

# Noble Energy

Weld County, CO (NAD 83)

Sec. 8-T4N-R64W (Northrup 8 PAD)

Northrup C08-73HN - A2

Design: MWD Survey

## Sperry Drilling Services Final Survey Report

20 March, 2012

Well Coordinates: 1,365,631.31 N, 3,258,829.68 E (40° 20' 00.02" N, 104° 34' 17.62" W)

Ground Level: 4,765.00 ft

Local Coordinate Origin:

Centered on Well Northrup C08-73HN - Slot A2

Viewing Datum:

KB @ 4778.00ft (Ensign 132)

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 Northrup C08-73HN - 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
690.00	0.00	0.00	690.00	0.00	0.00	0.00	0.00
Surface Casing Assumed Vertical at 690.00ft							
720.00	0.19	170.12	720.00	-0.05	0.01	0.05	0.63
First MWD Survey							
787.00	0.49	160.78	787.00	-0.43	0.12	0.44	0.45
879.00	0.46	168.78	879.00	-1.16	0.32	1.20	0.08
971.00	0.44	203.95	970.99	-1.85	0.25	1.86	0.30
1,062.00	0.51	211.09	1,061.99	-2.51	-0.10	2.47	0.10
1,157.00	0.53	195.52	1,156.99	-3.30	-0.44	3.20	0.15
1,253.00	0.40	206.19	1,252.98	-4.03	-0.70	3.89	0.16
1,348.00	0.41	206.96	1,347.98	-4.63	-1.00	4.44	0.01
1,443.00	0.55	229.95	1,442.98	-5.22	-1.51	4.96	0.25
1,538.00	0.44	227.78	1,537.97	-5.76	-2.12	5.41	0.12
1,633.00	0.61	208.32	1,632.97	-6.45	-2.63	6.02	0.26
1,728.00	0.91	139.04	1,727.96	-7.47	-2.38	7.06	0.95
1,792.00	1.89	115.88	1,791.94	-8.31	-1.10	8.07	1.74
1,855.00	3.06	98.92	1,854.88	-9.03	1.50	9.15	2.17
1,918.00	4.22	96.64	1,917.76	-9.56	5.46	10.23	1.86
1,982.00	5.29	87.21	1,981.54	-9.68	10.75	11.11	2.07
2,045.00	5.97	81.27	2,044.23	-9.05	16.89	11.34	1.42
2,108.00	7.06	80.83	2,106.82	-7.93	23.95	11.23	1.73
2,174.00	8.06	78.79	2,172.25	-6.39	32.49	10.91	1.57
2,237.00	9.33	77.92	2,234.52	-4.46	41.82	10.32	2.03
2,300.00	10.39	79.49	2,296.59	-2.35	52.40	9.73	1.74
2,364.00	12.16	80.43	2,359.36	-0.18	64.72	9.32	2.78
2,427.00	14.41	82.39	2,420.67	1.96	79.03	9.22	3.64
2,490.00	14.68	84.56	2,481.65	3.76	94.75	9.66	0.97
2,586.00	14.87	84.25	2,574.47	6.14	119.12	10.74	0.21
2,681.00	16.45	84.66	2,665.94	8.62	144.64	11.90	1.67
2,776.00	17.89	81.92	2,756.71	11.92	172.48	12.56	1.74
2,871.00	17.43	85.42	2,847.23	15.11	201.11	13.45	1.22
2,966.00	15.99	85.19	2,938.22	17.34	228.33	15.08	1.52
3,061.00	16.49	85.28	3,029.43	19.55	254.81	16.64	0.53
3,156.00	15.23	83.75	3,120.81	22.02	280.65	17.84	1.40
3,251.00	14.19	82.53	3,212.70	24.89	304.60	18.38	1.14
3,346.00	12.82	83.61	3,305.07	27.57	326.62	18.83	1.47
3,442.00	13.11	85.00	3,398.62	29.71	348.05	19.75	0.44
3,537.00	11.58	83.97	3,491.42	31.65	368.27	20.68	1.63
3,632.00	13.60	88.78	3,584.14	32.89	388.92	22.37	2.39
3,727.00	11.02	87.11	3,676.94	33.59	409.16	24.54	2.74
3,822.00	11.09	85.98	3,770.18	34.68	427.34	26.02	0.24
3,917.00	11.94	85.76	3,863.27	36.05	446.26	27.34	0.90
4,013.00	11.91	83.50	3,957.20	37.91	466.00	28.29	0.49
4,108.00	8.29	81.73	4,050.71	40.00	482.53	28.55	3.82
4,203.00	5.83	83.87	4,144.98	41.50	494.10	28.70	2.60
4,298.00	3.91	80.30	4,239.63	42.56	502.09	28.78	2.05
4,393.00	2.30	73.35	4,334.49	43.66	507.11	28.41	1.74
4,488.00	0.99	72.24	4,429.45	44.45	509.72	27.99	1.38
4,583.00	1.09	66.30	4,524.44	45.07	511.33	27.60	0.15

## Design Report for Northrup C08-73HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
4,678.00	1.55	23.02	4,619.41	46.61	512.66	26.26	1.12
4,773.00	1.30	9.42	4,714.38	48.86	513.34	24.14	0.44
4,868.00	1.22	340.02	4,809.36	50.87	513.17	22.12	0.68
4,963.00	1.29	349.39	4,904.34	52.87	512.63	20.06	0.23
5,058.00	1.76	348.81	4,999.30	55.35	512.15	17.53	0.49
5,153.00	0.87	338.32	5,094.28	57.46	511.60	15.38	0.97
5,248.00	1.41	328.35	5,189.26	59.12	510.72	13.60	0.60
5,343.00	0.63	312.09	5,284.24	60.47	509.72	12.13	0.87
5,438.00	0.46	294.87	5,379.24	60.98	508.98	11.52	0.25
5,533.00	0.41	292.21	5,474.24	61.27	508.32	11.14	0.06
5,627.00	0.46	18.49	5,568.23	61.75	508.13	10.64	0.63
5,722.00	0.50	63.18	5,663.23	62.30	508.62	10.16	0.39
5,817.00	0.62	44.43	5,758.23	62.85	509.35	9.72	0.23
5,913.00	0.69	71.92	5,854.22	63.40	510.26	9.30	0.33
6,008.00	0.10	147.74	5,949.22	63.51	510.85	9.28	0.71
6,075.00	0.25	166.43	6,016.22	63.32	510.92	9.48	0.24
6,103.00	0.15	154.59	6,044.22	63.23	510.95	9.57	0.38
6,166.00	0.07	350.21	6,107.22	63.19	510.98	9.61	0.35
6,198.00	3.01	203.90	6,139.20	62.44	510.63	10.31	9.59
6,230.00	6.00	214.22	6,171.10	60.29	509.35	12.25	9.64
6,261.00	7.42	209.63	6,201.89	57.21	507.45	15.03	4.89
6,293.00	9.80	205.81	6,233.53	52.96	505.24	18.93	7.65
6,325.00	12.36	195.87	6,264.93	47.21	503.12	24.32	9.95
6,357.00	15.38	194.19	6,295.99	39.80	501.14	31.38	9.52
6,388.00	18.36	189.08	6,325.66	30.99	499.36	39.84	10.73
6,420.00	21.54	189.02	6,355.73	20.21	497.65	50.28	9.94
6,452.00	23.92	189.43	6,385.25	8.01	495.66	62.08	7.45
6,484.00	26.55	191.24	6,414.19	-5.41	493.21	75.01	8.56
6,515.00	29.66	185.52	6,441.54	-19.84	491.12	89.01	13.26
6,547.00	32.60	182.21	6,468.93	-36.34	490.02	105.19	10.63
6,579.00	34.81	181.38	6,495.55	-54.09	489.47	122.68	7.05
6,610.00	36.27	179.53	6,520.77	-72.11	489.33	140.50	5.85
6,642.00	39.09	181.94	6,546.10	-91.66	489.07	159.81	9.94
6,673.00	42.26	181.96	6,569.60	-111.85	488.38	179.71	10.23
6,706.00	45.97	182.65	6,593.29	-134.80	487.45	202.29	11.34
6,737.00	47.65	181.87	6,614.51	-157.38	486.56	224.52	5.72
6,769.00	48.08	181.79	6,635.98	-181.10	485.80	247.90	1.36
6,800.00	50.02	179.73	6,656.30	-204.51	485.50	271.03	8.02
6,832.00	52.93	179.35	6,676.22	-229.54	485.70	295.84	9.14
6,864.00	56.12	178.46	6,694.79	-255.59	486.20	321.70	10.22
6,896.00	59.10	177.60	6,711.93	-282.59	487.14	348.56	9.58
6,927.00	61.47	176.05	6,727.30	-309.47	488.63	375.38	8.79
6,959.00	63.00	174.82	6,742.21	-337.69	490.89	403.64	5.87
6,991.00	64.57	174.88	6,756.34	-366.29	493.46	432.31	4.91
7,022.00	65.06	175.29	6,769.53	-394.24	495.87	460.32	1.98
7,054.00	66.74	175.61	6,782.60	-423.35	498.18	489.47	5.33
7,086.00	68.99	176.75	6,794.66	-452.93	500.16	519.03	7.77
7,117.00	70.73	176.93	6,805.33	-481.99	501.76	548.02	5.64
7,149.00	72.40	177.75	6,815.45	-512.31	503.17	578.24	5.76
7,181.00	74.47	178.09	6,824.57	-542.96	504.28	608.74	6.55
7,212.00	77.25	176.91	6,832.14	-572.99	505.59	638.65	9.70



## Design Report for Northrup C08-73HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
7,249.00	78.87	175.11	6,839.80	-609.10	508.11	674.76	6.47
7,324.00	83.89	174.41	6,851.04	-682.92	514.89	748.79	6.76
7,360.00	84.05	173.78	6,854.82	-718.53	518.57	784.57	1.80
7,392.00	84.88	174.52	6,857.91	-750.21	521.82	816.39	3.47
7,456.00	87.79	174.79	6,862.00	-813.80	527.77	880.18	4.57
7,551.00	91.63	177.50	6,862.48	-908.55	534.15	974.89	4.95
7,646.00	90.40	181.50	6,860.79	-1,003.51	534.98	1,069.01	4.40
7,741.00	90.65	181.97	6,859.92	-1,098.47	532.10	1,162.61	0.56
7,836.00	90.71	181.59	6,858.80	-1,193.41	529.15	1,256.19	0.40
7,931.00	89.97	181.46	6,858.23	-1,288.38	526.62	1,349.84	0.79
8,026.00	91.23	180.10	6,857.24	-1,383.36	525.33	1,443.69	1.95
8,121.00	92.00	180.19	6,854.56	-1,478.32	525.09	1,537.66	0.82
8,216.00	90.25	179.75	6,852.69	-1,573.30	525.14	1,631.70	1.90
8,310.00	88.89	180.57	6,853.40	-1,667.29	524.88	1,724.71	1.69
8,405.00	89.97	179.90	6,854.34	-1,762.28	524.49	1,818.70	1.34
8,500.00	89.23	179.94	6,855.01	-1,857.28	524.62	1,912.76	0.78
8,595.00	90.31	178.35	6,855.39	-1,952.26	526.04	2,006.99	2.02
8,690.00	90.15	178.17	6,855.01	-2,047.22	528.92	2,101.40	0.25
8,785.00	89.32	177.72	6,855.45	-2,142.16	532.33	2,195.87	0.99
8,880.00	88.55	179.25	6,857.21	-2,237.10	534.84	2,290.22	1.80
8,976.00	89.01	179.15	6,859.26	-2,333.07	536.18	2,385.41	0.49
9,070.00	88.43	179.14	6,861.36	-2,427.04	537.58	2,478.64	0.62
9,165.00	89.23	179.09	6,863.30	-2,522.01	539.05	2,572.86	0.84
9,260.00	90.09	180.98	6,863.86	-2,617.00	538.99	2,666.89	2.19
9,355.00	91.42	179.88	6,862.61	-2,711.98	538.28	2,760.82	1.82
9,451.00	91.32	179.89	6,860.31	-2,807.96	538.47	2,855.86	0.10
9,546.00	91.29	180.27	6,858.15	-2,902.93	538.34	2,949.87	0.40
9,641.00	89.88	180.41	6,857.18	-2,997.92	537.78	3,043.83	1.49
9,736.00	90.62	180.07	6,856.77	-3,092.92	537.38	3,137.81	0.86
9,831.00	89.75	179.99	6,856.46	-3,187.92	537.33	3,231.85	0.92
9,926.00	89.63	180.13	6,856.97	-3,282.92	537.23	3,325.89	0.19
10,021.00	90.40	179.92	6,856.95	-3,377.92	537.19	3,419.93	0.84
10,116.00	88.89	181.10	6,857.54	-3,472.91	536.34	3,513.85	2.02
10,211.00	89.75	180.69	6,858.66	-3,567.89	534.86	3,607.66	1.00
10,306.00	91.05	180.15	6,858.00	-3,662.88	534.16	3,701.61	1.48
10,367.00	90.90	177.53	6,856.96	-3,723.85	535.40	3,762.14	4.30
Final MWD Survey							
10,430.00	90.90	177.53	6,855.97	-3,786.79	538.11	3,824.83	0.00
Survey Projection to TD - Estimated BHL: 1189' FSL, 1320' FEL							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
690.00	690.00	0.00	0.00	Surface Casing Assumed Vertical at 690.00ft
720.00	720.00	-0.05	0.01	First MWD Survey
10,367.00	6,856.96	-3,723.85	535.40	Final MWD Survey
10,430.00	6,855.97	-3,786.79	538.11	Survey Projection to TD
10,430.00	6,855.97	-3,786.79	538.11	Estimated BHL: 1189' FSL, 1320' FEL

## Design Report for Northrup C08-73HN - MWD Survey

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (ft)	Origin +E/-W (ft)	Start TVD (ft)
Target	Northrup C08-73HN_PlanA - Rev1_BHL Tgt	171.88	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
690.00	10,430.00	Sperry MWD Surveys	MWD

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
Northrup	0.00	0.00	6,858.00	-3,775.83	538.69	1,361,855.63	3,259,368.35	40° 19' 22.656 N	104° 34' 11.172 W
- actual wellpath misses target center by 2.13ft at 10419.05ft MD (6856.15 TVD, -3775.85 N, 537.64 E)									
- Point									
Northrup	0.00	0.00	1.00	0.00	-22.30	1,365,631.31	3,258,807.38	40° 20' 0.024 N	104° 34' 17.904 W
- actual wellpath misses target center by 22.30ft at 1.00ft MD (1.00 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				1,831.70	318.00	1,365,949.29	3,260,661.30		
Point 2				1,847.70	-2,319.00	1,363,312.40	3,260,677.30		
Point 3				1,864.70	-4,961.00	1,360,670.52	3,260,694.30		
Point 4				-778.30	-4,996.00	1,360,635.52	3,258,051.41		
Point 5				-3,408.30	-5,041.00	1,360,590.52	3,255,421.52		
Point 6				-3,441.30	-2,396.00	1,363,235.41	3,255,388.52		
Point 7				-3,462.30	237.00	1,365,868.30	3,255,367.53		
Point 8				-822.30	279.00	1,365,910.29	3,258,007.41		
Point 9				1,831.70	318.00	1,365,949.29	3,260,661.30		
Northrup	0.00	0.00	1.00	0.00	-22.30	1,365,631.31	3,258,807.38	40° 20' 0.024 N	104° 34' 17.904 W
- actual wellpath misses target center by 22.30ft at 1.00ft MD (1.00 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				1,371.70	-142.00	1,365,489.31	3,260,201.32		
Point 2				1,387.70	-2,319.00	1,363,312.40	3,260,217.32		
Point 3				1,404.70	-4,501.00	1,361,130.50	3,260,234.32		
Point 4				-778.30	-4,536.00	1,361,095.50	3,258,051.41		
Point 5				-2,948.30	-4,581.00	1,361,050.50	3,255,881.50		
Point 6				-2,981.30	-2,396.00	1,363,235.41	3,255,848.51		
Point 7				-3,002.30	-223.00	1,365,408.32	3,255,827.51		
Point 8				-822.30	-181.00	1,365,450.31	3,258,007.41		
Point 9				1,371.70	-142.00	1,365,489.31	3,260,201.32		

**North Reference Sheet for Sec. 8-T4N-R64W (Northrup 8 PAD) - Northrup C08-73HN**

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

Vertical Depths are relative to KB @ 4778.00ft (Ensign 132). Northing and Easting are relative to Northrup C08-73HN - Slot A2

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° 30' 0.000 W°, Longitude Origin: 0° 0' 0.000 E°, Latitude Origin: 40° 47' 0.000 N°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99995788

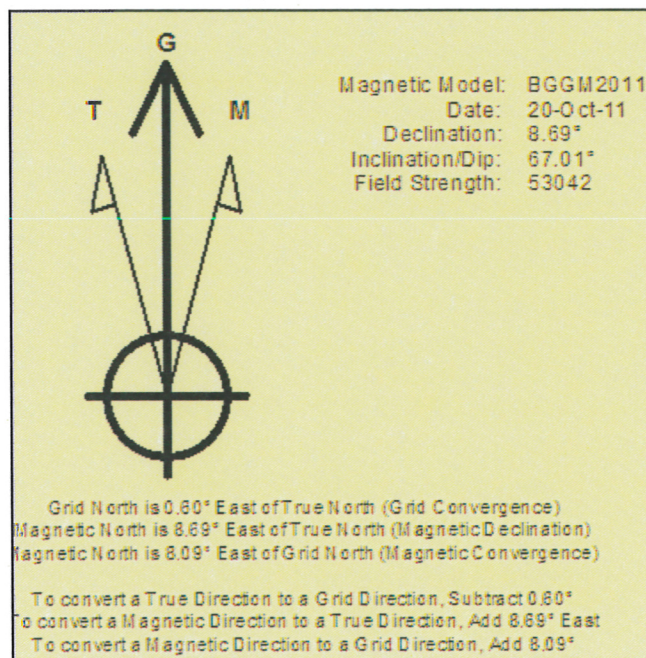
Grid Coordinates of Well: 1,365,631.31 ft N, 3,258,829.68 ft E

Geographical Coordinates of Well: 40° 20' 00.02" N, 104° 34' 17.62" W

Grid Convergence at Surface is: 0.60°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,430.00ft  
the Bottom Hole Displacement is 3,824.83ft in the Direction of 171.91° (Grid).

Magnetic Convergence at surface is: -8.09° (20 October 2011, , BGGM2011)

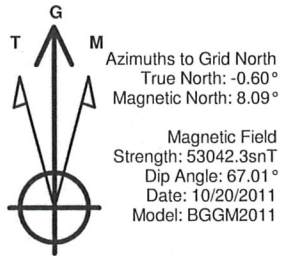




# Noble Energy

**HALLIBURTON**

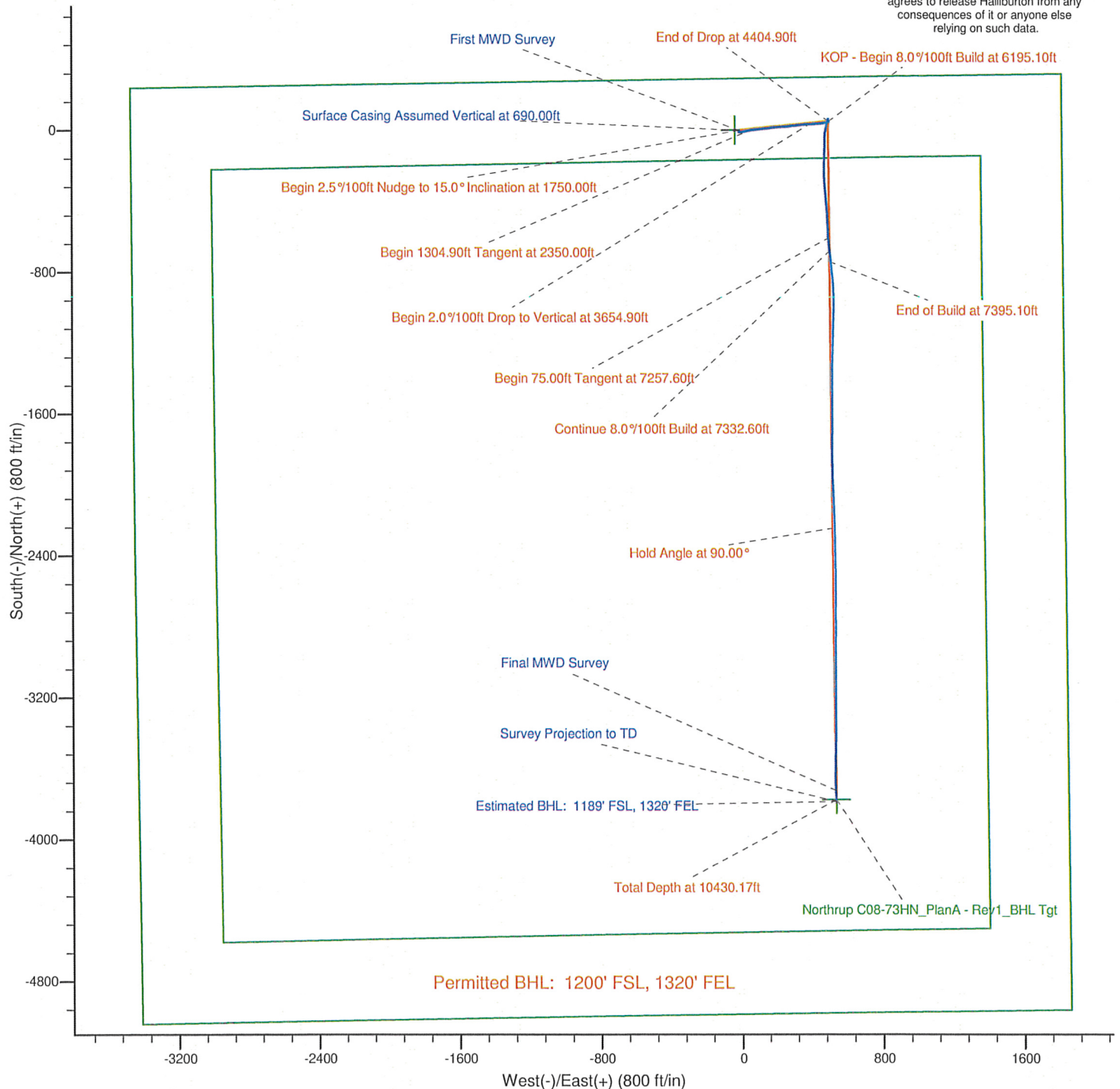
Sperry Drilling



## LEGEND

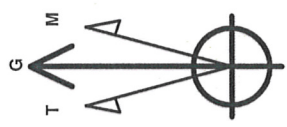
- Northrup C08-73HN, Plan A, Plan A - Rev 1 Proposal V0
- MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Northrup C08-73HN 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. 8-T4N-R64W (Northrup 8 PAD)  
 Well: Northrup C08-73HN

# Noble Energy



Azimuths to Grid North  
 True North: -0.60°  
 Magnetic North: 8.09°  
 Magnetic Field  
 Strength: 53042.3snT  
 Dip Angle: 67.01°  
 Date: 10/20/2011  
 Model: BGGM2011

## LEGEND

- Northrup C08-73HN, Plan A, Plan A - Rev 1 Proposal V0
- MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Northrup C08-73HN 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.

