

Sinclair Unit No. 16: EOR Report 2018



Overview

The Sinclair Unit No. 16 is a two section, two pattern waterflood in the three forks formation operated by Vermilion Energy. Pattern #1, located in Section 19-7-29 W1M and the west half of Section 20-007-29W1, consists of four active injectors at 00/13-19, 00/03-19, 00/15-19 and 02/14-20, ten horizontal producers at 00/04-19, 02/03-19, 02/15-19, 00/01-19, 02/01-19, 00/13-20 and 00/14-20. 00/01-19 is a planned future injection well conversion candidate. There is also one abandoned vertical well at 02-19. Pattern #2 is in Section 18-7-29 W1M and consists of four horizontal producers at 00/12-18, 00/13-18, 02/13-18 and 03/13-18. 03/13-18 was drilled in September 2018 and commenced production in October 2018. 02/13-18 is a planned future injection well. There is also one abandoned vertical well at 10-18 and a Manville water source well at 15-18. Figure 1 below is a map of the Unit and surrounding area showing the wellbore layouts.

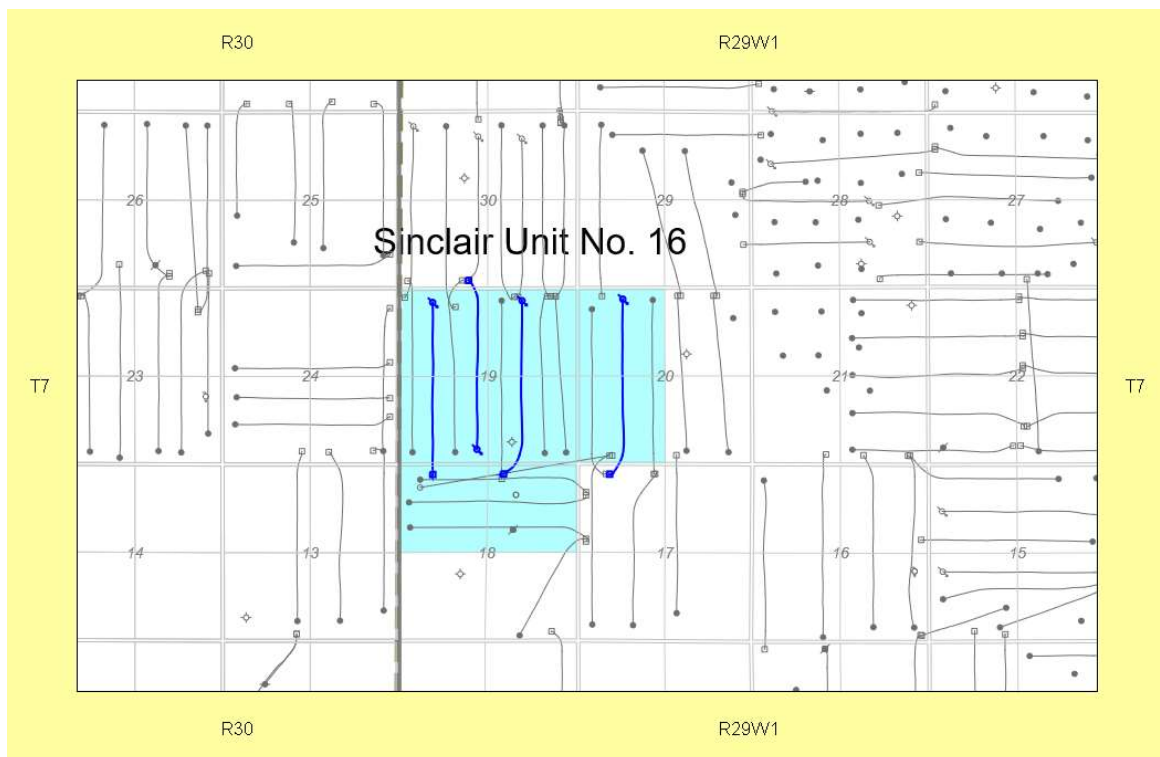


Figure 1: Sinclair Unit No. 16 Map

Producing zones of interest in the Unit are the Upper Devonian Lyleton A Member of the Three Forks Formation and the immediately overlying Mississippian Middle Bakken Siltstones. Horizontal wells have undulated through both the Three Forks Lyleton A Member and the Bakken Siltstones over the length of the laterals.

The Lyleton A Member of the Three Forks Formation was deposited in an evaporitic, shallow marine tidal flat / sabkha setting. Three distinct cleaning upward cycles make up the Lyleton A section in this area. These cycles grade upward from green shale/dolomitic siltstone breccias (poorer grade reservoir core Phi 0.12-0.19, Kmax 0.3-1.5mD) into cleaner, more massive ripple bedded dolomitic siltstones (best reservoir core Phi 0.12-0.19, Kmax 1.0-15.0mD). These cycles can also be correlated across the entire Sinclair area and represent excellent continuous reservoir units in which to efficiently sweep oil via waterflood. The Lyleton A member is the primary oil producing horizon in this area and is approximately 8m thick with net pay in the order of 3-4m. The Middle Bakken Siltstones unconformably overlie the Three Forks in this area. Bakken silts were deposited in a shallow marine setting and in this area are made up finely laminated quartzose siltstones, very fine sands and shales. Core porosities of 0.09-0.18 and permeabilities of 0.3-5mD are characteristic of this zone. The silts vary in thickness from less than 1m to 4m across the Unit.

The calculated OOIP for Unit No. 16 is $2,232 \times 10^3 \text{m}^3$ (14,038 mstb). Current recovery to date is $89.5 \times 10^3 \text{m}^3$ (562.8 mstb) which provides a current recovery factor of 4%. Primary recovery is estimated to be approximately 6% and incremental secondary recovery is expected to be 10-15%, bringing the total estimated recovery factor to 15-20%.

$2232 \times 10^3 \text{m}^3$ (14,038 mstb).

Performance Discussion

Injection into the Unit commenced in September 2015 in the 00/03-19 and 00/13-19 injection wells and has expanded in 2017 to include the 00/15-19 and 02/14-20 injection wells. Response to date in the producing wells directly offset injection has been encouraging.

It can be observed in figures 2 and 3 within the appended data that that total fluid and oil rates have been relatively flat throughout the year with no significant increase in Wcut.

This performance trend is consistent with analogous projects in that quantifiable response typically occurs in a period of six to 12 months after commencement of injection. This positive waterflood response within Sinclair Unit No. 16's active area supports Vermilions plans for future waterflood expansion. Overall Unit WOR for the year averaged 3.98, bringing the cumulative Unit WOR to 3.22 at year end. The yearly average VRR was 1.1 helped increase the Unit cumulative VRR to 0.25 at year end.

73(1) (a-c)(f) Production and Injection Data

The requested data referred to in clauses 1(a) to (c) and (f) of subsection 73(1) of the Oil and Gas Act (C.C.S.M. c. 034) is attached in appendix A as follows:

1. Figure 2: Unit No. 16 Monthly produced fluids and ratios in graphical and tabular format
2. Figure 3: Pattern #1 data in graphical and tabular format
3. Figure 4: Pattern #2 data in graphical and tabular format
4. Table 1: Sinclair Unit No. 16 monthly and cumulative production fluid and ratio data in tabular form
5. Individual injection well rate and pressure profiles:
 - a. 00/03-19
 - b. 00/13-19
 - c. 00/15-19
 - d. 02/14-20
6. Table 2: Monthly average injection rate and pressure data

73(1)(d) Reservoir Pressure Surveys

There were no pressure surveys executed in Unit No. 16 in 2018.

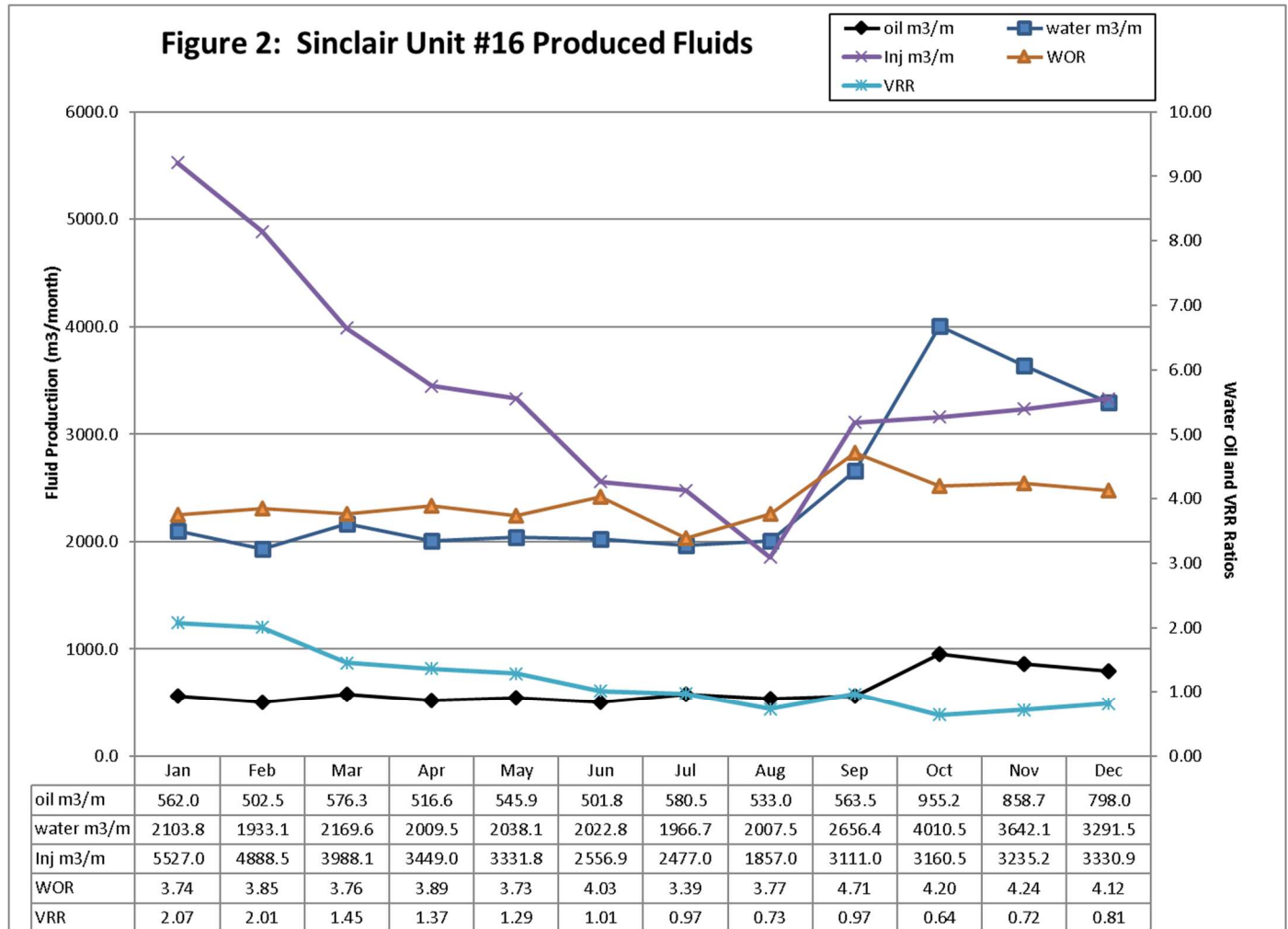
73(1)(e) Well Servicing

Other than routine maintenance such as downhole pump changes and tubing repairs, there were no well servicing operations completed within Unit No. 16 in 2018.

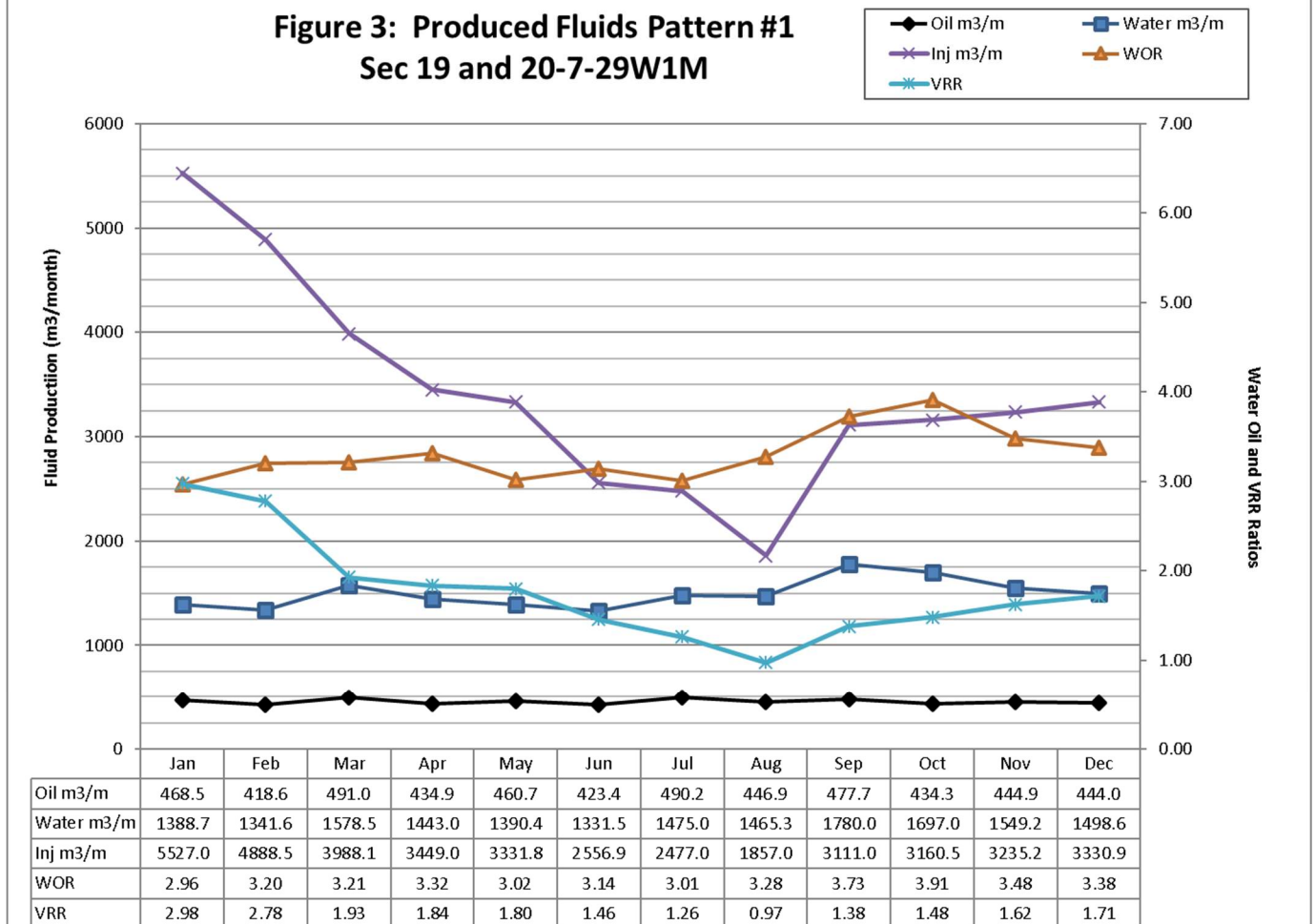
73(1)(g) Injection Fluid Quality Control and Treatment

Injection fluid for Sinclair Unit No. 16 is sourced from the Manville formation in the 100/15-18-007-29W1 water source well. The 15-18 well is on the same lease as the 15-18 injection facility and is pipeline connected. At the 15-18 facility the water is pumped through a filtration skid where it completes three stages of filtration. The primary filter stage is a 1-micron nominal bag filter, secondary is a 1-micron absolute bag filter and a tertiary 0.5-micron polisher cartridge filter. After the water is filtered it enters the injection pipeline system via a positive displacement pump. All water is treated with scale and biocide inhibitors prior to being injected into Unit No. 16.

Appendix A



**Figure 3: Produced Fluids Pattern #1
Sec 19 and 20-7-29W1M**



**Figure 4: Produced Fluids Pattern #2
Sec 18-7-29W1M**

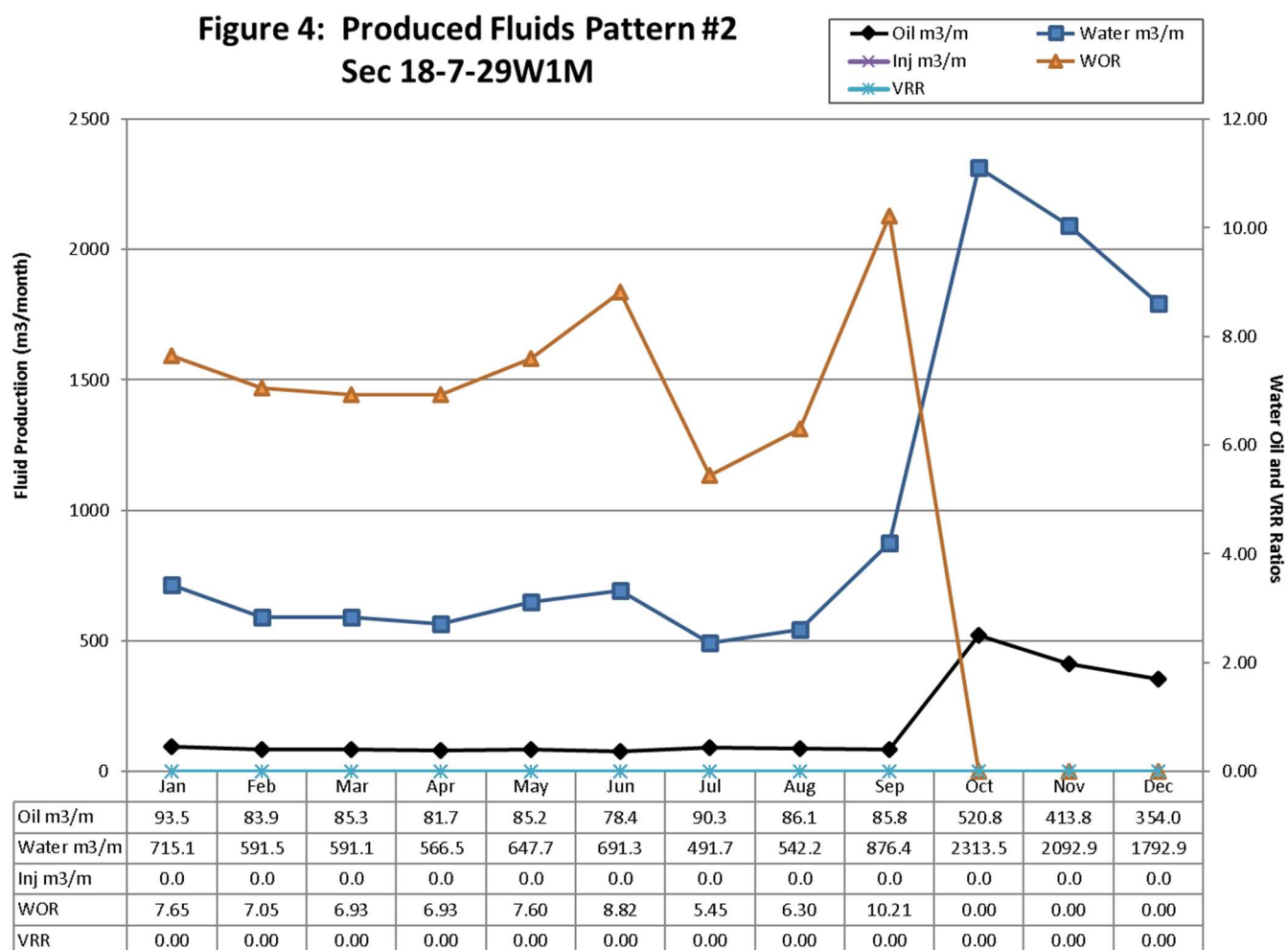


Table 1: Sinclair Unit #16 Produced Fluids

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018	CTD
2018 Oil Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018	CTD
Pattern #1 Sec 19&20-007-29W1	68425.1	468.5	418.6	491.0	434.9	460.7	423.4	490.2	446.9	477.7	434.3	444.9	444.0	5435.1	73860.2
Pattern #2 Sec 18-007-29W1	13558.7	93.5	83.9	85.3	81.7	85.2	78.4	90.3	86.1	85.8	520.8	413.8	354.0	2058.8	15617.5
Unit #16 Total Production	81983.8	562.0	502.5	576.3	516.6	545.9	501.8	580.5	533.0	563.5	955.2	858.7	798.0	7493.9	89477.7
2018 Water Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018	CTD
Pattern #1 Sec 19&20-007-29W1	199245.2	1388.7	1341.6	1578.5	1443.0	1390.4	1331.5	1475.0	1465.3	1780.0	1697.0	1549.2	1498.6	17938.8	217184.0
Pattern #2 Sec 18-007-29W1	58787.4	715.1	591.5	591.1	566.5	647.7	691.3	491.7	542.2	876.4	2313.5	2092.9	1792.9	11912.7	70700.1
Unit #16 Total Production	258032.6	2103.8	1933.1	2169.6	2009.5	2038.1	2022.8	1966.7	2007.5	2656.4	4010.5	3642.1	3291.5	29851.5	287884.1
Unit #16 WOR	3.15	3.74	3.85	3.76	3.89	3.73	4.03	3.39	3.77	4.71	4.20	4.24	4.12	3.98	3.22
2018 Water Injection m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018	CTD
Pattern #1 Sec 19&20-007-29W1	54867.6	5527.0	4888.5	3988.1	3449.0	3331.8	2556.9	2477.0	1857.0	3111.0	3160.5	3235.2	3330.9	40912.9	95780.5
Pattern #2 Sec 18-007-29W1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unit #16 Injection	54867.6	5527.0	4888.5	3988.1	3449.0	3331.8	2556.9	2477.0	1857.0	3111.0	3160.5	3235.2	3330.9	40912.9	95780.5
Unit #16 VRR	0.16	2.07	2.01	1.45	1.37	1.29	1.01	0.97	0.73	0.97	0.64	0.72	0.81	1.10	0.25

