

Waskada Unit No. 19
Waterflood Progress Report 2014
January 1st through December 31st 2014

Prepared for:
Manitoba Industry, Economic Development and Mines
Petroleum Branch

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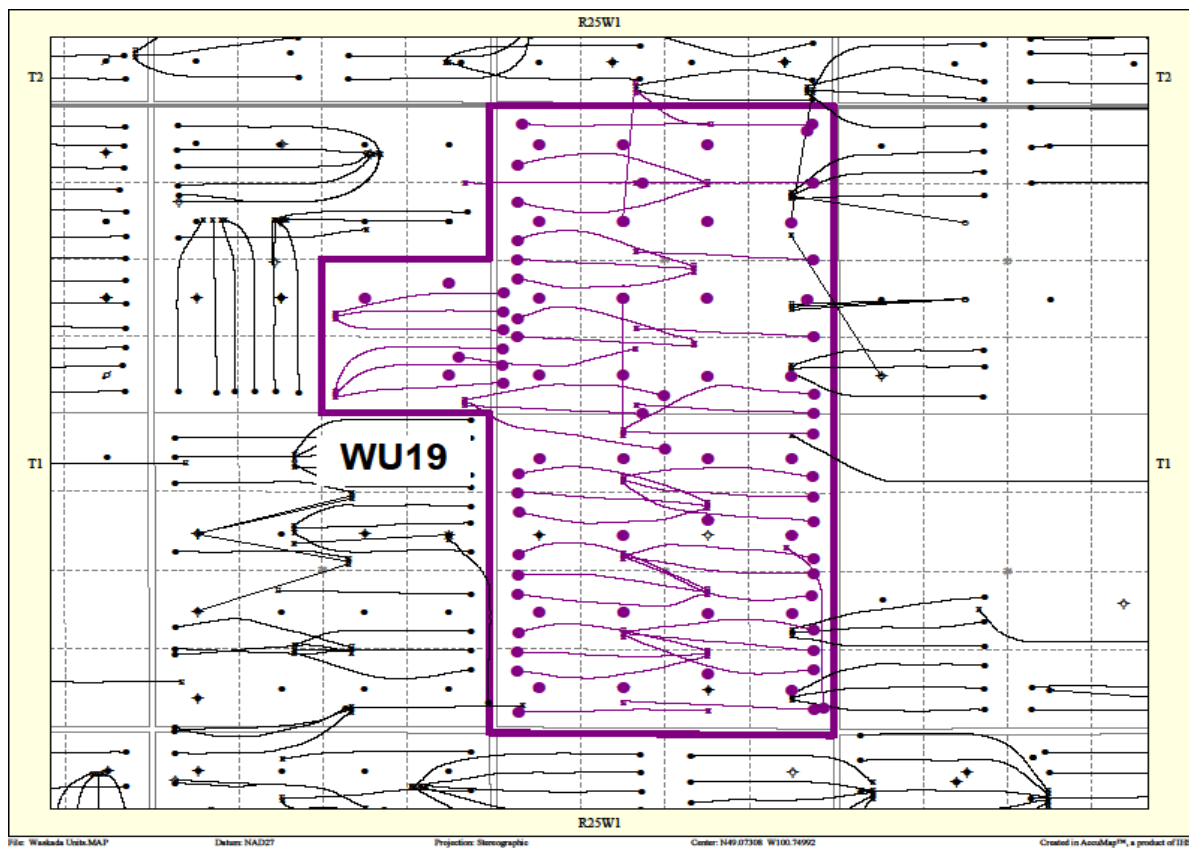
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INTRODUCTION

The Waskada Unit No. 19 pressure maintenance project commenced water injection into the Lower Amaranth A pool in accordance with Manitoba Energy and Mines Order No. PM 14, dated August 1, 2003. Waskada Unit No. 19 was acquired from EOG Resources Canada Inc. effective October 1, 2014 (closing date December 1, 2014) with Tundra Oil and Gas (Tundra) as the new operator. THE EOR project area, outlined in purple in [Figure 1](#), contains 81 wells over 36 LSDs in Township 1, Range 25W1 ([Table 1](#)).

Figure 1: Waskada Unit No. 19 Area Outline



PRODUCTION HISTORY

For the wells included in Waskada Unit No. 19, production started in December 2001 with the 00/13-34-001-25W1/00 well. Oil production peaked at 505.9 m³/d in December 2010. There are currently 49 producing wells in Waskada Unit No. 19. The average production for the unit was 81.48 m³/d of oil and 614.24 m³/d of water and the average WOR was 7.54 m³/m³ at the end of December 2014 ([Table 4](#)). The rates and WOR are presented in [Figure 2](#).

Figure 2: Waskada Unit No. 19 Production/Injection Rates and WOR vs Time

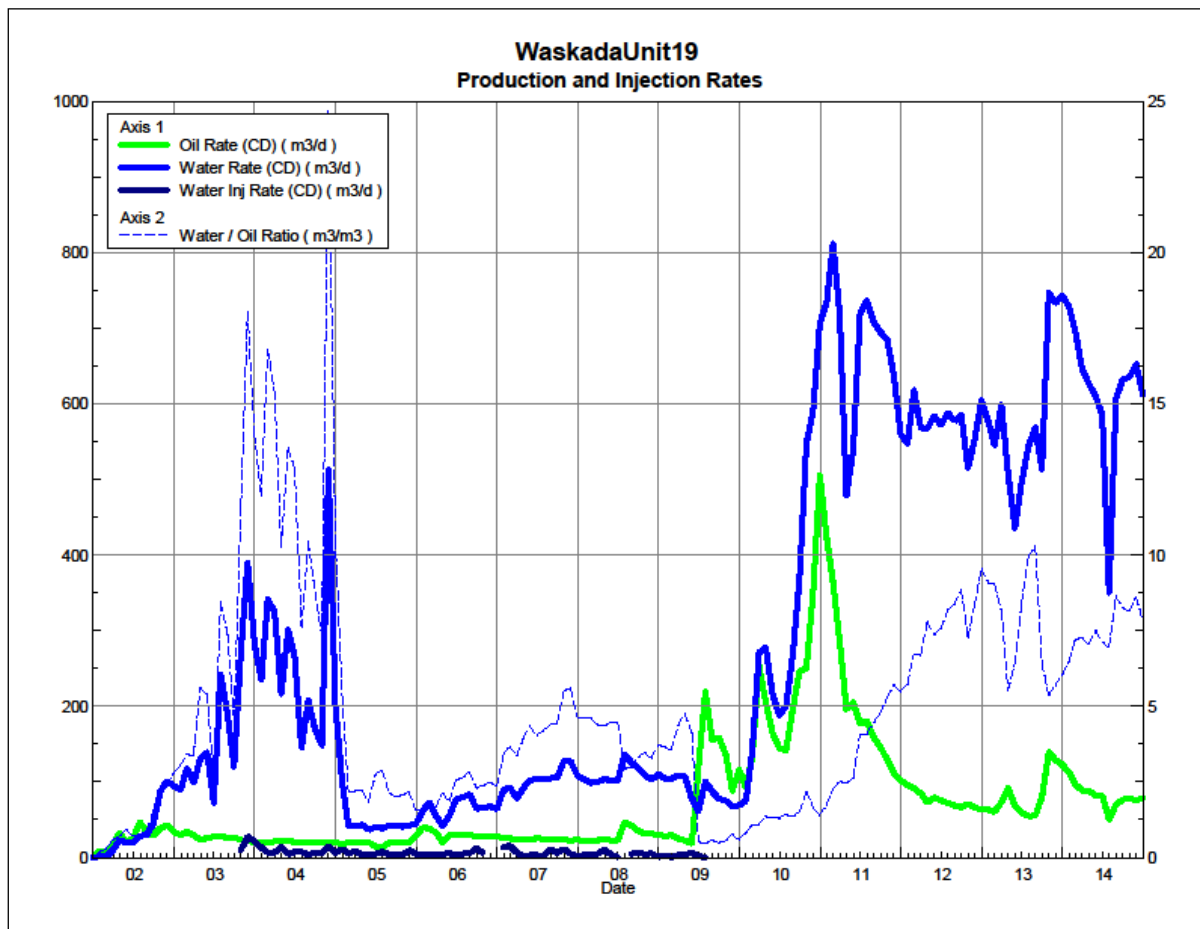
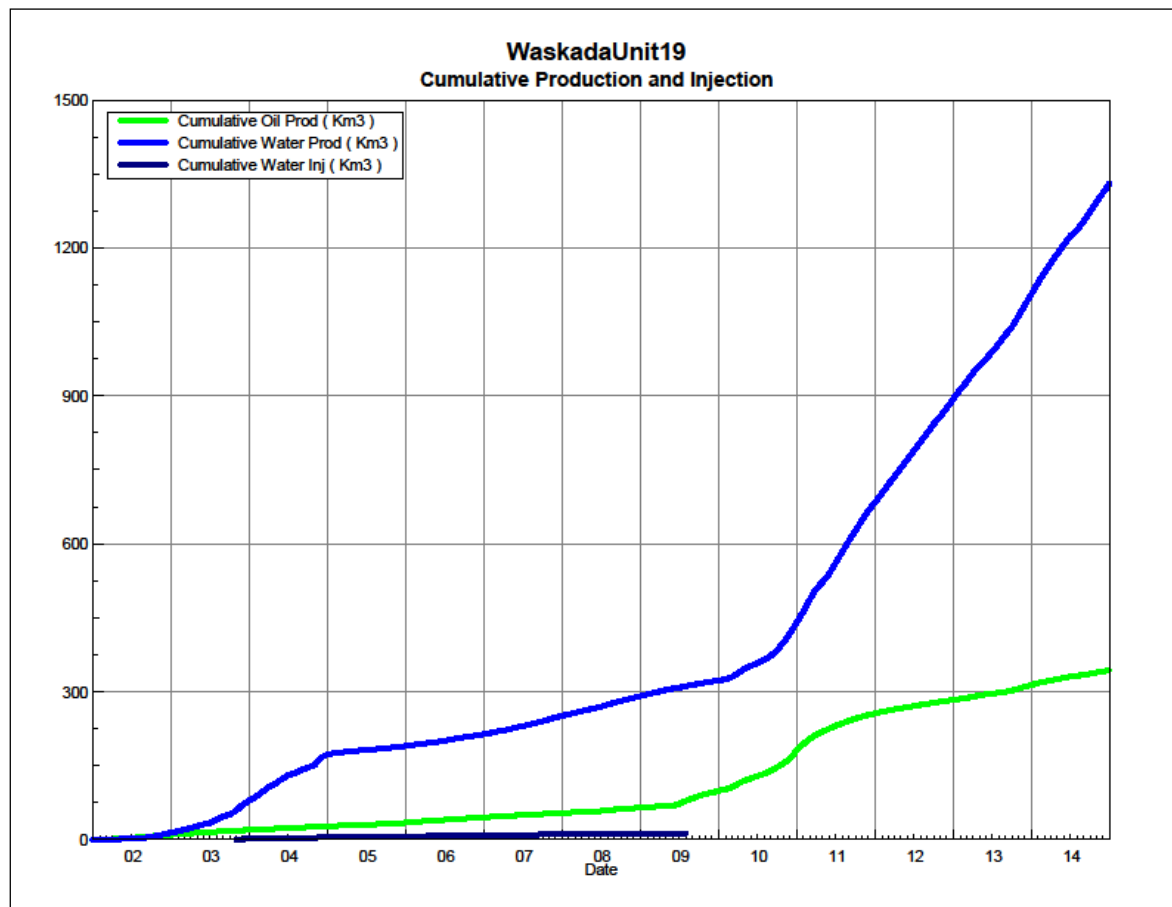


Figure 3 shows the cumulative production for Waskada Unit No. 19 to the end of December 2014 as 343.8 e³m³ of oil, and 1,331.5 e³m³ of water. The cumulative water injected is over 13.0 e³m³.

Figure 3. Waskada Unit No. 19 Cumulative Oil, Water and Water Injected vs. Time



WATERFLOOD HISTORY

Water injection commenced with 4 injector wells on October 2003. Four more injectors were added in November 2003. In 2011, EOG received permission to convert 3 Spearfish injection wells into Mississippian SWD wells. As of the end of December 2014, there are currently no active injection wells in Waskada Unit No. 19.

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 PERFORMANCE

From January 1 to December 31 in 2014, Waskada Unit No. 19 produced 126,969 m³ of total fluids (29,739 m³ oil, 224,198 m³ water). No water was injected in 2014. The cumulative VRR since injection commenced in October 2003 is presently at 0.007. Table 2 summarizes the yearly and cumulative VRR for Waskada Unit No. 19.

When water injection commenced in 2003, there was no visible effect on production. This was due to the fact injection rates were insignificant, and the amount of new wells being brought on production at the same time masked any possible benefits from injection. Until 2009, injection pressures remained high which limits injection rates. As a result, EOG discontinued injection into Waskada Unit No. 19 in August 2009.

In 2011, EOG received permission to convert 3 of the Spearfish injection wells to Mississippian disposal wells. The wells converted were 00/06-27, 00/14-27 and 02/02-27-001-25W1.

INJECTION WELLHEAD PRESSURES

Monthly injection wellhead pressures for 2014 are not in our database since Tundra acquired Waskada Unit No. 19 in October 2014. Individual injection rates can be found in Table 3.

RESERVOIR PRESSURE

There have been no pressure surveys done on the reservoir.

Gas volumes from the field are measured at the 15-9-2-25W1M battery. There is no individual well gas volume measurement. It is not possible to separate out the gas production from only the wells in Unit 16, so the effectiveness of the pressure maintenance program cannot be evaluated on the GOR.

WELL SERVICING

No maintenance was required on the 81 wells in Waskada Unit No. 19 in 2014.

CORROSION AND SCALE PREVENTION

The facilities in Unit 19 are currently using cathodic protection and chemicals to protect against corrosion and scale. All facilities are monitored every 3 months to assess the corrosion and ensure that proper electrical current is being supplied. There have been no issues with corrosion or scale to date.

Biocide chemical is added to the injection water to prevent any sulfide producing bacteria from forming.

CONCLUSION

The current pressure maintenance program is having little effect on oil production in Waskada Unit No. 19. Tundra will maintain the current pressure maintenance program, and continue to monitor production and pressure performance. Plans for future injection conversions and acid treatments to improve unit performance are being considered for 2015.

TABLE NO. 1: WASKADA UNIT NO. 19 WELL SUMMARY

UWI	Type	Status	On Prod Date	Cum Prd Oil (m3)	Cum Prd Water (m3)	Last Prod Date	On Inj Date	Cum Inj Water (m3)	Last Inj Date
100/01-27-001-25W1/0	Vertical	Pumping	2/1/2003	1,667	7,285	5/31/2013		0	
102/01-27-001-25W1/0	Horizontal	Producing	2/1/2010	3,292	101,254	12/31/2014		0	
103/01-27-001-25W1/0	Horizontal	Producing	12/1/2010	6,760	14,721	12/31/2014		0	
104/01-27-001-25W1/0	Horizontal	Producing	10/1/2013	2,007	1,768	12/31/2014		0	
102/02-27-001-25W1/0	Vertical	Producing	1/1/2006	1,114	32,319	7/31/2011		0	
100/03-27-001-25W1/0	Vertical	Abandoned	2/1/2003	24	741	3/31/2003		0	
100/04-27-001-25W1/0	Vertical	Injection	N/A	0	0	10/31/2008	Nov-2003	1,423	10/31/2008
102/04-27-001-25W1/0	Horizontal	Producing	11/1/2010	8,199	27,175	12/31/2014		0	
103/04-27-001-25W1/0	Horizontal	Producing	12/1/2010	7,057	38,117	12/31/2014		0	
100/05-27-001-25W1/0	Vertical	Pumping	10/1/2002	5,603	3,893	12/31/2014		0	
102/05-27-001-25W1/0	Horizontal	Producing	12/1/2010	6,087	8,106	12/31/2014		0	
103/05-27-001-25W1/0	Horizontal	Producing	12/1/2010	4,014	35,897	12/31/2014		0	
104/05-27-001-25W1/0	Horizontal	Producing	9/1/2010	8,934	98,379	12/31/2014		0	
100/06-27-001-25W1/0	Vertical	Injection	N/A	0	0	12/31/2014	Nov-2003	1,403	7/31/2009
100/07-27-001-25W1/0	Vertical	Pumping	2/1/2003	3,696	1,837	7/31/2013		0	
100/08-27-001-25W1/0	Vertical	Producing	1/1/2006	1,925	507	7/31/2014		0	
102/08-27-001-25W1/0	Horizontal	Producing	12/1/2010	4,890	28,216	12/31/2014		0	
103/08-27-001-25W1/0	Horizontal	Producing	12/1/2010	4,250	2,483	12/31/2014		0	
104/08-27-001-25W1/0	Horizontal	Producing	10/1/2010	3,645	30,404	12/31/2014		0	
100/09-27-001-25W1/0	Vertical	Abandoned	10/1/2002	226	6,620	10/31/2003		0	
102/09-27-001-25W1/0	Horizontal	Producing	10/1/2010	4,467	8,112	12/31/2014		0	
103/09-27-001-25W1/0	Horizontal	Producing	10/1/2010	4,681	6,634	12/31/2014		0	
104/09-27-001-25W1/0	Horizontal	Producing	8/1/2010	3,223	38,778	3/31/2014		0	
102/10-27-001-25W1/0	Vertical	Abandoned	N/A						
100/11-27-001-25W1/0	Vertical	Pumping	10/1/2002	3,425	66,792	12/31/2014		0	
102/12-27-001-25W1/0	Horizontal	Producing	9/1/2010	8,528	77,729	12/31/2014		0	
103/12-27-001-25W1/0	Horizontal	Producing	9/1/2010	6,333	40,515	12/31/2014		0	
104/12-27-001-25W1/0	Horizontal	Producing	9/1/2010	5,237	22,660	12/31/2014		0	
100/13-27-001-25W1/0	Vertical	Pumping	8/1/2002	3,061	111,529	9/30/2013		0	
102/13-27-001-25W1/0	Horizontal	Producing	9/1/2010	6,921	38,202	12/31/2014		0	
103/13-27-001-25W1/0	Horizontal	Producing	9/1/2010	2,317	45,643	12/31/2014		0	
100/14-27-001-25W1/0	Vertical	Injection	N/A	0	0	12/31/2014	Nov-2003	942	12/31/2008
102/14-27-001-25W1/0	Horizontal	Producing	11/1/2010	6,305	13,474	2/28/2014		0	
100/15-27-001-25W1/0	Vertical	Pumping	8/1/2002	4,128	1,976	5/31/2012		0	
100/16-27-001-25W1/0	Vertical	Producing	1/1/2006	1,842	752	7/31/2012		0	
102/16-27-001-25W1/0	Horizontal	Producing	8/1/2010	5,290	23,382	12/31/2014		0	
103/16-27-001-25W1/0	Horizontal	Producing	8/1/2010	5,066	6,564	12/31/2014		0	
104/16-27-001-25W1/0	Horizontal	Producing	3/1/2013	2,009	1,317	12/31/2014		0	
100/01-33-001-25W1/0	Vertical	Pumping	3/1/2002	4,823	49,476	6/30/2014		0	
100/07-33-001-25W1/0	Vertical	Pumping	3/1/2002	3,473	5,858	12/31/2013		0	
100/08-33-001-25W1/0	Vertical	Injection	N/A	0	0	5/31/2009	Nov-2003	1,411	5/31/2009
100/01-34-001-25W1/0	Vertical	Pumping	3/1/2002	3,379	1,044	12/31/2014		0	
102/01-34-001-25W1/0	Horizontal	Producing	6/1/2009	8,972	1,486	12/31/2014		0	
103/01-34-001-25W1/0	Horizontal	Producing	3/1/2013	3,227	1,361	12/31/2014		0	
100/02-34-001-25W1/0	Vertical	Injection	N/A	0	0	5/31/2009	Oct-2003	2,475	5/31/2009
100/03-34-001-25W1/0	Vertical	Pumping	3/1/2002	4,862	1,595	12/31/2014		0	
102/03-34-001-25W1/0	Horizontal	Producing	6/1/2009	11,195	75,314	12/31/2014		0	
103/03-34-001-25W1/0	Horizontal	Producing	11/1/2010	5,728	1,952	12/31/2014		0	
100/04-34-001-25W1/0	Vertical	Producing	12/1/2005	1,311	32,105	5/31/2010		0	
102/04-34-001-25W1/0	Horizontal	Producing	2/1/2010	6,409	1,853	12/31/2014		0	
103/04-34-001-25W1/0	Horizontal	Producing	9/1/2013	3,614	13,559	12/31/2014		0	
104/04-34-001-25W1/0	Horizontal	Producing	9/1/2013	1,811	18,053	12/31/2014		0	
105/04-34-001-25W1/0	Horizontal	Producing	9/1/2013	4,256	2,340	12/31/2014		0	
100/05-34-001-25W1/0	Vertical	Pumping	6/1/2002	4,268	1,619	6/30/2013		0	
102/05-34-001-25W1/0	Horizontal	Producing	6/1/2009	7,552	1,389	12/31/2014		0	
103/05-34-001-25W1/0	Horizontal	Producing	2/1/2010	6,298	1,670	12/31/2014		0	
104/05-34-001-25W1/0	Horizontal	Producing	3/1/2010	10,330	24,353	12/31/2014		0	
105/05-34-001-25W1/0	Horizontal	Producing	9/1/2013	2,364	22,557	12/31/2014		0	
106/05-34-001-25W1/0	Horizontal	Producing	9/1/2013	1,445	20,470	12/31/2014		0	
107/05-34-001-25W1/0	Horizontal	Producing	9/1/2013	5,575	3,099	12/31/2014		0	
100/06-34-001-25W1/0	Vertical	Producing	12/1/2005	2,271	536	6/30/2012		0	
100/07-34-001-25W1/0	Vertical	Pumping	3/1/2002	5,162	1,528	11/30/2014		0	
100/08-34-001-25W1/0	Vertical	Injection	N/A	0	0	12/31/2008	Oct-2003	1,675	12/31/2008
102/08-34-001-25W1/0	Horizontal	Producing	6/1/2009	5,152	1,206	12/31/2014		0	
100/09-34-001-25W1/0	Vertical	Producing	6/1/2002	4,558	1,568	11/30/2012		0	
102/09-34-001-25W1/0	Horizontal	Producing	6/1/2009	7,151	1,011	8/31/2013		0	
100/10-34-001-25W1/0	Vertical	Injection	N/A	0	0	5/31/2009	Oct-2003	3,204	5/31/2009
100/11-34-001-25W1/0	Vertical	Producing	6/1/2002	4,500	1,984	10/31/2014		0	
100/12-34-001-25W1/0	Vertical	Producing	12/1/2005	2,822	717	8/31/2013		0	
102/12-34-001-25W1/0	Horizontal	Producing	6/1/2009	7,620	3,700	12/31/2014		0	
103/12-34-001-25W1/0	Horizontal	Producing	3/1/2010	4,701	1,818	12/31/2014		0	
104/12-34-001-25W1/0	Horizontal	Producing	3/1/2010	4,748	8,576	12/31/2014		0	
100/13-34-001-25W1/0	Vertical	Pumping	12/1/2001	5,251	1,833	12/31/2014		0	
102/13-34-001-25W1/0	Horizontal	Producing	3/1/2010	8,576	59,559	12/31/2014		0	
103/13-34-001-25W1/0	Horizontal	Producing	3/1/2010	7,355	2,871	12/31/2014		0	
100/14-34-001-25W1/0	Vertical	Producing	12/1/2005	1,659	721	4/30/2012		0	
102/14-34-001-25W1/0	Horizontal	Producing	7/1/2008	7,886	9,960	12/31/2014		0	
100/15-34-001-25W1/0	Vertical	Pumping	6/1/2002	4,204	1,446	7/31/2012		0	
100/16-34-001-25W1/0	Vertical	Abandoned	N/A	0	0	8/31/2004	Oct-2003	479	8/31/2004
102/16-34-001-25W1/0	Horizontal	Producing	6/1/2009	7,543	2,007	12/31/2014		0	
103/16-34-001-25W1/0	Horizontal	Producing	8/1/2010	5,504	5,530	12/31/2014		0	

TABLE NO. 2 - Waskada Unit No. 19 VRR Calculations

Date	Monthly Oil Prod m3	Cum Oil Prod Km3	Monthly Water Prod m3	Cum Water Prod Km3	Water Oil Ratio m3/m3	Monthly Water Inj m3	Cum Water Inj Km3	VRR	Cum VRR
2001	4	0.004	0	0.000	0.00		0.000	0.000	0.000
2002	10,244	10.248	14,062	14.062	1.37		0.000	0.000	0.000
2003	9,591	19.839	65,411	79.473	6.82	1,818	1.818	0.024	0.018
2004	7,425	27.264	93,300	172.773	12.57	2,937	4.755	0.029	0.023
2005	7,093	34.357	16,885	189.658	2.38	2,138	6.893	0.085	0.030
2006	10,975	45.332	24,031	213.689	2.19	1,631	8.524	0.044	0.032
2007	8,780	54.112	37,568	251.257	4.28	2,421	10.945	0.051	0.035
2008	10,771	64.883	40,022	291.279	3.72	1,487	12.432	0.028	0.034
2009	34,114	98.998	31,617	322.895	0.93	579	13.011	0.008	0.030
2010	81,848	180.845	117,546	440.441	1.44	0	13.011	0.000	0.020
2011	75,155	256.000	243,772	684.213	3.24	0	13.011	0.000	0.013
2012	27,659	283.659	209,773	893.986	7.58	0	13.011	0.000	0.010
2013	30,379	314.038	213,317	1,107.303	7.02	0	13.011	0.000	0.009
2014	29,739	343.777	224,198	1,331.500	7.54	0	13.011	0.000	0.007

TABLE NO. 3

**Tundra Oil and Gas
Waskada Unit No. 19
2014 Injection Volumes**

Well Location	Date	Hours On	H ₂ O Inj Cal-d avg (m ³ /d)	Monthly Injected H ₂ O (m ³)
Unit No. 19 Total:				
	Jan-14	0	0.0	0
	Feb-14	0	0.0	0
	Mar-14	0	0.0	0
	Apr-14	0	0.0	0
	May-14	0	0.0	0
	Jun-14	0	0.0	0
	Jul-14	0	0.0	0
	Aug-14	0	0.0	0
	Sep-14	0	0.0	0
	Oct-14	0	0.0	0
	Nov-14	0	0.0	0
	Dec-14	0	0.0	0
2014 Group Totals:				0
Unit No. 19 Total:				
	2001	0		
	2002	0		
	2003	0	19.8	1,818
	2004	0	8.0	2,937
	2005	0	5.9	2,138
	2006	0	5.4	1,631
	2007	0	6.6	2,421
	2008	0	4.4	1,487
	2009	0	2.7	579
	2010	0	0.0	0
	2011	0	0.0	0
	2012	0	0.0	0
	2013	0	0.0	0
	2014	0	0.0	0
Group Totals:				13,011

TABLE NO. 4

**Tundra Oil and Gas
Waskada Unit No. 19
2014 Production Volumes**

Date	Hours On	Oil Rate (CD) m3/d	Monthly Oil Prod m3	Water Rate (CD) m3/d	Monthly Water Prod m3	Water Oil Ratio m3/m3	Well Count
Jan-14	38,928	112.47	3,487	728.16	22,573	6.47	55
Feb-14	34,368	96.64	2,706	696.25	19,495	7.20	55
Mar-14	37,368	88.78	2,752	645.84	20,021	7.27	54
Apr-14	34,560	88.82	2,665	626.76	18,803	7.06	53
May-14	32,856	81.29	2,520	609.93	18,908	7.50	53
Jun-14	33,432	81.93	2,458	584.89	17,547	7.14	53
Jul-14	27,360	50.32	1,560	350.06	10,852	6.96	52
Aug-14	33,288	70.24	2,177	606.88	18,813	8.64	51
Sep-14	33,360	76.56	2,297	631.91	18,957	8.25	51
Oct-14	35,448	78.06	2,420	635.42	19,698	8.14	51
Nov-14	34,464	75.60	2,268	652.48	19,574	8.63	50
Dec-14	34,848	78.38	2,430	611.51	18,957	7.80	49
	410,280		29,739		224,198		

Date	Hours On	Oil Rate (CD) m3/d	Monthly Oil Prod m3	Water Rate (CD) m3/d	Monthly Water Prod m3	Water Oil Ratio m3/m3	Well Count
2001	24	0.11	4	0.00	0	0.00	1
2002	68,280	28.07	10,244	38.53	14,062	1.37	9
2003	129,672	26.28	9,591	179.21	65,411	6.82	17
2004	132,144	20.29	7,425	254.92	93,300	12.57	16
2005	131,304	19.43	7,093	46.26	16,885	2.38	16
2006	187,747	30.07	10,975	65.84	24,031	2.19	23
2007	195,888	24.05	8,780	102.93	37,568	4.28	23
2008	201,480	29.43	10,771	109.35	40,022	3.72	24
2009	197,640	93.46	34,114	86.62	31,617	0.93	28
2010	308,304	224.24	81,848	322.04	117,546	1.44	41
2011	463,440	205.90	75,155	667.87	243,772	3.24	68
2012	447,576	75.57	27,659	573.15	209,773	7.58	62
2013	413,376	83.23	30,379	584.43	213,317	7.02	55
2014	410,280	81.48	29,739	614.24	224,198	7.54	49
	3,287,155		343,777		1,331,500		