

**Waskada Lower Amaranth Unit No. 1**

**Waterflood Progress Report 2019**

**January 1<sup>st</sup> through December 31<sup>st</sup> 2019**

**Prepared for:**

**Manitoba Industry, Economic Development and Mines**

**Petroleum Branch**

**Prepared by:**

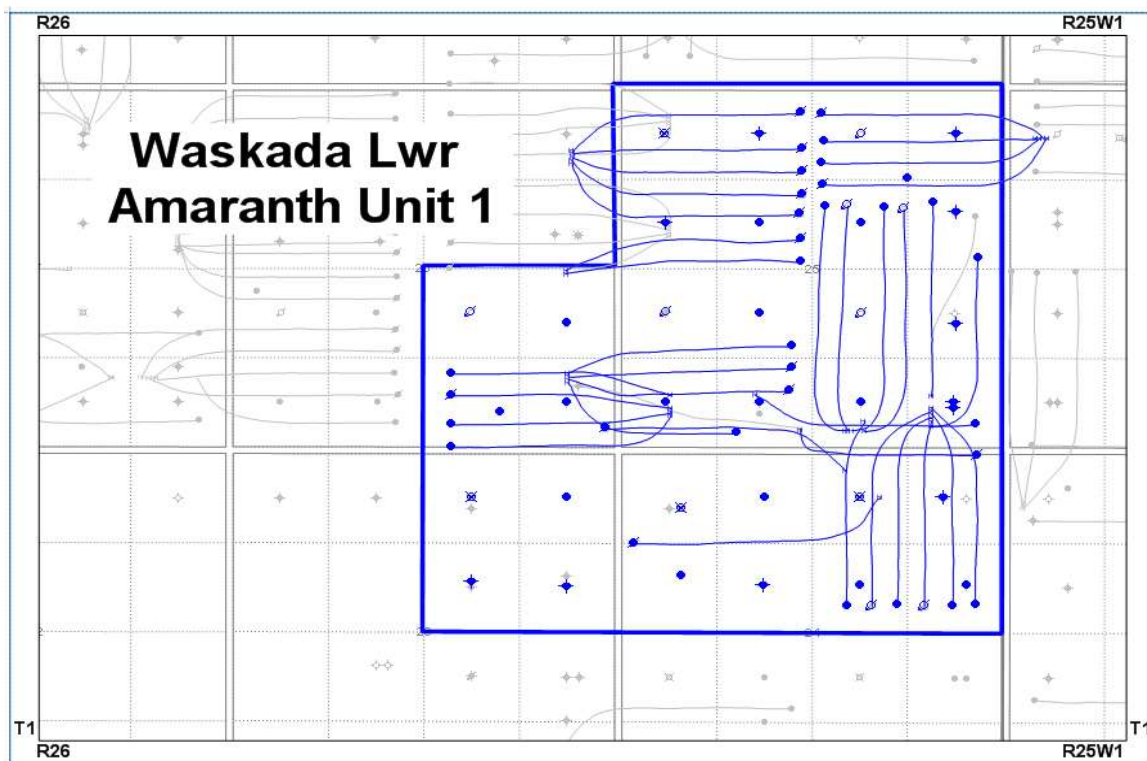
**Tundra Oil and Gas**

**March 19, 2020**

## INTRODUCTION

Waskada Lower Amaranth Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 58 effective February 1983. The Unit area contains 30 abandoned/suspended/inactive wells, including 8 suspended/inactive injectors, and 39 producing/inactive wells in 32 LSDs in Township 1, Range 26 W1 as shown in the figure below.

**Figure 1: Waskada Lower Amaranth Unit No. 1 Area Outline**



## Waskada Lower Amaranth Unit No. 1

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

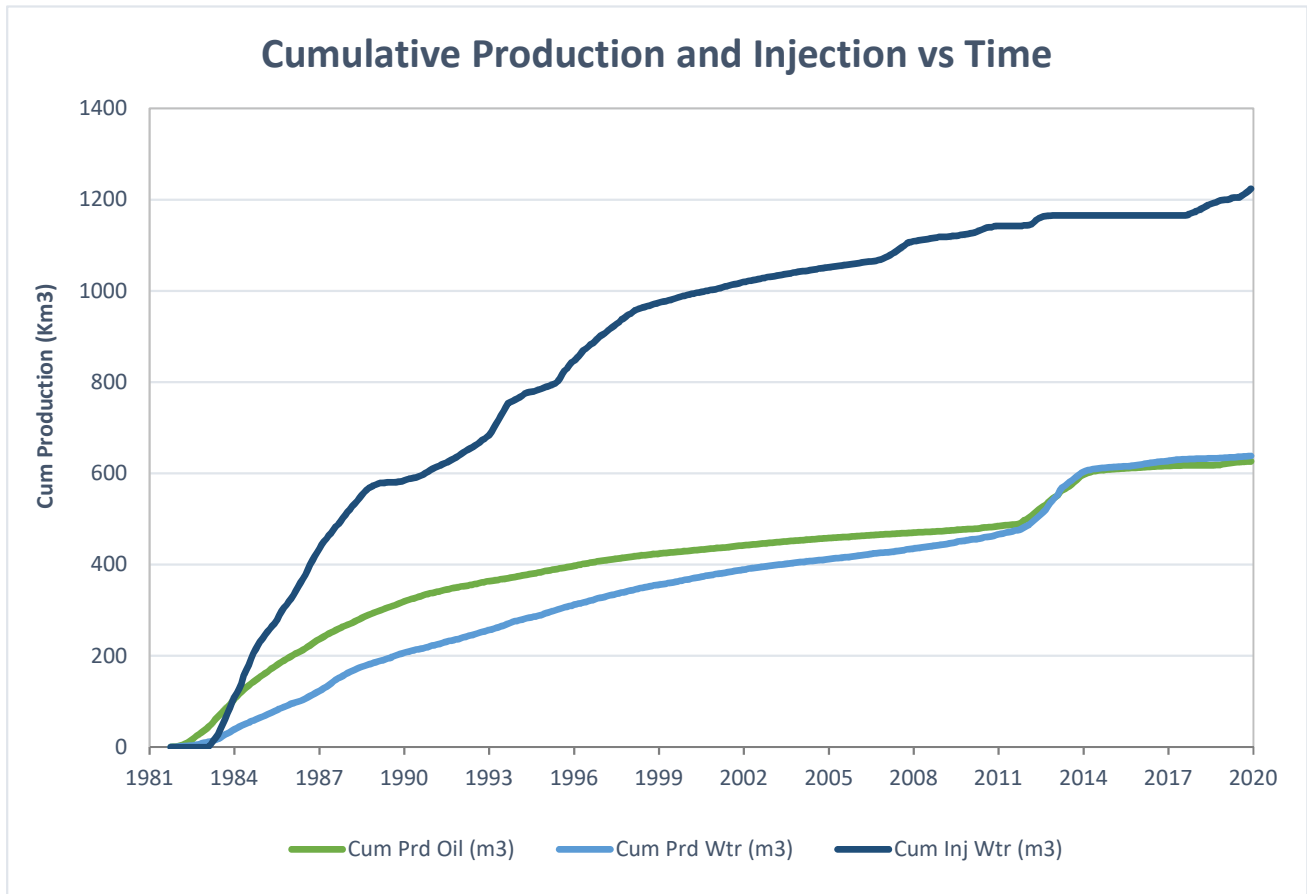
**a) Monthly oil and water production rates, injection rate, GOR and WOR**

MONTH	Cal Dly Oil m <sup>3</sup> /day	Cal Dly Wtr m <sup>3</sup> /day	Cal Inj Wtr m <sup>3</sup> /day	WOR m <sup>3</sup> /m <sup>3</sup>	GOR m <sup>3</sup> /m <sup>3</sup>
Jan-2019	38.11	9.11	8.71	0.24	0
Feb-2019	32.12	9.39	0.00	0.29	0
Mar-2019	24.78	7.55	61.90	0.30	0
Apr-2019	24.84	9.20	76.27	0.37	0
May-2019	20.69	11.28	25.32	0.55	0
Jun-2019	17.44	13.79	0.00	0.79	0
Jul-2019	14.43	13.07	16.61	0.91	0
Aug-2019	13.09	13.08	99.06	1.00	0
Sep-2019	10.76	13.17	118.73	1.22	0
Oct-2019	9.21	13.02	120.94	1.41	0
Nov-2019	2.70	9.75	139.00	3.61	0
Dec-2019	9.82	16.32	138.65	1.66	0

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

2019 PRODUCTION	
Produced Oil (m <sup>3</sup> )	6,606
Produced Gas (m <sup>3</sup> )	0
Produced Water (m <sup>3</sup> )	4,227
Fluid Injected (m <sup>3</sup> )	24,627
CUMULATIVE PRODUCTION	
Produced Oil (m <sup>3</sup> )	626,352
Produced Water (m <sup>3</sup> )	638,373

## Waskada Lower Amaranth Unit No. 1



c) Monthly wellhead injection pressure for each injection well

	00/07-25 Inj		00/15-25 Inj		00/07-26 Inj		00/05-25 Inj		03/10-25 Inj		03/09-24 Inj	
MONTH	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)
Jan-2019	0.0	0	0.0	1	0.0	0	0.0	0	83.0	266	38.0	-76
Feb-2019	0.0	0	0.0	1	0.0	0	0.0	0	0.0	313	0.0	-73
Mar-2019	0.0	0	0.0	-20	0.0	0	0.0	0	476.0	430	473.0	-66
Apr-2019	0.0	0	0.0	-83	0.0	0	0.0	0	469.0	-71	612.0	-90
May-2019	0.0	0	0.0	-88	0.0	0	0.0	0	117.0	-22	214.0	-90
Jun-2019	0.0	0	0.0	-88	0.0	0	0.0	0	0.0	-16	0.0	-90
Jul-2019	0.0	0	0.0	-88	0.0	0	0.0	0	0.0	-16	175.0	-90
Aug-2019	0.0	0	0.0	-56	0.0	-59	0.0	0	458.0	68	887.0	-88
Sep-2019	0.0	0	0.0	0	0.0	-86	0.0	0	890.0	-82	890.0	-88
Oct-2019	0.0	0	0.0	0	0.0	-82	0.0	0	907.0	-83	967.0	-17
Nov-2019	0.0	0	0.0	51	0.0	227	0.0	0	892.0	-82	1192.0	1000
Dec-2019	0.0	-90	0.0	1227	0.0	0	0.0	1466	921.0	-77	1229.0	1445
<b>Total</b>	0.0		0.0		0.0		0.0		5213.0		6677.0	
<b>Avg Inj P</b>		-8		71		0		122		52		140

	06/10-25 Inj		02/10-24 Inj		WLAMU1	
MONTH	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)
Jan-2019	75.0	-32	74.0	-84	270.0	9
Feb-2019	0.0	-32	0.0	-88	0.0	15
Mar-2019	481.0	15	489.0	-54	1919.0	38
Apr-2019	597.0	-78	610.0	-85	2288.0	-51
May-2019	234.0	-76	220.0	-87	785.0	-45
Jun-2019	0.0	-74	0.0	-87	0.0	-44
Jul-2019	177.0	-76	163.0	-87	515.0	-45
Aug-2019	863.0	-64	863.0	-85	3071.0	-36
Sep-2019	891.0	-82	891.0	-86	3562.0	-53
Oct-2019	908.0	-83	967.0	68	3749.0	-25
Nov-2019	894.0	-82	1192.0	1225	4170.0	293
Dec-2019	921.0	-13	1227.0	1761	4298.0	806
<b>Total</b>	6041.0		6696.0		24627.0	
<b>Avg Inj P</b>		-56		193		72

**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
<b>Total m3</b>	270.0	0.0	1919.0	2288.0	785.0	0.0	515.0	3071.0	3562.0	3749.0	4170.0	4298.0
<b>Daily (m<sup>3</sup>/d)</b>	8.71	0.00	61.90	76.27	25.32	0.00	16.61	99.06	118.73	120.94	139.00	138.65

2019 AVG. ANNUAL DAILY INJECTION = 67.10 m3/d
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CUMULATIVE INJECTION TO Dec 31, 2018 = 1,172,840 m3
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TOTAL 2019 ANNUAL INJECTION = 24,627 m3
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CUMULATIVE INJECTION TO Dec 31, 2019 = 1,224,033 m3
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**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 (Rm<sup>3</sup>/Sm<sup>3</sup>) = 1.17

MONTH	Mth Oil Prod (m <sup>3</sup> )	Cum Oil Prod (Km <sup>3</sup> )	Mth Water Prod (m <sup>3</sup> )	Cum Water Prod (Km <sup>3</sup> )	Mth Water Inj (m <sup>3</sup> )	Cum Water Inj (Km <sup>3</sup> )	VRR	Cum VRR
Jan-2019	1181.5	620.93	282.3	634.43	270.0	1199.68	0.162	0.882
Feb-2019	899.4	621.83	263	634.69	0.0	1199.68	0.000	0.881
Mar-2019	768.3	622.60	234.1	634.93	1919.0	1201.59	1.694	0.881
Apr-2019	745.3	623.34	276.1	635.20	2288.0	1203.88	1.993	0.882
May-2019	641.5	623.98	349.8	635.55	785.0	1204.67	0.713	0.882
Jun-2019	523.3	624.51	413.6	635.97	0.0	1204.67	0.000	0.881
Jul-2019	447.2	624.95	405.2	636.37	515.0	1205.18	0.555	0.881
Aug-2019	405.7	625.36	405.5	636.78	3071.0	1208.25	3.489	0.883
Sep-2019	322.8	625.68	395.2	637.17	3562.0	1211.82	4.609	0.885
Oct-2019	285.5	625.97	403.5	637.57	3749.0	1215.56	5.083	0.887
Nov-2019	80.9	626.05	292.4	637.87	4170.0	1219.73	10.774	0.890
Dec-2019	304.3	626.35	506	638.37	4298.0	1224.03	4.986	0.893

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

The injected fluid is treated by 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>
100/09-23-001-26W1/0	Vertical	Abandoned	-
102/10-23-001-26W1/0	Vertical	Abandoned	-
103/10-23-001-26W1/0	Horizontal	Producing	-
100/15-23-001-26W1/0	Vertical	Abandoned	-
100/16-23-001-26W1/0	Vertical	Producing	-
100/09-24-001-26W1/2	Vertical	Producing	-
102/09-24-001-26W1/0	Horizontal	Producing	-
103/09-24-001-26W1/0	Horizontal	Injection	-
104/09-24-001-26W1/0	Horizontal	Producing	-
100/10-24-001-26W1/0	Vertical	Producing	-
102/10-24-001-26W1/0	Horizontal	Injection	-
103/10-24-001-26W1/0	Horizontal	Producing	-
104/10-24-001-26W1/0	Horizontal	Producing	-
100/11-24-001-26W1/0	Vertical	Abandoned	-
100/12-24-001-26W1/2	Vertical	Commingle	-
102/12-24-001-26W1/0	Horizontal	Suspended	-
102/13-24-001-26W1/0	Vertical	Abandoned	-
103/13-24-001-26W1/0	Horizontal	Suspended	-
100/14-24-001-26W1/0	Vertical	Producing	-
100/15-24-001-26W1/0	Vertical	Abandoned	-
102/16-24-001-26W1/0	Vertical	Abandoned	-
103/16-24-001-26W1/2	Horizontal	Suspended	-
100/01-25-001-26W1/2	Vertical	Abandoned	-
102/01-25-001-26W1/0	Vertical	Abandoned	-
103/01-25-001-26W1/0	Horizontal	Producing	-
100/02-25-001-26W1/2	Vertical	Producing	-
100/03-25-001-26W1/2	Vertical	Abandoned Zone	-
103/03-25-001-26W1/0	Horizontal	Suspended	-
104/03-25-001-26W1/0	Horizontal	Suspended	-
105/03-25-001-26W1/0	Horizontal	Producing	-
100/04-25-001-26W1/2	Vertical	Abandoned Zone	-
100/05-25-001-26W1/2	Vertical	Suspended	-
100/06-25-001-26W1/0	Vertical	Producing	-
102/06-25-001-26W1/0	Horizontal	Producing	-
100/07-25-001-26W1/0	Vertical	Injection	-
102/08-25-001-26W1/0	Vertical	Abandoned	-
100/09-25-001-26W1/0	Vertical	Abandoned Zone	-
102/09-25-001-26W1/0	Horizontal	Pumping	-
103/09-25-001-26W1/0	Horizontal	Producing	-
100/10-25-001-26W1/0	Vertical	Producing	-
102/10-25-001-26W1/0	Horizontal	Suspended	-
103/10-25-001-26W1/0	Horizontal	Injection	-
104/10-25-001-26W1/0	Horizontal	Producing	-
105/10-25-001-26W1/0	Horizontal	Producing	-
106/10-25-001-26W1/0	Horizontal	Injection	-



## j) Well List

## Waskada Lower Amaranth Unit No. 1 Well List

<i><b>UWI</b></i>	<i><b>Type</b></i>	<i><b>Status</b></i>	<i><b>Future Plans</b></i>
100/11-25-001-26W1/0	Vertical	Abandoned Zone	-
102/11-25-001-26W1/0	Horizontal	Suspended	-
103/11-25-001-26W1/0	Horizontal	Suspended	-
104/11-25-001-26W1/0	Horizontal	Producing	-
105/11-25-001-26W1/0	Horizontal	Suspended	-
100/12-25-001-26W1/0	Vertical	Abandoned	-
100/13-25-001-26W1/0	Vertical	Abandoned	-
100/14-25-001-26W1/0	Vertical	Abandoned	-
102/14-25-001-26W1/0	Horizontal	Suspended	-
103/14-25-001-26W1/0	Horizontal	Suspended	-
104/14-25-001-26W1/0	Horizontal	Suspended	-
100/15-25-001-26W1/0	Vertical	Injection	-
102/15-25-001-26W1/0	Horizontal	Suspended	-
103/15-25-001-26W1/0	Horizontal	Producing	-
104/15-25-001-26W1/0	Horizontal	Producing	-
100/16-25-001-26W1/0	Vertical	Abandoned Zone	-
1B0/16-25-001-26W1/0	Vertical	Producing	-
100/01-26-001-26W1/2	Vertical	Commingled	-
100/02-26-001-26W1/0	Vertical	Abandoned Zone	-
102/02-26-001-26W1/0	Horizontal	Producing	-
103/02-26-001-26W1/0	Horizontal	Producing	-
104/02-26-001-26W1/0	Horizontal	Producing	-
105/02-26-001-26W1/0	Horizontal	Suspended	-
100/07-26-001-26W1/0	Vertical	Abandoned	-
100/08-26-001-26W1/0	Vertical	Producing	-