

# Waskada Unit No. 10

---

## Waterflood Progress Report

January 1<sup>st</sup> – December 31<sup>st</sup>, 2013

**PennWest**

Prepared by: Ron Coggan  
Senior Waterflood Engineer

## **Table of Contents:**

### **Introduction**

### **Unit Information and Geology**

### **Discussion**

Production Performance  
Voidage Replacement Ratio  
Pressure Surveys  
Corrosion and Scale Prevention

### **Summary and Recommendations**

### **Attachments**

- 1 Area Map.
- 2 A summary of the Unit Well List and History.
- 3 A Production and Injection plot of the Unit.
- 4 A summary of Unit Annual Volumes and Rates.
- 5 A Cumulative Production and Injection plot of the Unit.
- 6 A Unit Voidage Replacement Ratio Plot.
- 7 Individual Injection Well Performance Plots (2)

## **Introduction:**

The Waskada Unit No. 10 pressure maintenance project commenced water injection into the Mission Canyon designed and in accordance with Manitoba Energy and Mines Approval No. PM 46.

Please refer to Attachment 1 – Area Map.

PRESSURE MAINTENANCE: Governed by Board Order No. PM 46

## **Unit Information**

UNITIZED ZONE: Mission Canyon  
Original Unit, February 1, 1986 Board Order; Voluntary  
First Enlargement, September 1, 1986

POOL: Waskada Mission Canyon 3a C (03 43C)

This report documents the performance of the Waskada Unit No.10 pressure maintenance project for the period of January 1 to December 31, 2013. The Unit had production from 3 wells and no injection in 2013.

Unit 10 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 Mission Canyon in the Waskada area produces light density crude (approximately 36° API). Stratigraphically the Mission Canyon can be divided up into various members and marker beds (ie. MC3b, MC3a, MC2, MC1). It is overlain by the Charles Formation or the angular Paleozoic/Mississippian Unconformity, with beds dipping to the southwest. The lithology consists of complex interbedded grainstones, packstones, wackestones, and mudstones with some members consisting of predominantly primary anhydrite (ie. MC2). Porous members typically have porosity of 13-15% and permeabilities of 20-40 mD), although localized alteration due to the truncating Mississippian Unconformity can significantly reduce or eliminate those values in certain areas. Oil accumulation is generally found on isolated structural highs or areas with associated updip permeability degradation.

## **Discussion**

### **Production and Injection Performance**

Board Order No. PM 46 provided for pressure maintenance operations in Waskada Unit No.10. The Unit includes 2 abandoned injection wells and 6 producers. 3 wells produced for a short while in 2013. Pressure maintenance by water injection began in February 1986 and ceased in March 1987 and has remained shut in since this date. Water injection appears to have accelerated water production while

having little positive effect on oil production hence water injection has not been an effective enhanced recovery mechanism. The previous operator, Omega, therefore abandoned the injectors.

Please refer to Attachment 2 – A summary of the Unit Well List and History.

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 0.16 and the Cumulative VRR from injection start is at 0.19. Both have declined gradually since ceasing injection in 1987. The Monthly VRR for the short period of injection in the late 1980s was well above 1.0 and could have easily contributed to high water production. Currently there is no active injector in this Unit and PennWest has no plans to reactivate injection.

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

Please refer to Attachment 7 – Individual Injection Well Performance Plots (2)

### **Pressure Surveys:**

No pressure surveys were conducted in 2013.

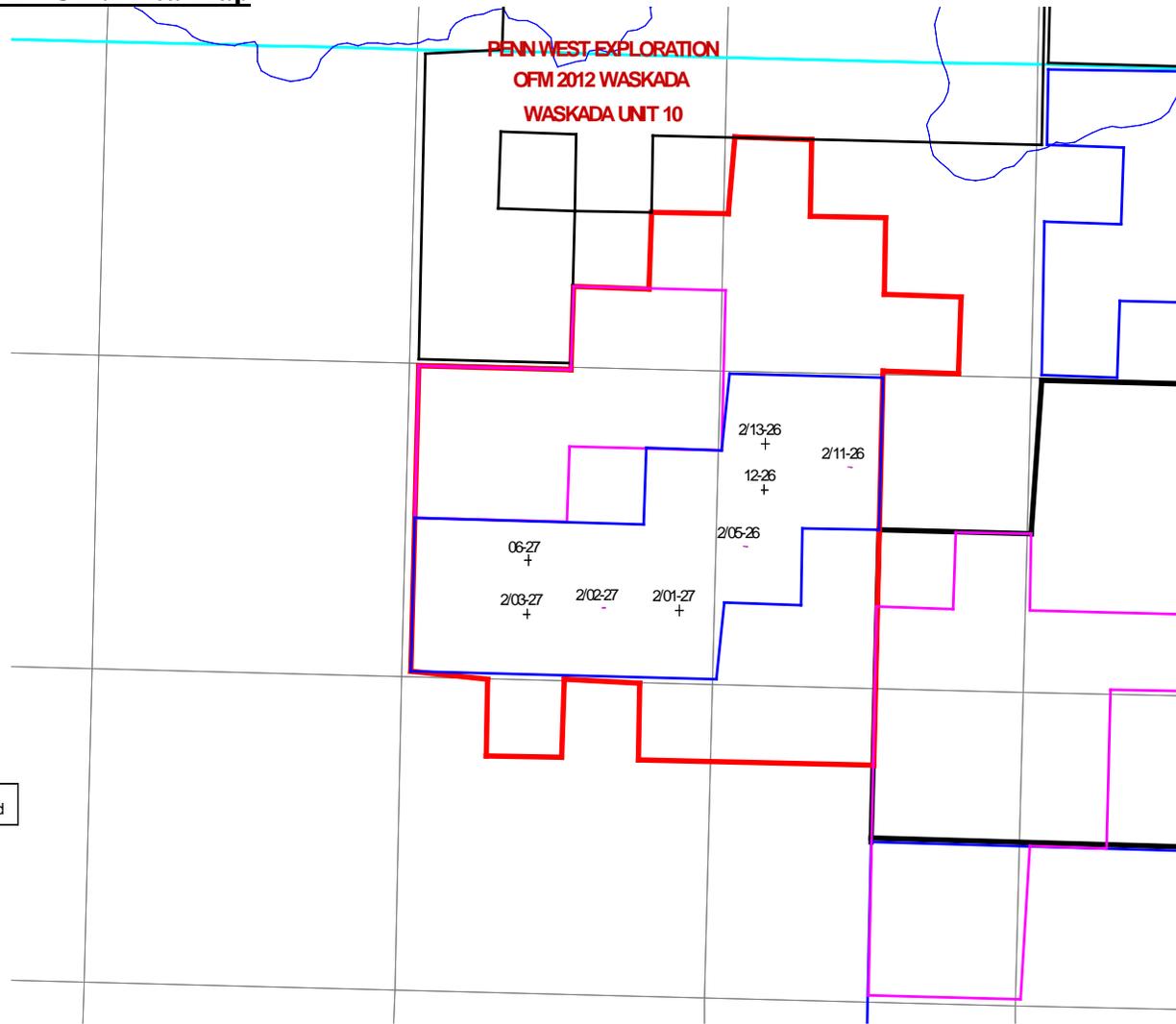
### **Corrosion and Scale Prevention Program:**

We currently inject ScalCor down all the new horizontal wells. PennWest will be installing cathodic protection on the wells. The new gathering system is Fibreglass and as such is not susceptible to corrosion.

### **Summary and Recommendations**

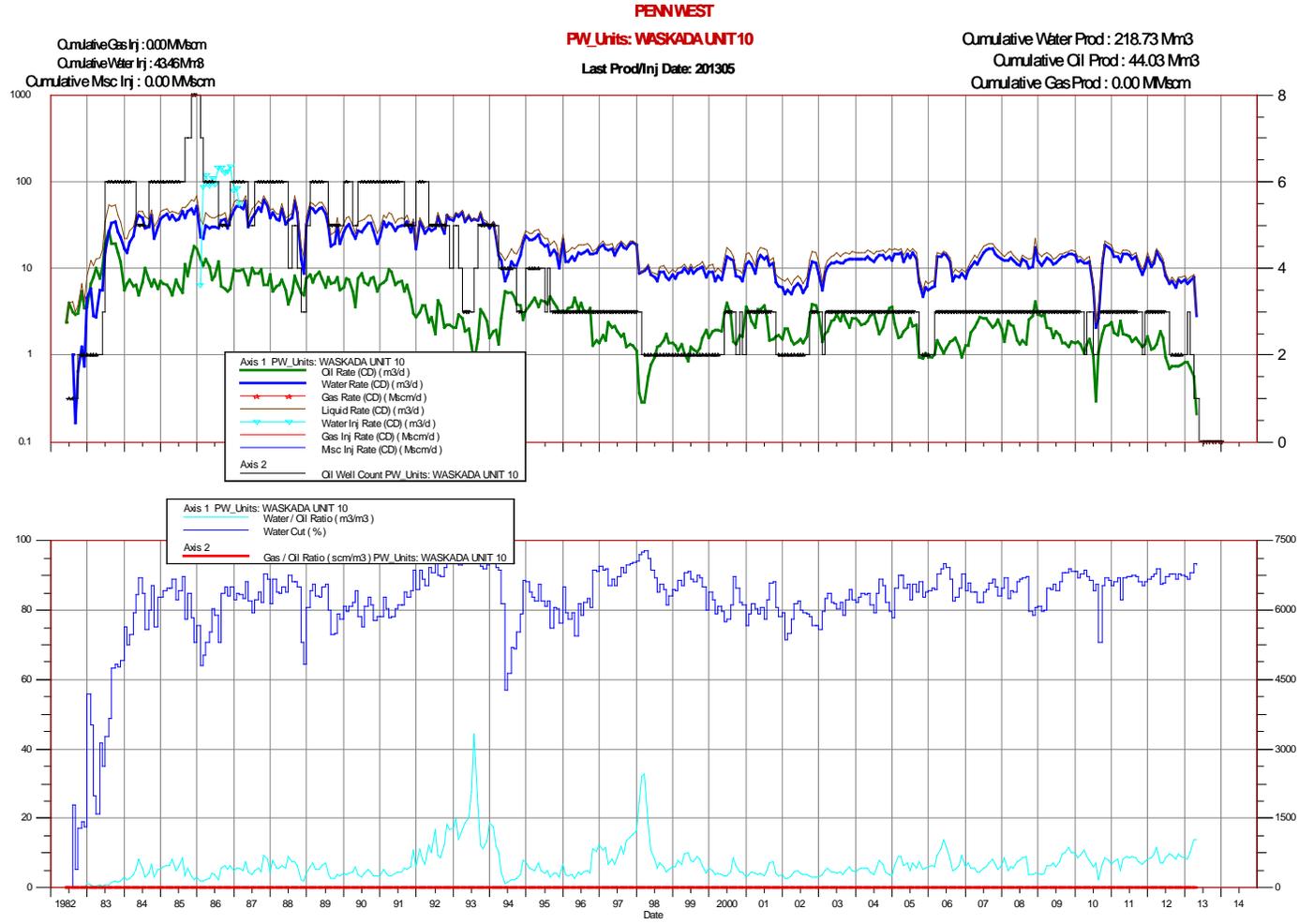
Since there is only one producer and no injection wells in this unit, we do not have any plans for this unit other than monitoring the 3 producers.

**ATTACHMENT 1 – Unit Area Map**



ATTACHMENT 2 Unit History: WASKADA UNIT 10														
					Kelly				Cum	Cum			Cum	Cum
				New	Bushing	Total	First	Oil	Water	Last	First	Water	Gas	Last
Well	Completion	OPERATOR	STATUS	Drills	Elevation	Depth	Production	Prod	Prod	Production	Injection	Inj	Inj	Injection
	Date				m	m	Date	Mm3	Mm3	Date	Date	Mm3	MMscm	Date
02/05-26-001-26W1/0	7/3/1983	PENN_WEST	PMP-OIL	<N/A>	470	955	7/1/1983	9.96	42.07	2/1/2013		0	0	
02/11-26-001-26W1/0	7/9/1983	PENN_WEST	PMP-OIL	<N/A>	473.7	950	7/1/1983	11.22	59.76	5/1/2013		0	0	
00/12-26-001-26W1/0	8/7/1982	PENN_WEST	ABD-OIL	<N/A>	471.1	951	10/1/1982	2.47	10.52	9/1/1995		0	0	
02/13-26-001-26W1/0	6/18/1983	PENN_WEST	ABD-WINJ	<N/A>	469.1	950	6/1/1983	0.61	5.84	1/1/1986	2/1/1986	20.4	0	3/1/1987
02/01-27-001-26W1/0	7/14/1983	PENN_WEST	ABD-OIL	<N/A>	467.8	949	11/1/1985	2.82	3.84	4/1/1992		0	0	
02/02-27-001-26W1/0	7/15/1983	PENN_WEST	OIL	<N/A>	467.4	957	9/1/1985	6.32	17.9	4/1/2013		0	0	
02/03-27-001-26W1/0	7/5/1983	PENN_WEST	ABD-OIL	<N/A>	466.3	950	7/1/1983	1.11	6.68	2/1/1986	3/1/1986	23.06	0	3/1/1987
00/06-27-001-26W1/0	6/10/1982	PENN_WEST	ABD-OIL	<N/A>	466.6	939	6/1/1982	9.52	72.1	3/1/1994		0	0	
3/18/2014 15:39 /														

# ATTACHMENT 3 – Unit Production and Injection Plot





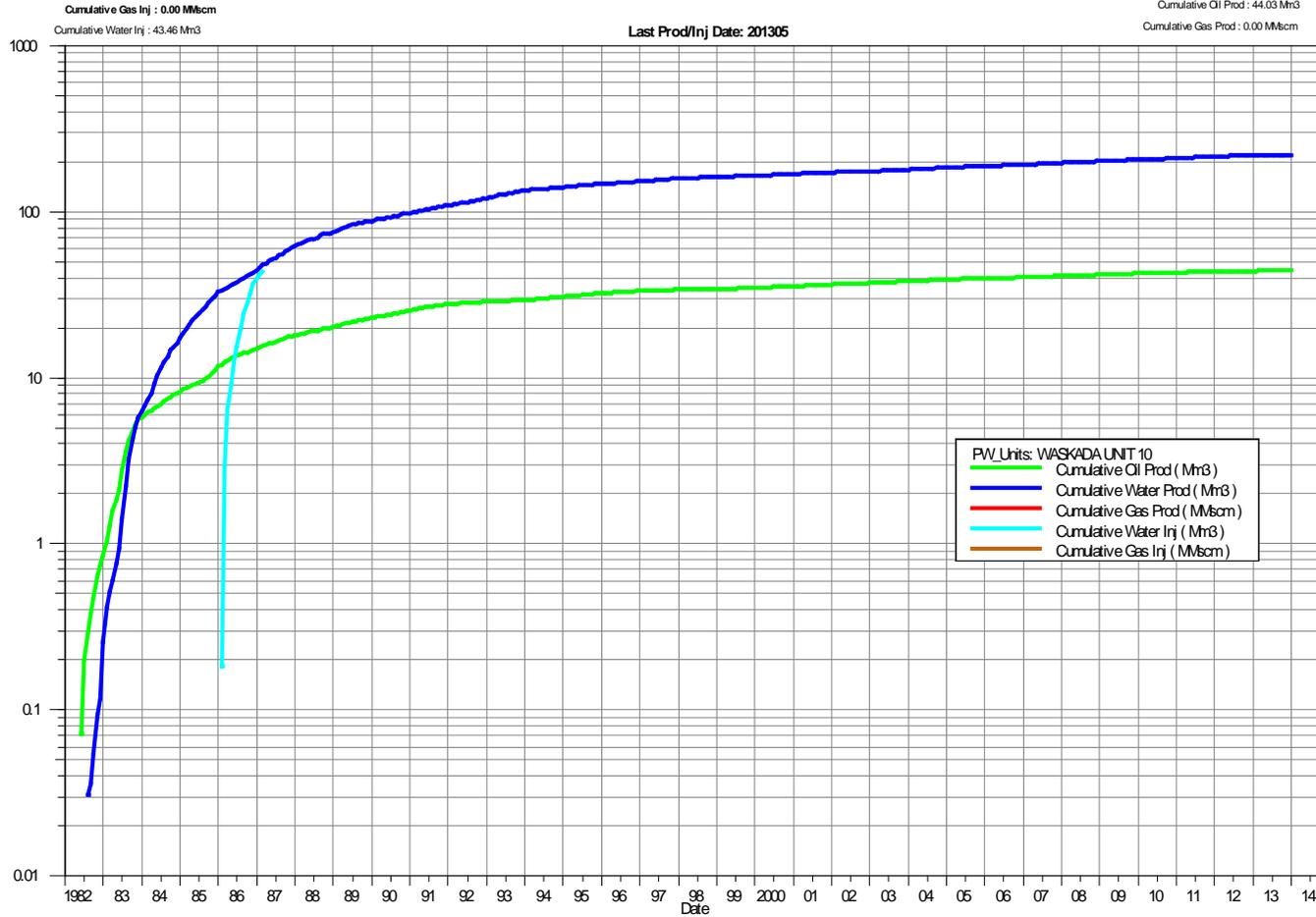
# ATTACHMENT 5 – Unit Cumulative Production and Injection Plot

PENWEST  
PW\_Units: WASKADA UNIT 10

Cumulative Water Prod : 218.73 Mr3

Cumulative Oil Prod : 44.03 Mr3

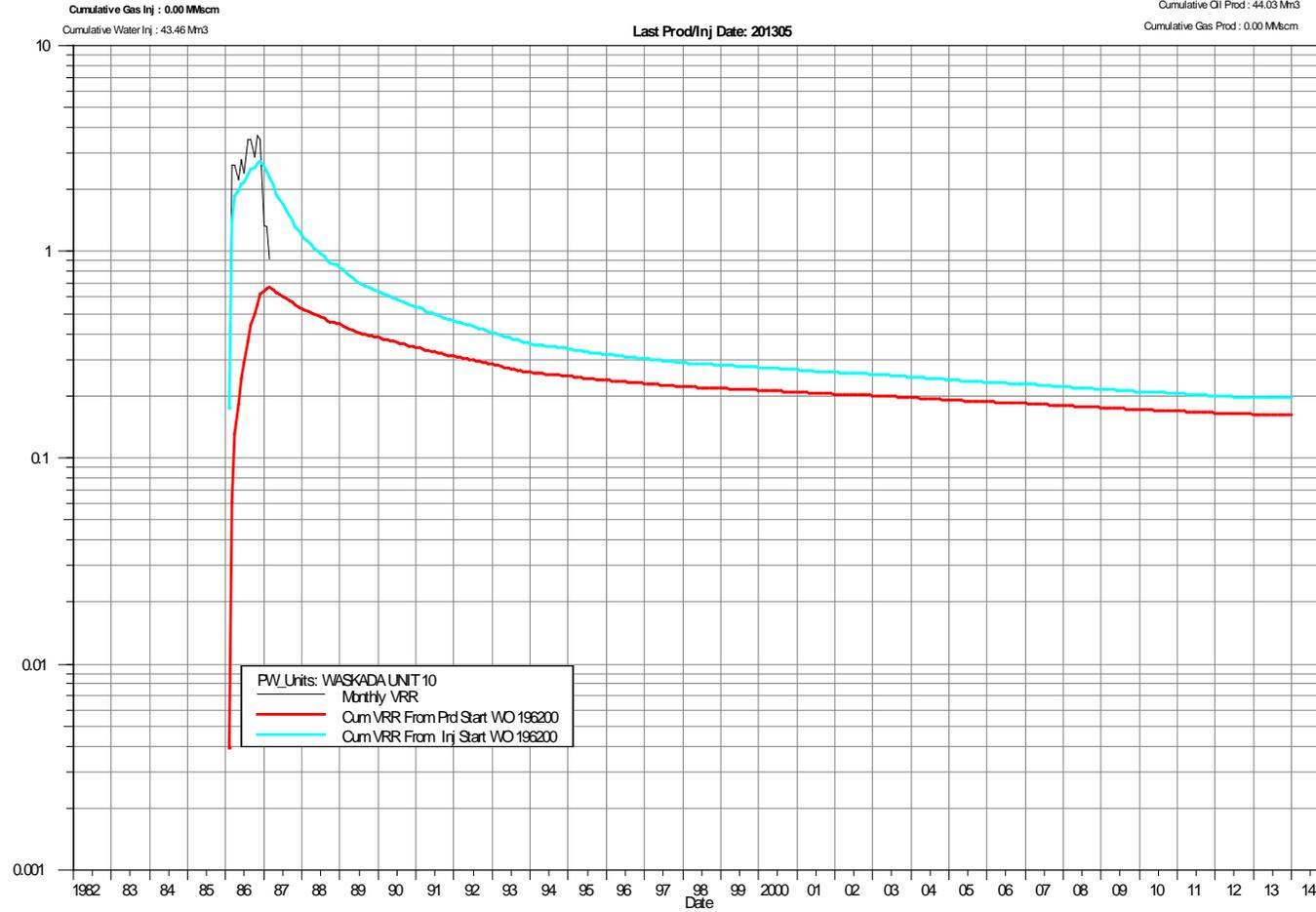
Cumulative Gas Prod : 0.00 MMscm



# ATTACHMENT 6 – Unit Voidage Replacement Ratio Plot

PENWEST  
PW\_Units: WASKADA UNIT 10

Cumulative Water Prod : 218.73 Mm3  
Cumulative Oil Prod : 44.03 Mm3  
Cumulative Gas Prod : 0.00 Mm3cm



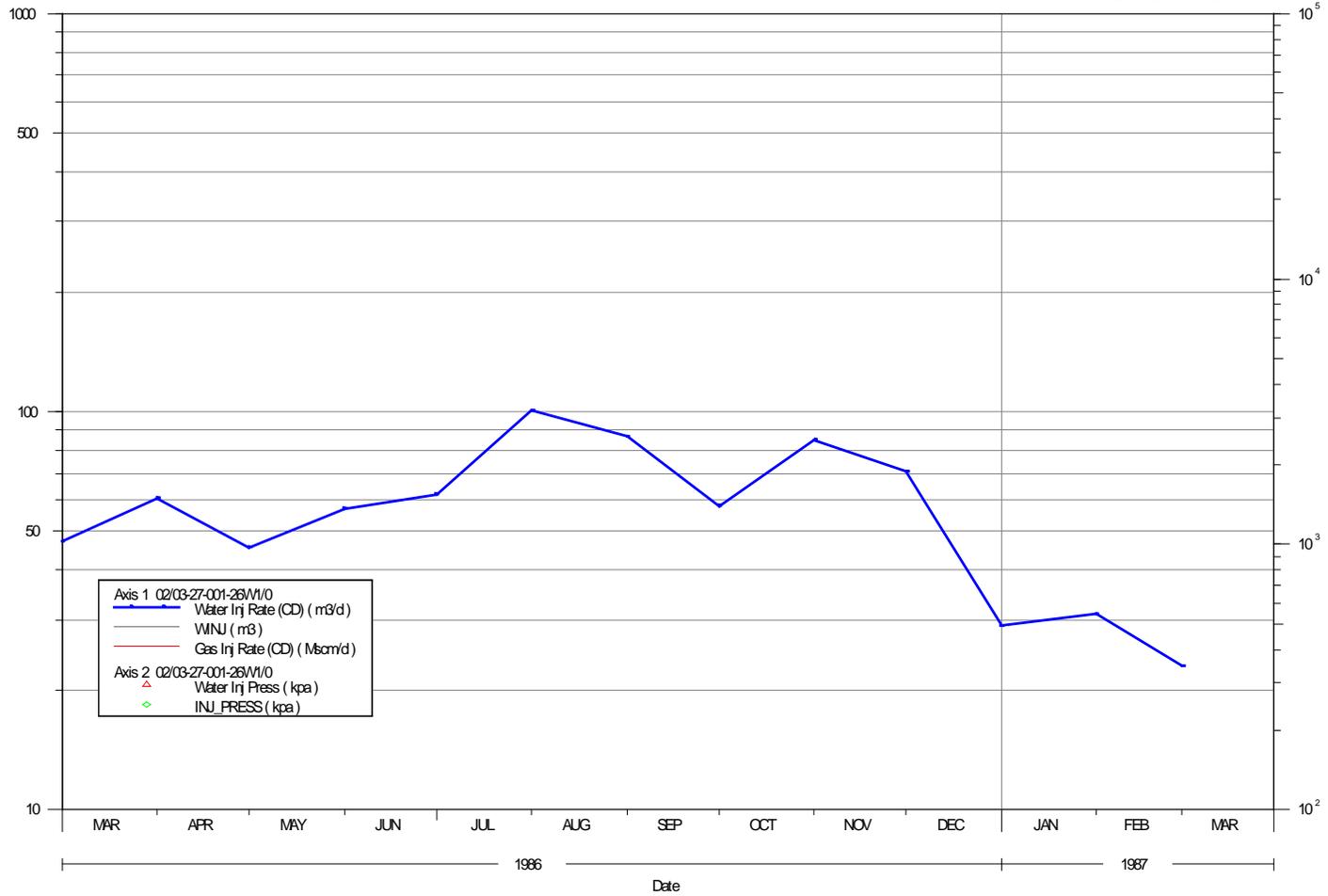
# ATTACHMENT 7 – Individual Injection Well performance Plots (2 Wells)

Status: ABD-OIL  
 Unit: WASKADA\_UNIT\_NO\_10\_-\_PM\_46  
 Zone: MSSION\_CANYON\_3A\_C  
 Operator: PENN\_WEST Approval: Amaranth

**PENNWEST EXPLORATION**

**02/03-27-001-26W1/0**

Cumulative Gas Inj : 0.00 MMscm      Cumulative Water Inj : 23.06 Mm3  
 Cumulative Water Prod : 6.68 Mm3  
 Cumulative Oil Prod : 1.11 Mm3  
 Cumulative Gas Prod : 0.00 MMscm



Status: ABD-WINJ  
Unit: WASKADA\_UNIT\_NO\_10\_-\_PM\_46  
Zone: MISSION\_CANYON\_3A\_C  
Operator: PENN\_WEST Approval: Amaranth

**PENNVEST EXPLORATION**  
**02/13-26-001-26WI/O**

Cumulative Gas Inj : 0.00 MMscm  
Cumulative Water Inj : 20.40 Mm3  
Cumulative Water Prod : 5.84 Mm3  
Cumulative Oil Prod : 0.61 Mm3  
Cumulative Gas Prod : 0.00 MMscm

