

Routledge Unit #1
2017 Annual EOR Report

Executive Summary

In 2017 oil production in the Routledge Unit #1 was 47.3 m³/d (298 bbl/d) totaling 17.3 e³m³ (108.7 mmbbl). Annual production inclined 20.8% from 2016 to 2017, the first time production inclined in a long time. By the end of 2017 cumulative oil production from the Routledge Unit #1 was 2 625 e³m³ (16.5 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. Further development with infills and injector conversions will result in improved recovery within the unit. In December 2017, there were 36 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 the Virden area secondary recovery should result in significant upside.

Significant events in 2017 are as follows:

- March 2017, suspend the 100/09-16-009-25W1/00 vertical well.
- May 2017, abandon the 100/12-16-009-25W1/00 vertical well.
- May 2017, suspend the 100/01-28-009-25W1/00 vertical well.
- May 2017, suspend the 100/10-32-009-25W1/00 vertical well.
- June 2017, abandon the 100/01-20-009-25W1/00 vertical well.
- October 2017, drill the 103/04-22-009-25W1/00 horizontal well in the Scallion formation.
- October 2017, drill the 102/05-10-009-25W1/00 horizontal well in the Sandhill/Oolites.
- October 2017, drill the 102/03-16-009-25W1/00 horizontal well in the Virden formation.
- October 2017, drill the 103/02-32-009-25W1/00 horizontal well in the Scallion formation.

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 2017, the wells injected a total volume of $205 \times 10^3 \text{ m}^3$ (1,292 mbbbl) of water, at an average per annum rate of $563 \text{ m}^3/\text{d}$ (3,539 bbl/d) of water. The average producing WOR for the unit was 49 m³/m³.

Water disposal in 2017 in the Routledge Unit #1 was $1,845 \text{ m}^3/\text{d}$ (11,604 bbl/d), totaling $673 \times 10^3 \text{ m}^3$ (4,235 mbbbl). Water was disposed into two wells (100/15-17-009-25W1/00 predominantly and 100/16-17-009-25W1/00).

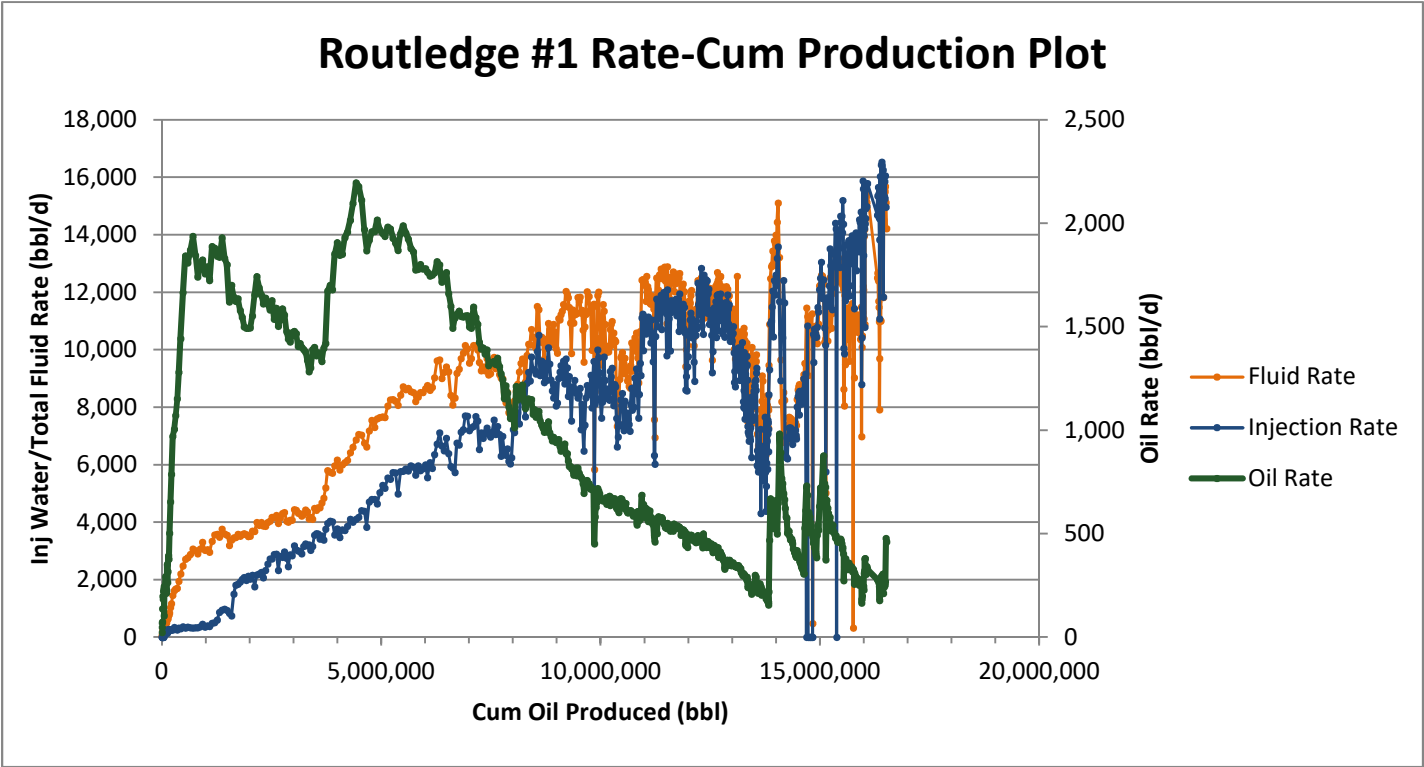
It is important to note that publicly available production data does not include contribution from the newly drilled wells. Volumes quoted, and unit graphs presented

above 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.

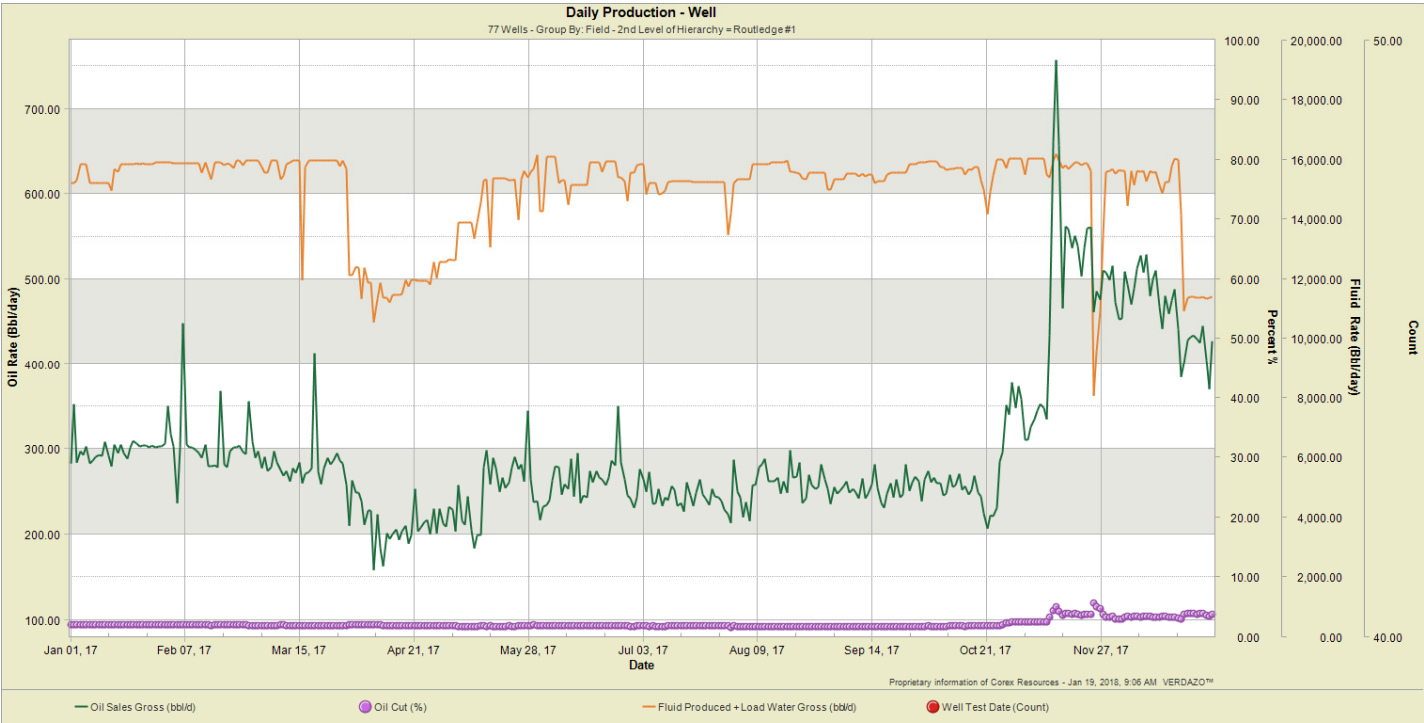
Detailed production, injection, voidage tables and plots for the total unit and each injection pattern are at the end of this report.

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



2017 Reservoir Pressure Surveys

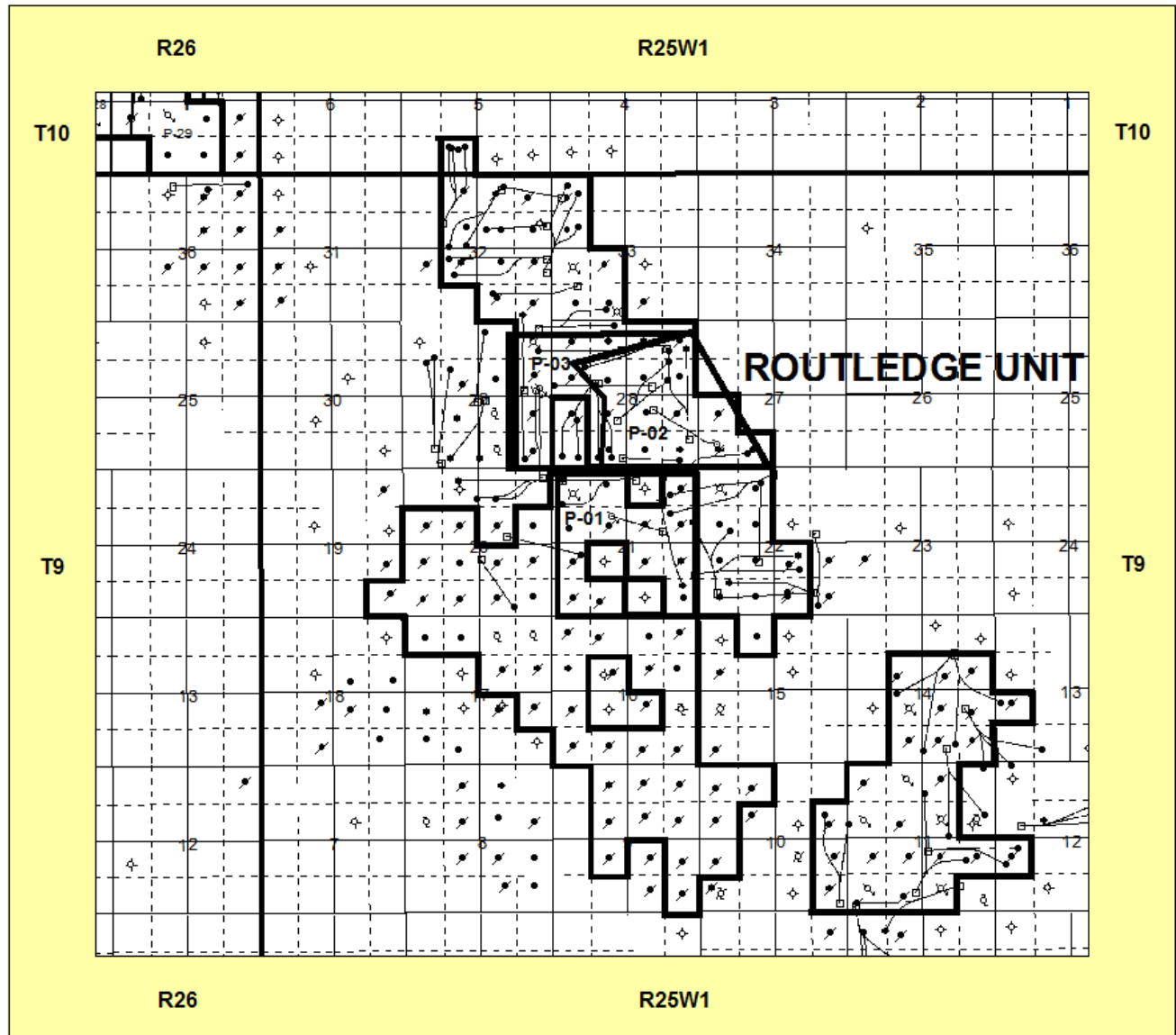
Unit	UWI	License	Test Type	Date of Pressure	Duration of SI	Datum BHP (kPaa)
Routledge	102/05-10-009-25W1/00	10770	BH BU	2017-10-25	11	6,146
Routledge	102/03-16-009-25W1/00	10771	BH BU	2017-10-30	12	6,128
Routledge	103/04-22-009-25W1/00	10600	BH BU	2017-10-15	5	4,484
Routledge	103/02-32-009-25W1/00	10678	BH BU	2017-11-01	9	4,923

In 2017, four pressures were taken on newly drilled wells, giving an average reservoir pressure of 5,400 kPa. The first two pressures listed are close to estimated initial reservoir pressure, and as there has been no injection in the area, this may indicate pressure support from an aquifer. Pressure measurements were taken in 2016 throughout the whole unit during a turnaround. Across the unit the average reservoir pressure is 4,300 kPaa. Note that the initial reservoir pressure was estimated at 6,700 kPa. Pressure is lower than the initial reservoir pressure and higher than the pressure data recorded in 2014 (ranging between 1,057 kPa to 6,869 kPa, with an average of 3,842 kPa). The pressure data would indicate that implementing the 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.

2017 Well Servicing

UWI	Unit	Licence	Operation	Date	Objective
100/09-16-009-25W1/00	RU#1	001817	Suspension	2017-03-16	
100/12-16-009-25W1/00	RU#1	001909	Abandon Well	2017-05-03	
TURNAROUND	RU#1	T17VIR005	Turnaround	2017-11-01	
SATELLITE CREDIT	RU#1	FF17VIR011	Satellite	2017-07-14	
102/03-16-009-25W1/00	RU#1	10771	Construction	2017-03-29	
102/03-16-009-25W1/00	RU#1	10771	Drilling - original	2017-10-15	
102/03-16-009-25W1/00	RU#1	10771	Initial Completion	2017-10-30	VIRDEN COMPLETION
100/01-28-009-25W1/00	RU#1	001445	Suspension	2017-05-10	
100/01-20-009-25W1/00	RU#1	001646	Abandon Well	2017-06-09	
103/02-32-009-25W1/00	RU#1	10678	Construction	2017-03-29	
103/02-32-009-25W1/00	RU#1	10678	Drilling - original	2017-10-19	
103/02-32-009-25W1/00	RU#1	10678	Initial Completion	2017-11-01	VIRDEN COMPLETION
103/02-32-009-25W1/00	RU#1	10678	Equip & Tie-In	2017-11-16	
103/04-22-009-25W1/00	RU#1	10600	Construction	2017-03-29	
103/04-22-009-25W1/00	RU#1	10600	Drilling - original	2017-10-06	
103/04-22-009-25W1/00	RU#1	10600	Initial Completion	2017-10-15	SCALLION COMPLETION
103/04-22-009-25W1/00	RU#1	10600	Equip & Tie-In	2017-10-21	
FLOWLINE ABANDONMENT	RU#1	A17VIR012	Pipelines	2017-07-13	
102/14-28-009-25W1/00	RU#1	005772	Pump Repair	2017-09-25	
102/14-28-009-25W1/00	RU#1	005772	Pump Repair	2017-12-18	
102/01-21-009-25W1/00	RU#1	005701	Pump Repair	2017-05-19	
102/11-32-009-25W1/00	RU#1	6267	Waterflood	2017-12-07	
IN LINE INSPECTION	RU#1	RM17VIR003	In Line Inspection	2017-07-04	
102/05-10-009-25W1/00	RU#1	10770	Construction	2017-03-29	
102/05-10-009-25W1/00	RU#1	10770	Equip & Tie-In	2017-06-01	
102/05-10-009-25W1/00	RU#1	10770	Drilling - original	2017-10-11	
102/05-10-009-25W1/00	RU#1	10770	Initial Completion	2017-10-25	VIRDEN COMPLETION
100/10-32-009-25W1/00	RU#1	001907	Suspension	2017-05-15	
HEADER UPGRADE	RU#1	RM17VIR002	Header Repair	2017-04-05	
HEADER REPAIR	RU#1	RM17VIR006	Header Repair	2017-04-17	

Waterflood Pattern Map

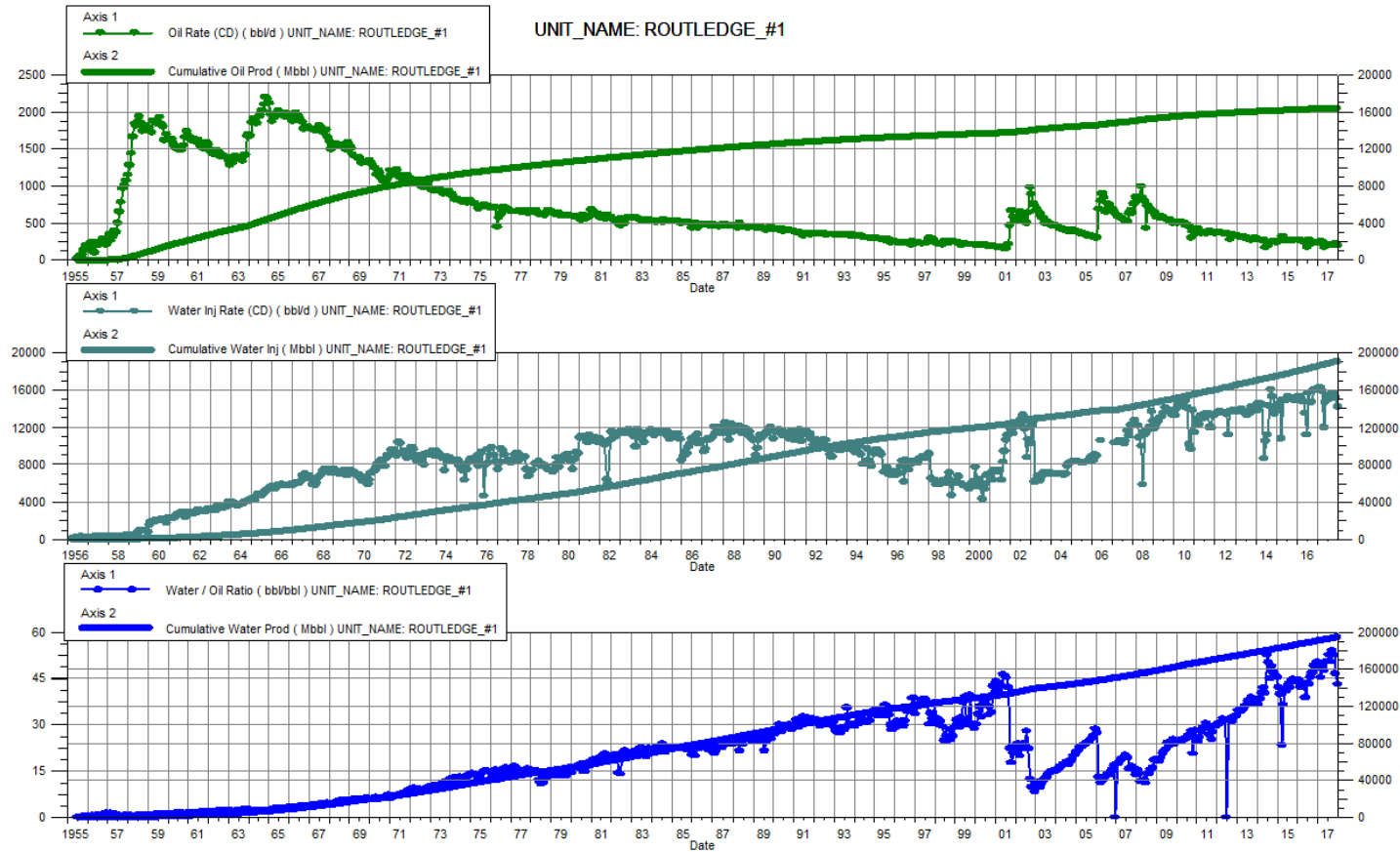


Waterflood Pattern Table

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

Total for Routledge Unit #1

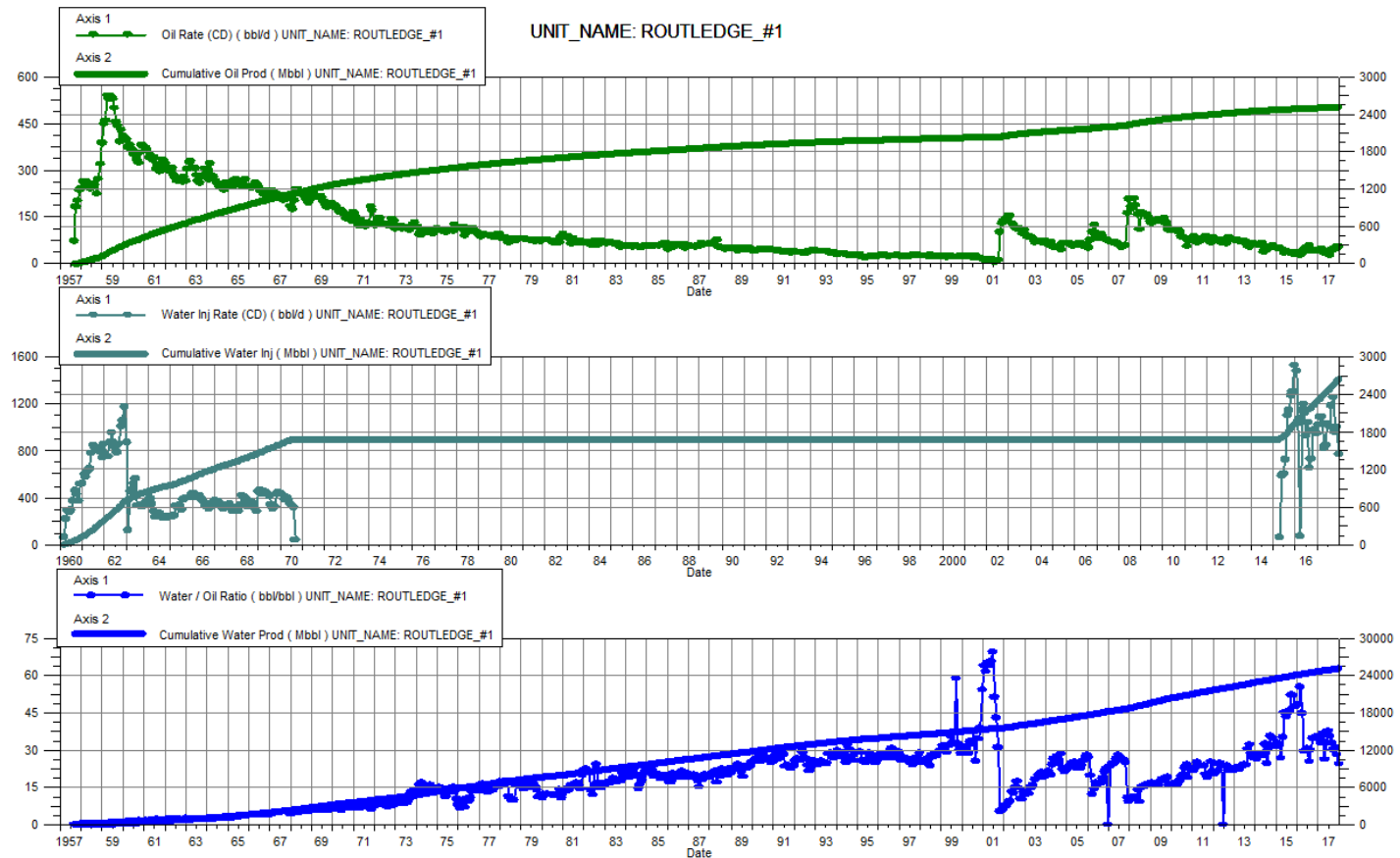
Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio	Water Inj Pressure kPa
1-31-2017	39.52	2608.43	1898.86	30328.44	2559.13	29737.59	48.05	1.32	0.90	4,631
2-28-2017	42.44	2609.62	1918.51	30382.16	2588.68	29810.07	45.21	1.32	0.90	4,719
3-31-2017	38.29	2610.81	1874.05	30440.26	2535.58	29888.68	48.94	1.33	0.90	4,601
4-30-2017	28.41	2611.66	1352.69	30480.84	1907.23	29945.89	47.62	1.38	0.90	4,378
5-31-2017	33.30	2612.69	1676.00	30532.79	2340.65	30018.45	50.33	1.37	0.90	4,378
6-30-2017	35.36	2613.75	1778.67	30586.15	2462.30	30092.32	50.30	1.36	0.91	4,378
7-31-2017	32.62	2614.76	1715.56	30639.34	2391.42	30166.46	52.60	1.37	0.91	4,378
8-31-2017	35.46	2615.86	1784.79	30694.67	2473.29	30243.13	50.34	1.36	0.91	4,378
9-30-2017	32.61	2616.84	1763.38	30747.57	2459.27	30316.91	54.07	1.37	0.91	4,378
10-31-2017	34.12	2617.90	1793.72	30803.17	2503.52	30394.52	52.57	1.37	0.91	4,378
11-30-2017	35.59	2618.97	1653.56	30852.78	2410.97	30466.85	46.46	1.43	0.91	4,378
12-31-2017	33.09	2619.99	1424.65	30896.94	2262.81	30536.99	43.05	1.55	0.91	4,378



Routledge Unit No. 1

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

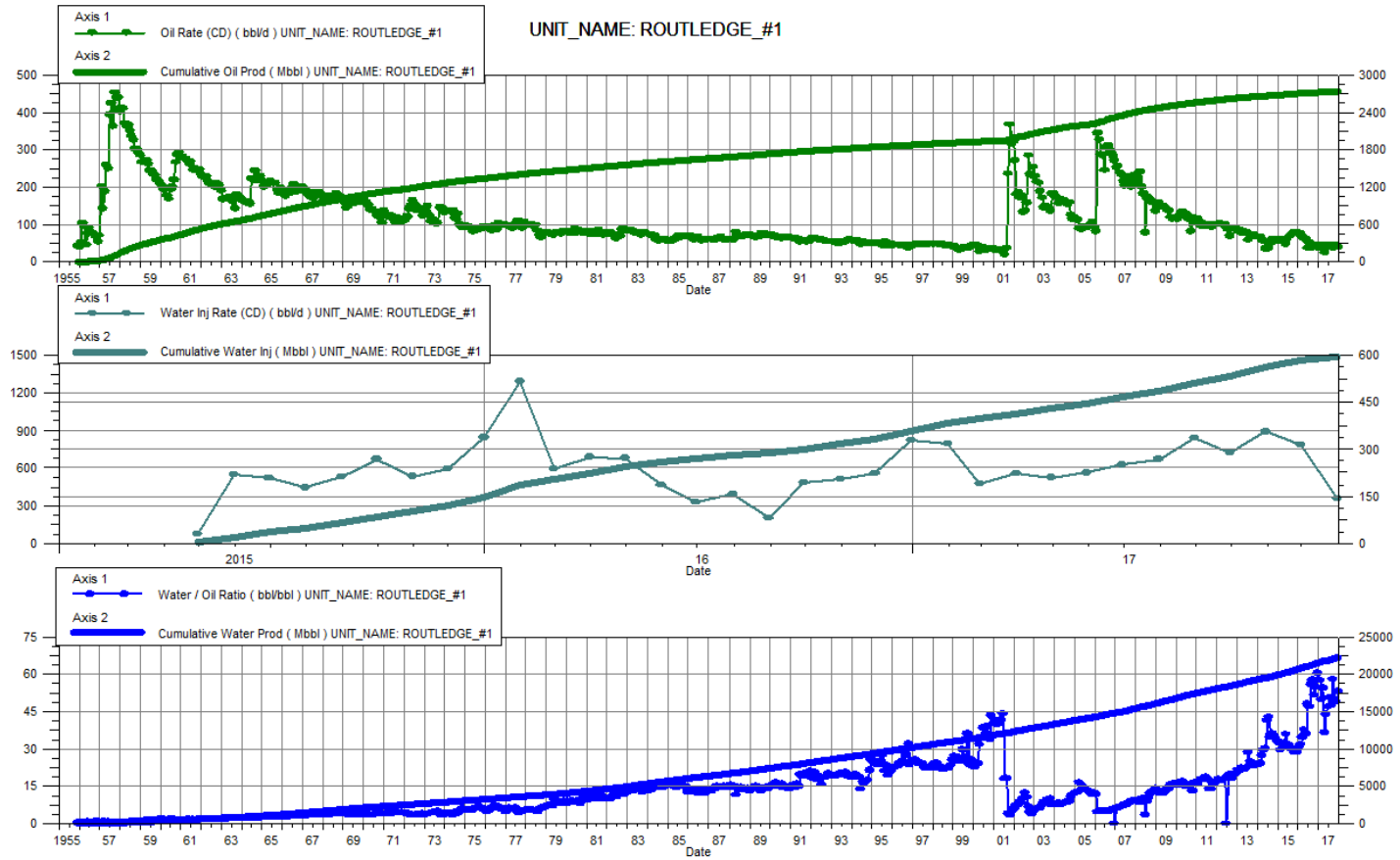
Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2017	7.15	399.29	244.73	3914.70	162.98	368.96	34.22	0.65	0.09	3,785.44
2-28-2017	7.45	399.50	243.39	3921.51	172.67	373.79	32.68	0.69	0.09	3,984.18
3-31-2017	6.56	399.71	240.40	3928.96	173.16	379.16	36.62	0.70	0.09	3,803.23
4-30-2017	5.90	399.88	155.26	3933.62	131.44	383.10	26.32	0.82	0.09	3,447.37
5-31-2017	5.77	400.06	190.60	3939.53	134.72	387.28	33.05	0.69	0.09	3,447.37
6-30-2017	6.10	400.25	229.63	3946.42	163.79	392.19	37.64	0.69	0.09	3,447.37
7-31-2017	4.59	400.39	163.27	3951.48	160.60	397.17	35.57	0.96	0.09	3,447.37
8-31-2017	6.80	400.60	223.77	3958.42	188.25	403.01	32.91	0.82	0.09	3,447.37
9-30-2017	7.94	400.84	238.95	3965.59	200.42	409.02	30.09	0.81	0.09	3,447.37
10-31-2017	7.73	401.08	240.04	3973.03	152.81	413.76	31.06	0.62	0.09	3,447.37
11-30-2017	8.67	401.34	242.41	3980.30	159.53	418.54	27.97	0.64	0.10	3,447.37
12-31-2017	8.83	401.61	215.04	3986.96	122.77	422.35	24.36	0.55	0.10	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
1-31-2017	6.38	434.21	366.48	3422.48	126.41	61.15	57.47	0.34	0.02	5,475.76
2-28-2017	7.34	434.41	364.11	3432.68	75.35	63.26	49.61	0.20	0.02	5,454.24
3-31-2017	6.47	434.61	351.53	3443.57	88.77	66.01	54.30	0.25	0.02	5,397.92
4-30-2017	4.01	434.73	146.58	3447.97	83.26	68.51	36.52	0.55	0.02	5,308.96
5-31-2017	6.04	434.92	264.21	3456.16	89.71	71.29	43.75	0.33	0.02	5,308.96
6-30-2017	7.54	435.15	352.99	3466.75	99.61	74.28	46.84	0.28	0.02	5,308.96
7-31-2017	6.87	435.36	346.41	3477.49	106.69	77.58	50.44	0.30	0.02	5,308.96
8-31-2017	7.47	435.59	353.38	3488.44	133.51	81.72	47.32	0.37	0.02	5,308.96
9-30-2017	6.08	435.77	351.94	3499.00	115.56	85.19	57.92	0.32	0.02	5,308.96
10-31-2017	7.13	436.00	350.81	3509.88	141.95	89.59	49.21	0.40	0.02	5,308.96
11-30-2017	7.11	436.21	347.39	3520.30	125.23	93.35	48.84	0.35	0.02	5,308.96
12-31-2017	6.55	436.41	346.64	3531.05	56.81	95.11	52.96	0.16	0.02	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
1-31-2017	6.41	202.92	289.99	2265.34	308.18	133.77	45.24	1.04	0.05	-
2-28-2017	6.81	203.11	297.74	2273.67	294.98	142.03	43.74	0.97	0.06	-
3-31-2017	6.65	203.32	291.14	2282.70	294.77	151.17	43.79	0.99	0.06	-
4-30-2017	4.93	203.47	169.51	2287.78	310.02	160.47	34.38	1.78	0.06	-
5-31-2017	5.50	203.64	262.65	2295.93	302.34	169.84	47.75	1.13	0.07	-
6-30-2017	5.54	203.80	287.10	2304.54	305.91	179.02	51.82	1.05	0.07	-
7-31-2017	5.42	203.97	278.46	2313.17	307.51	188.55	51.38	1.08	0.08	-
8-31-2017	5.27	204.13	280.61	2321.87	305.89	198.03	53.20	1.07	0.08	-
9-30-2017	4.63	204.27	275.47	2330.13	311.63	207.38	59.54	1.11	0.08	-
10-31-2017	4.33	204.41	278.48	2338.77	306.51	216.88	64.38	1.08	0.09	-
11-30-2017	4.34	204.54	275.38	2347.03	297.73	225.81	63.45	1.06	0.09	-
12-31-2017	4.75	204.69	287.36	2355.94	240.67	233.28	60.44	0.82	0.09	-

