30-015-33394

Cimarex Energy Company
White City 31 Fed #2

Completion Profiler

Completion Profile Analysis

Company	*Cimarex Energy Company*
Well Name	*White City 31 Fed #2*
Field	*White City*
Location	*Eddy County, New Mexico*
Customer Name	*Mike Karner*
Date of Survey	*June 7, 2017*
Date of Analysis	*June 9, 2017*
Logging Engineer	*Tyler Nixon*
Analyst	*Derrick George*

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Survey Objectives

- Identify gas producing intervals.
- Identify oil producing intervals.
- Identify the source of water production.
- Quantitative production profile.

Logging Procedures

Date	Time	Comment
06/07	07:30	Arrive on location
06/07	10:20	Gauge run start
06/07	11:40	Gauge run stop
06/07	12:53	Program Completion Profile String
06/07	13:10	Start GIH pass
06/07	13:53	Stop GIH pass
06/07	14:14	Start logging passes
06/07	17:18	Stop logging passes
06/07	17:19	Start out of well pass
06/07	17:48	Stop out of well pass
06/07	18:04	Start download
06/07	18:23	Stop download
06/07	19:30	Rig down

Interval Logged: [From 8,387 to 10,087 ft.]
30 ft/min
60 ft/min
90 ft/min

Well Information

Casing: 5.500" 17.0 lb/ft surface to 12,150 ft PBTD: 10,369 ft

Tubing: 2.875" 6.5 lb/ft surface to 8,332 ft

Perforations:

Perforation Data												
Stage 5 - Wolfcamp												
8,458	to	8,459	8,471	to	8,472	8,475	to	8,476	8,482	to	8,483	8,492	to	8,493
8,504	to	8,505	8,512	to	8,513	8,520	to	8,521	8,528	to	8,529	8,539	to	8,540
8,550	to	8,551	8,558	to	8,559	8,565	to	8,566	8,570	to	8,571	8,585	to	8,586
8,597	to	8,598	8,617	to	8,618	8,630	to	8,632	8,636	to	8,638	8,646	to	8,649
Stage 4 - Wolfcamp												
9,058	to	9,059	9,071	to	9,072	9,084	to	9,085	9,095	to	9,096	9,103	to	9,104
9,113	to	9,114	9,129	to	9,130	9,140	to	9,141	9,150	to	9,151	9,163	to	9,164
9,170	to	9,171	9,180	to	9,181	9,193	to	9,194	9,204	to	9,205	9,220	to	9,221
9,230	to	9,231	9,241	to	9,242	9,250	to	9,252	9,258	to	9,260	9,272	to	9,275
Stage 3 - Wolfcamp												
9,301	to	9,302	9,311	to	9,312	9,318	to	9,319	9,329	to	9,330	9,341	to	9,342
9,351	to	9,352	9,369	to	9,370	9,385	to	9,386	9,395	to	9,396	9,401	to	9,402
9,412	to	9,413	9,423	to	9,424	9,433	to	9,434	9,446	to	9,447	9,458	to	9,459
9,472	to	9,473	9,496	to	9,497	9,506	to	9,508	9,514	to	9,516	9,538	to	9,541
Stage 2 - Wolfcamp												
9,691	to	9,692	9,699	to	9,700	9,708	to	9,709	9,717	to	9,718	9,732	to	9,733
9,739	to	9,740	9,749	to	9,750	9,766	to	9,767	9,778	to	9,779	9,788	to	9,789
9,799	to	9,800	9,813	to	9,814	9,831	to	9,832	9,849	to	9,850	9,862	to	9,863
9,877	to	9,878	9,888	to	9,889	9,899	to	9,901	9,913	to	9,915	9,936	to	9,939
Stage 1 - Cisco Canyon												
9,967	to	9,968	9,984	to	9,985	10,000	to	10,001	10,014	to	10,015	10,026	to	10,027
10,035	to	10,036	10,043	to	10,044	10,050	to	10,051	10,066	to	10,067	10,076	to	10,077
10,083	to	10,084	10,095	to	10,096	10,107	to	10,108	10,116	to	10,117	10,126	to	10,127
10,136	to	10,137	10,150	to	10,151	10,164	to	10,166	10,170	to	10,172	10,181	to	10,184

Tool String

The 1 11/16" Completion Profiler string comprised the following sensors:

Battery housing; RS-232/CCL; Memory/CPU; Gamma Ray; Pressure/Temperature Combo; Centralizer; Induction Collar Locator; Fluid Density; Fluid Dielectric; Centralizer; Spinner Flowmeter.

Results

The following table summarizes the production from each frac stage.

MEASURED SURFACE RATES Flow Rates Reported at STP				
	Tubing	Gas	Oil	Water
	Psi	MCFD	BFPD	BFPD
Avg	640 psi	220 Mcf/d	120 bpd	922 bpd

GAS / OIL / WATER PRODUCTION PROFILE Flow Rates Reported at STP										
Zone Intervals	Q-Gas	Qp-Gas	Percent	Q-Oil	Qp-Oil	Percent	Q-Water	Qp-Water	Percent
feet	MCFD	MCFD	of Total	BFPD	BFPD	of Total	BFPD	BFPD	of Total
Surface to 8458	2026.0 Mcf/d		100.00 %	120.22 bpd		100.00 %	904.18 bpd		100.00 %
Stage 5 - Wolfcamp			41.59 %			41.59 %			68.24 %
8458 to 8649	2026.0 Mcf/d	842.7 Mcf/d		120.22 bpd	50.00 bpd		904.18 bpd	617.02 bpd	
Stage 4 - Wolfcamp			3.57 %			3.57 %			12.98 %
9058 to 9275	1183.3 Mcf/d	72.3 Mcf/d		70.22 bpd	4.29 bpd		287.15 bpd	117.40 bpd	
Stage 3 - Wolfcamp			11.33 %			11.33 %			7.57 %
9301 to 9541	1111.0 Mcf/d	229.6 Mcf/d		65.92 bpd	13.62 bpd		169.75 bpd	68.40 bpd	
Stage 2 - Wolfcamp			33.63 %			33.63 %			7.04 %
9691 to 9939	881.4 Mcf/d	681.3 Mcf/d		52.30 bpd	40.43 bpd		101.36 bpd	63.62 bpd	
Stage 1 - Cisco Canyon			8.73 %			8.73 %			3.52 %
9967 to 10084	200.1 Mcf/d	176.8 Mcf/d		11.87 bpd	10.49 bpd		37.74 bpd	31.84 bpd	
Flow Contribution from Below Log Depth			1.15 %			1.15 %			0.65 %
10087 to Below	23.3 Mcf/d		1.15 %	1.38 bpd		1.15 %	5.90 bpd		0.65 %

Completion Profile Analysis

The following table summarizes the production from each producing interval.

GAS / OIL / WATER PRODUCTION PROFILE Flow Rates Reported at STP										
Zone Intervals feet	Q-Gas MCFD	Qp-Gas MCFD	Percent of Total	Q-Oil BFPD	Qp-Oil BFPD	Percent of Total	Q-Water BFPD	Qp-Water BFPD	Percent of Total
Surface to 8458	2026.0 Mcf/d		100.00 %	120.22 bpd		100.00 %	904.18 bpd		100.00 %
Stage 5 - Wolfcamp			41.59 %			41.59 %			68.24 %
8458 to 8459	2026.0 Mcf/d	19.5 Mcf/d	0.96 %	120.22 bpd	1.15 bpd	0.96 %	904.18 bpd	28.55 bpd	3.16 %
8471 to 8472	2006.5 Mcf/d	13.0 Mcf/d	0.64 %	119.06 bpd	0.77 bpd	0.64 %	875.63 bpd	6.59 bpd	0.73 %
8475 to 8476	1993.5 Mcf/d	4.3 Mcf/d	0.21 %	118.29 bpd	0.25 bpd	0.21 %	869.04 bpd	4.39 bpd	0.49 %
8482 to 8483	1989.3 Mcf/d	177.4 Mcf/d	8.76 %	118.04 bpd	10.53 bpd	8.76 %	864.65 bpd	166.88 bpd	18.46 %
8492 to 8493	1811.9 Mcf/d	140.8 Mcf/d	6.95 %	107.51 bpd	8.36 bpd	6.95 %	697.77 bpd	24.15 bpd	2.67 %
8504 to 8505	1671.0 Mcf/d	3.4 Mcf/d	0.17 %	99.16 bpd	0.20 bpd	0.17 %	673.62 bpd	10.98 bpd	1.21 %
8512 to 8513	1667.7 Mcf/d	0.8 Mcf/d	0.04 %	98.96 bpd	0.05 bpd	0.04 %	662.64 bpd	10.98 bpd	1.21 %
8520 to 8521	1666.9 Mcf/d	2.0 Mcf/d	0.10 %	98.91 bpd	0.12 bpd	0.10 %	651.66 bpd	10.98 bpd	1.21 %
8528 to 8529	1664.9 Mcf/d	55.2 Mcf/d	2.72 %	98.79 bpd	3.27 bpd	2.72 %	640.68 bpd	57.09 bpd	6.31 %
8539 to 8540	1609.8 Mcf/d	324.5 Mcf/d	16.02 %	95.52 bpd	19.25 bpd	16.02 %	583.59 bpd	136.14 bpd	15.06 %
8550 to 8551	1285.3 Mcf/d	85.8 Mcf/d	4.24 %	76.26 bpd	5.09 bpd	4.24 %	447.45 bpd	79.05 bpd	8.74 %
8558 to 8559	1199.4 Mcf/d	1.8 Mcf/d	0.09 %	71.17 bpd	0.10 bpd	0.09 %	368.40 bpd	15.37 bpd	1.70 %
8565 to 8566	1197.7 Mcf/d	1.8 Mcf/d	0.09 %	71.07 bpd	0.11 bpd	0.09 %	353.03 bpd	2.20 bpd	0.24 %
8570 to 8571	1195.9 Mcf/d	1.8 Mcf/d	0.09 %	70.96 bpd	0.11 bpd	0.09 %	350.83 bpd	8.78 bpd	0.97 %
8585 to 8586	1194.1 Mcf/d	1.8 Mcf/d	0.09 %	70.85 bpd	0.11 bpd	0.09 %	342.05 bpd	4.39 bpd	0.49 %
8597 to 8598	1192.3 Mcf/d	1.8 Mcf/d	0.09 %	70.75 bpd	0.11 bpd	0.09 %	337.65 bpd	4.39 bpd	0.49 %
8617 to 8618	1190.5 Mcf/d	1.8 Mcf/d	0.09 %	70.64 bpd	0.11 bpd	0.09 %	333.26 bpd	13.18 bpd	1.46 %
8630 to 8632	1188.7 Mcf/d	1.8 Mcf/d	0.09 %	70.53 bpd	0.11 bpd	0.09 %	320.09 bpd	4.39 bpd	0.49 %
8636 to 8638	1186.9 Mcf/d	1.8 Mcf/d	0.09 %	70.43 bpd	0.11 bpd	0.09 %	315.70 bpd	13.18 bpd	1.46 %
8646 to 8649	1185.1 Mcf/d	1.8 Mcf/d	0.09 %	70.32 bpd	0.11 bpd	0.09 %	302.52 bpd	15.37 bpd	1.70 %
Stage 4 - Wolfcamp			3.57 %			3.57 %			12.99 %
9058 to 9059	1183.3 Mcf/d	11.0 Mcf/d	0.54 %	70.22 bpd	0.65 bpd	0.54 %	287.15 bpd	20.78 bpd	2.30 %
9071 to 9072	1172.4 Mcf/d	1.8 Mcf/d	0.09 %	69.57 bpd	0.11 bpd	0.09 %	266.37 bpd	4.13 bpd	0.46 %
9084 to 9085	1170.6 Mcf/d	1.8 Mcf/d	0.09 %	69.46 bpd	0.10 bpd	0.09 %	262.24 bpd	1.77 bpd	0.20 %
9095 to 9096	1168.8 Mcf/d	1.8 Mcf/d	0.09 %	69.35 bpd	0.11 bpd	0.09 %	260.48 bpd	1.77 bpd	0.20 %
9103 to 9104	1167.0 Mcf/d	20.0 Mcf/d	0.99 %	69.25 bpd	1.19 bpd	0.99 %	258.71 bpd	2.36 bpd	0.26 %
9113 to 9114	1147.0 Mcf/d	1.8 Mcf/d	0.09 %	68.06 bpd	0.10 bpd	0.09 %	256.35 bpd	16.29 bpd	1.80 %
9129 to 9130	1145.3 Mcf/d	1.8 Mcf/d	0.09 %	67.96 bpd	0.11 bpd	0.09 %	240.06 bpd	3.54 bpd	0.39 %
9140 to 9141	1143.5 Mcf/d	1.8 Mcf/d	0.09 %	67.85 bpd	0.11 bpd	0.09 %	236.52 bpd	2.95 bpd	0.33 %
9150 to 9151	1141.7 Mcf/d	10.9 Mcf/d	0.54 %	67.75 bpd	0.65 bpd	0.54 %	233.58 bpd	21.96 bpd	2.43 %
9163 to 9164	1130.8 Mcf/d	1.8 Mcf/d	0.09 %	67.10 bpd	0.11 bpd	0.09 %	211.62 bpd	7.08 bpd	0.78 %
9170 to 9171	1129.0 Mcf/d	1.8 Mcf/d	0.09 %	66.99 bpd	0.10 bpd	0.09 %	204.54 bpd	5.31 bpd	0.59 %
9180 to 9181	1127.3 Mcf/d	1.8 Mcf/d	0.09 %	66.89 bpd	0.11 bpd	0.09 %	199.24 bpd	6.49 bpd	0.72 %
9193 to 9194	1125.5 Mcf/d	1.8 Mcf/d	0.09 %	66.78 bpd	0.11 bpd	0.09 %	192.75 bpd	4.72 bpd	0.52 %
9204 to 9205	1123.6 Mcf/d	1.8 Mcf/d	0.09 %	66.67 bpd	0.11 bpd	0.09 %	188.03 bpd	2.36 bpd	0.26 %
9220 to 9221	1121.8 Mcf/d	1.8 Mcf/d	0.09 %	66.57 bpd	0.10 bpd	0.09 %	185.67 bpd	2.95 bpd	0.33 %
9230 to 9231	1120.1 Mcf/d	1.8 Mcf/d	0.09 %	66.46 bpd	0.11 bpd	0.09 %	182.73 bpd	1.77 bpd	0.20 %
9241 to 9242	1118.2 Mcf/d	1.8 Mcf/d	0.09 %	66.35 bpd	0.11 bpd	0.09 %	180.96 bpd	2.36 bpd	0.26 %
9250 to 9252	1116.4 Mcf/d	1.8 Mcf/d	0.09 %	66.25 bpd	0.11 bpd	0.09 %	178.60 bpd	1.77 bpd	0.20 %
9258 to 9260	1114.6 Mcf/d	1.8 Mcf/d	0.09 %	66.14 bpd	0.11 bpd	0.09 %	176.83 bpd	2.36 bpd	0.26 %
9272 to 9275	1112.8 Mcf/d	1.8 Mcf/d	0.09 %	66.03 bpd	0.11 bpd	0.09 %	174.47 bpd	4.72 bpd	0.52 %

Stage 3 - Wolfcamp					11.33 %			11.33 %			7.57 %
9301	to 9302	1111.0 Mcf/d	1.8 Mcf/d	0.09 %	65.92 bpd	0.11 bpd	0.09 %	169.75 bpd	3.54 bpd	0.39 %
9311	to 9312	1109.2 Mcf/d	1.8 Mcf/d	0.09 %	65.82 bpd	0.11 bpd	0.09 %	166.22 bpd	3.54 bpd	0.39 %
9318	to 9319	1107.4 Mcf/d	1.8 Mcf/d	0.09 %	65.71 bpd	0.10 bpd	0.09 %	162.68 bpd	3.54 bpd	0.39 %
9329	to 9330	1105.6 Mcf/d	1.7 Mcf/d	0.09 %	65.61 bpd	0.10 bpd	0.09 %	159.14 bpd	4.72 bpd	0.52 %
9341	to 9342	1103.9 Mcf/d	1.8 Mcf/d	0.09 %	65.50 bpd	0.11 bpd	0.09 %	154.42 bpd	3.54 bpd	0.39 %
9351	to 9352	1102.1 Mcf/d	1.8 Mcf/d	0.09 %	65.40 bpd	0.10 bpd	0.09 %	150.89 bpd	4.72 bpd	0.52 %
9369	to 9370	1100.4 Mcf/d	1.8 Mcf/d	0.09 %	65.29 bpd	0.11 bpd	0.09 %	146.17 bpd	4.13 bpd	0.46 %
9385	to 9386	1098.5 Mcf/d	1.8 Mcf/d	0.09 %	65.18 bpd	0.11 bpd	0.09 %	142.04 bpd	2.36 bpd	0.26 %
9395	to 9396	1096.7 Mcf/d	1.8 Mcf/d	0.09 %	65.08 bpd	0.11 bpd	0.09 %	139.68 bpd	2.36 bpd	0.26 %
9401	to 9402	1094.9 Mcf/d	1.8 Mcf/d	0.09 %	64.97 bpd	0.10 bpd	0.09 %	137.32 bpd	2.36 bpd	0.26 %
9412	to 9413	1093.2 Mcf/d	1.8 Mcf/d	0.09 %	64.87 bpd	0.11 bpd	0.09 %	134.97 bpd	7.08 bpd	0.78 %
9423	to 9424	1091.3 Mcf/d	1.1 Mcf/d	0.05 %	64.76 bpd	0.07 bpd	0.05 %	127.89 bpd	2.36 bpd	0.26 %
9433	to 9434	1090.2 Mcf/d	0.7 Mcf/d	0.04 %	64.69 bpd	0.04 bpd	0.04 %	125.53 bpd	3.54 bpd	0.39 %
9446	to 9447	1089.5 Mcf/d	116.3 Mcf/d	5.74 %	64.65 bpd	6.90 bpd	5.74 %	121.99 bpd	4.13 bpd	0.46 %
9458	to 9459	973.2 Mcf/d	6.1 Mcf/d	0.30 %	57.75 bpd	0.36 bpd	0.30 %	117.87 bpd	4.72 bpd	0.52 %
9472	to 9473	967.1 Mcf/d	49.0 Mcf/d	2.42 %	57.39 bpd	2.91 bpd	2.42 %	113.15 bpd	4.72 bpd	0.52 %
9496	to 9497	918.1 Mcf/d	6.3 Mcf/d	0.31 %	54.48 bpd	0.37 bpd	0.31 %	108.43 bpd	1.77 bpd	0.20 %
9506	to 9508	911.8 Mcf/d	6.2 Mcf/d	0.31 %	54.11 bpd	0.37 bpd	0.31 %	106.66 bpd	1.18 bpd	0.13 %
9514	to 9516	905.7 Mcf/d	18.7 Mcf/d	0.92 %	53.74 bpd	1.11 bpd	0.92 %	105.48 bpd	2.36 bpd	0.26 %
9538	to 9541	886.9 Mcf/d	5.5 Mcf/d	0.27 %	52.63 bpd	0.33 bpd	0.27 %	103.13 bpd	1.77 bpd	0.20 %
Stage 2 - Wolfcamp				33.63 %			33.63 %			7.04 %
9691	to 9692	881.4 Mcf/d	66.6 Mcf/d	3.29 %	52.30 bpd	3.95 bpd	3.29 %	101.36 bpd	8.25 bpd	0.91 %
9699	to 9700	814.8 Mcf/d	26.6 Mcf/d	1.32 %	48.35 bpd	1.58 bpd	1.32 %	93.10 bpd	7.08 bpd	0.78 %
9708	to 9709	788.2 Mcf/d	17.8 Mcf/d	0.88 %	46.77 bpd	1.05 bpd	0.88 %	86.03 bpd	2.95 bpd	0.33 %
9717	to 9718	770.4 Mcf/d	64.4 Mcf/d	3.18 %	45.72 bpd	3.82 bpd	3.18 %	83.08 bpd	7.61 bpd	0.84 %
9732	to 9733	706.1 Mcf/d	15.9 Mcf/d	0.79 %	41.90 bpd	1.05 bpd	0.88 %	75.47 bpd	2.95 bpd	0.33 %
9739	to 9740	690.1 Mcf/d	6.6 Mcf/d	0.32 %	40.84 bpd	0.26 bpd	0.22 %	72.52 bpd	1.18 bpd	0.13 %
9749	to 9750	683.6 Mcf/d	1.9 Mcf/d	0.09 %	40.58 bpd	0.26 bpd	0.22 %	71.35 bpd	1.77 bpd	0.20 %
9766	to 9767	681.7 Mcf/d	90.8 Mcf/d	4.48 %	40.32 bpd	2.22 bpd	1.84 %	69.58 bpd	4.72 bpd	0.52 %
9778	to 9779	590.9 Mcf/d	23.4 Mcf/d	1.16 %	38.10 bpd	1.64 bpd	1.36 %	64.86 bpd	2.36 bpd	0.26 %
9788	to 9789	567.5 Mcf/d	50.6 Mcf/d	2.50 %	36.46 bpd	1.87 bpd	1.56 %	62.50 bpd	3.54 bpd	0.39 %
9799	to 9800	516.9 Mcf/d	26.2 Mcf/d	1.29 %	34.59 bpd	1.66 bpd	1.38 %	58.96 bpd	1.18 bpd	0.13 %
9813	to 9814	490.7 Mcf/d	153.6 Mcf/d	7.58 %	32.93 bpd	2.76 bpd	2.29 %	57.78 bpd	1.77 bpd	0.20 %
9831	to 9832	337.1 Mcf/d	20.2 Mcf/d	1.00 %	30.17 bpd	11.37 bpd	9.46 %	56.01 bpd	1.77 bpd	0.20 %
9849	to 9850	316.9 Mcf/d	12.0 Mcf/d	0.59 %	18.81 bpd	0.71 bpd	0.59 %	54.25 bpd	4.13 bpd	0.46 %
9862	to 9863	304.9 Mcf/d	19.2 Mcf/d	0.95 %	18.09 bpd	1.14 bpd	0.95 %	50.12 bpd	1.18 bpd	0.13 %
9877	to 9878	285.8 Mcf/d	15.9 Mcf/d	0.78 %	16.96 bpd	0.94 bpd	0.78 %	48.94 bpd	1.77 bpd	0.20 %
9888	to 9889	269.9 Mcf/d	17.7 Mcf/d	0.88 %	16.02 bpd	1.05 bpd	0.88 %	47.17 bpd	2.36 bpd	0.26 %
9899	to 9901	252.2 Mcf/d	14.3 Mcf/d	0.71 %	14.96 bpd	0.85 bpd	0.71 %	44.81 bpd	2.36 bpd	0.26 %
9913	to 9915	237.8 Mcf/d	18.6 Mcf/d	0.92 %	14.11 bpd	1.11 bpd	0.92 %	42.45 bpd	1.77 bpd	0.20 %
9936	to 9939	219.2 Mcf/d	19.1 Mcf/d	0.94 %	13.01 bpd	1.13 bpd	0.94 %	40.68 bpd	2.95 bpd	0.33 %

Stage 1 - Cisco Canyon				**8.73 %**			**8.72 %**			**3.52 %**
9967 to **9968**	200.1 Mcf/d	17.4 Mcf/d	**0.86 %**	11.87 bpd	1.03 bpd	**0.86 %**	37.74 bpd	4.72 bpd	**0.52 %**
9984 to **9985**	182.7 Mcf/d	17.5 Mcf/d	**0.86 %**	10.84 bpd	1.04 bpd	**0.86 %**	33.02 bpd	2.95 bpd	**0.33 %**
10000 to **10001**	165.2 Mcf/d	17.7 Mcf/d	**0.87 %**	9.80 bpd	1.05 bpd	**0.87 %**	30.07 bpd	4.13 bpd	**0.46 %**
10014 to **10015**	147.6 Mcf/d	17.0 Mcf/d	**0.84 %**	8.76 bpd	1.01 bpd	**0.84 %**	25.94 bpd	2.36 bpd	**0.26 %**
10026 to **10027**	130.5 Mcf/d	17.4 Mcf/d	**0.86 %**	7.75 bpd	1.03 bpd	**0.86 %**	23.59 bpd	1.18 bpd	**0.13 %**
10035 to **10036**	113.2 Mcf/d	20.0 Mcf/d	**0.99 %**	6.71 bpd	1.19 bpd	**0.99 %**	22.41 bpd	1.77 bpd	**0.20 %**
10043 to **10044**	93.1 Mcf/d	20.4 Mcf/d	**1.01 %**	5.53 bpd	1.21 bpd	**1.01 %**	20.64 bpd	5.31 bpd	**0.59 %**
10050 to **10051**	72.8 Mcf/d	14.1 Mcf/d	**0.70 %**	4.32 bpd	0.84 bpd	**0.70 %**	15.33 bpd	2.95 bpd	**0.33 %**
10066 to **10067**	58.6 Mcf/d	22.0 Mcf/d	**1.09 %**	3.48 bpd	1.30 bpd	**1.09 %**	12.38 bpd	2.36 bpd	**0.26 %**
10076 to **10077**	36.7 Mcf/d	11.0 Mcf/d	**0.54 %**	2.18 bpd	0.65 bpd	**0.54 %**	10.02 bpd	1.77 bpd	**0.20 %**
10083 to **10084**	25.7 Mcf/d	2.4 Mcf/d	**0.12 %**	1.52 bpd	0.14 bpd	**0.12 %**	8.25 bpd	2.36 bpd	**0.26 %**
Flow Contribution from Below Log Depth			**1.15 %**			**1.15 %**			**0.65 %**
10087 to **Below**	23.3 Mcf/d		**1.15 %**	1.38 bpd		**1.15 %**	5.90 bpd		**0.65 %**

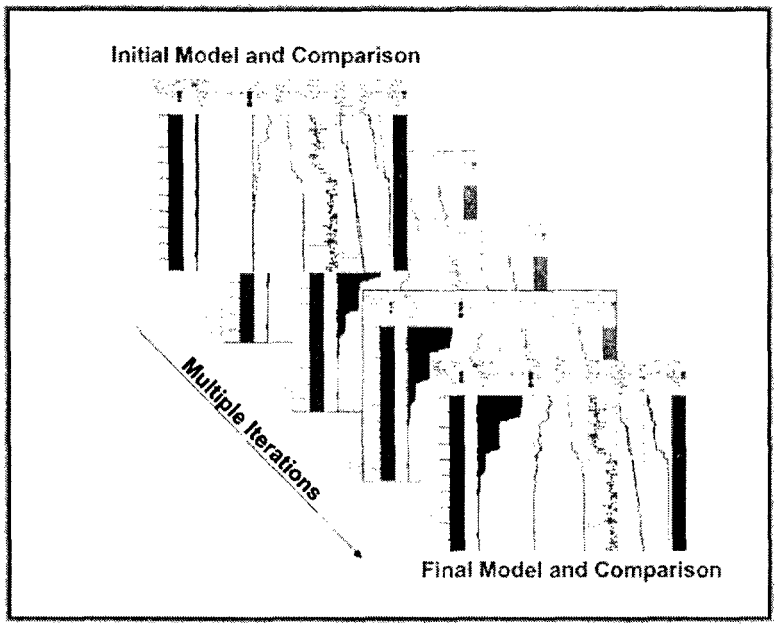
Analysis Summary

1. The perforations below 10,087 feet were not logged due to wellbore restrictions. Total production from these intervals was calculated based on the data below the 9,967 - 10,084 feet perforations.

2. The analysis was conducted as 3-phase. The oil production of 120 BOPD is too low to accurately quantify. The downhole oil rate, at 100% flow, accounts for approximately 4% of the total mass flow and about 3.5% of the total volumetric rate, assuming free gas entry and solution gas breaking out downhole. The GOR is assumed to be even across all zones.

Brief Description of Process

The analysis is performed using a global stochastic optimization technique.
In this technique an initial flow model is estimated. Then from this model the theoretical log responses are derived. The theoretical responses are compared to all available data and the model is adjusted until the best possible match of the theoretical and actual data is obtained.



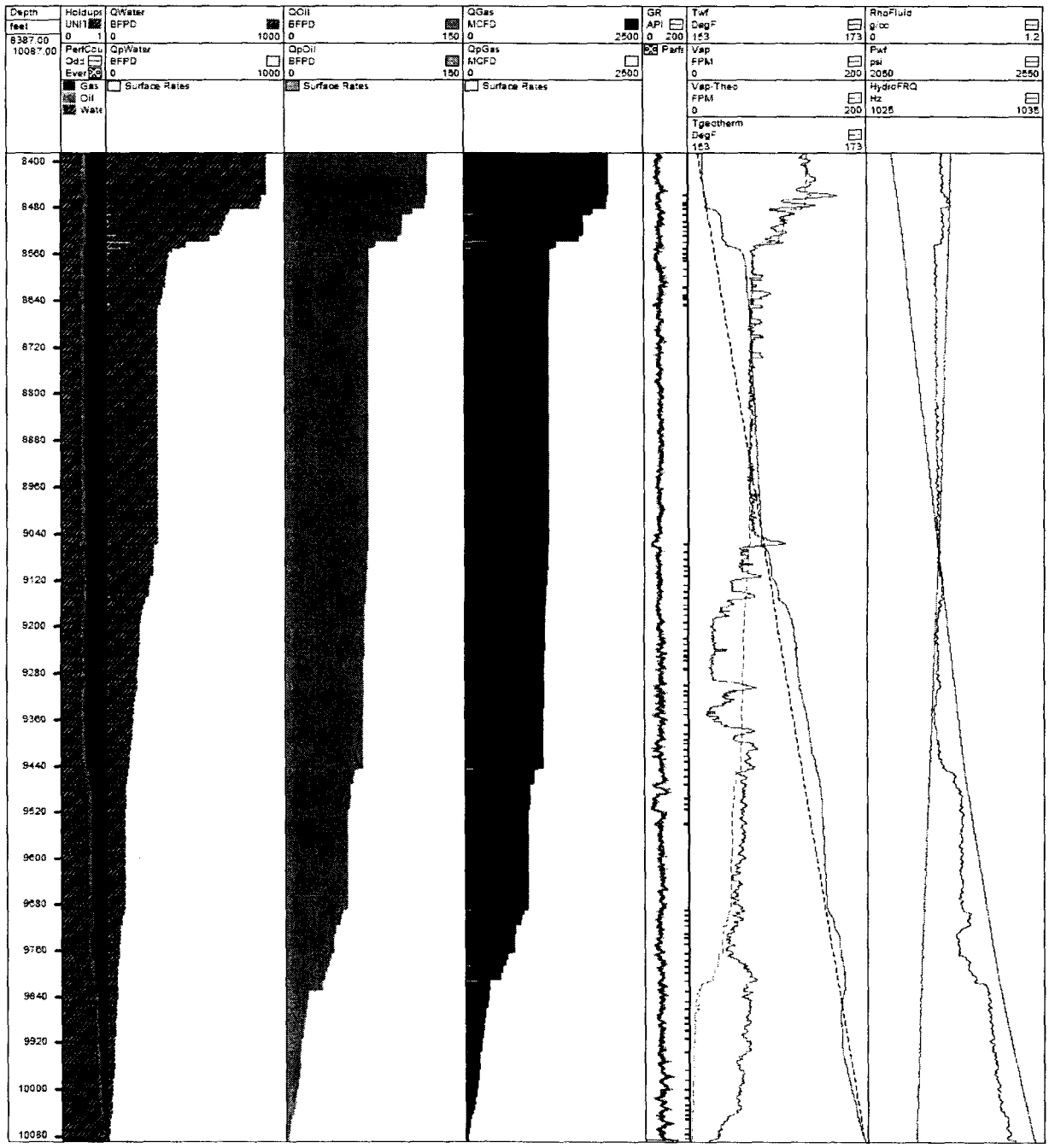
A comparison between the model responses and the recorded data is shown in this report. Good correlation between the theoretical and log data curves indicates that the flow model is in agreement with the log data and the actual well production profile. Discrepancies between the theoretical and raw data curves can be due to tool deficiencies, conflicts between the parameters or conditions that make the underlying empirical models (such as flow regimes) less applicable.

- The flow regimes were determined, directly from the flow rates and holdups, according to the Dukler-Taitel analytic model.
- The profile factors, to calculate the average effective fluid velocity from the apparent velocity, were based on the Reynolds number, calculated from the phase velocities and phase properties.
- Where gas was present the density, heat capacity and Joule-Thompson coefficients were derived from the Lee Kesler Pitzer equation of states.
- Solution gas in oil was derived from the Vasquez and Beggs or Ostein Glas0 correlation.

The analysis was performed in five steps:

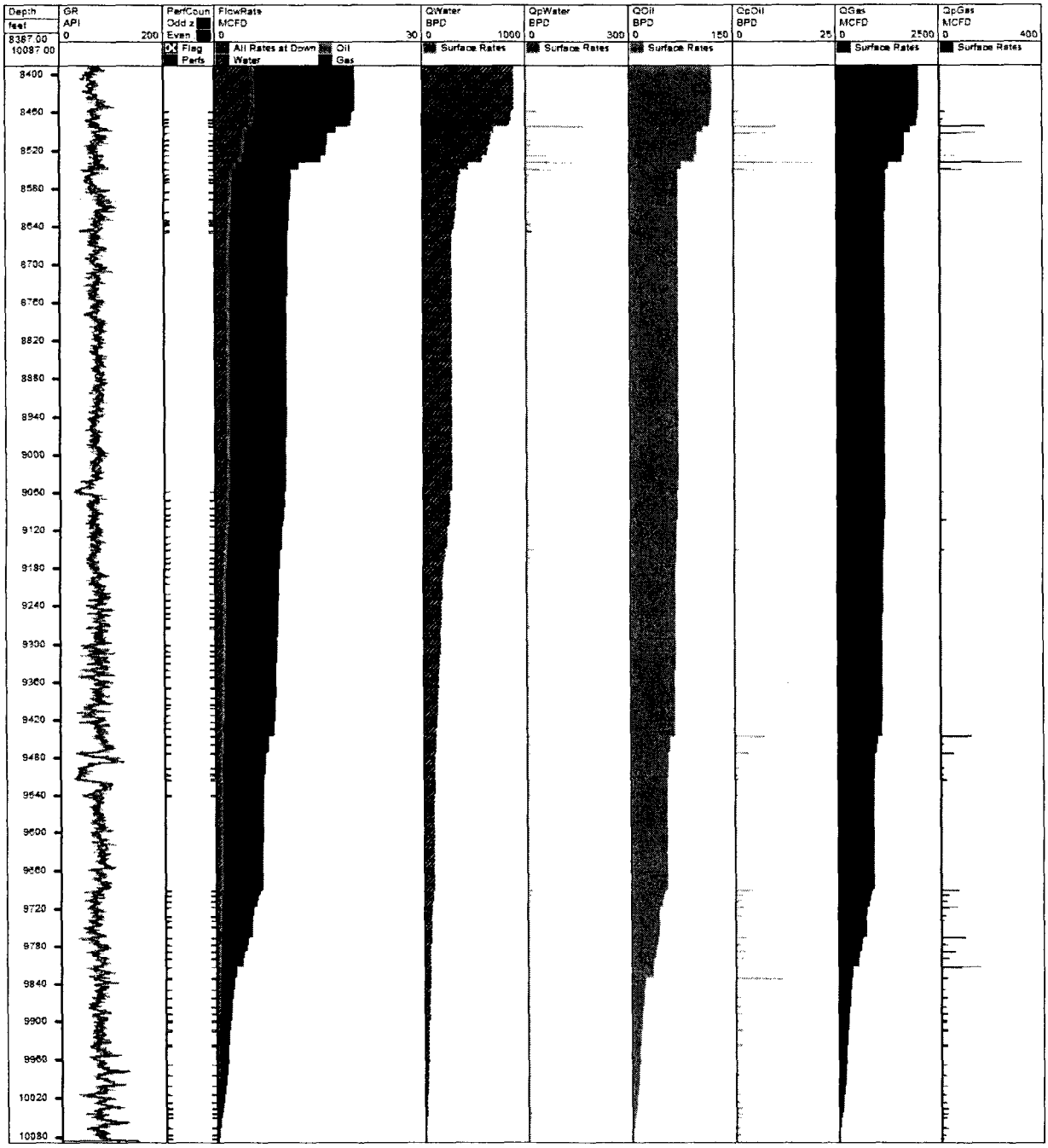
- The data preparation to filter the data, compute gradients and error estimates.
- The flow meter analysis to compute the apparent velocity.
- The profile determination to identify the potential producing and/or injecting zones.
- The computation of the flow rates (model) by global optimization.
- The computation of surface production rates and reporting

Model Results With Recorded Data



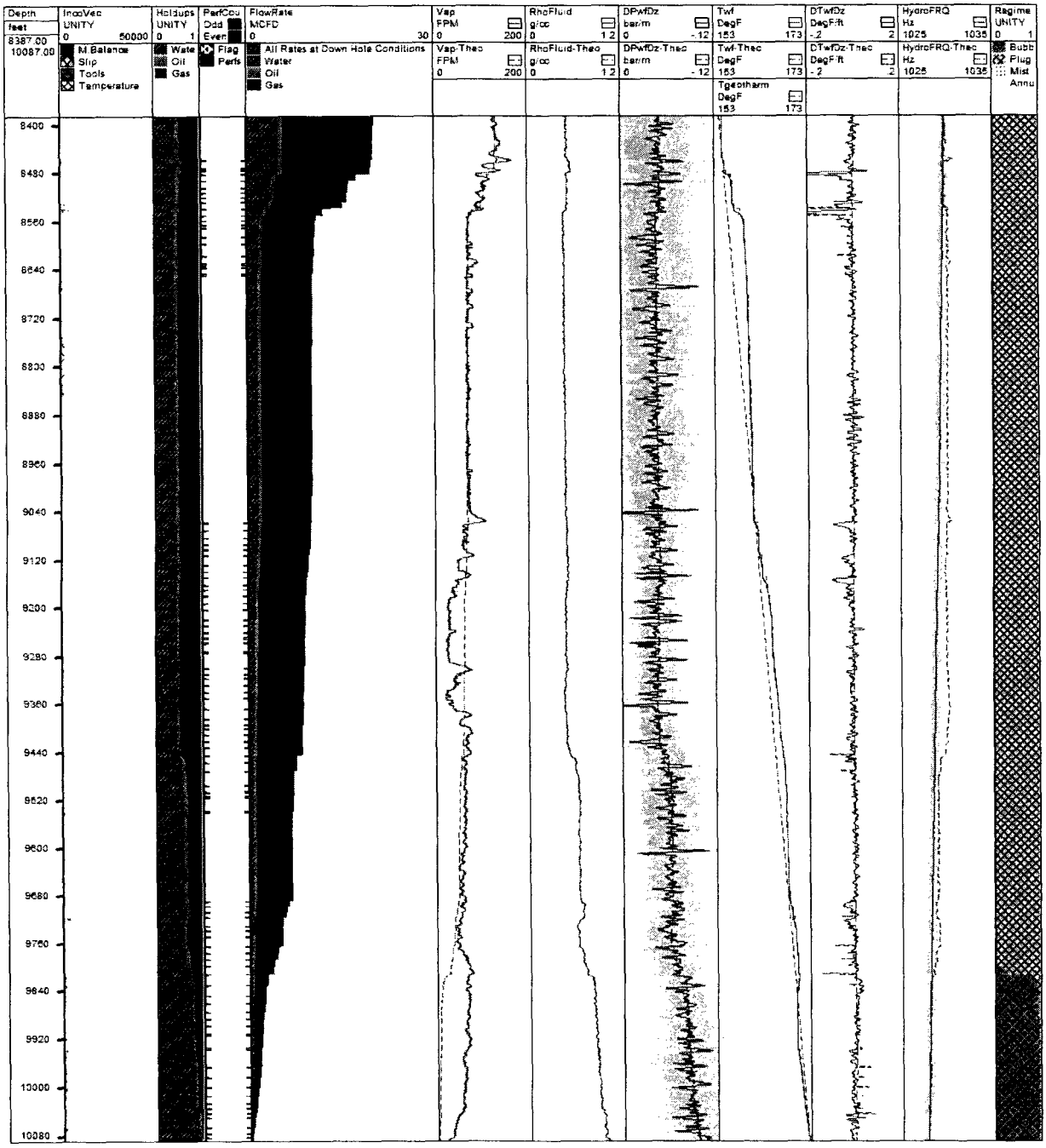
Completion Profile Analysis

Production Rates At Surface Conditions



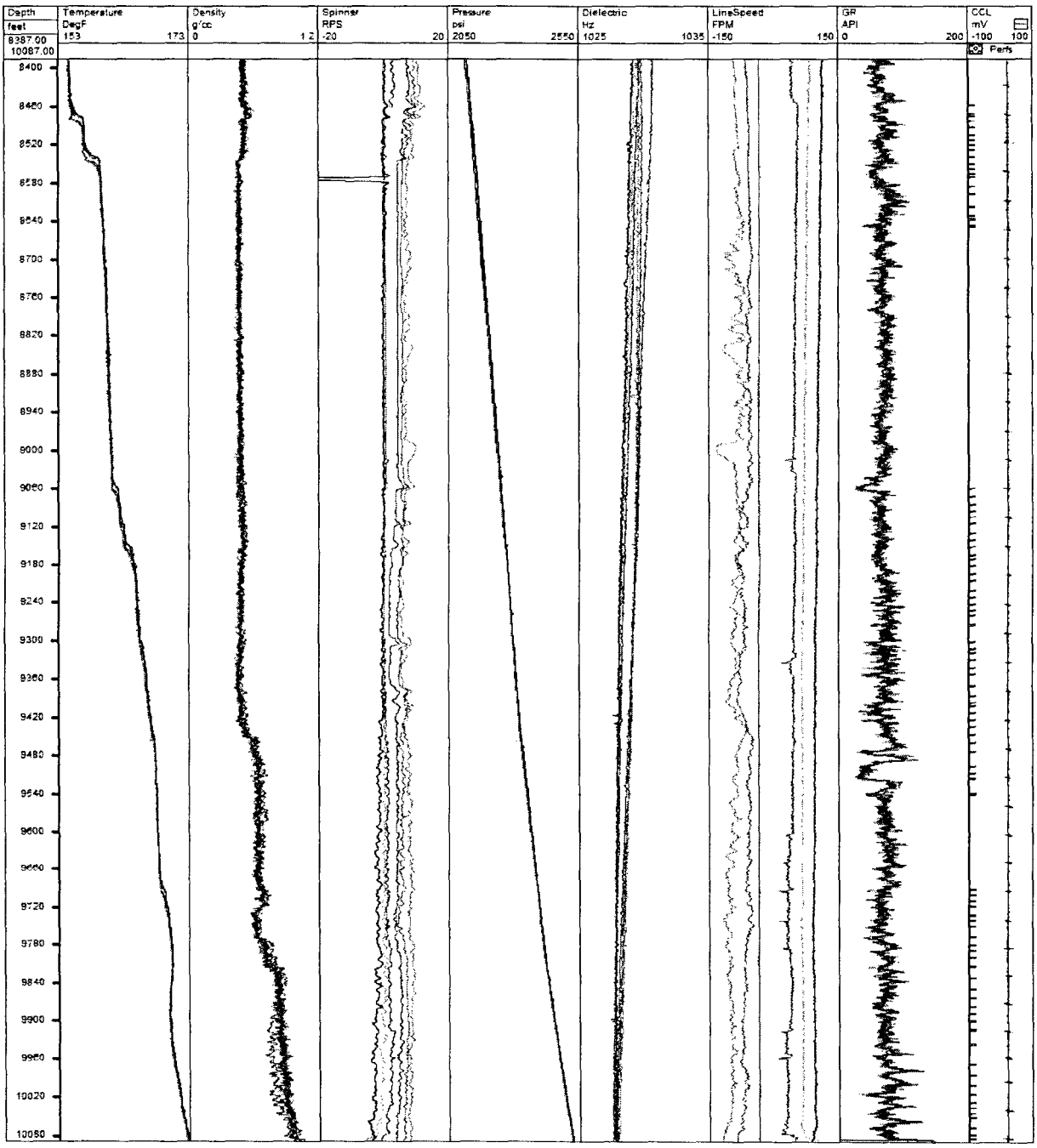
Completion Profile Analysis

Flow Model at Downhole Conditions With Comparison of Theoretical Response to Recorded Data



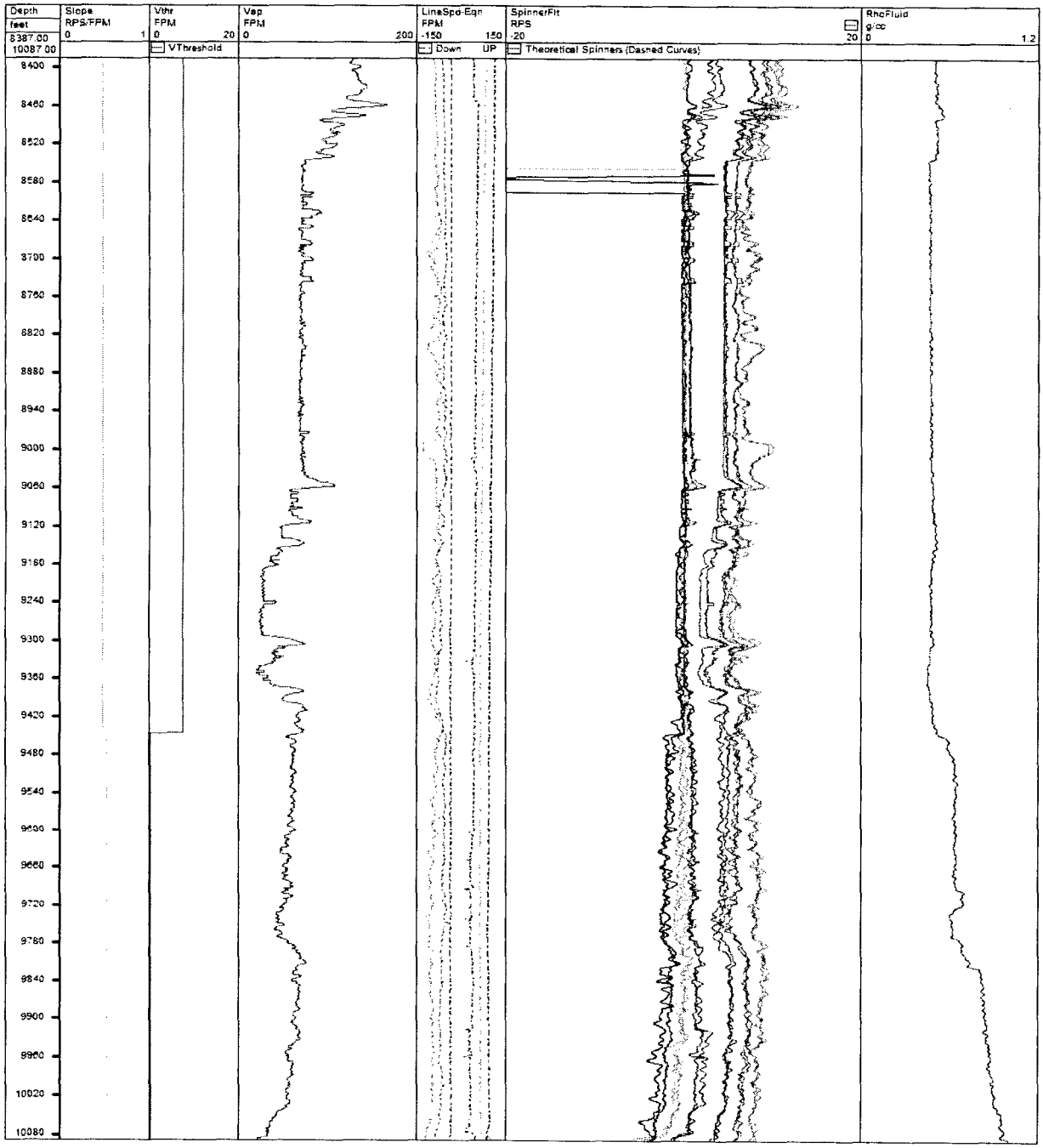
Completion Profile Analysis

Overlay of all Log Data

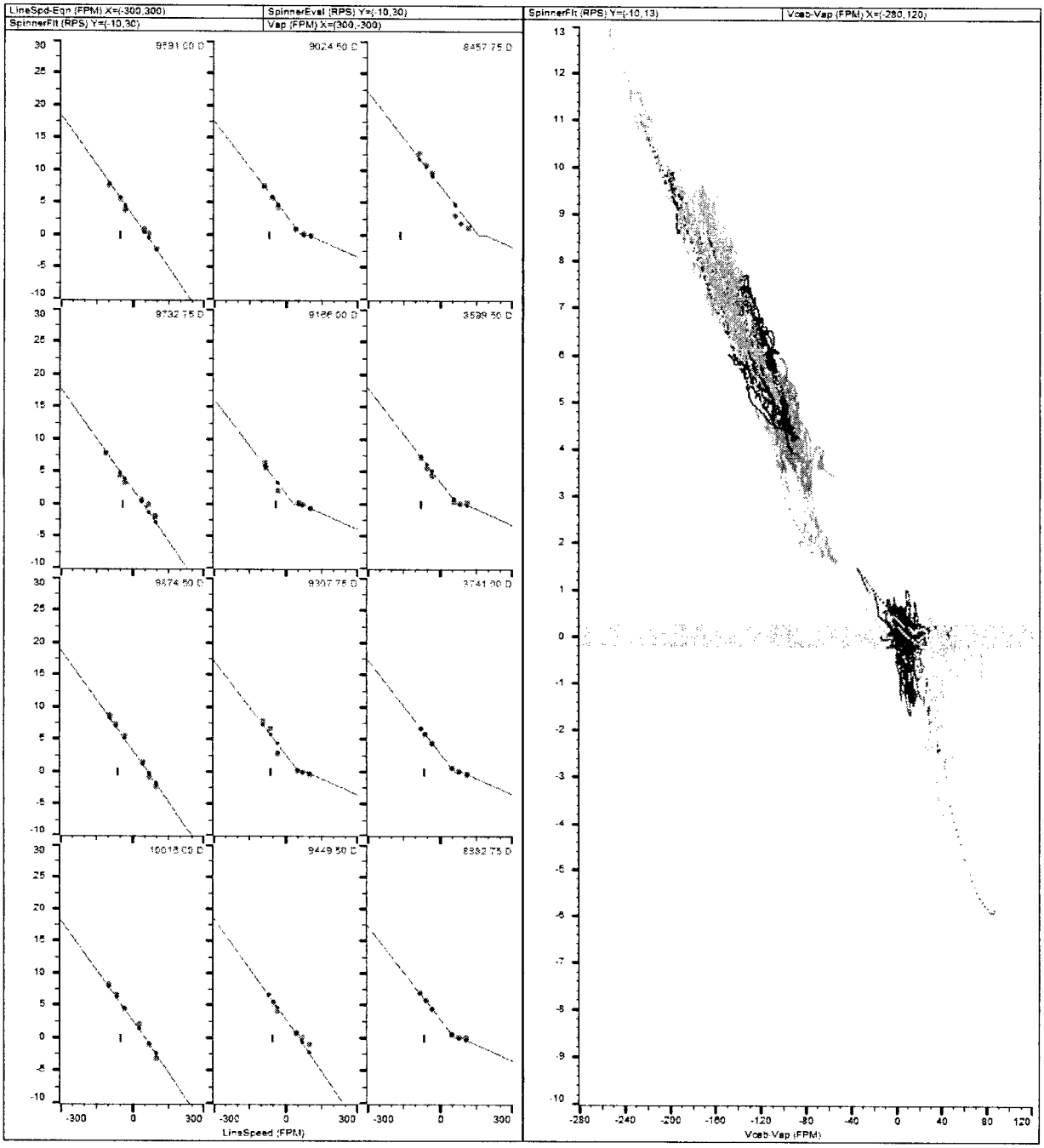


Completion Profile Analysis

Apparent Fluid Velocity Derived from Spinner

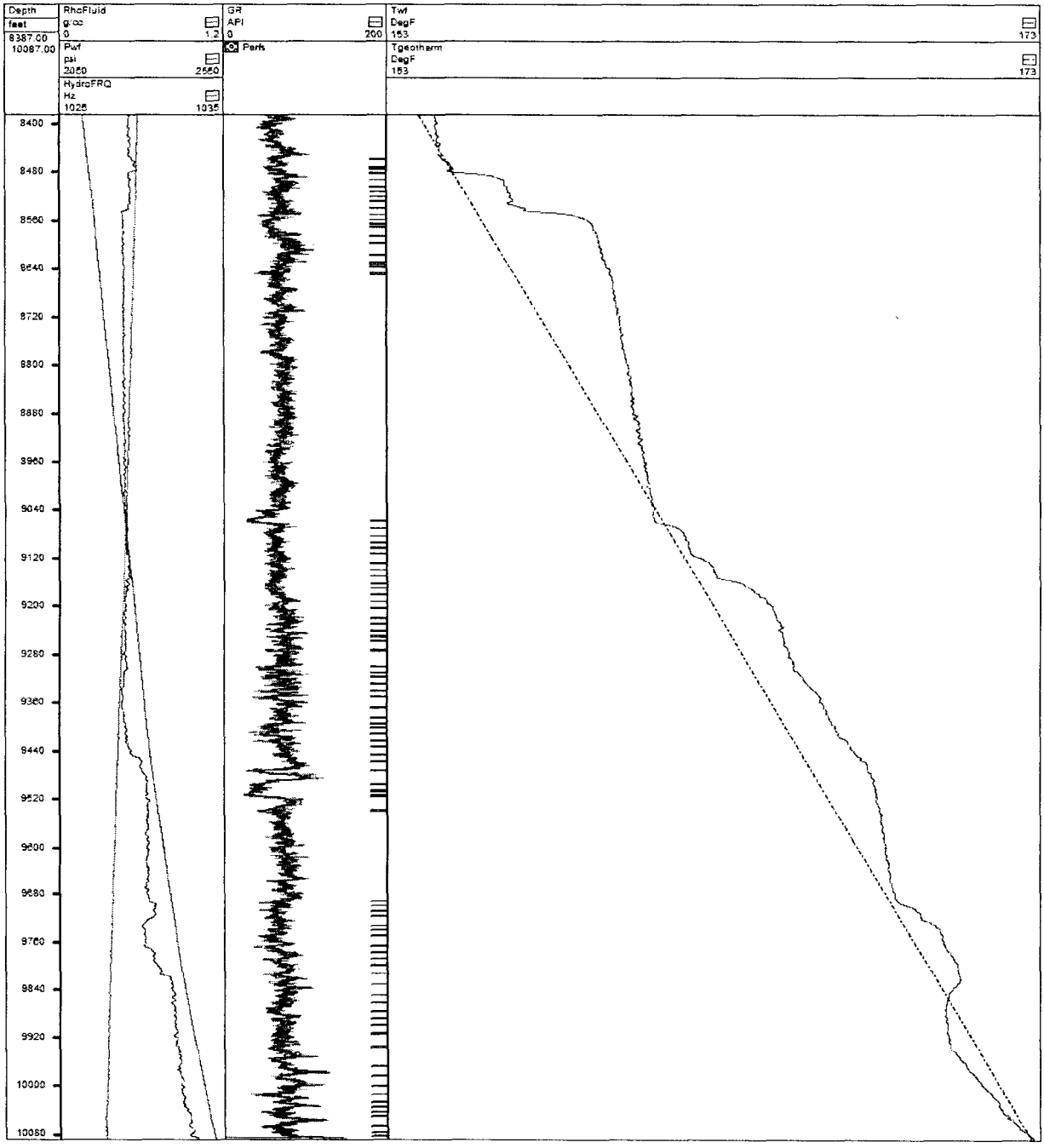


Spinner Calibration Plots
Relationship between R.P.S. and Fluid Velocity (fpm)



Completion Profile Analysis

Geothermal Gradient



Completion Profile Analysis

Well Information

Parameters used for Analysis

SPGG	UNITY	.658
APIOil	UNITY	52.6
DPipe	in	4.90
PipeAngle	DegAng	6.00
Geotherm	°F/ft	.0111
TgeoRef	°F	161
DgeoRef	ft	9021

Downhole Measured and Computed Parameters

Depth	Pwf	Twf	ρ_{gas}	ρ_{oil}	ρ_{water}	RhoFluid	B_{gas}	Vap
feet	psi	DegF	g/cc	g/cc	g/cc	g/cc	UNITY	FPM
8387.00	2117	154	.112	.736	1.03	.502	.00719	130
8508.50	2143	157	.113	.736	1.03	.517	.00715	104
8629.75	2166	160	.113	.735	1.03	.462	.00713	88.1
8751.25	2189	160	.114	.734	1.03	.474	.00706	68.6
8872.75	2212	160	.115	.734	1.03	.470	.00700	70.4
8994.25	2235	161	.116	.734	1.03	.471	.00693	70.4
9115.50	2259	162	.117	.734	1.03	.500	.00689	77.4
9237.00	2283	165	.117	.733	1.03	.470	.00686	27.8
9358.50	2307	166	.118	.732	1.03	.452	.00682	31.2
9479.75	2332	168	.119	.732	1.03	.620	.00677	59.6
9601.25	2365	168	.120	.732	1.03	.630	.00669	60.1
9722.75	2398	169	.122	.731	1.03	.637	.00661	48.5
9844.25	2434	170	.123	.731	1.03	.830	.00653	64.6
9965.50	2477	171	.125	.731	1.03	.874	.00643	53.7
10087.00	2525	173	.127	.730	1.03	1.00	.00635	19.1

Definitions

Curve Name	Description
Holdup	Holdups
PerfCount	Perforations
QGas	Total Gas Production at surface conditions
QpGas	Incremental Gas Production at surface conditions
QOil	Total Oil Production (if present downhole) at surface conditions
QpOil	Incremental Oil Production (if present downhole) at surface conditions
QWater	Total Water Production at surface conditions
QpWater	Incremental Water Production at surface conditions
GR	Gamma Ray/SpectraScan
Twf	Average Temperature
Vap	Apparent Velocity
Vap-Theo	Theoretical Apparent Velocity
Tgeotherm	Geothermal Gradient
RhoFluid	Average Fluid Density
Pwf	Average Pressure
HydroFrq	Average Fluid Dielectric
Flowrate	Total Flowrate at downhole conditions
Vap	Apparent Velocity
Vap-Theo	Theoretical Apparent Velocity
RhoFluid	Average Fluid Density
RhoFluid-Theo	Theoretical Average Fluid Density
DPwfDz	Differential Pressure
DPwfDz-Theo	Theoretical Differential Pressure
Twf	Average Temperature
Twf-Theo	Theoretical Average Temperature
Tgeotherm	Geothermal Gradient
DTwfDz	Differential Temperature
DTwfDz-Theo	Theoretical Differential Temperature
Regime	Flow Regimes
Temperature	Temperature Passes
Density	Fluid Density Passes
Spinner	Spinner Passes
Pressure	Pressure Passes
Linespeed	Linespeed Passes
Slope	Spinner Slope
Vthr	Spinner Threshold
SpinnerFlt	Spinner
DPipe	Inside diameter of the casing/tubing across logged interval
PipeAngle	Average pipe angle across logged interval
APIOil	Degree API of the oil
SPGG	Specific Gravity of the gas
TgeoRef	Reference Temperature for Geothermal Gradient calculations
DgeoRef	Reference Depth for Geothermal Gradient calculations
Goetherm	Geothermal Gradient across logged interval

Completion Profile Analysis

Tool Specifications

O.D.	1-11/16 in. (42.86 mm)
Length	11.9 ft.(3.63 m) in combination 23.28 ft. (7.1 m) stand alone
Pressure Rating	15,000 psi (103421.4 Kpa)
Temperature Rating	350 F (177 C)

Flow Measurement

Measurement of fluid velocity is made using the *Spinner Flowmeter*. This is calibrated by making logging passes at different line speeds to establish the relationship between instrument velocity in feet/minute and the spinner response in revolutions/second (RPS). With this relationship the measured RPS can be converted to fluid velocity in ft/minute. With a known pipe I. D. this can be used to calculate the flow rate in BPD.

$Q_{BPD} = ft/min \times 1.4 \times I.D.^2$

Mass flow rate can be computed using the *Temperature* data. This is based on an enthalpy model, taking into consideration; kinetic energy, frictional and Joule-Thompson heating as well as conduction and convection into the formation.

In gas wells the volumetric fraction of liquids (water) can be very small. Therefore water production may not be quantifiable by velocity measurement alone. Because of water's high mass relative to gas, mass flowrate computed from the *Temperature* data can be better at quantifying the water production.

Holdup Measurement

Holdup (γ) - The fraction of each phase in the wellbore (Water, Oil, Gas fraction) This should not be confused with Cut. I.e. 100% water holdup exists in the static rathole but does not flow.

The *Fluid Density* instrument uses a small gamma ray source and a gamma ray detector to measure the density of the wellbore fluid mixture. The mixture density is used to calculate the holdup fraction.

$\gamma water = (\rho mixture - \rho gas) / (\rho water - \rho gas)$

[For two-phase gas-water production]

ρ: density (gm/cc)

The *Fluid Dielectric* instrument works like an electric capacitor. The capacitor plates are exposed to the wellbore fluids and are a fixed size and distance apart. The value of the capacitance will change as the dielectric of the fluids between the plates change. The instrument response is then used to calculate the hydrocarbon and water fractions. This is possible because of the unique dielectric constant of water, oil and gas.
Water = 78, Oil = 4 and Gas = 1

The *Pressure* data can also be used to corroborate the fluid holdup measurements. This is done by measuring the pressure gradient or the derivative of the pressure curve with respect to depth. The resulting curve in psi/ft can be used to determine the water and gas fractions.

Note:
In three phase flow both fluid density and dielectric measurements are necessary. The dielectric is used to determine the water holdup then the density is used to calculate the remaining gas and oil holdups.