

Birdtail Unit No. 3

Waterflood Progress Report 2017

January 1st through December 31st 2017

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

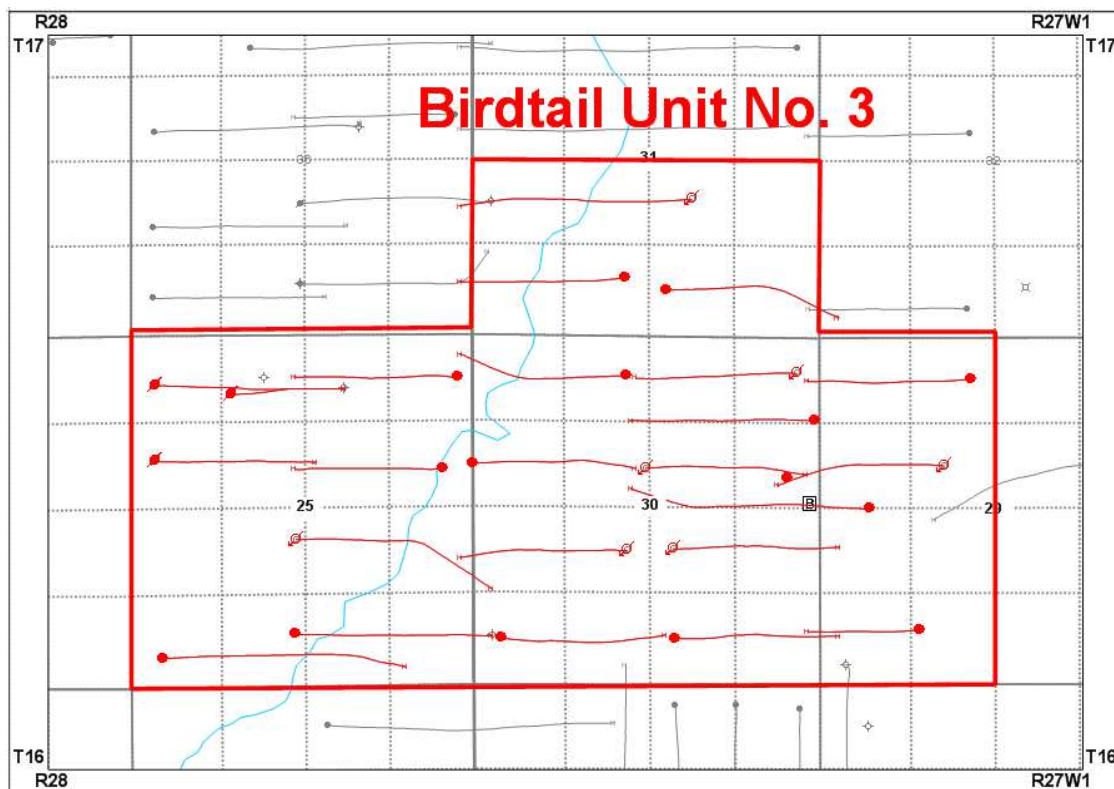
Tundra Oil and Gas

July 26, 2018

INTRODUCTION

Birdtail Unit No. 3 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 45 effective May 1, 2015 with Tundra Oil and Gas (Tundra) as Operator. The EOR project area, outlined in red in Figure 1, contains 1 vertical and 24 horizontal producing wells in 48 LSDs in Township 16, Ranges 27 & 28 W1.

Figure 1: Birdtail Unit No. 3 Area Outline



Birdtail Unit No. 3

Tundra Oil and Gas (Tundra), as the operator of the Birdtail Unit No. 3 Enhanced Oil Recovery (EOR) project hereby submits the 2017 EOR report as per section 73 of the Drilling and Production Regulations.

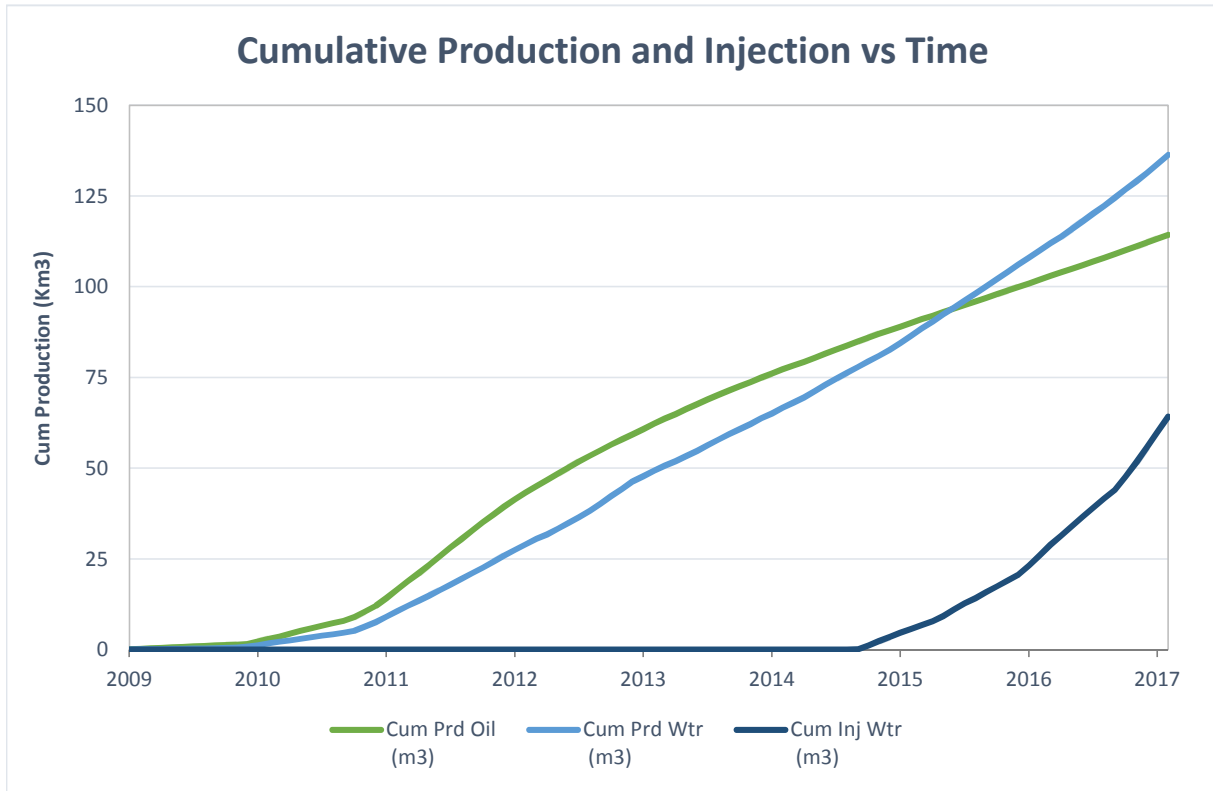
a) Monthly oil and water production rates, injection rate, GOR and WOR

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-2017	34.19	64.99	95.81	1.90	0
Feb-2017	33.59	65.61	87.93	1.95	0
Mar-2017	31.98	66.88	86.13	2.09	0
Apr-2017	33.24	69.84	84.17	2.10	0
May-2017	34.19	71.59	83.03	2.09	0
Jun-2017	32.72	68.19	82.30	2.08	0
Jul-2017	33.76	74.62	75.61	2.21	0
Aug-2017	34.37	72.84	118.23	2.12	0
Sep-2017	34.37	72.96	132.37	2.12	0
Oct-2017	34.30	74.05	134.68	2.16	0
Nov-2017	35.69	83.00	138.57	2.33	0
Dec-2017	34.89	82.74	137.45	2.37	0

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

2017 PRODUCTION	
Produced Oil (m ³)	12,389
Produced Gas (m ³)	0
Produced Water (m ³)	26,396
Fluid Injected (m ³)	38,243
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	114,354
Produced Water (m ³)	136,369

Birdtail Unit No. 3



c) Monthly wellhead injection pressure for each injection well

	00/11-29 Inj		00/07-30 Inj		00/11-30 Inj		00/06-30 Inj		00/06-25 Inj		00/07-31 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-2017	0.0	0	739.0	3461	360.0	3973	466.0	3482	771.0	1793	634.0	2959
Feb-2017	0.0	0	641.0	3462	315.0	3919	387.0	3468	683.0	1897	436.0	2977
Mar-2017	0.0	0	711.0	3482	343.0	3954	407.0	3481	772.0	2030	437.0	2984
Apr-2017	0.0	0	689.0	3482	326.0	3938	379.0	3484	740.0	2045	391.0	2984
May-2017	0.0	0	714.0	3482	332.0	3905	377.0	3483	771.0	2082	380.0	2985
Jun-2017	0.0	0	701.0	3481	316.0	3971	353.0	3481	746.0	2130	353.0	2988
Jul-2017	201.0	32	525.0	2810	281.0	3897	307.0	3414	560.0	2107	271.0	2848
Aug-2017	749.0	949	306.0	1079	341.0	3881	412.0	3602	781.0	2189	461.0	3063
Sep-2017	745.0	1900	385.0	725	335.0	3972	456.0	3979	830.0	2284	743.0	3540
Oct-2017	755.0	2372	491.0	920	339.0	3934	434.0	3979	906.0	2391	718.0	3751
Nov-2017	746.0	2546	595.0	1409	323.0	3969	404.0	3983	895.0	2461	727.0	3747
Dec-2017	768.0	2666	615.0	1538	327.0	3972	404.0	3978	923.0	2494	768.0	3766
Total	3964.0		7112.0		3938.0		4786.0		9378.0		6319.0	
Avg Inj P		872		2444		3940		3651		2159		3216

	00/16-30 Inj		Birdtail Unit 3	
MONTH	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2017	0.0	0	2970.0	3134
Feb-2017	0.0	0	2462.0	3145
Mar-2017	0.0	0	2670.0	3186
Apr-2017	0.0	0	2525.0	3186
May-2017	0.0	0	2574.0	3187
Jun-2017	0.0	0	2469.0	3210
Jul-2017	199.0	152	2344.0	2281
Aug-2017	615.0	2896	3665.0	2523
Sep-2017	477.0	3067	3971.0	2781
Oct-2017	532.0	3831	4175.0	3025
Nov-2017	467.0	3977	4157.0	3156
Dec-2017	456.0	3975	4261.0	3198
Total	2746.0		38243.0	
Avg Inj P		1492		3001

c) Monthly wellhead injection pressure for each injection well

MONTH	Jan-2017	Feb-2017	Mar-2017	Apr-2017	May-2017	Jun-2017	Jul-2017	Aug-2017	Sep-2017	Oct-2017	Nov-2017	Dec-2017
Total m3	2970.0	2462.0	2670.0	2525.0	2574.0	2469.0	2344.0	3665.0	3971.0	4175.0	4157.0	4261.0
Daily (m ³ /d)	95.81	87.93	86.13	84.17	83.03	82.30	75.61	118.23	132.37	134.68	138.57	137.45

2017 AVG. ANNUAL DAILY INJECTION = 104.69 m3/d
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CUMULATIVE INJECTION TO Dec 31, 2016 = 25,969 m3
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TOTAL 2017 ANNUAL INJECTION = 38,243 m3

CUMULATIVE INJECTION TO Dec 31, 2017 = 64,212 m3
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d) Summary of the result of any survey of reservoir pressure conducted in 2017. N/A

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

Well	Service Description	Date
100.05-29-016-27W1.00	Pump Change	6/2/2017
100.11-29-016-27W1.00	Convert well to WIW.	6/8/2017
100.14-29-016-27W1.00	Tubing Leak	10/16/2017
100.02-30-016-27W1.00	Pump Change	10/12/2017
100.16-30-016-27W1.00	Convert well to WIW.	6/6/2017
100.03-31-016-27W1.00	Pump Change	8/8/2017

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

VOIDAGE CALCULATIONS

OIL FORMATION VOLUME FACTOR (Rm3/Sm3) = 1.071

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-2017	1059.9	103.02	2014.6	111.99	2970.0	28.94	0.943	0.130
Feb-2017	940.5	103.96	1837.1	113.82	2462.0	31.40	0.866	0.139
Mar-2017	991.4	104.96	2073.3	115.90	2670.0	34.07	0.852	0.149
Apr-2017	997.3	105.95	2095.3	117.99	2525.0	36.60	0.798	0.158
May-2017	1060.0	107.01	2219.4	120.21	2574.0	39.17	0.767	0.167
Jun-2017	981.6	108.00	2045.8	122.26	2469.0	41.64	0.797	0.175
Jul-2017	1046.5	109.04	2313.3	124.57	2344.0	43.98	0.683	0.182
Aug-2017	1065.5	110.11	2258	126.83	3665.0	47.65	1.078	0.195
Sep-2017	1031.1	111.14	2188.7	129.02	3971.0	51.62	1.206	0.208
Oct-2017	1063.2	112.20	2295.6	131.31	4175.0	55.79	1.216	0.222
Nov-2017	1070.6	113.27	2490.1	133.80	4157.0	59.95	1.143	0.235
Dec-2017	1081.7	114.35	2565	136.37	4261.0	64.21	1.144	0.248

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

The injection water for Birdtail Unit No. 3 is sourced from the 00/02-19-016-27W/2 well (Lodgepole formation). The water is treated at the 09-05-16-27W1 battery where it is filtered to 0.50 microns and has scale inhibitor added.

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>
100/03-29-016-27W1/0	Horizontal	Producing	-
100/05-29-016-27W1/0	Horizontal	Producing	-
100/11-29-016-27W1/0	Horizontal	Injection	-
100/14-29-016-27W1/0	Horizontal	Producing	-
100/02-30-016-27W1/0	Horizontal	Producing	-
102/04-30-016-27W1/0	Horizontal	Producing	-
100/06-30-016-27W1/0	Horizontal	Injection	-
100/07-30-016-27W1/0	Horizontal	Injection	-
100/09-30-016-27W1/0	Vertical	Producing	-
100/11-30-016-27W1/0	Horizontal	Injection	-
100/14-30-016-27W1/0	Horizontal	Producing	-
100/16-30-016-27W1/0	Horizontal	Injection	-
102/16-30-016-27W1/0	Horizontal	Producing	-
100/02-31-016-27W1/0	Horizontal	Producing	-
100/03-31-016-27W1/0	Horizontal	Producing	-
100/07-31-016-27W1/0	Horizontal	Injection	-
100/03-25-016-28W1/2	Horizontal	Producing	-
100/04-25-016-28W1/0	Horizontal	Producing	-
100/06-25-016-28W1/0	Horizontal	Injection	-
100/09-25-016-28W1/0	Horizontal	Producing	-
102/09-25-016-28W1/0	Horizontal	Producing	WIW Conversion
100/12-25-016-28W1/0	Horizontal	Suspended	-
100/13-25-016-28W1/2	Horizontal	Suspended	-
102/14-25-016-28W1/3	Horizontal	Suspended	-
100/16-25-016-28W1/0	Horizontal	Producing	-