



Noble Energy

Weld County, CO (NAD 83)

Sec. 29-T6N-R62W (Wells Ranch AE29-32-A PAD)

Wells Ranch AE30-66-1BHNB

Design: Final Surveys

Sperry Drilling Services

Final Survey Report

09 May, 2014

Well Coordinates: 1,411,068.72 N, 3,318,298.60 E (40° 27' 22.14" N, 104° 21' 22.18" W)

Ground Level: 4,759.00 usft

Local Coordinate Origin:

Viewing Datum:

TVDs to System:

North Reference:

Unit System:

Geodetic Scale Factor Applied

Version: 5000.1 Build: 70

Centered on Well Wells Ranch AE30-66-1BHNB

RKB=30ft @ 4789.00usft (H&P 321)

N

Grid

Dec-Deg - API - US Survey Feet - Custom

HALLIBURTON

Design Report for Wells Ranch AE30-66-1BHNB - Final Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
330.00	0.80	13.56	329.99	2.24	0.54	-0.32	0.24
604.00	0.90	332.84	603.96	6.01	0.01	0.58	0.22
Tie-On to Surface Gyros @ 604.00ft							
813.00	1.06	329.39	812.93	9.14	-1.73	2.61	0.08
First MWD Survey @ 813.00ft							
904.00	1.33	334.35	903.91	10.81	-2.61	3.66	0.32
996.00	1.46	326.01	995.88	12.75	-3.73	4.96	0.26
1,088.00	0.90	241.83	1,087.87	13.38	-5.02	6.31	1.78
1,181.00	2.43	180.94	1,180.83	11.06	-5.70	6.75	2.30
1,274.00	2.47	176.42	1,273.75	7.09	-5.61	6.27	0.21
1,366.00	2.61	170.19	1,365.66	3.05	-5.13	5.40	0.34
1,458.00	3.13	162.10	1,457.54	-1.41	-4.00	3.84	0.72
1,550.00	1.35	156.67	1,549.47	-4.79	-2.80	2.31	1.95
1,642.00	1.10	134.26	1,641.45	-6.40	-1.73	1.10	0.58
1,737.00	0.99	129.83	1,736.43	-7.56	-0.45	-0.29	0.14
1,831.00	0.83	145.38	1,830.42	-8.64	0.56	-1.40	0.31
1,926.00	0.65	144.62	1,925.41	-9.65	1.26	-2.20	0.19
2,021.00	0.59	160.68	2,020.41	-10.55	1.74	-2.76	0.19
2,116.00	0.80	146.90	2,115.40	-11.57	2.26	-3.38	0.28
2,210.00	0.99	151.65	2,209.39	-12.83	3.00	-4.24	0.22
2,305.00	0.89	158.83	2,304.38	-14.24	3.66	-5.03	0.16
2,400.00	2.22	336.78	2,399.36	-13.24	3.20	-4.48	3.27
2,494.00	3.59	12.84	2,493.24	-8.70	3.14	-3.97	2.36
2,589.00	5.27	359.34	2,587.96	-1.43	3.75	-3.87	2.07
2,684.00	7.03	356.24	2,682.41	8.73	3.32	-2.45	1.88
2,778.00	9.62	353.39	2,775.41	22.28	2.04	0.15	2.79
2,873.00	11.71	354.60	2,868.76	39.76	0.21	3.67	2.21
2,968.00	11.71	353.67	2,961.79	58.94	-1.76	7.50	0.20
3,063.00	11.01	354.32	3,054.92	77.55	-3.72	11.27	0.75
3,158.00	9.39	350.70	3,148.42	94.22	-5.87	15.04	1.83
3,253.00	9.93	0.44	3,242.08	110.06	-7.06	17.77	1.81
3,347.00	9.85	353.79	3,334.69	126.16	-7.86	20.14	1.22
3,442.00	11.02	353.16	3,428.11	143.26	-9.82	23.77	1.24
3,537.00	12.36	353.90	3,521.14	162.38	-11.99	27.78	1.42
3,632.00	13.82	2.40	3,613.68	183.83	-12.59	30.48	2.54
3,726.00	14.67	4.33	3,704.79	206.92	-11.22	31.37	1.04
3,820.00	13.74	4.11	3,795.91	229.92	-9.52	31.93	0.99
3,915.00	12.27	355.37	3,888.48	251.24	-9.53	34.02	2.58
4,009.00	9.65	352.20	3,980.76	269.01	-11.41	37.62	2.86
4,104.00	9.11	346.62	4,074.49	284.21	-14.23	41.91	1.11
4,199.00	9.64	348.62	4,168.22	299.33	-17.54	46.68	0.65
4,294.00	9.16	354.52	4,261.95	314.65	-19.83	50.46	1.13
4,388.00	9.96	347.82	4,354.65	330.05	-22.26	54.38	1.46
4,483.00	11.26	353.43	4,448.02	347.29	-25.05	58.84	1.75
4,578.00	8.39	347.06	4,541.62	363.26	-27.67	63.00	3.23
4,673.00	8.69	357.40	4,635.57	377.19	-29.54	66.23	1.64
4,768.00	9.63	358.29	4,729.36	392.30	-30.11	68.27	1.00
4,863.00	10.87	356.81	4,822.84	409.19	-30.84	70.65	1.33
4,957.00	12.65	359.76	4,914.87	428.33	-31.38	73.05	2.00

Design Report for Wells Ranch AE30-66-1BHNB - Final Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,052.00	12.07	355.00	5,007.67	448.63	-32.29	75.94	1.23
5,147.00	9.68	352.00	5,100.96	466.44	-34.27	79.65	2.58
5,241.00	8.55	1.37	5,193.77	481.25	-35.20	82.02	1.98
5,336.00	10.61	353.74	5,287.45	497.01	-35.98	84.34	2.54
5,431.00	11.40	353.89	5,380.70	515.03	-37.94	88.04	0.83
5,526.00	11.48	352.20	5,473.81	533.74	-40.22	92.14	0.36
5,621.00	12.20	353.37	5,566.79	553.07	-42.66	96.46	0.80
5,715.00	12.46	350.02	5,658.62	572.93	-45.57	101.29	0.81
5,810.00	10.66	349.85	5,751.69	591.67	-48.89	106.43	1.90
5,889.00	9.91	354.76	5,829.42	605.63	-50.80	109.69	1.46
5,953.00	10.04	342.96	5,892.46	616.45	-52.94	112.87	3.19
6,000.00	12.60	325.88	5,938.56	624.62	-57.01	117.73	8.92
6,048.00	14.08	309.68	5,985.28	632.68	-64.45	125.92	8.34
6,094.00	18.27	294.54	6,029.47	639.26	-75.32	137.38	12.85
6,142.00	21.40	285.29	6,074.62	644.69	-90.62	153.14	9.22
6,189.00	25.21	283.57	6,117.78	649.30	-108.63	171.51	8.23
6,237.00	27.54	282.56	6,160.78	654.12	-129.40	192.65	4.94
6,284.00	30.28	282.04	6,201.92	658.95	-151.60	215.22	5.85
6,332.00	35.68	283.55	6,242.17	664.76	-177.06	241.12	11.38
6,379.00	39.68	286.23	6,279.37	672.17	-204.81	269.46	9.20
6,427.00	42.64	286.86	6,315.50	681.17	-235.09	300.47	6.23
6,474.00	45.72	284.67	6,349.20	690.05	-266.61	332.71	7.31
6,522.00	48.68	279.41	6,381.83	697.35	-301.03	367.68	10.13
6,568.00	53.23	274.83	6,410.80	701.73	-336.46	403.37	12.55
6,616.00	60.93	272.43	6,436.87	704.24	-376.64	443.60	16.58
6,663.00	67.59	271.24	6,457.27	705.59	-418.93	485.82	14.35
6,711.00	71.88	269.92	6,473.90	706.04	-463.95	530.67	9.30
6,758.00	74.95	268.79	6,487.31	705.52	-508.98	575.44	6.93
6,806.00	77.10	269.23	6,498.90	704.72	-555.55	621.71	4.57
6,860.00	80.90	269.93	6,509.20	704.33	-608.55	674.41	7.15
6,904.00	84.64	271.42	6,514.74	704.85	-652.19	717.89	9.14
7" Casing @ 6904' MD, 6514.74' TVD							
6,934.00	87.19	272.43	6,516.88	705.86	-682.09	747.75	9.14
7,001.00	88.86	272.08	6,519.19	708.49	-749.00	814.59	2.55
7,092.00	89.91	269.23	6,520.16	709.53	-839.97	905.24	3.34
7,185.00	91.88	268.96	6,518.71	708.06	-932.95	997.62	2.14
7,278.00	92.25	269.43	6,515.36	706.76	-1,025.88	1,089.98	0.64
7,371.00	92.41	269.56	6,511.58	705.94	-1,118.80	1,182.38	0.22
7,463.00	92.28	268.98	6,507.82	704.77	-1,210.71	1,273.74	0.65
7,554.00	91.42	268.30	6,504.88	702.61	-1,301.64	1,364.02	1.20
7,646.00	90.12	267.91	6,503.64	699.57	-1,393.58	1,455.22	1.48
7,741.00	88.40	268.12	6,504.87	696.28	-1,488.51	1,549.38	1.82
7,836.00	89.14	267.18	6,506.91	692.38	-1,583.40	1,643.44	1.26
7,931.00	89.41	266.75	6,508.11	687.35	-1,678.26	1,737.36	0.53
8,025.00	90.28	266.77	6,508.36	682.04	-1,772.11	1,830.24	0.93
8,120.00	92.03	268.54	6,506.45	678.15	-1,867.00	1,924.30	2.62
8,215.00	93.15	269.41	6,502.16	676.46	-1,961.89	2,018.56	1.49
8,310.00	94.04	270.28	6,496.20	676.20	-2,056.70	2,112.90	1.31
8,404.00	89.38	269.84	6,493.39	676.30	-2,150.63	2,206.39	4.98
8,499.00	89.75	269.23	6,494.12	675.53	-2,245.63	2,300.85	0.75
8,594.00	88.00	268.51	6,495.98	673.65	-2,340.58	2,395.18	1.99

Design Report for Wells Ranch AE30-66-1BHNB - Final Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
8,689.00	89.45	267.92	6,498.09	670.69	-2,435.51	2,489.36	1.65
8,784.00	89.69	267.71	6,498.81	667.07	-2,530.44	2,583.48	0.34
8,878.00	89.75	268.21	6,499.27	663.73	-2,624.38	2,676.65	0.54
8,973.00	87.90	265.73	6,501.22	658.71	-2,719.22	2,770.54	3.26
9,068.00	89.32	265.97	6,503.52	651.83	-2,813.94	2,864.14	1.52
9,162.00	90.62	266.97	6,503.57	646.05	-2,907.75	2,956.94	1.74
9,257.00	90.77	268.24	6,502.42	642.08	-3,002.66	3,051.01	1.35
9,352.00	91.26	269.60	6,500.73	640.29	-3,097.63	3,145.34	1.52
9,446.00	89.48	270.96	6,500.13	640.75	-3,191.62	3,238.93	2.38
9,541.00	86.58	271.05	6,503.39	642.41	-3,286.54	3,333.56	3.05
9,636.00	86.73	268.85	6,508.94	642.33	-3,381.37	3,427.93	2.32
9,730.00	87.99	268.22	6,513.27	639.93	-3,475.24	3,521.11	1.50
9,826.00	89.85	268.16	6,515.07	636.90	-3,571.17	3,616.29	1.94
9,920.00	88.86	268.87	6,516.13	634.46	-3,665.13	3,709.56	1.30
10,015.00	87.84	268.67	6,518.87	632.42	-3,760.07	3,803.85	1.09
10,110.00	89.20	268.61	6,521.32	630.17	-3,855.01	3,898.12	1.43
10,205.00	89.60	268.93	6,522.32	628.13	-3,949.98	3,992.43	0.54
10,300.00	88.40	268.85	6,523.97	626.29	-4,044.94	4,086.77	1.27
10,395.00	89.63	268.71	6,525.61	624.27	-4,139.91	4,181.08	1.30
10,490.00	90.37	269.51	6,525.61	622.79	-4,234.89	4,275.47	1.15
10,585.00	90.92	269.48	6,524.54	621.95	-4,329.88	4,369.92	0.58
10,679.00	87.96	269.66	6,525.46	621.25	-4,423.87	4,463.39	3.15
10,774.00	88.03	268.34	6,528.78	619.59	-4,518.79	4,557.70	1.39
10,868.00	86.18	265.70	6,533.53	614.71	-4,612.53	4,650.51	3.43
10,963.00	88.06	264.72	6,538.30	606.79	-4,707.08	4,743.83	2.23
11,058.00	89.04	265.77	6,540.71	598.92	-4,801.72	4,837.25	1.51
11,152.00	89.38	266.68	6,542.00	592.73	-4,895.50	4,929.98	1.03
11,247.00	87.97	269.85	6,544.20	589.85	-4,990.42	5,024.17	3.65
11,342.00	86.92	270.47	6,548.43	590.12	-5,085.32	5,118.64	1.28
11,437.00	86.15	269.20	6,554.18	589.85	-5,180.14	5,212.99	1.56
11,531.00	85.93	268.49	6,560.67	587.96	-5,273.90	5,306.11	0.79
11,626.00	85.99	267.91	6,567.36	584.98	-5,368.62	5,400.08	0.61
11,721.00	87.32	268.38	6,572.90	581.91	-5,463.40	5,494.12	1.48
11,816.00	88.30	269.24	6,576.53	579.94	-5,558.31	5,588.38	1.37
11,911.00	87.93	268.72	6,579.66	578.25	-5,653.24	5,682.69	0.67
12,009.00	90.43	269.42	6,581.06	576.66	-5,751.21	5,780.04	2.65
Final MWD Survey @ 12009.00ft							
12,073.00	90.43	269.42	6,580.58	576.01	-5,815.21	5,843.66	0.00
Straight Line Proj @ 12073' MD, 6580.58' TVD							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
604.00	603.96	6.01	0.01	Tie-On to Surface Gyros @ 604.00ft
813.00	812.93	9.14	-1.73	First MWD Survey @ 813.00ft
12,009.00	6,581.06	576.66	-5,751.21	Final MWD Survey @ 12009.00ft
12,073.00	6,580.58	576.01	-5,815.21	Straight Line Proj @ 12073' MD, 6580.58' TVD

Design Report for Wells Ranch AE30-66-1BHNB - Final Surveys

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (usft)	Origin +E/-W (usft)	Start TVD (usft)
Target	Wells Ranch AE30-66-1BHNB_BHL	275.60	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
330.00	604.00	Surface Gyros	Flexi-Shot
813.00	6,860.00	MWD Surveys - Intermediate	MWD+IFR1+MS_WY
6,934.00	12,009.00	MWD Surveys - Production	MWD+IFR1+MS_WY

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
6,904.00	6,514.74	7" Casing @ 6904' MD, 6514.74' TVD	7	8-3/4

Design Report for Wells Ranch AE30-66-1BHNB - Final Surveys

Wellbore Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Wells Ranch AE30-66- - actual wellpath hits target center - Point	0.00	0.00	0.00	0.00	0.00	1,411,068.72	3,318,298.60	40.456150	-104.356160
Wells Ranch AE30-66- - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,411,068.72	3,318,298.60	40.456150	-104.356160
Point 1				0.00	2,589.15	-4,983.47	1,413,657.78	3,313,315.31	
Point 2				0.00	-1,795.30	-4,955.17	1,409,273.49	3,313,343.61	
Point 3				0.00	-1,632.30	-536.01	1,409,436.48	3,317,762.61	
Point 4				0.00	2,749.27	-506.98	1,413,817.89	3,317,791.64	
Point 5				0.00	2,589.15	-4,983.47	1,413,657.78	3,313,315.31	
Wells Ranch AE30-66- - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,411,068.72	3,318,298.60	40.456150	-104.356160
Point 1				0.00	2,533.55	-10,275.60	1,413,602.18	3,308,023.38	
Point 2				0.00	-1,861.61	-10,228.82	1,409,207.18	3,308,070.16	
Point 3				0.00	-1,795.30	-5,875.21	1,409,273.49	3,312,423.61	
Point 4				0.00	2,589.15	-5,903.51	1,413,657.78	3,312,395.31	
Point 5				0.00	2,533.55	-10,275.60	1,413,602.18	3,308,023.38	
Wells Ranch AE30-66- - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,411,068.72	3,318,298.60	40.456150	-104.356160
Point 1				0.00	2,993.57	-10,735.61	1,414,062.18	3,307,563.38	
Point 2				0.00	-2,321.63	-10,688.83	1,408,747.18	3,307,610.16	
Point 3				0.00	-2,255.32	-5,415.19	1,408,813.49	3,312,883.61	
Point 4				0.00	3,049.17	-5,443.49	1,414,117.78	3,312,855.31	
Point 5				0.00	-2,255.32	-5,415.19	1,408,813.49	3,312,883.61	
Point 6				0.00	-2,092.32	-75.99	1,408,976.48	3,318,222.61	
Point 7				0.00	3,209.28	-46.96	1,414,277.89	3,318,251.64	
Point 8				0.00	3,049.17	-5,443.49	1,414,117.78	3,312,855.31	
Point 9				0.00	2,993.57	-10,735.61	1,414,062.18	3,307,563.38	
Wells Ranch AE30-66- - actual wellpath misses target center by 60.63usft at 12073.00usft MD (6580.58 TVD, 576.01 N, -5815.21 E) - Point	0.00	0.00	6,520.20	570.56	-5,815.60	1,411,639.26	3,312,483.21	40.457920	-104.377030
Wells Ranch AE30-66- - actual wellpath misses target center by 5.50usft at 12073.00usft MD (6580.58 TVD, 576.01 N, -5815.21 E) - Point	0.00	0.00	6,580.00	570.56	-5,815.60	1,411,639.26	3,312,483.21	40.457920	-104.377030

Directional Difficulty Index

Average Dogleg over Survey:	2.03 °/100usft	Maximum Dogleg over Survey:	16.58 °/100usft at 6,616.00 usft
Net Tortousity applicable to Plans:	1.19 °/100usft	Directional Difficulty Index:	6.463

Audit Info

North Reference Sheet for Sec. 29-T6N-R62W (Wells Ranch AE29-32-A PAD) - Wells Ranch AE30-66-1BHNB

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

Vertical Depths are relative to RKB=30ft @ 4789.00usft (H&P 321). Northing and Easting are relative to Wells Ranch AE30-66-1BHNB

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: 3,000,000.00usft, False Northing: 1,000,000.00usft, Scale Reduction: 0.99996326

Grid Coordinates of Well: 1,411,068.72 usft N, 3,318,298.60 usft E

Geographical Coordinates of Well: 40° 27' 22.14" N, 104° 21' 22.18" W

Grid Convergence at Surface is: 0.74°

Based upon Minimum Curvature type calculations, at a Measured Depth of 12,073.00usft
the Bottom Hole Displacement is 5,843.67usft in the Direction of 275.66° (Grid).

Magnetic Convergence at surface is: -7.56° (6 May 2014, , BGGM2013)

