

Routledge Unit #1
2018 Annual EOR Report

Executive Summary

In 2018 oil production in the Routledge Unit #1 was 52.6 m³/d (331 bbl/d) totaling 19.2 e³m³ (120.7 mmbbl). Annual production inclined 11% from 2017 to 2018, the second time consecutively, which hasn't been seen in the unit for quite some time. This is using the average yearly production, however, if you use December 2017 to December 2018 the unit production declined by 47.8%. By the end of 2018 cumulative oil production from the Routledge Unit #1 was 2 645 e³m³ (16.6 mmbbl).

In Routledge Unit #1 development began in 1955 and was developed primarily with vertical wells. The unit was largely left to primary decline with minimal water injection schemes implemented; most of the water was disposed and did not support the declining wells. Active programs of drilling horizontal wells in 2001, 2006, and 2007 revived the unit, increasing production to half the primary peak production rates. In 2014, three Scallion wells were drilled within the unit. In 2015 two wells were converted to injection and another in 2016. In 2017, two Scallion wells were drilled, as well as, one Oolite well and one Virden well. In 2018, there was no drilling activity within the unit. Further development with infills and injector conversions will result in improved recovery within the unit. In December 2018, there were 32 active oil producers, three injection wells and two disposal wells.

Discussion

With the approval for waterflooding Corex has begun to inject into the Lodgepole and continued infill drilling within the unit. Due to the surface conditions in the area most activity is required to be completed in the winter when the ground is frozen. Further injector conversions for waterflooding and pressure maintenance and continued infill drilling will help to gain incremental reserves from the unit. Considering the performance of other units in Virden secondary recovery should result in significant upside.

Significant events in 2018 are as follows:

- February 2018, abandon the 100/14-15-009-25W1/00 vertical well.
- February 2018, abandon the 100/01-28-009-25W1/00 vertical well.
- February 2018, abandon the 100/09-16-009-25W1/00 vertical well.
- February 2018, abandon the 100/15-16-009-25W1/00 vertical well.
- March 2018, abandon the 100/10-32-009-25W1/00 vertical well.
- March 2018, recompleate the 100/12-21-009-25W1/00 vertical well in the Oolites.
- May 2018, perform the downhole work to convert 102/04-22-009-25W1/00 horizontal well to injection.
- May 2018, perform the downhole work to convert 102/02-32-009-25W1/00 horizontal well to injection.

In April 2015, two Scallion horizontal wells were converted to injection (102/11-21-009-25W1/00 and 102/04-27-009-25W1/00). In 2016 another well was converted to injection, the 102/09-29-009-25W1/00 horizontal well. In 2018, the wells injected a total volume of $209.2 \times 10^3 \text{ m}^3$ (1,316 mbbbl) of water, at an average per annum rate of $573.6 \text{ m}^3/\text{d}$ (3,608 bbl/d) of water. Currently, only three of the six designated patterns are currently injecting. The average producing WOR for the unit was 50 m³/m³.

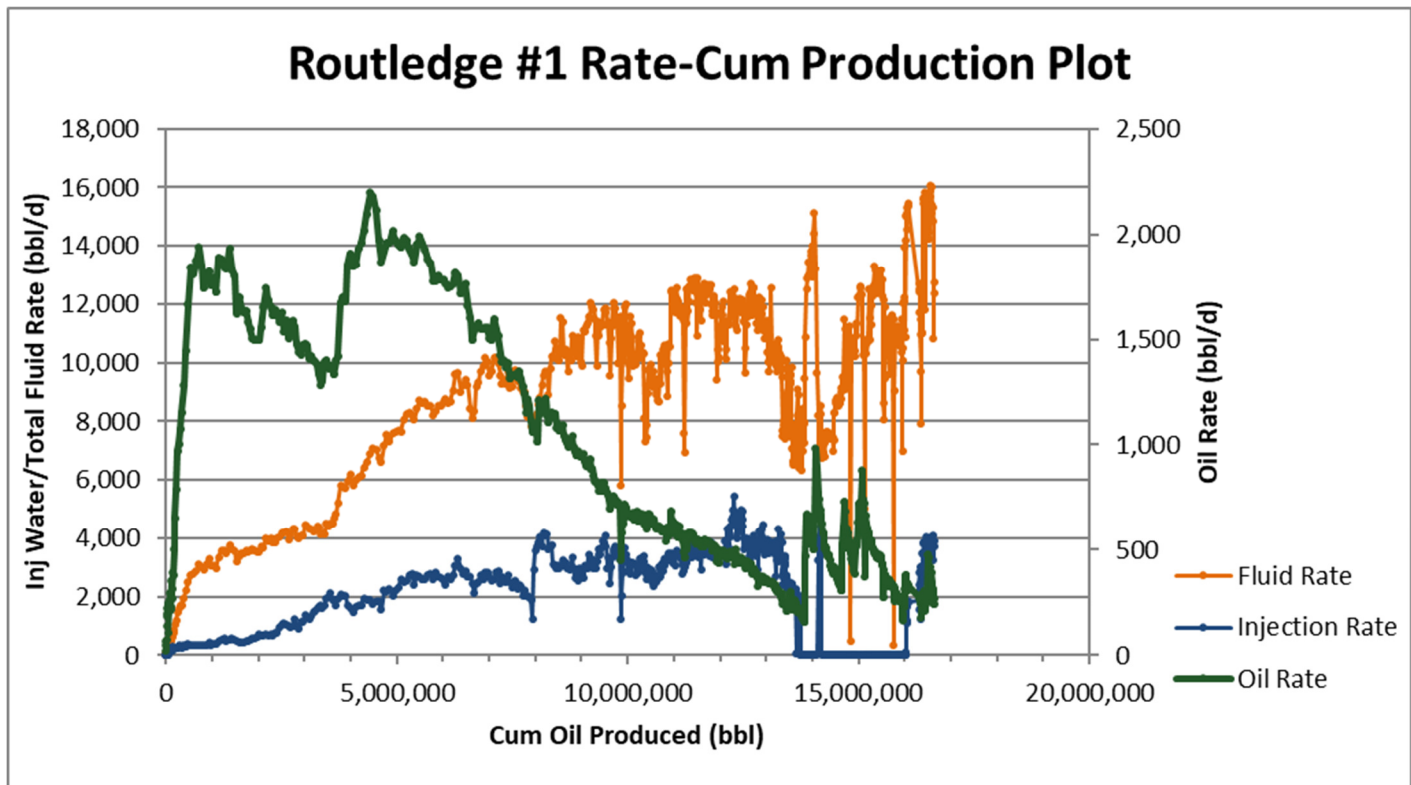
Water disposal in 2018 in the Routledge Unit #1 was $1,716 \text{ m}^3/\text{d}$ (10,790 bbl/d), totaling $625.9 \times 10^3 \text{ m}^3$ (3,937 mbbbl). Water was disposed into two wells (100/15-17-009-25W1/00 predominantly and 100/16-17-009-25W1/00).

It is important to note that publicly available production data does not include contribution from the newly drilled wells. Volumes quoted, and unit graphs presented are based on public production data augmented with proprietary data, and consequently should accurately reflect all wells. The pattern data within the tables below is based solely on publicly available production data and therefore missing some production volumes. These tables will be updated in subsequent progress reports.

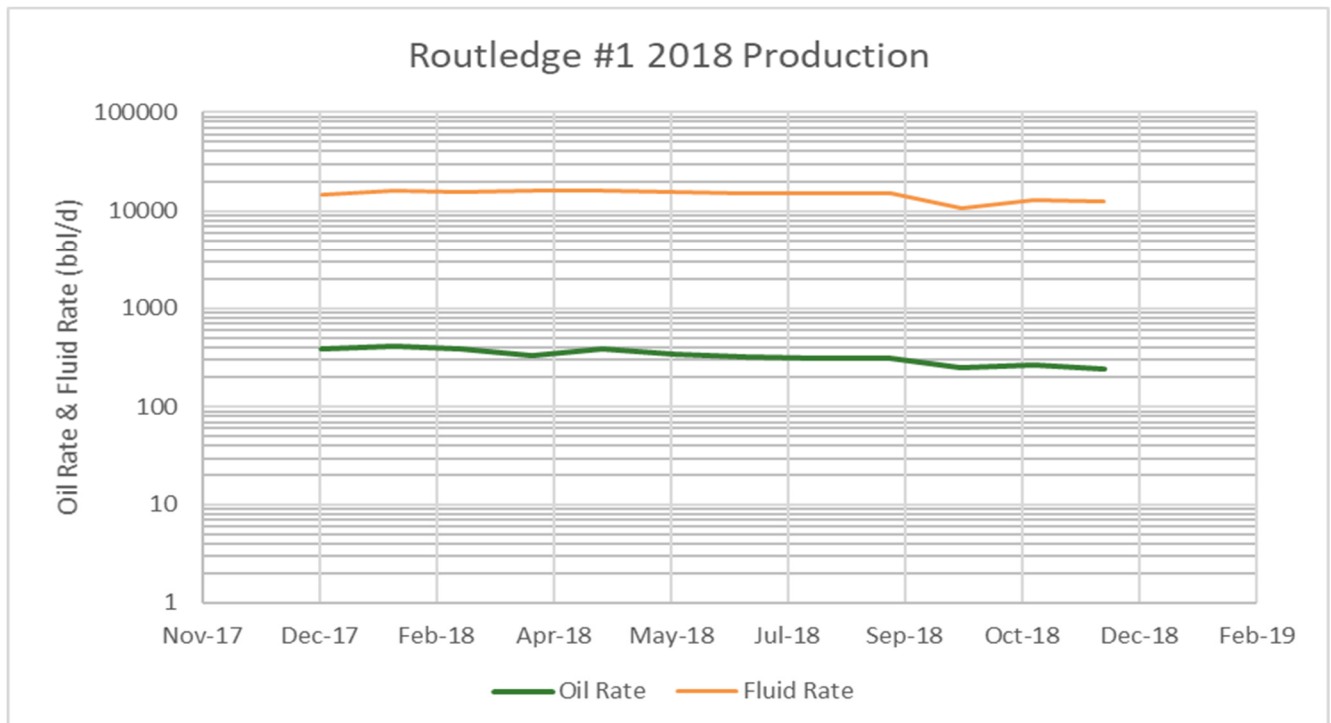
Detailed production, injection, voidage tables and plots for the total unit and each injection pattern are at the end of this report.

Below, in the composite rate – cumulative oil plot the historical unit production can be seen.

Routledge #1 – Rate vs Cum Oil Production



Routledge #1 – Rate vs Time



2018 Reservoir Pressure Surveys

Unit	UWI	License	Test Type	Date of Pressure	Duration of SI (days)	Datum BHP (kPaa)
Routledge	102/03-27-009-25W1/00	5649	AWS	2018-10-16	6	4,126
Routledge	103/12-28-009-25W1/00	10227	AWS	2018-10-16	6	4,825
Routledge	102/01-29-009-25W1/00	5773	AWS	2018-10-16	6	6,019
Routledge	102/01-32-009-25W1/00	5774	AWS	2018-10-16	6	5,425
Routledge	103/02-32-009-25W1/00	10678	AWS	2018-10-16	6	4,900
Routledge	102/13-33-009-25W1/00	6271	AWS	2018-10-16	6	3,207

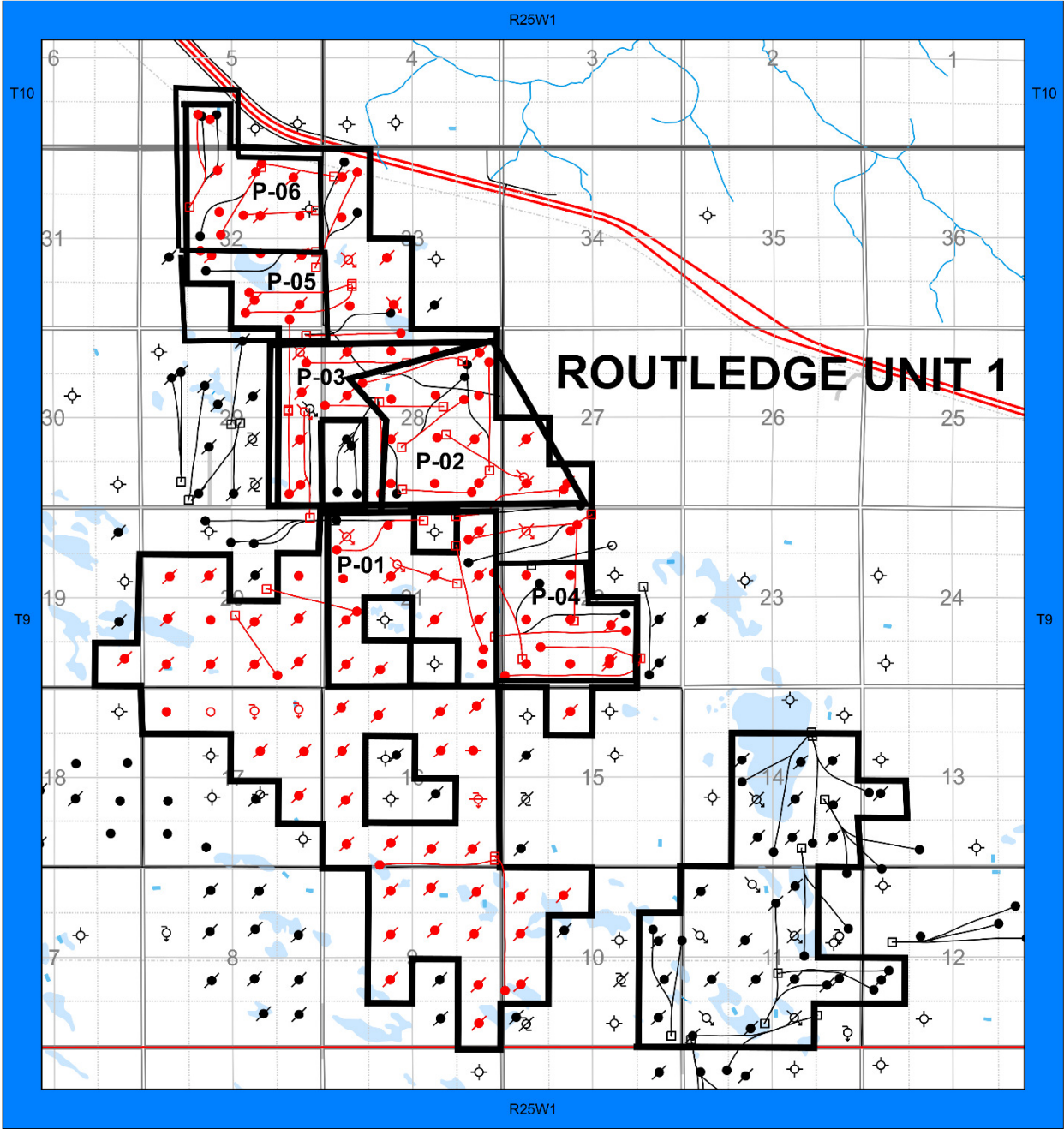
In 2018, six pressures were taken giving an average reservoir pressure of 4,750 kPa. All of the pressures were taken on wells in the lower pressure area in the northern portion of the unit where a waterflood has been implemented. Pressure measurements were taken in 2016 throughout the whole unit during a turnaround. Across the unit the average reservoir pressure is 4,300 kPaa. This data supports that we have seen an increase in pressure in some areas of the unit where the waterflood has been implemented. Note that the initial reservoir pressure was estimated at 6,700 kPa. In 2017, two pressures listed are close to estimated initial reservoir pressure in the south of the unit, and as there has been no injection in the area, this may indicate pressure support from an aquifer. The pressure data would indicate that the resulting injector conversions have helped to increase the reservoir pressure; however, the reservoir pressure in some areas is quite low and further conversions would be beneficial. Overall, the low pressures of the unit relative to the initial reservoir pressure suggest that additional water injection is needed for pressure support and to improve recovery.

In 2018 the instantaneous VRR was 1.47 and the cumulative VRR was 0.92, if you include the disposal within the unit. Excluding the focused disposal within the unit the VRR is 0.44, and the cumulative VRR would be 0.22. This indicates that there is still plenty of voidage to be replaced within the unit and further injector conversions would be beneficial. As discussed, there is partial support from an aquifer within the unit that is not taken into account within the VRR calculations.

2018 Well Servicing

UWI	Unit	Licence	Operation	Date	Objective
102/16-21-009-25W1/00	RU#1	6432	Pump Repair	2018-01-28	
100/14-15-009-25W1/00	RU#1	001611	Abandon Well	2018-02-12	
100/15-16-009-25W1/00	RU#1	001750	Abandon Well	2018-02-12	
100/01-28-009-25W1/00	RU#1	001445	Abandon Well	2018-02-14	
100/09-16-009-25W1/00	RU#1	001817	Abandon Well	2018-02-14	
100/10-32-009-25W1/00	RU#1	001907	Abandon Well	2018-02-14	
100/12-21-009-25W1/00	RU#1	001687	Recompletion	2018-03-19	
103/04-22-009-25W1/00	RU#1	10600	Pump Repair	2018-03-20	
102/14-28-009-25W1/00	RU#1	005772	Pump Repair	2018-04-03	
HEADER UPGRADE	RU#1	RM18VIR005	Header Repair	2018-04-19	
INSTALLATION HEADER BUILDING	RU#1	F18VIR011	Install Header Building	2018-05-09	
102/04-16-009-25W1/00	RU#1	10962	Equip & Tie-In	2018-05-22	
102/04-22-009-25W1/00	RU#1	005681	Injection Conversion	2018-05-23	
102/02-32-009-25W1/00	RU#1	10316	Injection Conversion	2018-05-28	
BATTERY UPGRADE	RU#1	F18VIR012	Preliminary Engineering	2018-05-30	
DEAD LEG REMOVAL	RU#1	RM18VIR021	Dead Leg Removal	2018-09-07	
PIPELINE TIE IN TO HEADER BUILDING	RU#1	F18VIR013	Pipelines	2018-10-09	
TURNAROUND	RU#1	T18VIR001	Turnaround	2018-10-12	
102/06-32-009-25W1/00	RU#1	005650	Pump Repair	2018-11-07	
PRELIMINARY ENGINEERING	RU#1	P19VIR002	Header / Separator Install	2018-12-11	

Waterflood Pattern Map

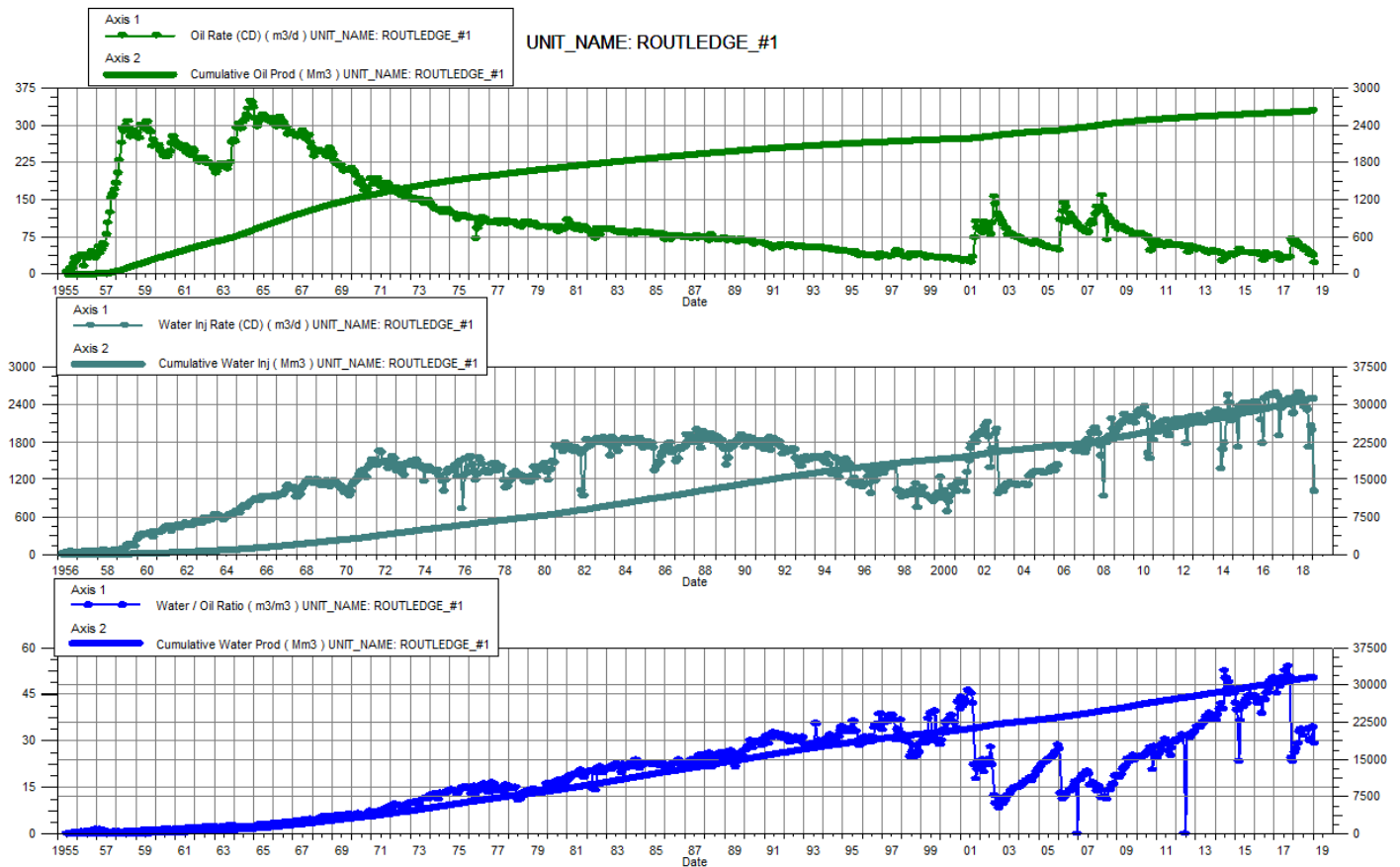


Waterflood Pattern Table

Pattern	Well
P-01	102/11-21-009-25W1/00
P-02	102/04-27-009-25W1/00
P-03	102/09-29-009-25W1/00
P-04	102/04-22-009-25W1/00
P-05	102/02-32-009-25W1/00
P-06	102/11-32-009-25W1/00

Total for Routledge Unit #1

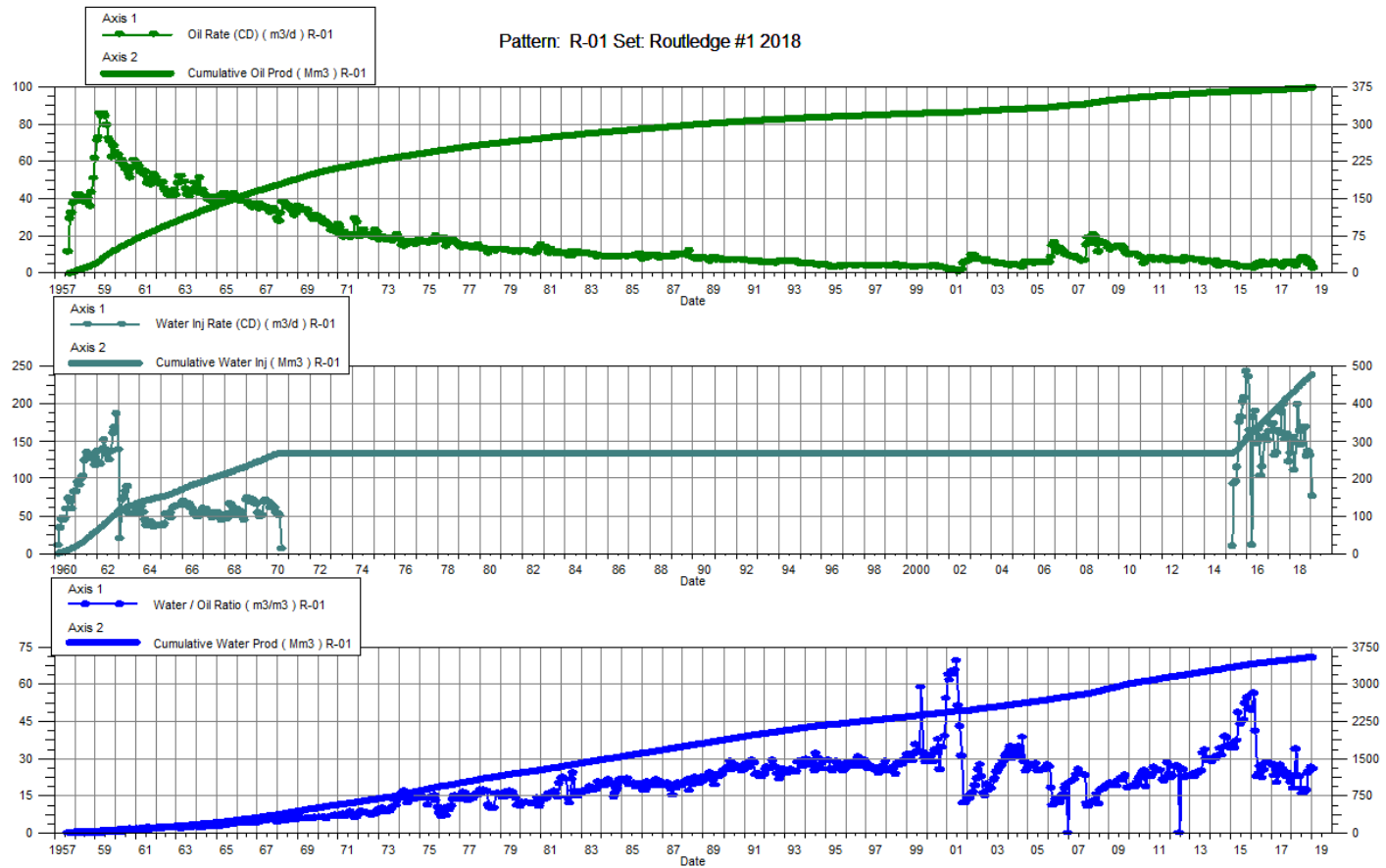
Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio	Water Inj Pressure kPa
1-31-2018	60.46	2624.02	1594.68	30953.06	2263.83	30607.17	26.38	1.37	0.91	2,918.78
2-28-2018	66.79	2625.89	1824.96	31004.16	2521.54	30677.77	27.33	1.33	0.91	2,918.78
3-31-2018	61.87	2627.80	1794.85	31059.80	2494.93	30755.12	29.01	1.34	0.91	2,918.78
4-30-2018	57.19	2629.52	1878.77	31116.16	2595.77	30832.99	32.85	1.34	0.91	2,918.78
5-31-2018	55.03	2631.23	1858.83	31173.78	2572.52	30912.74	33.78	1.34	0.91	2,918.78
6-30-2018	55.01	2632.88	1740.47	31226.00	2442.23	30986.01	31.64	1.36	0.91	2,918.78
7-31-2018	49.97	2634.43	1671.89	31277.83	2371.55	31059.52	33.46	1.38	0.92	2,918.78
8-31-2018	49.95	2635.97	1679.32	31329.89	2369.73	31132.98	33.62	1.37	0.92	2,918.78
9-30-2018	48.71	2637.44	1642.31	31379.15	2316.79	31202.49	33.72	1.37	0.92	2,918.78
10-31-2018	39.88	2638.67	1196.70	31416.25	1723.37	31255.91	30.01	1.39	0.92	2,918.78
11-30-2018	43.91	2639.99	1329.09	31456.13	2058.70	31317.67	30.27	1.50	0.92	2,918.78
12-31-2018	38.25	2641.18	1317.32	31496.96	1989.96	31379.36	34.44	1.47	0.92	2,918.78



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Pattern P-01 - 02/11-21-009-25W1/00

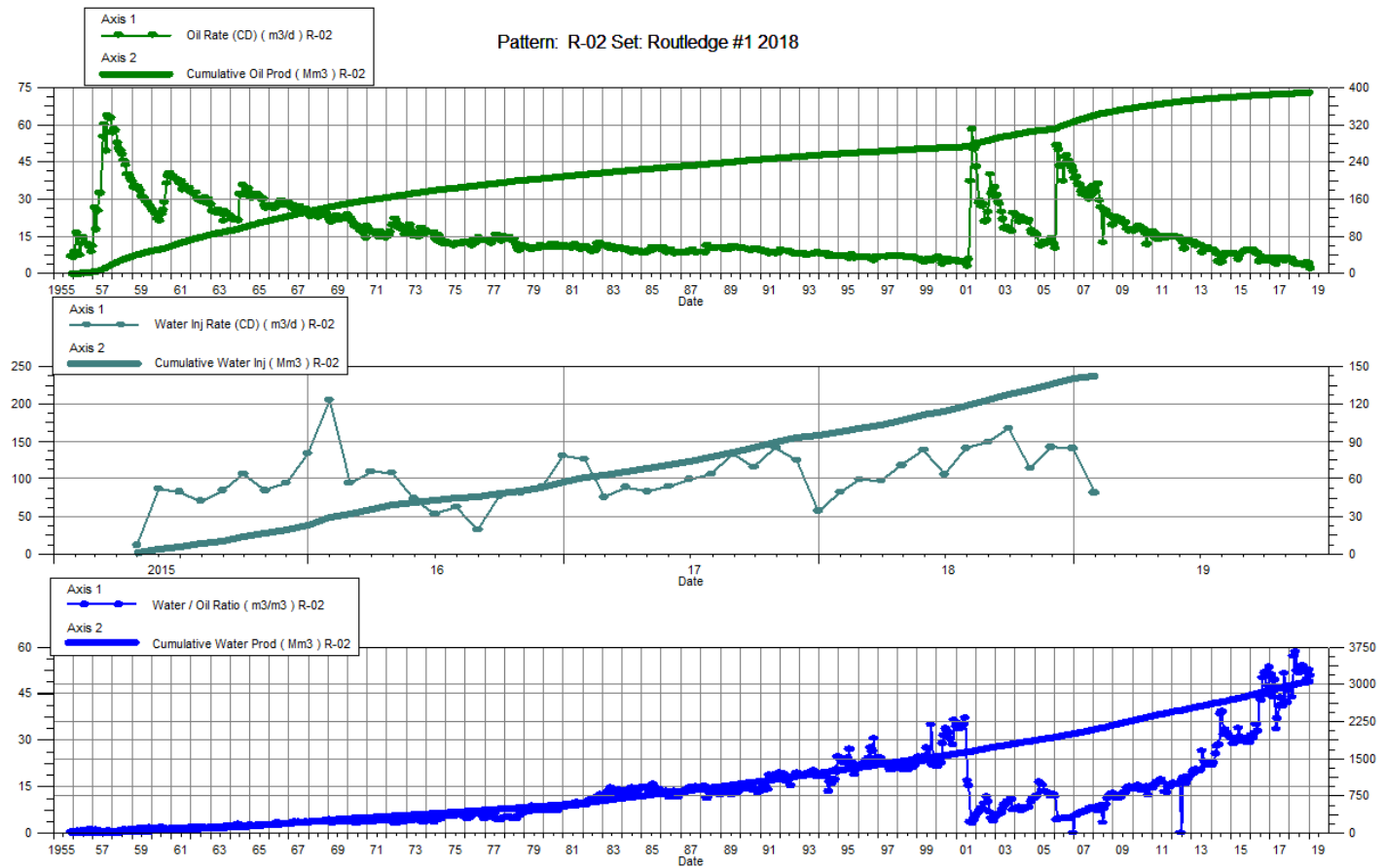
Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2018	5.53	371.70	98.82	3490.68	134.14	426.51	17.87	1.28	0.11	3,447.37
2-28-2018	5.91	371.87	136.28	3494.49	155.43	430.86	23.07	1.09	0.11	3,447.37
3-31-2018	3.95	371.99	133.39	3498.63	110.96	434.30	33.78	0.81	0.11	3,447.37
4-30-2018	6.25	372.18	144.63	3502.97	148.91	438.77	23.13	0.99	0.11	3,447.37
5-31-2018	6.30	372.37	142.76	3507.39	199.33	444.95	22.67	1.34	0.11	3,447.37
6-30-2018	7.67	372.60	137.41	3511.52	163.74	449.86	17.92	1.13	0.12	3,447.37
7-31-2018	8.80	372.88	141.00	3515.89	145.54	454.37	16.02	0.97	0.12	3,447.37
8-31-2018	8.64	373.14	139.20	3520.20	147.34	458.94	16.12	1.00	0.12	3,447.37
9-30-2018	8.08	373.39	140.56	3524.42	168.57	464.00	17.40	1.13	0.12	3,447.37
10-31-2018	5.47	373.56	132.64	3528.53	130.72	468.05	24.26	0.95	0.12	3,447.37
11-30-2018	6.27	373.74	155.31	3533.19	136.15	472.13	24.76	0.84	0.12	3,447.37
12-31-2018	5.65	373.92	149.71	3537.83	131.15	476.20	26.52	0.84	0.12	3,447.37



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Pattern P-02 - 02/04-27-009-25W1/00

Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2018	5.57	388.12	264.03	2971.71	82.05	97.65	47.39	0.30	0.03	5,308.96
2-28-2018	6.07	388.29	265.52	2979.15	99.34	100.43	43.74	0.37	0.03	5,308.96
3-31-2018	4.59	388.44	261.28	2987.24	97.33	103.45	56.92	0.37	0.03	5,308.96
4-30-2018	4.03	388.56	235.12	2994.30	118.51	107.01	58.41	0.50	0.03	5,308.96
5-31-2018	4.36	388.69	227.77	3001.36	138.48	111.30	52.23	0.60	0.03	5,308.96
6-30-2018	4.12	388.82	212.47	3007.73	106.13	114.48	51.57	0.49	0.03	5,308.96
7-31-2018	4.14	388.94	219.41	3014.53	141.19	118.86	52.99	0.63	0.04	5,308.96
8-31-2018	4.13	389.07	222.41	3021.43	149.44	123.49	53.91	0.66	0.04	5,308.96
9-30-2018	3.74	389.18	201.19	3027.47	167.80	128.53	53.82	0.82	0.04	5,308.96
10-31-2018	3.55	389.29	184.72	3033.19	114.55	132.08	51.99	0.61	0.04	5,308.96
11-30-2018	4.65	389.43	230.15	3040.10	142.69	136.36	49.48	0.61	0.04	5,308.96
12-31-2018	4.22	389.56	221.59	3046.97	140.75	140.72	52.54	0.62	0.04	5,308.96



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Pattern P-03 - 02/09-29-009-25W1/00

Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2018	4.61	167.23	313.94	2123.40	238.20	240.66	68.12	0.75	0.11	-
2-28-2018	5.36	167.38	291.66	2131.57	331.76	249.95	54.41	1.12	0.11	-
3-31-2018	5.60	167.55	292.82	2140.64	339.47	260.47	52.33	1.14	0.11	-
4-30-2018	4.31	167.68	267.02	2148.65	348.24	270.92	61.91	1.28	0.12	-
5-31-2018	4.70	167.83	257.59	2156.64	335.52	281.32	54.75	1.28	0.12	-
6-30-2018	4.13	167.95	248.34	2164.09	318.05	290.86	60.19	1.26	0.13	-
7-31-2018	4.97	168.10	255.52	2172.01	306.18	300.35	51.46	1.18	0.13	-
8-31-2018	4.88	168.25	252.30	2179.83	292.70	309.43	51.70	1.14	0.13	-
9-30-2018	3.99	168.37	258.28	2187.58	314.05	318.85	64.75	1.20	0.14	-
10-31-2018	2.98	168.47	232.59	2194.79	271.75	327.27	78.14	1.15	0.14	-
11-30-2018	3.92	168.58	274.09	2203.01	337.76	337.41	69.86	1.22	0.14	-
12-31-2018	3.65	168.70	263.39	2211.18	319.57	347.31	72.26	1.20	0.15	-

