

**PCGK: Pressure Case Gamma**  
**PCDC: Pressure Case Directional**

[illegible]

## WELL INFORMATION

<b>MWD Run Number</b>	200	300			
<b>Date run completed</b>	06-Aug-14	07-Aug-14			
<b>Rig Bit Number</b>	2	3			
<b>Bit Size (in)</b>	8.750	8.750			
<b>Tool Nominal OD (in)</b>	6.750	6.750			
<b>Log Start Depth (TVD, ft)</b>	624.98	5,285.40			
<b>Log End Depth (TVD, ft)</b>	5,285.40	6,010.05			
<b>Drill or Wipe</b>	Drill	Drill			
<b>Drill/Wipe Start Date and Time</b>	05-Aug-14 13:10	06-Aug-14 08:00			
<b>Drill/Wipe End Date and Time</b>	06-Aug-14 01:15	06-Aug-14 22:30			
<b>Min Inc (deg) @ Depth (TVD, ft)</b>	0.10 @ 901.98	1.09 @ 5,319.39			
<b>Max Inc (deg) @ Depth (TVD, ft)</b>	8.09 @ 2,585.31	80.80 @ 6,004.40			
<b>Bit TFA(in2) / Bit Type</b>	0.74 / PDC	0.86 / PDC			
<b>Flow Rate (gpm)</b>	597.50	567.05			
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	N/A / N/A	N/A / N/A			
<b>Fluid Type</b>	Fresh Water Gel	Fresh Water Gel			
<b>Density (ppg) / Viscosity (spqt)</b>	9.50 / 28.00	9.50 / 30.00			
<b>Filtrate CL (ppm)</b>	150.00	150.00			
<b>pH / Fluid Loss (mptm)</b>	8.00 / 0	9.20 / 0			
<b>PV (cP) / YP (lbf2)</b>	4 / 4.00	4 / 4.00			
<b>% Solids / % Sand</b>	7 / 0.1	7.00 / 0.10			
<b>% Oil / Oil:Water Ratio</b>	N/A / N/A	N/A / N/A			
<b>Rm @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A			
<b>Rmf @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A			
<b>Rmc @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A			
<b>Max Tool Temp (deg F) @ 100 ft</b>	174.93 / PDM	187.87 / PDM			

Max Tool Temp (degF) / Source	171.20 / PCM	167.97 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A			
Lead MWD Engineer	Juan Pablo Centeno	Juan Pablo Centeno			
Customer Representative	Justin Fields	Justin Fields			

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.93	5.93			
Sub Serial Number	245494	245494			
Insert Serial Number	11620315	11620315			
Date and Time Initialized	03-Aug-14 16:51	01-Jan-70 00:00			
Date and Time Read	07-Aug-14 05:51	07-Aug-14 05:56			
ECMB SW Version	N/A	N/A			

### Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	53.93	53.24			
Software Version	6.21	6.21			
Sub Serial Number	245494	245494			
Sonde Serial Number	11638628	11638628			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	334.88	47.59			

### Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	48.83	48.14			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	245494	245494			
Insert/Sonde Serial Number	11579806	11579806			

## REMARKS

1. All depths are calibrated to the driller's pipe tally and are measured from the Rig drill floor.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.
  - ROPA: Average Rate of Penetration is real time data.
  - PGRC: Smooth Pressure Case Gamma Ray Borehole corrected is recorded data.
4. The following smoothing parameters have been applied to the data:
  - 2" (1:600) log - 1 ft. interval, 3 ft. coercion distance, 5 ft. gap fill.
  - 5" (1:240) log for ROP - 0.5 ft. interval, 1.2 ft. coercion distance, 3 ft. gap fill.
  - 5" (1:240) log for Gamma Ray - 0.5 ft. interval, 0.6 ft. coercion distance, 3 ft. gap fill.
5. INSITE version 8.0.20

## WARRANTY

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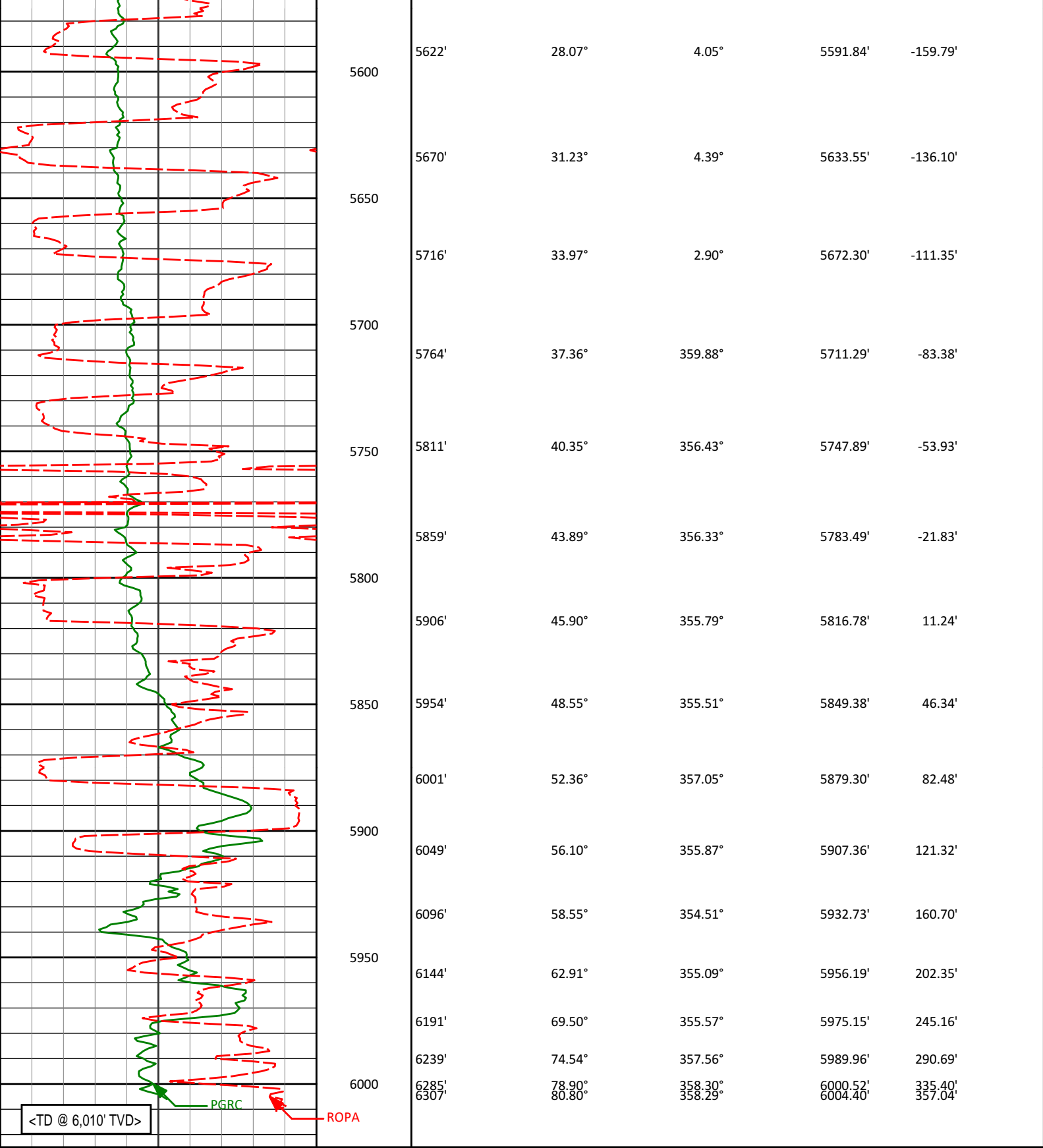
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## Sperry Drilling Services

### TVD Detail Log 1:600

Noble Energy, Inc  
Rainbow LC28-74-1HNA  
H&P 273  
T9N R59W

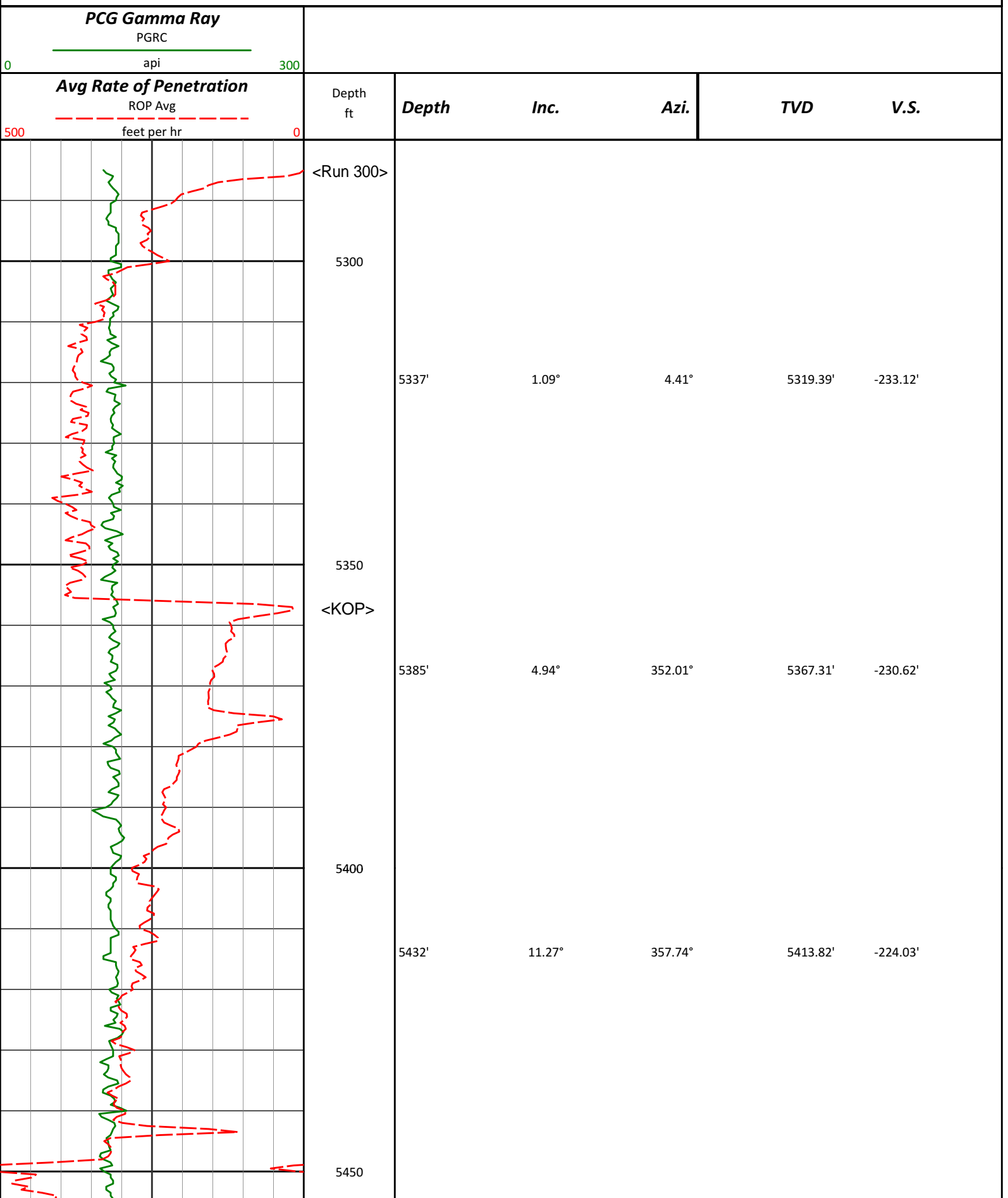
PCG Gamma Ray PGRC 0 300 api						
Avg Rate of Penetration ROP Avg 500 0 feet per hr		Depth ft	Depth	Inc.	Azi.	TVD V.S.
		<Run 300>				
		5300				
		5337'	5337'	1.09°	4.41°	5319.39' -233.12'
		5350				
		<KOP>	5385'	4.94°	352.01°	5367.31' -230.62'
		5400				
		5432'	5432'	11.27°	357.74°	5413.82' -224.03'
		5450				
		5480'	5480'	15.59°	1.25°	5460.50' -212.89'
		5500				
		5527'	5527'	20.05°	6.17°	5505.24' -198.55'
		5550				
		5575'	5575'	24.31°	4.28°	5549.67' -180.49'

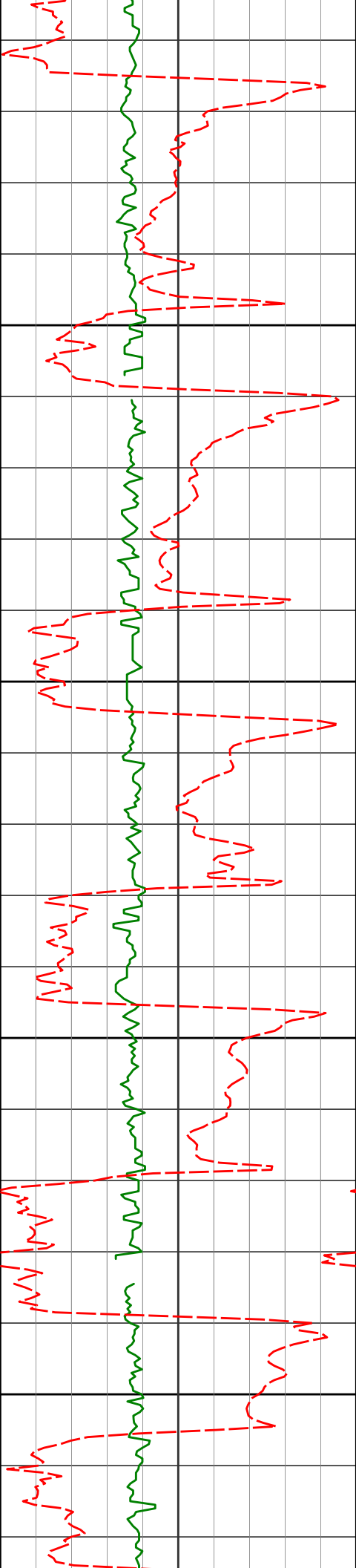


<div><div>Avg Rate of Penetration</div><div>ROP Avg</div><div>feet per hr</div></div>		Depth ft	Depth	Inc.	Azi.	TVD	V.S.
<div><div>PCG Gamma Ray</div><div>PGRC</div><div>api</div></div>							

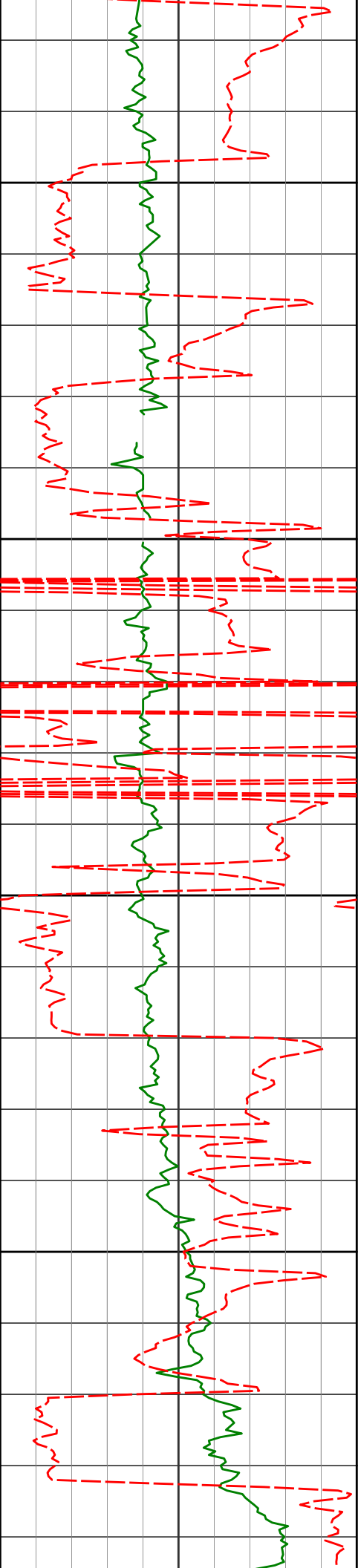
# TVD Detail Log 1:240

Noble Energy, Inc  
Rainbow LC28-74-1HNA  
H&P 273  
T9N R59W





	5480'	15.59°	1.25°	5460.50'	-212.89'
5500	5527'	20.05°	6.17°	5505.24'	-198.55'
5550	5575'	24.31°	4.28°	5549.67'	-180.49'
	5622'	28.07°	4.05°	5591.84'	-159.79'
5600					
	5670'	31.23°	4.39°	5633.55'	-136.10'
5650					
	5716'	33.97°	2.90°	5672.30'	-111.35'



5700

5764'

37.36°

359.88°

5711.29'

-83.38'

5750

5811'

40.35°

356.43°

5747.89'

-53.93'

5859'

43.89°

356.33°

5783.49'

-21.83'

5800

5906'

45.90°

355.79°

5816.78'

11.24'

5850

5954'

48.55°

355.51°

5849.38'

46.34'

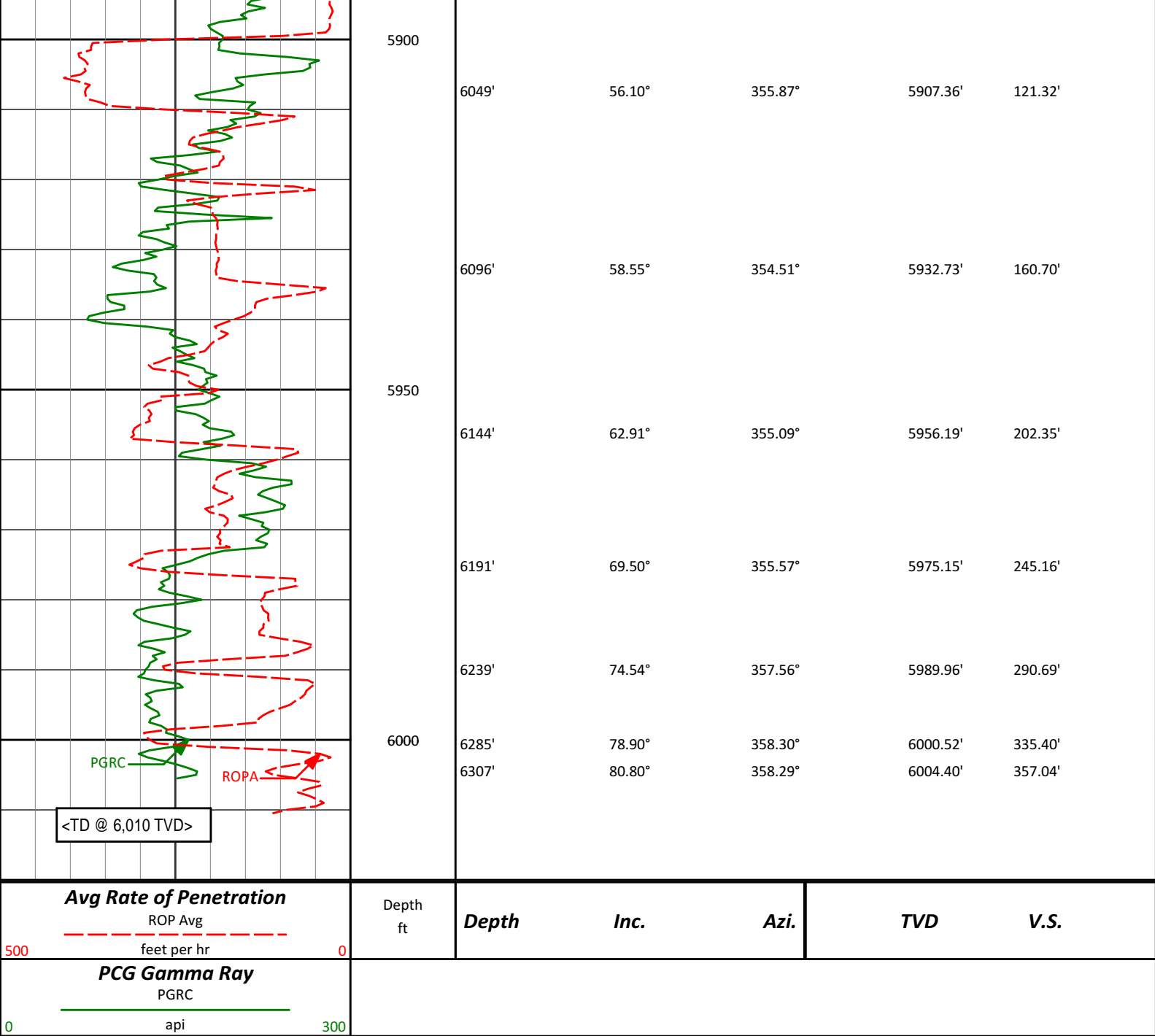
6001'

52.36°

357.05°

5879.30'

82.48'



## HALLIBURTON

### DIRECTIONAL SURVEY REPORT

Noble Energy  
Rainbow LC28-74-1HNA  
Wattenberg  
Weld Colorado  
USA  
CA-XX-0901400547

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
375.00	0.80	300.23	374.99	1.32 N	2.26 W	1.30	0.21
600.00	0.20	349.73	599.98	2.50 N	3.69 W	2.46	0.31
717.00	0.29	16.99	716.98	2.98 N	3.64 W	2.95	0.12
902.00	0.10	105.34	901.98	3.39 N	3.35 W	3.36	0.16
1181.00	0.25	45.02	1180.98	3.75 N	3.60 W	3.73	0.08



1181.00	0.23	43.02	1180.98	3.73 N	2.09 W	3.73	0.08
1460.00	0.31	349.48	1459.97	4.92 N	2.40 W	4.90	0.10
1553.00	0.29	346.53	1552.97	5.40 N	2.50 W	5.38	0.03
1645.00	0.37	3.94	1644.97	5.93 N	2.54 W	5.90	0.14
1737.00	3.04	158.94	1736.93	3.95 N	1.64 W	3.93	3.68
1832.00	5.27	155.79	1831.68	2.39 S	1.06 E	-2.38	2.36
1927.00	4.89	155.02	1926.30	10.04 S	4.56 E	-10.00	0.41
2022.00	7.17	155.78	2020.77	19.12 S	8.70 E	-19.04	2.40
2117.00	6.24	151.85	2115.12	29.08 S	13.57 E	-28.96	1.09
2212.00	7.37	162.56	2209.45	39.45 S	17.83 E	-39.29	1.78
2307.00	7.06	158.06	2303.70	50.69 S	21.84 E	-50.49	0.68
2401.00	6.74	156.56	2397.02	61.11 S	26.20 E	-60.87	0.39
2496.00	7.95	155.22	2491.24	72.19 S	31.17 E	-71.91	1.28
2591.00	8.09	154.79	2585.31	84.20 S	36.77 E	-83.87	0.16
2781.00	7.93	155.88	2773.45	108.26 S	47.82 E	-107.82	0.11
2876.00	7.92	156.46	2867.55	120.24 S	53.11 E	-119.75	0.09
2970.00	7.48	154.98	2960.70	131.72 S	58.29 E	-131.19	0.51
3065.00	6.86	158.87	3054.96	142.62 S	62.95 E	-142.04	0.82
3160.00	6.14	157.92	3149.34	152.62 S	66.90 E	-152.01	0.77
3255.00	5.32	158.08	3243.87	161.42 S	70.46 E	-160.77	0.86
3350.00	7.06	149.93	3338.31	170.56 S	75.03 E	-169.87	2.04
3445.00	7.09	149.29	3432.59	180.65 S	80.95 E	-179.91	0.09
3540.00	7.25	150.23	3526.85	190.90 S	86.92 E	-190.10	0.21
3635.00	7.49	152.50	3621.06	201.59 S	92.75 E	-200.74	0.40
3730.00	7.92	149.51	3715.20	212.72 S	98.94 E	-211.82	0.62
3825.00	7.57	148.82	3809.34	223.72 S	105.50 E	-222.75	0.39
3920.00	7.29	150.78	3903.54	234.33 S	111.68 E	-233.31	0.40
4015.00	4.28	142.75	3998.05	242.42 S	116.77 E	-241.35	3.27
4109.00	2.40	131.35	4091.88	246.51 S	120.37 E	-245.41	2.12
4204.00	2.01	124.54	4186.81	248.77 S	123.23 E	-247.64	0.49
4299.00	1.53	114.01	4281.77	250.23 S	125.76 E	-249.08	0.61
4394.00	1.57	109.87	4376.73	251.19 S	128.15 E	-250.01	0.13
4489.00	1.30	84.27	4471.70	251.52 S	130.44 E	-250.33	0.72
4583.00	1.32	67.17	4565.68	250.99 S	132.50 E	-249.78	0.42
4773.00	2.11	39.85	4755.60	247.45 S	136.76 E	-246.20	0.59
4868.00	2.02	46.13	4850.53	244.95 S	139.09 E	-243.68	0.26
4963.00	1.73	26.57	4945.48	242.51 S	140.94 E	-241.22	0.73
5058.00	1.38	10.03	5040.45	240.10 S	141.78 E	-238.81	0.59
5247.00	1.08	9.49	5229.41	236.11 S	142.46 E	-234.81	0.16
5337.00	1.09	4.41	5319.39	234.43 S	142.67 E	-233.12	0.11
5385.00	4.94	352.01	5367.31	231.93 S	142.42 E	-230.62	8.09
5432.00	11.27	357.74	5413.82	225.33 S	141.95 E	-224.03	13.57
5480.00	15.59	1.25	5460.50	214.19 S	141.91 E	-212.89	9.15
5527.00	20.05	6.17	5505.24	199.85 S	142.91 E	-198.55	10.01
5575.00	24.31	4.28	5549.67	181.81 S	144.54 E	-180.49	9.00
5622.00	28.07	4.05	5591.84	161.12 S	146.04 E	-159.79	8.00
5670.00	31.23	4.39	5633.55	137.44 S	147.79 E	-136.10	6.59
5716.00	33.97	2.90	5672.30	112.71 S	149.36 E	-111.35	6.20
5764.00	37.36	359.88	5711.29	84.74 S	150.01 E	-83.38	7.97
5811.00	40.35	356.43	5747.89	55.29 S	149.03 E	-53.93	7.84
5859.00	43.89	356.33	5783.49	23.17 S	147.00 E	-21.83	7.39
5906.00	45.90	355.79	5816.78	9.93 N	144.71 E	11.24	4.36
5954.00	48.55	355.51	5849.38	45.06 N	142.04 E	46.34	5.52
6001.00	52.36	357.05	5879.30	81.21 N	139.70 E	82.48	8.50
6049.00	56.10	355.87	5907.36	120.07 N	137.29 E	121.32	8.04
6096.00	58.55	354.51	5932.73	159.49 N	133.96 E	160.70	5.76
6144.00	62.91	355.09	5956.19	201.18 N	130.17 E	202.35	9.14
6191.00	69.50	355.57	5975.15	244.02 N	126.67 E	245.16	14.06
6239.00	74.54	357.56	5989.96	289.58 N	123.95 E	290.69	11.21
6285.00	78.90	358.30	6000.52	334.31 N	122.34 E	335.40	9.61
6307.00	80.80	358.29	6004.40	355.95 N	121.69 E	357.04	8.65
6362.00	87.40	358.29	6010.05	410.61 N	120.06 E	411.68	11.99

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 0.52 DEGREES (GRID)

A TOTAL CORRECTION OF 7.13 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 6362.00 FEET  
IS 427.80 FEET ALONG 16.30 DEGREES (GRID)

Surface surveys at 375 ft and 600 ft have had azimuths corrected to grid north, but were not taken by Halliburton.

Last survey is a projection from 6307 ft MD to TD at 6362 ft MD.

**Date Printed:07 August 2014**