Cimarex Energy Company
Park State 30 Com 1

Completion Profiler

Company	*Cimarex Energy Company*
Well Name	*Park State 36 Com 1*
Field	*White City Penn*
Location	*Eddy County, New Mexico*
Customer Name	*Steven Runyan*
Date of Survey	*November 30, 2017*
Date of Analysis	*January 5, 2018*
Logging Engineer	*Paulo Rios*
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
11/30	07:00	Arrive on location
11/30	09:00	Gauge run start
11/30	13:30	Gauge run stop
11/30	13:32	Program Completion Profile String
11/30	14:00	Start GIH pass
11/30	15:41	Stop GIH pass
11/30	15:47	Start logging passes
11/30	18:27	Stop logging passes
11/30	18:28	Start out of well pass
11/30	19:20	Stop out of well pass
11/30	19:30	Start download
11/30	20:00	Stop download
11/30	21:00	Rig down

Interval Logged: [From 8,424 to 10,518 ft.]
60 ft/min
90 ft/min
120 ft/min

Well Information

Casing: 5.500" 17.0 lb/ft surface to 12,072 ft PBTD: 11,385 ft

Tubing: 2.375" 4.6 lb/ft surface to 8,377 ft

Perforations:

Perforation Data																							
Stage 5 - Wolfcamp																							
8,455	to	8,456	8,462	to	8,463	8,470	to	8,471	8,478	to	8,479	8,486	to	8,487
8,494	to	8,495	8,503	to	8,504	8,510	to	8,511	8,517	to	8,518	8,526	to	8,527
8,535	to	8,536	8,545	to	8,546	8,553	to	8,554	8,560	to	8,561	8,568	to	8,569
8,576	to	8,577	8,583	to	8,584	8,594	to	8,596	8,608	to	8,610	8,616	to	8,619
Stage 4 - Wolfcamp																							
9,020	to	9,021	9,030	to	9,031	9,040	to	9,041	9,053	to	9,054	9,064	to	9,065
9,074	to	9,075	9,083	to	9,084	9,094	to	9,095	9,102	to	9,103	9,110	to	9,111
9,121	to	9,122	9,131	to	9,132	9,144	to	9,145	9,150	to	9,151	9,156	to	9,157
9,166	to	9,167	9,181	to	9,182	9,190	to	9,192	9,202	to	9,204	9,216	to	9,219
Stage 3 - Wolfcamp																							
9,258	to	9,259	9,266	to	9,267	9,280	to	9,281	9,292	to	9,293	9,303	to	9,304
9,316	to	9,317	9,326	to	9,327	9,336	to	9,337	9,343	to	9,344	9,353	to	9,354
9,365	to	9,366	9,376	to	9,377	9,386	to	9,387	9,400	to	9,401	9,418	to	9,419
9,430	to	9,431	9,436	to	9,437	9,450	to	9,452	9,466	to	9,468	9,475	to	9,478
Stage 2 - Wolfcamp																							
9,692	to	9,693	9,704	to	9,705	9,712	to	9,713	9,722	to	9,723	9,738	to	9,739
9,750	to	9,751	9,760	to	9,761	9,768	to	9,769	9,780	to	9,781	9,788	to	9,789
9,798	to	9,799	9,806	to	9,807	9,816	to	9,817	9,827	to	9,828	9,836	to	9,837
9,845	to	9,846	9,856	to	9,857	9,864	to	9,866	9,875	to	9,877	9,886	to	9,889
Stage 1 - Cisco Canyon																							
9,954	to	9,955	9,968	to	9,969	9,986	to	9,987	9,996	to	9,997	10,010	to	10,011
10,019	to	10,020	10,037	to	10,038	10,048	to	10,049	10,061	to	10,062	10,071	to	10,072
10,087	to	10,088	10,100	to	10,101	10,112	to	10,113	10,130	to	10,131	10,141	to	10,142
10,152	to	10,153	10,168	to	10,169	10,184	to	10,186	10,194	to	10,196	10,207	to	10,210

Tool String

The 1.700" 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 Psi	Gas MCFD	Oil BFPD	Water BFPD
Avg	150 psi	676 Mcf/d	30 bpd	150 bpd
Min		0 Mcf/d		
Max		1352 Mcf/d		

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 8455	1012.8 Mcf/d		100.00 %	30.99 bpd		100.00 %	141.58 bpd		100.00 %
Stage 5 - Wolfcamp			28.10 %			28.10 %			24.19 %
8455 to 8619	1012.8 Mcf/d	284.6 Mcf/d		30.99 bpd	8.71 bpd		141.58 bpd	34.25 bpd	
Stage 4 - Wolfcamp			16.57 %			16.57 %			21.75 %
9020 to 9219	728.2 Mcf/d	167.8 Mcf/d		22.28 bpd	5.13 bpd		107.34 bpd	30.79 bpd	
Stage 3 - Wolfcamp			32.72 %			32.72 %			25.94 %
9258 to 9478	560.4 Mcf/d	331.3 Mcf/d		17.14 bpd	10.14 bpd		76.55 bpd	36.72 bpd	
Stage 2 - Wolfcamp			9.89 %			9.89 %			17.35 %
9692 to 9889	229.0 Mcf/d	100.2 Mcf/d		7.01 bpd	3.06 bpd		39.83 bpd	24.56 bpd	
Stage 1 - Cisco Canyon			12.72 %			12.72 %			10.78 %
9954 to 10210	128.8 Mcf/d	128.8 Mcf/d		3.94 bpd	3.94 bpd		15.27 bpd	15.27 bpd	

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 8455	1012.8 Mcf/d		100.00 %	30.99 bpd		100.00 %	141.58 bpd		100.00 %
Stage 5 - Wolfcamp			28.11 %			28.11 %			24.19 %
8455 to 8456	1012.8 Mcf/d	124.4 Mcf/d	12.28 %	30.99 bpd	3.81 bpd	12.28 %	141.58 bpd	1.30 bpd	0.92 %
8462 to 8463	888.4 Mcf/d	5.7 Mcf/d	0.56 %	27.18 bpd	0.17 bpd	0.56 %	140.29 bpd	0.19 bpd	0.13 %
8470 to 8471	882.7 Mcf/d	5.7 Mcf/d	0.56 %	27.01 bpd	0.17 bpd	0.56 %	140.10 bpd	0.19 bpd	0.13 %
8478 to 8479	877.0 Mcf/d	15.2 Mcf/d	1.50 %	26.83 bpd	0.46 bpd	1.50 %	139.92 bpd	0.49 bpd	0.35 %
8486 to 8487	861.8 Mcf/d	1.9 Mcf/d	0.19 %	26.37 bpd	0.06 bpd	0.19 %	139.42 bpd	2.47 bpd	1.75 %
8494 to 8495	859.9 Mcf/d	0.9 Mcf/d	0.09 %	26.31 bpd	0.03 bpd	0.09 %	136.95 bpd	1.24 bpd	0.87 %
8503 to 8504	859.0 Mcf/d	2.8 Mcf/d	0.28 %	26.28 bpd	0.09 bpd	0.28 %	135.71 bpd	3.71 bpd	2.62 %
8510 to 8511	856.2 Mcf/d	24.7 Mcf/d	2.43 %	26.20 bpd	0.75 bpd	2.43 %	132.00 bpd	0.80 bpd	0.57 %
8517 to 8518	831.5 Mcf/d	2.8 Mcf/d	0.28 %	25.44 bpd	0.09 bpd	0.28 %	131.20 bpd	3.71 bpd	2.62 %
8526 to 8527	828.7 Mcf/d	3.8 Mcf/d	0.37 %	25.35 bpd	0.12 bpd	0.37 %	127.49 bpd	4.95 bpd	3.49 %
8535 to 8536	824.9 Mcf/d	13.3 Mcf/d	1.31 %	25.24 bpd	0.41 bpd	1.31 %	122.54 bpd	0.43 bpd	0.31 %
8545 to 8546	811.6 Mcf/d	17.1 Mcf/d	1.69 %	24.83 bpd	0.52 bpd	1.69 %	122.11 bpd	0.56 bpd	0.39 %
8553 to 8554	794.5 Mcf/d	2.8 Mcf/d	0.28 %	24.31 bpd	0.09 bpd	0.28 %	121.55 bpd	3.71 bpd	2.62 %
8560 to 8561	791.7 Mcf/d	15.2 Mcf/d	1.50 %	24.22 bpd	0.46 bpd	1.50 %	117.85 bpd	0.49 bpd	0.35 %
8568 to 8569	776.5 Mcf/d	3.3 Mcf/d	0.33 %	23.76 bpd	0.10 bpd	0.33 %	117.35 bpd	4.33 bpd	3.06 %
8576 to 8577	773.2 Mcf/d	3.8 Mcf/d	0.37 %	23.66 bpd	0.12 bpd	0.37 %	113.02 bpd	0.12 bpd	0.09 %
8583 to 8584	769.4 Mcf/d	3.3 Mcf/d	0.33 %	23.54 bpd	0.10 bpd	0.33 %	112.90 bpd	4.33 bpd	3.06 %
8594 to 8596	766.1 Mcf/d	9.5 Mcf/d	0.94 %	23.44 bpd	0.29 bpd	0.94 %	108.57 bpd	0.31 bpd	0.22 %
8608 to 8610	756.6 Mcf/d	9.5 Mcf/d	0.94 %	23.15 bpd	0.29 bpd	0.94 %	108.26 bpd	0.31 bpd	0.22 %
8616 to 8619	747.1 Mcf/d	19.0 Mcf/d	1.87 %	22.86 bpd	0.58 bpd	1.87 %	107.95 bpd	0.62 bpd	0.44 %
Stage 4 - Wolfcamp			16.57 %			16.57 %			21.75 %
9020 to 9021	728.2 Mcf/d	54.1 Mcf/d	5.34 %	22.28 bpd	1.65 bpd	5.34 %	107.34 bpd	0.74 bpd	0.52 %
9030 to 9031	674.1 Mcf/d	30.4 Mcf/d	3.00 %	20.63 bpd	0.93 bpd	3.00 %	106.59 bpd	0.19 bpd	0.13 %
9040 to 9041	643.7 Mcf/d	28.2 Mcf/d	2.78 %	19.69 bpd	0.86 bpd	2.78 %	106.41 bpd	0.43 bpd	0.31 %
9053 to 9054	615.5 Mcf/d	25.9 Mcf/d	2.56 %	18.83 bpd	0.79 bpd	2.56 %	105.98 bpd	0.68 bpd	0.48 %
9064 to 9065	589.6 Mcf/d	0.9 Mcf/d	0.09 %	18.04 bpd	0.03 bpd	0.09 %	105.30 bpd	4.33 bpd	3.06 %
9074 to 9075	588.8 Mcf/d	0.9 Mcf/d	0.09 %	18.01 bpd	0.03 bpd	0.09 %	100.97 bpd	0.19 bpd	0.13 %
9083 to 9084	587.9 Mcf/d	0.7 Mcf/d	0.07 %	17.99 bpd	0.02 bpd	0.07 %	100.78 bpd	0.37 bpd	0.26 %
9094 to 9095	587.2 Mcf/d	1.3 Mcf/d	0.13 %	17.97 bpd	0.04 bpd	0.13 %	100.41 bpd	2.47 bpd	1.75 %
9102 to 9103	585.9 Mcf/d	0.5 Mcf/d	0.05 %	17.93 bpd	0.02 bpd	0.05 %	97.94 bpd	1.85 bpd	1.31 %
9110 to 9111	585.4 Mcf/d	1.2 Mcf/d	0.12 %	17.91 bpd	0.04 bpd	0.12 %	96.08 bpd	3.71 bpd	2.62 %
9121 to 9122	584.2 Mcf/d	0.9 Mcf/d	0.09 %	17.88 bpd	0.03 bpd	0.09 %	92.38 bpd	0.37 bpd	0.26 %
9131 to 9132	583.4 Mcf/d	0.9 Mcf/d	0.09 %	17.85 bpd	0.03 bpd	0.09 %	92.00 bpd	0.06 bpd	0.04 %
9144 to 9145	582.5 Mcf/d	0.8 Mcf/d	0.08 %	17.82 bpd	0.02 bpd	0.08 %	91.94 bpd	0.62 bpd	0.44 %
9150 to 9151	581.7 Mcf/d	0.7 Mcf/d	0.07 %	17.80 bpd	0.02 bpd	0.07 %	91.32 bpd	0.12 bpd	0.09 %
9156 to 9157	581.0 Mcf/d	0.9 Mcf/d	0.09 %	17.78 bpd	0.03 bpd	0.09 %	91.20 bpd	3.09 bpd	2.18 %
9166 to 9167	580.1 Mcf/d	1.4 Mcf/d	0.14 %	17.75 bpd	0.04 bpd	0.14 %	88.11 bpd	0.25 bpd	0.18 %
9181 to 9182	578.7 Mcf/d	0.6 Mcf/d	0.06 %	17.71 bpd	0.02 bpd	0.06 %	87.86 bpd	0.19 bpd	0.13 %
9190 to 9192	578.1 Mcf/d	0.9 Mcf/d	0.09 %	17.69 bpd	0.03 bpd	0.09 %	87.68 bpd	9.89 bpd	6.99 %
9202 to 9204	577.2 Mcf/d	5.6 Mcf/d	0.56 %	17.66 bpd	0.17 bpd	0.56 %	77.79 bpd	1.05 bpd	0.74 %
9216 to 9219	571.6 Mcf/d	11.3 Mcf/d	1.11 %	17.49 bpd	0.34 bpd	1.11 %	76.74 bpd	0.19 bpd	0.13 %

Stage 3 - Wolfcamp					**32.72 %**			**32.72 %**			**25.94 %**
9258	to	**9259**	560.4 Mcf/d	17.1 Mcf/d	**1.69 %**	17.14 bpd	0.52 bpd	**1.69 %**	76.55 bpd	0.56 bpd	**0.39 %**
9266	to	**9267**	543.3 Mcf/d	1.4 Mcf/d	**0.14 %**	16.62 bpd	0.04 bpd	**0.14 %**	75.99 bpd	1.85 bpd	**1.31 %**
9280	to	**9281**	541.9 Mcf/d	26.5 Mcf/d	**2.62 %**	16.58 bpd	0.81 bpd	**2.62 %**	74.14 bpd	0.87 bpd	**0.61 %**
9292	to	**9293**	515.3 Mcf/d	4.7 Mcf/d	**0.47 %**	15.77 bpd	0.15 bpd	**0.47 %**	73.27 bpd	6.18 bpd	**4.37 %**
9303	to	**9304**	510.6 Mcf/d	62.6 Mcf/d	**6.18 %**	15.62 bpd	1.91 bpd	**6.18 %**	67.09 bpd	2.04 bpd	**1.44 %**
9316	to	**9317**	448.0 Mcf/d	7.1 Mcf/d	**0.70 %**	13.71 bpd	0.22 bpd	**0.70 %**	65.05 bpd	9.27 bpd	**6.55 %**
9326	to	**9327**	440.9 Mcf/d	5.7 Mcf/d	**0.56 %**	13.49 bpd	0.17 bpd	**0.56 %**	55.78 bpd	7.42 bpd	**5.24 %**
9336	to	**9337**	435.2 Mcf/d	39.8 Mcf/d	**3.93 %**	13.32 bpd	1.22 bpd	**3.93 %**	48.36 bpd	1.30 bpd	**0.92 %**
9343	to	**9344**	395.4 Mcf/d	28.4 Mcf/d	**2.81 %**	12.10 bpd	0.87 bpd	**2.81 %**	47.06 bpd	0.93 bpd	**0.66 %**
9353	to	**9354**	367.0 Mcf/d	7.6 Mcf/d	**0.75 %**	11.23 bpd	0.23 bpd	**0.75 %**	46.13 bpd	0.25 bpd	**0.18 %**
9365	to	**9366**	359.4 Mcf/d	0.9 Mcf/d	**0.09 %**	11.00 bpd	0.03 bpd	**0.09 %**	45.89 bpd	1.24 bpd	**0.87 %**
9376	to	**9377**	358.4 Mcf/d	15.2 Mcf/d	**1.50 %**	10.97 bpd	0.46 bpd	**1.50 %**	44.65 bpd	0.49 bpd	**0.35 %**
9386	to	**9387**	343.2 Mcf/d	19.0 Mcf/d	**1.87 %**	10.50 bpd	0.58 bpd	**1.87 %**	44.16 bpd	0.62 bpd	**0.44 %**
9400	to	**9401**	324.3 Mcf/d	17.1 Mcf/d	**1.69 %**	9.92 bpd	0.52 bpd	**1.69 %**	43.54 bpd	0.56 bpd	**0.39 %**
9418	to	**9419**	307.2 Mcf/d	0.5 Mcf/d	**0.05 %**	9.40 bpd	0.01 bpd	**0.05 %**	42.98 bpd	0.62 bpd	**0.44 %**
9430	to	**9431**	306.7 Mcf/d	7.6 Mcf/d	**0.75 %**	9.39 bpd	0.23 bpd	**0.75 %**	42.36 bpd	0.25 bpd	**0.18 %**
9436	to	**9437**	299.2 Mcf/d	7.6 Mcf/d	**0.75 %**	9.15 bpd	0.23 bpd	**0.75 %**	42.12 bpd	0.25 bpd	**0.18 %**
9450	to	**9452**	291.6 Mcf/d	55.0 Mcf/d	**5.43 %**	8.92 bpd	1.68 bpd	**5.43 %**	41.87 bpd	1.79 bpd	**1.27 %**
9466	to	**9468**	236.6 Mcf/d	1.9 Mcf/d	**0.19 %**	7.24 bpd	0.06 bpd	**0.19 %**	40.08 bpd	0.06 bpd	**0.04 %**
9475	to	**9478**	234.7 Mcf/d	5.7 Mcf/d	**0.56 %**	7.18 bpd	0.17 bpd	**0.56 %**	40.01 bpd	0.19 bpd	**0.13 %**
Stage 2 - Wolfcamp					**9.89 %**			**9.89 %**			**17.35 %**
9692	to	**9693**	229.0 Mcf/d	5.7 Mcf/d	**0.56 %**	7.01 bpd	0.17 bpd	**0.56 %**	39.83 bpd	0.19 bpd	**0.13 %**
9704	to	**9705**	223.3 Mcf/d	3.8 Mcf/d	**0.37 %**	6.83 bpd	0.12 bpd	**0.37 %**	39.64 bpd	0.12 bpd	**0.09 %**
9712	to	**9713**	219.5 Mcf/d	9.5 Mcf/d	**0.94 %**	6.72 bpd	0.29 bpd	**0.94 %**	39.52 bpd	0.31 bpd	**0.22 %**
9722	to	**9723**	210.0 Mcf/d	3.8 Mcf/d	**0.37 %**	6.43 bpd	0.12 bpd	**0.37 %**	39.21 bpd	0.12 bpd	**0.09 %**
9738	to	**9739**	206.3 Mcf/d	2.8 Mcf/d	**0.28 %**	6.31 bpd	0.09 bpd	**0.28 %**	39.09 bpd	3.71 bpd	**2.62 %**
9750	to	**9751**	203.4 Mcf/d	0.9 Mcf/d	**0.09 %**	6.22 bpd	0.03 bpd	**0.09 %**	35.38 bpd	1.24 bpd	**0.87 %**
9760	to	**9761**	202.5 Mcf/d	3.8 Mcf/d	**0.37 %**	6.19 bpd	0.12 bpd	**0.37 %**	34.14 bpd	0.12 bpd	**0.09 %**
9768	to	**9769**	198.7 Mcf/d	1.9 Mcf/d	**0.19 %**	6.08 bpd	0.06 bpd	**0.19 %**	34.02 bpd	0.06 bpd	**0.04 %**
9780	to	**9781**	196.8 Mcf/d	20.9 Mcf/d	**2.06 %**	6.02 bpd	0.64 bpd	**2.06 %**	33.96 bpd	0.68 bpd	**0.48 %**
9788	to	**9789**	175.9 Mcf/d	4.3 Mcf/d	**0.42 %**	5.38 bpd	0.13 bpd	**0.42 %**	33.28 bpd	5.56 bpd	**3.93 %**
9798	to	**9799**	171.7 Mcf/d	1.4 Mcf/d	**0.14 %**	5.25 bpd	0.04 bpd	**0.14 %**	27.71 bpd	1.85 bpd	**1.31 %**
9806	to	**9807**	170.2 Mcf/d	9.5 Mcf/d	**0.94 %**	5.21 bpd	0.29 bpd	**0.94 %**	25.86 bpd	0.31 bpd	**0.22 %**
9816	to	**9817**	160.7 Mcf/d	1.9 Mcf/d	**0.19 %**	4.92 bpd	0.06 bpd	**0.19 %**	25.55 bpd	2.47 bpd	**1.75 %**
9827	to	**9828**	158.9 Mcf/d	3.8 Mcf/d	**0.37 %**	4.86 bpd	0.12 bpd	**0.37 %**	23.08 bpd	0.12 bpd	**0.09 %**
9836	to	**9837**	155.1 Mcf/d	7.6 Mcf/d	**0.75 %**	4.74 bpd	0.23 bpd	**0.75 %**	22.95 bpd	0.25 bpd	**0.18 %**
9845	to	**9846**	147.5 Mcf/d	0.5 Mcf/d	**0.05 %**	4.51 bpd	0.01 bpd	**0.05 %**	22.70 bpd	0.62 bpd	**0.44 %**
9856	to	**9857**	147.0 Mcf/d	3.3 Mcf/d	**0.33 %**	4.50 bpd	0.10 bpd	**0.33 %**	22.09 bpd	4.33 bpd	**3.06 %**
9864	to	**9866**	143.7 Mcf/d	7.6 Mcf/d	**0.75 %**	4.40 bpd	0.23 bpd	**0.75 %**	17.76 bpd	0.25 bpd	**0.18 %**
9875	to	**9877**	136.1 Mcf/d	5.7 Mcf/d	**0.56 %**	4.16 bpd	0.17 bpd	**0.56 %**	17.51 bpd	0.19 bpd	**0.13 %**
9886	to	**9889**	130.4 Mcf/d	1.6 Mcf/d	**0.16 %**	3.99 bpd	0.05 bpd	**0.16 %**	17.33 bpd	2.06 bpd	**1.46 %**

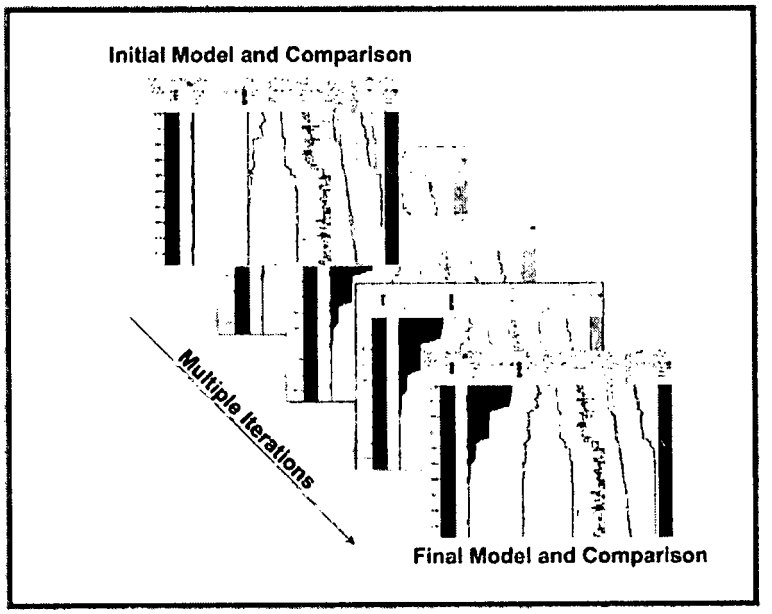
Stage 1 - Cisco Canyon					12.72 %			12.72 %			10.78 %
9954	to 9955	128.8 Mcf/d	4.4 Mcf/d	0.44 %	3.94 bpd	0.14 bpd	0.44 %	15.27 bpd	0.14 bpd	0.10 %
9968	to 9969	124.4 Mcf/d	1.6 Mcf/d	0.16 %	3.81 bpd	0.05 bpd	0.16 %	15.12 bpd	2.06 bpd	1.46 %
9986	to 9987	122.8 Mcf/d	3.2 Mcf/d	0.31 %	3.76 bpd	0.10 bpd	0.31 %	13.06 bpd	0.10 bpd	0.07 %
9996	to 9997	119.7 Mcf/d	4.4 Mcf/d	0.44 %	3.66 bpd	0.14 bpd	0.44 %	12.96 bpd	0.14 bpd	0.10 %
10010	to 10011	115.2 Mcf/d	1.3 Mcf/d	0.13 %	3.53 bpd	0.04 bpd	0.13 %	12.81 bpd	0.04 bpd	0.03 %
10019	to 10020	114.0 Mcf/d	0.8 Mcf/d	0.08 %	3.49 bpd	0.02 bpd	0.08 %	12.77 bpd	1.03 bpd	0.73 %
10037	to 10038	113.2 Mcf/d	11.4 Mcf/d	1.12 %	3.46 bpd	0.35 bpd	1.12 %	11.74 bpd	0.37 bpd	0.26 %
10048	to 10049	101.8 Mcf/d	1.7 Mcf/d	0.17 %	3.11 bpd	0.05 bpd	0.17 %	11.37 bpd	2.27 bpd	1.60 %
10061	to 10062	100.1 Mcf/d	1.3 Mcf/d	0.13 %	3.06 bpd	0.04 bpd	0.13 %	9.10 bpd	0.04 bpd	0.03 %
10071	to 10072	98.8 Mcf/d	0.2 Mcf/d	0.02 %	3.02 bpd	0.00 bpd	0.02 %	9.06 bpd	0.21 bpd	0.15 %
10087	to 10088	98.6 Mcf/d	10.7 Mcf/d	1.06 %	3.02 bpd	0.33 bpd	1.06 %	8.86 bpd	0.35 bpd	0.25 %
10100	to 10101	87.9 Mcf/d	2.4 Mcf/d	0.23 %	2.69 bpd	0.07 bpd	0.23 %	8.51 bpd	3.09 bpd	2.18 %
10112	to 10113	85.5 Mcf/d	9.5 Mcf/d	0.94 %	2.62 bpd	0.29 bpd	0.94 %	5.42 bpd	0.31 bpd	0.22 %
10130	to 10131	76.0 Mcf/d	10.7 Mcf/d	1.06 %	2.33 bpd	0.33 bpd	1.06 %	5.11 bpd	0.35 bpd	0.25 %
10141	to 10142	65.3 Mcf/d	0.2 Mcf/d	0.02 %	2.00 bpd	0.00 bpd	0.02 %	4.76 bpd	0.21 bpd	0.15 %
10152	to 10153	65.2 Mcf/d	7.0 Mcf/d	0.69 %	1.99 bpd	0.21 bpd	0.69 %	4.55 bpd	0.23 bpd	0.16 %
10168	to 10169	58.2 Mcf/d	1.9 Mcf/d	0.19 %	1.78 bpd	0.06 bpd	0.19 %	4.32 bpd	2.49 bpd	1.76 %
10184	to 10186	56.3 Mcf/d	13.3 Mcf/d	1.31 %	1.72 bpd	0.41 bpd	1.31 %	1.83 bpd	0.43 bpd	0.31 %
10194	to 10196	43.0 Mcf/d	33.5 Mcf/d	3.31 %	1.31 bpd	1.03 bpd	3.31 %	1.40 bpd	1.09 bpd	0.77 %
10207	to 10210	9.4 Mcf/d	9.4 Mcf/d	0.93 %	0.29 bpd	0.29 bpd	0.93 %	0.31 bpd	0.31 bpd	0.22 %

Analysis Summary

1. The analysis was conducted as 3-phase. The oil production of 30 BOPD is too low to accurately quantify. The downhole oil rate, at 100% flow, accounts for less than 5% of the total mass flow and less than 2% 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.



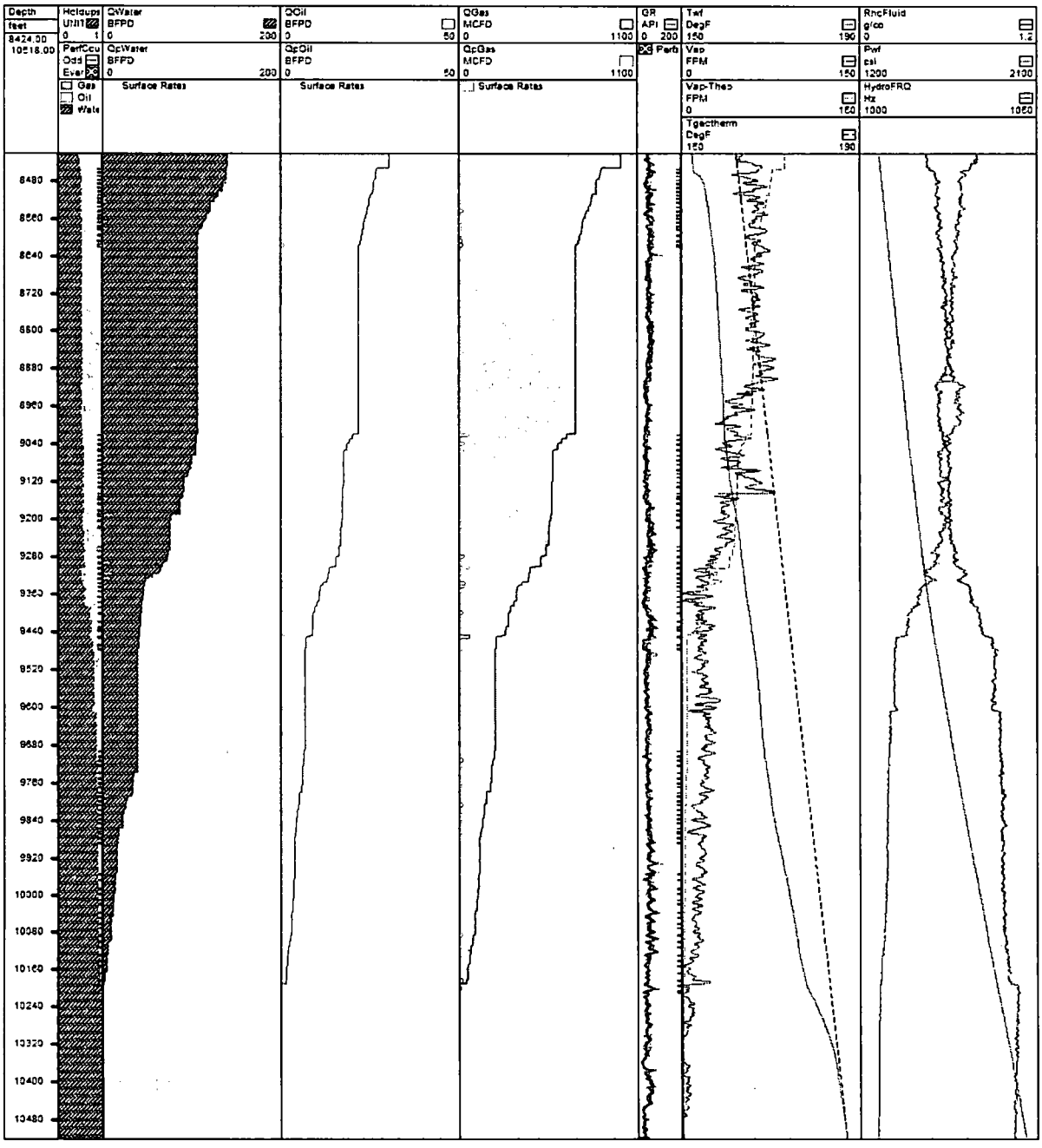
A comparison between the model responses and the recorded data is shown in this report. Good correlation between the theoretical and log data curves indicates that the flow model is in agreement with the log data and the actual well production profile. Discrepancies between the theoretical and raw data 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 Taitel-Dukler 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 Oistein Glaso correlation.

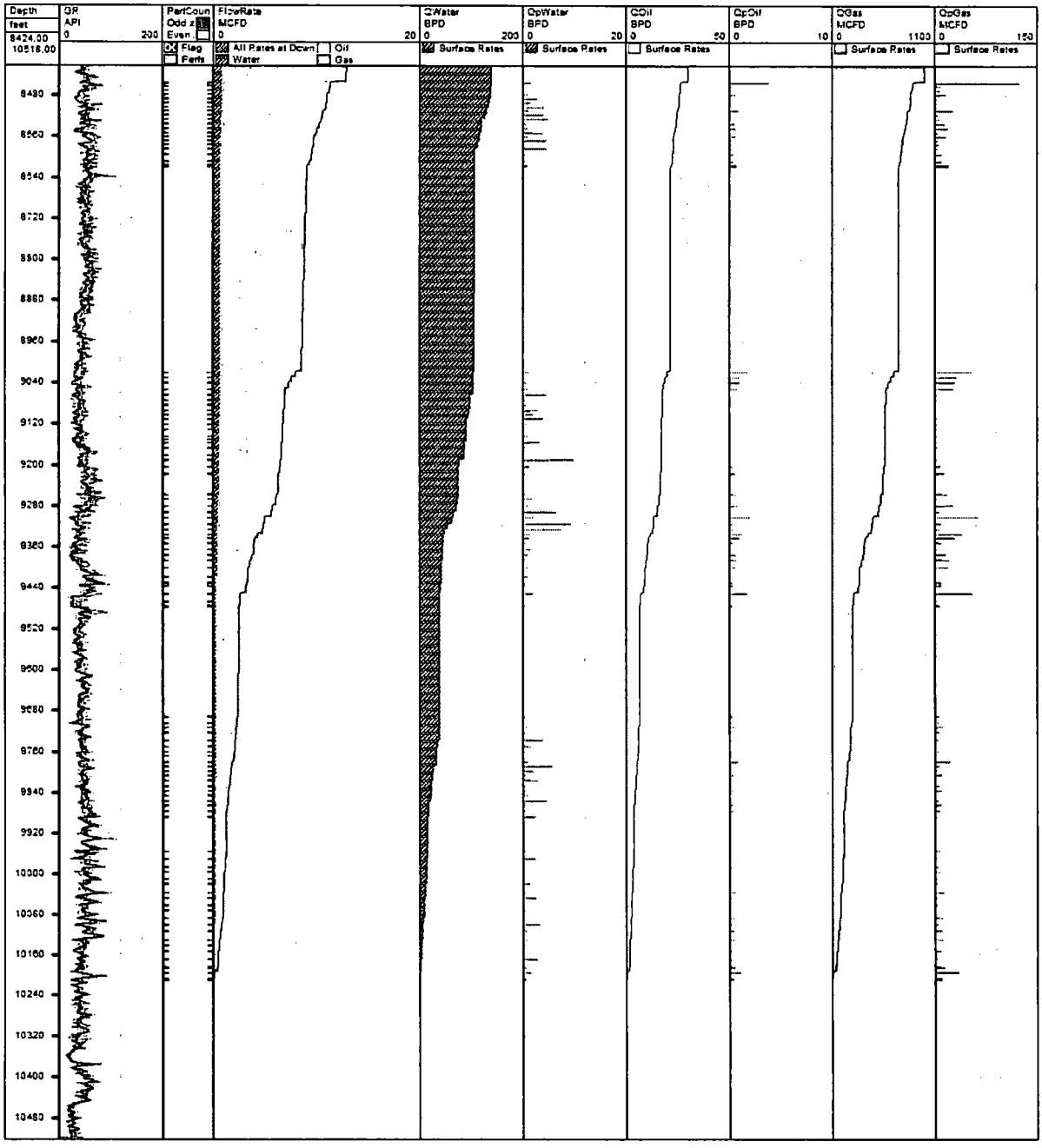
The analysis was performed in five steps:

- 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

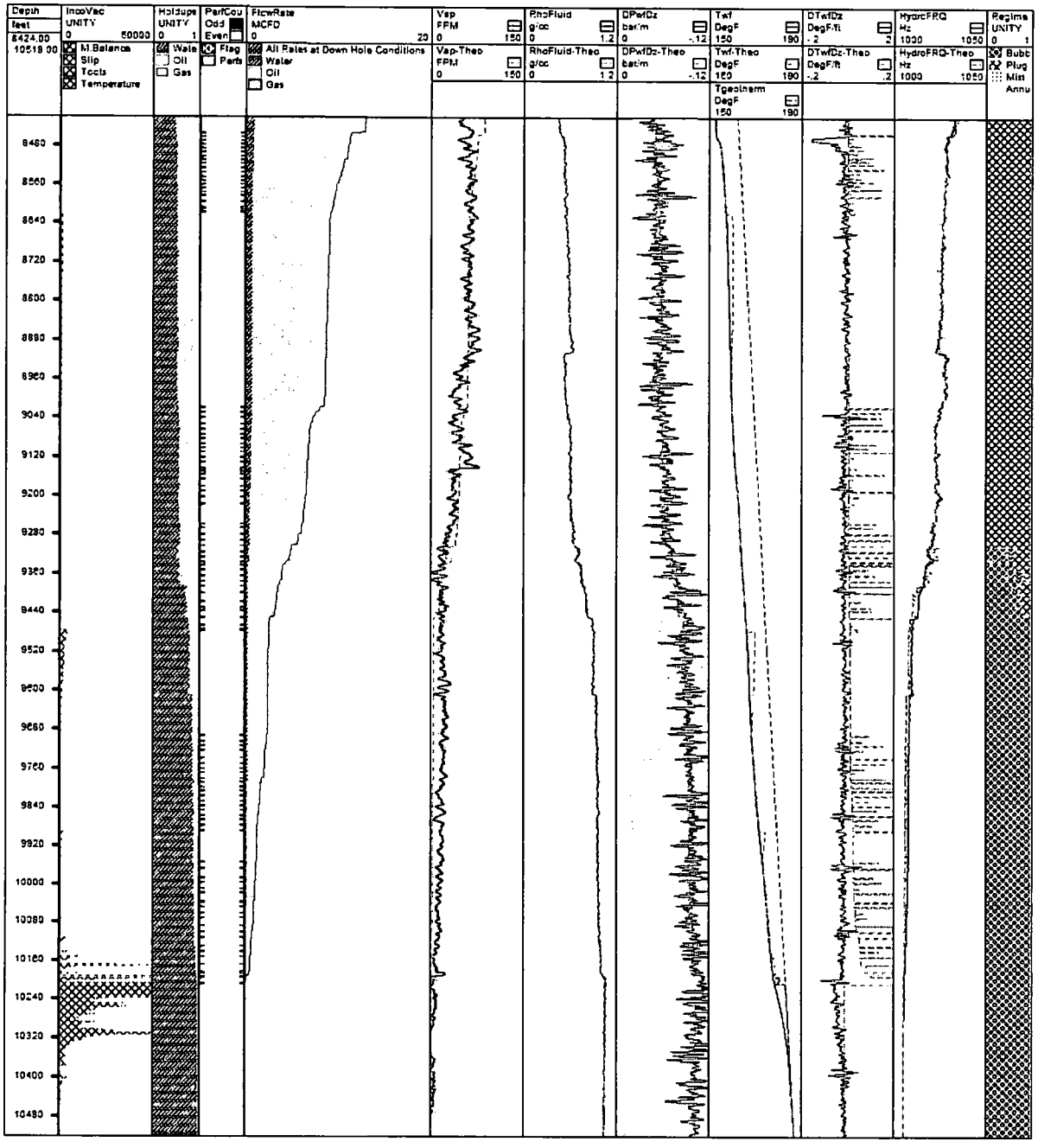


Production Rates At Surface Conditions



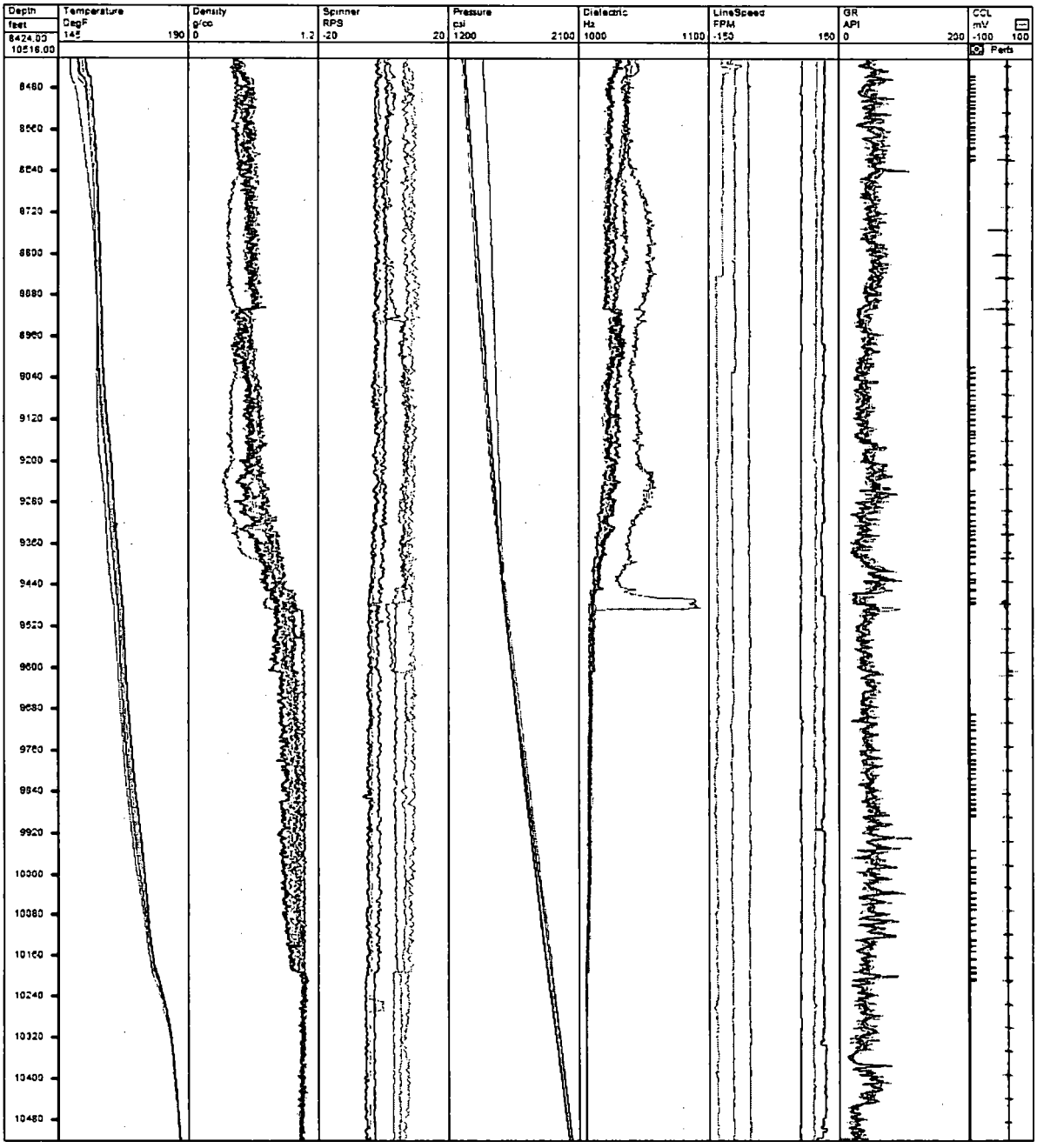
Completion Profile Analysis

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



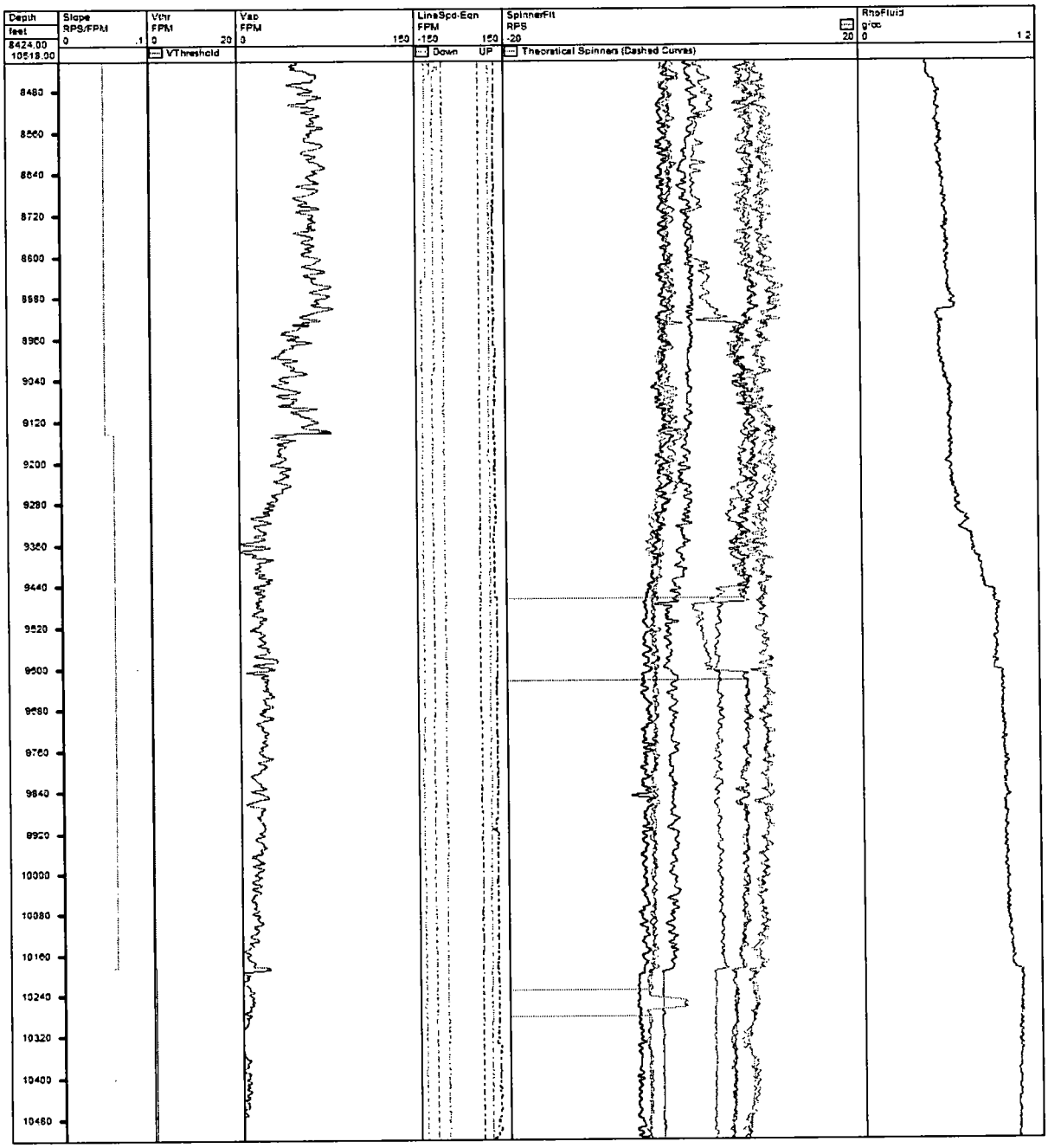
Completion Profile Analysis

Overlay of all Log Data

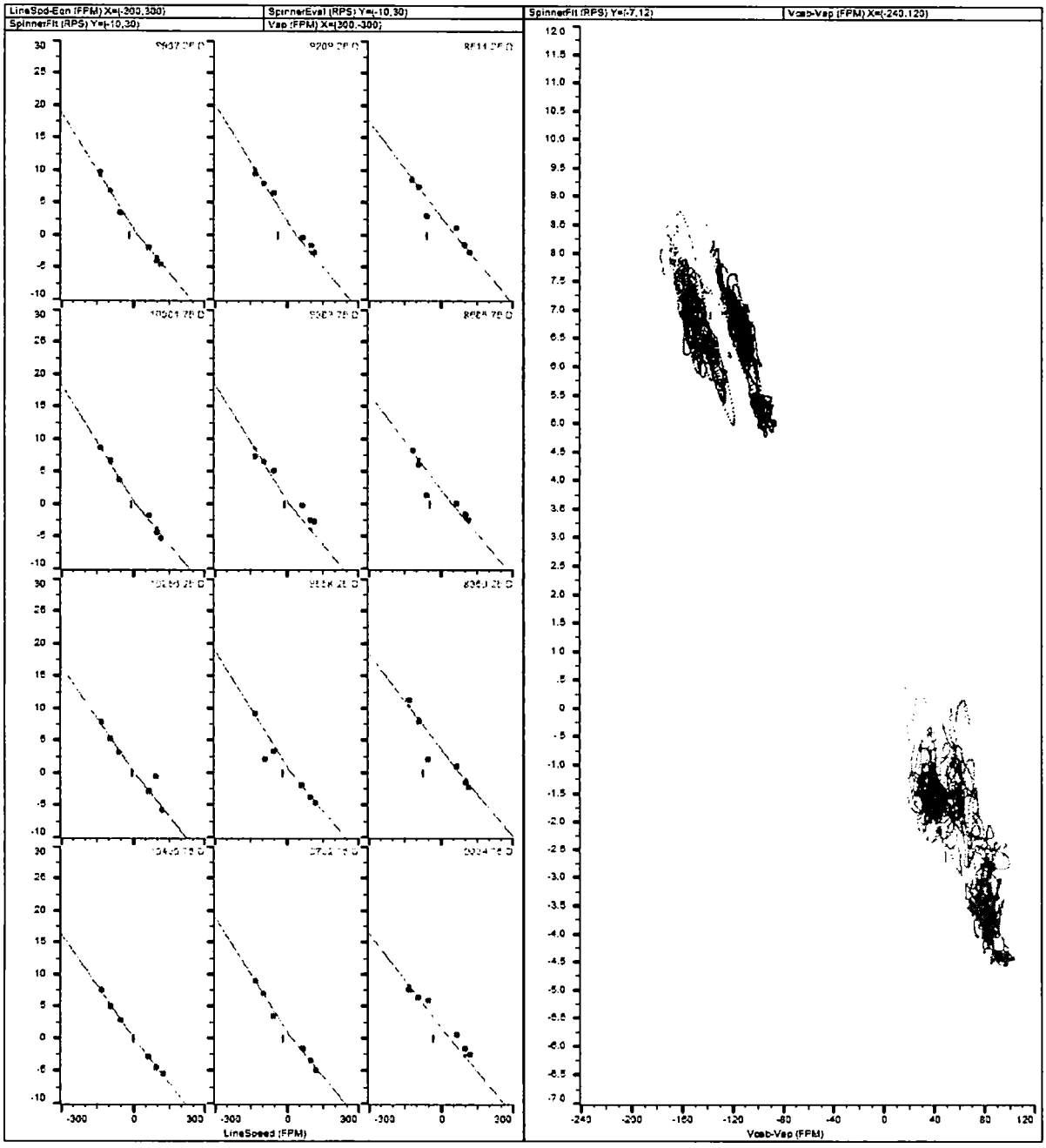


Completion Profile Analysis

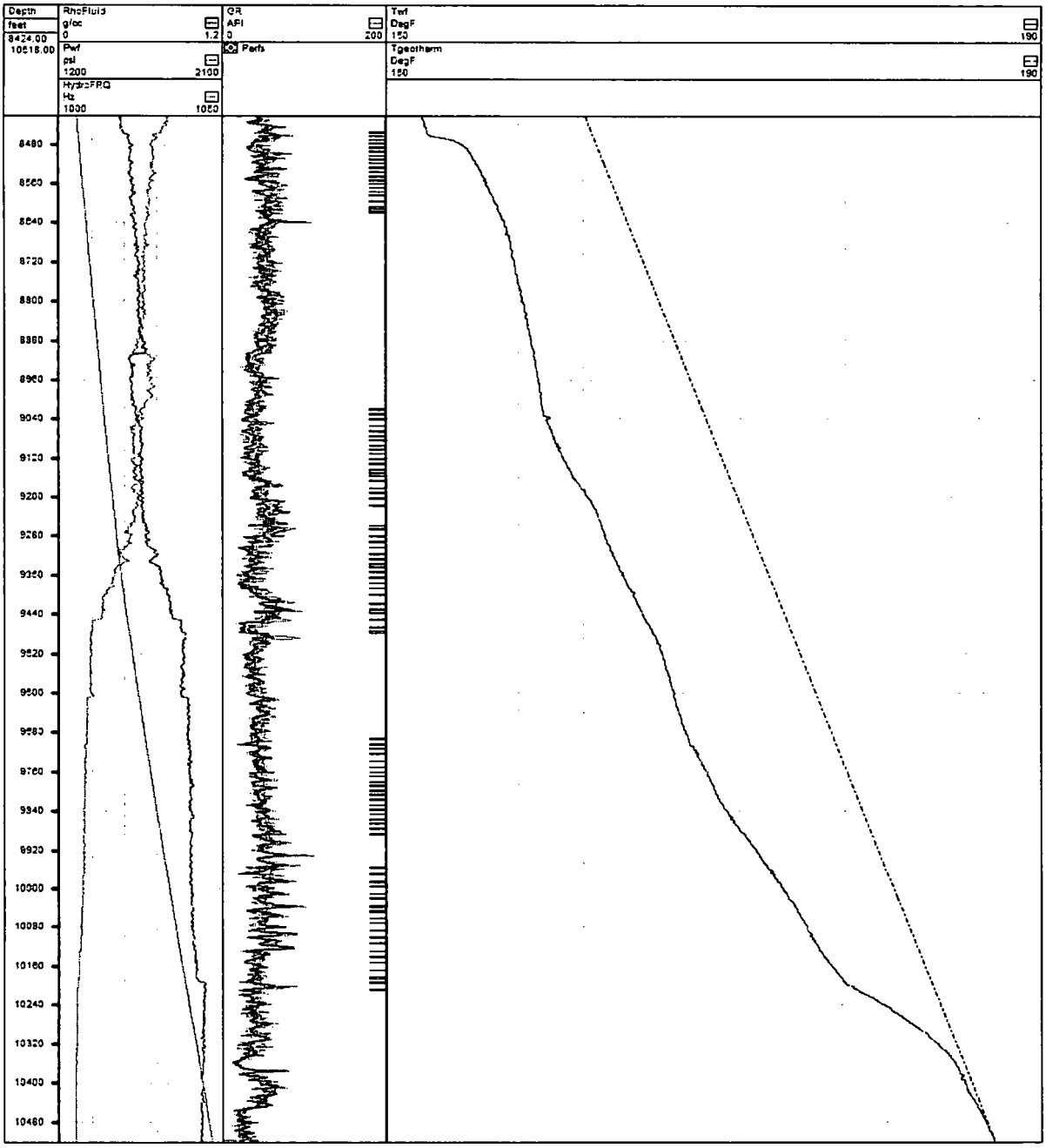
Apparent Fluid Velocity Derived from Spinner



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



Geothermal Gradient



Completion Profile Analysis

Well Information

Parameters used for Analysis

SPGG	UNITY	.683
APIOil	UNITY	52.3
DPipe	in	4.90
PipeAngle	DegAng	0
Geotherm	°F/ft	.0120
TgeoRef	°F	187
DgeoRef	ft	10518

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
8424.00	1296	152	.0700	.740	1.06	.452	.0119	49.9
8573.50	1331	156	.0713	.738	1.06	.532	.0117	56.3
8723.25	1368	158	.0732	.738	1.06	.593	.0114	63.5
8872.75	1406	159	.0752	.738	1.06	.602	.0111	68.9
9022.25	1443	160	.0772	.737	1.06	.563	.0108	45.2
9171.75	1485	162	.0791	.737	1.06	.611	.0106	36.7
9321.50	1529	164	.0812	.736	1.06	.708	.0103	14.9
9471.00	1584	166	.0839	.735	1.06	.906	.00996	12.4
9620.50	1645	168	.0870	.734	1.06	.950	.00961	21.8
9770.25	1709	170	.0901	.734	1.05	.963	.00928	18.8
9919.75	1775	173	.0930	.733	1.05	.963	.00898	14.4
10069.25	1841	175	.0959	.732	1.05	.978	.00871	10.7
10218.75	1910	179	.0987	.730	1.05	1.07	.00847	1.18
10368.50	1979	185	.101	.728	1.05	1.06	.00828	4.52
10518.00	2046	187	.104	.728	1.05	1.06	.00805	-3.67

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.

$\gamma_{water} \quad (\rho_{mixture} - \rho_{gas}) / (\rho_{water} - \rho_{gas})$

(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.