

# **WASKADA UNIT NO. 1**

## **WATERFLOOD PROGRESS REPORT**

**January 1, through December 31, 2010**

### **PennWest Exploration**

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## **INTRODUCTION**

The Waskada Unit No.1 pressure maintenance project commenced water injection into the Mission Canyon designed and in accordance with Manitoba Energy and Mines Approval No. PM 47. (See Appendix A – Area Map)

PRESSURE MAINTENANCE: Governed by Board Order No. PM 47

### **Unit Information**

UNITIZED ZONE: Mission Canyon

Original Unit, June 1, 1976 Board Order; Unitization Order No. 22

POOL: Waskada Mission Canyon 3b A (03 42A)

This report documents the performance of the Waskada Unit No.1 pressure maintenance project for the period of January 1 to December 31, 2010.

Unit # 1 is part of main Waskada. 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 (W1PM).

The Waskada Fields produce light density crude (approximately 36° API), predominantly from the Lower Amaranth formation. The 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 founded 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 meters 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.

## **UNIT HISTORY**

### **Waskada Unit #1 (Unit History)**

Abbreviated Well ID	Date Well Spudded	On Prod YYYY/MM	Org Operator Name	Ground Elevation (m)	Last Inject. YYYY/MM
00/03-30-001-25W1/0	1967/12	1967/12	Omega Hydcbns Ltd	467.0	954.0
00/04-30-001-25W1/0	1967/12	1967/12	Omega Hydcbns Ltd	467.4	958.3
00/05-30-001-25W1/0	1967/05	1967/05	Intl Hydcbns Lmted	467.9	973.8
00/06-30-001-25W1/0	1967/12	1967/12	Omega Nat Gas Co	468.2	952.2
00/11-30-001-25W1/0	1967/01	1967/01	Intl Hydcbns Lmted	468.2	957.7
00/12-30-001-25W1/0	1967/12	1967/12	Omega Hydcbns Ltd	467.6	964.1

### **Waskada Unit #1 (Production & Injection History)**

Abbreviated Well ID	First Prod YYYY/ MM	On Inject. YYYY/ MM	Last Prod. YYYY/MM	Cumulative OIL Prod. (m3)	Cumulative WTR Prod. (m3)	First 12 mo. Ave WC%	Last Inject. YYYY/ MM
00/03-30-001-25W1/0	1967/12		2010/12	22,555	36,645	0	
00/04-30-001-25W1/0	1967/12		1991/09	23,250	56,279	0	
00/05-30-001-25W1/0	1967/05		1977/06	15,933	2,776	0	
00/06-30-001-25W1/0	1967/12	1976/04	1975/02	10,286	0	0	1996/04
00/11-30-001-25W1/0	1967/01		1980/05	6,146	840	0	
00/12-30-001-25W1/0	1967/12		1993/07	15,552	13,590	0	

## **DISCUSSION**

### **Production Performance**

Board Order No. PM 47 provided for pressure maintenance operations in the Waskada Unit No.1. The Unit included an injection wells, 00/06-30-001-25W1/0 (abandoned since 1987/04), and five producers (only one of them active now) in the Waskada unit No 1 Pool. Pressure maintenance by water injection in 1976 and continued until 1983. The injector was shut in until 1991. It was put on injection on may1991, and was shut in again until Jan 1995. It was injecting until March 1996. The injector was abandoned in May 1996. (See Appendix D for oil, water and injection rates).

### **Voidage Replacement Ratio Calculation:**

Upon review of the voidage replacement ratio (VRR) for the Waskada Unit # 1 area, it was shown that the area has been under injected (Cum VRR), although monthly VRR was very high, initially, for few years. This is shown by instantaneous and cumulative VRR for the Waskada Unit # 1 (see Appendix C). Currently there is no active injector in this unit, and PennWest has no plans to re-activate any of the old injectors.

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

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

## **SUMMARY AND RECOMMENDATIONS**

### **Producers**

#### **Current Producing Well**

1. 00/03-30-001-25W1/0

#### **Current Suspended Producing Wells**

None

### **Abandoned Producing Wells**

1. 00/04-30-001-25W1/0 (since 1991/10)
2. 00/05-30-001-25W1/0 (since 1977/07)
3. 00/11-30-001-25W1/0 (since 1980/06)
4. 00/12-30-001-25W1/0 (since 1993/08)

### **Injectors**

#### **Current Injecting Wells**

None

#### **Current Suspended Injection Wells**

None

### **Abandoned Injection Wells**

1. 00/06-30-001-25W1/0 (since 1996/05)

Currently, there are only one active producers and no injection well in Waskada Unit 1; we do not have any plan for this unit other than monitoring the producer. PennWest's plan is to concentrate on Lower Amaranth Formation for now.

## **TABLES**

### **Waskada Unit #1**

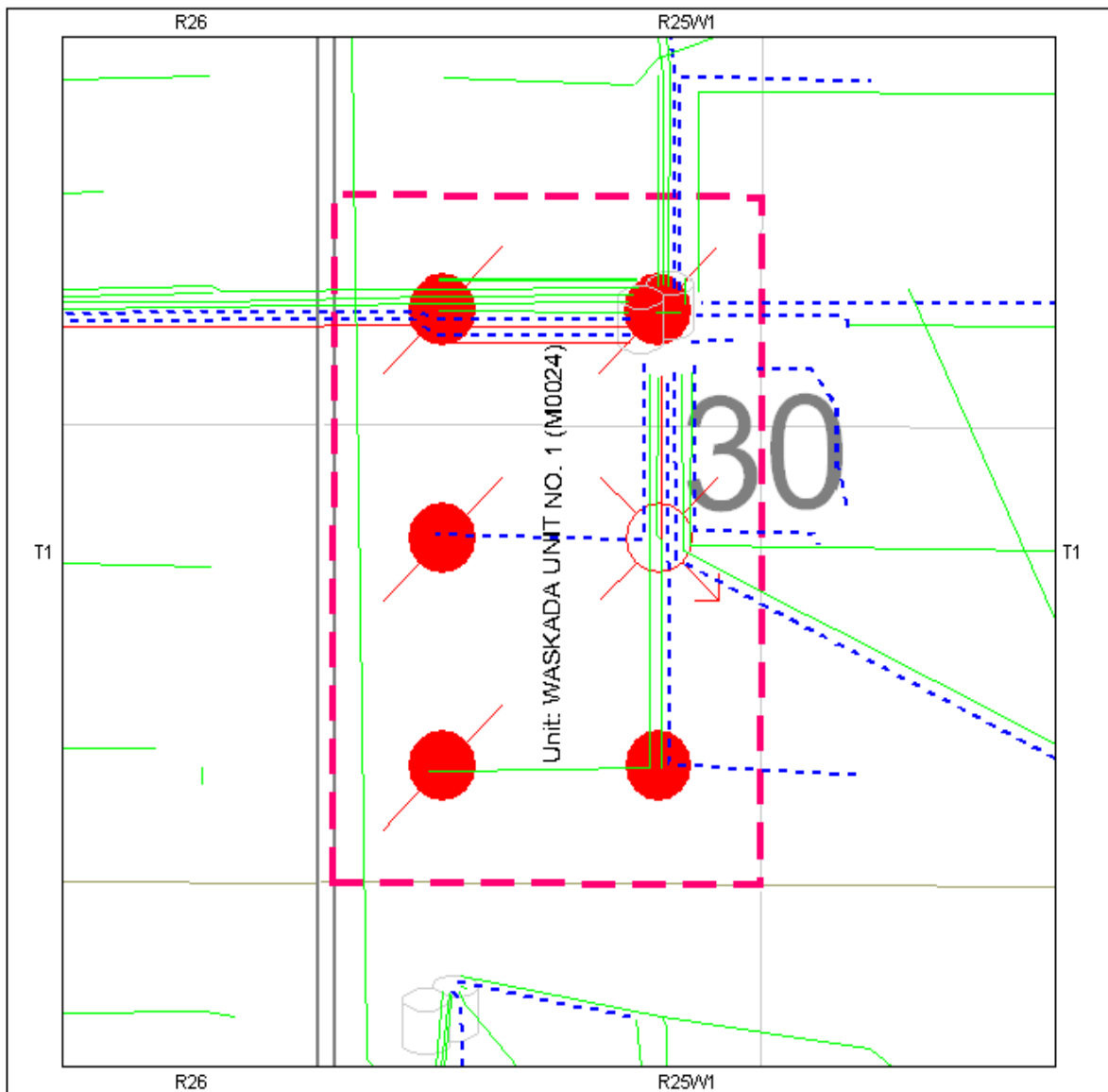
**Table 1: Rates History**

<b>Date</b>	<b>Oil</b>		<b>Water</b>		<b>Injection Water</b>	
<b>Year</b>	<b>m3/year</b>	<b>m3/day</b>	<b>m3/year</b>	<b>m3/day</b>	<b>m3/year</b>	<b>m3/day</b>
1967	3,459	9.48	0	0.00	0	0.00
1968	11,851	32.47	0	0.00	0	0.00
1969	8,960	24.55	0	0.00	0	0.00
1970	7,926	21.72	0	0.00	0	0.00
1971	6,743	18.48	0	0.00	0	0.00
1972	4,544	12.45	0	0.00	0	0.00
1973	3,604	9.87	0	0.00	0	0.00
1974	2,415	6.62	0	0.00	0	0.00
1975	2,390	6.55	0	0.00	0	0.00


1976	4,313	11.82	1,797	4.92	38,042	104.22
1977	6,712	18.39	3,317	9.09	12,109	33.18
1978	3,359	9.20	3,969	10.87	11,609	31.81
1979	1,986	5.44	2,883	7.90	6,729	18.44
1980	1,704	4.67	4,146	11.36	8,176	22.40
1981	2,014	5.52	9,351	25.62	15,005	41.11
1982	742	2.03	6,083	16.67	14,360	39.34
1983	1,190	3.26	9,346	25.61	19,474	53.35
1984	1,308	3.58	8,836	24.21	0	0.00
1985	3,056	8.37	9,208	25.23	0	0.00
1986	2,549	6.98	11,575	31.71	0	0.00
1987	3,083	8.45	7,413	20.31	0	0.00
1988	2,537	6.95	5,102	13.98	0	0.00
1989	1,284	3.52	5,026	13.77	0	0.00
1990	1,226	3.36	3,991	10.93	0	0.00
1991	499	1.37	3,451	9.46	5,194	14.23
1992	322	0.88	2,626	7.19	0	0.00
1993	584	1.60	1,016	2.78	0	0.00
1994	384	1.05	888	2.43	0	0.00
1995	252	0.69	872	2.39	1,530	4.19
1996	421	1.15	539	1.48	215	0.59
1997	316	0.86	935	2.56	0	0.00
1998	15	0.04	53	0.14	0	0.00
1999	142	0.39	105	0.29	0	0.00
2000	191	0.52	330	0.90	0	0.00
2001	357	0.98	841	2.30	0	0.00
2002	347	0.95	934	2.56	0	0.00
2003	264	0.72	835	2.29	0	0.00
2004	66	0.18	238	0.65	0	0.00
2005	32	0.09	80	0.22	0	0.00
2006	222	0.61	920	2.52	0	0.00
2007	74	0.20	413	1.13	0	0.00
2008	154	0.42	1,228	3.36	0	0.00
2009	67	0.18	934	2.56	0	0.00
2010	60	0.16	849	2.33	0	0.00

# **APPENDIX A**

## Appendix A – Area Map

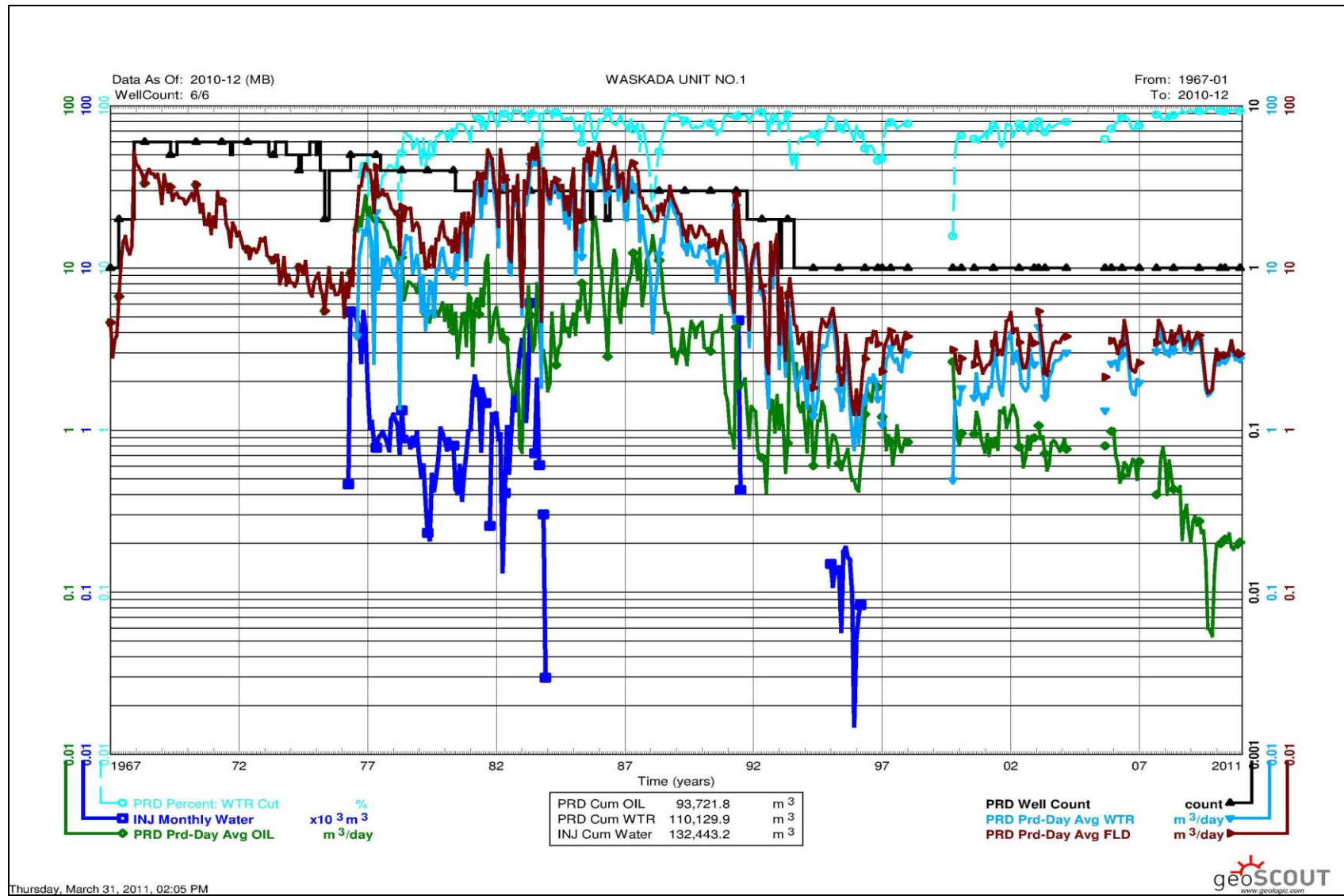


WELL SYMBOLS									
+	OIL	⚡	AO	⊕	PTN	⚡	D&A	⚡	WI
○	LCT	⚡	AWI	⊕	STN	⚡	CMM	⊕	DRL
⊕	RDR	⚡	WD	⚡	AW/S	⚡	AW/D	⚡	SWI
⚡	SO	⚡	WSC	⊕	J&A	□	SL		

<b>PennWest</b> Exploration	
Waskada Unit #1	
	By : _____ Scale = 1:10000 Date : 2011/04/14 Project : Waskada

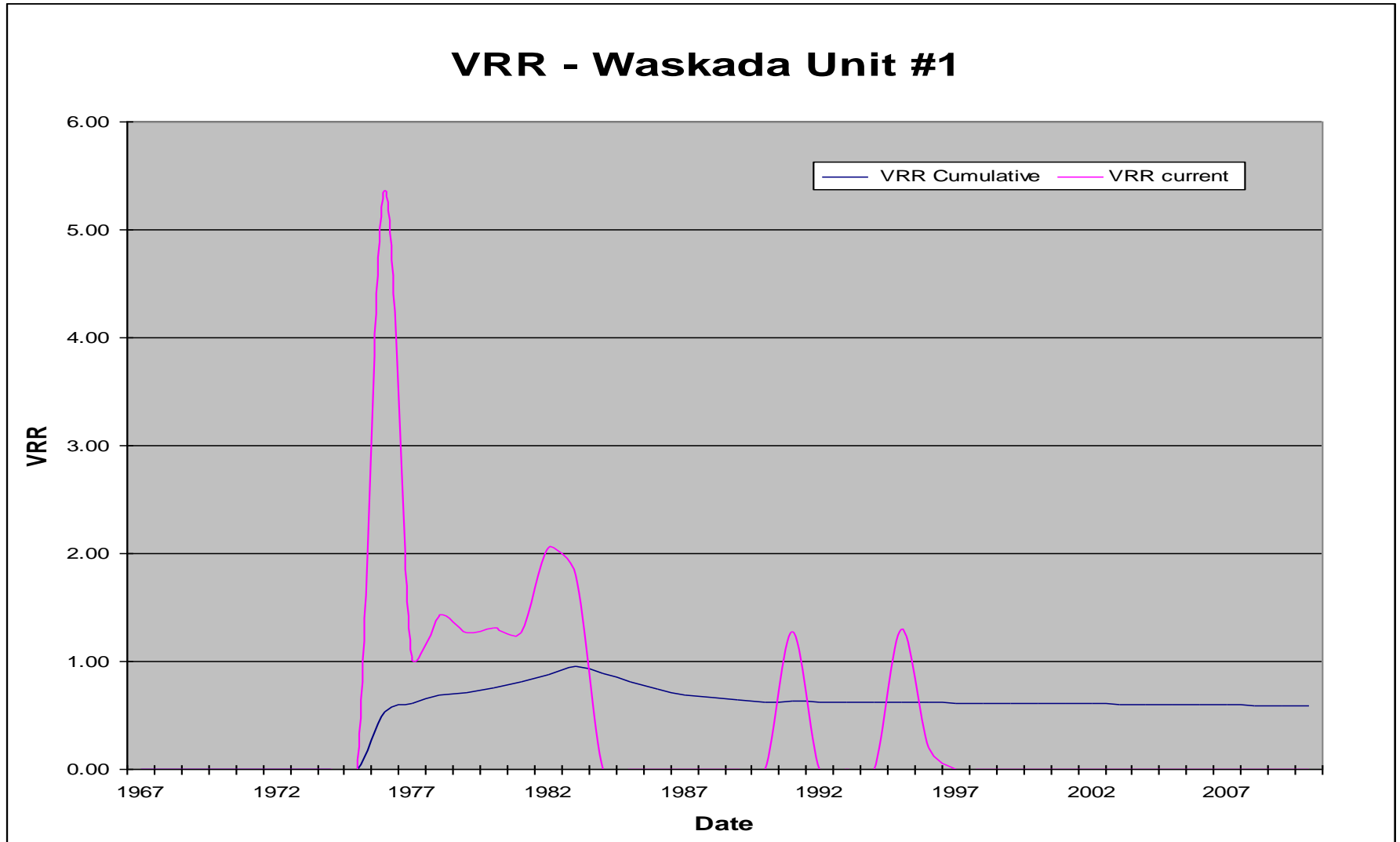
## **APPENDIX B**

## Appendix B – Production and Injection History plot



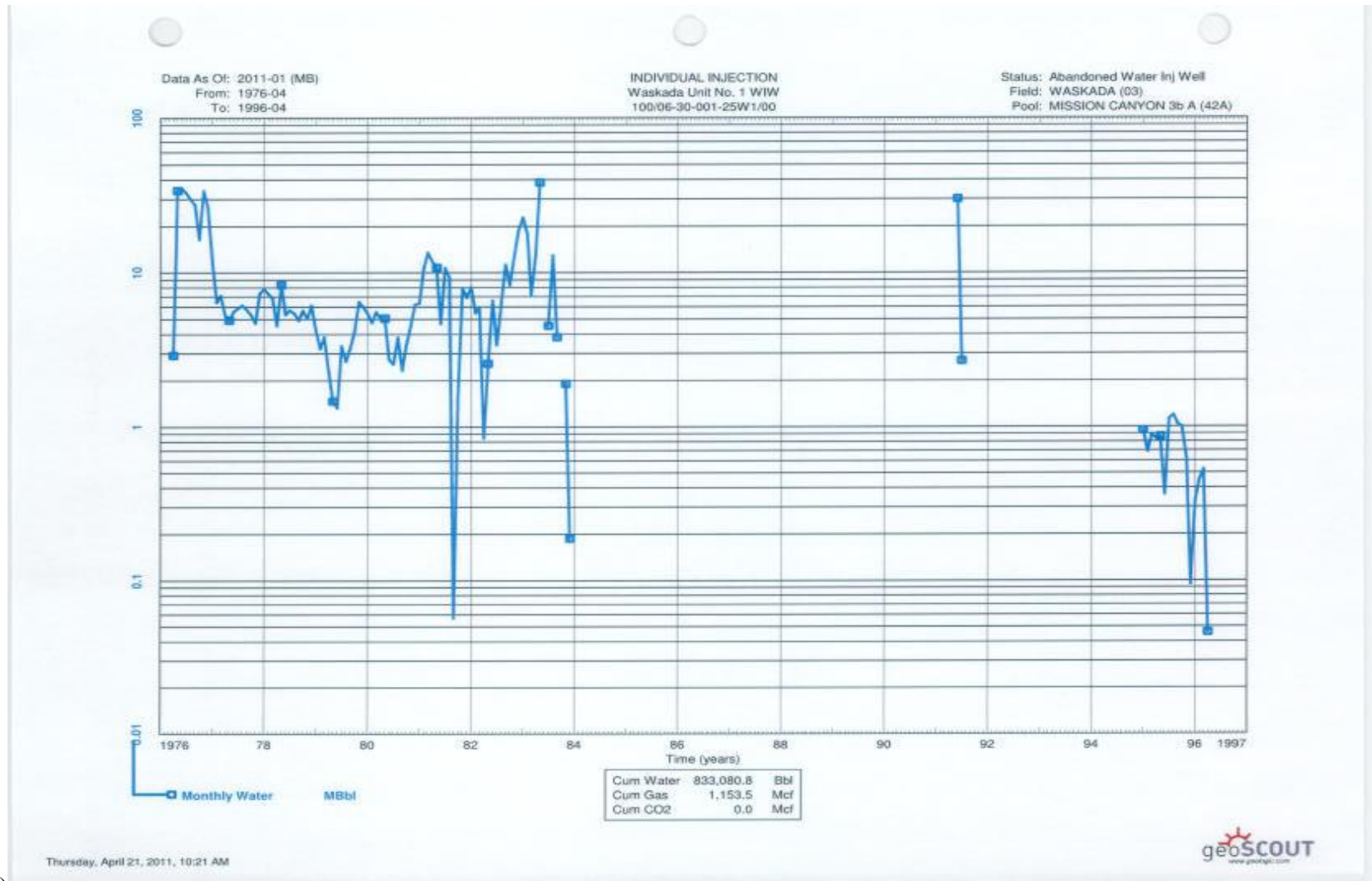
## **APPENDIX C**

## Appendix C – Voidage replacement Ratio VRR



## **APPENDIX D**

## Appendix D – Production and Injection Profiles (Individual

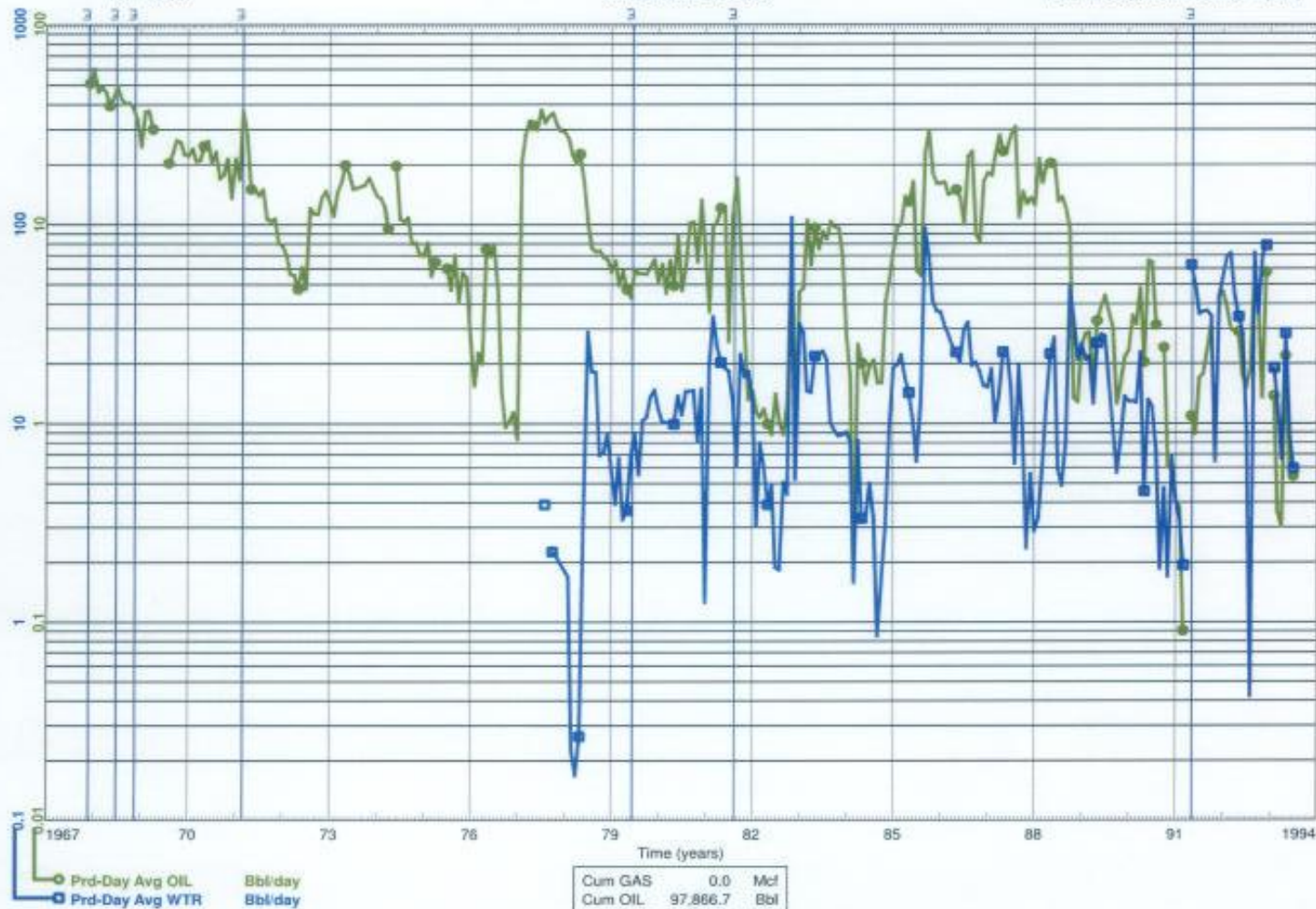


wells)

Data As Of: 2011-01 (MB)  
 From: 1967-12  
 To: 1993-07

INDIVIDUAL PRODUCTION  
 Waskada Unit No. 1  
 100/12-30-001-25W1/00

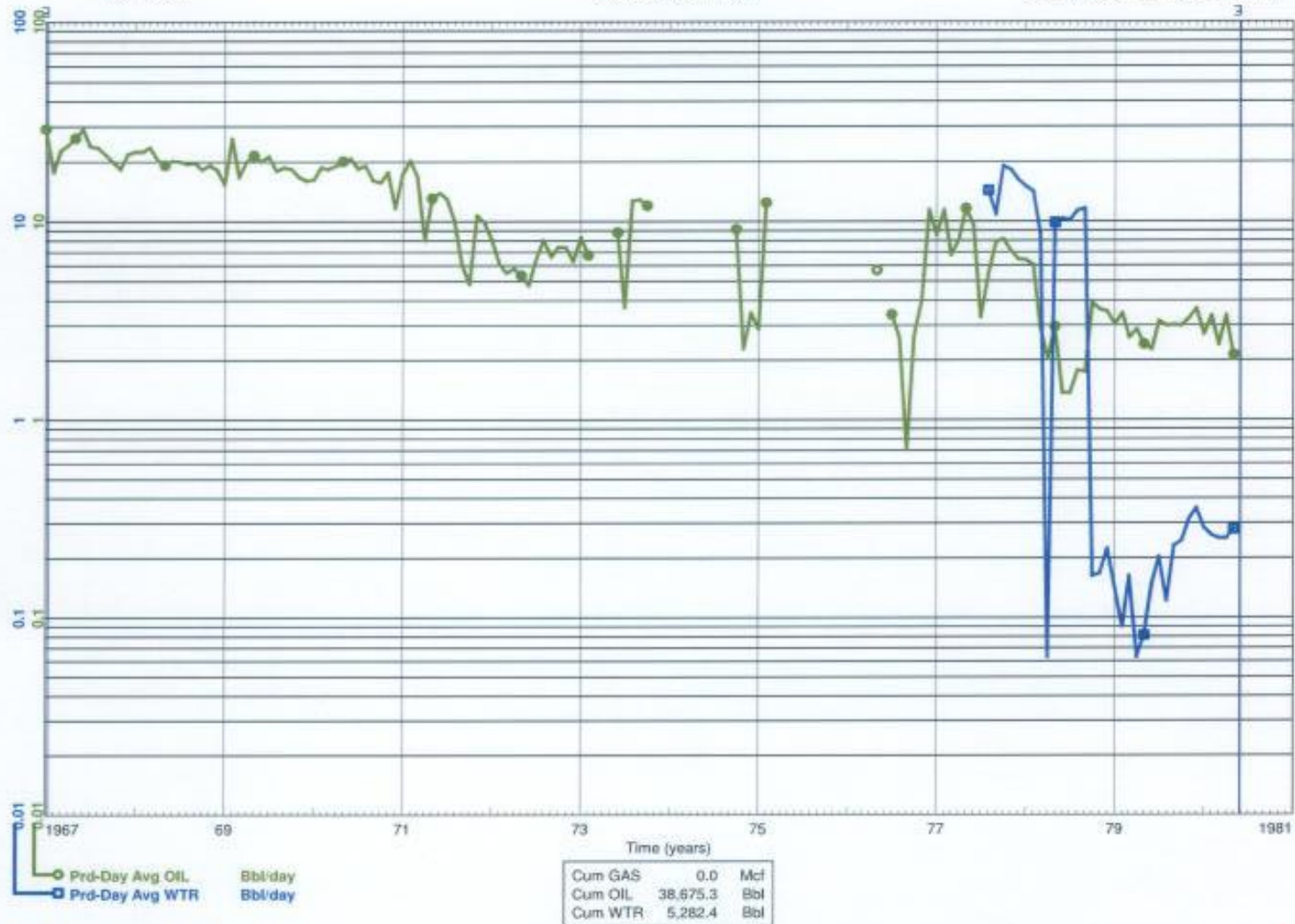
Status: Abandoned Producer  
 Field: WASKADA (03)  
 Pool: MISSION CANYON 3b A (42A)



Data As Of: 2011-01 (MB)  
From: 1967-01  
To: 1980-05

INDIVIDUAL PRODUCTION  
Waskada Unit No. 3 WSW  
100/11-30-001-25W1/00

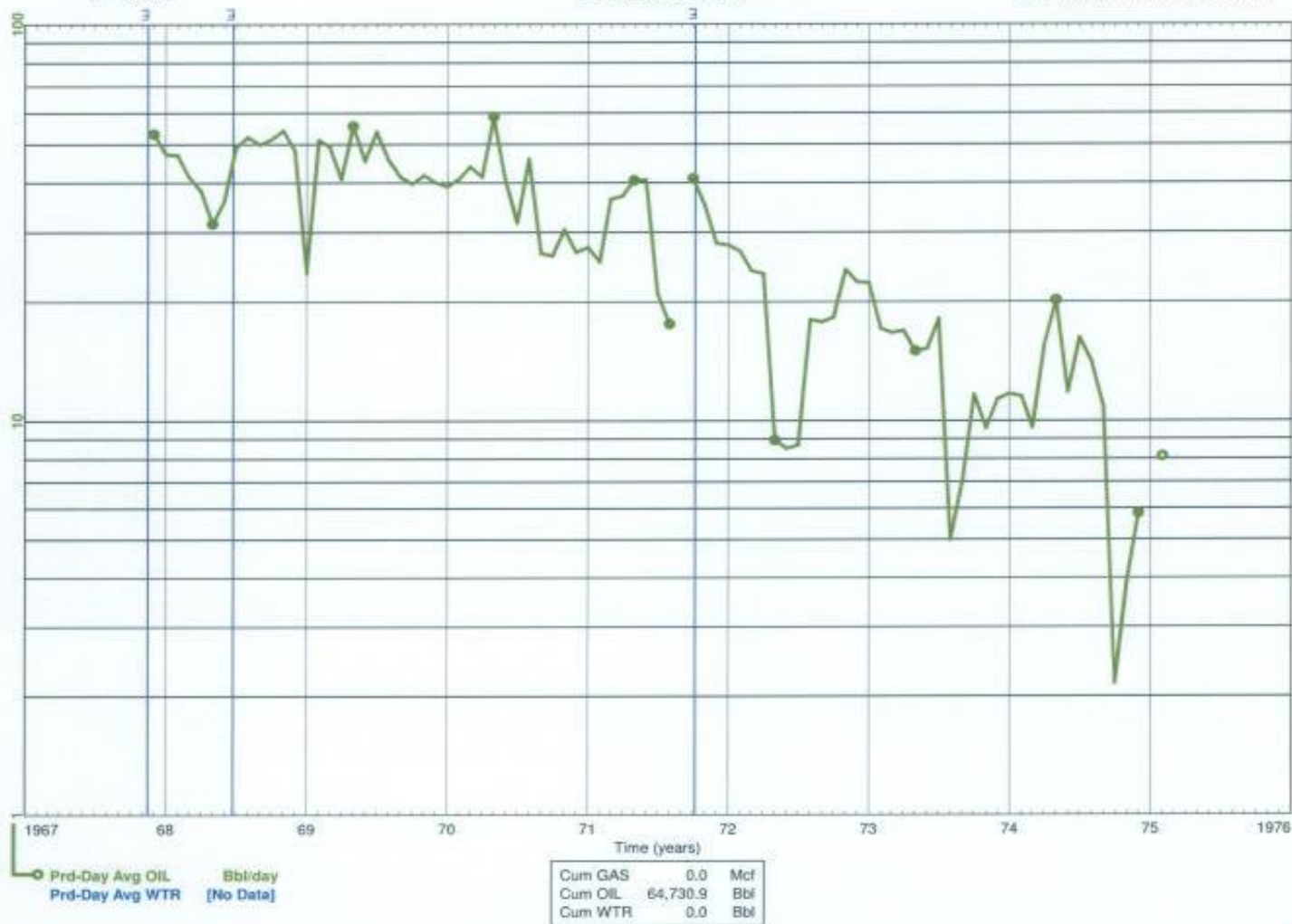
Status: Abandoned Producer  
Field: WASKADA (03)  
Pool: MISSION CANYON 3b A (42A)



Data As Of: 2011-01 (MB)  
From: 1967-12  
To: 1975-02

INDIVIDUAL PRODUCTION  
Waskada Unit No. 1 WIW  
100/06-30-001-25W1/00

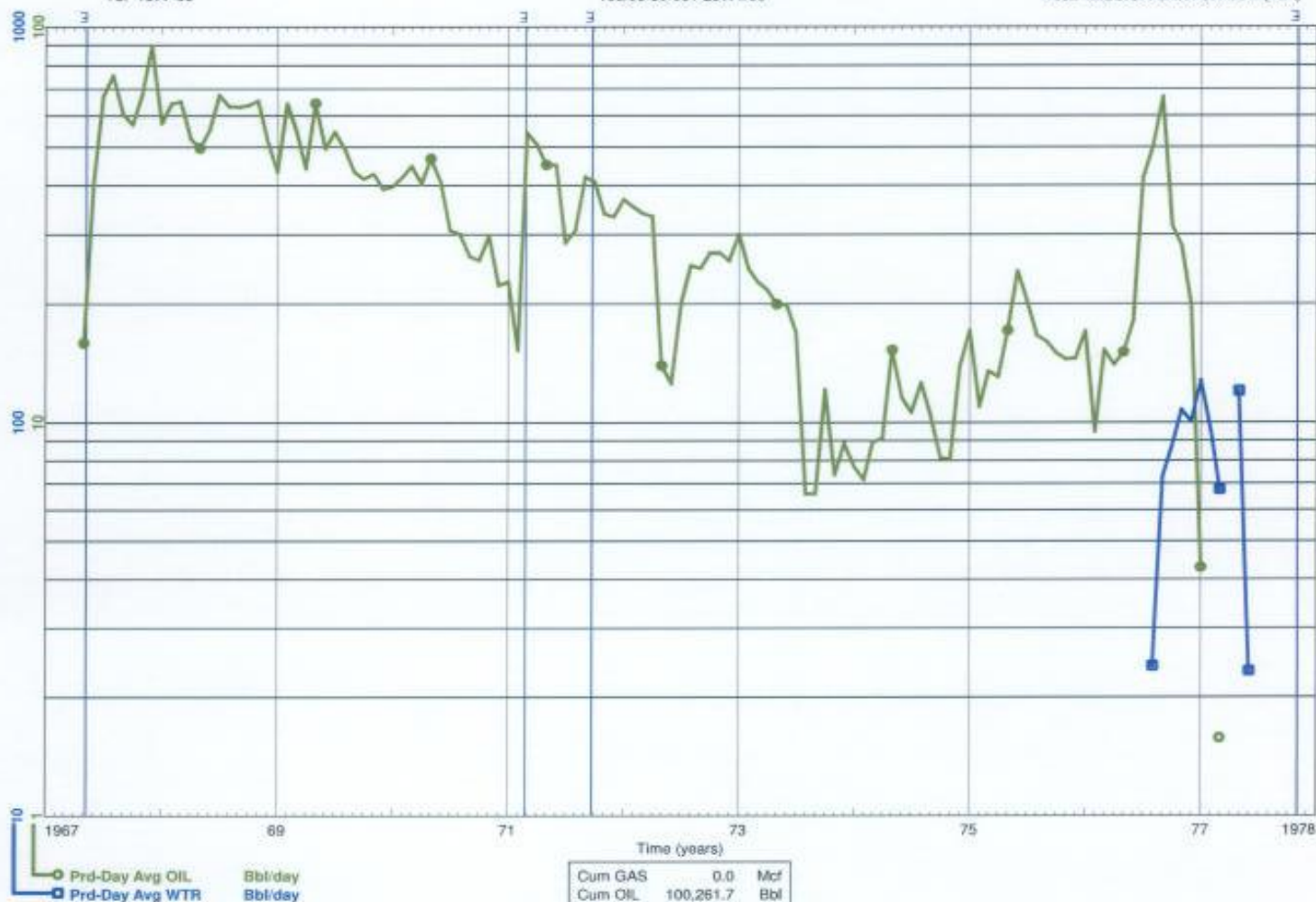
Status: Abandoned Water Inj Well  
Field: WASKADA (03)  
Pool: MISSION CANYON 3b A (42A)



Data As Of: 2011-01 (MB)  
 From: 1967-05  
 To: 1977-06

INDIVIDUAL PRODUCTION  
 Waskada Unit No. 3 WIW  
 100/05-30-001-25W1/00

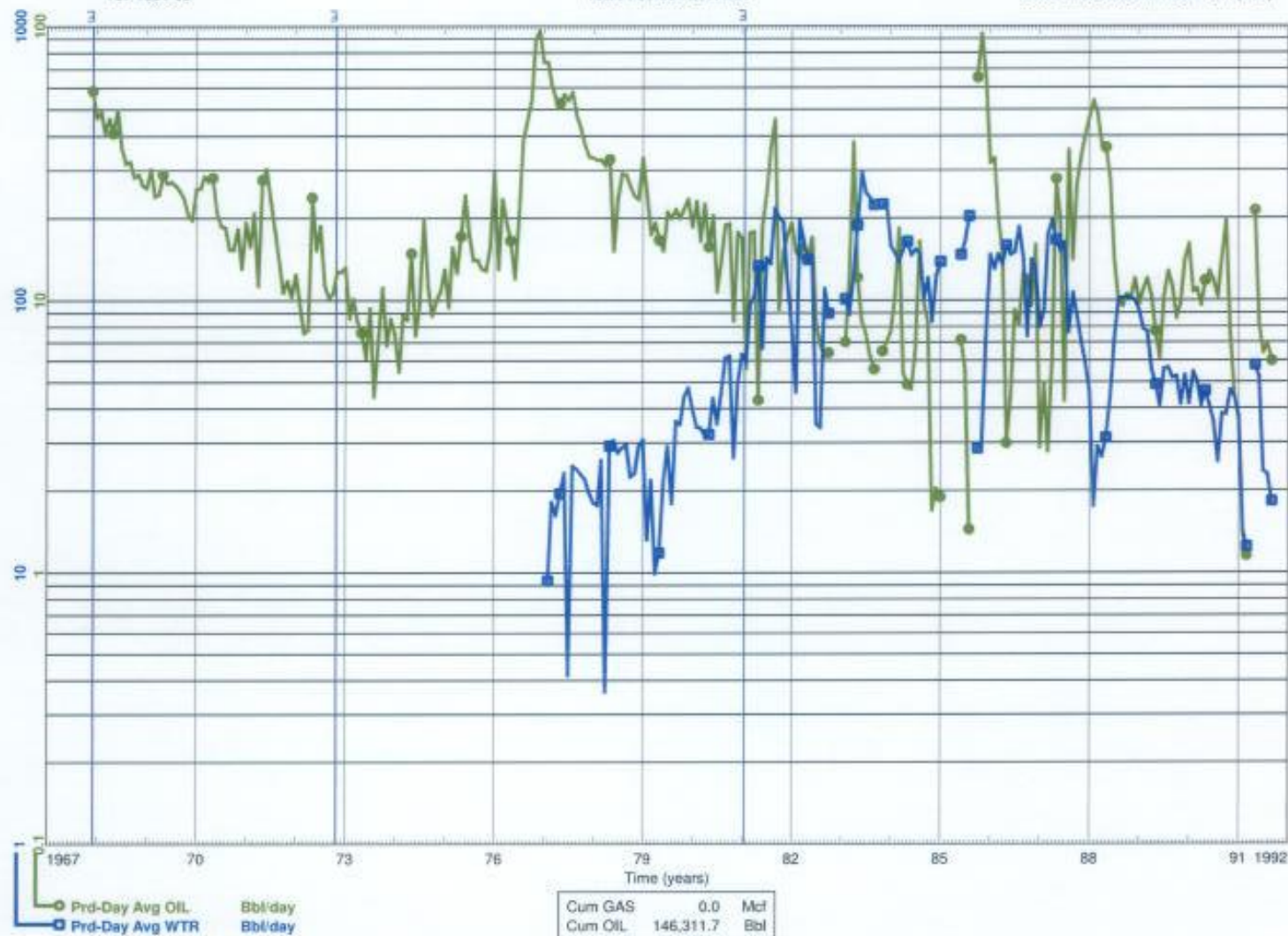
Status: Abandoned Producer  
 Field: WASKADA (03)  
 Pool: MISSION CANYON 3b A (42A)



Data As Of: 2011-01 (MB)  
 From: 1967-12  
 To: 1991-09

INDIVIDUAL PRODUCTION  
 Omega Waskada  
 100/04-30-001-25W1/00

Status: Abandoned Producer  
 Field: WASKADA (03)  
 Pool: MISSION CANYON 3b A (42A)



Data As Of: 2011-01 (MB)  
From: 1967-12  
To: 2011-01

INDIVIDUAL PRODUCTION  
Waskada Unit No. 1  
100/03-30-001-25W1/00

Status: Capable Of Oil Prod  
Field: WASKADA (03)  
Pool: MISSION CANYON 3b A (42A)

