

**NORTH EBOR UNIT NO. 1  
WATERFLOOD EOR PROJECT**

**ANNUAL REPORT FOR 2013**

**March 3, 2014**

**Tundra Oil and Gas Partnership**

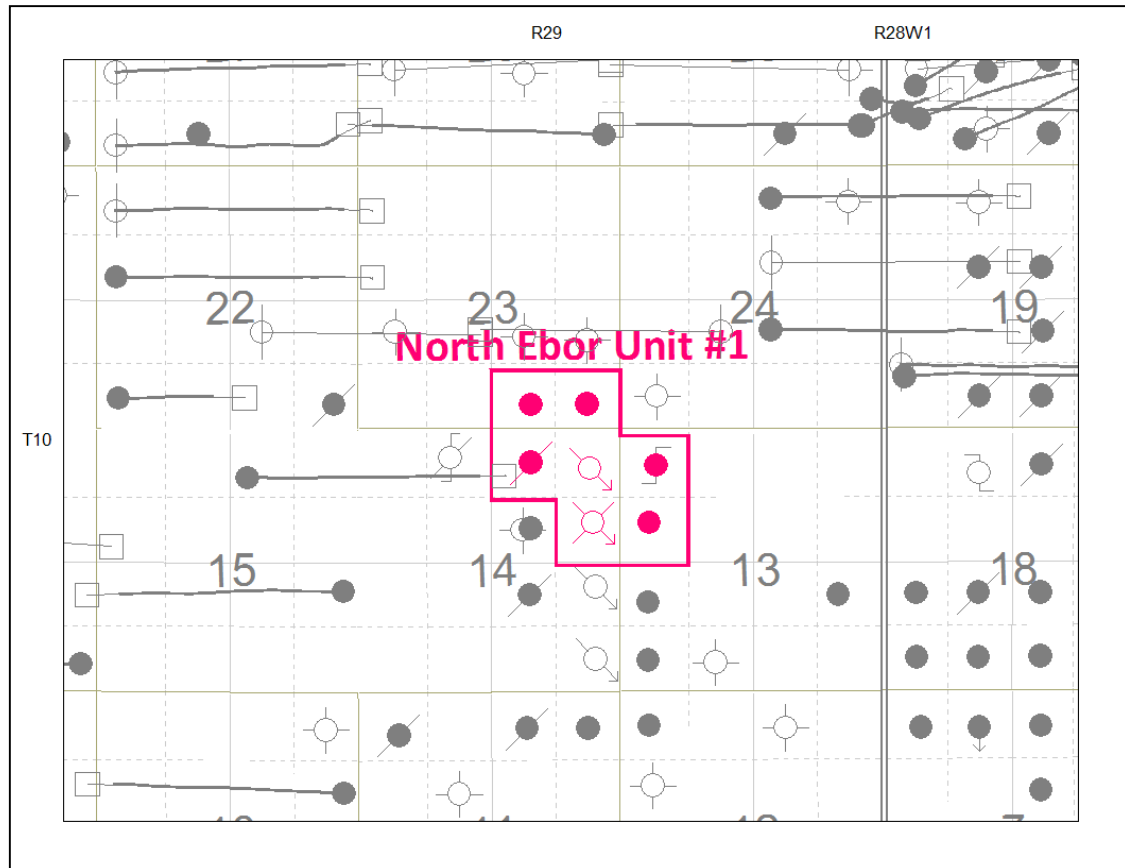
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## **INTRODUCTION**

North Ebor Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 62 effective July 1, 1990 with Tundra Oil and Gas as Operator. The EOR project area, outlined in Figure 1, contains 7 wells over 7 LSDs in Township 10, Range 29 W1. Well list and well status is available in Appendix A.

**Figure 1: North Ebor Unit # 1 Area Outline**



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra submits the following 2013 Annual Progress Report for North Ebor Unit No. 1 as required by Board Order No. PM 62.

## **DISCUSSION**

### **Production History**

For the wells included in North Ebor Unit No. 1, production started in June 1987 with 00/16-14-010-29W1/00 (00/16-14). Oil production peaked at 21.5 m<sup>3</sup>/d in August of 1989. In December 2013, the Unit was producing 0.88 m<sup>3</sup>/d of oil and 3.69 m<sup>3</sup>/d of water and had a WOR of 4.17 m<sup>3</sup>/m<sup>3</sup>. The oil production rate, injection rate, and WOR during

each month for each injection pattern and for whole project are presented in Appendix D. The rates and WOR are presented in Figure 2.

**Figure 2: North Ebor Unit No.1 Production/Injection Rates and WOR vs. Time**

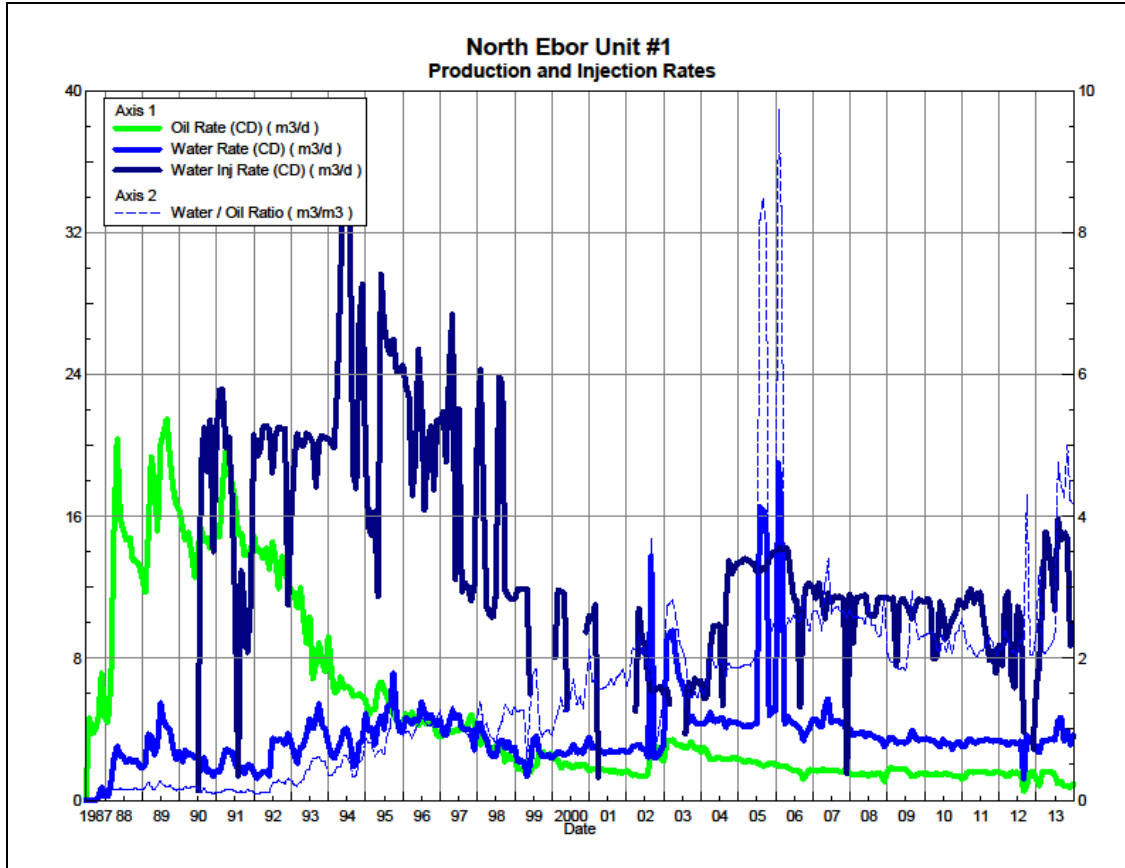
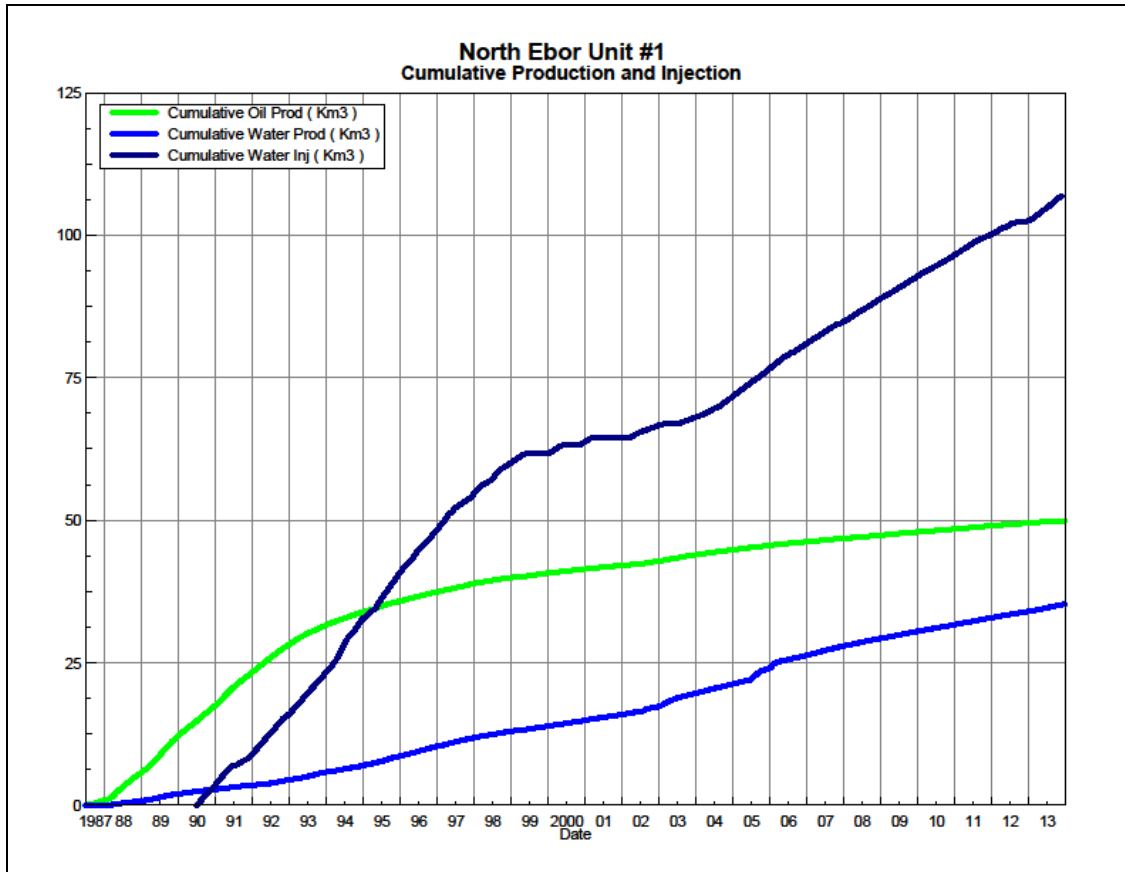


Figure 3 shows the cumulative production for North Ebor Unit No. 1 to the end of December 2013 as 49.9 E³m³ of oil, and 35.3 E³m³ of water. The cumulative water injected is 106.9 E³m³. The cumulative volume of oil, and water produced and fluid injected is presented in Appendix D.

**Figure 3: North Ebor Unit No. 1 Cumulative Oil, and Water Injected vs. Time**



### **Waterflood History**

Water injection started in June 1990 in the two injector's 00/09-14-010-29W1/0 (00/09-14) and 00/16-14-0101-29W1/0 (00/16-14). The 00/09-14 injector has been abandoned since September 1998, and water is only being injected through the 00/16-14 injector. In November 2013, the 00/16-14 vertical injector was suspended pending system modifications. An overall summary for each injector pattern is presented in Appendix C.

Any future revisions to the waterflood development or surveillance plan would be based on new production or performance response data, technical studies, or observed reservoir behavior and reserves recovery interpretations.

## **Waterflood EOR Operating Strategy and Performance**

### **Water Source and Quality**

Until November 2013, the injection water for North Ebor Unit No. 1 was being sourced from the 00/13-13-010-29W1/00 well (Lodgepole formation). Injected fluid consisted of produced water from the Lodgepole formation, from the unit and surrounding area. Injection water for North Ebor Unit No. 1 will in the future be supplied from the Jurassic source water well at 100/02-25-010-29W1 (2-25). Tundra received approval from the Petroleum Branch in March 2013 to use the 2-25 well as a source water well for waterflood operations. Jurassic-sourced water will be pumped from the 2-25 source well to the Daly 12-24-10-29 battery, where it will be filtered to 50 microns and then pumped up to injection system pressure.

### **Injection Wellhead Pressures**

The monthly wellhead injection pressure is summarized in Appendix B, and shows all injection pressure since 2003. Average injection pressure from injector 00/16-14 was about 1310 kPag in 2013.

### **Reservoir Pressure**

No reservoir pressure measurements were taken at North Ebor Unit No. 1 in 2013.

### **Well Servicing**

Table 1 lists the maintenance that was required in North Ebor Unit No. 1 in 2013.

**Table 1: Service and Maintenance in Kola Unit No. 2**

00/01-23-010-29W1/0	Pump Change	07/03/2013
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### **Voidage Replacement**

Cumulative voidage for the North Ebor Unit No. 1 was 1.204 in December 2013. As of 1990, monthly voidage is significantly greater than 1, and in June of 1997 cumulative VRR was 1. Calculation, plots and tables of the Voidage Replacement Ratio on a monthly and cumulative basis for each injection pattern and for the project area are presented in Appendix D.

### **Waterflood Performance Discussion**

The original oil-in-place (OOIP) of the Unit is estimated at 330.0 E<sup>3</sup>m<sup>3</sup>. In 2013, the recovery factor of the Unit is 15.1% based on 49.9 E<sup>3</sup>m<sup>3</sup> of cumulative oil recovered to date. The ultimate expected recoverable reserve based on decline analysis is 54.0 E<sup>3</sup>m<sup>3</sup> or an ultimate recovery factor of 16.4%.

The overall performance of this waterflood has been good as indicated by waterflood response observable in the individual wells and the recovery factor is above what is attainable under primary production. However sweep efficiency has been disappointing given the volume of water injected over time and any increased or supported oil rates, that may be as a result of injected water sweeping the reservoir, are not sustained for a very long time.

Trends in production are very stable and at a mature state. No changes are anticipated in the future trends. Optimization of the waterflood will be evaluated to understand why the sweep efficiency is not higher.

## **List of Appendices**

Appendix A: Well Name and Well Status

Appendix B: Monthly Injection Wellhead Pressures Table and Plots

Appendix C: North Ebor No.1 Injection Pattern Summary

Appendix D: Injector Pattern Production/Injection Rates, Cumulative and VRRs

Plots and Tables for the following injectors:

00/16-14-010-29W1/0



## Appendix A

UWI	Well Status
100/12-13-010-29W1/00	Capable of OIL Prod
100/13-13-010-29W1/00	ABD WTR Source
100/09-14-010-29W1/00	ABD WTR Injection
100/15-14-010-29W1/00	ABD Producer
100/16-14-010-29W1/00	WTR Injection
100/01-23-010-29W1/00	Capable of OIL Prod
100/02-23-010-29W1/00	Capable of OIL Prod

## Appendix B

### Average Monthly Injection Pressure (kPag)

Injection Pressure		Injection Pressure		Injection Pressure		Injection Pressure	
Month	100/16-14	Month	100/16-14	Month	100/16-14	Month	100/16-14
		Jan-05	7770	Jan-08	6523	Jan-11	9600
		Feb-05	7770	Feb-08	8986	Feb-11	9600
		Mar-05	7770	Mar-08	9284	Mar-11	9755
		Apr-05	7708	Apr-08	9470	Apr-11	10800
		May-05	7400	May-08	9400	May-11	10800
		Jun-05	7400	Jun-08	7893	Jun-11	10783
		Jul-05	7400	Jul-08	6258	Jul-11	10406
Aug-02	1583	Aug-05	7400	Aug-08	8417	Aug-11	10155
Sep-02	3815	Sep-05	8090	Sep-08	7930	Sep-11	10003
Oct-02	11075	Oct-05	8300	Oct-08	8000	Oct-11	9510
Nov-02	11364	Nov-05	8300	Nov-08	7917	Nov-11	9820
Dec-02	11723	Dec-05	8300	Dec-08	7732	Dec-11	9900
Jan-03	11976	Jan-06	8300	Jan-09	7656	Jan-12	9629
Feb-03	11647	Feb-06	8441	Feb-09	7739	Feb-12	9500
Mar-03	4119	Mar-06	8480	Mar-09	3495	Mar-12	9710
Apr-03	2488	Apr-06	8483	Apr-09	6927	Apr-12	9977
May-03	1773	May-06	8678	May-09	7200	May-12	9900
Jun-03	1347	Jun-06	8601	Jun-09	7200	Jun-12	9870
Jul-03	2683	Jul-06	8600	Jul-09	7400	Jul-12	9419
Aug-03	4697	Aug-06	4994	Aug-09	7400	Aug-12	9600
Sep-03	5600	Sep-06	6585	Sep-09	7400	Sep-12	9600
Oct-03	6247	Oct-06	8406	Oct-09	8290	Oct-12	0
Nov-03	6440	Nov-06	8720	Nov-09	8909	Nov-12	385
Dec-03	6830	Dec-06	8657	Dec-09	9373	Dec-12	1071
Jan-04	6830	Jan-07	9116	Jan-10	9400	Jan-13	1149
Feb-04	6830	Feb-07	8945	Feb-10	9401	Feb-13	1156
Mar-04	6830	Mar-07	9000	Mar-10	9432	Mar-13	1200
Apr-04	6830	Apr-07	8700	Apr-10	6587	Apr-13	1250
May-04	7501	May-07	9000	May-10	9168	May-13	1268
Jun-04	7600	Jun-07	8910	Jun-10	9733	Jun-13	1299
Jul-04	7600	Jul-07	8974	Jul-10	10123	Jul-13	1347
Aug-04	7600	Aug-07	9000	Aug-10	10200	Aug-13	1371
Sep-04	7813	Sep-07	9000	Sep-10	9910	Sep-13	1404
Oct-04	7770	Oct-07	9001	Oct-10	9600	Oct-13	1425
Nov-04	7770	Nov-07	300	Nov-10	9600	Nov-13	1425
Dec-04	7770	Dec-07	7897	Dec-10	9600	Dec-13	1425

## Appendix C

### North Ebor Unit No. 1 Pattern Summary as of December 2013

Pattern Name	Injector Location (010-29W1)	Status	Supported Wells (010-29W1)	No. of Supported Wells	Allocation Factor	Pattern Prod Start Month	Inj Start Month	Oil Rate (m³/d)	Water Rate (m³/d)	WOR (m³/m³)	Water Injection (m³/d)	Cum Oil (E³m³)	Cum Water (E³m³)	Cum Inj Water (E³m³)	Monthly VRR	Cum VRR
00/16-14-010-29W1 Injector	00/16-14	WTR Injection	01-23, 02-23, 09-14, 12-13, 13-13, 15-14	6	1	Jun 1987	Jun 1990	0.9	3.7	4.17	0.0	49.9	35.3	106.9	0.0	1.20

**Appendix D**  
**Rates and VRR**  
**Plots and Tables**

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 4.17 m3/m3

Pattern: 00/16-14-010-29Inj Set: NorthEborUnit#1

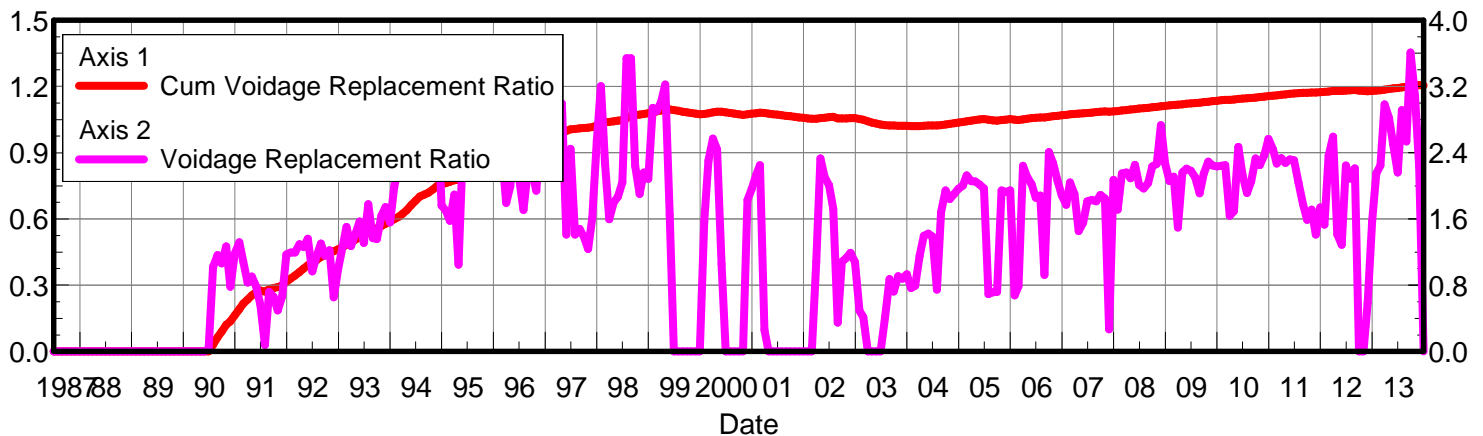
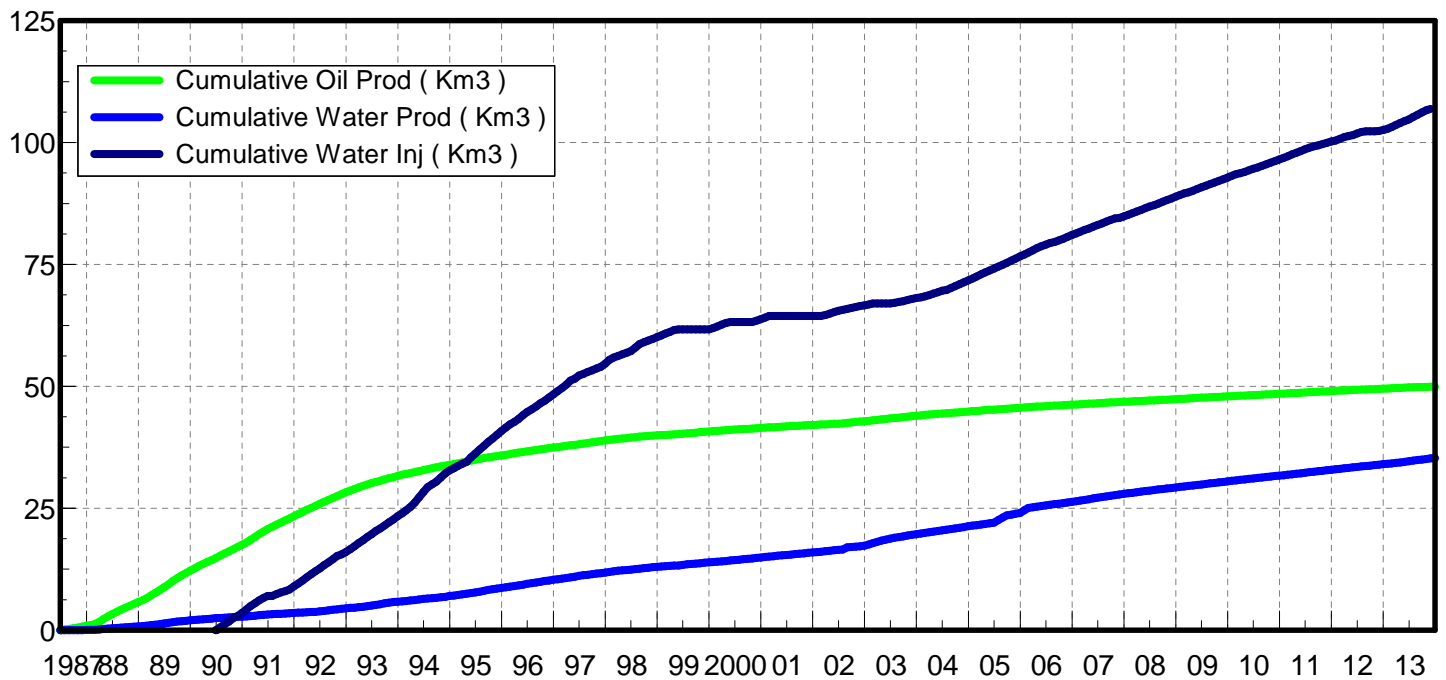
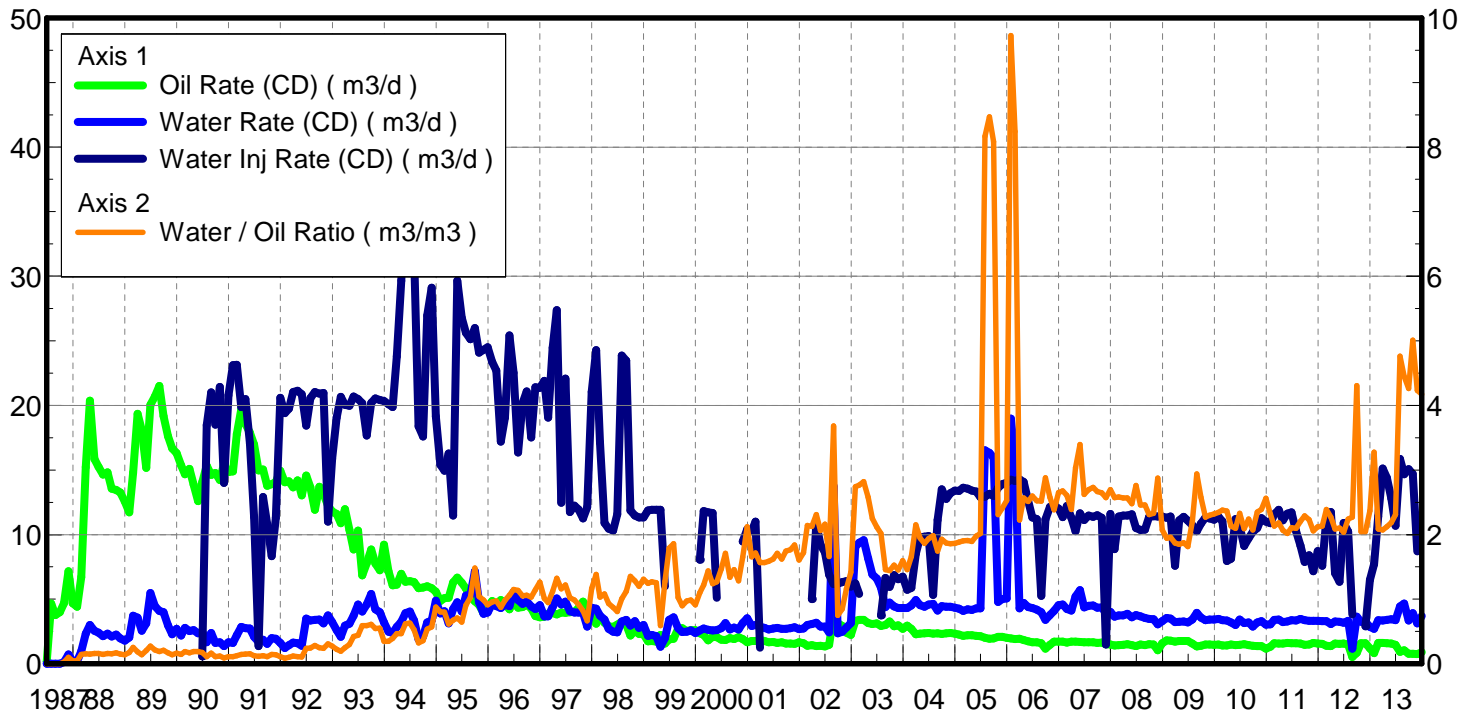
February 26, 2014

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 0.88 m3/d

Water Rate (CD) : 3.69 m3/d

Water Inj Rate (CD) : 8.71 m3/d



Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
6/30/1987	0.16	0.00	0.00		0.00	0.00	0.00	0.000	0.000
7/31/1987	4.65	0.01	0.00		0.15	0.00	0.00	0.000	0.000
8/31/1987	3.76	0.01	0.00		0.27	0.00	0.00	0.000	0.000
9/30/1987	4.00	0.00	0.00		0.39	0.00	0.00	0.000	0.000
10/31/1987	4.68	0.13	0.03		0.53	0.00	0.00	0.000	0.000
11/30/1987	7.16	0.73	0.10		0.75	0.03	0.00	0.000	0.000
12/31/1987	4.69	0.21	0.05		0.89	0.03	0.00	0.000	0.000
1/31/1988	4.43	0.21	0.05		1.03	0.04	0.00	0.000	0.000
2/29/1988	6.71	0.96	0.14		1.22	0.07	0.00	0.000	0.000
3/31/1988	15.21	2.32	0.15		1.69	0.14	0.00	0.000	0.000
4/30/1988	20.36	3.00	0.15		2.30	0.23	0.00	0.000	0.000
5/31/1988	15.85	2.55	0.16		2.80	0.31	0.00	0.000	0.000
6/30/1988	15.24	2.41	0.16		3.25	0.38	0.00	0.000	0.000
7/31/1988	14.65	2.13	0.15		3.71	0.45	0.00	0.000	0.000
8/31/1988	14.82	2.33	0.16		4.17	0.52	0.00	0.000	0.000
9/30/1988	13.56	2.10	0.16		4.57	0.58	0.00	0.000	0.000
10/31/1988	13.45	2.26	0.17		4.99	0.65	0.00	0.000	0.000
11/30/1988	13.27	1.97	0.15		5.39	0.71	0.00	0.000	0.000
12/31/1988	12.57	1.78	0.14		5.78	0.77	0.00	0.000	0.000
1/31/1989	11.73	2.03	0.17		6.14	0.83	0.00	0.000	0.000
2/28/1989	14.78	3.73	0.25		6.56	0.93	0.00	0.000	0.000
3/31/1989	19.36	3.57	0.18		7.16	1.04	0.00	0.000	0.000
4/30/1989	18.10	2.55	0.14		7.70	1.12	0.00	0.000	0.000
5/31/1989	15.17	3.13	0.21		8.17	1.22	0.00	0.000	0.000
6/30/1989	20.04	5.47	0.27		8.77	1.38	0.00	0.000	0.000
7/31/1989	20.69	4.45	0.22		9.41	1.52	0.00	0.000	0.000
8/31/1989	21.50	4.09	0.19		10.08	1.65	0.00	0.000	0.000
9/30/1989	19.17	3.99	0.21		10.65	1.77	0.00	0.000	0.000
10/31/1989	17.62	2.98	0.17		11.20	1.86	0.00	0.000	0.000
11/30/1989	16.68	2.29	0.14		11.70	1.93	0.00	0.000	0.000
12/31/1989	16.31	2.70	0.17		12.21	2.01	0.00	0.000	0.000
1/31/1990	15.35	2.19	0.14		12.68	2.08	0.00	0.000	0.000
2/28/1990	14.67	2.79	0.19		13.09	2.16	0.00	0.000	0.000
3/31/1990	15.09	2.53	0.17		13.56	2.24	0.00	0.000	0.000
4/30/1990	13.88	2.61	0.19		13.98	2.31	0.00	0.000	0.000
5/31/1990	12.58	2.36	0.19		14.37	2.39	0.00	0.000	0.000
6/30/1990	14.06	2.48	0.18	0.57	14.79	2.46	0.02	0.033	0.001
7/31/1990	15.35	1.67	0.11	18.47	15.26	2.51	0.59	1.021	0.031
8/31/1990	14.63	2.39	0.16	21.02	15.72	2.59	1.24	1.165	0.064
9/30/1990	14.78	1.60	0.11	18.50	16.16	2.64	1.80	1.063	0.090
10/31/1990	14.23	1.67	0.12	21.44	16.60	2.69	2.46	1.270	0.120
11/30/1990	15.46	1.38	0.09	14.00	17.07	2.73	2.88	0.781	0.137
12/31/1990	14.85	1.66	0.11	20.78	17.53	2.78	3.53	1.185	0.164
1/31/1991	14.89	1.62	0.11	23.12	17.99	2.83	4.24	1.318	0.192
2/28/1991	17.77	2.22	0.12	23.13	18.48	2.89	4.89	1.090	0.216
3/31/1991	19.69	2.86	0.15	19.86	19.10	2.98	5.51	0.830	0.235
4/30/1991	18.56	2.76	0.15	20.49	19.65	3.06	6.12	0.906	0.254
5/31/1991	17.88	2.74	0.15	17.06	20.21	3.15	6.65	0.781	0.269

Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
6/30/1991	16.97	2.08	0.12	11.37	20.72	3.21	6.99	0.562	0.276
7/31/1991	14.97	1.69	0.11	1.36	21.18	3.26	7.03	0.077	0.271
8/31/1991	15.04	1.87	0.12	12.92	21.65	3.32	7.43	0.720	0.281
9/30/1991	13.79	1.54	0.11	10.81	22.06	3.37	7.76	0.664	0.288
10/31/1991	13.90	2.00	0.14	8.33	22.49	3.43	8.02	0.494	0.292
11/30/1991	14.07	1.94	0.14	11.29	22.91	3.49	8.35	0.665	0.298
12/31/1991	14.93	1.60	0.11	20.58	23.38	3.54	8.99	1.171	0.315
1/31/1992	14.04	1.23	0.09	19.40	23.81	3.58	9.59	1.194	0.330
2/29/1992	14.13	1.43	0.10	19.74	24.22	3.62	10.17	1.193	0.344
3/31/1992	13.65	1.63	0.12	21.03	24.64	3.67	10.82	1.296	0.360
4/30/1992	14.19	1.59	0.11	21.13	25.07	3.72	11.45	1.261	0.375
5/31/1992	13.05	1.39	0.11	20.86	25.47	3.76	12.10	1.360	0.390
6/30/1992	14.58	3.49	0.24	18.44	25.91	3.86	12.65	0.967	0.401
7/31/1992	13.65	3.34	0.24	20.57	26.33	3.97	13.29	1.147	0.414
8/31/1992	11.93	3.40	0.29	21.05	26.70	4.07	13.94	1.303	0.427
9/30/1992	13.71	3.42	0.25	20.90	27.12	4.17	14.57	1.156	0.439
10/31/1992	13.13	3.14	0.24	20.95	27.52	4.27	15.22	1.220	0.452
11/30/1992	12.25	3.75	0.31	11.00	27.89	4.38	15.55	0.653	0.455
12/31/1992	11.80	3.23	0.27	15.89	28.26	4.48	16.04	1.003	0.462
1/31/1993	11.59	2.61	0.22	19.05	28.61	4.57	16.63	1.269	0.473
2/28/1993	10.89	2.09	0.19	20.67	28.92	4.62	17.21	1.505	0.484
3/31/1993	11.97	2.96	0.25	20.04	29.29	4.72	17.83	1.272	0.495
4/30/1993	10.35	3.09	0.30	19.96	29.60	4.81	18.43	1.410	0.505
5/31/1993	8.84	3.71	0.42	20.69	29.88	4.92	19.07	1.571	0.517
6/30/1993	10.31	4.58	0.44	20.48	30.18	5.06	19.69	1.312	0.527
7/31/1993	6.84	4.03	0.59	20.16	30.40	5.19	20.31	1.777	0.539
8/31/1993	7.77	4.59	0.59	17.68	30.64	5.33	20.86	1.370	0.548
9/30/1993	8.86	5.40	0.61	20.20	30.90	5.49	21.47	1.358	0.557
10/31/1993	7.77	4.23	0.54	20.55	31.14	5.62	22.10	1.640	0.568
11/30/1993	7.23	3.99	0.55	20.43	31.36	5.74	22.72	1.744	0.578
12/31/1993	9.22	3.19	0.35	20.35	31.65	5.84	23.35	1.558	0.588
1/31/1994	7.16	2.48	0.35	20.10	31.87	5.92	23.97	1.984	0.599
2/28/1994	6.07	2.38	0.39	19.88	32.04	5.98	24.53	2.240	0.609
3/31/1994	6.13	2.86	0.47	23.79	32.23	6.07	25.26	2.527	0.623
4/30/1994	6.95	3.24	0.47	29.67	32.44	6.17	26.15	2.779	0.640
5/31/1994	6.34	3.93	0.62	35.74	32.63	6.29	27.26	3.338	0.662
6/30/1994	6.39	4.04	0.63	36.56	32.83	6.41	28.36	3.362	0.683
7/31/1994	6.33	3.34	0.53	31.78	33.02	6.52	29.34	3.143	0.702
8/31/1994	5.86	1.88	0.32	18.40	33.20	6.57	29.91	2.259	0.711
9/30/1994	5.90	2.10	0.36	17.59	33.38	6.64	30.44	2.090	0.719
10/31/1994	6.00	3.21	0.53	26.96	33.57	6.74	31.28	2.801	0.734
11/30/1994	5.85	3.34	0.57	29.11	33.74	6.84	32.15	3.036	0.749
12/31/1994	5.59	4.90	0.88	19.15	33.92	6.99	32.74	1.761	0.757
1/31/1995	4.85	3.90	0.80	15.42	34.07	7.11	33.22	1.698	0.763
2/28/1995	5.08	4.06	0.80	14.95	34.21	7.22	33.64	1.576	0.768
3/31/1995	5.10	3.13	0.61	16.27	34.37	7.32	34.15	1.895	0.775
4/30/1995	6.29	4.23	0.67	11.47	34.55	7.45	34.49	1.046	0.777
5/31/1995	6.67	4.75	0.71	29.66	34.76	7.59	35.41	2.497	0.791

Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
6/30/1995	6.26	4.03	0.64	26.79	34.95	7.71	36.21	2.498	0.803
7/31/1995	5.83	5.28	0.91	25.62	35.13	7.88	37.01	2.227	0.814
8/31/1995	5.20	5.34	1.03	25.13	35.29	8.04	37.79	2.305	0.825
9/30/1995	4.82	7.15	1.48	25.99	35.44	8.26	38.57	2.111	0.836
10/31/1995	4.55	4.75	1.04	24.09	35.58	8.41	39.31	2.505	0.846
11/30/1995	3.93	3.87	0.98	24.30	35.69	8.52	40.04	3.012	0.858
12/31/1995	4.34	3.96	0.91	24.51	35.83	8.64	40.80	2.849	0.869
1/31/1996	4.85	4.64	0.96	23.35	35.98	8.79	41.53	2.375	0.879
2/29/1996	4.60	4.47	0.97	22.71	36.11	8.92	42.18	2.419	0.887
3/31/1996	4.94	4.30	0.87	17.19	36.27	9.05	42.72	1.794	0.893
4/30/1996	4.65	4.57	0.98	19.07	36.41	9.19	43.29	1.997	0.900
5/31/1996	4.21	4.47	1.06	25.43	36.54	9.33	44.08	2.835	0.911
6/30/1996	4.83	5.55	1.15	22.51	36.68	9.49	44.75	2.102	0.919
7/31/1996	4.34	4.94	1.14	16.36	36.82	9.65	45.26	1.709	0.923
8/31/1996	4.39	4.63	1.05	20.18	36.95	9.79	45.89	2.165	0.931
9/30/1996	4.57	4.84	1.06	21.08	37.09	9.93	46.52	2.168	0.938
10/31/1996	4.30	4.43	1.03	17.53	37.22	10.07	47.06	1.941	0.944
11/30/1996	3.70	4.23	1.14	21.42	37.33	10.20	47.70	2.617	0.952
12/31/1996	3.58	4.53	1.26	21.36	37.44	10.34	48.37	2.555	0.960
1/31/1997	3.64	3.68	1.01	21.91	37.56	10.45	49.04	2.894	0.969
2/28/1997	3.87	3.66	0.95	19.05	37.67	10.56	49.58	2.443	0.975
3/31/1997	3.91	4.38	1.12	24.46	37.79	10.69	50.34	2.855	0.985
4/30/1997	3.82	5.05	1.32	27.39	37.90	10.84	51.16	2.996	0.996
5/31/1997	3.96	4.59	1.16	12.46	38.02	10.99	51.54	1.411	0.998
6/30/1997	3.95	4.81	1.22	22.08	38.14	11.13	52.21	2.446	1.006
7/31/1997	3.98	4.07	1.02	11.75	38.27	11.26	52.57	1.411	1.008
8/31/1997	4.03	3.96	0.98	12.25	38.39	11.38	52.95	1.481	1.010
9/30/1997	4.31	3.96	0.92	11.95	38.52	11.50	53.31	1.393	1.012
10/31/1997	4.82	3.95	0.82	11.24	38.67	11.62	53.66	1.236	1.013
11/30/1997	4.33	2.88	0.66	12.12	38.80	11.71	54.02	1.613	1.015
12/31/1997	3.71	4.33	1.17	21.05	38.91	11.84	54.67	2.535	1.023
1/31/1998	3.09	4.27	1.38	24.29	39.01	11.97	55.43	3.205	1.032
2/28/1998	3.61	3.72	1.03	17.12	39.11	12.08	55.91	2.260	1.037
3/31/1998	3.17	3.43	1.08	10.91	39.21	12.18	56.24	1.598	1.039
4/30/1998	2.90	2.71	0.93	10.46	39.30	12.27	56.56	1.802	1.042
5/31/1998	2.85	2.48	0.87	10.31	39.39	12.34	56.88	1.865	1.044
6/30/1998	3.02	2.44	0.81	11.58	39.48	12.42	57.22	2.039	1.047
7/31/1998	3.24	3.27	1.01	23.86	39.58	12.52	57.96	3.541	1.057
8/31/1998	3.03	3.39	1.12	23.47	39.67	12.62	58.69	3.541	1.066
9/30/1998	2.18	2.96	1.36	11.87	39.74	12.71	59.05	2.242	1.070
10/31/1998	2.56	3.29	1.28	11.46	39.82	12.81	59.40	1.901	1.072
11/30/1998	2.31	2.77	1.20	11.33	39.88	12.90	59.74	2.162	1.076
12/31/1998	2.28	2.99	1.31	11.32	39.96	12.99	60.09	2.084	1.079
1/31/1999	1.75	2.17	1.24	11.87	40.01	13.06	60.46	2.942	1.083
2/28/1999	1.76	2.23	1.27	11.92	40.06	13.12	60.80	2.901	1.086
3/31/1999	1.70	2.14	1.26	11.93	40.11	13.18	61.17	3.012	1.091
4/30/1999	2.23	1.32	0.59	11.92	40.18	13.22	61.52	3.221	1.095
5/31/1999	1.55	1.98	1.27	6.00	40.23	13.29	61.71	1.648	1.096



Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
6/30/1999	1.90	3.39	1.79		40.28	13.39	61.71	0.000	1.093
7/31/1999	1.94	3.59	1.86		40.34	13.50	61.71	0.000	1.089
8/31/1999	2.69	2.76	1.03		40.43	13.58	61.71	0.000	1.086
9/30/1999	2.75	2.46	0.90		40.51	13.66	61.71	0.000	1.083
10/31/1999	2.54	2.47	0.97		40.59	13.73	61.71	0.000	1.080
11/30/1999	2.60	2.57	0.99		40.67	13.81	61.71	0.000	1.077
12/31/1999	2.60	2.38	0.91		40.75	13.89	61.71	0.000	1.074
1/31/2000	2.35	2.59	1.10	8.05	40.82	13.97	61.96	1.576	1.075
2/29/2000	2.24	2.73	1.22	11.83	40.88	14.05	62.30	2.304	1.078
3/31/2000	1.82	2.62	1.44	11.73	40.94	14.13	62.67	2.569	1.082
4/30/2000	2.08	2.57	1.24	11.68	41.00	14.20	63.02	2.437	1.085
5/31/2000	2.06	2.62	1.27	5.10	41.07	14.29	63.17	1.057	1.085
6/30/2000	1.87	2.75	1.47		41.12	14.37	63.17	0.000	1.083
7/31/2000	1.84	3.14	1.71		41.18	14.46	63.17	0.000	1.080
8/31/2000	1.99	2.66	1.34		41.24	14.55	63.17	0.000	1.077
9/30/2000	1.92	2.79	1.46		41.30	14.63	63.17	0.000	1.074
10/31/2000	2.06	2.65	1.28		41.36	14.71	63.17	0.000	1.072
11/30/2000	1.90	3.14	1.65	9.46	41.42	14.81	63.46	1.827	1.074
12/31/2000	1.66	3.53	2.12	10.41	41.47	14.92	63.78	1.959	1.076
1/31/2001	1.76	2.93	1.66	10.25	41.53	15.01	64.10	2.129	1.079
2/28/2001	1.75	3.01	1.72	11.00	41.58	15.09	64.41	2.251	1.081
3/31/2001	1.83	2.87	1.57	1.25	41.63	15.18	64.45	0.258	1.079
4/30/2001	1.77	2.77	1.56		41.69	15.26	64.45	0.000	1.077
5/31/2001	1.67	2.65	1.58		41.74	15.35	64.45	0.000	1.074
6/30/2001	1.68	2.72	1.62		41.79	15.43	64.45	0.000	1.072
7/31/2001	1.62	2.77	1.71		41.84	15.51	64.45	0.000	1.070
8/31/2001	1.67	2.71	1.62		41.89	15.60	64.45	0.000	1.067
9/30/2001	1.56	2.71	1.74		41.94	15.68	64.45	0.000	1.065
10/31/2001	1.56	2.76	1.77		41.99	15.77	64.45	0.000	1.062
11/30/2001	1.54	2.83	1.84		42.03	15.85	64.45	0.000	1.060
12/31/2001	1.67	2.68	1.61		42.08	15.93	64.45	0.000	1.058
1/31/2002	1.58	2.73	1.72		42.13	16.02	64.45	0.000	1.055
2/28/2002	1.40	2.99	2.14		42.17	16.10	64.45	0.000	1.053
3/31/2002	1.44	3.06	2.13	5.01	42.22	16.20	64.60	1.088	1.053
4/30/2002	1.37	3.17	2.31	10.80	42.26	16.29	64.92	2.331	1.056
5/31/2002	1.40	2.88	2.06	9.21	42.30	16.38	65.21	2.108	1.058
6/30/2002	1.33	2.88	2.16	8.63	42.34	16.47	65.47	2.005	1.060
7/31/2002	1.46	2.43	1.66	6.89	42.39	16.54	65.68	1.724	1.062
8/31/2002	3.74	13.76	3.68	6.16	42.50	16.97	65.87	0.347	1.055
9/30/2002	3.15	2.37	0.75	6.20	42.60	17.04	66.06	1.082	1.055
10/31/2002	2.92	2.48	0.85	6.32	42.69	17.12	66.26	1.129	1.056
11/30/2002	2.41	2.80	1.16	6.40	42.76	17.20	66.45	1.192	1.056
12/31/2002	2.23	3.16	1.42	5.98	42.83	17.30	66.63	1.079	1.056
1/31/2003	3.31	9.08	2.74	6.23	42.93	17.58	66.83	0.493	1.053
2/28/2003	3.39	9.38	2.77	5.41	43.03	17.84	66.98	0.416	1.049
3/31/2003	3.40	9.57	2.82		43.13	18.14	66.98	0.000	1.042
4/30/2003	3.16	8.15	2.58		43.23	18.38	66.98	0.000	1.037
5/31/2003	3.07	6.91	2.25		43.32	18.60	66.98	0.000	1.032

Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
6/30/2003	3.11	6.59	2.12		43.41	18.80	66.98	0.000	1.027
7/31/2003	2.93	5.90	2.02	3.75	43.51	18.98	67.09	0.416	1.024
8/31/2003	3.01	4.39	1.46	6.65	43.60	19.11	67.30	0.874	1.024
9/30/2003	3.28	4.73	1.44	5.96	43.70	19.26	67.48	0.723	1.023
10/31/2003	2.91	4.44	1.53	6.87	43.79	19.39	67.69	0.910	1.022
11/30/2003	2.97	4.31	1.45	6.56	43.88	19.52	67.89	0.877	1.022
12/31/2003	2.71	4.32	1.60	6.74	43.96	19.66	68.10	0.934	1.021
1/31/2004	2.95	4.30	1.46	5.73	44.05	19.79	68.28	0.768	1.021
2/29/2004	2.71	4.50	1.66	5.87	44.13	19.92	68.45	0.793	1.020
3/31/2004	2.29	4.93	2.15	8.53	44.20	20.07	68.71	1.155	1.020
4/30/2004	2.33	4.53	1.95	9.79	44.27	20.21	69.00	1.394	1.021
5/31/2004	2.36	4.40	1.86	9.85	44.34	20.35	69.31	1.421	1.023
6/30/2004	2.37	4.59	1.94	9.89	44.42	20.48	69.61	1.388	1.024
7/31/2004	2.34	4.63	1.98	5.33	44.49	20.63	69.77	0.747	1.023
8/31/2004	2.35	4.11	1.75	11.13	44.56	20.76	70.12	1.680	1.025
9/30/2004	2.32	4.47	1.93	13.50	44.63	20.89	70.52	1.944	1.028
10/31/2004	2.36	4.41	1.87	12.77	44.70	21.03	70.92	1.841	1.030
11/30/2004	2.37	4.41	1.86	13.20	44.77	21.16	71.31	1.900	1.033
12/31/2004	2.33	4.34	1.86	13.40	44.85	21.29	71.73	1.964	1.036
1/31/2005	2.26	4.26	1.88	13.39	44.92	21.42	72.14	2.004	1.039
2/28/2005	2.15	4.10	1.91	13.63	44.98	21.54	72.52	2.128	1.041
3/31/2005	2.21	4.23	1.91	13.55	45.05	21.67	72.94	2.056	1.044
4/30/2005	2.20	4.18	1.90	13.41	45.11	21.80	73.35	2.053	1.047
5/31/2005	2.17	4.29	1.98	13.33	45.18	21.93	73.76	2.015	1.050
6/30/2005	2.12	4.28	2.02	12.89	45.24	22.06	74.15	1.967	1.053
7/31/2005	2.02	16.52	8.17	12.94	45.31	22.57	74.55	0.692	1.050
8/31/2005	1.93	16.34	8.47	13.15	45.37	23.08	74.96	0.715	1.047
9/30/2005	1.97	15.95	8.08	13.00	45.42	23.55	75.35	0.720	1.045
10/31/2005	2.07	4.79	2.31	13.64	45.49	23.70	75.77	1.946	1.047
11/30/2005	2.08	5.00	2.41	13.91	45.55	23.85	76.19	1.926	1.050
12/31/2005	2.00	5.07	2.53	14.03	45.61	24.01	76.62	1.945	1.053
1/31/2006	1.95	18.99	9.73	14.25	45.67	24.60	77.06	0.676	1.049
2/28/2006	1.92	15.83	8.24	14.15	45.73	25.04	77.46	0.791	1.048
3/31/2006	1.93	4.30	2.23	14.27	45.79	25.18	77.90	2.242	1.051
4/30/2006	1.84	4.72	2.57	14.08	45.84	25.32	78.32	2.106	1.054
5/31/2006	1.75	4.39	2.51	12.61	45.90	25.45	78.71	2.017	1.056
6/30/2006	1.66	4.32	2.60	11.32	45.95	25.58	79.05	1.855	1.058
7/31/2006	1.66	4.18	2.52	11.20	46.00	25.71	79.40	1.881	1.060
8/31/2006	1.58	3.99	2.52	5.26	46.05	25.84	79.56	0.926	1.060
9/30/2006	1.18	3.39	2.88	11.18	46.08	25.94	79.90	2.407	1.062
10/31/2006	1.47	3.78	2.58	12.15	46.13	26.06	80.28	2.271	1.065
11/30/2006	1.72	4.09	2.38	12.21	46.18	26.18	80.64	2.059	1.067
12/31/2006	1.71	4.54	2.65	12.02	46.23	26.32	81.02	1.888	1.069
1/31/2007	1.71	4.58	2.67	11.36	46.29	26.46	81.37	1.772	1.071
2/28/2007	1.63	4.25	2.61	12.22	46.33	26.58	81.71	2.040	1.073
3/31/2007	1.72	4.11	2.39	11.30	46.38	26.71	82.06	1.898	1.075
4/30/2007	1.72	5.22	3.03	10.26	46.44	26.86	82.37	1.455	1.076
5/31/2007	1.68	5.71	3.40	11.65	46.49	27.04	82.73	1.552	1.078

Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
6/30/2007	1.66	4.36	2.62	11.13	46.54	27.17	83.06	1.812	1.080
7/31/2007	1.67	4.50	2.70	11.48	46.59	27.31	83.42	1.829	1.081
8/31/2007	1.65	4.51	2.73	11.38	46.64	27.45	83.77	1.815	1.083
9/30/2007	1.63	4.34	2.67	11.50	46.69	27.58	84.12	1.892	1.085
10/31/2007	1.65	4.36	2.65	11.30	46.74	27.72	84.47	1.847	1.087
11/30/2007	1.52	3.91	2.57	1.49	46.79	27.83	84.51	0.270	1.085
12/31/2007	1.49	4.01	2.69	11.60	46.83	27.96	84.87	2.073	1.088
1/31/2008	1.42	3.66	2.57	8.88	46.88	28.07	85.15	1.714	1.089
2/29/2008	1.45	3.75	2.58	11.40	46.92	28.18	85.48	2.149	1.091
3/31/2008	1.46	3.75	2.57	11.46	46.96	28.30	85.83	2.161	1.093
4/30/2008	1.51	3.87	2.57	11.47	47.01	28.41	86.18	2.092	1.095
5/31/2008	1.45	3.58	2.48	11.56	47.05	28.52	86.53	2.254	1.098
6/30/2008	1.36	3.77	2.76	10.50	47.09	28.64	86.85	2.010	1.099
7/31/2008	1.49	3.66	2.46	10.35	47.14	28.75	87.17	1.969	1.101
8/31/2008	1.45	3.56	2.46	10.37	47.19	28.86	87.49	2.031	1.103
9/30/2008	1.51	3.48	2.31	11.37	47.23	28.96	87.83	2.233	1.105
10/31/2008	1.48	3.45	2.33	11.43	47.28	29.07	88.19	2.266	1.107
11/30/2008	1.06	3.04	2.88	11.40	47.31	29.16	88.53	2.734	1.110
12/31/2008	1.60	3.31	2.07	11.39	47.36	29.26	88.88	2.271	1.112
1/31/2009	1.82	3.54	1.94	11.30	47.41	29.37	89.23	2.057	1.114
2/28/2009	1.79	3.49	1.96	11.41	47.46	29.47	89.55	2.111	1.116
3/31/2009	1.73	3.22	1.87	7.58	47.52	29.57	89.79	1.496	1.117
4/30/2009	1.76	3.25	1.85	11.09	47.57	29.67	90.12	2.160	1.119
5/31/2009	1.75	3.28	1.87	11.37	47.63	29.77	90.47	2.206	1.121
6/30/2009	1.76	3.20	1.82	11.09	47.68	29.87	90.81	2.179	1.123
7/31/2009	1.56	3.43	2.20	10.72	47.73	29.97	91.14	2.102	1.125
8/31/2009	1.34	3.94	2.94	10.25	47.77	30.10	91.46	1.909	1.127
9/30/2009	1.39	3.57	2.58	10.86	47.81	30.20	91.78	2.147	1.128
10/31/2009	1.48	3.36	2.27	11.34	47.86	30.31	92.13	2.291	1.131
11/30/2009	1.49	3.42	2.30	11.26	47.90	30.41	92.47	2.244	1.133
12/31/2009	1.47	3.42	2.32	11.15	47.95	30.52	92.82	2.234	1.135
1/31/2010	1.49	3.48	2.34	11.38	47.99	30.62	93.17	2.243	1.137
2/28/2010	1.42	3.38	2.38	11.03	48.03	30.72	93.48	2.250	1.139
3/31/2010	1.41	3.34	2.37	7.95	48.08	30.82	93.72	1.638	1.140
4/30/2010	1.50	3.20	2.13	8.13	48.12	30.92	93.97	1.693	1.141
5/31/2010	1.43	3.00	2.10	11.21	48.16	31.01	94.32	2.471	1.143
6/30/2010	1.47	3.42	2.33	10.62	48.21	31.11	94.63	2.131	1.145
7/31/2010	1.51	3.15	2.09	9.11	48.26	31.21	94.92	1.915	1.146
8/31/2010	1.43	3.21	2.24	9.73	48.30	31.31	95.22	2.053	1.148
9/30/2010	1.39	2.89	2.07	10.20	48.34	31.40	95.52	2.330	1.150
10/31/2010	1.36	3.21	2.35	10.50	48.38	31.50	95.85	2.250	1.152
11/30/2010	1.38	3.29	2.39	11.28	48.43	31.60	96.19	2.369	1.154
12/31/2010	1.18	3.03	2.56	11.00	48.46	31.69	96.53	2.566	1.156
1/31/2011	1.32	3.05	2.32	10.88	48.50	31.78	96.87	2.441	1.158
2/28/2011	1.60	3.40	2.13	11.58	48.55	31.88	97.19	2.268	1.160
3/31/2011	1.57	3.43	2.18	11.92	48.60	31.99	97.56	2.335	1.162
4/30/2011	1.56	3.22	2.07	11.10	48.64	32.08	97.89	2.275	1.164
5/31/2011	1.62	3.28	2.02	11.62	48.69	32.18	98.25	2.317	1.166

Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
6/30/2011	1.60	3.37	2.10	11.71	48.74	32.28	98.61	2.306	1.168
7/31/2011	1.60	3.35	2.10	10.29	48.79	32.39	98.92	2.035	1.170
8/31/2011	1.57	3.46	2.21	9.14	48.84	32.50	99.21	1.777	1.171
9/30/2011	1.48	3.38	2.29	7.88	48.88	32.60	99.44	1.588	1.172
10/31/2011	1.49	3.32	2.23	8.39	48.93	32.70	99.70	1.711	1.173
11/30/2011	1.62	3.33	2.06	7.15	48.98	32.80	99.92	1.413	1.173
12/31/2011	1.57	3.34	2.12	8.72	49.03	32.90	100.19	1.739	1.174
1/31/2012	1.55	3.30	2.13	7.58	49.08	33.01	100.42	1.530	1.175
2/29/2012	1.38	3.30	2.39	11.29	49.12	33.10	100.75	2.360	1.177
3/31/2012	1.35	3.08	2.27	11.74	49.16	33.20	101.12	2.593	1.179
4/30/2012	1.57	3.28	2.08	7.01	49.20	33.30	101.33	1.413	1.179
5/31/2012	1.55	3.26	2.10	6.35	49.25	33.40	101.52	1.290	1.180
6/30/2012	1.56	3.18	2.04	10.91	49.30	33.49	101.85	2.247	1.181
7/31/2012	1.48	3.32	2.24	10.25	49.35	33.59	102.17	2.087	1.183
8/31/2012	0.52	1.17	2.27	3.81	49.36	33.63	102.29	2.211	1.184
9/30/2012	0.85	3.65	4.31		49.39	33.74	102.29	0.000	1.182
10/31/2012	1.59	3.26	2.05		49.44	33.84	102.29	0.000	1.180
11/30/2012	1.59	3.26	2.05	2.90	49.48	33.94	102.37	0.584	1.179
12/31/2012	1.20	2.85	2.37	6.49	49.52	34.03	102.57	1.568	1.179
1/31/2013	0.83	2.71	3.28	7.72	49.55	34.11	102.81	2.150	1.180
2/28/2013	1.61	3.36	2.09	11.43	49.59	34.21	103.13	2.247	1.182
3/31/2013	1.61	3.34	2.07	15.13	49.64	34.31	103.60	2.985	1.185
4/30/2013	1.60	3.40	2.12	14.40	49.69	34.41	104.03	2.819	1.188
5/31/2013	1.57	3.44	2.19	12.78	49.74	34.52	104.43	2.498	1.191
6/30/2013	1.46	3.38	2.31	10.68	49.78	34.62	104.75	2.161	1.192
7/31/2013	0.93	4.44	4.76	15.85	49.81	34.76	105.24	2.914	1.196
8/31/2013	1.05	4.66	4.45	14.66	49.84	34.90	105.70	2.535	1.198
9/30/2013	0.78	3.34	4.26	15.07	49.87	35.00	106.15	3.609	1.202
10/31/2013	0.78	3.93	5.01	14.70	49.89	35.12	106.60	3.083	1.205
11/30/2013	0.74	3.12	4.23	8.71	49.91	35.22	106.86	2.231	1.206
12/31/2013	0.88	3.69	4.17		49.94	35.33	106.86	0.000	1.204