

Project: Weld County, CO (NAD 83)
 Site: Sec. 20-T6N-R62W (Wells Ranch AE20 North PAD)
 Well: Wells Ranch AE20-68-1HN
 Wellbore: Plan B
 Design: Field Surveys

Noble Energy

HALLIBURTON
 Sperry Drilling

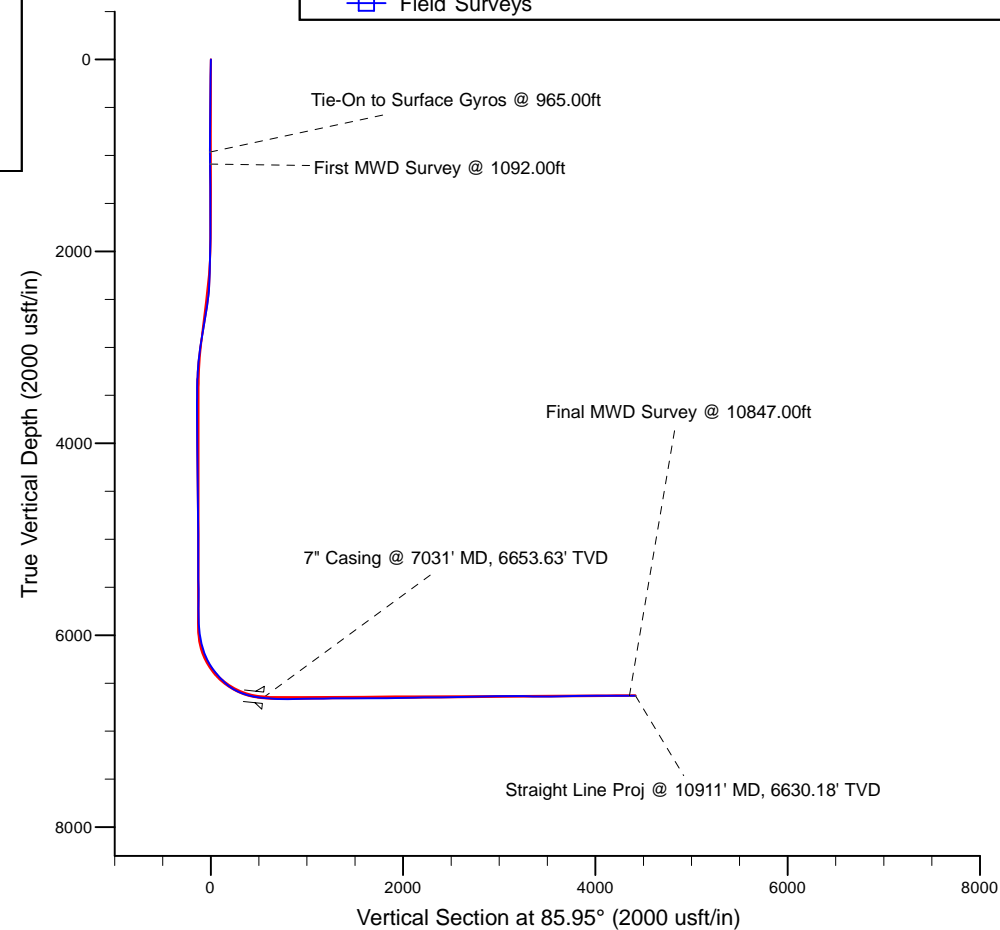
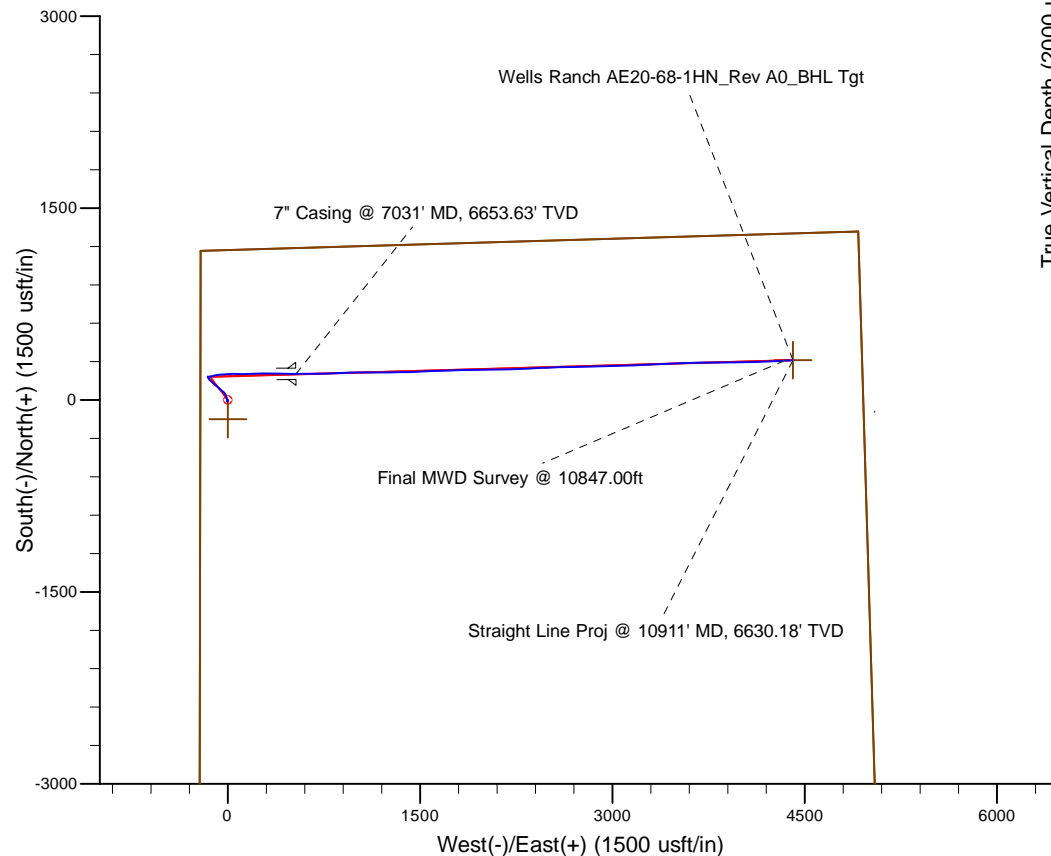
Platted SHL: 1173' FNL, 215' FWL
 Platted Lat/Long: 40.47630° N, 104.35519° W
 Location: Sec. 20-T6N-R62W

7" Casing: ~982.61' FNL, ~745.47' FWL
 Lat/Long: 40° 28' 36.642 N, 104° 21' 11.778 W
 State Planes - CO Northern: 1,418,617.68' N, 3,319,004.77' E
 Location: Sec. 20-T6N-R62W

BHL: ~990.58' FNL, ~537.88' FEL
 Lat/Long: 40° 28' 37.189 N, 104° 20' 21.597 W
 State Planes - CO Northern: 1,418,723.50' N, 3,322,881.57' E
 Location: Sec. 20-T6N-R62W

LEGEND

- Wells Ranch AE20-68-1HN, Plan B, Rev B0 - Proposal V0
- ◇— Wells Ranch AE20-68-1HN, Plan A, Rev A0 Proposal V0
- Field Surveys



WELL DETAILS: Wells Ranch AE20-68-1HN

Ground Level: 4841.00
 KB=30' @ 4871.00usft (H&P 321)

Created By: Fred Hartmann
 Created On: 11/12/2013

Noble Energy

Weld County, CO (NAD 83)

Sec. 20-T6N-R62W (Wells Ranch AE20 North PAD)

Wells Ranch AE20-68-1HN - A5

Design: Field Surveys

Sperry Drilling Services

Final Survey Report

12 November, 2013

Well Coordinates: 1,418,412.29 N, 3,318,473.74 E (40° 28' 34.68" N, 104° 21' 18.68" W)

Ground Level: 4,841.00 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 AE20-68-1HN - Slot A5

KB=30' @ 4871.00usft (H&P 321)

N

Grid

API - US Survey Feet - Custom

HALLIBURTON

Design Report for Wells Ranch AE20-68-1HN - Field 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
350.00	1.20	217.02	349.97	-2.93	-2.21	-2.41	0.34
720.00	1.00	217.42	719.91	-8.58	-6.50	-7.09	0.05
965.00	0.20	69.62	964.90	-10.13	-7.40	-8.10	0.48
Tie-On to Surface Gyros @ 965.00ft							
1,092.00	0.97	107.34	1,091.89	-10.38	-6.17	-6.88	0.65
First MWD Survey @ 1092.00ft							
1,184.00	0.87	106.27	1,183.88	-10.80	-4.75	-5.50	0.11
1,276.00	0.98	98.01	1,275.86	-11.11	-3.30	-4.08	0.19
1,369.00	1.05	101.02	1,368.85	-11.38	-1.68	-2.48	0.09
1,461.00	0.91	335.82	1,460.84	-10.88	-1.15	-1.92	1.89
1,556.00	1.49	322.81	1,555.82	-9.21	-2.21	-2.85	0.67
1,651.00	1.88	322.81	1,650.78	-6.98	-3.89	-4.38	0.41
1,746.00	1.52	349.29	1,745.74	-4.50	-5.07	-5.38	0.90
1,840.00	0.77	356.90	1,839.72	-2.64	-5.34	-5.51	0.81
1,935.00	2.18	357.89	1,934.69	-0.20	-5.44	-5.44	1.48
2,030.00	3.43	340.99	2,029.57	4.29	-6.43	-6.11	1.56
2,125.00	5.97	344.08	2,124.25	11.73	-8.71	-7.86	2.69
2,220.00	8.13	347.46	2,218.52	23.04	-11.52	-9.87	2.31
2,315.00	9.02	337.11	2,312.47	36.46	-15.88	-13.26	1.87
2,409.00	8.75	326.95	2,405.34	49.24	-22.65	-19.11	1.69
2,504.00	10.02	312.12	2,499.08	60.84	-32.72	-28.34	2.86
2,599.00	12.94	311.68	2,592.17	73.46	-46.80	-41.49	3.08
2,693.00	13.51	310.75	2,683.68	87.63	-62.98	-56.62	0.65
2,788.00	13.79	312.27	2,776.00	102.49	-79.76	-72.32	0.48
2,883.00	12.66	311.58	2,868.48	117.01	-95.93	-87.42	1.20
2,978.00	10.85	308.49	2,961.48	129.49	-110.71	-101.29	2.02
3,073.00	11.52	315.18	3,054.68	141.78	-124.40	-114.07	1.54
3,168.00	9.65	311.44	3,148.06	153.78	-137.06	-125.85	2.10
3,263.00	6.67	322.21	3,242.09	163.41	-146.41	-134.49	3.51
3,357.00	3.18	333.13	3,335.73	170.06	-150.93	-138.54	3.83
3,452.00	2.98	339.70	3,430.60	174.72	-152.98	-140.25	0.43
3,547.00	3.08	338.93	3,525.46	179.42	-154.76	-141.69	0.11
3,641.00	1.85	345.10	3,619.37	183.24	-156.05	-142.71	1.34
3,736.00	0.70	128.89	3,714.36	184.36	-156.00	-142.58	2.58
3,831.00	0.87	149.80	3,809.35	183.37	-155.18	-141.83	0.35
3,926.00	0.94	148.22	3,904.34	182.09	-154.41	-141.15	0.08
4,021.00	0.85	118.72	3,999.33	181.09	-153.38	-140.20	0.49
4,116.00	0.96	109.88	4,094.32	180.48	-152.01	-138.88	0.19
4,211.00	0.59	105.02	4,189.31	180.08	-150.79	-137.69	0.40
4,305.00	1.06	60.01	4,283.30	180.39	-149.57	-136.45	0.82
4,400.00	0.22	65.00	4,378.29	180.90	-148.65	-135.49	0.89
4,495.00	0.53	112.71	4,473.29	180.81	-148.08	-134.93	0.44
4,590.00	0.63	100.41	4,568.29	180.55	-147.16	-134.03	0.17
4,685.00	0.63	85.53	4,663.28	180.49	-146.12	-133.00	0.17
4,780.00	0.84	78.28	4,758.27	180.68	-144.92	-131.79	0.24
4,874.00	0.55	30.15	4,852.27	181.21	-144.02	-130.85	0.67
4,969.00	0.75	53.01	4,947.26	181.97	-143.29	-130.07	0.34
5,064.00	0.41	36.45	5,042.25	182.62	-142.59	-129.33	0.40
5,159.00	0.45	100.95	5,137.25	182.82	-142.03	-128.75	0.48

Design Report for Wells Ranch AE20-68-1HN - Field Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,254.00	0.25	314.52	5,232.25	182.90	-141.81	-128.53	0.71
5,349.00	0.38	47.40	5,327.25	183.26	-141.72	-128.42	0.49
5,443.00	0.20	141.62	5,421.25	183.34	-141.39	-128.08	0.47
5,538.00	0.56	108.60	5,516.25	183.06	-140.85	-127.56	0.43
5,633.00	0.22	238.84	5,611.25	182.82	-140.56	-127.29	0.76
5,728.00	0.64	51.82	5,706.24	183.05	-140.30	-127.02	0.90
5,846.00	1.86	77.11	5,824.21	183.89	-137.92	-124.58	1.11
5,916.00	2.01	87.11	5,894.18	184.20	-135.59	-122.23	0.53
5,964.00	3.25	82.85	5,942.12	184.41	-133.39	-120.03	2.61
6,011.00	7.90	79.03	5,988.89	185.20	-128.90	-115.49	9.92
6,059.00	11.52	72.05	6,036.19	187.30	-121.10	-107.56	7.92
6,106.00	14.38	72.27	6,081.99	190.53	-111.07	-97.33	6.09
6,154.00	16.19	75.77	6,128.30	193.99	-98.91	-84.95	4.23
6,201.00	19.44	81.03	6,173.04	196.82	-84.83	-70.70	7.71
6,249.00	22.69	87.05	6,217.83	198.54	-67.68	-53.48	8.13
6,296.00	26.46	87.08	6,260.57	199.54	-48.17	-33.94	8.02
6,344.00	31.11	85.00	6,302.62	201.17	-25.12	-10.84	9.91
6,391.00	35.03	86.33	6,342.00	203.09	0.45	14.80	8.48
6,439.00	37.98	89.24	6,380.58	204.17	28.97	43.33	7.12
6,485.00	40.82	90.92	6,416.13	204.11	58.16	72.44	6.59
6,533.00	42.04	90.22	6,452.12	203.80	89.92	104.10	2.72
6,580.00	45.75	89.90	6,485.98	203.77	122.50	136.60	7.91
6,628.00	50.44	88.17	6,518.03	204.39	158.21	172.26	10.13
6,675.00	55.57	87.51	6,546.30	205.81	195.71	209.77	10.97
6,723.00	61.49	87.90	6,571.35	207.45	236.60	250.67	12.35
6,770.00	66.76	88.66	6,591.85	208.71	278.85	292.91	11.31
6,818.00	68.91	90.28	6,609.96	209.11	323.30	337.27	5.46
6,865.00	73.91	91.32	6,624.94	208.49	367.83	381.64	10.84
6,913.00	78.15	92.06	6,636.53	207.11	414.38	427.98	8.96
6,959.00	81.30	91.33	6,644.73	205.77	459.61	473.01	7.02
6,987.00	82.94	90.14	6,648.57	205.42	487.34	500.64	7.21
7,031.00	83.86	89.93	6,653.63	205.39	531.05	544.24	2.14
7" Casing @ 7031' MD, 6653.63' TVD							
7,092.00	85.13	89.63	6,659.48	205.63	591.77	604.82	2.14
7,187.00	87.16	89.67	6,665.87	206.21	686.55	699.40	2.14
7,282.00	90.93	88.10	6,667.45	208.06	781.50	794.25	4.30
7,377.00	90.86	87.69	6,665.97	211.55	876.42	889.18	0.44
7,471.00	91.79	87.57	6,663.79	215.43	970.31	983.11	1.00
7,566.00	90.46	90.11	6,661.93	217.35	1,065.27	1,077.96	3.02
7,661.00	91.36	90.48	6,660.42	216.86	1,160.25	1,172.68	1.02
7,755.00	90.09	89.20	6,659.23	217.13	1,254.24	1,266.45	1.92
7,850.00	89.38	89.94	6,659.67	217.84	1,349.23	1,361.26	1.08
7,945.00	90.52	87.57	6,659.75	219.90	1,444.20	1,456.13	2.77
8,040.00	89.97	86.46	6,659.35	224.85	1,539.07	1,551.11	1.30
8,135.00	90.71	88.74	6,658.78	228.83	1,633.98	1,646.07	2.52
8,229.00	89.35	87.91	6,658.73	231.58	1,727.94	1,739.98	1.69
8,324.00	91.57	88.77	6,657.97	234.33	1,822.89	1,834.89	2.51
8,419.00	91.36	89.30	6,655.54	235.93	1,917.84	1,929.72	0.60
8,514.00	91.05	89.08	6,653.54	237.27	2,012.81	2,024.55	0.40
8,609.00	91.48	89.36	6,651.45	238.56	2,107.78	2,119.37	0.54
8,704.00	90.43	88.37	6,649.86	240.45	2,202.75	2,214.23	1.52

Design Report for Wells Ranch AE20-68-1HN - Field Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
8,798.00	90.03	87.35	6,649.49	243.96	2,296.68	2,308.18	1.17
8,893.00	89.57	86.73	6,649.82	248.86	2,391.55	2,403.16	0.81
8,988.00	91.63	87.80	6,648.82	253.39	2,486.43	2,498.12	2.44
9,083.00	92.68	88.25	6,645.25	256.67	2,581.30	2,592.99	1.20
9,178.00	92.01	88.58	6,641.36	259.29	2,676.19	2,687.82	0.79
9,273.00	90.03	89.12	6,639.67	261.20	2,771.15	2,782.68	2.16
9,368.00	91.14	88.94	6,638.70	262.81	2,866.13	2,877.54	1.18
9,462.00	90.28	88.92	6,637.54	264.56	2,960.10	2,971.40	0.92
9,557.00	90.83	87.49	6,636.62	267.54	3,055.05	3,066.32	1.61
9,652.00	90.52	87.70	6,635.50	271.52	3,149.96	3,161.27	0.39
9,746.00	89.08	87.47	6,635.83	275.48	3,243.87	3,255.23	1.55
9,841.00	88.89	87.14	6,637.51	279.95	3,338.75	3,350.19	0.40
9,936.00	88.64	86.85	6,639.56	284.93	3,433.60	3,445.15	0.40
10,031.00	90.19	87.75	6,640.53	289.40	3,528.49	3,540.12	1.89
10,126.00	91.67	89.66	6,638.99	291.55	3,623.44	3,634.99	2.54
10,220.00	92.22	88.96	6,635.79	292.68	3,717.38	3,728.77	0.95
10,315.00	90.86	89.61	6,633.24	293.87	3,812.34	3,823.57	1.59
10,410.00	91.29	89.83	6,631.46	294.33	3,907.32	3,918.35	0.51
10,504.00	89.75	88.60	6,630.61	295.62	4,001.30	4,012.19	2.10
10,599.00	90.25	88.32	6,630.61	298.17	4,096.27	4,107.10	0.60
10,694.00	90.09	88.02	6,630.32	301.20	4,191.22	4,202.02	0.36
10,789.00	89.94	87.14	6,630.30	305.22	4,286.13	4,296.98	0.94
10,847.00	90.09	87.19	6,630.28	308.08	4,344.06	4,354.97	0.27
Final MWD Survey @ 10847.00ft							
10,911.00	90.09	87.19	6,630.18	311.22	4,407.98	4,418.96	0.00
Straight Line Proj @ 10911' MD, 6630.18' TVD							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
965.00	964.90	-10.13	-7.40	Tie-On to Surface Gyros @ 965.00ft
1,092.00	1,091.89	-10.38	-6.17	First MWD Survey @ 1092.00ft
10,847.00	6,630.28	308.08	4,344.06	Final MWD Survey @ 10847.00ft
10,911.00	6,630.18	311.22	4,407.98	Straight Line Proj @ 10911' MD, 6630.18' TVD

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
Target	Wells Ranch AE20-68-1HN_Rev A0_BHL Tgt	85.95	Slot	0.00	0.00	6,626.85

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
350.00	965.00	Surface Gyros	Flexi-Shot
1,092.00	6,987.00	MWD Surveys - Vert/Build	MWD
7,092.00	10,847.00	MWD Surveys - Lateral	MWD

Design Report for Wells Ranch AE20-68-1HN - Field Surveys

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
7,031.00	6,653.63	7" Casing @ 7031' MD, 6653.63' TVD	7	8-3/4

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 AE20-66-	0.00	0.00	1.00	-149.39	-0.85	1,418,262.91	3,318,472.89	40° 28' 33.204 N	104° 21' 18.720 W
- actual wellpath misses target center by 149.40usft at 2.25usft MD (2.25 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1			1.00	856.00	248.00	1,419,118.85	3,318,720.95		
Point 2			1.00	1,007.00	4,457.00	1,419,269.48	3,322,929.82		
Point 3			1.00	-3,383.00	4,615.00	1,414,879.62	3,323,087.43		
Point 4			1.00	-3,525.00	239.00	1,414,738.01	3,318,711.57		
Point 5			1.00	856.00	248.00	1,419,118.85	3,318,720.95		
Wells Ranch AE20-66-	0.00	0.00	1.00	-149.39	-0.85	1,418,262.91	3,318,472.89	40° 28' 33.204 N	104° 21' 18.720 W
- actual wellpath misses target center by 149.40usft at 2.25usft MD (2.25 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1			1.00	1,316.00	-212.00	1,419,578.88	3,318,261.01		
Point 2			1.00	1,467.00	4,917.00	1,419,729.42	3,323,389.84		
Point 3			1.00	-3,843.00	5,075.00	1,414,419.60	3,323,547.37		
Point 4			1.00	-3,985.00	-221.00	1,414,278.07	3,318,251.55		
Point 5			1.00	1,316.00	-212.00	1,419,578.88	3,318,261.01		
Wells Ranch AE20-68-	0.00	0.00	6,626.85	312.36	4,408.65	1,418,724.64	3,322,882.23	40° 28' 37.200 N	104° 20' 21.588 W
- actual wellpath misses target center by 3.59usft at 10911.00usft MD (6630.18 TVD, 311.22 N, 4407.98 E)									
- Point									

Directional Difficulty Index

Average Dogleg over Survey:	1.78 °/100usft	Maximum Dogleg over Survey:	12.35 °/100usft at 6,723.00 usft
Net Tortousity applicable to Plans:	0.50 °/100usft	Directional Difficulty Index:	6.188

Audit Info

North Reference Sheet for Sec. 20-T6N-R62W (Wells Ranch AE20 North PAD) - Wells Ranch AE20-68-1HN

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

Vertical Depths are relative to KB=30' @ 4871.00usft (H&P 321). Northing and Easting are relative to Wells Ranch AE20-68-1HN - Slot A5

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: 3,000,000.00usft, False Northing: 1,000,000.00usft, Scale Reduction: 0.99996458

Grid Coordinates of Well: 1,418,412.29 usft N, 3,318,473.74 usft E

Geographical Coordinates of Well: 40° 28' 34.68" N, 104° 21' 18.68" W

Grid Convergence at Surface is: 0.74°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,911.00usft the Bottom Hole Displacement is 4,418.96usft in the Direction of 85.96° (Grid).

Magnetic Convergence at surface is: -7.62° (17 October 2013, , BGGM2013)

