

2019



VERMILION
E N E R G Y



Sinclair Unit No.16 Waterflood Project 2019 Performance Report

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June 23, 2020

[2019 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. 16 is a two section area located in the N/2 of Section 18, Section 19 and W/2 of Section 20-007-29W1 (referred to as the “project area” or “scheme area”). The waterflood is operated by Vermilion Energy and utilizes two injection patterns in the Three Forks formation. The first waterflood pattern has wells in a north-south orientation. Pattern #1 is located in Section 19 and the W/2 of Section 20-007-29W1 and consists of four (4) injectors, and seven (7) active horizontal production wells. There is also one (1) well which has been shut in (planned future injection well, 100/01-19-007-29W1), and one (1) vertical abandoned well located at 100/02-19-007-29W1. Please see below for the wells associated with the first injection pattern:

Injection wells in Pattern #1:

- 100/03-19-007-29W1/00 HZ
- 100/13-19-007-29W1/00 HZ
- 100/15-19-007-29W1/00 HZ
- 102/14-20-007-29W1/00 HZ

Production wells in Pattern #1:

- 100/01-19-007-29W1/00 HZ
- 102/01-19-007-29W1/00 HZ
- 102/03-19-007-29W1/00 HZ
- 100/04-19-007-29W1/00 HZ
- 102/15-19-007-29W1/00 HZ
- 100/13-20-007-29W1/00 HZ
- 100/14-20-007-29W1/00 HZ

The second injection pattern encompasses the N/2 of Section 18-007-29W1 and the wells have an east-south orientation. Pattern #2 consists of four (4) horizontal producers and there are no injection wells. Vermilion has plans to convert the 102/13-18-007-29W1 to an injection well in the future. There is also one (1) abandoned vertical well at 100/10-18-007-29W1, and a Mannville water source well at 100/15-18-007-29W1. Please see below for the wells associated with the second injection pattern:

Production wells in Pattern #2:

- 100/12-18-007-29W1/00 HZ
- 100/13-18-007-29W1/00 HZ
- 102/13-18-007-29W1/00 HZ
- 103/13-18-007-29W1/00 HZ



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

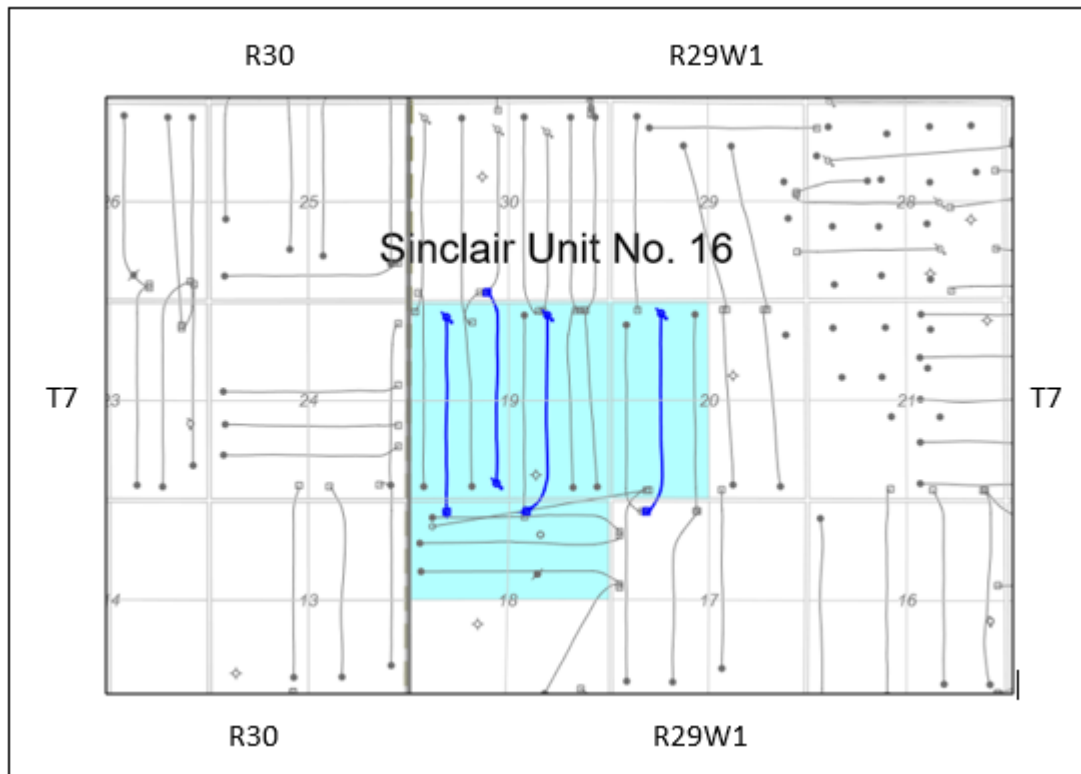


Figure 1: Sinclair Unit No. 16 Map

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 original oil in place (OOIP) for the Sinclair Unit No. 16 is estimated to be approximately 2.2 e6m3 (14,038 mstb), of which approximately 6% is recoverable under primary production. Production in the scheme area started in 2003 and to date has produced approximately 96.4 e3m3 of oil, which accounts to approximately 4.3% of OOIP. Water injection started in 2015 and to date, the scheme has injected approximately 115.7 e3m3 of water back into pool.

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 area 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 #16 Produced Fluids for 2019

| 2019 Oil Production m3/month | Prior CTD | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2019 | CTD |
|--------------------------------|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|----------|
| Pattern #1 - Oil Production | 73860.23 | 425.2 | 355.4 | 414.5 | 382.5 | 429.8 | 412.7 | 421.2 | 344.9 | 344.2 | 368.8 | 373.6 | 363 | 4635.8 | 78496.03 |
| Pattern #2 - Oil Production | 15617.48 | 267.8 | 225.4 | 206.4 | 203.4 | 227.7 | 177.5 | 181.6 | 175.6 | 181.9 | 169.8 | 153.6 | 149.7 | 2320.4 | 17937.88 |
| Total Oil Production | 89477.7 | 693.0 | 580.8 | 620.9 | 585.9 | 657.5 | 590.2 | 602.8 | 520.5 | 526.1 | 538.6 | 527.2 | 512.7 | 6956.2 | 96433.9 |
| 2019 Water Production m3/month | Prior CTD | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2019 | CTD |
| Pattern #1 - Water Production | 217184 | 1331.8 | 1264.4 | 1584.2 | 1333.2 | 1434.2 | 1416.3 | 1460.2 | 992.6 | 1057.3 | 1060.9 | 917.2 | 900.8 | 14753.1 | 231937.1 |
| Pattern #2 - Water Production | 70700.14 | 515.3 | 526 | 792.8 | 685.1 | 716 | 805.4 | 728.7 | 407.2 | 461.9 | 411.6 | 426.6 | 439.3 | 6915.9 | 77616.04 |
| Total Water Production | 287884.1 | 1847.1 | 1790.4 | 2377.0 | 2018.3 | 2150.2 | 2221.7 | 2188.9 | 1399.8 | 1519.2 | 1472.5 | 1343.8 | 1340.1 | 21669.0 | 309553.1 |
| Scheme Area WOR | 3.22 | 2.67 | 3.08 | 3.83 | 3.44 | 3.27 | 3.76 | 3.63 | 2.69 | 2.89 | 2.73 | 2.55 | 2.61 | 3.12 | 3.21 |
| 2019 Water Injection m3/month | Prior CTD | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2019 | CTD |
| Pattern #1 - Water Injection | 95780.49 | 3323.5 | 2620.3 | 2625.9 | 2514.9 | 1564.7 | 1891.9 | 1188 | 1332.2 | 686.9 | 637.6 | 932.1 | 687.2 | 20005.2 | 115785.7 |
| Pattern #2 - Water Injection | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Water Injection | 95780.5 | 3323.5 | 2620.3 | 2625.9 | 2514.9 | 1564.7 | 1891.9 | 1188.0 | 1332.2 | 686.9 | 637.6 | 932.1 | 687.2 | 20005.2 | 115785.7 |
| Scheme Area VRR | 0.25 | 1.31 | 1.11 | 0.88 | 0.97 | 0.56 | 0.67 | 0.43 | 0.69 | 0.34 | 0.32 | 0.50 | 0.37 | 0.70 | 0.29 |

Injection into the Unit commenced in September 2015 in the 100/03-19 and 100/13-19 injection wells. Vermilion expanded the flood in 2017 to include two additional injection wells located at 100/15-19 and 102/14-20 injection wells. Response to date in the producing wells directly offset injection have been encouraging.

As seen above, total fluid and oil rates have been relatively flat throughout the year with no significant increase in water cut. This positive waterflood response within Sinclair Unit No. 16's active area supports Vermilion's plans for future waterflood expansion.



Overall water-to-oil ratios (WOR) for the unit averaged 3.12 for 2019, which brings the cumulative WOR for the unit to 3.21 at the end of 2019. Water Injection volumes have fluctuated over the year with higher volumes in the first six (6) months, and lower volumes in the last six months. Instantaneous VRR for the year averaged 0.70, which has increased the cumulative VRR for the unit to 0.29 at year-end. Overall performance for the unit is represented in both tabular and graphical formats on a monthly and cumulative basis for 2019 (Attachment 1).

Pattern #1: Section 14-007-29W1

As mentioned above, Pattern #1 is found in Section 19 and the W/2 of Section 20-007-29W1. The section's WOR fluctuated throughout the year, ranging from 2.46 to 3.56. WOR for the year averaged 3.18, resulting in the cumulative WOR of 2.95 to date.

VRR ranged from 0.45 to 1.89 throughout the year. Average VRR for 2019 is 1.03, resulting in the cumulative VRR to increase from 0.33 at the beginning of the year to 0.37 at the end of the year. Please refer to Table 2 below and Attachment 2 for the graphical data.

Table 2: Sinclair Unit No. 16 - Pattern #1 Produced Fluids

| | Prior CTD | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2019 | CTD |
|-------------------------------|-----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|----------|-----------|
| Pattern #1 - Oil Production | 73860.23 | 425.20 | 355.40 | 414.50 | 382.50 | 429.80 | 412.70 | 421.20 | 344.90 | 344.20 | 368.80 | 373.60 | 363.00 | 4635.80 | 78496.03 |
| Pattern #1 - Water Production | 217184.00 | 1331.80 | 1264.40 | 1584.20 | 1333.20 | 1434.20 | 1416.30 | 1460.20 | 992.60 | 1057.30 | 1060.90 | 917.20 | 900.80 | 14753.10 | 231937.10 |
| Pattern #1 - Water Injection | 95780.49 | 3323.50 | 2620.30 | 2625.90 | 2514.90 | 1564.70 | 1891.90 | 1188.00 | 1332.20 | 686.90 | 637.60 | 932.10 | 687.20 | 20005.20 | 115785.69 |
| Pattern #1 - WOR | 2.94 | 3.13 | 3.56 | 3.82 | 3.49 | 3.34 | 3.43 | 3.47 | 2.88 | 3.07 | 2.88 | 2.46 | 2.48 | 3.18 | 2.95 |
| Pattern #1 - VRR | 0.33 | 1.89 | 1.62 | 1.31 | 1.47 | 0.84 | 1.03 | 0.63 | 1.00 | 0.49 | 0.45 | 0.72 | 0.54 | 1.03 | 0.37 |

Pattern #2: Section 11-007-29W1

Pattern #2 is found in the N/2 of Section 18-007-29W1. As mentioned above, there are currently no active injection wells in Pattern #2. Please refer to Table 3 below and Attachment 3 for the graphical data.

Table 3: Sinclair Unit No. 16 - Pattern #2 Produced Fluids

| | Prior CTD | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2019 | CTD |
|-------------------------------|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|----------|
| Pattern #2 - Oil Production | 15617.48 | 267.80 | 225.40 | 206.40 | 203.40 | 227.70 | 177.50 | 181.60 | 175.60 | 181.90 | 169.80 | 153.60 | 149.70 | 2320.40 | 17937.88 |
| Pattern #2 - Water Production | 70700.14 | 515.30 | 526.00 | 792.80 | 685.10 | 716.00 | 805.40 | 728.70 | 407.20 | 461.90 | 411.60 | 426.60 | 439.30 | 6915.90 | 77616.04 |
| Pattern #2 - Water Injection | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pattern #2 - WOR | 4.53 | 1.92 | 2.33 | 3.84 | 3.37 | 3.14 | 4.54 | 4.01 | 2.32 | 2.54 | 2.42 | 2.78 | 2.93 | 2.98 | 4.33 |
| Pattern #2 - VRR | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

1.2 MONTHLY WELLHEAD INJECTION PRESSURE

Please refer to Attachment 4 for production plots showing injection rate vs pressure for each injection well for 2019, and Attachment 5 for the monthly average rate and pressure data.

1.3 SURVEY OF RESERVOIR PRESSURE

There were no pressure surveys executed in Unit No. 16 in 2019.



1.4 WELL SERVICING

The only well servicing that occurred in 2019 resulted from routine pump changes. No other servicing operations were completed within Unit in 2019.

1.5 METHOD OF QUALITY CONTROL AND TREATMENT

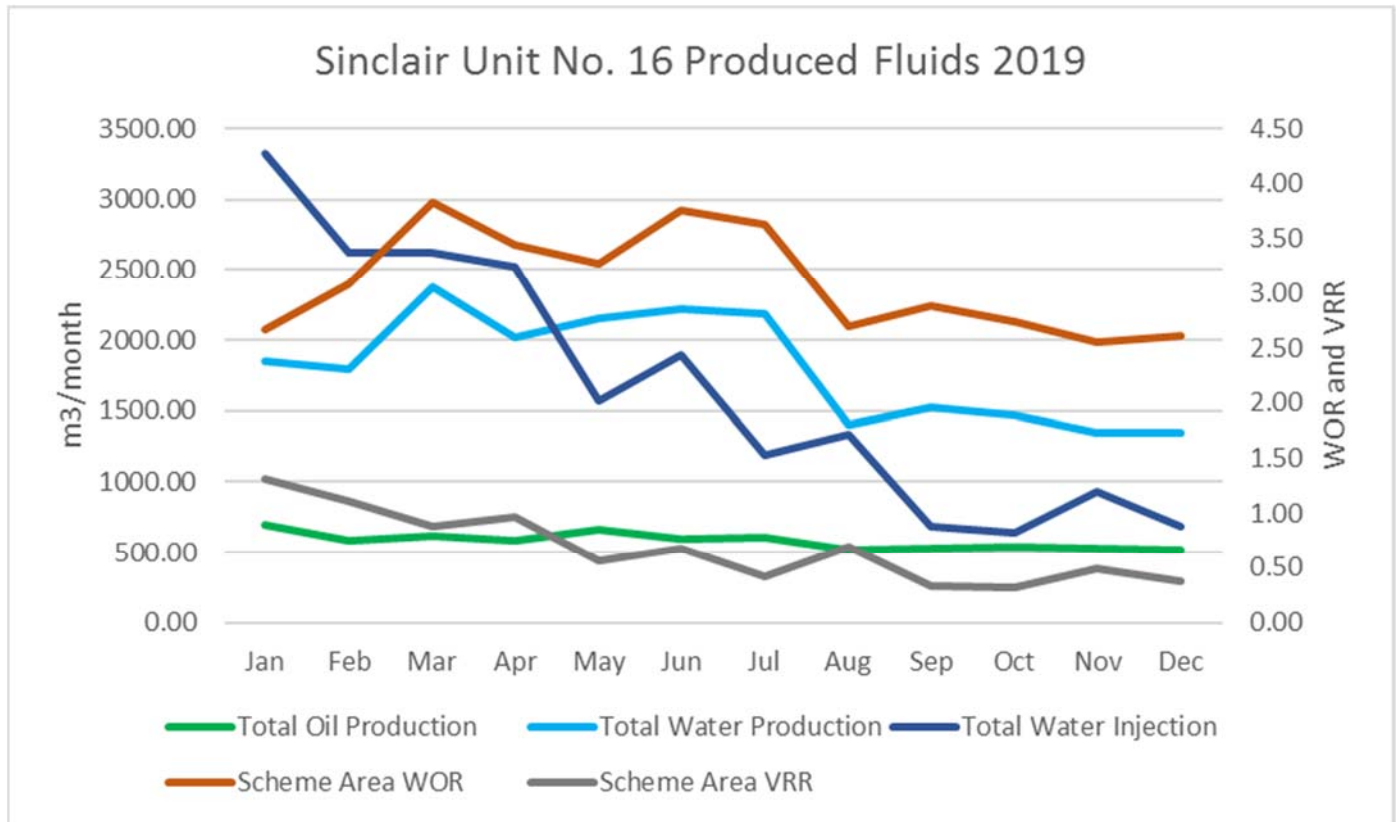
Injection fluid for Sinclair Unit No. 16 is sourced from the Mannville formation in the 100/15-18-007-29W1 water source well. The 15-18 well is on the same lease as the 15-18 injection facility and is pipeline connected. At the 15-18 facility the water is pumped through a filtration skid where it completes 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.

2.0 ATTACHMENTS

- Attachment 1: Produced Fluids for Whole Waterflood Project (Tabular and Graphical)
- Attachment 2: Produced Fluids for Pattern #1 of the Waterflood Project (Tabular and Graphical)
- Attachment 3: Produced Fluids for Pattern #2 of the Waterflood Project (Tabular and Graphical)
- Attachment 4: Injection Rate Vs Pressure for Injection Wells
- Attachment 5: Monthly Average Rate and Pressure Data



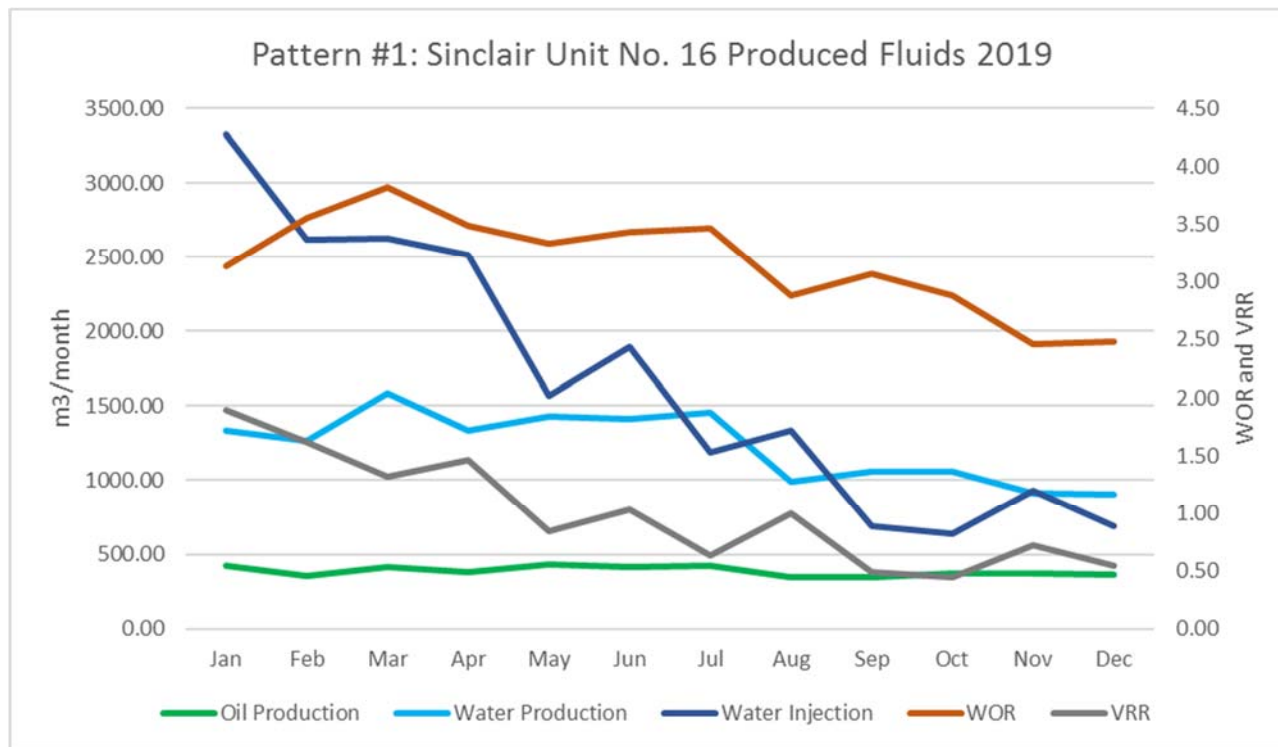
ATTACHMENT 1: PRODUCED FLUIDS FOR WHOLE WATERFLOOD PROJECT (TABULAR AND GRAPHICAL)



| 2019 Oil Production m3/month | Prior CTD | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2019 | CTD |
|--------------------------------|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|-----------------|
| Pattern #1 - Oil Production | 73860.23 | 425.2 | 355.4 | 414.5 | 382.5 | 429.8 | 412.7 | 421.2 | 344.9 | 344.2 | 368.8 | 373.6 | 363 | 4635.8 | 78496.03 |
| Pattern #2 - Oil Production | 15617.48 | 267.8 | 225.4 | 206.4 | 203.4 | 227.7 | 177.5 | 181.6 | 175.6 | 181.9 | 169.8 | 153.6 | 149.7 | 2320.4 | 17937.88 |
| Total Oil Production | 89477.7 | 693.0 | 580.8 | 620.9 | 585.9 | 657.5 | 590.2 | 602.8 | 520.5 | 526.1 | 538.6 | 527.2 | 512.7 | 6956.2 | 96433.9 |
| 2019 Water Production m3/month | Prior CTD | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2019 | CTD |
| Pattern #1 - Water Production | 217184 | 1331.8 | 1264.4 | 1584.2 | 1333.2 | 1434.2 | 1416.3 | 1460.2 | 992.6 | 1057.3 | 1060.9 | 917.2 | 900.8 | 14753.1 | 231937.1 |
| Pattern #2 - Water Production | 70700.14 | 515.3 | 526 | 792.8 | 685.1 | 716 | 805.4 | 728.7 | 407.2 | 461.9 | 411.6 | 426.6 | 439.3 | 6915.9 | 77616.04 |
| Total Water Production | 287884.1 | 1847.1 | 1790.4 | 2377.0 | 2018.3 | 2150.2 | 2221.7 | 2188.9 | 1399.8 | 1519.2 | 1472.5 | 1343.8 | 1340.1 | 21669.0 | 309553.1 |
| Scheme Area WOR | | 3.22 | 2.67 | 3.08 | 3.83 | 3.44 | 3.27 | 3.76 | 3.63 | 2.69 | 2.89 | 2.73 | 2.55 | 2.61 | 3.12 |
| 2019 Water Injection m3/month | Prior CTD | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 2019 | CTD |
| Pattern #1 - Water Injection | 95780.49 | 3323.5 | 2620.3 | 2625.9 | 2514.9 | 1564.7 | 1891.9 | 1188 | 1332.2 | 686.9 | 637.6 | 932.1 | 687.2 | 20005.2 | 115785.7 |
| Pattern #2 - Water Injection | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Water Injection | 95780.5 | 3323.5 | 2620.3 | 2625.9 | 2514.9 | 1564.7 | 1891.9 | 1188.0 | 1332.2 | 686.9 | 637.6 | 932.1 | 687.2 | 20005.2 | 115785.7 |
| Scheme Area VRR | | 0.25 | 1.31 | 1.11 | 0.88 | 0.97 | 0.56 | 0.67 | 0.43 | 0.69 | 0.34 | 0.32 | 0.50 | 0.37 | 0.70 |



ATTACHMENT 2: PRODUCED FLUIDS FOR PATTERN #1 OF THE WATERFLOOD PROJECT (TABULAR AND GRAPHICAL)

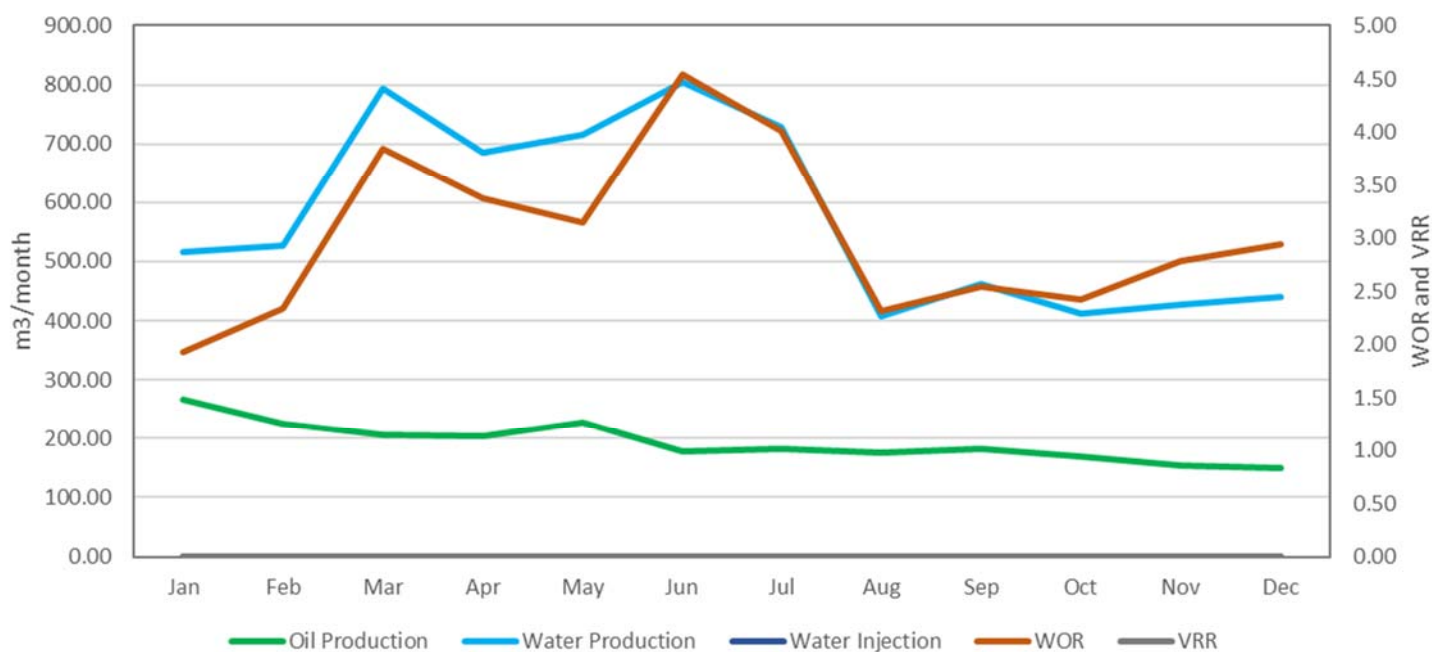


| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|
| Oil Production | 425.20 | 355.40 | 414.50 | 382.50 | 429.80 | 412.70 | 421.20 | 344.90 | 344.20 | 368.80 | 373.60 | 363.00 |
| Water Production | 1331.80 | 1264.40 | 1584.20 | 1333.20 | 1434.20 | 1416.30 | 1460.20 | 992.60 | 1057.30 | 1060.90 | 917.20 | 900.80 |
| Water Injection | 3323.50 | 2620.30 | 2625.90 | 2514.90 | 1564.70 | 1891.90 | 1188.00 | 1332.20 | 686.90 | 637.60 | 932.10 | 687.20 |
| WOR | 3.13 | 3.56 | 3.82 | 3.49 | 3.34 | 3.43 | 3.47 | 2.88 | 3.07 | 2.88 | 2.46 | 2.48 |
| VRR | 1.89 | 1.62 | 1.31 | 1.47 | 0.84 | 1.03 | 0.63 | 1.00 | 0.49 | 0.45 | 0.72 | 0.54 |



ATTACHMENT 3: PRODUCED FLUIDS FOR PATTERN #2 OF THE WATERFLOOD PROJECT (TABULAR AND GRAPHICAL)

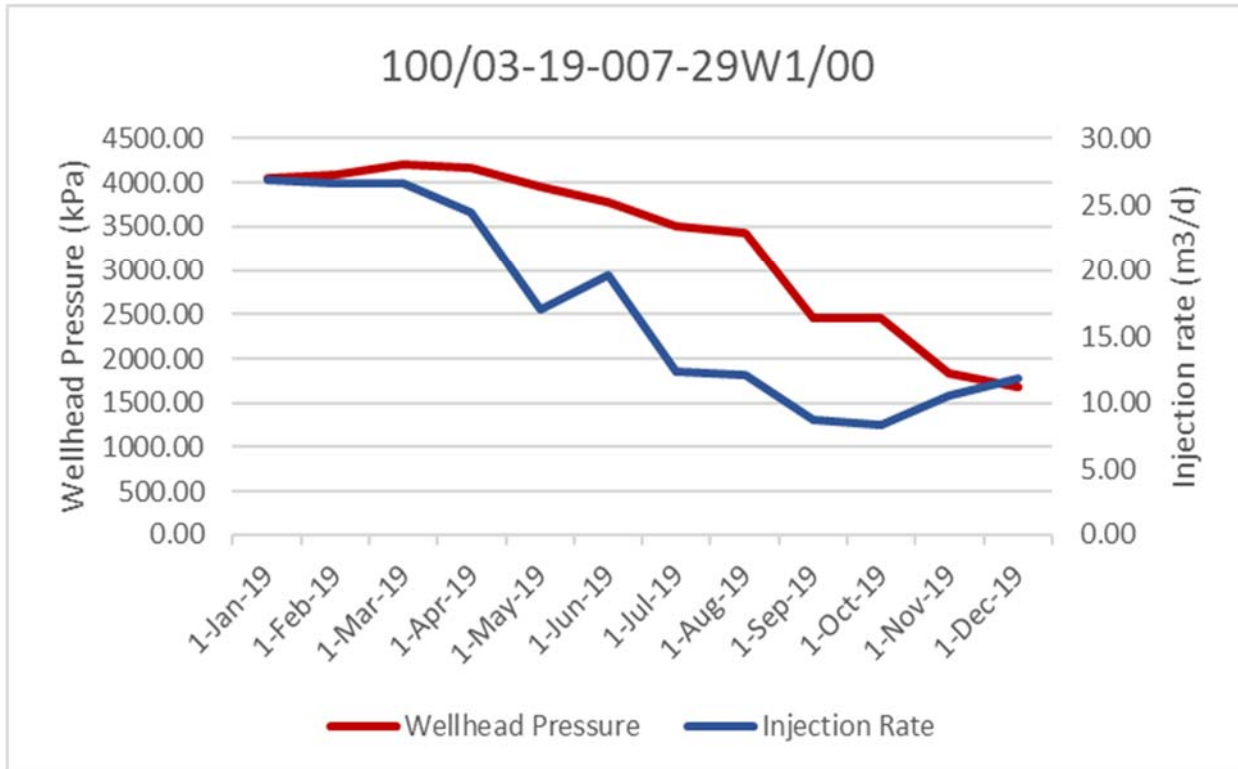
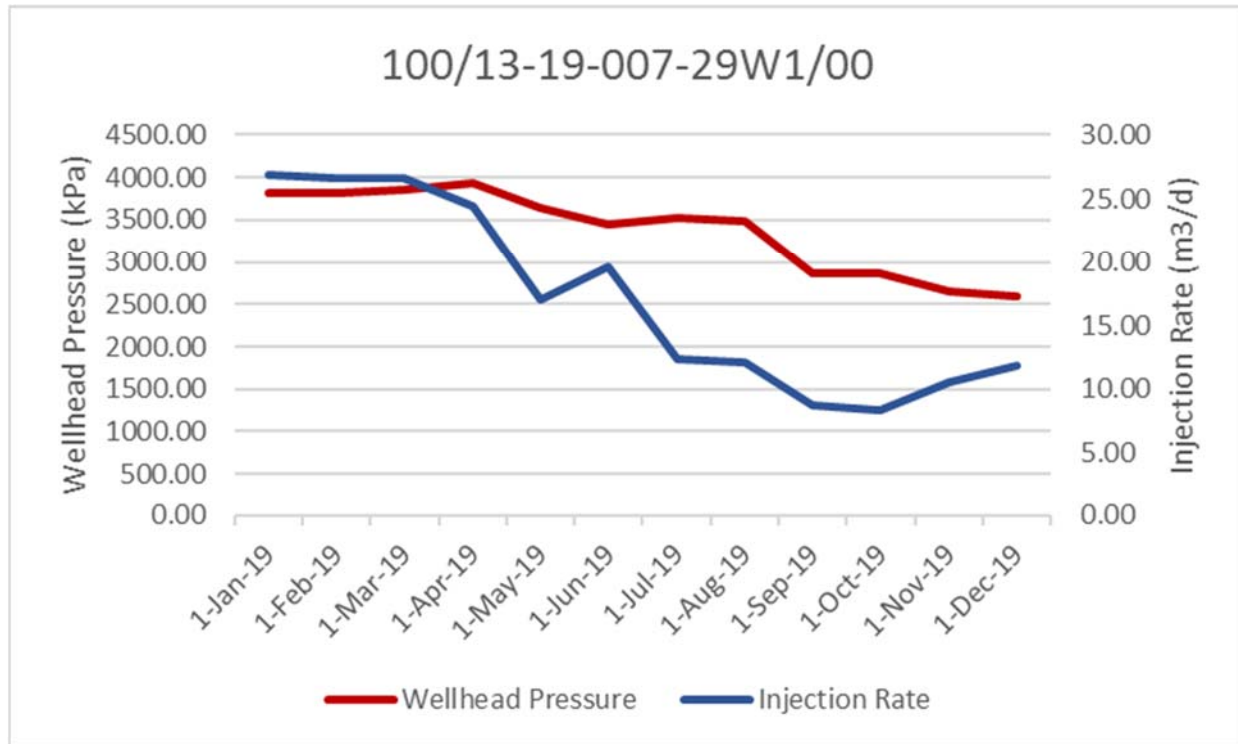
Pattern #2: Sinclair Unit No. 16 Produced Fluids 2019

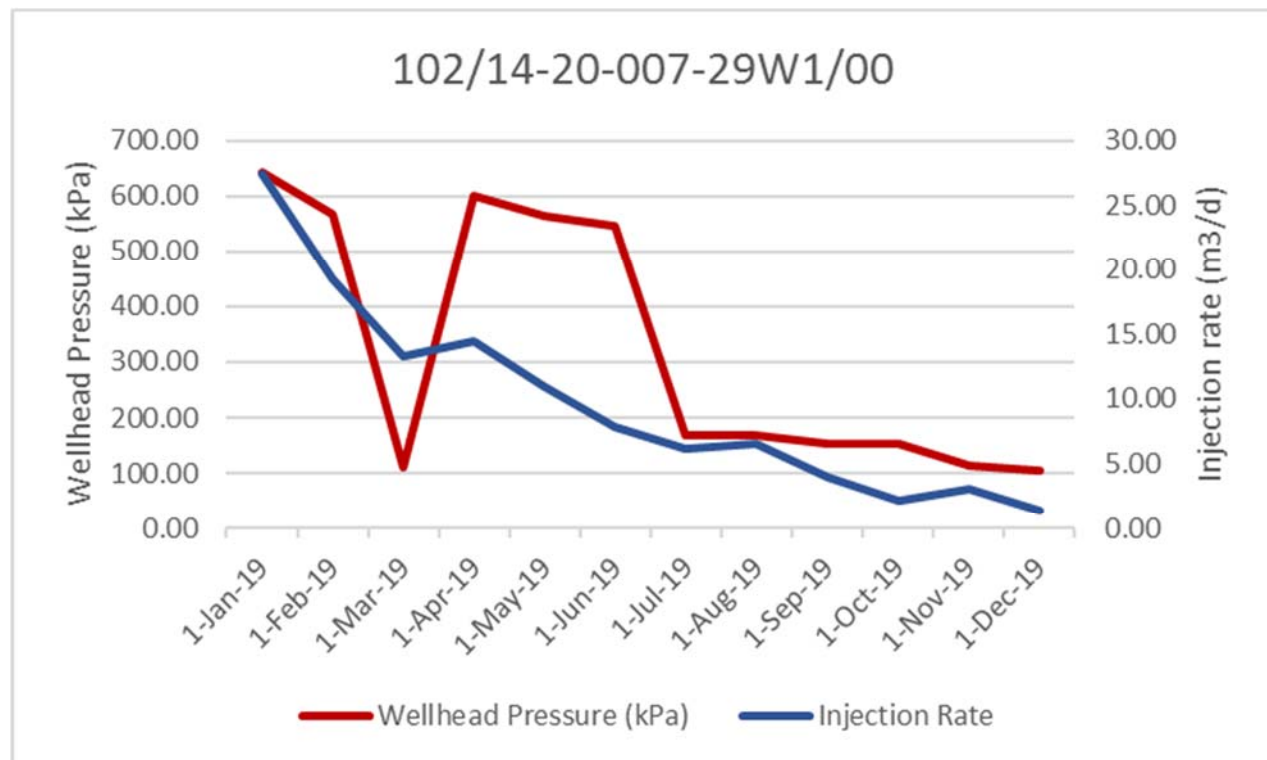
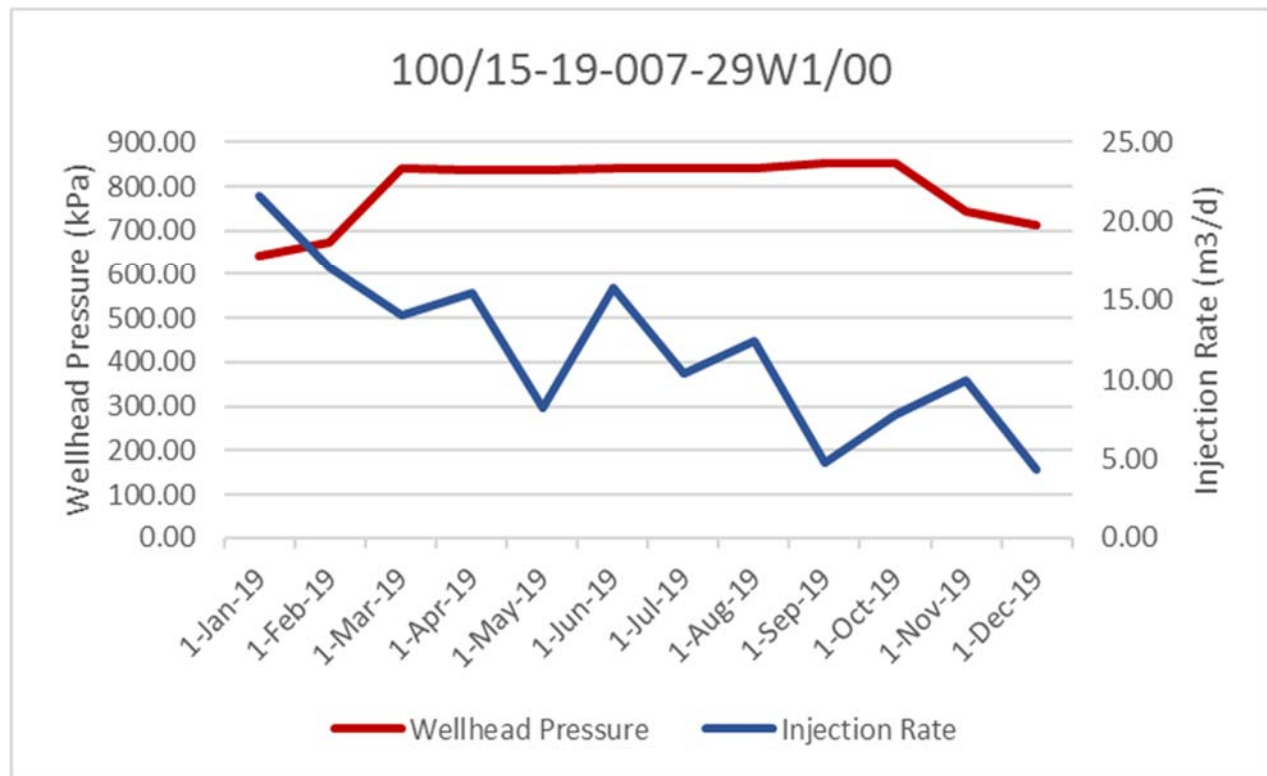


| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Oil Production | 267.80 | 225.40 | 206.40 | 203.40 | 227.70 | 177.50 | 181.60 | 175.60 | 181.90 | 169.80 | 153.60 | 149.70 |
| Water Production | 515.30 | 526.00 | 792.80 | 685.10 | 716.00 | 805.40 | 728.70 | 407.20 | 461.90 | 411.60 | 426.60 | 439.30 |
| Water Injection | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| WOR | 1.92 | 2.33 | 3.84 | 3.37 | 3.14 | 4.54 | 4.01 | 2.32 | 2.54 | 2.42 | 2.78 | 2.93 |
| VRR | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |



ATTACHMENT 4: INJECTION RATE VS PRESSURE FOR INJECTION WELLS





ATTACHMENT 5: MONTHLY AVERAGE RATE AND PRESSURE DATA

| Monthly Averages | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 00/13-19 Injection Rate (m3/d) | 26.85 | 26.66 | 26.58 | 24.36 | 17.05 | 19.58 | 12.41 | 12.14 | 8.73 | 8.32 | 10.55 | 11.78 |
| 00/13-19 Injection Pressure (kPa) | 3815.01 | 3819.97 | 3850.03 | 3926.01 | 3639.05 | 3440.49 | 3535.01 | 3492.06 | 2870.01 | 2870.01 | 2645.93 | 2590.02 |
| 00/03-19 Injection Rate (m3/d) | 26.85 | 26.66 | 26.58 | 24.36 | 17.05 | 19.58 | 12.41 | 12.14 | 8.73 | 8.32 | 10.55 | 11.78 |
| 00/03-19 Injection Pressure (kPa) | 4059.98 | 4079.97 | 4200.01 | 4169.19 | 3959.04 | 3783.50 | 3499.99 | 3432.21 | 2449.98 | 2449.98 | 1833.94 | 1679.98 |
| 00/15-19 Injection Rate (m3/d) | 21.68 | 17.10 | 14.06 | 15.53 | 8.27 | 15.77 | 10.35 | 12.43 | 4.77 | 7.83 | 9.93 | 4.33 |
| 00/15-19 Injection Pressure (kPa) | 644.00 | 671.96 | 839.99 | 837.16 | 837.23 | 839.99 | 839.99 | 840.88 | 853.98 | 853.98 | 741.95 | 714.02 |
| 02/14-20 Injection Rate (m3/d) | 27.45 | 19.30 | 13.35 | 14.51 | 10.99 | 7.82 | 6.21 | 6.54 | 3.92 | 2.21 | 3.10 | 1.39 |
| 02/14-20 Injection Pressure (kPa) | 644.00 | 567.99 | 112.00 | 601.50 | 564.96 | 546.00 | 168.00 | 167.06 | 154.00 | 154.00 | 114.80 | 105.00 |

