

**North Pierson Unit No. 1**

**Waterflood Progress Report 2018**

**January 1<sup>st</sup> through December 31<sup>st</sup> 2018**

**Prepared for:**

**Manitoba Industry, Economic Development and Mines**

**Petroleum Branch**

**Prepared by:**

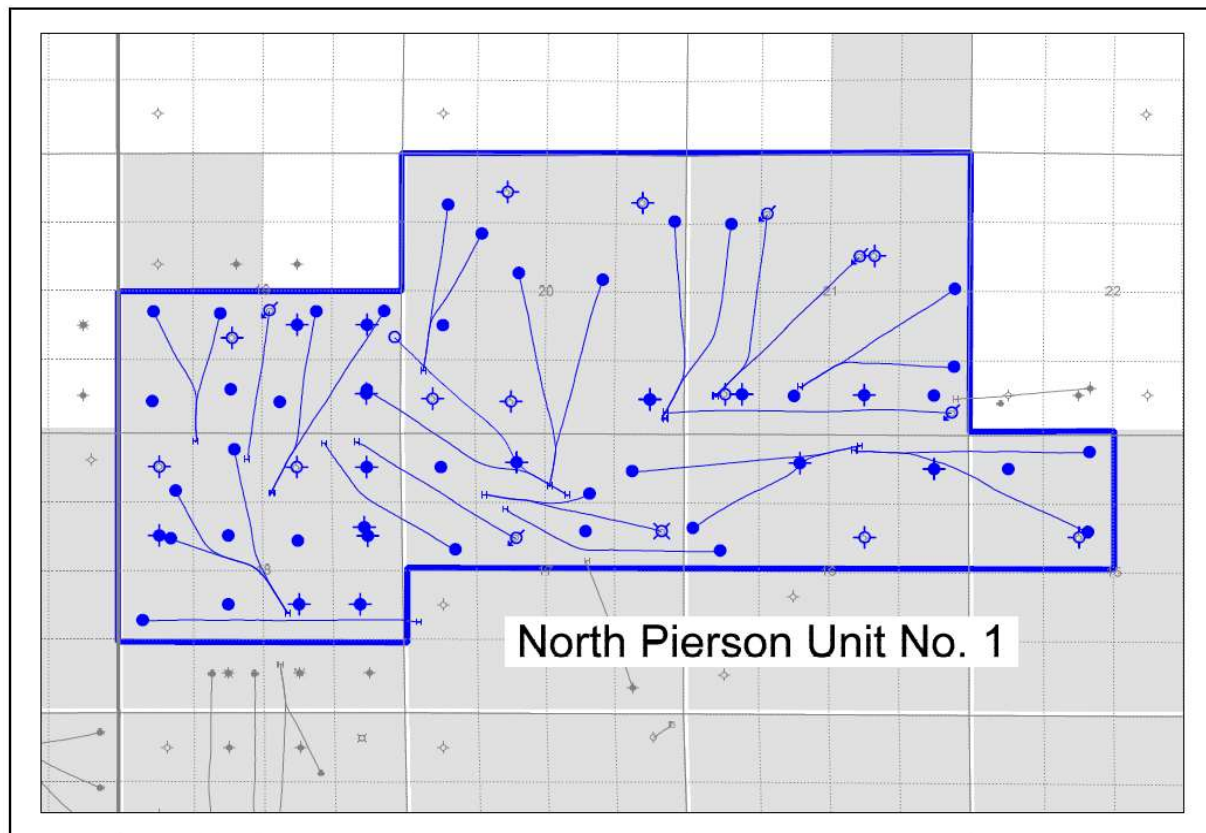
**Tundra Oil and Gas**

**June 26, 2019**

## INTRODUCTION

North Pierson Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 31, effective January 1st, 2014 with Tundra Oil and Gas as Operator. The EOR project area, outlined in blue in Figure 1, contains 27 abandoned wells, 12 producing vertical wells, 26 producing horizontal wells and 5 injection wells in 72 LSDs in Township 3, Range 28W1.

**Figure 1: North Pierson Unit No. 1 Area Outline**



## North Pierson Unit No. 1

Tundra Oil and Gas (Tundra), as the operator of the North Pierson Unit No. 1 Enhanced Oil Recovery (EOR) project hereby submits the 2018 EOR report as per section 73 of the Drilling and Production Regulations.

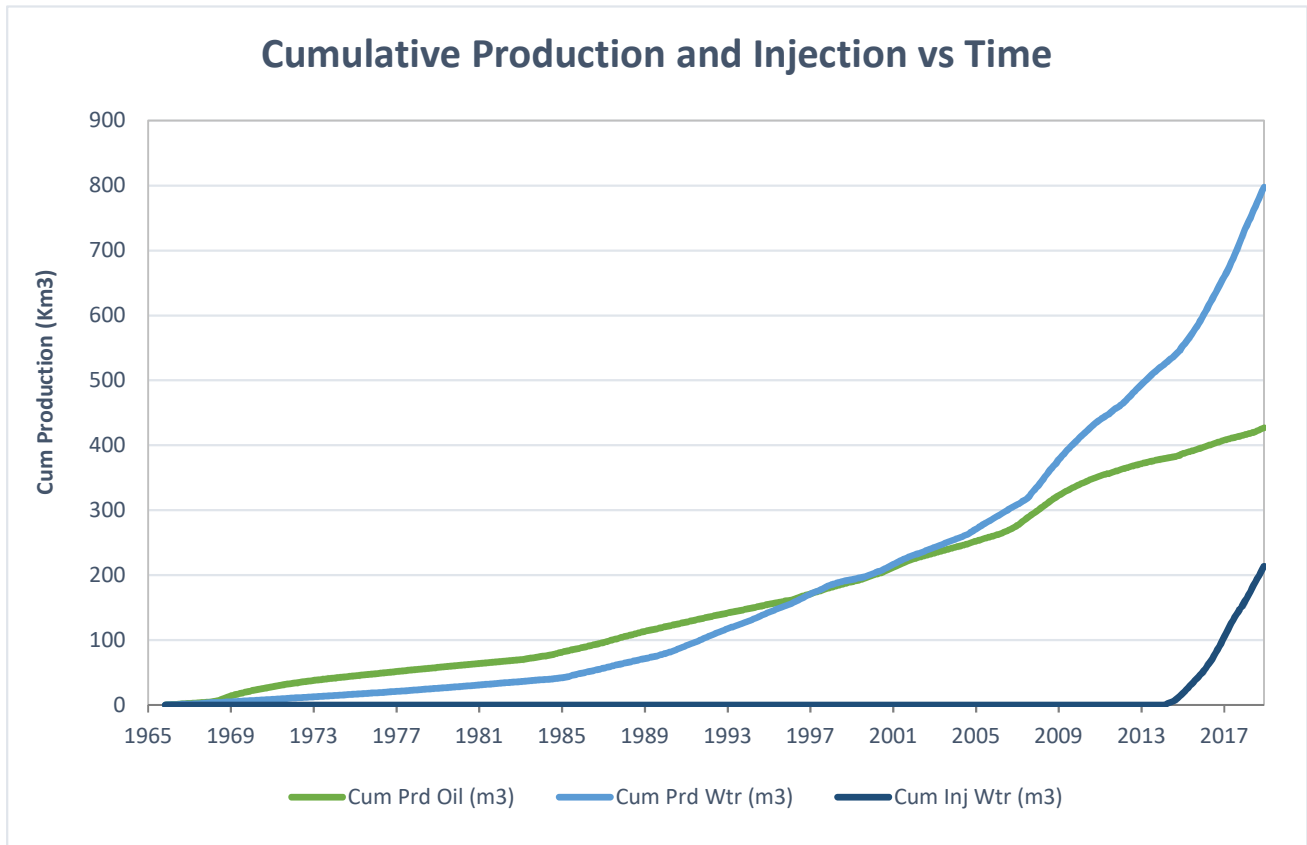
**a) Monthly oil and water production rates, injection rate, GOR and WOR**

MONTH	Cal Dly Oil m <sup>3</sup> /day	Cal Dly Wtr m <sup>3</sup> /day	Cal Inj Wtr m <sup>3</sup> /day	WOR m <sup>3</sup> /m <sup>3</sup>	GOR m <sup>3</sup> /m <sup>3</sup>
Jan-2018	24.13	200.59	139.03	8.31	11.5
Feb-2018	24.21	197.13	159.64	8.14	13.42
Mar-2018	23.75	186.27	159.29	7.84	14.13
Apr-2018	25.07	188.88	169.00	7.54	13.83
May-2018	26.77	197.72	170.29	7.39	12.53
Jun-2018	27.17	197.08	170.17	7.25	12.15
Jul-2018	31.63	197.71	153.94	6.25	10.61
Aug-2018	33.87	196.03	154.42	5.79	10.09
Sep-2018	39.52	201.74	157.80	5.11	8.94
Oct-2018	41.40	194.90	159.03	4.71	8.26
Nov-2018	39.42	192.49	156.07	4.88	8.96
Dec-2018	37.27	183.36	157.26	4.92	9.18

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

2018 PRODUCTION	
Produced Oil (m <sup>3</sup> )	11,396
Produced Gas (m <sup>3</sup> )	122
Produced Water (m <sup>3</sup> )	70,979
Fluid Injected (m <sup>3</sup> )	57,952
CUMULATIVE PRODUCTION	
Produced Oil (m <sup>3</sup> )	426,894
Produced Water (m <sup>3</sup> )	797,485

## North Pierson Unit No. 1



c) Monthly wellhead injection pressure for each injection well

	00/11-17 Inj		02/07-19 Inj		03/01-21 Inj		02/10-21 Inj		NPU1	
MONTH	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)
Jan-2018	1575.0	2393	1504.0	2340	0.0	-90	1231.0	-85	4310.0	1140
Feb-2018	1404.0	2692	1360.0	2330	593.0	-73	1113.0	-84	4470.0	1216
Mar-2018	1501.0	2732	1294.0	2225	919.0	1154	1224.0	-85	4938.0	1507
Apr-2018	1528.0	2609	1459.0	1722	894.0	2295	1189.0	-84	5070.0	1636
May-2018	1597.0	2692	1525.0	2203	925.0	2791	1232.0	-67	5279.0	1904
Jun-2018	1550.0	2703	1476.0	2259	887.0	2939	1192.0	367	5105.0	2067
Jul-2018	1570.0	2673	1504.0	2225	490.0	1899	1208.0	995	4772.0	1948
Aug-2018	1551.0	2620	1477.0	2178	552.0	893	1207.0	1634	4787.0	1831
Sep-2018	1533.0	2604	1483.0	2191	597.0	1282	1121.0	2051	4734.0	2032
Oct-2018	1570.0	2566	1520.0	2200	615.0	1243	1225.0	2675	4930.0	2171
Nov-2018	1522.0	2527	1478.0	2190	597.0	1203	1085.0	2974	4682.0	2224
Dec-2018	1571.0	2527	1517.0	2144	731.0	1347	1056.0	2984	4875.0	2250
<b>Total</b>	18472.0		17597.0		7800.0		14083.0		57952.0	
<b>Avg Inj P</b>		2611		2184		1407		1106		1827

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
<b>Total m3</b>	4310.0	4470.0	4938.0	5070.0	5279.0	5105.0	4772.0	4787.0	4734.0	4930.0	4682.0	4875.0
<b>Daily (m<sup>3</sup>/d)</b>	139.03	159.64	159.29	169.00	170.29	170.17	153.94	154.42	157.80	159.03	156.07	157.26

2018 AVG. ANNUAL DAILY INJECTION =	158.83 m3/d
CUMULATIVE INJECTION TO Dec 31, 2017 =	155,720 m3
TOTAL 2018 ANNUAL INJECTION =	57,952 m3
CUMULATIVE INJECTION TO Dec 31, 2018 =	213,672 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

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

**VOIDAGE CALCULATIONS**

OIL FORMATION VOLUME FACTOR (Rm3/Sm3) = 1.24

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	747.9	416.25	6218.2	732.72	4310.0	160.03	0.603	0.128
Feb-2018	677.9	416.92	5519.7	738.24	4470.0	164.50	0.703	0.131
Mar-2018	736.1	417.66	5774.4	744.02	4938.0	169.44	0.738	0.134
Apr-2018	752.0	418.41	5666.4	749.68	5070.0	174.51	0.768	0.138
May-2018	829.8	419.24	6129.2	755.81	5279.0	179.79	0.737	0.141
Jun-2018	815.0	420.06	5912.4	761.73	5105.0	184.89	0.737	0.144
Jul-2018	980.5	421.04	6129	767.85	4772.0	189.66	0.650	0.147
Aug-2018	1050.1	422.09	6077	773.93	4787.0	194.45	0.649	0.150
Sep-2018	1185.5	423.27	6052.3	779.98	4734.0	199.19	0.629	0.153
Oct-2018	1283.3	424.56	6041.8	786.03	4930.0	204.12	0.646	0.156
Nov-2018	1182.7	425.74	5774.8	791.80	4682.0	208.80	0.647	0.158
Dec-2018	1155.3	426.89	5684.1	797.48	4875.0	213.67	0.685	0.161

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

Injection water for NPU1 is supplied from the Mannville formation in the 100/03-18-03-28W1 well.

Mannville water is pumped from the 100/03-18 source well to the Pierson 01-18-03-28W1 battery, where it is filtered and then pumped up to injection system pressure.

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>
100/11-15-003-28W1/0	Vertical	Abandoned	-
102/11-15-003-28W1/2	Horizontal	Producing	-
100/13-15-003-28W1/0	Vertical	Producing	-
100/14-15-003-28W1/0	Horizontal	Producing	-
100/10-16-003-28W1/0	Vertical	Abandoned	-
100/12-16-003-28W1/0	Horizontal	Pumping	-
102/12-16-003-28W1/0	Horizontal	Producing	-
100/14-16-003-28W1/0	Vertical	Abandoned	-
100/16-16-003-28W1/0	Vertical	Abandoned	-
100/09-17-003-28W1/2	Horizontal	Drain	-
100/10-17-003-28W1/0	Vertical	Pumping	-
100/11-17-003-28W1/0	Horizontal	Injection	-
100/12-17-003-28W1/0	Horizontal	Producing	-
100/13-17-003-28W1/0	Vertical	Producing	-
100/14-17-003-28W1/0	Vertical	Abandoned	-
100/15-17-003-28W1/0	Horizontal	Pumping	-
100/16-17-003-28W1/2	Horizontal	Producing	-
100/05-18-003-28W1/0	Horizontal	Producing	-
100/06-18-003-28W1/0	Vertical	Producing	-
100/07-18-003-28W1/0	Vertical	Abandoned	-
100/08-18-003-28W1/0	Vertical	Abandoned	-
100/09-18-003-28W1/0	Vertical	Abandoned	-
102/09-18-003-28W1/0	Vertical	Abandoned	-
100/10-18-003-28W1/0	Vertical	Producing	-
100/11-18-003-28W1/0	Vertical	Producing	-
100/12-18-003-28W1/0	Vertical	Abandoned	-
102/12-18-003-28W1/2	Horizontal	Producing	-
100/13-18-003-28W1/0	Vertical	Abandoned	-
102/13-18-003-28W1/3	Horizontal	Producing	-
100/14-18-003-28W1/0	Horizontal	Producing	-
100/15-18-003-28W1/0	Vertical	Abandoned	-
100/16-18-003-28W1/0	Vertical	Abandoned	-
100/01-19-003-28W1/0	Dir/Dev	Abandoned Zone	-
102/01-19-003-28W1/0	Horizontal	Producing	-
100/02-19-003-28W1/0	Vertical	Suspended	-
100/03-19-003-28W1/0	Vertical	Suspended	-
100/04-19-003-28W1/0	Vertical	Suspended	-
102/05-19-003-28W1/0	Horizontal	Producing	-
100/06-19-003-28W1/0	Vertical	Abandoned	-
100/06-19-003-28W1/2	Horizontal	Producing	-
100/07-19-003-28W1/0	Vertical	Abandoned	-
102/07-19-003-28W1/0	Horizontal	Injection	-
102/07-19-003-28W1/2	Horizontal	Producing	-
100/08-19-003-28W1/0	Vertical	Abandoned	-
102/08-19-003-28W1/0	Horizontal	Producing	-

## j) Well List

## North Pierson Unit No. 1 Well List

<i><b>UWI</b></i>	<i><b>Type</b></i>	<i><b>Status</b></i>	<i><b>Future Plans</b></i>
103/08-19-003-28W1/2	Horizontal	Potential	-
100/01-20-003-28W1/0	Vertical	Abandoned	-
100/01-20-003-28W1/2	Vertical	Abandoned	-
100/03-20-003-28W1/0	Vertical	Abandoned	-
100/04-20-003-28W1/0	Vertical	Abandoned	-
100/05-20-003-28W1/0	Vertical	Producing	-
100/07-20-003-28W1/2	Horizontal	Producing	-
100/11-20-003-28W1/0	Horizontal	Producing	-
102/11-20-003-28W1/2	Horizontal	Producing	-
100/13-20-003-28W1/0	Horizontal	Producing	-
100/14-20-003-28W1/0	Vertical	Abandoned	-
100/16-20-003-28W1/0	Vertical	Abandoned	-
100/16-20-003-28W1/2	Horizontal	Producing	-
100/01-21-003-28W1/0	Vertical	Producing	-
102/01-21-003-28W1/0	Horizontal	Producing	-
103/01-21-003-28W1/0	Horizontal	Injection	-
100/02-21-003-28W1/0	Vertical	Abandoned	-
100/03-21-003-28W1/0	Vertical	Producing	-
100/04-21-003-28W1/0	Vertical	Abandoned	-
102/04-21-003-28W1/0	Vertical	Abandoned	-
100/09-21-003-28W1/2	Horizontal	Producing	-
100/10-21-003-28W1/0	Vertical	Abandoned	-
102/10-21-003-28W1/0	Horizontal	Injection	-
100/12-21-003-28W1/0	Horizontal	Producing	-
100/14-21-003-28W1/2	Horizontal	Injection	-