

**WASKADA UNIT NO. 15  
WATERFLOOD EOR PROJECT**

**ANNUAL WATERFLOOD PROGRESS REPORT FOR 2015**

**June 30, 2016**

**Tundra Oil and Gas Partnership**

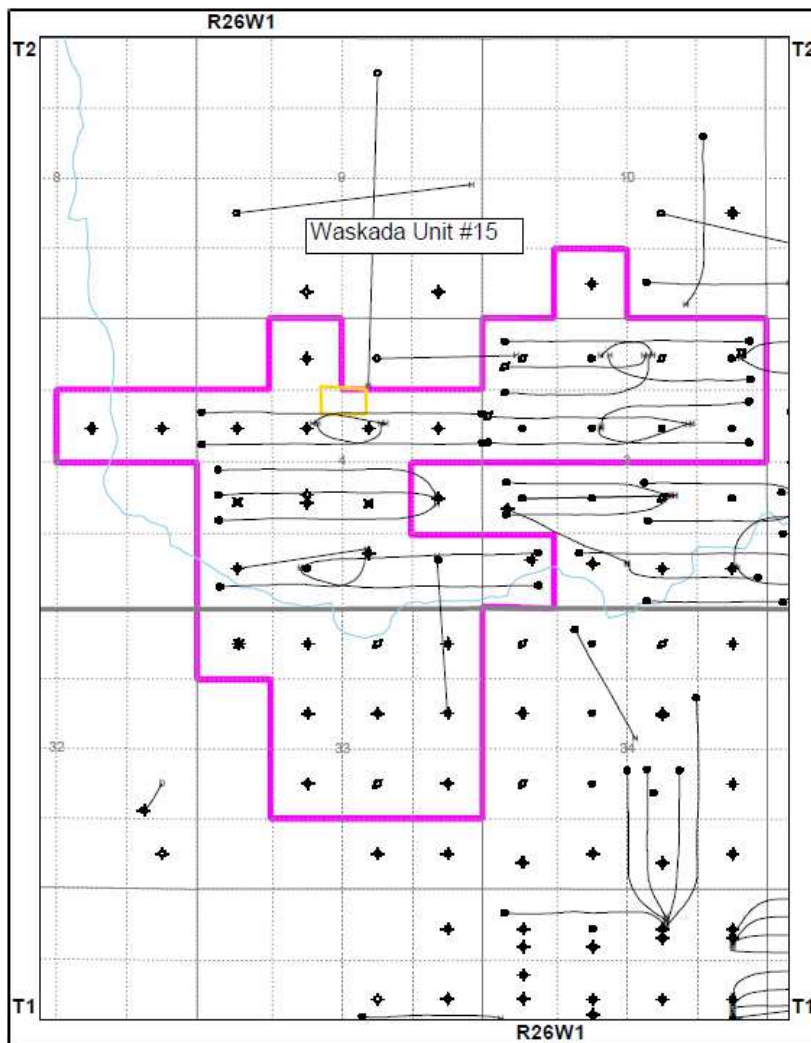
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## **INTRODUCTION**

Waskada Unit No. 15 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 58 effective February 1988. The Unit area contains 27 abandoned/suspended/inactive wells, including 9 abandoned/inactive injectors, and 26 producing/inactive wells in 34 LSDs in Township 1, Range 26 W1 as shown in the figure below.

**Figure 1: Waskada Unit 15 Area Outline**



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra hereby submits the following 2015 Annual Progress Report for Waskada Unit No. 15.

## **DISCUSSION**

### **Production History**

For the wells included in Waskada Unit No. 15, production started in October 1982 with the 00/09-33-001-26W1/0 Vertical well. Average oil production peaked for the first time at 1.9 m<sup>3</sup>/d per well in August 1985. This production was coming from 29 wells and totaled 54.2 m<sup>3</sup>/d for the whole Unit. The production at the end of December 2015 averaged 0.4 m<sup>3</sup>/d per well, totaling 2.3 m<sup>3</sup>/day for the Unit. Water injection commenced in Waskada Unit No. 15 in March 1987 until end of February 2010, and then through 2013. The rates and WOR are presented in Figure 2. There was no water injection through 2015, and there are no plans for injector re-activation.

**Figure 2: Waskada Unit 15 Production/Injection Rates and WOR vs Time**

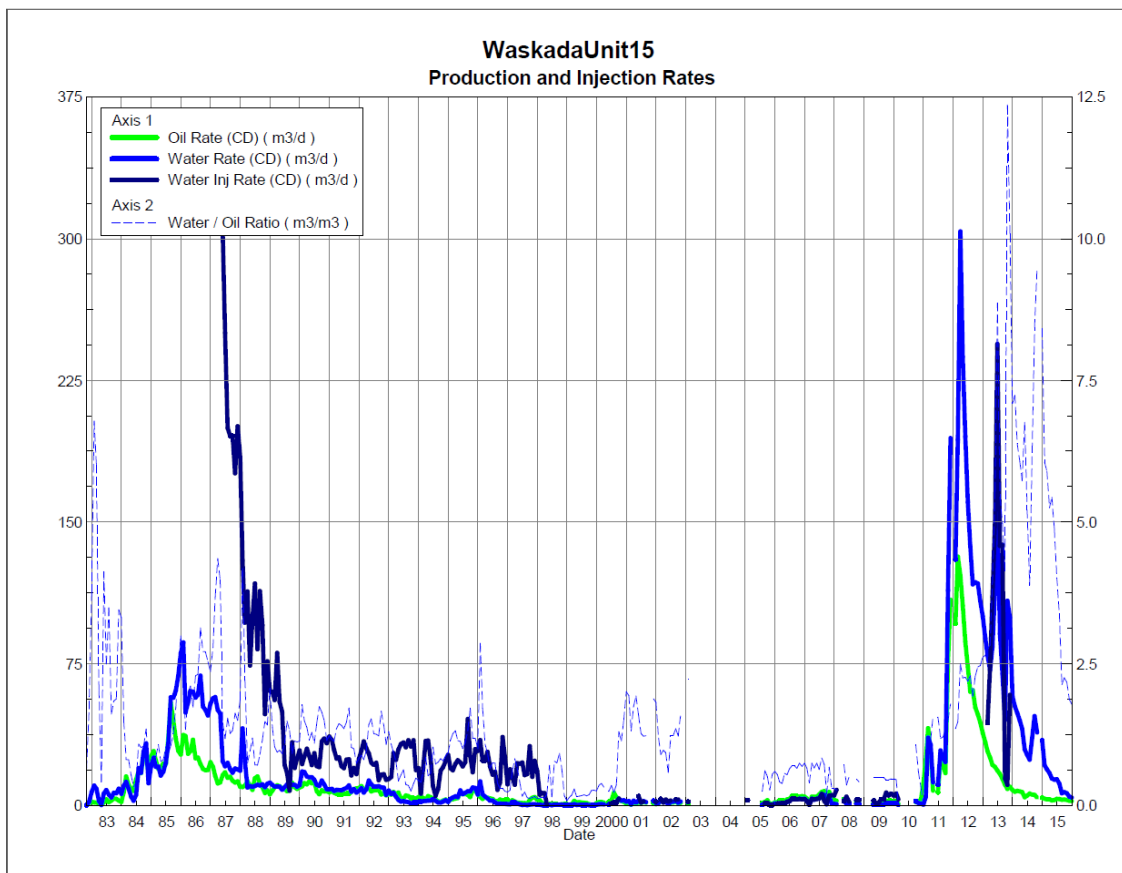
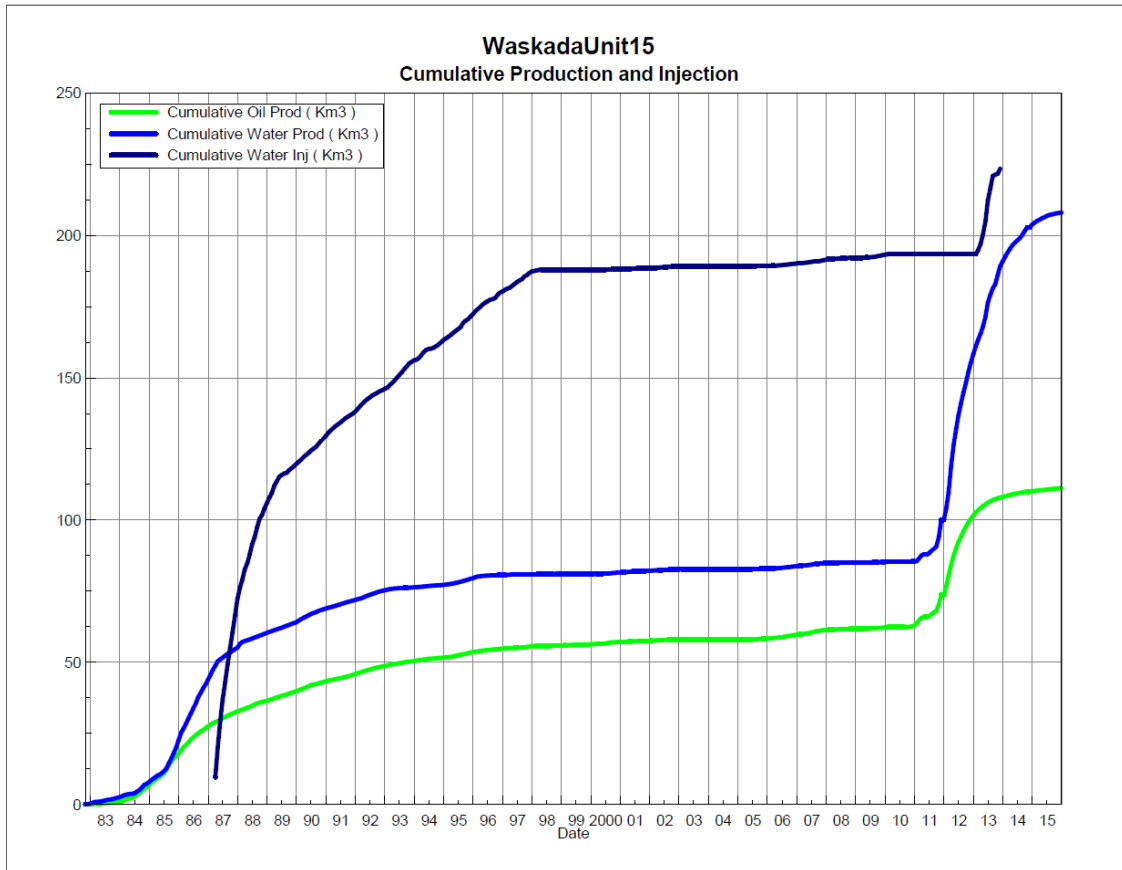


Figure 3 shows the cumulative production for Waskada Unit No. 15 to the end of December 2015 as 111.1 e<sup>3</sup>m<sup>3</sup> of oil, and 208.0 e<sup>3</sup>m<sup>3</sup> of water.

**Figure 3: Waskada Unit 15 Cumulative Oil, Water and Water Injected vs Time**



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

### **Corrosion and Scale Prevention**

The facilities in Unit 15 are currently using cathodic and chemical protection against corrosion and scale in the new horizontal wells. 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.

### **Injection Wellhead Pressures**

No injection wellhead pressures were recorded in 2015.

## Reservoir Pressure

Where practical, Tundra is committed to collecting pressure data from newly drilled injection wells. Since no new wells were drilled in the Unit, therefore, no pressure surveys were conducted in 2015.

## Well Servicing

No well servicing was performed in 2015 for Waskada Unit No. 15.

## Waterflood Performance Discussion

From January 1 to December 31 in 2015, Waskada Unit No. 15 produced 5.3 e3m3 of fluid (1.1 e3m3 of Oil, 4.2 e3m3 of Water). There is no active injection in this Unit, and Tundra Oil and Gas has no plans to reactivate injection in the near future. Due to the horizontal wells being produced and no pressure support occurring in the Unit, the cumulative VRR has dropped in the last 2 years, down to 0.665.

Table 2 summarizes the yearly and cumulative VRR for Waskada Unit No. 15.

**Figure 4: Waskada Unit 15 Production and Injection Rate**

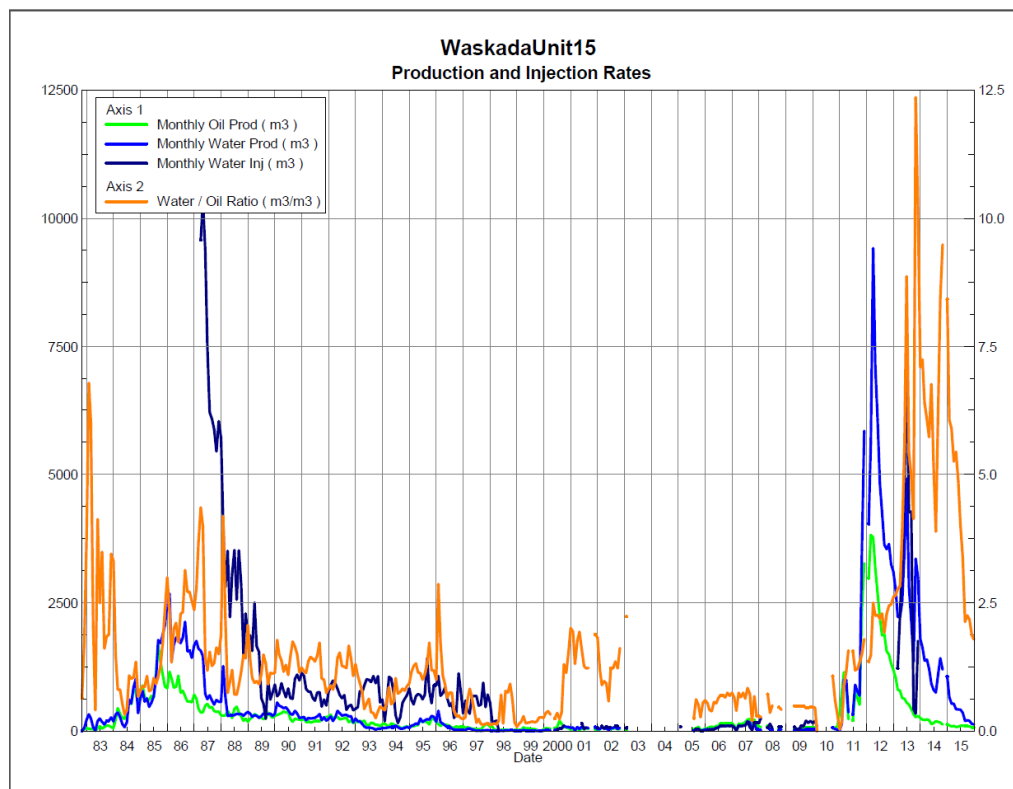


TABLE NO. 1: WASKADA UNIT NO. 15 WELL SUMMARY

UWI	Type	Status	On Prod Date	Cum Prd Oil (m3)	Cum Prd Water (m3)	Last Prod Date	Cum Inj Water (m3)	Last Inj Date
100/06-33-001-26W1/0	Vertical	Abandoned	11/12/1985	1351.8	15785.5	2/29/1988	0	
100/07-33-001-26W1/0	Vertical	Injection	8/31/1985	412	230.9	2/28/1987	36029.1	2/28/1998
100/08-33-001-26W1/0	Vertical	Abandoned	7/27/1985	1423.9	11098.8	3/31/1993	0	
100/09-33-001-26W1/0	Vertical	Abandoned	10/29/1982	2307.5	9720.4	3/31/1993	0	
100/10-33-001-26W1/0	Vertical	Abandoned	11/12/1985	1677.3	861.5	7/31/1996	0	
100/11-33-001-26W1/0	Vertical	Abandoned	11/19/1985	199.8	209.7	7/31/1989	0	
100/13-33-001-26W1/2	Vertical	Abandoned	9/13/1985	709.2	4177.3	2/28/1987	18925.4	9/30/2000
100/14-33-001-26W1/0	Vertical	Abandoned	8/10/1985	2181.7	1472.2	2/28/1995	0	
100/15-33-001-26W1/0	Vertical	Injection	7/15/1985	1689.3	784.7	11/30/2001	23368.6	9/30/2000
100/16-33-001-26W1/0	Vertical	Abandoned	7/18/1985	2246.6	8618.8	4/30/1996	0	
100/04-03-002-26W1/2	Vertical	Producing	3/16/1985	1721.5	2034.8	11/30/2011	0	
102/04-03-002-26W1/0	Horizontal	Producing	11/20/2011	2353.1	3628.9	12/31/2015	0	
103/04-03-002-26W1/0	Horizontal	Producing	11/20/2011	5140.9	11397.7	12/31/2015	0	
100/09-03-002-26W1/0	Vertical	Producing	7/11/1984	3984.5	2210.7	8/31/2011	0	
102/09-03-002-26W1/0	Horizontal	Producing	12/10/2010	2997.3	4105.1	6/30/2013	0	
103/09-03-002-26W1/0	Horizontal	Producing	12/8/2010	5072.1	4795.3	10/31/2014	0	
100/10-03-002-26W1/0	Vertical	Producing	1/20/1984	3939.8	1471.7	8/31/2011	0	
100/11-03-002-26W1/0	Vertical	Producing	5/19/1984	4090.6	2397.1	1/31/2012	0	
100/12-03-002-26W1/0	Vertical	Producing	7/15/1984	6125	1755.7	9/30/2011	0	
102/12-03-002-26W1/0	Horizontal	Injection	10/6/2011	2176.8	2919.2	12/31/2012	18092	11/30/2013
103/12-03-002-26W1/0	Horizontal	Producing	10/6/2011	2093.8	4242.9	12/31/2015	0	
100/13-03-002-26W1/0	Vertical	Injection	7/26/1985	824.2	534.6	2/28/1987	32313.8	2/28/2010
102/13-03-002-26W1/0	Horizontal	Producing	11/1/2011	2599.2	10598	7/31/2015	0	
103/13-03-002-26W1/0	Horizontal	Injection	11/1/2011	1594.5	3181.3	1/31/2013	11765.9	11/30/2013
104/13-03-002-26W1/0	Horizontal	Producing	10/30/2011	2109.6	7501.4	12/31/2015	0	
100/14-03-002-26W1/0	Vertical	Producing	12/22/1982	3796.4	1399.2	1/31/2010	0	
100/15-03-002-26W1/0	Vertical	Suspended	8/29/1985	503.5	500.5	11/30/1986	28386.3	2/28/2010
100/16-03-002-26W1/0	Vertical	Producing	8/29/1985	2733	1958.8	8/31/2011	0	
102/16-03-002-26W1/0	Horizontal	Producing	9/29/2011	3368.4	6786.7	1/31/2014	0	
103/16-03-002-26W1/0	Horizontal	Producing	9/29/2011	1971.3	3157.1	12/31/2014	0	
100/01-04-002-26W1/0	Vertical	Producing	8/30/1984	4288.9	6292.1	10/31/2011	0	
100/02-04-002-26W1/0	Vertical	Abandoned	8/29/1984	2736.8	1866.8	7/31/1996	0	
100/03-04-002-26W1/0	Vertical	Producing	12/20/1984	6245.3	2150.9	11/30/2011	0	
100/04-04-002-26W1/0	Vertical	Abandoned	7/20/1985	356.2	646.7	5/31/1988	0	
102/04-04-002-26W1/0	Horizontal	Producing	12/17/2010	1698.3	3090.8	7/31/2014	0	
100/05-04-002-26W1/0	Vertical	Abandoned	7/12/1985	288.9	360.8	9/30/1986	20650	9/30/2002
102/05-04-002-26W1/0	Horizontal	Producing	3/9/2012	2045.4	7136	12/31/2014	0	
103/05-04-002-26W1/0	Horizontal	Producing	3/11/2012	2234.1	18302.2	1/31/2015	0	
104/05-04-002-26W1/0	Horizontal	Producing	3/12/2012	2562.5	9390.6	12/31/2015	0	
102/06-04-002-26W1/0	Vertical	Abandoned	12/28/1984	1245.8	1095.9	11/30/1989	0	
100/07-04-002-26W1/0	Vertical	Abandoned	9/4/1984	563.7	1177.2	2/28/1987	33872.3	7/31/1997
100/09-04-002-26W1/0	Vertical	Abandoned	1/28/1984	3003.7	1770.7	2/29/1996	0	
102/09-04-002-26W1/0	Horizontal	Producing	1/26/2012	2653.7	5156.8	3/31/2015	0	
103/09-04-002-26W1/0	Horizontal	Producing	1/27/2012	2426.6	4729.1	12/31/2015	0	
100/10-04-002-26W1/0	Vertical	Abandoned	9/5/1984	566.3	1221.9	9/30/1988	0	
100/11-04-002-26W1/0	Vertical	Abandoned	7/30/1985	204.8	528.6	12/31/1987	0	
100/12-04-002-26W1/0	Vertical	Abandoned	7/27/1985	260.1	461.2	7/31/1988	0	
102/12-04-002-26W1/0	Horizontal	Producing	1/31/2012	1702.3	6580.2	5/31/2015	0	
103/12-04-002-26W1/0	Horizontal	Producing	2/12/2012	1138.5	4364.8	4/30/2014	0	
100/14-04-002-26W1/0	Vertical	Abandoned	7/25/1985	265	550.3	10/31/1987	0	
100/09-05-002-26W1/0	Vertical	Abandoned	8/23/1985	533.4	637.9	7/31/1989	0	
100/10-05-002-26W1/0	Vertical	Abandoned	10/20/1985	30.9	76	7/31/1986	0	
100/03-10-002-26W1/0	Vertical	Abandoned	1/21/1984	537.8	440.6	2/29/1988	0	
				110983.6	207564.6	223403.4		

**TABLE NO. 2 - VRR Calculations**

Date	Mth Oil Prod m3	Cum Oil Prod Km3	Mth Water Prod m3	Cum Water Prod Km3	Water Oil Ratio m3/m3	Mth Water Inj m3	Cum Water Inj Km3	VRR	Cum VRR
12/31/1982	99	98.600	283	282.800	2.87		0.000	0.000	0.000
12/31/1983	766	865.000	2250	2533.100	2.94		0.000	0.000	0.000
12/31/1984	5911	6776.200	5350	7883.200	0.91		0.000	0.000	0.000
12/31/1985	11052	17828.600	14638	22521.000	1.32		0.000	0.000	0.000
12/31/1986	9603	27431.500	21297	43817.800	2.22		0.000	0.000	0.000
12/31/1987	5191	32622.600	11284	55101.600	2.17	72161	72160.500	4.182	0.779
12/31/1988	3763	36385.900	5164	60265.300	1.37	33716	105876.300	3.552	1.037
12/31/1989	3395	39780.800	3741	64006.100	1.10	13791	119667.000	1.804	1.090
12/31/1990	3431	43211.800	4756	68762.200	1.39	10110	129777.000	1.162	1.096
12/31/1991	2573	45784.500	3036	71798.200	1.18	8522	138299.300	1.422	1.111
12/31/1992	2810	48594.300	3406	75204.300	1.21	7933	146232.400	1.195	1.116
12/31/1993	1780	50374.600	1036	76239.800	0.58	10080	156311.900	3.270	1.165
12/31/1994	1185	51559.300	829	77069.000	0.70	7045	163357.000	3.215	1.198
12/31/1995	1967	53526.100	2345	79413.900	1.19	9088	172445.200	1.973	1.223
12/31/1996	1192	54718.300	1144	80557.800	0.96	7875	180320.000	3.131	1.257
12/31/1997	826	55543.800	240	80797.900	0.29	7067	187386.500	5.941	1.295
12/31/1998	274	55817.800	87	80884.900	0.32	579	187965.300	1.439	1.296
12/31/1999	394	56212.000	80	80964.700	0.20		187965.300	0.000	1.291
12/31/2000	872	57084.200	520	81485.000	0.60	240	188205.300	0.158	1.279
12/31/2001	368	57451.800	575	82060.000	1.56	323	188528.500	0.324	1.273
12/31/2002	493	57944.400	546	82605.800	1.11	575	189103.900	0.517	1.267
12/31/2003	27	57970.900	59	82664.900	2.23	64	189167.900	0.714	1.267
12/31/2004		57970.900		82664.900			189167.900		1.267
12/31/2005	278	58249.300	137	82801.700	0.49	176	189343.800	0.385	1.264
12/31/2006	1372	59621.000	876	83677.800	0.64	875	190218.800	0.357	1.249
12/31/2007	1681	61301.600	1074	84752.200	0.64	1270	191489.200	0.422	1.233
12/31/2008	434	61735.600	201	84953.600	0.46	706	192195.600	1.008	1.232
12/31/2009	429	62164.700	201	85155.000	0.47	1064	193259.700	1.531	1.234
12/31/2010	665	62830.000	180	85335.200	0.27	286	193545.500	0.302	1.228
12/31/2011	10732	73561.600	14561	99895.700	1.36		193545.500	0.000	1.049
12/31/2012	27920	101481.600	58494	158390.000	2.10		193545.500	0.000	0.704
12/31/2013	6549	108030.900	32560	190949.600	4.97	29858	223403.400	0.745	0.709
12/31/2014	1961	109992.000	12861	203811.000	6.56		223403.400	0.000	0.676
12/31/2015	1101	111093.300	4224	208035.200	3.84		223403.400	0.000	0.665



TABLE NO. 3

**Tundra Oil and Gas  
Waskada Unit No. 15  
2015 Injection Volumes**

Well Location	Date	Hours On	H <sub>2</sub> O Inj Cal-d avg (m <sup>3</sup> /d)	Monthly Injected H <sub>2</sub> O (m <sup>3</sup> )
<b>Unit No. 15 Total:</b>				
	Jan-15	0	0.0	0.00
	Feb-15	0	0.0	0.00
	Mar-15	0	0.0	0.00
	Apr-15	0	0.0	0.00
	May-15	0	0.0	0.00
	Jun-15	0	0.0	0.00
	Jul-15	0	0.0	0.00
	Aug-15	0	0.0	0.00
	Sep-15	0	0.0	0.00
	Oct-15	0	0.0	0.00
	Nov-15	0	0.0	0.00
	Dec-15	0	0.0	0.00
<b>2015 Group Totals:</b>				<b>0.00</b>
<b>Unit No. 15 Total:</b>				
	1981	0	0	0.00
	1982	0	0	0.00
	1983	0	0	0.00
	1984	0	0	0.00
	1985	0	0	0.00
	1986	0	0	0.00
	1987	0	236.0	7,216.05
	1988	0	92.1	2,809.65
	1989	0	37.9	1,149.22
	1990	0	27.7	842.50
	1991	0	23.4	710.19
	1992	0	21.7	661.09
	1993	0	27.6	839.96
	1994	0	19.3	587.09
	1995	0	24.9	757.35
	1996	0	21.5	656.23
	1997	0	19.4	588.88
	1998	0	4.8	144.70
	1999	0	0.0	0.00
	2000	0	2.0	60.00
	2001	0	2.6	80.80
	2002	0	2.7	82.20
	2003	0	2.1	64.00
	2004	0	0.0	0.00
	2005	0	1.2	35.18
	2006	0	2.4	72.92
	2007	0	3.5	105.87
	2008	0	3.8	117.73
	2009	0	3.9	118.23
	2010	0	4.8	142.90
	2011	0	0.0	0.00
	2012	0	0.0	0.00
	2013	0	98.1	2,985.79
	2014	0	0.0	0.00
	2015	0	0.0	0.00
<b>Group Totals:</b>				<b>20,828.53</b>

TABLE NO. 4

**Tundra Oil and Gas  
Waskada Unit No. 15  
2015 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-15	5,736	3.51	109	21.24	658	6	8
Feb-15	5,088	3.24	91	19.07	534	6	8
Mar-15	5,448	3.26	101	17.12	531	5	7
Apr-15	4,056	2.63	79	14.28	428	5	6
May-15	4,896	2.80	87	13.62	422	5	7
Jun-15	5,040	3.47	104	13.92	418	4	7
Jul-15	4,872	3.41	106	11.52	357	3	7
Aug-15	4,464	3.00	93	6.38	198	2	6
Sep-15	4,320	3.13	94	7.03	211	2	6
Oct-15	4,464	2.96	92	6.43	199	2	6
Nov-15	4,296	2.49	75	4.65	139	2	6
Dec-15	4,272	2.33	72	4.16	129	2	6
	56,952		1,101		4,224		

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
31/12/1982	1536	1.07	33	3.06	94	2.03	1
31/12/1983	12845	2.10	64	6.18	188	3.12	2
31/12/1984	58560	16.15	493	14.58	446	0.86	7
31/12/1985	163185	30.21	921	39.95	1220	1.31	19
31/12/1986	238848	26.36	800	58.23	1775	2.30	27
31/12/1987	171190	14.23	433	31.08	940	2.21	20
31/12/1988	120408	10.29	314	14.12	430	1.48	14
31/12/1989	96504	9.31	283	10.25	312	1.12	11
31/12/1990	108264	9.43	286	13.06	396	1.41	12
31/12/1991	113184	7.05	214	8.31	253	1.22	13
31/12/1992	123384	7.67	234	9.30	284	1.23	14
31/12/1993	93288	4.89	148	2.86	86	0.55	11
31/12/1994	70416	3.25	99	2.28	69	0.74	8
31/12/1995	85632	5.37	164	6.41	195	1.21	10
31/12/1996	64848	3.26	99	3.13	95	0.85	7
31/12/1997	30384	2.27	69	0.66	20	0.32	4
31/12/1998	22416	0.75	23	0.24	7	0.40	3
31/12/1999	18840	1.07	33	0.22	7	0.20	2
31/12/2000	30048	2.59	79	1.55	47	0.75	4
31/12/2001	16560	1.20	37	1.88	58	1.59	2
31/12/2002	18000	1.63	49	1.81	55	1.12	3
31/12/2003	1776	0.85	27	1.91	59	2.23	2
31/12/2004	0	0.00	0	0.00	0	0.00	0
31/12/2005	7344	1.52	46	0.75	23	0.47	2
31/12/2006	51792	3.75	114	2.39	73	0.61	6
31/12/2007	56,112	4.57	140	2.91	90	0.57	6
31/12/2008	12,000	2.37	72	1.11	34	0.46	3
31/12/2009	12,576	1.56	48	0.73	22	0.48	2
31/12/2010	11,736	3.62	111	0.99	30	0.42	3
31/12/2011	43,872	35.47	1,073	48.09	1456	1.24	6
31/12/2012	147,840	76.50	2,327	159.96	4875	2.17	17
31/12/2013	136,488	18.00	546	89.22	2713	5.89	16
31/12/2014	104,208	5.87	178	38.48	1169	6.72	13
31/12/2015	56,952	3.02	92	11.62	352	3.76	7
	2,301,036		9,648		17,873		