

# Noble Energy

Weld County, CO (NAD 83)

Sec. 4-T4N-R65W (Knaub-Frankie 4 PAD)

Knaub PC G04-64-1HN

Design: MWD Survey

## Sperry Drilling Services

### Final Survey Report

14 April, 2013

Well Coordinates: 1,367,968.51 N, 3,229,500.93 E (40°20' 25.98" N, 104°40' 36.05" W)

Ground Level: 4,678.00 ft

Local Coordinate Origin: Centered on Well Knaub PC G04-64-1HN - Slot A4

Viewing Datum: Corrected KB=30' @ 4708.00ft (H&P 321)

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 Knaub PC G04-64-1HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (7100ft)
637.00	0.00	0.00	637.00	0.00	0.00	0.00	0.00
716.00	0.46	327.88	716.00	0.27	-0.17	-0.20	0.58
<b>First MWD Survey</b>							
993.00	0.29	50.31	992.99	1.66	-0.22	-0.45	0.18
1,269.00	0.25	71.45	1,268.99	2.30	0.89	0.56	0.04
1,455.00	0.10	86.80	1,454.99	2.43	1.43	1.08	0.08
1,739.00	0.92	284.78	1,738.98	3.03	-0.52	-0.94	0.36
2,024.00	1.16	262.59	2,023.93	3.24	-5.60	-6.00	0.16
2,309.00	1.48	236.32	2,308.86	0.83	-11.52	-11.52	0.24
2,404.00	0.57	348.78	2,403.85	0.61	-12.63	-12.59	1.87
2,688.00	1.03	309.92	2,687.82	3.63	-14.86	-15.23	0.24
2,973.00	1.24	275.60	2,972.77	5.58	-19.90	-20.49	0.25
3,258.00	1.54	264.08	3,257.69	5.49	-26.78	-27.28	0.14
3,352.00	0.83	237.02	3,351.67	4.98	-28.60	-29.02	0.94
3,637.00	1.77	231.94	3,636.59	1.15	-33.80	-33.63	0.33
3,732.00	1.23	225.65	3,731.56	-0.47	-35.69	-35.26	0.59
3,826.00	1.28	138.70	3,825.54	-1.96	-35.71	-35.08	1.84
4,111.00	1.75	111.92	4,110.44	-5.98	-29.58	-28.44	0.29
4,395.00	2.29	90.66	4,394.27	-7.66	-19.88	-18.60	0.32
4,490.00	2.17	69.40	4,489.20	-7.05	-16.30	-15.14	0.87
4,585.00	1.21	152.14	4,584.17	-7.31	-14.15	-12.98	2.47
4,680.00	2.15	181.00	4,679.13	-9.98	-13.71	-12.17	1.30
4,774.00	3.97	189.43	4,772.99	-14.95	-14.27	-12.03	1.99
4,869.00	5.39	195.07	4,867.67	-22.50	-15.97	-12.65	1.57
4,964.00	7.07	202.54	4,962.11	-32.21	-19.37	-14.65	1.96
5,059.00	9.76	205.15	5,056.08	-44.90	-25.04	-18.47	2.86
5,153.00	11.75	209.51	5,148.42	-60.45	-33.14	-24.31	2.29
5,248.00	11.59	204.94	5,241.46	-77.52	-41.93	-30.61	0.99
5,343.00	12.19	200.52	5,334.43	-95.57	-49.47	-35.53	1.15
5,438.00	13.17	198.45	5,427.11	-115.23	-56.41	-39.64	1.14
5,532.00	10.60	194.85	5,519.09	-133.74	-62.01	-42.59	2.84
5,627.00	12.56	195.94	5,612.15	-152.12	-67.09	-45.03	2.08
5,722.00	12.91	194.70	5,704.81	-172.32	-72.62	-47.66	0.47
5,817.00	13.06	193.01	5,797.38	-193.04	-77.73	-49.81	0.43
5,912.00	12.56	196.57	5,890.02	-213.40	-83.09	-52.25	0.98
6,007.00	12.81	201.49	5,982.70	-233.10	-89.90	-56.22	1.17
6,102.00	13.39	198.82	6,075.23	-253.32	-97.30	-60.71	0.88
6,165.00	11.81	198.44	6,136.71	-266.34	-101.70	-63.23	2.51
6,238.00	10.45	194.80	6,208.34	-279.83	-105.75	-65.34	2.10
6,290.00	10.40	190.79	6,259.48	-289.00	-107.83	-66.12	1.40
6,338.00	15.08	182.16	6,306.29	-299.50	-108.88	-65.67	10.50
6,385.00	19.78	177.29	6,351.12	-313.56	-108.73	-63.55	10.46
6,433.00	23.15	177.36	6,395.79	-331.10	-107.92	-60.27	7.02
6,479.00	27.86	175.16	6,437.29	-350.86	-106.59	-56.19	10.44
6,527.00	32.61	167.41	6,478.77	-374.68	-102.82	-49.10	12.79
6,574.00	34.30	157.54	6,518.01	-399.30	-95.00	-37.89	12.11
6,622.00	33.49	150.44	6,557.87	-423.32	-83.29	-22.92	8.42
6,669.00	32.09	141.58	6,597.40	-444.40	-69.13	-5.94	10.63
6,717.00	31.24	134.68	6,638.27	-463.15	-52.35	13.31	7.75
6,764.00	32.11	126.19	6,678.29	-479.10	-33.59	34.13	9.66

## Design Report for Knaub PC G04-64-1HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
6,812.00	34.38	123.72	6,718.43	-494.16	-12.02	57.60	5.51
6,859.00	38.49	121.21	6,756.24	-509.11	11.54	83.03	9.30
6,907.00	43.76	116.83	6,792.39	-524.36	39.15	112.51	12.51
6,954.00	48.65	112.24	6,824.92	-538.38	70.01	145.04	12.56
7,002.00	53.31	107.96	6,855.14	-551.15	105.02	181.50	11.92
7,049.00	57.94	105.75	6,881.67	-562.37	142.14	219.82	10.59
7,097.00	60.97	103.53	6,906.06	-572.80	182.13	260.89	7.46
7,144.00	64.53	101.42	6,927.58	-581.82	222.92	302.54	8.56
7,192.00	67.45	99.80	6,947.11	-589.88	266.02	346.34	6.82
7,238.00	72.29	98.04	6,962.94	-596.57	308.67	389.51	11.12
7,286.00	76.04	97.72	6,976.03	-602.89	354.40	435.68	7.84
7,333.00	80.28	96.22	6,985.67	-608.47	400.05	481.66	9.55
7,376.00	82.53	91.36	6,992.10	-611.27	442.46	524.04	12.34
7,431.00	85.56	87.81	6,997.81	-610.87	497.15	578.12	8.46
7" Casing Point Estimated from section lines 1641' FSL 762' FWL (Not a survey point)							
7,456.00	86.95	86.21	6,999.44	-609.57	522.06	602.60	8.46
7,504.00	87.00	85.93	7,001.97	-606.29	569.88	649.49	0.59
7,599.00	86.79	88.47	7,007.12	-601.65	664.62	742.63	2.68
7,694.00	88.92	88.98	7,010.68	-599.54	759.52	836.30	2.31
7,789.00	90.46	90.04	7,011.19	-598.73	854.51	930.23	1.97
7,884.00	91.33	91.55	7,009.71	-600.05	949.49	1,024.45	1.83
7,979.00	91.97	91.03	7,006.97	-602.19	1,044.43	1,118.74	0.87
8,073.00	90.52	90.70	7,004.93	-603.60	1,138.39	1,211.97	1.58
8,169.00	89.45	91.23	7,004.95	-605.22	1,234.38	1,307.23	1.24
8,264.00	90.83	91.33	7,004.72	-607.34	1,329.35	1,401.56	1.46
8,359.00	91.20	90.75	7,003.04	-609.07	1,424.32	1,495.82	0.72
8,453.00	89.91	90.91	7,002.13	-610.43	1,518.30	1,589.06	1.38
8,548.00	89.88	90.87	7,002.30	-611.90	1,613.29	1,683.32	0.05
8,643.00	89.94	91.29	7,002.45	-613.70	1,708.27	1,777.61	0.45
8,738.00	91.05	91.10	7,001.63	-615.68	1,803.25	1,871.92	1.19
8,833.00	90.37	90.24	7,000.45	-616.79	1,898.23	1,966.11	1.15
8,928.00	90.22	89.72	6,999.96	-616.75	1,993.23	2,060.16	0.57
9,022.00	88.58	90.24	7,000.95	-616.72	2,087.22	2,153.21	1.83
9,117.00	90.31	91.02	7,001.87	-617.77	2,182.21	2,247.40	2.00
9,212.00	90.59	90.68	7,001.12	-619.17	2,277.19	2,341.64	0.46
9,307.00	90.37	89.14	7,000.33	-619.03	2,372.19	2,435.67	1.64
9,401.00	89.41	90.35	7,000.51	-618.61	2,466.18	2,528.67	1.64
9,496.00	90.12	90.85	7,000.90	-619.60	2,561.18	2,622.86	0.91
9,591.00	90.06	90.57	7,000.75	-620.78	2,656.17	2,717.08	0.30
9,686.00	91.17	89.23	6,999.73	-620.61	2,751.16	2,811.10	1.83
9,781.00	90.77	91.55	6,998.12	-621.26	2,846.14	2,905.22	2.48
9,876.00	89.48	90.61	6,997.91	-623.05	2,941.12	2,999.51	1.68
9,971.00	88.24	90.33	6,999.80	-623.83	3,036.09	3,093.65	1.34
10,066.00	89.29	90.98	7,001.85	-624.92	3,131.06	3,187.83	1.30
10,161.00	90.77	91.30	7,001.80	-626.81	3,226.04	3,282.13	1.59
10,256.00	90.40	90.67	7,000.83	-628.44	3,321.02	3,376.40	0.77
10,351.00	90.37	90.03	7,000.19	-629.02	3,416.02	3,470.53	0.67
10,445.00	91.11	89.45	6,998.98	-628.59	3,510.01	3,563.53	1.00
10,540.00	90.86	90.86	6,997.35	-628.85	3,604.99	3,657.60	1.51
10,635.00	91.54	89.61	6,995.36	-629.24	3,699.97	3,751.69	1.50
10,730.00	90.46	90.51	6,993.70	-629.34	3,794.95	3,845.74	1.48

## Design Report for Knaub PC G04-64-1HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
10,825.00	87.56	88.46	6,995.34	-628.49	3,889.92	3,939.64	3.74
10,919.00	88.67	90.02	6,998.43	-627.24	3,983.85	4,032.47	2.04
11,014.00	89.94	90.91	6,999.58	-628.01	4,078.84	4,126.62	1.63
11,109.00	90.12	90.85	6,999.53	-629.47	4,173.83	4,220.87	0.20
11,204.00	91.14	89.30	6,998.49	-629.59	4,268.82	4,314.94	1.95
11,299.00	89.72	90.17	6,997.78	-629.16	4,363.81	4,408.92	1.75
11,346.00	90.12	90.94	6,997.84	-629.61	4,410.81	4,455.52	1.85
<b>Final MWD Survey</b>							
11,410.00	90.12	90.94	6,997.71	-630.66	4,474.80	4,519.02	0.00
<b>Bit Projection - Estimated BHL 1604' FSL 546' FEL</b>							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
716.00	716.00	0.27	-0.17	First MWD Survey
7,431.00	6,997.81	-610.87	497.15	7" Casing Point Estimated from section lines 1641' FSL 762' FWL (Not a survey point)
11,346.00	6,997.84	-629.61	4,410.81	Final MWD Survey
11,410.00	6,997.71	-630.66	4,474.80	Bit Projection
11,410.00	6,997.71	-630.66	4,474.80	Estimated BHL 1604' FSL 546' FEL

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (ft)
				+N/-S (ft)	+E/-W (ft)	
Target	Knaub PC G04-64-1HN_PlanC - Rev0_B HL Tgt	98.09	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
716.00	11,410.00	Sperry MWD Surveys	MWD
7,431.00	11,410.00	Sperry MWD Surveys	MWD

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
7,431.00	6,997.81	7"	7	7-1/2

**Design Report for Knaub PC G04-64-1HN - 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
Knaub PC	0.00	0.00	6,993.02	-607.60	465.00	1,367,360.94	3,229,965.91	40.33887	-104.67503
- actual wellpath misses target center by 4.31ft at 7398.54ft MD (6994.79 TVD, -611.52 N, 464.84 E)									
- Point									
Knaub PC	0.00	0.00	60.00	69.22	-0.64	1,368,037.72	3,229,500.29	40.34074	-104.67668
- actual wellpath misses target center by 581.14ft at 637.00ft MD (637.00 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				-243.64	-2,249.78	1,365,718.82	3,229,257.30		
Point 2				-319.64	2,882.22	1,370,850.61	3,229,181.30		
Point 3				4,990.36	2,939.22	1,370,907.60	3,234,491.08		
Point 4				5,044.36	-2,236.78	1,365,731.82	3,234,545.08		
Point 5				-243.64	-2,249.78	1,365,718.82	3,229,257.30		
Knaub PC	0.00	0.00	7,000.00	-635.69	4,474.84	1,367,332.85	3,233,975.58	40.33869	-104.66065
- actual wellpath misses target center by 5.53ft at 11410.00ft MD (6997.71 TVD, -630.66 N, 4474.80 E)									
- Point									
Knaub PC	0.00	0.00	60.00	69.22	-0.64	1,368,037.72	3,229,500.29	40.34074	-104.67668
- actual wellpath misses target center by 581.14ft at 637.00ft MD (637.00 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				216.36	-1,789.78	1,366,178.80	3,229,717.28		
Point 2				140.36	2,422.22	1,370,390.62	3,229,641.28		
Point 3				4,530.36	2,479.22	1,370,447.62	3,234,031.10		
Point 4				4,584.36	-1,776.78	1,366,191.80	3,234,085.10		
Point 5				216.36	-1,789.78	1,366,178.80	3,229,717.28		

## North Reference Sheet for Sec. 4-T4N-R65W (Knaub-Frankie 4 PAD) - Knaub PC G04-64-1HN

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

Vertical Depths are relative to Corrected KB=30' @ 4708.00ft (H&P 321). Northing and Easting are relative to Knaub PC G04-64-1HN - Slot A4

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 -105.50000°; Longitude Origin:0.00000°; Latitude Origin:40.78333°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99995807

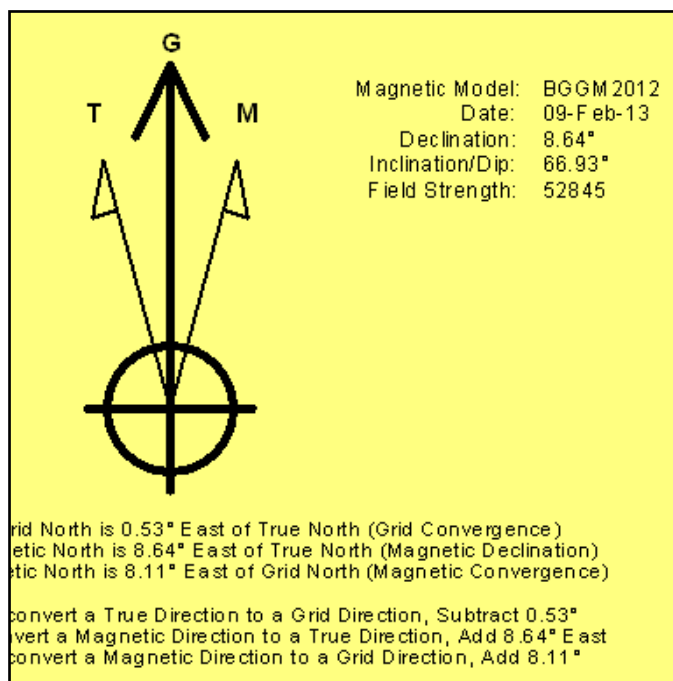
Grid Coordinates of Well: 1,367,968.51 ft N, 3,229,500.93 ft E

Geographical Coordinates of Well: 40°20' 25.98" N, 104°40' 36.05" W

Grid Convergence at Surface is: 0.53°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,410.00ft the Bottom Hole Displacement is 4,519.02ft in the Direction of 98.02°(Grid).

Magnetic Convergence at surface is: -8.11° (9 February 2013, , BGGM2012)



Project: Weld County, CO (NAD 83)  
Site: Sec. 4-T4N-R65W (Knaub-Frankie 4 PAD)  
Well: Knaub PC G04-64-1HN

# Noble Energy

**HALLIBURTON**

Sperry Drilling



Azimuths to Grid North  
True North: -0.53°  
Magnetic North: 8.11°

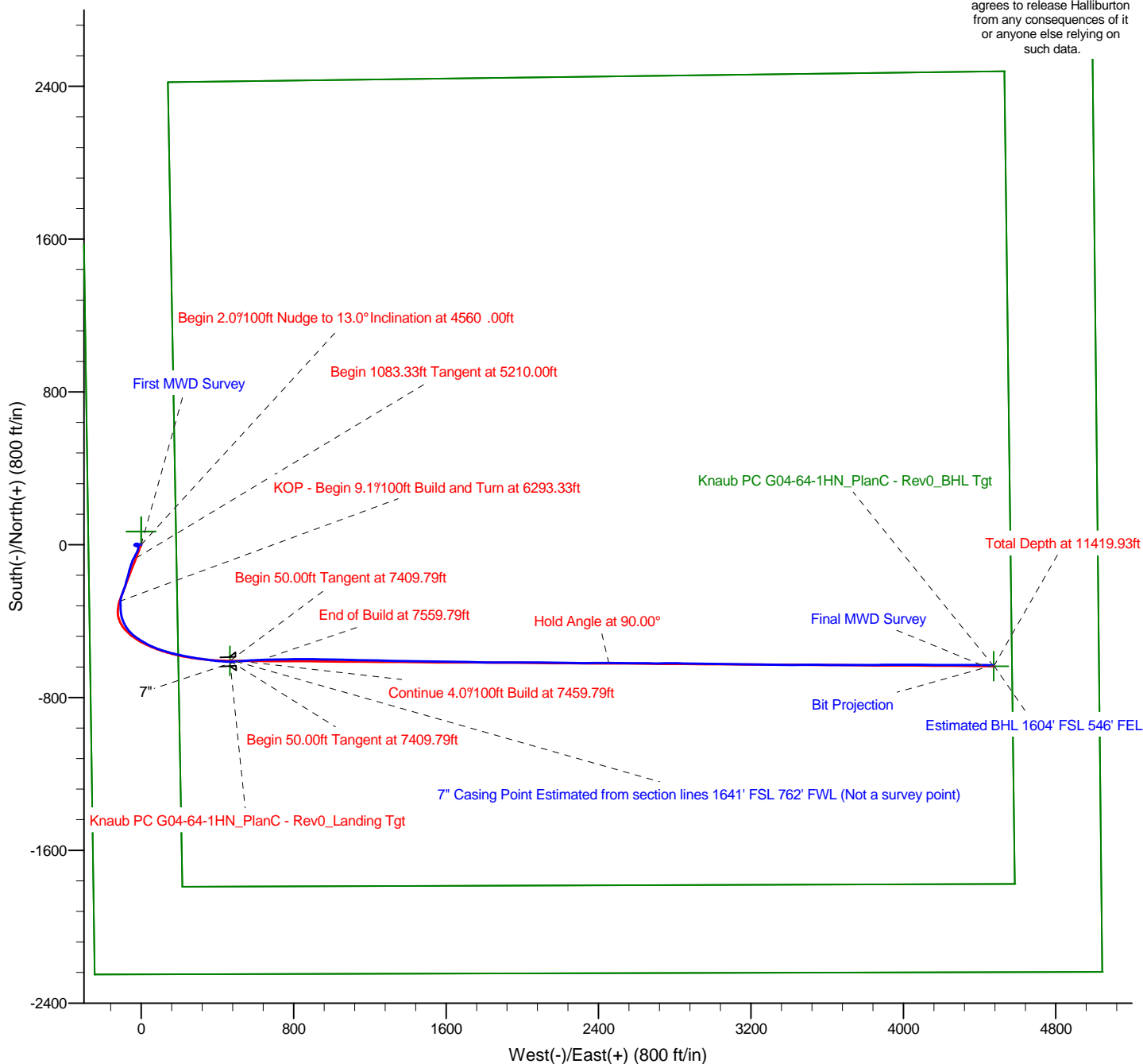
Magnetic Field  
Strength: 52845.4snT  
Dip Angle: 66.93°  
Date: 2/9/2013  
Model: BGGM2012

## LEGEND

- Knaub PC G04-64-1HN, Plan C, Plan C - Rev 0 Proposal V0
- MWD Survey

Permitted BHL: 1650' FSL, 535' FEL

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Knaub PC G04-64-1HN 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.

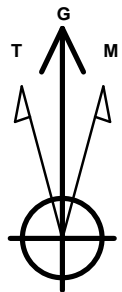


Project: Weld County, CO (NAD 83)  
 Site: Sec. 4-T4N-R65W (Knaub-Frankie 4 PAD)  
 Well: Knaub PC G04-64-1HN

# Noble Energy

**HALLIBURTON**

Sperry Drilling



Azimuths to Grid North  
 True North: -0.53°  
 Magnetic North: 8.11°

Magnetic Field  
 Strength: 52845.4snT  
 Dip Angle: 66.93°  
 Date: 2/9/2013  
 Model: BGGM2012

## LEGEND

- Knaub PC G04-64-1HN, Plan C, Plan C - Rev 0 Proposal V0
- MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Knaub PC G04-64-1HN 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.

