Noble Energy

Weld County, CO (NAD 83)
Sec. 4-T4N-R65W (Knaub-Frankie 4 PAD)
Frankie PC G04-65HN

Design: Vaughn Gyro and Sperry MWD Surveys

Sperry Drilling Services

Final Survey Report

14 April, 2013

Well Coordinates: 1,367,990.37 N, 3,229,500.73 E (40°20' 26.20" N, 104°40' 36.05" W)
Ground Level: 4,678.00 ft

Local Coordinate Origin:	Centered on Well Frankie PC G04-65HN - Slot A3
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: 43I

HALLIBURTON

Design Report for Frankie PC G04-65HN - Vaughn Gyro and Sperry MWD Surveys

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
100.00	0.29	107.99	100.00	-0.08	0.24	-0.11	0.29
Surveys from 100.00ft to 1839.00ft are Vaughn Gyro Surveys							
200.00	0.29	80.12	200.00	-0.11	0.73	-0.22	0.14
300.00	0.40	77.48	300.00	0.01	1.32	-0.20	0.11
400.00	0.28	90.79	399.99	0.08	1.90	-0.22	0.15
500.00	0.44	76.34	499.99	0.17	2.52	-0.23	0.18
600.00	0.67	12.66	599.99	0.83	3.02	0.35	0.62
700.00	0.96	330.69	699.98	2.14	2.74	1.68	0.64
800.00	0.84	347.75	799.97	3.58	2.17	3.20	0.29
900.00	1.06	328.33	899.95	5.09	1.53	4.79	0.39
1,000.00	1.00	322.21	999.94	6.57	0.51	6.41	0.13
1,100.00	0.97	329.01	1,099.92	7.98	-0.47	7.96	0.12
1,200.00	1.05	341.02	1,199.91	9.58	-1.20	9.65	0.23
1,300.00	1.24	342.92	1,299.89	11.49	-1.82	11.63	0.19
1,390.00	0.18	74.04	1,389.88	12.46	-1.97	12.61	1.40
1,427.00	1.66	141.51	1,426.87	12.05	-1.58	12.15	4.32
1,459.00	3.00	137.83	1,458.85	11.07	-0.73	11.05	4.22
1,491.00	2.42	136.52	1,490.81	9.96	0.30	9.79	1.84
1,522.00	2.07	130.07	1,521.79	9.12	1.18	8.83	1.39
1,554.00	2.09	135.02	1,553.77	8.34	2.03	7.92	0.56
1,586.00	2.14	130.87	1,585.74	7.54	2.89	6.99	0.51
1,617.00	1.99	133.18	1,616.72	6.79	3.72	6.13	0.54
1,649.00	1.93	136.21	1,648.71	6.02	4.50	5.25	0.39
1,712.00	1.71	137.42	1,711.67	4.57	5.87	3.60	0.35
1,776.00	2.48	155.62	1,775.63	2.61	7.08	1.47	1.58
1,839.00	2.50	157.51	1,838.57	0.10	8.17	-1.18	0.13
Tie-On to Vaughn Gyro Survey - Tie On To Vaughn Gyro Surveys							
1,932.00	0.31	100.69	1,931.54	-1.82	9.19	-3.23	2.52
First Sperry MWD Survey							
2,027.00	0.19	215.33	2,026.54	-1.99	9.36	-3.43	0.44
2,122.00	0.52	232.41	2,121.54	-2.38	8.93	-3.74	0.36
2,217.00	1.79	287.86	2,216.52	-2.19	7.18	-3.28	1.64
2,312.00	3.71	311.26	2,311.41	0.29	3.46	-0.25	2.30
2,407.00	4.20	311.09	2,406.18	4.61	-1.47	4.78	0.52
2,502.00	4.09	310.96	2,500.93	9.11	-6.65	10.04	0.11
2,597.00	5.75	316.15	2,595.58	14.77	-12.52	16.54	1.81
2,692.00	7.69	311.26	2,689.92	22.40	-20.59	25.33	2.12
2,787.00	10.04	315.90	2,783.78	32.53	-31.13	36.99	2.59
2,881.00	10.47	319.12	2,876.28	44.88	-42.43	50.95	0.77
2,976.00	12.77	322.50	2,969.33	59.74	-54.47	67.51	2.52
3,071.00	12.61	321.77	3,062.01	76.21	-67.28	85.78	0.24
3,166.00	11.22	320.24	3,154.96	91.47	-79.61	102.77	1.50
3,261.00	11.20	318.83	3,248.15	105.52	-91.60	118.52	0.29
3,356.00	10.66	319.92	3,341.42	119.19	-103.33	133.85	0.61
3,451.00	11.61	328.49	3,434.64	134.06	-113.98	150.21	2.01
3,545.00	11.93	328.49	3,526.66	150.41	-124.01	167.92	0.34
3,640.00	12.46	326.96	3,619.52	167.38	-134.73	186.35	0.65
3,735.00	12.51	322.49	3,712.27	184.13	-146.58	204.75	1.02
3,830.00	13.20	330.39	3,804.90	201.72	-158.21	223.94	1.99

Design Report for Frankie PC G04-65HN - Vaughn Gyro and Sperry MWD Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
3,924.00	13.16	338.94	3,896.43	221.04	-167.36	244.45	2.07
4,019.00	12.61	338.59	3,989.04	240.79	-175.03	265.15	0.58
4,114.00	10.90	335.29	4,082.05	258.60	-182.57	283.93	1.94
4,209.00	10.10	334.81	4,175.45	274.30	-189.87	300.57	0.84
4,303.00	9.38	334.89	4,268.10	288.69	-196.63	315.84	0.77
4,398.00	9.10	333.24	4,361.86	302.42	-203.30	330.44	0.40
4,493.00	7.06	330.44	4,455.92	314.21	-209.56	343.06	2.19
4,588.00	4.16	323.33	4,550.45	322.05	-214.50	351.58	3.13
4,683.00	1.39	295.92	4,645.33	325.32	-217.60	355.29	3.16
4,777.00	0.80	250.78	4,739.32	325.60	-219.24	355.83	1.06
5,062.00	1.23	267.96	5,024.27	324.84	-224.18	355.84	0.18
5,157.00	0.50	232.49	5,119.26	324.55	-225.53	355.77	0.92
5,441.00	0.65	276.04	5,403.25	323.96	-228.12	355.59	0.16
5,725.00	0.68	337.81	5,687.23	325.68	-230.36	357.65	0.24
6,010.00	0.21	336.60	5,972.23	327.72	-231.20	359.78	0.17
6,200.00	0.15	34.58	6,162.22	328.24	-231.19	360.30	0.10
6,259.00	0.41	76.49	6,221.22	328.36	-230.94	360.38	0.54
6,294.00	0.60	55.26	6,256.22	328.49	-230.67	360.46	0.74
6,342.00	5.59	103.83	6,304.14	328.07	-228.19	359.67	10.86
6,389.00	12.20	94.38	6,350.55	327.15	-221.01	357.63	14.37
6,437.00	15.55	93.06	6,397.14	326.42	-209.52	355.12	7.01
6,483.00	18.26	92.60	6,441.15	325.76	-196.16	352.38	5.90
6,531.00	21.09	90.59	6,486.34	325.33	-180.01	349.43	6.05
6,578.00	23.26	89.71	6,529.87	325.29	-162.27	346.63	4.67
6,626.00	24.67	91.04	6,573.73	325.15	-142.78	343.45	3.15
6,673.00	27.95	93.87	6,615.85	324.23	-121.97	339.29	7.48
6,721.00	32.09	92.51	6,657.40	322.91	-98.00	334.25	8.73
6,767.00	35.67	91.68	6,695.59	321.98	-72.38	329.33	7.85
6,815.00	39.86	90.86	6,733.52	321.34	-42.99	324.11	8.78
6,862.00	43.44	90.76	6,768.64	320.90	-11.77	318.81	7.62
6,910.00	47.43	90.21	6,802.32	320.62	22.42	313.19	8.36
6,957.00	52.08	89.42	6,832.67	320.74	58.29	307.72	9.97
7,005.00	55.53	89.87	6,861.01	320.98	97.02	301.90	7.23
7,052.00	59.76	91.45	6,886.16	320.51	136.71	295.24	9.43
7,100.00	63.12	92.53	6,909.10	319.03	178.84	287.21	7.28
7,147.00	66.05	92.64	6,929.27	317.12	221.24	278.70	6.24
7,195.00	68.73	92.00	6,947.72	315.33	265.51	270.03	5.71
7,242.00	72.94	90.84	6,963.14	314.23	309.88	262.02	9.26
7,290.00	76.82	90.87	6,975.66	313.54	356.21	254.11	8.08
7,324.00	80.71	91.05	6,982.28	312.98	389.54	248.35	11.45
7,390.00	84.43	87.53	6,990.82	313.80	454.96	238.95	7.73
7,411.00	84.54	87.85	6,992.84	314.65	475.85	236.53	1.59
7,420.00	84.76	87.98	6,993.68	314.97	484.80	235.45	2.83
7" Casing Point Estimated from section lines 2581' FSL 766' FWL (Not a survey point)							
7,506.00	86.82	89.26	6,999.99	317.03	570.54	224.10	2.83
7,601.00	89.63	90.63	7,002.94	317.12	665.48	209.37	3.29
7,696.00	90.09	92.16	7,003.17	314.81	760.45	192.27	1.68
7,791.00	90.00	92.16	7,003.09	311.22	855.38	173.91	0.10
7,886.00	90.68	92.34	7,002.53	307.50	950.31	155.42	0.74
7,980.00	90.74	91.38	7,001.36	304.45	1,044.25	137.74	1.01
8,075.00	90.77	91.71	7,000.11	301.88	1,139.21	120.39	0.34

Design Report for Frankie PC G04-65HN - Vaughn Gyro and Sperry MWD Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
8,170.00	90.74	90.75	6,998.86	299.85	1,234.18	103.56	1.01
8,265.00	90.49	89.93	6,997.84	299.29	1,329.17	88.18	0.90
8,360.00	90.56	91.83	6,996.97	297.83	1,424.15	71.92	2.00
8,455.00	88.55	90.30	6,997.71	296.07	1,519.12	55.35	2.65
8,550.00	89.38	92.04	6,999.42	294.12	1,614.08	38.61	2.03
8,644.00	89.38	91.48	7,000.43	291.24	1,708.03	21.10	0.60
8,739.00	89.14	91.25	7,001.66	288.98	1,803.00	4.04	0.35
8,834.00	90.71	90.45	7,001.79	287.57	1,897.98	-12.17	1.86
8,929.00	90.77	90.32	7,000.56	286.93	1,992.97	-27.63	0.15
9,024.00	90.98	91.70	6,999.10	285.26	2,087.94	-44.10	1.46
9,119.00	90.77	91.31	6,997.65	282.77	2,182.90	-61.38	0.46
9,214.00	90.34	92.57	6,996.73	279.55	2,277.84	-79.37	1.40
9,308.00	90.52	92.42	6,996.02	275.46	2,371.75	-98.07	0.26
9,403.00	89.38	91.96	6,996.10	271.84	2,466.68	-116.46	1.29
9,498.00	89.44	91.94	6,997.07	268.60	2,561.62	-134.48	0.07
9,593.00	89.38	91.58	6,998.04	265.68	2,656.57	-152.18	0.39
9,688.00	89.51	91.20	6,998.96	263.37	2,751.53	-169.28	0.42
9,783.00	90.31	90.84	6,999.11	261.68	2,846.52	-185.77	0.93
9,878.00	90.74	91.28	6,998.25	259.93	2,941.50	-202.33	0.65
9,972.00	89.97	91.39	6,997.67	257.74	3,035.47	-219.16	0.83
10,067.00	89.51	91.23	6,998.10	255.56	3,130.44	-236.13	0.52
10,162.00	88.77	91.45	6,999.53	253.34	3,225.40	-253.15	0.81
10,257.00	87.90	90.82	7,002.29	251.46	3,320.34	-269.82	1.13
10,352.00	90.22	90.19	7,003.85	250.63	3,415.32	-285.46	2.52
10,447.00	91.42	90.41	7,002.50	250.13	3,510.31	-300.78	1.29
10,541.00	90.09	90.20	7,001.26	249.63	3,604.30	-315.94	1.43
10,636.00	90.46	88.77	7,000.80	250.49	3,699.29	-329.92	1.56
10,731.00	90.00	93.26	7,000.41	248.81	3,794.25	-346.40	4.75
10,826.00	90.31	93.46	7,000.16	243.24	3,889.09	-366.70	0.39
10,921.00	89.45	90.92	7,000.36	239.61	3,984.01	-385.10	2.83
11,016.00	89.23	90.98	7,001.46	238.05	4,078.99	-401.47	0.24
11,111.00	90.09	90.93	7,002.02	236.47	4,173.97	-417.85	0.91
11,206.00	90.31	90.42	7,001.69	235.35	4,268.96	-433.78	0.58
11,301.00	90.83	90.65	7,000.75	234.47	4,363.96	-449.48	0.60
11,340.00	91.17	90.33	7,000.06	234.13	4,402.95	-455.89	1.20
Final Sperry MWD Survey							
11,403.00	91.17	90.33	6,998.78	233.77	4,465.93	-466.08	0.01
Survey Projection to TD - Estimated BHL 2493' FSL 546' FEL							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates +N/-S (ft)	Local Coordinates +E/-W (ft)	Comment
100.00	100.00	-0.08	0.24	Surveys from 100.00ft to 1839.00ft are Vaughn Gyro Surveys
1,839.00	1,838.57	0.10	8.17	Tie-On to Vaughn Gyro Survey
1,839.00	1,838.57	0.10	8.17	Tie On To Vaughn Gyro Surveys
1,932.00	1,931.54	-1.82	9.19	First Sperry MWD Survey
7,420.00	6,993.68	314.97	484.80	7" Casing Point Estimated from section lines 2581' FSL 766' FWL (Not a survey point)
11,340.00	7,000.06	234.13	4,402.95	Final Sperry MWD Survey
11,403.00	6,998.78	233.77	4,465.93	Survey Projection to TD
11,403.00	6,998.78	233.77	4,465.93	Estimated BHL 2493' FSL 546' FEL

Design Report for Frankie PC G04-65HN - Vaughn Gyro and Sperry MWD Surveys

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (ft)	Origin +E/-W (ft)	Start TVD (ft)
User	No Target (Freehand)	351.02	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
100.00	1,839.00	Corrected Vaughn Gyro Surveys	ISCWSA-GYRO-3
1,932.00	11,403.00	Sperry MWD Surveys	MWD
7,420.00	11,403.00	Sperry MWD Surveys	MWD

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
7,420.00	6,993.68	7"	7	7-1/2

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
Frankie PC	0.00	0.00	7,000.00	235.00	4,466.04	1,368,225.36	3,233,966.58	40.34114	-104.66065
- actual wellpath misses target center by 1.74ft at 11403.00ft MD (6998.78 TVD, 233.77 N, 4465.93 E)									
- Point									
Knaub PC	0.00	0.00	60.00	47.36	-0.44	1,368,037.72	3,229,500.29	40.34074	-104.67668
- actual wellpath misses target center by 47.39ft at 59.96ft MD (59.96 TVD, -0.03 N, 0.09 E)									
- Polygon									
Point 1				-243.44	-2,271.64	1,365,718.82	3,229,257.30		
Point 2				-319.44	2,860.36	1,370,850.61	3,229,181.30		
Point 3				4,990.56	2,917.36	1,370,907.60	3,234,491.08		
Point 4				5,044.56	-2,258.64	1,365,731.82	3,234,545.08		
Point 5				-243.44	-2,271.64	1,365,718.82	3,229,257.30		
Knaub PC	0.00	0.00	60.00	47.36	-0.44	1,368,037.72	3,229,500.29	40.34074	-104.67668
- actual wellpath misses target center by 47.39ft at 59.96ft MD (59.96 TVD, -0.03 N, 0.09 E)									
- Polygon									
Point 1				216.56	-1,811.64	1,366,178.80	3,229,717.28		
Point 2				140.56	2,400.36	1,370,390.62	3,229,641.28		
Point 3				4,530.56	2,457.36	1,370,447.62	3,234,031.10		
Point 4				4,584.56	-1,798.64	1,366,191.80	3,234,085.10		
Point 5				216.56	-1,811.64	1,366,178.80	3,229,717.28		

North Reference Sheet for Sec. 4-T4N-R65W (Knaub-Frankie 4 PAD) - Frankie PC G04-65HN

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 Frankie PC G04-65HN - Slot A3

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: 1,367,990.37 ft N, 3,229,500.73 ft E

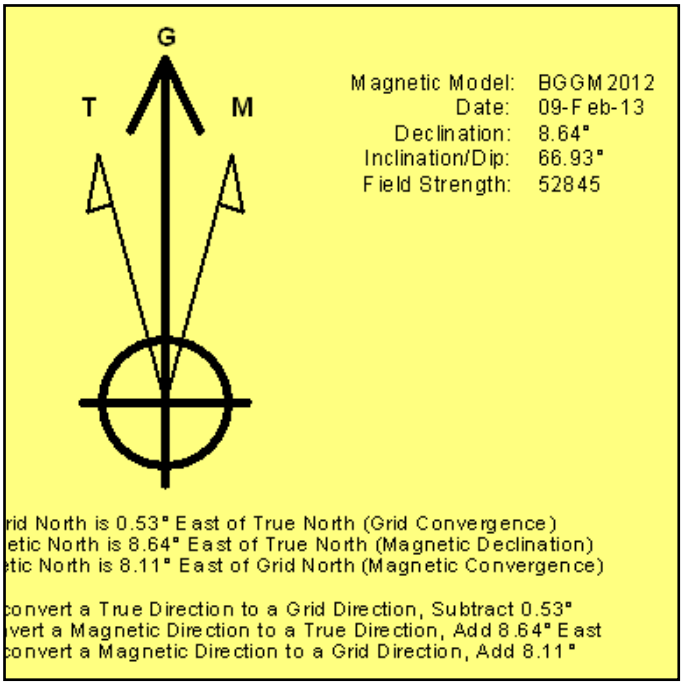
Geographical Coordinates of Well: 40° 20' 26.20" N, 104° 40' 36.05" W

Grid Convergence at Surface is: 0.53°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,403.00ft

the Bottom Hole Displacement is 4,472.05ft in the Direction of 87.00° (Grid).

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



Project: Weld County, CO (NAD 83)
Site: Sec. 4-T4N-R65W (Knaub-Frankie 4 PAD)
Well: Frankie PC G04-65HN

Noble Energy

HALLIBURTON
Sperry Drilling

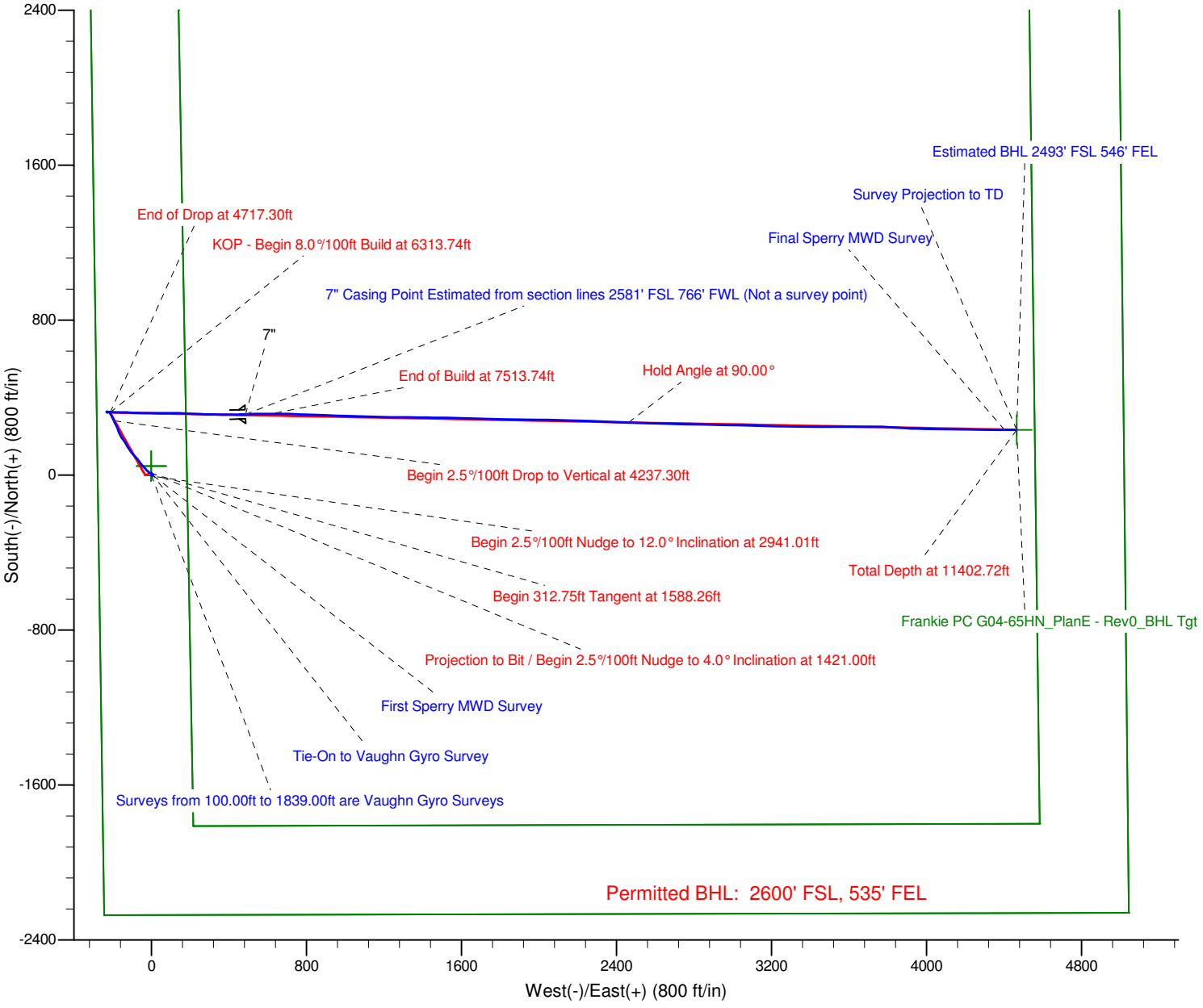
Azimuths to Grid North
True North: -0.53°
Magnetic North: 8.11°

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

LEGEND

Frankie PC G04-65HN, Plan E, Plan E - Rev 0 Proposal V0
Vaughn Gyro and Sperry MWD Surveys

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Frankie PC G04-65HN 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: Frankie PC G04-65HN

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

Frankie PC G04-65HN, Plan E, Plan E - Rev 0 Proposal V0
Vaughn Gyro and Sperry MWD Surveys

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Frankie PC G04-65HN 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.