

East Routledge Unit No. 1

Waterflood Progress Report 2018

January 1st through December 31st 2018

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

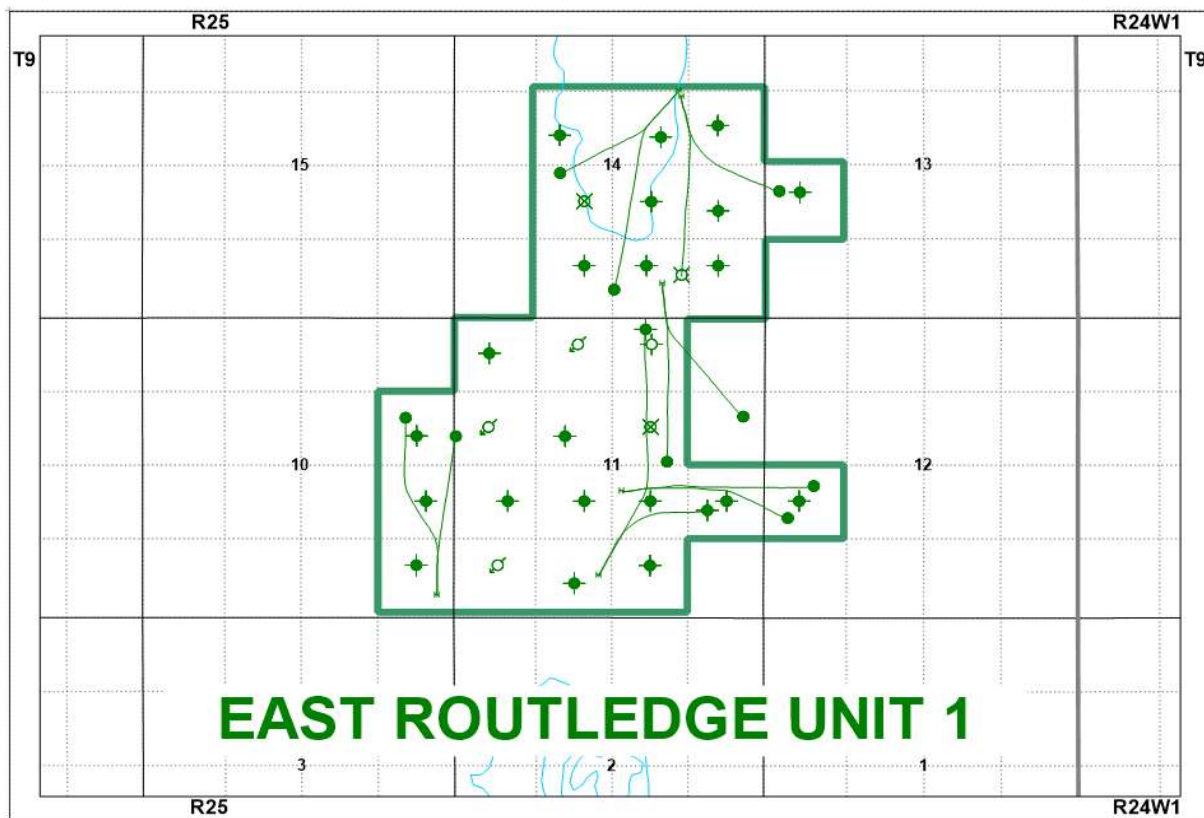
Tundra Oil and Gas

July 11, 2019

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 2018 EOR report as per section 73 of the Drilling and Production Regulations.

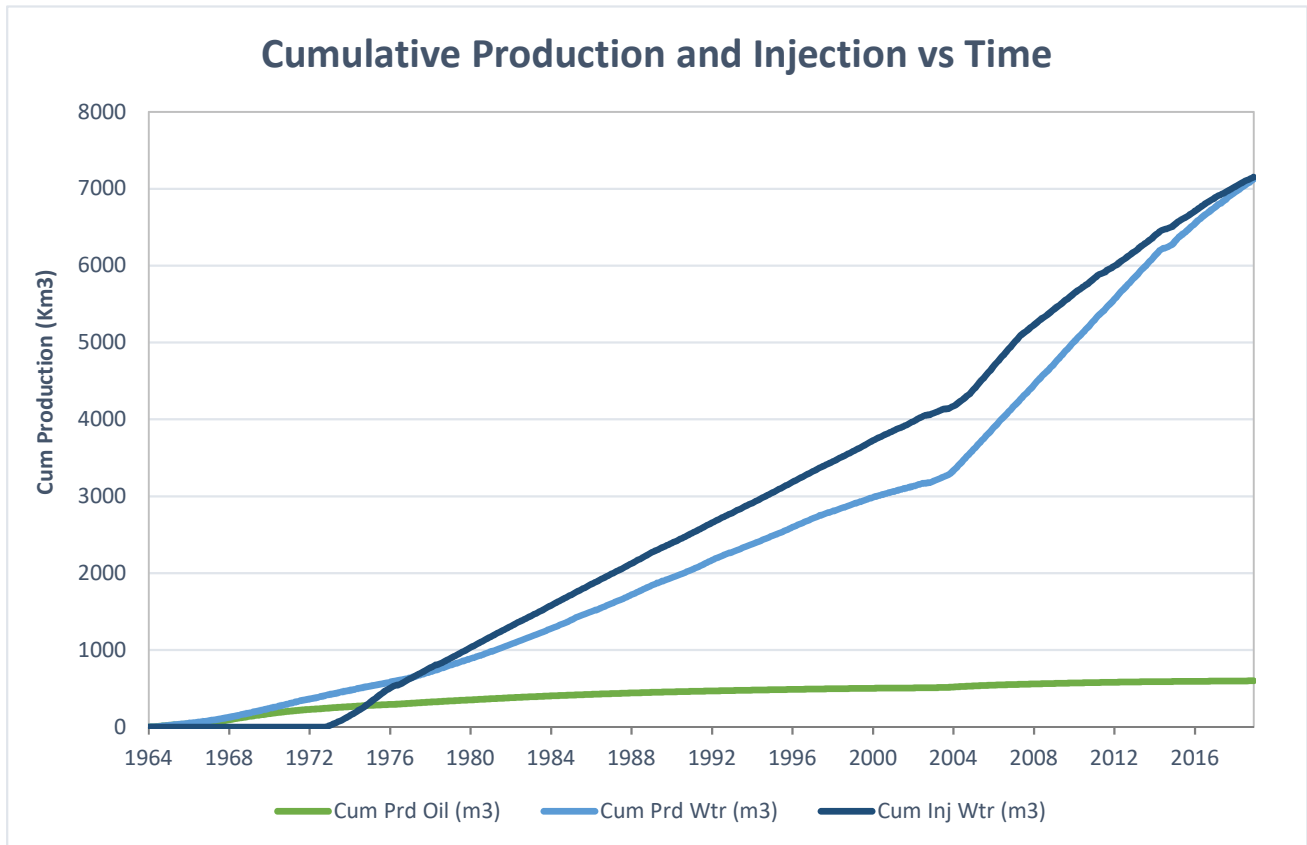
a) Monthly oil and water production rates, injection rate, GOR and WOR

MONTH	Cal Dly Oil m 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-2018	6.58	522.02	410.45	79.33	0
Feb-2018	6.30	516.24	405.71	81.94	0
Mar-2018	5.95	507.64	401.06	85.25	0
Apr-2018	6.08	502.35	389.41	82.62	0
May-2018	6.22	525.26	454.71	84.46	0
Jun-2018	5.04	475.74	377.81	94.33	0
Jul-2018	6.29	520.13	343.59	82.65	0
Aug-2018	6.12	519.49	343.38	84.89	0
Sep-2018	4.67	435.54	291.06	93.26	0
Oct-2018	6.13	512.20	340.45	83.52	0
Nov-2018	6.14	518.97	344.34	84.52	0
Dec-2018	5.85	517.96	338.68	88.52	0

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

2018 PRODUCTION	
Produced Oil (m ³)	2,172
Produced Gas (m ³)	0
Produced Water (m ³)	184,798
Fluid Injected (m ³)	135,041
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	600,164
Produced Water (m ³)	7,125,452

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-2018	3517	3497	0.0	2000	9207	2839	12724.0	2778
Feb-2018	3174	3600	0.0	2000	8185	2800	11359.8	2800
Mar-2018	3478	3600	0.0	2000	8955	2800	12432.8	2800
Apr-2018	3589	3577	0.0	2000	8094	3157	11682.4	2911
May-2018	4138	3857	0.0	2000	9959	3448	14096.1	3102
Jun-2018	3040	3193	0.0	1933	8294	3023	11334.2	2717
Jul-2018	0.0	0	0.0	0	10651	3600	10651.3	1200
Aug-2018	0.0	0	0.0	0	10645	3665	10644.9	1222
Sep-2018	0.0	0	0.0	0	8732	3143	8731.9	1048
Oct-2018	0.0	0	0.0	0	10554	3441	10554.0	1147
Nov-2018	0.0	0	0.0	0	10330	3917	10330.1	1306
Dec-2018	0.0	0	0.0	0	10499	3687	10499.0	1229
Total	20936.2		0.0		114104.3		135040.5	
Avg Inj P		1777		994		3293		2022

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
Total m3	12724.0	11359.8	12432.8	11682.4	14096.1	11334.2	10651.3	10644.9	8731.9	10554.0	10330.1	10499.0
Daily (m³/d)	410.45	405.71	401.06	389.41	454.71	377.81	343.59	343.38	291.06	340.45	344.34	338.68

2018 AVG. ANNUAL DAILY INJECTION = 370.05 m3/d
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CUMULATIVE INJECTION TO Dec 31, 2017 = 7,016,962 m3

TOTAL 2018 ANNUAL INJECTION = 135,041 m3
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CUMULATIVE INJECTION TO Dec 31, 2018 = 7,152,002 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
100.14-11-009-25W1.00	WIW Packer Repair	4/6/2018

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-2018	204.0	598.20	16182.5	6956.84	12724.0	7029.69	0.776	0.927
Feb-2018	176.4	598.37	14454.7	6971.29	11359.8	7041.05	0.776	0.927
Mar-2018	184.6	598.56	15736.8	6987.03	12432.8	7053.48	0.780	0.926
Apr-2018	182.4	598.74	15070.4	7002.10	11682.4	7065.16	0.765	0.926
May-2018	192.8	598.93	16283.1	7018.38	14096.1	7079.26	0.855	0.926
Jun-2018	151.3	599.08	14272.2	7032.65	11334.2	7090.59	0.785	0.925
Jul-2018	195.1	599.28	16124.1	7048.78	10651.3	7101.24	0.652	0.925
Aug-2018	189.7	599.47	16104.1	7064.88	10644.9	7111.89	0.653	0.924
Sep-2018	140.1	599.61	13066.1	7077.95	8731.9	7120.62	0.661	0.924
Oct-2018	190.1	599.80	15878.1	7093.83	10554.0	7131.17	0.656	0.923
Nov-2018	184.2	599.98	15569.2	7109.40	10330.1	7141.50	0.655	0.923
Dec-2018	181.4	600.16	16056.7	7125.45	10499.0	7152.00	0.646	0.922

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	Producing	-
100/10-11-009-25W1/0	Vertical	Abandoned	-
102/10-11-009-25W1/0	Horizontal	Producing	-
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.