

East Routledge Unit No. 1

Waterflood Progress Report 2019

January 1st through December 31st 2019

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

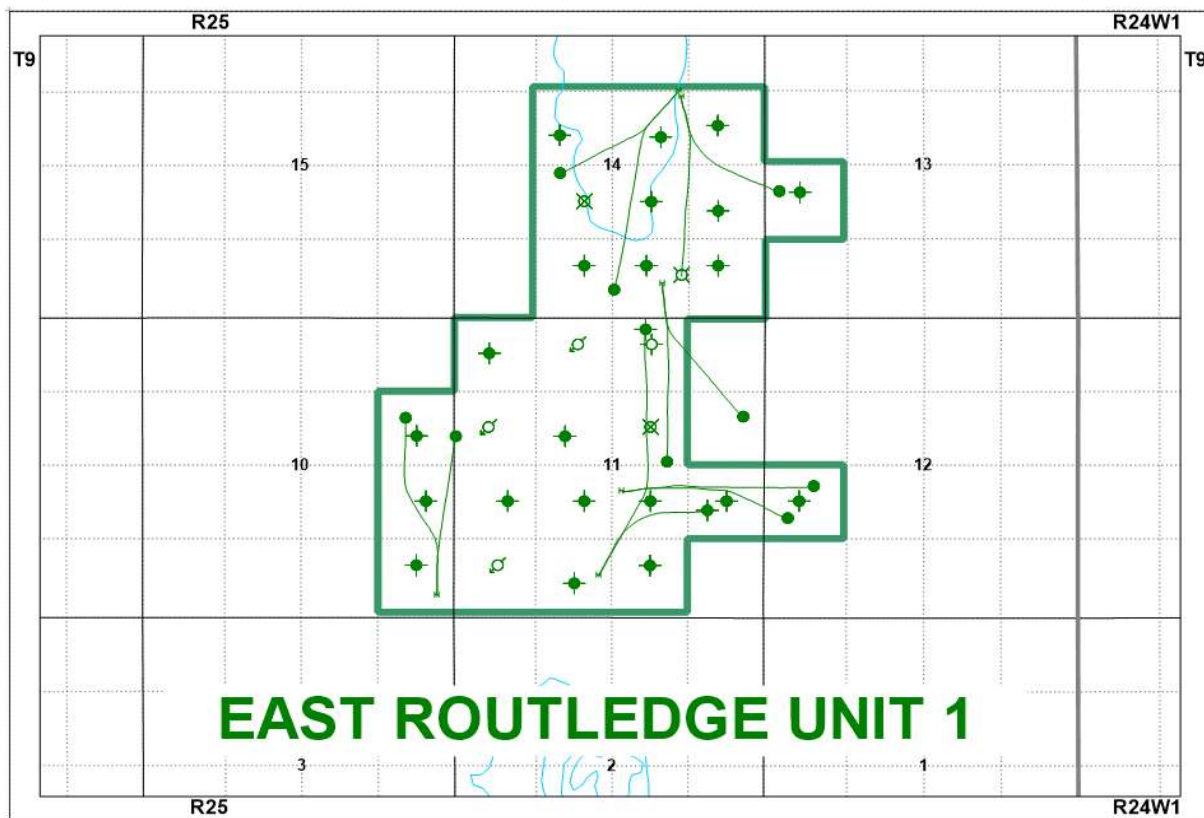
Tundra Oil and Gas

April 22, 2020

INTRODUCTION

East Routledge Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 20 effective May 1972 with Samedan Oil of Canada Ltd. as Operator. Tundra Oil and Gas (Tundra) acquired the unit from Topa Resources Ltd. and became operator in April 2002. The EOR project area contains 39 wells in 27 LSDs in Township 9, Range 25 W1 as shown in the figure below.

Figure 1: East Routledge Unit No. 1 Area Outline



East Routledge Unit No. 1

Tundra Oil and Gas (Tundra), as the operator of the East Routledge Unit No. 1 Enhanced Oil Recovery (EOR) project hereby submits the 2019 EOR report as per section 73 of the Drilling and Production Regulations.

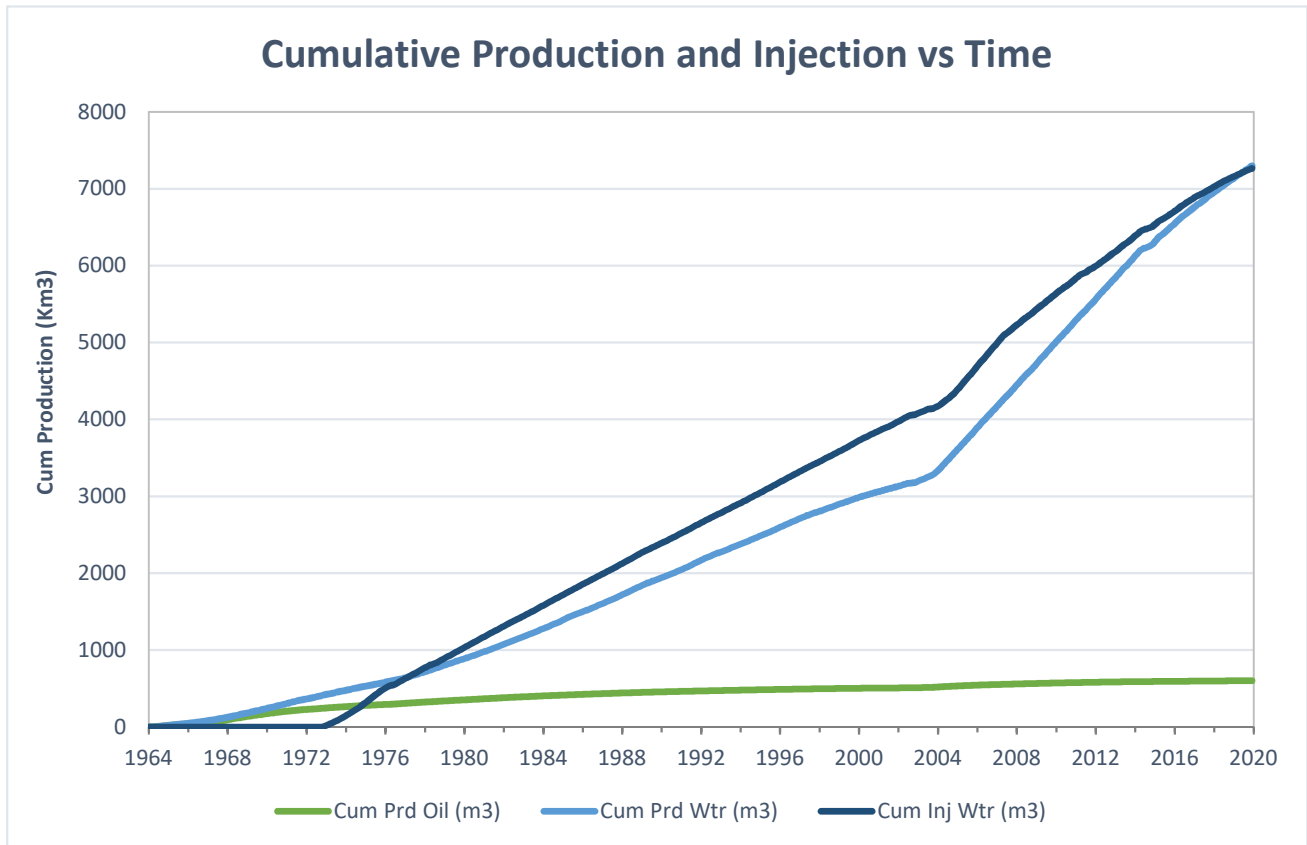
a) Monthly oil and water production rates, injection rate, GOR and WOR

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	6.16	522.30	345.28	84.73	0
Feb-2019	6.16	519.85	303.39	84.43	0
Mar-2019	5.59	486.17	317.81	86.92	0
Apr-2019	2.99	295.42	246.65	98.80	0
May-2019	5.56	522.06	345.71	93.87	0
Jun-2019	5.45	500.92	329.00	91.91	0
Jul-2019	5.41	496.12	337.18	91.76	0
Aug-2019	5.93	521.57	334.59	87.97	0
Sep-2019	5.19	472.84	309.78	91.17	0
Oct-2019	4.37	423.07	289.80	96.86	0
Nov-2019	5.11	453.20	263.94	88.69	0
Dec-2019	5.03	468.75	255.84	93.15	0

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

2019 PRODUCTION	
Produced Oil (m ³)	1,914
Produced Gas (m ³)	0
Produced Water (m ³)	172,869
Fluid Injected (m ³)	111,989
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	602,079
Produced Water (m ³)	7,298,321

East Routledge Unit No. 1



c) Monthly wellhead injection pressure for each injection well

	00/04-11 Inj		00/12-11 Inj		00/14-11 Inj		ERU1	
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)
Jan-2019	0.0	0	0.0	0	10703.7	3841	10703.7	3841
Feb-2019	0.0	0	0.0	0	8495.0	3786	8495.0	3786
Mar-2019	0.0	0	0.0	0	9852.1	3786	9852.1	3786
Apr-2019	0.0	0	0.0	0	7399.5	2813	7399.5	2813
May-2019	0.0	0	0.0	0	10717.1	3776	10717.1	3776
Jun-2019	0.0	0	0.0	0	9870.0	4158	9870.0	4158
Jul-2019	0.0	0	0.0	0	10452.6	3908	10452.6	3908
Aug-2019	0.0	0	0.0	0	10372.3	3695	10372.3	3695
Sep-2019	0.0	0	0.0	0	9293.3	4067	9293.3	4067
Oct-2019	0.0	0	0.0	0	8983.9	4085	8983.9	4085
Nov-2019	0.0	0	0.0	0	7918.3	3832	7918.3	3832
Dec-2019	0.0	0	0.0	0	7931.1	3855	7931.1	3855
Total	0.0		0.0		111988.9		111988.9	
Avg Inj P		0		0		3800		3800

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	10703.7	8495.0	9852.1	7399.5	10717.1	9870.0	10452.6	10372.3	9293.3	8983.9	7918.3	7931.1
Daily (m³/d)	345.28	303.39	317.81	246.65	345.71	329.00	337.18	334.59	309.78	289.80	263.94	255.84

2019 AVG. ANNUAL DAILY INJECTION = 306.58 m3/d
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CUMULATIVE INJECTION TO Dec 31, 2018 = 7,152,002 m3

TOTAL 2019 ANNUAL INJECTION = 111,989 m3
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CUMULATIVE INJECTION TO Dec 31, 2019 = 7,263,991 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
100.16-11-009-25W1.00	Pump Change	12/20/2019

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

VOIDAGE CALCULATIONS

OIL FORMATION VOLUME FACTOR (Rm3/Sm3) = 1.05

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	191.1	600.36	16191.2	7141.64	10703.7	7162.71	0.653	0.922
Feb-2019	172.4	600.53	14555.9	7156.20	8495.0	7171.20	0.576	0.921
Mar-2019	173.4	600.70	15071.3	7171.27	9852.1	7181.05	0.646	0.920
Apr-2019	89.7	600.79	8862.6	7180.13	7399.5	7188.45	0.826	0.920
May-2019	172.4	600.96	16183.8	7196.32	10717.1	7199.17	0.655	0.920
Jun-2019	163.5	601.13	15027.6	7211.34	9870.0	7209.04	0.649	0.919
Jul-2019	167.6	601.29	15379.6	7226.72	10452.6	7219.49	0.672	0.919
Aug-2019	183.8	601.48	16168.8	7242.89	10372.3	7229.86	0.634	0.918
Sep-2019	155.6	601.63	14185.3	7257.08	9293.3	7239.16	0.648	0.918
Oct-2019	135.4	601.77	13115.2	7270.19	8983.9	7248.14	0.678	0.917
Nov-2019	153.3	601.92	13595.9	7283.79	7918.3	7256.06	0.576	0.917
Dec-2019	156.0	602.08	14531.4	7298.32	7931.1	7263.99	0.540	0.916

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

Currently there is no source water being used at East Routledge Unit No. 1. Produced water is re-injected back into the formation after filtration.

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>
100/01-10-009-25W1/0	Vertical	Abandoned Zone	-
100/08-10-009-25W1/0	Vertical	Abandoned	-
100/09-10-009-25W1/0	Vertical	Abandoned Zone	-
102/09-10-009-25W1/0	Horizontal	Producing	-
102/09-10-009-25W1/2	Horizontal	Producing	-
100/02-11-009-25W1/0	Vertical	Abandoned	-
100/03-11-009-25W1/0	Vertical	Abandoned	-
100/04-11-009-25W1/0	Vertical	Injection	-
100/05-11-009-25W1/0	Vertical	Abandoned	-
100/06-11-009-25W1/0	Vertical	Abandoned	-
100/07-11-009-25W1/0	Vertical	Abandoned	-
100/08-11-009-25W1/0	Vertical	Abandoned	-
102/08-11-009-25W1/0	Horizontal	Abandoned Zone	-
103/09-11-009-25W1/2	Horizontal	Abandoned Zone	-
100/10-11-009-25W1/0	Vertical	Abandoned	-
102/10-11-009-25W1/0	Horizontal	Abandoned Zone	-
100/11-11-009-25W1/0	Vertical	Abandoned	-
100/12-11-009-25W1/0	Vertical	Injection	-
100/13-11-009-25W1/0	Vertical	Abandoned	-
100/14-11-009-25W1/0	Vertical	Injection	-
100/15-11-009-25W1/0	Vertical	Abandoned	-
102/15-11-009-25W1/2	Horizontal	Abandoned Zone	-
100/05-12-009-25W1/0	Vertical	Abandoned	-
102/05-12-009-25W1/0	Horizontal	Producing	-
103/05-12-009-25W1/2	Horizontal	Producing	-
100/05-13-009-25W1/0	Vertical	Abandoned	-
102/05-13-009-25W1/0	Horizontal	Pumping	-
100/01-14-009-25W1/0	Vertical	Abandoned	-
100/02-14-009-25W1/0	Vertical	Abandoned Zone	-
102/02-14-009-25W1/0	Horizontal	Producing	-
102/02-14-009-25W1/2	Horizontal	Drain	-
100/03-14-009-25W1/0	Vertical	Abandoned Zone	-
100/06-14-009-25W1/0	Vertical	Abandoned	-
102/06-14-009-25W1/2	Horizontal	Producing	-
100/07-14-009-25W1/0	Vertical	Abandoned	-
100/08-14-009-25W1/0	Vertical	Abandoned Zone	-
100/09-14-009-25W1/0	Vertical	Abandoned Zone	-
100/10-14-009-25W1/0	Vertical	Abandoned	-
100/11-14-009-25W1/0	Vertical	Abandoned	-

k) Discussion

Tundra has no definite plans to significantly alter the way in which the waterflood at East Routledge Unit No. 1 is currently operating; i.e. no drilling plans. The focus at this phase in the pools development is really acceleration of long-life post water breakthrough (high WCT) reserves; in the foreseeable future Tundra will focus on smaller capex items such as pump up-sizes and potentially 1-2 electrical submersible pump installations.