

# Noble Energy

Weld County, CO (NAD 83)

Sec. 14-T5N-R67W

Roach N14-65-1HN

Design: Sperry MWD Survey

## Sperry Drilling Services Final Survey Report

15 August, 2013

Well Coordinates: 1,388,591.97 N, 3,180,305.01 E (40° 23' 53.81" N, 104° 51' 09.43" W)  
Ground Level: 4,934.00 ft

Local Coordinate Origin:	Centered on Well Roach N14-65-1HN
Viewing Datum:	KB=16' @ 4950.00ft (Precision 829)
TVDs to System:	N
North Reference:	Grid
Unit System:	API - US Survey Feet - Custom
Geodetic Scale Factor Applied	
Version: 2003.16 Build: 431	

**HALLIBURTON**

## Design Report for Roach N14-65-1HN - Sperry MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,325.00	0.00	0.00	1,325.00	0.00	0.00	0.00	0.00
Surface Casing Assumed Vertical at 1325.00ft							
1,356.00	0.25	189.12	1,356.00	-0.07	-0.01	0.01	0.82
First MWD Survey							
1,450.00	0.64	40.01	1,450.00	0.13	0.29	-0.29	0.93
1,544.00	0.53	267.87	1,544.00	0.52	0.20	-0.18	1.14
1,638.00	1.50	317.19	1,637.98	1.41	-1.08	1.12	1.30
1,733.00	0.99	97.95	1,732.97	2.21	-1.11	1.18	2.48
1,827.00	1.11	78.16	1,826.96	2.28	0.59	-0.52	0.40
1,921.00	1.79	102.43	1,920.93	2.15	2.91	-2.84	0.96
2,015.00	5.02	65.36	2,014.76	3.55	8.08	-7.96	3.99
2,110.00	6.65	75.13	2,109.26	6.69	17.17	-16.95	2.01
2,204.00	9.91	76.65	2,202.27	9.96	30.31	-29.98	3.48
2,325.00	8.66	72.47	2,321.68	15.11	49.14	-48.64	1.17
2,415.00	9.80	78.92	2,410.52	18.62	63.12	-62.50	1.70
2,504.00	12.08	79.01	2,497.89	21.86	79.70	-78.97	2.57
2,594.00	13.69	78.95	2,585.63	25.69	99.40	-98.55	1.78
2,683.00	16.49	75.57	2,671.55	30.86	121.97	-120.95	3.30
2,773.00	17.06	75.22	2,757.72	37.41	147.11	-145.87	0.63
2,863.00	13.54	79.64	2,844.52	42.68	170.24	-168.83	4.11
2,953.00	12.62	74.65	2,932.18	47.18	190.09	-188.52	1.61
3,042.00	12.19	73.53	3,019.11	52.42	208.48	-206.74	0.56
3,132.00	10.98	71.60	3,107.27	57.82	225.73	-223.81	1.41
3,222.00	11.71	76.02	3,195.51	62.73	242.73	-240.65	1.26
3,311.00	13.53	71.13	3,282.36	68.28	261.35	-259.08	2.36
3,401.00	14.26	72.02	3,369.73	75.11	281.85	-279.37	0.85
3,491.00	13.05	66.95	3,457.19	82.51	301.74	-299.02	1.89
3,580.00	11.54	78.54	3,544.16	88.21	319.72	-316.80	3.24
3,670.00	10.23	77.06	3,632.53	91.79	336.33	-333.30	1.49
3,760.00	10.87	74.43	3,721.01	95.85	352.30	-349.13	0.89
3,849.00	11.25	81.83	3,808.36	99.34	368.98	-365.70	1.65
3,939.00	9.02	89.14	3,896.96	100.70	384.73	-381.39	2.86
4,029.00	4.45	83.72	3,986.31	101.18	395.26	-391.90	5.12
4,118.00	1.34	124.91	4,075.19	100.97	399.54	-396.19	3.99
4,387.00	1.46	252.28	4,344.16	98.13	398.86	-395.60	0.93
4,656.00	2.05	311.44	4,613.05	100.28	391.99	-388.66	0.67
4,925.00	2.76	19.75	4,881.86	109.57	390.56	-386.95	1.03
5,194.00	0.95	235.00	5,150.77	114.39	390.93	-387.16	1.33
5,463.00	1.14	354.20	5,419.75	115.78	388.84	-385.03	0.67
5,732.00	1.15	55.98	5,688.71	119.97	390.80	-386.86	0.44
6,001.00	1.13	311.36	5,957.67	123.23	391.04	-387.00	0.67
6,225.00	1.85	304.46	6,181.60	126.75	386.39	-382.24	0.33
6,315.00	1.15	276.34	6,271.57	127.67	384.29	-380.12	1.11
6,360.00	5.95	227.46	6,316.47	126.14	382.13	-378.00	11.71
6,405.00	12.20	229.12	6,360.89	121.45	376.81	-372.83	13.90
6,450.00	15.29	227.06	6,404.59	114.29	368.87	-365.11	6.95
6,494.00	18.58	233.25	6,446.68	106.14	359.00	-355.51	8.51
6,539.00	24.03	235.77	6,488.59	96.69	345.67	-342.48	12.29
6,584.00	28.91	244.83	6,528.88	86.90	328.23	-325.36	14.04

## Design Report for Roach N14-65-1HN - Sperry MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
6,629.00	30.33	259.28	6,568.05	80.15	307.19	-304.54	16.15
6,673.00	35.89	267.47	6,604.91	77.51	283.36	-280.80	16.19
6,718.00	39.47	269.98	6,640.52	76.92	255.87	-253.34	8.65
6,763.00	41.08	270.47	6,674.85	77.04	226.78	-224.26	3.63
6,808.00	42.45	275.01	6,708.42	78.48	196.86	-194.31	7.38
6,853.00	43.37	274.73	6,741.38	81.08	166.33	-163.72	2.08
6,898.00	47.10	277.06	6,773.06	84.38	134.56	-131.86	9.07
6,943.00	49.75	276.88	6,802.92	88.47	101.15	-98.33	5.89
6,987.00	50.70	276.65	6,831.07	92.45	67.57	-64.65	2.19
7,032.00	54.49	276.66	6,858.41	96.59	32.07	-29.04	8.43
7,077.00	58.87	277.27	6,883.12	101.16	-5.24	8.40	9.81
7,122.00	63.14	277.42	6,904.93	106.19	-44.27	47.57	9.48
7,167.00	66.35	275.30	6,924.12	110.69	-84.71	88.13	8.31
7,212.00	67.04	272.22	6,941.93	113.39	-125.94	129.43	6.47
7,256.00	71.15	270.55	6,957.63	114.38	-167.03	170.52	9.99
7,301.00	75.87	268.85	6,970.40	114.15	-210.16	213.63	11.10
7,346.00	78.61	268.78	6,980.34	113.24	-254.04	257.45	6.09
7,383.00	83.47	269.84	6,986.10	112.80	-290.57	293.95	13.44
7,424.00	84.62	269.95	6,990.35	112.73	-331.35	334.71	2.82
Estimated 7" Casing Point: 2320' FSL, 798' FEL (Not a Survey Station)							
7,562.00	88.49	270.31	6,998.64	113.04	-469.07	472.38	2.82
7,651.00	89.20	268.22	7,000.44	111.91	-558.04	561.27	2.48
7,741.00	90.77	269.71	7,000.46	110.28	-648.02	651.15	2.40
7,831.00	90.55	271.49	6,999.42	111.22	-738.01	741.12	2.00
7,920.00	89.35	272.94	6,999.49	114.66	-826.94	830.12	2.12
8,010.00	89.88	272.85	7,000.10	119.20	-916.82	920.10	0.59
8,100.00	90.40	272.52	6,999.88	123.42	-1,006.72	1,010.08	0.69
8,189.00	89.63	272.58	6,999.86	127.38	-1,095.63	1,099.08	0.87
8,279.00	88.98	270.70	7,000.95	129.96	-1,185.58	1,189.06	2.21
8,368.00	89.01	270.83	7,002.50	131.15	-1,274.56	1,278.04	0.15
8,458.00	89.45	268.46	7,003.72	130.59	-1,364.54	1,367.96	2.68
8,548.00	89.63	267.64	7,004.44	127.53	-1,454.49	1,457.76	0.94
8,638.00	89.88	266.51	7,004.83	122.93	-1,544.37	1,547.46	1.28
8,727.00	88.64	267.47	7,005.97	118.26	-1,633.24	1,636.13	1.76
8,817.00	89.85	270.75	7,007.16	116.86	-1,723.20	1,726.01	3.88
8,907.00	90.28	270.79	7,007.06	118.07	-1,813.19	1,816.00	0.48
8,997.00	90.99	270.35	7,006.07	118.96	-1,903.18	1,905.97	0.93
9,086.00	89.51	269.18	7,005.69	118.59	-1,992.18	1,994.91	2.12
9,176.00	89.75	269.04	7,006.27	117.19	-2,082.17	2,084.81	0.32
9,266.00	90.83	270.47	7,005.81	116.81	-2,172.16	2,174.75	2.00
9,355.00	90.93	269.64	7,004.45	116.90	-2,261.15	2,263.70	0.95
9,445.00	89.85	270.05	7,003.84	116.65	-2,351.14	2,353.64	1.29
9,535.00	90.00	270.04	7,003.96	116.73	-2,441.14	2,443.60	0.17
9,624.00	90.31	268.99	7,003.72	115.98	-2,530.14	2,532.53	1.23
9,714.00	90.68	267.51	7,002.95	113.24	-2,620.09	2,622.35	1.69
9,803.00	90.15	268.67	7,002.30	110.28	-2,709.04	2,711.16	1.43
9,893.00	90.96	271.05	7,001.43	110.06	-2,799.03	2,801.10	2.79
9,982.00	91.23	270.41	6,999.73	111.19	-2,888.00	2,890.07	0.79
10,072.00	90.74	271.11	6,998.18	112.38	-2,977.98	2,980.04	0.95
10,162.00	88.71	271.94	6,998.61	114.77	-3,067.94	3,070.03	2.44
10,251.00	88.89	271.61	7,000.48	117.53	-3,156.88	3,159.01	0.43

## Design Report for Roach N14-65-1HN - Sperry MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
10,341.00	89.41	270.76	7,001.81	119.39	-3,246.85	3,248.99	1.11
10,431.00	89.14	269.93	7,002.96	119.94	-3,336.84	3,338.96	0.97
10,520.00	90.74	271.57	7,003.05	121.10	-3,425.83	3,427.94	2.57
10,610.00	90.65	270.18	7,001.96	122.47	-3,515.81	3,517.92	1.55
10,699.00	91.91	271.07	6,999.97	123.44	-3,604.78	3,606.87	1.74
10,789.00	92.40	270.51	6,996.59	124.68	-3,694.70	3,696.80	0.83
10,878.00	91.20	270.94	6,993.79	125.80	-3,783.65	3,785.73	1.43
10,968.00	90.03	271.18	6,992.82	127.47	-3,873.63	3,875.72	1.33
11,058.00	90.83	270.80	6,992.14	129.03	-3,963.61	3,965.71	0.99
11,148.00	90.68	272.92	6,990.95	131.95	-4,053.55	4,055.69	2.36
11,237.00	89.72	268.01	6,990.64	132.67	-4,142.52	4,144.64	5.62
11,288.00	90.06	267.59	6,990.74	130.71	-4,193.48	4,195.52	1.06
Final MWD Survey							
11,353.00	90.06	267.59	6,990.67	127.97	-4,258.42	4,260.34	0.01
Survey Projection to TD - Estimated BHL: 2305' FSL, 537' FWL							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
1,325.00	1,325.00	0.00	0.00	Surface Casing Assumed Vertical at 1325.00ft
1,356.00	1,356.00	-0.07	-0.01	First MWD Survey
7,424.00	6,990.35	112.73	-331.35	Estimated 7" Casing Point: 2320' FSL, 798' FEL (Not a Survey Station)
11,288.00	6,990.74	130.71	-4,193.48	Final MWD Survey
11,353.00	6,990.67	127.97	-4,258.42	Survey Projection to TD
11,353.00	6,990.67	127.97	-4,258.42	Estimated BHL: 2305' FSL, 537' FWL

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	+N/-S (ft)	+E/-W (ft)	Start TVD (ft)
Target	Roach N14-65-1HN_PlanA - Rev0_B	271.79	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
1,325.00	7,424.00	Sperry MWD Surveys	MWD
7,424.00	11,353.00	Sperry MWD Surveys	MWD

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
7,424.00	6,990.35	7" Csg	7	8-3/4

## Design Report for Roach N14-65-1HN - Sperry MWD Survey

Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
Roach	0.00	0.00	6,973.07	133.21	-4,259.76	1,388,725.18	3,176,045.42	40.398730	-104.867910
- actual wellpath misses target center by 18.41ft at 11353.00ft MD (6990.67 TVD, 127.97 N, -4258.42 E)									
- Point									
Roach	0.00	0.00	0.00	0.00	0.00	1,388,591.97	3,180,305.01	40.398280	-104.852620
- actual wellpath hits target center									
- Polygon									
Point 1				27.00	-1,752.00	1,386,840.04	3,180,332.01		
Point 2				-4,315.00	-1,713.00	1,386,879.04	3,175,990.18		
Point 3				-4,361.00	2,624.00	1,391,215.87	3,175,944.18		
Point 4				-20.00	2,589.00	1,391,180.87	3,180,285.01		
Point 5				27.00	-1,752.00	1,386,840.04	3,180,332.01		
Roach	0.00	0.00	0.00	0.00	0.00	1,388,591.97	3,180,305.01	40.398280	-104.852620
- actual wellpath hits target center									
- Polygon									
Point 1				487.00	-2,212.00	1,386,380.06	3,180,791.99		
Point 2				-4,775.00	-2,173.00	1,386,419.06	3,175,530.20		
Point 3				-4,821.00	3,084.00	1,391,675.85	3,175,484.20		
Point 4				440.00	3,049.00	1,391,640.85	3,180,744.99		
Point 5				487.00	-2,212.00	1,386,380.06	3,180,791.99		

**North Reference Sheet for Sec. 14-T5N-R67W - Roach N14-65-1HN**

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to Grid North Reference.

Vertical Depths are relative to KB=16' @ 4950.00ft (Precision 829). Northing and Easting are relative to Roach N14-65-1HN

Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)

Central Meridian is -105.500000°, Longitude Origin:0.000000°, Latitude Origin:40.783333°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99996015

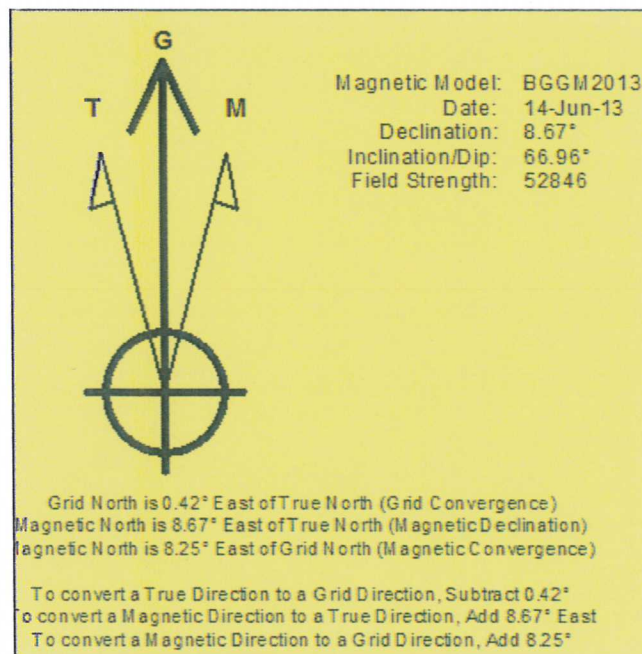
Grid Coordinates of Well: 1,388,591.97 ft N, 3,180,305.01 ft E

Geographical Coordinates of Well: 40° 23' 53.81" N, 104° 51' 09.43" W

Grid Convergence at Surface is: 0.42°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,353.00ft  
the Bottom Hole Displacement is 4,260.35ft in the Direction of 271.72° (Grid).

Magnetic Convergence at surface is: -8.25° (14 June 2013, , BGGM2013)





Azimuths to Grid North  
 True North: -0.42°  
 Magnetic North: 8.25°

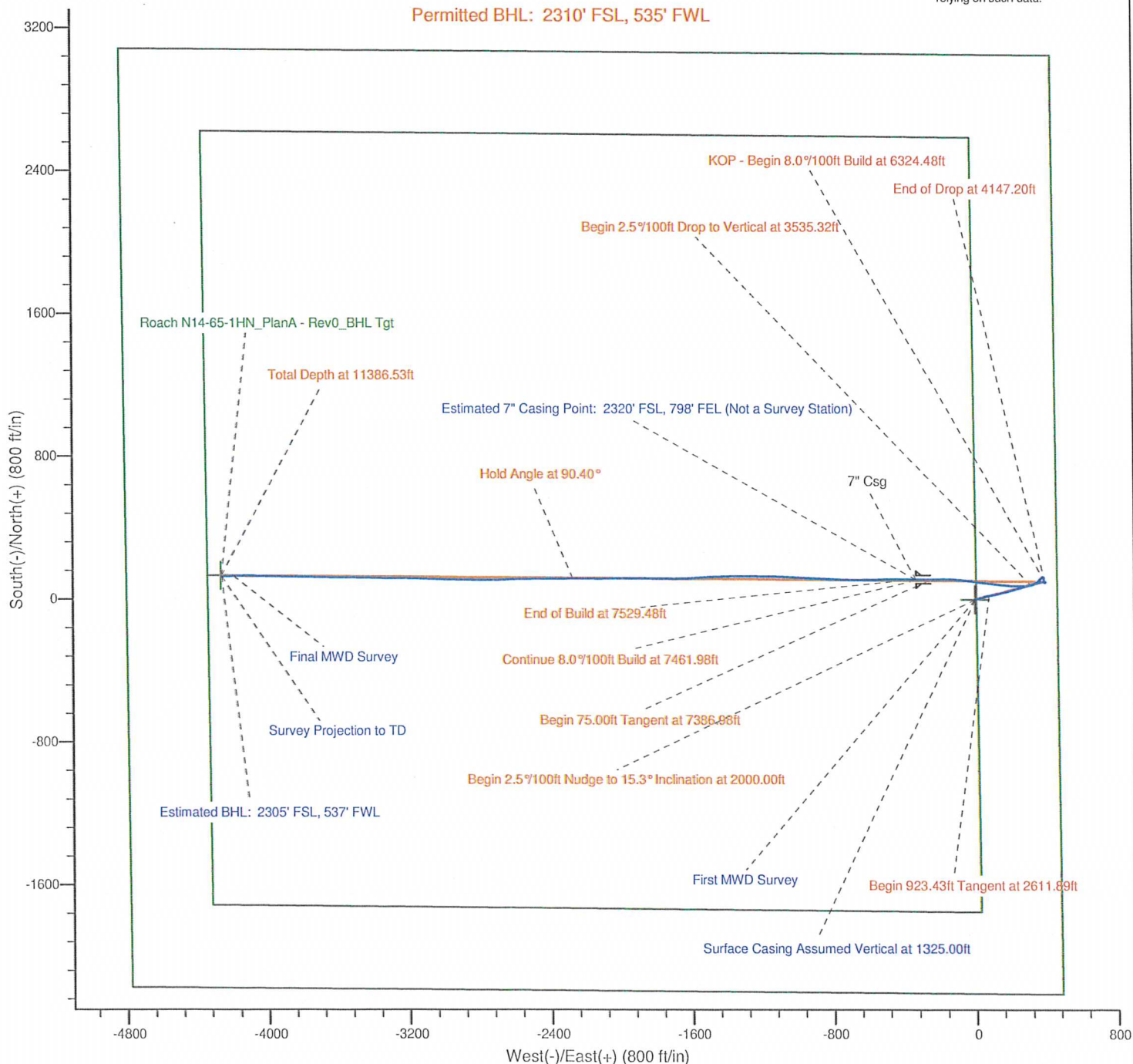
Magnetic Field  
 Strength: 52845.9snT  
 Dip Angle: 66.96°  
 Date: 6/14/2013  
 Model: BGGM2013

### LEGEND

- Roach N14-65-1HN, Plan A, Plan A - Rev 0 Proposal V0
- Sperry MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Roach N14-65-1HN well located at Weld County, CO. At the conclusion of the job Halliburton performed a final survey on the well. Noble Energy has requested that Halliburton provide them the distances from BHL to section lines from that final survey to allow Noble Energy to meet its requirements under Colorado law. These distances are generated by a mathematical algorithm based on rough data collected after the well is drilled. Halliburton considers it to be a rough estimate only and it is not to be relied upon in any application where accurate data is required. In consideration for Halliburton releasing this data to Noble Energy, Noble Energy agrees to release Halliburton from any consequences of it or anyone else relying on such data.

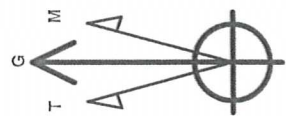
Permitted BHL: 2310' FSL, 535' FWL



Project: Weld County, CO (NAD 83)  
Site: Sec. 14-T5N-R67W  
Well: Roach N14-65-1HN

# Noble Energy

**HALLIBURTON**  
Sperry Drilling



Azimuths to Grid North  
True North: -0.42°  
Magnetic North: 8.25°  
Magnetic Field  
Strength: 52845.9snT  
Dip Angle: 66.96°  
Date: 6/14/2013  
Model: BGGM2013

## LEGEND

- Roach N14-65-1HN, Plan A, Plan A - Rev 0 Proposal V0
- Sperry MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Roach N14-65-1HN well located at Weld County, CO. At the conclusion of the job Halliburton performed a final survey on the well. Noble Energy has requested that Halliburton provide them the distances from BHL to section lines from that final survey to allow Noble Energy to meet its requirements under Colorado law. These distances are generated by a mathematical algorithm based on rough data collected after the well is drilled. Halliburton considers it to be a rough estimate only and it is not to be relied upon in any application where accurate data is required. In consideration for Halliburton releasing this data to Noble Energy, Noble Energy agrees to release Halliburton from any consequences of it or anyone else relying on such data.

