



Chevron Canada Resources

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1989-02-24

Viriden Lodgepole "A" Pool
North Viriden Scallion Unit #1
Reduced Spacing Project

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

Attention: Mr. C. S. Kang, Chairman

Gentlemen:

Chevron Canada Resources as operator of North Viriden Scallion Unit #1 (NVSU #1) and on behalf of working interest owners hereby requests:

1. Pursuant to sections 20(1) and 21(3) of the Manitoba Petroleum Drilling and Production Regulations, approval to decrease the size of drilling spacing units from 16 hectares (40 acres) to 8 hectares (20 acres) within the application area (Attachment 1). It is understood that the target areas will be square with sides sixty-five metres from the sides of the 8 hectare drilling spacing units.
2. Pursuant to section 64 of the Manitoba Petroleum Drilling and Production Regulations, amendment of section 1(1) of pressure maintenance order No. PM 51 to include the addition of eleven unit water injection wells as listed on Attachment 2.
3. Amendment of the definition of "New Oil Well" in section 1(1) of the Petroleum Crown Royalty and Incentives Regulation to delete the following clause:

"but does not include an infill or additional well drilled in a spacing unit in which, when such well was drilled, there was already a well producing or capable of producing from the pool in which the well is completed or where the spacing unit was deemed to be producing from that pool under an existing pooling or unitization agreement."

This will enable "New Oil" royalty status for the reduced spacing project's infill well production.

The proposed reduced spacing project area is part of NVSU #1 which is wholly contained within the Mississippian Lodgepole "A" Pool. The following sections and attachments contain all the supporting information associated with the above requests.

A. TECHNICAL DETAILS

1. Attachment 1 shows the 144 hectare proposed reduced spacing project area and the status of all wells in NVSU #1.
2. Attachment 2 contains a list of proposed infill wells and injection well conversions.
3. Attachment 3 contains the following geological information for the reduced spacing project area:
 - a) type log showing reservoir units
 - b) cross-section illustrating pay continuity
 - c) net pay map
 - d) structure map
 - e) isoporosity map
 - f) isopermeability map
4. Attachment 4 is the report outlining the technical justification for the reduced spacing project. Incremental reserves associated with 8 hectare spacing are forecasted to be 100 000 m³.
5. Attachment 5 is a summary of reservoir parameters for the reduced spacing project area.
6. Attachment 6 is a map showing the results of the 1987 reservoir pressure survey for NVSU #1.

B. BENEFITS TO CROWN

1. Attachment 7 is a proposal for calculation of Crown royalties and mineral taxes for the unit. It assumes new oil status for infill wells in the reduced spacing project area.
2. Attachment 8 outlines the benefits to the Crown due to incremental Crown royalties and Freehold mineral taxes as a result of the reduced spacing project.
3. The reduced spacing project will result in incremental Crown royalties and Freehold mineral taxes (over continued waterflood) totalling 7 240 m³.

C. SURFACE CONSIDERATIONS

1. Attachment 9 is an areal photograph of the reduced spacing project area illustrating the proposed infill locations and associated lease trails.
2. Attachment 10 is an enviromental impact assessment of the proposed project.
3. Attachment 11 is Chevron's impact assessment of the infill wells relating to surface operations.
4. Attachment 12 is a map showing the proposed location of the fibreglass production pipelines.
5. Attachment 13 is a map showing the proposed location of the cement lined water injection pipelines.
6. A description of existing surface facilities is detailed in Battery permit #B-05-001-17. New processing facilities will not be required for this reduced spacing project.

D. CORRESPONDENCE WITH SURFACE OWNERS

1. Attachment 14 shows the surface owners within one kilometer of the project area.
2. Attachment 15 contains the consent to survey forms signed by the landowners who will have proposed infill wells located on their property.
3. Attachment 16 contains the notification sent to landowners who will have proposed injection well conversions on their property.

E. IMPACT ON LESSEES, LESSORS AND WORKING INTEREST OWNERS

1. Lessees, lessors and working interest owners are identified in the NVSU #1 unit agreement.
2. The incremental recovery (100 000 m³) will increase income in an equitable fashion for all lessees and lessors in NVSU #1.

F. DRILLING PRECAUTIONS

Attachment 17 contains a list of precautions that will be taken during drilling operations.

G. WATER INJECTION

1. Attachment 18 summarizes the water injection details.
2. Attachment 19 is a typical wellbore diagram for the proposed injection well conversions.

H. CORROSION CONTROL

Attachment 20 summarizes the methods of corrosion control that will be used.

I. MONITORING

Attachment 21 summarizes the proposed monitoring program for the reduced spacing project.

If there are any questions regarding this application please contact Bonnie Carnahan at (403) 234-5170 or Cliff Butchko at (403) 234-5156 in our Calgary office, or Lyle Martinson at (204) 748-1334 in our Virden office. Additional copies of the Application may be requested from our Information Centre (403) 234-5580.

Yours very truly,



for C. G. FOLDEN, P.Eng.
Manager,
Reservoir Engineering

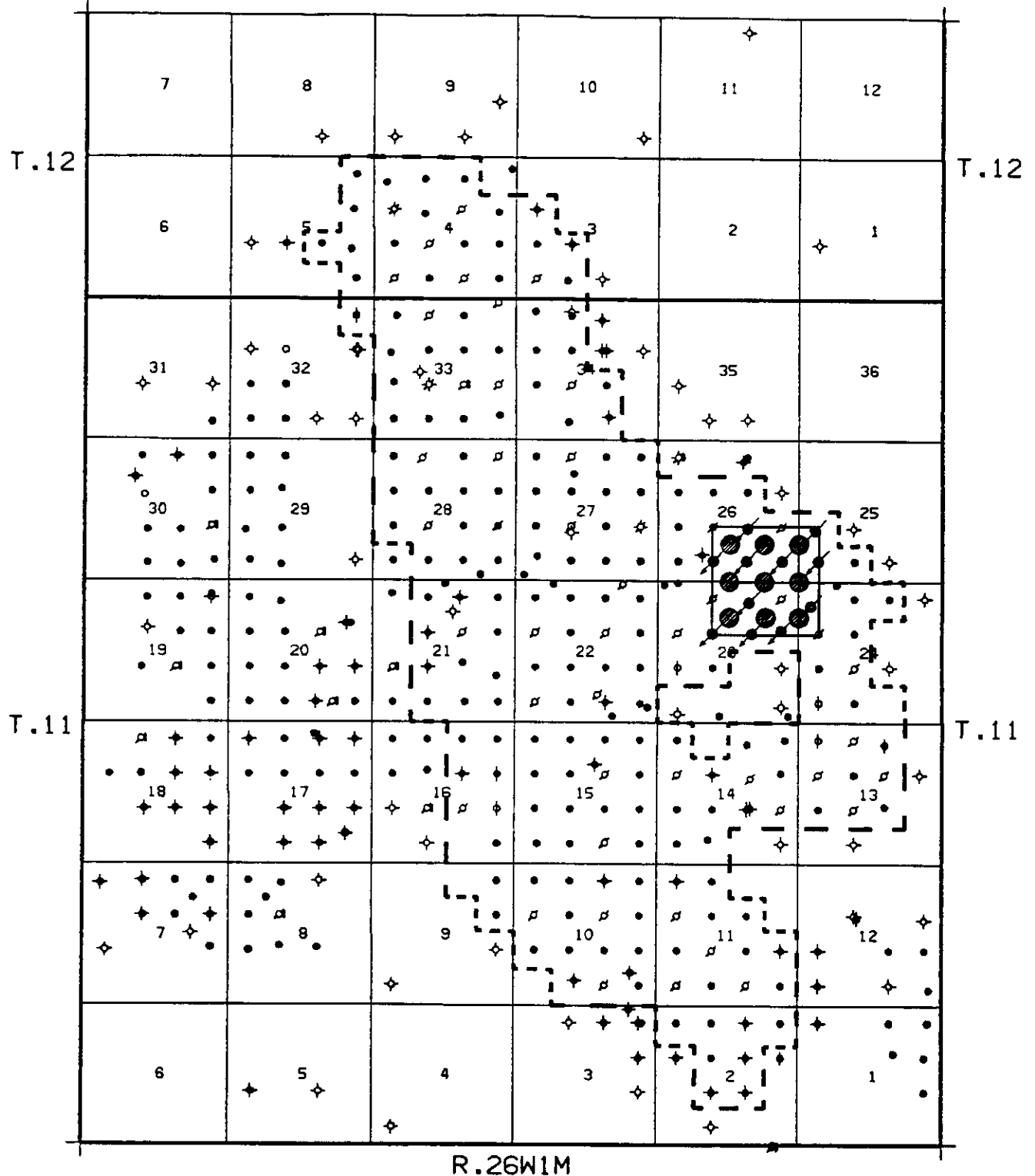
BRC/gk

cc: Mr. J. R. D. Partridge - Chief/Land Utilization and Soil Survey Section,
Agriculture
Mr. S. J. Puchniak - Director of Mining and Use Taxes
Mr. S. Scrafield - Senior Policy Planner,
Municipal Affairs
Mr. D. Wotton - Head Terrestrial Standards and Studies,
Environment and Workplace Safety and Health

Mr. W. C. Heaman
Mr. and Mrs. W. Peters
Mr. P. W. Tapp
Rural Municipality of Wallace
Surface Rights Association

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CR213-31

NVSU #1 INFILL PROJECT



NORTH VIRDEN SCALLION UNIT NO. 1

AS OF 1989-01-25

SCALE 1" = 1 MILE

- PROJECT BOUNDARY
- PROPOSED INFILL SITES
- ⊗ PROPOSED CONVERSIONS



**NORTH VIRDEN SCALLION UNIT #1
REDUCED SPACING PROJECT
PROPOSED INFILL WELLS**

1. Chevron NVSU #1 03D-26-11-26 (WPM)
2. Chevron NVSU #1 02D-26-11-26 (WPM)
3. Chevron NVSU #1 01D-26-11-26 (WPM) ✓
4. Chevron NVSU #1 14D-23-11-26 (WPM) ✓
5. Chevron NVSU #1 15D-23-11-26 (WPM) ✓
6. Chevron NVSU #1 13C-24-11-26 (WPM) ✓
7. Chevron NVSU #1 11D-23-11-26 (WPM) ✓
8. Chevorn NVSU #1 10D-23-11-26 (WPM) ✓
9. Chevron NVSU #1 09D-23-11-26 (WPM) ✓

**NORTH VIRDEN SCALLION UNIT #1
REDUCED SPACING PROJECT
PROPOSED INJECTION WELL CONVERSIONS**

1. Chevron Scallion	09-23-11-26 (WPM)
2. Chevron Scallion	10-23-11-26 (WPM)
3. Chevron Scallion	11-23-11-26 (WPM)
4. Chevron Scallion	15-23-11-26 (WPM)
5. Chevron Scallion Prov.	13-24-11-26 (WPM)
6. Chevorn Scallion	04-25-11-26 (WPM)
7. Chevron Scallion	05-25-11-26 (WPM)
8. Fargo Scallion	01-26-11-26 (WPM)
9. Fargo Scallion	02-26-11-26 (WPM)
10. Sun W.C. Tapp Scallion	03-26-11-26 (WPM)
11. Fargo Scallion	07-26-11-26 (WPM)



North Virden Scallion Reduced-Spacing Waterflood Pilot

Geological Information

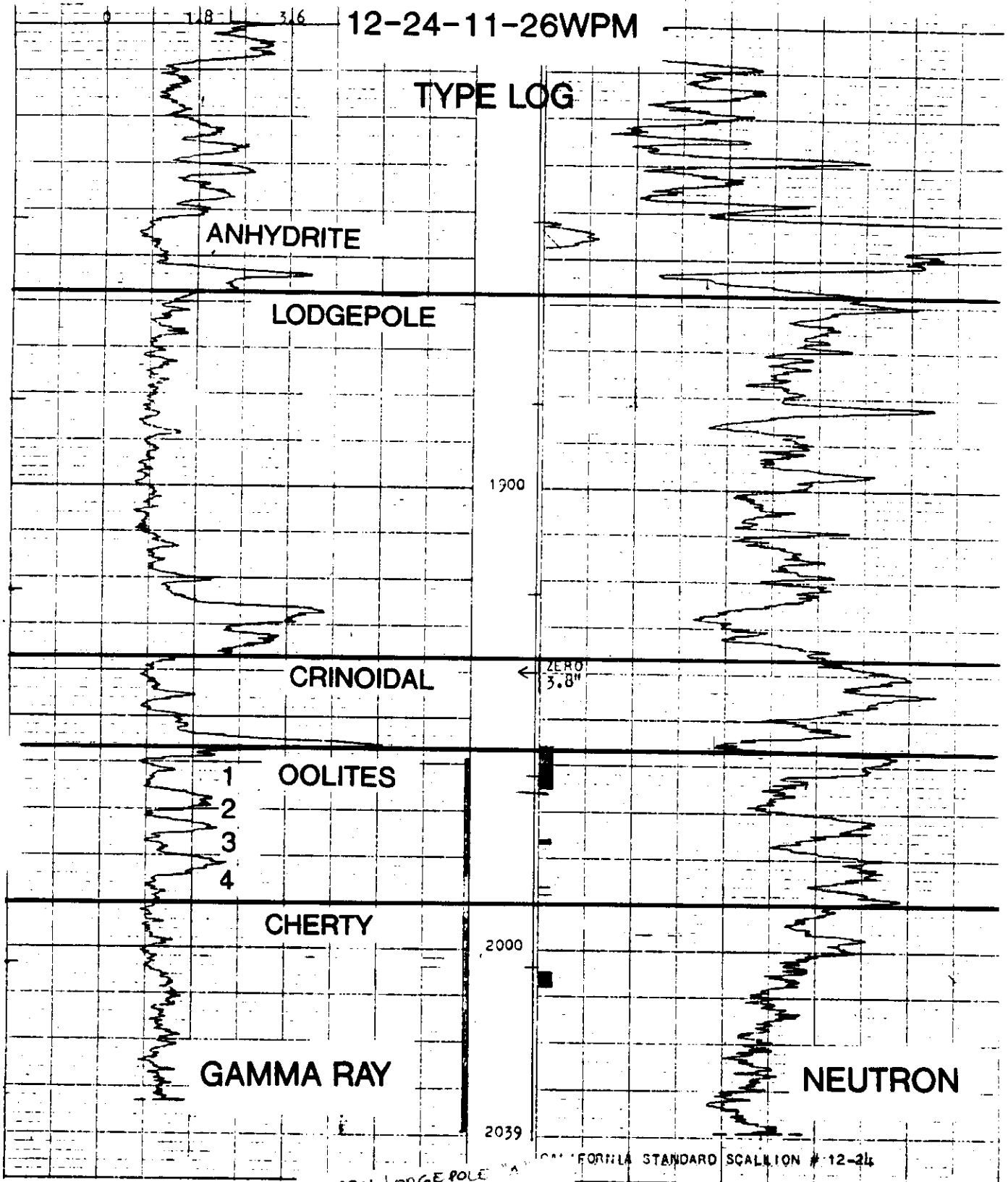
North Virden Scallion Unit #1 produces from the Mississippian Lodgepole Formation. In the pilot area, the main reservoir is the Cherty Member with additional production from the Oolites and Crinoidal members. All the reservoirs are limestones. Anhydritic dolostones in the upper part of the Lodgepole Formation are generally tight and serve as caprock.

As requested, the following information has been provided for the pilot area:

- type log showing reservoir units
- cross-section illustrating pay continuity (Following attachment #21)
- net pay map (Following attachment #21)
- structure map
- Isoporosity (ϕ h/h) and Isopermeability (kh/h) maps

Please note the limited well control in the isoporosity and isopermeability maps. Available data was contoured to reflect depositional control of porosity and permeability. Some of the older core analyses give pessimistic permeability values. This occurs where permeability measurements were not separated into horizontal and vertical components. Averaging horizontal and vertical permeability gives pessimistic values since vertical permeability is generally half that of horizontal permeability. The infill wells will provide better data for reservoir analysis.

If you have any questions, please contact Ms. Robin Stanford at (403) 234-6160.



VIRIDEN LODGEPOLE "A"
 POOL NVSU #1
 Reduced Spacing
 application by
 Chevron Canada Limited

Subsea Structure on top of Cherty

CI = 10'

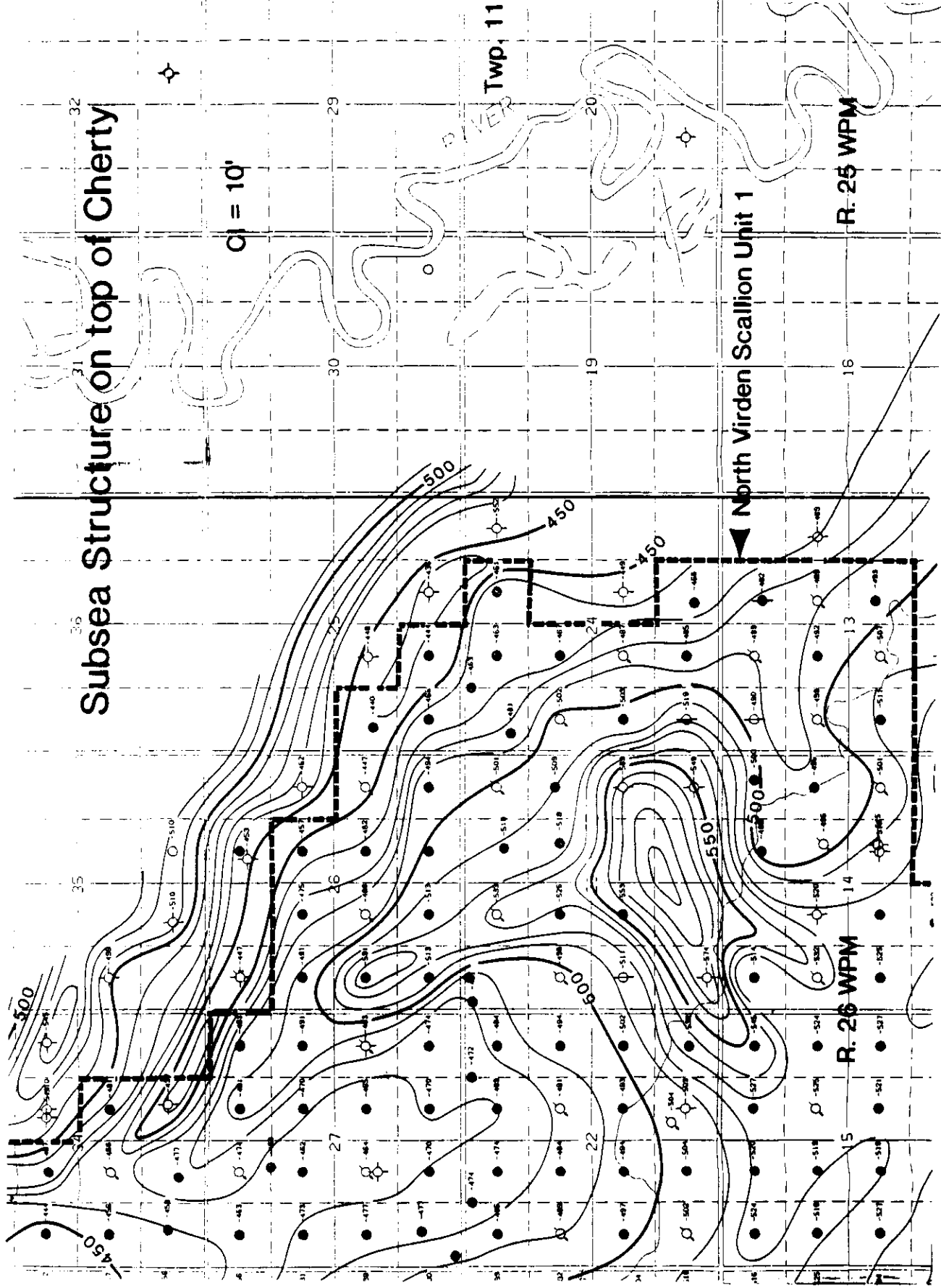
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PIVER

North Virden Scallion Unit 1

R. 25 WPM

R. 26 WPM



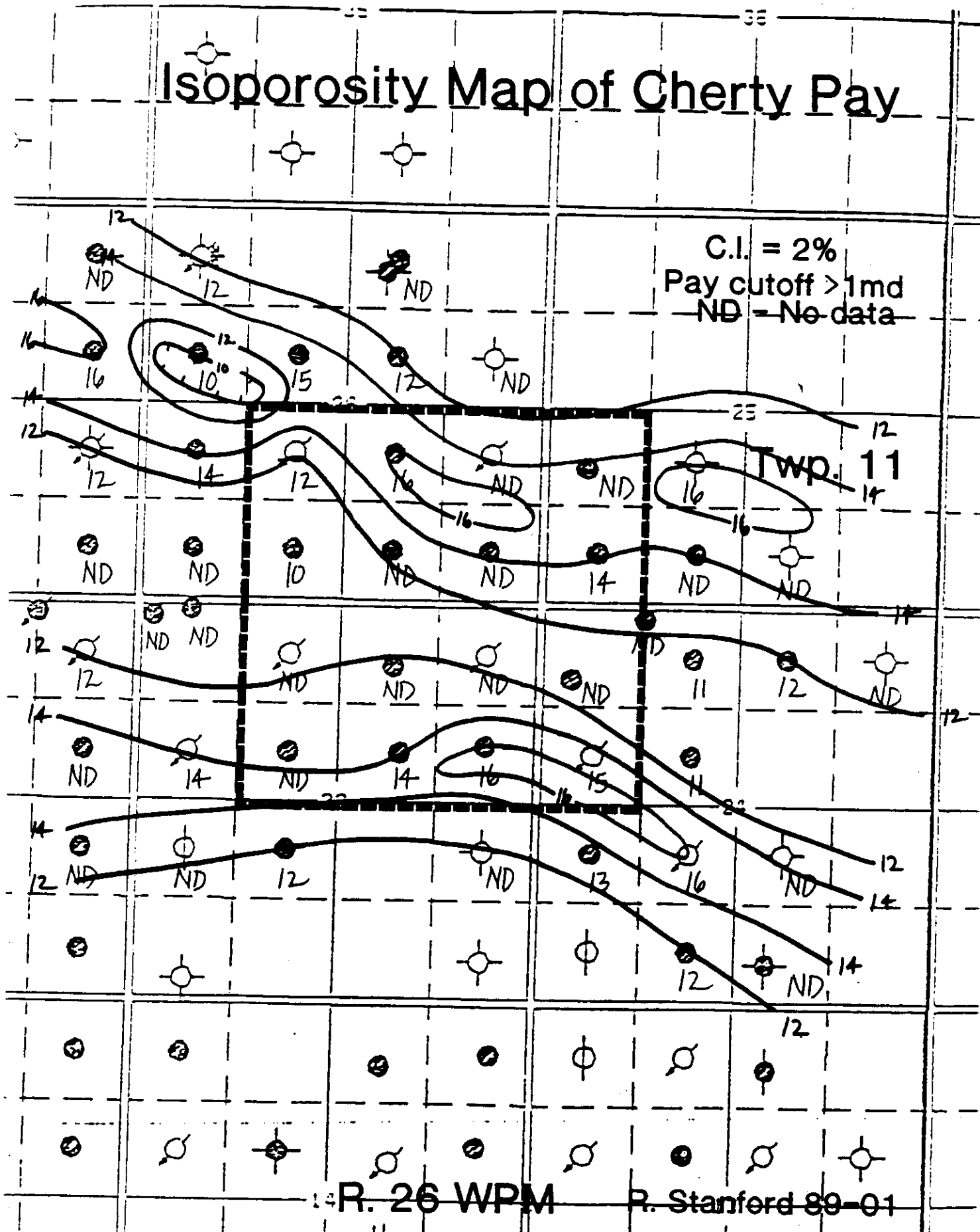
Isoporosity Map of Cherty Pay

C.I. = 2%
Pay cutoff > 1md
ND - No data

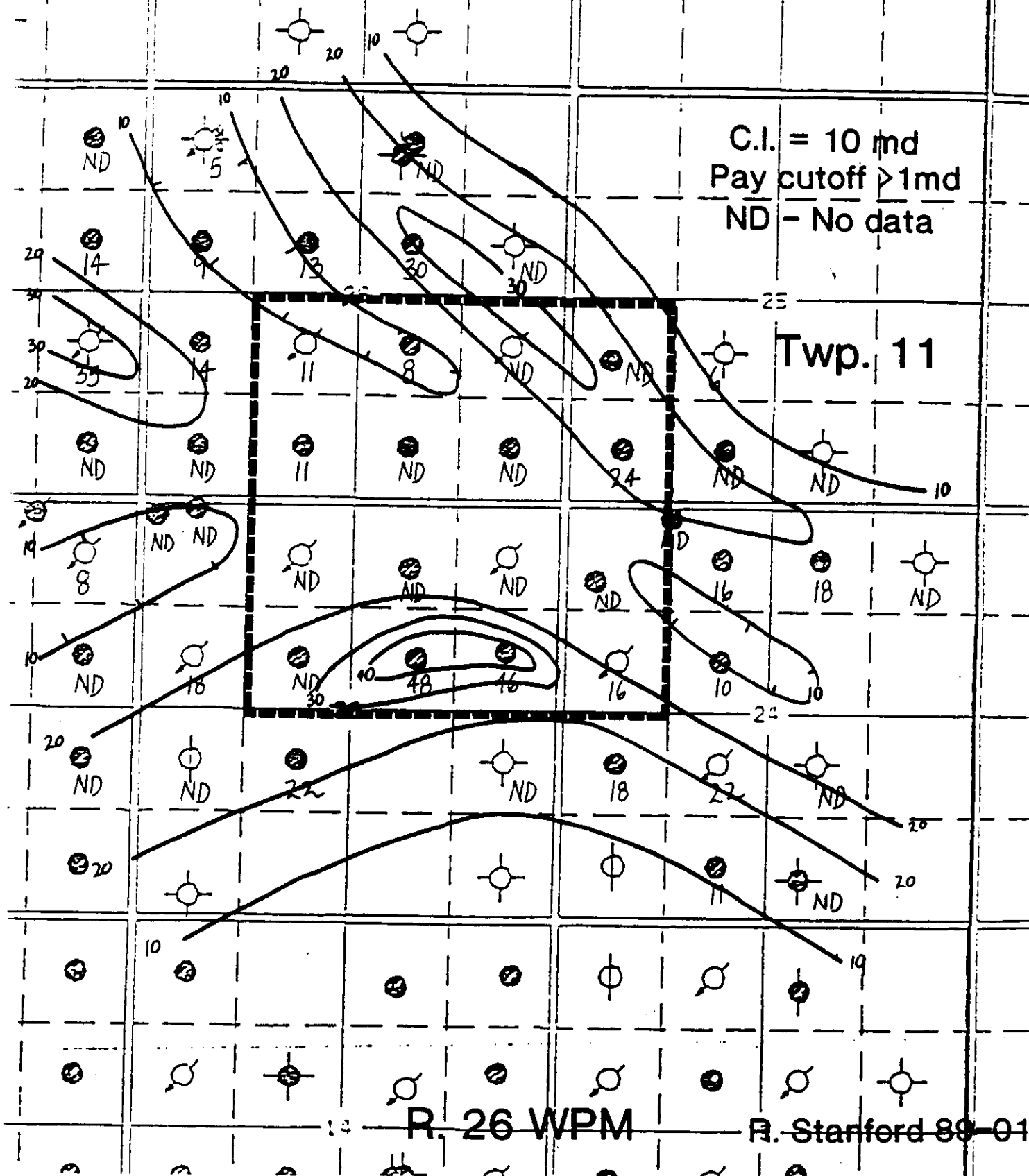
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R. 26 WPM

R. Stanford 89-01



Isopermeability Map of Cherty Pay



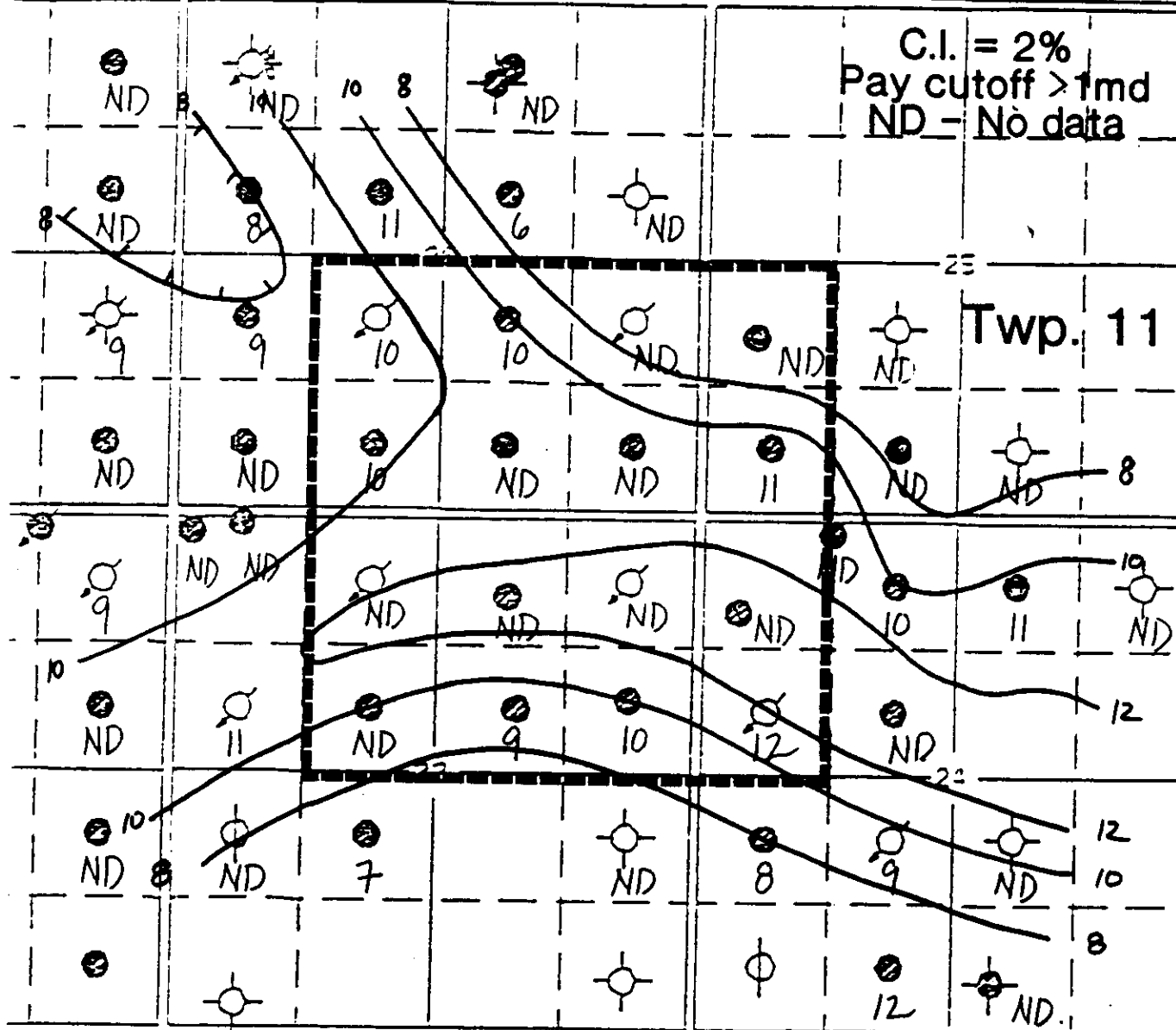
R. 26 WPM

R. Stanford 89-01

Isoporosity Map of Oolites Pay

C.I. = 2%
Pay cutoff > 1md
ND - No data

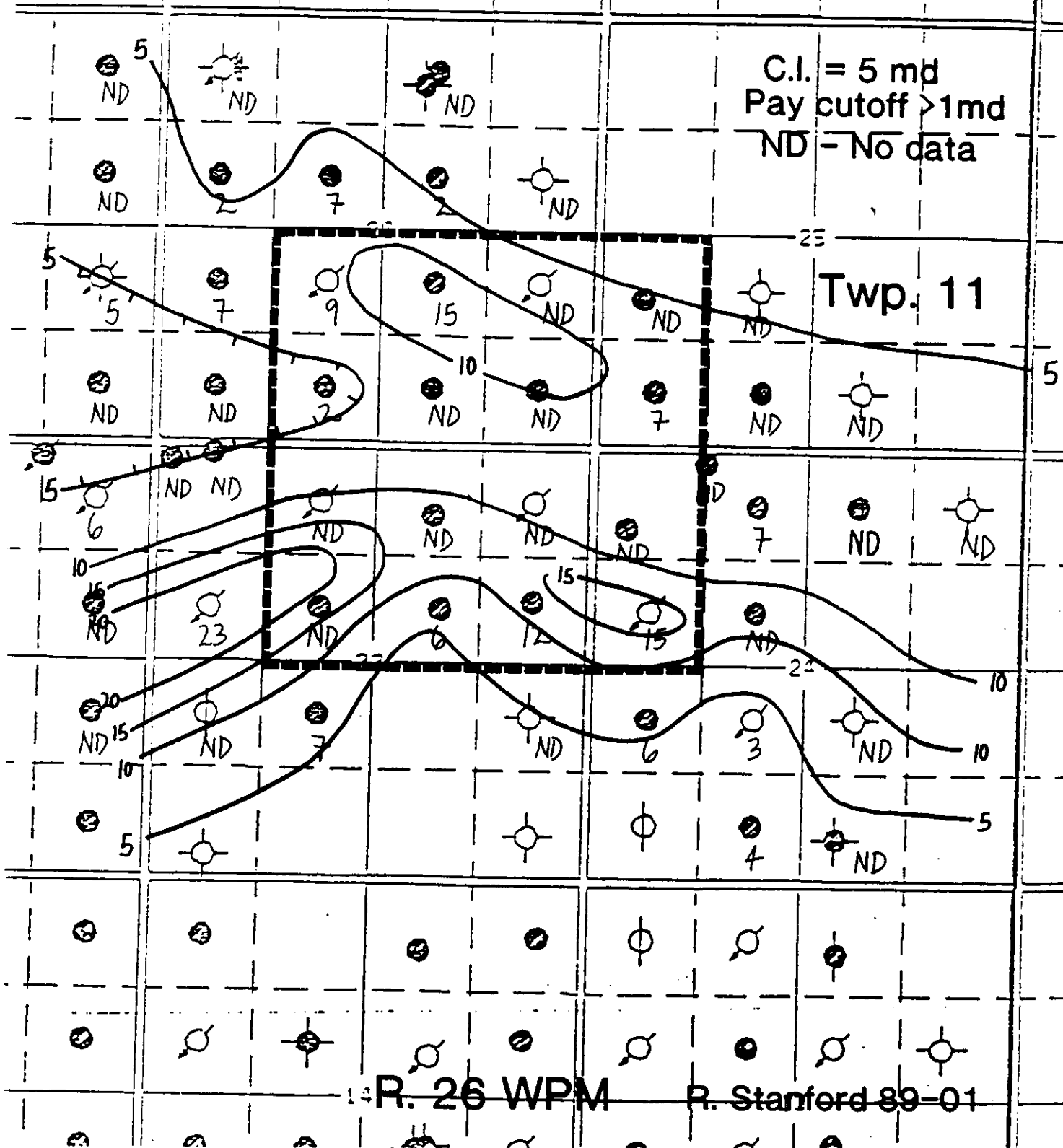
Twp. 11



R. 26 WPM

R. Stanford 89-01

Isopermeability Map of Oolites Pay





11

North Virden Scallion Unit #1
Reduced Spacing Project
Technical Justification

Summary

Chevron Canada Resources is proposing a reduced spacing waterflood project on 8 ha well spacing for North Virden Scallion Unit #1. The project involves drilling 9 infill wells and converting 11 existing producers to injectors. Incremental oil reserves are forecasted to be 100 000 m³.

Introduction

North Virden Scallion Unit #1 was discovered in 1954. It was placed on primary production with 16 ha well spacing until 1962. In 1962 the pool was unitized and waterflooding initiated. Production is partially supported by a horizontal edge aquifer acting on the southwestern side of the Unit. Between 1974 and 1978, six "corridor" wells were drilled on 8 ha spacing. One "corridor" well (16C-22-11-26 WPM) was converted to a water injector in 1986-09.

Current pool recovery is 27% OOIP. Ultimate recovery is forecasted to be 32% OOIP. Infill drilling on 8 ha spacing has been evaluated as a method of improving oil recovery from the Unit.

Discussion

A. Selection of Reduced Spacing Project Area

The infill drilling project area was selected based on several technical factors:

1. good net pay
2. low current recovery
3. low water production
4. poor ultimate recovery

Figure 1 is the recovery map used in the selection of the project area. It shows current recovery as a percent of OOIP for each location. Relative variations in recovery are realistic, however, actual values could be in error due to uncertainties in net pay and connate water saturations.

The reduced spacing project area selected is shown in Figure 2. Table 1 summarizes the reservoir parameters used to select the project area.

Table 1

Reservoir Parameters Used for Project Selection

	Reduced Spacing <u>Project Area</u>	<u>Total Unit</u>
Average Net Pay (m)	12.5	11.2
Current WOR (m^3/m^3)	3.6	5.8
Current Recovery Factor (% OOIP)	24.2	26.7
Ultimate Recovery Factor (% OOIP)	30.5	32.0

The proposed project involves drilling 9 infill wells on 8 ha spacing and converting 11 producers to water injectors.

B. Geology

Production at North Virden Scallion is from the Mississippian Lodgepole "A" Pool where the Crinoidal, 1st through 4th Oolite and Cherty members comprise the productive horizons (refer to Figure 3).

A recent Lodgepole geological review included the determination of the amount and stratigraphic position of net pay in the study area. Figure 3 shows that the majority of pay is located in the Cherty member, which is very continuous. The 3rd and 4th Oolite members also have good pay and pay continuity. The upper pay zones are thinner and less continuous. However, infill experience (Chevron and industry) in other carbonate reservoirs indicates pay continuity is typically worse than predicted.

There is significant variation in permeability in the Lodgepole formation, reducing the vertical sweep efficiency. The reduced well spacing and conversion of existing producers to injectors will increase both vertical and areal sweep efficiency. This will result in incremental oil production.

C. Project Design

A five spot waterflood pattern was selected for NVSU #1 because:

- 1) Laboratory studies indicate recovery is higher for five spot patterns than nine spot patterns with the same well spacing⁽¹⁾.
- 2) A Laysim streamtube model of Daly Unit #3 indicated recovery is 5% higher for five spot patterns than for nine spot patterns. Similar results would be expected for NVSU #1.

Drilling producing wells makes this project more viable than drilling injection wells.

If producers are drilled:

- eleven producing wells would be converted to injectors
- new wells would encounter poorly swept zones, resulting in higher initial oilcuts

If injectors are drilled:

- five injection wells would be converted to producers
- the converted wells would have very high watercuts for a significant length of time, resulting in reduced project feasibility (economically and technically).

The optimum strategy for reduced spacing development, both technically and economically, is to use 5 spot patterns with 8 ha well spacing in NVSU #1. The Project is more viable if producing wells are drilled as opposed to injection wells.

D. Production History

The production forecast for the NVSU #1 infill drilling project was developed based on performance of:

- 1) NVSU #1 waterflood with 16 ha well spacing
- 2) NVSU #1 "corridor" wells on 8 ha spacing
- 3) conversion of "corridor" well (16C-22) to a water injector
- 4) Daly Unit #1 waterflood with 8 ha well spacing

1. Performance of NVSU #1 Waterflood

Waterflooding began in NVSU #1 in 1962 with 16 ha well spacing. The waterflood recovery factor is estimated to be 32% OOIP. Figure 4 shows the following production response:

- a) peak oil production rate was greater than original production rate (oil rate increased by 165%)
- b) fluid rate stabilized and remained constant
- c) after peak production was reached oil production has declined at 6.5%/year

2. Performance of NVSU #1 Corridor Wells

Six "corridor" wells were drilled on 8 ha spacing between 1974 and 1978. Figure 5 shows the corridor region. The corridor wells are:

A 14-21-11-26 WPM
A 14-22-11-26 WPM
C 16-22-11-26 WPM
A 13-23-11-26 WPM
A 04-27-11-26 WPM
A 01-28-11-26 WPM

The WOR at the "corridor" wells was 70% lower than the WOR at the offsetting locations. Table 2 summarizes the WOR for the new wells and the offsetting wells.

Table 2

"Corridor" Region WOR

<u>Year</u>	<u>"Corridor" Wells</u>	<u>Offsetting Wells</u>
1955	-	0.1
1974	0.2	0.6
1978	0.3	0.9

Individual well plots for the "corridor" wells showed oil rates were constant for one to two years before declining. There was minimal interference between the "corridor" wells and offsetting wells.

3. Performance of 16C-22 Conversion

In 1978-02, the 16C-22 well was drilled on 8 ha spacing and placed on production. Figure 6 shows the production history for the 16C-22 five spot pattern. It shows infill drilling on 8 ha spacing had the following results:

- a) peak production rate was greater than peak waterflood rate
- b) fluid rate stabilized at a constant rate
- c) incremental recovery as a result of drilling the 8 ha producing well is estimated to be 6.1% OOIP (based on decline analysis)

In 1986-09, the 16C-22 well was converted to a water injector. Production tests showed:

- a) fluid rates and reservoir pressure responded within nine months
- b) oil rates have remained stable for two years

Since production decline has not been established, incremental recovery due to the well conversion cannot be estimated.

Incremental recovery due to waterflooding on 8 ha spacing would be greater than 6.1% OOIP (the incremental recovery associated with drilling 8 ha producers).

4. Performance of Daly Unit #1 Waterflood on 8 ha Well Spacing

Several five spot waterflood patterns were established in Daly Unit #1 in the 1970's with 8 ha well spacing. Figure 7 shows the production history for these patterns. It shows:

- a) waterflood response time was one year
- b) waterflood production declined at 15%/year
- c) incremental recovery associated with waterflooding on 8 ha spacing is between 4% and 9% OOIP(2)

E. Production Forecast

1. Base Case Production Forecast

Figure 8 shows the production history for the proposed infill project area. Oil production in the project area is declining at 5.8%/year. Current recovery is 24.2% OOIP and ultimate recovery is forecasted to be 30.5% OOIP.

The base case production forecast for the project area was developed using this information and based on an economic life of 30 years. Figure 9 and Table 3 show the base case production forecast for the project area.

The boundary wells have produced from both within the project boundary and outside of it. Approximately 55% of the base case production forecast is from inside the reduced spacing project boundary. The remaining 45% is from outside this boundary.

2. Reduced Spacing Production Forecast

The reduced spacing project production forecast has been developed based on two components: an infill drilling component and a waterflood realignment component.

a. Infill Drilling Component

The project area production forecast for the infill drilling case was developed assuming:

- a) 1989-01 start date
- b) economic project life of 23 years (economic limit of 0.2 m³/d/well)
- c) constant fluid rate of 125 m³/d (current fluid rate)
- d) WOR at infill locations 70% lower than current WOR for the project area
- e) initial oil rate from infill wells equal to original oil rate in the project area (oil rate increases by 150%)
- f) waterflood breakthrough occurs after one year
- g) oil production declines at 15%/year after breakthrough
- h) incremental recovery in the reduced spacing project area is 7.6% OOIP (88 000 m³)
- i) ultimate recovery for the reduced spacing project area is 38.1% OOIP

Figure 9 and Table 3 show the reduced spacing project area production forecast.

b. Waterflood Realignment Component

Oil production would be affected by waterflood realignment. Conversion of wells to injectors along the project boundary would affect production from wells outside the reduced spacing project area.

Incremental recovery due to waterflood realignment was estimated to be 11 900 m³ (0.7% OOIP outside of project boundary). This was developed by estimating the impact of conversions on production from neighboring wells. Peak response was predicted to occur within two years with production declining at 15%/year after that time. Table 3 summarizes the incremental production associated with this component.

Table 4 summarizes the incremental recovery associated with both components.

Table 4

Incremental Recovery

		Reduced Spacing	Outside Project	
		<u>Project Area</u>	<u>Boundary</u>	<u>Total</u>
OOIP	(m ³)	1 161 700	1 758 900	2 920 600
Base Case Reserves	(m ³)	67 720	55 630	123 350
Reduced Spacing Reserves	(m ³)	155 720	67 530	223 250
Incremental Reserves	(m ³)	88 000	11 900	99 900
	(%OOIP)	7.6	0.7	

3. Total Unit Production Forecast

The base case production forecast for the total unit was developed by extrapolating the production shown in Figure 4.

The infill case production forecast for the total unit was developed by adding the incremental production from the reduced spacing project area (including waterflood realignment) to the total unit base case production forecast. Total incremental production is estimated to be 99 900 m³ as shown in Table 4.

The total unit production forecasts are shown in Figure 11 and Table 3.

Conclusion

The infill drilling project proposed for North Virden Scallion Unit #1 will result in approximately 100 000 m³ of incremental oil. This project will help to maximize oil recovery from this field. Results from this project may support expansion of infill drilling to other areas of NVSU #1.

References

1. Cotman N. T., Still G. R. and Crawford P. B., "Laboratory Comparison of Oil Recovery in Five-Spot and Nine-Spot Waterflood Patterns," Producers Monthly, 1962-12, pp 10-13.
2. Schierman D. N., "Daly Unit No. 3 Request for Reduced Drilling Spacing Unit Approval," 1986-02-04.

TABLE 3

ASSUME: 1989-01 start up

Peak production is equal to maximum original production

Water breakthrough occurs after one year

Production decline: project base: 5.8%/year

unit base: 6.5%/year

infill: 15.0%/year

NORTH VIRDEN SCALLION UNIT #1
PRODUCTION FORECAST

YEAR	REDUCED SPACING PROJECT				TOTAL UNIT		% NEW OIL
	BASE	INFILL	WF	INCREMENT	BASE	INFILL	
	(m3/d)	COMPONENT (m3/d)	COMPONENT (m3/d)	(m3/d)	(m3/d)	(m3/d)	
1989	23.00	61.00	0.00	38.00	340.00	378.00	16.14
1990	21.67	56.43	13.00	47.76	317.90	345.66	15.43
1991	20.41	47.96	26.00	53.55	297.24	330.79	13.67
1992	19.23	40.77	22.10	43.64	277.92	321.56	12.68
1993	18.11	34.65	18.78	35.33	259.85	295.18	11.74
1994	17.06	29.45	15.97	28.36	242.96	271.32	10.86
1995	16.07	25.04	13.57	22.54	227.17	249.71	10.03
1996	15.14	21.28	11.54	17.68	212.40	230.08	9.25
1997	14.26	18.09	9.81	13.63	198.60	212.23	8.52
1998	13.43	15.38	8.34	10.28	185.69	195.96	7.85
1999	12.65	13.07	7.08	7.50	173.62	181.12	7.22
2000	11.92	11.11	6.02	5.21	162.33	167.54	6.63
2001	11.23	9.44	5.12	3.33	151.78	155.11	6.09
2002	10.58	8.03	4.35	1.80	141.92	143.71	5.58
2003	9.96	6.82	3.70	0.56	132.69	133.25	5.12
2004	9.39	5.80	3.14	-0.44	124.07	123.62	4.69
2005	8.84	4.93	2.67	-1.24	116.00	114.76	4.29
2006	8.33	4.19	2.27	-1.87	108.46	106.59	3.93
2007	7.85	3.56	1.93	-2.35	101.41	99.06	3.60
2008	7.39	3.03	1.64	-2.72	94.82	92.10	3.29
2009	6.96	2.57	1.39	-2.99	88.66	85.66	3.00
2010	6.56	2.19	1.19	-3.19	82.89	79.71	2.74
2011	6.18	1.86	1.01	-3.31	77.51	74.19	2.51
2012	5.82	0.00	0.86	-4.96	72.47	67.50	0.00
2013	5.48	0.00	0.73	-4.75	67.76	63.00	0.00
2014	5.16	0.00	0.62	-4.55	63.35	58.81	0.00
2015	4.86	0.00	0.53	-4.34	59.24	54.90	0.00
2016	4.58	0.00	0.45	-4.14	55.39	51.25	0.00
2017	4.32	0.00	0.38	-3.94	51.79	47.85	0.00
2018	4.07	0.00	0.32	-3.74	48.42	44.68	0.00
2019	3.83	0.00	0.27	-3.56	45.27	41.72	0.00
2020	3.61	0.00	0.23	-3.37	42.33	38.95	0.00
TOTAL (m3)	123351	155721	67529	99899	1686987	1786886	
OOIP (E3 m3)	2920.6	1161.7	1758.9				
SHARE OF BASE PROD (m3)		67720	55631				
INCREMENTAL PROD (m3)		88001	11898				
(%)		7.58	0.68				

FIGURE 1
NORTH VIRDEN SCALLION UNIT #1

RECOVERY MAP

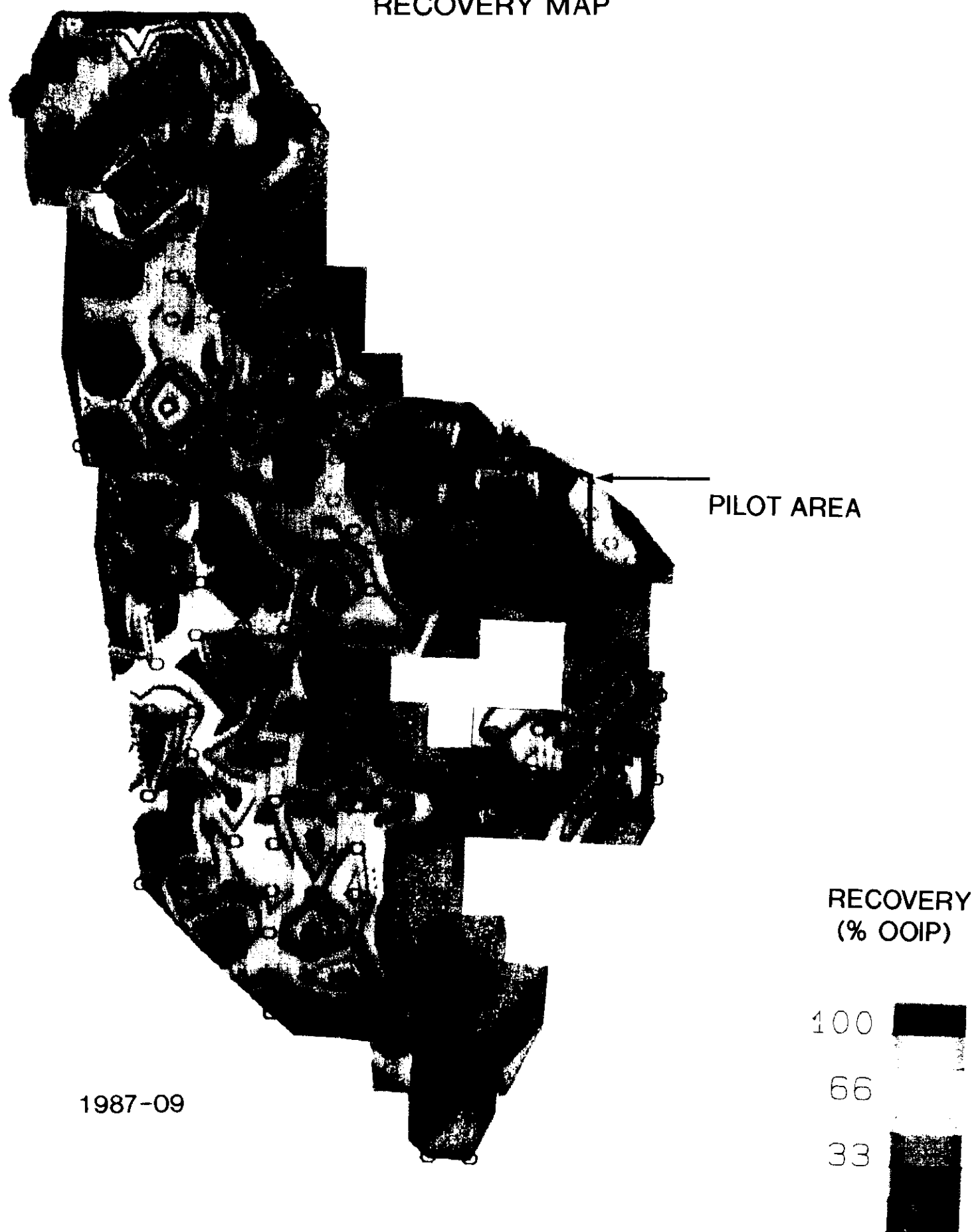
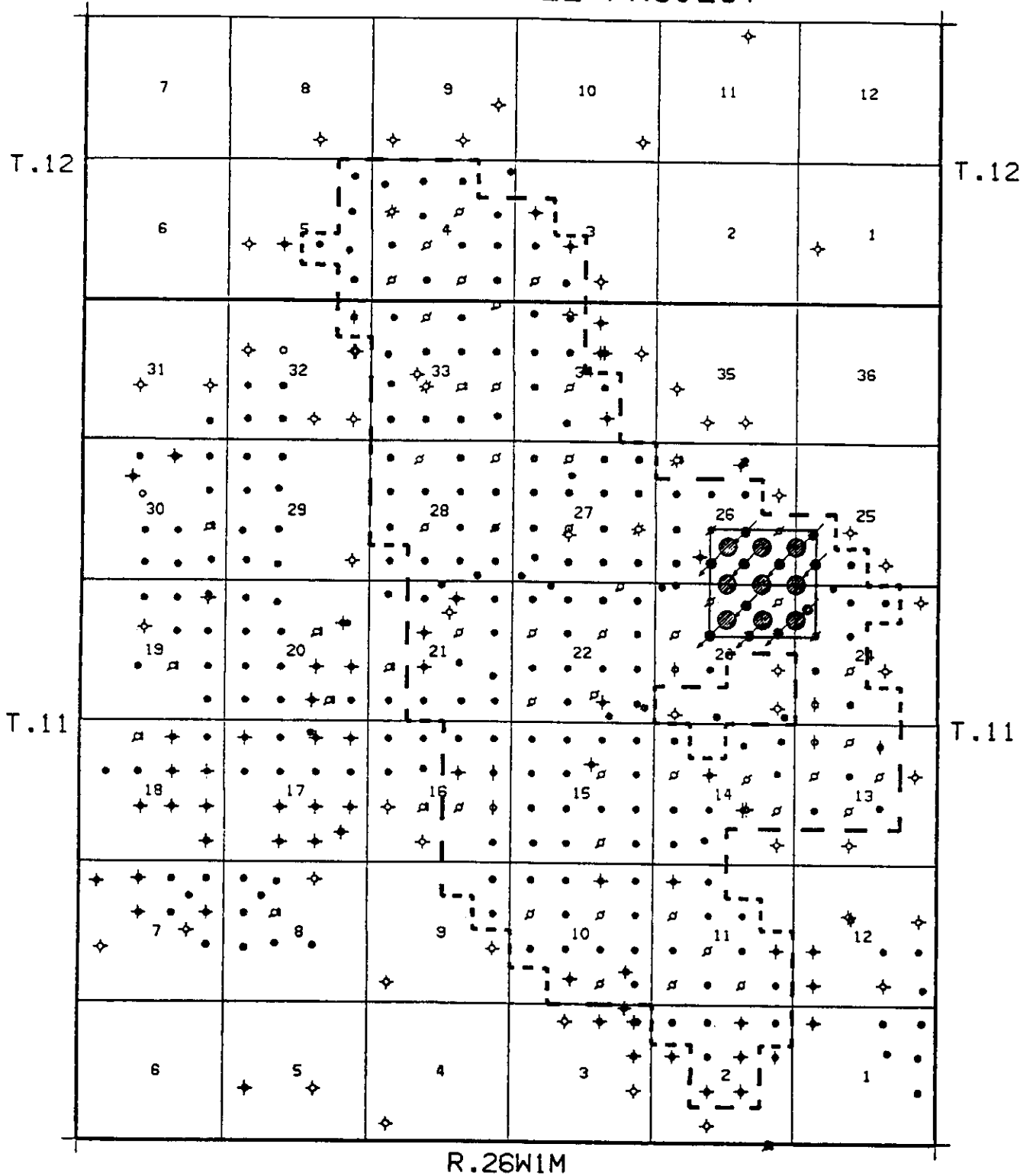


FIGURE 2

NVSU #1 INFILL PROJECT



NORTH VIRDEN SCALLION UNIT NO. 1

AS OF 1989-01-25

SCALE 1" = 1 MILE

- PROJECT BOUNDARY
- PROPOSED INFILL SITES
- ◆ PROPOSED CONVERSIONS

FIGURE 3

NORTH VIRDEN SCALLION INFILL PROJECT

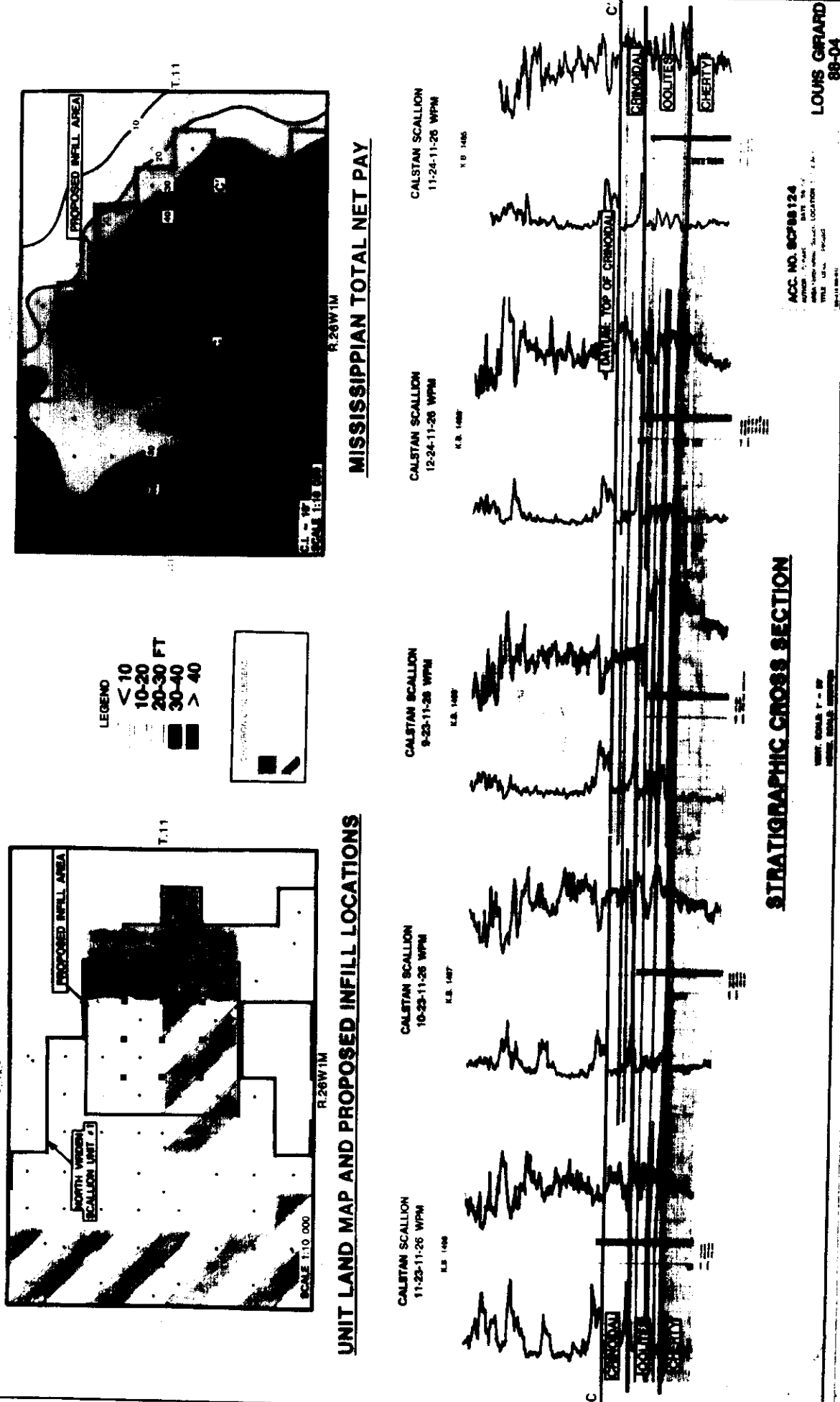


FIGURE 4

PERFORMANCE OF NVSU NO.1 WATERFLOOD

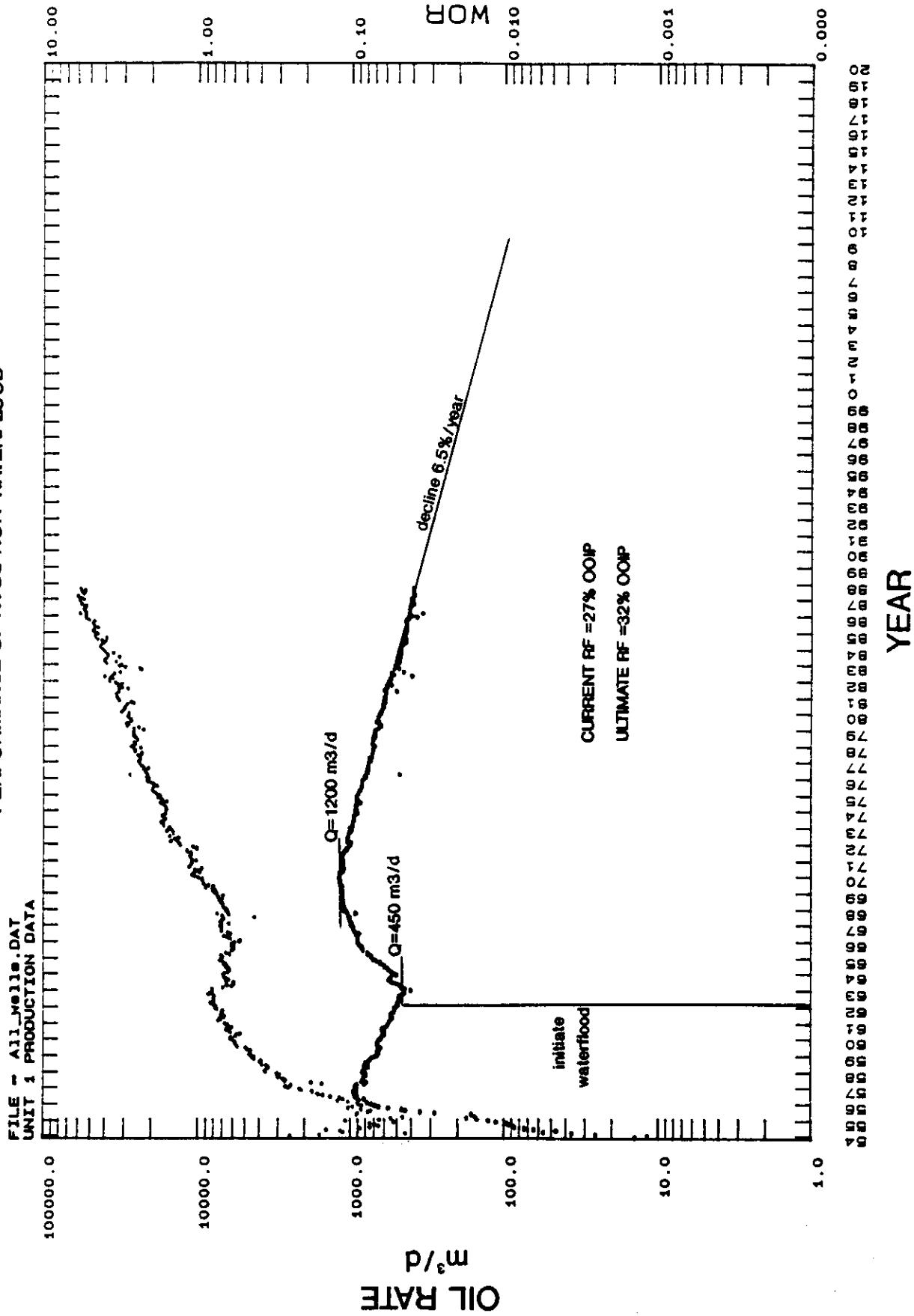
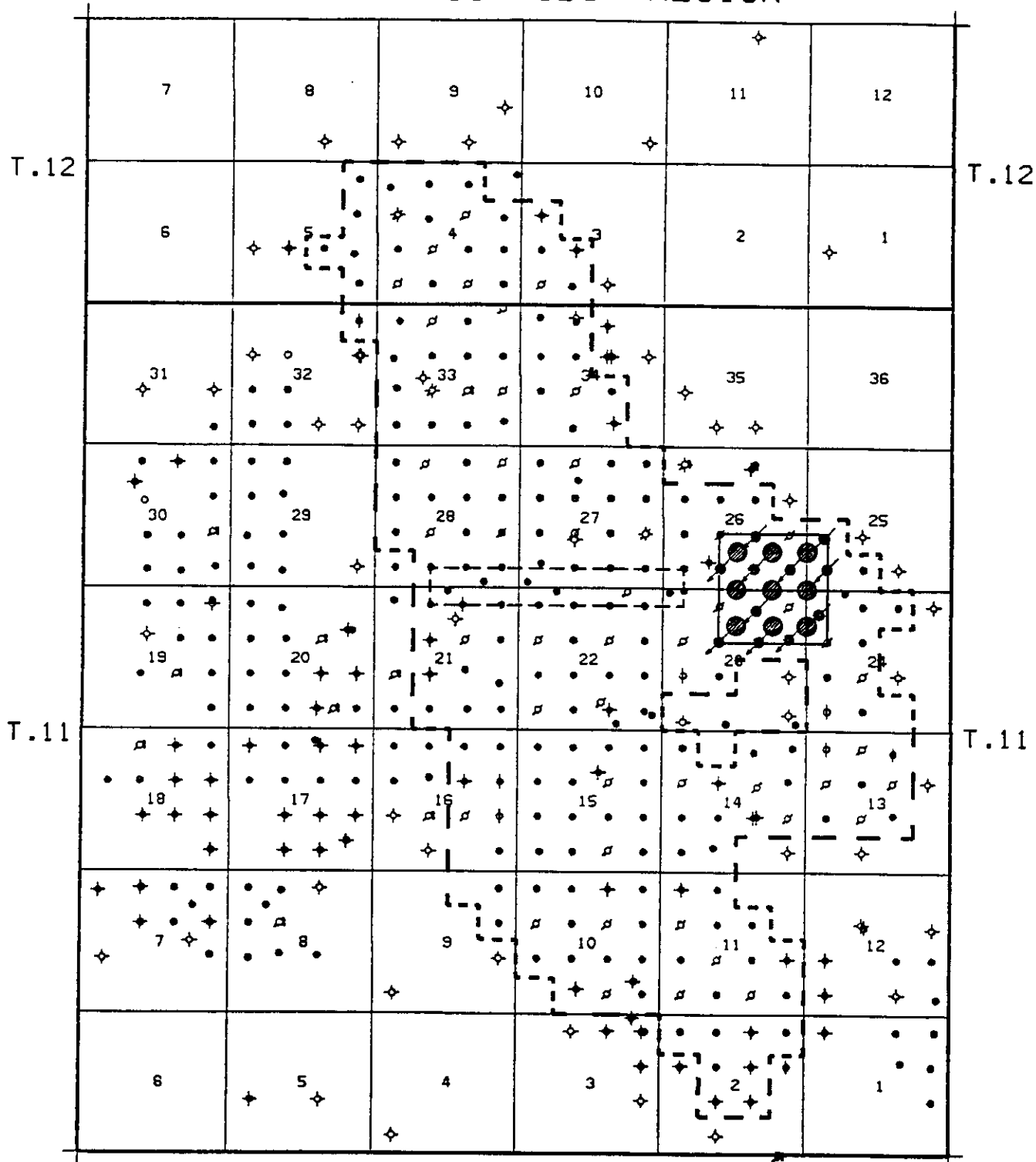


FIGURE 5
NVSU #1 CORRIDOR REGION



R.26W1M

NORTH VIRDEN SCALLION UNIT NO. 1

AS OF 1989-01-25

SCALE 1" = 1 MILE

- PROJECT BOUNDARY
- PROPOSED INFILL SITES
- ◆ PROPOSED CONVERSIONS
- CORRIDOR REGION

FIGURE 6

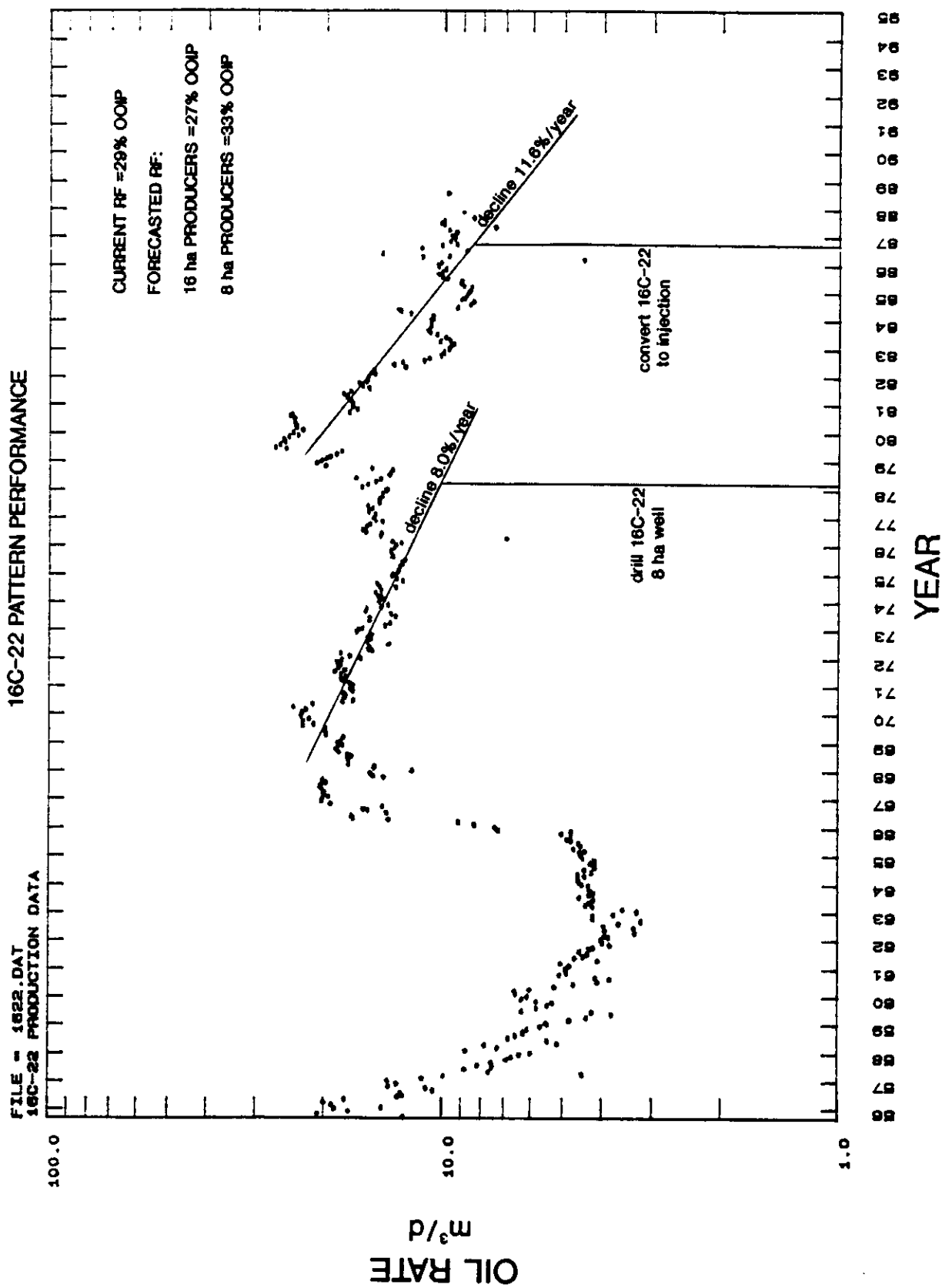


FIGURE 7
DALY NO. 1 PATTERNS A-I
PRODUCTION PLOT
SUMMARY

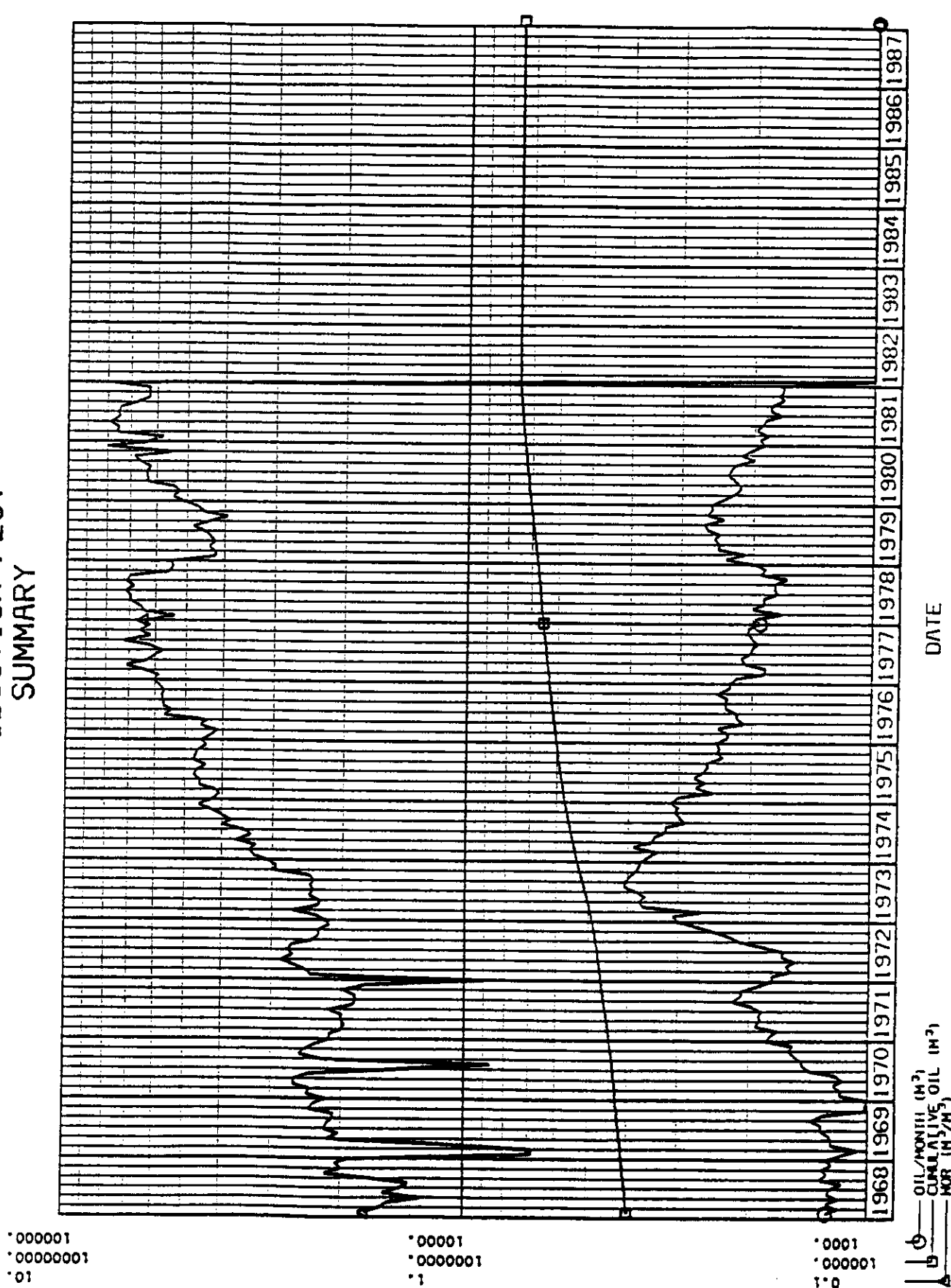


FIGURE 8

REDUCED SPACING PROJECT AREA

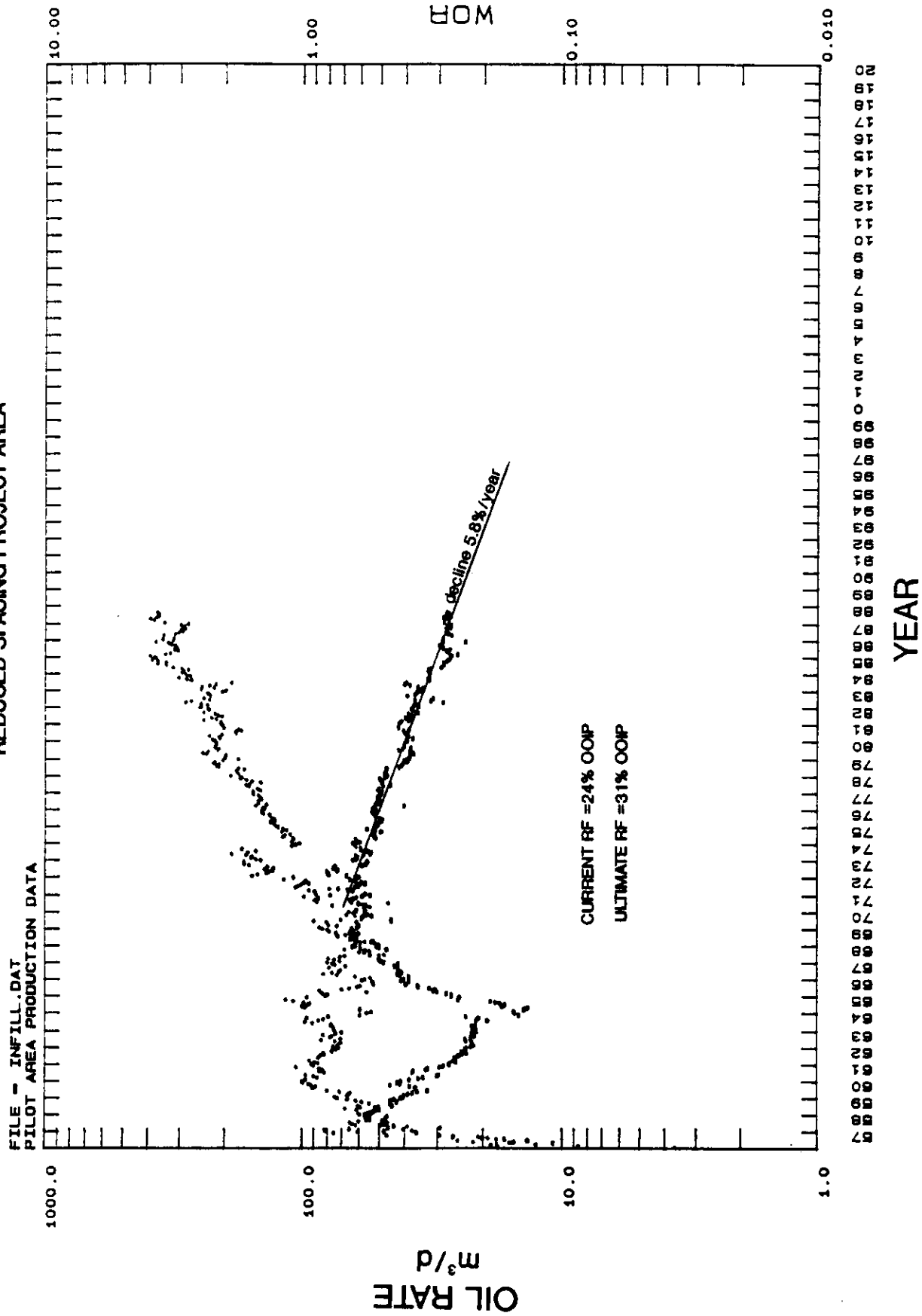


FIGURE 9
NORTH VIRDEN SCALLION UNIT #1
 PROJECT AREA PRODUCTION FORECAST

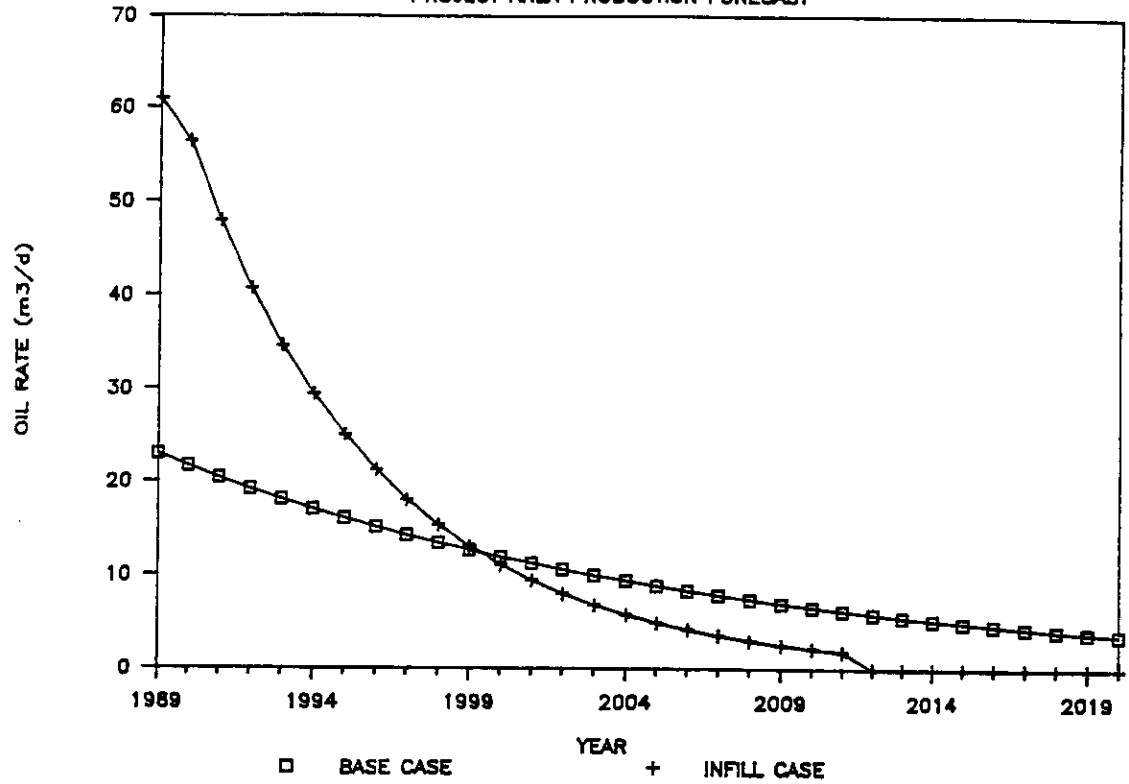
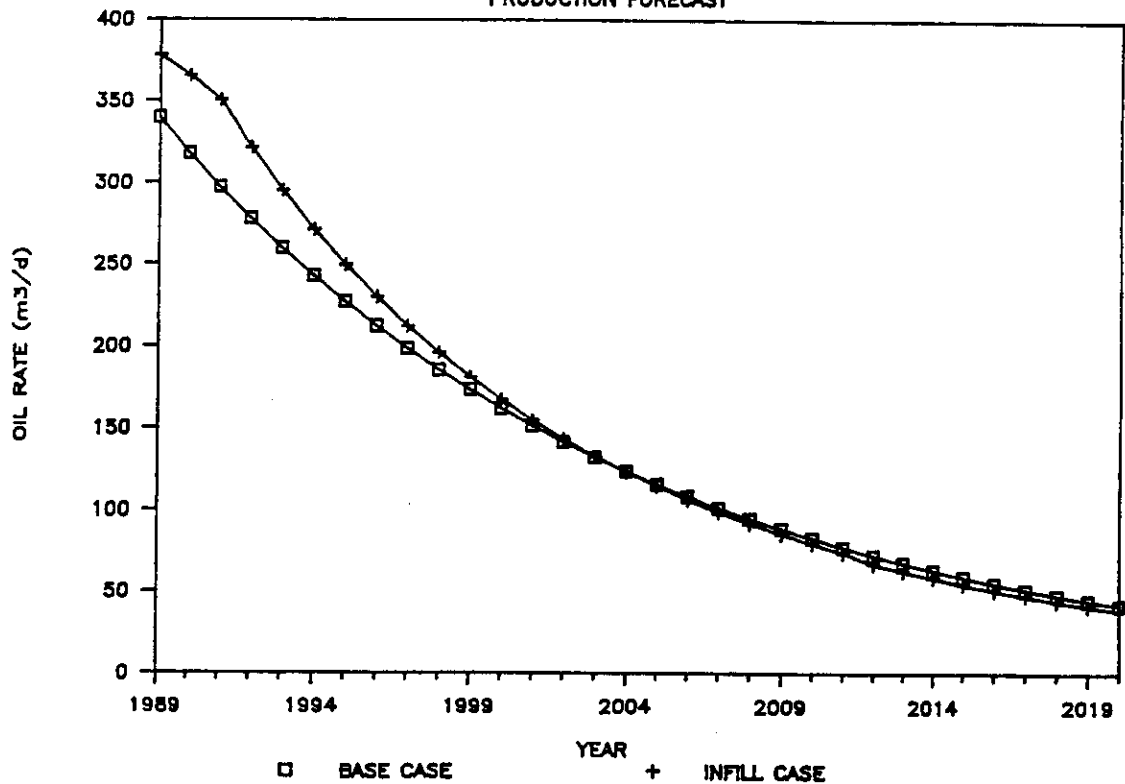


FIGURE 10
NORTH VIRDEN SCALLION UNIT #1
 PRODUCTION FORECAST



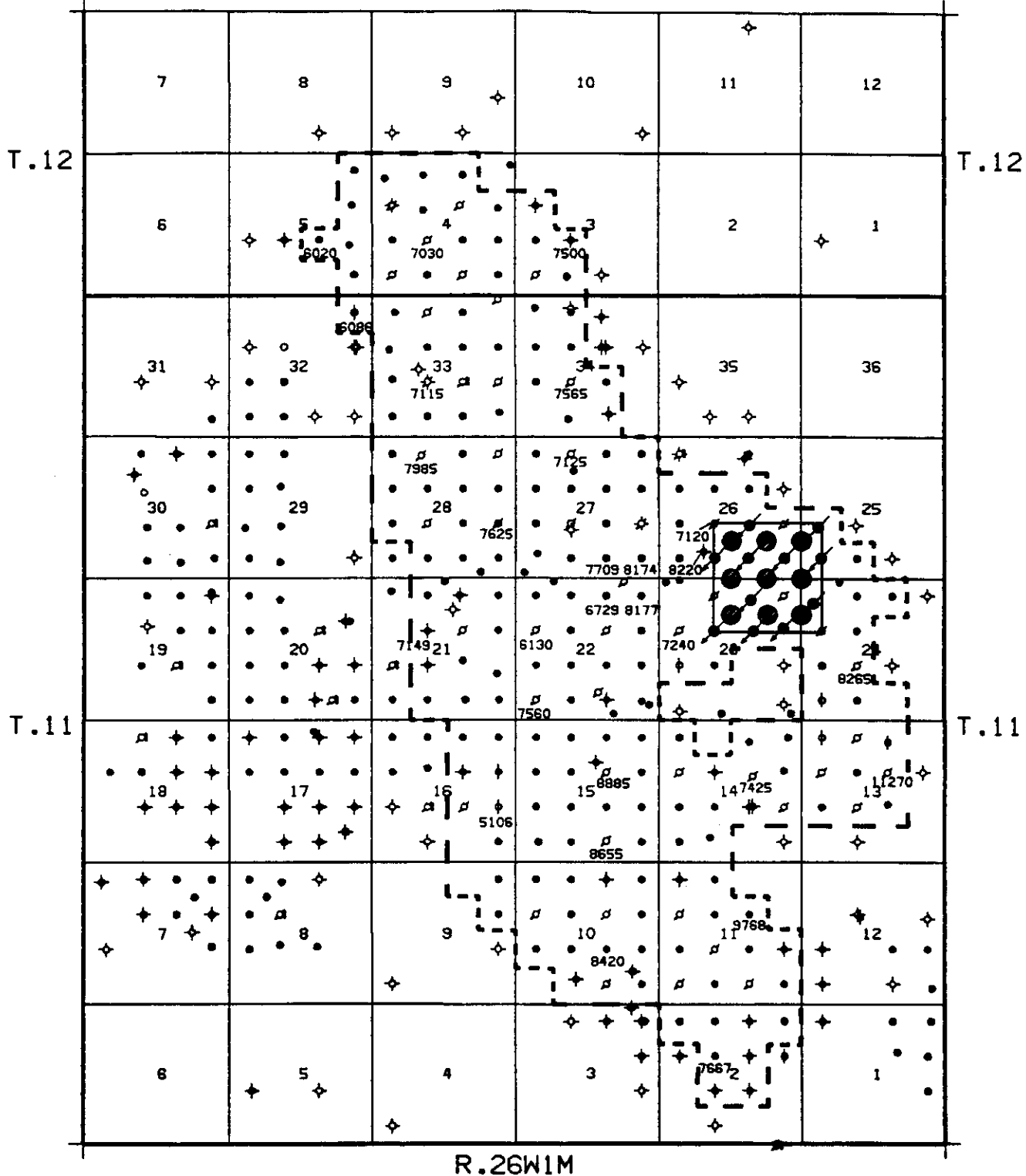


North Virden Scallion Unit #1
Reduced Spacing Project
Reservoir Parameters

Original Oil in Place	(m ³)	1 162 000
Current Recovery Factor	(%)	24.2
Base Case Recovery Factor	(%)	30.5
Infill Case Recovery Factor	(%)	38.1
Boi		1.045
P _{BP}	(kPag)	1 000
GOR	(m ³ /m ³)	12.5
Swi		0.45
Ø avg	(%)	12.1
μ _{oPB}	(cp)	3.52






NVSU #1 1987 RESERVOIR PRESSURE



NORTH VIRDEN SCALLION UNIT NO. 1

AS OF 1989-01-25

SCALE 1" = 1 MILE

-  PROJECT BOUNDARY
 PROPOSED INFILL SITES
 PROPOSED CONVERSIONS



**CROWN ROYALTY AND FREEHOLD MINERAL TAX
CALCULATION PROPOSAL FOR THE
REDUCED SPACING PROJECT IN
NORTH VIRDEN SCALLION UNIT #1**

Prepared by

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Chevron Canada Resources

1989-02

NORTH VIRDEN SCALLION UNIT #1
REDUCED SPACING PROJECT
CROWN ROYALTY AND FREEHOLD MINERAL TAX CALCULATIONS

Introduction

Chevron Canada Resources is requesting new oil status for all production from the nine infill wells proposed for the North Virden Scallion Unit #1 reduced spacing project.

This report outlines the Crown royalty and Freehold mineral tax calculations proposed by Chevron. They are similar to the calculations used in Daly Unit #3.

Discussion

A. Proposed Royalty Administration

Chevron proposes calculating Crown royalties and Freehold mineral taxes by:

- 1) determining the new oil fraction of total unit production
- 2) calculating Crown royalties and Freehold mineral taxes on allocated production
- 3) applying the new oil fraction to the calculation of royalties and taxes for each tract in a similar manner to that used for Daly Unit #3

1. Calculation of New Oil Percentage

Chevron proposes calculating the new oil fraction as follows:

$$\text{New oil fraction} = \frac{\text{total production from infill wells} \\ \text{in reduced spacing project area}}{\text{total unit production}}$$

If the infill wells produced 1 716.4 m³/mo and total unit production was 11 122.2 m³/mo, the new oil percent would be:

$$\text{new oil \%} = \frac{1\,716.4}{11\,122.2} \times 100 = 15.43\%$$

2. Calculation of Crown Royalties

The proposed Crown royalty calculations are similar to the calculations used in Daly Unit #3. Total Unit production would be allocated back to each tract according to tract factors. Crown royalties would then be generated as follows:

a) Old Crown Royalty:

$$\begin{array}{lcl} \text{old Crown} & & \text{old Crown royalty calculated on} \\ \text{royalty payable} & = & \text{fraction of production which is old} \end{array}$$

b) New Crown Royalty:

$$\text{new Crown royalty payable} = \left(\begin{array}{l} \text{new Crown royalty} \\ \text{for total production} \end{array} \right) - \left(\begin{array}{l} \text{new Crown royalty} \\ \text{for old production} \end{array} \right)$$

Table 1 shows the Crown royalty calculation for a production rate of 11 122.2 m³/mo and 15.43% new oil.

3. Calculation of Freehold Mineral Taxes

The Freehold mineral tax would be calculated on allocated production in the same manner as Crown royalties:

a) Old Freehold Mineral Tax:

$$\begin{array}{lcl} \text{old mineral} & & \text{old mineral tax calculated on} \\ \text{tax payable} & = & \text{fraction of production which is old} \end{array}$$

b) New Freehold Mineral Tax

$$\text{new mineral tax payable} = \left(\begin{array}{c} \text{new mineral tax} \\ \text{for total production} \end{array} \right) - \left(\begin{array}{c} \text{new mineral tax for} \\ \text{old production} \end{array} \right)$$

Table 2 shows the Freehold mineral tax calculation for a production rate of 11 122.2 m³/d and 15.43% new oil.

Summary

The proposed calculations for Crown Royalties and Freehold mineral taxes are based on the method already in place in Daly Unit #3. This method results in an equitable distribution of royalties and taxes.

TABLE 1

CROWN ROYALTY CALCULATION

TOTAL OIL RATE (m3/mo)	% NEW OIL (%)
11122.2	15.43

TRACT	TRACT FACTOR	ALLOCATED PRODUCTION TOTAL	OLD PRODUCTION	TOTAL CROWN ROYALTY BASE		OLD CROWN ROYALTY BASE		OLD ROYALTY	NEW ROYALTY	TOTAL ROYALTY
				Q<50	Q>=50	Q<50	Q>=50			
		(m3/mo)	(m3/mo)	(m3/mo)	(m3/mo)	(m3/mo)	(m3/mo)	(m3/mo)	(m3/mo)	(m3/mo)
16-10	0.0004859	5.4	4.6	0.1	0.0	0.1	0.0	0.1	0.0	0.1
01-11	0.0023308	25.9	21.9	2.5	0.0	1.8	0.0	1.8	0.4	2.2
02-11	0.0014463	16.1	13.6	1.0	0.0	0.7	0.0	0.7	0.2	0.9
03-11	0.0025109	27.9	23.6	2.9	0.0	2.1	0.0	2.1	0.5	2.6
04-11	0.0024659	27.4	23.2	2.8	0.0	2.0	0.0	2.0	0.4	2.5
05-11	0.0014195	15.8	13.4	0.9	0.0	0.7	0.0	0.7	0.1	0.8
06-11	0.0014473	16.1	13.6	1.0	0.0	0.7	0.0	0.7	0.2	0.9
07-11	0.0018943	21.1	17.8	1.7	0.0	1.2	0.0	1.2	0.3	1.5
08-11	0.0007409	8.2	7.0	0.3	0.0	0.2	0.0	0.2	0.0	0.2
10-11	0.0006268	7.0	5.9	0.2	0.0	0.1	0.0	0.1	0.0	0.2
11-11	0.0027178	30.2	25.6	3.4	0.0	2.5	0.0	2.5	0.5	3.0
12-11	0.0017894	19.9	16.8	1.5	0.0	1.1	0.0	1.1	0.2	1.3
13-11A	0.0014086	15.7	13.2	0.9	0.0	0.7	0.0	0.7	0.1	0.8
14-11	0.0005226	5.8	4.9	0.1	0.0	0.1	0.0	0.1	0.0	0.1
09-16	0.0073335	81.6	69.0	0.0	23.6	0.0	18.0	18.0	3.1	21.1
10-16	0.0010983	12.2	10.3	0.6	0.0	0.4	0.0	0.4	0.1	0.5
15-16	0.0046646	51.9	43.9	0.0	10.3	7.3	0.0	7.3	1.7	8.9
16-16	0.0168047	186.9	158.1	0.0	71.0	0.0	58.1	58.1	7.1	65.2
02-22A	0.0045666	50.8	43.0	0.0	9.8	7.0	0.0	7.0	1.6	8.5
02-24	0.0007119	7.9	6.7	0.2	0.0	0.2	0.0	0.2	0.0	0.2
11-24	0.0013085	14.6	12.3	0.8	0.0	0.6	0.0	0.6	0.1	0.7
12-24	0.0043678	48.6	41.1	8.9	0.0	6.4	0.0	6.4	1.4	7.8
13-24	0.0022290	24.8	21.0	2.3	0.0	1.7	0.0	1.7	0.4	2.0
13-24A	0.0000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14-24	0.0092479	102.9	87.0	0.0	33.2	0.0	26.1	26.1	3.9	30.0
15-24	0.0034235	38.1	32.2	5.5	0.0	3.9	0.0	3.9	0.9	4.8
TOTAL	0.0775633	862.7	729.6	37.7	147.9	41.2	102.1	143.3	23.3	166.6

TABLE 2

MINERAL TAX CALCULATION

TOTAL OIL RATE (m3/mo)	% NEW OIL (%)
11122.2	15.43

TRACT	TRACT FACTOR	ALLOCATED PRODUCTION		OLD MINERAL TAX		***** TOTAL PRODUCTION		NEW MINERAL TAX *****		TOTAL MINERAL TAX	
		TOTAL	OLD								
		(m3/mo)	(m3/mo)	20<Q<65 (m3/mo)	Q>=65 (m3/mo)	36<Q<65 (m3/mo)	Q>=65 (m3/mo)	36<Q<65 (m3/mo)	Q>=65 (m3/mo)	(m3/mo)	(m3/mo)
06-02	0.0000096	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
07-02	0.0000148	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-02	0.0005438	6.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-02	0.0012345	13.7	11.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-02	0.0023775	26.4	22.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3
14-02	0.0017602	19.6	16.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-02	0.0007861	8.7	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-02	0.0002958	3.3	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03-03	0.0110989	123.4	104.4	0.0	29.6	0.0	16.0	0.0	12.3	3.7	33.4
04-03	0.0140283	156.0	132.0	0.0	41.4	0.0	22.4	0.0	17.5	4.7	46.1
05-03	0.0032245	35.9	30.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5
06-03	0.0008362	9.3	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-03	0.0001554	1.7	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
01-04	0.0031930	35.5	30.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.4
02-04	0.0049150	54.7	46.2	5.4	0.0	2.4	0.0	1.2	0.0	1.3	6.7
03-04	0.0085183	94.7	80.1	0.0	19.3	0.0	10.4	0.0	7.5	2.9	22.1
04-04	0.0066001	73.4	62.1	11.5	0.0	0.0	6.2	3.9	0.0	2.4	13.6
05-04	0.0069117	76.9	65.0	0.0	12.8	0.0	6.9	0.0	4.5	2.3	15.1
06-04	0.0027567	30.7	25.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
07-04	0.0015830	17.6	14.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08-04	0.0047525	52.9	44.7	4.9	0.0	2.1	0.0	1.0	0.0	1.2	6.1
09-04	0.0067035	74.6	63.1	11.9	0.0	0.0	6.4	4.0	0.0	2.4	14.3
10-04	0.0073827	84.3	71.3	0.0	15.5	0.0	8.3	0.0	5.8	2.5	18.0
11-04	0.0094587	105.2	89.0	0.0	23.0	0.0	12.4	0.0	9.2	3.2	26.2
12-04	0.0122186	135.9	114.9	0.0	34.1	0.0	18.4	0.0	14.3	4.1	38.3
13-04	0.0048607	54.1	45.7	5.2	0.0	2.3	0.0	1.1	0.0	1.2	6.5
04-04	0.0108811	121.0	102.3	0.0	28.8	0.0	15.5	0.0	11.8	3.7	32.4
15-04	0.0038930	43.3	36.6	2.7	0.0	0.8	0.0	0.1	0.0	0.7	3.4
01-05	0.0051873	57.7	48.8	6.2	0.0	3.0	0.0	1.5	0.0	1.5	7.7
07-05	0.0001592	1.8	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08-05	0.0026800	29.8	25.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.7
09-05	0.0019689	21.9	18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-05	0.0022697	25.2	21.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
09-09	0.0035529	39.5	33.4	2.0	0.0	0.4	0.0	0.0	0.0	0.4	2.4
15-09	0.0000795	0.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-09	0.0120881	134.4	113.7	0.0	33.6	0.0	18.1	0.0	14.1	4.1	37.7
01-10	0.0021619	24.0	20.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
02-10	0.0029284	31.5	26.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.9
03-10	0.0000707	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05-10	0.0032054	35.7	30.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.4
06-10	0.0040391	44.9	38.0	3.1	0.0	1.0	0.0	0.2	0.0	0.8	3.8
07-10	0.0039145	43.5	36.8	2.8	0.0	0.8	0.0	0.1	0.0	0.7	3.5

08-10	0.0051389	57.2	48.3	6.1	0.0	2.9	0.0	1.5	0.0	1.4	7.5
09-10	0.0049788	55.4	46.8	5.6	0.0	2.6	0.0	1.2	0.0	1.3	6.9
10-10	0.0084561	94.1	79.5	0.0	19.0	0.0	10.2	0.0	7.4	2.8	21.9
11-10	0.0091972	102.3	86.5	0.0	22.0	0.0	11.8	0.0	8.7	3.1	25.1
12-10	0.0052826	58.8	49.7	6.5	0.0	3.2	0.0	1.6	0.0	1.5	8.0
13-10	0.0068278	75.9	64.2	12.4	0.0	0.0	6.7	4.3	0.0	2.4	14.8
14-10	0.0083815	93.2	78.8	0.0	18.7	0.0	10.1	0.0	7.2	2.8	21.5
15-10	0.0068154	75.8	64.1	12.4	0.0	0.0	6.6	4.3	0.0	2.4	14.8
16-10	0.0027919	31.1	26.3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
05-13	0.0029868	33.2	28.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1
06-13	0.0013791	15.3	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
07-13	0.0025835	28.7	24.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
10-13	0.0043423	48.3	40.8	3.8	0.0	1.4	0.0	0.5	0.0	0.9	4.7
11-13	0.0061194	68.1	57.6	9.5	0.0	0.0	5.1	3.0	0.0	2.2	11.7
12-13	0.0082076	91.3	77.2	0.0	18.0	0.0	9.7	0.0	6.9	2.8	20.8
13-13	0.0015064	16.8	14.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14-13	0.0041603	46.3	39.1	3.4	0.0	1.2	0.0	0.3	0.0	0.8	4.2
15-13	0.0011730	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03-14	0.0057916	64.4	54.5	8.3	0.0	4.3	0.0	2.4	0.0	1.9	10.2
04-14	0.0004116	4.6	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05-14	0.0040612	45.2	38.2	3.1	0.0	1.0	0.0	0.3	0.0	0.8	3.9
06-14	0.0050079	55.7	47.1	5.7	0.0	2.6	0.0	1.3	0.0	1.3	7.0
07-14A	0.0047382	52.7	44.6	4.9	0.0	2.1	0.0	1.0	0.0	1.2	6.0
08-14	0.0047002	52.3	44.2	4.8	0.0	2.0	0.0	0.9	0.0	1.1	5.9
09-14	0.0044880	49.9	42.2	4.2	0.0	1.7	0.0	0.7	0.0	1.0	5.2
10-14	0.0014987	16.7	14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-14	0.0000199	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-14	0.0010448	11.6	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-14	0.0010973	12.2	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-14	0.0038417	42.7	36.1	2.6	0.0	0.7	0.0	0.1	0.0	0.7	3.3
16-14	0.0015396	17.1	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
01-15	0.0036860	41.0	34.7	2.3	0.0	0.5	0.0	0.0	0.0	0.5	2.9
02-15	0.0129243	143.7	121.6	0.0	37.0	0.0	20.0	0.0	13.6	4.3	41.3
03-15	0.0115111	128.0	108.3	0.0	31.3	0.0	16.9	0.0	13.0	3.9	35.2
04-15	0.0165779	184.4	155.9	0.0	51.7	0.0	27.9	0.0	22.3	5.6	57.2
05-15	0.0091406	101.7	86.0	0.0	21.8	0.0	11.7	0.0	8.6	3.1	24.8
06-15	0.0141917	157.8	133.5	0.0	42.1	0.0	22.7	0.0	18.0	4.8	46.9
07-15	0.0118702	132.0	111.7	0.0	32.7	0.0	17.7	0.0	13.7	4.0	36.7
08-15	0.0094213	104.8	88.6	0.0	22.9	0.0	12.3	0.0	9.2	3.2	26.1
09-15	0.0014068	15.6	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-15	0.0057911	64.4	54.5	8.3	0.0	4.3	0.0	2.4	0.0	1.9	10.2
11-15	0.0102519	114.0	96.4	0.0	26.2	0.0	14.1	0.0	10.7	3.4	29.7
12-15	0.0134819	149.9	126.8	0.0	39.2	0.0	21.2	0.0	16.6	4.5	43.8
13-15	0.0043071	47.9	40.5	3.7	0.0	1.4	0.0	0.5	0.0	0.9	4.6
14-15	0.0020513	22.8	19.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-15	0.0013562	15.1	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-15	0.0006707	7.5	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
01-16	0.0016357	18.2	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02-16	0.0037994	42.3	35.7	2.5	0.0	0.7	0.0	0.0	0.0	0.7	3.2
07-16	0.0055305	61.5	52.0	7.3	0.0	3.7	0.0	2.0	0.0	1.7	9.1
08-16	0.0033853	37.7	31.8	1.7	0.0	0.2	0.0	0.0	0.0	0.2	1.9
01-21	0.0183164	203.7	172.3	0.0	58.7	0.0	31.7	0.0	25.6	6.2	64.8
02-21	0.0161680	179.8	152.1	0.0	50.0	0.0	27.0	0.0	21.6	5.4	55.5
03-21	0.0157605	175.3	148.2	0.0	48.4	0.0	26.1	0.0	20.8	5.3	53.7
06-21	0.0022871	25.4	21.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
07-21	0.0097539	108.5	91.7	0.0	24.2	0.0	13.1	0.0	9.8	3.3	27.5

08-21	0.0102001	113.4	95.9	0.0	26.0	0.0	14.0	0.0	10.6	3.4	29.5
09-21	0.0116143	129.2	109.2	0.0	31.7	0.0	17.1	0.0	13.2	3.9	35.6
10-21	0.0040685	45.3	38.3	3.1	0.0	1.0	0.0	0.3	0.0	0.8	3.9
11-21	0.0003199	3.6	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14-21	0.0041837	46.5	39.4	3.4	0.0	1.2	0.0	0.4	0.0	0.8	4.3
14-21A	0.0000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-21	0.0017394	19.3	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-21	0.0078928	87.8	74.2	0.0	16.7	0.0	9.0	0.0	6.3	2.7	19.4
01-22	0.0002750	3.1	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02-22A	0.0033518	39.5	33.4	2.0	0.0	0.4	0.0	0.0	0.0	0.4	2.4
03-22	0.0046069	51.2	43.3	4.5	0.0	1.9	0.0	0.8	0.0	1.1	5.6
04-22	0.0065528	72.9	61.6	11.3	0.0	0.0	6.1	3.7	0.0	2.3	13.6
05-22	0.0074268	82.6	69.9	0.0	14.9	0.0	8.0	0.0	5.5	2.5	17.4
06-22	0.0068713	76.4	64.6	12.6	0.0	0.0	6.8	4.4	0.0	2.4	15.0
07-22	0.0051120	56.9	48.1	6.0	0.0	2.8	0.0	1.4	0.0	1.4	7.4
08-22	0.0044536	49.5	41.9	4.1	0.0	1.6	0.0	0.6	0.0	1.0	5.1
09-22	0.0051941	57.8	48.9	6.2	0.0	3.0	0.0	1.5	0.0	1.5	7.7
10-22	0.0052647	58.6	49.5	6.5	0.0	3.1	0.0	1.6	0.0	1.5	8.0
11-22	0.0123294	137.1	116.0	0.0	34.6	0.0	18.7	0.0	14.5	4.1	38.7
12-22	0.0125408	139.5	118.0	0.0	35.4	0.0	19.1	0.0	14.9	4.2	39.7
13-22	0.0082852	92.1	77.9	0.0	18.3	0.0	9.9	0.0	7.1	2.8	21.1
14-22	0.0039599	44.0	37.2	2.9	0.0	0.9	0.0	0.2	0.0	0.7	3.6
14-22A	0.0000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-22	0.0017950	20.0	16.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-22	0.0012837	14.3	12.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-22A	0.0000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05-23	0.0032109	35.7	30.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.4
06-23	0.0005674	6.3	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09-23	0.0015519	17.3	14.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-23	0.0002407	2.7	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-23	0.0008586	9.5	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-23	0.0050933	56.6	47.9	5.9	0.0	2.8	0.0	1.4	0.0	1.4	7.3
13-23	0.0020751	23.1	19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-23A	0.0000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14-23	0.0020849	23.2	19.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-23	0.0012654	14.1	11.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-23	0.0015997	17.8	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03-24	0.0047614	53.0	44.8	4.9	0.0	2.2	0.0	1.0	0.0	1.2	6.1
04-24	0.0000311	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05-24	0.0000424	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06-24	0.0014533	16.2	13.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03-25	0.0059506	66.2	56.0	8.9	0.0	0.0	4.8	2.7	0.0	2.1	11.0
04-25	0.0065418	72.8	61.5	11.2	0.0	0.0	6.1	3.7	0.0	2.3	13.5
05-25	0.0022756	25.3	21.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
01-26	0.0014364	16.0	13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02-26	0.0029969	33.3	28.2	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1
03-26	0.0003970	4.4	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
04-26	0.0032798	36.5	30.8	1.6	0.0	0.1	0.0	0.0	0.0	0.1	1.7
05-26	0.0010571	11.8	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06-26	0.0048583	54.0	45.7	5.2	0.0	2.3	0.0	1.1	0.0	1.2	6.5
07-26	0.0068588	76.3	64.5	12.6	0.0	0.0	6.7	4.3	0.0	2.4	15.0
08-26	0.0042646	47.4	40.1	3.6	0.0	1.3	0.0	0.4	0.0	0.9	4.5
10-26	0.0045004	50.1	42.3	4.2	0.0	1.7	0.0	0.7	0.0	1.0	5.2
11-26	0.0022605	25.1	21.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
12-26	0.0027749	30.9	26.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
01-27	0.0025878	28.8	24.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5

02-27	0.0020213	22.5	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03-27	0.0038142	42.4	35.9	2.6	0.0	0.7	0.0	0.0	0.0	0.7	3.3
03-27A	0.0000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
04-27	0.0064998	72.3	61.1	11.0	0.0	0.0	6.0	3.6	0.0	2.3	13.4
04-27A	0.0000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05-27	0.0040536	45.1	38.1	3.1	0.0	1.0	0.0	0.3	0.0	0.8	3.9
06-27	0.0038353	42.7	36.1	2.6	0.0	0.7	0.0	0.1	0.0	0.7	3.3
07-27	0.0013014	14.5	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08-27	0.0033929	37.7	31.9	1.7	0.0	0.2	0.0	0.0	0.0	0.2	2.0
09-27	0.0049907	55.5	46.9	5.6	0.0	2.6	0.0	1.3	0.0	1.3	6.9
10-27	0.0038951	43.3	36.6	2.8	0.0	0.8	0.0	0.1	0.0	0.7	3.4
11-27	0.0039321	43.7	37.0	2.8	0.0	0.9	0.0	0.1	0.0	0.7	3.5
12-27	0.0057961	64.5	54.5	8.3	0.0	4.3	0.0	2.4	0.0	1.9	10.2
13-27	0.0040160	44.7	37.8	3.0	0.0	1.0	0.0	0.2	0.0	0.7	3.8
14-27A	0.0055638	61.9	52.3	7.5	0.0	3.8	0.0	2.1	0.0	1.7	9.2
15-27	0.0056971	63.4	53.6	7.9	0.0	4.1	0.0	2.3	0.0	1.8	9.8
16-27	0.0017483	19.4	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
01-28	0.0033633	37.4	31.6	1.7	0.0	0.2	0.0	0.0	0.0	0.2	1.9
01-28A	0.0000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02-28	0.0061133	68.0	57.5	9.5	0.0	0.0	5.1	2.9	0.0	2.2	11.7
03-28	0.0043655	48.6	41.1	3.9	0.0	1.5	0.0	0.5	0.0	0.9	4.8
05-28	0.0006346	7.1	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06-28	0.0032718	36.4	30.8	1.5	0.0	0.1	0.0	0.0	0.0	0.1	1.6
07-28	0.0049152	54.7	46.2	5.4	0.0	2.4	0.0	1.2	0.0	1.3	6.7
08-28	0.0028332	31.5	26.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.9
09-28	0.0055586	61.8	52.3	7.4	0.0	3.8	0.0	2.0	0.0	1.7	9.2
10-28	0.0061929	68.9	58.3	9.8	0.0	0.0	5.3	3.1	0.0	2.2	12.0
11-28	0.0049800	55.4	46.8	5.6	0.0	2.6	0.0	1.2	0.0	1.3	6.9
12-28	0.0014181	15.8	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-28	0.0025896	28.8	24.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
14-28	0.0012678	14.3	12.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-28	0.0042209	46.9	39.7	3.5	0.0	1.3	0.0	0.4	0.0	0.9	4.4
16-28	0.0050964	56.7	47.9	5.9	0.0	2.8	0.0	1.4	0.0	1.4	7.3
16-32	0.0004404	4.9	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
01-33	0.0008110	9.0	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02-33	0.0044763	49.8	42.1	4.2	0.0	1.7	0.0	0.7	0.0	1.0	5.2
03-33	0.0067656	75.2	63.6	12.2	0.0	0.0	6.5	4.2	0.0	2.4	14.6
04-33	0.0016985	18.9	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05-33	0.0009051	10.1	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06-33	0.0077053	85.7	72.5	0.0	16.0	0.0	8.6	0.0	6.0	2.6	18.6
07-33	0.0036096	40.1	34.0	2.2	0.0	0.5	0.0	0.0	0.0	0.5	2.6
08-33	0.0095233	105.9	89.6	0.0	23.3	0.0	12.5	0.0	9.3	3.2	26.5
09-33	0.0008716	9.7	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-33	0.0057622	64.1	54.2	8.2	0.0	4.2	0.0	2.4	0.0	1.9	10.1
11-33	0.0048610	54.1	45.7	5.2	0.0	2.3	0.0	1.1	0.0	1.2	6.5
12-33	0.0038761	43.1	36.5	2.7	0.0	0.8	0.0	0.1	0.0	0.7	3.4
13-33	0.0052341	58.2	49.2	6.4	0.0	3.1	0.0	1.6	0.0	1.5	7.9
14-33	0.0089166	99.2	83.9	0.0	20.9	0.0	11.2	0.0	8.2	3.0	23.9
15-33	0.0045746	50.9	43.0	4.4	0.0	1.8	0.0	0.8	0.0	1.1	5.5
16-33	0.0013905	15.5	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02-34	0.0000016	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03-34	0.0037125	41.3	34.9	2.4	0.0	0.6	0.0	0.0	0.0	0.6	2.9
04-34	0.0000907	1.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05-34	0.0005277	5.9	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06-34	0.0008633	9.6	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
07-34	0.0018695	20.8	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

11-34	0.0018707	20.8	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-34	0.0010496	11.7	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-34	0.0071073	79.0	66.9	0.0	13.6	0.0	7.3	0.0	4.9	2.4	16.0
14-34	0.0008786	9.8	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.9224367	10259.5	8664.7	472.0	1053.6	125.6	652.4	107.5	433.5	236.9	1762.5



**North Virden Scallion Unit #1
Reduced Spacing Project
Incremental Crown Royalties and Freehold Mineral Taxes**

Crown royalties and Freehold mineral taxes were calculated for the North Virden Scallion Unit #1 reduced spacing project. Calculations were based on the following assumptions:

- 1) base case and infill case production forecasts as presented in the technical justification section of the reduced spacing application
- 2) Crown royalty and Freehold mineral tax holiday on 2 000 m³ production/well
- 3) new oil status for infill wells in the reduced spacing project area
- 4) Crown royalty and Freehold mineral tax calculations as proposed in the reduced spacing application

Figure 1 is a plot of cumulative Crown royalties and Freehold mineral taxes with time. Figure 2 is a plot of annual Crown royalties and Freehold mineral taxes.

The North Virden Scallion Unit #1 infill drilling project is profitable for the Crown, royalty owners and working interest owners. With new oil status for production from infill wells in the reduced spacing project area, the Crown will receive 7 240 m³ in incremental royalties and taxes. Without new oil status the project is uneconomic.

FIGURE 1
NORTH VIRDEN SCALLION UNIT #1

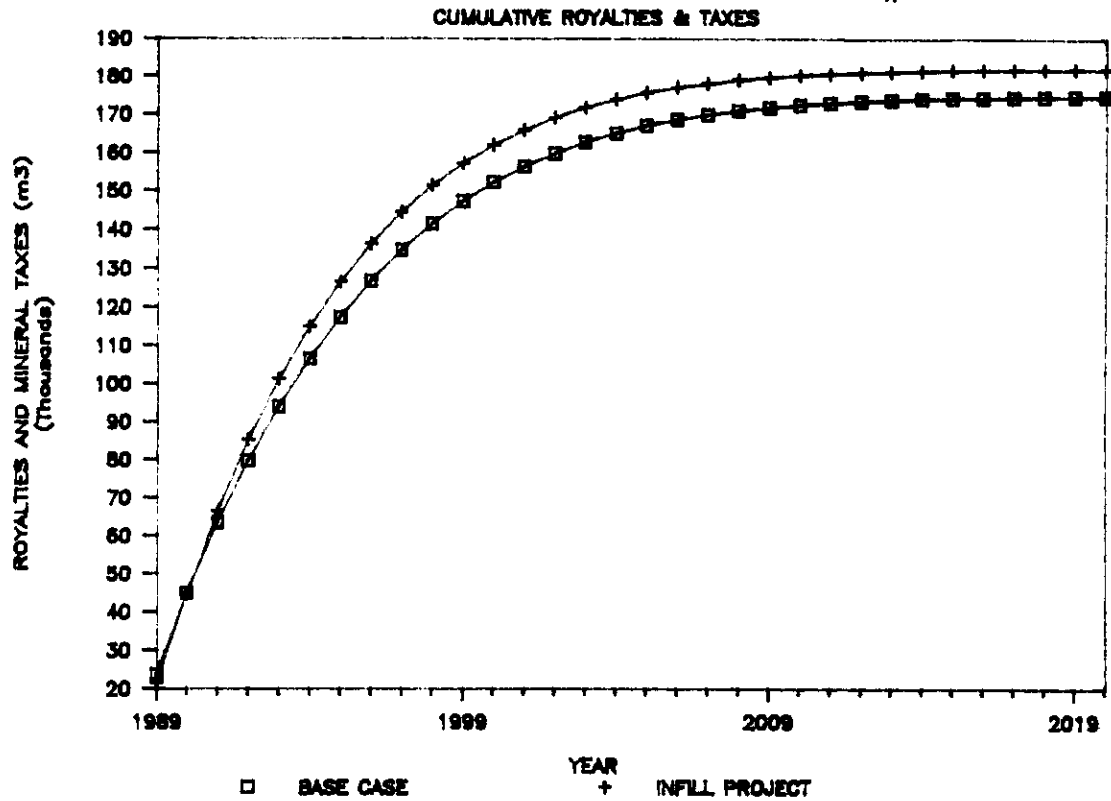
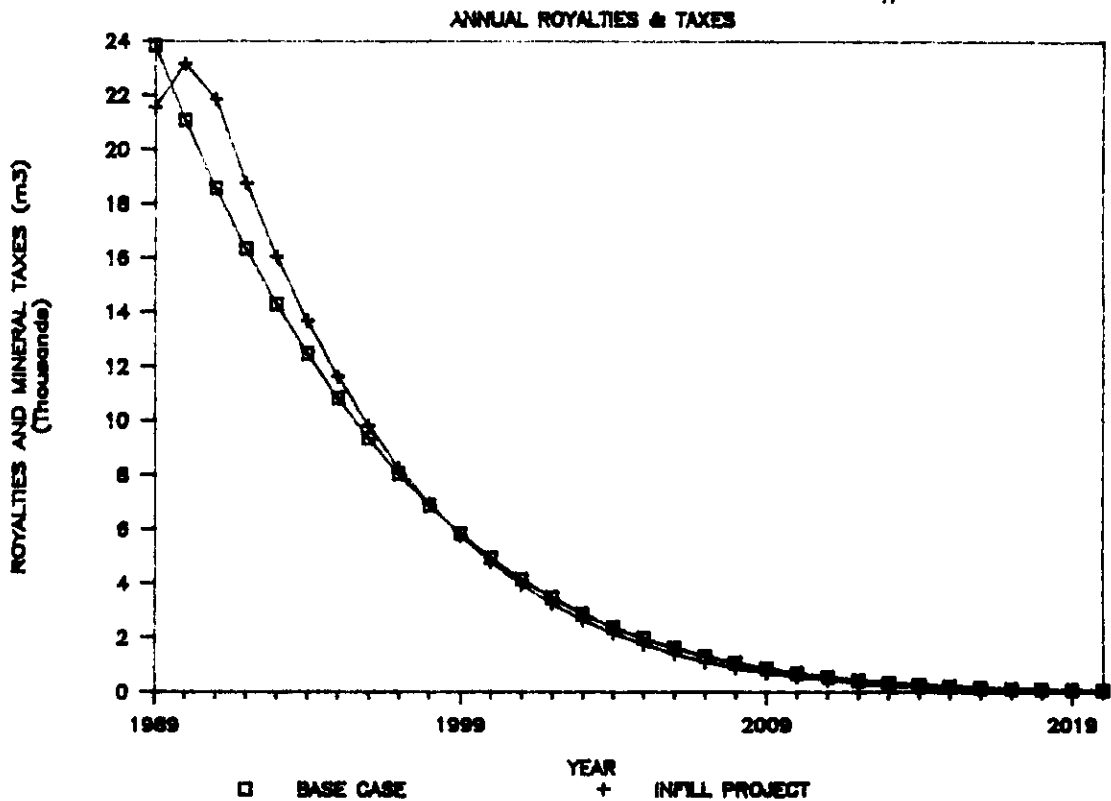
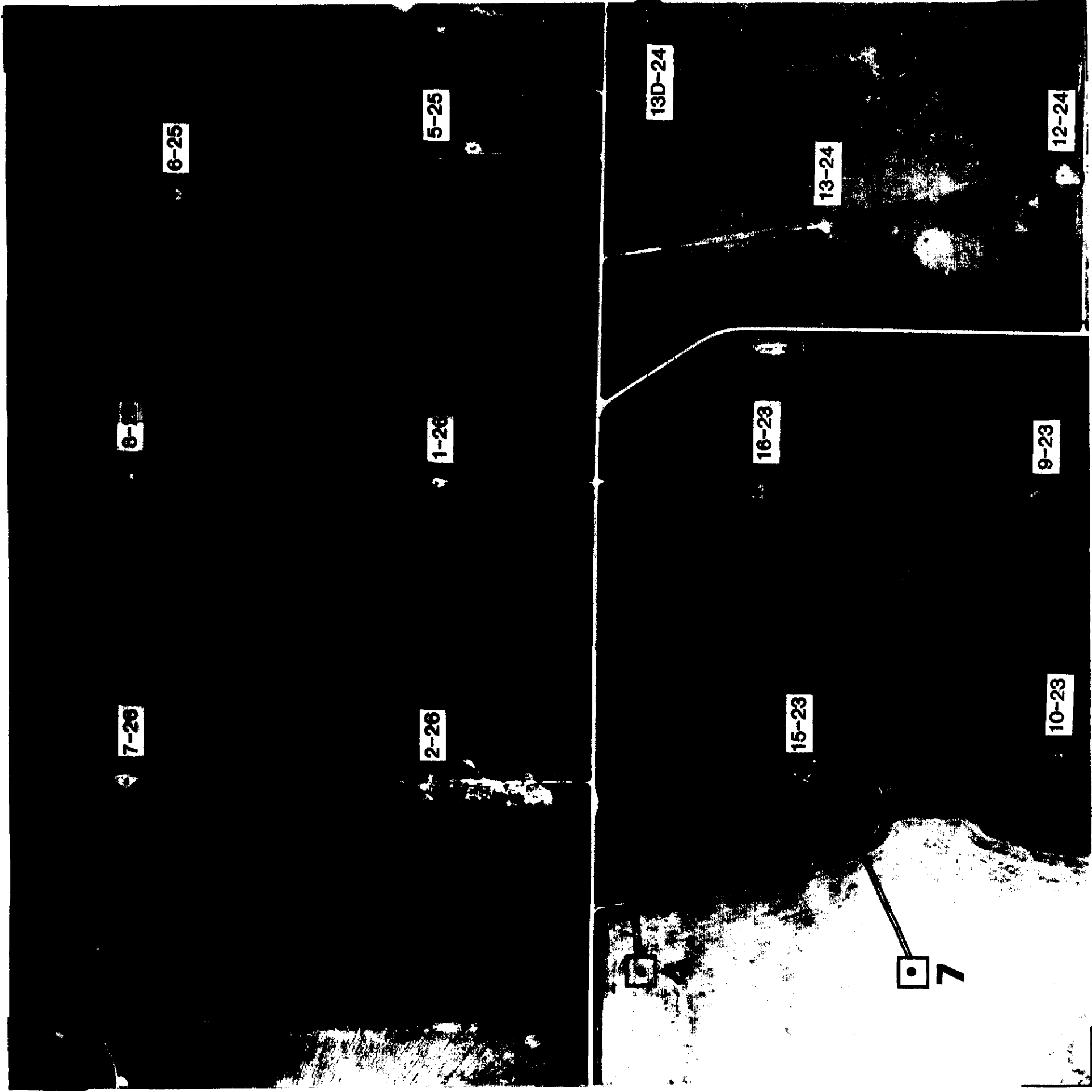


FIGURE 2
NORTH VIRDEN SCALLION UNIT #1





NORTH



AERIAL PHOTOGRAPH
OF
REDUCED SPACING
PROJECT AREA

KEY:



EXISTING WELLS



PROPOSED WELLS

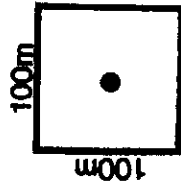


PROPOSED LEASE TRAILS

3

WELL NUMBER

SCALE:



DRILLING LEASE SIZE
(TO SCALE)



**ENVIRONMENTAL IMPACT ASSESSMENT OF THE
REDUCED SPACING PROJECT IN
NORTH VIRDEM SCALLION UNIT NO. 1**

Prepared by

C. K. Rouse

Chevron Canada Resources

Regulations and Environment Division

1989-02

**ENVIRONMENTAL IMPACT ASSESSMENT OF THE
REDUCED SPACING PROJECT IN
NORTH VIRDEN SCALLION UNIT NO. 1**

The purpose of this assessment is to evaluate impacts which may result on the surrounding environment from the proposed Chevron Canada Resources reduced spacing project in North Virden Scallion Unit No. 1.

The following are the main issues which must be addressed:

1. Disposal of drilling fluids on drill sites;
2. Risk to water supplies from drilling operations;
3. Surface impact from the installation of flowlines;
4. Oil and salt water spills from flowline and water injection line failures;
5. Risk to water supplies from oil and salt water spills;
6. Control of weed growth around production facilities.

The following preventative measures and contingency actions will be employed by Chevron to address these impacts:

1. Disposal of Drilling Fluids on Drill Sites

The Manitoba Energy and Mines Petroleum Drilling and Production Regulations are in place to ensure that drilling fluids are disposed of in an environmentally safe manner and that the drill site is fully restored. These regulations will be strictly adhered to by Chevron and its contractors in the reduced spacing project. As with other existing wells in the North Virden Scallion Unit No. 1, water based drilling muds will be used in the reduced spacing project and the use of oil and salt based muds is not anticipated.

2. Risk to Water Supplies from Drilling Operations

It is the policy of Chevron and its contractors to strictly adhere to surface casing requirements and cementing procedures during drilling operations as are presented in the Manitoba Energy and Mines Petroleum Drilling and Production Regulations. These requirements during drilling operations ensure the protection of shallow aquifers used for domestic potable water.

3. Surface Impact from the Installation of Flowlines

The possible impacts to agricultural soil during flowline installation are mixing of topsoil with subsoil, compaction of the topsoil and topsoil loss. To address these concerns Chevron will institute procedures, in consultation with the landowner, to strip and stockpile the topsoil before the flowline is installed. The topsoil will be replaced after the flowline is in place. These procedures will prevent soil mixing, topsoil loss and topsoil compaction so that the productive capability of the soil is maintained.

4. Oil and Salt Water Spills from Flowline and Water Injection Line Failures

To repair equipment and to reclaim land damaged by a spill is very costly. It is in the best interest of Chevron to institute programs which will minimize the probability of spills occurring. The major cause of spills is corrosion of steel in flowlines. To greatly reduce the probability of corrosion in flowlines in the reduced spacing project, Chevron will install production flowlines constructed of non-corrodible fibreglass pipe and will ensure that all new water injection lines will have polyethylene outer jackets over cement-lined steel pipe to protect the injection lines from external and internal corrosion. In addition, during 1987 and 1988 Chevron replaced all water injection lines in North Virden Scallion Unit No. 1 with new corrosion-protected pipe. The cost of this project was \$1 295 000. This effort will drastically reduce the probability of a spill being caused by these facilities.

Another possible cause of spills is through flowline failure due to over pressure. Wax buildup is the main cause of pressure buildup in the flowline. Flowlines will be cleaned regularly in the reduced spacing project to prevent wax buildup. In addition, high pressure shutdown switches will be installed on all producing wells to shut down pumps and prevent excessive buildup of pressure. As is Chevron's standard practice, close monitoring of facilities and production rates will also be a high priority in the reduced spacing project to ensure a spill does not occur.

Although unlikely, a spill may occur even though all preventative measures have been implemented. Should a spill occur, it is/will be Chevron's standard practice to conduct the following spill response procedure:

- a. Isolate the pipeline leak by shutting in the well or valves at either end of the line;
- b. Notify the landowner and the Petroleum Branch;
- c. Isolate and remove spilled fluid;
- d. Conduct an on-site inspection and evaluation of the spill damage;
- e. Repair the pipeline and evaluate the cause of the pipeline failure;
- f. Apply first aid chemical treatment to damaged soil;
- g. Complete the required Petroleum Branch spill report;
- h. Conduct an ongoing site reclamation program for the spill area;
- i. Pay annual compensation to landowners for crop loss due to the spill.

Chevron will continue its aerial surveillance program to detect a spill early if one should occur. Twice a week a low flying aircraft will fly over the project area. Early detection of a spill will minimize the amount of material spilled and the resulting damage.

5. Risk to Water Supplies from Oil and Saltwater Spills

As stated in Section 4, Chevron will take all the preventative measures to ensure a spill does not occur by the installation of non-corrodible fibreglass flowlines and the use of internal and external corrosion protection on water injection lines. The probability of a spill occurring in the reduced spacing project is very low. If a spill should occur, however, such that the use of a landowner's dugout or drinking water is inhibited, Chevron will implement procedures to delineate the extent of contamination and will provide assistance to the landowner.

6. Control of Weed Growth Around Production Facilities

Chevron will expand its ongoing weed control program to include the new production and injection facilities associated with the reduced spacing project.



**Assessment of Infill Locations
Relating to Surface Operations
North Virden Scallion Unit No. 1
Reduced Spacing Project**

Prepared by C. P. Butchko

**Chevron Canada Resources
Regulations and Environment Division**

1989-02

Assessment of Infill Locations
Relating to Surface Operations
North Virden Scallion Unit No. 1
Reduced Spacing Project

This discussion will cover all aspects of the proposed infill wells and their effects on surface operations, from initial inception to final abandonment. The emphasis will be on the infill placement criteria and associated agricultural impact. Guidelines for locating the project infills are also recommended in this assessment.

The final location of this proposed reduced spacing infill project was chosen for several reasons as discussed in the "Technical Justification" section of this application. This area has favourable geological and reservoir characteristics which will enable an evaluation of 8 hectare (20 acre) well spacing on ultimate oil recovery. Another consideration in locating this project was the effects it would have on surface owners and operations. The project is situated on the edge of the active farming area in the unit. Over half of the project's 360 acres is on non-cultivated lands as shown on attachment 9. Of all the project sites considered, this one had the least impact on agricultural operations.

As shown in the "Technical Justification" section of this application there is strong technical support to justify the drilling of nine infill producers on 8 hectare spacing. Since the existing 16 hectare wells are located near the centre of each legal subdivision, the nine 8 hectare wells would ideally be located at the corners of each legal subdivision within the project area. It is often difficult to locate the wells in these ideal targets due to surface constraints. This is especially true when drilling 8 hectare wells since the ideal surface locations will occasionally be on road allowances and property lines.

The Daly Unit No. 3 reduced spacing hearing which occurred on 1986-08-07, addressed many of the same issues that relate to this project. In keeping with the Board's decision report associated with Daly Unit No. 3, Chevron proposes to formally adopt the Board's "Conditions of Reduced Spacing Approval" as guidelines for locating wells in the North Virden Scallion Unit No. 1 reduced spacing project. The only change would be to item 3 to reflect locating the facilities (wells) in accordance with the photo referenced earlier in this submission. Item 1 of the Board's "conditions" for Daly references an impact minimization study by R. A. Berrien Associates Ltd. Chevron has used this study's "Placement Criteria" in locating the North Virden Scallion reduced spacing infill wells. For convenience the Board's "Conditions of Reduced Spacing Approval" from the Daly decision and "Placement Criteria" from the Berrien Report are attached at the end of this assessment report.

There is some flexibility associated with moving the 8 hectare locations. Since oil recovery decreases as the well is located further from the ideal target, Chevron attempts to minimize the movement as much as possible. The 8 hectare well target areas, as designated by the Manitoba Energy and Mines Petroleum Division, will require the wells to be located within 76 metres of

the ideal target (LSD corners). Chevron believes that this amount of wellhead movement is technically satisfactory. Should significantly more than 76 metres of surface movement be required, the well would be reevaluated. Chevron would determine if the well should be directionally drilled from an acceptable surface location, or not drilled at all if increased drilling costs offset the benefits of that particular well.

Chevron's initial assessment of the proposed nine infill wells resulted in the surface locations as illustrated on the Attachment 9 areal photograph (photo). For convenience the proposed infill locations are numbered from 1 to 9 on the photo. These locations as shown would all be drilled vertically. Note that these are not final locations since land owner and Petroleum Division concurrence has not been obtained. Also shown on the photo is an existing 8 hectare well at 13D-24 located on the east side of the project area.

The Manitoba Petroleum Drilling and Production Regulations require a 50 metre separation distance between a wellhead and road allowance. The Rural Municipality of Wallace only requires a 38 metre (125 ft) separation distance. Chevron requires a 100 x 100 metre drilling lease with the wellhead located within 10 metres of the lease centre. This is a physical limitation based on the orientation of the drilling rig and location of sumps, pipe racks and equipment trailers. The 10 metre flexibility is dependent on the type of drilling rig and location of the lease road entering the lease.

To remain within the above guidelines and regulations, wells 3, 4, 5, 6 and 9 are located with the wellheads 50 metres from the road allowance and in the centre of the drilling lease. The drilling leases associated with wells 4, 5 and 9, which are on cultivated lands, cannot be moved to overlap the road allowances since the road and ditches will prevent this. The wellheads could possibly be moved 10 metres closer to the road allowances after special approval was obtained from the Petroleum Division relaxing their 50 metre requirement. Since this small 10 metre movement is administratively difficult to obtain, does not reduce the agricultural impact, and has a very small effect on oil recovery, Chevron does not intend to pursue it for these wells.

The following discussions summarize the placement for each infill location:

Well 1 (3D-26-11-26 WPM):

- location moved west of ideal due to fence and property line
- located in bush and uncultivated land
- lease and trail have negligible agricultural impact

Well 2 (2D-26-11-26 WPM):

- location is in ideal position - no surface constraints
- located in bush
- lease and trail have negligible agricultural impact

Well 3 (1D-26-11-26 WPM):

- location moved west of ideal due to road allowance
- located on uncultivated land
- lease and trail have negligible agricultural impact

Wells 4 and 5 (14D and 15D-23-11-26 WPM):

- locations both moved south of ideal due to road and road allowance
- optimum technical location is south of road to get closer to the existing 15-23 well.
- both located on cultivated land
- some agricultural impact since farmer will have to farm around pumping well

Well 6 (13C-24-11-26 WPM):

- location moved south and east due to intersecting road allowances
- located on uncultivated land and old slough bottom
- lease and trail have negligible agricultural impact

Well 7 (11D-23-11-26 WPM):

- location is in ideal position
- located on cultivated land
- movement within constraints in any direction would still result in location on cultivated land
- some agricultural impact since farmer will have to farm around pumping well

Well 8 (10D-23-11-26 WPM):

- location moved north and east of ideal due to cultivated land
- located on edge of bush and cultivated land
- lease and trail have minimal agricultural impact

Well 9 (9D-23-11-26 WPM):

- location moved west of ideal due to road and road allowance
- optimum technical location is west of road to maintain a reasonable distance from the existing 13-24 well.
- located on cultivated land
- some agricultural impact since farmer will have to farm around pumping well

The wellsite locations as chosen by Chevron are not final. They represent Chevron's attempt to minimize agricultural impact, and simultaneously maximize oil recovery at reasonable drilling costs to maintain project viability. Since over half of the surface area affected by the project is on non-cultivated land, Chevron does not see slant drilling 9 infills from a single pad as being a reasonable and economically attractive alternative in this case. Chevron considers deviated and slant drilling to be realistic alternatives to vertical wells when circumstances warrant such procedures.

Should this reduced spacing project prove economically successful, and should the decision then be made to expand into the remainder of the Unit, another reduced spacing application and impact assessment would be required. Due to the significant amount of cultivated land that would be affected Chevron would include a technical evaluation of slant and deviated drilling at that time. It should be noted that this reduced spacing project may never be expanded, as was recently experienced at the Daly Unit No. 3 Project which has been indefinitely suspended.

During actual drilling operations there will be a temporary increase in truck traffic and noise throughout the project area. Chevron feels these effects will be minimal since no residences are located within the project area. There will be a very slight increase in truck traffic due to operators checking the wells throughout the life of the project. Chevron is not planning on the installation of additional surface treating and separation facilities within the project area.

Once drilling and service rig operations are completed, the landowners will be able to farm over the lease trails and close to the well as is normally done on cultivated lands. Additionally, the landowners will be compensated for the impact that Chevron's installations have on their agricultural operations.

Once the oil reserves are depleted and these wells are no longer required, all surface equipment will be removed and the surface leases and roads will be reclaimed. Chevron maintains an ongoing abandonment and lease reclamation program throughout its operations in the Virden area. The land is returned to its original condition as soon as is practicable in an effort to minimize agricultural impact.

Chevron is of the firm belief that agricultural and petroleum operations can coexist on the same lands. This is required to ensure maximum development of Manitoba's resources above and below the surface. In an effort to minimize any adverse impacts of this coexistence, Chevron is attempting to provide as much information as possible to affected and concerned parties associated with this project. Additionally, Chevron is planning on conducting an "open house" in Virden which is tentatively planned for late March. Any questions and/or concerns prior or subsequent to the open house should be directed to Mr. Lyle Martinson in Chevron's Virden office (phone 748-1334).

Conditions of Reduced Spacing Approval

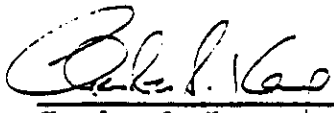
1. The proposed wellsites and other facilities shall be located and installed in accordance with the Placement Criteria^{*} provided in Exhibit No. 45AB entitled "Impact Minimization of Reducing Spacing Units in the Daly Field" by R.A. Berrien Associates (Rural) Ltd. (hereinafter referred to as "the Berrien Report").
2. Notwithstanding Condition No. 1, the following specific criteria shall be utilized in locating and installing new facilities:
 - a) Electric power will be installed underground.
 - b) Wherever practicable in conjunction with new facilities, existing power lines will be installed underground and access roads will be modified or relocated to lessen their impact on agricultural operations.
 - c) All facilities located within 200 metres of any aircraft runway will be appropriately marked or painted so as to be clearly visible from the air.
 - d) Wherever practicable, facilities will be located so as to take full advantage of any existing obstacles and thereby minimize the impact of the facility on agricultural operations.

*** ATTACHED**

- a) If in the opinion of the landowner and the Executive Director of the Petroleum Division, the proposed location of a wellsite would result in a significant impact on agricultural operations, the wellsite shall be relocated to a suitable surface location to be determined as indicated below, and the proposed well drilled directionally if necessary.
 - b) Wherever practicable, lease access will be through use of non built-up trails instead of built-up roads.
3. Prior to commencement of surveying for construction of any new facilities related to these approvals, Chevron shall submit to the Winnipeg Office of the Petroleum Division complete details of location and type of planned facility. Such details should employ and be accompanied by the appropriate Section map or maps from the Berrien Report. Any departure from the recommendations of the Berrien Report shall be clearly noted and justified.
4. The proposed facility site shall be jointly inspected by the landowner and an authorized representative of the Petroleum Division.
5. If the landowner indicates his general agreement with the location of the proposed facility, the Executive Director of the Petroleum Division will notify Chevron that an application may be submitted for a drilling license or for approval to construct the proposed facility.

6. If the landowner and the representative of the Petroleum Division are of the opinion that agricultural impacts can be significantly reduced by relocation of the proposed facility, the Executive Director of the Petroleum Division will request Chevron to consider the recommended relocation.
7. If Chevron declines to relocate a proposed facility to alleviate concerns expressed by the landowner and the representative of the Petroleum Division, the Executive Director of the Petroleum Division shall determine if the degree of impact caused by the facility is acceptable. If the degree of impact is deemed to be acceptable, the Executive Director shall notify Chevron to make application for approval of the facility. If the degree of impact is deemed to be unacceptable, the Executive Director shall inform Chevron that he is not prepared to approve the facility unless it is relocated to a suitable location.
8. Upon application for approval of a surface facility which is proposed to be located less than fifty metres from a government road allowance, Chevron shall submit, in support of the application, written evidence that the Rural Municipality or the Department of Highways, as the case may be, concurs with the proposed location of the facility.


Wm. McDonald
Deputy Chairman


Charles S. Kang
Chairman

2. Single Pad Per Quarter Section

This scenario is very much like that of the single pad noted above, but virtually no change is required as there would be adequate room to manoeuver equipment about the lease. Aside from a marginal increase in noise and activity levels, this site is indistinguishable from an ordinary wellsite.

3. Sixteen Vertical Wells Per Section

This scenario obviously has the most potential to create problems for the landowners. We will address this in detail in the following sections.

(a) Background Considerations

Chevron Canada Resources Limited has asked us to examine the subject lands with a view to placing the wells and roads in such a fashion that the impact on agriculture will be minimized. No specific constraints were placed upon us and we were provided a free hand to select and weight the judgment criteria for placement. That flexibility extended to a capacity to offset wells from their most geologically desirable locations in order to maximize the surface integration. The optional considerations at our disposal included:

- underground power;
- relocation advice for existing facilities;
- trails rather than roads; and
- well offsets to a maximum of 50 yards. = 46m RADIUS

The use of these options, while no doubt less convenient and more costly to Chevron, greatly enhanced likelihood of placing a well and access road in such a way as to minimize surface disturbance.
NORMAL TARGET \Rightarrow 76m RAD.

(b) Placement Criteria

The only fixed element in the study was the general location of some 79 wells that we were informed would be drilled if the entire enhanced recovery program were to be implemented. That number of wells includes some wells that will be needed if the NW 1/4 26-9-28WPM is added to the unit.

The single most important consideration in the study was the adherence to, or integration with, existing linear disturbances or field obstructions. This consideration clearly recognizes that it is the roads, and not the wells, that are the most problematic in terms of day to day operations and farming difficulties.

Each prospective wellsite was viewed from the perspective of those elements that give rise to compensation under the Surface Rights Act. The goal was to minimize the adverse effect and loss of use.

One consideration investigated included setback requirements from municipal roads. A great many of the wells in this project are on the perimeter of sections. Hence, the closer they might be to the fence line, the less interference they will create. We have requested that Chevron seek relaxations of the 50 meter setback requirements of the Petroleum Branch, and the 125 feet setbacks required by the R.M. of Wallace and the R.M. of Pipestone. The minimum distance that can still allow the well to be drilled is 60 feet from a boundary point. That is the setback Chevron will be seeking.

Other factors we took into consideration include the following.

- (i) Power poles: Chevron has made the commitment that power supply, if needed, will all be underground.
- (ii) Trails versus roads: Chevron has stated that where appropriate we may recommend non-built up roads that may be farmed over.
- (iii) Obstacle elimination: in a few cases there may be a preference to remove an obstacle going in a different direction before putting in another to service the new well. Chevron has given assurances, where warranted, that they will do it.
- (iv) Fence lines: existing fence lines have been given higher priorities to other existing linear disturbances, such as the edge of a crop type in a field.
- (v) Pasture areas versus crop land: areas of permanent pasture were considered preferred areas for wellsites and roads versus cropped areas and these were utilized where possible.

- (vi) Topographic features: there were numerous occasions where depressional lands were found. Many tree and bush covered sloughs were also in the area. Where possible, wells were tucked in tight to these obstacles, or in some situations, actually placed within the depressional or sloughy area.
- (vii) Field patterns: where there was evidence of a predominant direction of work in a field, for whatever reason, care was taken to see this was maintained when new placements were made.
- (viii) Land administration: in some situations there was no significant difference in the impact of a well on one side of a road or the other, from an agricultural viewpoint. In such cases, if one of the possible placements was on land where no other wells were found, versus one where, of necessity, wells would be situated, the well would be placed on the property along with the other wells.
- (ix) Patterns of ownership: holdings larger than quarter sections are the rule rather than the exception. Access that traversed quarter section boundaries always considered the ownership of the lands, and where the only boundary was a legal one, an effort was made to preserve the integrity of the field.

(c) Method of Criteria Application

Having determined the factors which were important in placing the wells and roads, the subject properties were inspected, wellsite by wellsite, and specific situations were noted. Without a survey, of necessity, many sites could only be estimated as to their prospective location. However, back in the office, with the help of aerial photography, these were more precisely plotted.

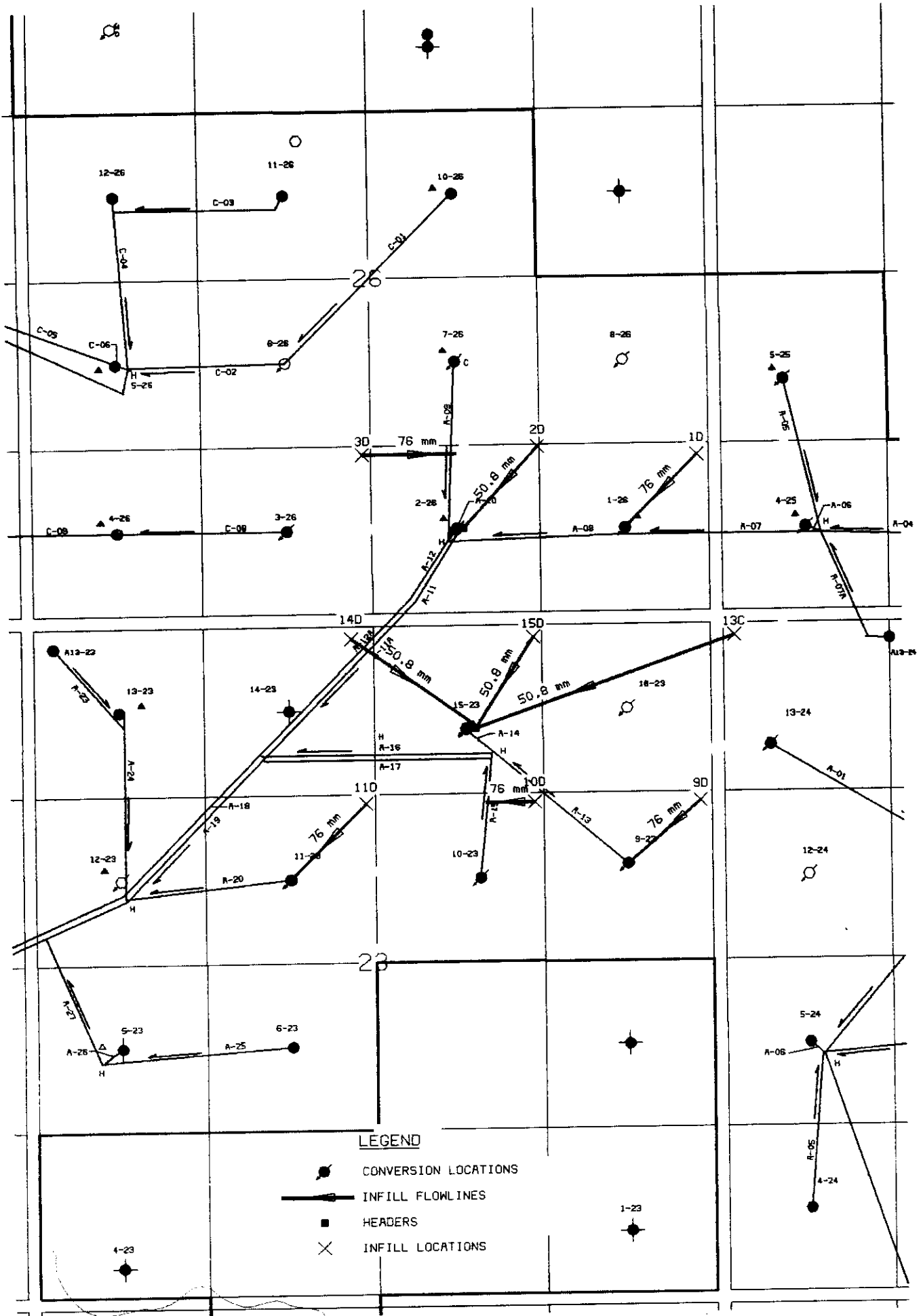
The resulting maps that are attached indicate the new and existing wells, the existing roads and trails, and the recommended new access routes.

The routes we recommended were considered against the apparent impact of the West Daly infill well program. This appeared to be a similar development that was accommodated quite well by the farmer in his operations.

The plans and maps that illustrate the potential facility placement are appended to this report, on a section by section basis.



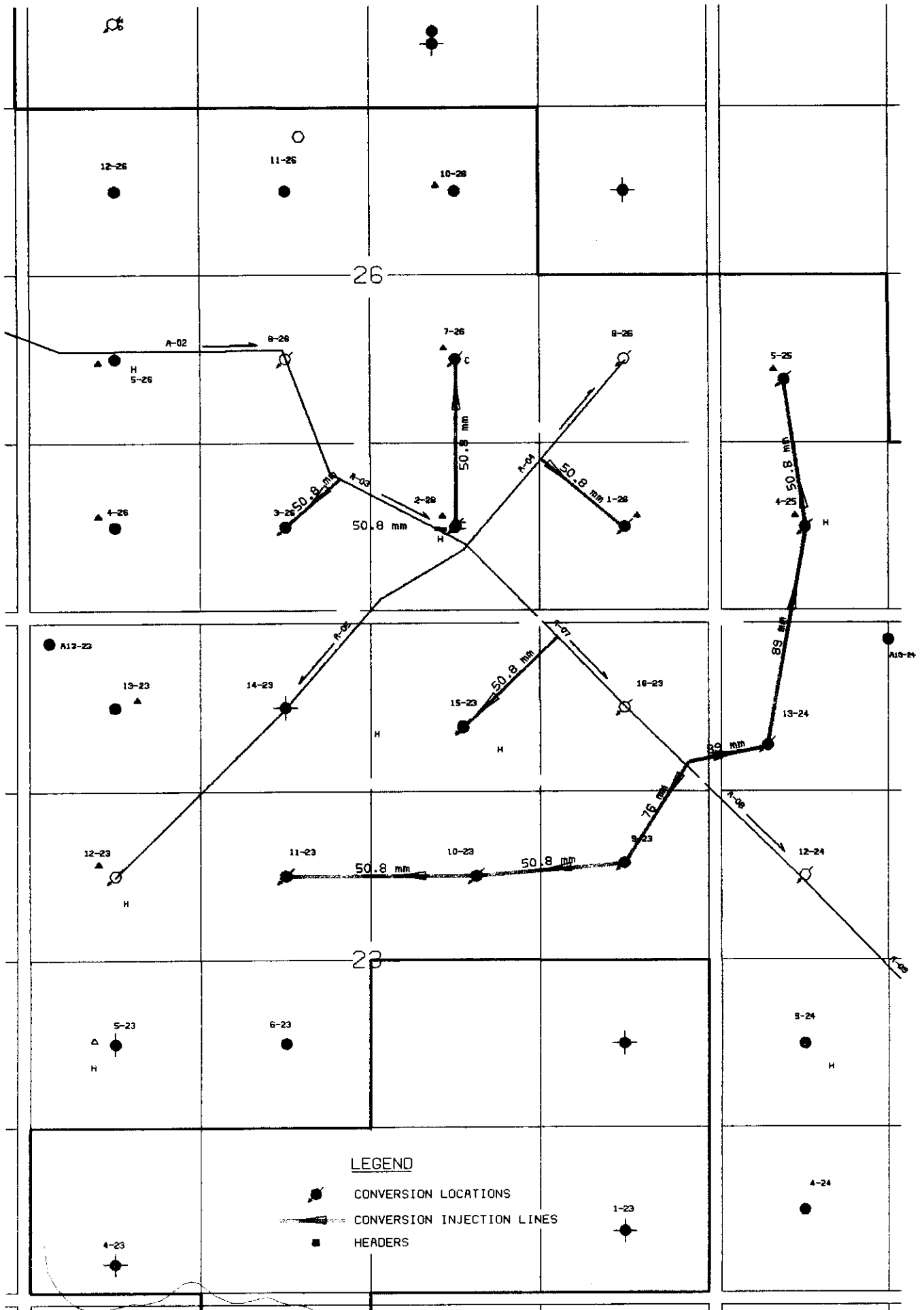
NORTH VIRDEN SCALLION UNIT #1 PROPOSED INFILL WELL FLOWLINE TIE-INS





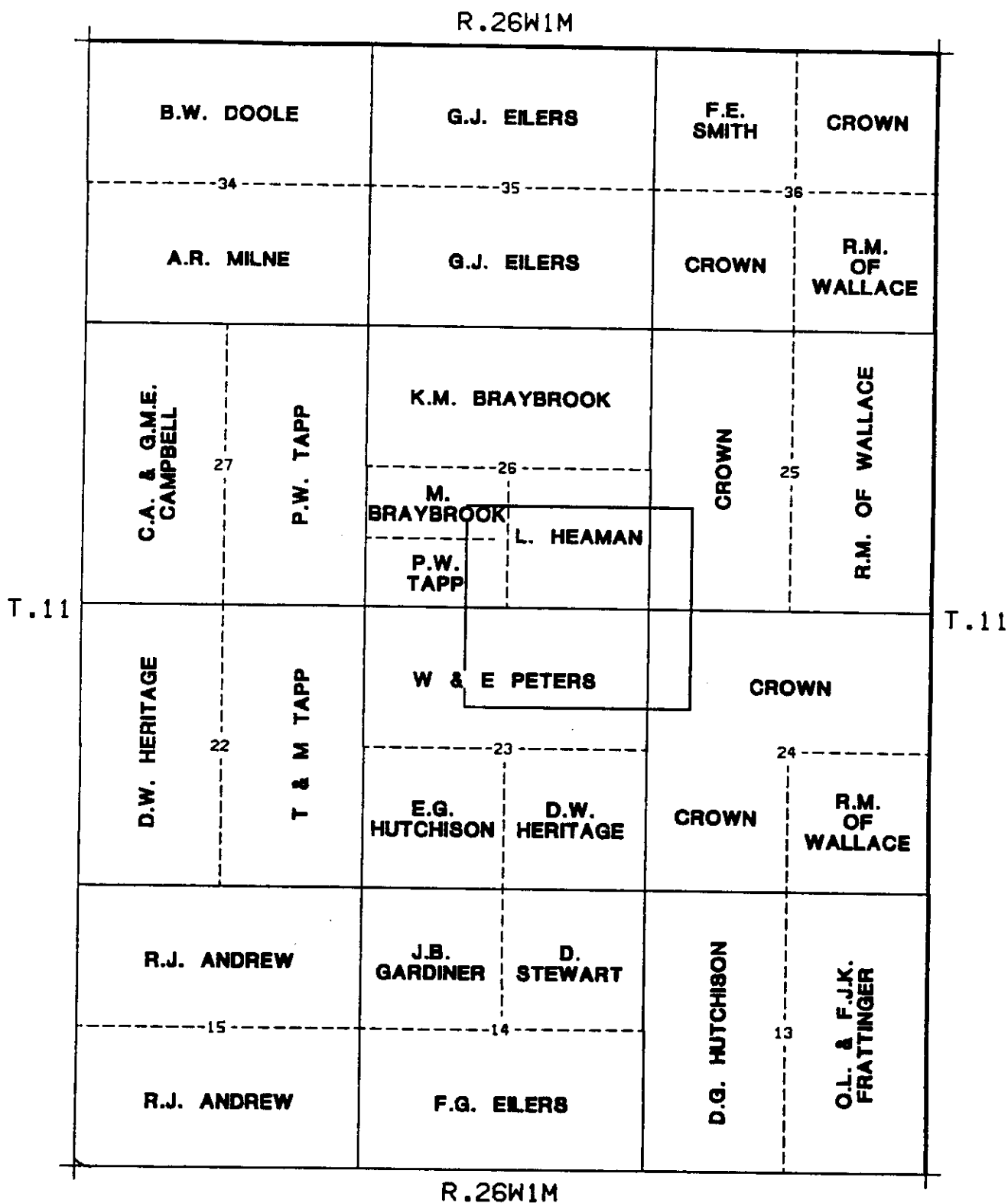
NORTH VIRDEN SCALLION UNIT #1

PROPOSED INJECTION WELL CONVERSIONS - TIE-INS





NVSU #1 INFILL PROJECT SURFACE OWNERS 87-07-01



— PROJECT BOUNDARY

SCALE 2" = 1 MILE

G03418



November 21 19 88

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

Landowner Contact Report

I, the undersigned, hereby grant you permission to do survey work and the removal of trees where necessary on the following lands (owned, leased, purchased) by me and described as follows:

W2-23-11-26-WP

This permission is granted in consideration of your promise as follows:

All work under this permit will be conducted at the risk
and expense of Chevron Canada Resources Limited

Also I, the undersigned, hereby acknowledge that I am in agreement with the proposed route as shown on the sketch.

Special Requirements:

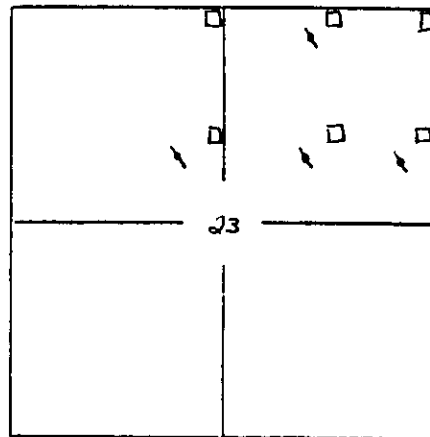
Make Contact before survey
to landowner for Route of Access Road.

Proposed new wells ☐

Converted wells ☒

Nature of land likely to be crossed:

Crop



Registered Owner: Walter J. Peters Address: Box 308

Virden Manitoba R0M 2C0

Occupant: _____ Address: _____

Edmund Peters
Witness

Walter J. Peters
Edmund Peters
(Person Granting Permit)

1 copy to Landowner
1 copy to Contractor
1 copy to District Office

22 Nov 19 88

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

Landowner Contact Report

I, the undersigned, hereby grant you permission to do survey work and the removal of trees where necessary on the following lands (owned, leased, purchased) by me and described as follows:

SE 26, 11-26 WPM

This permission is granted in consideration of your promise as follows:

All work under this permit will be conducted at the risk
and expense of Chevron Canada Resources Limited

Also I, the undersigned, hereby acknowledge that I am in agreement with
the proposed route as shown on the sketch.

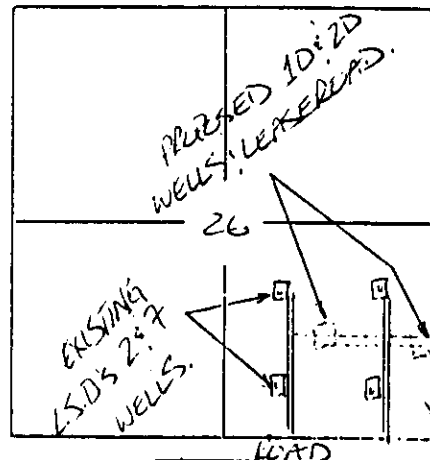
Special Requirements:

CONTACT OWNER PRIOR TO SURVEY
TO DISCUSS LEASEROAD
LOCATIONS.

Nature of land likely to be crossed:

PASTURE

NOTE: CATTLE



Registered Owner:

WILLIAM C. (LYLE)

Address:

Box 251 VIRDEN, MAN. R0M 2C0
845-2343

Occupant:

N/A

Address:

L. Ross
Witness
IAN C. ROSS

W. C. Heaman
(Person Granting Permit)

1 copy to Landowner
1 copy to Contractor
1 copy to District Office

23 Nov 19 88

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

Landowner Contact Report

I, the undersigned, hereby grant you permission to do survey work and the removal of trees where necessary on the following lands (owned, leased, purchased) by me and described as follows:

5 1/2 CE SW 26, 11-26 WPM

This permission is granted in consideration of your promise as follows:

All work under this permit will be conducted at the risk
and expense of Chevron Canada Resources Limited

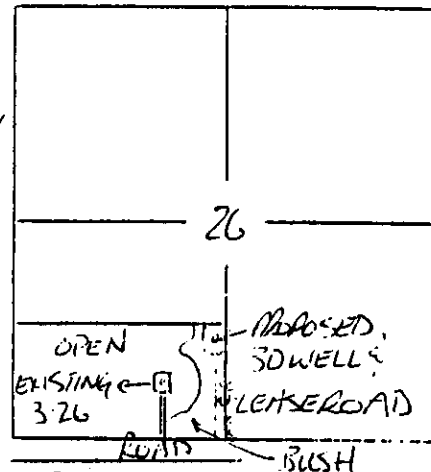
Also I, the undersigned, hereby acknowledge that I am in agreement with
the proposed route as shown on the sketch.

Special Requirements:

CONTACT OWNER PRIOR TO SURVEY
TO DISCUSS LEAK ROAD
LOCATIONS.

Nature of land likely to be crossed:

CULT. & BUSH AS PER
SKETCH.



Registered Owner: PHILIP TAPP

Address: Box 496 W. CREALMAN RD. RM 200
748-1571

Occupant: N/A

Address: _____

[Signature]
Witness
IAN C. ROSS

[Signature]
(Person Granting Permit)

- 1 copy to Landowner
- 1 copy to Contractor
- 1 copy to District Office

1989-01-27

13c-24-11-26 WPM
Water Injection Well Proposal
Infill and Conversion Pilot Project

Agriculture Canada
Prairie Farm Rehabilitation
Administration
Motherwell Building
1901 Victoria Avenue
Regina, Saskatchewan
S4P 0R5

Attention: Mr. Frank Luchinski

Gentlemen:

Chevron Canada Resources is proposing the above captioned wellsite and access as part of the North Virden Scallion Unit 1 Infill and Conversion Project. In order to process our application to the Manitoba Petroleum Branch we will require your usual form of approval.


As we propose to make application for reduced spacing to the Manitoba Petroleum Branch in early February we would greatly appreciate your earliest attention to this matter.

Also as part of the Conversion Project some producing wells may be converted to injection wells. The wells affected would be 4-25-11-26, 5-25-11-26 and 13-25-11-26.

Should you require any further information in this regard, please contact Rod Banks at (403) 234-6141.

Thank you for your consideration in this matter.

Yours very truly,


H. H. POCKRANT
Supervisor
Field Land Operations

RB/jl

bcc: B. Carnahan



Agriculture
Canada

Prairie Farm Administration du
Rehabilitation Retablissement agricole
Administration des Prairies

Our File: 4557:925-7W1-11

Motherwell Building
1901 Victoria Avenue
Regina, Saskatchewan
S4P 0R5

January 26, 1989

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

Attention: Rod Banks

Dear Sir:

Re: Wallace Community Pasture
Wellsite and Access Road
LS 13C of 24-11-26 W1 (Prov. Land)

Right-of-Entry

In compliance with your request of January 26, 1989, permission is hereby granted to Chevron Canada Resources Limited, to enter upon the above shown land lying within the confines of the PFRA Wallace Community Pasture for the purpose of surveying a wellsite and access road and drilling an injection well.

The conditions on which this Licence is granted are as follows:

1. The Licensee's field crew(s) must have in their possession, a copy of the signed Right-of-Entry Licence prior to entry upon the said land.
2. The Licensee will advise the Pasture Manager of the location of the well and roadway, and obtain his approval of said location prior to construction.
3. The Licensee must contact the PFRA officials responsible for managing the said land,

Pasture Manager
Albert Webb
Box 2110
Virden, Manitoba
ROM 2C0 (Ph: 748-1466)

Assistant Area Manager
Jim Nugent
Box 275, 244 - 10th Street
Brandon, Manitoba
R7A 5Z2 (Ph: 726-7584)

Canada

and have them sign this Right-of-Entry Licence before he or any of his representatives enter upon Her Majesty's land and shall inform the said officials when the Licensee's operations are completed or suspended.

4. The Licensee will have this Right-of-Entry Licence signed in duplicate by the above named officials of PFRA, and will distribute the copies in the following manner:
 - a) one copy will be retained by the Licensee;
 - b) one copy will be sent to the Land Division of PFRA.
5. The Licensee will cooperate with the said officials in the matter of closing of gates where necessary and confining vehicular traffic to established roadways, and shall conduct all operations so that they will not conflict with or disorganize the operations of the pasture.
6. The Licensee agrees to be responsible for, and does hereby indemnify and save Canada harmless from and against all damages and losses suffered by Her Majesty arising out of the use of this Licence by the Licensee, including soil damage in the pasture area and/or for any losses for which Her Majesty may have a responsibility to any third party.
7. The Licensee accepts the responsibility to determine if any surface or sub-surface rights have been previously granted to other parties with respect to the subject land, including such rights which may have been granted to Saskatchewan Power Corporation and Saskatchewan Telecommunications.
8. The Licensee shall have quiet enjoyment of the said land and the rights and privileges hereby granted.
9. Her Majesty, in the event that the said land is required for purposes by reason of circumstances that in the opinion of Her Majesty constitutes an emergency, may at any time cancel this Licence without compensation by giving sixty days' notice of such cancellation in writing at the address of the Licensee shown above.
10. The Licensee shall submit a plan of survey, in triplicate, to Manitoba Department of Natural Resources, Director, Crown Lands, Winnipeg, Manitoba, for further documentation.
11. The Licensee is responsible for enclosing the wellsite with a fence meeting PFRA standards and erecting an LS wellsite sign, as well as conforming to applicable rules and regulations for oil companies operating on Canada lands.
12. Fire protection measures shall be taken by the company as directed by the Pasture Manager.

13. The Licensee will contact the Pasture Manager as to availability, location and access to water, and the company will be charged a fee of \$500.00 per wellsite.
14. The Licensee will be responsible for removing from the pasture area, all garbage and other materials following completion of their drilling program.
15. The Licensee will obtain the Pasture Manager's permission to cut fences where necessary, and will construct a crossing or gate satisfactory to the Pasture Manager, or repair the fence to PFRA standards, as required by the Pasture Manager.
16. This Licence shall immediately terminate and become null and void if the Licensee fails to comply with any of the terms stated herein.

This Licence expires the 31st day of July, 1989.

Approved this the 26th day of January, 1989, by Jim Nugent,
Assistant Area Manager.

CHEVRON CANADA RESOURCES
LIMITED

Per:

J. Nugent
Assistant Area Manager

Official Capacity

A. Webb
Pasture Manager

Natalie F. Giraudier
Natalie F. Giraudier
Property Administration Officer
Land Division

c.c.: J. Nugent
A. Webb
Paula Eyler, Manitoba Natural Resources



Chevron



Chevron Canada Resources

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7
Phone (403) 234-5000 Fax (403) 234-5947

1989-01-27

Philip W. Tapp
Box 496
Virden, Manitoba
R0M 2C0

RE: Infill and Conversion Project
SW⁴ 26-11-26-WPM

Gentlemen:

Chevron Canada Resources Limited is in the process of applying for reduced spacing in the North Virden Scallion Unit #1. As part of this Infill and Conversion Project, Chevron will be converting some existing producing wells to water injection wells.

This letter is to inform you, the landowner, that upon approval of the proposed project the following wells are to be converted.

3-26-11-26-WPM

Yours truly,



H.H. Pockrant
Supervisor Field Land
Operations

RDB/rb

Chevron



Chevron Canada Resources

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7
Phone (403) 234-5000 Fax (403) 234-5947

1989-01-27

Walter and Erna Peters
Box 308
Virden, Manitoba
R0M 2C0

RE: Infill and Conversion Project
N^o 23-11-26-WPM

Gentlemen:

Chevron Canada Resources Limited is in the process of applying for reduced spacing in the North Virden Scallion Unit #1. As part of this Infill and Conversion Project, Chevron will be converting some existing producing wells to water injection wells.

This letter is to inform you, the landowner, that upon approval of the proposed project the following wells are to be converted.

9-23-11-26-WPM
10-23-11-26-WPM
11-23-11-26-WPM
15-23-11-26-WPM

Yours truly,



H.H. Pockrant
Supervisor Field Land
Operations

RDB/rb



Chevron Canada Resources

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7
Phone (403) 234-5000 Fax (403) 234-5947

1989-01-27

Mr. W.C. Lyle Heaman Jr.
Box 291
Virden Manitoba
R0M 2C0

RE: Infill and Conversion Project
SE 26-11-26-WPM

Gentlemen:

Chevron Canada Resources Limited is in the process of applying for reduced spacing in the North Virden Scallion Unit #1. As part of this Infill and Conversion Project, Chevron will be converting some existing producing wells to water injection wells.

This letter is to inform you, the landowner, that upon approval of the proposed project the following wells are to be converted.

1-26-11-26-WPM
3-26-11-26-WPM
7-26-11-26-WPM

Yours truly,

A handwritten signature in dark ink, appearing to be "H.H. Pockrant".

H.H. Pockrant
Supervisor Field Land
Operations

RDB/rb

Chevron



Chevron Canada Resources

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7
Phone (403) 234-5000 Fax (403) 234-5947

1989-01-27

Department of Natural Resources
Land, Leases and Permits
Box 2
600 1495 St. James Street
Winnipeg, Manitoba
R3H 0W9

RE: Infill and Conversion Project
NW $\frac{1}{4}$ 24-11-26-WPM and
SW $\frac{1}{4}$ 25-11-26-WPM


Gentlemen:

Chevron Canada Resources Limited is in the process of applying for reduced spacing in the North Virden Scallion Unit #1. As part of this Infill and Conversion Project, Chevron will be converting some existing producing wells to water injection wells.

This letter is to inform you, the landowner, that upon approval of the proposed project the following wells are to be converted.

13-24-11-26-WPM
4-25-11-26-WPM

Yours truly,


H.H. Pockrant
Supervisor Field Land
Operations

RDB/rb



Chevron Canada Resources

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7
Phone (403) 234-5000 Fax (403) 234-5947

1989-01-27

R.W. of Wallace
Box 2200
Virden, Manitoba
R0M 2C0

RE: Infill and Conversion Project
SW# 25-11-26-WPM

Gentlemen:

Chevron Canada Resources Limited is in the process of applying for reduced spacing in the North Virden Scallion Unit #1. As part of this Infill and Conversion Project, Chevron will be converting some existing producing wells to water injection wells.

This letter is to inform you, the landowner, that upon approval of the proposed project the following wells are to be converted.

5-25-11-26-WPM

Yours truly,

A handwritten signature in dark ink, appearing to be "H.H. Pockrant".

H.H. Pockrant
Supervisor Field Land
Operations

RDB/rb



**NORTH VIRDEN SCALLION UNIT #1
REDUCED SPACING PROJECT
DRILLING PRECAUTIONS**

The following precautions will be taken during drilling operations:

- a) pressure surveys will be conducted in the reduced spacing project area prior to drilling
- b) surrounding water injection wells will be shut in prior to drilling
- c) the wells will initially be drilled to approximately 20 m above the high pressure Lodgepole reservoir
- d) a 177.8 mm casing string will then be run and cemented in place at this depth
- e) a heavy mud system ($1\,860\text{ kg/m}^3$) will be used to drill the Lodgepole Zone (overbalance at least $2\,100\text{ kPa}$)
- f) the drilling mud will remain in the wellbore until the well is completed (open hole completion)
- g) the wells will be secured prior to moving the drilling rig

These procedures are based on discussing with the Manitoba Energy and Mines Petroleum Division.

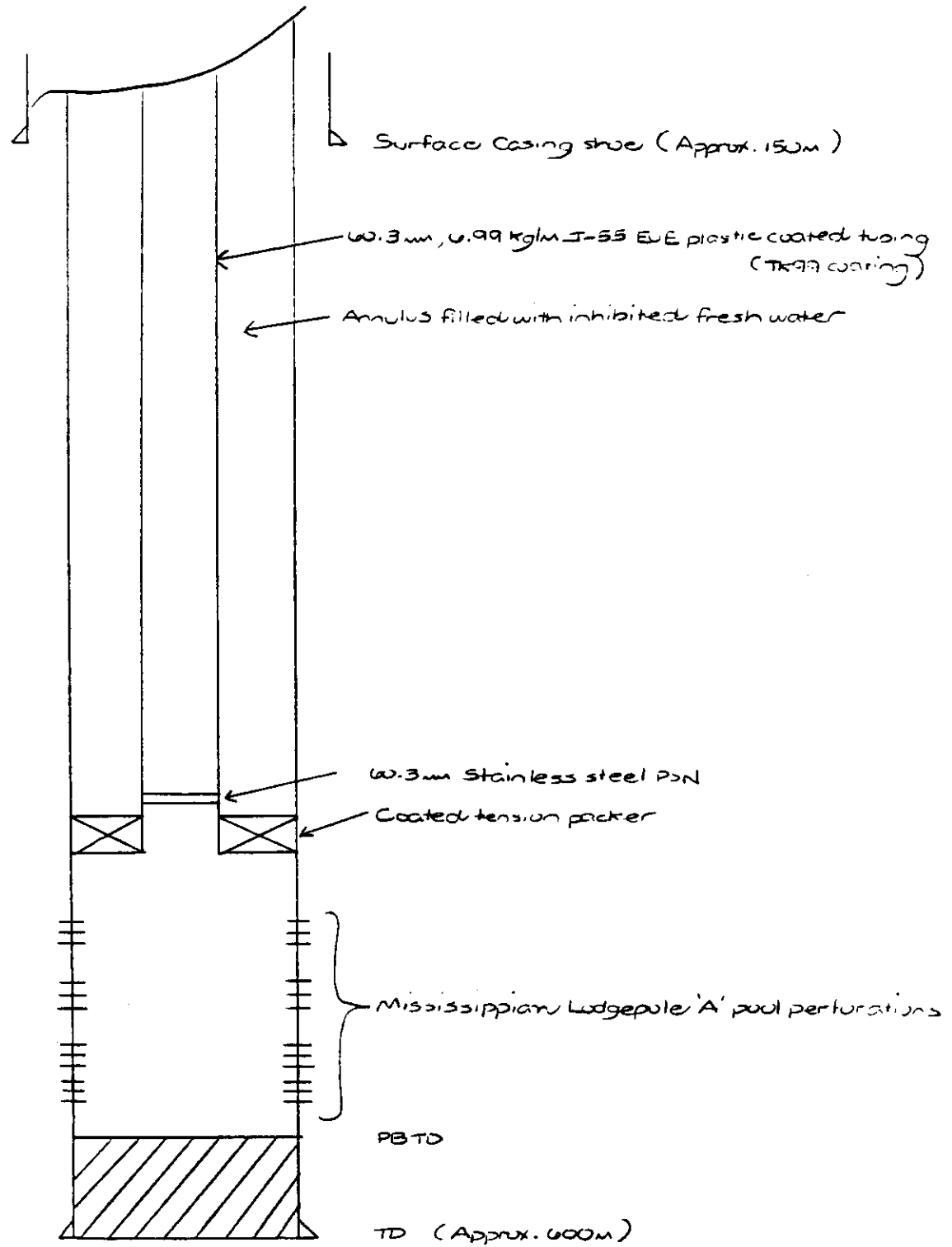


**NORTH VIRDEN SCALLION UNIT #1
REDUCED SPACING PROJECT
WATER INJECTION DETAILS**

1. The reduced spacing project's injection water will be from the Lodgepole A pool.
2. All injection water will be filtered at the 6-27 plant.
3. Injection volumes will be measured at each injection wellhead using 25.4 mm Flotrac turbine meters.
4. Injection rates will be sufficient to maintain 100% voidage replacement on a reduced spacing project area basis.
5. Injection wellhead pressures will not exceed 8 000 kPag.
6. Sweep efficiency will be maximized in the reduced spacing project area by completing or recompleting all wells (producers and injectors) in all oil bearing members of the Mississippian Lodgepole A pool.
7. Injection in the reduced spacing project is expected to commence as soon as possible after infill wells are placed on production (approximately 1989-10).



NORTH VIRDEN SCALLION UNIT #1
REDUCED SPACING PROJECT
TYPICAL DOWNHOLE CONFIGURATION FOR PROPOSED CONVERSIONS





**NORTH VIRDEN SCALLION UNIT #1
REDUCED SPACING PROJECT
CORROSION CONTROL**

1. Corrosion of injection wellbores will be controlled by:
 - a) installing a coated packer above the injection zone
 - b) installing plastic coated tubing
 - c) filling the annulus with inhibited fresh water
 - d) cathodically protecting casing
 - e) using stainless steel surface fittings
 - f) installing cement lined surface pipe
2. Corrosion of producing wellbores will be controlled by cathodically protecting and chemically inhibiting the casing.
3. Corrosion of flowlines will be controlled by:
 - a) cathodically protecting and chemically inhibiting the existing steel lines
 - b) installing fibreglass flowlines for all new installations
4. Corrosion of surface facilities will be controlled by:
 - a) using corrosion resistant piping and fittings (fibreglass, stainless steel and cement lined)
 - b) inhibiting with corrosion chemical



NORTH VIRDEN SCALLION UNIT #1
REDUCED SPACING PROJECT
MONITORING PROGRAM

1. A net oil computer will be used for production testing wells in the reduced spacing project area. This computer will measure both total fluid rate and watercut.
2. A minimum of four production tests will be completed each year for all producing wells in the reduced spacing project area.
3. Pressure surveys will be conducted annually in the reduced spacing project area.

Map Oversized

Attachment 3

Virden Lodgepole "A" Pool

North Virden Scallion Unit #1

Reduced Spacing Application

by

Chevron Canada Resources

Please contact
Engineering Department

MB Industry Trade and Mines
Petroleum Branch