

# 2020



VERMILION  
E N E R G Y



## Sinclair Unit No.15 Waterflood Project 2020 Performance Report

Prepared for: Vermilion Energy Inc.  
Prepared By: VZFOX Canada Ltd. - Engineering  
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# [2020 WATERFLOOD PERFORMANCE REPORT]

Manitoba Mineral Resources requires the annual waterflood performance reports as per Manitoba Petroleum Guideline 11 – Enhanced Oil Recovery (EOR) Annual Report.



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## 1.0 ANNUAL REPORT

The Sinclair Unit No. 15 is a one section waterflood located in Section 15-007-29W1 (referred to as the “project area” or “scheme area”). The waterflood is operated by Vermilion Energy and utilizes one injection pattern in the Bakken Three Forks formation. The waterflood pattern consists of eight (8) horizontal wellbores predominately with an east-west orientation, spaced between 185 – 300m apart. The waterflood has two (2) horizontal injectors, one six (6) horizontal producers. There is also one (1) vertical well at 100/01-15-007-29W1/00 which was suspended in June 2018. Please see below for the wells associated with the waterflood:

Injection wells:

- 100/05-15-007-29W1/00 HZ
- 100/12-15-007-29W1/00 HZ

Production wells:

- 100/03-15-007-29W1/00 HZ
- 102/03-15-007-29W1/00 HZ
- 100/04-15-007-29W1/00 HZ
- 100/09-15-007-29W1/00 HZ
- 100/15-15-007-29W1/00 HZ
- 100/16-15-007-29W1/00 HZ

Please see Figure 1 below for the project area map displaying the wellbore layouts:

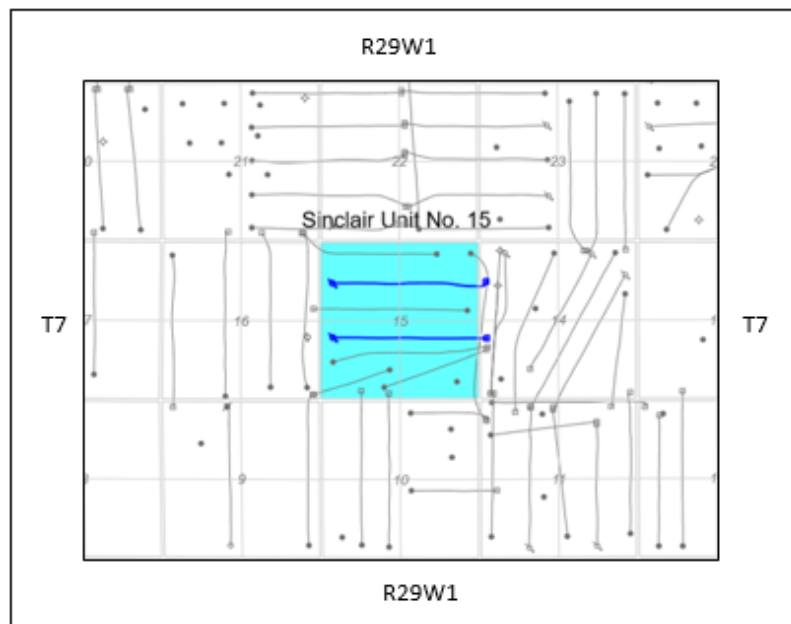


Figure 1: Sinclair Unit No. 15 Map



The main productive zones within the Three Forks in section 15-007-29W1 are the Upper Devonian Lyleton A Dolomitic Siltstone member and the overlying Mississippian Middle Bakken Siltstone member. Horizontal wells in section 15 have undulated through both the Three Forks Lyleton A Member and the Bakken Siltstones over the length of the laterals.

The original oil in place (OOIP) for the Sinclair Unit No. 15 is estimated to be approximately 838.3 e3m3 (5,272 mstb), of which approximately 6.8% is recoverable under primary production. Production within the scheme area commenced in 2006, and to date approximately 55.5 e3m3 of oil, which accounts to approximately 6.6% of OOIP.

Vermilion anticipates an incremental recovery of ~10-15% with secondary recovery, for a total recovery factor of 15-20%.

## 1.1 OIL PRODUCTION RATE, INJECTION RATE, GOR, & WOR (ANNUAL AND CUMULATIVE)

Detailed production and injection data for the whole project can be found in Table #1 below and in Attachment 1. The provided data outlines production and injection volumes, instantaneous and cumulative voidage replacement ratios (VRR) and water/oil ratios (WOR) on an annual and cumulative basis.

Table 1: Sinclair Unit No. 15 Produced Fluids for 2020

Sinclair Unit #15 Produced Fluids															
2020 Oil Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Total Oil Production	53484.8	195.7	177.0	188.0	180.9	197.2	127.2	192.7	164.9	155.6	164.7	145.4	165.6	2054.9	55539.7
2020 Water Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Total Water Production	127251.2	992.5	976.1	1023.3	1044.8	1193.5	690.7	1106.3	985.9	909.0	968.0	954.7	913.2	11758.0	139009.2
WOR	2.38	5.07	5.51	5.44	5.78	6.05	5.43	5.74	5.98	5.84	5.88	6.57	5.51	5.72	2.50
2020 Water Injection m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Total Water Injection	45476.6	1092.3	553.1	1078.1	1113.6	1146.8	1041.6	1244.6	1174.7	1102.3	1178.7	1060.6	1059.0	12845.4	58322.0
VRR	0.25	0.92	0.48	0.89	0.91	0.82	1.27	0.96	1.02	1.04	1.04	0.96	0.98	0.93	0.30

Two new producers (100/04-15 and 100/16-15) were drilled and brought on production in August 2017. Injection in the Sinclair Unit No 15 commenced in October 2017 and to date the scheme has injected approximately 58.3 e3m3 of water back into pool. The producing wells in Unit 15 haven't shown a significant response to water injection yet, however it is important to consider the injection volume fill-up time when observing early waterflood performance trends.

Although early in the waterflood's life, initial indications are positive as the injection wells have demonstrated an ability to meet VRR targets without any abnormal early pressure buildup. The instantaneous VRR averaged 0.93 for the year, which has increased the cumulative VRR for the unit at 0.30. Overall water-to-oil ratios (WOR) for the unit averaged 5.72 for 2020, which brings the cumulative WOR for the unit to 2.50 at the end of 2020.



Overall performance for the unit is represented in both tabular and graphical formats on a monthly and cumulative basis for 2020 (Attachment 1).

## 1.2 MONTHLY WELLHEAD INJECTION PRESSURE

Please refer to Attachment 2 for production plots showing injection rate vs pressure for each injection well for 2020, and Attachment 3 for the monthly average rate and pressure data.

## 1.3 SURVEY OF RESERVOIR PRESSURE

There were no pressure surveys executed in Unit No. 15 in 2020.

## 1.4 WELL SERVICING

The only well servicing that occurred in 2020 resulted from routine pump changes. No other servicing operations were completed within Unit in 2020.

## 1.5 METHOD OF QUALITY CONTROL AND TREATMENT

Injection water for Sinclair Unit No. 15 is sourced from the Mannville formation via the 100/14-09-007-29W1 water source well. The 100/14-09 source well is pipeline connected to Vermilion's 08-16 facility. At 08-16, injection water is filtered to 1 micron nominal remaining particulate through two six-bag canister filters and injected down the two unit injection wells. All water is treated with scale inhibitor and biocide.

# 2.0 ATTACHMENTS

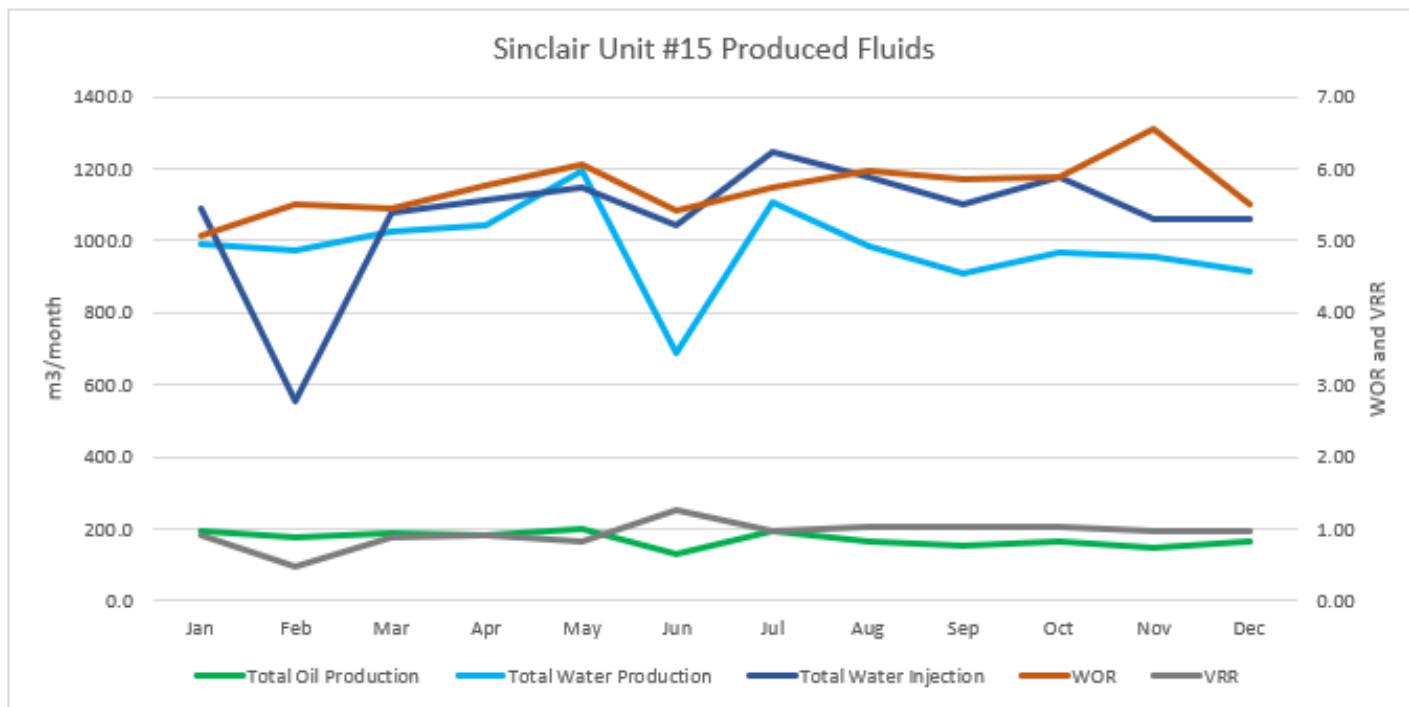
Attachment 1: Produced Fluids for Whole Waterflood Project (Tabular and Graphical)

Attachment 2: Injection Rate Vs Pressure for Injection Wells

Attachment 3: Monthly Average Rate and Pressure Data



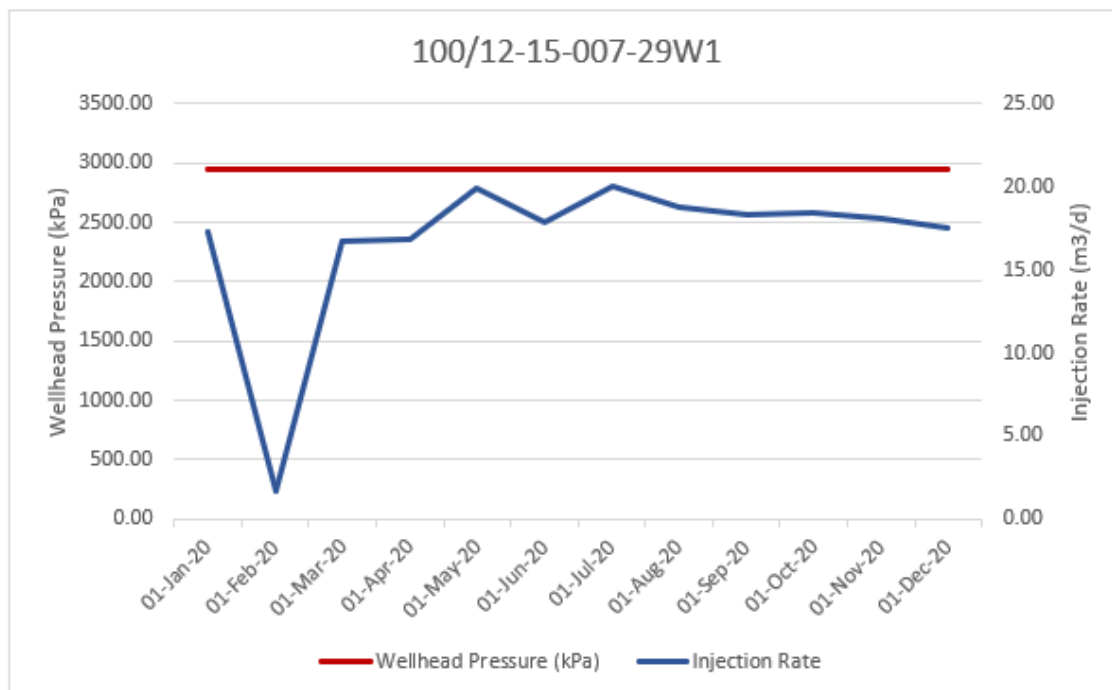
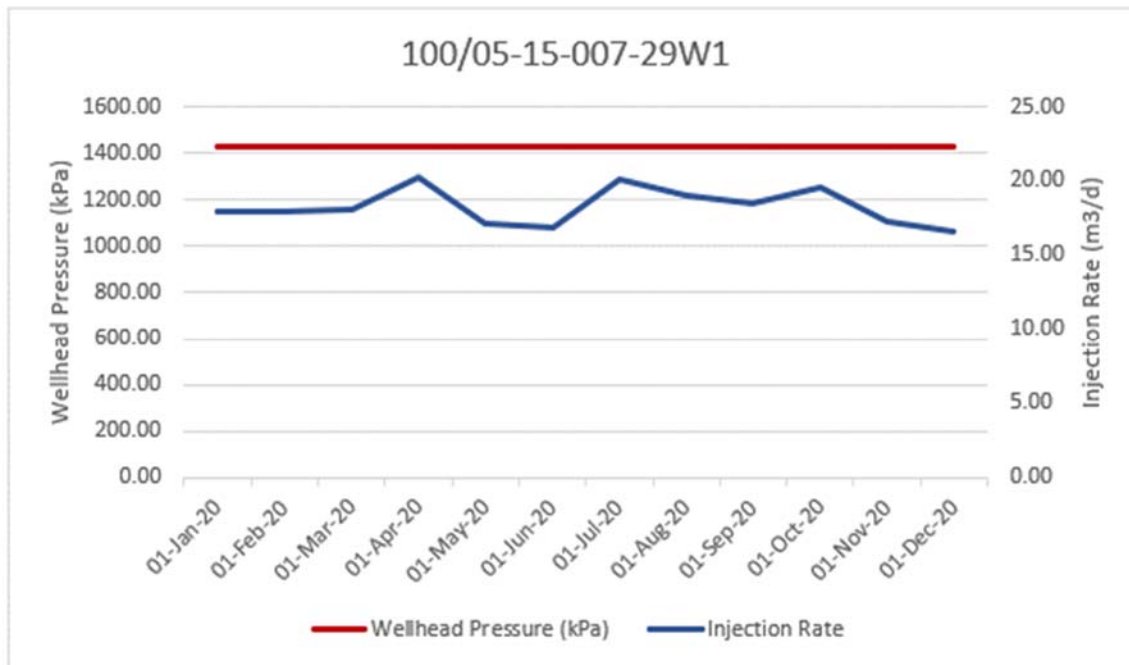
## ATTACHMENT 1: PRODUCED FLUIDS FOR WHOLE WATERFLOOD PROJECT (TABULAR AND GRAPHICAL)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total Oil Production	195.7	177.0	188.0	180.9	197.2	127.2	192.7	164.9	155.6	164.7	145.4	165.6
Total Water Production	992.5	976.1	1023.3	1044.8	1193.5	690.7	1106.3	985.9	909.0	968.0	954.7	913.2
Total Water Injection	1092.3	553.1	1078.1	1113.6	1146.8	1041.6	1244.6	1174.7	1102.3	1178.7	1060.6	1059.0
WOR	5.07	5.51	5.44	5.78	6.05	5.43	5.74	5.98	5.84	5.88	6.57	5.51
VRR	0.92	0.48	0.89	0.91	0.82	1.27	0.96	1.02	1.04	1.04	0.96	0.98



## ATTACHMENT 2: INJECTION RATE VS PRESSURE FOR INJECTION WELLS



### ATTACHMENT 3: MONTHLY AVERAGE RATE AND PRESSURE DATA

Monthly Averages	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
00/05-15 Injection Rate (m3/d)	17.92	18.01	18.04	20.32	17.13	16.87	20.14	19.07	18.46	19.55	17.23	16.68
00/05-15 Injection Pressure (kPa)	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423
00/12-15 Injection Rate (m3/d)	17.32	1.74	16.74	16.80	19.87	17.85	20.01	18.83	18.28	18.48	18.12	17.48
00/12-15 Injection Pressure (kPa)	2945	2945	2945	2945	2945	2945	2945	2945	2945	2945	2945	2945

