

# Sinclair Unit No. 4: EOR Report 2017

## Overview

Note: Vermilion Energy has assumed operatorship of Sinclair Unit No.4 through the acquisition of Red River Oil Inc. effective Feb 15, 2018. Within the 2017 EOR Report, operations undertaken by Red River in 2017 will be reported as so.

The Sinclair Unit No. 4 is a two section, two pattern water flood in the three forks formation. Pattern #1, located in Section 14-7-29 W1M, consists of three injectors at 13-14, 15-14 and 16-14, three horizontal producers at 9-14, 02/16-14 and 14-14 and two vertical producers at 4-14 and 11-14. Pattern #2 is located in Section 11-7-29 W1M and consists of two injectors at 02/2-11 and 3-11, four horizontal producers at 1-11, 2-11, 4-11 and 02/13-11 and two vertical producers at 6-11 and 14-11. A horizontal wellbore exists at 13-11 that was downhole-abandoned in 2016. Figure 1 below is a map of the Unit displaying the patterns and wellbore layout.

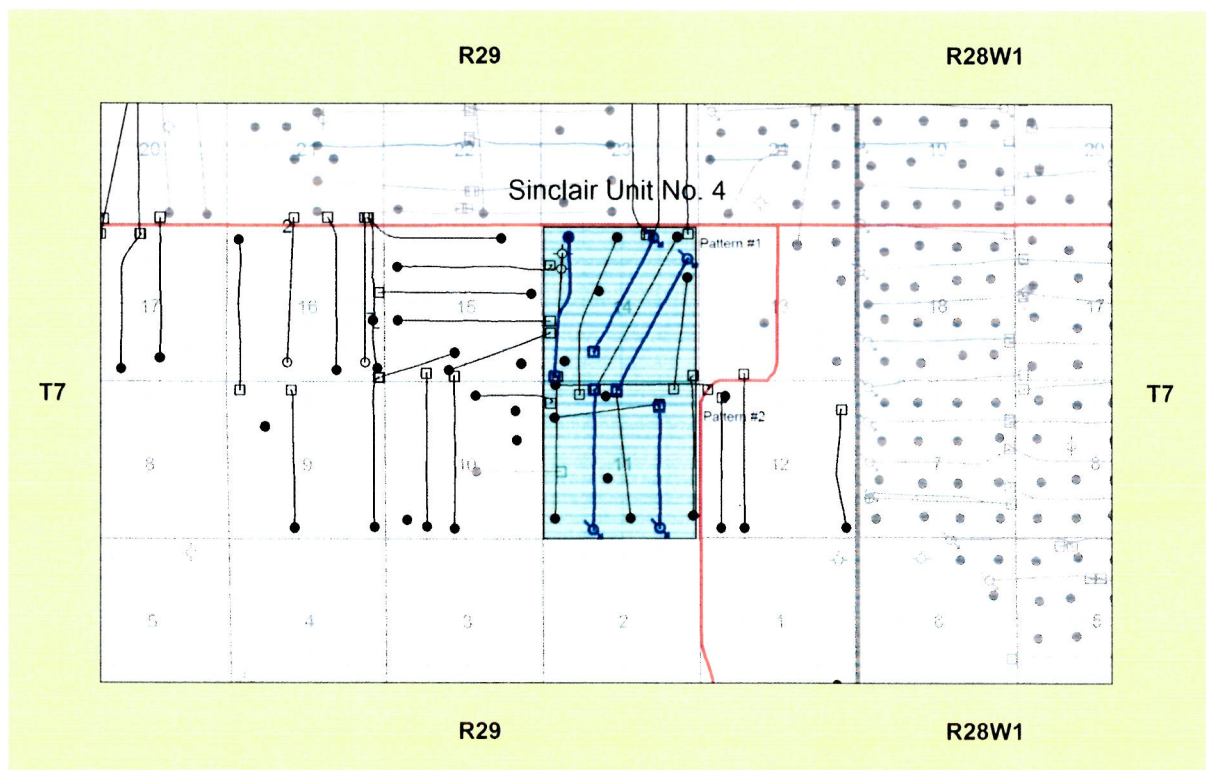


Figure 1: Sinclair Unit No. 4 Map

Unit No. 4 continues to show positive responses since Red River took over operatorship as a variety of optimization work focused on improved Unit performance continues to be

executed. The current recovery of the OOIP (8,551 mstb) for Unit No. 4 is approximately 5.1% (436.1 mstb). Primary recovery was originally estimated at 8% (684 mstb). This is consistent with reservoir work Red River has completed on its lands whereby the primary recovery factor is generally estimated at 5% (4 wells per section) and 8% with infill drilling. Furthermore, Red River estimates that secondary recovery of an additional 10% is still a reasonable projection as the Unit is further optimized.

To maximize recovery in Unit No. 4 Red River has continued to focus on improving the sweep efficiency and VRR of the project area through wellbore optimization work. Red River is pleased to report that a considerable optimization program has been executed in 2017. Over the course of 2017 the following wells had downhole optimization intervention work completed:

- 02/16-14-007-29W1 – Packers Plus liner drillout in January 2017
- 00/02-11-007-29W1 – Packers Plus liner drillout in January 2017
- 00/04-11-007-29W1 – Packers Plus liner drillout in February 2017
- 00/09-14-007-29W1 – Packers Plus liner drillout in March 2017
- 00/03-11-007-29W1 – Injection well coil cleanout and acid stimulation in July 2017

Red River is pleased to report that both producing and injection well workovers have been deemed successful considering the productivity/injectivity has been improved at all wells. The improved productivity is a good indication that there previously was a degree of skin build up (potential sand bridging or frac seat scaling) at some point along the wellbore. Red River has identified additional candidates for intervention workovers and has plans to execute in continued efforts to optimize Unit performance.

## **Performance Discussion**

Overall Unit WOR for the year averaged 4.82, bringing the cumulative Unit WOR to 3.25 at year end. Injection, although still below target, improved again from the previous year. A yearly VRR of 0.99 helped increase the Unit cumulative VRR to 0.56 at year end. Figure 2 in appendix A illustrates the overall pool 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.

### **Pattern #1: Section 14-7-29W1M**

The pattern WOR remained relatively flat throughout the year with an average of 2.55 overall resulting in the cumulative WOR to date of 2.01. The yearly VRR equated to 1.7, which in turn improved the pattern cumulative VRR from 0.62 at the beginning of the year to 0.66 at year end. Appendix A, Figure 3 illustrates the Pattern #1 performance in graphical and tabular format.

### **Pattern #2: Section 11-7-29W1M**

Section 11's WOR averaged 7.03 for 2017, bringing the cumulative to date WOR to 4.51 from 4.38 at the beginning of the year. A yearly VRR of 0.69 resulted in no change in VRR from 2016 at 0.50. Figure 4 illustrates the Pattern #2 performance in graphical and tabular format.

## **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. 4 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. 4 monthly and cumulative production fluid and ratio data in tabular form
5. Individual injection well rate and pressure profiles:

- a. 00/15-14
- b. 00/16-14
- c. 00/13-14
- d. 02/02-11
- e. 00/03-11

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. 4 in 2017.

### 73(1)(e) Well Servicing

As previously discussed, Red River completed the following well servicing workovers other than routine maintenance pump changes in 2017.

- 1. 02/16-14-007-29W1 – Packers Plus liner drillout in January 2017
- 2. 00/02-11-007-29W1 – Packers Plus liner drillout in January 2017
- 3. 00/04-11-007-29W1 – Packers Plus liner drillout in February 2017
- 4. 00/09-14-007-29W1 – Packers Plus liner drillout in March 2017
- 5. 00/03-11-007-29W1 – Injection well coil cleanout and acid stimulation in July 2017

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

Injection water for Sinclair Unit No. 04 is sourced from the Manville formation via the 100/14-09-007-29W1 water source well. The 100/14-09 source well is pipeline connected to Red River'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 5 unit injection wells. All water is treated with scale inhibitor and biocide. Injection pressures at the wellhead are limited to a maximum of 6000 kPa.



# Figure 2: Sinclair Unit #4 Produced Fluids

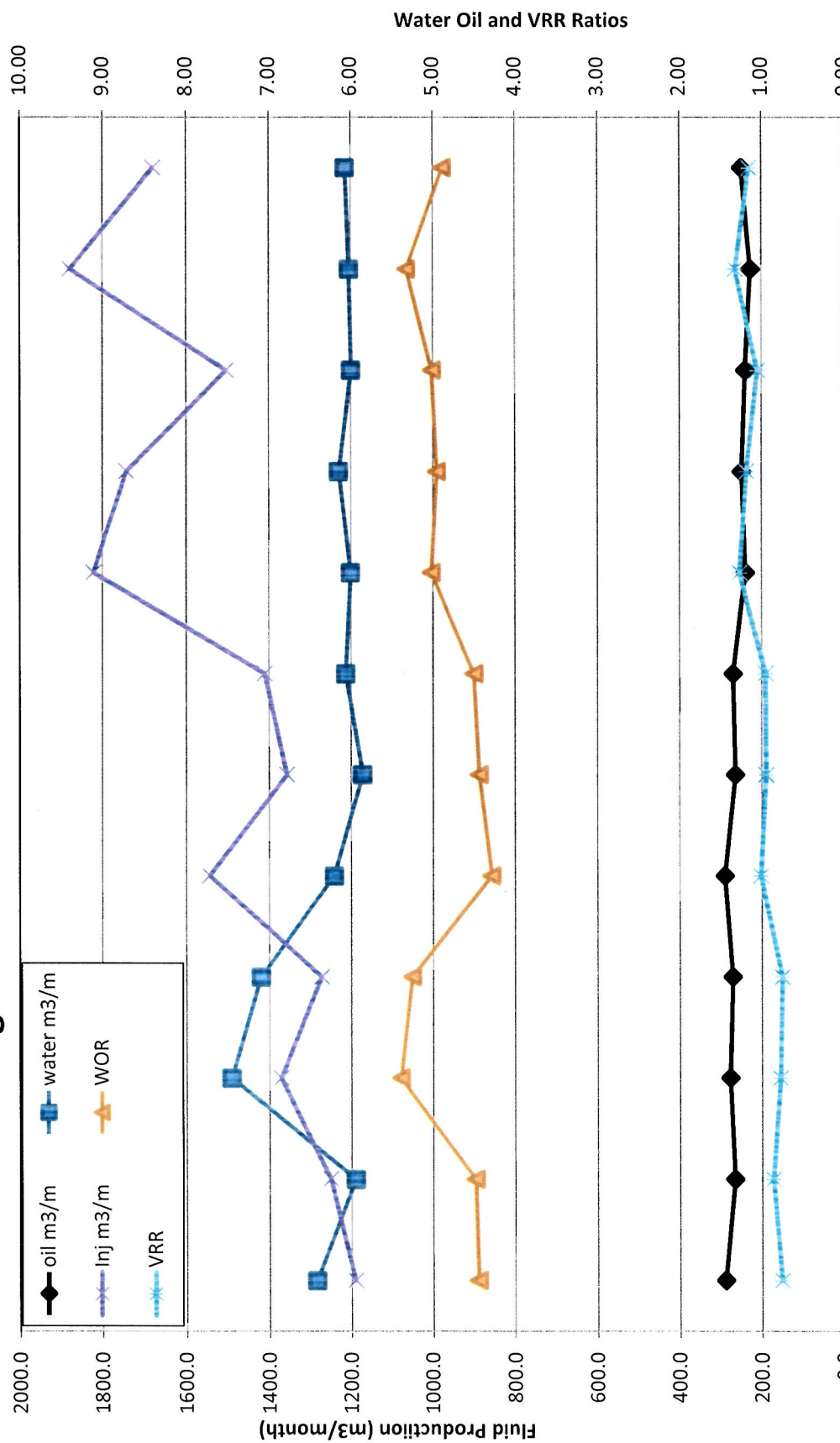


Table 1: Sinclair Unit #4 Produced Fluids

2017 Oil Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2017	CTD
Pattern #1 Sec 14	33446.5	151.4	148.1	141.9	138.3	136.4	125.6	132.1	103.9	118.6	126.5	108.8	108.2	1539.8	34986.3
Pattern #2 Sec 11	32766.2	136.9	116.9	134.4	131.9	153.0	138.2	137.1	135.2	129.5	112.7	117.2	140.2	1583.2	34349.4
Unit #4 Total Production	66212.7	288.2	265.0	276.3	270.2	289.4	263.8	269.2	239.1	248.1	239.2	226.1	248.4	3123.0	69335.6

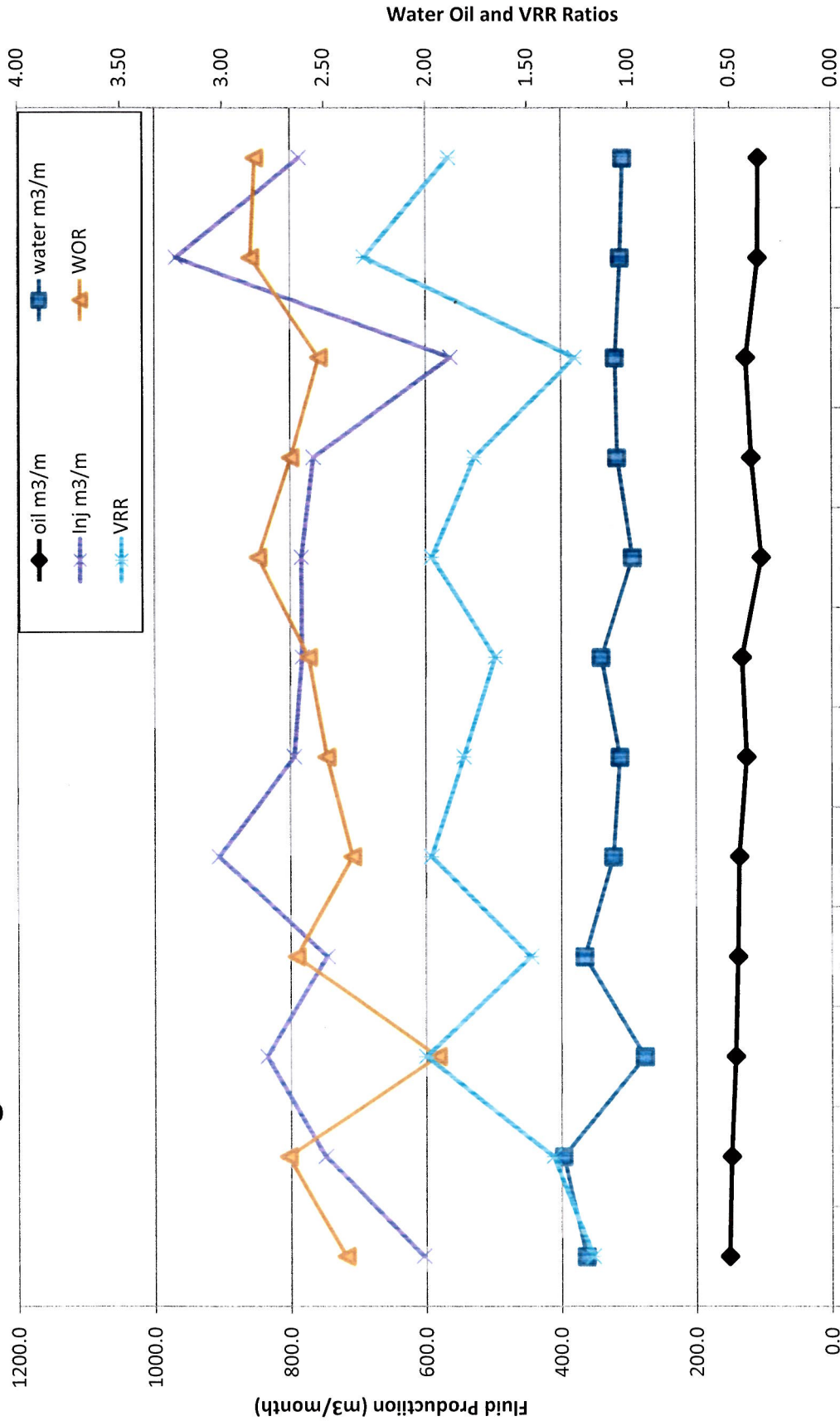
2017 Water Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2017	CTD
Pattern #1 Sec 14	66315.8	362.7	396.7	275.9	364.7	322.3	312.3	340.1	293.7	316.1	319.2	311.6	307.7	3923.0	70238.8
Pattern #2 Sec 11	143674.4	919.7	791.9	1214.3	1054.1	917.8	858.6	871.7	906.0	912.4	879.3	891.7	905.3	11122.7	154797.0
Unit #4 Total Production	209990.2	1282.3	1188.6	1490.1	1418.8	1240.1	1171.0	1211.8	1199.7	1228.6	1198.5	1203.3	1212.9	15045.7	225035.9

Unit #4 WOR	3.17	4.45	4.49	5.39	5.25	4.28	4.44	4.50	5.02	4.95	5.01	5.32	4.88	4.82	3.25
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2017 Water Injection m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2017	CTD
Pattern #1 Sec 14	60309.5	603.7	748.5	835.1	745.4	905.1	794.4	782.5	783.2	765.3	564.0	968.4	786.5	9282.0	69591.4
Pattern #2 Sec 11	86654.5	585.7	500.9	535.2	525.3	638.0	561.0	627.6	1038.5	977.7	938.3	910.6	892.2	8731.0	95385.4
Unit #4 Injection	146964.0	1189.4	1249.4	1370.2	1270.7	1543.0	1355.4	1410.1	1821.7	1743.1	1502.3	1879.0	1678.6	18012.9	164976.9

Unit #4 VRR	0.53	0.76	0.86	0.78	0.75	1.01	0.94	0.95	1.27	1.18	1.04	1.31	1.15	0.99	0.56
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Figure 3: Produced Fluids Pattern #1 Sec 14-7-29W1M



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
oil m3/m	151.4	148.1	141.9	138.3	136.4	125.6	132.1	103.9	118.6	126.5	108.8	108.2
water m3/m	362.7	396.7	275.9	364.7	322.3	312.3	340.1	293.7	316.1	319.2	311.6	307.7
Inj m3/m	603.7	748.5	835.1	745.4	905.1	794.4	782.5	783.2	765.3	564.0	968.4	786.5
WOR	2.40	2.68	1.94	2.64	2.36	2.49	2.58	2.83	2.66	2.52	2.86	2.84
VRR	1.17	1.37	2.00	1.48	1.97	1.81	1.66	1.97	1.76	1.27	2.30	1.89

Figure 4: Produced Fluids Pattern #2 Sec 11-7-29W1M

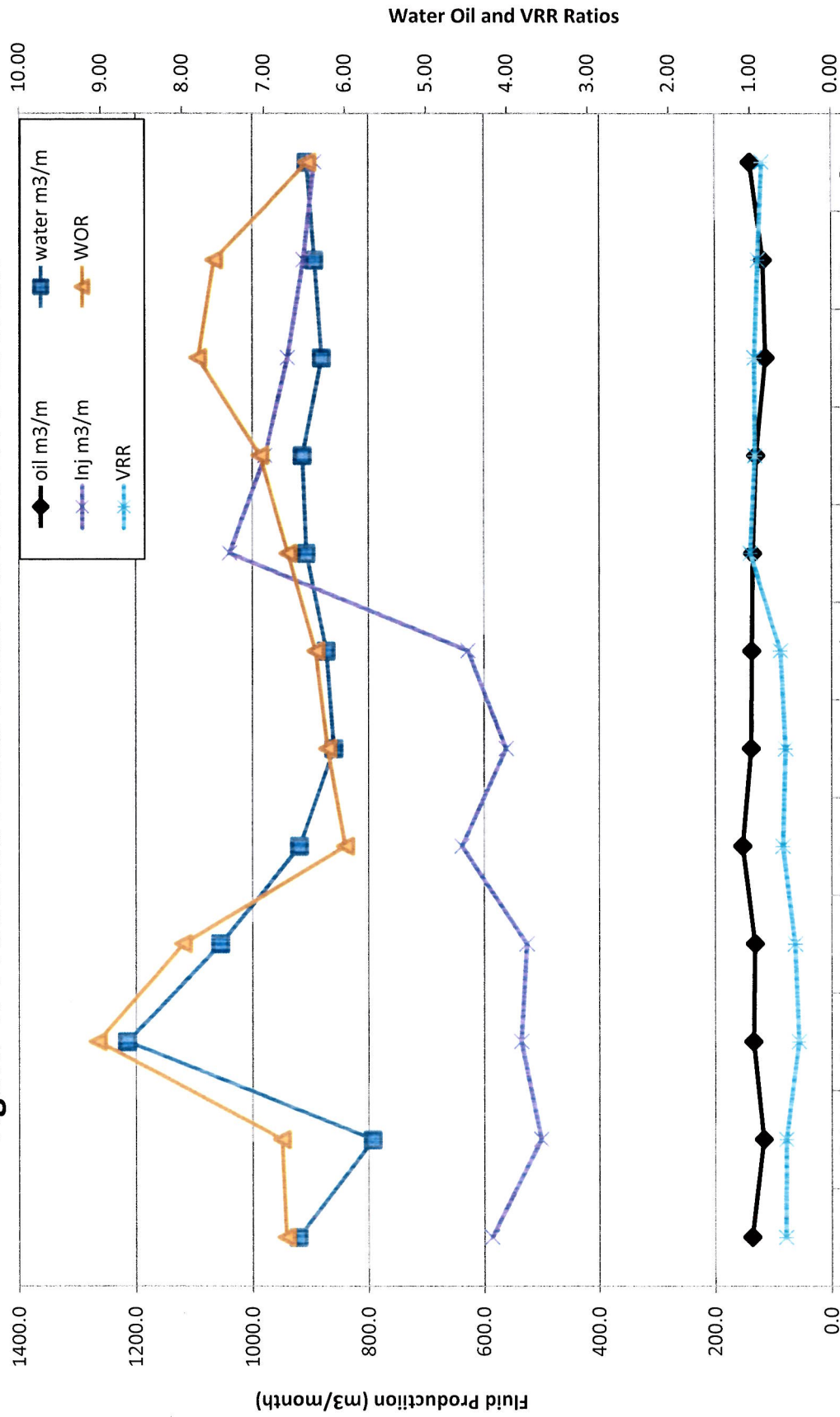


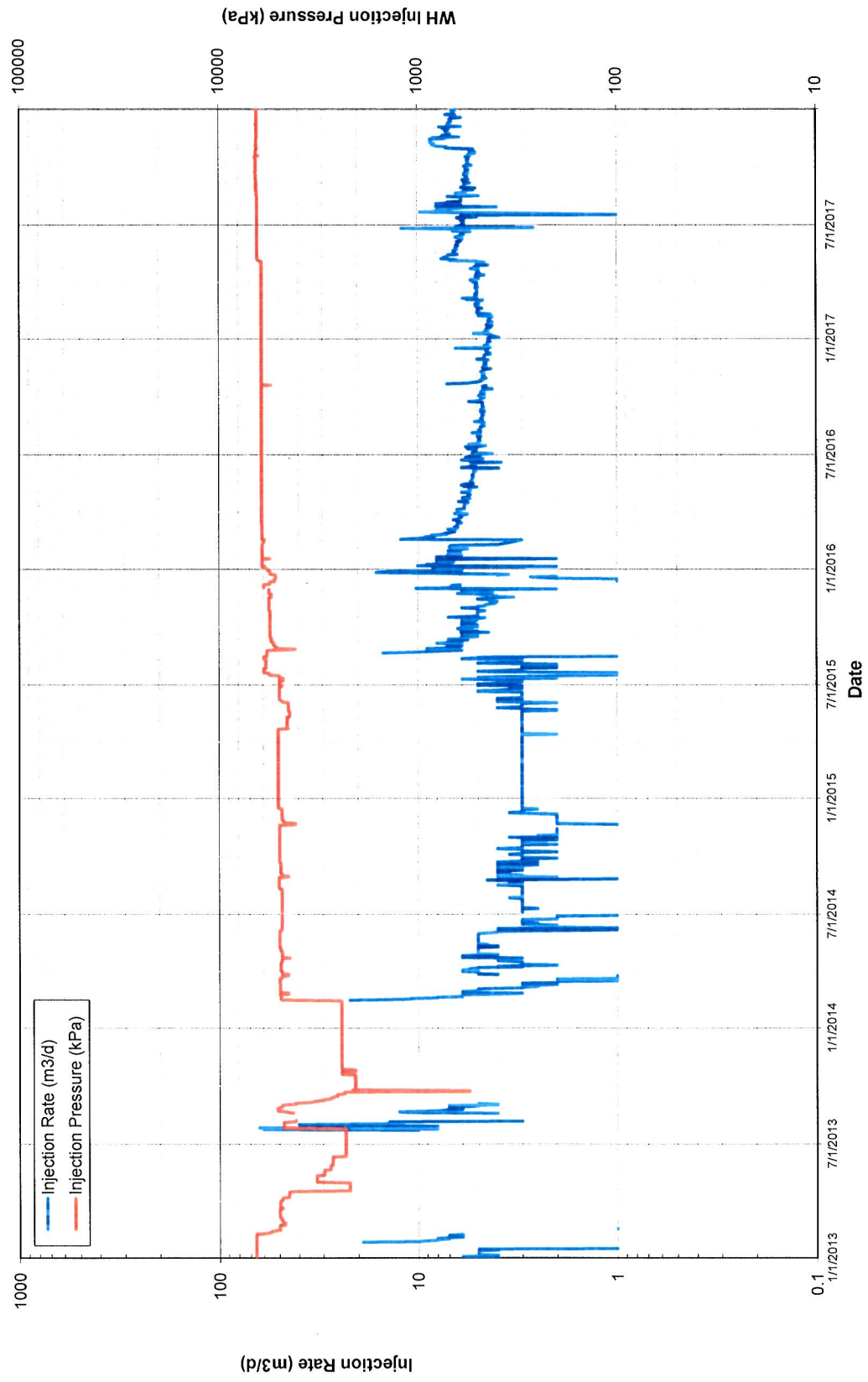


Table 2: Sinclair Unit #4 Monthly Average Injection Data

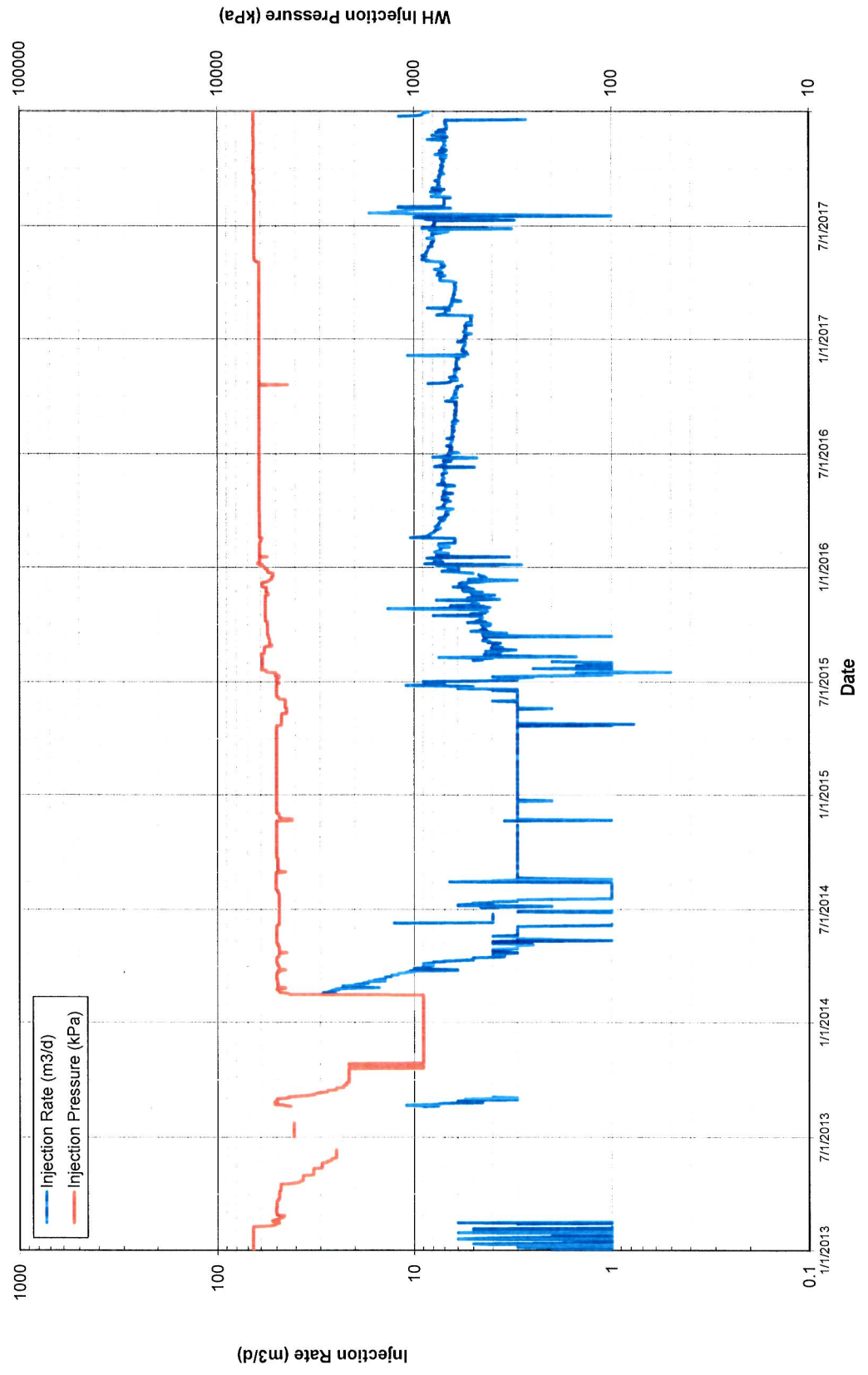
Pattern #1 Monthly Averages	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
00/15-14 Injection Rate (m3/d)	4.4	4.7	5.1	5.0	6.4	6.2	6.2	6.0	5.7	5.5	7.6	6.7
00/15-14 Injection Pressure (kPa)	6067	6067	6067	6067	6337	6378	6378	6407	6476	6471	6425	6418
00/16-14 Injection Rate (m3/d)	5.4	6.4	6.2	7.2	8.4	7.8	9.1	7.3	7.4	7.2	7.1	6.6
00/16-14 Injection Pressure (kPa)	6067	6067	6067	6067	6395	6447	6447	6442	6471	6510	6494	6501
00/13-14 Injection Rate (m3/d)	10	16	16	13	14	12	13	12	12	5	18	12
00/13-14 Injection Pressure (kPa)	6067	5464	6063	6067	6333	6378	6378	6403	6476	2301	6010	6369

Pattern #2 Monthly Averages	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
02/2-11 Injection Rate (m3/d)	10.8	10.6	10.7	10.9	13.3	12.2	13.1	12.6	12.1	11.8	11.6	11.7
02/2-11 Injection Pressure (kPa)	6067	6067	6067	6067	6363	6412	6412	6455	6550	6516	6481	6481
00/3-11 Injection Rate (m3/d)	8.1	7.2	6.6	6.6	7.2	6.5	9.3	20.9	20.5	18.4	18.8	17.0
00/3-11 Injection Pressure (kPa)	6067	6067	6067	6067	6333	6378	4911	3050	4333	4810	4863	4970

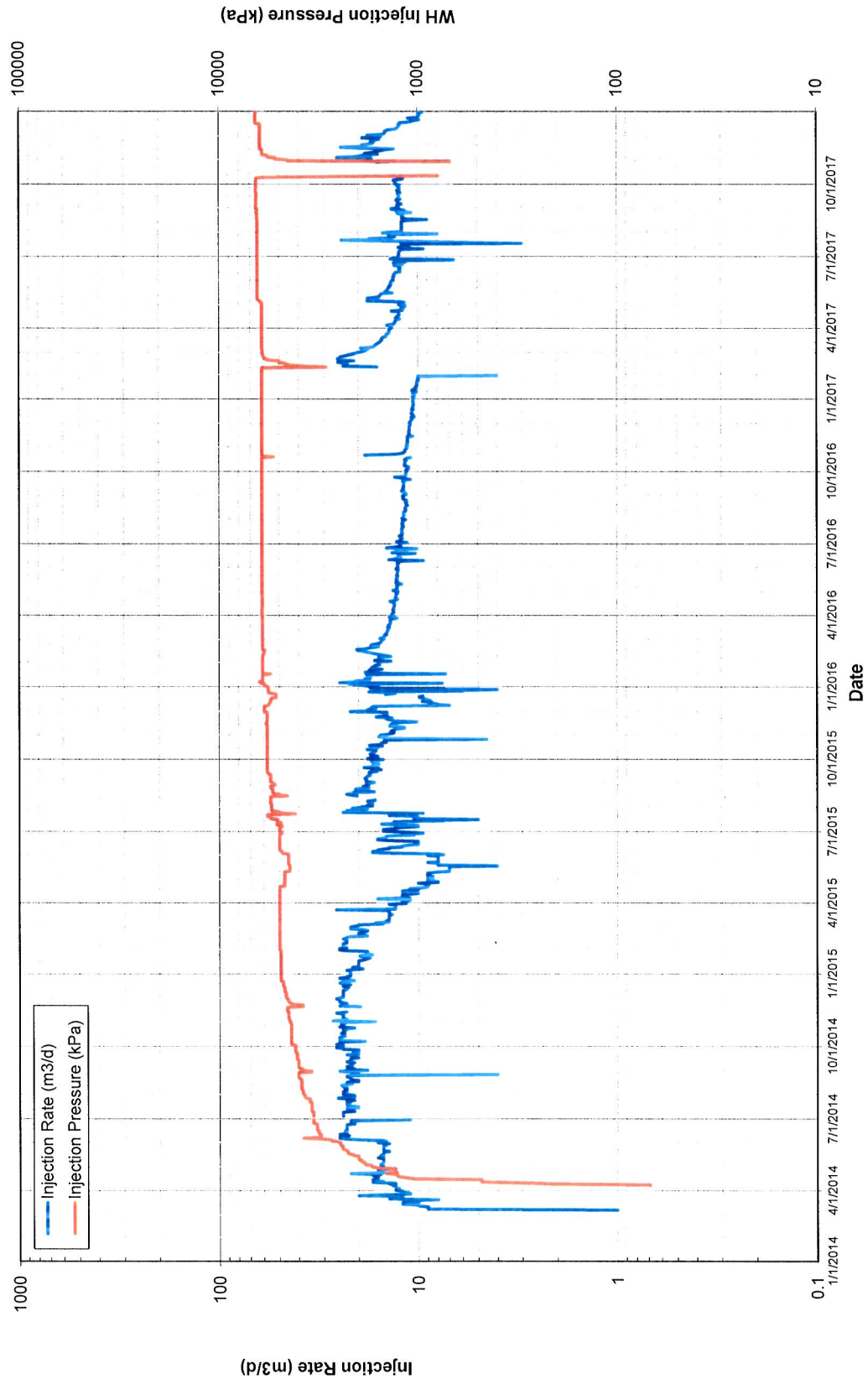
00/15-14-7-29 W1M



00/16-14-7-29 W1M

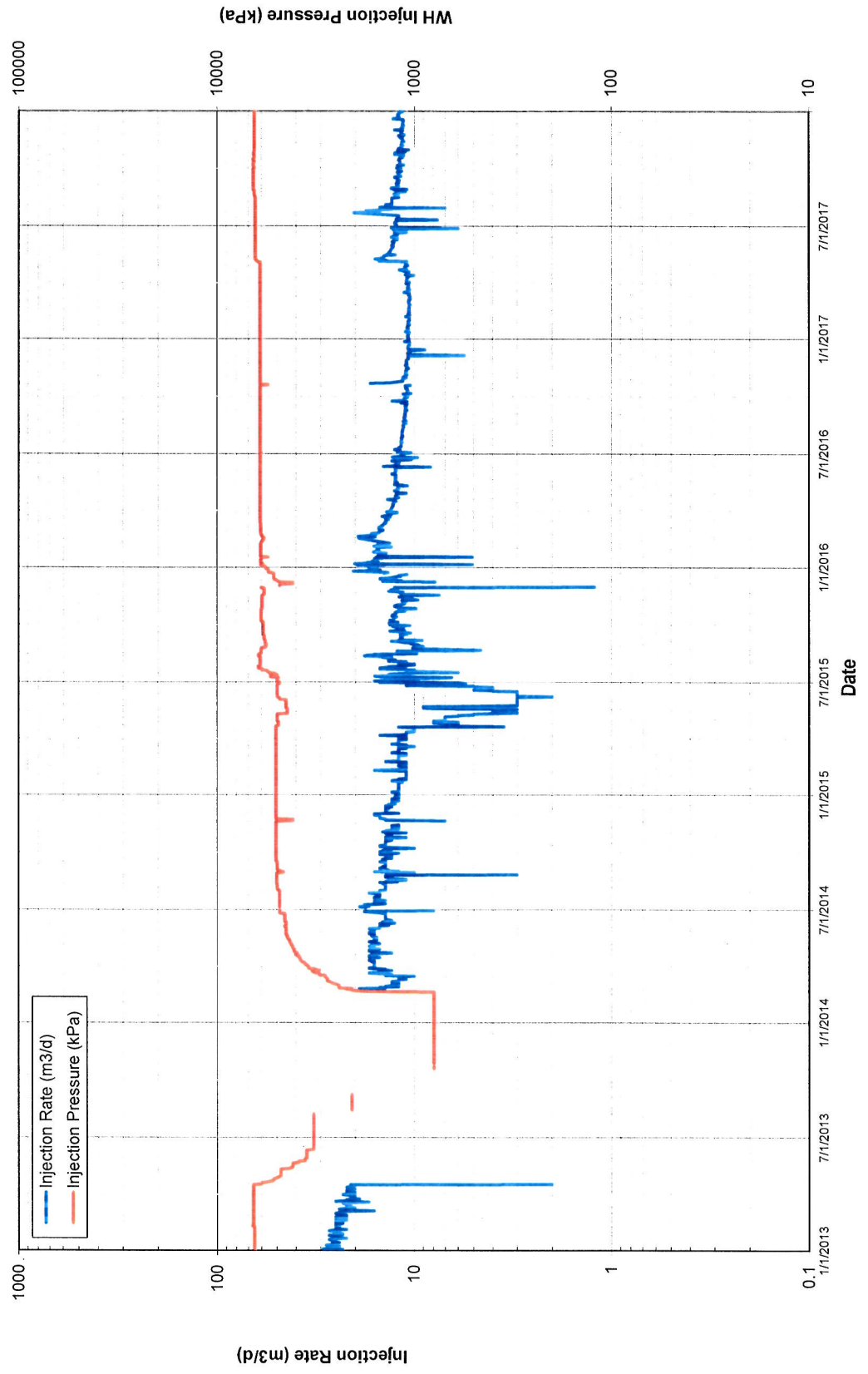


00/13-14-7-29 W1M





02/02-11-7-29 W1M



00/03-11-7-29 W1M

