

**Ewart Unit No. 10**

**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:**

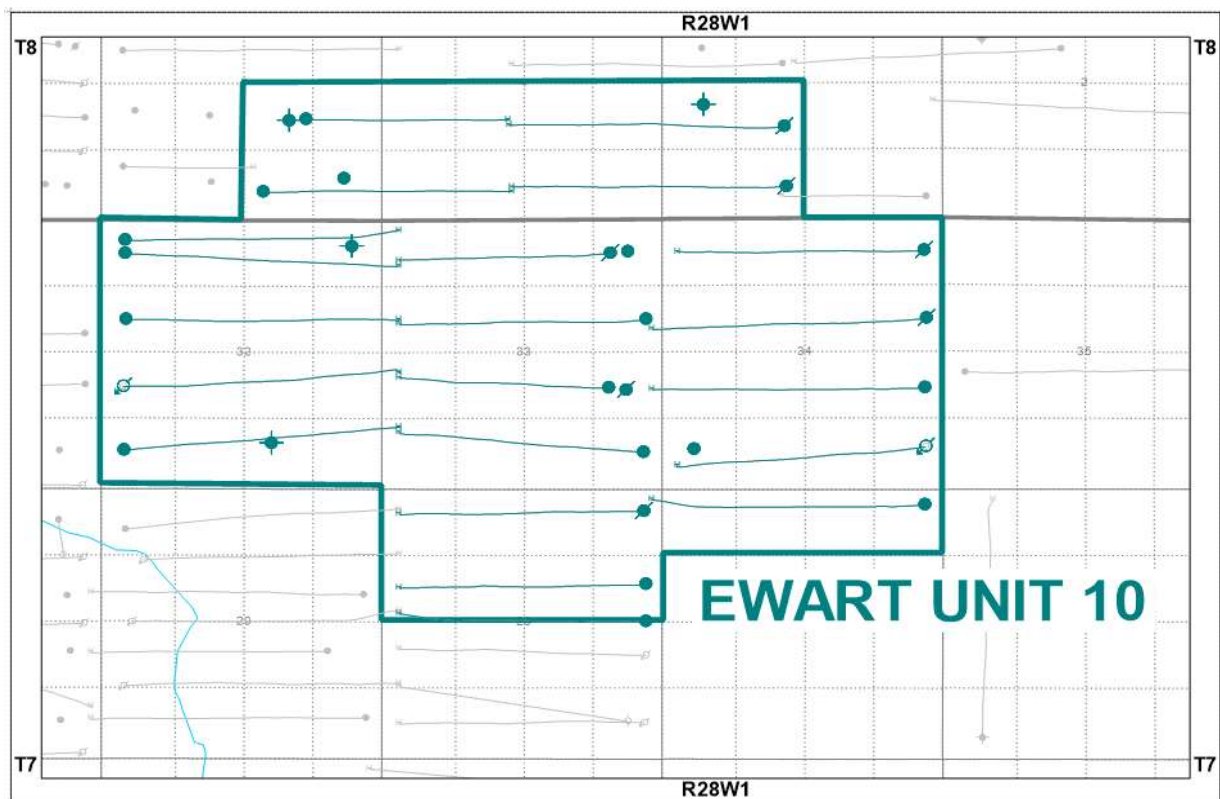
**Tundra Oil and Gas**

**April 25, 2019**

## INTRODUCTION

Ewart Unit No. 10 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 56, effective October 1, 2016 with Tundra Oil and Gas (Tundra) as Operator. The EOR project area, outlined in green in Figure 1, contains 8 vertical (4 abandoned and 4 producing) and 21 horizontal producing wells in 76 LSDs in Township 7, Range 28W1.

**Figure 1: Ewart Unit No. 10 Area Outline**



## Ewart Unit No. 10

Tundra Oil and Gas (Tundra), as the operator of the Ewart Unit No. 10 Enhanced Oil Recovery (EOR) project hereby submits the 2018 EOR report as per section 73 of the Drilling and Production Regulations.

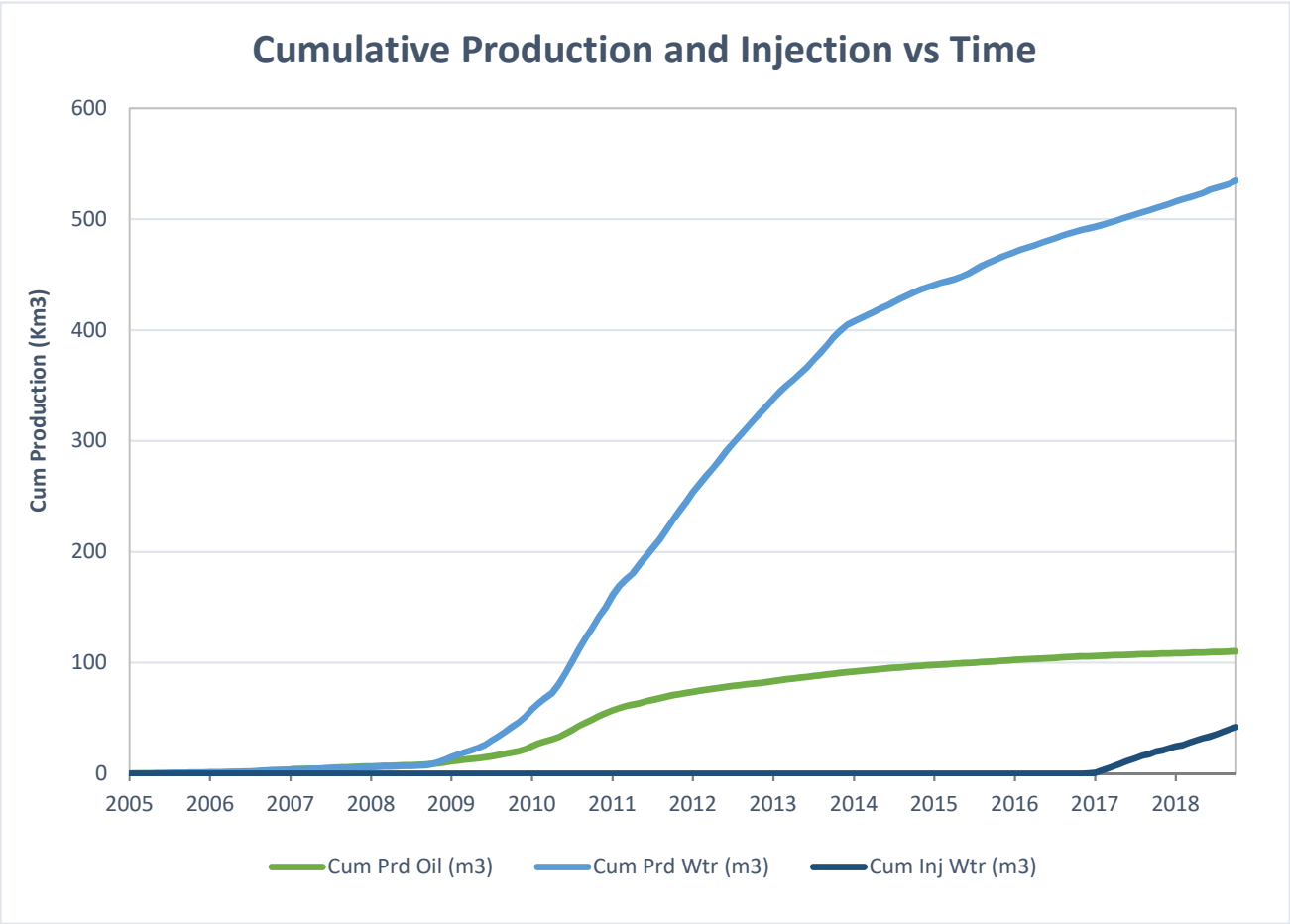
**a) Monthly oil and water production rates, injection rate, GOR and WOR**

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	5.73	55.53	42.26	9.69	0
Feb-2018	5.35	70.06	54.71	13.10	0
Mar-2018	5.34	71.14	55.97	13.32	0
Apr-2018	5.21	62.64	46.07	12.01	0
May-2018	5.35	53.82	69.61	10.07	0
Jun-2018	5.36	66.64	66.30	12.43	0
Jul-2018	6.74	62.99	69.29	9.34	0
Aug-2018	6.50	89.34	43.13	13.74	0
Sep-2018	4.63	64.17	65.07	13.87	0
Oct-2018	5.36	55.32	74.94	10.32	0
Nov-2018	5.49	67.90	72.13	12.37	0
Dec-2018	9.92	92.16	68.13	9.29	0

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

2018 PRODUCTION	
Produced Oil (m <sup>3</sup> )	2,164
Produced Gas (m <sup>3</sup> )	0
Produced Water (m <sup>3</sup> )	24,691
Fluid Injected (m <sup>3</sup> )	22,142
CUMULATIVE PRODUCTION	
Produced Oil (m <sup>3</sup> )	110,344
Produced Water (m <sup>3</sup> )	534,738

Ewart Unit No. 10



c) Monthly wellhead injection pressure for each injection well

	00/05-32 Inj		00/01-34 Inj		EU10	
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)
Jan-2018	1072.0	4857	238.0	51	1310.0	2454
Feb-2018	863.0	4927	669.0	-8	1532.0	2460
Mar-2018	849.0	5062	886.0	467	1735.0	2765
Apr-2018	1081.0	24501	301.0	22	1382.0	12262
May-2018	1224.0	5418	934.0	691	2158.0	3054
Jun-2018	980.0	5366	1009.0	1648	1989.0	3507
Jul-2018	1111.0	5533	1037.0	2182	2148.0	3858
Aug-2018	1219.0	5739	118.0	1512	1337.0	3625
Sep-2018	1035.0	5801	917.0	1462	1952.0	3631
Oct-2018	1124.0	5869	1199.0	2760	2323.0	4315
Nov-2018	1134.0	6155	1030.0	2989	2164.0	4572
Dec-2018	1182.0	6170	930.0	2992	2112.0	4581
<b>Total</b>	12874.0		9268.0		22142.0	
<b>Avg Inj P</b>		7116		1397		4257

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>	1310.0	1532.0	1735.0	1382.0	2158.0	1989.0	2148.0	1337.0	1952.0	2323.0	2164.0	2112.0
<b>Daily (m<sup>3</sup>/d)</b>	42.26	54.71	55.97	46.07	69.61	66.30	69.29	43.13	65.07	74.94	72.13	68.13

2018 AVG. ANNUAL DAILY INJECTION =	60.63 m3/d
CUMULATIVE INJECTION TO Dec 31, 2017 =	19,909 m3
TOTAL 2018 ANNUAL INJECTION =	22,142 m3
CUMULATIVE INJECTION TO Dec 31, 2018 =	42,051 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
100.04-34-007-28W1.00	Rigless Acid	6/28/2018
100.08-34-007-28W1.00	Packers Plus Drill out	11/5/2018
100.09-28-007-28W1.00	Pump Change	7/24/2018
100.12-32-007-28W1.00	Cemented Liner Clean Out	11/15/2018
100.16-33-007-28W1.00	Polish Rod Repair	9/7/2018
100.02-05-008-28W1.00	BK Packers Plus drill out	12/4/2018
102.07-05-008-28W1.00	Cemented Liner Clean Out	9/30/2018

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

**VOIDAGE CALCULATIONS**

$$\text{OIL FORMATION VOLUME FACTOR (Rm3/Sm3)} = 1.071$$

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-2018	177.7	108.36	1721.4	511.77	1310.0	21.22	0.685	0.034
Feb-2018	149.7	108.51	1961.8	513.73	1532.0	22.75	0.722	0.036
Mar-2018	165.5	108.67	2205.2	515.94	1735.0	24.49	0.728	0.039
Apr-2018	156.4	108.83	1879.1	517.81	1382.0	25.87	0.675	0.041
May-2018	165.7	109.00	1668.4	519.48	2158.0	28.03	1.169	0.044
Jun-2018	160.8	109.16	1999.1	521.48	1989.0	30.02	0.916	0.047
Jul-2018	209.0	109.37	1952.6	523.43	2148.0	32.16	0.987	0.050
Aug-2018	201.5	109.57	2769.5	526.20	1337.0	33.50	0.448	0.052
Sep-2018	138.8	109.71	1925.1	528.13	1952.0	35.45	0.941	0.055
Oct-2018	166.1	109.87	1714.9	529.84	2323.0	37.78	1.227	0.058
Nov-2018	164.7	110.04	2036.9	531.88	2164.0	39.94	0.978	0.061
Dec-2018	307.6	110.34	2857.1	534.74	2112.0	42.05	0.663	0.064

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

The injection water for Ewart Unit No. 10 is sourced from the 02/14-30-007-28W1 well (Mannville formation). The water is treated at the 04-01-008-29W1 filtration plant where it is filtered to 0.1 microns and has scale inhibitor and biocide added. The injection water is then distributed to the injectors through the dedicated infrastructure system.

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><b>UWI</b></i>	<i><b>Type</b></i>	<i><b>Status</b></i>	<i><b>Future Plans</b></i>
100/16-27-007-28W1/0	Horizontal	Producing	-
100/09-28-007-28W1/0	Horizontal	Producing	-
102/09-28-007-28W1/0	Horizontal	Producing	-
100/16-28-007-28W1/0	Horizontal	Suspended	-
100/02-32-007-28W1/0	Vertical	Abandoned Zone	-
102/04-32-007-28W1/0	Horizontal	Producing	-
100/05-32-007-28W1/0	Horizontal	Injection	-
100/12-32-007-28W1/0	Horizontal	Producing	-
100/13-32-007-28W1/0	Horizontal	Producing	-
102/13-32-007-28W1/0	Horizontal	Producing	-
100/16-32-007-28W1/0	Vertical	Abandoned Zone	-
100/01-33-007-28W1/0	Horizontal	Producing	-
100/08-33-007-28W1/0	Vertical	Suspended	-
102/08-33-007-28W1/0	Horizontal	Producing	-
100/09-33-007-28W1/0	Horizontal	Producing	-
100/16-33-007-28W1/0	Vertical	Producing	-
102/16-33-007-28W1/0	Horizontal	Suspended	-
100/01-34-007-28W1/0	Horizontal	Injection	-
100/04-34-007-28W1/0	Vertical	Producing	-
100/08-34-007-28W1/0	Horizontal	Producing	-
100/09-34-007-28W1/0	Horizontal	Suspended	-
100/16-34-007-28W1/0	Horizontal	Suspended	-
100/03-03-008-28W1/0	Horizontal	Suspended	-
100/05-03-008-28W1/0	Vertical	Abandoned Zone	-
100/06-03-008-28W1/0	Horizontal	Suspended	-
100/01-05-008-28W1/0	Vertical	Producing	-
100/02-05-008-28W1/0	Horizontal	Producing	-
100/07-05-008-28W1/0	Vertical	Abandoned Zone	-
102/07-05-008-28W1/0	Horizontal	Producing	-

**k) Discussion**

Tundra plans to convert nine (9) of the existing horizontal producing wells to horizontal injection wells which will result in effective 40 acre waterflood patterns within Ewart Unit No. 10. In December 2016, the 00/05-32 and 00/01-34-007-28W1 wells were converted to injection and injection commenced in February 2017.