

**PCDC - Pressure Case Directional**  
**PCGK - Pressure Case Gamma**

**1 : 240**

Country : USA		Company : Noble Energy	
Field : Wattenberg		Rig : H&P 322	
Location : Lat: 40° 28' 3.65" North Long: 104° 26' 2.87" West		Well : Wells Ranch AA21-63HN	
Well : Wells Ranch AA21-63HN		Country : USA	
Company : Noble Energy		API Number : 05-123-37600	
Rig : H&P 322		Directional Drilling	
LOCATION		Other Services	
Latitude : 40° 28' 3.65" North Longitude : 104° 26' 2.87" West UTM Easting = 3296552.173 ft UTM Northing = 1414998.691 ft		Elev. KB N/A DF 4754.00 ft GL 4730.00 ft WD N/A	
Permanent Datum : Ground Level		Elevation : 4730.00 ft	
Log Measured From : Drill Floor		24.00 ft Above Permanent Datum	
Drilling Measured From : Drill Floor		TVD LOG	
Depth Logged : 961.98 ft To 6,692.10 ft		Unit No. : 11210425	
Date Logged : 24-Jan-14 To 27-Jan-14		Job No. : CA-XX-0900918612	
Total Depth MD : 7,056.00 ft TVD : 6,692.10 ft		Plot Type : Final	
Spud Date : 24-Jan-14		Plot Date : 29-Jan-14	
Run No.	Borehole Record (TVD)		Run No.
	Size From To		Size From To
2	8.750 in 961.98 ft 6,015.38 ft		
3	8.750 in 6,015.38 ft 6,692.10 ft		
		Casing Record (TVD)	
		Size Weight From To	
		9.625 in 36.00 lbpf SURFACE	951.98 ft
		7.000 in 26.00 lbpf SURFACE	6,690.95 ft

**WELL INFORMATION**

MWD Run Number	100	200		
Date run completed	26-Jan-14	27-Jan-14		
Rig Bit Number	2	3		
Bit Size (in)	8.750	8.750		
Tool Nominal OD (in)	6.750	6.750		
Log Start Depth (TVD, ft)	961.98	6,015.38		
Log End Depth (TVD, ft)	6,015.38	6,692.10		
Drill or Wipe	Drill	Drill		
Drill/Wipe Start Date and Time	25-Jan-14 22:20	27-Jan-14 02:00		
Drill/Wipe End Date and Time	26-Jan-14 14:30	27-Jan-14 11:30		
Min Inc (deg) @ Depth (TVD, ft)	0.20 @ 749.98	1.84 @ 6,073.36		
Max Inc (deg) @ Depth (TVD, ft)	11.58 @ 2,504.22	80.51 @ 6,684.12		
Bit TFA(in2) / Bit Type	0.75 / PDC	0.98 / PDC		
Flow Rate (gpm)	556.00	585.00		
Max AV (fpm) / CV (fpm) @ MWD	510.0 / 510.0	500.0 / 500.0		
Fluid Type	Fresh Water Gel	Fresh Water Gel		
Density (ppg) / Viscosity (spqt)	9.05 / 28.00	10.85 / 37.00		
Filtrate CL (ppm)	2,900.00	3,000.00		
pH / Fluid Loss (mptm)	8.30 / N/A	9.60 / N/A		
PV (cP) / YP (lhf2)	2 / 3.00	9 / 10.00		
% Solids / % Sand	4.50 / 0.25	11.60 / 0.50		
% Oil / Oil:Water Ratio	N/A / N/A	N/A / N/A		
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A		
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A		
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A		

Max Tool Temp (degF) / Source	150.10 / PCM	160.83 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A			
Lead MWD Engineer	Robert Ley	Robert Ley			
Customer Representative	Charles Collver	Charles Collver			

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.84	5.84			
Sub Serial Number	246473	246473			
Insert Serial Number	11680738	11680738			
Date and Time Initialized	25-Jan-14 08:01	01-Jan-70 00:00			
Date and Time Read	27-Jan-14 17:52	27-Jan-14 17:43			
ECMB SW Version	N/A	N/A			

### Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	61.00	58.00			
Software Version	6.21	6.21			
Sub Serial Number	246473	246473			
Sonde Serial Number	11638621	11638621			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	106.07	316.54			

### Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	53.82	50.92			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	246473	246473			
Insert/Sonde Serial Number	11681001	11681001			

## REMARKS

1. All depths are measured depths and are calibrated to the driller' pipe tally and are measured from the 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.
4. The Following smoothing parameters have been applied to the data"

PGXR (Gamma Ray CG):  
Interval Resolution: 0.5 feet  
Coercion Distance: 0.6 feet  
Gap Fill: 3.0 feet

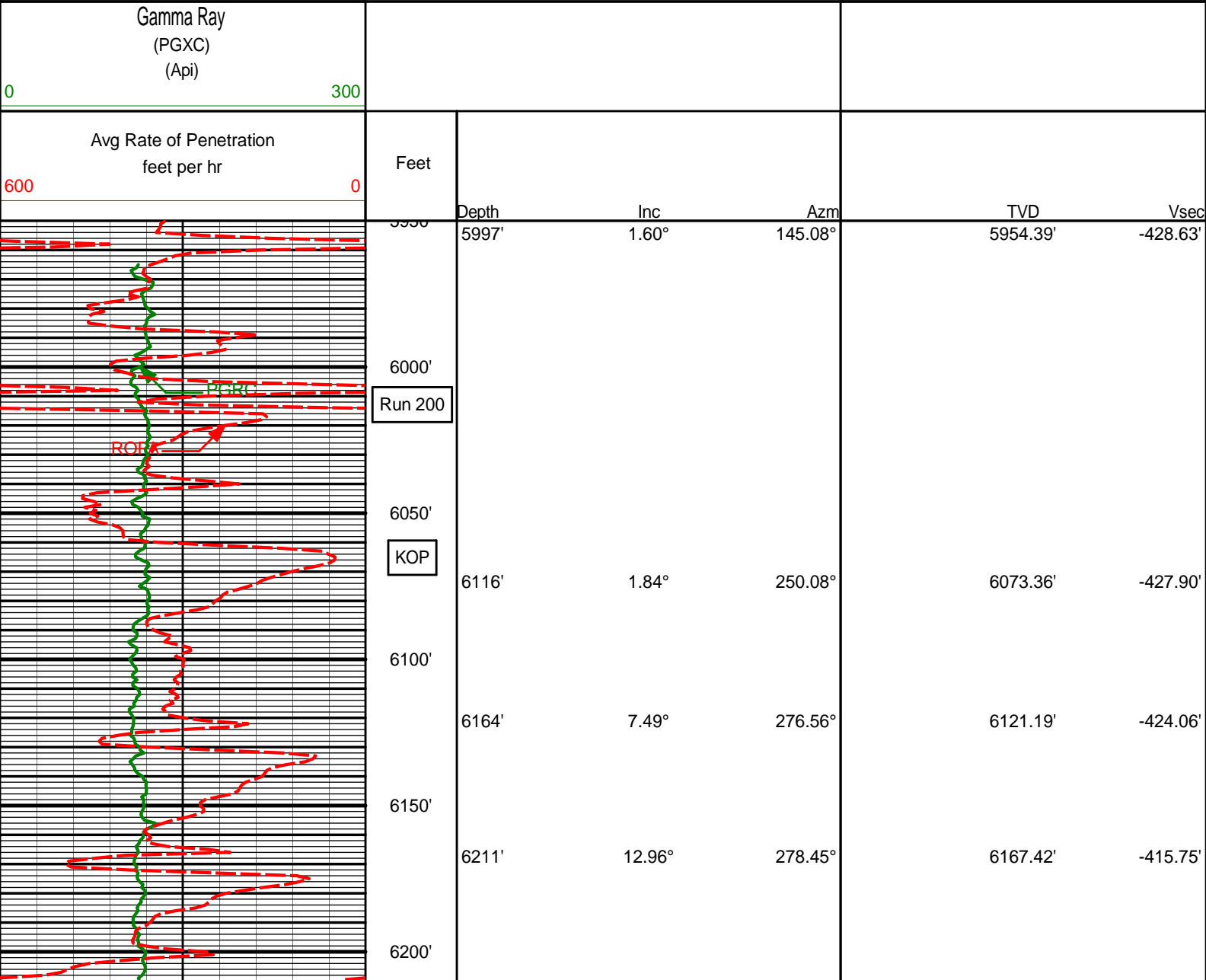
ROPA (Rate of Penetration):  
Interval Resolution: 0.5 feet  
Coercion Distance: 1.2 feet

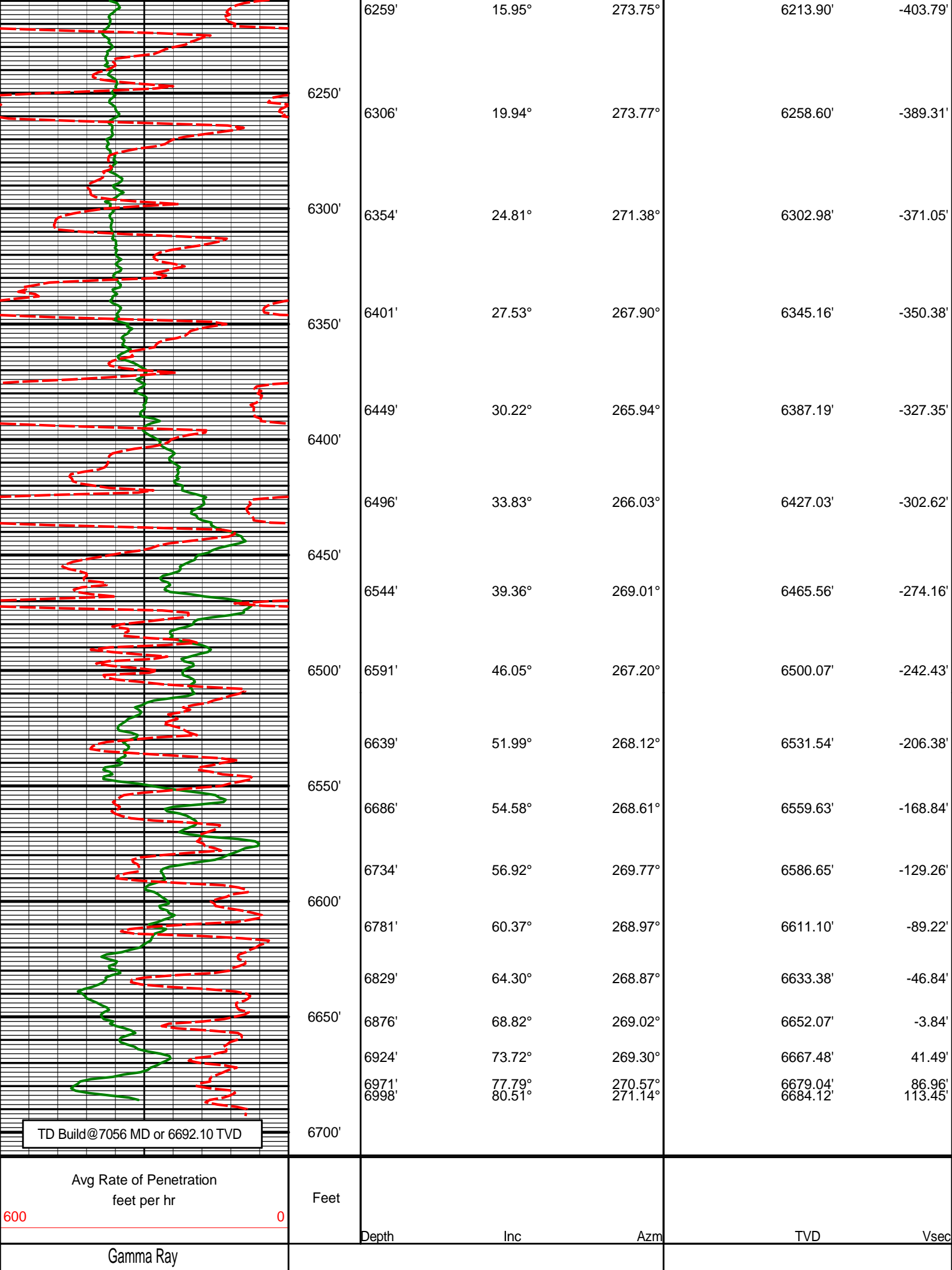
## WARRANTY

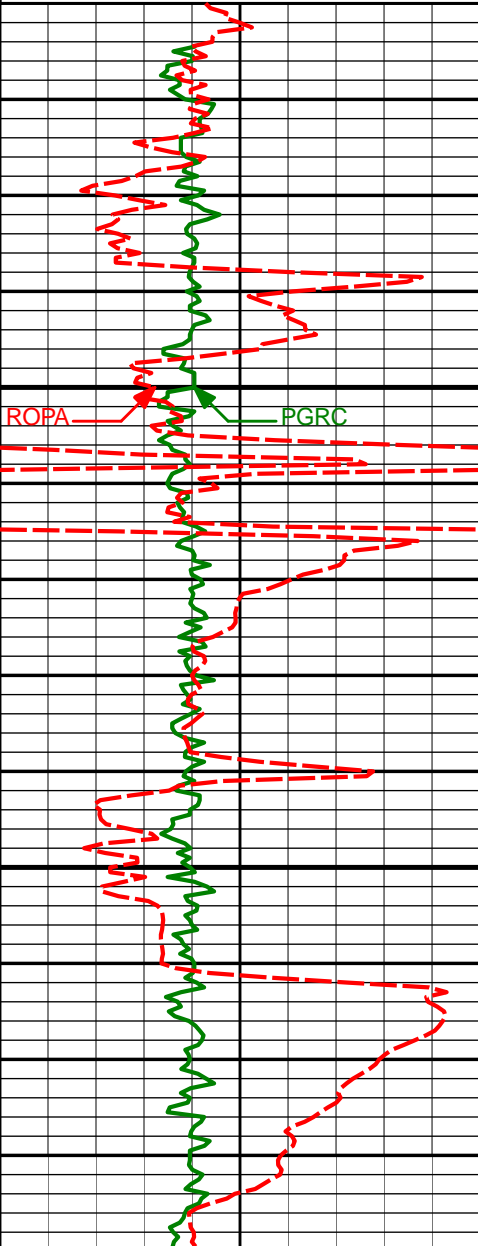
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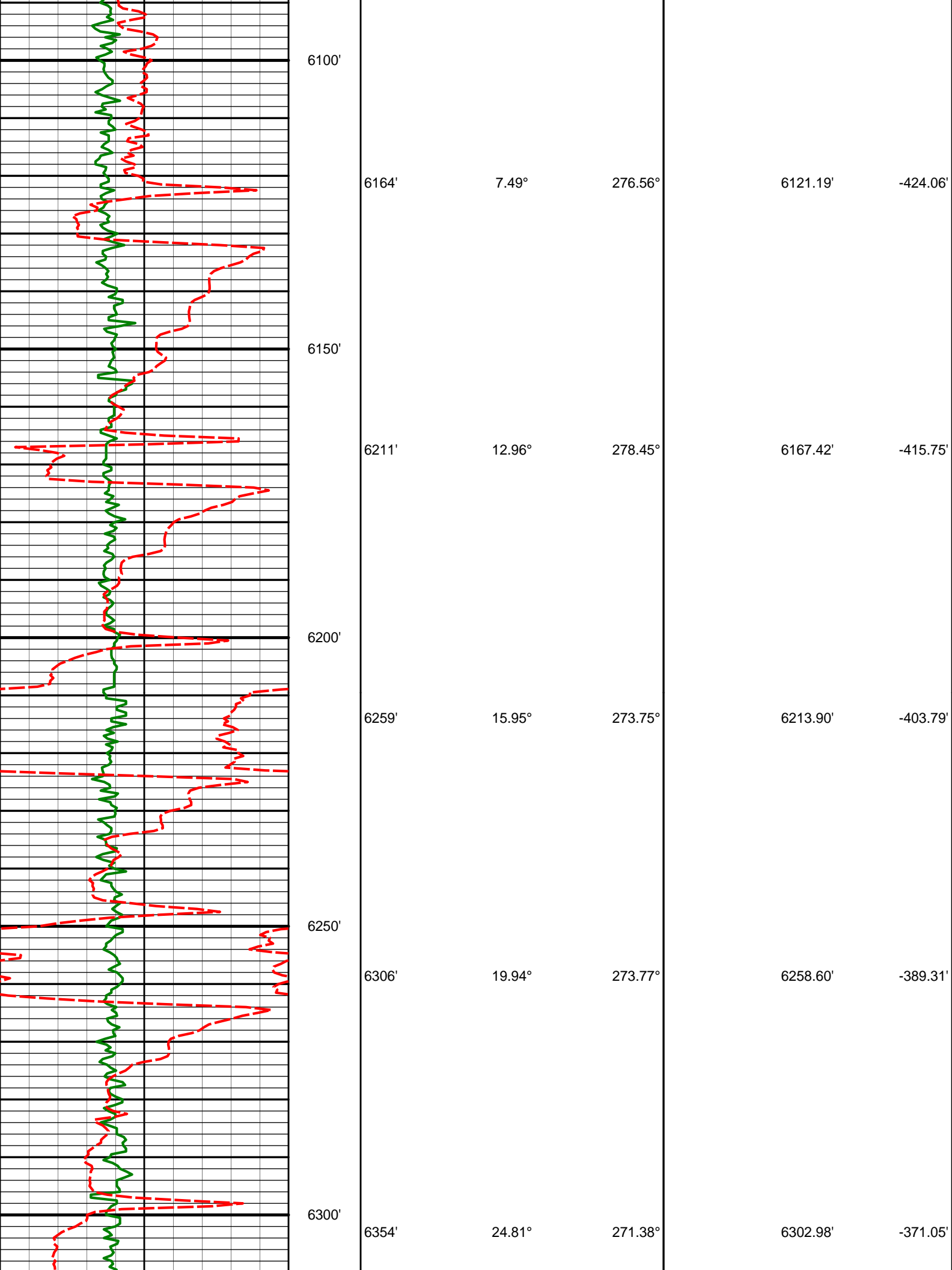
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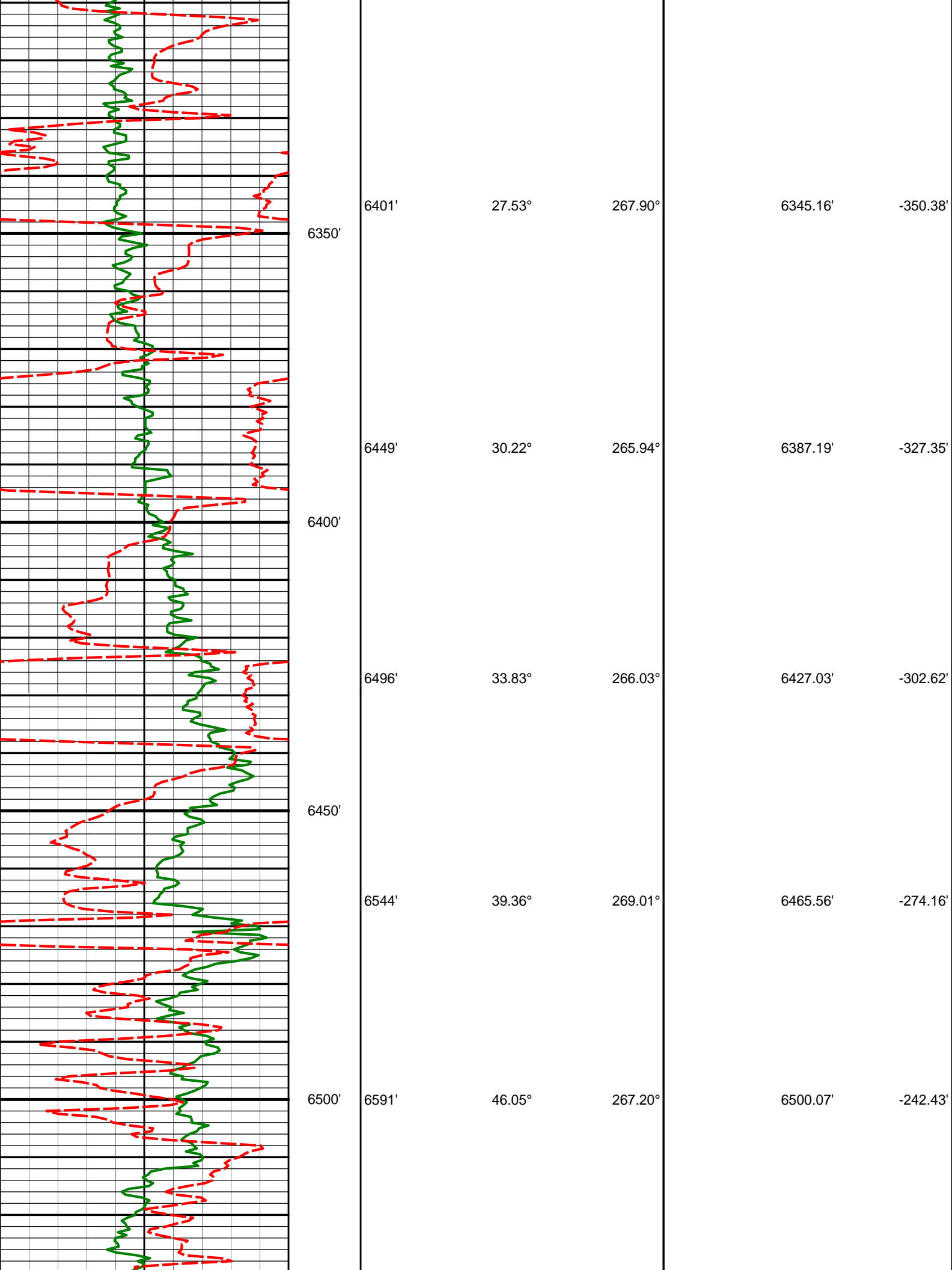
TVD Detail Log 1:600

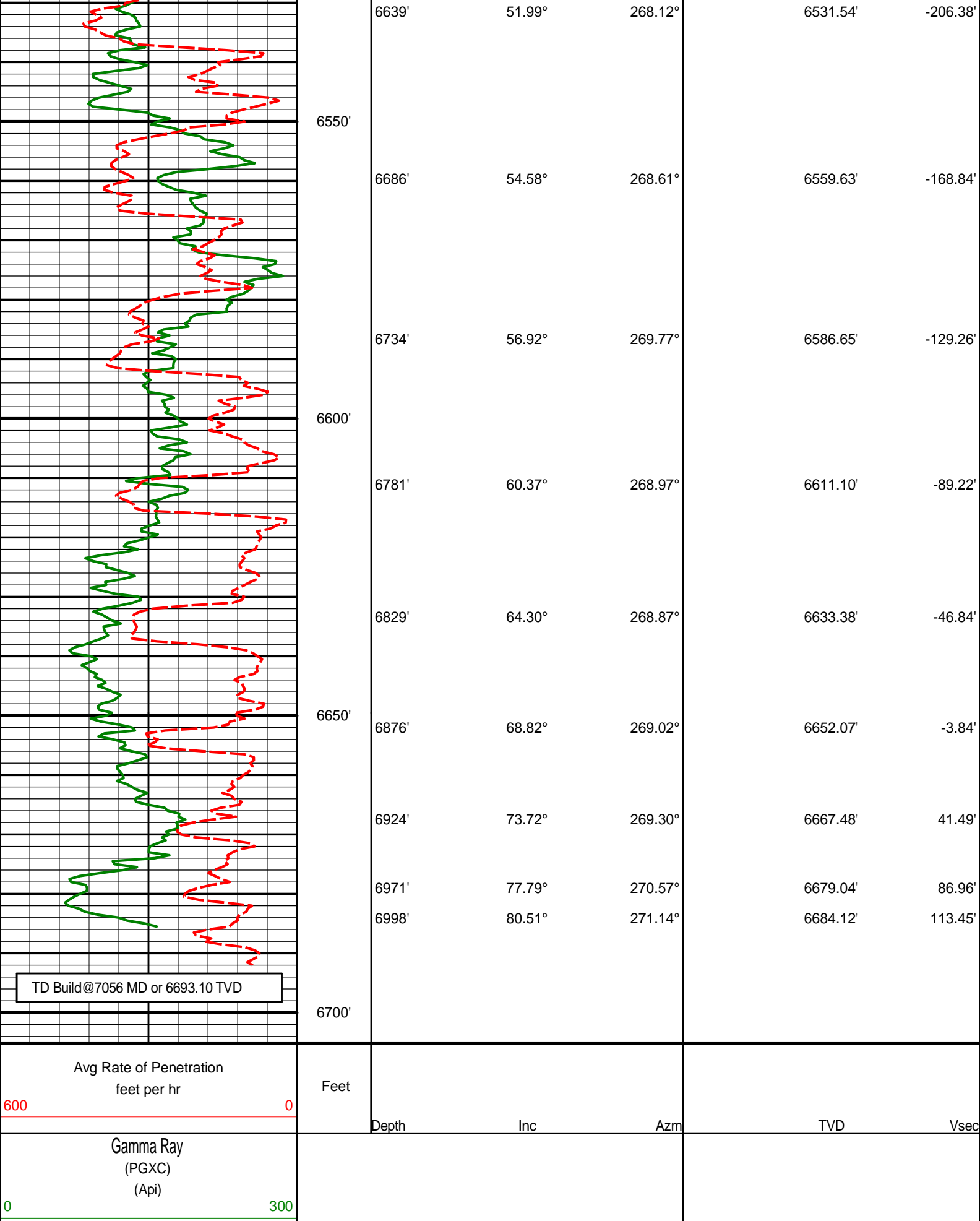




(PGXC) (Api)					
0300					
HALLIBURTON					
TVD Detail Log 1:240					
Gamma Ray (PGXC) (Api)					
0300					
Avg Rate of Penetration feet per hr		Feet			
6000					
		Depth	Inc	Azm	TVD
					Vsec
		6000'			
ROPA		PGRC			
		Run 200			
		6050'			
		KOP			
		6116'	1.84°	250.08°	6073.36'
					-427.90'









# DIRECTIONAL SURVEY REPORT

Noble Energy  
Wells Ranch AA21-63HN  
Wattenberg  
Weld Colorado  
USA  
CA-XX-0900918612

<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
235.00	0.50	266.19	235.00	0.07 S	1.02 W	1.02	0.21
512.00	0.50	313.79	511.99	0.69 N	3.10 W	3.14	0.15
750.00	0.20	245.39	749.98	1.23 N	4.23 W	4.29	0.20
940.00	0.40	314.89	939.98	1.56 N	5.00 W	5.08	0.20
1103.00	0.41	163.37	1102.98	1.41 N	5.24 W	5.31	0.48
1196.00	0.52	144.72	1195.98	0.75 N	4.90 W	4.93	0.20
1289.00	1.74	86.37	1288.96	0.49 N	3.24 W	3.26	1.65
1382.00	3.46	69.73	1381.86	1.56 N	0.81 E	-0.72	2.00
1475.00	5.15	67.93	1474.60	4.10 N	7.31 E	-7.07	1.82
1570.00	7.18	58.77	1569.04	8.78 N	16.34 E	-15.82	2.37
1665.00	8.31	53.99	1663.18	15.89 N	26.97 E	-26.04	1.37
1759.00	9.12	52.12	1756.09	24.46 N	38.34 E	-36.92	0.91
1854.00	10.48	49.71	1849.70	34.67 N	50.88 E	-48.87	1.50
1949.00	8.97	48.25	1943.33	45.20 N	63.00 E	-60.38	1.61
2044.00	8.59	53.82	2037.22	54.32 N	74.25 E	-71.11	0.98
2139.00	9.07	55.99	2131.09	62.69 N	86.18 E	-82.56	0.62
2234.00	9.94	53.83	2224.79	71.72 N	99.01 E	-94.87	0.98
2329.00	10.06	56.20	2318.35	81.18 N	112.53 E	-107.84	0.45
2423.00	10.01	59.98	2410.91	89.84 N	126.43 E	-121.23	0.70
2518.00	11.58	60.34	2504.22	98.69 N	141.87 E	-136.15	1.65
2613.00	9.99	56.16	2597.54	108.00 N	157.00 E	-150.75	1.86
2708.00	10.10	52.53	2691.09	117.65 N	170.46 E	-163.65	0.68
2803.00	11.00	58.19	2784.48	127.50 N	184.77 E	-177.39	1.44
2898.00	11.47	58.73	2877.67	137.17 N	200.54 E	-192.59	0.51
2993.00	11.05	59.08	2970.84	146.75 N	216.42 E	-207.91	0.45
3088.00	10.44	60.93	3064.17	155.61 N	231.74 E	-222.73	0.74
3183.00	10.54	57.38	3157.59	164.47 N	246.58 E	-237.05	0.69
3277.00	8.60	56.17	3250.27	173.02 N	259.66 E	-249.63	2.08
3372.00	8.52	60.21	3344.22	180.47 N	271.66 E	-261.20	0.64
3467.00	8.83	66.56	3438.13	186.86 N	284.46 E	-273.62	1.06
3562.00	9.01	70.37	3531.99	192.26 N	298.15 E	-286.99	0.65
3657.00	10.11	66.19	3625.67	198.12 N	312.78 E	-301.27	1.37
3752.00	10.38	66.48	3719.15	204.90 N	328.25 E	-316.34	0.29
3847.00	10.94	61.46	3812.52	212.63 N	344.02 E	-331.65	1.14
3941.00	10.87	56.74	3904.82	221.75 N	359.26 E	-346.37	0.95
4036.00	8.72	56.36	3998.43	230.65 N	372.75 E	-359.33	2.26
4130.00	8.47	52.56	4091.38	238.80 N	384.18 E	-370.29	0.66
4225.00	8.57	52.28	4185.33	247.39 N	395.33 E	-380.95	0.11
4320.00	7.71	52.58	4279.37	255.59 N	405.99 E	-391.14	0.91
4415.00	5.96	50.39	4373.69	262.60 N	414.85 E	-399.59	1.86
4510.00	5.18	46.22	4468.24	268.71 N	421.74 E	-406.13	0.93
4605.00	3.55	42.20	4562.97	273.86 N	426.81 E	-410.91	1.74
4700.00	2.83	36.83	4657.82	277.92 N	430.20 E	-414.06	0.82
4795.00	2.78	30.34	4752.70	281.78 N	432.77 E	-416.42	0.34
4890.00	2.15	12.61	4847.62	285.51 N	434.32 E	-417.76	1.04
4985.00	1.76	12.11	4942.56	288.67 N	435.01 E	-418.28	0.41
5174.00	0.66	42.72	5131.52	292.31 N	436.36 E	-419.42	0.65
5364.00	0.31	103.55	5321.51	293.00 N	437.61 E	-420.63	0.31
5459.00	0.44	106.50	5416.51	292.83 N	438.21 E	-421.23	0.14
5554.00	0.76	146.61	5511.50	292.20 N	438.90 E	-421.96	0.54
5649.00	1.07	144.01	5606.49	290.96 N	439.77 E	-422.90	0.33
5744.00	1.42	136.79	5701.47	289.39 N	441.10 E	-424.31	0.40
5839.00	1.42	139.81	5796.44	287.63 N	442.66 E	-425.96	0.08
5934.00	1.37	139.06	5891.41	285.88 N	444.16 E	-427.56	0.05
5997.00	1.60	145.08	5954.39	284.59 N	445.15 E	-428.63	0.45
6116.00	1.84	250.08	6073.36	282.57 N	444.31 E	-427.90	2.30
6164.00	7.49	276.56	6121.19	282.67 N	440.47 E	-424.06	12.28
6211.00	12.96	278.45	6167.42	283.79 N	432.21 E	-415.75	11.67
6259.00	15.95	273.75	6213.90	285.01 N	420.30 E	-403.79	6.68
6306.00	19.94	273.77	6258.60	285.96 N	405.85 E	-389.31	8.48

6354.00	24.81	271.38	6302.98	286.75 N	387.61 E	-371.05	10.32
6401.00	27.53	267.90	6345.16	286.58 N	366.89 E	-350.38	6.64
6449.00	30.22	265.94	6387.19	285.32 N	343.76 E	-327.35	5.94
6496.00	33.83	266.03	6427.03	283.58 N	318.90 E	-302.62	7.70
6544.00	39.36	269.01	6465.56	282.39 N	290.32 E	-274.16	12.09
6591.00	46.05	267.20	6500.07	281.30 N	258.49 E	-242.43	14.47
6639.00	51.99	268.12	6531.54	279.84 N	222.29 E	-206.38	12.44
6686.00	54.58	268.61	6559.63	278.76 N	184.64 E	-168.84	5.59
6734.00	56.92	269.77	6586.65	278.21 N	144.97 E	-129.26	5.25
6781.00	60.37	268.97	6611.10	277.76 N	104.84 E	-89.22	7.50
6829.00	64.30	268.87	6633.38	276.96 N	62.34 E	-46.84	8.18
6876.00	68.82	269.02	6652.07	276.17 N	19.24 E	-3.84	9.63
6924.00	73.72	269.30	6667.48	275.51 N	26.20 W	41.49	10.23
6971.00	77.79	270.57	6679.04	275.46 N	71.74 W	86.96	9.04
6998.00	80.51	271.14	6684.12	275.85 N	98.25 W	113.45	10.30

**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 273.19 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.69 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 6998.00 FEET  
IS 292.83 FEET ALONG 340.40 DEGREES (GRID)**

**Tie-In @ Surface**

**Surveys at 235 ft, 512 ft, 750 ft and 940 ft were taken and provided by HP 322 while they were drilling the surface hole and have been covered from magnetic north to grid north.**