

Daly Unit No. 12

Waterflood Progress Report 2019

January 1st through December 31st 2019

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

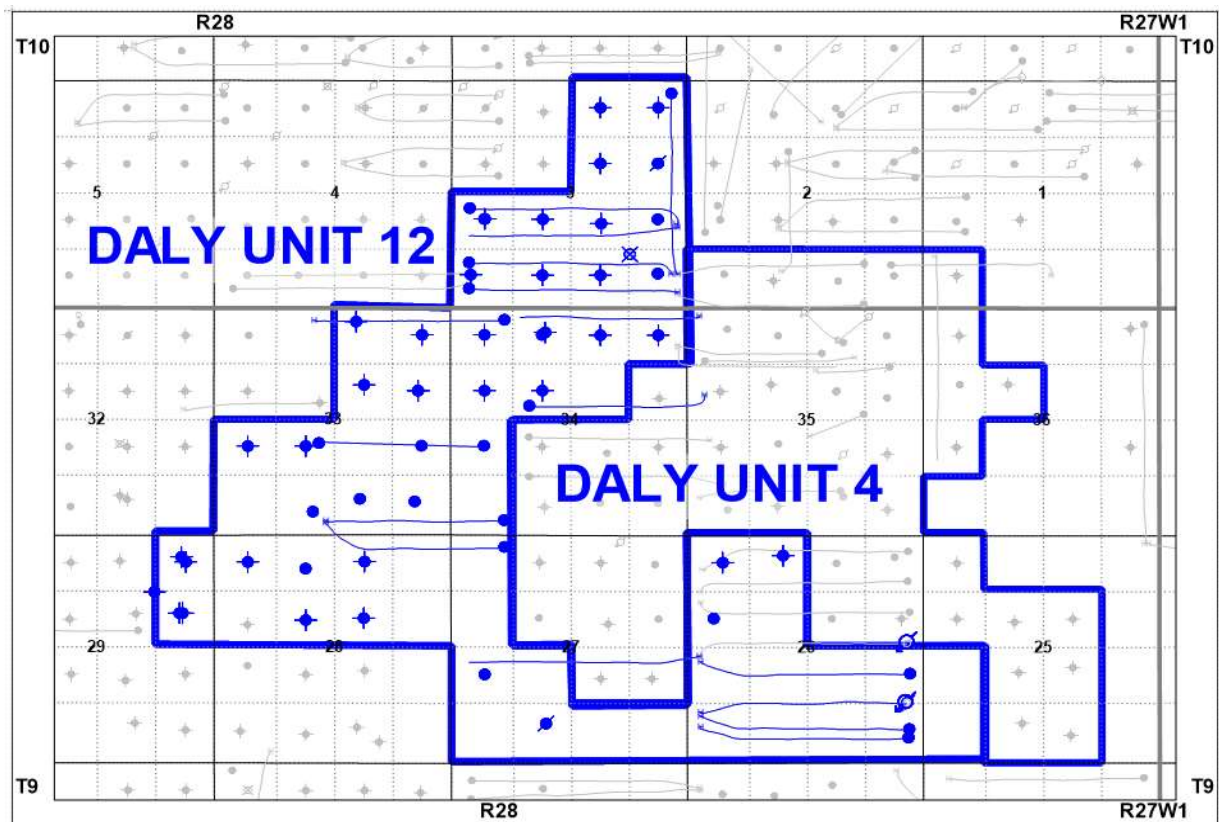
Tundra Oil and Gas

April 16, 2020

INTRODUCTION

Daly Unit No. 12 Enhanced Oil Recovery (EOR) Waterflood Project was approved on January 1, 2016 with Tundra Oil and Gas (Tundra) as Operator. The EOR project area, outlined in blue in Figure 1, contains 45 vertical wells (9 producing, 36 abandoned/suspended) and 16 horizontal wells (15 producing, 1 injector) in 65 LSDs in Townships 9-10, Range 28W1.

Figure 1: Daly Unit No. 12 Area Outline



Daly Unit No. 12

Tundra Oil and Gas (Tundra), as the operator of the Daly Unit No. 12 Enhanced Oil Recovery (EOR) project hereby submits the 2019 EOR report as per section 73 of the Drilling and Production Regulations.

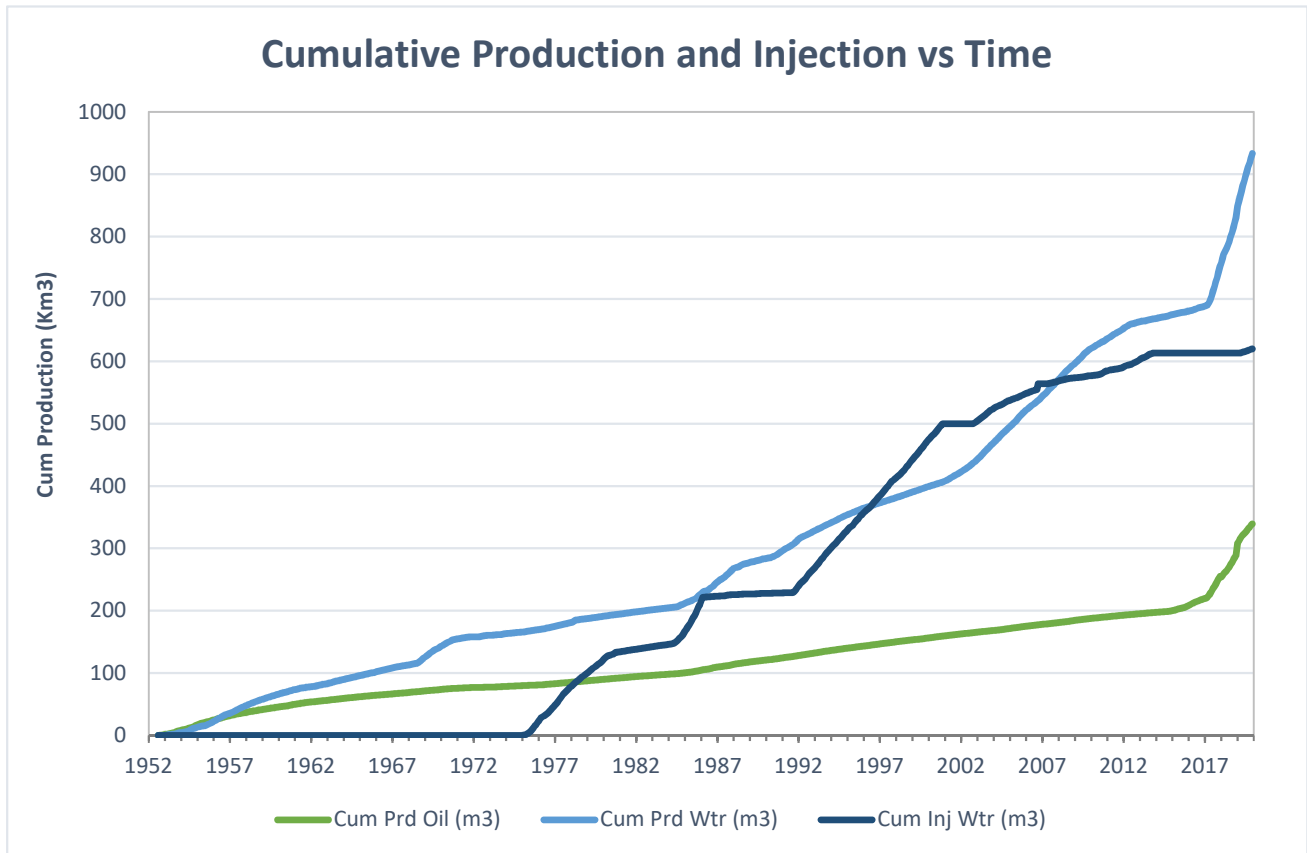
a) Monthly oil and water production rates, injection rate, GOR and WOR

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	131.41	286.28	0.00	2.18	0
Feb-2019	123.53	263.76	0.00	2.14	0
Mar-2019	123.08	275.74	0.49	2.24	0
Apr-2019	101.30	252.28	12.63	2.49	0
May-2019	87.78	297.22	23.12	3.39	0
Jun-2019	81.99	248.23	21.81	3.03	0
Jul-2019	69.37	238.85	17.67	3.44	0
Aug-2019	80.28	249.38	27.13	3.11	0
Sep-2019	95.99	232.44	28.85	2.42	0
Oct-2019	96.19	235.11	28.43	2.44	0
Nov-2019	88.73	242.62	27.45	2.73	0
Dec-2019	73.88	243.15	20.37	3.29	0

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

2019 PRODUCTION	
Produced Oil (m ³)	35,021
Produced Gas (m ³)	0
Produced Water (m ³)	93,250
Fluid Injected (m ³)	6,356
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	339,265
Produced Water (m ³)	933,418

Daly Unit No. 12



c) Monthly wellhead injection pressure for each injection well

	03/01-26 Inj		DU12	
MONTH	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2019	0.0	0	0.0	0
Feb-2019	0.0	0	0.0	0
Mar-2019	15.1	7	15.1	7
Apr-2019	379.0	-52	379.0	-52
May-2019	716.8	-98	716.8	-98
Jun-2019	654.3	-98	654.3	-98
Jul-2019	547.7	-99	547.7	-99
Aug-2019	841.1	-95	841.1	-95
Sep-2019	865.5	442	865.5	442
Oct-2019	881.2	2056	881.2	2056
Nov-2019	823.4	2774	823.4	2774
Dec-2019	631.6	2958	631.6	2958
Total	6355.7		6355.7	
Avg Inj P		649		649

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	0.0	0.0	15.1	379.0	716.8	654.3	547.7	841.1	865.5	881.2	823.4	631.6
Daily (m³/d)	0.00	0.00	0.49	12.63	23.12	21.81	17.67	27.13	28.85	28.43	27.45	20.37

2019 AVG. ANNUAL DAILY INJECTION = 17.33 m3/d

CUMULATIVE INJECTION TO Dec 31, 2018 = 613,501 m3

TOTAL 2019 ANNUAL INJECTION = 6,356 m3
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CUMULATIVE INJECTION TO Dec 31, 2019 = 619,857 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
100.03-33-009-28W1.00	BP Install	11/25/2019
102.05-34-009-28W1.00	BHP Change	6/28/2019
102.11-34-009-28W1.00	Pump Channgge	2/22/2019
102.13-27-009-28W1.00	Pump Change	4/4/2019
103.01-26-009-28W1.00	CLC WIW Conversion	3/7/2019
100.09-03-010-28W1.00	Downhole Recoder Install	6/13/2019
100.09-03-010-28W1.00	Recorder Recovery and Hang Tubing String	8/16/2019
102.05-03-010-28W1.00	Pump Change	5/8/2019
102.16-03-010-28W1.00	Pump Change	2/12/2019
102.16-03-010-28W1.00	Pump Change	4/23/2019
102.16-03-010-28W1.00	Rigless Acid	8/14/2019
103.04-03-010-28W1.00	Pump Change	5/9/2019

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	4073.6	308.32	8874.6	849.04	0.0	613.50	0.000	0.523
Feb-2019	3458.8	311.78	7385.4	856.43	0.0	613.50	0.000	0.518
Mar-2019	3815.6	315.59	8547.9	864.98	15.1	613.52	0.001	0.513
Apr-2019	3038.9	318.63	7568.3	872.54	379.0	613.90	0.035	0.509
May-2019	2721.3	321.35	9213.9	881.76	716.8	614.61	0.059	0.504
Jun-2019	2459.6	323.81	7446.8	889.21	654.3	615.27	0.065	0.501
Jul-2019	2150.6	325.96	7404.5	896.61	547.7	615.81	0.057	0.497
Aug-2019	2488.8	328.45	7730.7	904.34	841.1	616.66	0.081	0.494
Sep-2019	2879.6	331.33	6973.1	911.31	865.5	617.52	0.087	0.490
Oct-2019	2981.8	334.31	7288.3	918.60	881.2	618.40	0.085	0.487
Nov-2019	2662.0	336.97	7278.5	925.88	823.4	619.23	0.082	0.484
Dec-2019	2290.3	339.26	7537.5	933.42	631.6	619.86	0.064	0.481

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

The injection water for Daly Unit No. 12 will be supplied from the existing source and injection water system at the Sinclair 3-4-8-29 Battery. All existing injection water is obtained from the Lodgepole formation in the 102/16-32-007-29W1 water source well. Lodgepole water from the 102/16-32 source well is pumped to the main Water Plant at 3-4-8-29W1, filtered, and 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**

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
102/01-26-009-28W1/0	Horizontal	Producing	-
103/01-26-009-28W1/0	Horizontal	Injection	-
104/01-26-009-28W1/0	Horizontal	Producing	-
102/08-26-009-28W1/0	Horizontal	Producing	-
100/12-26-009-28W1/0	Vertical	Producing	-
100/13-26-009-28W1/0	Vertical	Abandoned Zone	-
100/14-26-009-28W1/0	Vertical	Abandoned Zone	-
100/03-27-009-28W1/0	Vertical	Suspended	-
102/05-27-009-28W1/0	Horizontal	Producing	-
102/13-27-009-28W1/0	Horizontal	Producing	-
100/10-28-009-28W1/0	Vertical	Abandoned	-
100/11-28-009-28W1/0	Vertical	Abandoned	-
100/13-28-009-28W1/0	Vertical	Abandoned	-
100/14-28-009-28W1/0	Vertical	Producing	-
100/15-28-009-28W1/0	Vertical	Abandoned	-
100/09-29-009-28W1/0	Vertical	Abandoned Zone	-
102/09-29-009-28W1/0	Vertical	Abandoned Zone	-
102/10-29-009-28W1/0	Vertical	Abandoned	-
100/16-29-009-28W1/0	Vertical	Abandoned	-
102/16-29-009-28W1/0	Vertical	Abandoned Zone	-
100/01-33-009-28W1/0	Vertical	Producing	-
100/02-33-009-28W1/0	Vertical	Commingled	-
100/03-33-009-28W1/0	Vertical	Producing	-
100/05-33-009-28W1/0	Vertical	Abandoned	-
100/06-33-009-28W1/0	Vertical	Abandoned	-
102/06-33-009-28W1/0	Vertical	Commingled	-
100/08-33-009-28W1/0	Vertical	Producing	-
100/09-33-009-28W1/0	Vertical	Abandoned	-
100/09-33-009-28W1/2	Vertical	Abandoned Zone	-
100/10-33-009-28W1/0	Vertical	Abandoned	-
100/15-33-009-28W1/0	Vertical	Abandoned Zone	-
100/16-33-009-28W1/0	Vertical	Abandoned Zone	-
102/04-34-009-28W1/0	Horizontal	Producing	-
102/05-34-009-28W1/0	Horizontal	Producing	-
100/11-34-009-28W1/0	Vertical	Abandoned	-
102/11-34-009-28W1/0	Horizontal	Producing	-
100/12-34-009-28W1/0	Vertical	Abandoned Zone	-
100/13-34-009-28W1/0	Vertical	Abandoned Zone	-
102/13-34-009-28W1/0	Horizontal	Producing	-
100/14-34-009-28W1/0	Vertical	Abandoned Zone	-
102/14-34-009-28W1/0	Horizontal	Producing	-
100/15-34-009-28W1/0	Vertical	Abandoned	-
100/16-34-009-28W1/0	Vertical	Abandoned	-
100/01-03-010-28W1/0	Vertical	Abandoned	-
102/01-03-010-28W1/0	Vertical	Producing	-

j) Well List

Daly Unit No. 12 Well List

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
100/02-03-010-28W1/0	Vertical	Abandoned Zone	-
100/03-03-010-28W1/0	Vertical	Abandoned Zone	-
100/04-03-010-28W1/0	Vertical	Abandoned	-
102/04-03-010-28W1/0	Horizontal	Producing	-
103/04-03-010-28W1/0	Horizontal	Producing	-
100/05-03-010-28W1/0	Vertical	Abandoned	-
102/05-03-010-28W1/0	Horizontal	Producing	-
103/05-03-010-28W1/0	Horizontal	Producing	-
100/06-03-010-28W1/0	Vertical	Abandoned	-
100/07-03-010-28W1/0	Vertical	Abandoned Zone	-
100/08-03-010-28W1/0	Vertical	Producing	-
100/09-03-010-28W1/0	Vertical	Suspended	-
100/10-03-010-28W1/0	Vertical	Abandoned	-
100/15-03-010-28W1/0	Vertical	Abandoned Zone	-
100/16-03-010-28W1/0	Vertical	Abandoned Zone	-
102/16-03-010-28W1/0	Horizontal	Producing	-

k) Discussion

Wells in Daly Unit No. 12 have been on 40 acre primary production since the early 1950's, coincident with primary developments in the offset Daly Unit Nos. 1 & 3. In the mid-1970's Chevron successfully implemented a pilot waterflood focused in the SE/4 of Sec 03-010-28W1, within the proposed Unit boundary. The pilot targeted the Lodgepole reservoir via an inverted 5-spot vertical pattern flood, whereby the 100/01-03-010-28W1 vertical was converted to injection to flood the offsetting 4 vertical producers. It appears the flood was successful in arresting decline rates and improving the overall recovery of the Lodgepole reservoir in this area.

Where there are existing undrilled DSU's in Daly Unit No. 12, Tundra plans to drill infill 40 acre verticals. Additional E-W horizontals will be drilled between existing rows of vertical wells, resulting in an effective 20 acre spacing over the Unit area. Every second horizontal will then be converted to water injection service after a period of production (expected 2-3 years after each well's first production). Plans are for the new future injection wells to be cemented liner horizontals, stimulated via multiple hydraulic fracture treatments to obtain suitable injection rates. This helps ensure optimum placement of each fracture stage to prevent, or minimize, the potential for out-of-zone fracture growth thereby limiting the potential for future out-of-zone injection.