

PennWest

Waskada Unit No.4

Waterflood Progress Report

January 1st – December 31st, 2014

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INTRODUCTION:

The Waskada Unit No.4 pressure maintenance project commenced water injection into the Lower Amaranth designed and in accordance with Manitoba Energy and Mines Approval No. PM 58.

Please refer to Attachment 1 – Area Map.

PRESSURE MAINTENANCE: Governed by Board Order No. PM 58

UNIT INFORMATION

UNITIZED ZONE: Lower Amaranth
Original Unit, January 1, 1984 Board Order – Voluntary

POOL: Waskada Lower Amaranth A (03 29A)

This report documents the performance of the Waskada Unit No. 4 pressure maintenance project for the period of January 1 to December 31, 2014. The Unit had 8 active producers and no active injectors at the end of 2014. There were no new drills in 2014.

Please refer to Attachment 1A – Area Map of Unit

Unit No. 4 is part of the main Waskada field. The Waskada field is situated on the northeast rim of the Williston Basin in southern Manitoba. It comprises a large portion of Township 1 and 2, Ranges 25 and 26 W1

GEOLOGY

The Waskada Fields produce light density crude (approximately 36° API), predominantly from the Lower Amaranth formation. This is an interlaminated, shallow marine to subtidal succession of sandstones, siltstones, and shale progressively onlaps the Mississippian unconformity surface from basin center, up dip to the north and eastern basin limits in Saskatchewan and Manitoba. The fine grained reservoir rock has a complex reservoir characterization with 13 to 16 % porosity and permeability on the order of 0.5 to 15 md. The Lower Amaranth, the oldest Mesozoic unit, is a clastic red bed sequence lying directly on the Paleozoic erosional surface. It consists of a series of dolomitic siltstones and sandstones interbedded with argillaceous siltstones and shales. The section is usually subdivided into a lower sandy unit and an overlying shale unit. The lower sequence is the oil production zone. The bulk of pay is found in the laminated sandstone/siltstone facies.

The Lower Amaranth has been classified into four general lithological types:

1. Interbedded shale/siltstone/sandstone by grain size, color and texture
2. Siltstone – This lithology occurs in distinct intervals up to two or three metres in thickness. It is generally light green in color and dolomitic.
3. Laminated sandstone – This occurs in distinct sandy intervals with a wide range of grain sizes and primary sedimentary structures.
4. Massive sandstone – This lithology occurs in thin intervals and usually associated with the laminated sandstones facies. Beds are usually light grey to reddish grey in color and coarse to medium – grained.

DISCUSSION

Production and Injection Performance

Board Order No. PM 58 provided for pressure maintenance operations in Waskada Unit No.4. From the startup of injection in June 1984, injection rates fluctuated to the same degree in each injector, making it difficult to link any production responses to any injector. The Unit includes 9 injection wells; at the end of 2014 none are currently active. Injection ceased essentially in 2011; there was 1 month's injection into 05-13 in June. There are currently 8 active producers.

Please refer to Attachment 2 – A Summary of the Unit Well List and History with New Drills

Please refer to Attachment 3 – A Production and Injection plot of the Unit.

Please refer to Attachment 4 – A Summary of Unit Annual Volumes and Rates.

Please refer to Attachment 5 – A Cumulative Production and Injection plot of the Unit.

Voidage Replacement Ratio Calculation:

The Cumulative VRR from production start is at 1.3; the Cumulative VRR from injection start is at 1.7. Both have been decreasing slightly in the last 3 years due to essentially no injection from 2011 onwards and the startup of new producers. Currently there are no active injectors in this Unit and PennWest has no plans to reactivate at this time any of the old injectors.

Please refer to Attachment 6 – A Unit Voidage Replacement Ratio Plot.

Please refer to Attachment 7 – Individual Injection Well Performance Plots (9).

Pressure Surveys:

There were no pressure surveys conducted in 2014.

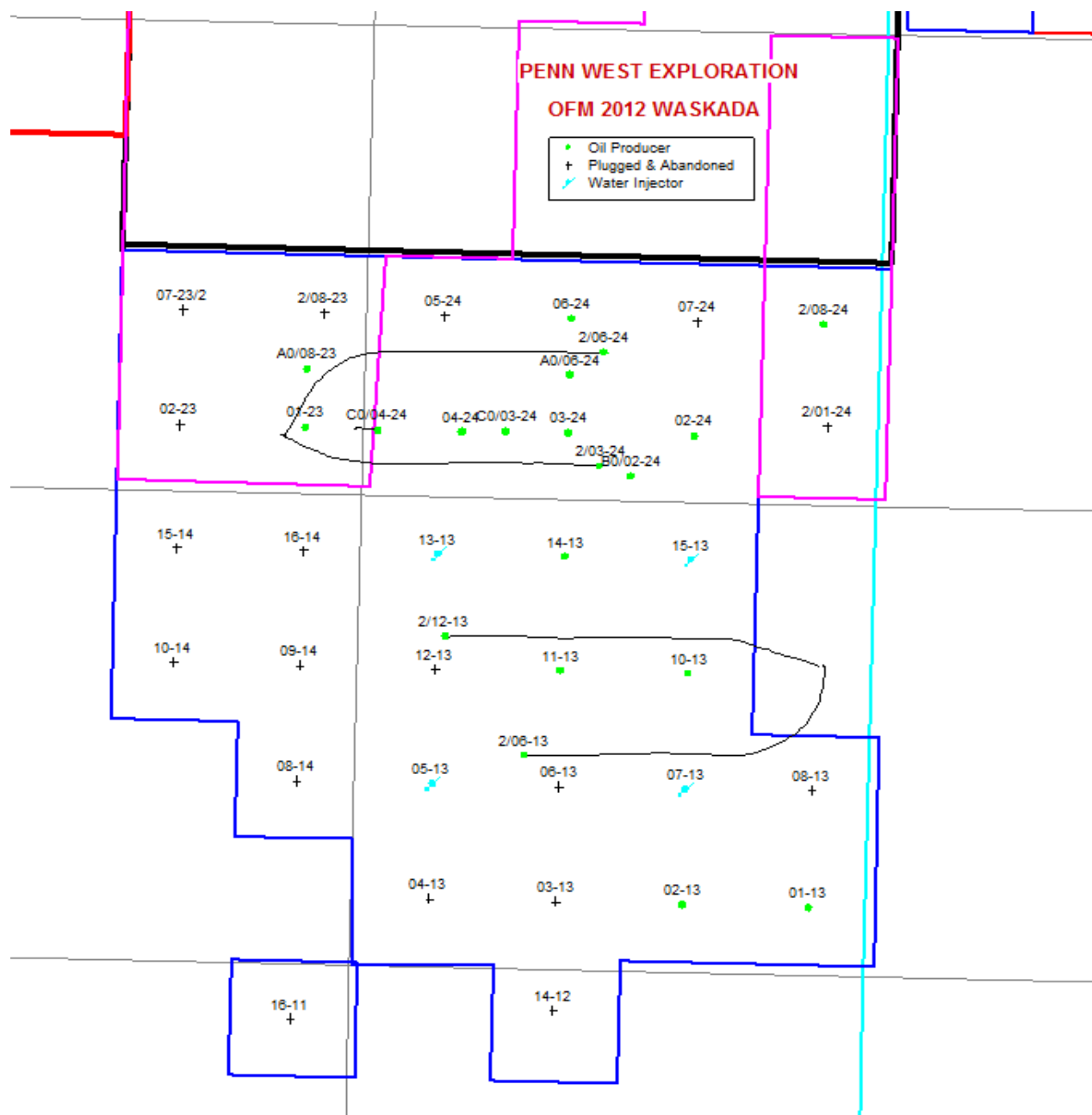
Corrosion and Scale Prevention Program:

Scale corrosion programs are implemented throughout the field. Wells and pipelines have mitigation measures in place.

SUMMARY AND RECOMMENDATIONS

The behavior of Waskada Unit 4 producers are indicated by good initial oil productivity, rapidly declining to low rates, with almost no discernible water flood response. It is also believed that fracture stimulation treatments, performed on these wells prior to initiation of water injection, “broke through” into the higher productivity Mississippian and that the majority of injected water to date has entered this zone. This is one of the major explanations for lack of waterflood response to date and the continued decline in oil productivities.

ATTACHMENT 1 – UNIT AREA MAP



ATTACHMENT 2- UNIT HISTORY

Unit History: Waskada - Unit# 4

<i>UWI</i>	<i>Completion Date</i>	<i>Operator</i>	<i>Status</i>	<i>New Drills</i>	<i>Kb Elevation m</i>	<i>Total Depth m</i>	<i>First prd Date</i>	<i>Cum Oil Prd m3</i>	<i>Cum Water Prd m3</i>	<i>Last Prd Date</i>	<i>First Inj Date</i>	<i>Cum Water Inj m3</i>	<i>Cum Gas Inj scm</i>	<i>Last Inj Date</i>
00/01-13-001-26W1/0	12/15/1981	PENN_WEST	OIL	<N/A>	470.40	947.00	3/1/1982	12999.90	11789.90	5/1/2012		0.00	0.00	
00/01-23-001-26W1/0	7/2/1982	PENN_WEST	OIL	<N/A>	470.50	953.00	8/1/1982	15453.10	11896.80	9/1/2013		0.00	0.00	
00/02-13-001-26W1/0	9/12/1982	PENN_WEST	OIL	<N/A>	470.20	953.00	10/1/1982	11941.80	1612.90	1/1/2012		0.00	0.00	
00/02-23-001-26W1/0	10/26/1982	PENN_WEST	ABD-OIL	<N/A>	468.30	953.00	12/1/1982	2263.10	34835.60	3/1/1990		0.00	0.00	
00/02-24-001-26W1/0	7/3/1982	PENN_WEST	OIL	<N/A>	468.90	953.00	12/1/1982	15971.30	14768.20	5/1/2012		0.00	0.00	
00/03-13-001-26W1/0	8/16/1982	PENN_WEST	ABD-OIL	<N/A>	468.20	949.00	10/1/1982	2982.40	1141.60	1/1/1997		0.00	0.00	
00/03-24-001-26W1/0	6/23/1983	PENN_WEST	OIL	<N/A>	471.30	952.10	7/1/1983	19680.80	63120.50	1/1/2015		0.00	0.00	
00/04-13-001-26W1/0	7/27/1982	PENN_WEST	ABD-OIL	<N/A>	469.50	955.00	9/1/1982	1842.40	1023.30	3/1/1990		0.00	0.00	
00/04-24-001-26W1/0	6/27/1983	PENN_WEST	OIL	<N/A>	473.20	950.00	7/1/1983	30156.60	79430.30	1/1/2015		0.00	0.00	
00/05-13-001-26W1/0	7/23/1982	PENN_WEST	WTR-INJ	<N/A>	470.00	953.50	9/1/1982	791.70	414.70	5/1/1984	6/1/1984	46874.50	829900.00	6/1/2013
00/05-24-001-26W1/0	6/19/1983	PENN_WEST	ABD-WINJ	<N/A>	469.30	957.00	7/1/1983	2593.30	2027.40	5/1/1984	6/1/1984	106355.80	852000.00	4/1/1993
00/06-13-001-26W1/0	6/18/1982	PENN_WEST	ABD-OIL	<N/A>	470.00	953.00	7/1/1982	6436.50	33350.30	4/1/1990		0.00	0.00	
00/06-24-001-26W1/0	7/2/1983	PENN_WEST	OIL	<N/A>	472.00	948.00	7/1/1983	12553.60	2598.00	3/1/2013		0.00	0.00	
00/07-13-001-26W1/0	8/8/1982	PENN_WEST	WTR-INJ	<N/A>	470.70	946.00	9/1/1982	2006.40	375.50	11/1/1985	12/1/1985	138303.80	0.00	2/1/2011
00/07-23-001-26W1/2	9/20/1982	PENN_WEST	ABD-OIL	<N/A>	470.90	950.00		0.00	0.00		8/1/1984	85398.60	365200.00	9/1/2001
00/07-24-001-26W1/0	9/28/1981	PENN_WEST	ABD-WINJ	<N/A>	470.30	961.00	11/1/1981	3040.10	290.40	5/1/1984	6/1/1984	146072.00	713700.00	6/1/2009
00/08-13-001-26W1/0	8/3/1982	PENN_WEST	ABD-OIL	<N/A>	470.90	952.00	11/1/1982	2455.60	460.90	9/1/1989		0.00	0.00	
00/08-14-001-26W1/0	6/15/1982	PENN_WEST	ABD-OIL	<N/A>	470.20	944.60	8/1/1982	7314.60	12918.10	6/1/2000		0.00	0.00	
00/09-14-001-26W1/0	8/20/1982	PENN_WEST	ABD-OIL	<N/A>	468.70	948.00	11/1/1982	3891.60	12525.80	12/1/1989		0.00	0.00	
00/10-13-001-26W1/0	6/26/1982	PENN_WEST	OIL	<N/A>	469.90	952.00	8/1/1982	11716.30	1857.00	1/1/2015		0.00	0.00	
00/10-14-001-26W1/0	9/10/1982	OMEGA_HYDROC	ABD-OIL	<N/A>	469.10	953.50	12/1/1982	635.60	10532.70	6/1/1986		0.00	0.00	
00/11-13-001-26W1/0	6/22/1982	PENN_WEST	OIL	<N/A>	468.40	954.00	11/1/1982	5211.90	3568.80	7/1/2011		0.00	0.00	
00/12-13-001-26W1/0	7/31/1982	PENN_WEST	ABD-OIL	<N/A>	469.80	953.00	9/1/1982	4216.90	2101.80	9/1/1997		0.00	0.00	
00/13-13-001-26W1/0	6/29/1982	PENN_WEST	WTR-INJ	<N/A>	472.00	953.00	7/1/1982	2753.90	1905.40	5/1/1984	6/1/1984	78381.80	2601200.00	10/1/2005
00/14-12-001-26W1/0	3/10/1982	PENN_WEST	ABD-OIL	<N/A>	469.80	935.00	7/1/1982	1009.70	913.00	7/1/1989		0.00	0.00	
00/14-13-001-26W1/0	11/27/1981	PENN_WEST	OIL	<N/A>	468.70	952.00	4/1/1982	11786.00	6699.30	11/1/2012		0.00	0.00	

00/15-13-001-26W1/0	7/14/1981	PENN_WEST	WTR- INJ	<N/A>	470.20	954.00	11/1/1981	3662.90	632.90	5/1/1984	6/1/1984	75819.10	1530600.00	10/1/2006
00/15-14-001-26W1/0	8/24/1982	PENN_WEST	ABD- WINJ	<N/A>	469.40	950.00	11/1/1982	612.40	4789.60	5/1/1984	6/1/1984	29143.70	525000.00	6/1/2000
00/16-11-001-26W1/0	7/15/1982	OMEGA_HYDROC	ABD- OIL	<N/A>	466.50	946.00	8/1/1982	474.40	3864.10	12/1/1985	12/1/1985	15531.00	0.00	4/1/1989
00/16-14-001-26W1/0	2/22/1982	PENN_WEST	ABD- OIL	<N/A>	467.00	942.00	4/1/1982	5246.40	1744.80	1/1/1991		0.00	0.00	
02/01-24-001-26W1/0	6/2/1983	PENN_WEST	ABD- OIL	<N/A>	469.50	955.50	6/1/1983	5262.50	3368.90	5/1/1996		0.00	0.00	
02/03-24-001-26W1/0	10/17/2011	PENN_WEST	OIL	<N/A>	470.40	1782.00	12/1/2011	3390.40	892.30	1/1/2015		0.00	0.00	
02/06-13-001-26W1/0	1/19/2013	PENN_WEST	OIL	2013	470.30	1855.00	3/1/2013	301.50	10812.40	4/1/2014		0.00	0.00	
02/06-24-001-26W1/0	10/24/2011	PENN_WEST	OIL	<N/A>	470.60	1890.00	12/1/2011	4239.60	1810.10	1/1/2015		0.00	0.00	
02/08-23-001-26W1/0	5/28/1983	PENN_WEST	ABD- OIL	<N/A>	470.40	950.00	6/1/1983	6276.50	27058.70	6/1/1996		0.00	0.00	
02/08-24-001-26W1/0	8/3/1983	PENN_WEST	PMP- OIL	<N/A>	472.60	930.00	8/1/1983	14104.30	10831.10	2/1/2012		0.00	0.00	
02/12-13-001-26W1/0	1/25/2013	PENN_WEST	OIL	2013	470.40	1990.00	3/1/2013	6055.30	6094.20	1/1/2015		0.00	0.00	
A0/06-24-001-26W1/0	4/4/1991	PENN_WEST	OIL	<N/A>	472.10	960.00	4/1/1991	2659.00	3284.10	3/1/2011		0.00	0.00	
A0/08-23-001-26W1/0	2/28/1991	PENN_WEST	OIL	<N/A>	468.00	963.00	3/1/1991	5515.80	1743.60	1/1/2015		0.00	0.00	
B0/02-24-001-26W1/0	11/1/1997	PENN_WEST	OIL	<N/A>	469.40	960.00	12/1/1997	4788.30	311.30	2/1/2012		0.00	0.00	
C0/03-24-001-26W1/0	4/8/1991	PENN_WEST	OIL	<N/A>	472.10	965.00	4/1/1991	2705.10	1603.40	1/1/2015		0.00	0.00	
C0/04-24-001-26W1/0	3/6/1991	PENN_WEST	OIL	<N/A>	469.90	970.00	3/1/1991	3586.30	5264.70	2/1/2012		0.00	0.00	

ATTACHMENT 3 – UNIT PRODUCTION AND INJECTION PLOT

PENN WEST

UNIT: WASKADA_UNIT_NO_4_-_PM_58

Last Prod/Inj Date: 201501

Cumulative Gas Inj : 7.42 MMscm

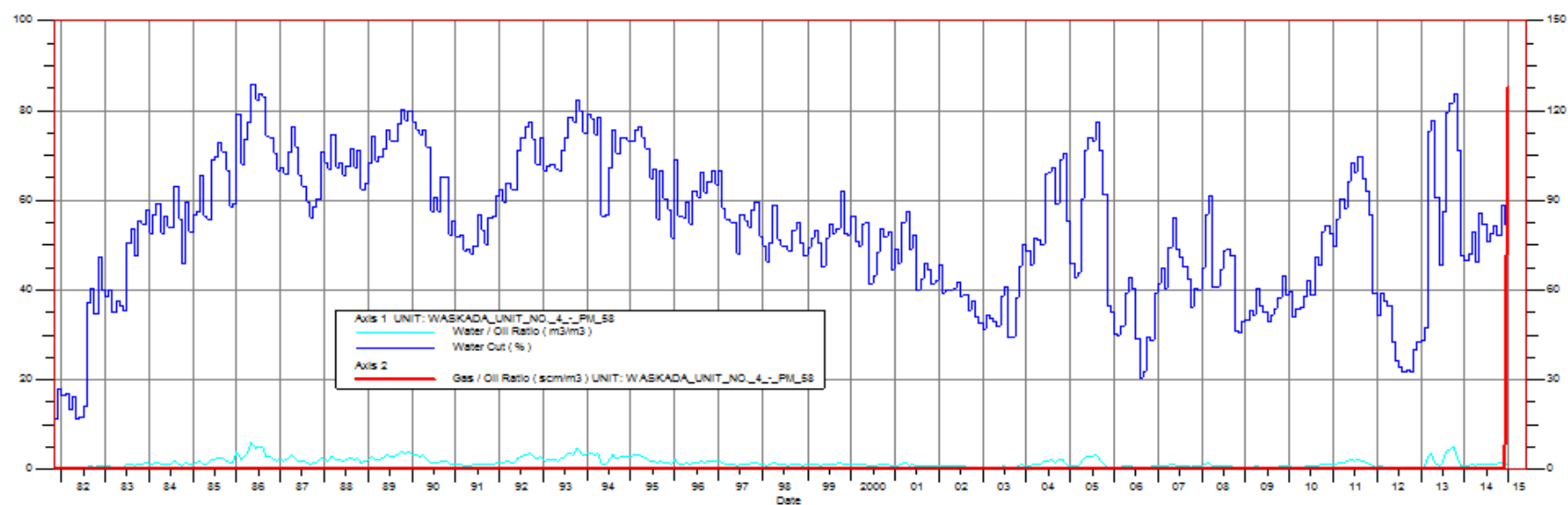
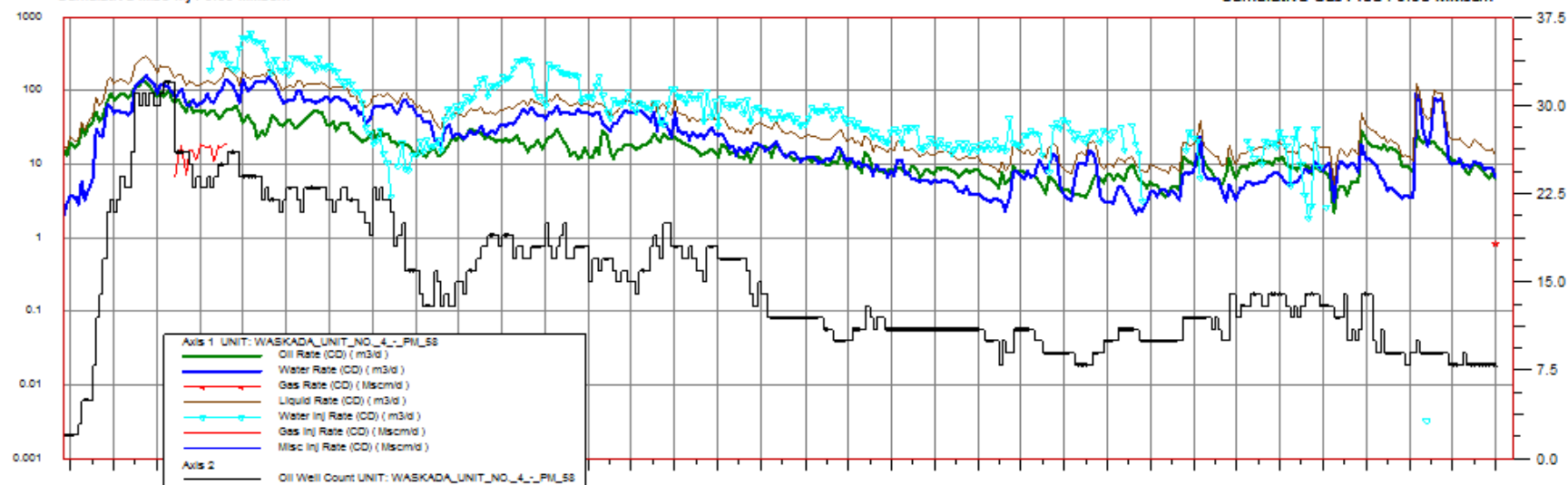
Cumulative Water Inj : 721.88 Mm3

Cumulative Misc Inj : 0.00 MMscm

Cumulative Water Prod : 396.26 Mm3

Cumulative Oil Prod : 260.59 Mm3

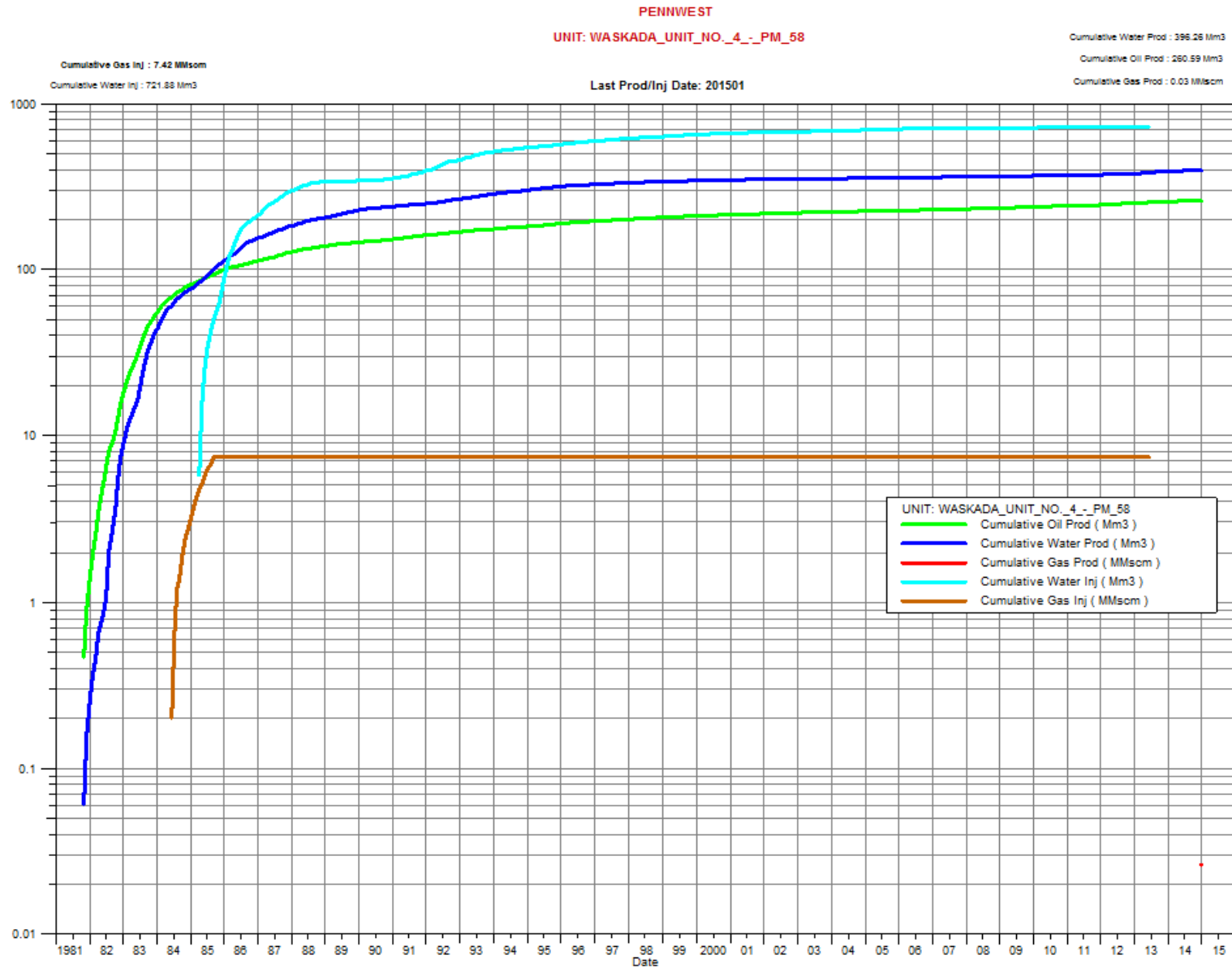
Cumulative Gas Prod : 0.03 MMscm



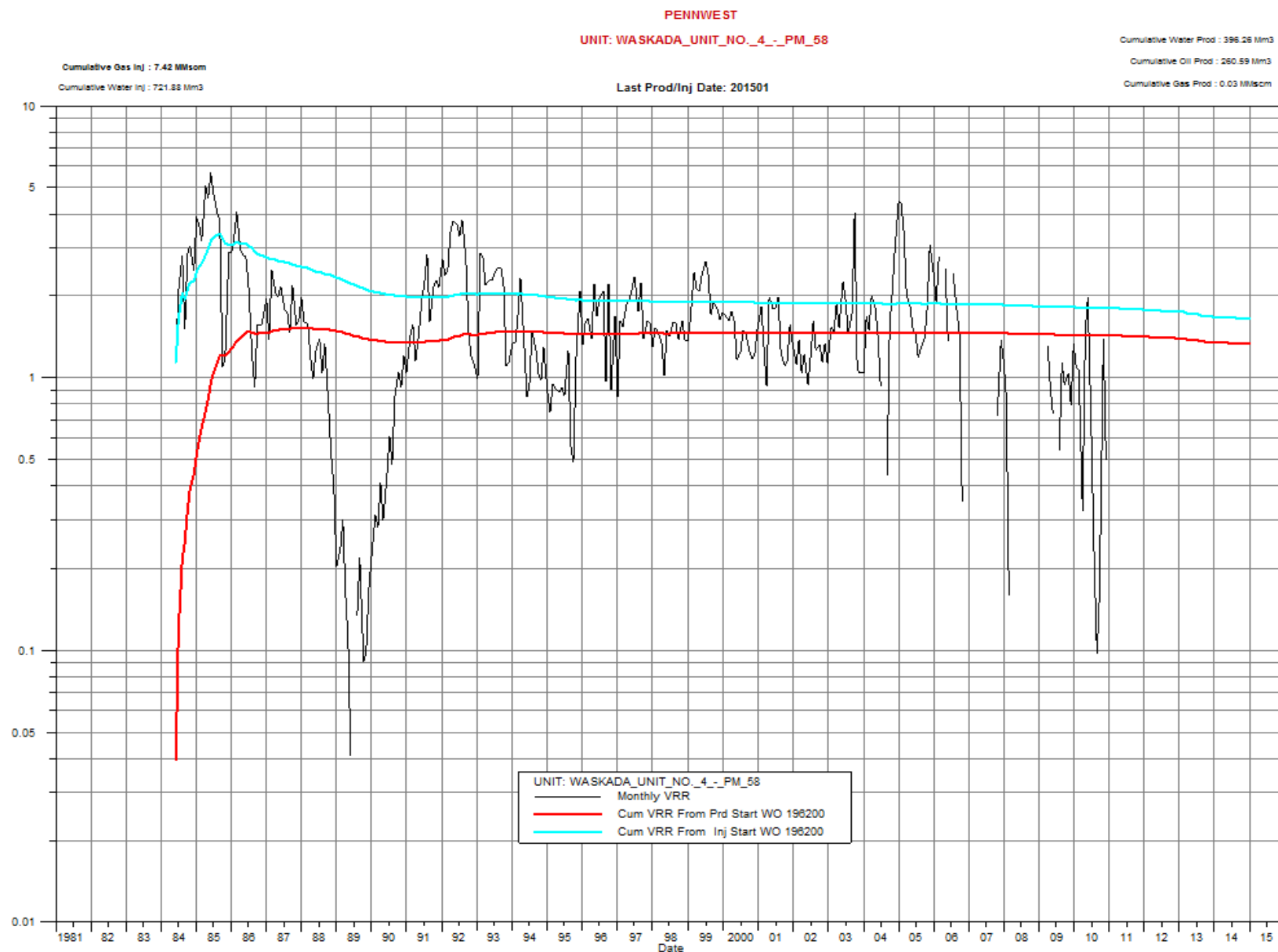
ATTACHMENT 4 –UNIT ANNUAL VOLUMES AND RATES

<i>Unit : Waskada - Unit # 4 -- PM58</i>								
<i>Rates and Volume History</i>								
<i>Date</i>	<i>Annual Oil Prd</i>	<i>Annual Oil Rate</i>	<i>Annual Water Prod</i>	<i>Annual Water Prod Rate</i>	<i>Annual Water Inj</i>	<i>Annual Water Inj Rate</i>	<i>Annual Gas Inj</i>	<i>Annual Gas Inj rate</i>
	<i>m3</i>	<i>m3/d</i>	<i>m3</i>	<i>m3/d</i>	<i>m3</i>	<i>m3/d</i>	<i>Mscm</i>	<i>Mscm/d</i>
1/1/1981	891.00	2.44	153.60	0.42	0	0	0	0
1/1/1982	14700.60	40.28	7215.40	19.77	0	0	0	0
1/1/1983	37396.70	102.46	34057.10	93.31	0	0	0	0
1/1/1984	26933.20	73.59	33399.90	91.26	0	0.00	2679.10	7.32
1/1/1985	19313.50	52.91	34523.40	94.58	73162	200.44	4738.50	12.98
1/1/1986	12944.70	35.46	43741.70	119.84	134971	369.78	0.00	0.00
1/1/1987	15258.20	41.80	28894.30	79.16	86108	235.91	0.00	0.00
1/1/1988	10750.90	29.37	23051.20	62.98	43873	119.87	0.00	0.00
1/1/1989	7953.80	21.79	22723.10	62.26	4701	12.88	0.00	0.00
1/1/1990	5811.50	15.92	11722.60	32.12	10613	29.08	0.00	0.00
1/1/1991	8955.70	24.54	10017.80	27.45	36491	99.97	0.00	0.00
1/1/1992	7311.20	19.98	16486.10	45.04	66196	180.86	0.00	0.00
1/1/1993	7059.50	19.34	18650.20	51.10	56746	155.47	0.00	0.00
1/1/1994	6296.30	17.25	15906.10	43.58	30651	83.98	0.00	0.00
1/1/1995	7690.50	21.07	15621.10	42.80	22900	62.74	0.00	0.00
1/1/1996	6364.20	17.39	10418.40	28.47	28328	77.40	0.00	0.00
1/1/1997	5288.30	14.49	6833.30	18.72	21899	60.00	0.00	0.00
1/1/1998	5366.20	14.70	5577.20	15.28	16369	44.85	0.00	0.00
1/1/1999	4174.40	11.44	4629.10	12.68	18559	50.85	0.00	0.00
1/1/2000	3483.70	9.52	3486.90	9.53	10759	29.40	0.00	0.00
1/1/2001	3015.60	8.26	2747.00	7.53	9240	25.32	0.00	0.00
1/1/2002	2980.70	8.17	1890.40	5.18	6490	17.78	0.00	0.00
1/1/2003	2536.40	6.95	1516.50	4.15	7229	19.81	0.00	0.00
1/1/2004	2268.90	6.20	3250.60	8.88	8263	22.58	0.00	0.00
1/1/2005	1788.60	4.90	2914.90	7.99	9895	27.11	0.00	0.00
1/1/2006	2587.90	7.09	1213.20	3.32	5897	16.16	0.00	0.00
1/1/2007	2394.60	6.56	1808.90	4.96	1296	3.55	0.00	0.00
1/1/2008	3356.60	9.17	2919.80	7.98	1513	4.13	0.00	0.00
1/1/2009	3672.10	10.06	2132.10	5.84	4100	11.23	0.00	0.00
1/1/2010	3504.60	9.60	2692.20	7.38	5562	15.24	0.00	0.00
1/1/2011	2765.20	7.58	3539.90	9.70	71	0.19	0.00	0.00
1/1/2012	5838.60	15.95	2473.80	6.76	0	0	0	0
1/1/2013	6394.40	17.52	16212.90	44.42	0	0	0	0
1/1/2014	3335.70	9.14	3633.90	9.96	0	0	0	0
Sum	260384.00		396054.60		721880			

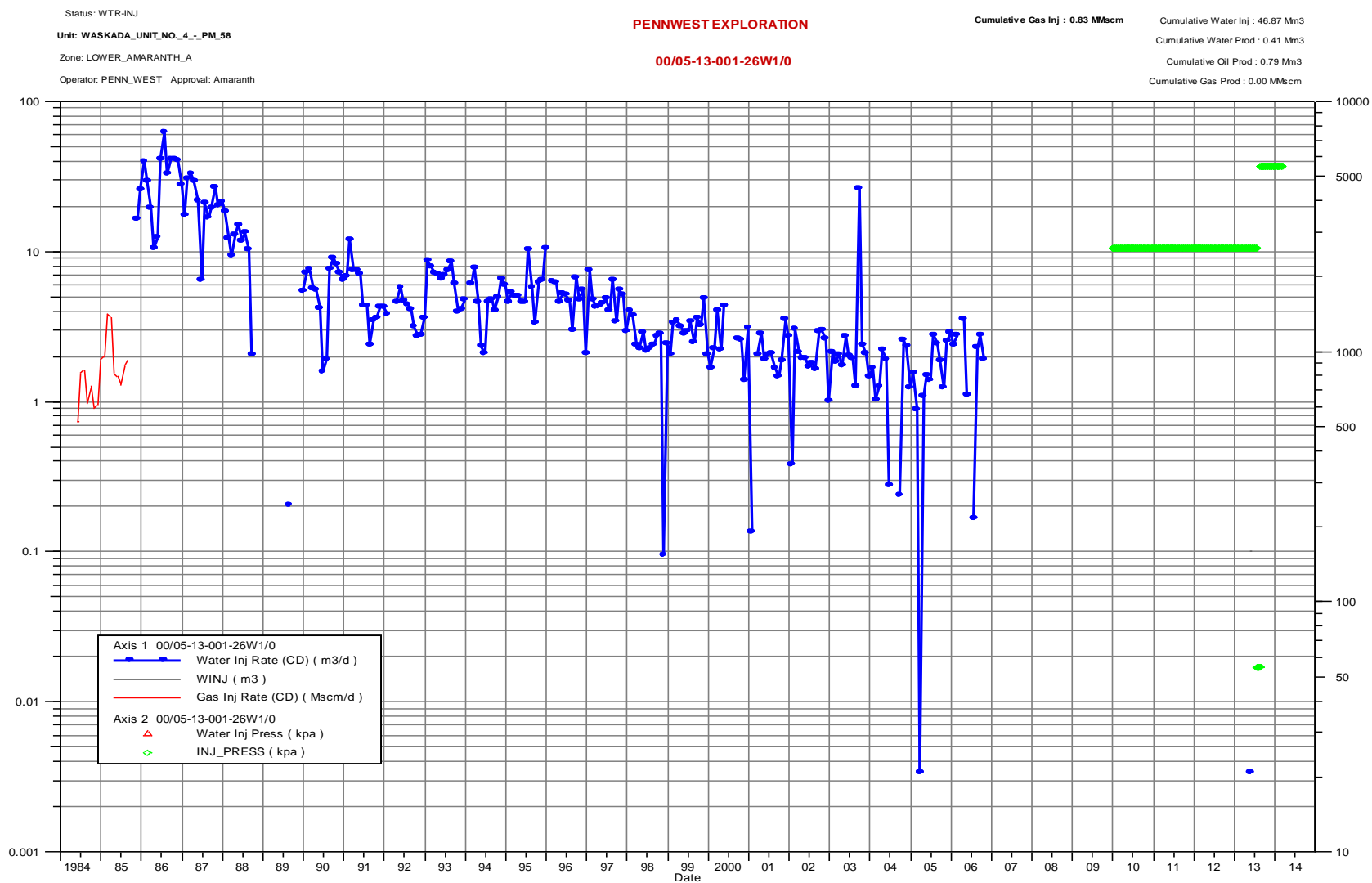
ATTACHMENT 5 – UNIT CUMULATIVE PRODUCTION AND INJECTION PLOT



ATTACHMENT 6 – UNIT VOIDAGE REPLACEMENT RATIO PLOT



ATTACHMENT 7 – INDIVIDUAL INJECTION WELL PERFORMANCE PLOTS (9 WELLS)

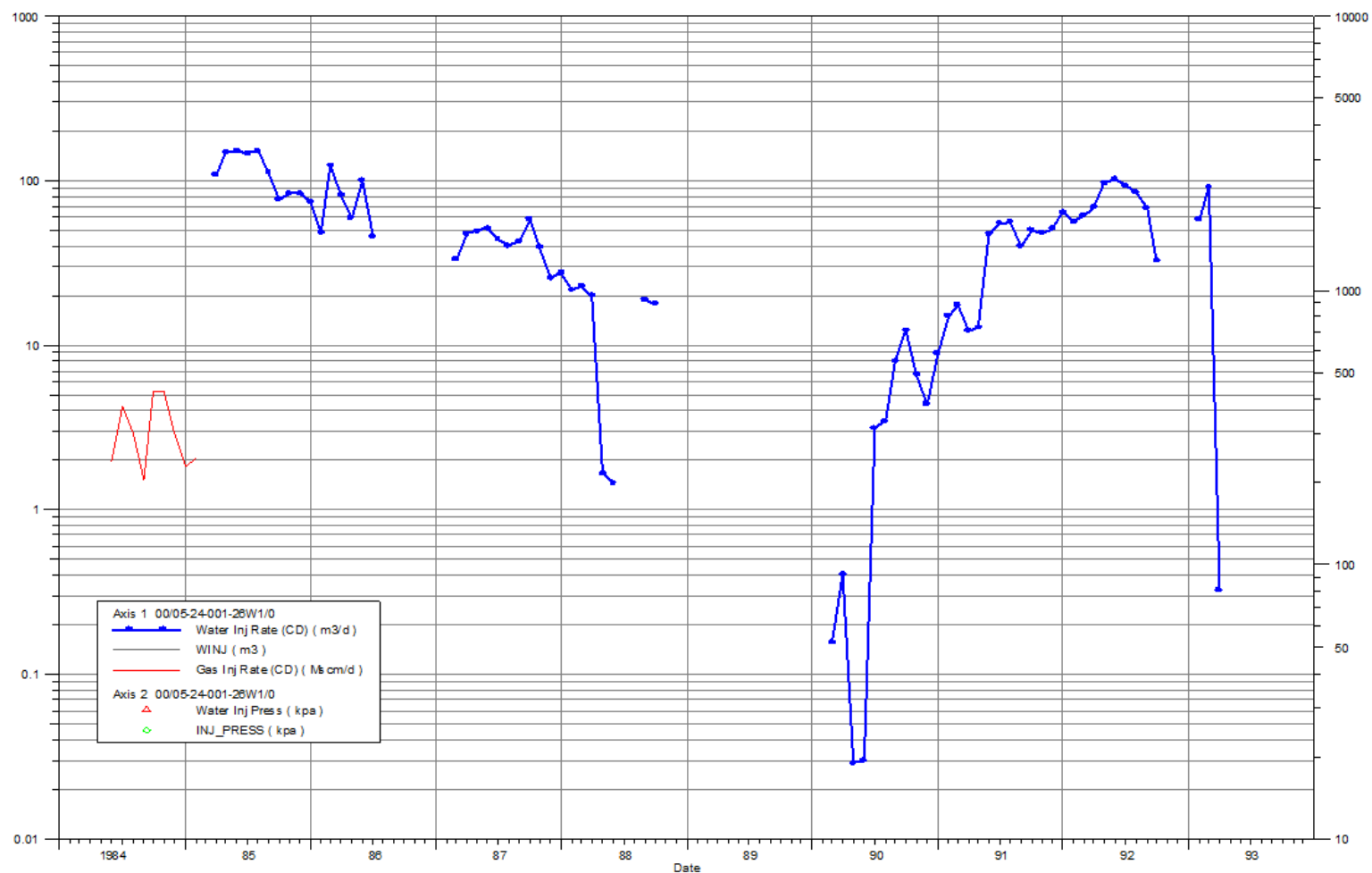


Status: ABC-WINJ
Unit: WA BKADA_UNIT_NO_4_1_PM_68
Zone: LOWER_AMARANTH_A
Operator: PENN_WEST Approval: Amaranth

PENNWEST EXPLORATION

00/05-24-001-26W1/0

Cumulative Gas Inj : 0.86 MMscm
Cumulative Water Inj : 106.36 Mm3
Cumulative Water Prod : 2.03 Mm3
Cumulative Oil Prod : 2.59 Mm3
Cumulative Gas Prod : 0.00 MMscm



Status: WTR-INJ

Unit: WA BKADA_UNIT_NO_4_-PM_68

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNWEST EXPLORATION

00/07-13-001-26W1/0

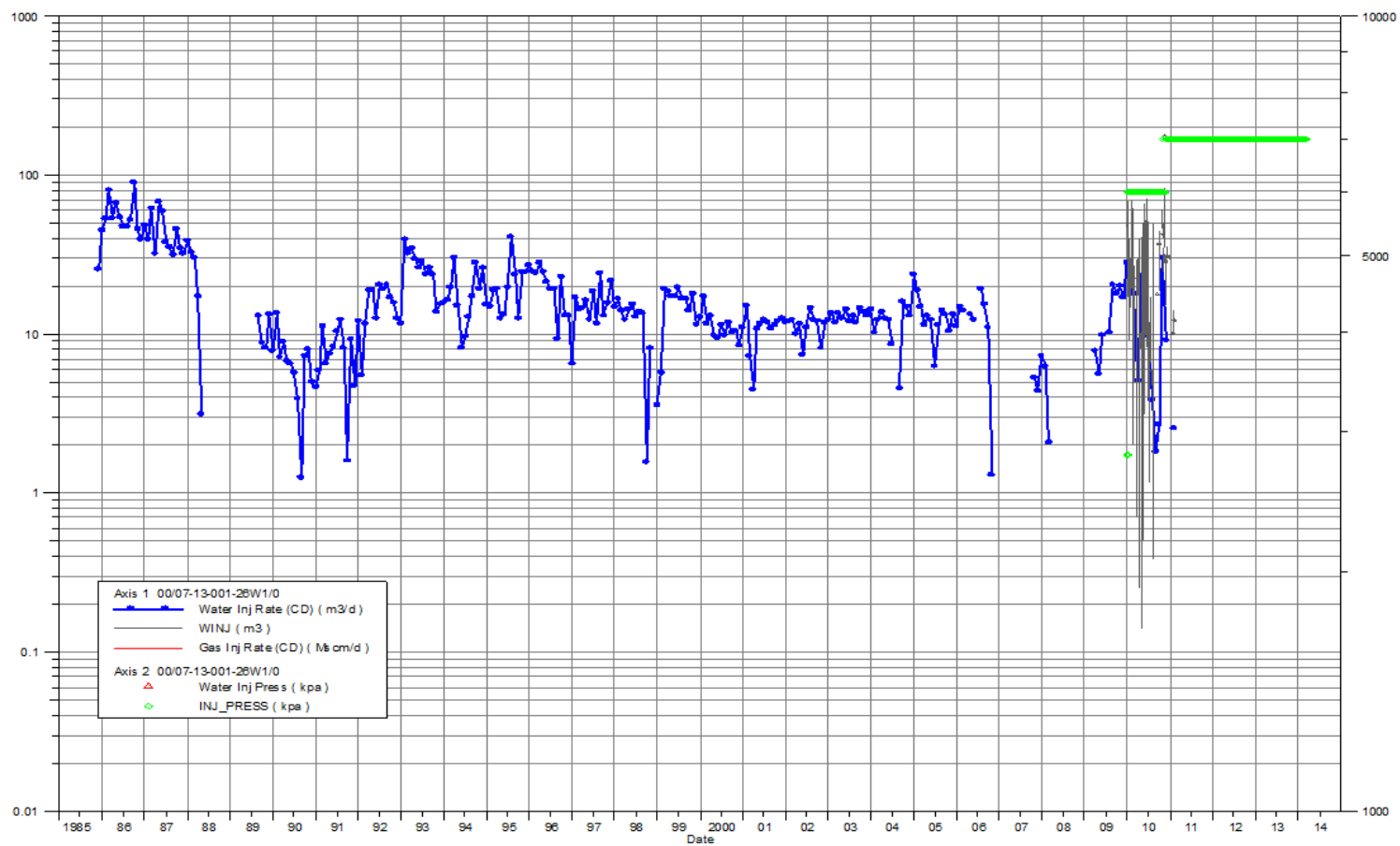
Cumulative Gas Inj : 0.00 MM scm

Cumulative Water Inj : 138.30 Mm3

Cumulative Water Prod : 0.38 Mm3

Cumulative Oil Prod : 2.01 Mm3

Cumulative Gas Prod : 0.00 MM scm



Status: ABC-OIL

Unit: WA SKADA_UNIT_NO_4_-PM_68

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNWEST EXPLORATION

00/07-23-001-26W1/2

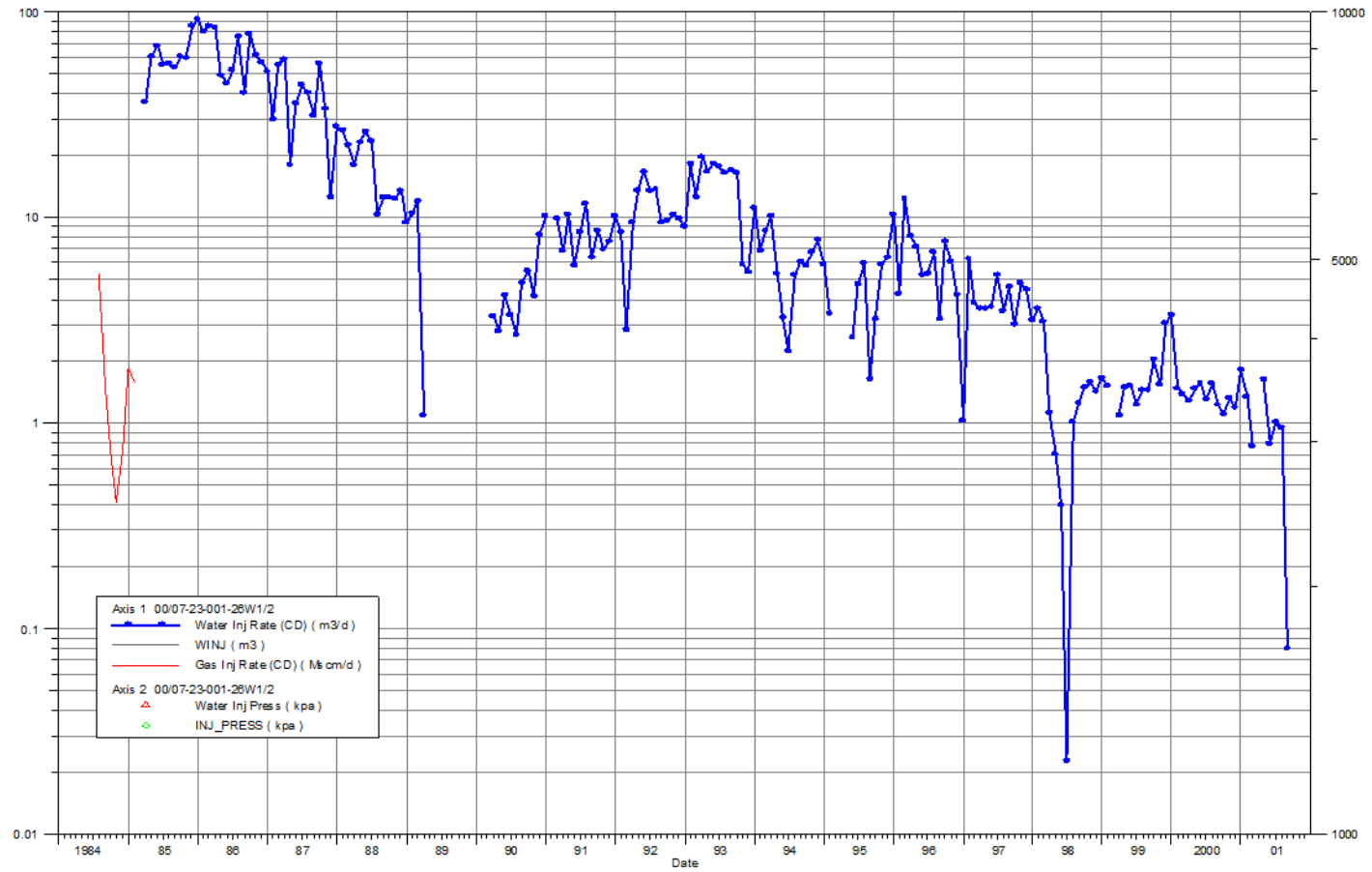
Cumulative Gas Inj : 0.37 MMsm

Cumulative Water Inj : 85.40 Mm3

Cumulative Water Prod : ~ Mm3

Cumulative Oil Prod : ~ Mm3

Cumulative Gas Prod : ~ MMsm

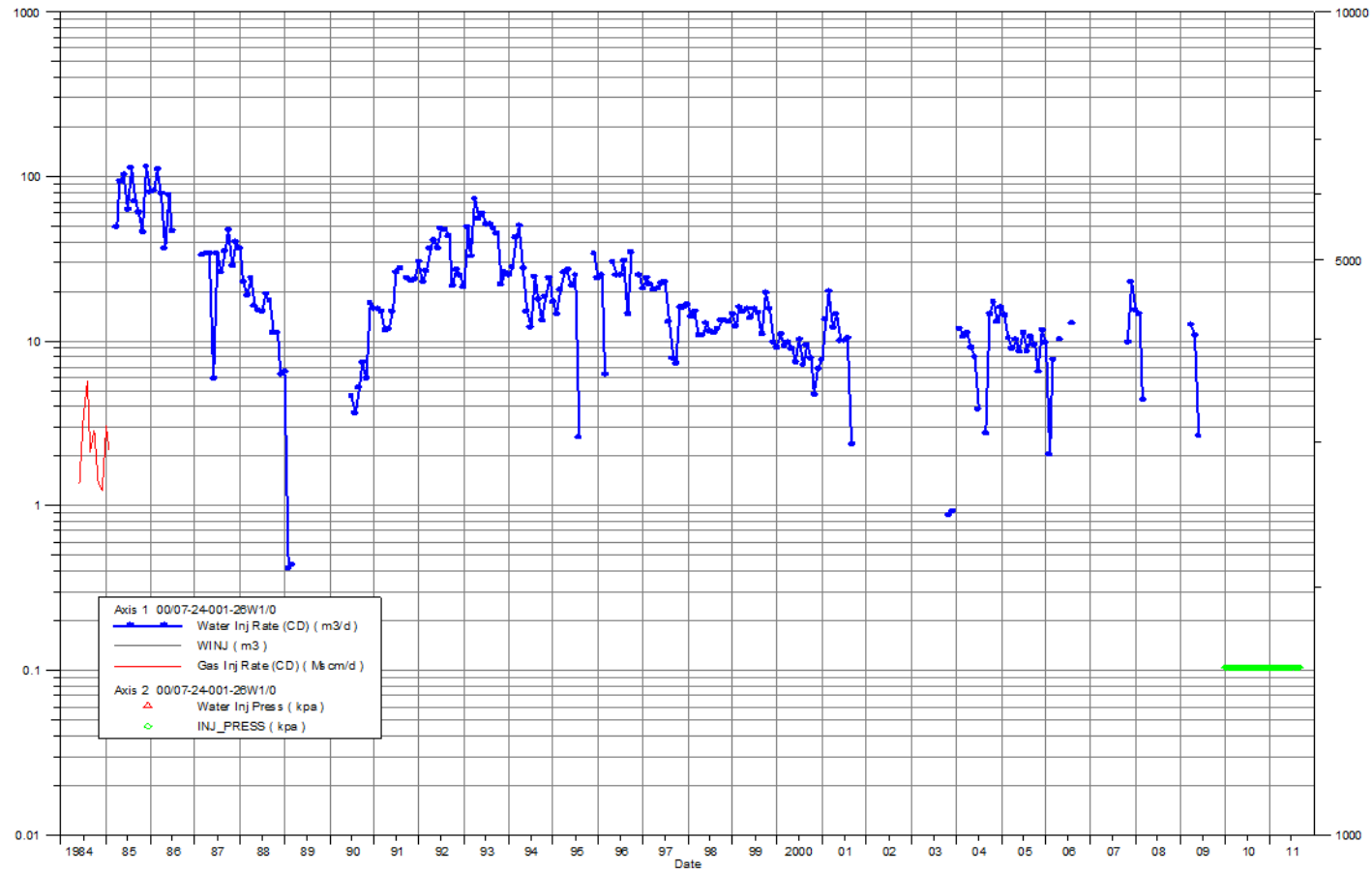


Status: ABQ-WINJ
Unit: WA SKADA_UNIT_NO_4_-PM_68
Zone: LOWER_AMARANTH_A
Operator: PENN_WEST Approval: Amaranth

PENNWEST EXPLORATION

00/07-24-001-26W1/0

Cumulative Gas Inj : 0.71 MMscm
Cumulative Water Inj : 146.07 Mm3
Cumulative Water Prod : 0.29 Mm3
Cumulative Oil Prod : 3.04 Mm3
Cumulative Gas Prod : 0.00 MMscm

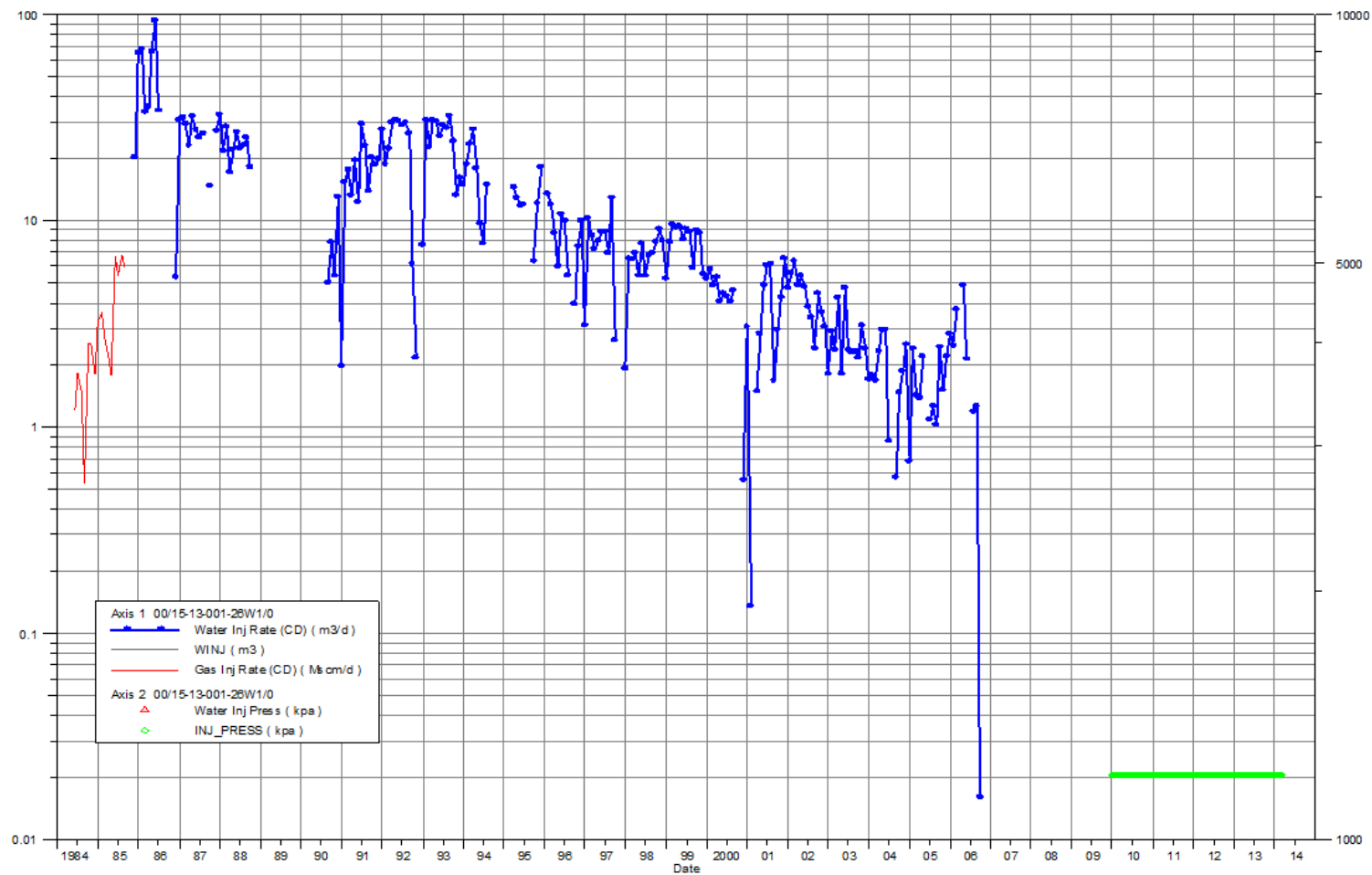


Status: WTR-INJ
Unit: WA BKADA_UNIT_NO_4_-PM_68
Zone: LOWER_AMARANTH_A
Operator: PENN_WEST Approval: Amaranth

PENN WEST EXPLORATION

00/15-13-001-26W1/0

Cumulative Gas Inj : 1.62 MM scm
Cumulative Water Inj : 75.82 Mm3
Cumulative Water Prod : 0.63 Mm3
Cumulative Oil Prod : 3.66 Mm3
Cumulative Gas Prod : 0.00 MM scm



Status: ABO-WINJ

Unit: WA SKADA_UNIT_NO_4_-PM_68

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNWEST EXPLORATION

00/15-14-001-26W1/0

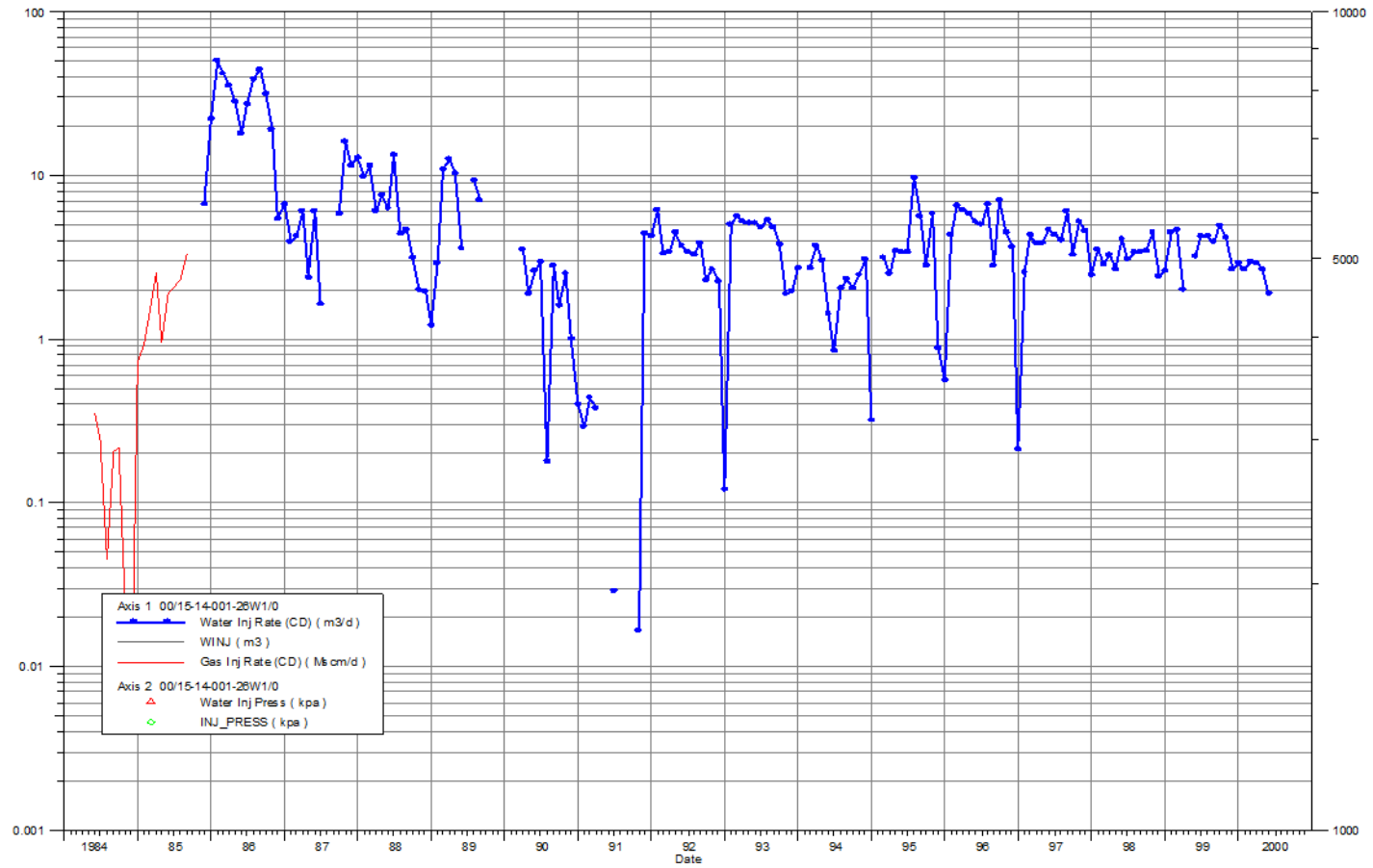
Cumulative Gas Inj : 0.63 MMsm

Cumulative Water Inj : 29.14 Mm3

Cumulative Water Prod : 4.79 Mm3

Cumulative Oil Prod : 0.61 Mm3

Cumulative Gas Prod : 0.00 MMsm



Status: AB OIL

Unit: WA SKADA_UNIT_NO_4_PW_68

Zone: LOWER AMARANTH_A

Operator: OMEGA HYDROCO Approval: Amarant

PENNWEST EXPLORATION

00/16-11-001-26W1/0

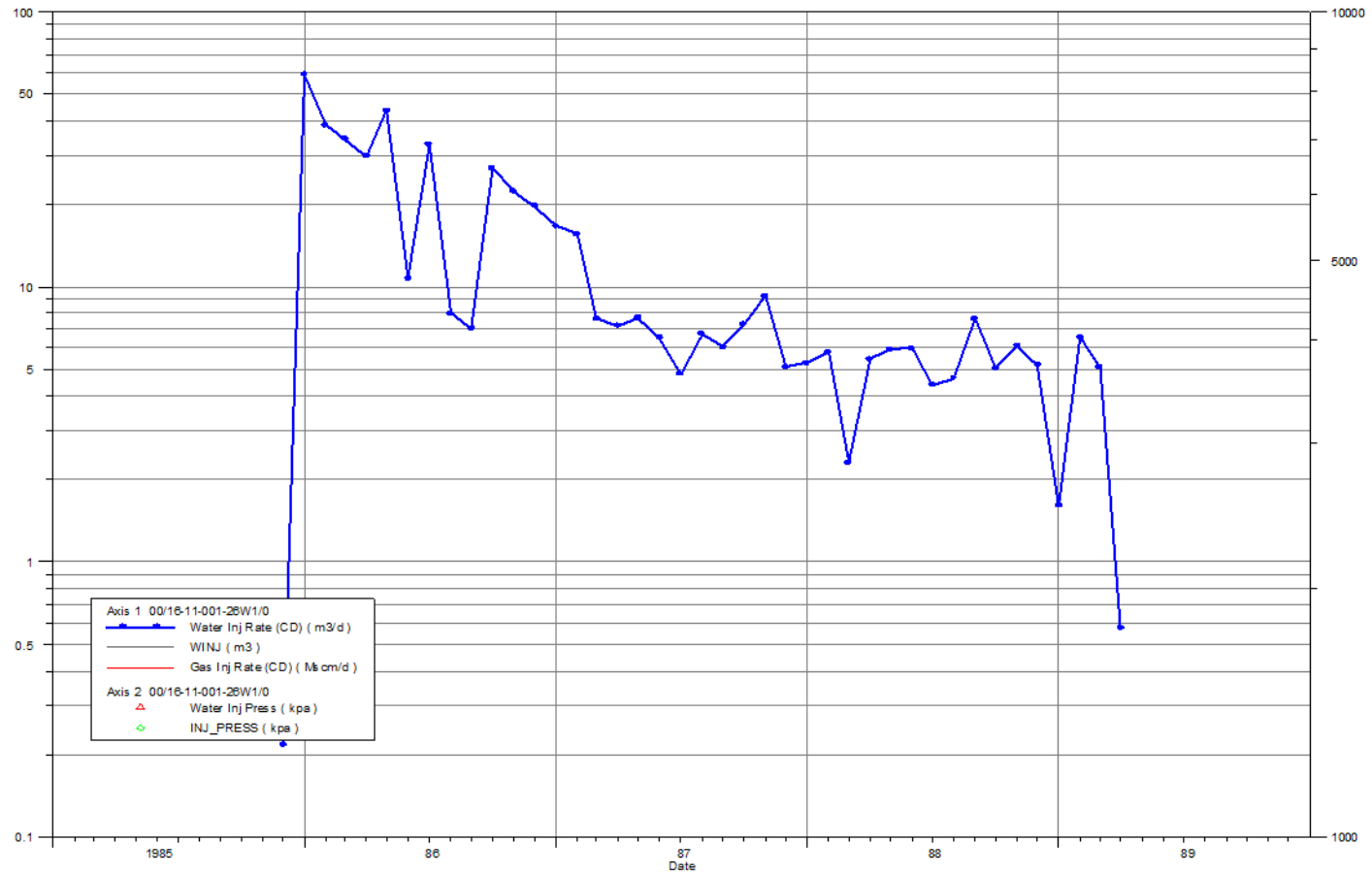
Cumulative Gas Inj : 0.00 MMscm

Cumulative Water Inj : 15.53 Mm3

Cumulative Water Prod : 3.86 Mm3

Cumulative Oil Prod : 0.47 Mm3

Cumulative Gas Prod : 0.00 MMscm



Status: WTR-INJ

Unit: WASKADA_UNIT_NO_4_-_PM_58

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNWEST EXPLORATION

00/13-13-001-26W1/0

Cumulative Gas Inj : 2.60 MMscm

Cumulative Water Inj : 78.38 Mm3

Cumulative Water Prod : 1.91 Mm3

Cumulative Oil Prod : 2.75 Mm3

Cumulative Gas Prod : 0.00 MMscm

