

Ewart Unit No. 10

Waterflood Progress Report 2019

January 1st through December 31st 2019

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

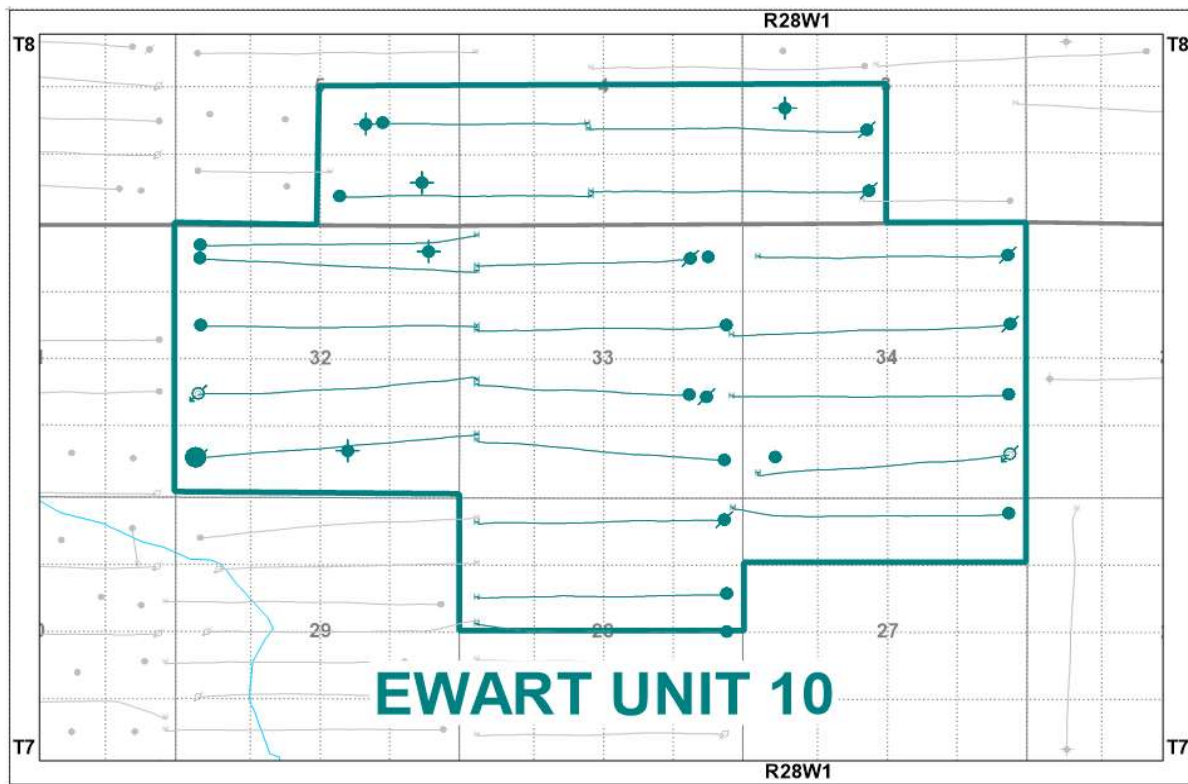
Tundra Oil and Gas

May 27, 2020

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 blue in Figure 1, contains 8 vertical (5 abandoned, 1 suspended and 2 producing) and 21 horizontal (13 producing, 6 suspended and 2 injectors) wells in 76 LSDs in Townships 7-8, 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 2019 EOR report as per section 73 of the Drilling and Production Regulations.

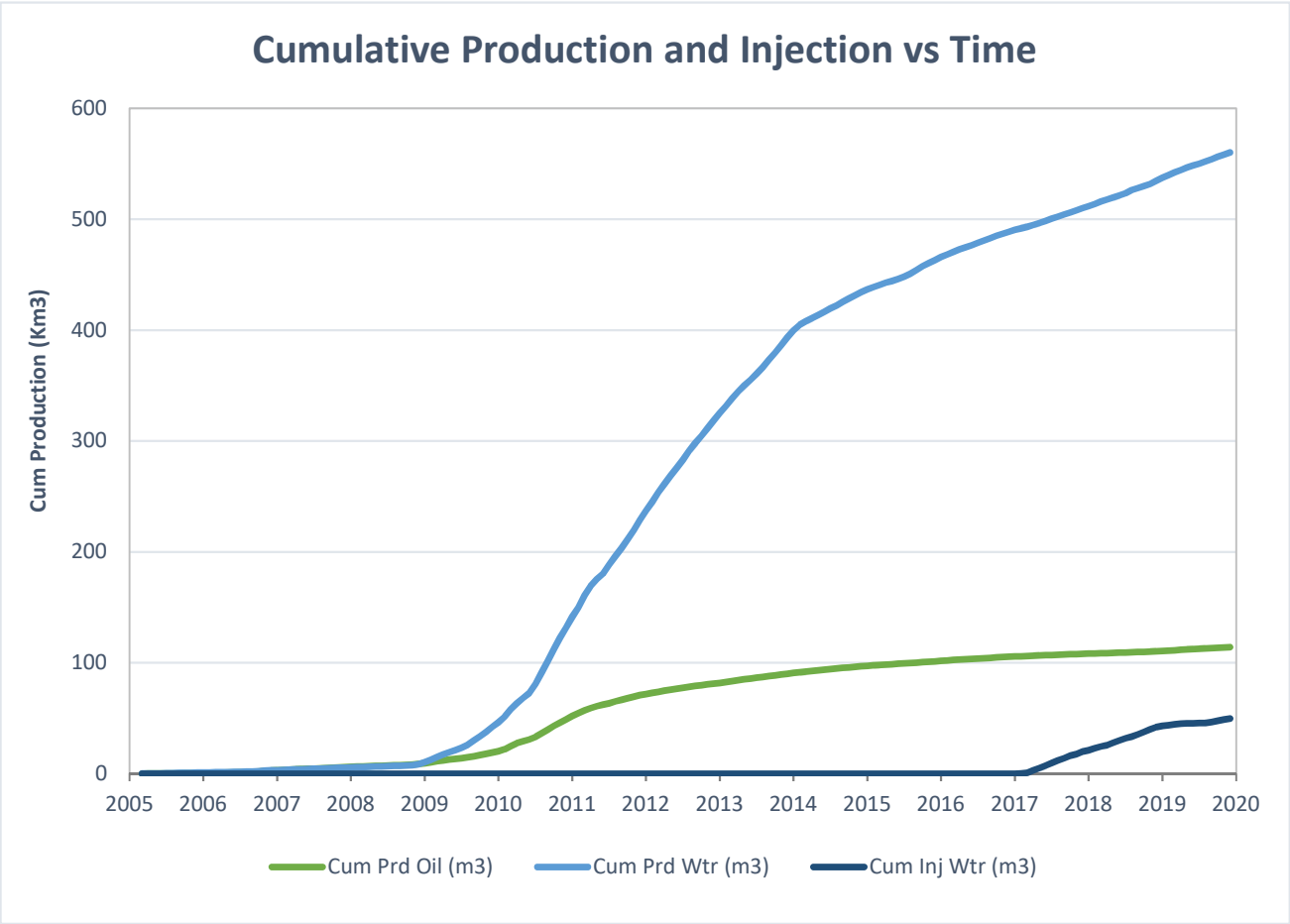
a) Monthly oil and water production rates, injection rate, GOR and WOR

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	10.89	88.56	33.90	8.13	0
Feb-2019	10.49	82.89	26.75	7.90	0
Mar-2019	12.06	77.73	27.94	6.45	0
Apr-2019	11.82	76.04	20.03	6.43	0
May-2019	11.68	67.40	1.45	5.77	0
Jun-2019	10.50	55.21	4.33	5.26	0
Jul-2019	9.88	55.14	4.48	5.58	0
Aug-2019	11.21	69.24	4.81	6.18	0
Sep-2019	8.74	70.33	31.27	8.05	0
Oct-2019	8.87	65.96	33.26	7.44	0
Nov-2019	9.98	64.28	34.07	6.44	0
Dec-2019	10.70	64.97	33.35	6.07	0

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

2019 PRODUCTION	
Produced Oil (m ³)	3,859
Produced Gas (m ³)	0
Produced Water (m ³)	25,456
Fluid Injected (m ³)	7,755
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	114,206
Produced Water (m ³)	560,194

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 ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2019	206.0	4946	845.0	2958	1051.0	3952
Feb-2019	0.0	3055	749.0	3070	749.0	3062
Mar-2019	0.0	2335	866.0	3440	866.0	2887
Apr-2019	0.0	2335	601.0	3280	601.0	2808
May-2019	45.0	1740	0.0	2947	45.0	2344
Jun-2019	130.0	1621	0.0	3915	130.0	2768
Jul-2019	139.0	2811	0.0	130	139.0	1470
Aug-2019	149.0	1827	0.0	-95	149.0	866
Sep-2019	144.0	1843	794.0	513	938.0	1178
Oct-2019	143.0	1802	888.0	1395	1031.0	1598
Nov-2019	145.0	1698	877.0	2016	1022.0	1857
Dec-2019	146.0	2260	888.0	2434	1034.0	2347
Total	1247.0		6508.0		7755.0	
Avg Inj P		2356		2167		2261

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	1051.0	749.0	866.0	601.0	45.0	130.0	139.0	149.0	938.0	1031.0	1022.0	1034.0
Daily (m³/d)	33.90	26.75	27.94	20.03	1.45	4.33	4.48	4.81	31.27	33.26	34.07	33.35

2019 AVG. ANNUAL DAILY INJECTION =	21.30 m3/d
CUMULATIVE INJECTION TO Dec 31, 2018 =	42,051 m3
TOTAL 2019 ANNUAL INJECTION =	7,755 m3
CUMULATIVE INJECTION TO Dec 31, 2019 =	49,806 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
100.05-32-007-28W1.00	Tracer Study for Waterflood Pattern Learnings	10/29/2019
102.04-32-007-28W1.00	Rigless Acid	10/16/2019

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-2019	337.5	110.69	2745.3	537.48	1051.0	43.10	0.338	0.066
Feb-2019	293.6	110.98	2320.9	539.80	749.0	43.85	0.284	0.067
Mar-2019	373.8	111.35	2409.7	542.21	866.0	44.72	0.308	0.068
Apr-2019	354.7	111.71	2281.1	544.50	601.0	45.32	0.226	0.068
May-2019	362.1	112.07	2089.5	546.58	45.0	45.36	0.018	0.068
Jun-2019	314.9	112.38	1656.3	548.24	130.0	45.49	0.065	0.068
Jul-2019	306.4	112.69	1709.2	549.95	139.0	45.63	0.068	0.068
Aug-2019	347.5	113.04	2146.5	552.10	149.0	45.78	0.059	0.068
Sep-2019	262.1	113.30	2109.8	554.21	938.0	46.72	0.392	0.069
Oct-2019	275.0	113.58	2044.7	556.25	1031.0	47.75	0.441	0.070
Nov-2019	299.4	113.87	1928.5	558.18	1022.0	48.77	0.454	0.072
Dec-2019	331.7	114.21	2014.2	560.19	1034.0	49.81	0.436	0.073

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**

j) Well List

Ewart Unit No. 10 Well List

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</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	WIW Conversion
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	Abandoned Zone	-
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.