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PS Platform

Interpretation Results - Final Report

Client: Cimarex Energy Company

Well: Federal 13 Com #4

Field: White City

County: Eddy, New Mexico

API: 30-015-34199

Log Date: 7-Mar-2017

Analyst: Leonid Kolomytsev

Daniel Amyotte

Casey Chadwick

NM OIL CONSERVATION
ARTESIA DISTRICT
JUN 01 2017
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Production logging
with confidence

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These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

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Federal 13 Com #4
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Logging Objective:

Flow contribution from each perforation.

Well Bore Information:

Production Tubing: 2-7/8" 6.5# L-80 @ 8597' MD

Production Casing: 5-1/2" 17# P-110 @ 12358' MD

Perforations: 6 Stages / 54 Perforations Clusters

Correlation: by Field Engineer to EOT.

Logging Tool: Standard PSP-DEFT-GHOST w/ 2.25" FBS on Digital Slickline (DSL)

General Logging Procedure:

RU & RIH w/ Gauge Ring. Report Tag Depth. ROH.

RU & RIH w/ PSP. Record Main Flowing Passes at variable logging speeds
(based on well conditions) from Top Log Interval (TLI) to Bottom Log Interval (BLI).

Record Main Station Stops (at least 2 minutes each) between perforations, stages, major changes in flow regime, or as directed by client or production log analyst.

Record any addition Flowing Passes and/or Station Stops as needed or requested.

ROH. Delivery data to interpreter.

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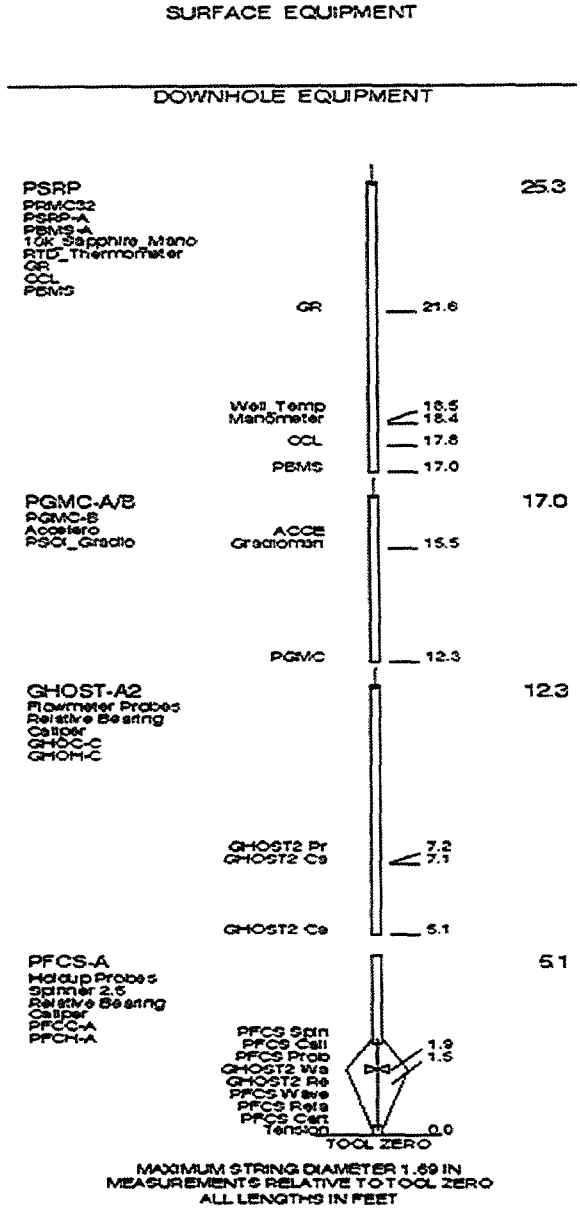
PL Tool Diagram:



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7-Mar-2017

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Interpretation Results: Surface Flowrate Results - Stage

Formation	Stage	Perforations		Gas (mcfpd)	Oil (bpd)	Water (bpd)	Gas (%)	Oil (%)	Water (%)
Wolfcamp	6	8646	8879	145	--	70	8.0%	--	9.2%
	5	9084	9266	145	--	240	8.0%	--	31.6%
	4	9371	9561	85	--	80	4.7%	--	10.5%
	3	9619	9835	880	--	370	48.5%	--	48.7%
	2	9894	10088	160	--	0	8.8%	--	0.0%
	1	10143	10351	400	--	0	22.0%	--	0.0%
Total				1815	--	760	100.0%	--	100.0%

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Interpretation Results: Surface Flowrate Results - Detail

Formation	Stage	Perforations		Gas (mcfpd)	Oil (bpd)	Water (bpd)	Gas (%)	Oil (%)	Water (%)	
Wolfcamp	6	8646	8647	120	--	40	6.6%	--	5.3%	
		8689	8690	0	--	0	0.0%	--	0.0%	
		8715	8717	15	--	0	0.8%	--	0.0%	
		8742	8743	0	--	0	0.0%	--	0.0%	
		8760	8761	0	--	0	0.0%	--	0.0%	
		8783	8784	10	--	10	0.6%	--	1.3%	
		8804	8806	0	--	0	0.0%	--	0.0%	
		8830	8832	0	--	10	0.0%	--	1.3%	
		8849	8851	0	--	0	0.0%	--	0.0%	
		8877	8879	0	--	10	0.0%	--	1.3%	
Wolfcamp	5	9084	9085	trace	--	0	trace	--	0.0%	**
		9110	9111	0	--	0	0.0%	--	0.0%	
		9131	9132	0	--	0	0.0%	--	0.0%	
		9147	9148	0	--	0	0.0%	--	0.0%	
		9186	9187	50	--	40	2.8%	--	5.3%	
		9203	9204	0	--	0	0.0%	--	0.0%	
		9217	9219	35	--	40	1.9%	--	5.3%	
		9245	9247	50	--	80	2.8%	--	10.5%	
		9264	9266	10	--	80	0.6%	--	10.5%	
Wolfcamp	4	9371	9372	35	--	30	1.9%	--	3.9%	
		9391	9392	0	--	10	0.0%	--	1.3%	
		9416	9417	10	--	20	0.6%	--	2.6%	
		9432	9433	0	--	0	0.0%	--	0.0%	
		9466	9467	40	--	20	2.2%	--	2.6%	
		9484	9485	0	--	0	0.0%	--	0.0%	
		9504	9506	0	--	0	0.0%	--	0.0%	
		9524	9526	0	--	0	0.0%	--	0.0%	
		9542	9544	0	--	0	0.0%	--	0.0%	
		9559	9561	0	--	0	0.0%	--	0.0%	
Wolfcamp	3	9619	9620	450	--	0	24.8%	--	0.0%	
		9643	9644	20	--	50	1.1%	--	6.6%	
		9665	9666	25	--	50	1.4%	--	6.6%	
		9693	9694	10	--	40	0.6%	--	5.3%	
		9712	9714	35	--	80	1.9%	--	10.5%	
		9750	9752	295	--	0	16.3%	--	0.0%	
		9784	9786	45	--	90	2.5%	--	11.8%	
		9833	9835	0	--	60	0.0%	--	7.9%	

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Interpretation Results: Surface Flowrate Results - Detail (Continued)

Wolfcamp	2	9894	9895	45	--	0	2.5%	--	0.0%	
		9923	9924	0	--	0	0.0%	--	0.0%	
		9941	9942	45	--	0	2.5%	--	0.0%	
		9961	9962	35	--	0	1.9%	--	0.0%	
		9985	9986	trace	--	0	trace	--	0.0%	**
		10035	10036	35	--	0	1.9%	--	0.0%	
		10050	10051	trace	--	0	trace	--	0.0%	**
		10068	10070	trace	--	0	trace	--	0.0%	**
		10086	10088	0	--	0	0.0%	--	0.0%	
Wolfcamp	1	10143	10144	115	--	0	6.3%	--	0.0%	
		10157	10158	trace	--	0	trace	--	0.0%	**
		10208	10209	trace	--	0	trace	--	0.0%	**
		10229	10230	285	--	0	15.7%	--	0.0%	
		10244	10246	0	--	0	0.0%	--	0.0%	
		10263	10265	0	--	0	0.0%	--	0.0%	
		10306	10308	0	--	0	0.0%	--	0.0%	
		10349	10351	0	--	0	0.0%	--	0.0%	
Total				1815	--	760	100.0%	--	100.0%	

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Federal 13 Com #4
7-Mar-2017

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Interpretation Remarks

This interpretation is based on PSP Production Log data recorded on 07-Mar-2017 in memory on slickline. The Field Engineer (FE) is Blake Melcher. Five down and four up main logging passes were recorded over the main logging interval under flowing conditions. Color coding is as follows: D1/U1-Red, D2/U2-Dk Blue, D3/U3-Green, D4/U4-Lt Blue, D5-Violet. Down pass curves have solid coding. Up pass have dashed coding. Station stops are presented as circles at their respective depths.

Main logging passes are correlated by Field Engineer. Top Log Interval (TLI) is observed @ 8400' MD. Bottom Log Interval (BLI) is observed @ 10462' MD.

EOT is observed on the averaged X-Y caliper measurement (C1C2) @ 8603" MD. The average X-Y caliper measurement (C1C2) is consistent and agrees with nominal ID. A nominal ID of 4.892" is used in the interpretation calculations.

Downhole pressure (WPRE) is stable during the main passes. Down and Up passes are used in the interpretation calculations.

Downhole temperature (WTEP) trends are repeatable. Down pass temperatures are used preferentially in the interpretation calculations.

All DEFT (electrical) probes are functioning properly and the basis of the water holdup (Yw) image. DEFT (electrical) probe measurements are most consistent on down passes which are used preferentially in the interpretation calculations. DEFT (electrical) probes provide a confident measurement of water holdup, independent of PVT information, by counting the hydrocarbon bubbles during a dominate water flow regime or water droplets during a dominate gas or oil flow regime.

* GHOST (optical) probes measurements were not consistent between individual probes and passes, and are not used in the interpretation calculations.

The gradiomanometer density measurement (WFDE) is confident and used in the interpretation calculations.

Spinner response is consistent and provides a confident slope and liquid threshold for downhole in-situ spinner calibrations. All spinner passes are used in the spinner calibrations and apparent velocity calculations.

Total downhole rates (QZT) are calculated using the apparent spinner velocity, a nominal casing ID, averaged water holdup (Yw), fluid density (WFDE) and an established water-hydrocarbons flow model. Rates are calculated downhole and presented in downhole barrels on the log snapshots. Calculated downhole rates are then converted to surface rates at standard conditions and presented in the above table.

PVT Information: Oil gravity of 52 API, Gas gravity of 0.7178 s.g. Water salinity 63000 ppm was provided by Cimarex .

** A report of "trace" gas production is based on temperature, water holdup and density but does not appear to be of sufficient volume to observed on the spinner. Therefore, "trace" gas suggests minimal or negligible gas production, if any, into the wellbore.

Overall, data quality is high (except for the GHOST optical probes) and the downhole environment is stable resulting in a high level of confidence in gas/water interpretation calculations and results.

Leonid Kolomytsev, Production Engineer
Schlumberger, Houston, TX, USA

Casey Chadwick, Production Logging Domain Champion,
North America Wireline, Houston, TX, USA

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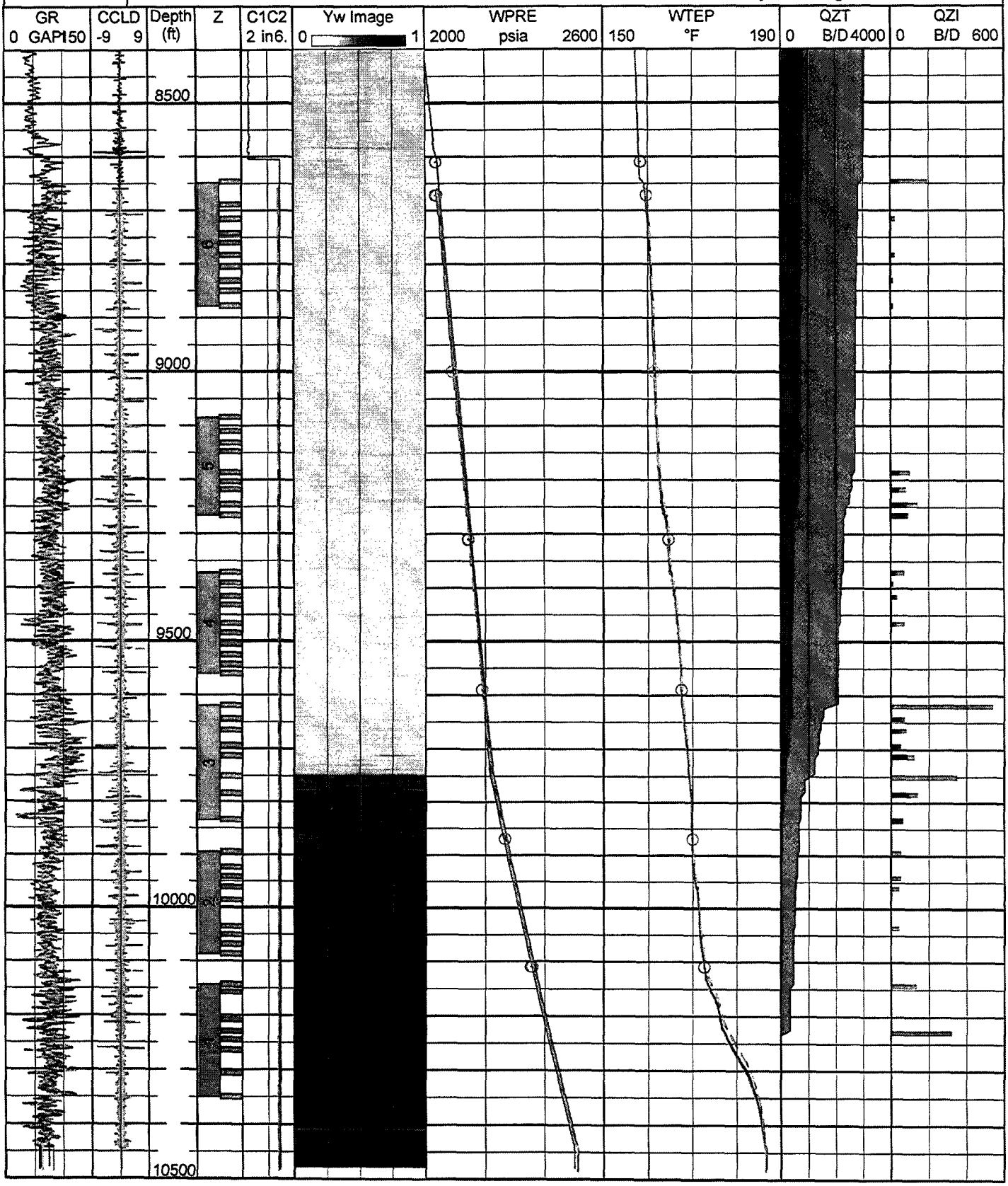
PSP Production Log - Interpretation Results

Cimarex_Federal 13 Com4 Interp_new

Company: Cimarex Energy Company
Field: White City
Well: Federal 13 Com #4

Test: PSP Production Log
Date: 07-Mar-2017
Survey: Flowing



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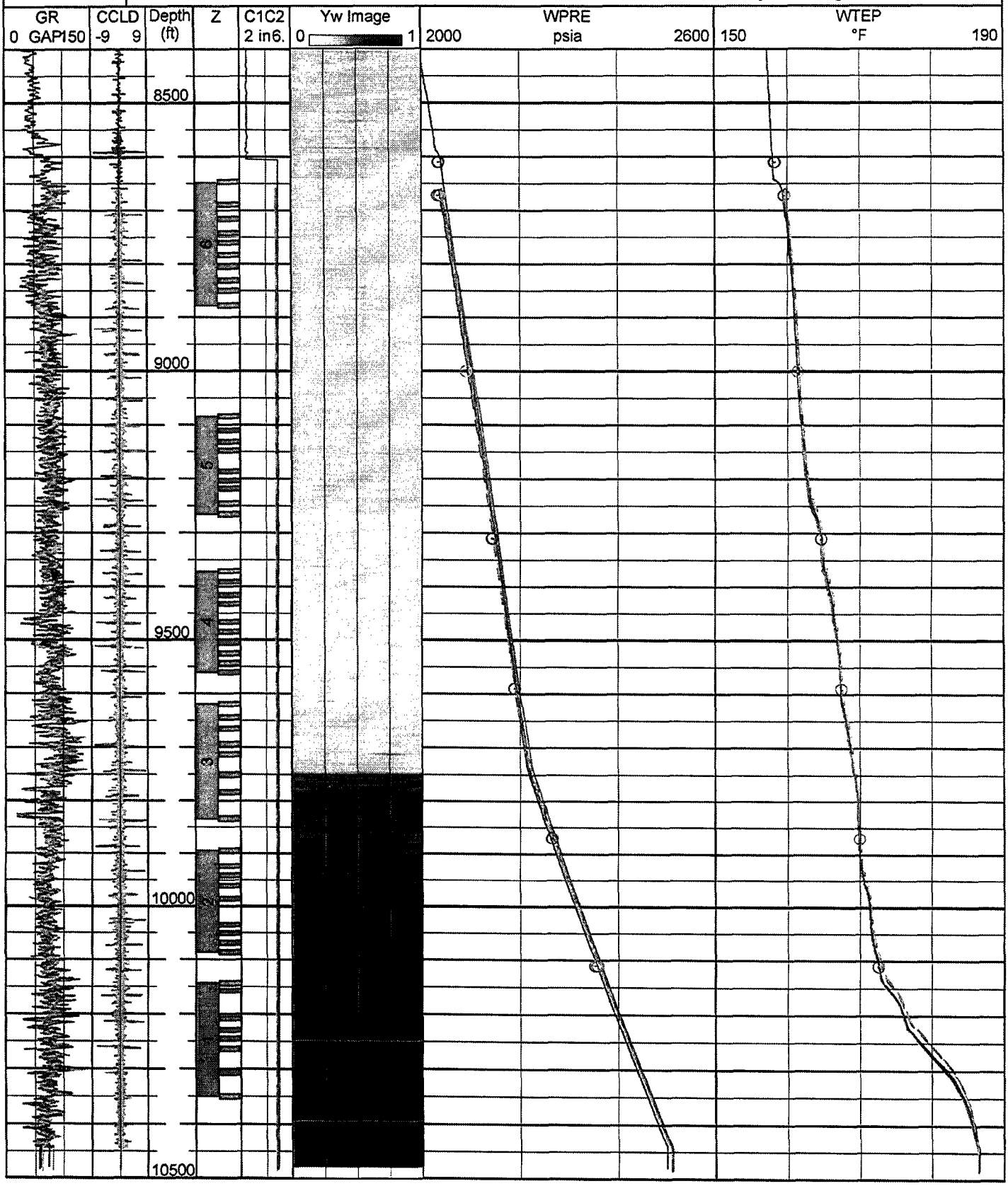
PSP Production Log - Pressure & Temperature

Cimarex_Federal 13 Com4 Interp_ne...

Company: Cimarex Energy Company
Field: White City
Well: Federal 13 Com #4

Test: PSP Production Log
Date: 07-Mar-2017
Survey: Flowing



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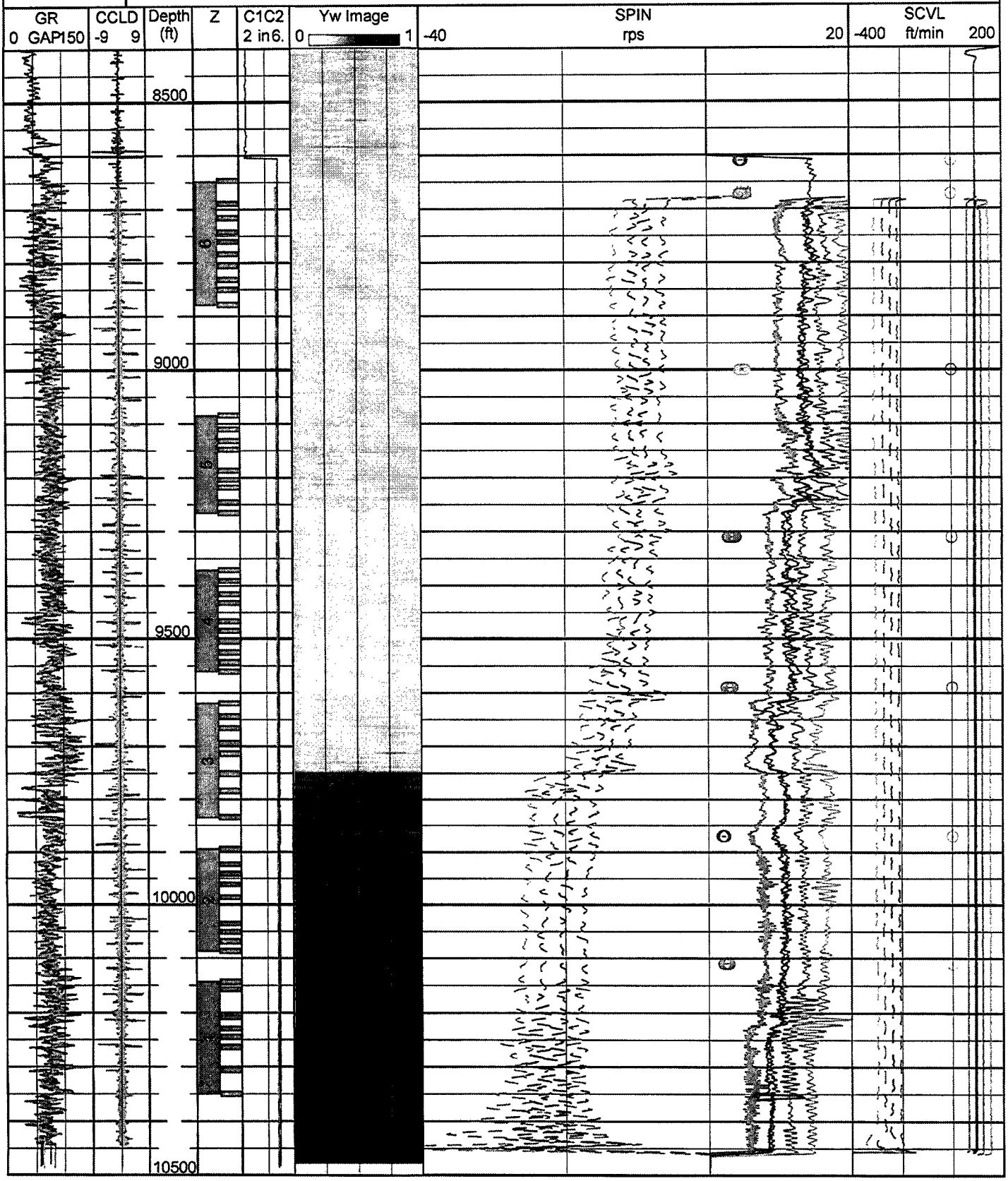
PSP Production Log - Spinner & Cable Velocity

Cimarex_Federal 13 Com4 Interp_ne...

Company: Cimarex Energy Company
Field: White City
Well: Federal 13 Com #4

Test: PSP Production Log
Date: 07-Mar-2017
Survey: Flowing



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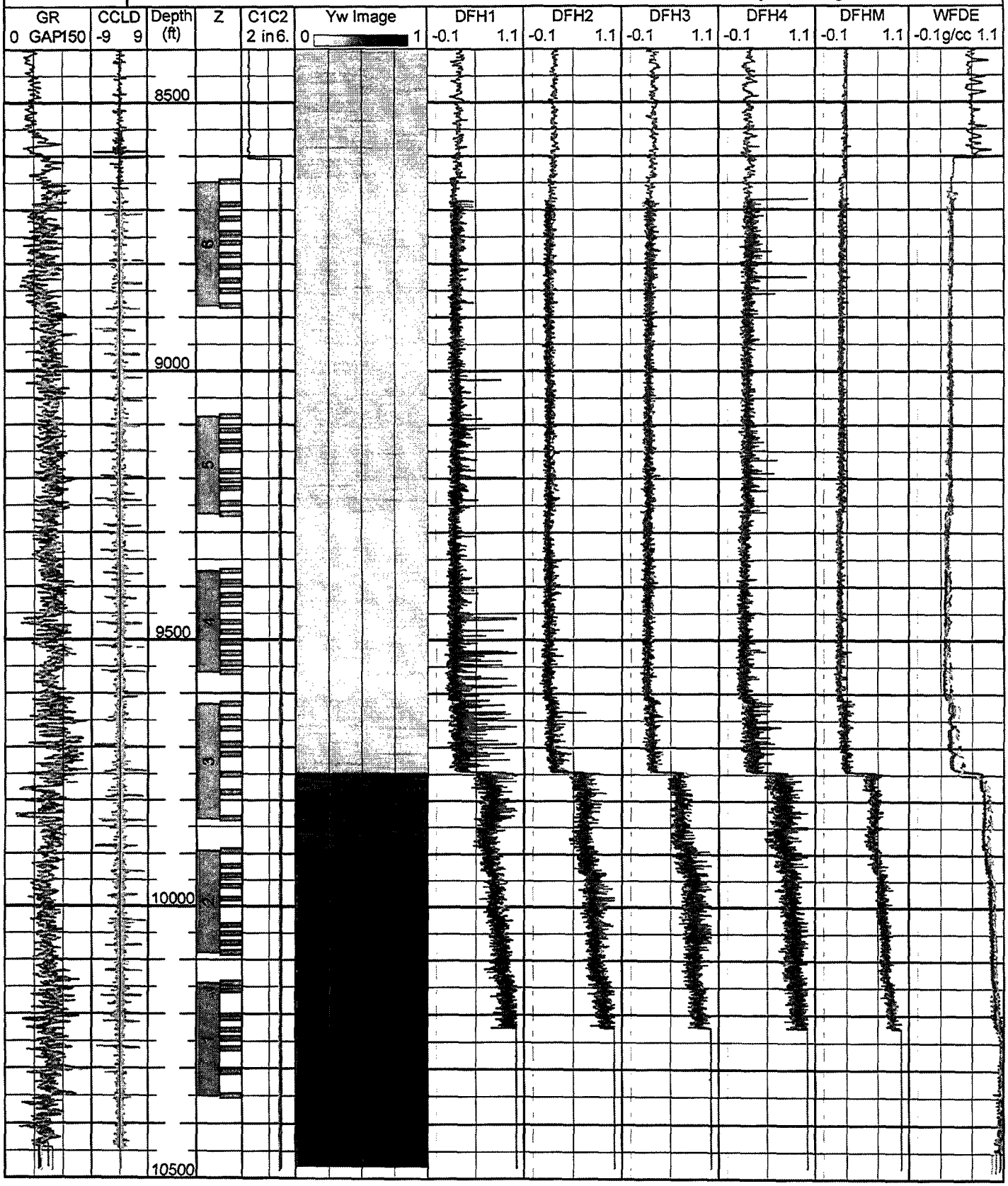
PSP Production Log - DEFT Water Holdup & Density

Cimarex_Federal 13 Com4 Interp_ne...

Company: Cimarex Energy Company
Field: White City
Well: Federal 13 Com #4

Test: PSP Production Log
Date: 07-Mar-2017
Survey: Flowing



PSP & FSI Interpretation Mnemonics

CALI_FSI	Flow Scanner Caliper
CCLC/CCLD	Casing Collar Locator
CVEL/SCVL	Cable Velocity
D1RB	DEFT Relative Bearing Probe 1
DFBFx_FSI (0-5)	FSI Vertical DEFT Bubble Count Array (0-Bot, 5-Top)
DFBM	PSP Mean DEFT Bubble Count
DFBx (1-4)	PSP Individual Probe DEFT Bubble Count
DFHFx_FSI (0-5)	FSI Vertical DEFT Water Holdup Array (0-Bot, 5-Top)
DFHM	PSP Mean DEFT Water Holdup
DFHx (1-4)	PSP Individual Probe DEFT Water Holdup
GHBFx_FSI (0-5)	FSI Vertical GHOST Bubble Count Array (0-Bot, 5-Top)
GHBM2	PSP Mean GHOST Bubble Count
GHBx (5-8)	PSP Individual Probe GHOST Bubble Count
GHHFx_FSI (0-5)	FSI Vertical GHOST Gas Holdup Array (0-Bot,5-Top)
GHHM2	PSP Mean GHOST Gas Holdup
GHHx (5-8)	PSP Individual Probe GHOST Gas Holdup
GR	Gamma Ray
HTEN	Head Tension/Compression
MWFD	Pressure Derived Density
PFC1	PSP Caliper 1 (X)
PFC2	PSP Caliper 2 (Y)
RB_FSI	FSI Relative Bearing
SPIN/SPI1	Full Bore Spinner / Inline Spinner
SPIFx_FSI (0-4)	FSI Vertical Micro-Spinner Array (0-Bot, 4-Top)
WFDE	Gradio Well Fluid Density
WPRE	Well Pressure
WTEP	Well Temperature

Color Coding is typically the same for all the curves that belong to the same pass
RED – Pass One / Dk Blue – Pass Two / Green – Pass Three / Lt Blue – Pass Four

VAFV/VAPP	Apparent fluid velocity (gas, water & oil)
QGI, QOI, QWI	Interval Gas, Oil, Water Rates (down hole unless stated otherwise)
QGT, QOT, QWT	Cumulative Gas, Oil, Water Rates (down hole unless stated otherwise)

Tool Mnemonics List

DEFT	Digital Fluid Entry Tool (Resistivity Probes)
GHOST	Gas Holdup Optical Sensor Tool (Optical Probes)
FSI	Flow Scanner Imager
PSP	Production Services Platform
PBMS	Production Basic Measurement Sonde (Temperature, Pressure, CCL, GR)
PCMS	Production Compression Measurement Sonde
PGMC	Production GradioManometer Carrier (Density)
PFCS	Production Flowmeter Caliper Sonde (Holdup, Caliper, Full Bore Spinner)
PILS	Production In-Line Spinner