

Waskada Unit No. 18

Waterflood Progress Report 2018

January 1st through December 31st 2018

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

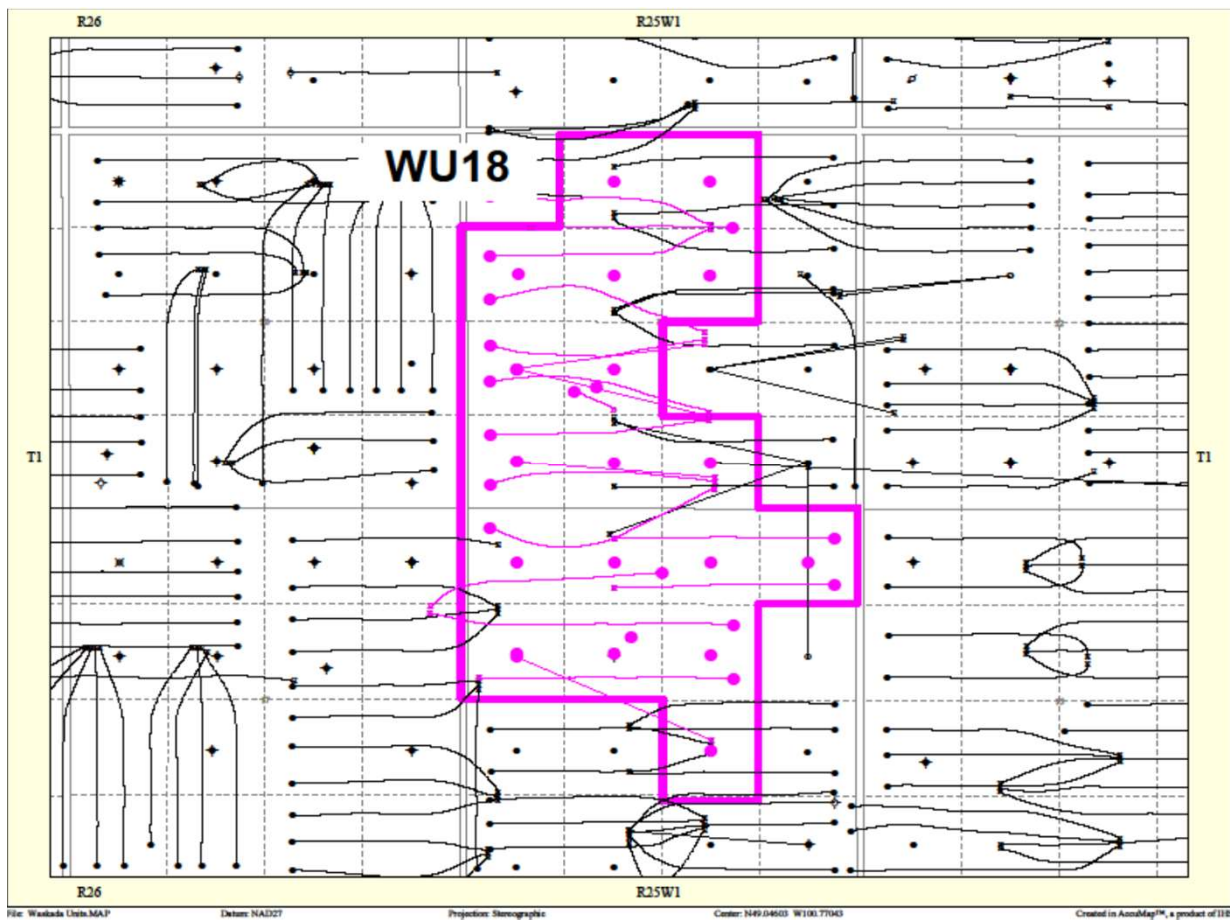
Tundra Oil and Gas

June 26, 2019

INTRODUCTION

The Waskada Unit No. 18 pressure maintenance project commenced water injection into the Lower Amaranth A pool in accordance with Manitoba Energy and Mines Order No. PM 68, dated October 1, 1991. Waskada Unit No. 18 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 pink in Figure 1, contains 34 wells over 18 LSDs in Township 1, Range 25W1.

Figure 1: Waskada Unit No. 18 Area Outline



Waskada Unit No. 18

Tundra Oil and Gas (Tundra), as the operator of the Waskada Unit No. 18 Enhanced Oil Recovery (EOR) project hereby submits the 2018 EOR report as per section 73 of the Drilling and Production Regulations.

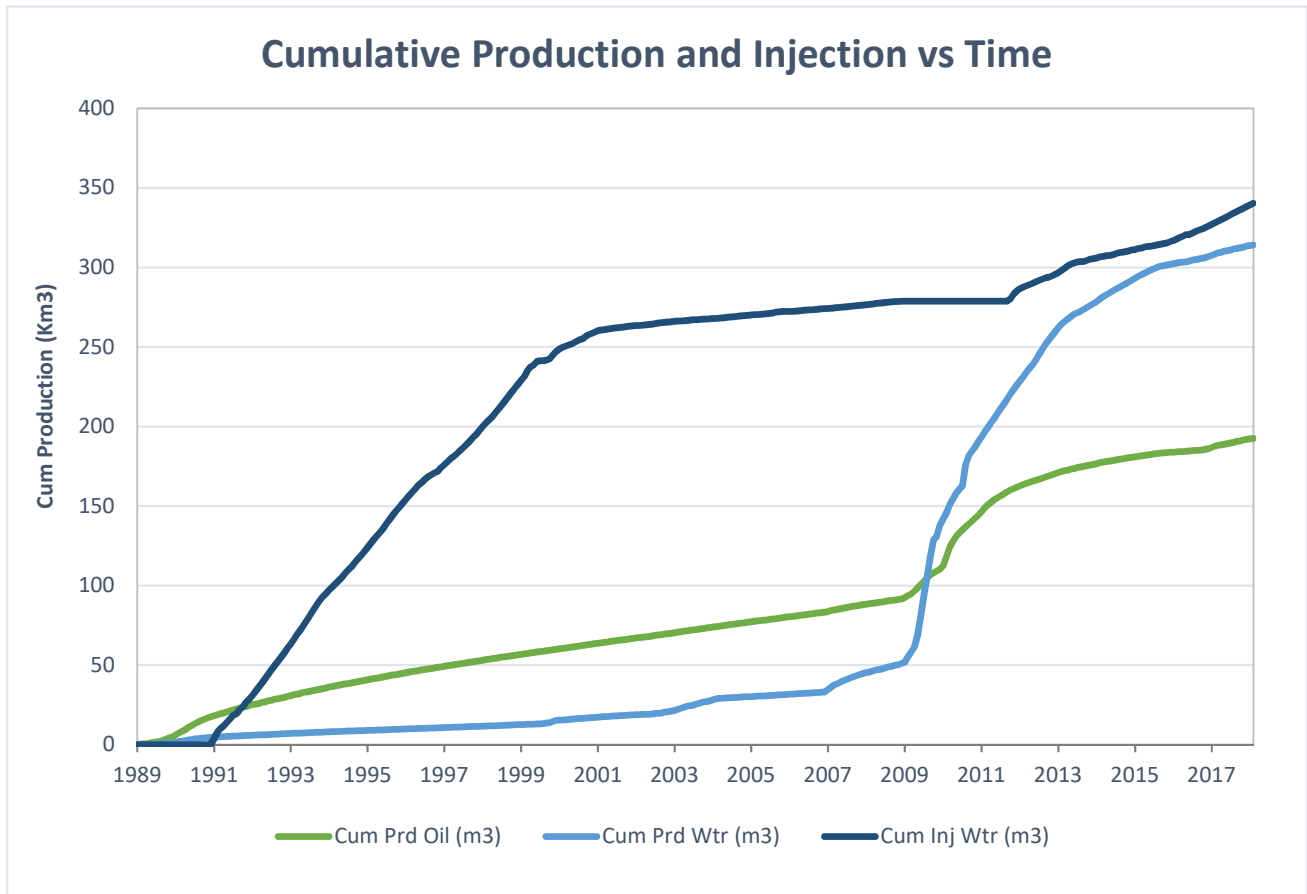
a) Monthly oil and water production rates, injection rate, GOR and WOR

MONTH	Cal Dly Oil m ³ /day	Cal Dly Wtr m ³ /day	Cal Inj Wtr m ³ /day	WOR m ³ /m ³	GOR m ³ /m ³
Jan-2018	19.79	22.70	64.45	1.15	27.54
Feb-2018	14.62	18.87	65.29	1.29	36.16
Mar-2018	14.00	16.11	67.14	1.15	30.88
Apr-2018	12.58	15.30	69.16	1.22	35.5
May-2018	12.53	14.14	68.96	1.13	34.5
Jun-2018	14.55	18.74	68.86	1.29	27.73
Jul-2018	15.87	15.25	68.10	0.96	22.36
Aug-2018	11.72	14.03	62.75	1.20	30.27
Sep-2018	15.13	13.29	65.97	0.88	22.25
Oct-2018	13.77	14.43	65.94	1.05	28.12
Nov-2018	12.58	12.95	66.25	1.03	31.8
Dec-2018	10.64	13.09	66.84	1.23	36.39

b) Cumulative volume of oil, gas and water produced and fluid injected

2018 PRODUCTION	
Produced Oil (m ³)	5,102
Produced Gas (m ³)	152
Produced Water (m ³)	5,739
Fluid Injected (m ³)	12,162
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	192,544
Produced Water (m ³)	314,158

Waskada Unit No. 18



c) Monthly wellhead injection pressure for each injection well

	00/10-21 Inj		03/11-16 Inj		00/14-21 Inj		00/15-21 Inj		02/12-21 Inj		WU18	
MONTH	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2018	0.0	0	0.0	0	133.8	4976	500.2	2979	365.0	4970	999.0	2585
Feb-2018	0.0	0	0.0	0	120.2	4975	472.5	2975	321.3	4970	914.0	2584
Mar-2018	0.0	0	0.0	0	132.3	4978	558.8	2969	349.5	4968	1040.6	2583
Apr-2018	0.0	0	0.0	0	126.8	4947	581.1	2851	329.5	4947	1037.4	2549
May-2018	0.0	0	0.0	0	128.2	4964	603.3	2750	337.5	4965	1069.0	2536
Jun-2018	0.0	0	0.0	0	123.7	4949	585.1	2740	324.0	4965	1032.8	2531
Jul-2018	0.0	0	0.0	0	126.9	4976	600.6	2536	328.2	4972	1055.6	2497
Aug-2018	0.0	0	0.0	0	125.7	4992	611.5	2699	235.4	4969	972.6	2532
Sep-2018	0.0	0	0.0	0	116.7	4938	565.7	2533	307.2	5005	989.6	2495
Oct-2018	0.0	0	0.0	0	120.4	4957	590.1	2561	311.5	4967	1022.0	2497
Nov-2018	0.0	0	0.0	0	113.3	4924	583.3	2559	297.1	4968	993.7	2490
Dec-2018	0.0	0	0.0	0	120.8	4976	612.6	2584	302.6	4969	1036.0	2506
Total	0.0		0.0		1488.8		6864.7		3808.9		12162.3	
Avg Inj P		0		0		4963		2728		4969		2532

MONTH	Jan-2018	Feb-2018	Mar-2018	Apr-2018	May-2018	Jun-2018	Jul-2018	Aug-2018	Sep-2018	Oct-2018	Nov-2018	Dec-2018
Total m3	999.0	914.0	1040.6	1037.4	1069.0	1032.8	1055.6	972.6	989.6	1022.0	993.7	1036.0
Daily (m³/d)	32.23	32.64	33.57	34.58	34.48	34.43	34.05	31.37	32.99	32.97	33.12	33.42

2018 AVG. ANNUAL DAILY INJECTION = 33.32 m3/d

CUMULATIVE INJECTION TO Dec 31, 2017 = 328,207 m3

TOTAL 2018 ANNUAL INJECTION = 12,162 m3

CUMULATIVE INJECTION TO Dec 31, 2018 = 340,370 m3

d) Summary of the result of any survey of reservoir pressure conducted in 2018. N/A

e) **Date and type of any well servicing.**

Well	Service Description	Date
102.05-21-001-25W1.00	Pump Change	12/16/2018
102.13-16-001-25W1.00	Pump Change/ PSN Lower	10/11/2018
103.05-21-001-25W1.00	Cemented Liner Cleanout & P. Test Csg	6/18/2018
103.12-21-001-25W1.00	Spearfish Cemented Liner Cleanout	7/30/2018

f) **Calculations of voidage replacement ratio on a monthly and cumulative basis**

VOIDAGE CALCULATIONS

OIL FORMATION VOLUME FACTOR (Rm3/Sm3) = 1.17

MONTH	Mth Oil Prod (m3)	Cum Oil Prod (Km3)	Mth Water Prod (m3)	Cum Water Prod (Km3)	Mth Water Inj (m3)	Cum Water Inj (Km3)	VRR	Cum VRR
Jan-2018	613.6	188.06	703.8	309.12	999.0	329.21	0.703	0.622
Feb-2018	409.3	188.46	528.4	309.65	914.0	330.12	0.907	0.623
Mar-2018	433.9	188.90	499.3	310.15	1040.6	331.16	1.033	0.623
Apr-2018	377.5	189.28	458.9	310.61	1037.4	332.20	1.152	0.624
May-2018	388.4	189.66	438.3	311.05	1069.0	333.27	1.197	0.625
Jun-2018	436.4	190.10	562.2	311.61	1032.8	334.30	0.963	0.626
Jul-2018	491.9	190.59	472.9	312.08	1055.6	335.36	1.007	0.627
Aug-2018	363.4	190.96	435	312.52	972.6	336.33	1.131	0.628
Sep-2018	454.0	191.41	398.6	312.92	989.6	337.32	1.064	0.628
Oct-2018	426.8	191.84	447.3	313.36	1022.0	338.34	1.080	0.629
Nov-2018	377.3	192.21	388.6	313.75	993.7	339.33	1.197	0.630
Dec-2018	329.8	192.54	405.8	314.16	1036.0	340.37	1.309	0.631

g) **An outline of the method used for quality control and treatment of the injected fluid**

The injected fluid is treated by filtration.

h) **A report of any unusual performance problems and remedial measures taken or being considered. N/A**

i) **Any other information necessary to evaluate the project**

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
100/07-16-001-25W1/0	Vertical	Abandoned Zone	-
100/10-16-001-25W1/0	Vertical	Abandoned Zone	-
102/10-16-001-25W1/0	Horizontal	Producing	-
103/10-16-001-25W1/0	Horizontal	Producing	-
102/11-16-001-25W1/0	Vertical	Abandoned	-
103/11-16-001-25W1/0	Vertical	Injection	-
100/12-16-001-25W1/0	Vertical	Producing	-
100/13-16-001-25W1/0	Vertical	Producing	-
102/13-16-001-25W1/0	Horizontal	Potential	-
100/14-16-001-25W1/0	Vertical	Pumping	-
102/14-16-001-25W1/0	Horizontal	Producing	-
100/15-16-001-25W1/0	Vertical	Injection	-
100/16-16-001-25W1/0	Vertical	Pumping	-
102/16-16-001-25W1/0	Horizontal	Suspended	-
103/16-16-001-25W1/0	Horizontal	Suspended	-
100/02-21-001-25W1/0	Vertical	Pumping	-
100/03-21-001-25W1/0	Vertical	Producing	-
100/04-21-001-25W1/0	Vertical	Abandoned	-
102/04-21-001-25W1/0	Horizontal	Producing	-
103/04-21-001-25W1/0	Horizontal	Producing	-
100/05-21-001-25W1/0	Vertical	Producing	-
102/05-21-001-25W1/0	Horizontal	Producing	-
103/05-21-001-25W1/0	Horizontal	Producing	-
100/06-21-001-25W1/0	Vertical	Abandoned	-
102/06-21-001-25W1/0	Vertical	Abandoned	-
100/10-21-001-25W1/0	Vertical	Injection	-
100/11-21-001-25W1/0	Vertical	Pumping	-
100/12-21-001-25W1/0	Vertical	Pumping	-
102/12-21-001-25W1/0	Horizontal	Injection	-
103/12-21-001-25W1/0	Horizontal	Producing	-
102/13-21-001-25W1/2	Horizontal	Producing	-
100/14-21-001-25W1/0	Vertical	Injection	-
100/15-21-001-25W1/0	Vertical	Injection	-
102/15-21-001-25W1/0	Horizontal	Suspended	-

k) Discussion

Water injection commenced with 4 injector wells on October 1991. Two more injectors were added in March 2001. **In 2011, EOG received permission to convert 3 Spearfish injection wells into Mississippian SWD wells. The wells converted were 00/10-21, 00/15-16 and 03/11-16-001-25W1.**