

Kola Unit No. 2

Waterflood Progress Report 2019

January 1st through December 31st 2019

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

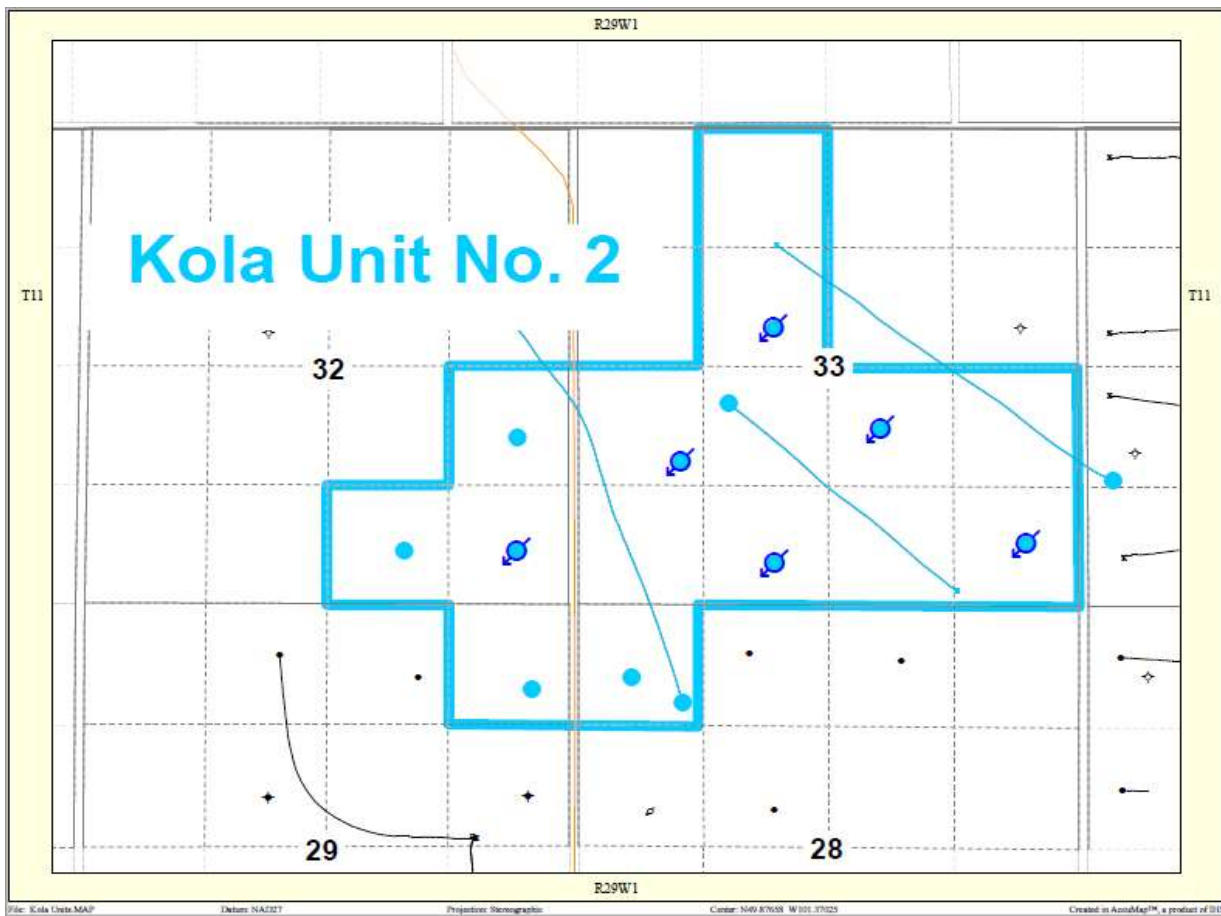
Tundra Oil and Gas

April 28, 2020

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 2019 EOR report as per section 73 of the Drilling and Production Regulations.

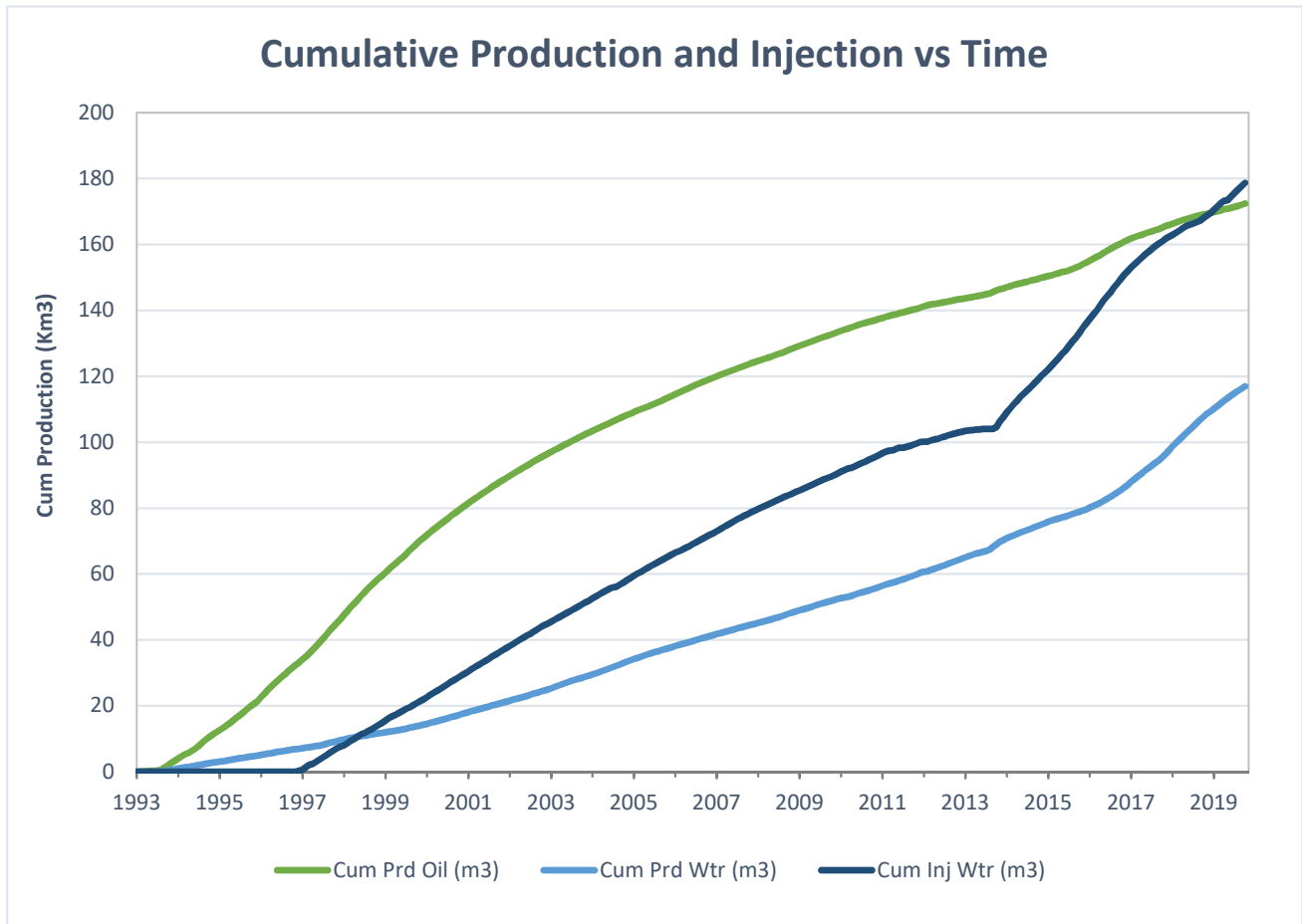
a) Monthly oil and water production rates, injection rate, GOR and WOR

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	7.11	30.39	25.39	4.27	0
Feb-2019	7.46	27.06	23.82	3.63	0
Mar-2019	9.74	27.47	34.26	2.82	0
Apr-2019	8.72	26.05	31.80	2.99	0
May-2019	8.84	26.63	33.71	3.01	0
Jun-2019	7.86	25.23	24.50	3.21	0
Jul-2019	7.41	26.51	5.58	3.58	0
Aug-2019	8.18	24.66	37.03	3.02	0
Sep-2019	9.53	25.33	35.60	2.66	0
Oct-2019	10.51	23.25	32.84	2.21	0
Nov-2019	12.72	21.39	33.70	1.68	0
Dec-2019	10.80	21.68	32.68	2.01	0

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

2019 PRODUCTION	
Produced Oil (m ³)	3,314
Produced Gas (m ³)	0
Produced Water (m ³)	9,296
Fluid Injected (m ³)	10,681
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	172,446
Produced Water (m ³)	116,999

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-2019	104.0	3241	150.0	6512	152.0	-103	76.0	6544	168.0	1878	137.0	6511
Feb-2019	107.0	3728	114.0	5780	109.0	57	61.0	6305	172.0	2821	104.0	5712
Mar-2019	128.0	4317	164.0	6601	303.0	1756	87.0	6600	230.0	3559	150.0	6498
Apr-2019	141.0	5113	146.0	6599	286.0	2008	77.0	6598	167.0	2548	137.0	6189
May-2019	144.0	5421	147.0	6600	302.0	2205	80.0	6599	230.0	3981	142.0	6532
Jun-2019	97.0	3904	103.0	5308	204.0	1572	77.0	6600	152.0	2798	102.0	6455
Jul-2019	13.0	258	14.0	562	21.0	-43	49.0	5506	7.0	-89	69.0	3746
Aug-2019	146.0	4878	211.0	6451	296.0	1606	93.0	6600	237.0	3023	165.0	6264
Sep-2019	142.0	5465	169.0	6600	297.0	2116	80.0	6603	231.0	3978	149.0	6531
Oct-2019	135.0	5237	159.0	6366	291.0	2199	79.0	6518	219.0	3818	135.0	6270
Nov-2019	131.0	5433	155.0	6598	302.0	2472	78.0	6600	216.0	4002	129.0	6315
Dec-2019	132.0	5426	154.0	6533	308.0	2578	80.0	6601	217.0	3997	122.0	6226
Total	1420.0		1686.0		2871.0		917.0		2246.0		1541.0	
Avg Inj P		4368		5876		1535		6473		3026		6104

	KU2	
MONTH	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2019	787.0	4097
Feb-2019	667.0	4067
Mar-2019	1062.0	4889
Apr-2019	954.0	4843
May-2019	1045.0	5223
Jun-2019	735.0	4440
Jul-2019	173.0	1657
Aug-2019	1148.0	4803
Sep-2019	1068.0	5216
Oct-2019	1018.0	5068
Nov-2019	1011.0	5237
Dec-2019	1013.0	5227
Total	10681.0	
Avg Inj P		4564

c) Monthly wellhead injection pressure for each injection well

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	787.0	667.0	1062.0	954.0	1045.0	735.0	173.0	1148.0	1068.0	1018.0	1011.0	1013.0
Daily (m³/d)	25.39	23.82	34.26	31.80	33.71	24.50	5.58	37.03	35.60	32.84	33.70	32.68

2019 AVG. ANNUAL DAILY INJECTION = 29.24 m3/d

CUMULATIVE INJECTION TO Dec 31, 2018 = 178,732 m3

TOTAL 2019 ANNUAL INJECTION = 10,681 m3

CUMULATIVE INJECTION TO Dec 31, 2019 = 178,732 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

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	220.4	169.35	942.2	108.65	787.0	168.84	0.668	0.582
Feb-2019	208.8	169.56	757.7	109.40	667.0	169.50	0.680	0.582
Mar-2019	302.0	169.86	851.5	110.25	1062.0	170.57	0.904	0.584
Apr-2019	261.7	170.12	781.5	111.04	954.0	171.52	0.898	0.585
May-2019	274.0	170.40	825.6	111.86	1045.0	172.57	0.934	0.586
Jun-2019	235.7	170.63	756.8	112.62	735.0	173.30	0.728	0.587
Jul-2019	229.8	170.86	821.7	113.44	173.0	173.47	0.162	0.585
Aug-2019	253.5	171.12	764.4	114.20	1148.0	174.62	1.108	0.587
Sep-2019	285.8	171.40	759.9	114.96	1068.0	175.69	1.002	0.589
Oct-2019	325.8	171.73	720.7	115.69	1018.0	176.71	0.952	0.590
Nov-2019	381.5	172.11	641.8	116.33	1011.0	177.72	0.963	0.591
Dec-2019	334.8	172.45	672	117.00	1013.0	178.73	0.983	0.592

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	-