

Waskada Unit No. 16

Waterflood Progress Report 2019

January 1st through December 31st 2019

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

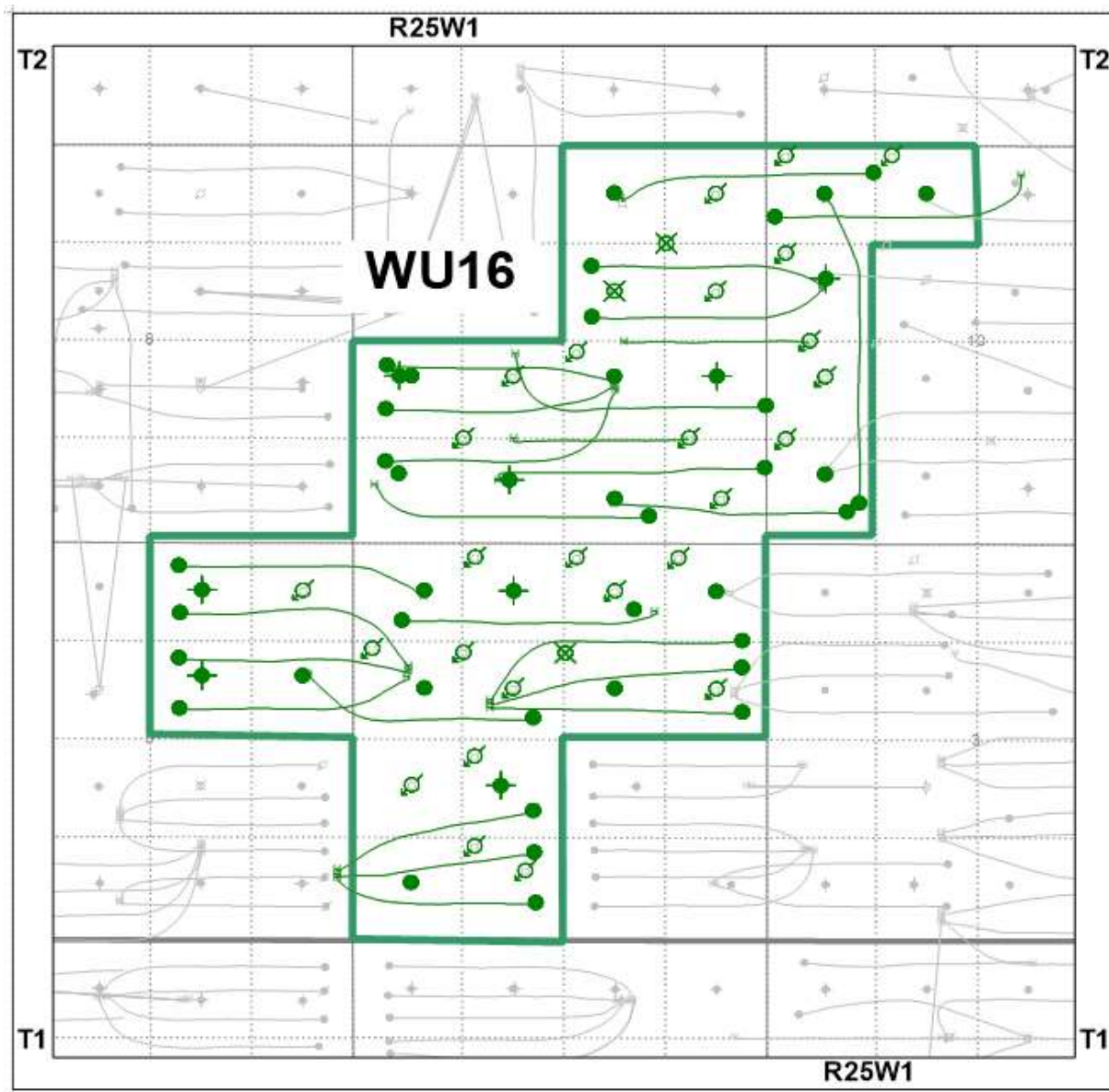
Tundra Oil and Gas

March 19, 2020

INTRODUCTION

The Waskada Unit No.16 pressure maintenance project commenced water injection into the Lower Amaranth A pool in accordance with Manitoba Energy and Mines Order No. PM 57, dated May 1, 1987. This unit was enlarged on October 1, 1988 to its current boundary. Waskada Unit No. 16 was acquired from EOG Resources Canada Inc. effective October 1, 2014 with Tundra Oil and Gas (Tundra) as the new operator. THE EOR project area, outlined in green in Figure 1, contains 76 wells (11 abandoned, 39 producing/inactive and 26 injectors (only 3 currently on injection)) over 33 LSDs in Township 2, Range 25W1.

Figure 1: Waskada Unit No. 16 Area Outline



Waskada Unit No. 16

Tundra Oil and Gas (Tundra), as the operator of the Waskada Unit No. 16 Enhanced Oil Recovery (EOR) project hereby submits the 2019 EOR report as per section 73 of the Drilling and Production Regulations.

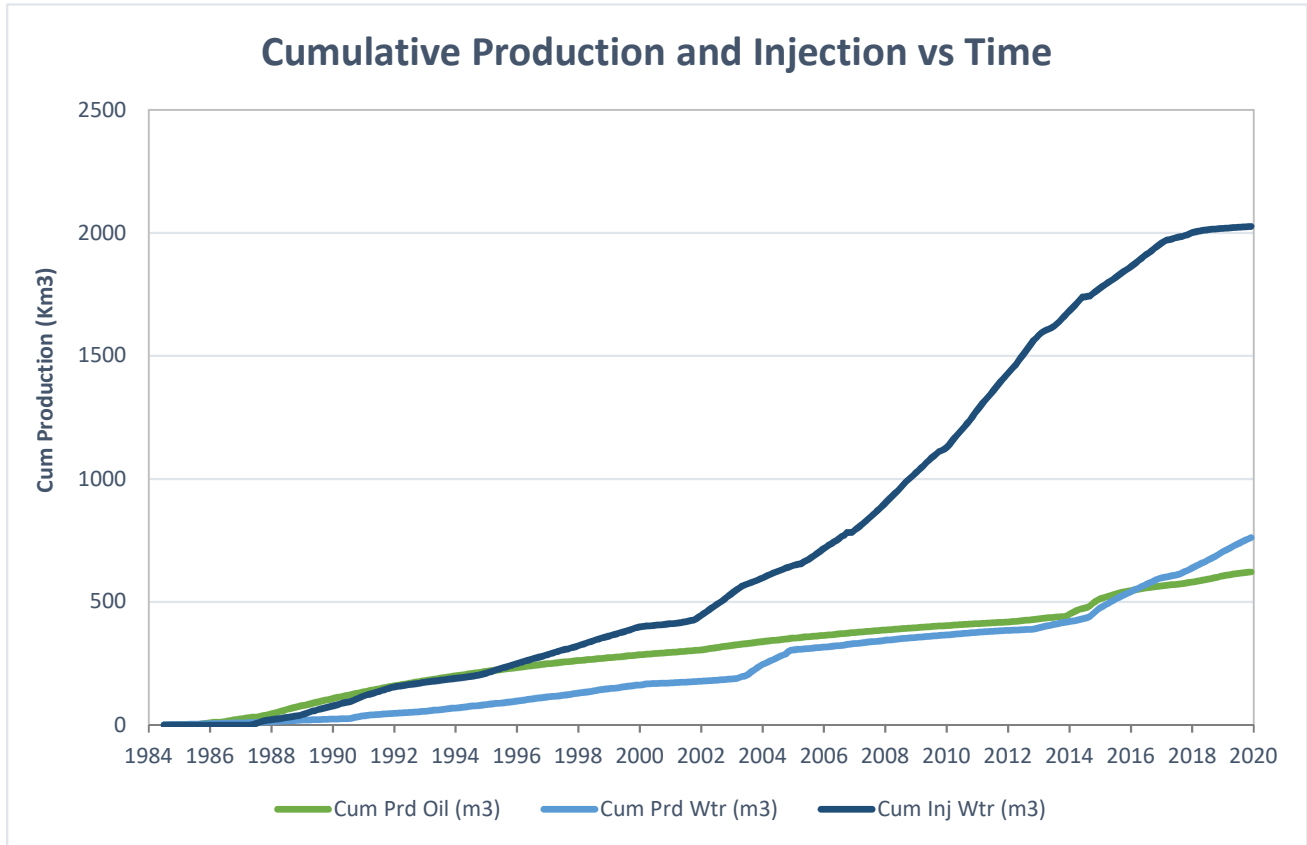
a) Monthly oil and water production rates, injection rate, GOR and WOR

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-2019	78.52	197.12	39.37	2.51	0
Feb-2019	69.84	182.38	63.53	2.61	0
Mar-2019	57.28	177.95	47.85	3.11	0
Apr-2019	49.06	175.96	52.09	3.59	0
May-2019	48.01	193.71	28.64	4.03	0
Jun-2019	46.74	179.70	22.98	3.84	0
Jul-2019	42.53	178.48	22.62	4.20	0
Aug-2019	42.19	172.21	22.94	4.08	0
Sep-2019	40.43	158.34	21.79	3.92	0
Oct-2019	42.28	164.29	22.26	3.89	0
Nov-2019	43.67	150.10	21.89	3.44	0
Dec-2019	40.14	158.69	21.80	3.95	0

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

2019 PRODUCTION	
Produced Oil (m ³)	18,232
Produced Gas (m ³)	0
Produced Water (m ³)	63,545
Fluid Injected (m ³)	8,689
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	621,829
Produced Water (m ³)	761,623

Waskada Unit No. 16



c) Monthly wellhead injection pressure for each injection well

	00/16-05 Inj		C0/06-04 Inj		C0/12-04 Inj		C0/11-04 Inj		02/01-09 Inj		00/09-04 Inj	
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-2019	304.6	242	305.7	2348	0.0	4900	0.0	3291	0.0	5000	0.0	3677
Feb-2019	278.0	259	277.8	2494	0.0	4900	333.7	4247	0.0	5000	0.0	3677
Mar-2019	236.7	236	220.2	2452	0.0	4900	284.9	4863	0.0	5000	0.0	3677
Apr-2019	290.8	299	290.1	2567	0.0	4900	200.4	4675	0.0	5000	0.0	3677
May-2019	149.7	316	308.4	2507	0.0	4900	429.6	4969	0.0	5000	0.0	3677
Jun-2019	0.0	328	299.0	2611	0.0	4900	390.5	4921	0.0	5000	0.0	3677
Jul-2019	0.0	328	311.5	2640	0.0	4900	389.8	4893	0.0	5000	0.0	3677
Aug-2019	0.0	328	309.6	2805	0.0	4900	401.4	4874	0.0	5000	0.0	3677
Sep-2019	0.0	328	300.1	2911	0.0	4900	353.5	4947	0.0	5000	0.0	3677
Oct-2019	0.0	328	307.8	3000	0.0	4900	382.4	4974	0.0	5000	0.0	3677
Nov-2019	0.0	328	297.0	3019	0.0	4900	359.7	4951	0.0	5000	0.0	3677
Dec-2019	0.0	328	307.8	3079	0.0	4900	368.0	4872	0.0	5000	0.0	3677
Total	1259.7		3534.8		0.0		3893.7		0.0		0.0	
Avg Inj P		304		2703		4900		4706		5000		3677

	WU16	
MONTH	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2019	610.3	3243
Feb-2019	889.4	3429
Mar-2019	741.7	3521
Apr-2019	781.3	3520
May-2019	887.6	3562
Jun-2019	689.4	3573
Jul-2019	701.3	3573
Aug-2019	711.0	3597
Sep-2019	653.5	3627
Oct-2019	690.2	3646
Nov-2019	656.7	3646
Dec-2019	675.8	3643
Total	8688.3	
Avg Inj P		3548

c) Monthly wellhead injection pressure for each injection well

MONTH	Jan-2019	Feb-2019	Mar-2019	Apr-2019	May-2019	Jun-2019	Jul-2019	Aug-2019	Sep-2019	Oct-2019	Nov-2019	Dec-2019
Total m3	610.3	889.4	741.7	781.3	887.6	689.4	701.3	711.0	653.5	690.2	656.7	675.8
Daily (m³/d)	19.69	31.77	23.93	26.04	28.63	22.98	22.62	22.94	21.78	22.26	21.89	21.80

2019 AVG. ANNUAL DAILY INJECTION = 23.86 m3/d

CUMULATIVE INJECTION TO Dec 31, 2018 = 2,017,563 m3

TOTAL 2019 ANNUAL INJECTION = 8,688 m3
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CUMULATIVE INJECTION TO Dec 31, 2019 = 2,026,251 m3

d) Summary of the result of any survey of reservoir pressure conducted in 2019. N/A

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

Well	Service Description	Date
102.15-05-002-25W1.00	Pump Change	11/28/2019
103.05-09-002-25W1.00	Cemented Liner Clean Out	10/24/2019
103.10-05-002-25W1.00	Cemented Liner Clean Out	11/7/2019
103.15-05-002-25W1.00	Pump Change	3/19/2019
104.03-04-002-25W1.00	Pump Change	4/5/2019
104.05-09-002-25W1.00	Pump Change	4/24/2019
104.13-10-002-25W1.00	Cemented Liner Clean Out	10/2/2019

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-2019	2434.0	606.03	6110.8	704.19	610.3	2018.17	0.068	1.428
Feb-2019	1955.5	607.99	5106.6	709.29	889.4	2019.06	0.120	1.421
Mar-2019	1775.8	609.76	5516.3	714.81	741.7	2019.80	0.098	1.414
Apr-2019	1471.9	611.23	5278.9	720.09	781.3	2020.59	0.112	1.408
May-2019	1488.4	612.72	6005	726.10	887.7	2021.47	0.115	1.401
Jun-2019	1402.2	614.12	5391.1	731.49	689.5	2022.16	0.098	1.395
Jul-2019	1318.5	615.44	5532.8	737.02	701.3	2022.86	0.099	1.388
Aug-2019	1307.9	616.75	5338.4	742.36	711.0	2023.58	0.104	1.382
Sep-2019	1213.0	617.96	4750.2	747.11	653.6	2024.23	0.106	1.377
Oct-2019	1310.7	619.27	5093	752.20	690.2	2024.92	0.104	1.371
Nov-2019	1310.0	620.58	4503	756.70	656.7	2025.58	0.109	1.366
Dec-2019	1244.4	621.83	4919.3	761.62	675.8	2026.25	0.106	1.361

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>
100/03-04-002-25W1/0	Vertical	Injection	-
103/03-04-002-25W1/0	Horizontal	Producing	-
104/03-04-002-25W1/0	Horizontal	Producing	WIW Conversion
1C0/03-04-002-25W1/0	Vertical	Injection	-
100/04-04-002-25W1/0	Vertical	Producing	-
100/05-04-002-25W1/0	Vertical	Injection	-
100/06-04-002-25W1/0	Vertical	Abandoned Zone	-
103/06-04-002-25W1/0	Horizontal	Producing	-
1C0/06-04-002-25W1/0	Vertical	Injection	-
100/09-04-002-25W1/0	Vertical	Injection	-
102/09-04-002-25W1/0	Horizontal	Producing	-
103/09-04-002-25W1/0	Horizontal	Producing	WIW Conversion
104/09-04-002-25W1/0	Horizontal	Producing	-
100/10-04-002-25W1/0	Vertical	Producing	-
1C0/10-04-002-25W1/0	Vertical	Abandoned	-
100/11-04-002-25W1/0	Vertical	Injection	-
103/11-04-002-25W1/0	Horizontal	Producing	-
1C0/11-04-002-25W1/0	Vertical	Injection	-
100/12-04-002-25W1/0	Vertical	Producing	-
1C0/12-04-002-25W1/0	Vertical	Injection	-
100/13-04-002-25W1/2	Vertical	Producing	-
102/13-04-002-25W1/0	Horizontal	Producing	-
100/14-04-002-25W1/0	Vertical	Abandoned Zone	-
1C0/14-04-002-25W1/0	Vertical	Injection	-
100/15-04-002-25W1/0	Vertical	Injection	-
102/15-04-002-25W1/0	Vertical	Producing	-
1C0/15-04-002-25W1/0	Vertical	Injection	-
100/16-04-002-25W1/0	Vertical	Producing	-
1C0/16-04-002-25W1/0	Vertical	Injection	-
100/09-05-002-25W1/0	Vertical	Producing	-
100/10-05-002-25W1/0	Vertical	Abandoned	-
102/10-05-002-25W1/0	Horizontal	Producing	-
103/10-05-002-25W1/0	Horizontal	Producing	WIW Conversion
100/15-05-002-25W1/0	Vertical	Abandoned Zone	-
102/15-05-002-25W1/0	Horizontal	Producing	WIW Conversion
103/15-05-002-25W1/0	Horizontal	Producing	-
100/16-05-002-25W1/0	Vertical	Injection	-
100/01-09-002-25W1/0	Vertical	Injection	-
102/01-09-002-25W1/0	Horizontal	Injection	-
103/01-09-002-25W1/0	Horizontal	Producing	-
100/02-09-002-25W1/0	Vertical	Producing	-
102/02-09-002-25W1/0	Horizontal	Producing	-
100/03-09-002-25W1/0	Vertical	Abandoned Zone	-
1C0/03-09-002-25W1/0	Vertical	Injection	-
100/04-09-002-25W1/2	Vertical	Producing	-

j) Well List

Waskada Unit No. 16 Well List

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
102/04-09-002-25W1/0	Horizontal	Producing	WIW Conversion
100/05-09-002-25W1/0	Vertical	Abandoned	-
102/05-09-002-25W1/0	Vertical	Pumping	-
103/05-09-002-25W1/0	Horizontal	Producing	-
104/05-09-002-25W1/0	Horizontal	Producing	WIW Conversion
100/06-09-002-25W1/0	Vertical	Injection	-
100/07-09-002-25W1/0	Vertical	Producing	-
1C0/07-09-002-25W1/0	Vertical	Injection	-
100/08-09-002-25W1/0	Vertical	Abandoned Zone	-
102/08-09-002-25W1/0	Horizontal	Producing	-
100/09-09-002-25W1/0	Vertical	Injection	-
1C0/09-09-002-25W1/0	Vertical	Abandoned	-
100/10-09-002-25W1/0	Vertical	Abandoned	-
102/10-09-002-25W1/0	Horizontal	Producing	-
103/10-09-002-25W1/0	Horizontal	Producing	-
100/15-09-002-25W1/0	Vertical	Producing	-
100/16-09-002-25W1/0	Vertical	Injection	-
100/04-10-002-25W1/0	Vertical	Producing	-
102/04-10-002-25W1/0	Horizontal	Producing	-
103/04-10-002-25W1/0	Horizontal	Producing	-
1C0/04-10-002-25W1/0	Vertical	Injection	-
100/05-10-002-25W1/0	Vertical	Injection	-
102/05-10-002-25W1/0	Horizontal	Injection	-
100/12-10-002-25W1/0	Vertical	Abandoned Zone	-
1C0/12-10-002-25W1/0	Vertical	Injection	-
100/13-10-002-25W1/0	Vertical	Producing	-
103/13-10-002-25W1/0	Horizontal	Producing	-
104/13-10-002-25W1/0	Horizontal	Producing	-
1C0/13-10-002-25W1/0	Vertical	Injection	-
100/14-10-002-25W1/0	Vertical	Producing	-
1C0/14-10-002-25W1/0	Vertical	Injection	-