



WELL INFORMATION					
MWD Run Number	100	200	300		
Date run completed	14-Oct-13	14-Oct-13	15-Oct-13		
Rig Bit Number	2	3	4		
Bit Size (in)	8.750	8.750	8.750		
Tool Nominal OD (in)	6.750	6.750	6.750		
Log Start Depth (TVD, ft)	939.97	5,835.80	6,483.15		
Log End Depth (TVD, ft)	5,835.80	6,483.15	6,541.19		
Drill or Wipe	Drill	Drill	Drill		
Drill/Wipe Start Date and Time	13-Oct-13 13:15	14-Oct-13 10:00	15-Oct-13 04:00		
Drill/Wipe End Date and Time	14-Oct-13 03:15	14-Oct-13 16:00	15-Oct-13 09:15		
Min Inc (deg) @ Depth (TVD, ft)	.36 @ 4,938.92	2.27 @ 5,883.77	63.58 @ 6,501.43		
Max Inc (deg) @ Depth (TVD, ft)	13.29 @ 2,582.82	51.95 @ 6,450.82	82.17 @ 6,535.36		
Bit TFA(in2) / Bit Type	.91 / PDC	1.24 / PDC	1.24 / PDC		
Flow Rate (gpm)	596.30	567.00	500.00		
Max AV (fpm) / CV (fpm) @ MWD	500.0 / 500.0	382.6 / 475.0	382.6 / 475.0		
Fluid Type	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
Density (ppg) / Viscosity (spqt)	8.50 / 28.00	9.90 / 36.00	10.40 / 39.00		
Filtrate CL (ppm)	2,500.00	2,300.00	2,300.00		
pH / Fluid Loss (mptm)	9.00 / 20	9.70 / 8	9.20 / 7		
PV (cP) / YP (Ihf2)	2 / 3.00	12 / 11.00	15 / 14.00		
% Solids / % Sand	0.90 / 0.15	8.70 / 0.20	10.20 / 0.20		
% Oil / Oil:Water Ratio	0 / 0:95	0 / 0:95	0 / 0:95		
Rm @ Measured Temp (degF)	NA @ NA	NA @ NA	NA @ NA		
Rmf @ Measured Temp (degF)	NA @ NA	NA @ NA	N/A @ N/A		
Rmc @ Measured Temp (degF)	NA @ NA	NA @ NA	N/A @ N/A		
Max Tool Temp (deg F) / S	145.00 / PCM	151.40 / PCM	145.00 / PCM		

Max Tool Temp (degF) / Source	145.90 / PCM	151.10 / PCM	145.90 / PCM		
Rm @ Max Tool Temp (degF)	NA @ NA	NA @ NA	N/A @ N/A		
Lead MWD Engineer	Brett Vandergon	Brett Vandergon	Brett Vandergon		
Customer Representative	Matt Settles	Matt Settles	Matt Settles		

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM	PCM		
Software Version	5.84	5.84	5.84		
Sub Serial Number	11404301	11404301	11404301		
Insert Serial Number	11227514	11227514	11227514		
Date and Time Initialized	12-Oct-13 21:32	01-Jan-70 00:00	01-Jan-70 00:00		
Date and Time Read	15-Oct-13 15:44	15-Oct-13 15:50	15-Oct-13 15:55		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	58.00	57.00	55.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	11404301	11404301	11404301		
Sonde Serial Number	12177530	12177530	12177530		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	287.79	217.70	279.05		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	51.45	49.99	47.89		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	11404301	11404301	11404301		
Insert/Sonde Serial Number	11579776	11579776	11579776		

## REMARKS

1. All depths are true vertical bit depths, referenced to the Driller's pipe tally and are measured from the Drill Floor, unless otherwise specified.
2. No depth corrections have been made for pipe stretch or compression.
3. Critical annual velocities are calculated using the "Power Law" model for water based fluids and the "Bingham Plastic" model for oil and synthetic based fluids.
4. All data presented is recorded data unless otherwise specified.
5. The following smoothing parameters have been applied to the data:  
  
PGRC (Corrected Gamma Ray):  
Interval Resolution: 0.5 ft  
Interval Distance: 0.6 ft  
Gap Fill: 3.0 ft

ROPA (Average Rate of Penetration)  
Interval Resolution: 0.5 ft  
Interval Distance: 1.2 ft  
Gap Fill: 3.0 ft

Cap 1111: 3.0 ft

6. Surveys at MD 360' and 615' were done by gyro.

7. INSITE version 7.4.2

## WARRANTY

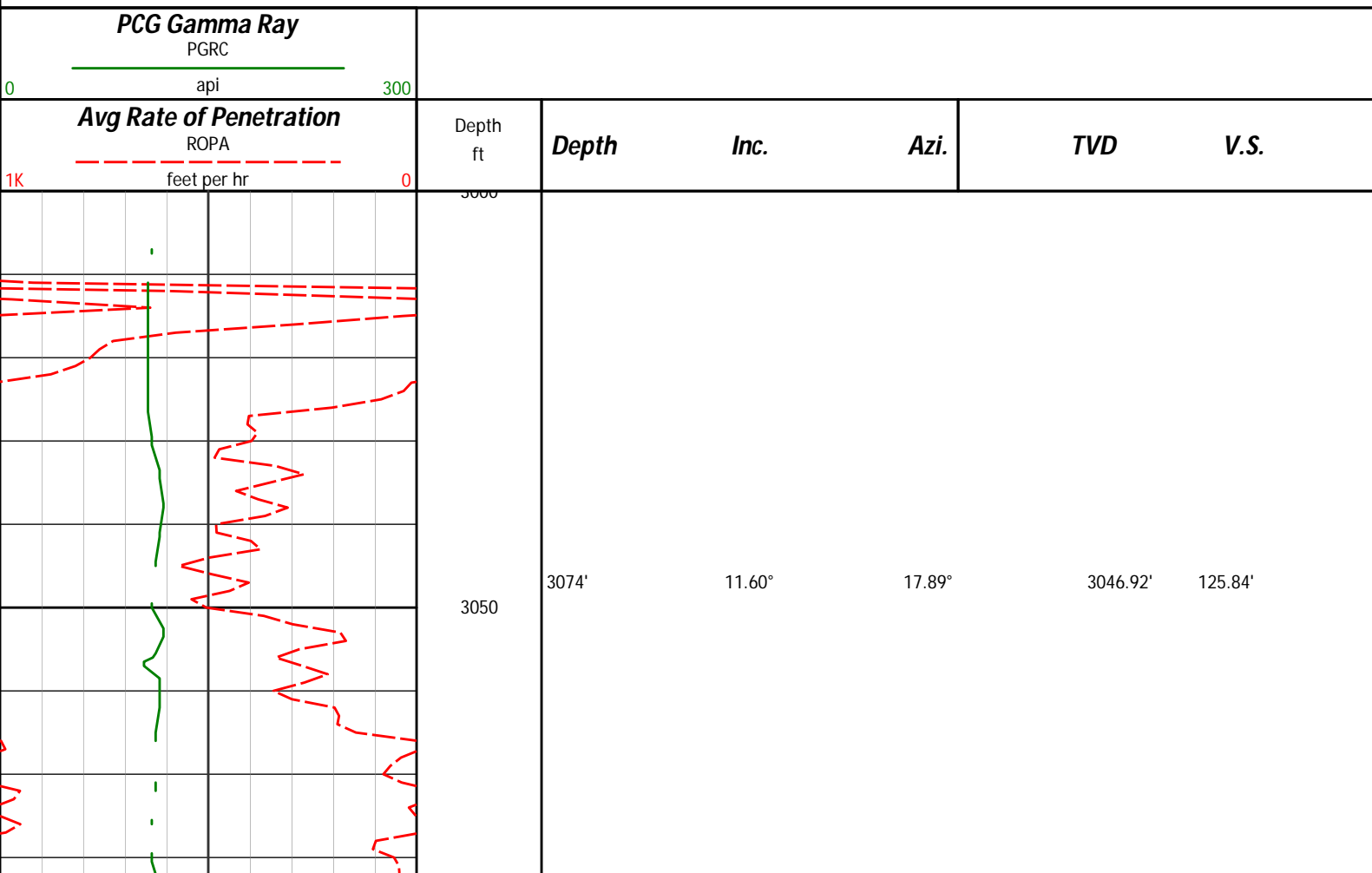
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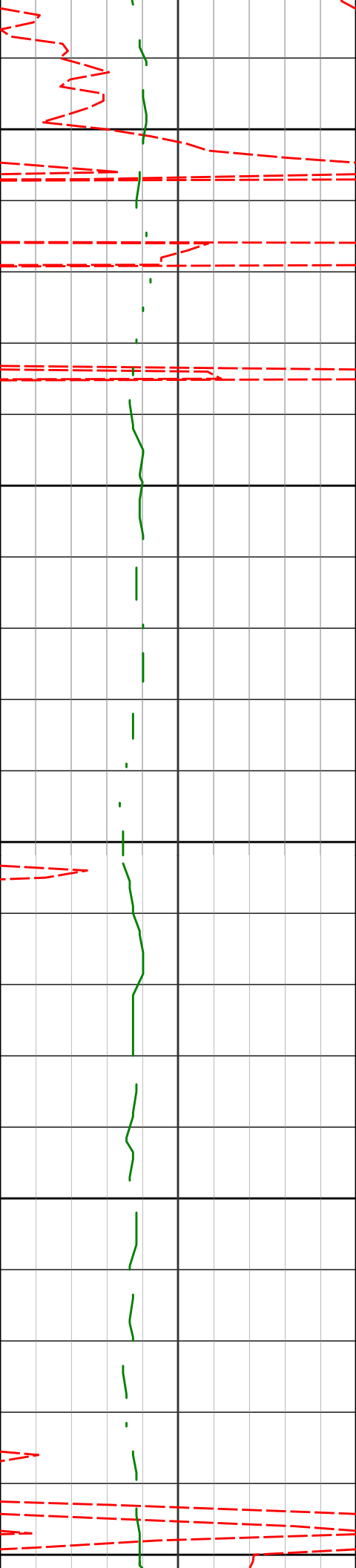
# HALLIBURTON

Sperry Drilling Services

## TVD Detail Log 1:240

Noble Energy  
Wells Ranch AE20-64HN  
H&P 343  
T6N-R62W





3100

3150

3200

3250

3300

3169'

10.02°

16.33°

3140.23'

132.39'

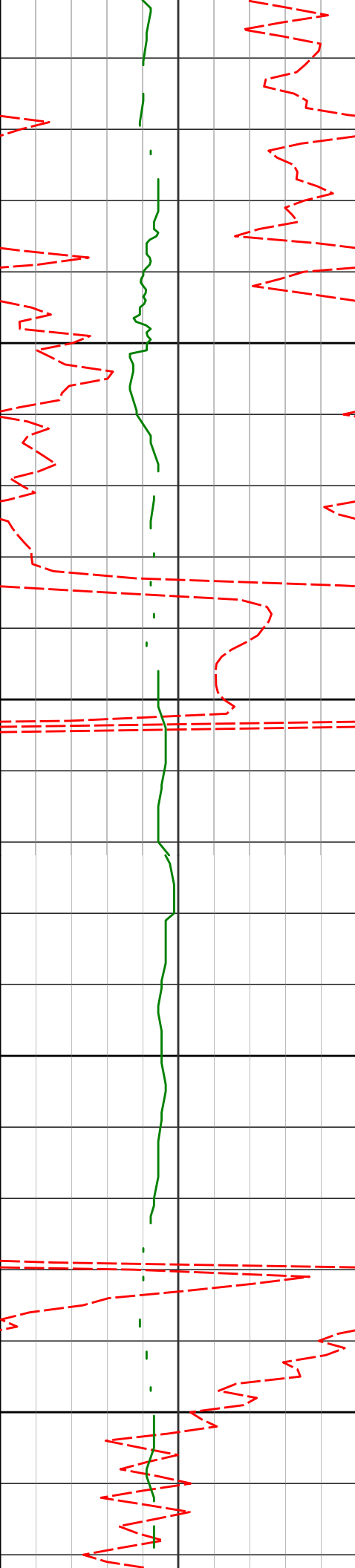
3264'

8.76°

15.14°

3233.96'

137.74'



3359'

7.02°

14.89°

3328.05'

142.08'

3350

3400

3454'

7.44°

24.00°

3422.30'

146.92'

3450

3500

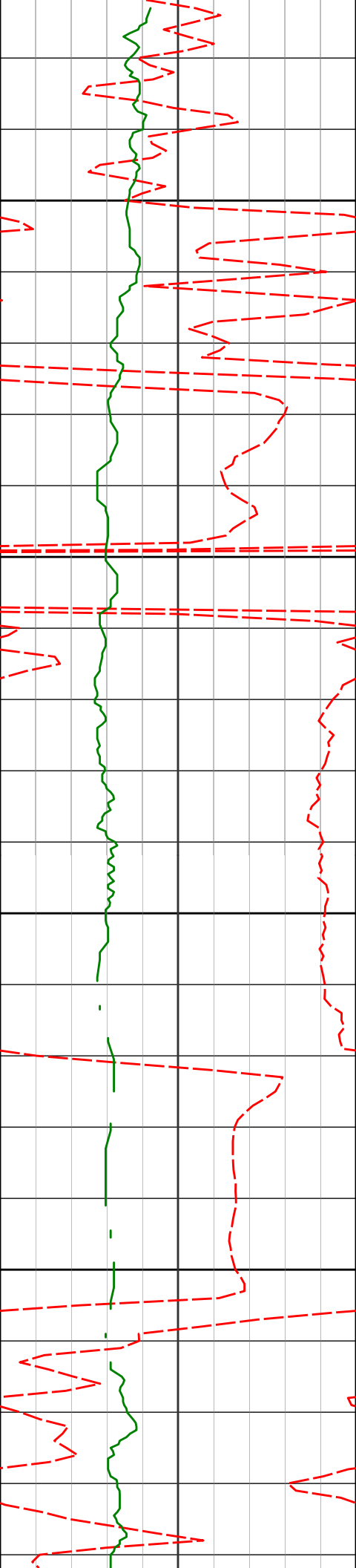
3549'

7.36°

25.44°

3516.51'

152.88'



3550

3600

3650

3700

3644'

6.33°

17.39°

3610.83'

157.85'

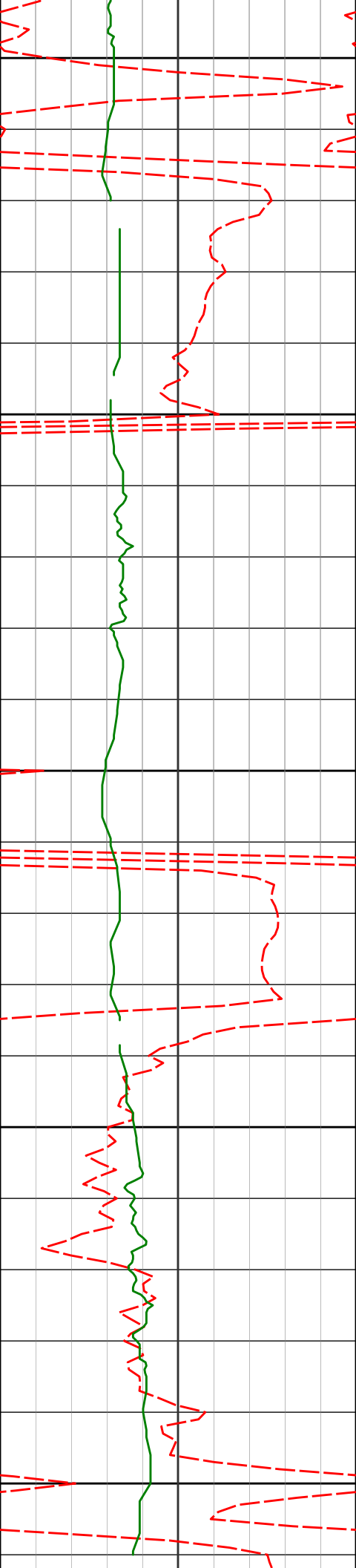
3739'

4.50°

8.21°

3705.41'

160.61'



3750

3800

3850

3900

3950

3834'

2.35°

338.88°

3800.24'

160.87'

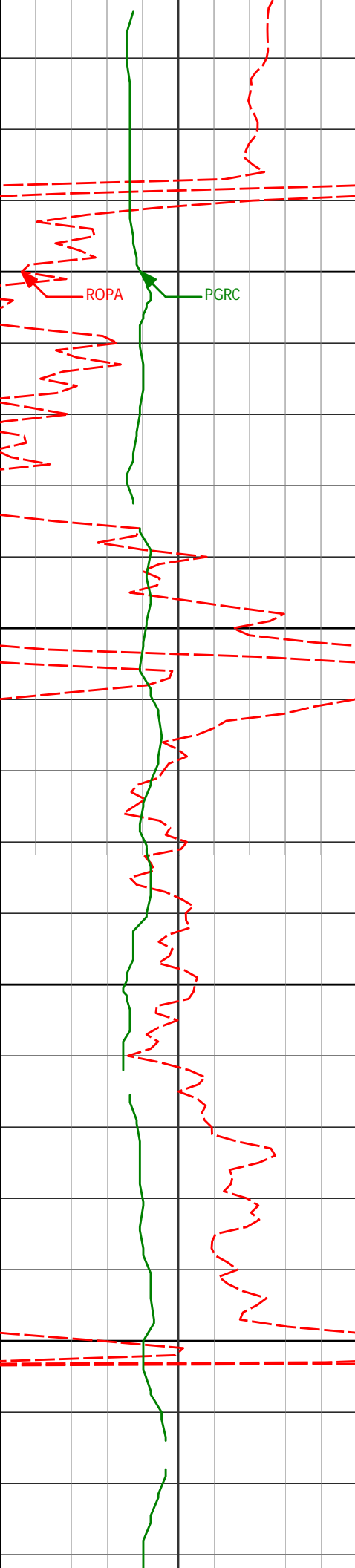
3929'

3.02°

319.12°

3895.14'

158.82'



4023'

1.02°

293.42°

3989.07'

156.61'

4000

4050

4118'

0.79°

271.90°

4084.06'

155.21'

4100

4150

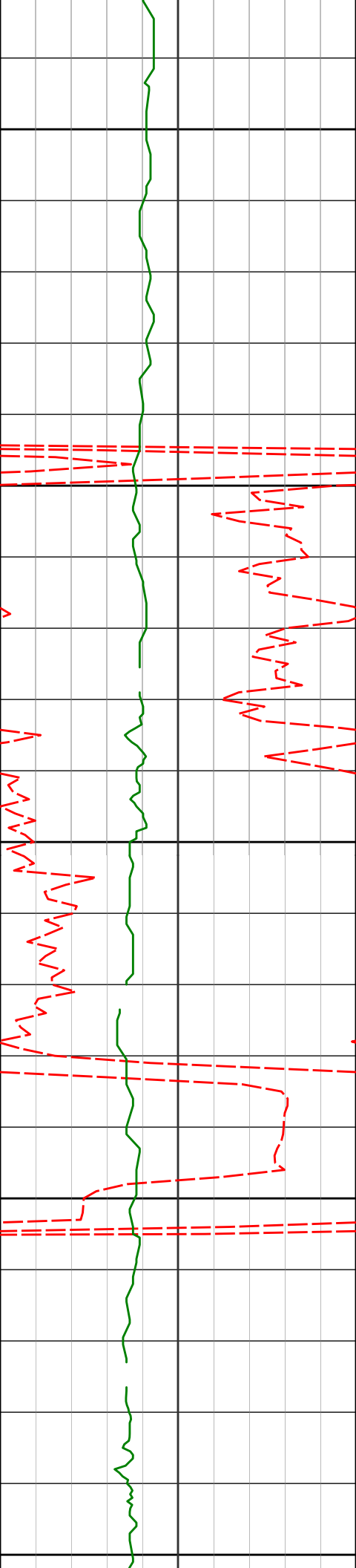
4213'

0.72°

328.60°

4179.06'

154.29'



4200

4250

4300

4350

4400

4308'

1.09°

313.03°

4274.04'

153.41'

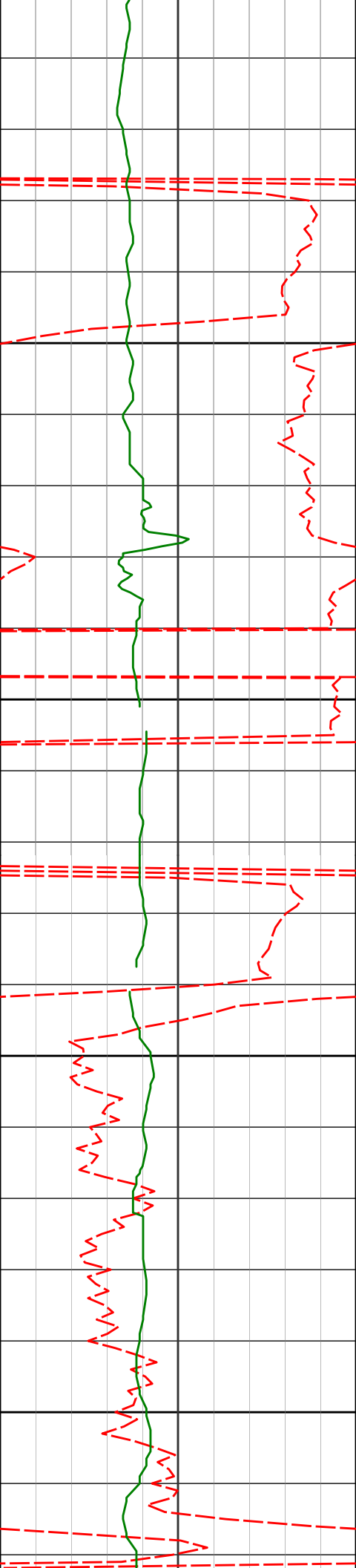
4403'

1.41°

303.02°

4369.02'

151.87'



4450

4498'

1.00°

306.34°

4464.00'

150.31'

4500

4550

4593'

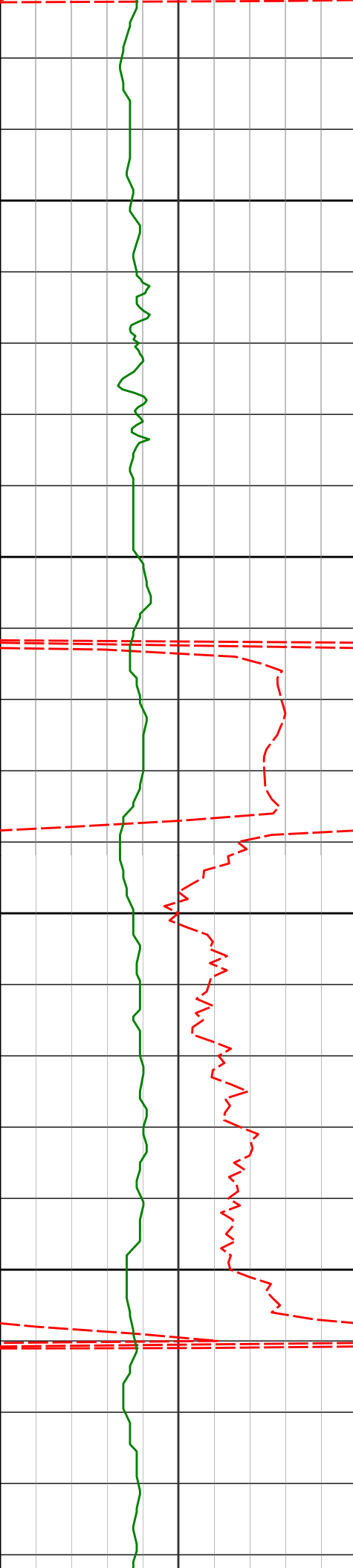
0.68°

65.53°

4559.00'

150.21'

4600



4650

4688'

1.38°

69.35°

4653.98'

151.84'

4700

4750

4783'

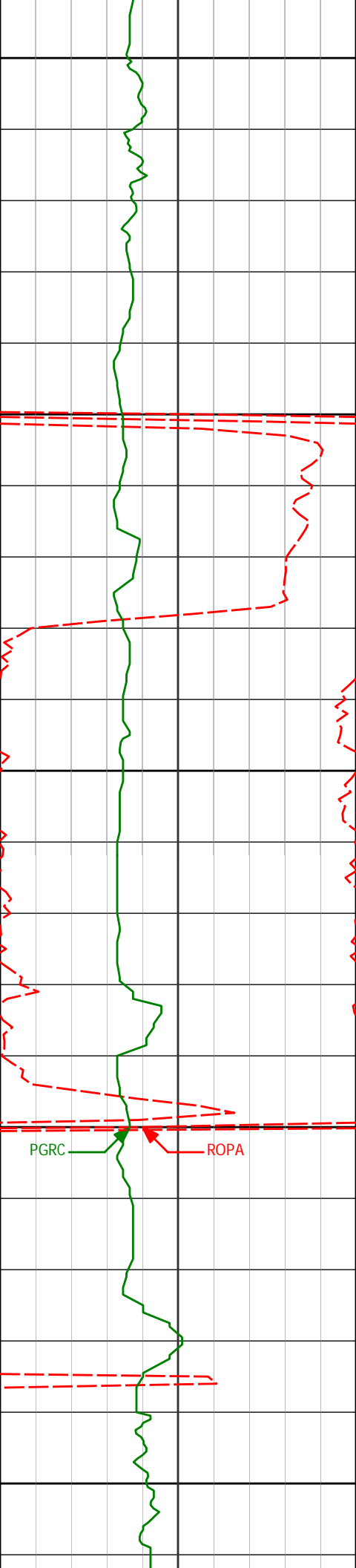
1.65°

137.31°

4748.95'

153.78'

4800



4850

4900

4950

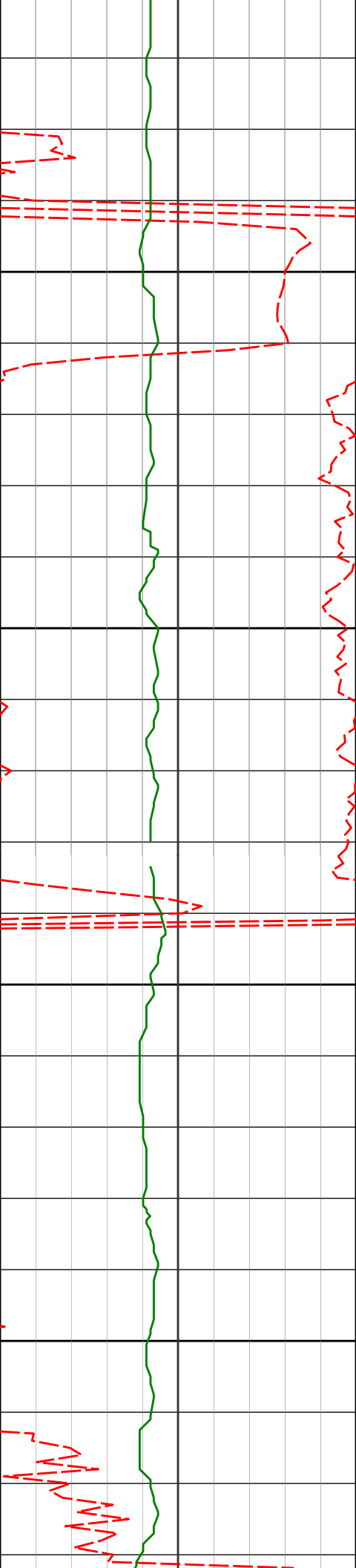
5000

5050

PGRC

ROPA

4878'	0.88°	129.65°	4843.93'	155.16'
4973'	0.36°	152.19°	4938.92'	155.80'
5068'	0.44°	150.71°	5033.92'	156.07'



5100

5162'

1.57°

183.88°

5127.91'

156.04'

5150

5200

5257'

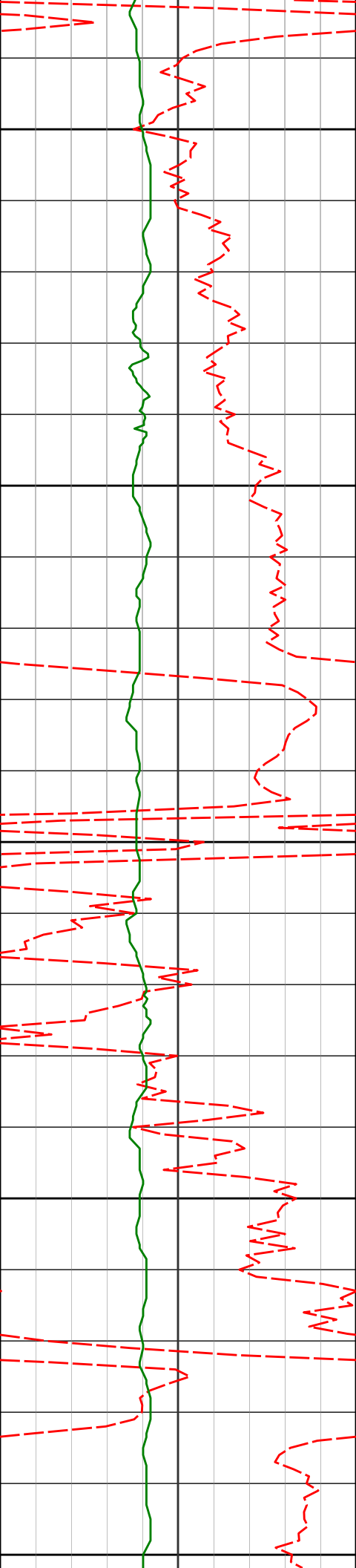
0.98°

188.77°

5222.88'

155.66'

5250



5300

5352'

1.08°

181.70°

5317.87'

155.38'

5350

5400

5447'

1.01°

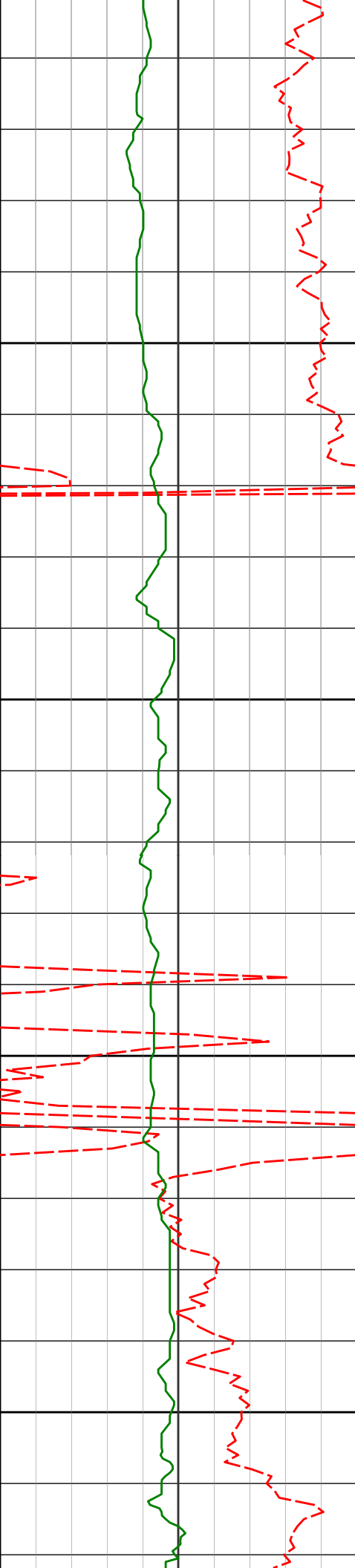
232.93°

5412.85'

154.58'

5450

5500



5550

5600

5650

5700

5542'

0.96°

201.40°

5507.84'

153.53'

5637'

0.83°

177.24°

5602.83'

153.17'

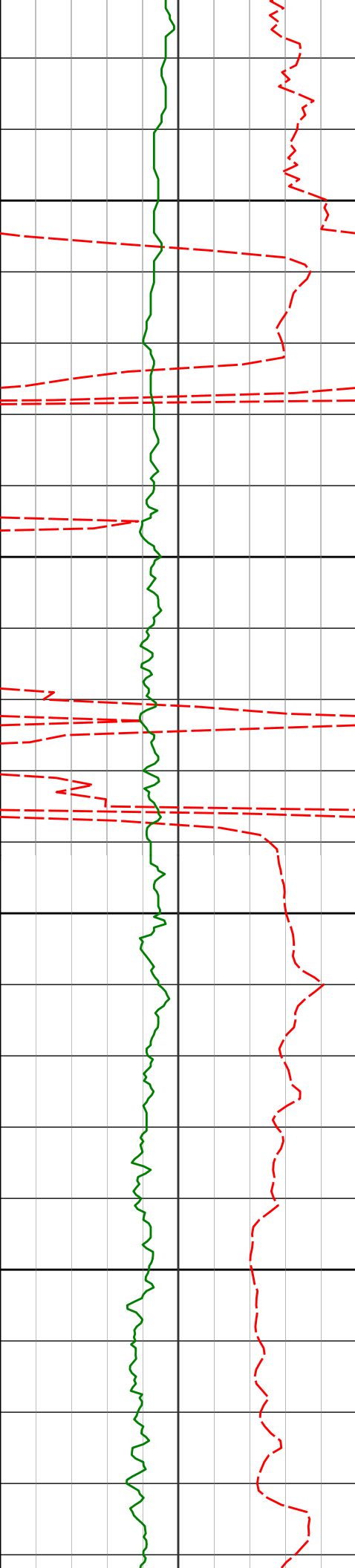
5732'

0.90°

181.44°

5697.82'

153.07'



Run 200

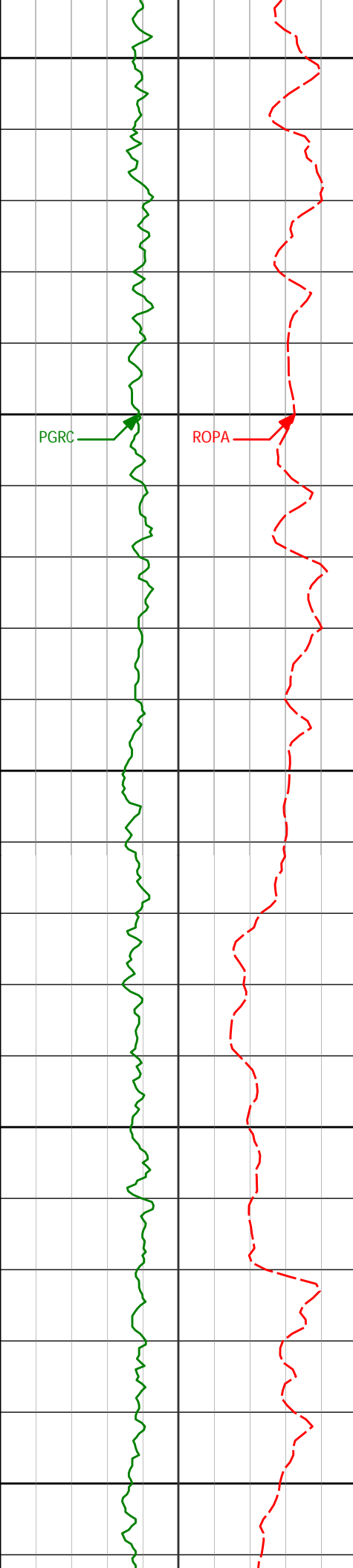
5918'

2.27°

102.93°

5883.77'

155.96'



5950

6013'

9.62°

92.35°

5978.20'

165.65'

6000

PGRC

ROPA

6050

6108'

16.13°

81.47°

6070.77'

186.72'

6100

6150

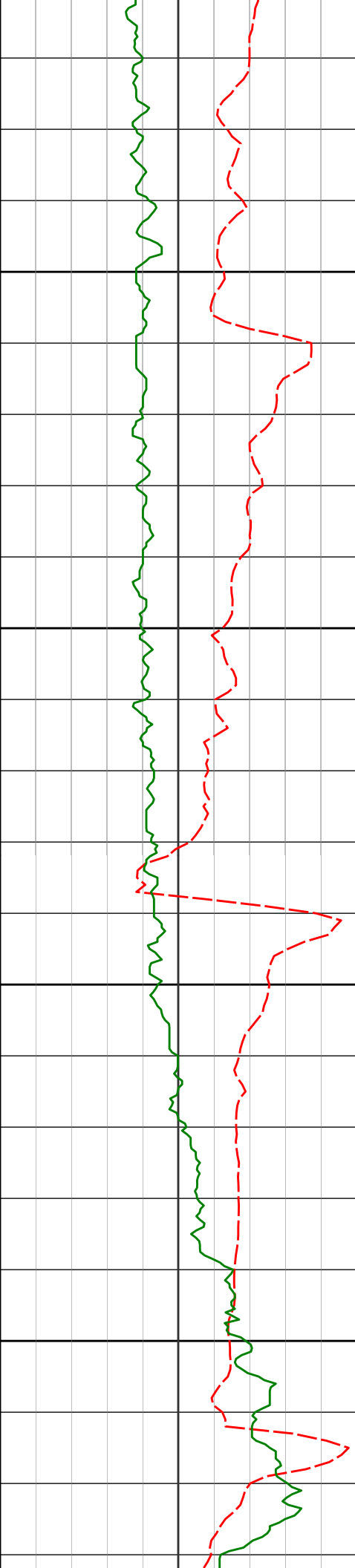
6203'

23.57°

76.89°

6160.07'

218.71'



6200

6298'

31.45°

79.40°

6244.27'

262.19'

6250

6300

6393'

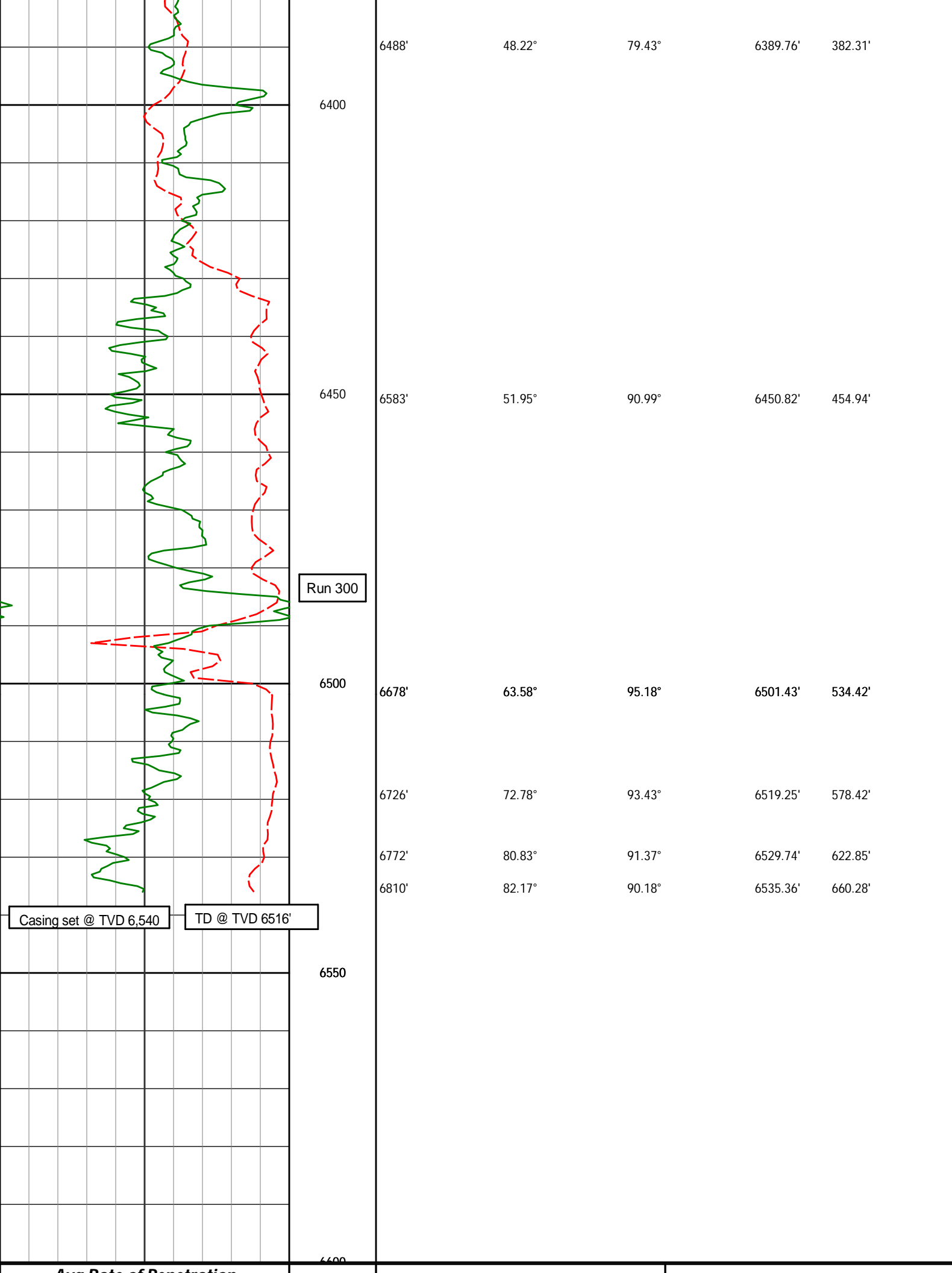
39.74°

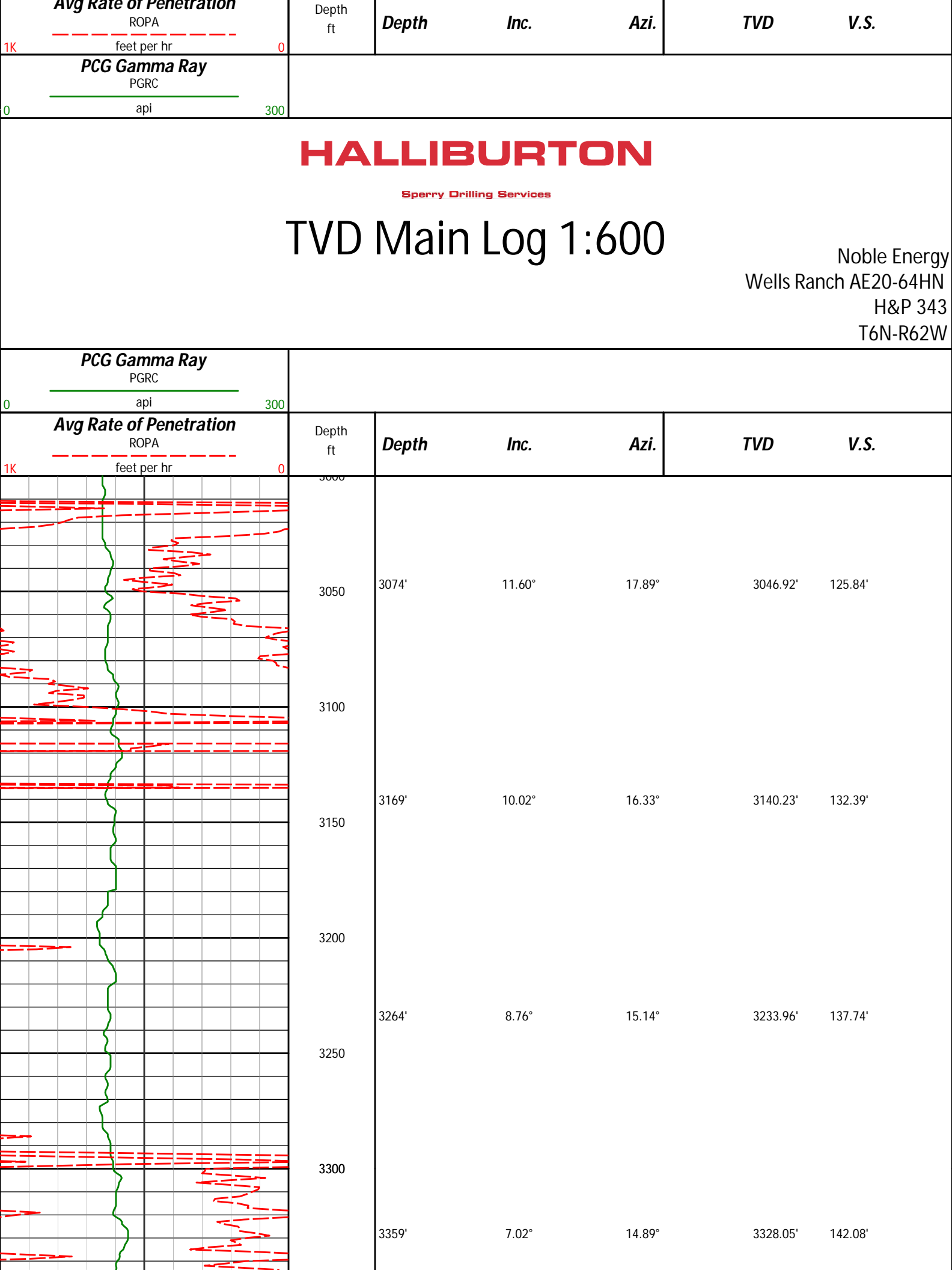
76.92°

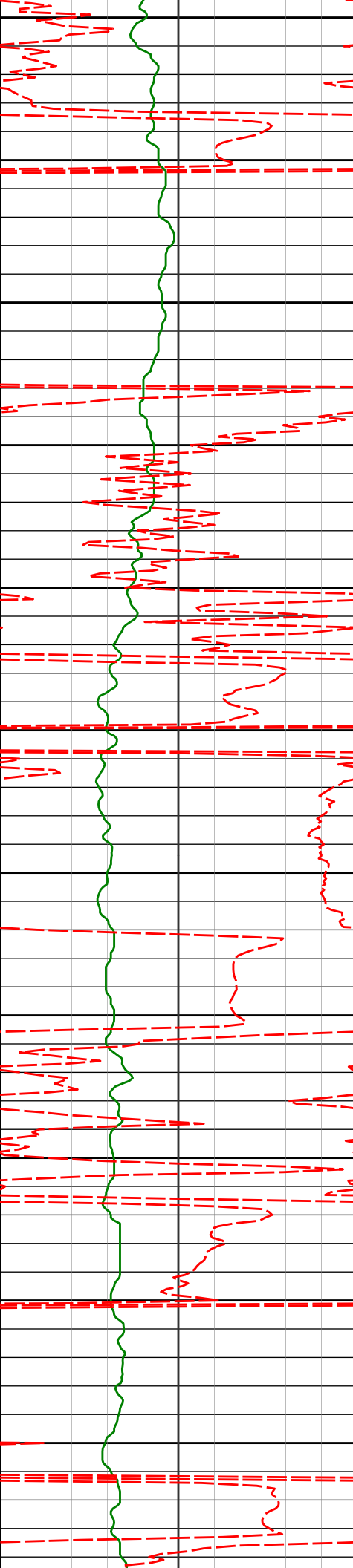
6321.45'

316.95'

6350







3350

3400

3454'

7.44°

24.00°

3422.30'

146.92'

3450

3500

3549'

7.36°

25.44°

3516.51'

152.88'

3550

3600

3644'

6.33°

17.39°

3610.83'

157.85'

3650

3700

3739'

4.50°

8.21°

3705.41'

160.61'

3750

3800

3834'

2.35°

338.88°

3800.24'

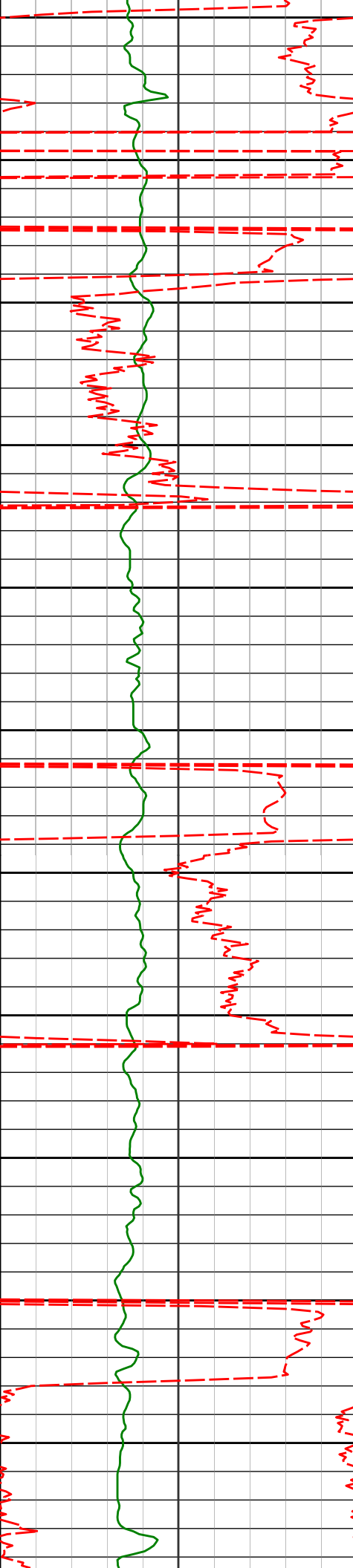
160.87'

3850

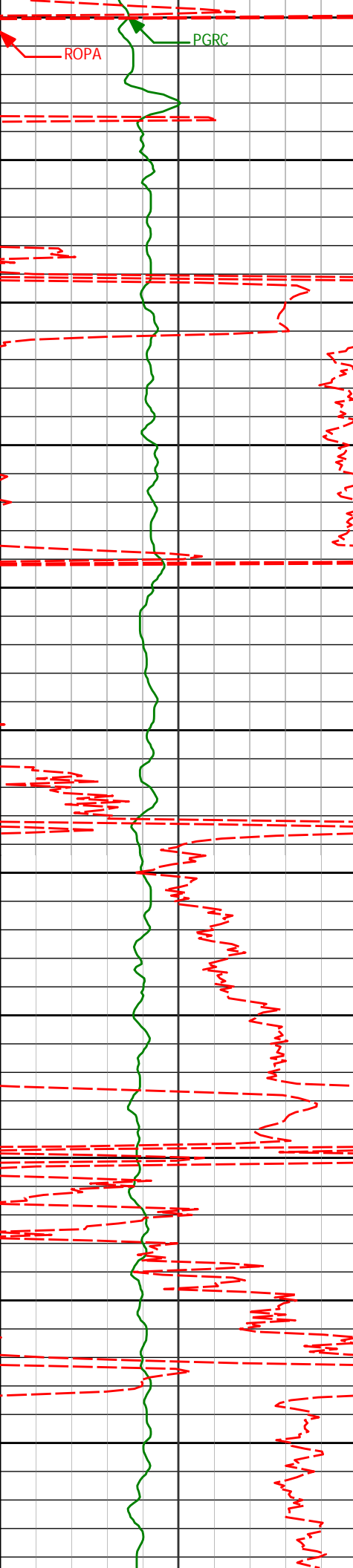


3900  
3950  
4000  
4050  
4100  
4150  
4200  
4250  
4300  
4350  
4400

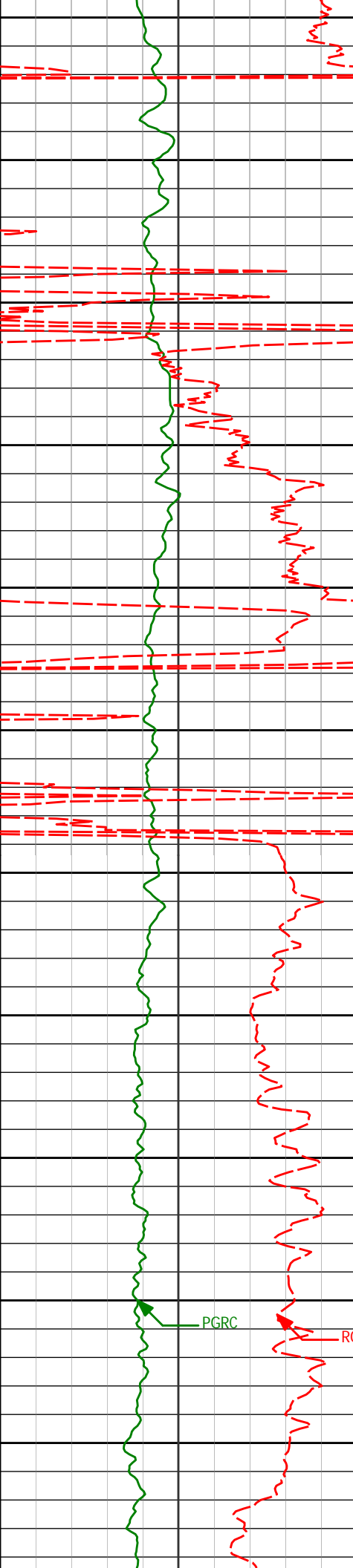
3929'	3.02°	319.12°	3895.14'	158.82'
4023'	1.02°	293.42°	3989.07'	156.61'
4118'	0.79°	271.90°	4084.06'	155.21'
4213'	0.72°	328.60°	4179.06'	154.29'
4308'	1.09°	313.03°	4274.04'	153.41'
4403'	1.41°	303.02°	4369.02'	151.87'



4450				
4498'	1.00°	306.34°	4464.00'	150.31'
4500				
4550				
4593'	0.68°	65.53°	4559.00'	150.21'
4600				
4650				
4688'	1.38°	69.35°	4653.98'	151.84'
4700				
4750				
4783'	1.65°	137.31°	4748.95'	153.78'
4800				
4850				
4878'	0.88°	129.65°	4843.93'	155.16'
4900				
4973'	0.36°	152.19°	4938.92'	155.80'
4950				



5068'	0.44°	150.71°	5033.92'	156.07'
5162'	1.57°	183.88°	5127.91'	156.04'
5257'	0.98°	188.77°	5222.88'	155.66'
5352'	1.08°	181.70°	5317.87'	155.38'
5447'	1.01°	232.93°	5412.85'	154.58'
5542'	0.96°	201.40°	5507.84'	153.53'

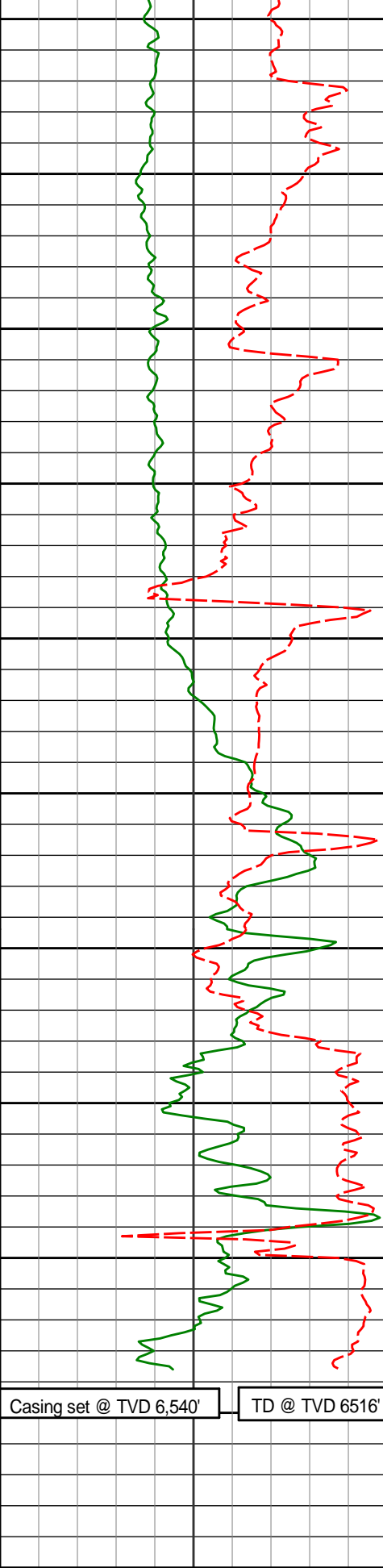


5550					
5600	5637'	0.83°	177.24°	5602.83'	153.17'
5650					
5700	5732'	0.90°	181.44°	5697.82'	153.07'
5750					
5800	5812'	0.63°	107.33°	5777.81'	153.41'
5850					
5900	5918'	2.27°	102.93°	5883.77'	155.96'
5950					
6000	6013'	9.62°	92.35°	5978.20'	165.65'
6050	6108'	16.13°	81.47°	6070.77'	186.72'

Run 200

PGRC

ROPA



6100					
6150	6203'	23.57°	76.89°	6160.07'	218.71'
6200					
6250	6298'	31.45°	79.40°	6244.27'	262.19'
6300					
6350	6393'	39.74°	76.92°	6321.45'	316.95'
6400	6488'	48.22°	79.43°	6389.76'	382.31'
6450	6583'	51.95°	90.99°	6450.82'	454.94'
Run 300					
6500	6678'	63.58°	95.18°	6501.43'	534.42'
	6726'	72.78°	93.43°	6519.25'	578.42'
	6772'	80.83°	91.37°	6529.74'	622.85'
	6810'	82.17°	90.18°	6535.36'	660.28'
Casing set @ TVD 6,540'	TD @ TVD 6516'				
6550					
6600					

Avg Rate of Penetration ROPA feet per hr		Depth ft	Depth	Inc.	Azi.	TVD	V.S.
1K	0						
PCG Gamma Ray PGRC							



# HALLIBURTON

## DIRECTIONAL SURVEY REPORT

Noble Energy  
Wells Ranch AE20-64HN  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0900807451

Surveys are tied into three non-Halliburton surveys at MD 365', 645', and 925' taken with a gyro while drilling surface hole.

<i>Measured Depth (feet)</i>	<i>Inclination (degrees)</i>	<i>Direction (degrees)</i>	<i>Vertical Depth (feet)</i>	<i>Latitude (feet)</i>	<i>Departure (feet)</i>	<i>Vertical Section (feet)</i>	<i>Dogleg (deg/100ft)</i>
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
365.00	0.40	238.94	365.00	0.66 S	1.09 W	-1.14	0.11
645.00	0.60	342.14	644.99	0.23 N	2.38 W	-2.35	0.28
925.00	0.80	282.74	924.97	2.06 N	4.73 W	-4.56	0.26
996.00	1.38	282.54	995.96	2.36 N	6.05 W	-5.85	0.82
1088.00	1.29	282.48	1087.93	2.82 N	8.15 W	-7.90	0.10
1181.00	1.36	270.44	1180.91	3.05 N	10.27 W	-10.01	0.31
1274.00	1.58	265.63	1273.88	2.97 N	12.65 W	-12.39	0.27
1367.00	0.65	96.87	1366.87	2.80 N	13.41 W	-13.15	2.39
1460.00	0.71	99.93	1459.86	2.64 N	12.32 W	-12.08	0.08
1555.00	3.86	42.27	1554.78	4.91 N	9.58 W	-9.18	3.72
1650.00	5.64	26.23	1649.46	11.46 N	5.37 W	-4.47	2.32
1745.00	7.39	36.68	1743.84	20.55 N	0.34 E	1.92	2.22
1840.00	9.13	42.98	1837.86	30.96 N	9.13 E	11.49	2.06
1935.00	11.18	44.36	1931.36	43.06 N	20.71 E	23.96	2.17
2030.00	11.22	36.61	2024.56	57.07 N	32.66 E	36.95	1.58
2124.00	9.86	28.48	2116.98	71.49 N	41.95 E	47.33	2.14
2219.00	11.46	23.73	2210.33	87.28 N	49.63 E	56.20	1.92
2314.00	10.82	16.62	2303.55	104.46 N	55.98 E	63.85	1.59
2409.00	11.35	15.33	2396.78	122.02 N	61.00 E	70.20	0.62
2504.00	11.09	20.87	2489.96	139.57 N	66.73 E	77.26	1.17
2599.00	13.29	20.87	2582.82	158.32 N	73.88 E	85.83	2.32
2694.00	12.20	19.75	2675.47	177.97 N	81.16 E	94.60	1.18
2789.00	11.00	19.00	2768.53	195.99 N	87.50 E	102.31	1.27
2884.00	13.09	18.96	2861.43	214.73 N	93.95 E	110.18	2.20
2979.00	12.67	17.48	2954.04	234.84 N	100.57 E	118.33	0.56
3074.00	11.60	17.89	3046.92	253.87 N	106.64 E	125.84	1.13
3169.00	10.02	16.33	3140.23	270.89 N	111.89 E	132.39	1.69
3264.00	8.76	15.14	3233.96	285.81 N	116.11 E	137.74	1.34
3359.00	7.02	14.89	3328.05	298.40 N	119.49 E	142.08	1.83
3454.00	7.44	24.00	3422.30	309.63 N	123.48 E	146.92	1.28
3549.00	7.36	25.44	3516.51	320.74 N	128.60 E	152.88	0.21
3644.00	6.33	17.39	3610.83	331.24 N	132.78 E	157.85	1.48
3739.00	4.50	8.21	3705.41	339.93 N	134.87 E	160.61	2.13
3834.00	2.35	338.88	3800.24	345.43 N	134.70 E	160.87	2.85
3929.00	3.02	319.12	3895.14	349.14 N	132.37 E	158.82	1.19
4023.00	1.02	293.42	3989.07	351.35 N	129.98 E	156.61	2.28
4118.00	0.79	271.90	4084.06	351.70 N	128.55 E	155.21	0.43
4213.00	0.72	328.60	4179.06	352.23 N	127.58 E	154.29	0.76
4308.00	1.09	313.03	4274.04	353.36 N	126.61 E	153.41	0.46
4403.00	1.41	303.02	4369.02	354.61 N	124.97 E	151.87	0.41
4498.00	1.00	306.34	4464.00	355.74 N	123.32 E	150.31	0.44
4593.00	0.68	65.53	4559.00	356.47 N	123.17 E	150.21	1.53
4688.00	1.38	69.35	4653.98	357.10 N	124.75 E	151.84	0.74
4783.00	1.65	137.31	4748.95	356.50 N	126.75 E	153.78	1.80
4878.00	0.88	129.65	4843.93	355.03 N	128.24 E	155.16	0.83
4973.00	0.36	152.19	4938.92	354.30 N	128.94 E	155.80	0.59
5068.00	0.44	150.71	5033.92	353.72 N	129.26 E	156.07	0.08
5162.00	1.57	183.88	5127.91	352.12 N	129.34 E	156.04	1.30
5257.00	0.98	188.77	5222.88	350.02 N	129.13 E	155.66	0.63
5352.00	1.08	181.70	5317.87	348.32 N	128.98 E	155.38	0.17
5447.00	1.01	232.93	5412.85	346.92 N	128.29 E	154.58	0.95
5542.00	0.96	201.40	5507.84	345.68 N	127.33 E	153.53	0.57
5637.00	0.83	177.24	5602.83	344.25 N	127.07 E	153.17	0.42

5732.00	0.90	181.44	5697.82	342.81 N	127.09 E	153.07	0.10
5812.00	0.63	107.33	5777.81	342.06 N	127.49 E	153.41	1.18
5918.00	2.27	102.93	5883.77	341.41 N	130.09 E	155.96	1.55
6013.00	9.62	92.35	5978.20	340.66 N	139.87 E	165.65	7.79
6108.00	16.13	81.47	6070.77	342.30 N	160.88 E	186.72	7.28
6203.00	23.57	76.89	6160.07	348.57 N	192.47 E	218.71	8.00
6298.00	31.45	79.40	6244.27	357.45 N	235.40 E	262.19	8.38
6393.00	39.74	76.92	6321.45	368.91 N	289.44 E	316.95	8.86
6488.00	48.22	79.43	6389.76	382.30 N	353.96 E	382.31	9.11
6583.00	51.95	90.99	6450.82	388.17 N	426.35 E	454.94	10.11
6678.00	63.58	95.18	6501.43	383.66 N	506.42 E	534.42	12.79
6726.00	72.78	93.43	6519.25	380.34 N	550.80 E	578.42	19.46
6772.00	80.83	91.37	6529.74	378.48 N	595.51 E	622.85	18.03
6810.00	82.17	90.18	6535.36	377.98 N	633.09 E	660.28	4.69
6928.00	89.63	89.02	6543.79	378.80 N	750.70 E	777.60	6.40
6973.00	90.65	90.14	6543.68	379.13 N	795.69 E	822.49	3.37
7066.00	91.11	90.74	6542.25	378.42 N	888.68 E	915.15	0.81
7159.00	90.00	89.60	6541.35	378.14 N	981.67 E	1007.84	1.71
7251.00	90.18	89.46	6541.21	378.90 N	1073.67 E	1099.62	0.25
7344.00	91.20	90.34	6540.09	379.06 N	1166.66 E	1192.35	1.45
7437.00	91.82	91.92	6537.64	377.23 N	1259.61 E	1284.88	1.82
7530.00	89.51	92.69	6536.56	373.49 N	1352.52 E	1377.23	2.62
7622.00	88.58	90.80	6538.09	370.69 N	1444.46 E	1468.68	2.29
7716.00	89.14	90.63	6539.96	369.51 N	1538.43 E	1562.29	0.62
7808.00	89.63	90.17	6540.95	368.87 N	1630.42 E	1653.96	0.73
7900.00	92.10	91.06	6539.56	367.88 N	1722.40 E	1745.59	2.85
7991.00	91.85	91.32	6536.42	365.99 N	1813.33 E	1836.10	0.40
8084.00	89.48	92.05	6535.34	363.26 N	1906.27 E	1928.56	2.67
8179.00	90.06	92.25	6535.72	359.70 N	2001.20 E	2022.94	0.65
8274.00	90.06	91.74	6535.63	356.39 N	2096.15 E	2117.34	0.54
8369.00	91.76	92.51	6534.12	352.87 N	2191.06 E	2211.71	1.96
8464.00	90.86	91.07	6531.94	349.90 N	2285.99 E	2306.13	1.79
8559.00	91.45	91.02	6530.03	348.17 N	2380.95 E	2400.68	0.62
8654.00	91.02	90.61	6527.98	346.82 N	2475.92 E	2495.26	0.63
8748.00	89.32	89.92	6527.70	346.38 N	2569.92 E	2588.94	1.95
8843.00	90.25	90.38	6528.06	346.13 N	2664.91 E	2683.64	1.09
8938.00	89.11	89.80	6528.59	345.99 N	2759.91 E	2778.34	1.35
9033.00	89.26	90.07	6529.94	346.09 N	2854.90 E	2873.06	0.33
9128.00	89.63	90.05	6530.86	345.99 N	2949.90 E	2967.77	0.39
9223.00	90.55	90.35	6530.71	345.66 N	3044.89 E	3062.46	1.02
9318.00	91.54	90.18	6528.98	345.22 N	3139.88 E	3157.13	1.06
9413.00	92.44	90.51	6525.68	344.65 N	3234.82 E	3251.74	1.01
9508.00	90.49	89.61	6523.25	344.55 N	3329.78 E	3346.41	2.26
9603.00	91.26	90.12	6521.80	344.78 N	3424.77 E	3441.14	0.97
9698.00	90.80	90.06	6520.09	344.63 N	3519.75 E	3535.83	0.49
9793.00	88.67	90.05	6520.53	344.54 N	3614.74 E	3630.53	2.24
9888.00	89.69	89.92	6521.89	344.56 N	3709.73 E	3725.24	1.08
9983.00	90.77	89.21	6521.51	345.28 N	3804.73 E	3820.01	1.36
10077.00	90.31	91.03	6520.63	345.08 N	3898.72 E	3913.71	2.00
10172.00	89.57	89.89	6520.73	344.32 N	3993.71 E	4008.37	1.43
10267.00	91.17	90.31	6520.11	344.16 N	4088.71 E	4103.07	1.74
10362.00	88.49	89.97	6520.39	343.92 N	4183.70 E	4197.76	2.84
10457.00	89.48	91.24	6522.08	342.92 N	4278.68 E	4292.38	1.69
10552.00	91.54	91.04	6521.23	341.03 N	4373.65 E	4386.92	2.18
10601.00	92.53	91.15	6519.49	340.10 N	4422.61 E	4435.66	2.03
10665.00	92.53	91.15	6516.67	338.81 N	4486.53 E	4499.30	0.00

**CALCULATION BASED ON MINIMUM CURVATURE METHOD**

**SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT  
TVD VALUES GIVEN RELATIVE TO DRILLING MEASUREMENT POINT**

**VERTICAL SECTION RELATIVE TO WELL HEAD**

**VERTICAL SECTION IS COMPUTED ALONG A DIRECTION OF 85.59 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.62 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 10665.00 FEET  
IS 4499.31 FEET ALONG 85.68 DEGREES (GRID)**