

Kola Unit No. 2

Waterflood Progress Report 2018

January 1st through December 31st 2018

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

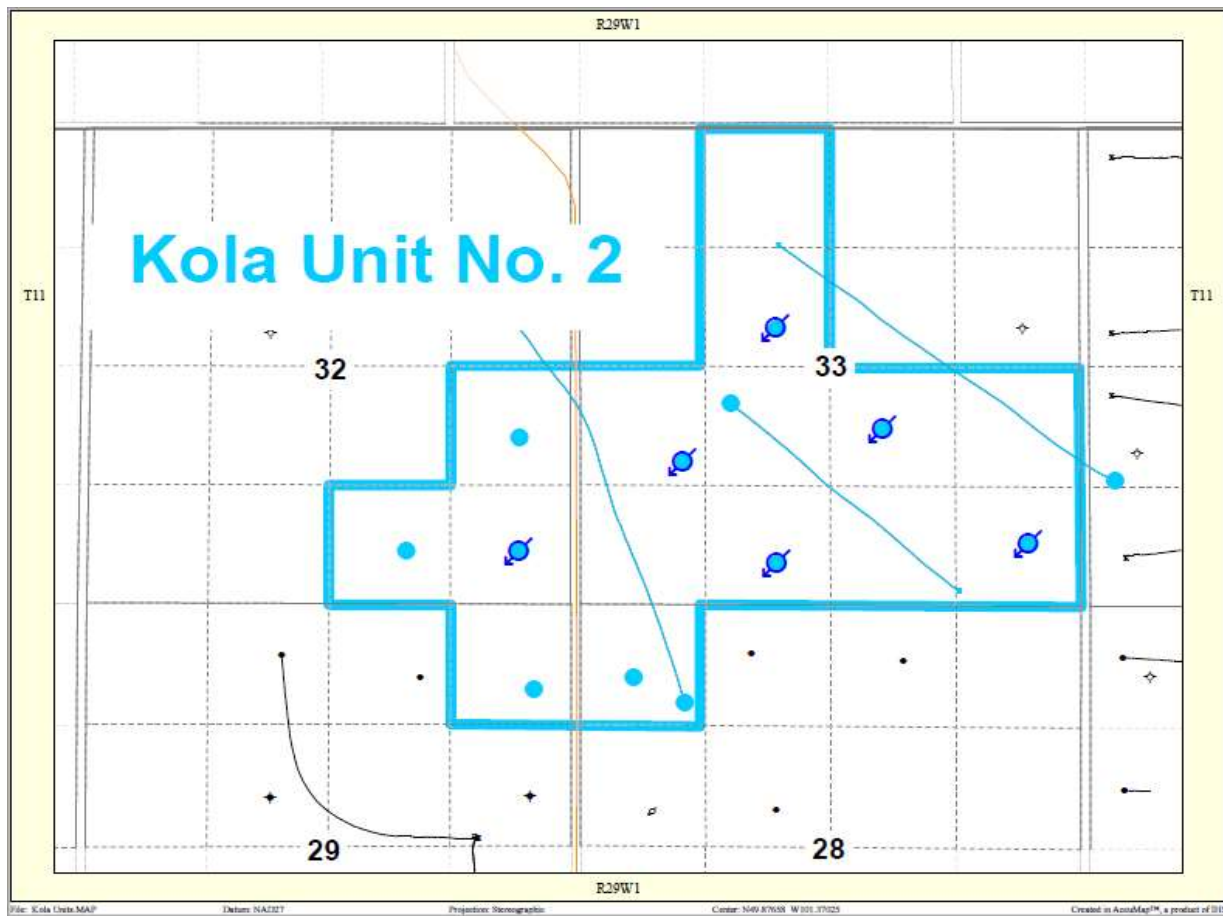
Tundra Oil and Gas

July 9, 2019

INTRODUCTION

Kola Unit No. 2 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 4 effective December 1, 1996 with Tundra Oil and Gas as Operator. The EOR project area contains 13 wells in 15 LSDs in Township 10, Range 29 W1 as shown in the figure below.

Figure 1: Kola Unit No. 2 Area Outline



Kola Unit No. 2

Tundra Oil and Gas (Tundra), as the operator of the Kola Unit No. 2 Enhanced Oil Recovery (EOR) project hereby submits the 2018 EOR report as per section 73 of the Drilling and Production Regulations.

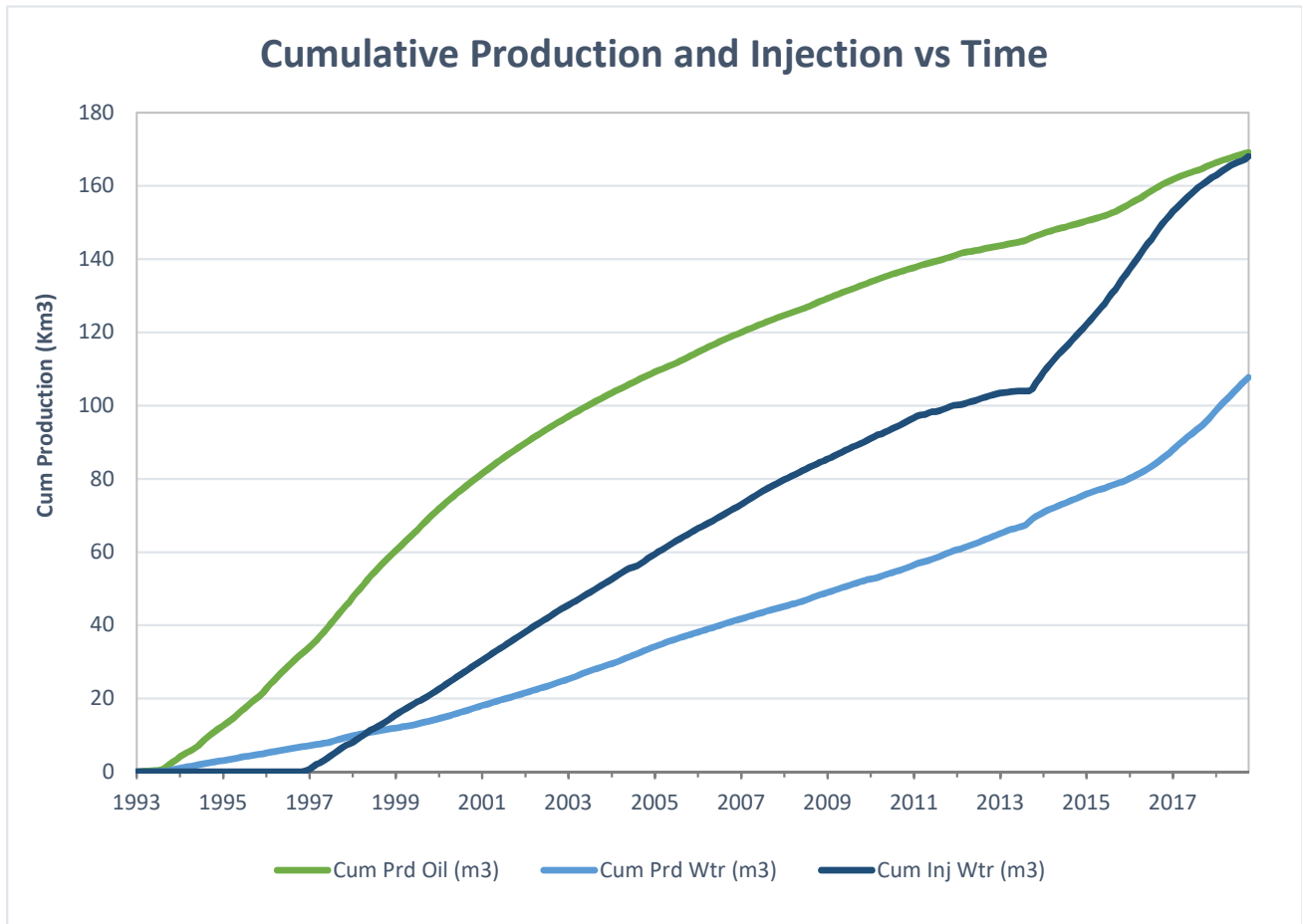
a) Monthly oil and water production rates, injection rate, GOR and WOR

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	14.20	29.79	22.84	2.10	0
Feb-2018	12.30	40.90	22.82	3.32	0
Mar-2018	12.61	41.02	18.77	3.25	0
Apr-2018	11.56	33.55	21.77	2.90	0
May-2018	11.73	33.76	22.55	2.88	0
Jun-2018	10.66	32.28	20.90	3.03	0
Jul-2018	10.32	30.30	22.55	2.94	0
Aug-2018	10.28	33.06	14.52	3.22	0
Sep-2018	9.15	34.18	12.43	3.73	0
Oct-2018	10.89	34.45	12.19	3.16	0
Nov-2018	8.99	30.66	14.37	3.41	0
Dec-2018	7.54	29.05	25.94	3.85	0

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

2018 PRODUCTION	
Produced Oil (m ³)	3,960
Produced Gas (m ³)	0
Produced Water (m ³)	12,240
Fluid Injected (m ³)	7,043
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	169,132
Produced Water (m ³)	107,703

Kola Unit No. 2



c) Monthly wellhead injection pressure for each injection well

	00/01-32 Inj		00/07-33 Inj		00/05-33 Inj		00/01-33 Inj		00/03-33 Inj		00/11-33 Inj	
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)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2018	124.0	5449	140.0	6002	0.0	-97	76.0	7741	258.0	5998	110.0	6006
Feb-2018	112.0	5494	124.0	5997	0.0	-101	68.0	6001	233.0	6000	102.0	5997
Mar-2018	22.0	805	137.0	6001	0.0	-103	65.0	5831	259.0	5996	99.0	5512
Apr-2018	0.0	-93	149.0	6268	0.0	-101	90.0	6275	266.0	6260	148.0	5235
May-2018	0.0	-92	161.0	6578	0.0	-100	87.0	6581	284.0	6543	167.0	6473
Jun-2018	0.0	-92	145.0	6161	0.0	-101	78.0	6394	259.0	6089	145.0	6140
Jul-2018	0.0	-92	162.0	6558	0.0	-101	85.0	6589	293.0	6563	159.0	6556
Aug-2018	2.0	-93	127.0	5274	0.0	340	71.0	5823	134.0	3418	116.0	5330
Sep-2018	0.0	-93	160.0	6597	0.0	-102	85.0	6599	0.0	-88	128.0	6602
Oct-2018	0.0	-93	156.0	6567	0.0	-103	83.0	6586	0.0	-87	139.0	6567
Nov-2018	28.0	258	150.0	6508	12.0	-103	79.0	6571	16.0	-89	146.0	6509
Dec-2018	99.0	2921	151.0	6599	159.0	-104	80.0	6571	175.0	1088	140.0	6600
Total	387.0		1762.0		171.0		947.0		2177.0		1599.0	
Avg Inj P		1190		6259		-65		6463		3974		6127

	KU2	
MONTH	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2018	708.0	5183
Feb-2018	639.0	4898
Mar-2018	582.0	4007
Apr-2018	653.0	3974
May-2018	699.0	4330
Jun-2018	627.0	4098
Jul-2018	699.0	4345
Aug-2018	450.0	3349
Sep-2018	373.0	3253
Oct-2018	378.0	3240
Nov-2018	431.0	3276
Dec-2018	804.0	3946
Total	7043.0	
Avg Inj P		3992

c) Monthly wellhead injection pressure for each injection well

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	708.0	639.0	582.0	653.0	699.0	627.0	699.0	450.0	373.0	378.0	431.0	804.0
Daily (m³/d)	22.84	22.82	18.77	21.77	22.55	20.90	22.55	14.52	12.43	12.19	14.37	25.94

2018 AVG. ANNUAL DAILY INJECTION = 19.30 m3/d

CUMULATIVE INJECTION TO Dec 31, 2017 = 161,008 m3

TOTAL 2018 ANNUAL INJECTION = 7,043 m3
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CUMULATIVE INJECTION TO Dec 31, 2018 = 168,051 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
102.13-28-010-29W1.00	Polish Rod Repair	8/1/2018

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-2018	440.2	165.61	923.6	96.39	708.0	161.72	0.508	0.591
Feb-2018	344.5	165.96	1145.3	97.53	639.0	162.35	0.422	0.590
Mar-2018	390.8	166.35	1271.6	98.80	582.0	162.94	0.344	0.588
Apr-2018	346.9	166.69	1006.5	99.81	653.0	163.59	0.474	0.588
May-2018	363.7	167.06	1046.5	100.86	699.0	164.29	0.487	0.587
Jun-2018	319.8	167.38	968.3	101.83	627.0	164.92	0.478	0.587
Jul-2018	319.8	167.70	939.2	102.76	699.0	165.61	0.545	0.587
Aug-2018	318.7	168.02	1025	103.79	450.0	166.06	0.329	0.585
Sep-2018	274.6	168.29	1025.4	104.82	373.0	166.44	0.283	0.584
Oct-2018	337.7	168.63	1067.8	105.88	378.0	166.82	0.264	0.582
Nov-2018	269.8	168.90	919.7	106.80	431.0	167.25	0.357	0.581
Dec-2018	233.7	169.13	900.6	107.70	804.0	168.05	0.699	0.582

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

Injected fluid consisted of produced water from the Lodgepole formation, from the unit and surrounding area until November 2013. Injection water for Kola Unit No. 2 is now being provided from the Jurassic source water well at 100/02-25-010-29W1 (2-25). Tundra received approval from the Petroleum Branch in March 2013 to use the 2-25 well as a source water well for waterflood operations. Jurassic-sourced water is pumped from the 2-25 source well to the Daly 12-24-10-29 battery, where it is filtered to 50 microns 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

j) Well List

Kola Unit No. 2 Well List

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
100/13-28-010-29W1/0	Vertical	Producing	-
102/13-28-010-29W1/0	Horizontal	Producing	-
100/16-29-010-29W1/0	Vertical	Pumping	-
100/01-32-010-29W1/0	Vertical	Injection	-
100/02-32-010-29W1/0	Vertical	Pumping	-
100/08-32-010-29W1/0	Vertical	Pumping	-
100/01-33-010-29W1/0	Vertical	Injection	-
100/03-33-010-29W1/0	Vertical	Injection	-
100/05-33-010-29W1/0	Vertical	Injection	-
100/06-33-010-29W1/0	Horizontal	Producing	-
100/07-33-010-29W1/0	Vertical	Injection	-
100/11-33-010-29W1/0	Vertical	Injection	-
102/05-34-010-29W1/0	Horizontal	Producing	-