

Sinclair Unit No. 9: EOR Report 2018

Overview

The Sinclair Unit No. 9 waterflood is a one section (30-007-29W1), one pattern flood within the Bakken Three Forks formation operated by Vermilion Energy. The pattern consists of seven horizontal wellbores oriented north-south and spaced at 185-300m. Three injectors are located at 00/13-30, 00/14-30 and 00/15-30 while four producers are located at 02/14-30, 02/15-30, 00/16-30 and 02/16-30. There is one abandoned vertical well at 11-30. Figure 1 below is a Unit map showing the wellbore layout.

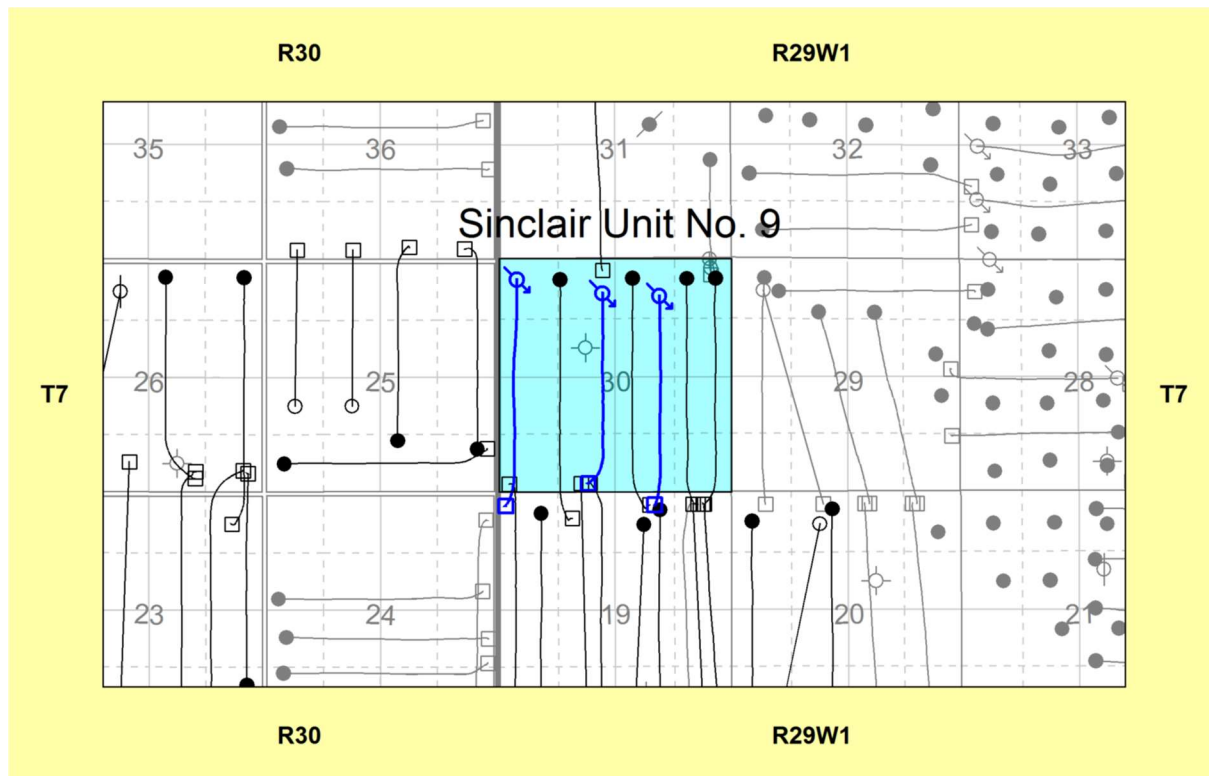


Figure 1: Sinclair Unit No. 9 Map

The main productive zones within the Three Forks in section 30-007-29W1 are the Upper Devonian Lyleton A Dolomitic Siltstone member and the overlying Mississippian Middle Bakken Siltstone member. Horizontal wells in section 30 have undulated through both the Three Forks Lyleton A Member and the Bakken Siltstones over the length of the laterals.

Vermilion estimates the original-oil-in-place for Unit No. 9 is $1,212 \times 10^3 \text{m}^3$ (7,629 mstb). Current recovery to date is $32.0 \times 10^3 \text{m}^3$ (201 mstb) or 2.6% of the OOIP. The primary recovery was estimated to at 3.1% based on 4 wells per section and 5.5% with infill drilling. An incremental 10-15% is expected with secondary recovery, bringing the total estimated recovery factor to 15-20%.

Performance Discussion

Performance results to date in the Sinclair Unit No. 9 flood have been positive. The pattern has observed relatively stable total fluid production with no significant change in oil-cuts throughout the year. Overall Unit WOR for the year averaged 5.88, bringing the cumulative Unit WOR to 3.83 at year end. The yearly average VRR was 1.19 helped increase the Unit cumulative VRR to 0.65 at year end. Figure 2 in appendix A illustrates the overall pattern performance in graphical and tabular format. Appendix A, Table 1 illustrates the overall pool performance, both monthly and cumulatively, in tabular format. Appendix A also includes individual injection well profiles and monthly average injection pressures.

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: Monthly produced fluids and ratios in graphical and tabular format
2. Table 1: Monthly and cumulative produced fluids and ratios in tabular format
3. Individual injection well rate and pressure profiles:
 - a. 100/13-30
 - b. 100/14-30
 - c. 100/14-30
4. Table 2: Monthly average injection rate and pressure data

73(1) (d) Reservoir Pressure Surveys

There were no pressure surveys executed in Unit No. 9 in 2018.

73(1) (e) Well Servicing

Other than routine pump changes there were no servicing operations completed within Unit No. 9 in 2018.

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

Injection fluid for Sinclair Unit No. 9 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. 9.

Appendix A

Figure #3: Produced Fluids Unit No. 9

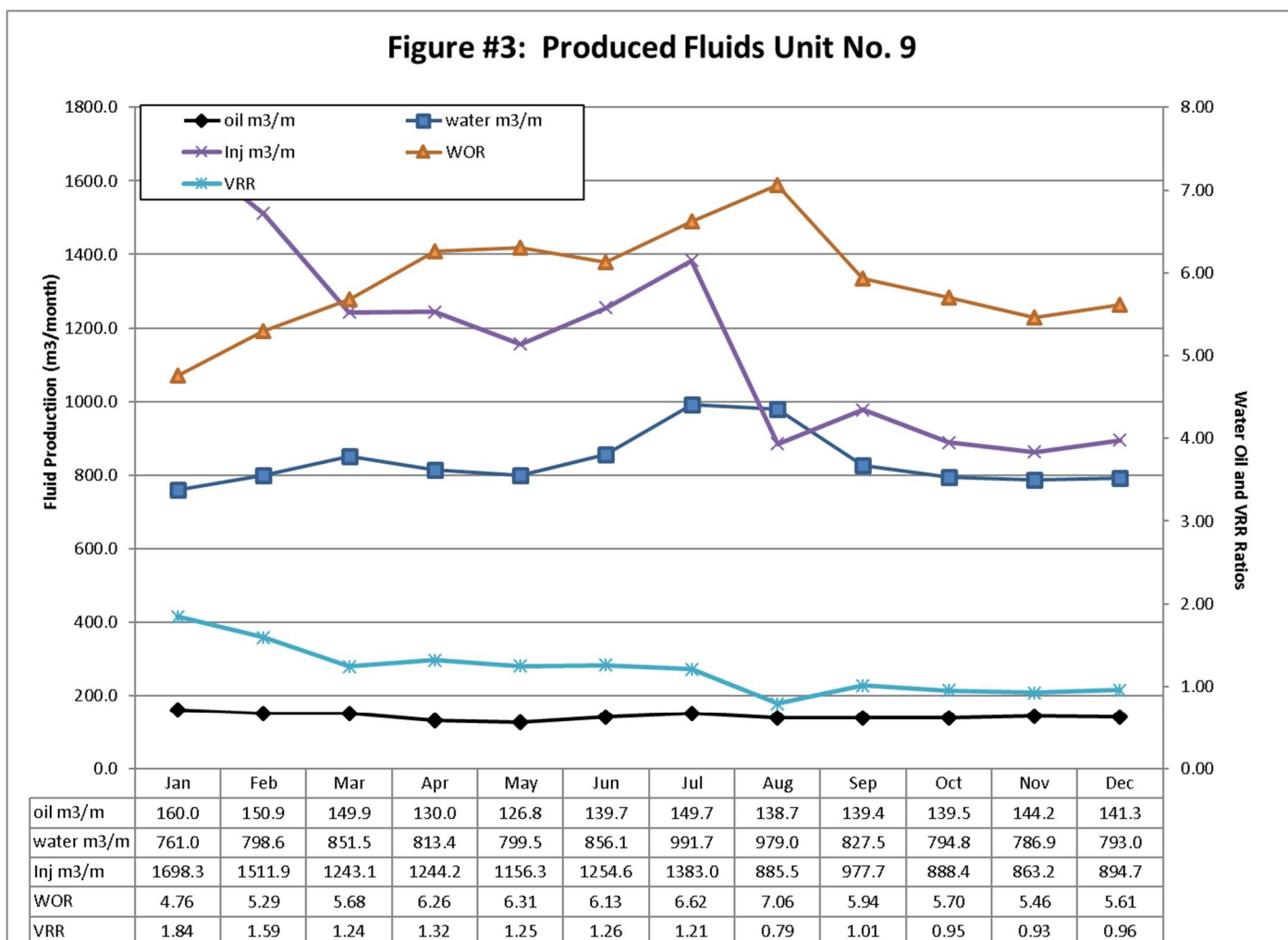
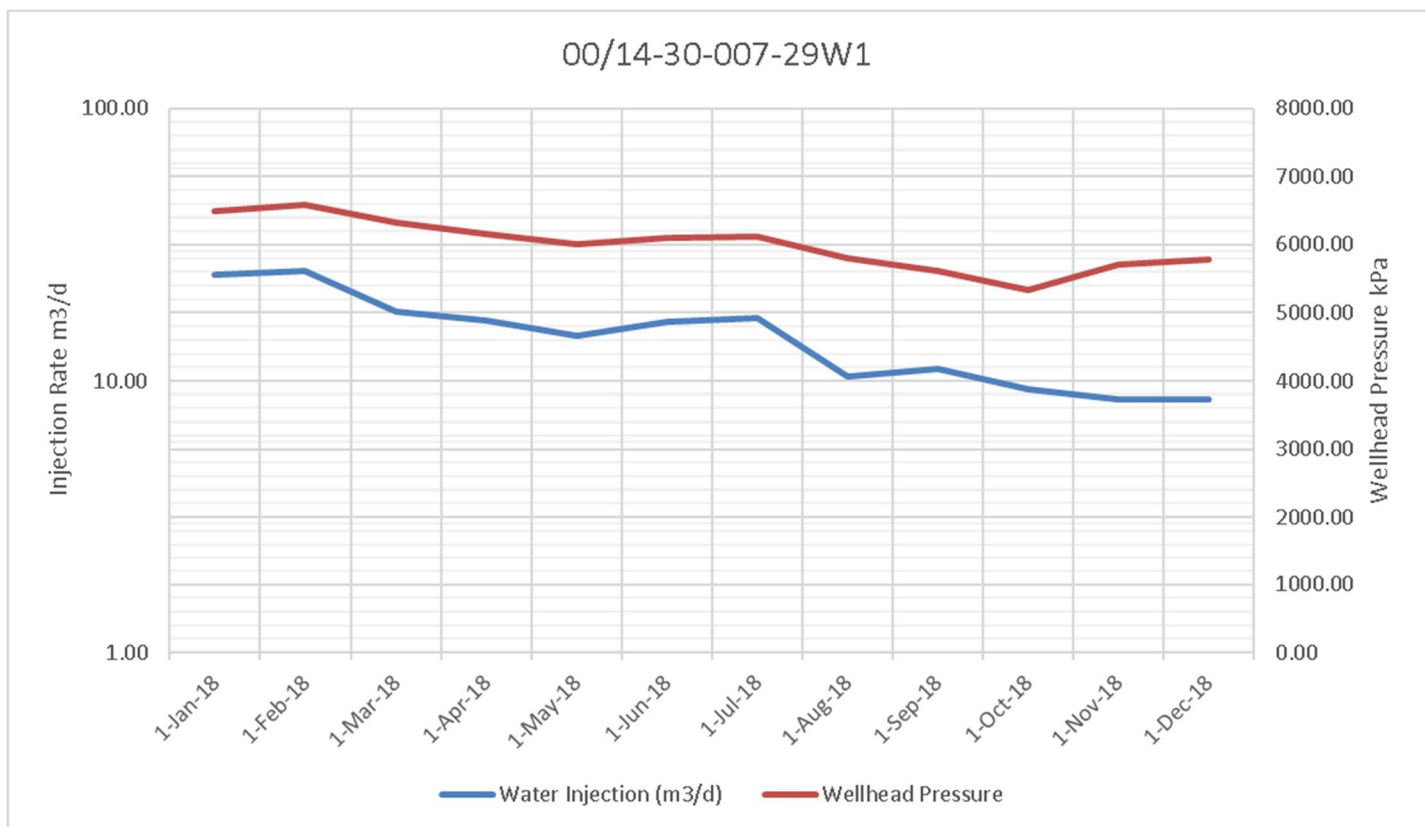
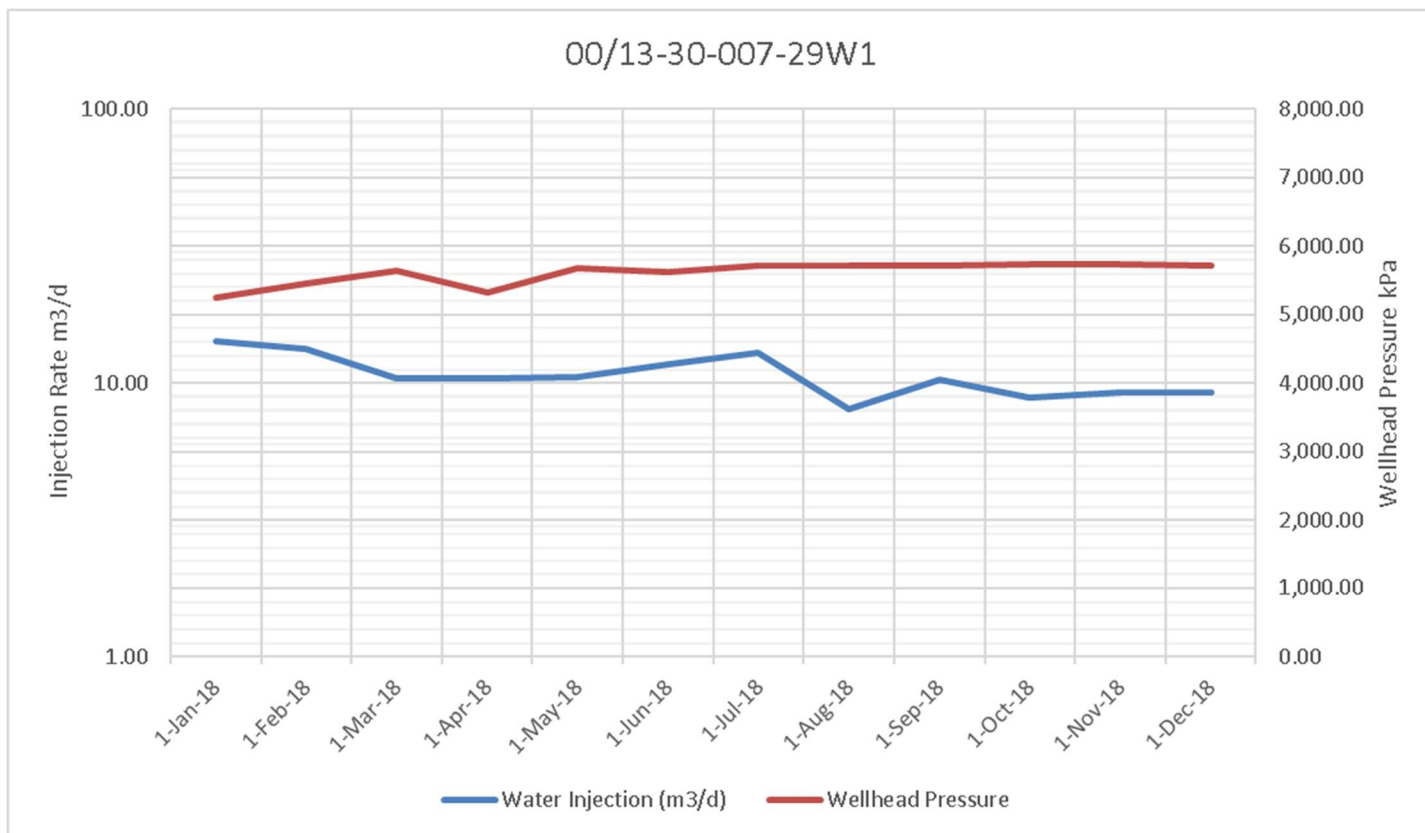
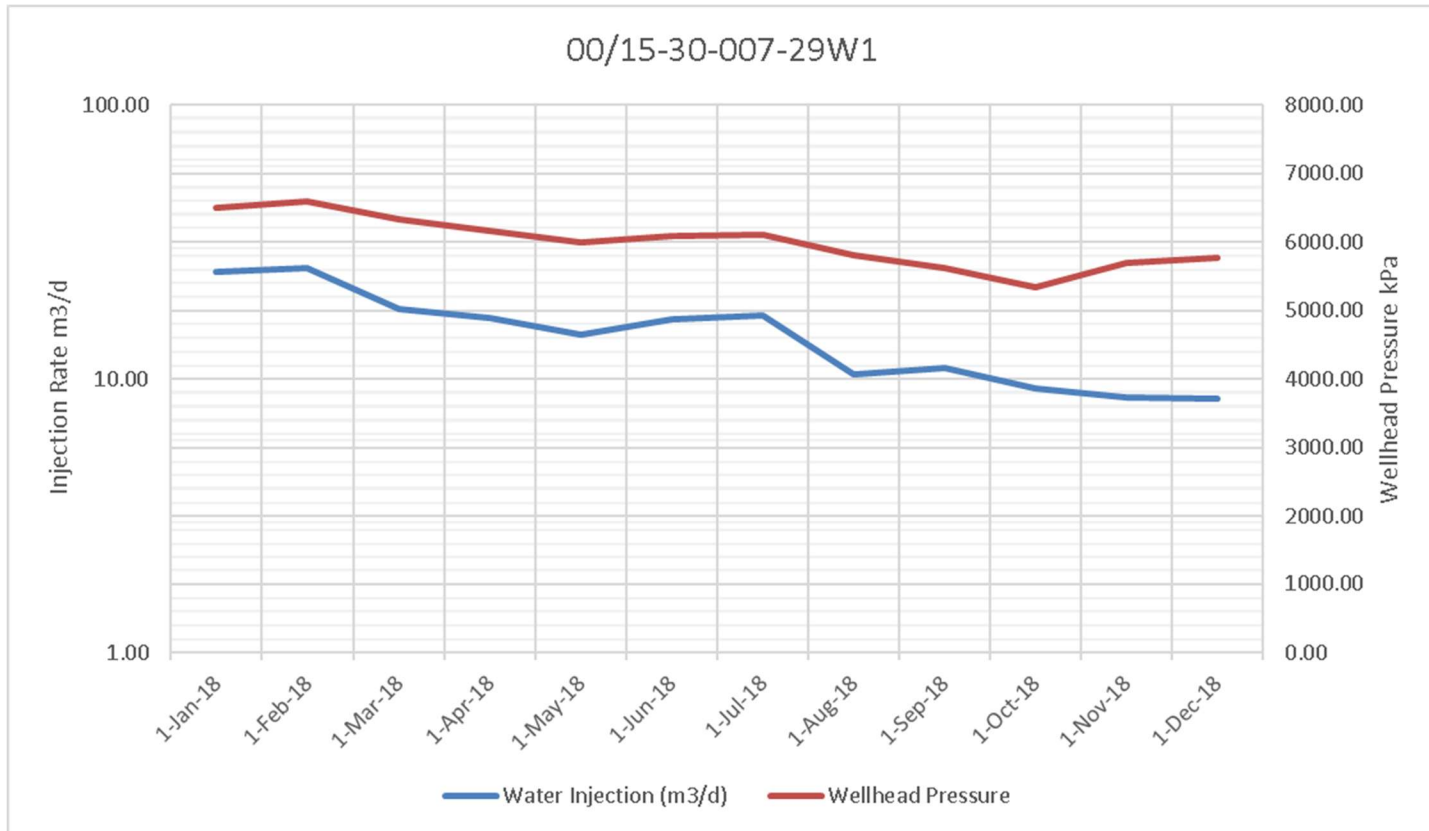


Table 1: Sinclair Unit #9 Produced Fluids

2018 Oil Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018	CTD	
Unit #9 Total Production	30317.3	160.0	150.9	149.9	130.0	126.8	139.7	149.7	138.7	139.4	139.5	144.2	141.3	1710.1	32027.4	
2018 Water Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018	CTD	
Unit #9 Total Production	112734.2	761.0	798.6	851.5	813.4	799.5	856.1	991.7	979.0	827.5	794.8	786.9	793.0	10053.0	122787.2	
Unit #9 WOR	3.72	4.76	5.29	5.68	6.26	6.31	6.13	6.62	7.06	5.94	5.70	5.46	5.61	5.88	3.83	
2018 Water Injection m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018	CTD	
Unit #9 Injection	85905.1	1698.3	1511.9	1243.1	1244.2	1156.3	1254.6	1383.0	885.5	977.7	888.4	863.2	894.7	14000.9	99906.0	
Unit #9 VRR	0.60	1.84	1.59	1.24	1.32	1.25	1.26	1.21	0.79	1.01	0.95	0.93	0.96	1.19	0.65	





2015 Monthly Averages	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
00/13-30 Injection Rate (m3/d)	14.24	13.33	10.37	10.46	10.56	11.72	12.87	8.079	10.29	8.891	9.212	9.249
00/13-30 Injection Pressure (kPa)	5250	5460	5635	5320	5670	5615	5705	5705	5705	5740	5740	5723
00/14-30 Injection Rate (m3/d)	24.66	25.34	18	16.71	14.57	16.53	16.99	10.43	11.04	9.293	8.567	8.531
00/14-30 Injection Pressure (kPa)	6500	6586	6325	6155	6000	6095	6115	5810	5616	5343	5701	5775
00/15-30 Injection Rate (m3/d)	15.88	15.32	11.73	12.54	12.17	13.58	14.75	10.06	11.26	10.47	11	11.08
00/15-30 Injection Pressure (kPa)	5812	5801	5610	5595	5600	5650	5650	5087	5110	5343	5512	5618