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FUS  
WASKADA  
LAM A Pool  
Pressure Surveys.

81 00 002

January 23, 1992

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

Attention: Mr. John Fox  
Chief Petroleum Engineer

Dear Sir:

RE: 1992 Annual Pressure Survey  
Omega Waskada 7A-30-1-25 WPM  
Omega Waskada 13-32-1-25 WPM  
Omega Waskada 7-15-1-26 WPM  
Omega Waskada 5-32-1-25 WPM  
Omega Waskada 13-30-1-25 WPM  
Omega Waskada 15-20-1-25 WPM  
Omega Waskada 7-24-1-26 WPM  
Omega Waskada 13-31-1-25 WPM  
Omega Waskada 7-25-1-26 WPM  
Omega Waskada 13A-24-1-26 WPM  
Omega Waskada 5-8-2-25 WPM

~~WASKADA~~

In accordance with the Pressure Maintenance rules contained in Board Order No. PM4 please find attached a copy of a recently conducted pressure test for each of the aforementioned wells.

Should there be any questions or comments please contact the undersigned at (403) 261-0743.

Yours truly,

OMEGA HYDROCARBONS LTD.

K. Thomas  
Production Technologist

KT/ns

c.c.: Waskada Pressure Data Binders  
Wellfiles

**1992 Annual Pressure Survey  
Waskada Lower Amaranth Injection Wells**

<b>Well</b>	<b>Pool</b>	<b>Test Date</b>	<b>Shut-In Time (Hrs)</b>	<b>Pressure @ MPP (kPag)</b>	<b>Pressure @ Datum (kPag)</b>
7A-30-1-25 WPM	LAm	91/08/27	936.25	9,743	9,738
13-32-1-25 WPM	LAm	91/08/27	512.04	8,319	8,476
7-13-1-26 WPM	LAm	91/10/08	604.20	9,734	9,644
5-32-1-25 WPM	LAm	91/10/08	551.40	8,669	8,824
13-30-1-25 WPM	LAm	91/09/09	656.15	11,230	11,229
15-20-1-25 WPM	LAm	91/08/27	1,280.22	9,822	9,912
7-24-1-26 WPM	LAm	91/08/27	586.41	9,541	9,448
13-31-1-25 WPM	LAm	91/10/08	512.54	9,356	9,372
7-25-1-26 WPM	LAm	91/08/27	163.94	8,088	8,025
13A-24-1-26 WPM	LAm	91/11/12	343.31	6,918	6,877
5-8-2-25 WPM	LAm	91/11/12	110.74	6,449	6,732

Lower Amaranth Datum Depth = 440 m subsea

**GENERAL WELL INFORMATION**

5-8-2-25 WPM  
Test Date: 91/11/12

GL: 471.7 m  
KB: 475.9 m  
MPP: 888.75 mKB  
Datum: 915.9 mKB  
Hydrostatic Head: 9,235 kpa (Assuming a gradient of 10.44 kpa/m)  
Last Shut-in Date: 90/10/01  
Actual Inj. (Hrs): 6,484  
Actual Inj. (m<sup>3</sup>): 2,042.6  
Avg. Rate (m<sup>3</sup>/d): 7.56

$\phi$  = 14.8  
h = 6.9 m

P\* = 4,129 kpa  
Pws = 9,325 kpa  
PR = 6,539 kpa

\* Average reservoir pressure at MPP = 6,539 kpa (6,449 kPag)  
Average reservoir pressure @ Datum = 6,822 kpa (6,732 kPag)

OMEGA WASKADA  
LOW ? AMARANTH INJECTOR

5-8-2-25 WPM  
DECEMBER 1991

SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	3516 kPa
Transmissivity	[kh/ult	=	4.57 mD.m/mPa.s
	[kh/ulw	=	4.57 mD.m/mPa.s
Mobility	[k/ult	=	0.66 mD/mPa.s
	[k/u]w	=	0.66 mD/mPa.s
Flow Capacity	[kh]w	=	2.97 mD.m
Permeability	kw	=	0.43 mD
Skin Factor	s	=	-4.5
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	2.42
Damage Ratio	DR	=	0.41
Injectivity Index	PI	=	0.00078090 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	633 m

AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	6539 kPa

STABILIZED RATE PREDICTIONS

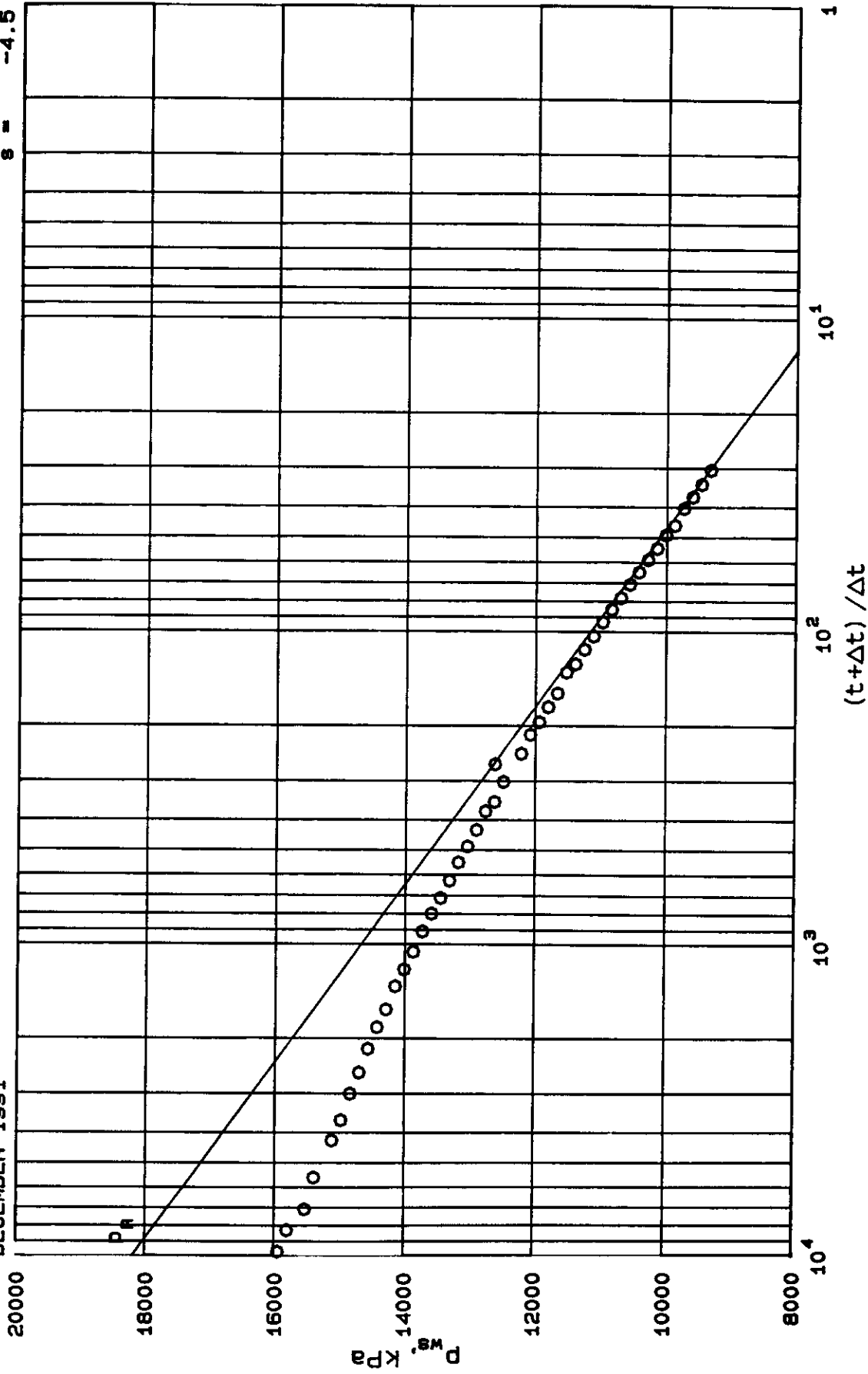
Time to Stabilization	ts	=	4142 hr
Stabilized Rate	qs	=	7.6 m <sup>3</sup> /d
Productivity Index	PI	=	0.00077994 m <sup>3</sup> /d/kPa

# HORNER PRESSURE FALLOFF PLOT

OMEGA WASKADA  
LOWER AMARANTH INJECTOR  
5-8-2-25 WPM  
DECEMBER 1991

$m =$  3516 kPa  
 $p_R =$  6539 kPa  
 $A =$  4.57 mD.m/mPa.s  
 $s =$  -4.5

$[kh/\mu]_t =$



**GENERAL WELL INFORMATION**

13A-24-1-26 WPM

Test Date: 91/11/12

GL: 465.6 m

KB: 470.1 m

MPP: 914.0 mKB

Datum: 910.1 mKB

Hydrostatic Head: 9,495.18 kpa (Assuming a gradient at 10.44 kPa/m)

Last Shut-in Date: 90/07/13

Actual Inj. (Hrs): 3,789

Actual Inj. (m<sup>3</sup>): 1,532

Avg. Rate (m<sup>3</sup>/d): 9.70

$\phi$  = 14.6

h = 11.2 m

P\* = 5,646 kpa

Pws = 9,792 kpa

PR = 7,008 kpa

\* Average reservoir pressure at MPP = 7,008 kpa (6,918 kPag)

Average reservoir pressure @ Datum = 6,967 kpa (6,877 kPag)

OMEGA WASKADA  
LOWER AMARANTH INJECTOR

13A-24-1-26 WPM  
DECEMBER 1991

SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	3667 kPa
Transmissivity	[kh/ult	=	5.62 mD.m/mPa.s
	[kh/ulw	=	5.62 mD.m/mPa.s
Mobility	[k/ult	=	0.50 mD/mPa.s
	[k/ulw	=	0.50 mD/mPa.s
Flow Capacity	[khlw	=	3.65 mD.m
Permeability	kw	=	0.33 mD
Skin Factor	s	=	-4.7
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	2.64
Damage Ratio	DR	=	0.38
Injectivity Index	PI	=	0.00105477 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	424 m

AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	7008 kPa

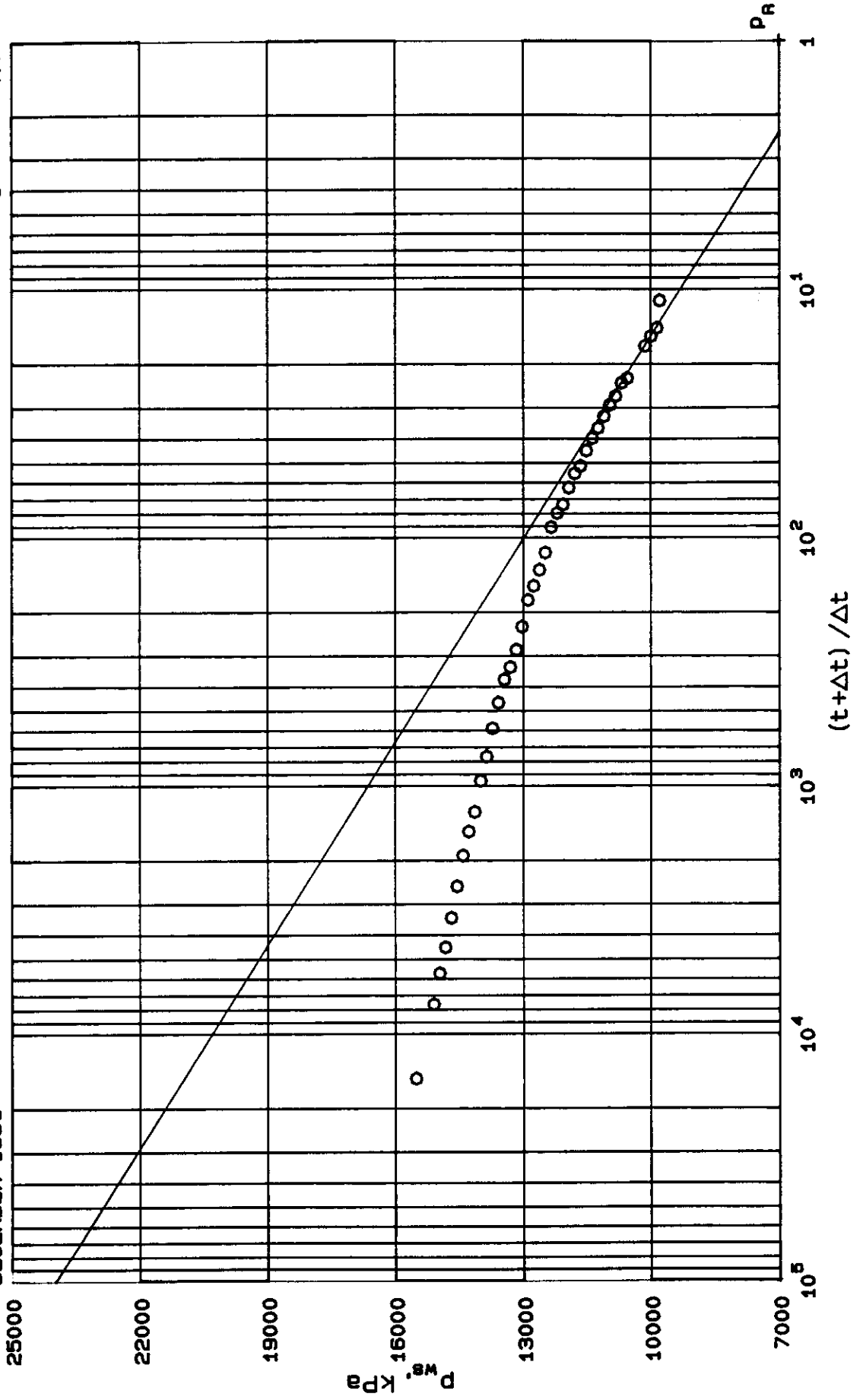
STABILIZED RATE PREDICTIONS

Time to Stabilization	ts	=	5406 hr
Stabilized Rate	qs	=	9.6 m <sup>3</sup> /d
Productivity Index	PI	=	0.00103906 m <sup>3</sup> /d/kPa

# HORNER PRESSURE FALLOFF PLOT

OMEGA WASKADA  
 LOWER AMARANTH INJECTOR  
 13A-24-1-26 WPM  
 DECEMBER 1991

$m =$  3667 kPa  
 $P_R =$  7008 kPa  
 $[kh/\omega]_t =$  5.62 mD.m/mPa.s  
 $s =$  -4.7





# GENERAL WELL INFORMATION

7-25-1-26 WPM

Test Date: 91/08/27

GL: 465.7 m

KB: 469.8 m

MPP: 915.8 mKB

Datum: 909.8 mKB

Hydrostatic Head: 9,515 kpa (Assuming a gradient of 10.44 kpa/m)

Last Shut-in Date: 89/10

Actual Inj. (Hrs): 11,760

Actual Inj. (m<sup>3</sup>): 6,980.4

Avg. Rate (m<sup>3</sup>/d): 14.2

O = 14.7%

h = 12.10 m

P\* = 5,280 kPa

Pws = 10,157 kPa

PR = 8,178 kPa

\*Average reservoir pressure at MPP = 8,178 kPa (8,088 kPag)

Average reservoir pressure at Datum = 8,115 kPa (8,025 kPag)

# WATER PRESSURE FALLOFF ANALYSIS - HORNER

OMEGA WASKADA  
7-25-1-26 WPM

LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

## SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	2626 kPa
Transmissivity	{kh/ult	=	11.49 mD.m/mPa.s
	{kh/ulw	=	11.49 mD.m/mPa.s
Mobility	{k/ult	=	0.95 mD/mPa.s
	{k/ulw	=	0.95 mD/mPa.s
Flow Capacity	{khlw	=	7.46 mD.m
Permeability	kw	=	0.62 mD
Skin Factor	s	=	-3.8
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	2.00
Damage Ratio	DR	=	0.50
Injectivity Index	PI	=	0.00162552 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	1024 m

## AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	8178 kPa

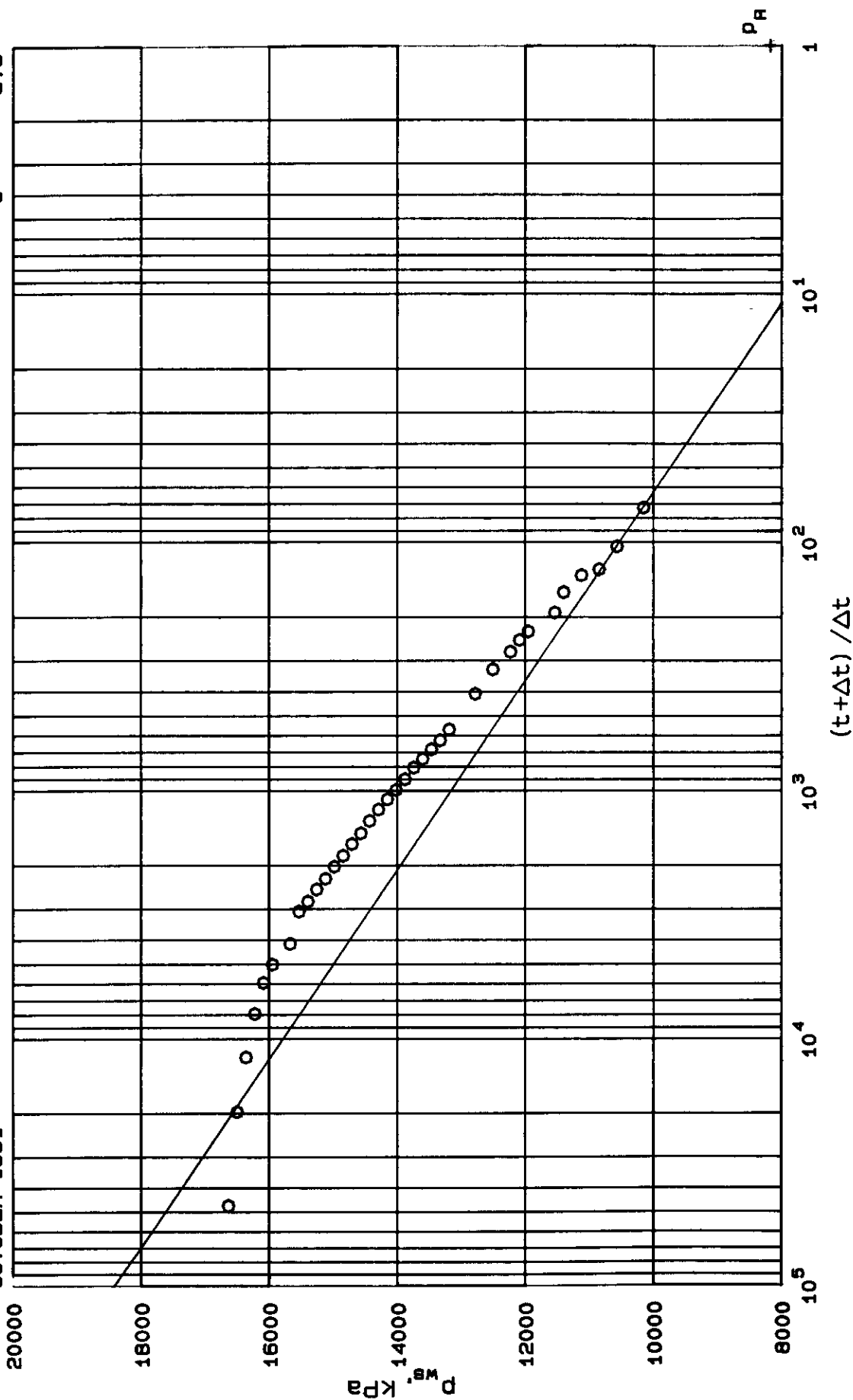
## STABILIZED RATE PREDICTIONS

Time to Stabilization	ts	=	2870 hr
Stabilized Rate	qs	=	14.2 m <sup>3</sup> /d
Productivity Index	PI	=	0.00162440 m <sup>3</sup> /d/kPa

# HORIZONTAL MEASURED FALLOFF PLOT

OMEGA WASKADA  
7-25-1-26 WPM  
LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

$m = 2626 \text{ kPa}$   
 $p_R = 8178 \text{ kPa}$   
 $[kh/\mu]_t = 11.49 \text{ mD.m/MPa.s}$   
 $s = -3.8$



## GENERAL WELL INFORMATION

13-31-1-25 WPM  
Test Date: 91/10/08

GL: 467.6 m  
KB: 472.1 m  
MPP: 910.5 mKB  
Datum: 912.1 mKB  
Hydrostatic Head: 9,459 kpa (Assuming a gradient of 10.44 kpa/m)  
Last Shut-in Date: Static Gradient 01/28/91  
Actual Inj. (Hrs): 1,655  
Actual Inj. (m<sup>3</sup>): 1,247.9  
Avg. Rate (m<sup>3</sup>/d): 18.1

0 = 15.2%  
h = 7.4 m

P\* = 9,204 kPa  
Pws = 9,687 kPa  
PR = 10,170 kPa (over corrected)

\*Average reservoir pressure at MPP =  $0.5(9,687-9,204)+9,204 = 9,445\text{kpa}$  (9,356kPag)  
Average reservoir pressure at Datum = 9,461 kPa (9,372 kPag)

# WATER PRESSURE FALLOFF ANALYSIS - HORNER

OMEGA WASKADA  
13-31-1-25 WPM

LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

## SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	978 kPa
Transmissivity	[kh/ult	=	39.34 mD.m/mPa.s
	[kh/ulw	=	39.34 mD.m/mPa.s
Mobility	[k/ult	=	5.32 mD/mPa.s
	[k/ulw	=	5.32 mD/mPa.s
Flow Capacity	[kh]w	=	25.55 mD.m
Permeability	kw	=	3.45 mD
Skin Factor	s	=	-2.7
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	1.55
Damage Ratio	DR	=	0.65
Injectivity Index	PI	=	0.00430316 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	897 m

## AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	10170 kPa

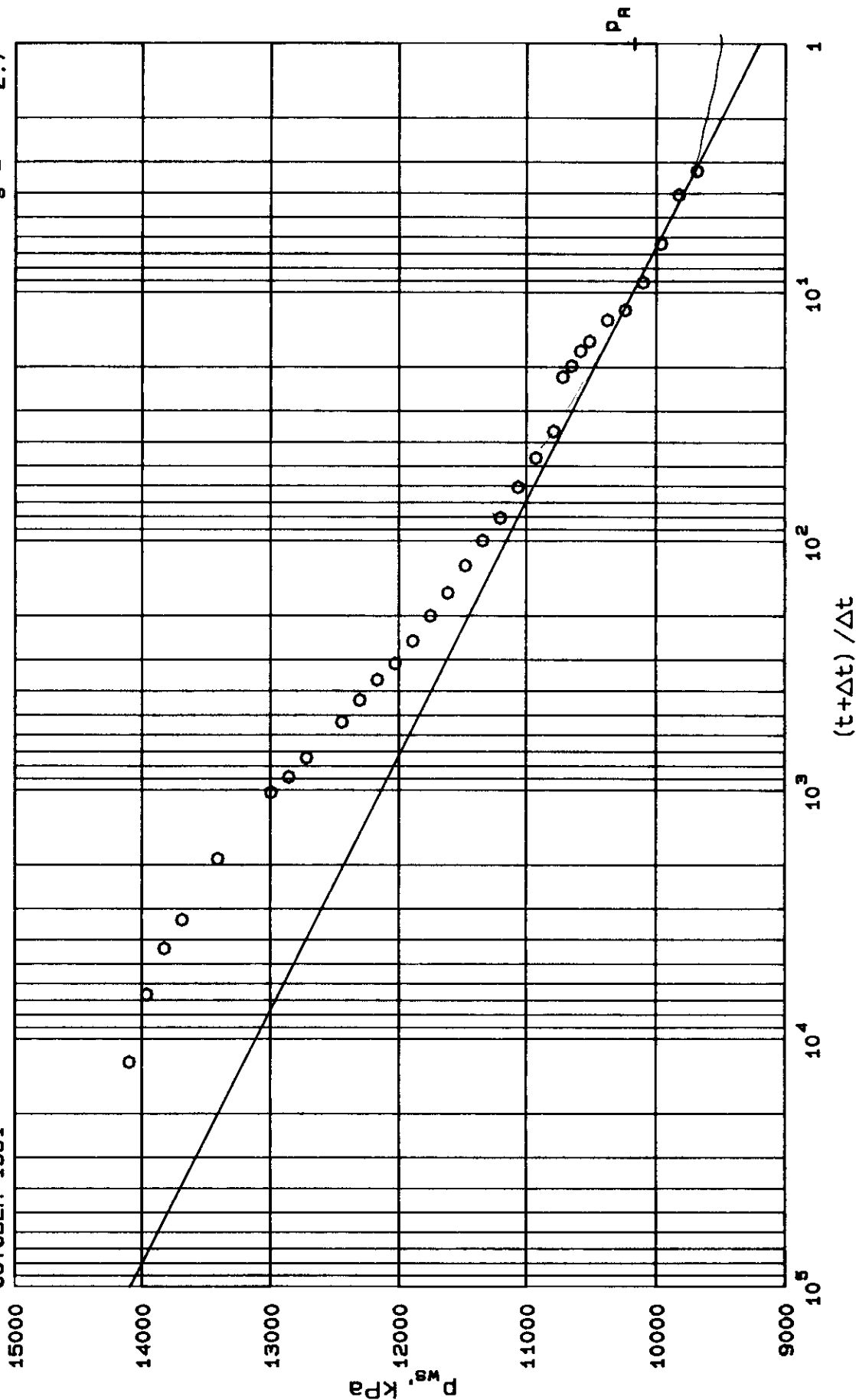
## STABILIZED RATE PREDICTIONS

Time to Stabilization	ts	=	526 hr
Stabilized Rate	qs	=	18.1 m <sup>3</sup> /d
Productivity Index	PI	=	0.00430106 m <sup>3</sup> /d/kPa

# HORNER PRESSURE FALLOFF PLOT

OMEGA WASKADA  
13-31-1-25 WPM  
LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

$m = 978 \text{ kPa}$   
 $p_R = 10170 \text{ kPa}$   
 $[kh/\mu]_t = 39.34 \text{ mD.m/mPa.s}$   
 $s = -2.7$



### GENERAL WELL INFORMATION

7-24-1-26 WPM  
Test Date: 91/08/27

GL: 466.1 mCF  
KB: 470.3 mKB  
MPP: 915 mKB  
Datum: 906.1 mcf  
Hydrostatic Head: 9,507 kpa (Assuming a gradient of 10.44 kpa/m)  
Last Shut-in Date: 90/07  
Actual Inj. (Hrs): 3,512  
Actual Inj. (m<sup>3</sup>): 5,578.4 m<sup>3</sup>  
Avg. Rate (m<sup>3</sup>/d): 38 m<sup>3</sup>/d

0 = 15.2%  
h = 10.8 m

P\* = 8,767 kPa  
Pws = 10,495 kPa  
PR = 11,154 kPa (over corrected)

Average reservoir pressure at MPP =  $0.5(10,495 - 8,767) + 8,767 = 9,631 \text{ kPa}$  (9,541 kPag)  
Average reservoir pressure at Datum = 9,538 kPa (9,448 kPag)

# WATER PRESSURE FALLOFF ANALYSIS - HORNER

OMEGA WASKADA  
7-1 1-26 WPM

LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

## SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	2083 kPa
Transmissivity	[kh/ult]	=	38.75 mD.m/mPa.s
	[kh/ulw]	=	38.75 mD.m/mPa.s
Mobility	[k/ult]	=	3.59 mD/mPa.s
	[k/ulw]	=	3.59 mD/mPa.s
Flow Capacity	[kh]w	=	25.17 mD.m
Permeability	kw	=	2.33 mD
Skin Factor	s	=	-5.5
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	3.51
Damage Ratio	DR	=	0.29
Injectivity Index	PI	=	0.00959299 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	1075 m

## AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	11154 kPa

## STABILIZED RATE PREDICTIONS

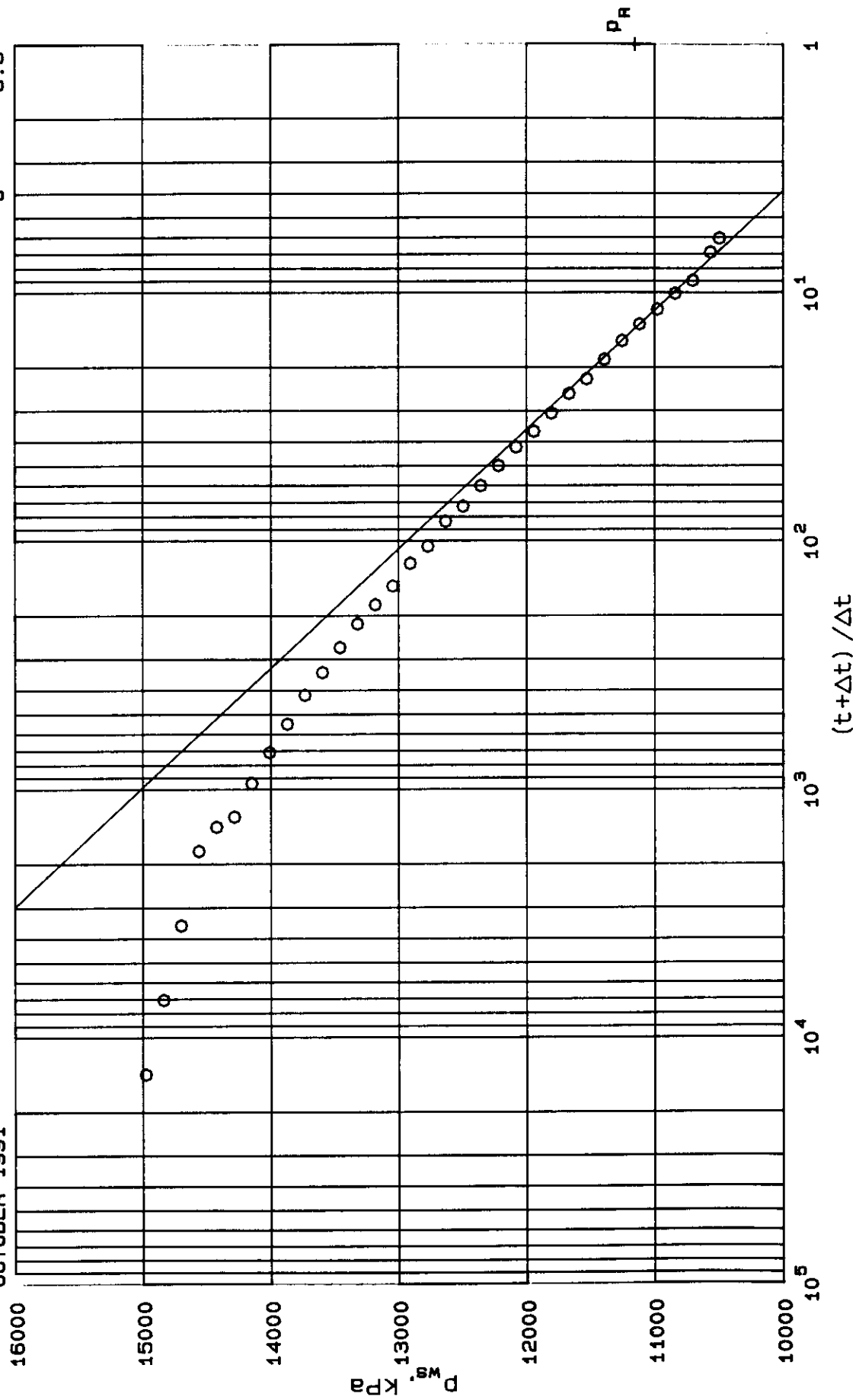
Time to Stabilization	ts	=	779 hr
Stabilized Rate	qs	=	38.0 m <sup>3</sup> /d
Productivity Index	PI	=	0.00958145 m <sup>3</sup> /d/kPa



11-10-1991, 11:00 AM, 11:00 AM, 11:00 AM

OMEGA WASKADA  
7-24-1-26 WPM  
LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

$m = 2083 \text{ KPa}$   
 $P_R = 11154 \text{ KPa}$   
 $38.75 \text{ mD.m/mPa.s}$   
 $s = -5.5$



## GENERAL WELL INFORMATION

15-20-1-25 WPM

Test Date:

GL: 470.2 m

KB: 473.7 m

MPP: 905.0 mKB

Datum: 913.7 mKB

Hydrostatic Head: 9,411.66 kpa (Assuming a gradient of 10.44 kpa/m)

Last Shut-in Date: 90/07

Actual Inj. (Hrs): 6,672

Actual Inj. (m<sup>3</sup>): 3,143

Avg. Rate (m<sup>3</sup>/d): 11.3

0 = 14.2%

h = 10.5 m

P\* = 9,700 kPa

Pws = 10,123 kPa

PR = 10,586 kPa

\*Average reservoir pressure at MPP =  $.5(10,123 - 9,700) + 9,700 = 9,911 \text{ kPa}$  (9,822 kPag)

Average reservoir pressure at Datum = 10,002 kPa (9,912 kPag)

# WATER PRESSURE FALLOFF ANALYSIS - HORNER

OMEGA WASKADA  
15-20-1-25 WPM

LOWER AMARANTH INJECTOR  
NOVEMBER 1991

## SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	603 kPa
Transmissivity	[kh/ult	=	39.82 mD.m/mPa.s
	[kh/ulw	=	39.82 mD.m/mPa.s
Mobility	[k/ult	=	3.79 mD/mPa.s
	[k/ulw	=	3.79 mD/mPa.s
Flow Capacity	[kh]w	=	25.86 mD.m
Permeability	kw	=	2.46 mD
Skin Factor	s	=	3.7
Pressure Drop Due to Skin		=	1930 kPa
Flow Efficiency	FE	=	0.68
Damage Ratio	DR	=	1.48
Injectivity Index	PI	=	0.00189950 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	1562 m

## AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	10586 kPa

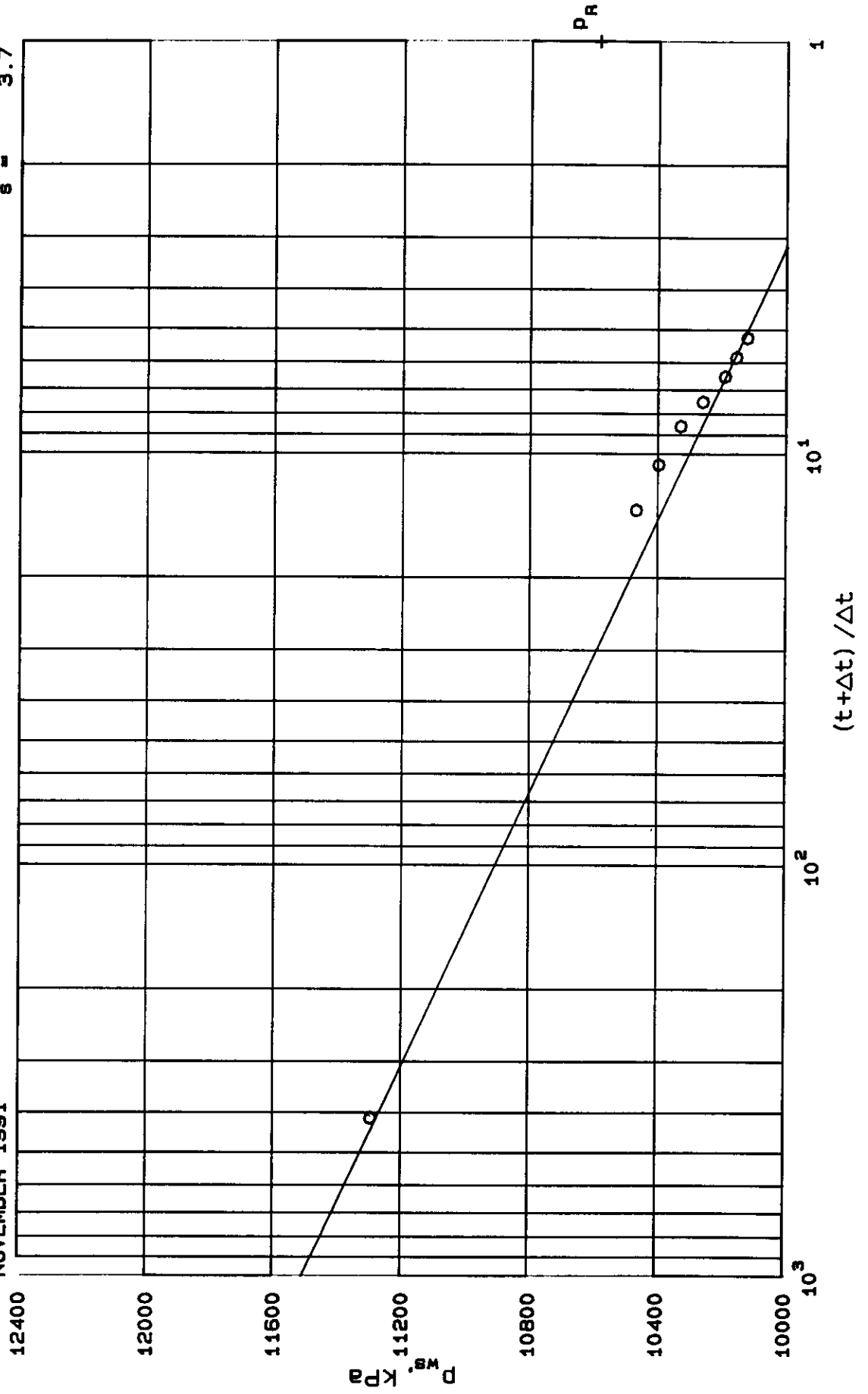
## STABILIZED RATE PREDICTIONS

Time to Stabilization	ts	=	700 hr
qs = 11.3 m <sup>3</sup> /d	PI	=	0.00189907 m <sup>3</sup> /d/kPa @ s = 3.7
qs = 16.7 m <sup>3</sup> /d	PI	=	0.00281059 m <sup>3</sup> /d/kPa @ s = 0.0
qs = 34.9 m <sup>3</sup> /d	PI	=	0.00586858 m <sup>3</sup> /d/kPa @ s = -4.0

# Pressure vs. Time Plot

OMEGA WASKADA  
15-20-1-25 WPM  
LOWER AMARANTH INJECTOR  
NOVEMBER 1991

$m = 603 \text{ kPa}$   
 $p_R = 10586 \text{ kPa}$   
 $[kh/\mu]_t = 39.82 \text{ mD.m/MPa.s}$   
 $s = 3.7$



### GENERAL WELL INFORMATION

13-30-1-25 WPM  
Test Date: 91/09/09

GL: 467.4 m  
KB: 471.9 m  
MPP: 912 mKB  
Datum: 911.9 mKB  
Hydrostatic Head: 9,474 kpa (Assuming a gradient of 10.44 kpa/m)  
Last Shut-in Date: 91/04  
Actual Inj. (Hrs): 1,187  
Actual Inj. (m<sup>3</sup>): 1,493.1  
Avg. Rate (m<sup>3</sup>/d): 30.2

0 = 14.7%  
h = 8.9 m

P\* = 9,612 kPa  
Pws = 11,357 kPa  
PR = 11,320 kPa

\*Average reservoir pressure at MPP = 11,320 kPa (11,230 kPag)  
Average reservoir pressure at Datum = 11,319 kPa (11,229 kPag)

# WATER PRESSURE FALLOFF ANALYSIS - HORNER

OMEGA WASKADA  
13-30-1-25 WPM

LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

## SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	6846 kPa
Transmissivity	[kh/ult	=	9.37 mD.m/mPa.s
	[kh/ulw	=	9.37 mD.m/mPa.s
Mobility	[k/ult	=	1.05 mD/mPa.s
	[k/ulw	=	1.05 mD/mPa.s
Flow Capacity	[kh]w	=	6.09 mD.m
Permeability	kw	=	0.68 mD
Skin Factor	s	=	-6.9
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	11.74
Damage Ratio	DR	=	0.09
Injectivity Index	PI	=	0.00788701 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	343 m

## AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	11320 kPa

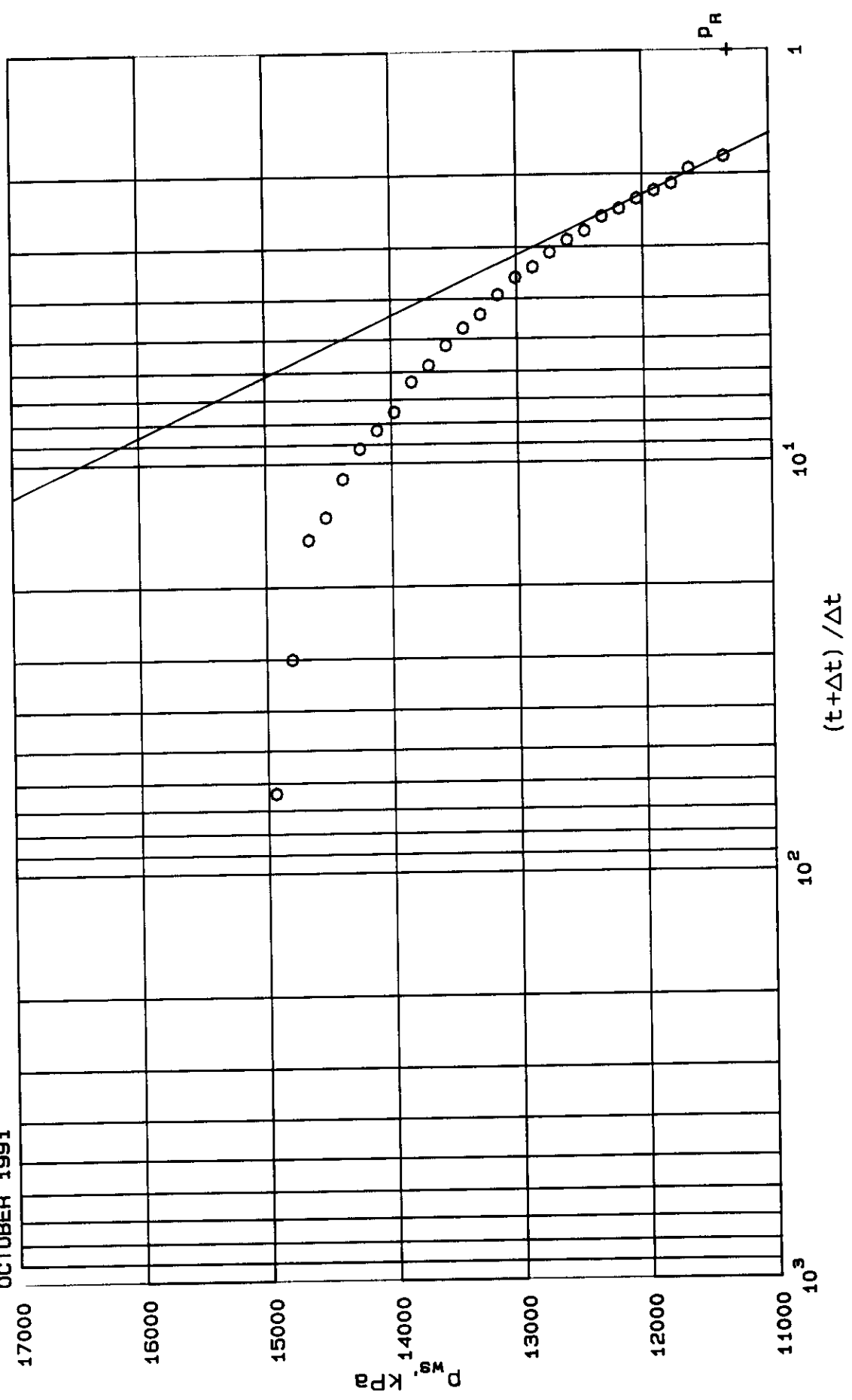
## STABILIZED RATE PREDICTIONS

Time to Stabilization	ts	=	2583 hr
Stabilized Rate	qs	=	25.6 m <sup>3</sup> /d
Productivity Index	PI	=	0.00669564 m <sup>3</sup> /d/kPa

# Pressure vs. Time Plot

OMEGA WASKADA  
13-30-1-25 WPM  
LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

$m = 6846 \text{ kPa}$   
 $P_R = 11320 \text{ kPa}$   
 $[kh/\omega]_t = 9.37 \text{ mD.m/mPa.s}$   
 $s = -6.9$



# GENERAL WELL INFORMATION

5-32-1-25 WPM

Test Date: 91/10/08

GL: 470.3 m

KB: 475.12 m

MPP: 900.25 mKB

Datum: 915.12 mKB

Hydrostatic Head: 9,348 kpa (Assuming a gradient of 10.44 kpa/m)

Last Shut-in Date: 91/02

Actual Inj. (Hrs): 2,256

Actual Inj. (m<sup>3</sup>): 240.4

Avg. Rate (m<sup>3</sup>/d): 2.56

0 = 15%

h = 7.0 m

P\* = 8,413 kPa

Pws = 10,610 kPa

PR = 8,759 kPa

\*Average reservoir pressure at MPP = 8,759 kPa (8,669 kPag)

Average reservoir pressure at Datum = 8,914 kPa (8,824 kPag)



# WATER PRESSURE FALLOFF ANALYSIS - HORNER

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OMEGA WASKADA  
5-32-1-25 WPM

LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

## SEMILOG STRAIGHT LINE RESULTS

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Slope	m	=	3678 kPa
Transmissivity	[kh/ult	=	1.48 mD.m/mPa.s
	[kh/ulw	=	1.48 mD.m/mPa.s
Mobility	[k/ult	=	0.21 mD/mPa.s
	[k/ulw	=	0.21 mD/mPa.s
Flow Capacity	[kh]w	=	0.96 mD.m
Permeability	kw	=	0.14 mD
Skin Factor	s	=	-4.6
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	2.76
Damage Ratio	DR	=	0.36
Injectivity Index	PI	=	0.00030471 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	210 m

## AVERAGE PRESSURE CALCULATION

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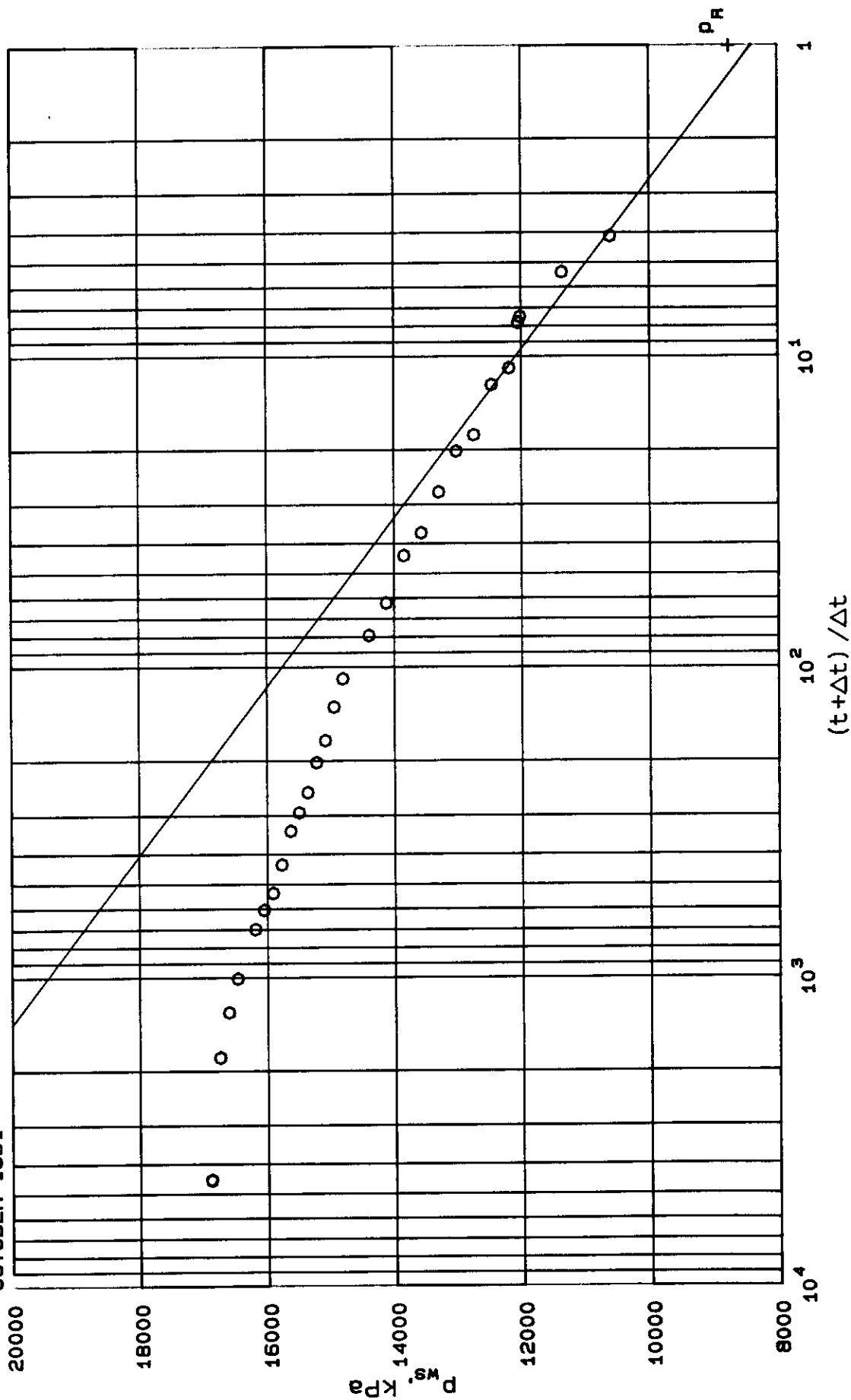
Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	8759 kPa

## STABILIZED RATE PREDICTIONS

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Time to Stabilization	ts	=	13092 hr
Stabilized Rate	qs	=	2.2 m <sup>3</sup> /d
Productivity Index	PI	=	0.00026220 m <sup>3</sup> /d/kPa

$m$	$=$	3678 kPa
$P^A$	$=$	8759 kPa
$[kh/\omega]_t$	$=$	1.48 MD.m/mPa.s
$s$	$=$	-4.6



## GENERAL WELL INFORMATION

7-13-1-26 WPM  
Test Date: 91/10/08

GL: 466.5 m  
KB: 470.7 m  
MPP: 918.5 mKB  
Datum: 910.7 mKB  
Hydrostatic Head: 9,545 kpa (Assuming a gradient of 10.44 kpa/m)  
Last Shut-in Date: Static Gradient 02/08/91  
Actual Inj. (Hrs): 3,768  
Actual Inj. (m<sup>3</sup>): 2,141.6  
Avg. Rate (m<sup>3</sup>/d): 13.64

O = 13.6%

h = 8.8 m

P\* = 9,598 kPa  
Pws = 10,049 kPa  
PR = 10,404 kPa (over corrected)

\*Average reservoir pressure at MPP =  $.5(10,049 - 9,598) + 9,598 = 9,824 \text{ kPa}$  (9,734 kPag)  
Average reservoir pressure at Datum = 9,734 kPa (9,644 kPag)

# WATER PRESSURE FALLOFF ANALYSIS - HORNER

OMEGA WASKADA  
7-13-1-26 WPM

LOWER AMARANTH INJECTOR  
OCTOBER 1991

## SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	567 kPa
Transmissivity	[kh/ult	=	51.08 mD.m/mPa.s
	[kh/ulw	=	51.08 mD.m/mPa.s
Mobility	[k/ult	=	5.80 mD/mPa.s
	[k/ulw	=	5.80 mD/mPa.s
Flow Capacity	[kh]w	=	33.17 mD.m
Permeability	kw	=	3.77 mD
Skin Factor	s	=	-2.2
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	1.41
Damage Ratio	DR	=	0.71
Injectivity Index	PI	=	0.00509125 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	1476 m

## AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	10404 kPa

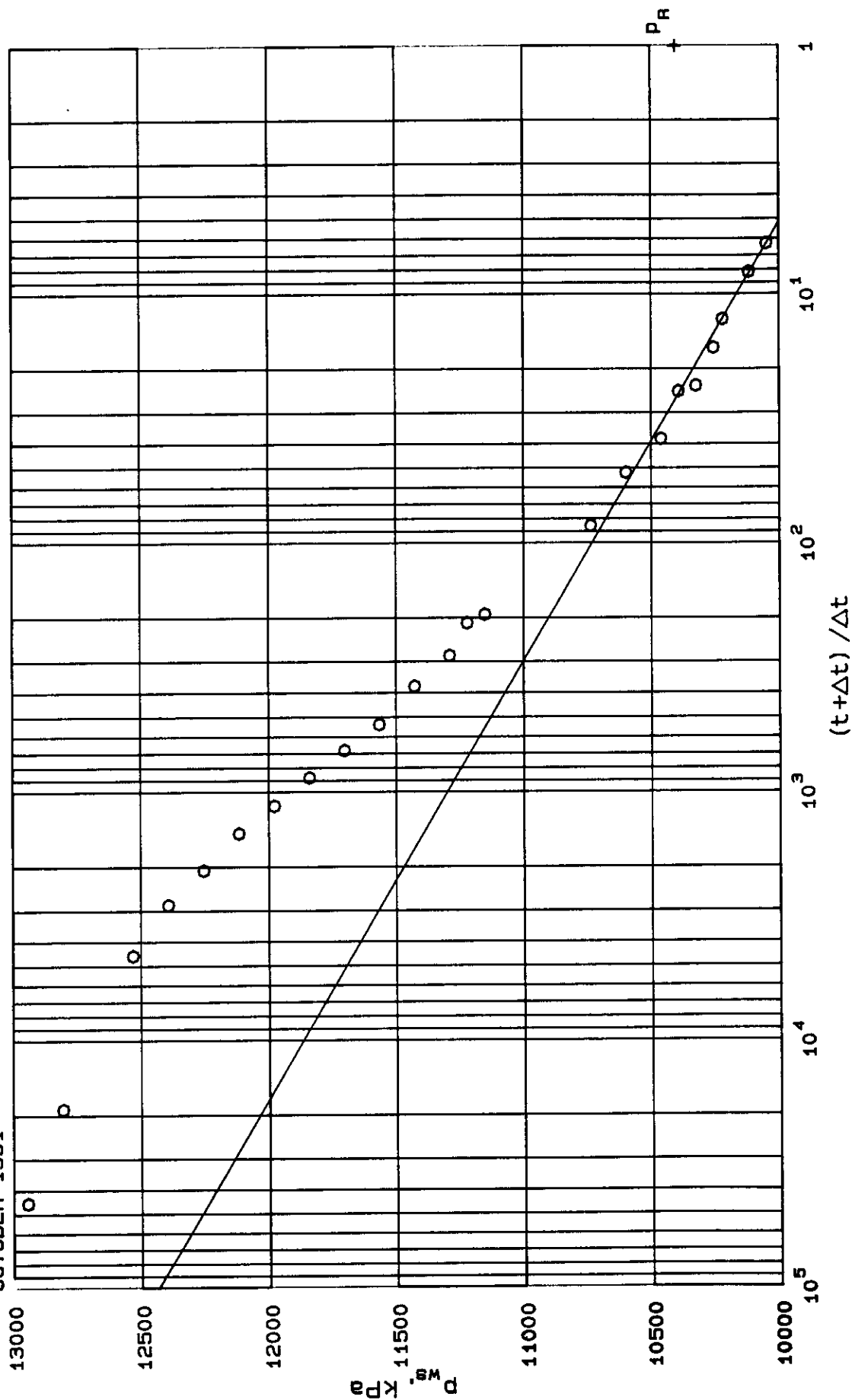
## STABILIZED RATE PREDICTIONS

Time to Stabilization	ts	=	443 hr
Stabilized Rate	qs	=	13.6 m <sup>3</sup> /d
Productivity Index	PI	=	0.00508892 m <sup>3</sup> /d/kPa

# Pressure Transient Test Data Plot

OMEGA WASKADA  
7-13-1-26 WPM  
LOWER AMARANTH INJECTOR  
OCTOBER 1991

$m = 567 \text{ kPa}$   
 $p_R = 10404 \text{ kPa}$   
 $[kh/\mu]_t = 51.08 \text{ mD.m/mPa.s}$   
 $s = -2.2$



# GENERAL WELL INFORMATION

13-32-1-25 WPM  
Test Date: 91/08/27

GL: 470.85 m  
KB: 475.05 m  
MPP: 900.00 mKB  
Datum: 915.05 mKB  
Hydrostatic Head: 9,353 kpa (Assuming a gradient of 10.44 kpa/m)  
Last Shut-in Date: 91/09/19  
Actual Inj. (Hrs): 7,512  
Actual Inj. (m<sup>3</sup>): 1,677.6  
Avg. Rate (m<sup>3</sup>/d): 5.36

o = 15.4%  
h = 10.10 m

P\* = 6,995 kPa  
Pws = 9,719 kPa  
PR = 8,409 kPa

\*Average reservoir pressure at MPP = 8,409 kPa (8,319 kPag)  
Average reservoir pressure at Datum = 8,566 kPa (8,476 kPag)

# WATER PRESSURE FALLOFF ANALYSIS - HORNER

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OMEGA WASKADA  
13-32-1-26 WPM

LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

## SEMILOG STRAIGHT LINE RESULTS

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Slope	m	=	2386 kPa
Transmissivity	[kh/u]t	=	4.77 mD.m/mPa.s
	[kh/u]w	=	4.77 mD.m/mPa.s
Mobility	[k/u]t	=	0.47 mD/mPa.s
	[k/u]w	=	0.47 mD/mPa.s
Flow Capacity	[kh]w	=	3.10 mD.m
Permeability	kw	=	0.31 mD
Skin Factor	s	=	-3.9
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	2.04
Damage Ratio	DR	=	0.49
Injectivity Index	PI	=	0.00068797 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	567 m

## AVERAGE PRESSURE CALCULATION

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Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	8409 kPa

## STABILIZED RATE PREDICTIONS

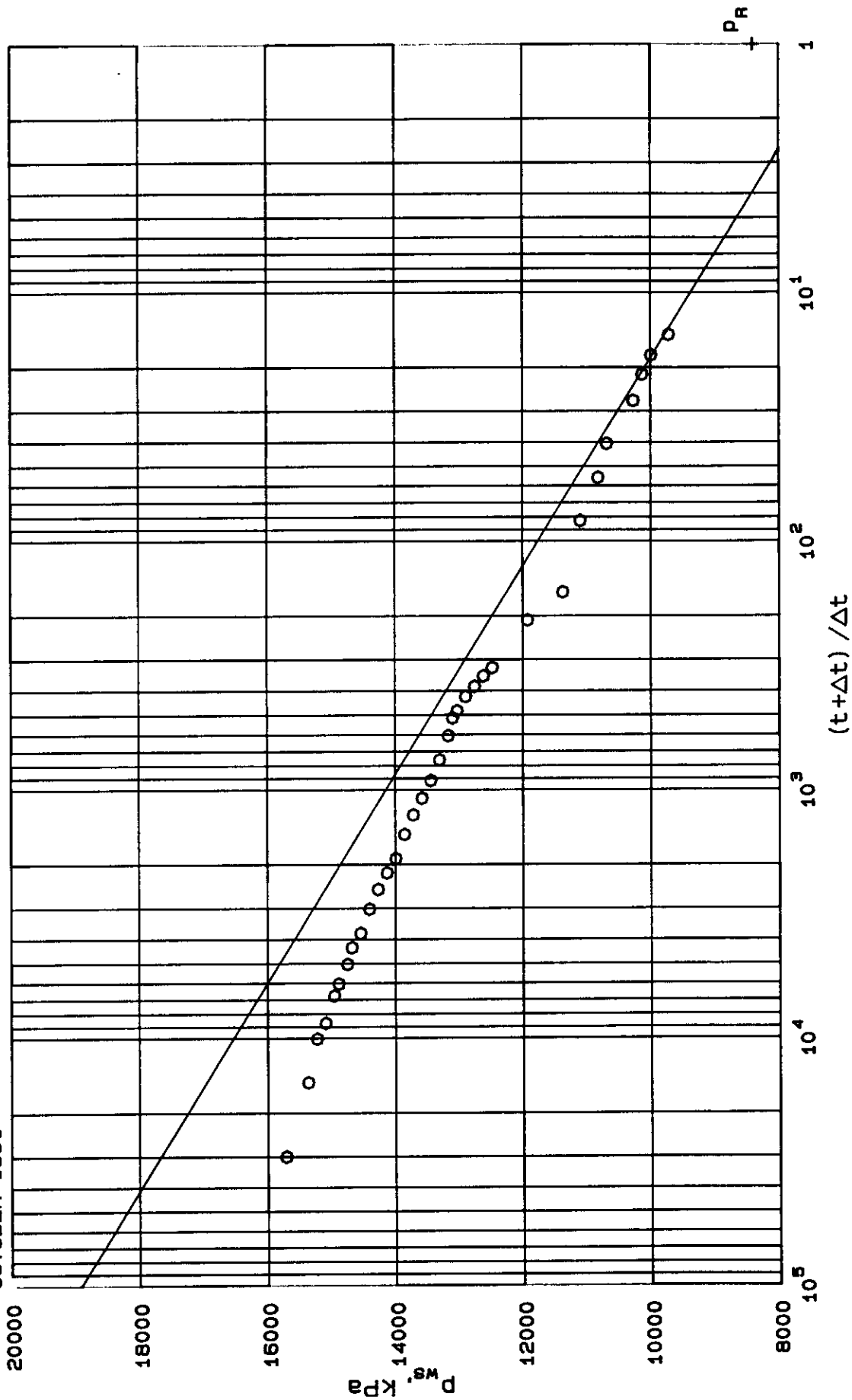
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Time to Stabilization	ts	=	5978 hr
Stabilized Rate	qs	=	5.3 m <sup>3</sup> /d
Productivity Index	PI	=	0.00068668 m <sup>3</sup> /d/kPa

Pressure vs. Time Plot

OMEGA WASKADA  
13-32-1-26 WPM  
LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

$m = 2386 \text{ kPa}$   
 $P_R = 8409 \text{ kPa}$   
 $[kh/\omega]_t = 4.77 \text{ mD.m/mPa.s}$   
 $s = -3.9$





## GENERAL WELL INFORMATION

7A-30-1-25 WPM  
Test Date: 91/08/27

GL: 468.4 m  
KB: 472.6 m  
MPP: 904.5 mKB  
Datum: 912.6 mKB  
Hydrostatic Head: 9,399 kpa (Assuming a gradient of 10.44 kpa/m)  
Last Shut-in Date: 90/09/21  
Actual Inj. (Hrs): 2,592  
Actual Inj. (m<sup>3</sup>): 2,307  
Avg. Rate (m<sup>3</sup>/d): 21.3

0 = 15.0%  
h = 8.0 m

P\* = 9,032 kPa  
Pws = 10,454 kPa  
PR = 11,031 kPa (over corrected)

Average reservoir pressure at MPP =  $0.5(10,454 - 9,032) + 9,032 = 9,743$  kpa  
Average reservoir pressure at Datum = 9,828 kPa (9,738 kPag)

# WATER PRESSURE FALLOFF ANALYSIS - HORNER

OM A WASKADA  
7-30-1-25 WPM

LOWER AMARANTH WATER INJECTOR  
OCTOBER 1991

## SEMILOG STRAIGHT LINE RESULTS

Slope	m	=	2385 kPa
Transmissivity	[kh/ult]	=	19.03 mD.m/mPa.s
	[kh/ulw]	=	19.03 mD.m/mPa.s
Mobility	[k/ult]	=	2.38 mD/mPa.s
	[k/ulw]	=	2.38 mD/mPa.s
Flow Capacity	[kh]w	=	12.36 mD.m
Permeability	kw	=	1.54 mD
Skin Factor	s	=	-5.0
Pressure Drop Due to Skin		=	--- kPa
Flow Efficiency	FE	=	2.82
Damage Ratio	DR	=	0.35
Injectivity Index	PI	=	0.00379457 m <sup>3</sup> /d/kPa
Radius of Inv.	rinv	=	755 m

## AVERAGE PRESSURE CALCULATION

Drainage Area	A	=	64 ha
Shape/Well Configuration		=	R1A
Average Reserv. Pressure	pR	=	11031 kPa

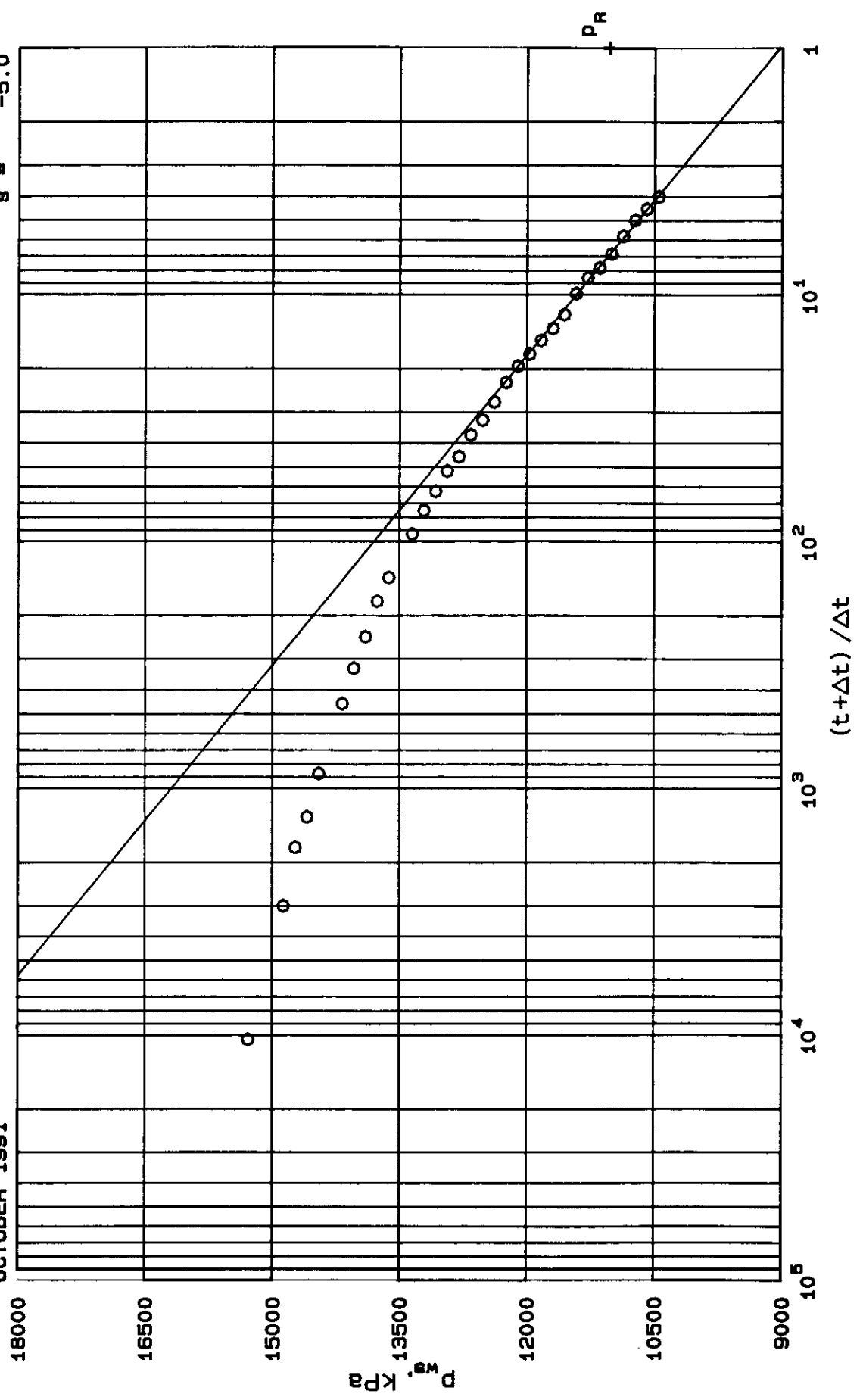
## STABILIZED RATE PREDICTIONS

Time to Stabilization	ts	=	1163 hr
Stabilized Rate	qs	=	21.3 m <sup>3</sup> /d
Productivity Index	PI	=	0.00379090 m <sup>3</sup> /d/kPa

# HORNER AND COILED FALL-OUT PLOT

OMEGA WASKADA  
 7-30-1-25 WPM  
 LOWER AMARANTH WATER INJECTOR  
 OCTOBER 1991

$m = 2385 \text{ kPa}$   
 $P_R = 11031 \text{ kPa}$   
 $[kh/\omega]_t = 19.03 \text{ mD.m/mPa.s}$   
 $s = -5.0$





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

March 18, 1991

**MANITOBA ENERGY & MINES**  
Petroleum Branch  
555 - 330 Graham Avenue  
Winnipeg, Manitoba  
R3C 4E3

**Attention:** Mr. L.R. Dubreuil  
Director

Dear Sir:

**Re: Waskada Lower Amaranth A Pool**  
**Expansion of Pressure Maintenance**

In response to your January 22, 1991 letter, Omega has reviewed the feasibility of expanding pressure maintenance operations in Sections 3, 9, 10, 11, 14, 15 and 16, all in Township 2, Range 25, WPM.

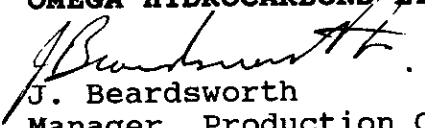
Omega is considering the expansion of Unit 8 to include company operated production in Sections 9 and 16. This expansion is subject to finalizing development plans for undrilled acreage in section 16 and to a satisfactory technical and economic appraisal of the project.

Omega's development of Sections 3, 11 and 14 is incomplete and, as such, expansion of pressure maintenance operations in these areas is not feasible at the present time. Enron is considering the unitization of sections 3, 10 and 15. The initial phase would involve only Enron wells, however, provisions would be made for possible future expansion to include Omega wells.

Please advise if you require further information on this matter.

Yours truly,

**OMEGA HYDROCARBONS LTD.**

  
J. Beardsworth  
Manager, Production Operations

JB:jlbb

c.c.: Waskada LAm Pressure Maintenance Monitoring File



John  
Review in 6 months?



Energy and Mines

Petroleum

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

(204) 945-6577  
FAX: (204) 945-0586

January 22, 1991

Mr. Dan Boyko  
Omega Hydrocarbons Ltd.  
1300, 112 — 4th Avenue S.W.  
Calgary, Alberta  
T2P 0H3

Dear Sir:

Re: Waskada Lower Amaranth A Pool  
Expansion of Pressure Maintenance Operations

Drilling in the Waskada Field over the past 2-3 years has resulted in a significant expansion of the Waskada Lower Amaranth A Pool to the north and east. A total of 41 producing wells operated by Omega and Enron now surround Waskada Unit No. 16. Cumulative oil production from these wells had reached a total of  $80.7 \times 10^3 \text{ m}^3$  by October 31, 1990, approximately 5% of the total production from the pool.

The Petroleum Branch requests that Omega review, either separately or jointly with Enron, the feasibility of expanding pressure maintenance operations in Sections 3,9,10,11,14,15 & 16 in Township 2-25 (WPM). We request that Omega report on the results of this feasibility study prior to March 31, 1991.

If you have any questions please contact the undersigned at (204) 945-6573 or John N. Fox, Chief Petroleum Engineer at (204) 945-6574.

Yours truly,

A handwritten signature in dark ink, appearing to read "L.R. Dubreuil". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

L.R. Dubreuil  
Director

LRD:cvs

cc: Mr. H. Dale Logie  
Enron Oil Canada Ltd.



January 22, 1991

Mr. H. Dale Logie, P. Eng.  
Chief Reservoir Engineer  
Enron Oil Canada Ltd.  
1300, 700 — 9th Avenue S.W.  
Calgary, Alberta  
T2P 3V4

Dear Sir:

Re: Waskada Lower Amaranth A Pool  
Expansion of Pressure Maintenance Operations

Drilling in the Waskada Field over the past 2-3 years has resulted in a significant expansion of the Waskada Lower Amaranth A Pool to the north and east. A total of 41 producing wells operated by Enron and Omega now surround Waskada Unit No. 16. Cumulative oil production from these wells had reached a total of  $80.7 \times 10^3 \text{ m}^3$  by October 31, 1990, approximately 5% of the total production from the pool.

The Petroleum Branch requests that Enron review, either separately or jointly with Omega, the feasibility of expanding pressure maintenance operations in Sections 3,9,10,11,14,15 & 16 in Township 2-25 (WPM). We request that Enron report on the results of this feasibility study prior to March 31, 1991.

If you have any questions please contact the undersigned at (204) 945-6573 or John N. Fox, Chief Petroleum Engineer at (204) 945-6574.

Yours truly,

A handwritten signature in cursive script, appearing to read "L.R. Dubreuil". The signature is written in dark ink and is positioned above the typed name and title.

L.R. Dubreuil  
Director

LRD:cvs

cc: Mr. Dan Boyko  
Omega Hydrocarbons Ltd.

## WASKADA UNIT NO. 16 EXPANSION

- contact ENRON / OMEGA re:  
expansion of waterflood  
to NE portion of the  
field

