Manitoba

Energy and Mines | Petroleum

555 — 330 Graham Avenue
Winnipeg, Manitoba, CANADA
R3C 4E3

(204) 945-6577

November 20, 1986

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

Attention: Mr. C. G. Folden,
Supervisor Reservoir Engineering

Dear Cal:

Re: Waskada Unit No. 6 - Reservoir Pressure Concern

Your letter of November 13, 1986 in response to our previous letter indicating concerns regarding the long delay in formation of the subject proposed Unit is acknowledged.

With respect to the level of reservoir pressure in the area, we reiterate our concerns and provide the following comments:

1. The pressure data noted in your letter is by and large from peripheral parts of the Pool where withdrawals have been low and aquifer support probably at a maximum. An exception to this is 4-18, however, we note that this well could possibly be affected by water injection at 7-13-1-26 WPM.

2. The 4-18 well was surveyed in 1984 along with several other wells and a pressure of 5 900 kPa was reported. Thus assuming the Horner Buildup pressure to be correct, a pressure drop of 1 600 kPa has occurred over a period of about 27 months (i.e. 59 kPa/mo.). Applying this decline rate to wells in the central part of the area, pressures well below the bubble point are estimated (Example: for the well 16-1, P1984/04 = 4 758 kPa
P = 59 x 31 months = 1 829 kPa P1986/11 = 4 758 - 1 829 = 2 929 kPa). Applying this pressure drop to the isobaric map submitted after the 1984 survey (attached), we contend that a substantial portion of the reservoir is now below the bubble point.

With respect to your comment that a gas saturation may improve waterflood recovery through reduction of residual oil saturation, we accept this concept as valid. However, as the pressure drops below the bubble point, the critical gas saturation is reached and the gas becomes mobile. This results in excess gas production. The loss of gas results in increased oil viscosity and an increased mobility ratio. This in turn would result in poorer areal sweep and loss of recovery. Consequently, while a pressure level slightly below the bubble point may increase recovery slightly, pressures below this may reduce recovery substantially.

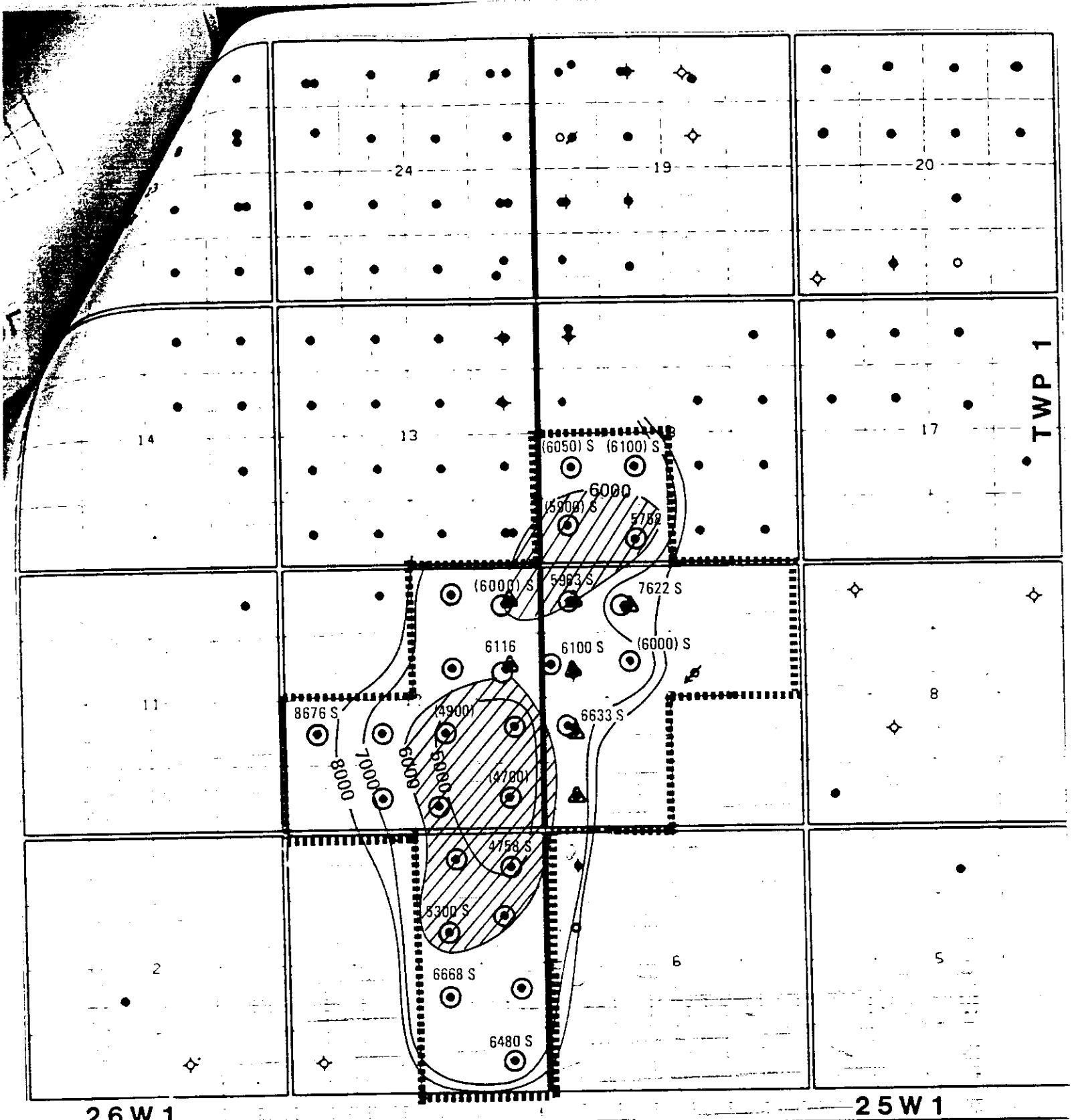
In view of the above, we reiterate the need to accelerate formation of the Unit and urge you to take whatever steps necessary to obtain the minimum levels of royalty and working interest owner consents requested by the Board as a prerequisite to the hearing.

Yours sincerely,

[illegible]

H. Clare Moster, P. Eng.
Executive Director
Petroleum Division

LRD/lk



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

Chevron Canada Resources Limited

WASKADA AREA
PROPOSED WATERFLOOD
SPEARFISH PRESSURE SURVEY
1984–04

FIGURE 9

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

K.E. Godard
Chief Engineer

1986-11-13

Lower Amaranth A Pool
Proposed Waskada Unit No. 6

Manitoba Energy and Mines -
Petroleum Branch
555 - 330 Graham Avenue
Winnipeg, Manitoba
R3C 4E3

Attention: Mr. H. C. Moster, Executive Director

Gentlemen:

In a letter dated 1986-10-20, the Petroleum Branch expressed concern about:

1. The delay in unitization and hence implementing pressure maintenance in the subject Unit.

2. A significant portion of the Unit reservoir being below the bubble point pressure.

3. The detrimental effects on ultimate recovery if the reservoir pressure goes below the bubble point pressure.

The purpose of this letter is to address the Petroleum Branch concerns.

Unitization has been delayed because of problems with some mineral owners. One mineral owner would not agree to the tract participation factors as approved by the WIO. A negotiated compromise was required and this caused a delay in unitization. Two mineral owners will not voluntarily execute the Unit agreement and this is also delaying unitization. Compulsory unitization proceedings were initiated in 1986-05. Currently, Chevron is attempting to obtain WIO and mineral owner approval of the plan for unitization.

The delay in unitization could be reduced by a Petroleum Branch recommendation to the Board, to immediately and unilaterally set a unitization hearing date in the near future. With a prompt hearing and decision by the Board, the waterflood could be implemented before the end of 1986. With the cooperation of the Board, Chevron would be prepared to install the pipelines as soon as the Unit is effective.

The Petroleum Branch opined that the reservoir pressure in a significant portion of Unit No. 6 has declined below the bubble point. This conclusion is based on using the modified Muskat method to determine reservoir pressure from partial pressure buildups.

Chevron has reviewed this method and determined that because of the relative inaccuracy of the sonolog pressure data, and the graphical accuracy required by the Muskat method, no conclusive estimate of reservoir pressure could be made.

However, using type curve analyses of the buildups at Wells 6-7 and 4-18, the Horner Buildup plots were determined to be valid (see Figure 1). The following reservoir pressure estimates were obtained from the Horner Plots:

1. Well 16-7 - 4 500 kPa
2. Well 4-18 - 4 300 kPa

These reservoir pressure estimates indicate that the reservoir pressure is slightly above the bubble point pressure of 4 220 kPa. Both of these wells are in the northern portion of the Unit.

Chevron also surveyed four wells in the southern portion of the Unit which have been shut in for long periods (this data has been sent to the Board).

The wells were:

1. 4- 7- 1-25 - 5 421 kPa
2. 13- 6- 1-25 - 7 186 kPa
3. 7- 1- 1-26 - 5 744 kPa
4. 5-12- 1-26 - 8 396 kPa

The maximum and minimum reservoir pressures observed at these wells are 8 400 and 5 400 kPa respectively. This minimum pressure is 3 000 kPa below the original reservoir pressure but still higher than the bubble point pressure of 4 220 kPa.

The Petroleum Branch also opined that ultimate oil recovery would be reduced if the reservoir pressure dropped below the bubble point. Research has been done on the effects of free gas saturation on waterflood oil recovery. The results of the research indicate that a gas saturation in a reservoir at the start of waterflooding will actually increase oil recovery. Waterflood residual oil saturation is lower in reservoirs with a gas saturation than in reservoirs with no gas saturation. This research indicates that waterflooding below the bubble point pressure may be beneficial. A list of references is attached.

In summary, Chevron is prepared to unitize and commence the waterflood in 1986. The Board could help to expedite the Unit No. 6 waterflood by setting a unitization hearing date now.

Any questions regarding this matter, should be address to Kevin Matieshin at (204) 748-1334 or Doug Schierman at (403) 234-5150.

Sincerely,

Doug Schierman

for C. G. FOLDEN, P.Eng.
Supervising Engineer
Reservoir Engineering

DS/ds
Attach.

References

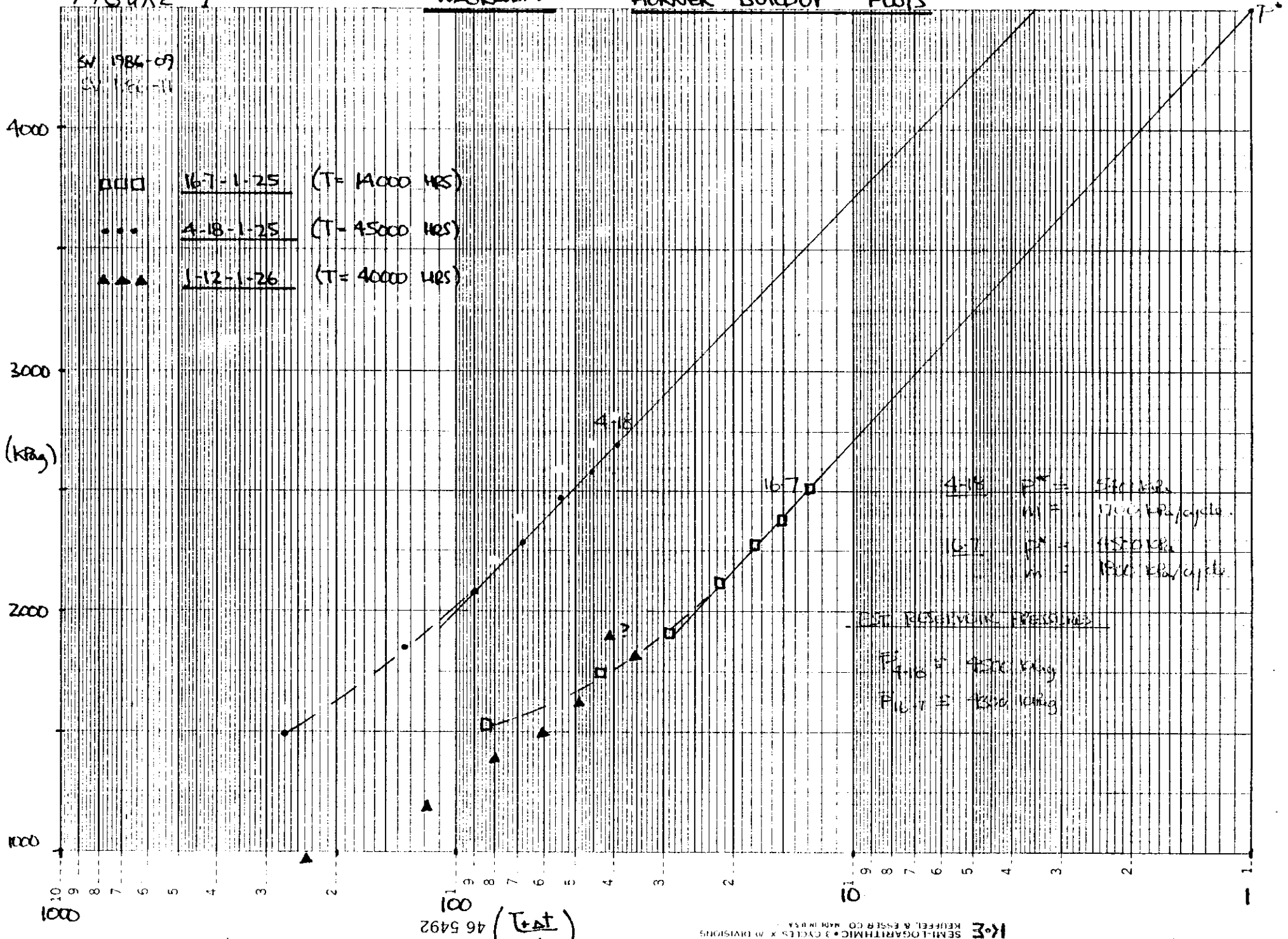
1. "Dyes A. B. Production of Water-Driven Reservoirs Below Their Bubble Point," Trans AIME (1954), 201, 240.

2. Holmgren C. R. and Morse R. A., "Effect Free Gas Saturation on Oil Recovery by Waterflooding," Trans AIME (1951), 192, 135.

3. Kyte et. al; "Mechanism of Waterflooding in the Presence of Free Gas," Trans AIME (1956), 207, 215.

FIGURE 1

WASKADA – HORNER BUILDUP PLOTS



Manitoba

Energy and Mines | Petroleum

555 — 330 Graham Avenue
Winnipeg, Manitoba, CANADA
R3C 4E3

(204) 945-6577

October 20, 1986

Chevron Canada Resources Limited
Box 100
Virden, Manitoba
ROM 2CO

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

Dear Kevin:

Re: Proposed Waskada Unit No. 6
1986 Pressure Survey

Upon development of the Waskada Lower Amaranth A Pool, it was soon recognized that pressure maintenance operations would have to be implemented at an early stage to ensure maximization of ultimate recovery. As a result of this realization, pressure maintenance projects covering a substantial part of the Pool have been initiated and have met with success.

As a result of this, Chevron and its working interest partners proposed an extension of the waterflood project into the area of the proposed Unit No. 6. After consideration of the application, The Oil and Natural Gas Conservation Board approved the proposal by issuing Board Order No. PM 44, dated May 14, 1985. However, due to numerous delays in achieving unitization in the area, pressure maintenance has still not been initiated.

Noting that the extensive delay in initiating water injection may be jeopardizing ultimate recovery, the Board directed Chevron to conduct a pressure survey in 1986 in a minimum of three wells in the proposed Unit Area. The Petroleum Division has recently completed a review of the data obtained and is of the opinion that a significant portion of the proposed Unit area is at or below the bubble point pressure of 4 220 kPa. This evaluation is based on noted decreases in pressure levels between the 1984 survey and the 1986 survey and the application of the modified Muskat method of determining static drainage area pressure to two partial pressure buildups attached to your letter of October 9, 1986.

Based on our general interpretation of pressure levels in the area, we are greatly concerned that continued delay of implementation of pressure maintenance will have an irreversible detrimental effect on ultimate recovery. However, given that it appears likely that forced unitization will be necessary, it is unlikely that water injection would be commenced before spring 1987. The only other option available to minimize the detrimental effects of continued pressure depletion is restriction of production in areas that are below or near the bubble point pressure until reservoir withdrawals are being replaced. The Petroleum Division is considering recommending this option to the Board, unless it can be demonstrated that continued production without injection will not jeopardize ultimate recovery. You are requested to submit any comments you may have in this regard prior to November 15, 1986.

If you have any questions regarding the foregoing, please contact L. R. Dubreuil at (204) 945-6574.

Yours sincerely,

Original Signed by H. C. Moster

H. Clare Moster, P. Eng.
Executive Director
Petroleum Division

LRD/lk

b.c. Charles S. Kang
Wm. McDonald
B. Ball

PS-1-25

Manitoba

Memorandum

Date October 17, 1986

To H. Clare Moster

From L.R. Dubreuil

Telephone

Subject Proposed Waskada Unit No. 6 - 1986 Pressure Survey

First | Fold

Upon review of the pressure data submitted by Chevron, I am of the opinion that a large part of the area of the proposed Waskada Unit No. 6 is at or below the bubble point (4 220 kPa). This is based on limited pressure data obtained in 1986 and on data obtained in 1984 adjusted for probable pressure declines. (see Fig. No. 1).

I have applied a technique called the Modified Muskat method to the build-ups for the 4-18 and 16-7 wells. In this method, a static reservoir pressure $\overline{P}$ is assumed and a plot of log $\overline{P}$ - Pw vs Δt is made. A straight line indicates an accurate assumption. If the $\overline{P}$ assumed is too low the line curves downward. Applying this technique to these two wells, pressures well below the bubble point are estimated.

Although there is no gas measurement data, it is possible that a significant amount of excess gas is currently being produced. This would result in a wastage of reservoir energy and could jeapordize ultimate recovery even upon implementation of water injection.

In view of the difficulties being encountered in Unitization, it is unlikely that water injection will be commenced before spring. This added delay would increase the chance of permanent reservoir damage.

An alternative that the Board may wish to consider is restriction of production to those areas that can be demonstrated to exceed the bubble point.

The attached draft letter indicates the Division's concerns and indicates that it is considering recommending to the Board that production be restricted in areas where the pressure is below the bubble point until such time as pressure maintenance is fully implemented.

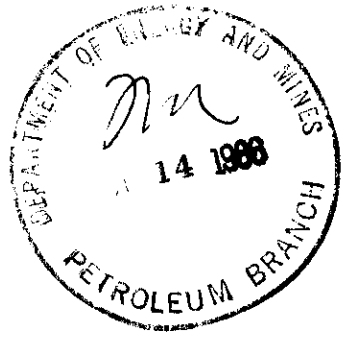
L.R. Dubreuil

LRD:dah

Chevron Canada Resources Limited

Box 100
Virden, MB
R0M 2C0

1986-10-09



Department of Energy and Mines
Petroleum Branch
555-330 Graham Avenue
Winnipeg, MB
R3C 4E3

Attention: Mr. H. C. Moster
Director, Petroleum Branch

Dear Sir:

Re: Proposed Waskada Unit No. 6 - Reservoir Pressure Survey Results

As per the Oil and Natural Gas Conservation Board letter dated 1986-06-18, a reservoir pressure survey was recently performed on three producing, and two shut-in Lower Amaranth wells in the subject area. Producing wells 16-7 and 4-18-1-25 and 1-12-1-26 were shut-in 49 days (1986-07-11 to 08-29) and sonolog fluid levels taken until the pressure buildup was less than 5% per week. Their results are as follows:

Chevron Newscope Waskada 16-7-1-25 WPM	2544 kPa	Datum depth
Chevron Waskada 4-18-1-25 WPM	2791 kPa	"
Chevron Waskada 1-12-1-26 WPM	2175 kPa	"

It should be noted that these pressures were not extrapolated to determine an actual BHP, as the pressure data was still on the straight-line portion of the Horner plot(s) (attached). To make a hypothetical extrapolation would be questionable at best. In order to provide an accurate BHP, required shut-in times for all three wells would have to be approximately 300 days. It should also be noted that very little annular fluid inflow (average 2 - 3 tubing joints) occurred during the shut-in period, indicating extremely poor near-wellbore permeability.

In an attempt to determine more accurate reservoir pressures in the subject area, sonologs were taken on shut-in wells 7-1 and 5-12-1-26 WPM. The 7-1 shot taken 1986-05-22, which represented a shut-in period of approximately eleven months, had a calculated reservoir pressure of 5744 kPa D.D. This corresponds to a decrease of approximately 924 kPa from the 1984-04 pressure survey. 5-12 was sonologged on 1986-10-04 and had a calculated BHP of 8396 kPa D.D., which is a decline of only 280 kPa from the 1984-04 survey.

This well has been shut-in since 1984-09-26, although it was circulated to inhibited fresh water on 1986-06-24. As a result, a fresh water gradient (9.81kPa/M) was used in the calculation. These shut-in results appear to be more representative of the reservoir pressures in the subject area.

As discussed with Mr. Dubreuil on 1986-10-08, it is proposed to sonolog shut-in wells 13-6 and 4-7-1-25 to obtain additional reservoir pressure data. These results will be submitted once the data is received and pressures are calculated.

Chevron apologizes for the delay in submitting these results and for any inconvenience this may have caused.

If further information is required, please contact Mr. J. Cooke at 748-1334 or at the letterhead address.

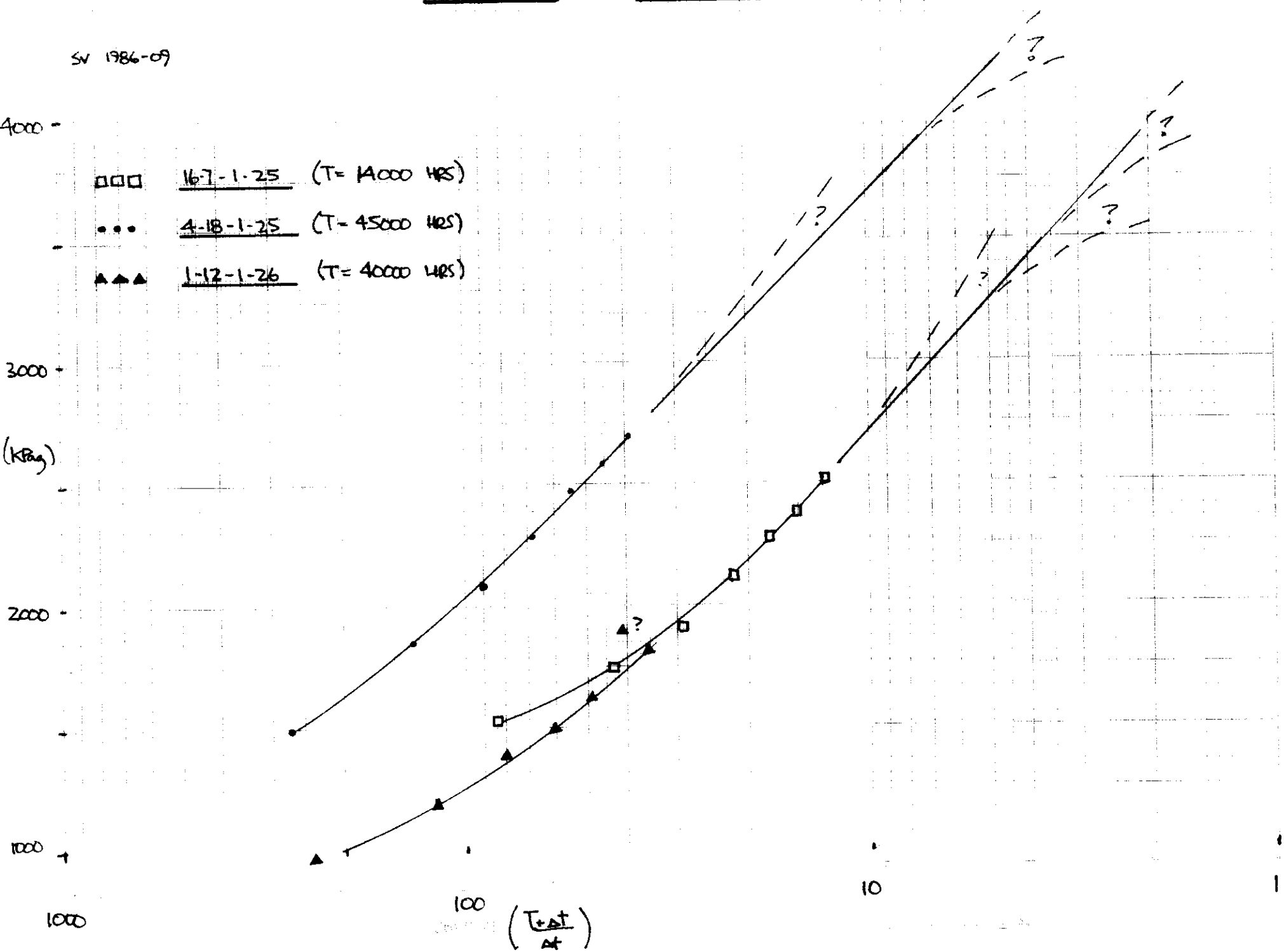
Yours truly,

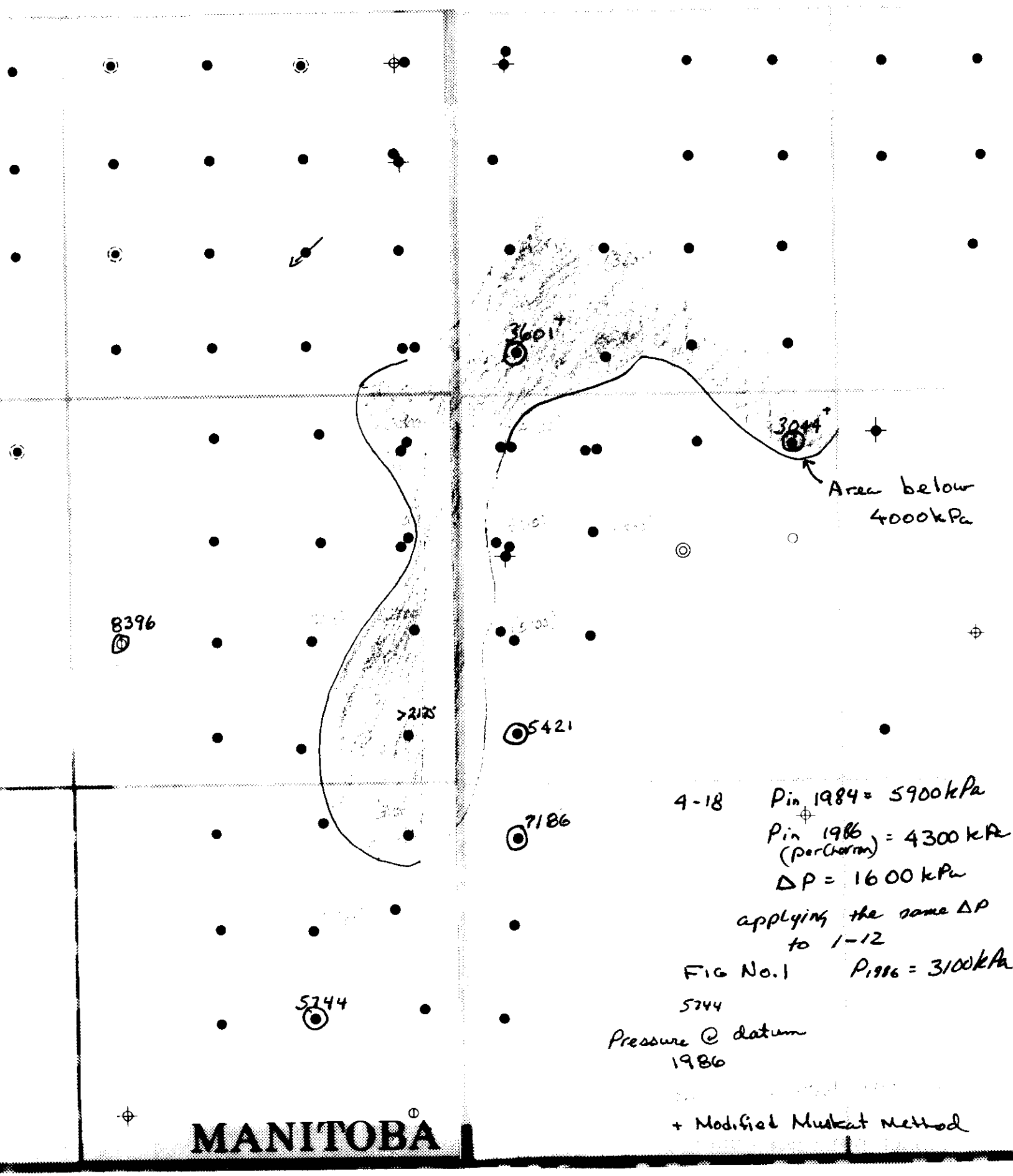
for K. G. Matieshin, P. Eng.
Area Supervisor
Virden

JC/cm

WASKADA - HORNER BUILDUP PLOTS

SV 1986-09




3601+
3044+
Area below
4000kPa
8396
>2125
5421
7186
5744
4-18
P_{in} 1984 = 5900kPa
P_{in} 1986 (perCharron) = 4300 kPa
ΔP = 1600 kPa
applying the same ΔP
to 1-12
Fig No.1
P_{1986} = 3100kPa
5744
Pressure @ datum
1986
MANITOBA
+ Modified Muskat Method

Manitoba

Memorandum

October 17, 1986

To H. Clare Moster

From L.R. Dubreuil

Telephone

Subject Proposed Waskada Unit No. 6 - 1986 Pressure Survey

First | Fold

Upon review of the pressure data submitted by Chevron, I am of the opinion that a large part of the area of the proposed Waskada Unit No. 6 is at or below the bubble point (4 220 kPa). This is based on limited pressure data obtained in 1986 and on data obtained in 1984 adjusted for probable pressure declines. (see Fig. No. 1).

I have applied a technique called the Modified Muskat method to the build-ups for the 4-18 and 16-7 wells. In this method, a static reservoir pressure $\overline{P}$ is assumed and a plot of log $\overline{P}$ - Pw vs Δt is made. A straight line indicates an accurate assumption. If the $\overline{P}$ assumed is too low the line curves downward. Applying this technique to these two wells, pressures well below the bubble point are estimated.

Although there is no gas measurement data, it is possible that a significant amount of excess gas is currently being produced. This would result in a wastage of reservoir energy and could jeapordize ultimate recovery even upon implementation of water injection.

In view of the difficulties being encountered in Unitization, it is unlikely that water injection will be commenced before spring. This added delay would increase the chance of permanent reservoir damage.

An alternative that the Board may wish to consider is restriction of production to those areas that can be demonstrated to exceed the bubble point.

The attached draft letter indicates the Division's concerns and indicates that it is considering recommending to the Board that production be restricted in areas where the pressure is below the bubble point until such time as pressure maintenance is fully implemented.

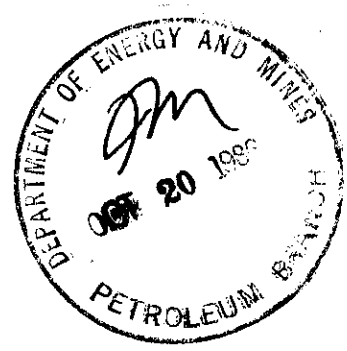
L.R. Dubreuil

LRD:dah

Chevron Canada Resources Limited

Box 100
Virden, MB
R0M 2C0

1986-10-15



Department of Energy and Mines
Petroleum Branch
555-330 Graham Avenue
Winnipeg, Manitoba
R3C 4E3

Attention: Mr. H. C. Moster
Director, Petroleum Branch

Dear Sir:

Re: Proposed Waskada Unit No. 6 - Additional Reservoir Pressure Survey Results

As indicated in Chevron's letter to the Petroleum Branch dated 1986-10-09, sonologs were taken at shut-in wells 13-6 and 4-7-1-25 WPM on 1986-10-11 to obtain additional reservoir pressure data in the subject area. Assuming an oil gradient of 7.45 kPa/M, calculated datum depth BHP's and corresponding shut-in times are as follows;

Well	Date Shut-In	Shut-In Period	BHP
Newscope South Waskada 13-6-1-25 WPM	1984-07-01	833 days	7186 kPa D.D.
Newscope South Waskada 4-7-1-25 WPM	1986-04-03	191 days	5421 kPa D.D.

These pressures appear to be representative and indicate that the reservoir pressure is still above the bubble point pressure in this area.

It is proposed to obtain sonolog data on Chevron Newscope Waskada 9-7-1-25 WPM once it's completed and the load fluid is recovered. Although this well is not presently in the proposed Unit, the pressure data obtained should be useful in comparing pressures in the immediate area (i.e. 16-7). These results will be submitted once the data is received and pressures are calculated.

If further information is required, please contact Mr. J. Cooke at 748-1334 or at the letterhead address.

Yours truly,

John Cooke
for K. G. Matieshin, P. Eng.
Area Supervisor
Virden

JC/cm

cc: Newscope Resources Ltd.

July 2, 1986

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

Attention: Mr. K.G. Matieshin
Area Supervisor

Dear Kevin:

Re: Reservoir Pressure Survey
Proposed Waskada Unit No. 6

Your letter of June 27, 1986 outlining the proposed reservoir pressure survey for the subject proposed Unit is acknowledged. Upon review, we find your proposal to be acceptable, and you are therefore authorized to proceed.

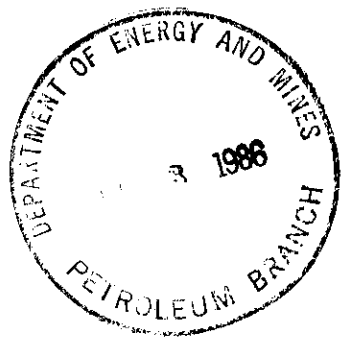
Yours sincerely,

for H. Clare Moster, P. Eng.
Executive Director
Petroleum Branch

Chevron Canada Resources Limited

Box 100
Virden, MB
R0M 2C0

1986-06-27



Department of Energy and Mines
Petroleum Branch
555-330 Graham Avenue
Winnipeg, MB
R3C 4E3

Attention: Mr. H. C. Moster
Director, Petroleum Branch

Dear Sir:

Re: Proposed Waskada Unit No. 6 - Reservoir Pressure Survey

In reply to the Oil and Natural Gas Conservation Board letter dated 1986-06-18 regarding the subject Unit, Chevron proposes to perform a Lower Amaranth Pool pressure survey on the following wells;

(1) Chevron Newscope Waskada 16-7-1-25 WPM
(2) Chevron Waskada 4-18-1-25 WPM
(3) Chevron Waskada 7-1-1-26 WPM
(4) Chevron Waskada 1-12-1-26 WPM

Well 7-1 has been shut-in since 1985-06 and a sonolog taken on 86-05-22 resulted in a calculated reservoir pressure of 5831 kPa MPP. This compares to a 1984-04 reservoir pressure of 6668 kPa. The remaining three producing wells will be shut-in and sonolog fluid levels taken until the pressure buildup is less than 5% per week.

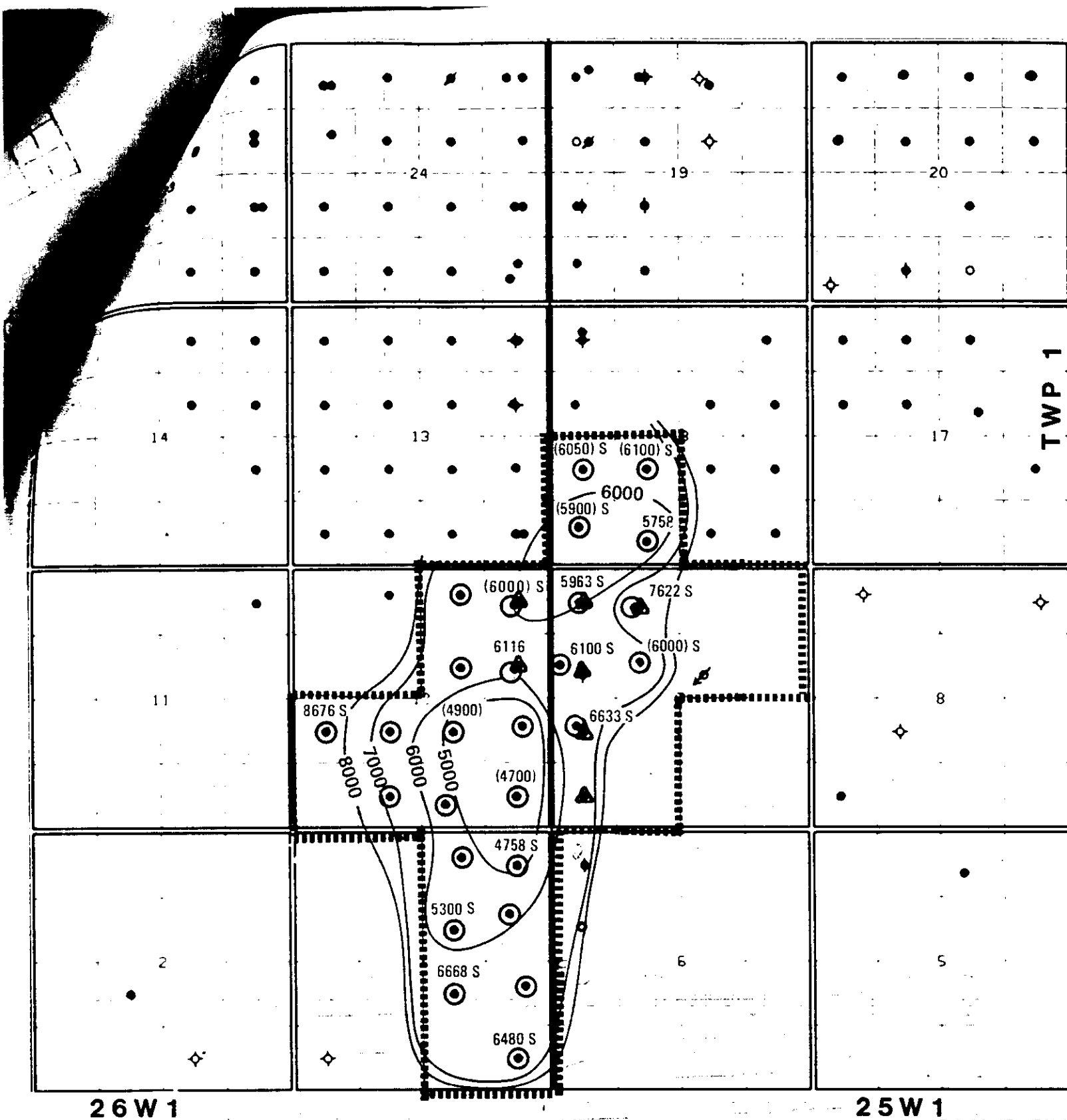
Since the Board has requested that the results of this survey be submitted prior to 1986-08-01, it is imperative that the survey be commenced as soon as possible. As a result, your earliest attention to this matter would be appreciated.

If further information is required, please contact Mr. John Cooke at 748-1334 or at the letterhead address.

Yours very truly,

John Cooke
for K. G. Matieshin, P. Eng.
Area Supervisor
Virden

JC/cm



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

Chevron Canada Resources Limited

WASKADA AREA
PROPOSED WATERFLOOD
SPEARFISH PRESSURE SURVEY
1984–04

FIGURE 9

	S. HOLDICH	
	L. CHARLTON	
	DOCUMENT NO.	INTERPRETATION OVERLAY NO.

Waskada Unit 6 Pressure History

Well	Date	P@ datum		
5-7LAm	4-84	6633		
11-7	4-84	6005		
12-7LAm	3-84	6105		
13-7LAm	4-84	6105		
14-7LAm	4-84	7621		
3-18	3-84	5660		
4-18	4-84	5866 X		
5-18	4-84	6067		
6-18	4-84	6070		
7-1	4-84	6667	6-86	5831
10-1	4-84	5224		
16-1	4-84	4758		
1-12	3-84	4625 X		
5-12	3-84	8685		
7-12	4-84	5247		
8-12	4-84	2902		
9-12	4-84	6084		
16-12	3-84	5966		
16-7		X		

Manitoba

Energy and Mines | Petroleum

555 — 330 Graham Avenue
Winnipeg, Manitoba, CANADA
R3C 4E3

(204) 945-6577

September 16, 1985

Chevron Canada Resources Limited
Box 100
Virden, Manitoba
R0M 2C0

Attention: Mr. K. Matieshin,
Area Supervisor

Dear Kevin:

Re: Proposed Waskada Unit No. 6
1985 Reservoir Pressure Survey

Your letter of September 9, 1985 outlining your plans for the 1985 reservoir pressure survey for the proposed Waskada Unit No. 6 is acknowledged.

It is suggested that the areal coverage of the survey could be significantly improved by addition of one well in the northeast part of the Unit area (we would suggest 15-7). Except as noted above, your plans are acceptable and you are authorized to proceed with the survey.

Yours sincerely,

Original Signed by H. C. Moster

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

LRD/lk

Chevron Canada Resources Limited
Box 100 Virden,MB ROM 2CO

1985-09-09

Manitoba Department of Energy and Mines
Petroleum Branch
555-330 Graham Avenue
Winnipeg, Manitoba
R3C 4E3

Attention: Mr. H. C. Moster
Director, Petroleum Branch

Dear Sir:

Subject: Waskada Unit No. 6
Lower Amaranth'A' and Mission Canyon Formations
1985 Subsurface Pressure Survey

In compliance with the Oil and Natural Gas Conservation Board Order No. PM 44, and in particular Section 3.(3) of the Pressure Maintenance Rules, Chevron Canada Resources Limited, as Interim Operator of Waskada Unit No. 6, submits the following attached information regarding the subject 1985 subsurface pressure survey:

(1) List of wells to be surveyed
(2) Measurement technique
(3) Well status

The 7 wells proposed for survey in the Lower Amaranth 'A' pool will be measured using the Acoustic Well Sounder or Sonolog method. The wells will be shut-in and fluid levels taken until the pressure buildup on a log-log graph plot is linear and can be extrapolated.

One of the proposed three wells to be surveyed in the Mission Canyon (MC3) formation (3-12-1-26 WPM) is presently completed in both zones, with a cement retainer isolating the MC3 from the producing Lower Amaranth 'A' formation. Chevron proposes to sting into the cement retainer(s) and measure the MC3 pressure with a pressure recorder. For the other two MC3 wells, the method of pressure measurement will be identical to the proposed method of the Lower Amaranth 'A' pool wells.

The survey will likely commence in early October. If any additional information is required, please contact Mr. John Cooke at 748-1334 or at the letterhead address.

Yours truly,

C Y Folden

C. G. Folden
Area Superintendent
Virden Area

JC/cm

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

1985 Proposed Waskada Unit No. 6

Bottom Hole Pressure Survey

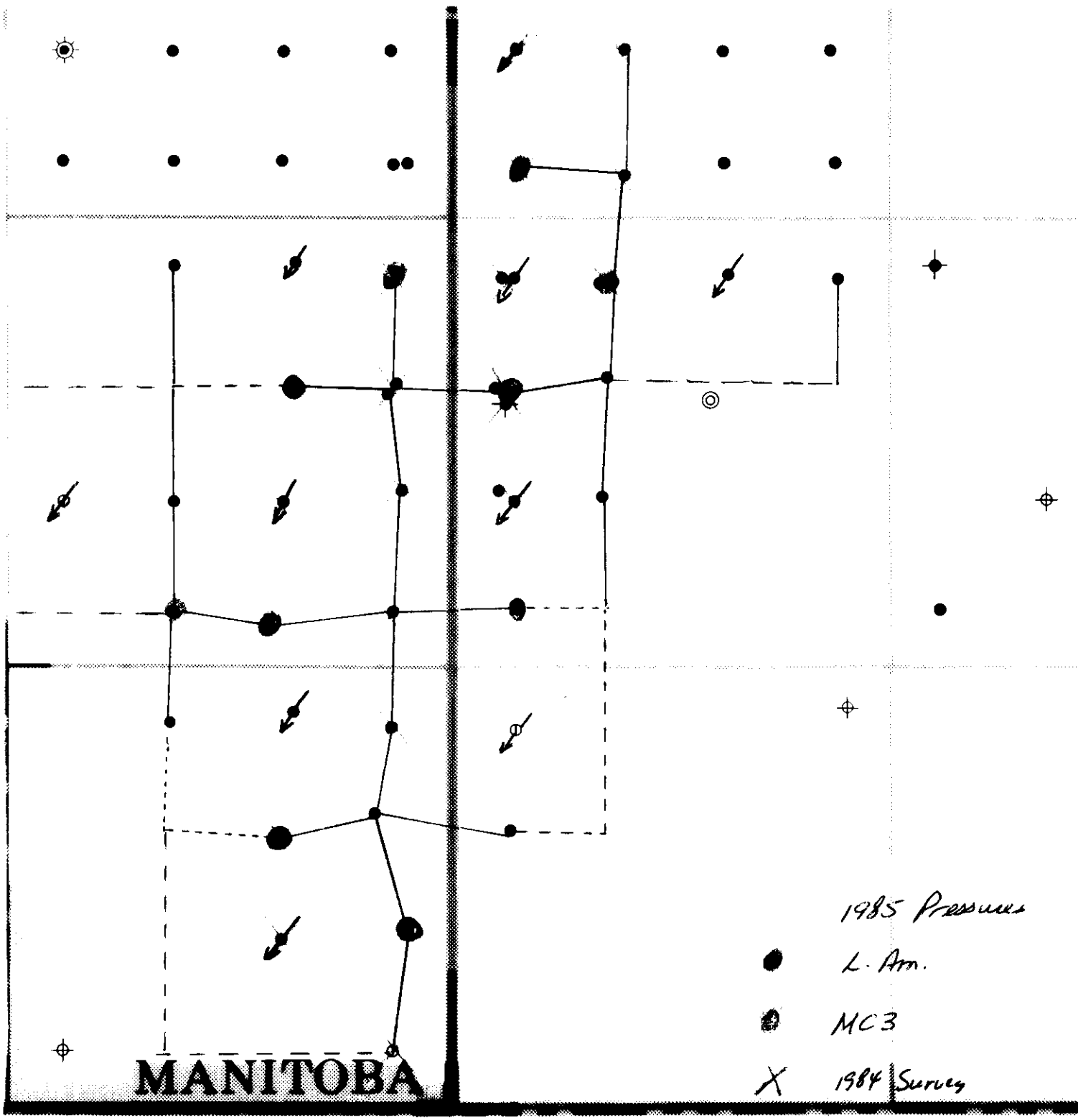
A. Lower Amaranth A Pool

Well	Type of Survey	Well Status
8-1-1-26	Sonolog	Producing
10-1-1-26	"	"
2-12-1-26	"	"
10-12-1-26	"	"
4-7-1-25	"	"
12-7-1-25	"	"
4-18-1-25	"	"

B. Mission Canyon (MC3) Pool

Well	Type of Survey	Well Status
3-12-1-26	Pressure Bomb	Producing - Lower Amaranth 'A'
16-12-1-26	Sonolog	" - MC3
14-7-1-25	"	" "

NOTE: The one MC3 well to be surveyed with a pressure bomb will require a service rig since it is completed in both zones with a cement retainer isolating the MC3 zone from the producing Lower Amaranth'A' zone.



1985

)LEUM BRANCH

MAP

- Location
- Standing
- Producer
- Abandoned producer
- Dry and abandoned
- Water injection w
- Water injection w
- Abandoned wate
- Abandoned wate
- Salt water dispos