

Birdtail Unit No. 1

Waterflood Progress Report 2017

January 1st through December 31st 2017

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

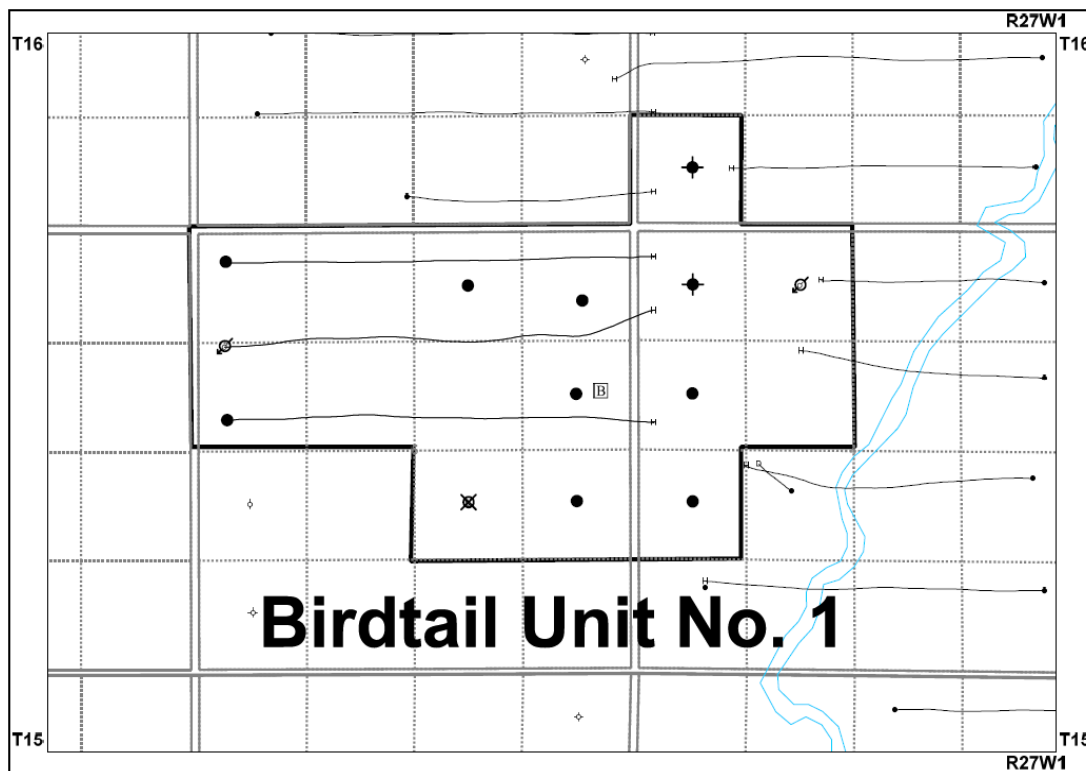
Tundra Oil and Gas

August 9, 2018

INTRODUCTION

Birdtail Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 7 effective August 1, 1999 with Progress Energy Production Partnership as Operator. Tundra acquired the unit from Progress Energy Production Partnership and become operator in October 2003. The EOR project area contains 13 wells in 16 LSDs in Township 16, Range 27 W1 as shown in the figure below.

Figure 1: Birdtail Unit No. 1 Area Outline



Birdtail Unit No. 1

Tundra Oil and Gas (Tundra), as the operator of the Birdtail Unit No. 1 Enhanced Oil Recovery (EOR) project hereby submits the 2017 EOR report as per section 73 of the Drilling and Production Regulations.

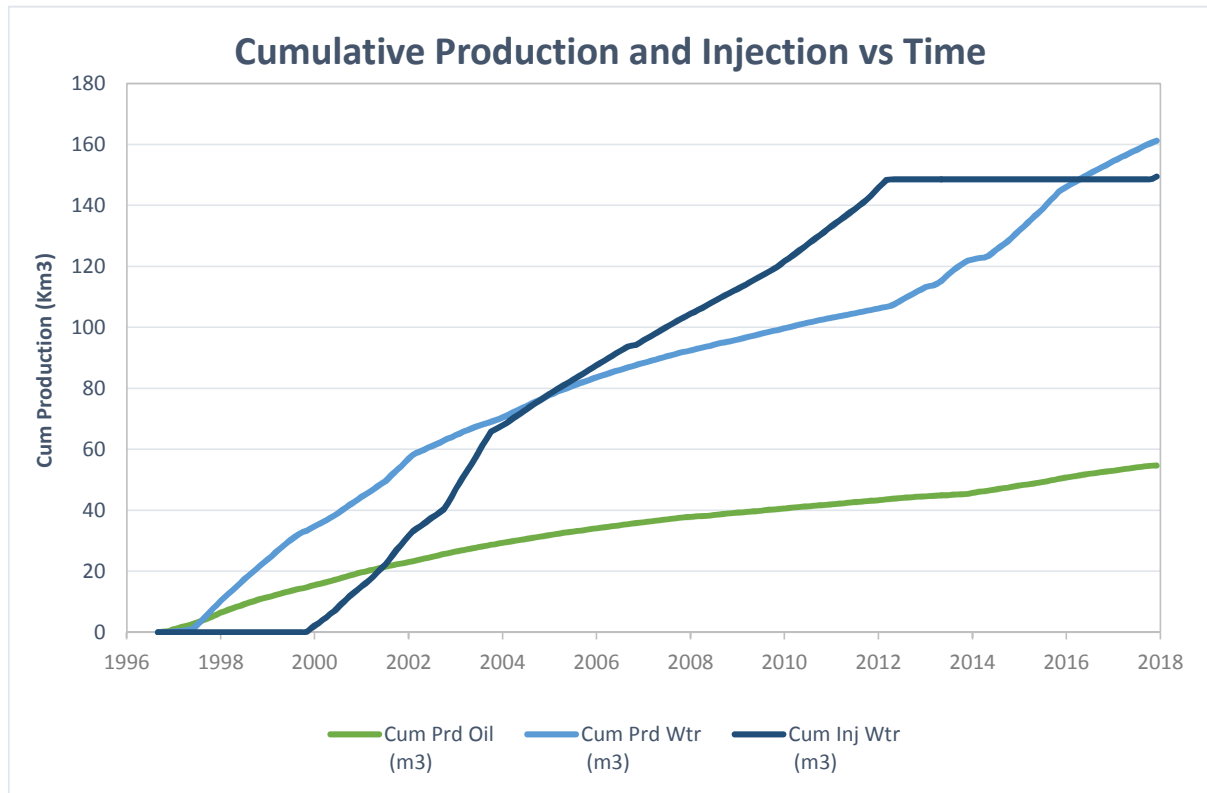
a) Monthly oil and water production rates, injection rate, GOR and WOR

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	5.58	22.13	0.00	3.96	0
Feb-2017	5.76	22.26	0.00	3.86	0
Mar-2017	6.06	21.05	0.00	3.47	0
Apr-2017	6.17	20.05	0.00	3.25	0
May-2017	6.09	20.07	0.00	3.29	0
Jun-2017	5.73	18.94	0.00	3.30	0
Jul-2017	6.02	20.35	0.00	3.38	0
Aug-2017	5.51	21.74	0.00	3.94	0
Sep-2017	4.56	23.22	0.00	5.10	0
Oct-2017	3.20	17.76	0.00	5.55	0
Nov-2017	3.03	17.27	8.97	5.70	0
Dec-2017	2.63	17.07	22.35	6.49	0

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

2017 PRODUCTION	
Produced Oil (m ³)	1,834
Produced Gas (m ³)	0
Produced Water (m ³)	7,353
Fluid Injected (m ³)	962
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	54,690
Produced Water (m ³)	161,219

Birdtail Unit No. 1



c) Monthly wellhead injection pressure for each injection well

MONTH	02/12-05 Inj		Birdtail Unit 1	
	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2017	-	-	-	-
Feb-2017	-	-	-	-
Mar-2017	-	-	-	-
Apr-2017	-	-	-	-
May-2017	-	-	-	-
Jun-2017	-	-	-	-
Jul-2017	-	-	-	-
Aug-2017	-	-	-	-
Sep-2017	-	-	-	-
Oct-2017	-	-	-	-
Nov-2017	269.0	297	269.0	297
Dec-2017	693.0	2868	693.0	2868
Total	962.0		962.0	
Avg Inj P		1583		1583

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	-	-	-	-	-	-	-	-	-	-	269.0	693.0
Daily (m³/d)	-	-	-	-	-	-	-	-	-	-	8.97	22.35

2017 AVG. ANNUAL DAILY INJECTION = 15.66 m3/d

CUMULATIVE INJECTION TO Dec 31, 2016 = 148,474 m3

TOTAL 2017 ANNUAL INJECTION = 962 m3

CUMULATIVE INJECTION TO Dec 31, 2017 = 149,436 m3

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
102.12-05-016-27W1.00	Water Injection Conversion	10/20/2017

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	173.1	53.03	686	154.55	0.0	148.47	0.000	0.703
Feb-2017	161.4	53.19	623.2	155.18	0.0	148.47	0.000	0.700
Mar-2017	187.9	53.38	652.6	155.83	0.0	148.47	0.000	0.697
Apr-2017	185.0	53.56	601.5	156.43	0.0	148.47	0.000	0.694
May-2017	188.9	53.75	622.3	157.05	0.0	148.47	0.000	0.692
Jun-2017	172.0	53.92	568.3	157.62	0.0	148.47	0.000	0.689
Jul-2017	186.7	54.11	630.9	158.25	0.0	148.47	0.000	0.687
Aug-2017	170.9	54.28	673.8	158.92	0.0	148.47	0.000	0.684
Sep-2017	136.7	54.42	696.7	159.62	0.0	148.47	0.000	0.681
Oct-2017	99.2	54.52	550.6	160.17	0.0	148.47	0.000	0.679
Nov-2017	90.9	54.61	518.1	160.69	269.0	148.74	0.437	0.679
Dec-2017	81.6	54.69	529.3	161.22	693.0	149.44	1.124	0.680

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

The injection water for Birdtail Unit No. 1 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>
100/05-04-016-27W1/0	Vertical	Producing	-
100/12-04-016-27W1/0	Vertical	Pumping	-
100/13-04-016-27W1/0	Vertical	Abandoned	-
100/14-04-016-27W1/0	Vertical	Injection	-
100/07-05-016-27W1/0	Vertical	Abandoned	-
100/08-05-016-27W1/0	Vertical	Producing	-
100/09-05-016-27W1/0	Vertical	Pumping	-
100/12-05-016-27W1/0	Horizontal	Producing	-
102/12-05-016-27W1/0	Horizontal	Injection	-
100/13-05-016-27W1/0	Horizontal	Producing	-
100/15-05-016-27W1/0	Vertical	Producing	-
100/16-05-016-27W1/0	Vertical	Pumping	-
100/04-09-016-27W1/0	Vertical	Abandoned	-

k) Discussion

Water injection started in November 1999 in the two injectors at 00/14-04 and 00/07-05-016-27W1 (00/07-05). The 00/07-05 injector has been abandoned since July 2003. In April 2012, injection into the 00/14-04 well was suspended.

Tundra is in the process of redeveloping this unit. Tundra no longer wants to use produced water for injection in this Unit, so they currently have in place a new source of water at 00/02-32-016-27W1. As part of the redevelopment of this unit, Tundra drilled a horizontal producer at 00/13-05-016-27W1/0 in the north part of the unit in 2013 along with the construction of a new injection line coming from the Birdtail battery located at 09-05-016-27W1. This line will supply filtered source water to the unit.

In September 2014, Tundra drilled another horizontal producer at 00/12-05-016-27W1/0. Tundra also applied to expand the Unit to include the NE/4 of 05-016-27W1/0 in 2014. In July 2015, a produce first horizontal injector between the 00/12-05 and 00/13-05 producers was drilled at 02/12-05-016-27W1/0. Tundra also plans to convert a couple of vertical wells into injectors to improve the sweep efficiency of the waterflood.