

February 28, 2013

Manitoba Innovation, Energy and Mines  
Box 1359, 227 King Street West  
Virden, Manitoba  
ROM 2C0

Attention: Jennifer Abel, Chief Petroleum Engineer, Virden Office

**RE: Annual Report – Enhanced Oil Recovery Project**

---

As per section 73 of the Drilling and Production Regulations, ARC Resources Ltd. (“ARC”) as operator of an Enhanced Oil Recovery (EOR) project, is submitting an annual report for the Waterflood project in the Goodlands area of Manitoba (the “Project”).

The injection wells within this Project were originally drilled as Lower Amaranth producers, and were converted to water injectors between 2002 and 2004 to provide pressure support to the offsetting new infill producers. The Lower Amaranth development was initially produced through vertical wells, but advancements in horizontal drilling and completion techniques have led to horizontal infill drilling with increased economic recovery. ARC drilled and completed its first horizontal well within the Project utilizing this technique, 00/1-15-001-24W1, in late 2010, with production beginning in January 2011. Two additional horizontal wells were drilled in 2011, 02/07-10-001-24W1 and 02/11-11-001-24W1. In 2012 4 more horizontal wells, 103/07-10-001-24W1/00, 103/11-11-001-24W1/00, 102/12-11-001-24W1/00 and 104/07-10-001-24W1/00, were drilled.

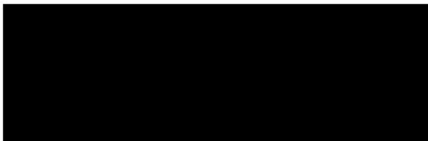
Water Injection continues to be a challenge, as injection pressures remain high, while injection continues to lag behind production. This, combined with increased production from infill drilling, has led to a drop in the overall VRR of the Project. ARC has planned additional drilling of horizontal wells in the Project for 2013 and is continuing to evaluate ways of increasing water injection. Two methods currently under consideration are to frac the existing injectors to improve connectivity to the reservoir, or convert vertical producers into additional injectors. As part of this year's drilling program, ARC is conducting pressure surveys on the new wells in order to quantify the pressure support being provided by the injectors.

The following information, as requested by the Department of Innovation, Energy and Mines, is contained in this report, and will illustrate the current status of the project:

- (a) the monthly oil production rate, injection rate, GOR, and WOR for each pattern and the project;
- (b) the cumulative volume of oil, gas, and water produced and fluid injected for each pattern and the project;
- (c) the monthly wellhead injection pressure for each injection well;
- (d) the results of reservoir pressure surveys conducted during the year;
- (e) the date and type of well servicing;
- (f) calculations of the voidage replacement ratio on a monthly and cumulative basis for each injection pattern and for the project area;
- (g) an outline of the method used for quality control and treatment of the injected fluid;
- (h) a report of any unusual performance problems and remedial measures taken or being considered.

Should you have any questions, or require additional data, please do not hesitate to contact me by phone at 403 503 8716 or by email at [kmccutcheon@arcresources.com](mailto:kmccutcheon@arcresources.com)

Sincerely,



Kate McCutcheon, P.Eng.

List of Attachments

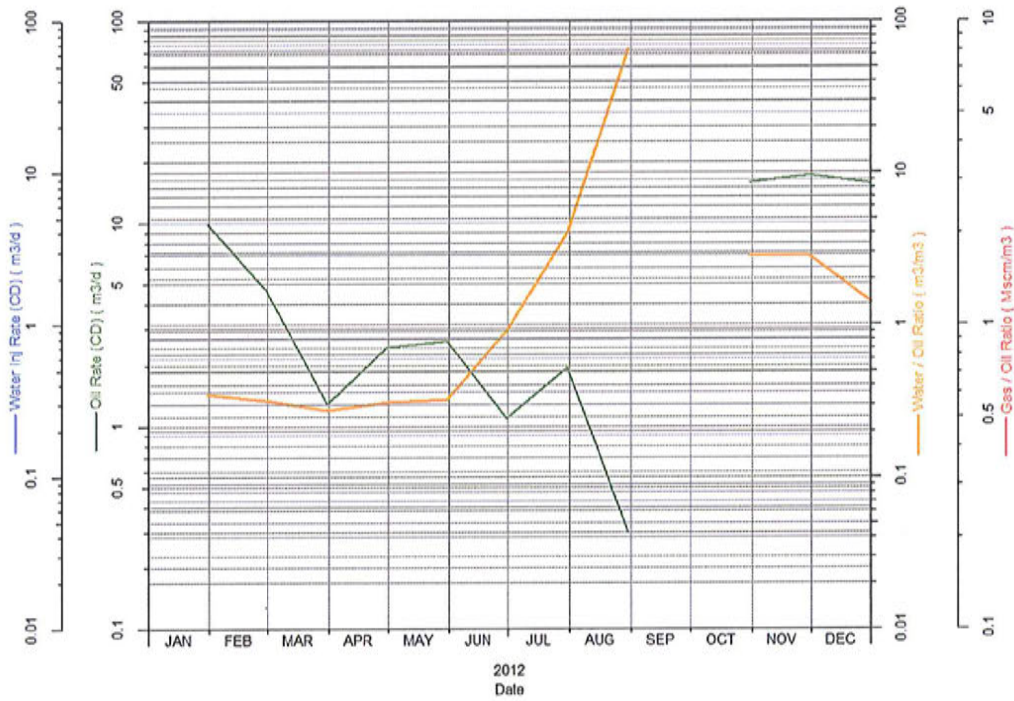
Attachment 1: Schematic of the Injection Facilities

Attachment 2: Map of the Water Flood including Patterns

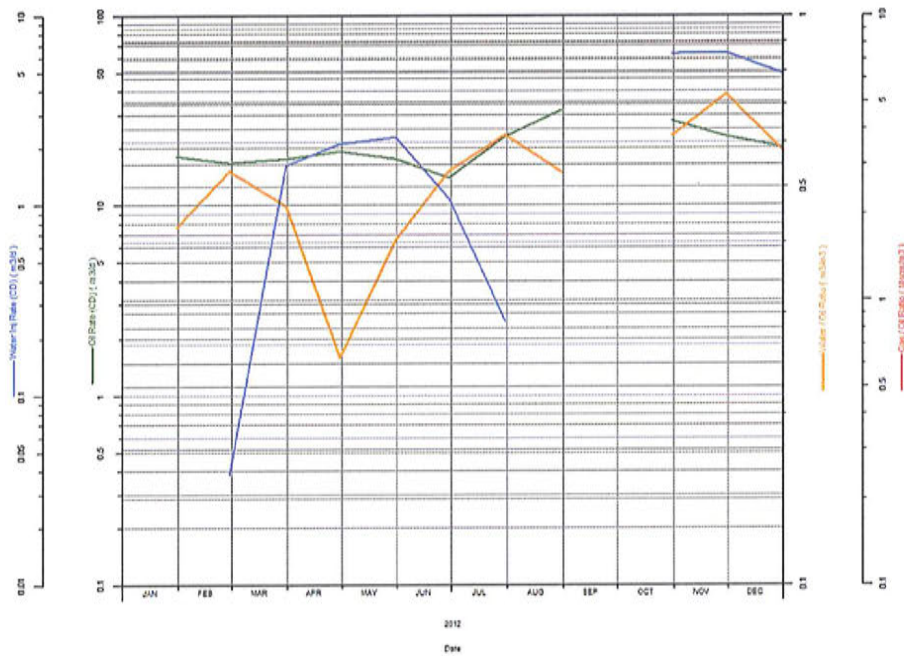
Attachment 3: Allocation factors for Waterflood Patterns

**A: Oil rate, injection rate, GOR and WOR in graphical form**

**PATTERN A**

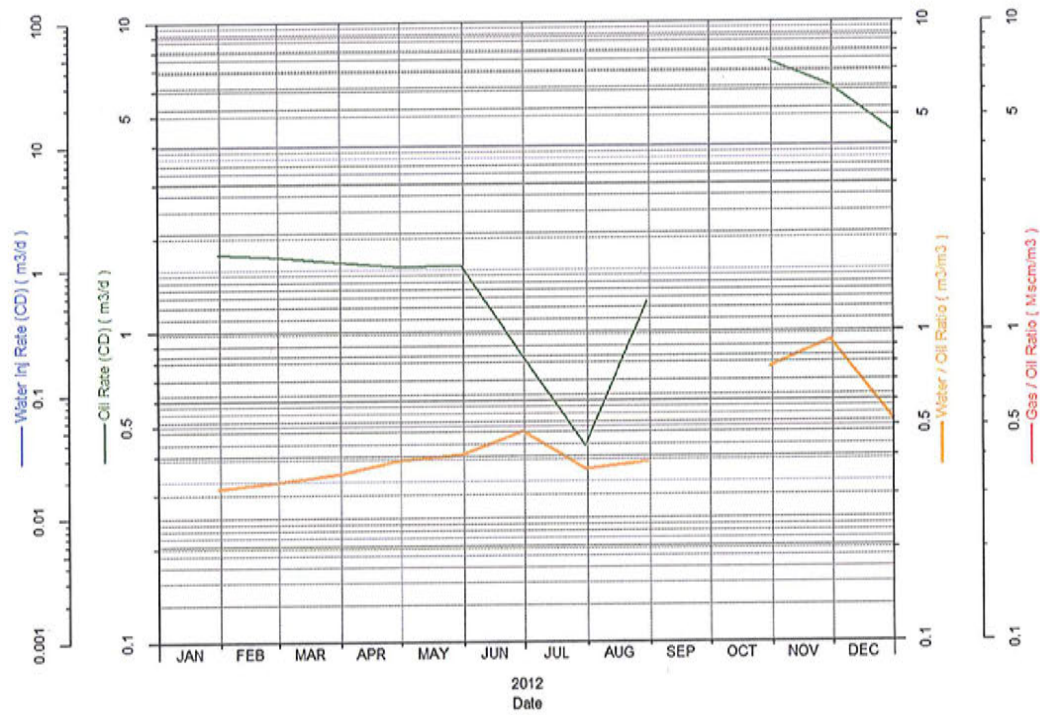


**PATTERN B**

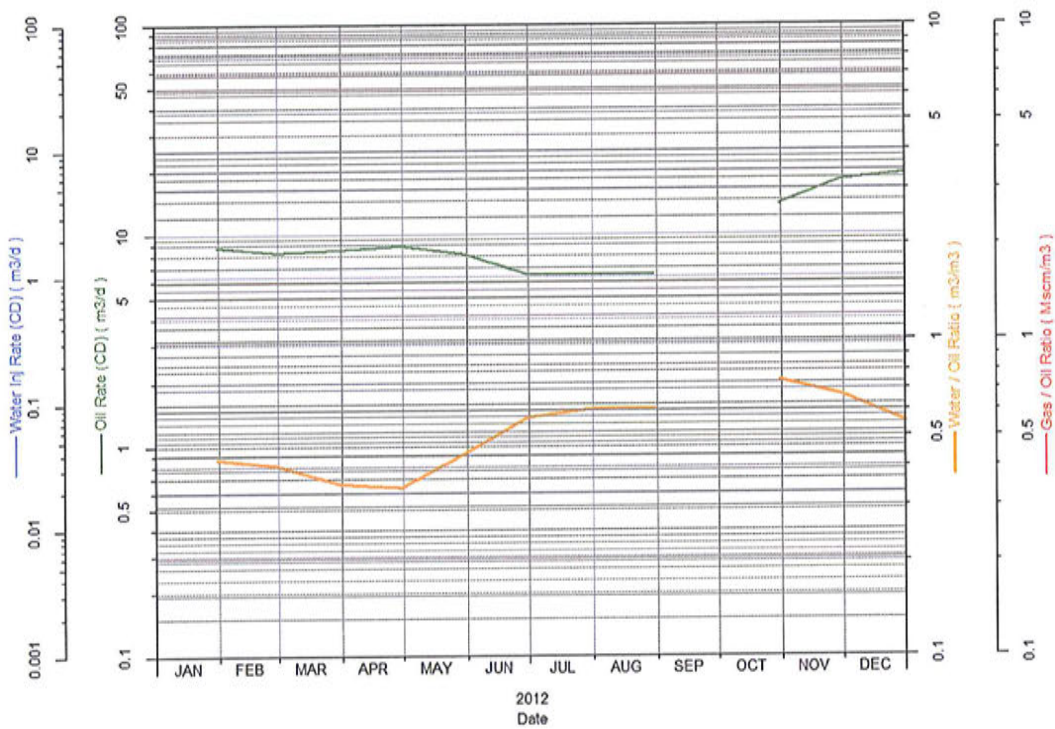




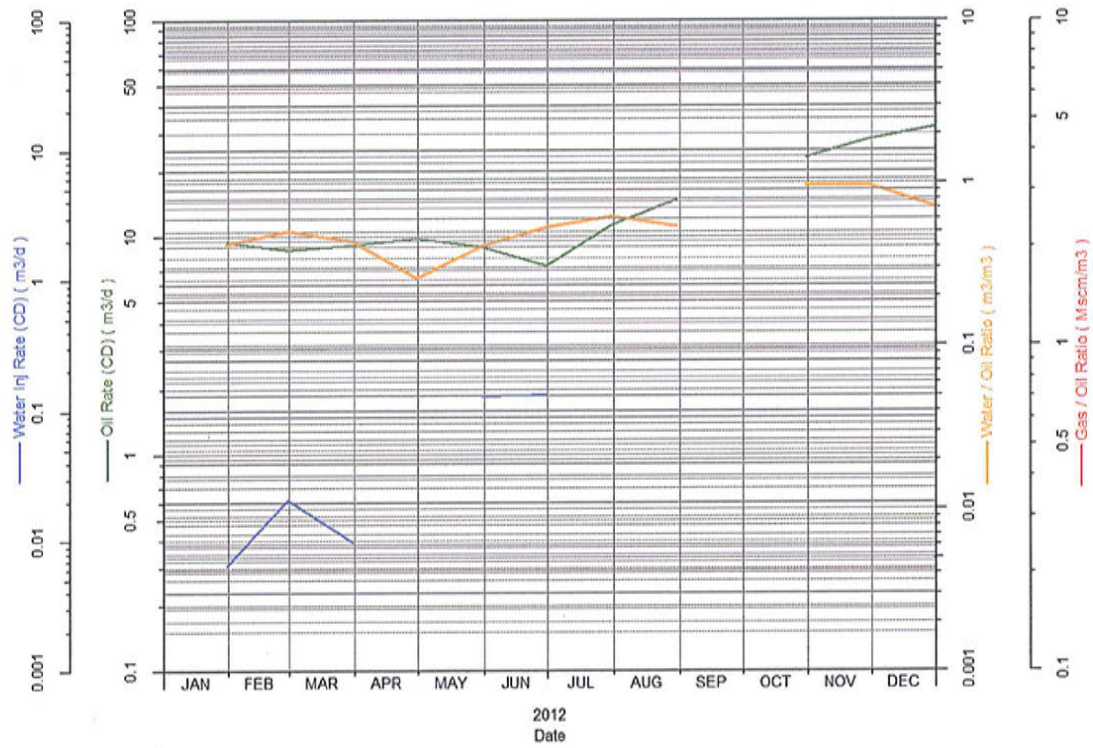
**PATTERN C**



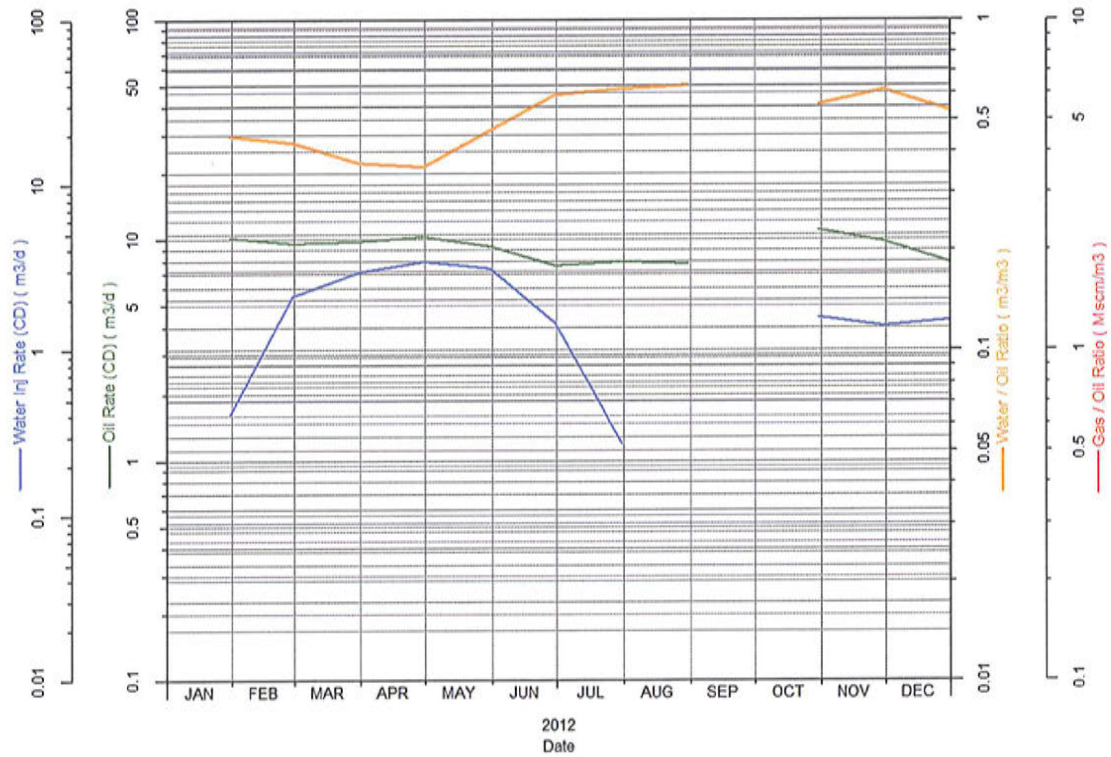
**PATTERN D**



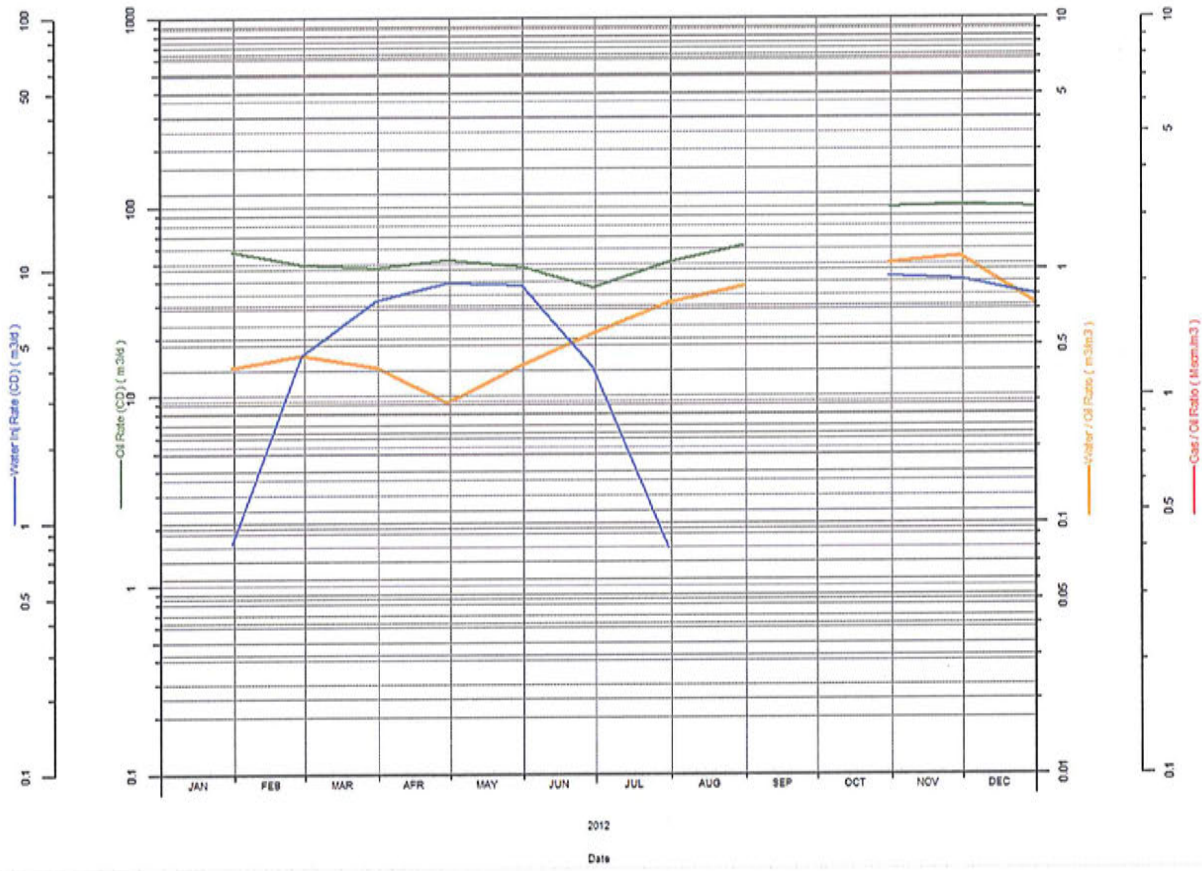
**PATTERN E**



**PATTERN F**



UNIT





### A: Oil rate, injection rate, GOR and WOR in tabular form

Date	Oil Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Gas Oil Ratio Mscm/m3
------	--------------------	-----------------------	--------------------------	-----------------------

#### PATTERN A

1/31/2012	9.94	0.35		0.00
2/29/2012	4.71	0.32	0.01	0.00
3/31/2012	1.28	0.27		0.00
4/30/2012	2.44	0.31		0.00
5/31/2012	2.62	0.32		0.00
6/30/2012	1.09	0.91		0.00
7/31/2012	1.94	4.03		0.00
8/31/2012	0.30	65.59		0.00
10/31/2012	15.90	2.83		0.00
11/30/2012	17.31	2.82		0.00
12/31/2012	15.76	1.41		0.00

Date	Oil Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Gas Oil Ratio Mscm/m3
------	--------------------	-----------------------	--------------------------	-----------------------

#### PATTERN B

1/31/2012	18.21	0.42	0.00	0.00
2/29/2012	16.69	0.53	0.04	0.00
3/31/2012	17.62	0.46	1.63	0.00
4/30/2012	19.20	0.25	2.11	0.00
5/31/2012	17.66	0.40	2.29	0.00
6/30/2012	14.02	0.53	1.09	0.00
7/31/2012	23.08	0.62	0.25	0.00
8/31/2012	31.76	0.53	0.00	0.00
10/31/2012	27.84	0.61	6.27	0.00
11/30/2012	23.13	0.73	6.34	0.00
12/31/2012	20.24	0.56	4.95	0.00

#### PATTERN C

1/31/2012	1.79	0.31		0.00
2/29/2012	1.76	0.33	0.30	0.00
3/31/2012	1.68	0.35		0.00
4/30/2012	1.63	0.39		0.00
5/31/2012	1.64	0.40		0.00
6/30/2012	0.83	0.48		0.00
7/31/2012	0.43	0.36		0.00
8/31/2012	1.25	0.38		0.00
10/31/2012	7.43	0.77		0.00
11/30/2012	6.21	0.94		0.00
12/31/2012	4.42	0.52		0.00

#### PATTERN D

1/31/2012	8.84	0.42		0.00
2/29/2012	8.32	0.40		0.00
3/31/2012	8.54	0.35		0.00
4/30/2012	8.94	0.34		0.00
5/31/2012	8.10	0.44		0.00
6/30/2012	6.60	0.57		0.00
7/31/2012	6.52	0.61		0.00
8/31/2012	6.55	0.61		0.00
10/31/2012	14.01	0.74		0.00
11/30/2012	18.14	0.67		0.00
12/31/2012	19.50	0.55		0.00

#### PATTERN E

1/31/2012	9.45	0.42	0.01	0.00
2/29/2012	8.68	0.50	0.02	0.00
3/31/2012	9.12	0.44	0.01	0.00
4/30/2012	9.87	0.26		0.00
5/31/2012	9.03	0.41	0.13	0.00
6/30/2012	7.34	0.53	0.13	0.00
7/31/2012	11.28	0.62		0.00
8/31/2012	14.82	0.54		0.00
10/31/2012	23.42	0.96		0.00
11/30/2012	28.36	0.96		0.00
12/31/2012	32.29	0.70		0.00

#### PATTERN F

1/31/2012	10.26	0.44	0.41	0.00
2/29/2012	9.63	0.42	2.11	0.00
3/31/2012	9.87	0.37	2.97	0.00
4/30/2012	10.38	0.36	3.41	0.00
5/31/2012	9.33	0.46	3.13	0.00
6/30/2012	7.69	0.59	1.45	0.00
7/31/2012	7.96	0.62	0.27	0.00
8/31/2012	7.79	0.63		0.00
10/31/2012	11.04	0.56	1.58	0.00
11/30/2012	9.81	0.61	1.40	0.00
12/31/2012	7.92	0.53	1.52	0.00

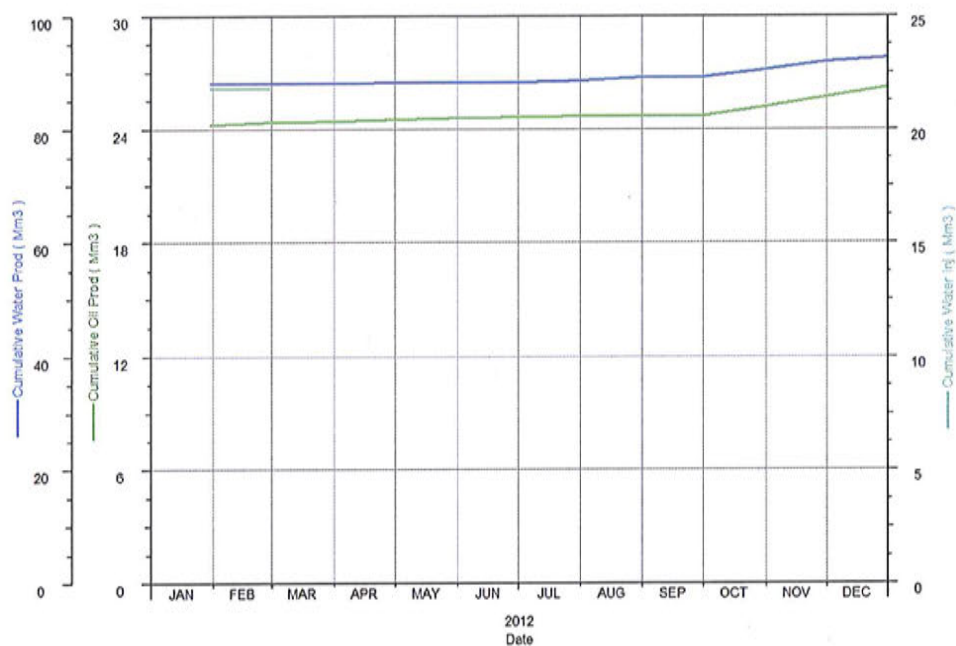
### UNIT

Date	Oil Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Gas Oil Ratio Mscm/m3
------	--------------------	-----------------------	--------------------------	-----------------------

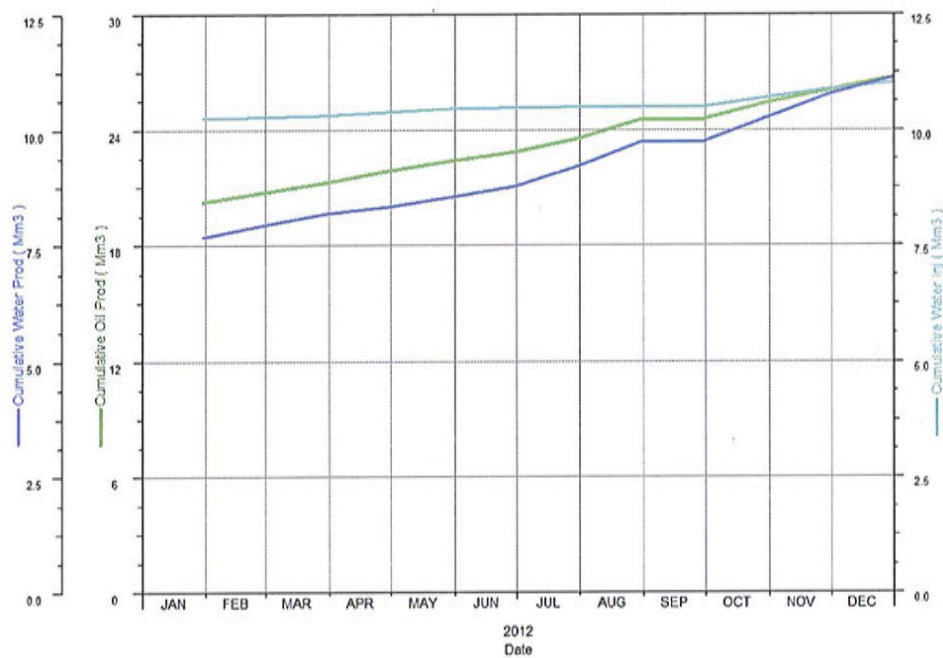
1/31/2012	58.49	0.41	0.82	0.00
2/29/2012	49.79	0.46	4.59	0.00
3/31/2012	48.12	0.41	7.57	0.00
4/30/2012	52.46	0.30	8.93	0.00
5/31/2012	48.37	0.42	8.68	0.00
6/30/2012	37.46	0.56	4.12	0.00
7/31/2012	51.21	0.74	0.79	0.00
8/31/2012	62.47	0.86	0.00	0.00
10/31/2012	99.64	1.07	9.43	0.00
11/30/2012	102.96	1.13	9.13	0.00
12/31/2012	100.13	0.74	7.98	0.00

**B: Cumulative oil volume, cumulative water produced and cumulative water injected in graphical form**

**PATTERN A**

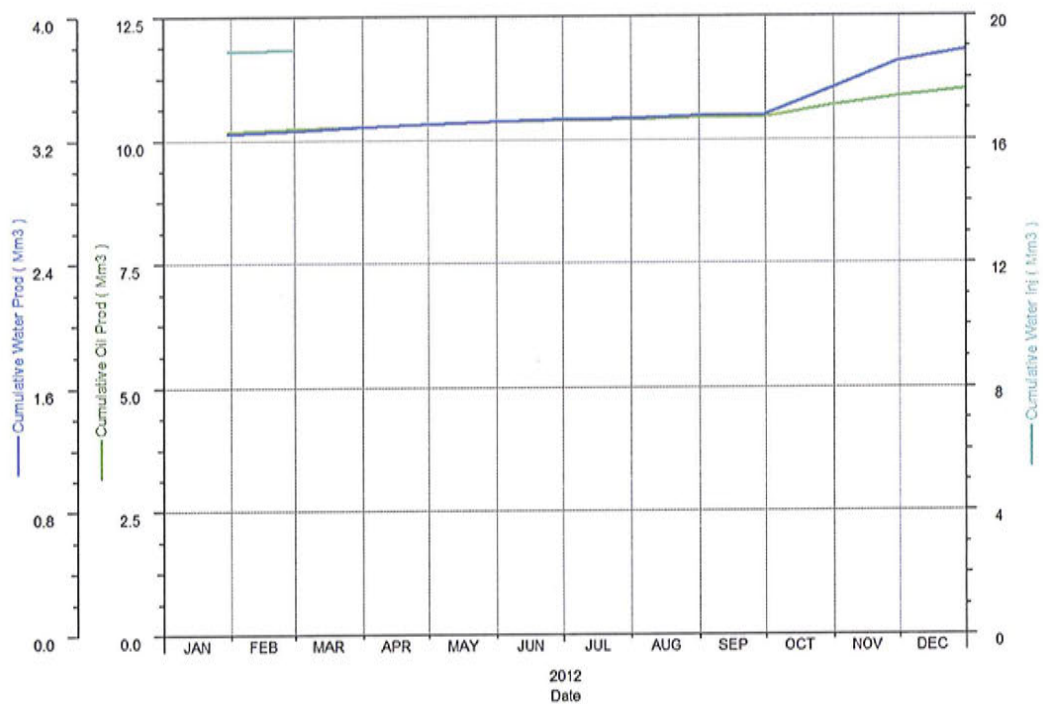


**PATTERN B**

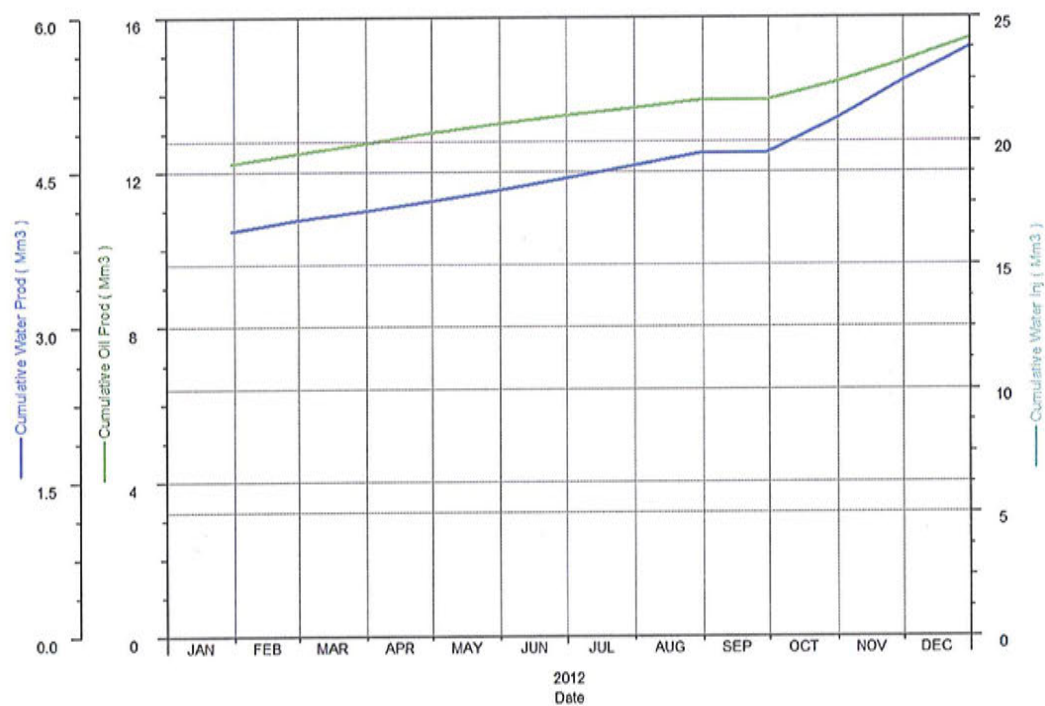




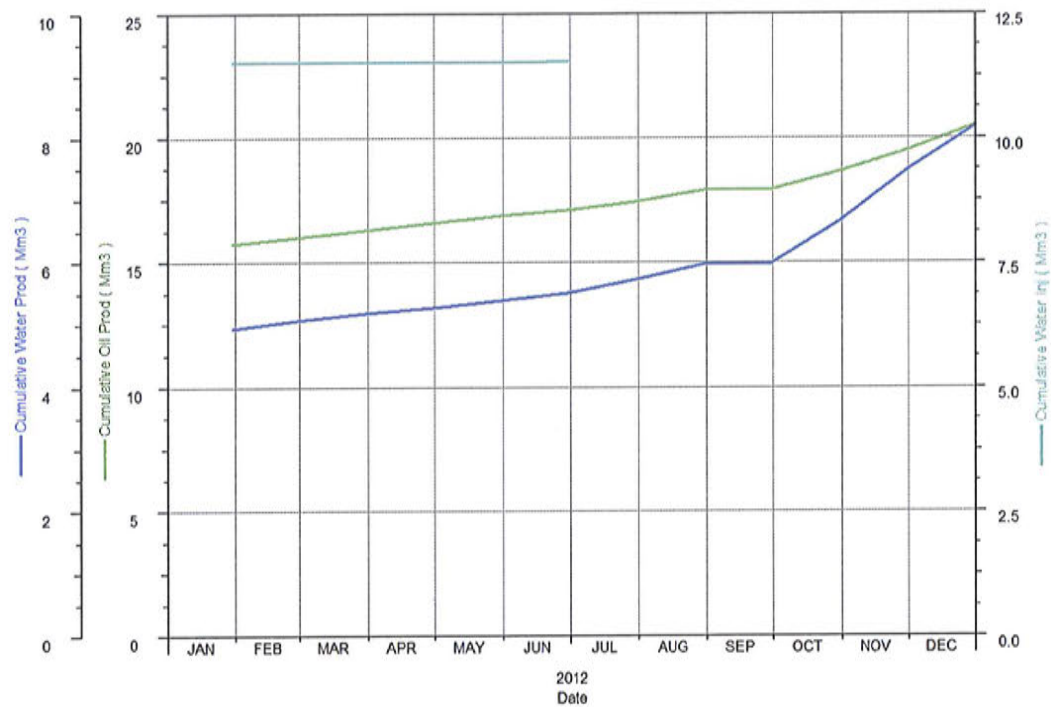
**PATTERN C**



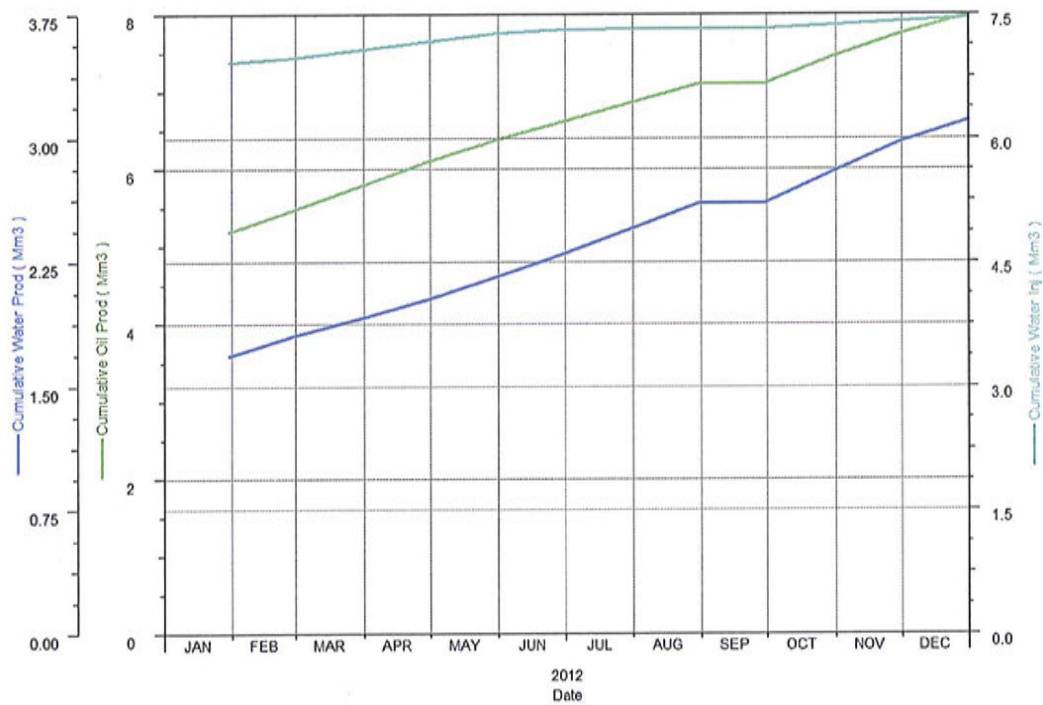
**PATTERN D**



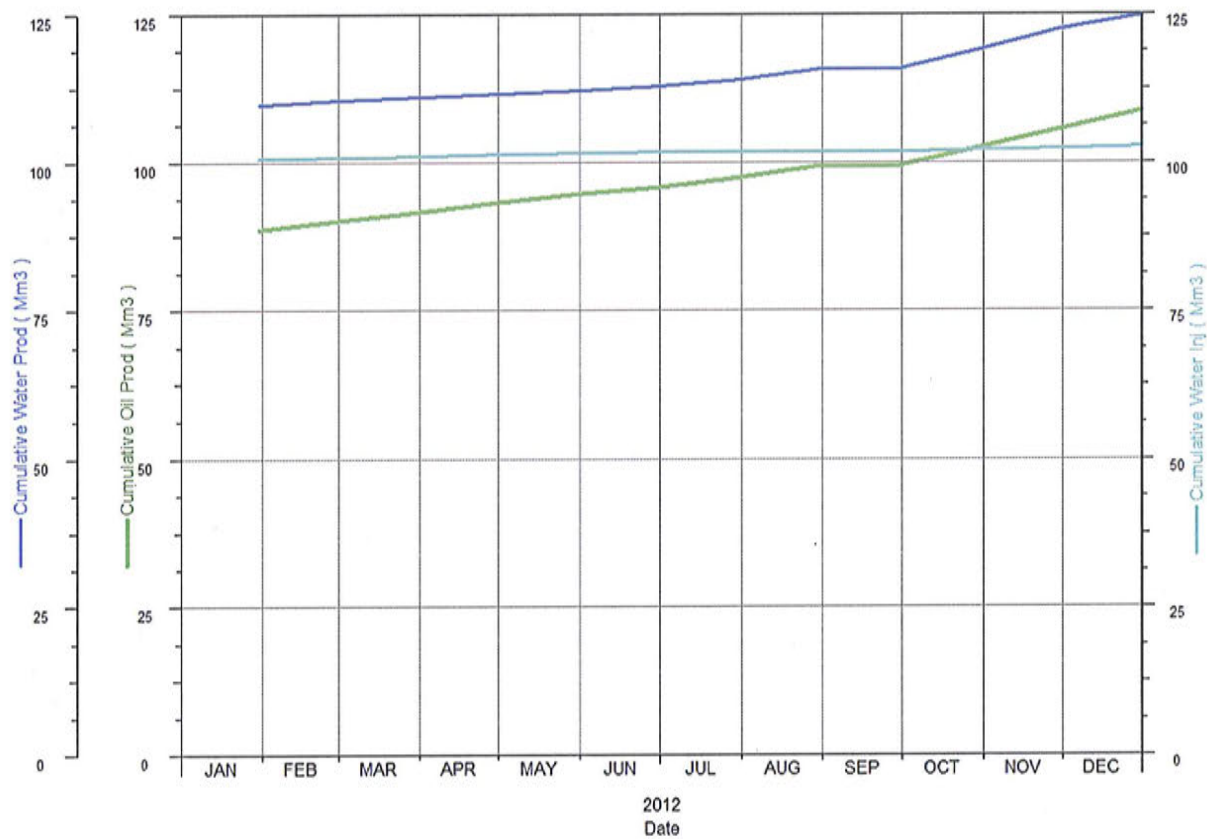
**PATTERN E**



**PATTERN F**



**UNIT**





## B: Cumulative oil volume, cumulative water produced and cumulative water injected in tabular form

Date	Cum Oil Prod Mm3	Cum Water Inj Mm3	Cum Water Prod Mm3
------	------------------	-------------------	--------------------

**Pattern A**

1/31/2012	24.25	21.79	88.08
2/29/2012	24.39	21.79	88.13
3/31/2012	24.43	21.79	88.14
4/30/2012	24.50	21.79	88.16
5/31/2012	24.58	21.79	88.19
6/30/2012	24.62	21.79	88.22
7/31/2012	24.68	21.79	88.46
8/31/2012	24.69	21.79	89.06
10/31/2012	25.18	21.79	90.46
11/30/2012	25.70	21.79	91.92
12/31/2012	26.19	21.79	92.61

**Pattern C**

1/31/2012	10.17	18.90	3.25
2/29/2012	10.22	18.91	3.26
3/31/2012	10.27	18.91	3.28
4/30/2012	10.32	18.91	3.30
5/31/2012	10.37	18.91	3.32
6/30/2012	10.40	18.91	3.33
7/31/2012	10.41	18.91	3.34
8/31/2012	10.45	18.91	3.35
10/31/2012	10.68	18.91	3.53
11/30/2012	10.87	18.91	3.71
12/31/2012	11.00	18.91	3.78

**Pattern E**

1/31/2012	15.78	11.52	4.95
2/29/2012	16.03	11.52	5.07
3/31/2012	16.31	11.52	5.20
4/30/2012	16.61	11.52	5.27
5/31/2012	16.89	11.53	5.39
6/30/2012	17.11	11.53	5.50
7/31/2012	17.46	11.53	5.72
8/31/2012	17.91	11.53	5.97
10/31/2012	18.64	11.53	6.66
11/30/2012	19.49	11.53	7.48
12/31/2012	20.49	11.53	8.18

Date	Cum Oil Prod Mm3	Cum Water Inj Mm3	Cum Water Prod Mm3
------	------------------	-------------------	--------------------

**Pattern B**

1/31/2012	20.26	10.27	7.68
2/29/2012	20.75	10.27	7.94
3/31/2012	21.29	10.32	8.19
4/30/2012	21.87	10.39	8.33
5/31/2012	22.42	10.46	8.55
6/30/2012	22.84	10.49	8.78
7/31/2012	23.55	10.50	9.22
8/31/2012	24.54	10.50	9.74
10/31/2012	25.40	10.69	10.27
11/30/2012	26.10	10.88	10.78
12/31/2012	26.72	11.04	11.14

**Pattern D**

1/31/2012	12.24	24.39	3.94
2/29/2012	12.48	24.39	4.03
3/31/2012	12.74	24.39	4.13
4/30/2012	13.01	24.39	4.22
5/31/2012	13.26	24.39	4.33
6/30/2012	13.46	24.39	4.44
7/31/2012	13.66	24.39	4.56
8/31/2012	13.86	24.39	4.69
10/31/2012	14.30	24.39	5.01
11/30/2012	14.84	24.39	5.37
12/31/2012	15.45	24.39	5.71

**Pattern F**

1/31/2012	5.20	6.92	1.68
2/29/2012	5.48	6.98	1.80
3/31/2012	5.79	7.07	1.92
4/30/2012	6.10	7.17	2.03
5/31/2012	6.39	7.27	2.16
6/30/2012	6.62	7.31	2.30
7/31/2012	6.87	7.32	2.45
8/31/2012	7.11	7.32	2.60
10/31/2012	7.45	7.37	2.79
11/30/2012	7.74	7.41	2.98
12/31/2012	7.99	7.46	3.11

### Unit

Date	Cum Oil Prod Mm3	Cum Water Inj Mm3	Cum Water Prod Mm3
------	------------------	-------------------	--------------------

1/31/2012	88.69	100.71	109.83
2/29/2012	90.13	100.85	110.49
3/31/2012	91.62	101.08	111.10
4/30/2012	93.20	101.35	111.56
5/31/2012	94.70	101.62	112.19
6/30/2012	95.82	101.74	112.82
7/31/2012	97.41	101.77	114.00
8/31/2012	99.35	101.77	115.67
10/31/2012	102.43	102.06	118.98
11/30/2012	105.52	102.33	122.48
12/31/2012	108.63	102.58	124.77

## C: Wellhead injection pressure in tabular form

### 07-10-01-24W1 Inj Well

Production Month	Avg Injection Pressure (KPA)
1/1/2012	7600
2/1/2012	6660
3/1/2012	8500
4/1/2012	7652
5/1/2012	9415
6/1/2012	8838
7/1/2012	7300
8/1/2012	5800
9/1/2012	5454
10/1/2012	6488
11/1/2012	6600
12/1/2012	5819

### 09-10-01-24W1 Inj Well

Production Month	Avg Injection Pressure (KPA)
1/1/2012	1800
2/1/2012	4900
3/1/2012	8000
4/1/2012	8350
5/1/2012	8900
6/1/2012	4550
7/1/2012	0
8/1/2012	0
9/1/2012	0
10/1/2012	0
11/1/2012	0
12/1/2012	0

### 10-10-01-24W1 Inj Well

Production Month	Avg Injection Pressure (KPA)
1/1/2012	8600
2/1/2012	7033
3/1/2012	8600
4/1/2012	8850
5/1/2012	9000
6/1/2012	8500
7/1/2012	8700
8/1/2012	8700
9/1/2012	5140
10/1/2012	6800
11/1/2012	6800
12/1/2012	6800

### 12-11-01-24W1 Inj Well

Production Month	Avg Injection Pressure (KPA)
1/1/2012	8600
2/1/2012	7040
3/1/2012	8600
4/1/2012	8900
5/1/2012	9425
6/1/2012	8533
7/1/2012	8600
8/1/2012	8600
9/1/2012	5160
10/1/2012	6500
11/1/2012	6650
12/1/2012	6800

**13-11-01-24W1 Inj Well**

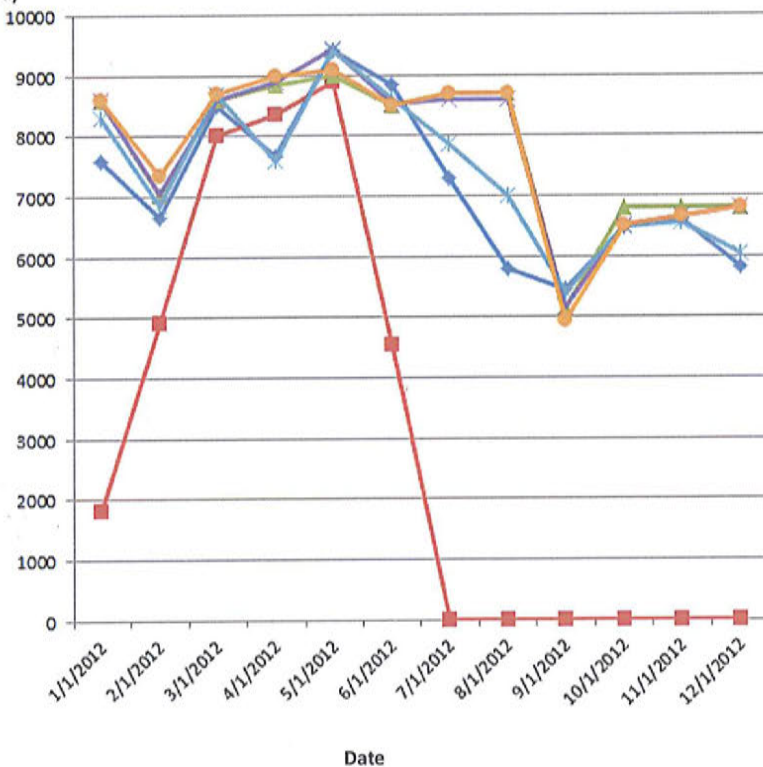
Production Month	Avg Injection Pressure (KPA)
1/1/2012	8300
2/1/2012	6860
3/1/2012	8700
4/1/2012	7590
5/1/2012	9400
6/1/2012	8633
7/1/2012	7850
8/1/2012	7000
9/1/2012	5406
10/1/2012	6492
11/1/2012	6567
12/1/2012	6050

**16-10-01-24W1 Inj Well**

Production Month	Avg Injection Pressure (KPA)
1/1/2012	8600
2/1/2012	7340
3/1/2012	8700
4/1/2012	9000
5/1/2012	9100
6/1/2012	8500
7/1/2012	8700
8/1/2012	8700
9/1/2012	4933
10/1/2012	6500
11/1/2012	6650
12/1/2012	6800

**C: Wellhead injection pressure in graphical form**

Injection Pressure (kPa)



Well Name

- 07-10-01-24W1 Inj. Well
- 09-10-01-24W1
- 10-10-01-24W1
- 12-11-01-24W1
- 13-11-01-24W1
- 16-10-01-24W1



## D: 2012 Reservoir Pressures and Flowing Pressures

In 2012 static and flowing pressures were collected with the intention of conducting RTA analysis on the data. Unfortunately the wells were not flowing as a single phase fluid, so the tests were incompatible to this type of analysis. Nonetheless the results are summarized in the tables below.

Shut in Pressures (please note the field was not shut in, so the pressure is not stabilized)				
API/UWI	Test Type	Survey Dates	Measured Pressure (MPa)	Calculated MPP Pressure (MPa)
02/12-6-1-24W1 4-7-1-24W1	Surface Pressure	Jan 16-Feb 3, 2012	1.6	8.6
00/9-10-1-24W1	Static Gradient	May 7, 2012	9.7	9.8
03/11-11-1-24W1 3-14-1-24W1	Static Gradient	May 9, 2012	5.1	5.2

Flowing Pressures				
API/UWI	Test Type	Survey Dates	Measured Pressure (MPa)	Calculated Flowing MPP Pressure (MPa)
03/4-4-1-24W1 2-4-1-24W1	Surface Pressure	Start: Feb 3, 2012	3.6	4.2
		End: July 29, 2012	2.5	2.9
03/11-6-1-24W1 12-5-1-24W1	Surface Pressure	Start: Dec 6, 2011	1.1	8.0
		End: Dec 17, 2011	1.2	7.3

## E: 2012 Well Servicing Summary

API/UWI	Job Cat	Job Type	Job SubType	Start Date
100/05-11-001-24W1/00	Well Servicing	Rod	BHP Change	9/18/2012
100/08-10-001-24W1/00	Well Servicing	Stimulation	Bullheaded Chemical	10/2/2012
1C0/16-10-001-24W1/00	Well Servicing	Stimulation	Annular Chemical	10/1/2012
1D0/08-10-001-24W1/00	Well Servicing	Stimulation	Bullheaded Chemical	10/2/2012
100/01-15-001-24W1/00	Well Servicing	Tubing	Stripping	9/12/2012

## F: Voidage Replacement Ratio Calculations

Monthly VRR							
Date	Unit	Pattern A	Pattern B	Pattern C	Pattern D	Pattern E	Pattern F
1/31/2012	0.008	0.000	0.000	0.000	0.000	0.000	0.022
2/29/2012	0.052	0.002	0.001	0.104	0.000	0.001	0.125
3/31/2012	0.091	0.000	0.052	0.000	0.000	0.001	0.177
4/30/2012	0.105	0.000	0.070	0.000	0.000	0.000	0.195
5/31/2012	0.103	0.000	0.075	0.000	0.000	0.008	0.187
6/30/2012	0.058	0.000	0.042	0.000	0.000	0.010	0.098
7/31/2012	0.007	0.000	0.005	0.000	0.000	0.000	0.018
8/31/2012	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/31/2012	0.039	0.000	0.116	0.000	0.000	0.000	0.076
11/30/2012	0.036	0.000	0.133	0.000	0.000	0.000	0.073
12/31/2012	0.039	0.000	0.128	0.000	0.000	0.000	0.103
<b>Project Cum VRR</b>	<b>0.381</b>	<b>0.171</b>	<b>0.237</b>	<b>1.028</b>	<b>0.930</b>	<b>0.326</b>	<b>0.544</b>

## G: Quality Control and Treatment of the Injected Fluid

The current quality and treatment control for the injection water at Goodlands begins with a two phase filtering process. Filters are changed 2-3 times per week to ensure the water quality is maintained.

Phase 1: Fluid is filtered down to 10 microns.

Phase 2: Fluid is further filtered to 5 microns.

The operators monitor the water tanks to ensure there is no oil carryover. In the event that oil is noticed on top of the water, the tanks will be skimmed to ensure that the oil is not re-injected through the water injection wells.

Please see Attachment 1 for further details and specifications on the Injection system in place.

## **H: Unusual Performance Problems and Remedial Measures**

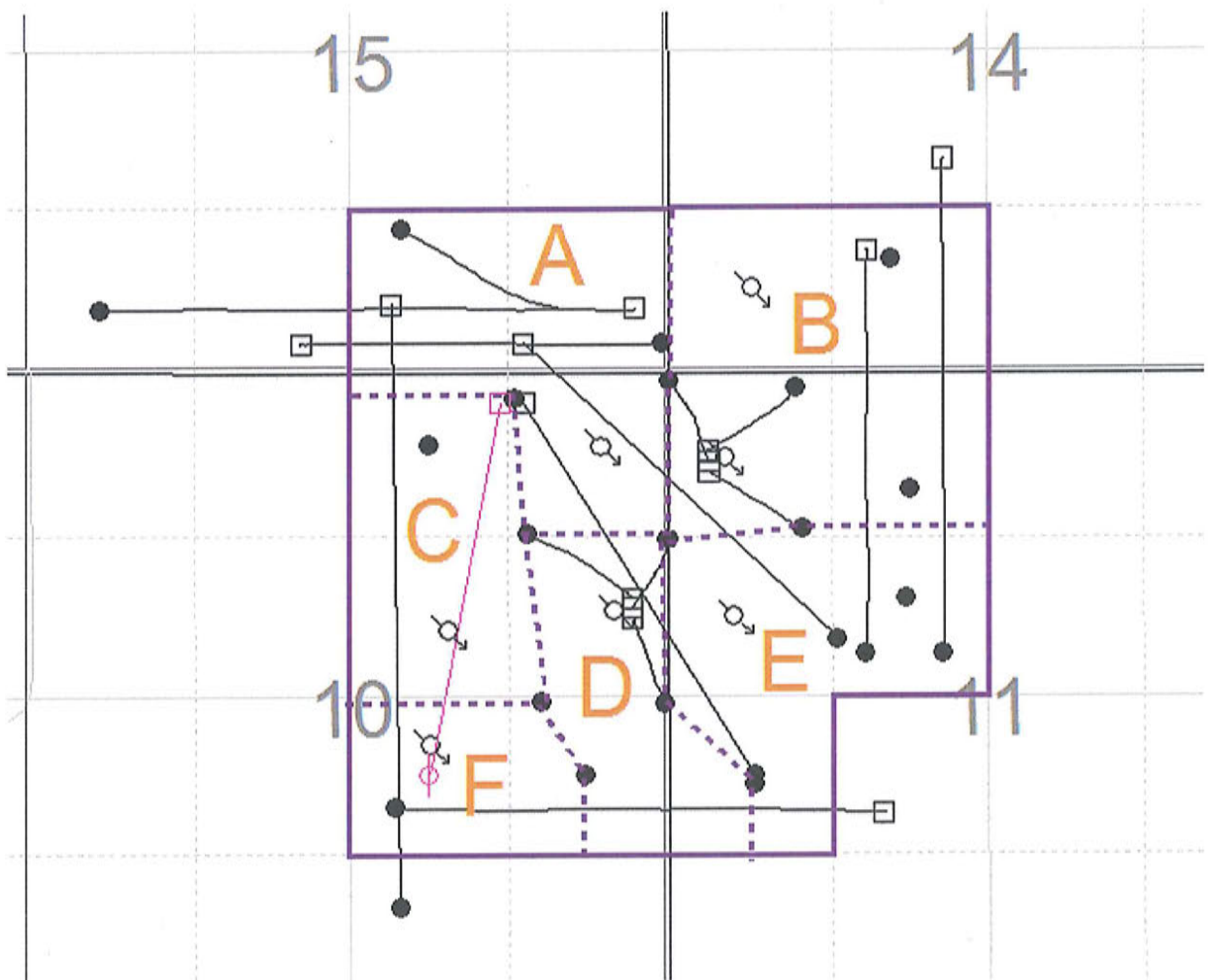
A smaller injection pump has been installed at the battery to resolve the on-off cycling issues with the previous pump, addressed in our previous annual report.

Production was interrupted in September & October this year, as some drilling fluid was accidentally introduced into the production stream during drilling operations, and we had to shut-in wells to clean out the system. The production losses during this period were not a reflection of the reservoir deliverability or the effectiveness of the Waterflood.





## ATTACHMENT 2: Map of the Water Flood including Patterns



### ATTACHMENT 3: Allocation factors for Waterflood Patterns

**PATTERN A**

Well	Factor
00/01-15-001-24W1/0	1
00/04-15-001-24W1/0	1
00/16-10-001-24W1/0	1
B0/16-10-001-24W1/0	0.33
C0/13-11-001-24W1/0	0.5
C0/16-10-001-24W1/0	0.5
W0/09-10-001-24W1/0	0.25
03/07-10-001-24W1/0	0.3
04/07-10-001-24W1/0	0.3
02/12-11-001-24W1/0	0.6

**PATTERN B**

Well	Factor
00/03-14-001-24W1/0	1
00/04-14-001-24W1/0	0
00/13-11-001-24W1/0	1
00/14-11-001-24W1/0	1
A0/13-11-001-24W1/0	0.5
C0/13-11-001-24W1/0	0.5
D0/13-11-001-24W1/0	1
02/11-11-001-24W1/0	0.7
W0/09-10-001-24W1/0	0.25
03/11-11-001-24W1/0	0.7

**PATTERN C**

Well	Factor
00/10-10-001-24W1/0	1
00/15-10-001-24W1/0	1
B0/16-10-001-24W1/0	0.33
C0/08-10-001-24W1/0	0.33
C0/16-10-001-24W1/0	0.5
03/07-10-001-24W1/0	0.5
04/07-10-001-24W1/0	0.4

**PATTERN D**

Well	Factor
00/05-11-001-24W1/0	0.5
00/08-10-001-24W1/0	0.5
00/09-10-001-24W1/0	1
B0/16-10-001-24W1/0	0.34
C0/08-10-001-24W1/0	0.33
D0/08-10-001-24W1/0	0.5
W0/09-10-001-24W1/0	0.25
02/07-10-001-24W1/0	0.4
02/05-11-001-24W1/0	0.5

**PATTERN E**

Well	Factor
00/05-11-001-24W1/0	0.5
00/11-11-001-24W1/0	1
02/05-11-001-24W1/0	0.5
02/11-11-001-24W1/0	0.3
A0/13-11-001-24W1/0	0.5
D0/08-10-001-24W1/0	0.5
W0/09-10-001-24W1/0	0.25
02/07-10-001-24W1/0	0.1
00/12-11-001-24W1/0	1
03/11-11-001-24W1/0	0.3
02/12-11-001-24W1/0	0.4

**PATTERN F**

Well	Factor
00/07-10-001-24W1/0	0.5
00/08-10-001-24W1/0	0.5
02/07-10-001-24W1/0	0.5
03/07-10-001-24W1/0	0.2
04/07-10-001-24W1/0	1
C0/08-10-001-24W1/0	0.34