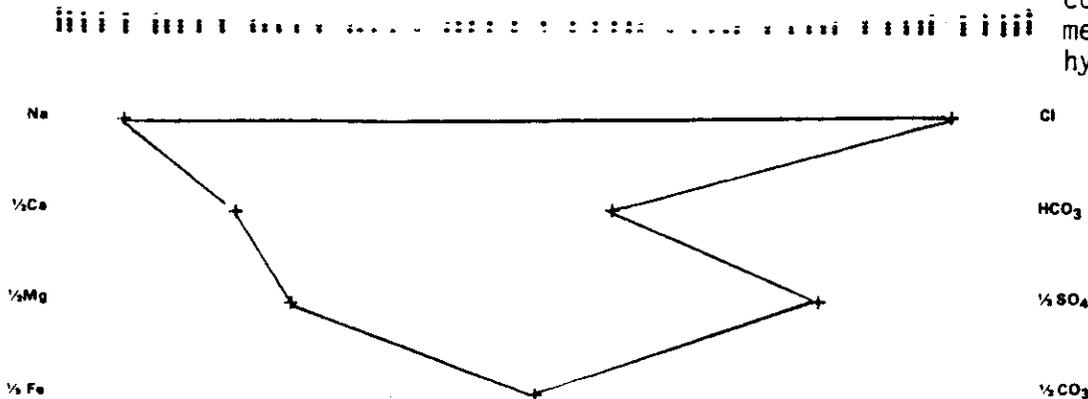
TOTAL SOLIDS	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$
EVAPORATED @ 110°C	111 700
EVAPORATED @ 180°C	
AT 1GM/TON	101 600
CALCULATED	111 450
ORGANICS: TRACE	
RELATIVE DENSITY	1.075 @ 25°C
REFRACTIVE INDEX	1.3497 @ 25°C
OBSERVED pH	7.8 @ 24°C
RESISTIVITY (Ohm m)	0.073 @ 25°C

H<sub>2</sub>S NIL

REMARKS

Yellow colored filtrate recovered from a sample containing a trace sediment and a trace of hydrocarbons.

LOGARITHMIC PATTERN  $c / mol \cdot m^{-3}$





CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST. JOHN CALGARY



WATER ANALYSIS

LABORATORY NUMBER

CB4-6046-1

CONTAINER IDENTITY

LICENCE NUMBER

OPERATOR NAME

CHEVRON CANADA RESOURCES LIMITED

LOCATION

3-12-1-26 W1

WELL NAME

Chevron Waskada 3-12-1-26

ELEVATIONS  
K.B. (metres): GRD

467.6 463.3

FIELD OR AREA

Waskada

POOL OR ZONE

MC3

NAME OF SAMPLER

D. Spencer

COMPANY

TEST TYPE NO

TEST RECOVERY

MULTIPLE RECOVERY Y N

SAMPLING POINT

AMT. & TYPE OF CUSHION

MUD RESISTIVITY

Lease Production Tank

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

WATER

m<sup>3</sup>/d OIL

m<sup>3</sup>/d GAS

10<sup>3</sup>m<sup>3</sup>/d

SEPARATOR

TREATER

RESERVOIR

SOURCE

GAUGE PRESSURE kPa

SEPARATOR

TREATER

RESERVOIR

SOURCE

935 - 936.5

TEMPERATURE C

DATE SAMPLED (Y M D)

1984-07-11

DATE RECEIVED (Y M D)

1984-07-26

DATE REPORTED (Y M D)

1984-07-30

ANALYST

S. Sargious

OTHER INFORMATION

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

Na

42 100 0.3617 1831.35

Cl

66 750 0.5735 1882.35

TOTAL SOLIDS  $\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

K

30 0.0003 0.77

Br

EVAPORATED @ 110°C  
132 200

EVAPORATED @ 180°C

Ca

2 643 0.0227 65.95

I

AT IGNITION  
107 900

CALCULATED  
116 383

Mg

267 0.0023 10.98

HCO<sub>3</sub>

305 0.0026 5.00

ORGANICS: TRACE

Ba

4 288 0.0369 44.60

SO<sub>4</sub>

0 0.0000 0.00

RELATIVE DENSITY @ 25°C  
1.078

REFRACTIVE INDEX @ 25°C  
1.3505

Sr

CO<sub>3</sub>

0 0.0000 0.00

OBSERVED pH  
7.7 @ 24°C

RESISTIVITY (Ω·m) @ 25°C  
0.070

Fe PRESENT

OH

0 0.0000 0.00

H<sub>2</sub>S NIL

REMARKS

Clear, colorless filtrate recovered from a sample containing a trace sediment and a trace of hydrocarbons.

LOGARITHMIC PATTERN  $c / mol \cdot m^{-3}$



Na

Cl

1/2 Ca

HCO<sub>3</sub>

1/2 Mg

1/2 SO<sub>4</sub>

1/2 Fe

1/2 CO<sub>3</sub>



# CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST. JOHN CALGARY



LABORATORY NUMBER

C84-6047-1

## WATER ANALYSIS

CONTAINER IDENTITY

LICENCE NUMBER

7-1-1-26 W1

FIELD OR AREA

Waskada

TEST TYPE NO

MULTIPLE RECOVERY Y N

Test Interval (metres)

Perforations (metres)

914 - 925

DATE SAMPLED (Y M D)

1984-07-23

DATE RECEIVED (Y M D)

1984-07-26

DATE REPORTED (Y M D)

1984-07-30

ANALYST

S. Sargious

OTHER INFORMATION

ION	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$	Mass Fraction	$\frac{c}{mol \cdot m^{-3}}$	ION	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$	Mass Fraction	$\frac{c}{mol \cdot m^{-3}}$
Na	41 000	0.3612	1783.50	Cl	65 500	0.5770	1847.10
K	30	0.0003	0.77	Br			
Ca	2 138	0.0188	53.35	I			
Mg	112	0.0010	4.61	HCO <sub>3</sub>	372	0.0033	6.10
Ba				SO <sub>4</sub>	4 362	0.0384	45.37
Sr				CO <sub>3</sub>	0	0.0000	0.00
Fe	PRESENT			OH	0	0.0000	0.00

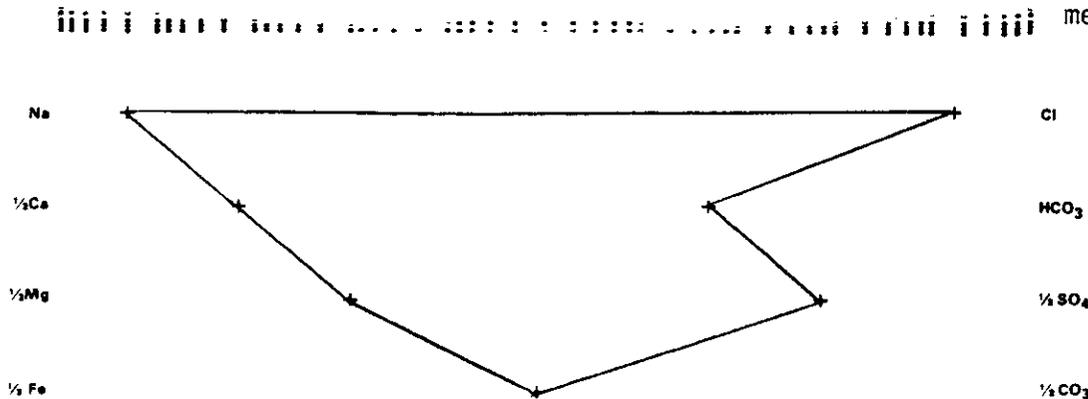
H<sub>2</sub>S NIL

TOTAL SOLIDS	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$
EVAPORATED @ 110°C	164 900
EVAPORATED @ 180°C	
AT IGNITION	104 600
CALCULATED	113 514
ORGANICS: TRACE	
RELATIVE DENSITY	1.073 @ 20°C
REFRACTIVE INDEX	1.3501 @ 20°C
OBSERVED pH	7.6 @ 24°C
RESISTIVITY (Ohm/cm)	0.069 @ 25°C

### REMARKS

Clear, colorless filtrate recovered from a sample containing a trace sediment.

### LOGARITHMIC PATTERN $c / mol \cdot m^{-3}$





CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST. JOHN CALGARY



WATER ANALYSIS

LABORATORY NUMBER

C84-6047-2

CONTAINER IDENTITY

OPERATOR NAME

CHEVRON CANADA RESOURCES LIMITED

1-1-1-26 W1

WELL NAME

Chevron Waskada 1-1-1-26

ELEVATIONS  
A.B. (IMPERIAL) GRD  
466.6 462

FIELD OR AREA  
Waskada

POOL OR ZONE  
Spearfish

NAME OF SAMPLER  
D. Spencer

TEST TYPE NO

TEST RECOVERY

MULTIPLE RECOVERY Y N

SAMPLING POINT

AMT. & TYPE OF CUSHION

MUD RESISTIVITY

Lease Production Tank

Test Interval (metres)

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

Perforations (metres)

WATER

m<sup>3</sup> d OIL

m<sup>3</sup> d GAS

10<sup>3</sup> m<sup>3</sup> d

SEPARATOR

TREATER

RESERVOIR

SOURCE

GAUGE PRESSURE

MPa

SEPARATOR

TREATER

RESERVOIR

SOURCE

918 - 930

TEMPERATURE °C

DATE SAMPLED (Y.M.D.)

DATE RECEIVED (Y.M.D.)

DATE REPORTED (Y.M.D.)

ANALYST

OTHER INFORMATION

1984-07-23

1984-07-26

1984-07-30

S. Sargious

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

ION

$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

Mass Fraction

$\frac{c}{mol \cdot m^{-3}}$

Na 42 100 0.3616 1831.35

Cl 66 250 0.5691 1868.25

TOTAL SOLIDS  $\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$

K 30 0.0003 0.77

Br

EVAPORATED @ 110°C  
145 900

EVAPORATED @ 180°C

Ca 2 042 0.0175 50.95

I

AT IGNITION  
104 700

CALCULATED  
116 415

Mg 1 191 0.0102 48.95

HCO<sub>3</sub>

366 0.0031 6.00

ORGANICS: TRACE

Ba

SO<sub>4</sub>

4 436 0.0382 46.14

RELATIVE DENSITY @ 25°C  
1.076

REFRACTIVE INDEX @ 25°C  
1.3504

Sr

CO<sub>3</sub>

0 0.0000 0.00

OBSERVED pH  
7.9 @ 24°C

RESISTIVITY (Ohm m)  
0.069 @ 25°C

Fe PRESENT

OH

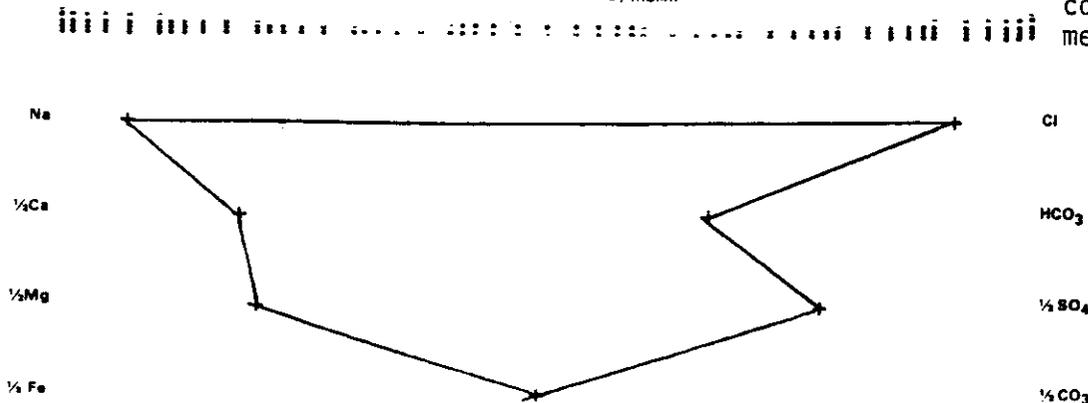
0 0.0000 0.00

H<sub>2</sub>S NIL

REMARKS

Clear, colorless filtrate recovered from a sample containing a trace sediment.

LOGARITHMIC PATTERN c/mol·m<sup>-3</sup>





CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON FORT ST. JOHN CALGARY



LABORATORY NUMBER

C84-6048

WATER ANALYSIS

CONTAINER IDENTITY

REFERENCE NUMBER

OPERATOR NAME

CHEVRON CANADA RESOURCES LIMITED

1-12-1-26 W1

Chevron Waskada 1-12-1-26

ELEVATIONS  
K.B. (m) test GRD 464  
468.3

FIELD OR AREA  
Waskada

POOL OR ZONE  
Spearfish

NAME OF SAMPLER  
D. Spencer

ELEVATIONS

K.B. (m) test GRD

464

468.3

COMPANY

TEST TYPE

NO

TEST RECOVERY

MULTIPLE  
RECOVERY

Y N

SAMPLING POINT

AMT. & TYPE OF CUSHION

MUD RESISTIVITY

Lease Production Tank

@ 25°C

Test Interval (metres)

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

WATER

m<sup>3</sup> d

OIL

m<sup>3</sup> d

GAS

10<sup>3</sup> m<sup>3</sup> d

SEPARATOR

TREATER

RESERVOIR

SOURCE

GAUGE PRESSURE

kPa

SEPARATOR

TREATER

RESERVOIR

SOURCE

TEMPERATURE

°C

DATE SAMPLED (Y-M-D)

DATE RECEIVED (Y-M-D)

DATE REPORTED (Y-M-D)

ANALYST

OTHER INFORMATION

1984-07-19

1984-07-26

1984-07-30

S. Sargious

ION	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$	Mass Fraction	$\frac{c}{mol \cdot m^{-3}}$
Na	39 300	0.3622	1709.55
K	25	0.0002	0.64
Ca	2 090	0.0193	52.15
Mg	335	0.0031	13.77

ION	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$	Mass Fraction	$\frac{c}{mol \cdot m^{-3}}$
Cl	62 250	0.5737	1755.45
Br			
I			
HCO <sub>3</sub>	287	0.0026	4.71
SO <sub>4</sub>	4 226	0.0389	43.95
CO <sub>3</sub>	0	0.0000	0.00
OH	0	0.0000	0.00

TOTAL SOLIDS	$\frac{m \cdot V^{-1}}{g \cdot m^{-3}}$
EVAPORATED @ 110°C	109 300
AT IGNITION	100 300
EVAPORATED @ 180°C	
CALCULATED	108 513

Ba			
Sr			
Fe	PRESENT		

SO <sub>4</sub>	4 226	0.0389	43.95
CO <sub>3</sub>	0	0.0000	0.00
OH	0	0.0000	0.00

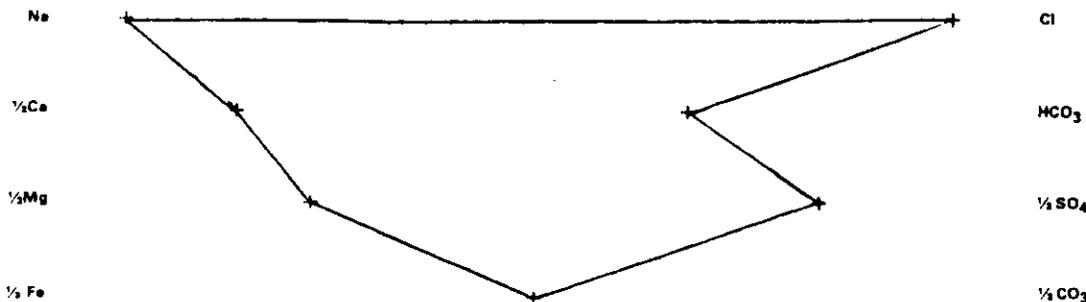
ORGANICS: TRACE	RELATIVE DENSITY @ 25°C	REFRACTIVE INDEX @ 25°C
	1.071	1.3494
OBSERVED pH	RESISTIVITY (ohm cm) @ 25°C	
8.0 @ 24°C	0.073	

H<sub>2</sub>S NIL

REMARKS

Clear, colorless filtrate recovered from a sample containing a trace sediment and a trace of hydrocarbons.

LOGARITHMIC PATTERN  $c/mol \cdot m^{-3}$



Special Core Analysis Study

for

OMEGA HYDROCARBONS LTD.

Omega Waskada 2-2-2-26 WIM  
Spearfish Formation  
Manitoba

## CORE LABORATORIES - CANADA, LTD.

LAB

1984 08 01

Omega Hydrocarbons Ltd.  
630, 330 - Fifth Avenue S.W.  
Calgary, Alberta  
T2P 0L4

Attention: Mr. Mark Mawdsley

Gentlemen:

SUBJECT: Liquid Permeability - Liquid Sensitivity  
Measurements  
Omega Waskada 2-2-2-26 W1M  
Our File Number: 7009-312-84-063

As requested by Mr. Mark Mawdsley in a telephone conversation with Mr. Jim Heather on June 19, 1984, Liquid Permeability - Liquid Sensitivity Measurements were performed on 3 core plugs from the Spearfish Formation of the subject well. Samples used in this study are lithologically described and identified as to sample number, depth interval, permeability to air, Boyle's Law porosity and grain density on page 1.

Cylindrical core plugs, 38 mm in diameter, were drilled from weathered, full diameter core pieces using 60 000 ppm T.D.S. brine as the bit lubricant and coolant. The brine was comprised of Sodium Chloride and Calcium Chloride. The core plugs were extracted with toluene to remove all hydrocarbons, leached of inorganic salts with methanol and dried in a vacuum oven at 85°C. Permeability to air, porosity and grain density values of samples used in this study are reported with the liquid permeability data.

Four simulated brines were prepared for use in this study. They are identified as 92 400 ppm T.D.S. brine synthesized from a water analysis of the Omega Waskada 7-25-1-25 W1M well, 183 745 ppm T.D.S. brine from Omega Waskada 16-13-1-26 W1M, 5 900 ppm T.D.S. brine from Omega Waskada 11-29-1-25 W1M and 114 339 ppm T.D.S. brine from the Omega Waskada 11-30-1-25 W1M well. The

Omega Hydrocarbons Ltd.

brines were synthesized in accordance with water analysis information received from Mr. Mark Mawdsley. The chemical constituents of the brines are presented on pages 2 through 8.

In preparation for Liquid Permeability - Liquid Sensitivity Measurements, 3 core plugs were evacuated and pressure saturated with 92 400 ppm T.D.S. simulated formation brine. Specific permeabilities to the saturant were measured and then permeabilities as a function of pore volume throughput were determined for the other simulated waters as indicated in the tabular data on pages 9 through 11. In all cases, the samples do not appear to have been significantly affected by the fluids tested.

Upon completion of Special Core Analysis testing, the 3 samples were forwarded to our Core Department for Klinkenberg Permeability Determination. Results of these tests will be reported under separate cover when available.

We appreciate the opportunity to be of service to Omega Hydrocarbons Ltd. Should you have any questions pertaining to these test results or if we may be of further assistance, please do not hesitate to contact us.

Yours truly,

CORE LABORATORIES-CANADA, LTD.

A handwritten signature in black ink, appearing to read "C. L. Hunt". The signature is written in a cursive style with a prominent initial "C" and a long, sweeping tail on the "t".

C. L. (Clay) Hunt

JH:jjm



# CORE LABORATORIES - CANADA LTD.

CALGARY, ALBERTA



PAGE 1 of 11  
FILE 7009-312-84-063

COMPANY Omega Hydrocarbons Ltd.  
WELL Omega Waskada 2-2-2-26  
LOCATION LSD 2-2-2-26 W1M

FORMATION Spearfish  
FIELD Waskada  
PROVINCE Manitoba

## IDENTIFICATION OF SAMPLES

<u>SAMPLE NUMBER</u>	<u>DEPTH METRES</u>	<u>PERMEABILITY MILLIDARCYs</u>	<u>POROSITY FRACTION</u>	<u>GRAIN DENSITY kg/m<sup>3</sup></u>	<u>LITHOLOGICAL DESCRIPTION</u>
3A	908.71	2.37	0.154	2710	SST: grysh tn, wl ind, vf gr, wl srt, sh, dol
15A	914.05	1.22	0.149	2700	SST: grysh olv, wl ind, vf-f gr, mod srt, sh, dol
43A	924.45	2.53	0.151	2720	SST: tn, wl ind, vf gr, wl srt, sh, dol



# CORE LABORATORIES - CANADA LTD.

CALGARY, ALBERTA



PAGE 2 of 11

FILE 7009-312-84-063

COMPANY Omega Hydrocarbons Ltd.  
 WELL Omega Waskada 2-2-2-26  
 LOCATION LSD 2-2-2-26 W1M

FORMATION Spearfish  
 FIELD Waskada  
 PROVINCE Manitoba

## SIMULATED BRINE COMPOSITION

<u>Constituents</u>	<u>Concentration, mg/L</u>
Sodium Chloride (NaCl)	72 355
Potassium Chloride (KCl)	547
Calcium Chloride (CaCl <sub>2</sub> )	2 769
Magnesium Chloride (MgCl <sub>2</sub> ·6H <sub>2</sub> O)	3 094
Sodium Bicarbonate (NaHCO <sub>3</sub> )	275
Sodium Sulphate (Na <sub>2</sub> SO <sub>4</sub> )	5 767

The brine composition was prepared from the following analysis:

COMPANY	Omega Hydrocarbons Ltd.	FORMATION	Spearfish
WELL	Omega Waskada 7-25-1-25	FIELD	Waskada
LOCATION	LSD 7-25-1-25 W1M	PROVINCE	Manitoba

<u>Constituent</u>	<u>Concentration, mg/L</u>	<u>Constituent</u>	<u>Concentration, mg/L</u>
Sodium	39 607	Chloride	47 000
Potassium	287	Sulphate	1 950
Calcium	950	Bicarbonate	54
Magnesium	740		

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Plastic  
 CONTAINER IDENTITY

WATER ANALYSIS

7009-312-84-063  
 7021-84-318  
 LABORATORY NUMBER

Omega Hydrocarbons Ltd.  
 OPERATOR

3 of 11  
 PAGE

16-13-1-26  
 LOCATION

WELL OR SAMPLE LOCATION NAME

KB ELEV. CRD. ELEV.

FIELD OR AREA

POOL OR ZONE

SAMPLER

TEST TYPE & NO.

TEST RECOVERY

Produced Water

POINT OF SAMPLE

AMT. & TYPE CUSHION

MUD RESISTIVITY @ °C

PUMPING

FLOWING

GAS LIFT

SWAB

WATER

m<sup>3</sup>/d

OIL

m<sup>3</sup>/d

GAS

m<sup>3</sup>/d

TEST INTERVALS OR PERFS.

SEPARATOR RESERVOIR

CONTAINER @ °C WHEN SAMPLED

CONTAINER @ °C WHEN RECEIVED

SEPARATOR

PRESSURES, kPa

TEMPERATURES, °C

84 04 11

84 04 13

LS

DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

ION	mg/L	mg Fraction	MEQ/L
Na	66200.	0.3603	2879.5
K	919.	0.0050	23.5
Ca	3311.	0.0180	165.2
Mg	1016.	0.0055	83.6
Ba			
Sr			
Fe	NOT DETECTED		

ION	mg/L	mg Fraction	MEQ/L
Cl	110434.	0.6010	3114.9
Br			
I			
HCO <sub>3</sub>	378.	0.0021	6.2
SO <sub>4</sub>	1488.	0.0081	31.0
CO <sub>3</sub>	0.	0.0000	0.0
OH	0.	0.0000	0.0
H <sub>2</sub> S		PRESENT	

TOTAL SOLIDS mg/L

BY EVAPORATION @ 110°C

BY EVAPORATION @ 180°C

183745.

AT IGNITION

CALCULATED

1.1250 @ 15.4°C

1.3616 @ 22.

SPECIFIC GRAVITY

REFRACTIVE INDEX

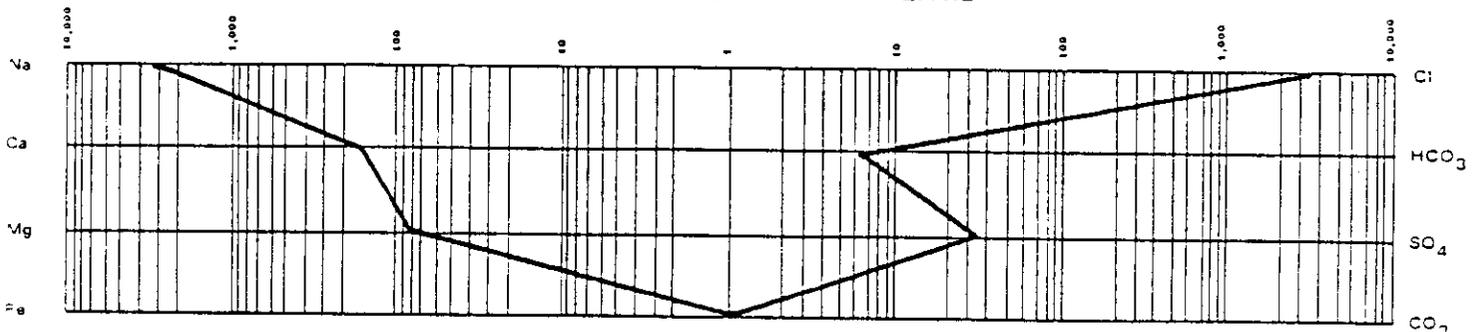
6.5

0.047

pH

RESISTIVITY (OHM/METERS) @ 25°C

LOGARITHMIC PATTERN MEQ PER LITRE



REMARKS NaCl equiv. 183576.



# CORE LABORATORIES - CANADA LTD.

CALGARY, ALBERTA



PAGE 4 of 11  
FILE 7009-312-84-063

COMPANY Omega Hydrocarbons Ltd.  
WELL Omega Waskada 16-13-1-26  
LOCATION LSD 16-13-1-26 W1M

FORMATION Spearfish  
FIELD Waskada  
PROVINCE Manitoba

## SIMULATED BRINE COMPOSITION

<u>Constituents</u>	<u>Concentration, mg/L</u>
Sodium Chloride (NaCl)	166 136
Potassium Chloride (KCl)	1 752
Calcium Chloride (CaCl <sub>2</sub> )	9 168
Magnesium Chloride (MgCl <sub>2</sub> ·6H <sub>2</sub> O)	8 496
Sodium Bicarbonate (NaHCO <sub>3</sub> )	520
Sodium Sulphate (Na <sub>2</sub> SO <sub>4</sub> )	2 200



WATER ANALYSIS

7009-312-84-063  
7021-84-318  
LABORATORY NUMBER

Plastic  
CONTAINER IDENTITY

Omega Hydrocarbons Ltd.  
OPERATOR

5 of 11  
PAGE

11-29-1-25  
LOCATION

WELL OR SAMPLE LOCATION NAME

KB ELEV. GRO. ELEV.

FIELD OF AREA

POOL OR ZONE

SAMPLER

TEST TYPE & NO.

TEST RECOVERY

Produced Water

POINT OF SAMPLE

AMY. & TYPE CUSHION

MUD RESISTIVITY @ °C

PUMPING

FLOWING

GAS LIFT

SWAB

WATER

m<sup>3</sup>/d

OIL

m<sup>3</sup>/d

GAS

m<sup>3</sup>/d

TEST INTERVALS OR PERFS.

SEPARATOR RESERVOIR

CONTAINER WHEN SAMPLED @ °C

CONTAINER WHEN RECEIVED @ °C

SEPARATOR

PRESSURES, kPa

TEMPERATURES, °C

84 04 11

84 04 13

LS

DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

ION	mg/L	mg Fraction	MEQ/L
Na	2092.	0.3545	91.0
K	9.	0.0015	0.2
Ca	20.	0.0034	1.0
Mg	1.	0.0002	0.1
Ba			
Sr			
Fe		TRACE	

ION	mg/L	mg Fraction	MEQ/L
Cl	2393.	0.4056	67.5
Br			
I			
HCO <sub>3</sub>	1212.	0.2055	19.9
SO <sub>4</sub>	172.	0.0292	3.6
CO <sub>3</sub>	0.	0.0000	0.0
OH	0.	0.0000	0.0
H <sub>2</sub> S		NOT DETECTED	

TOTAL SOLIDS mg/L

BY EVAPORATION @ 110°C

BY EVAPORATION @ 100°C

5900.

AT IGNITION

CALCULATED

1.0035 @ 15.4°C

1.3324 @ 22.

SPECIFIC GRAVITY

REFRACTIVE INDEX

8.2

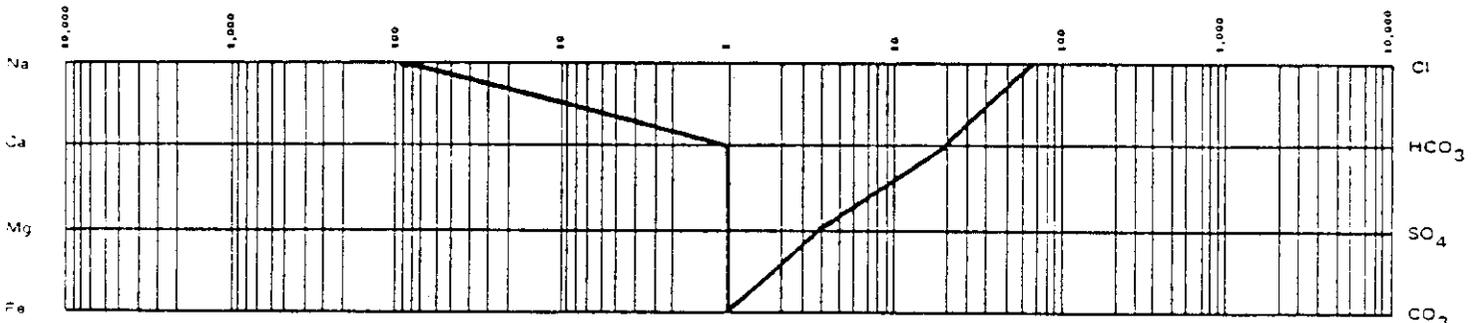
1.150

@ 25°C

pH

RESISTIVITY (OHM/METERS)

LOGARITHMIC PATTERN MEQ PER LITRE



REMARKS

NaCl equiv. 4929.



# CORE LABORATORIES - CANADA LTD.

CALGARY, ALBERTA



PAGE 6 of 11

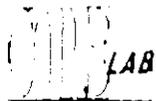
FILE 7009-312-84-063

COMPANY Omega Hydrocarbons Ltd.  
WELL Omega Waskada 11-29-1-25  
LOCATION LSD 11-29-1-25 W1M

FORMATION Spearfish  
FIELD Waskada  
PROVINCE Manitoba

## SIMULATED BRINE COMPOSITION

<u>Constituents</u>	<u>Concentration, mg/L</u>
Sodium Chloride (NaCl)	3 868
Potassium Chloride (KCl)	17
Calcium Chloride (CaCl <sub>2</sub> )	55
Magnesium Chloride (MgCl <sub>2</sub> ·6H <sub>2</sub> O)	8
Sodium Bicarbonate (NaHCO <sub>3</sub> )	1 669
Sodium Sulphate (Na <sub>2</sub> SO <sub>4</sub> )	254



CORE LABORATORIES - CANADA LTD.  
Petroleum Reservoir Engineering  
CALGARY ALBERTA



WATER ANALYSIS

7009-312-84-063  
7021-84-318

Plastic

CONTAINER IDENTITY

LABORATORY NUMBER

7 of 11

Omega Hydrocarbons Ltd.

OPERATOR

PAGE

11-30-1-25

LOCATION

WELL OR SAMPLE LOCATION NAME

KB ELEV.

GRD. ELEV.

FIELD OR AREA

POOL OR ZONE

SAMPLER

TEST TYPE & NO.

TEST RECOVERY

Injection Water

POINT OF SAMPLE

AMT. & TYPE CUSHION

@

°C

MUD RESISTIVITY

PUMPING

FLOWING

GAS LIFT

SWAB

WATER

m<sup>3</sup>/d

OIL

m<sup>3</sup>/d

GAS

m<sup>3</sup>/d

TEST INTERVALS OR PERFS.

SEPARATOR RESERVOIR

@ °C

CONTAINER WHEN SAMPLED

@ °C

CONTAINER WHEN RECEIVED

SEPARATOR

PRESSURES, kPa

TEMPERATURES, °C

84 04 11

84 04 13

LS

DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

ION	mg/L	mg Fraction	MEQ/L
Na	41000.	0.3586	1783.4
K	313.	0.0027	8.0
Ca	2364.	0.0207	118.0
Mg	575.	0.0050	47.3
Ba			
Sr			
Fe	NOT DETECTED		

ION	mg/L	mg Fraction	MEQ/L
Cl	66801.	0.5842	1884.2
Br			
I			
HCO <sub>3</sub>	371.	0.0032	6.1
SO <sub>4</sub>	2916.	0.0255	60.7
CO <sub>3</sub>	0.	0.0000	0.0
OH	0.	0.0000	0.0
H <sub>2</sub> S		PRESENT	

TOTAL SOLIDS mg/L

BY EVAPORATION @ 110°C

BY EVAPORATION @ 100°C

114339.

AT IGNITION

CALCULATED

1.0790 @ 15.4°C

1.3506 @ 22.

SPECIFIC GRAVITY

REFRACTIVE INDEX

7.2

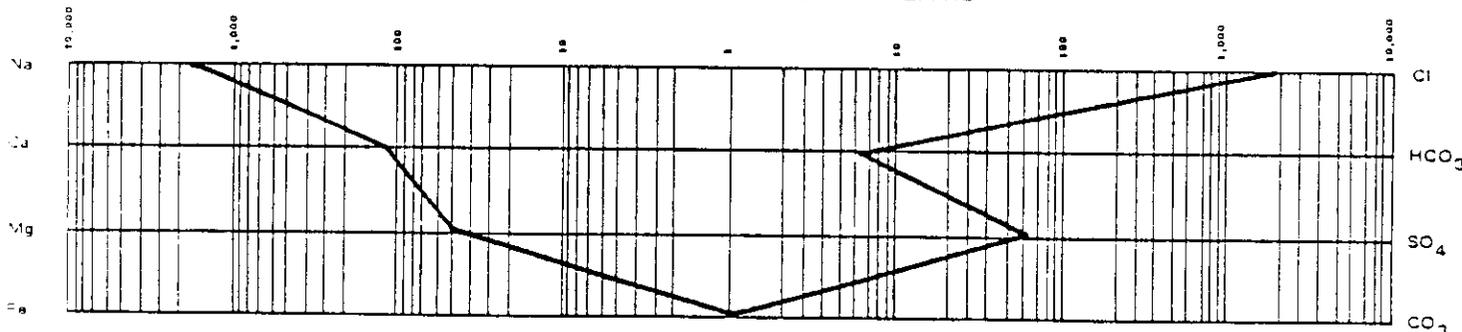
0.070

@ 25°C

pH

RESISTIVITY (OHM/METERS)

LOGARITHMIC PATTERN MEQ PER LITRE



REMARKS

NaCl equiv. 113068.



# CORE LABORATORIES - CANADA LTD.

CALGARY, ALBERTA



PAGE 8 of 11

FILE 7009-312-84-063

COMPANY Omega Hydrocarbons Ltd.

WELL Omega Waskada 11-30-1-25

LOCATION LSD 11-30-1-25 W1M

FORMATION Spearfish

FIELD Waskada

PROVINCE Manitoba

## SIMULATED BRINE COMPOSITION

### Constituents

### Concentration, mg/L

Sodium Chloride (NaCl)	99 995
Potassium Chloride (KCl)	597
Calcium Chloride (CaCl <sub>2</sub> )	6 546
Magnesium Chloride (MgCl <sub>2</sub> ·6H <sub>2</sub> O)	4 808
Sodium Bicarbonate (NaHCO <sub>3</sub> )	511
Sodium Sulphate (Na <sub>2</sub> SO <sub>4</sub> )	4 312

These analyses, opinions or interpretations are based on observations and material supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories - Canada Ltd. (all errors and omissions excepted) but Core Laboratories - Canada Ltd. and its officers and employees, assume no responsibility and make no warranty or representations as to the productivity, proper operation, or profitability of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

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LIQUID PERMEABILITY MILLIDARCYS	THROUGHPUT PORE VOLUME	LIQUID/AIR PERMEABILITY RATIO
0.18	1.06	0.076
0.16	2.65	0.068
0.16	5.30	0.068
0.16	7.94	0.068
0.16	10.6	0.068
0.17	Reverse	0.072

183 745 ppm T.D.S. Simulated Formation Brine

92 400 ppm T.D.S. Simulated Formation Brine

POROSITY FRACTION: 0.154  
AIR PERMEABILITY, md: 2.37  
GRAIN DENSITY, kg/m<sup>3</sup>: 2710

LIQUID PERMEABILITY DATA  
Sample Number: 3A

COMPANY	Omega Hydrocarbons Ltd.	FORMATION	Spartfish
WELL	Omega Waskada 2-2-26	FIELD	Waskada
LOCATION	LSD 2-2-26 W1M	PROVINCE	Manitoba
PAGE	9 of 11	FILE	7009-312-84-063





# CORE LABORATORIES - CANADA LTD.

CALGARY, ALBERTA



PAGE 10 of 11

FILE 7009-312-84-063

COMPANY Omega Hydrocarbons Ltd.  
 WELL Omega Waskada 2-2-2-26  
 LOCATION LSD 2-2-2-26 WIM

FORMATION Spearfish  
 FIELD Waskada  
 PROVINCE Manitoba

### LIQUID PERMEABILITY DATA

Sample Number: 15A

POROSITY, FRACTION: 0.149  
 AIR PERMEABILITY, mD: 1.22  
 GRAIN DENSITY, kg/m<sup>3</sup>: 2700

<u>LIQUID PERMEABILITY MILLIDARCYS</u>	<u>THROUGHPUT PORE VOLUME</u>	<u>LIQUID/AIR PERMEABILITY RATIO</u>
92 400 ppm T.D.S. Simulated Formation Brine		
0.13	0.83	0.107
5 900 ppm T.D.S. Simulated Formation Brine		
0.12	0.83	0.098
0.12	2.07	0.098
0.12	4.14	0.098
0.12	6.21	0.098
0.12	8.29	0.098
0.12	10.4	0.098
0.12	Reverse	0.098

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# CORE LABORATORIES - CANADA LTD.

CALGARY, ALBERTA



PAGE 11 of 11

FILE 7009-312-84-063

COMPANY Omega Hydrocarbons Ltd.  
 WELL Omega Waskada 2-2-2-26  
 LOCATION LSD 2-2-2-26 W1M

FORMATION Spearfish  
 FIELD Waskada  
 PROVINCE Manitoba

### LIQUID PERMEABILITY DATA

Sample Number: 43A

POROSITY, FRACTION: 0.151  
 AIR PERMEABILITY, mD: 2.53  
 GRAIN DENSITY, kg/m<sup>3</sup>: 2720

<u>LIQUID PERMEABILITY MILLIDARCYS</u>	<u>THROUGHPUT PORE VOLUME</u>	<u>LIQUID/AIR PERMEABILITY RATIO</u>
92 400 ppm T.D.S. Simulated Formation Brine		
0.03	0.91	0.012
114 339 ppm T.D.S. Simulated Formation Brine		
0.02	0.91	0.008
0.02	1.82	0.008
0.02	3.64	0.008
0.02	5.14	0.008
0.02	9.10	0.008
0.02	Reverse	0.008

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August 16, 1984

Chevron Canada Resources Limited  
500 - 5th Avenue S.W.  
Calgary, Alberta  
T2P 0L7

Sasko Oil & Gas Ltd.  
574, 330 - 5th Avenue S.W.  
Calgary, Alberta  
T2P 0L4

Attention: Mr. Stan Borowski

Attention: Mr. Jeff Ross

Gentlemen:

Re: Waskada Unit No. 5  
Special Core Study Results

I have enclosed Core Lab's Klinkenberg Air Permeability test results from the 2-2-2-26 WPM well. After the Water Suitability Testing (Core Lab File No. 7009 - 312 - 84 - 063), the same core plugs were cleaned and dried and tested at one overburden pressure in an unsteady-state permeometer. This report completes the requirements described in AFE No. 84-139 Revision No. 1. As before Rex's copy will be withheld pending their approval of the AFE.

Should there be any questions or comments regarding this testing, please contact the undersigned at 261-0743.

Yours truly,

OMEGA HYDROCARBONS LTD.

  
D. Mark Mawdsley  
Engineer

cc Land Dept

DMM/tt

CORE LABORATORIES-CANADA LTD.



1984 08 08

Omega Hydrocarbons Ltd.  
630, 330 - Fifth Avenue S.W.  
Calgary, Alberta

Attention: Mr. Mark Mawdsley

Dear Sir:

Subject: Omega Waskada 2-2-2-26 W1M

We are pleased to submit the requested Klinkenberg Air Permeability Study from the subject well. Suitable selected samples were extracted with cold toluene to remove all hydrocarbons, leached of salt with methanol and dried in a gravity oven at 132°C. Routine air permeabilities and helium porosities were determined and are reported in the tabular data. The samples were confined at a net overburden pressure of 13 445 kPa and the klinkenberg air permeability was measured by the non-steady state method. The measurements are reported as follows:

Page 1: Logarithmic plot of air permeability versus klinkenberg corrected air permeability.

This plot may be used to obtain a klinkenberg corrected permeability value for a given air permeability from the subject well, provided additional samples are taken to represent a wider permeability range.

Page 2: Summary of permeability data.

The measured and plotted values from page one are presented in tabular form for easy reference.

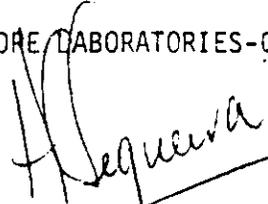
.../2

1984 08 08  
Mr. Mark Mawdsley  
Page 2

Thank you for the opportunity to be of service. Should you have any questions pertaining to these test results or if we may be of further assistance, please do not hesitate to contact us.

Yours truly,

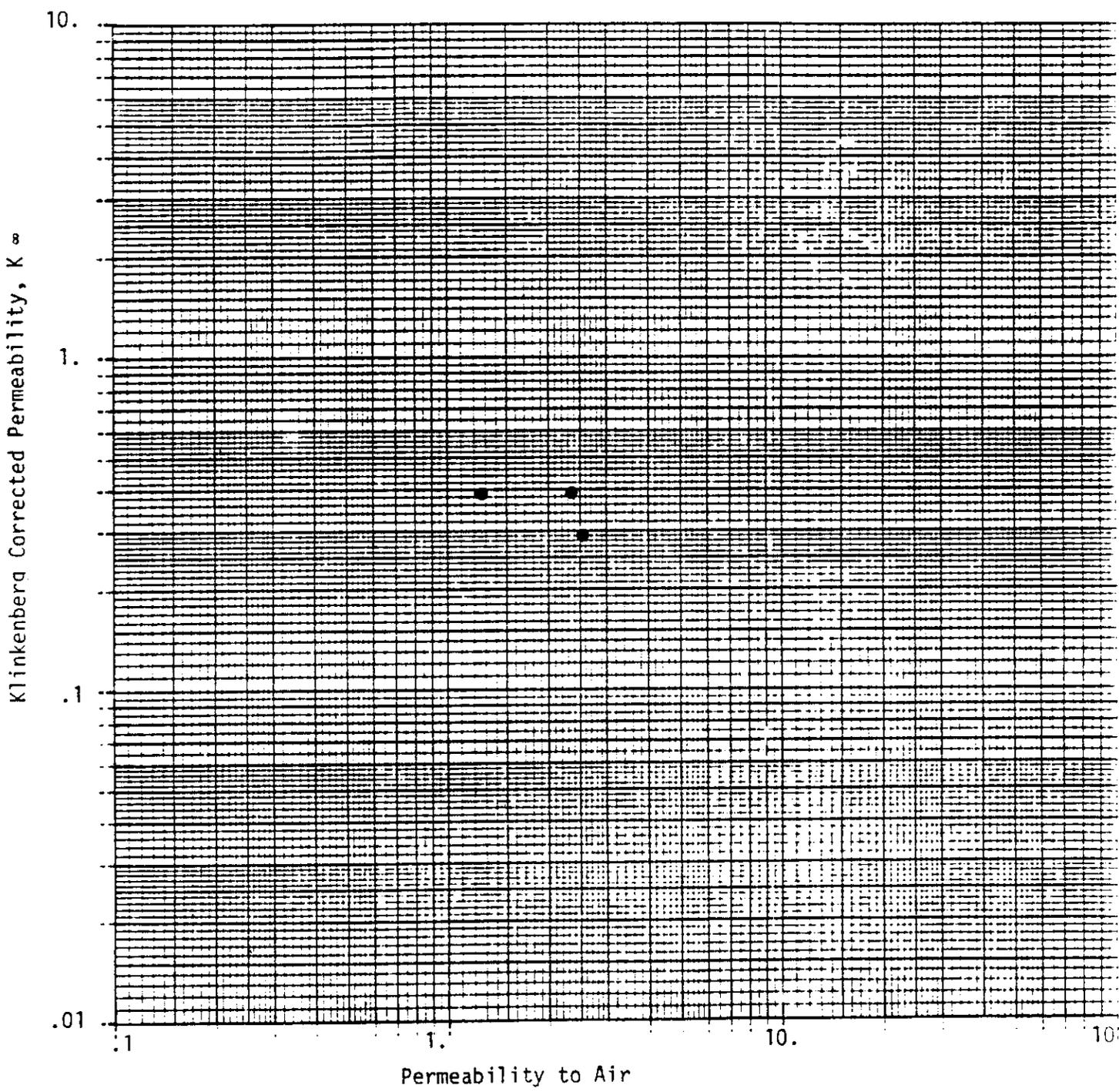
CORE LABORATORIES-CANADA, LTD.

  
for Olaf Karbinski  
Manager, Core Analysis

OK:sb  
attached

COMPANY Omega Hydrocarbons Ltd.  
WELL Omega Waskada 2-2-2-26  
LOCATION LSD 2-2-2-26 W1M

FORMATION Spearfish  
FIELD Waskada  
PROVINCE Manitoba





# CORE LABORATORIES - CANADA LTD.

CALGARY, ALBERTA



PAGE 2 of 2

FILE 7004-83-849

COMPANY Omega Hydrocarbons Ltd.

FORMATION Spearfish

WELL Omega Waskada 2-2-2-26

FIELD Waskada

LOCATION LSD 2-2-2-26 W1M

PROVINCE Manitoba

## Summary of Permeability Data

<u>Sample Number</u>	<u>Porosity, Fraction of Pore Volume</u>	<u>Net Overburden Pressure, kPa</u>	<u>Reciprocal of the Mean Pressure Atmospheres<sup>-1</sup></u>	<u>Air Permeability Millidarcies</u>
3	0.153	-	-	2.37
		13 445	∞	0.390 *
15	0.149	-	-	1.22
		13 445	∞	0.397 *
43	0.151	-	-	2.53
		13 445	∞	0.287 *

\* Klinkenberg Air Permeability Measured by the Non-Steady State Method

A P P E N D I X D

T A B L E 1  
WASKADA FIELD  
LOWER AMARANTH POOL

SUMMARY OF 1984 PRESSURE SURVEY RESULTS

Page 1 of 3

WELL	SURVEY DATES	TYPE OF SURVEY	TIME & DATE OF SHUT-IN	DEPTH OF MPP (m CF)	DATUM DEPTH (m CF)	RESERVOIR PRESSURE AT MPP (kPa)	RESERVOIR PRESSURE AT DATUM (kPa)	Permeability (mD)	Oil	Water	Gas	SKIN FACTOR
Newscope												
5-7LAM-1-25WPM	04-17 to 04-30	AWS-BU	10:20 1984-04-17	916.5	905.8	6713	6633	378.7	272.2	-	-	-7.48
Newscope												
11-7LAM-1-25WPM	04-17 to 04-30	AWS-BU	10:30 1984-04-17	922.5	904.3	5985*	5849 @ 312.0 hours shut-in.					
Newscope												
12-7LAM-1-25WPM	03-21 to 04-01	AWS-BU	11:32 1984-03-21	915.3	906.0	6169	6100	147.8	45.7	-	-	-4.95
Newscope												
13-7LAM-1-25WPM	04-18 to 04-30	AWS-BU	10:45 1984-04-18	915.5	905.8	6034	5963	42.0	52.2	-	-	-7.14
Newscope												
14-7LAM-1-25WPM	04-18 to 04-30	AWS-BU	11:20 1984-04-18	910.6	904.2	7666	7622	15.0	9.3	-	-	-4.74
Chevron												
3-18LAM-1-25WPM	03-23 to 03-26	SSR-BU	16:00 1984-03-23	917.5	907.5	5833 (final 2 points extrapolated)						
Chevron												
4-18LAM-1-25WPM	03-23 to 04-09	AWS-BU	10:37 1984-03-23	913.8	908.8	3832*	3798 @ 411.13 hours shut-in.					
Chevron												
5-18LAM-1-25WPM	03-23 to 04-19	AWS-BU	1250 1984-03-23	913.8	909.1	3233*	3201 @ 646.12 hours shut-in.					

\* Data is of insufficient quality or duration for extrapolation. Pressure shown is the last calculated or recorded pressure.

KEY TO ABBREVIATIONS

AWS Acoustic Well Sounder  
 BU Buildup Survey  
 FO Fall-off Survey  
 MBH Matthews-Brons-Hazebroek Average Pressure  
 SSR Subsurface Pressure Recorders  
 SR Surface Recorder  
 S Static Survey

Pool Datum 440 m SS

T A B L E 1  
WASKADA FIELD  
LOWER AMARANTH POOL  
SUMMARY OF 1984 PRESSURE SURVEY RESULTS

WELL	SURVEY DATES	TYPE OF SURVEY	TIME & DATE OF SHUT-IN	DEPTH OF MPP (m CF)	DATUM DEPTH (m CF)	RESERVOIR PRESSURE AT MPP (kPa)	RESERVOIR PRESSURE AT DATUM (kPa)	Permeability (mD)		SKIN FACTOR
								Oil	Water	
Chevron 6-18LAM-1-25WPM	03-23 to 04-19	AWS-BU	09:03 1984-03-23	912.4	908.0	3586*	3556 @ 649.70 hours shut-in.	-	-	-
Chevron 1-1LAM-1-26WPM	03-23 to 04-19	AWS-BU	09:45 1984-03-23	919.9	902.5	6610	6480	2.3	13.8	-5.94
Chevron 7-1LAM-1-26WPM	03-23 to 04-19	AWS-BU	11:55 1984-03-23	915.4	903.7	6755	6668	1.9	7.0	-6.39
Chevron 10-1LAM-1-26WPM	03-28 to 04-16	AWS-BU	11:05 1984-03-28	916.1	905.0	3210*	3133 @ 456.0 hours shut-in.	-	-	-
Chevron 16-1LAM-1-26WPM	03-24 to 04-09	AWS-BU	11:03 1984-03-24	915.0	905.3	4825	4758	14.3	1.7	-3.65
Chevron 1-12LAM-1-26WPM	03-25 to 04-05	SSR-BU	06:00 1984-03-25	914.1	-	2908*	@ 261.5 hours shut-in.	-	-	-
Chevron 5-12LAM-1-26WPM	03-24 to 04-01	AWS-BU	13:25 1984-03-24	927.6	908.1	8822	8676	2.4	18.2	-6.06
Chevron 7-12LAM-1-26WPM	04-01 to 04-16	AWS-BU	11:11 1984-04-01	913.1	905.4	2571*	2518 @ 359.32 hours shut-in.	-	-	-

\* Data is of insufficient quality or duration for extrapolation. Pressure shown is the last calculated or recorded pressure.

KEY TO ABBREVIATIONS

- AWS Acoustic Well Sounder
- BU Buildup Survey
- FO Fall-off Survey
- MBH Matthews-Brons-Hazebroek Average Pressure
- SSR Subsurface Pressure Recorders
- SR Surface Recorder
- S Static Survey

Pool Datum 440 m SS

T A B L E 1  
WASKADA FIELD  
LOWER AMARANTH POOL  
SUMMARY OF 1984 PRESSURE SURVEY RESULTS

WELL	SURVEY DATES	TYPE OF SURVEY	TIME & DATE OF SHUT-IN	DEPTH OF MPP (m CF)	DATUM DEPTH (m CF)	RESERVOIR PRESSURE AT MPP (kPa)	RESERVOIR PRESSURE AT DATUM (kPa)	Permeability (mD)		SKIN FACTOR
								Oil	Water Gas	
Chevron										
8-12LAM-1-26WPM	03-28 to 04-16	AWS-BU	10:55 1984-03-28	912.4	905.4	1836*	1788 @ 455.83 hours shut-in.			
Newscope										
9-12LAM-1-26WPM	03-25 to 04-05	SSR-BU	11:00 1984-03-25	912.4	-	6185	-	26.0	7.7	-6.88
Newscope										
16-12LAM-1-26WPM	03-22 to 04-01	AWS-BU	10:07 1984-03-22	911.0	906.1	5088*	5054 @ 239.68 hours shut-in.			

\*Data is of insufficient quality or duration for extrapolation. Pressure shown is the last calculated or recorded pressure.

KEY TO ABBREVIATIONS

- AWS Acoustic Well Sounder
- BU Buildup Survey
- FO Fall-off Survey
- MBH Matthews-Brons-Hazebroek Average Pressure
- SSR Subsurface Pressure Recorders
- SR Surface Recorder
- S Static Survey

Pool Datum 440 m SS

## APPENDIX E

Water Disposal At  
Newscope et al Waskada SWD 10-7-1-25

<u>Date</u>	<u>Water Disposed m<sup>3</sup></u>	<u>Wellhead Pressure kPa</u>
1984-08-21	159.0	10
1984-08-22	204.8	10
1984-08-23	202.9	10
1984-08-24	205.0	10
1984-08-25	205.0	10
1984-08-26	203.2	10
1984-08-27	144.7	10
1984-08-28	181.0	10
1984-08-29	192.0	10
1984-08-30	191.0	10
1984-08-31	193.0	10
1984-09-01	204.0	10
1984-09-02	<u>203.0</u>	<u>10</u>
Average	191.4	10

→ *bb*  
*file*

November 13, 1984

**Chevron Canada Resources Limited**  
300 - 5th Avenue S.W.  
Calgary, Alberta  
T2P 0G7

**Attention: Mr. R. A. Filgate, P. Eng.**  
**Supervising Engineer, Reservoir**

**Dear Sir:**

**Re: Waskada Lower Amaranth A Pool**  
**Waterflood Possibility**

This will acknowledge receipt of your Waskada Lower Amaranth Waterflood Development Status Report dated October 12, 1984.

As noted in its letter of September 7, 1984, the Board is concerned over the limited amount of progress on this project and specifically in the delay of planned commencement of injection to June 1, 1985.

In the Board's September 7th letter, it was pointed out that a delay in injection could jeopardize recoverable reserves. A review of reservoir pressure data obtained in the spring of 1984 confirms that pressures have dropped substantially from initial levels and that the reservoir pressure in part of the reservoir in this area appears to have dropped below the bubble point. Consequently, the Board has concluded that there is increased urgency in the need to initiate pressure maintenance operations and therefore finds your proposed schedule for implementing the project to be unsatisfactory.

You are directed to proceed with this project as quickly as possible and to submit a comprehensive application for approval of waterflood operations prior to December 1, 1984.

Yours sincerely

**THE OIL AND NATURAL GAS**  
**CONSERVATION BOARD**

cc: J. F. Rodgwell  
Petroleum Branch

ORIGINAL SIGNED TO  
IAN HUGHES

**Ian Hugh**  
**Deputy Chairman**



BCM/IN/bb



## Inter-Departmental Memo

Date November 7, 1984

To H. Clare Moster

From Bob Dubreuil

Telephone

Subject Re: Waskada Lower Amaranth A Pool Chevron/Newscope Area - Pressure Maintenance

A review of pressure and production performance has been made for wells in the southern part of the Waskada Lower Amaranth A Pool. The review was undertaken to determine whether Chevron's current schedule to initiate pressure maintenance in the area in June 1985 was satisfactory.

CONCLUSIONS:

- 1) A portion of the Waskada Lower Amaranth A Pool that is operated by Chevron/Newscope was below the bubble point in the spring of 1984.
- 2) The stabilized production observed over the last few months may be reflecting production below the bubble point by solution gas drive or recompletion of wells into the subject pool.
- 3) Although there may be partial aquifer support in the extreme part of this area, this does not appear to be very effective.
- 4) Pressure maintenance operations should be commenced as soon as possible. A draft of a letter to Chevron is attached.

DISCUSSION:

Table 1 is a summary of results derived from subsurface pressure surveys conducted in the spring of 1984 in the Waskada Unit No. 4 area and the area in the south part of the pool operated by Chevron and Newscope.

Map No. 1 shows the average reservoir pressures ( $\bar{p}$ ) for the various wells surveyed. This map indicates that a significant portion of Unit 4 and some areas in the Chevron/Newscope area had reservoir pressures below the bubble point (4 220 kPa based on PVT sample obtained at 8-26-1-26 (WPM)).

Chevron has provided a plot of average well production which indicates producing rates have stabilized. It is noted however that observed production rate declines demonstrate a levelling trend when pressures fall below the bubble point and this may be a contributing factor to the observed rate stabilization. Another factor which may affect the average rate per well is the recompletion of a number of wells from the Mississippian to the Lower Amaranth. As has been observed in most Lower Amaranth completions, initial rates are normally quite high but decline rapidly.

LRD/sb  
Att:

First Fold

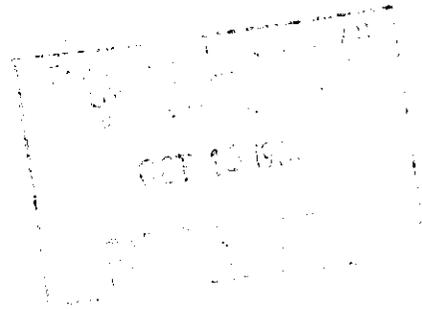


**Chevron Canada Resources Limited**

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

R. L. Barley  
Chief Engineer

1984-10-12



Waskada Lower Amaranth Waterflood  
Development Status Report

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

Attention: Mr. Ian Haugh

Gentlemen:

The following Waskada Lower Amaranth Waterflood Development Status Report is for the period 1984-08 and 1984-09:

1. Updated production plots for the Chevron/Newscope wells are attached as Figures 1, 2, and 3. Figure 1 indicates that the oil rate is stabilizing.
2. The geologic cross sections have been completed.
3. The economic evaluation has been completed along with a draft of the waterflood application. A copy of the draft was sent to Newscope Resources on 1984-10-11.
4. Attached as Figure 4 is a revised Waterflood Development Timetable.
5. Unitization negotiations will begin during 1984-10 and water injection is expected to commence in 1985-06.
6. Several activities listed on the original development timetable have been completed. They are:
  - (a) Agreement with Newscope for Chevron to coordinate reservoir pressure survey.
  - (b) Submit development plans to Manitoba Petroleum Branch.
  - (c) Preliminary evaluation of waterflood.
  - (d) Evaluate water at compatibility.
  - (e) Gather pressure data and evaluate (pressure survey results forwarded to Petroleum Branch during 1984-09).
  - (f) Determine economic feasibility.

7. The proposed water injection locations have also been changed. The new proposed locations are:

5- 7LAM-1 - 25 WPM  
13- 7LAM-1 - 25 WPM  
5-18- 1 - 25 WPM  
7- 1- 1 - 26 WPM  
15- 1- 1 - 26 WPM  
5-12- 1 - 26 WPM  
7-12- 1 - 26 WPM  
5-12LAM 1 - 26 WPM

These locations will maintain pattern continuity with Waskada Unit 1.

8. Plans are being developed to install flowlines and temporary batteries for the E-1/2 of Section 1 and the SE-1/4 of Section 12 before winter.

Any questions regarding the Status Report should be addressed to Cal Folden at (204) 748-1334 in Virden, or Doug Schierman at (403) 234-5167.

Yours truly,



for

R. A. FILGATE, P.Eng.  
Supervising Engineer  
Reservoir

DNS/lgs  
Attach.

cc: Newscope Resources Limited

FIGURE 1

# WASKADA SPEARFISH UNIT NO. 6

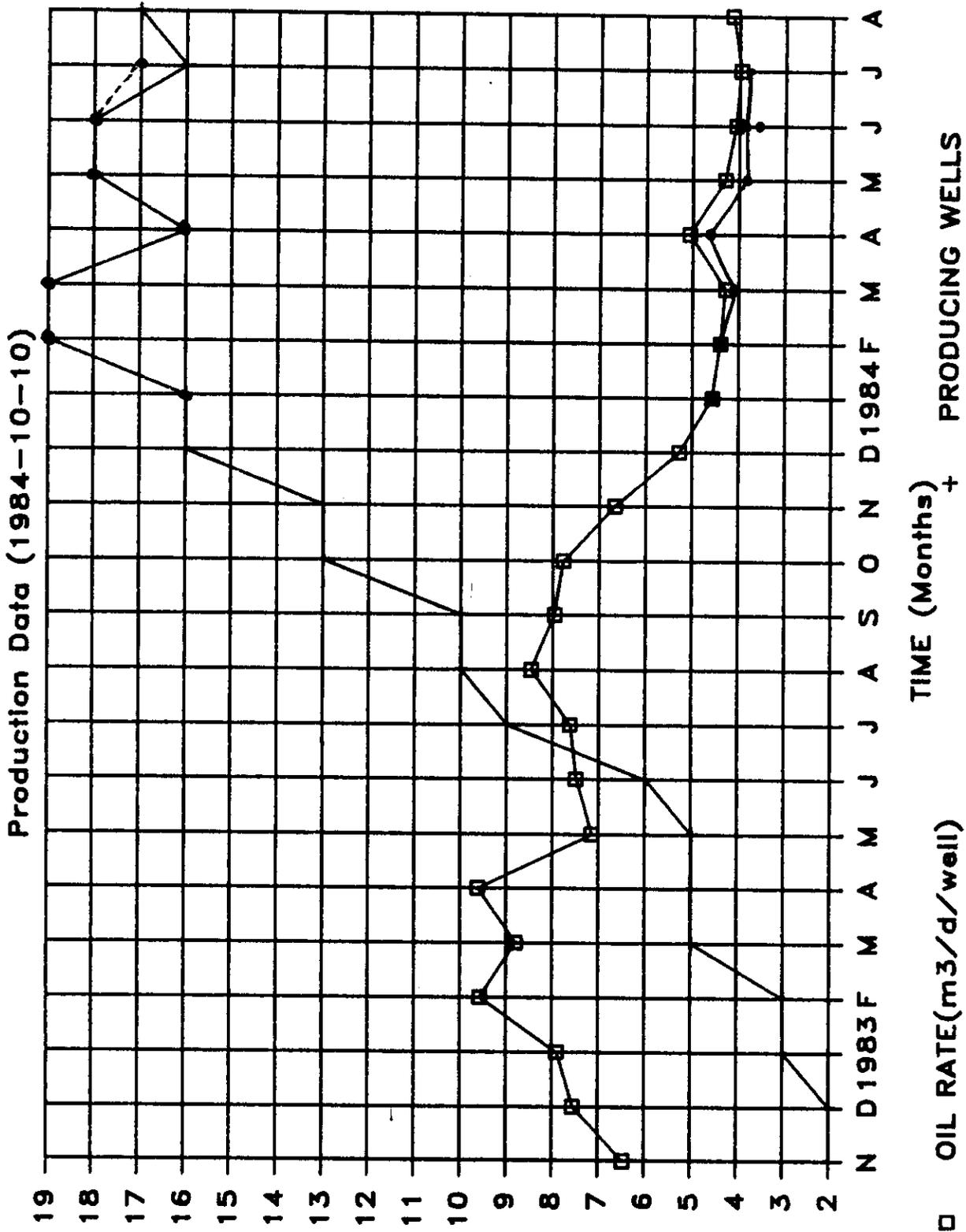


FIGURE 2

# WASKADA SPEARFISH UNIT NO. 6

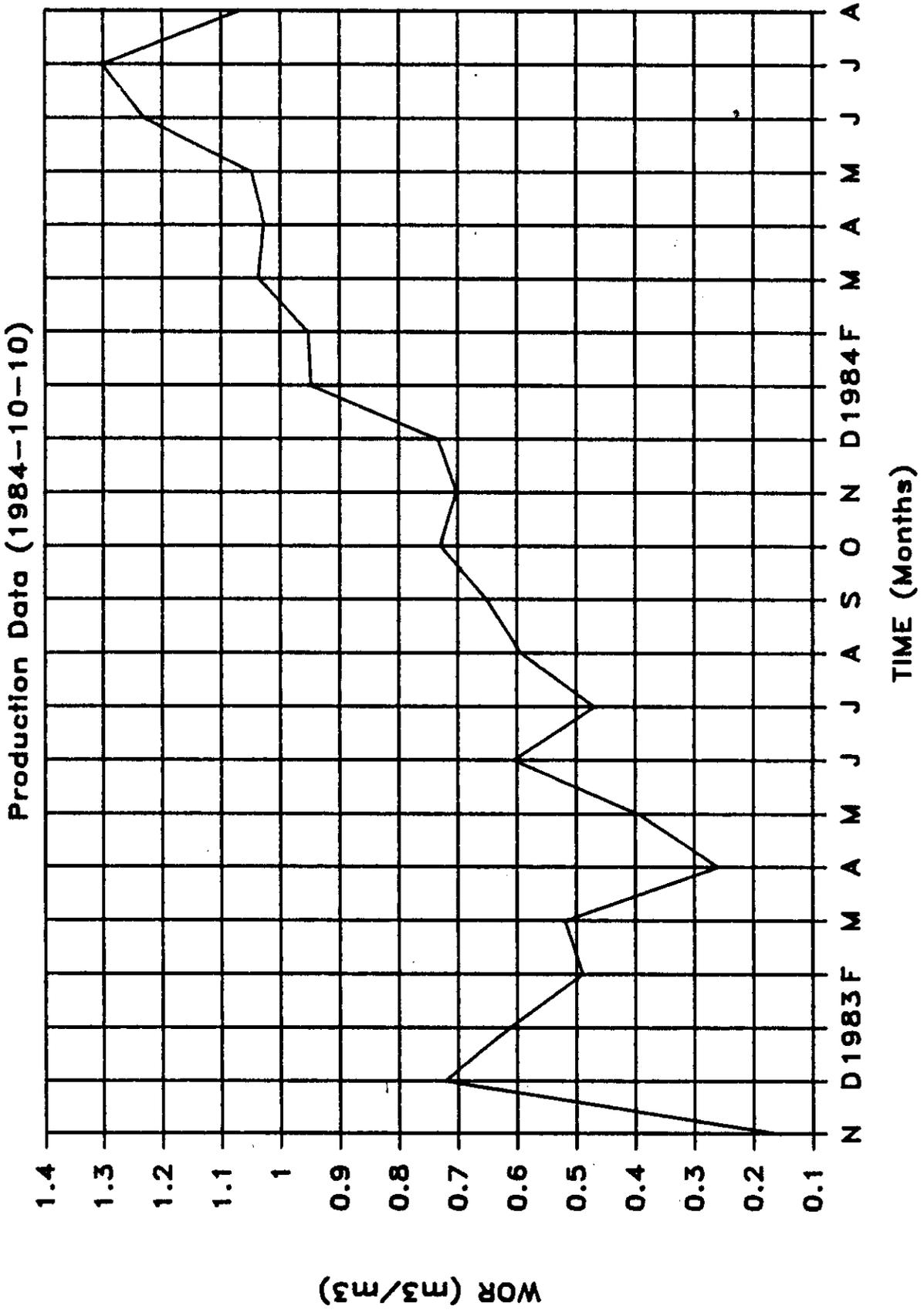


FIGURE 3

# WASKADA SPEARFISH UNIT NO. 6

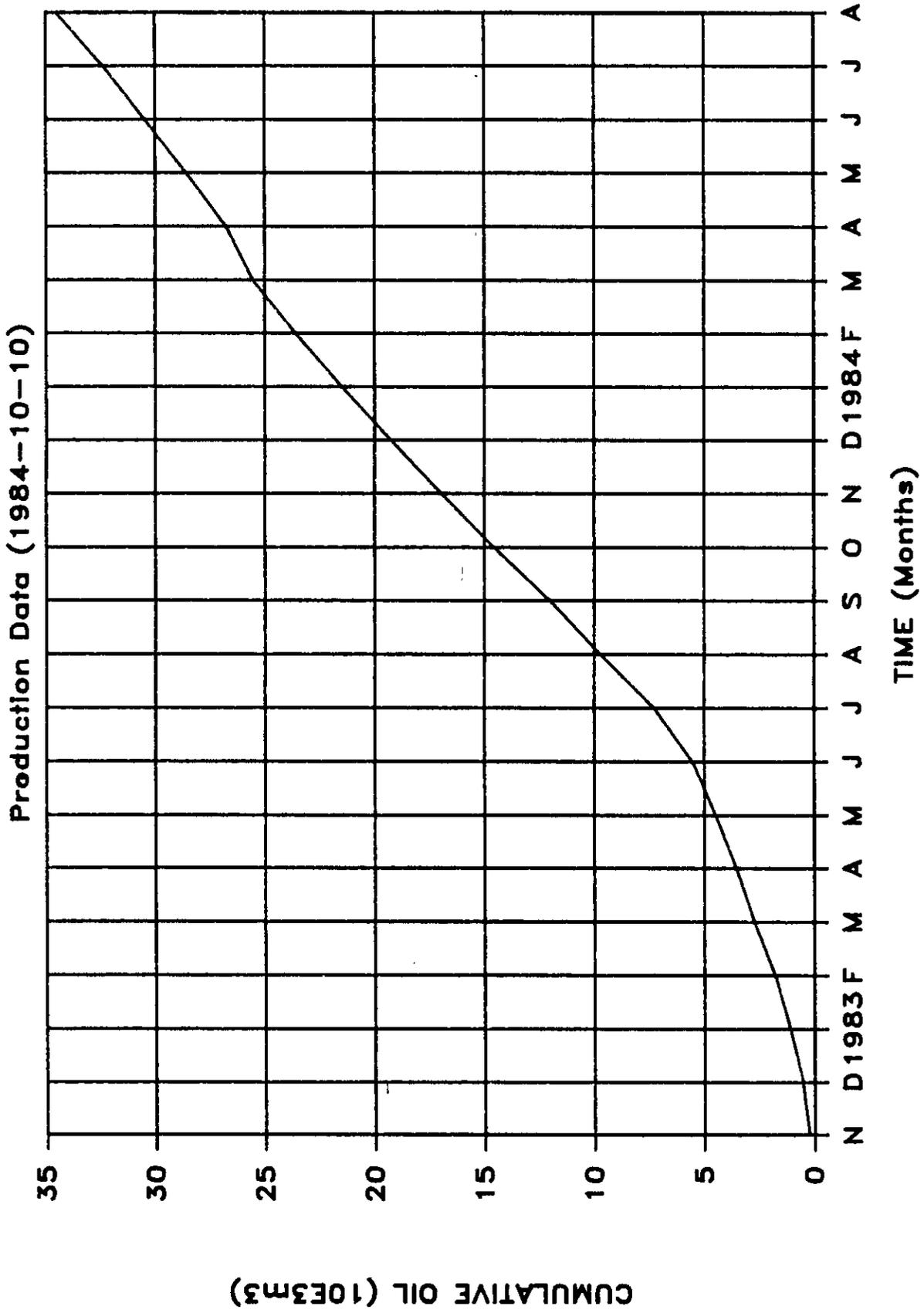
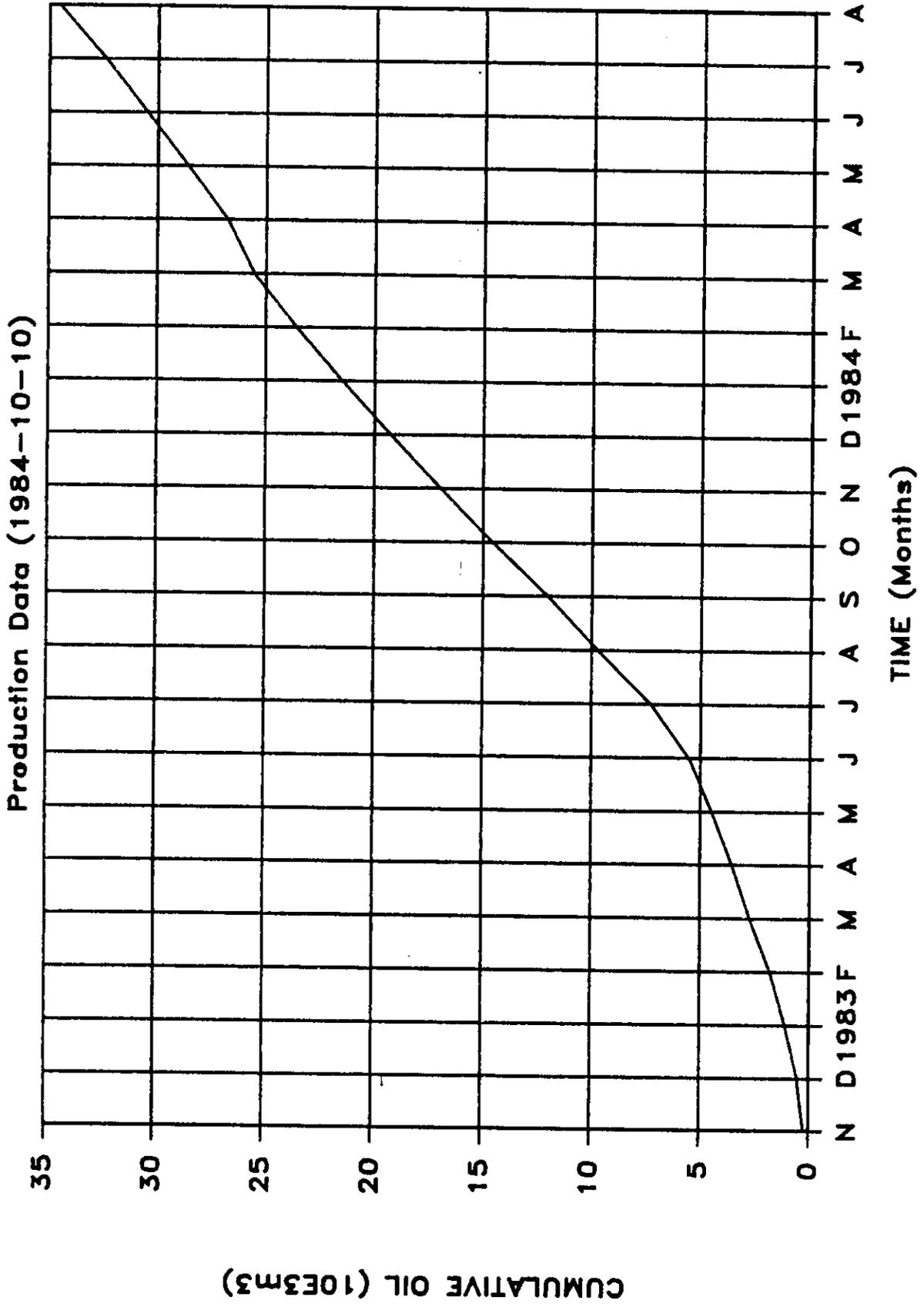


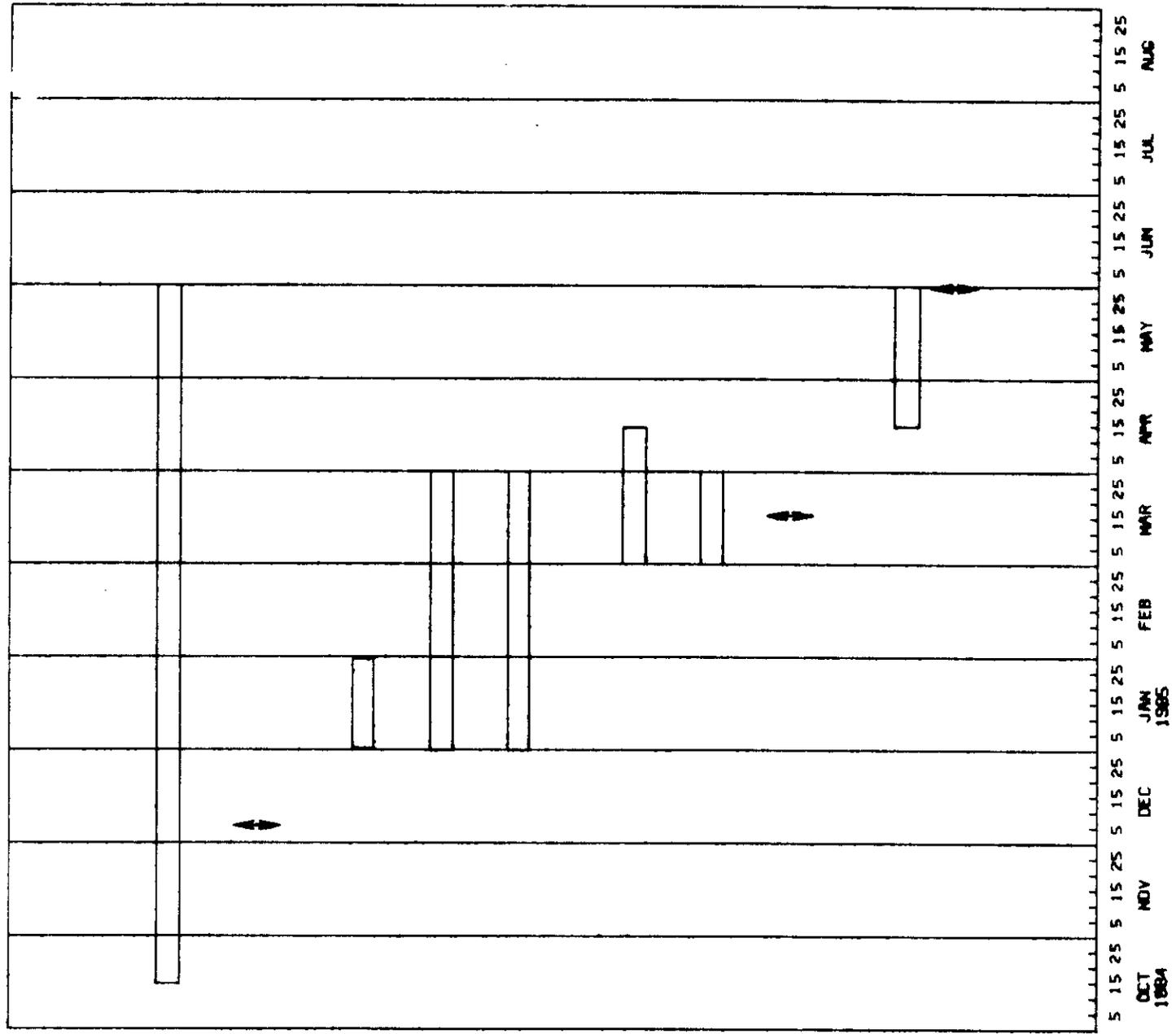
FIGURE 3

# WASKADA SPEARFISH UNIT NO. 6



# WASKADA LOWER AMARANTH 'A' POOL DEVELOPMENT TIMETABLE

FIGURE 4



## ACTIVITY

1. UNITIZATION
2. SUBMIT WATERFLOOD APPLICATION
3. OBTAIN INTERNAL APPROVALS
4. DESIGN FACILITIES
5. OBTAIN SURFACE RIGHTS
6. ORDER EQUIPMENT AND OBTAIN BIDS
7. OBTAIN PARTNER APPROVAL
8. INTERIM UNIT AGREEMENT
9. FACILITY CONSTRUCTION AND WELL CONVERSION
10. COMMENCE INJECTION

OCT 1984  
 5 15 25 5 15 25 5 15 25 5 15 25 5 15 25 5 15 25 5 15 25 5 15 25 5 15 25 5 15 25 5 15 25  
 NOV DEC JAN 1985 FEB MAR APR MAY JUN JUL AUG

COPY

September 7, 1984

Chevron Canada Resources Limited  
500 - 5th Avenue S.W.  
Calgary, Alberta  
T2P 0L7

Attention: Mr. R. A. Filgate, P. Eng  
Supervising Engineer, Reservoir

Dear Sir:

Re: Waskada Lower Amaranth A Pool  
Waterflood Feasibility

This will acknowledge with thanks receipt of your letter of August 16, 1984 and Waskada Lower Amaranth Waterflood Development Status Report for the period 1984-06 and 1984-07.

While noting the contents of this report, the Board is concerned over the limited progress on this project, particularly in view of the fact that primary performance and pressure data in adjacent parts of the pool indicate that delay of pressure maintenance may jeopardize ultimate recoverable reserves.

Accordingly, you are requested to provide a revised project schedule, leading to an early decision on this project and an application to conduct pressure maintenance operations. The Board would appreciate receiving this material prior to October 15, 1984.

Yours sincerely

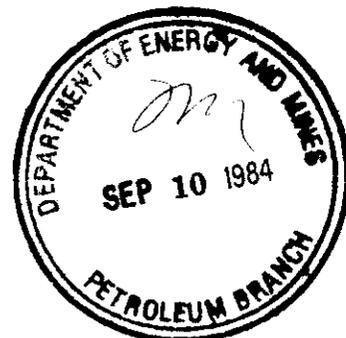
THE OIL AND NATURAL GAS  
CONSERVATION BOARD

ORIGINAL SIGNED BY  
IAN HAUGH

Ian Haugh  
Deputy Chairman

cc: Marc Eliason  
J. F. Rodgwell  
Petroleum Branch

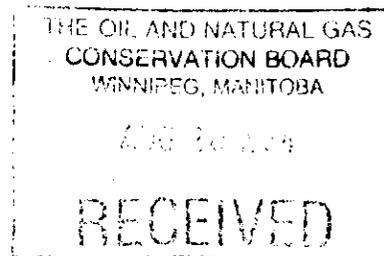
LRD/IH/bb





**Chevron Canada Resources Limited**  
500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

R. L. Bailey  
Chief Engineer



1984-08-16

Waskada Lower Amaranth Waterflood  
Development Status Report

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

Attention: Mr. Ian Haugh

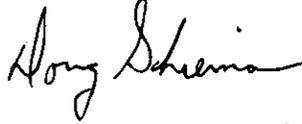
Gentlemen:

The following Waskada Lower Amaranth Waterflood Development Status Report is for the period 1984-06 and 1984-07:

1. The results of the Lower Amaranth pressure survey have been compiled and reviewed. A reservoir pressure map is being drafted. This data will be forwarded to the Petroleum Branch when the map is finished.
2. Updated production plots for the Chevron/Newscope wells are attached as Figures 1, 2, 3, 4, 5, and 6. Figure 1 indicates that the oil rate is stabilizing.
3. The geologic cross sections are still being developed.
4. Primary and waterflood production forecasts are being finalized. These forecasts are being used to determine if the Lower Amaranth Waterflood Development is economically feasible.
5. Unitization progress has been delayed pending the outcome of the economic evaluation.
6. Wells 8-1, 15-1, 2-12, 3-12, and 6-12 were recompleted in the Lower Amaranth and are being pumped.

Any questions regarding this Status Report should be addressed to Cal Folden at (204) 748-1334 in Virden, or Doug Schierman at (403) 234-5167.

Yours truly,



for

R. A. FILGATE, P.Eng.  
Supervising Engineer  
Reservoir

DNS/nl

cc: Newscope Resources Limited

FIGURE 1

# WASKADA SPEARFISH UNIT NO. 6

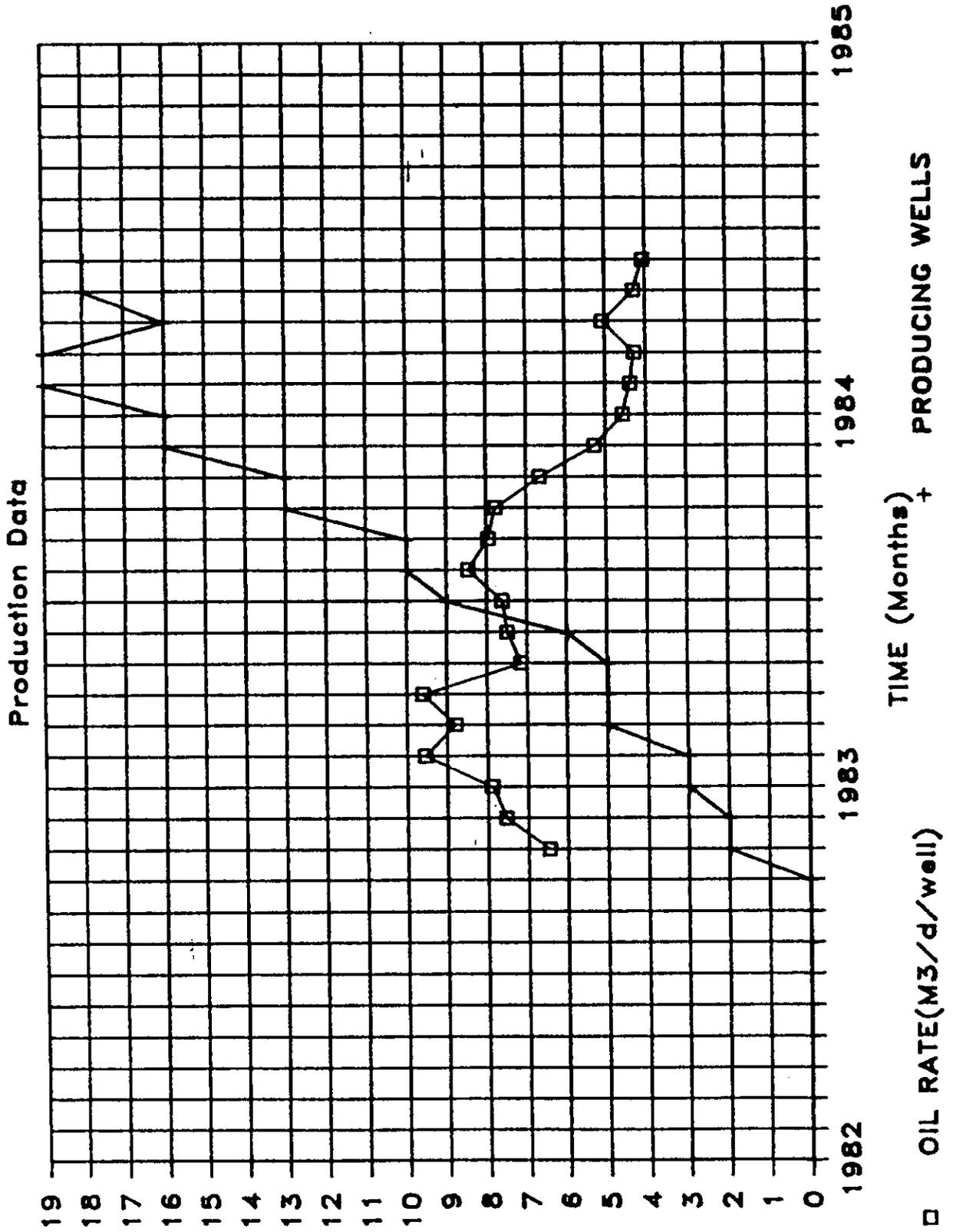


FIGURE 2

# WASKADA SPEARFISH UNIT NO. 6

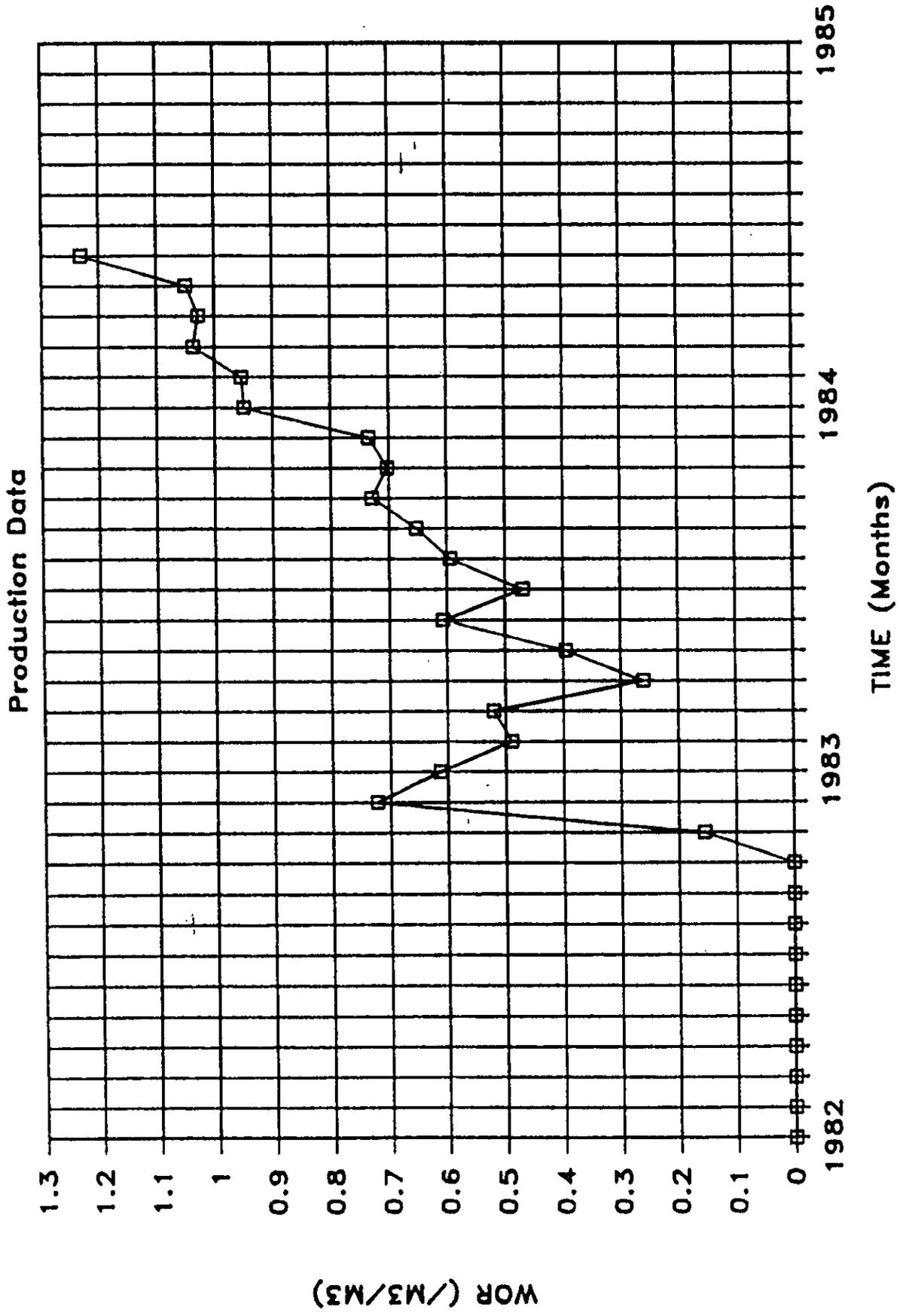


FIGURE 3

# WASKADA SPEARFISH UNIT NO. 6

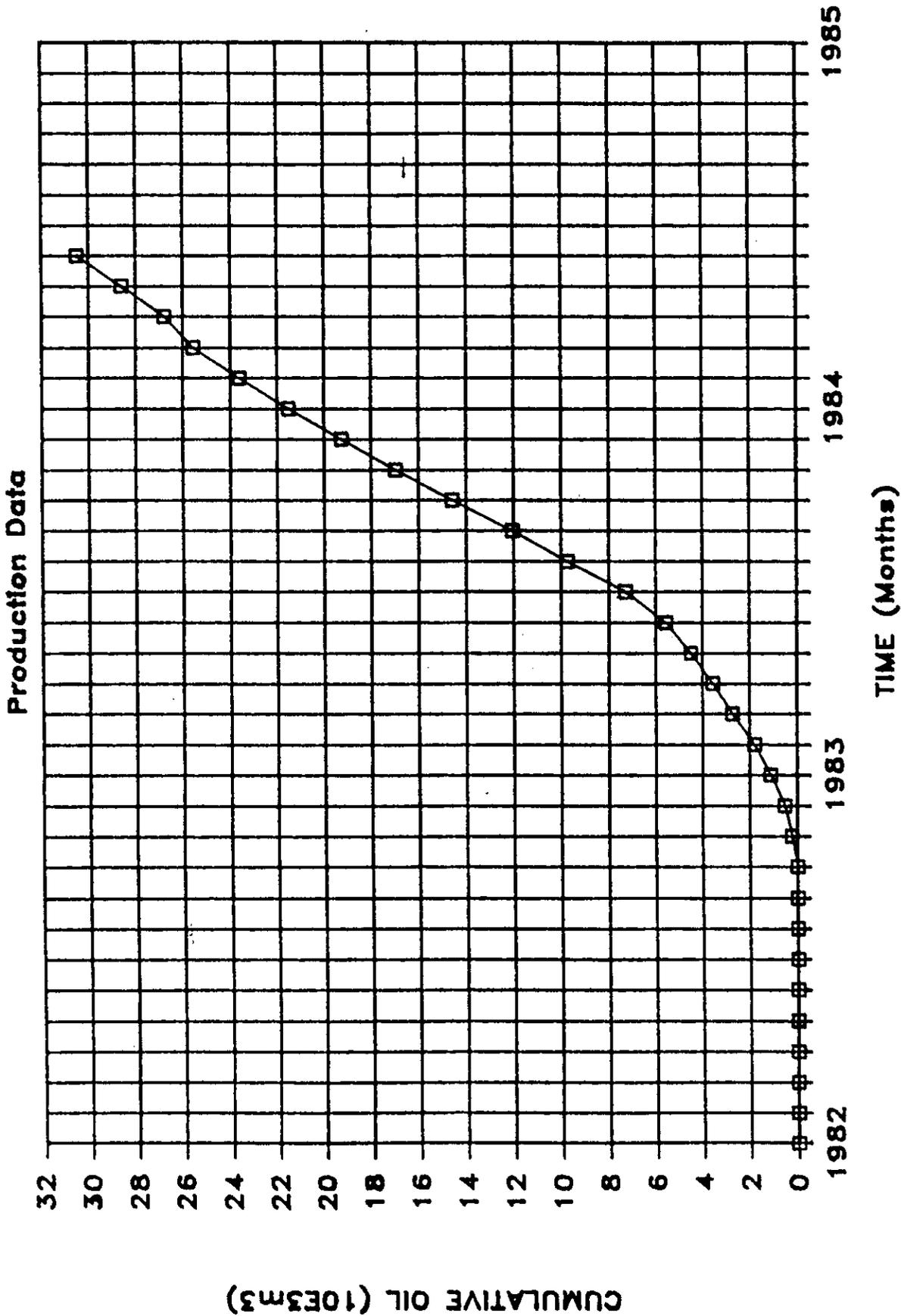


FIGURE 4

# WASKADA SPEARFISH UNIT NO. 6

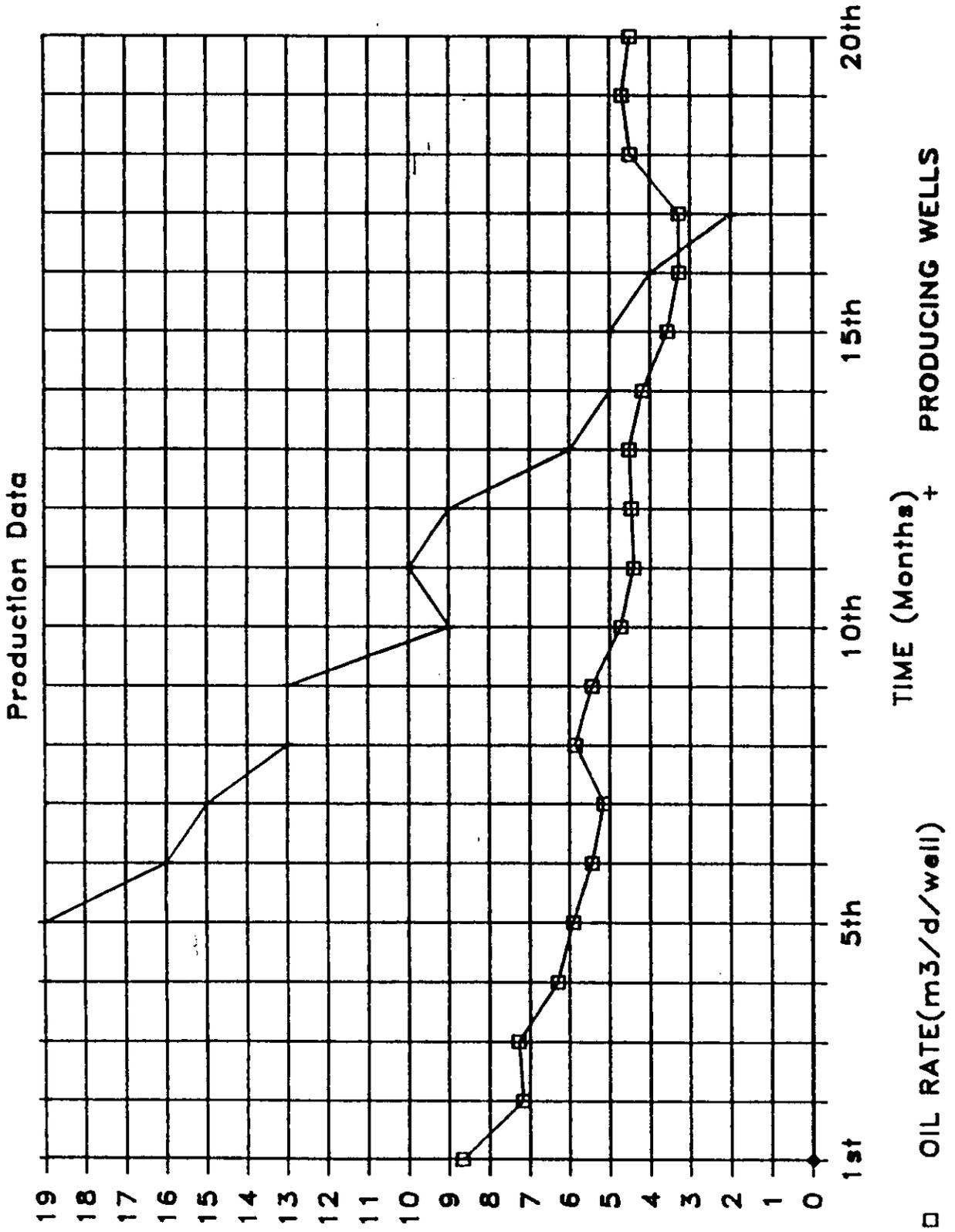


FIGURE 5

# WASKADA SPEARFISH UNIT NO. 6

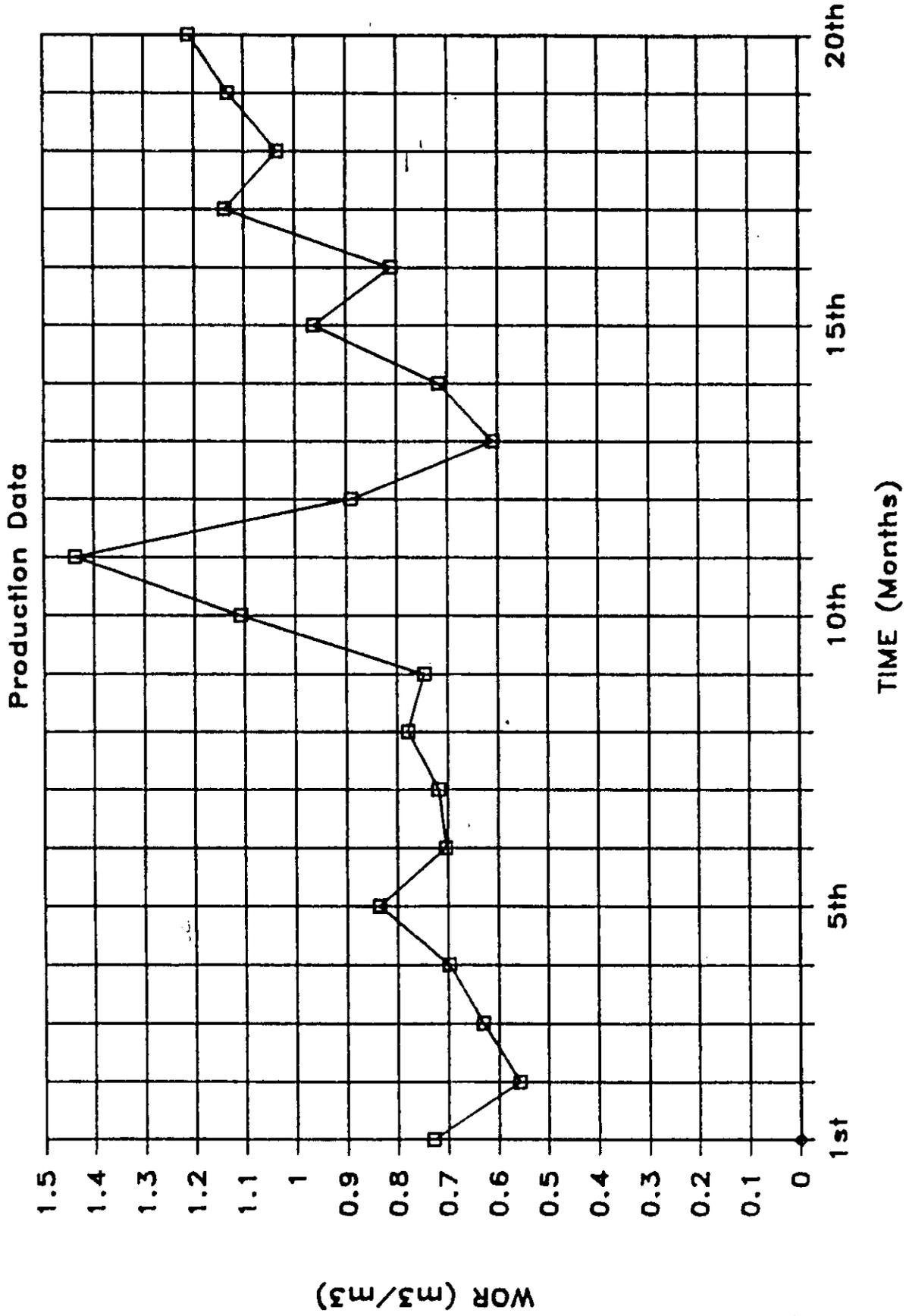
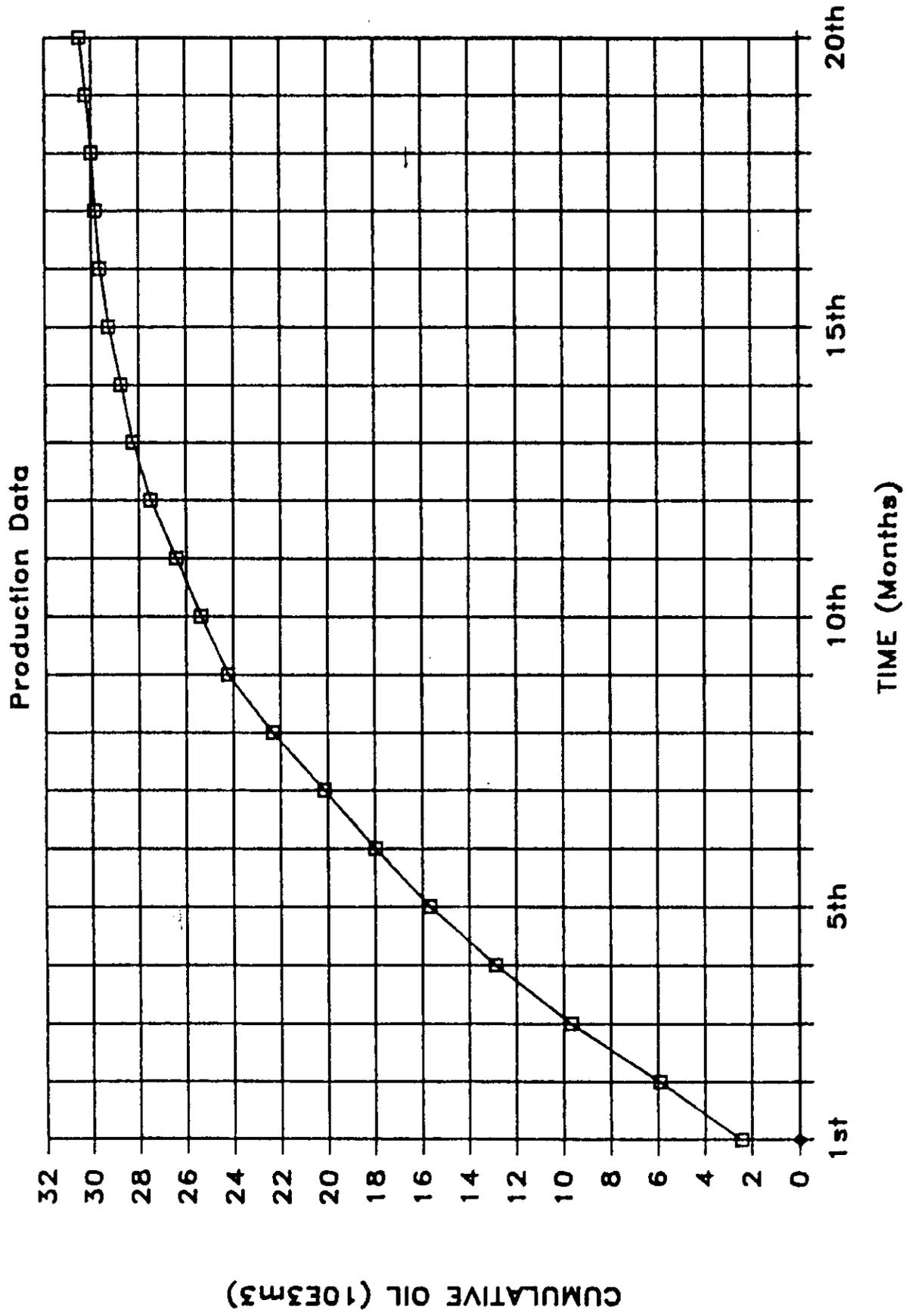


FIGURE 6

# WASKADA SPEARFISH UNIT NO. 6



June 20, 1984

Chevron Canada Resources Limited  
500 - 5th Avenue S.W.  
Calgary, Alberta  
T2P 0L7

Attention: Mr. R. A. Filgate, P. Eng.  
Supervising Engineer, Reservoir

Dear Sirs:

Re: Waskada Waterflood Development

Your letter of June 12, 1984 providing the status of your waterflood investigations in the Waskada Field is acknowledged.

It is noted that your progress in this regard has fallen somewhat behind the schedule attached to your letter of February 22, 1984 (e.g. "Gather Data and Evaluate" was to be completed by the end of May). Consequently, we request that you provide an updated project schedule with your next progress report.

In addition, please provide an update of the status of Unit negotiations with the next progress report.

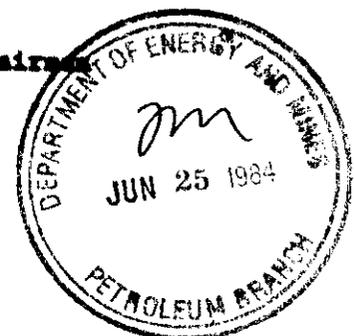
Yours sincerely,

THE OIL AND NATURAL GAS  
CONSERVATION BOARD

  
Ian Naugh  
Deputy Chairman

LRD/lk

b.c. Petroleum Branch ✓



Chevron

**Chevron Canada Resources Limited**

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

Oil & Gas  
Operations

1984-06-12

Waskada Waterflood Development  
Status Report

Manitoba  
Department of Energy and Mines  
The Oil and Natural Gas Conservation Board.  
309 Legislative Building  
Winnipeg, Manitoba  
R3C 0V8

Attention: Mr. Ian Haugh

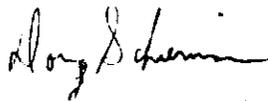
Gentlemen:

The following Waskada Waterflood Development Status Report is for the period 1984-04 and 1984-05:

1. The reservoir pressure survey has been completed and the data is being interpreted. The pressure survey results will be forwarded to the Petroleum Branch when completed.
2. Production plots for the Chevron/Newscope wells are attached as Figures 1, 2, 3, 4, and 5. The production plot on Figure 1 was made on a normalized time basis, i.e., all 1st month, 2nd month, etc. production from the individual wells was combined to calculate an average oil rate and WOR.
3. The waterflood performance computer program is being calibrated to match the historical producing WOR and liquid production rate.
4. Geologic  $\Delta h$ ,  $kh$  and  $h$  maps are completed and cross sections are being developed.

Any questions regarding this Status Report should be addressed to Cal Folden at (204) 748-1334 in Virden, or Doug Schierman at (403) 234-5167 in Calgary.

Yours truly,



DNS/gr

for

R. A. FILGATE, P.Eng.  
Supervising Engineer  
Reservoir

cc: Newscope Resources Limited

FIGURE 4

WATER INJECTION EFFECTS ON OIL RATE

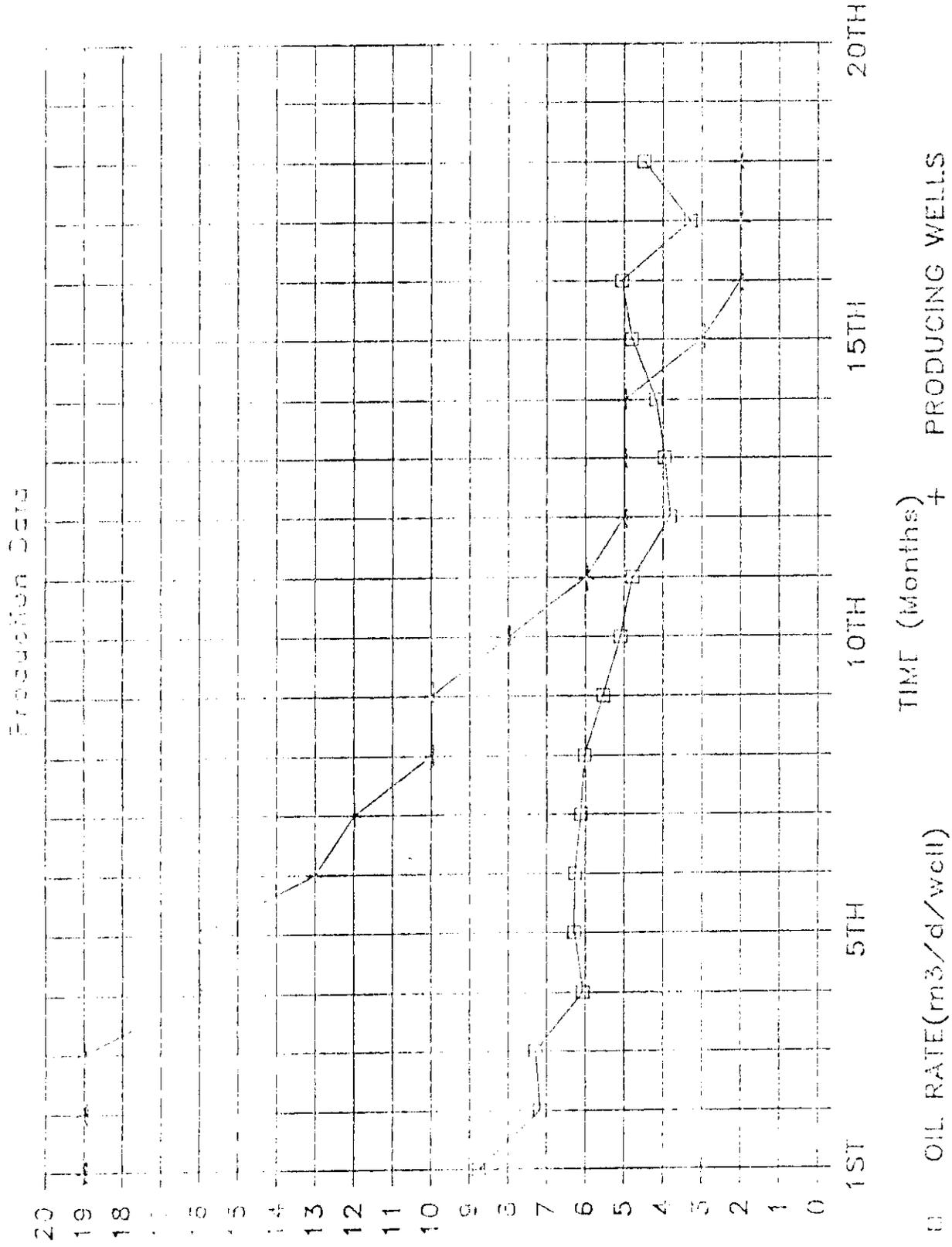


FIGURE 2

# WABAD-SEQUESTER UNIT NO. 8

Production Data

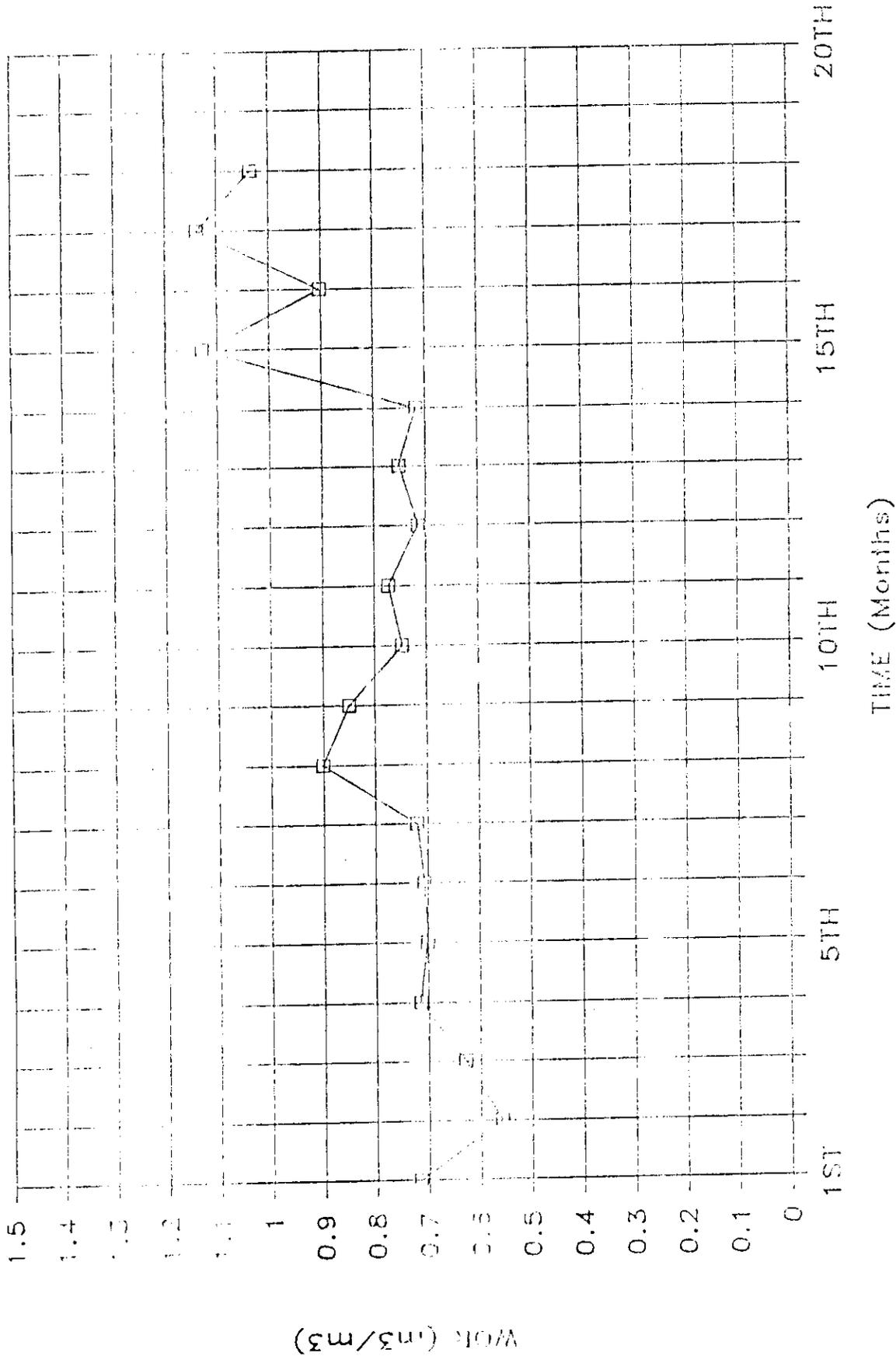


FIGURE 5

W-SKALDA SPEARFISH UNIT, N.C. 6

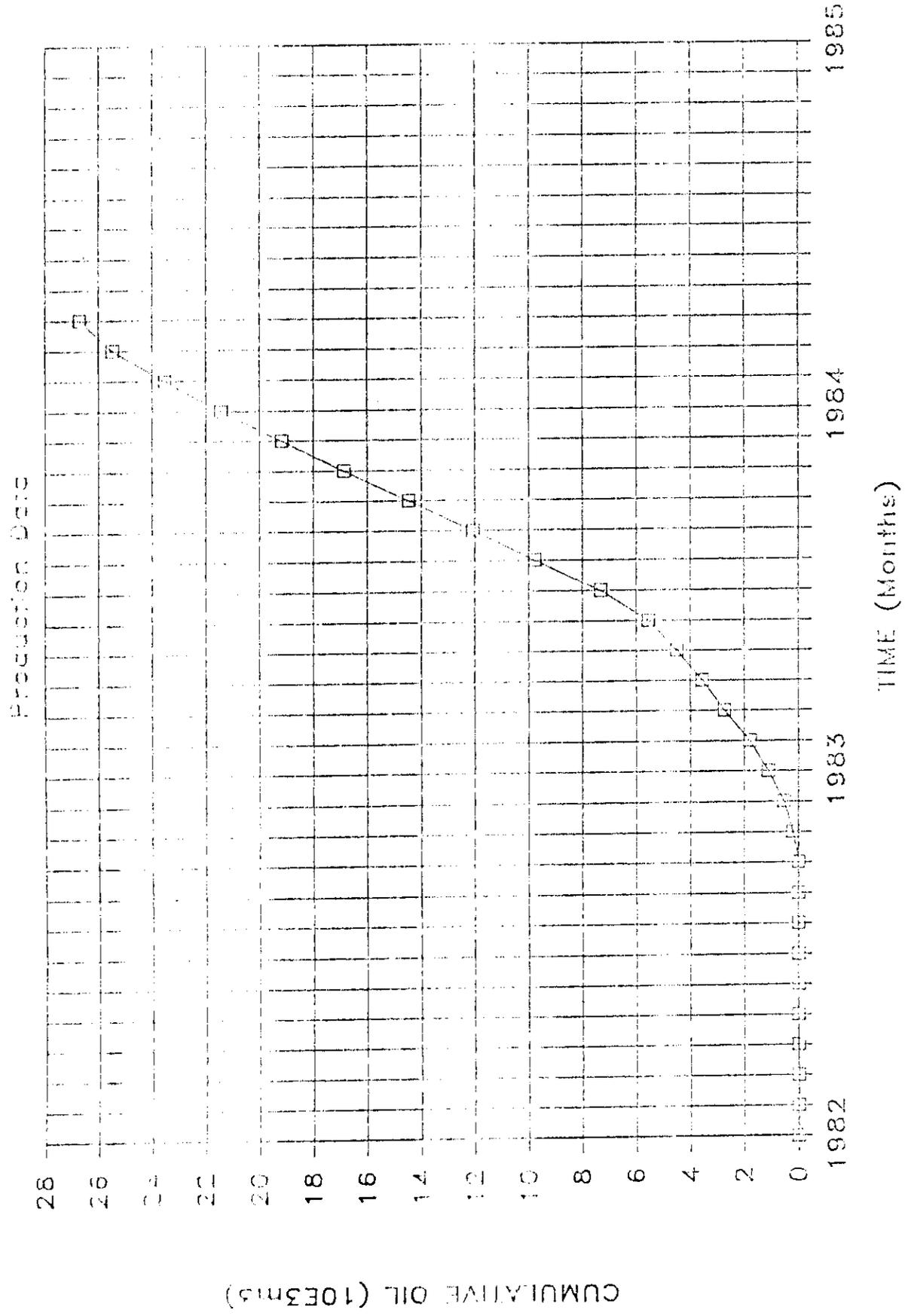
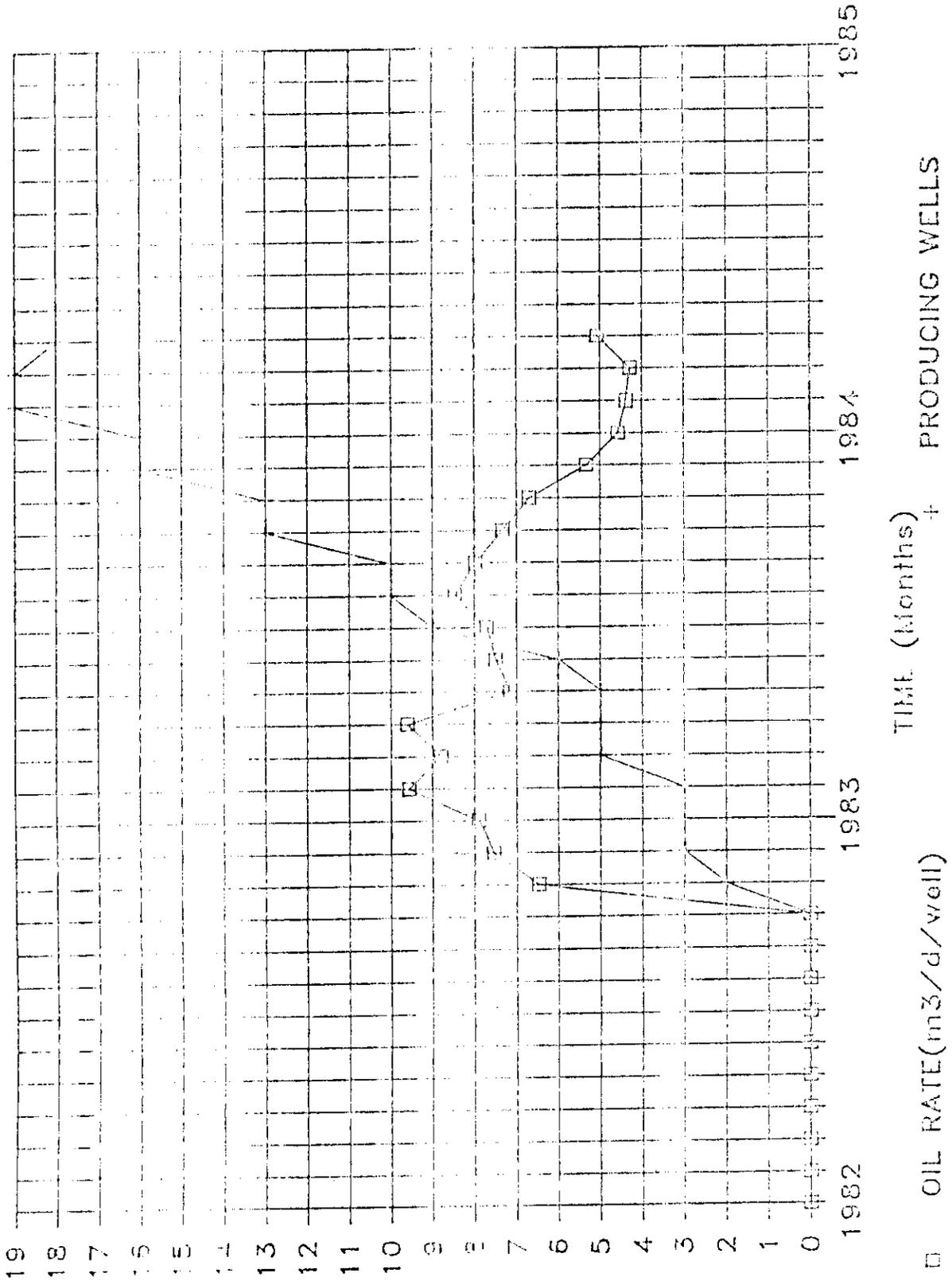


FIGURE 4

WASKADA SEPARATION UNIT NO. 6

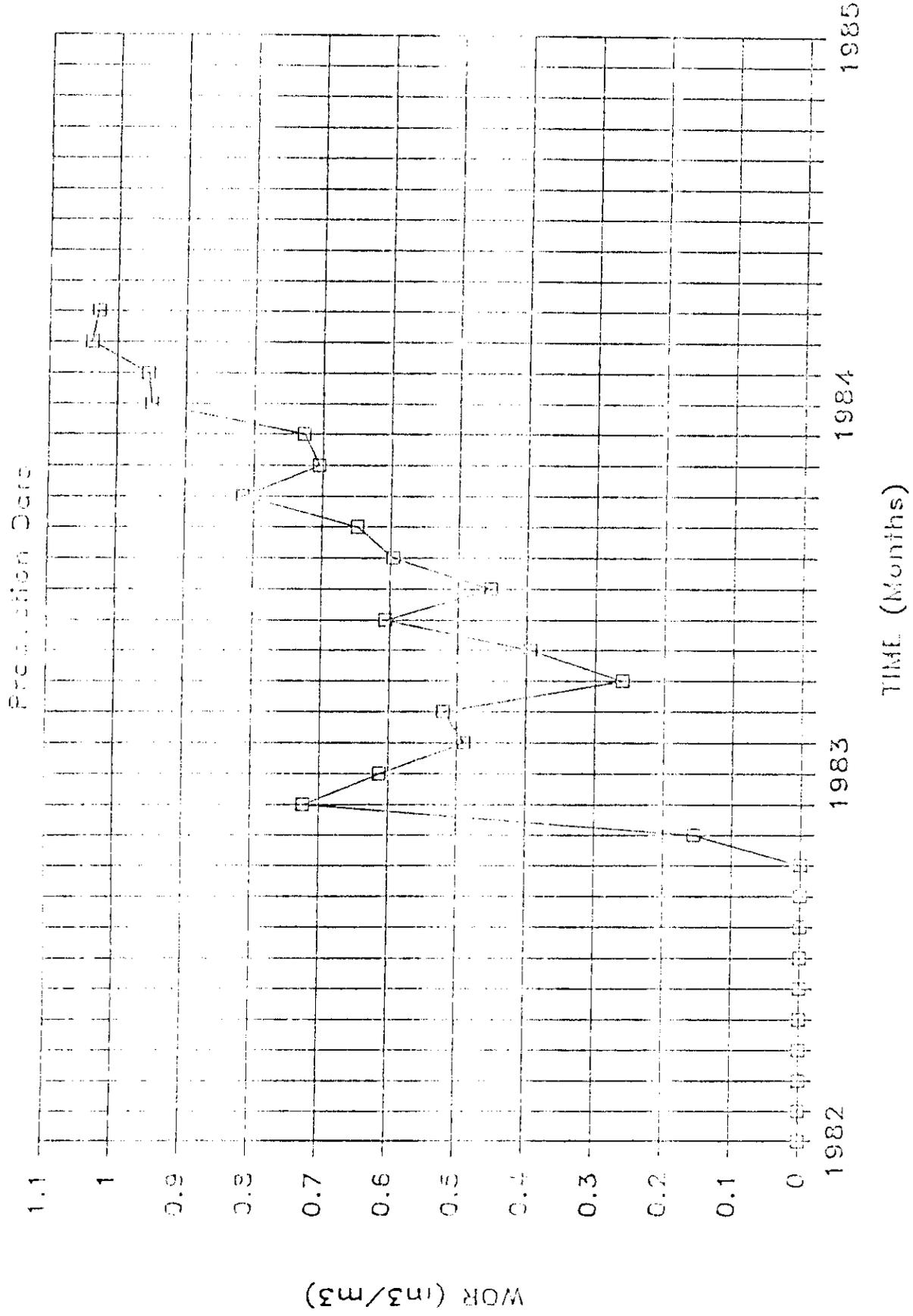
Production Data



□ OIL RATE(m³/d/well)      TIME (Months)      PRODUING WELLS

FIGURE 5

W-SKADA SFE-FISH UNIT NO. 8



February 22, 1984

Chevron Canada Resources Limited  
500 - Fifth Avenue S.W.  
Calgary, Alberta  
T2P 0L7

Attention: Mr. D. N. Sherman, P. Eng.,

Dear Doug:

Re: Waskada Lower Amaranth A Pool - GOR Data

Enclosed, further to your recent request, are copies of production summaries showing GOR data for a number of injection patterns in Waskada Lower Amaranth A Pool. This data represents pre-injection conditions.

Pre-injection gas-oil ratio data from the area of the pilot waterflood is very limited. Consequently, after discussion with Cal Folden, it was decided that the attached data would be more meaningful for your purposes.

Also enclosed is an invoice for \$9.00 for copying charges (36 copies @ \$0.25/copy).

Yours sincerely,



L. R. Dubreuil  
Chief Petroleum Engineer  
Petroleum Branch

LRD/sb  
Encls.

May 17, 1984

Chevron Canada Resources Limited  
500 - 5th Avenue  
Calgary, Alberta  
T2P 0L7

Attention: Louise Ruitenbeck

Dear Ms. Ruitenbeck:

Waskada Lower Amaranth A Pool  
- Waterflood Progress Reports

Enclosed, per your request, are copies of the Waskada Lower Amaranth A Pool waterflood progress reports for Pattern Nos. 10, 11, 18 and 19 for the months of February and March 1984. With respect to recompletion of wells in these patterns into the Lower Amaranth, the following is provided:

<u>WELL</u>	<u>DATE COMPLETED</u>
Omega Waskada 3-25-1-26	Dec. 14, 1982
Omega Waskada 4-25-1-26	Nov. 14, 1982
Omega Waskada 2-25-1-26	Dec. 13, 1982
Omega Waskada 5-25-1-26	Oct. 3, 1981
Omega Waskada 1-26-1-26	Jan. 28, 1982
Omega Waskada 12-24-1-26	Dec. 16, 1982
Omega Waskada 9-24-1-26	Dec. 11, 1982

All other wells in the patterns have produced only from the Lower Amaranth.

Yours sincerely,

*[Signature]*  
L. R. Dubreuil

L. R. Dubreuil  
Chief Petroleum Engineer  
Petroleum Branch

LRD/sb  
Encls.

April 24, 1984

Chevron Canada Resources Limited  
270 - Fifth Avenue S.W.  
Calgary, Alberta  
T2P 0L7

Attention: Mr. G. W. Shierman, P. Eng.

Dear Sirs:

Re: Waskada Field - Waterflood Development Activities

Your letter of April 6, 1984 outlining pressure maintenance related activities in the Waskada Field is acknowledged.

We request that you continue to keep us informed of your progress in this regard and that you notify us of any significant deviation from your previously submitted "Development Timetable".

Yours sincerely,

THE OIL AND NATURAL GAS  
CONSERVATION BOARD

ORIGINAL SIGNED BY  
IAN HAUGH

Ian Haugh  
Deputy Chairman

LRD/lk

b.c. Petroleum Branch ✓

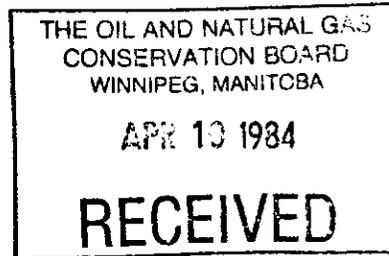




**Chevron Canada Resources Limited**  
500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

R. L. Bailey  
Chief Engineer

1984-04-06



Waskada Waterflood Development  
Status Report

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

Attention: Mr. Ian Haugh

Gentlemen:

Chevron/Newscope Waskada Waterflood Development activities currently in progress are listed below:

1. The reservoir pressure survey commenced on 1984-03-22.
2. Bottom hole pressure gauges were placed in four wells:  
  
3-18-1-25 LAM  
9-01-1-26 LAM  
1-12-1-26 LAM  
9-12-1-26 LAM
3. Acoustic wells sounding devices are being used for all other wells being surveyed.
4. Production data is being plotted on an individual well basis and on a 9 spot pattern basis to develop primary production forecasts.
5. Data for a waterflood performance computer program is being compiled. This program calculates pattern waterflood performance in a layered reservoir flooded with a repetitive well pattern. The program accounts for non-unit mobility ratio displacements, areal sweep efficiency, vertical sweep efficiency and reservoir fill-up of free gas saturation.

p.c. - H. Clare Moster  
April 16, 1984 - ra

6. Unit participation factors are being calculated from oil reserves, oil production rate and oil cut.
7. Geologic  $\phi$ h, kh, and h maps are being updated with the data from a comparison of two core analysis methods.
8. Geologic cross sections are being constructed.

Any questions regarding this status report should be addressed to Cal Folden at (204) 748-1334 or Doug Schierman at (403) 234-5167.

Yours truly,



for

R. A. FILGATL, P.Eng.  
Supervising Engineer  
Reservoir

DNS/gr

cc. Newscope Resources Limited

## PRESSURE MAINTENANCE

### WASKADA FIELD

- Chevron is also considering pressure maintenance. They plan a comprehensive pressure survey which will be co-ordinated with road bans (to minimize lost production). The Branch has suggested to both Chevron and New Scope that such a survey would best be done jointly.

- Chevron further plans to submit to the Board by March 1st, 1984 a preliminary review of the need for pressure maintenance. This will not (as discussed above) include pressure data. Chevron has also suggested that they may want to run an injectivity test, although data from Omega's flood may negate the need for this.

- Pressures obtained by Omega prior to initiation of the pilot injection scheme indicated severe pressure drops to levels below the bubble point (4220 kPa).

- Recent pressures, most notably at 7-26-1-26 (taken prior to the well being put on injection) also indicated a built-up pressure of less than the bubble point. It is significant that this well is only one-half mile removed from injection in the pilot scheme. This suggests very low transmissibility and the need for pattern injection.

- Rapid pressure declines are also reflected by drastic drops in productivity over the first year of a wells production (Examples are 15-24-1-26 (now a WIW ), 15-13-1-26 and 1-13-1-26).

- With respect to Omega, no plans further to those already before the Board have been provided. It is likely that pressure maintenance will be required in the northern extension (centered on Section 2-2-26 and in the eastern development (section 17 and 18-1-25 WPM) when development in these areas is complete.

- One problem is with operators such as Tundra and Roxy that have minor Lower Amaranth developments which are not large enough to support a separate pressure maintenance scheme. To date, Omega has shown no willingness to include such lands in one of its units.

- Another, largely unanswered question is the need for pressure maintenance in the Mississippian pools. Due to a much stronger water drive in these pools, the need is much less obvious than in the Lower Amaranth. We plan to broach the subject with individual operators but suggest that we proceed on a low key so as not to confuse this issue with respect to the Lower Amaranth.

March 2, 1984

Chevron Canada Resources Limited  
500 - 5th Avenue S.W.  
Calgary, Alberta  
T2P 0L7

Attention: Mr. M. R. A. Filgate,  
Supervisor, Reservoir Engineering

Dear Sirs:

Re: Waskada Lower Amaranth A Pool

Your letter of February 22, 1984 outlining your program to evaluate the need for pressure maintenance in the subject pool is acknowledged.

We request that Chevron provide brief status reports on the progress of your program at the end of each month.

In reviewing your program, we note that your "first choice injectors" while apparently in a nine-spot configuration do not coincide with the injection pattern set up in Omega's pressure maintenance projects to the North. In the interests of maximizing areal sweep for the entire pool, we would suggest that consideration be given to standardizing the injection pattern.

Yours sincerely,

THE OIL AND NATURAL GAS  
CONSERVATION BOARD

ORIGINAL SIGNED BY  
IAN HAUGH

Ian Haugh  
Deputy Chairman

LRD/lk

b.c. Petroleum Branch ✓





**Chevron Canada Resources Limited**  
500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

1984-02-22

Waskada Lower Amaranth "A" Pool  
Pressure Maintenance Development Program

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

Attention: Ian Haugh

Gentlemen:

On 1983-12-06, The Oil and Natural Gas Conservation Board requested that Chevron Canada Resources Limited (CCRL) submit 'a preliminary review of the need for and feasibility of enhanced recovery operations in the lands operated by Chevron Canada Resources Limited in the Waskada Lower Amaranth "A" Pool.' The subject review was also to include the results of a reservoir pressure survey.

In reponse to The Board request, Chevron is submitting a Waskada Development Plan and Timetable (see Attachment 1). This development plan is for evaluating and implementing a waterflood in the Spearfish Reservoir and possibly also in the MC3 Reservoir.

Plans are to conduct a reservoir pressure survey during 1984-03/04 as Chevron plans to shut in its operated wells during spring break up. Pressures obtained after wells are allowed to build up will be more representative of a ~~stabilized~~ stabilized reservoir, plus build up pressure data will be obtained.

Further discussions with the Petroleum Branch on 1984-01-30 revealed that the Petroleum Branch would prefer a joint response from the operators in this area of the Lower Amaranth "A" Pool. Consequently, Chevron is submitting the Waskada Development Plan for the area operated by both Chevron and Newscope Resources. Also, Chevron has approval from Newscope to coordinate the reservoir pressure survey in the Lower Amaranth "A" Pool (see Attachment 2).

Any questions regarding this matter should be directed to Cal Folden in Virden at (204) 748-1334 or Doug Schierman in Calgary at (403) 234-5167.

Sincerely,



R. A. FILGATE, P.Eng.  
Supervising Engineering  
Reservoir

DS/ds  
Attach.

cc: Newscope Resources Limited

1984-02-22

Waskada Development Plans and Timetable

**A. SPEARFISH RESERVOIR**

1. Spearfish Development Plans

- a) Obtain agreement with Newscope to work together on the Spearfish Development:
  - i) Set operatorship question aside for now
  - ii) Provide for vertical enlargement (MC3)
  
- b) Evaluate potential for waterflooding the Spearfish:
  - i) Define the Spearfish Geology -  $\emptyset h$  and kh maps
    - extent of natural fracturing
    - moveable fines
  
  - ii) Omega Waterflood Pilot Data - PVT study
    - special core study
    - production and injection history
  
  - iii) Omega Model Study
  
  - iv) Newburg Field Data - engineering study
    - special core analysis
    - production and injection history
    - operating experience

- c) Gather reservoir data during and after spring breakup:
  - i) Obtain reservoir pressures at all wells.
  - ii) Obtain buildup pressures from the following wells:
    - first choice injectors 3-18, 11-7, 9-12, 1-12, 3-12 and 9-1.
  - iii) Drawdown test on 3-18 after breakup if well will flow.
  - iv) Obtain Spearfish downhole sample from 3-18 for PVT analysis
    - compare results with PVT studies from Newscope, Omega and Newburg Field
    - determine if further PVT testing required.
  - v) Injectivity and fall off test
  
- d) Evaluate water sources, compatibility and injectivity:
  - i) Mississippian, Blairmore, produced
  - ii) Omega water compatibility tests
  - iii) Determine if injectivity will be sufficient to replace voidage
  
- e) Determine profitability indicators for the proposed waterflood.
  
- f) Obtain interim unitization agreement
  - i) chose operator
  - ii) provide for vertical enlargement
  
- g) Make application to the Manitoba Petroleum Branch for waterflood approval.
  
- h) Design required waterflood and production facilities, order equipment and obtain surface rights.

- i) Construct facilities and tie in wells.
- j) Convert wells to water injection.
- k) Monitor and optimize waterflood.

**B. MISSION CANYON 3 RESERVOIR**

1. MC3 Development Plans

- a) Obtain agreement with Newscope to work together on the MC3 Development:
  - i) Coordinate with SF plans
  - ii) Set operatorship question aside for now
- b) Evaluate the potential for waterflooding the MC3:
  - i) Define the MC3 geology -  $\phi$ h and kh maps
    - extent of MC3
    - core studies
  - ii) Determine if aquifer is active
  - iii) Determine if the reserves justify a waterflood
  - iv) Review Newscope PVT study on 12-7
- c) Gather reservoir data during spring break up:
  - i) Obtain reservoir pressures at all wells.
  - ii) Obtain buildup pressures from wells in each part of the reservoir
    - Sec. 7, 2-12, Sec. 1 (separate pools)
- d) Evaluate water sources, compatibility, and injectivity
  - i) Determine if injectivity will be sufficient to replace voidage
  - ii) Other items done in SF study.
- e) Determine profitability indicators for the proposed waterflood

f) Obtain interm unitization agreement

i) include in SF agreement

g),

h),

i), same as for SF plans.

j),

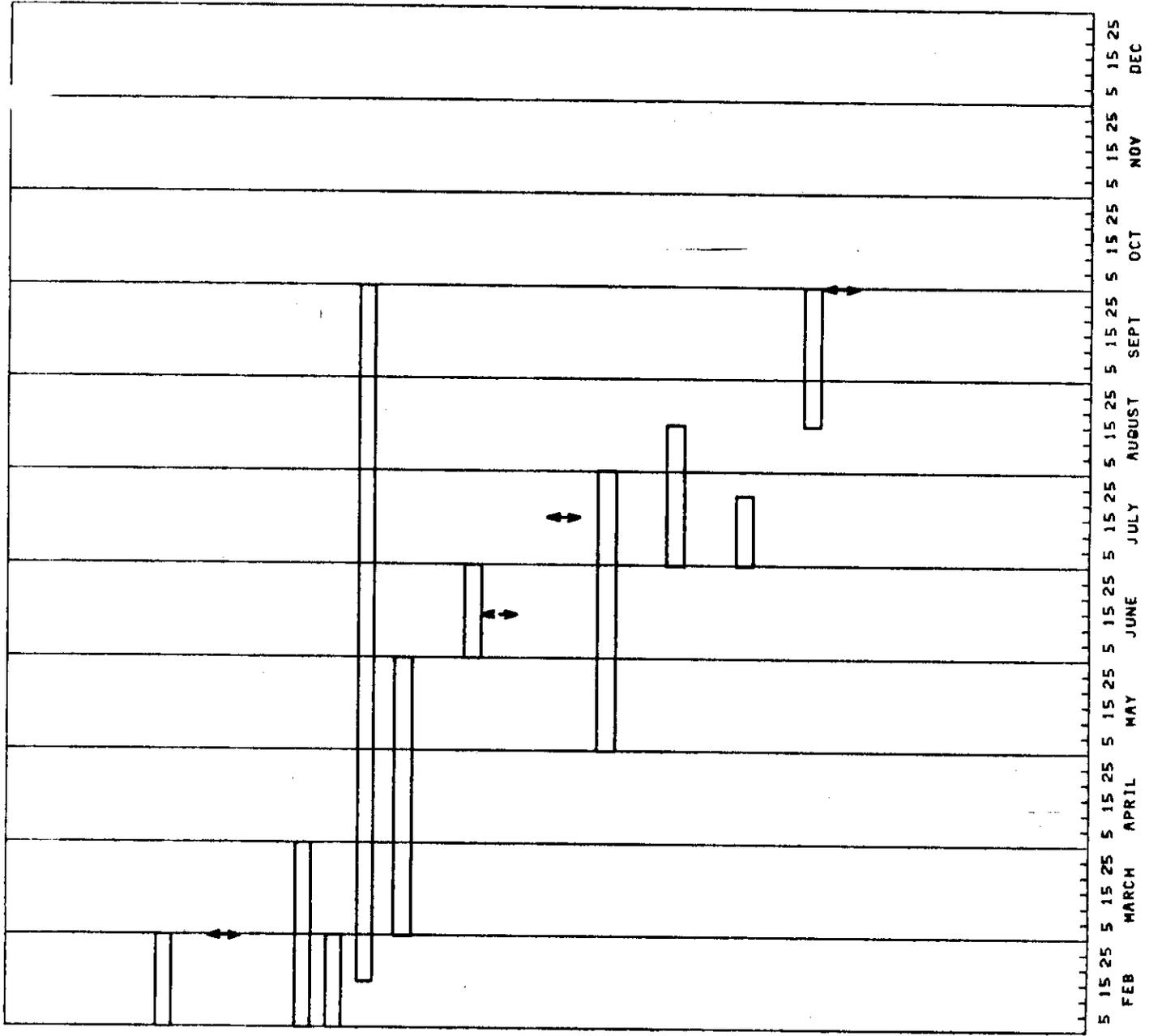
k),

2. MC3 Development Timetable

a) Coordinated with SF Development

WASKADA LOWER AMARANTH 'A' POOL  
DEVELOPMENT TIMETABLE

1984-02-01



ACTIVITY

1. AGREEMENT WITH NEWSCOPE
2. SUBMIT DEVELOPMENT PLANS TO MANITOBA PETROLEUM BRANCH
3. PRELIMINARY EVALUATION OF WATER FLOOD
4. EVALUATE WATER COMPATIBILITY
5. UNITIZATION
6. GATHER DATA AND EVALUATE
7. DETERMINE ECONOMIC FEASIBILITY AND OBTAIN INTERNAL APPROVALS
8. INTERIM UNIT AGREEMENT
9. SUBMIT WATERFLOOD APPLICATION
10. DESIGN FACILITIES
11. ORDER EQUIPMENT AND OBTAIN BIDS
12. OBTAIN PARTNER APPROVAL AND SURFACE RIGHTS
13. FACILITY CONSTRUCTION AND WELL CONVERSION
14. COMMENCE INJECTION

# Newscope Resources Limited

Suite 1600, 700-9th Avenue S.W.  
Calgary, Alberta T2P 3V4  
Phone: (403) 266-1101

ATTACHMENT 2

Feb. 13, 1984

Chevron Canada Resources Ltd.  
500 - 5th Ave. S.W.  
Calgary, Alta.  
T2P OL7

Attn: C. B. Holmlund - Co-ordinator of  
Units & Joint Ventures - Producing Dept.

Subject: Waskada Spearfish Reservoir  
Pressure Survey

Further to our meeting of 84-02-06, concerning the subject matter, please accept this letter as New Scope concurrence on the proposed reservoir pressure survey and agreement for Chevron to co-ordinate same.

New Scope suggests that 13-6-1-25 well which is presently shut-in may be close to a stabilized pressure. It should be considered as a candidate for build-up work. Also this well could be a candidate for both injection in the Spearfish and for the MC3. New Scope concurs with using 3-18 for a drawdown test and we have enclosed a copy of the PVT analysis conducted on the 12-7 well for your analysis.

New Scope will participate on a working interest well count basis in the costs of the survey and hereby requests a cost estimate for the pressure surveys (sonic and bottom hole recorder work) plus the build-up and draw-down tests.

New Scope has completed an independent analysis of the primary reservoir properties and characteristics for the E $\frac{1}{2}$  Sec.7 and the W $\frac{1}{2}$  Sec. 12 and is prepared to contribute this information to the proposed secondary recovery study. Our preliminary analysis indicated that reservoir pressure depletion is occurring at a rapid rate and we may be very near the bubble point. We feel that it is imperative that the pressure surveys be conducted as soon as possible and await your cost estimate and proposed testing schedule.

At the present time, New Scope does not anticipate shutting in all its Waskada wells during break-up and would need to schedule the shut downs of specific wells in order to get representative pressure data.

In regards to water sources, New Scope is presently disposing of both produced and outside operators water in the 10-7 SWD 1-25 WPM well and this water would be available for water injection. Other sources of produced water exist in the Waskada area, and water production capabilities shall be forwarded to you when available.

Please be advised that the 13-7 LAM and 14-7 LAM wells have been completed and are presently recovering load oil. Enclosed are completion reports for the period to 84-02-10 for your files.

Yours truly,

NEWSCOPE RESOURCES LIMITED

A handwritten signature in cursive, appearing to read 'R. D. Weir', written in dark ink.

R. D. Weir  
Vice President - Operations

R.D.W./bs

c.c. Waskada Secondary Recovery  
Chevron Correspondence file  
Bill Simpson

DATE: February 7, 1984

TO: H. Clare Moster  
RE: Newscope Resources Limited

*BOB*

FROM: Ian Haugh

Dept.: \_\_\_\_\_

Branch: \_\_\_\_\_

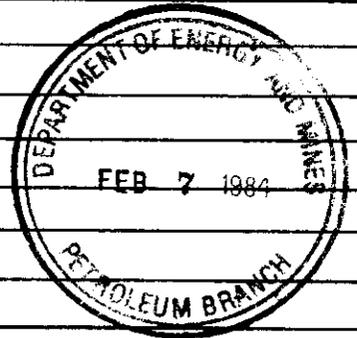
Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

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|---|---|
| <input type="radio"/> Take action                             | <input type="radio"/> Circulate                     |
| <input type="radio"/> Per your request                        | <input type="radio"/> See me re attached            |
| <input type="radio"/> Call me on this matter                  | <input type="radio"/> For your information          |
| <input type="radio"/> Investigate and report                  | <input type="radio"/> Supply data for my reply      |
| <input type="radio"/> For your revision or approval           | <input type="radio"/> Reply direct with copy to me  |
| <input type="radio"/> Return with comments or recommendations | <input type="radio"/> Draft reply for signature of: |

COMMENTS: \_\_\_\_\_

Please draft reply for my signature.



# Newscope Resources Limited

Suite 1600, 700-9th Avenue S.W.  
Calgary, Alberta T2P 3V4  
Phone: (403) 266-1101

THE OIL AND NATURAL GAS  
CONSERVATION BOARD  
WINNIPEG, MANITOBA

FEB 6 1984

RECEIVED

January 23, 1984

The Oil & Natural Gas Conservation Board  
309, Legislative Building  
Winnipeg, Manitoba

Attn: Mr. Jan Hough  
Deputy Chairman

Subject: Pressure Maintenance Waskada  
Your letter dated Dec. 6/83

In regards to the subject letter, New Scope has commenced a study of the reservoir properties and economic of secondary recovery in the Waskada Lower Amaranth A Pool in the E  $\frac{1}{2}$  Sec. 7-1-25 WPM and the W  $\frac{1}{2}$  Sec. 12-1-26 WPM.

The study is being conducted by the Computer Modelling Group and is expected to be completed by the end of March 1984, and the result of the study will be forwarded to you.

New Scope will be conducting a virgin pressure survey on the presently drilling well 14-7-1-25 WPM well. The results of the survey should be available by the end of January.

Yours truly

NEWSCOPE RESOURCES LIMITED



R. D. Weir  
Vice President - Operations

cc Waskada Secondary Recovery file  
Oil and Natural Gas Conservation Board file  
Waskada General File

RDW/bs

p.c. - H. Clare Moster  
Feb. 7/84 - IH/ra



MANITOBA  
DEPARTMENT OF ENERGY AND MINES

THE OIL AND NATURAL GAS CONSERVATION BOARD  
309 LEGISLATIVE BUILDING  
WINNIPEG, MANITOBA  
R3C 0V8

December 6, 1983

New Scope Resources Limited  
1600, 700 - 9th Avenue S.W.  
Calgary, Alberta  
T2P 3V4

Attention: Mr. Doug Weston,  
President

Dear Sirs:

Re: Pressure Maintenance Operations  
Waskada Lower Amaranth A Pool



You are hereby advised that Board Order No. PM 40 authorizing waterflood pressure maintenance operations in a portion of the Waskada Lower Amaranth A Pool has been filed as Manitoba Regulation No. 250/83.

At this time, the Board wishes to point out that the initial performance of the pilot waterflood project in the Waskada Lower Amaranth Unit No. 1 has been very positive in comparison to performance prior to initiation of water injection, and compared to current performance on non-waterflooded areas. Further, pre-injection pressure data indicates a rapid pressure decline to levels below the bubble point under primary depletion. Consequently, it appears at the present time, that pressure maintenance may be required to achieve maximum recovery in the Waskada Lower Amaranth A Pool.

Inasmuch as New Scope Resources Limited operates a number of wells which are completed in and are producing from the Waskada Lower Amaranth A Pool, you are hereby requested to submit to the Board, prior to March 1, 1984, a preliminary review of the need for and feasibility of enhanced recovery operations in the lands operated by New Scope Resources Limited in the Waskada Lower Amaranth A Pool. Your review should include the results of a reservoir pressure survey designed to evaluate the general level of pressure in your portions of the Pool.

Please direct all questions and inquiries in this regard to the Petroleum Branch (Ph.: (204) 944-6574).

Yours sincerely,

THE OIL AND NATURAL GAS  
CONSERVATION BOARD

*[Faint, illegible text]*

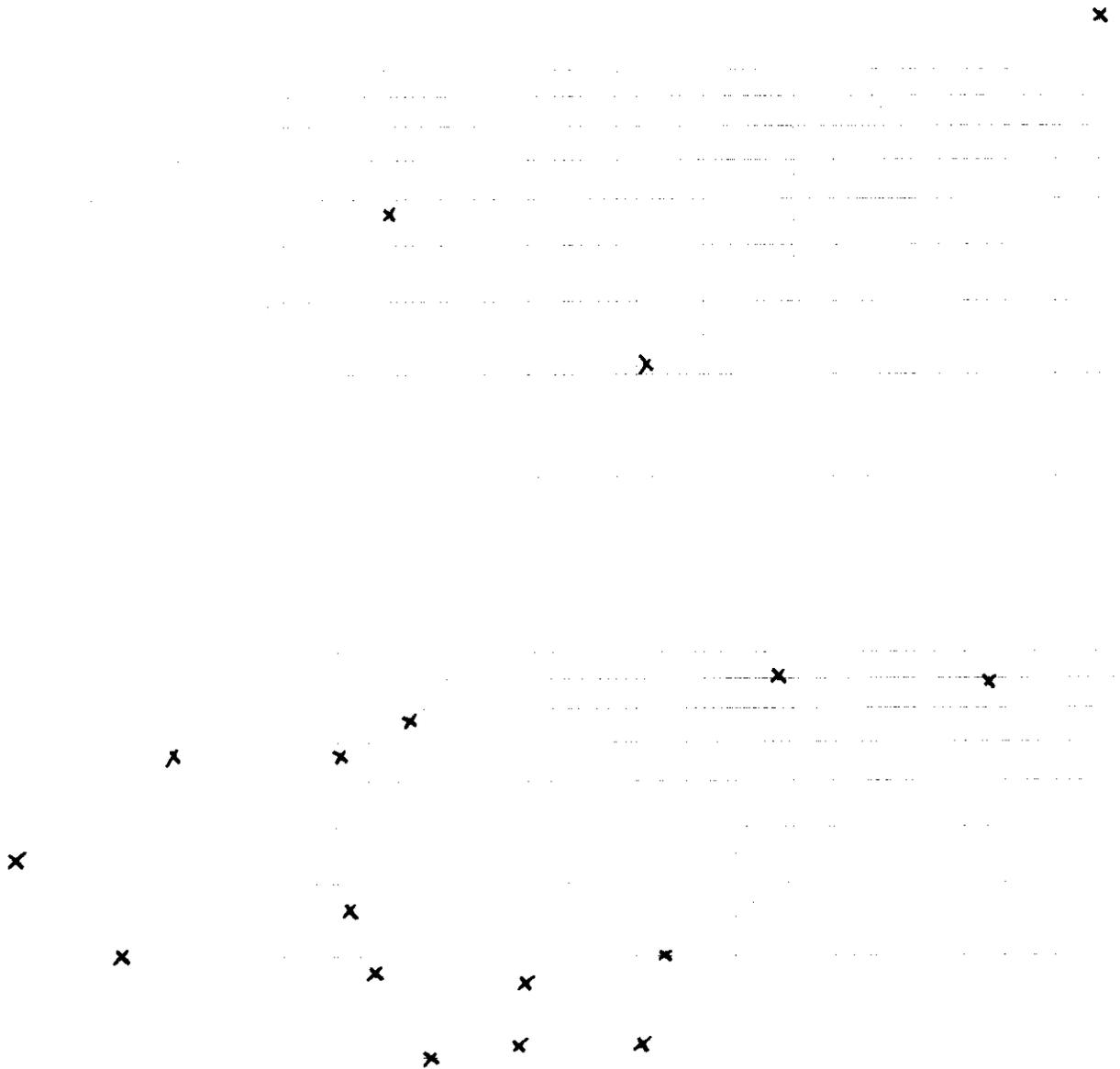
Ian Haugh  
Deputy Chairman

LRD/lk

b.c. Petroleum Branch

WOR  
(JULY 88)

0



418

x  
420

425  
TOP Red Beds (m ss)

930

433

TOTAL FLUIDS PROD JUNE 84  
 TOTAL FLUIDS PROD DEC 83

		0.82	0.42	0.83	0.37	0.30
0.74	0.62	0.89	0.60	0.53	1.05	
	0.61	2.83				
		0.75	0.94	1.28	1.06	
		0.55	1.13	0.91		
		0.84	0.64			

MANITOBA

PRODUCTION  
DATA

JUNE 1984

1.25  
●  
2.10

0.23  
●  
0.61

4.56  
●  
0.78  
  
7.60  
●  
0.19

3.19  
●●  
4.97  
  
5.65  
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MANITOBA