

**DALY UNIT NO. 10**  
**WATERFLOOD EOR PROJECT**  
**ANNUAL REPORT FOR 2015**

**June 14, 2016**

**Tundra Oil and Gas Partnership**

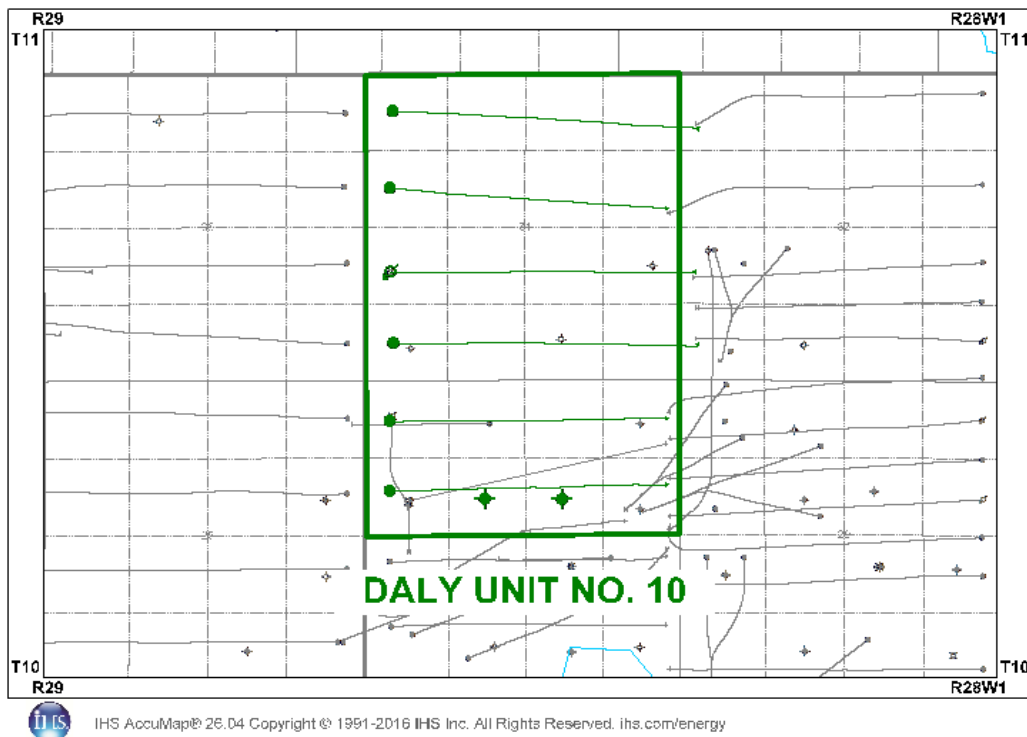
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## **INTRODUCTION**

Daly Unit No. 10 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 48, effective October 1st, 2015 with Tundra Oil and Gas as Operator. The EOR project area, outlined in green in Figure 1, contains 2 abandoned vertical wells and 5 horizontal producing wells and 1 injection well in 24 LSDs in Township 10, Range 28W1.

**Figure 1: Daly Unit No. 10 Area Outline**



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra submits the following 2015 Annual Progress Report for Daly Unit No. 10 as required by Waterflood Order No. 48.

## **DISCUSSION**

### **Production History**

For the wells included in Daly Unit No. 10, production started in July 1987 with the 00/11-30-010-28W1/00 well. Oil production peaked at 61.84 m<sup>3</sup>/d in January 2012. In 2015, the average production for the unit was 7.77 m<sup>3</sup>/d of oil and 27.66 m<sup>3</sup>/d of water, and the average WOR was 3.59 m<sup>3</sup>/m<sup>3</sup>. Water injection commenced in Daly Unit No. 10 in December 2015. The oil production rate, injection rate and WOR for each injection pattern is presented in Appendix A. The rates and WOR are presented in Figure 2.

**Figure 2: Daly Unit No. 10 Production/Injection Rates and WOR vs. Time**

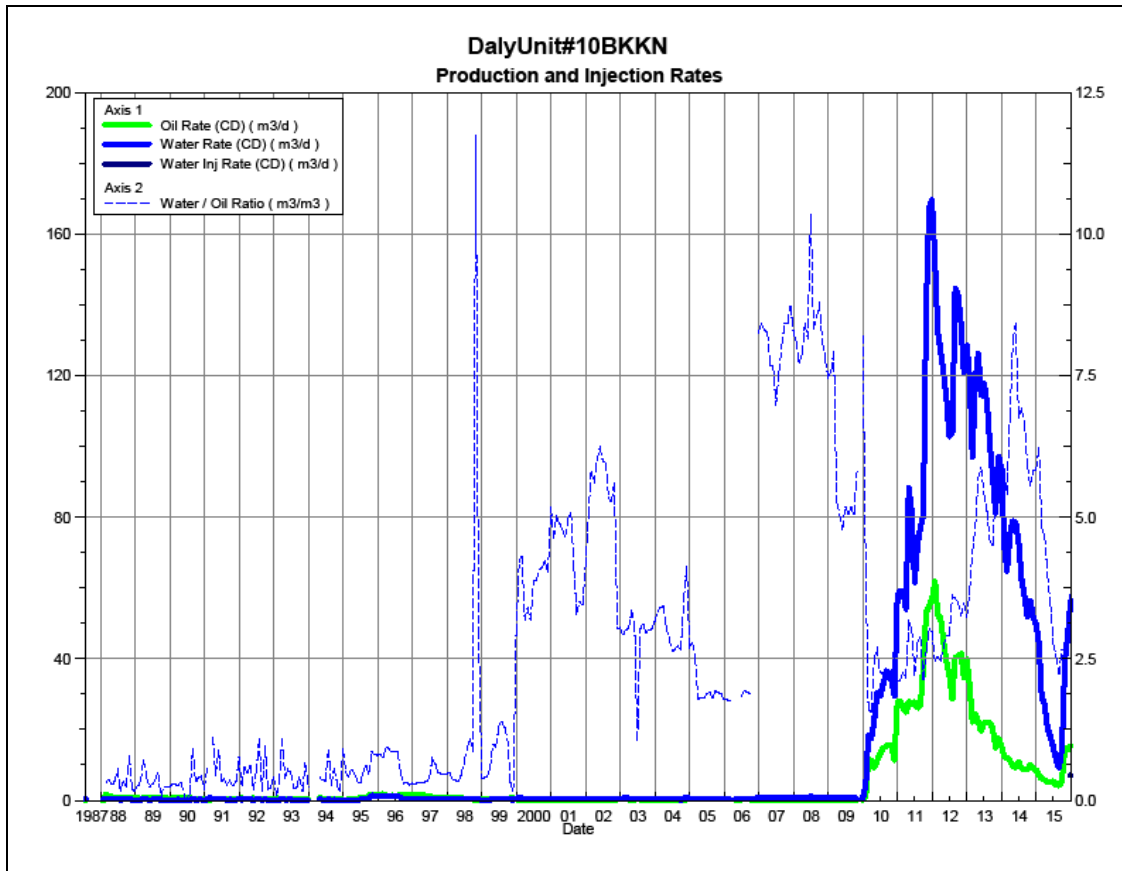
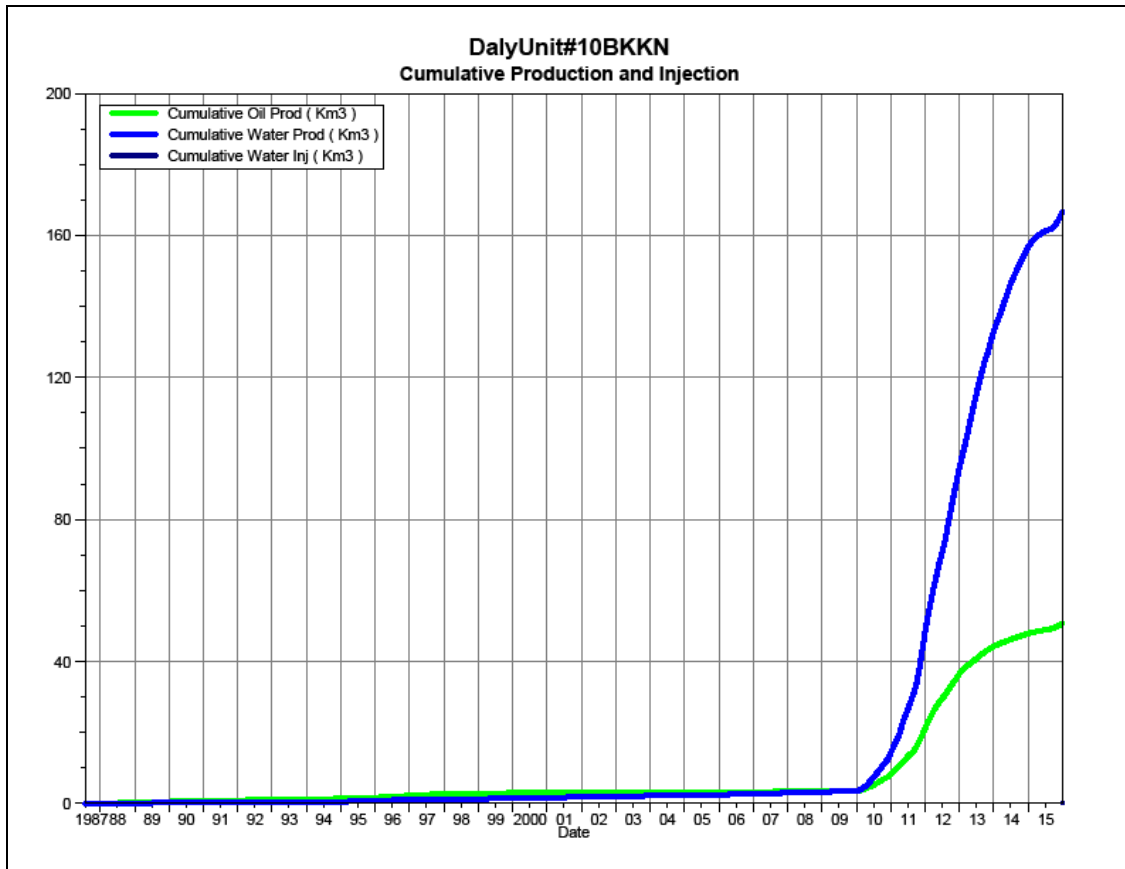


Figure 3 shows the cumulative production for Daly Unit No. 10 to the end of December 2015 as 50.75 e³m³ of oil and 166.71 e³m³ of water, representing a 12.9% recovery factor of the OOIP. The cumulative volume of oil, and water produced and fluid injected for each injection pattern is presented in Appendix A.

**Figure 3: Daly Unit No. 10 Cumulative Oil, Water and Water Injected vs. Time**



### **Waterflood History**

The two (2) horizontal injection wells proposed for Daly Unit No. 10 were drilled in 2011 and put on production that same year. Water injection commenced in Daly Unit No. 10 in December 2015 with the conversion of the 00/05-31-010-28W1 producer to an injector. All of the horizontal wells are fracture stimulated to improve the injection rates. Daly Unit No. 10 will be the first horizontal line drive at 40 acre spacing in the “Daly” portion of the Daly Sinclair Field.

Production performance by injector pattern are summarized in Appendix A.

Any future revisions to the waterflood development or surveillance plan would be based on new production or performance response data, technical studies, or observed reservoir behavior and reserves recovery interpretations.

## **Waterflood EOR Operating Strategy and Performance**

### **Water Source and Quality**

Injection water for Daly Unit No. 10 will be supplied from the Jurassic source water well at 100/02-25-010-29W1 (00/02-25). Tundra received approval from the Petroleum Branch in March 2013 to use the 00/02-25 well as a source water well for waterflood operations. Jurassic-sourced water will be pumped from the 00/02-25 source well to the Daly 12-24-10-29 battery, where it will be filtered and then pumped up to injection system pressure.

### **Injection Wellhead Pressures**

The average monthly wellhead injection pressures are summarized in Appendix B for Daly Unit No. 10.

### **Reservoir Pressure**

Where practical, Tundra is committed to collecting pressure data from newly drilled wells. For Daly Unit No. 10, there is currently no pressure data available.

### **Well Servicing**

Table 1 lists the maintenance that was required in Daly Unit No. 10 in 2015.

**Table 1: Service and Maintenance in Daly Unit No. 10**

00/05-31-010-28W1/0	WIW Conversion	10/30/2015
02/04-31-010-28W1/0	PP Drill-out	12/19/2015

### **Waterflood Performance Discussion**

Water injection began December 2015, after the conversion of the 00/05-31-010-28W1 producer to an injector. Since water injection only started in December 2015, there is no waterflood analysis that can be done at this time.

A summary table of the injection pattern(s) is presented in Appendix A. Plots of the production and injection data along with the VRR information are presented in Appendix C for each of the injection pattern(s).

## **List of Appendices**

Appendix A: Injection Pattern Summary

Appendix B: Average Monthly Injection Wellhead Pressures

Appendix C: Production/Injection Rates, Cumulative and VRR Plots for the following injectors:

02/13-30-010-28W1/0

00/05-31-010-28W1/0

## Appendix A

### Daly Unit No. 10 Pattern Summary as of December 2015

Pattern Name	Injector Location (010-28W1)	Status	No. of Supported Wells	Supported Wells (010-28W1)	Allocation Factor	Pattern Prod Start Month	Inj Start Month	Oil Rate (m³/d)	Water Rate (m³/d)	WOR (m³/m³)	Water Injection (m³/d)	Cum Oil (E³m³)	Cum Water (E³m³)	Cum Inj Water (E³m³)	Monthly VRR	Cum VRR
02/13-30-010-28 Injector	02/16-30	Capable of Oil Production	4	00/10-30, 00/11-30 02/12-30, 02/04-31	1 0.5	Jul 1987	-	8.67	40.27	4.65	-	21.34	88.03	0.0	0.000	0.000
00/05-31-010-28 Injector	00/05-32	Water Injection	2	02/04-31, 00/12-31	0.5	Jan 2010	Dec 2015	0.85	5.83	6.82	7.06	17.45	50.67	0.2	1.047	0.003



**Appendix B**

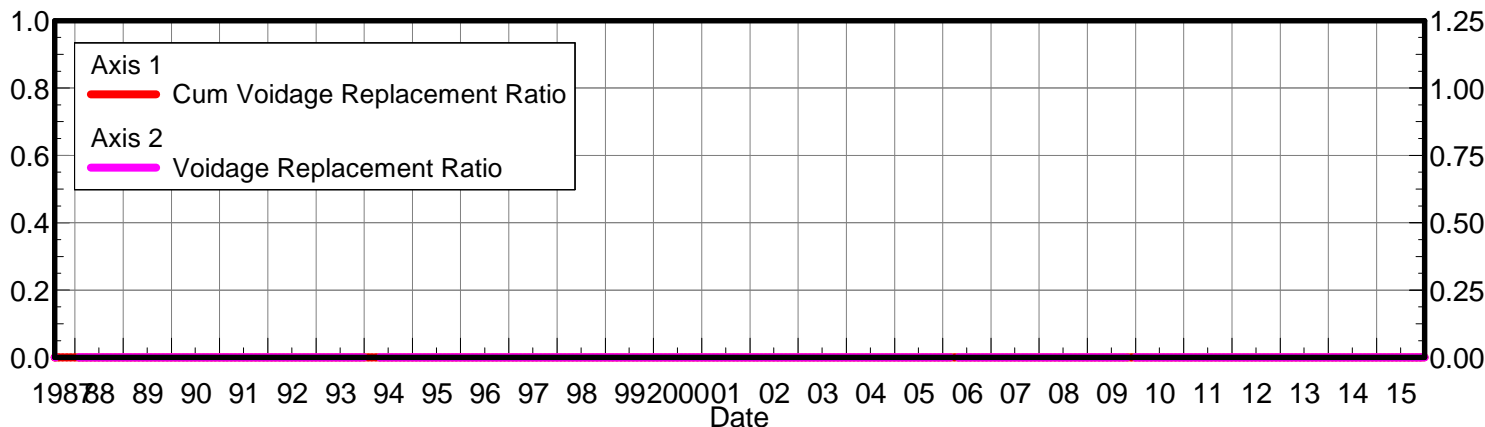
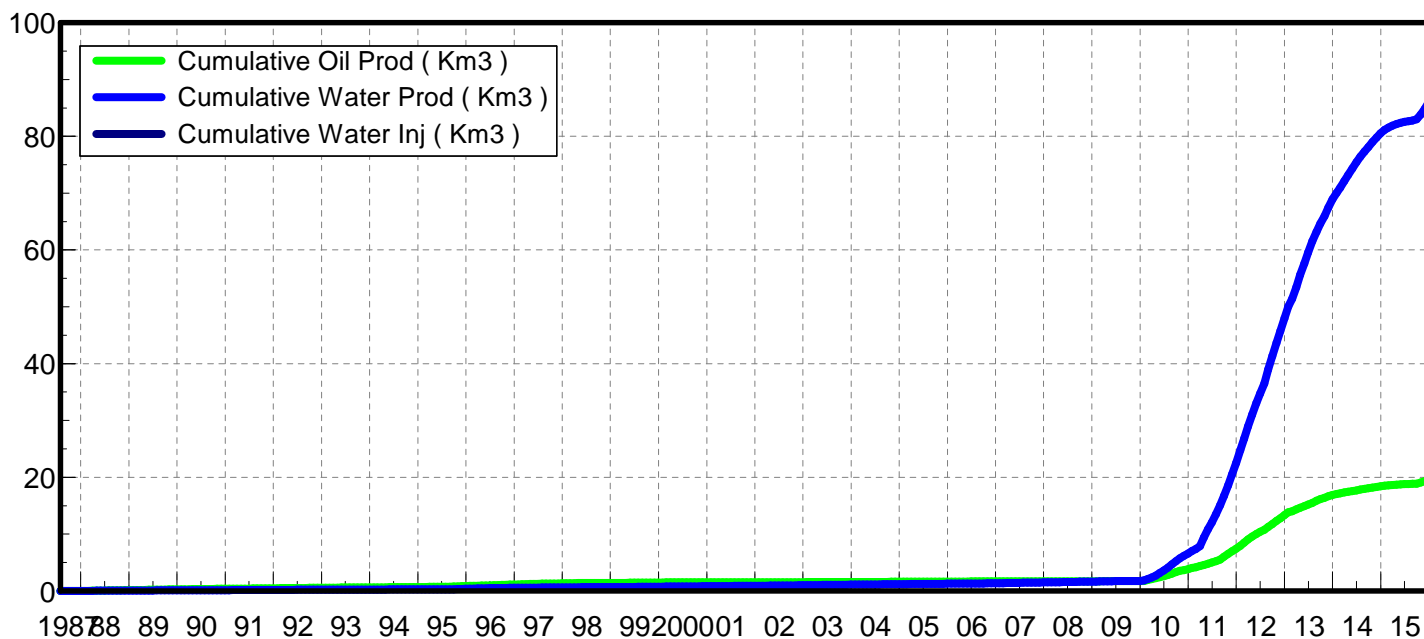
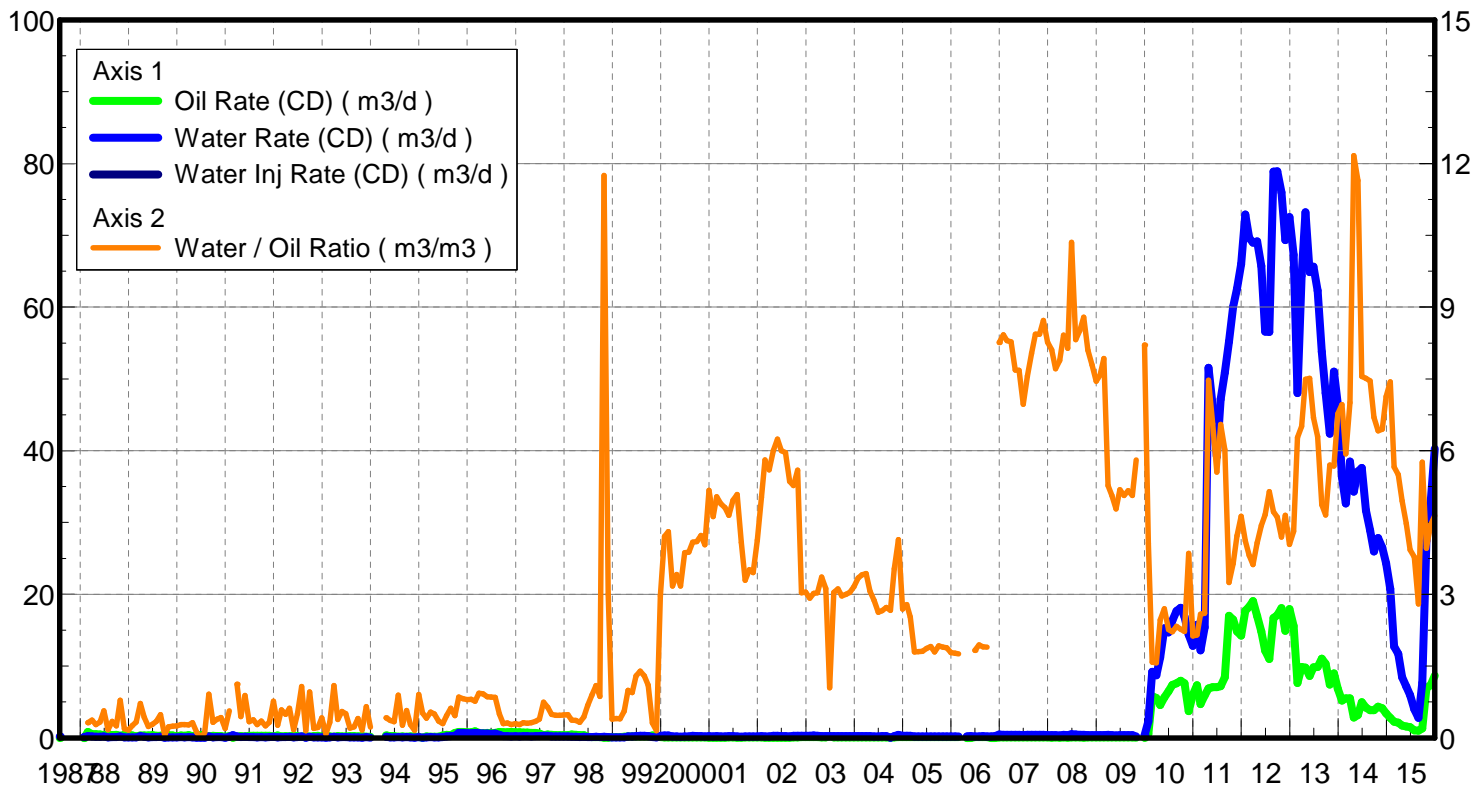
**Average Monthly Injection Pressure  
(kPag)**

<b>Month</b>	<b>100/05-31</b>
Jan-15	
Feb-15	
Mar-15	
Apr-15	
May-15	
Jun-15	
Jul-15	
Aug-15	
Sep-15	
Oct-15	
Nov-15	
Dec-15	
	-58

## **Appendix C**

### **Rates and VRR Plots**

Oil Formation Vol Factor : 0.243 m3/m3  
 Water Formation Vol Factor : 1.00150 m3/m3  
 Water / Oil Ratio : 4.49 m3/m3  
 Pattern: 02/13-30-010-28Inj Set: DalyUnit#10BKKN  
 May 24, 2016  
 Operator: Tundra\_O&G\_Prtshp  
 Rate (CD) : 10.29 m3/d  
 Water Rate (CD) : 46.22 m3/d  
 Water Inj Rate (CD) : \* m3/d



Oil Formation Vol Factor : 1.00150 m3/m3  
 Water Formation Vol Factor : 1.00150 m3/m3  
 Water / Oil Ratio : 5.15 m3/m3  
 Pattern: 00/05-31-010-28Inj Set: DalyUnit#10BKKN  
 May 24, 2016  
 Operator: Tundra\_O&G\_Prtshp  
 Oil Rate (CD) : 2.62 m3/d  
 Water Rate (CD) : 13.50 m3/d  
 Water Inj Rate (CD) : 19.06 m3/d

