

Project: Weld County, CO (NAD 83)
 Site: Sec. 30-T8N-R63W
 Well: Bethyl GW30-16
 Wellbore: Plan A
 Design: Final Surveys

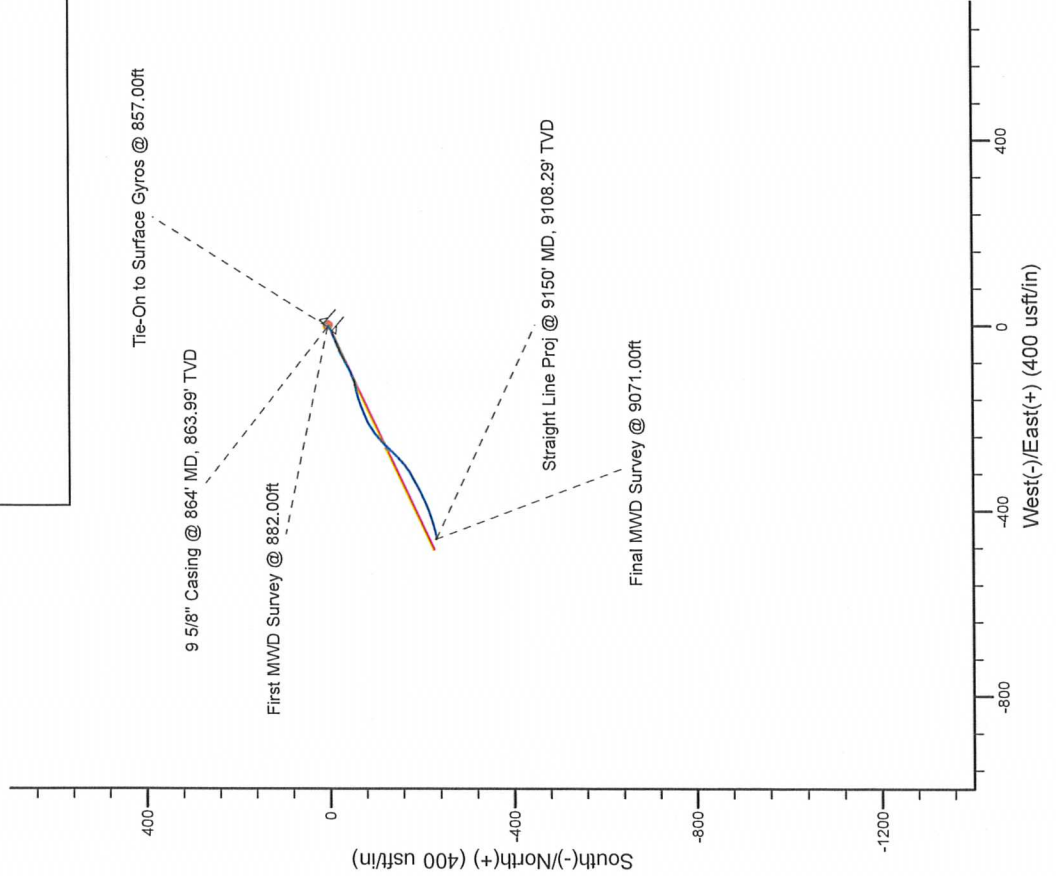
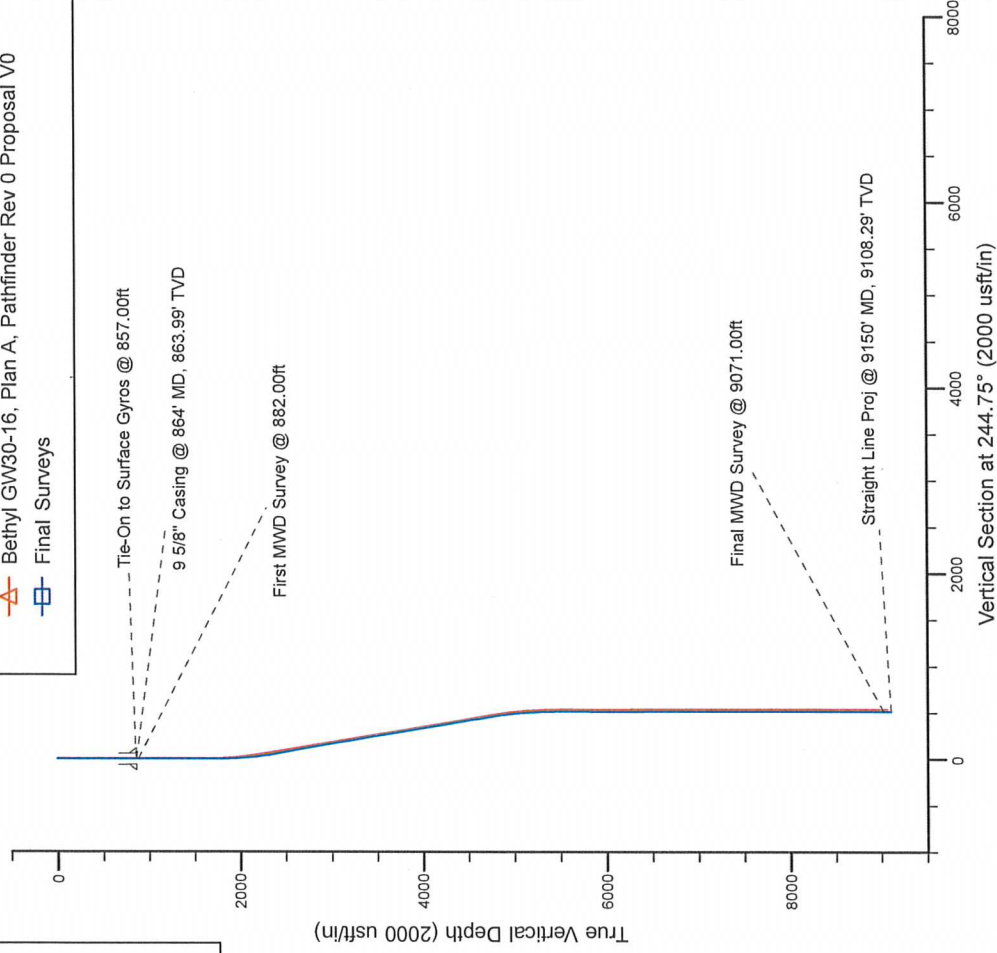
Noble Energy



Platted SHL: 875 FSL, 179' FEL
 Platted Lat/Long: 40.62679° N, 104.46901° W
 Location: Sec. 30-T8N-R63W
 BHL: Lat/Long: 40° 37' 34.208 N, 104° 28' 14.457 W
 State Planes - CO Northern: 1,472,613.57' N, 3,285,712.76' E
 Location: Sec. 30-T8N-R63W

LEGEND

- Bethyl GW30-16, Plan A, Pathfinder Rev 0 Proposal V0
- Final Surveys



WELL DETAILS: Bethyl GW30-16
 Ground Level: 4938.00
 KB=16' @ 4954.00usft (Precision 829)

Created By: Fred Hartmann
 Created On: 11/13/2013

Noble Energy

Weld County, CO (NAD 83)

Sec. 30-T8N-R63W

Bethyl GW30-16

Design: Final Surveys

Sperry Drilling Services

Final Survey Report

13 November, 2013

Well Coordinates: 1,472,845.19 N, 3,286,174.34 E (40° 37' 36.44" N, 104° 28' 08.44" W)

Ground Level: 4,938.00 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 Bethyl GW30-16

KB=16' @ 4954.00usft (Precision 829)

N

Grid

API - US Survey Feet - Custom

HALLIBURTON

Design Report for Bethyl GW30-16 - 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
131.00	0.20	262.00	131.00	-0.03	-0.23	0.22	0.15
207.00	0.50	309.00	207.00	0.16	-0.62	0.49	0.52
319.00	0.60	318.00	318.99	0.90	-1.39	0.87	0.12
414.00	0.30	284.00	413.99	1.33	-1.96	1.21	0.41
510.00	0.20	198.90	509.99	1.23	-2.26	1.52	0.36
605.00	0.20	279.00	604.99	1.10	-2.48	1.77	0.27
699.00	0.40	278.90	698.99	1.18	-2.96	2.18	0.21
794.00	0.20	302.70	793.99	1.32	-3.43	2.54	0.24
857.00	0.20	307.20	856.99	1.45	-3.61	2.65	0.02
Tie-On to Surface Gyros @ 857.00ft							
864.00	0.12	311.19	863.99	1.46	-3.63	2.66	1.15
9 5/8" Casing @ 864' MD, 863.99' TVD							
882.00	0.09	107.77	881.99	1.47	-3.63	2.65	1.15
First MWD Survey @ 882.00ft							
972.00	0.13	114.56	971.99	1.40	-3.47	2.54	0.05
1,061.00	0.14	89.30	1,060.99	1.36	-3.27	2.37	0.07
1,151.00	0.25	31.00	1,150.99	1.53	-3.06	2.11	0.24
1,241.00	0.14	348.65	1,240.98	1.81	-2.98	1.92	0.19
1,330.00	0.11	245.20	1,329.98	1.88	-3.07	1.98	0.22
1,420.00	0.18	354.04	1,419.98	1.98	-3.17	2.02	0.27
1,510.00	0.06	117.73	1,509.98	2.10	-3.14	1.94	0.24
1,599.00	0.20	169.33	1,598.98	1.93	-3.07	1.96	0.19
1,689.00	0.31	205.78	1,688.98	1.55	-3.15	2.18	0.21
1,779.00	0.91	195.09	1,778.98	0.64	-3.44	2.84	0.68
1,868.00	1.75	221.85	1,867.95	-1.05	-4.53	4.55	1.15
1,958.00	3.38	242.34	1,957.86	-3.31	-7.80	8.46	2.05
2,048.00	4.64	247.50	2,047.64	-5.93	-13.51	14.75	1.45
2,137.00	5.75	245.67	2,136.27	-9.15	-20.90	22.80	1.26
2,227.00	6.96	248.62	2,225.72	-12.99	-30.09	32.75	1.39
2,317.00	8.82	247.02	2,314.86	-17.67	-41.52	45.09	2.08
2,406.00	11.17	245.61	2,402.51	-23.90	-55.65	60.53	2.65
2,496.00	11.14	243.06	2,490.81	-31.44	-71.34	77.93	0.55
2,585.00	10.95	240.71	2,578.16	-39.47	-86.38	94.96	0.55
2,675.00	9.56	243.35	2,666.72	-47.00	-100.51	110.96	1.63
2,765.00	9.83	250.00	2,755.44	-52.98	-114.41	126.08	1.28
2,854.00	9.81	258.57	2,843.14	-57.08	-128.98	141.01	1.64
2,944.00	9.82	256.55	2,931.82	-60.39	-143.96	155.97	0.38
3,034.00	9.72	252.22	3,020.52	-64.49	-158.66	171.01	0.82
3,123.00	9.69	250.35	3,108.24	-69.31	-172.87	185.92	0.36
3,213.00	9.77	246.74	3,196.95	-74.87	-187.02	201.09	0.68
3,303.00	10.14	246.12	3,285.59	-81.09	-201.28	216.64	0.43
3,392.00	9.69	240.56	3,373.27	-87.94	-214.97	231.94	1.19
3,482.00	9.60	238.92	3,461.99	-95.54	-227.99	246.96	0.32
3,571.00	9.27	228.99	3,549.80	-104.08	-239.76	261.25	1.86
3,661.00	9.40	223.63	3,638.61	-114.15	-250.30	275.08	0.98
3,750.00	9.56	224.82	3,726.39	-124.66	-260.52	288.81	0.28
3,840.00	9.85	224.95	3,815.10	-135.41	-271.23	303.07	0.32
3,930.00	9.34	225.99	3,903.84	-145.93	-281.92	317.23	0.60
4,019.00	10.18	226.70	3,991.55	-156.34	-292.84	331.55	0.95

Design Report for Bethyl GW30-16 - Final Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
4,109.00	10.02	233.72	4,080.16	-166.43	-304.94	346.80	1.38
4,199.00	9.94	238.48	4,168.80	-175.12	-317.87	362.20	0.92
4,288.00	9.68	241.03	4,256.50	-182.76	-330.97	377.31	0.57
4,378.00	9.97	241.13	4,345.18	-190.19	-344.41	392.63	0.32
4,468.00	9.61	241.92	4,433.87	-197.49	-357.86	407.91	0.43
4,557.00	9.62	246.40	4,521.62	-203.96	-371.23	422.76	0.84
4,647.00	9.72	247.65	4,610.34	-209.86	-385.15	437.87	0.26
4,736.00	9.71	248.74	4,698.07	-215.44	-399.09	452.86	0.21
4,826.00	9.22	250.83	4,786.84	-220.56	-412.98	467.60	0.66
4,916.00	8.03	255.62	4,875.82	-224.49	-425.88	480.94	1.54
5,005.00	6.46	253.23	4,964.11	-227.48	-436.69	492.00	1.80
5,095.00	4.74	256.53	5,053.68	-229.80	-445.16	500.65	1.94
5,184.00	3.06	255.41	5,142.47	-231.26	-451.03	506.58	1.89
5,274.00	2.52	264.22	5,232.36	-232.06	-455.32	510.81	0.76
5,364.00	1.20	280.12	5,322.31	-232.10	-458.22	513.45	1.56
5,453.00	0.20	272.62	5,411.30	-231.93	-459.29	514.34	1.13
5,543.00	0.09	350.93	5,501.30	-231.85	-459.46	514.46	0.22
5,633.00	0.66	223.64	5,591.30	-232.15	-459.83	514.93	0.80
5,722.00	0.30	318.85	5,680.30	-232.35	-460.34	515.47	0.84
5,812.00	0.22	105.49	5,770.30	-232.22	-460.33	515.40	0.55
5,901.00	0.43	0.15	5,859.30	-231.93	-460.16	515.13	0.60
5,991.00	0.11	9.94	5,949.30	-231.51	-460.14	514.93	0.36
6,080.00	0.07	355.67	6,038.30	-231.37	-460.13	514.87	0.05
6,170.00	0.40	317.18	6,128.30	-231.08	-460.35	514.94	0.39
6,260.00	0.11	65.65	6,218.30	-230.82	-460.49	514.95	0.50
6,349.00	0.17	202.35	6,307.30	-230.90	-460.46	514.96	0.29
6,439.00	0.03	312.69	6,397.30	-231.01	-460.53	515.07	0.20
6,528.00	0.16	182.27	6,486.30	-231.12	-460.55	515.13	0.20
6,618.00	0.04	39.40	6,576.30	-231.22	-460.53	515.16	0.21
6,708.00	0.10	237.21	6,666.30	-231.24	-460.58	515.21	0.15
6,797.00	0.20	128.09	6,755.30	-231.38	-460.52	515.22	0.28
6,887.00	0.17	83.50	6,845.30	-231.46	-460.27	515.02	0.16
6,977.00	0.15	154.73	6,935.30	-231.55	-460.08	514.90	0.21
7,066.00	0.13	216.43	7,024.29	-231.74	-460.09	514.99	0.16
7,156.00	0.28	202.20	7,114.29	-232.02	-460.24	515.24	0.17
7,246.00	0.43	313.80	7,204.29	-231.99	-460.56	515.52	0.66
7,335.00	0.18	301.66	7,293.29	-231.69	-460.92	515.72	0.29
7,425.00	0.20	242.49	7,383.29	-231.69	-461.18	515.95	0.21
7,515.00	0.34	338.30	7,473.29	-231.51	-461.42	516.09	0.46
7,604.00	0.34	250.89	7,562.29	-231.35	-461.77	516.34	0.53
7,694.00	0.09	39.52	7,652.29	-231.38	-461.98	516.54	0.47
7,784.00	0.15	206.11	7,742.29	-231.44	-461.98	516.57	0.26
7,874.00	0.10	60.39	7,832.29	-231.50	-461.97	516.58	0.27
7,963.00	0.14	65.39	7,921.29	-231.42	-461.80	516.39	0.05
8,053.00	0.06	97.99	8,011.29	-231.38	-461.65	516.25	0.11
8,143.00	0.10	265.13	8,101.29	-231.39	-461.69	516.28	0.18
8,232.00	0.13	160.32	8,190.29	-231.50	-461.73	516.36	0.21
8,322.00	0.20	290.85	8,280.29	-231.54	-461.84	516.48	0.33
8,412.00	0.16	77.32	8,370.29	-231.45	-461.87	516.47	0.38
8,501.00	0.10	164.57	8,459.29	-231.50	-461.72	516.36	0.21
8,591.00	0.09	161.20	8,549.29	-231.64	-461.68	516.38	0.01

Design Report for Bethyl GW30-16 - Final Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
8,681.00	0.07	55.57	8,639.29	-231.68	-461.61	516.33	0.14
8,770.00	0.10	228.97	8,728.29	-231.70	-461.63	516.36	0.19
8,860.00	0.22	22.29	8,818.29	-231.59	-461.62	516.30	0.35
8,950.00	0.07	259.51	8,908.29	-231.44	-461.61	516.23	0.29
9,039.00	0.06	109.94	8,997.29	-231.47	-461.62	516.25	0.14
9,071.00	0.09	176.49	9,029.29	-231.50	-461.60	516.25	0.27
Final MWD Survey @ 9071.00ft							
9,150.00	0.09	176.49	9,108.29	-231.62	-461.59	516.29	0.00
Straight Line Proj @ 9150' MD, 9108.29' TVD							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
857.00	856.99	1.45	-3.61	Tie-On to Surface Gyros @ 857.00ft
882.00	881.99	1.47	-3.63	First MWD Survey @ 882.00ft
9,071.00	9,029.29	-231.50	-461.60	Final MWD Survey @ 9071.00ft
9,150.00	9,108.29	-231.62	-461.59	Straight Line Proj @ 9150' MD, 9108.29' TVD

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (usft)	Origin +E/-W (usft)	Start TVD (usft)
User	No Target (Freehand)	244.75	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
131.00	857.00	Surface Gyros	Flexi-Shot
882.00	9,071.00	MWD Surveys	MWD

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
864.00	863.99	9 5/8" Casing @ 864' MD, 863.99' TVD	9-5/8	13-3/4

Wellbore Targets

Target Name	Dip Angle	Dip Dir.	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
- hit/miss target	(°)	(°)	(°)	(°)	(°)	(°)	(°)		
- Shape									

Directional Difficulty Index

Average Dogleg over Survey:	0.59 °/100usft	Maximum Dogleg over Survey:	2.65 °/100usft at 2,406.00 usft
Net Tortousity applicable to Plans:	0.38 °/100usft	Directional Difficulty Index:	4.467

Design Report for Bethyl GW30-16 - Final Surveys

Audit Info

North Reference Sheet for Sec. 30-T8N-R63W - Bethyl GW30-16

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

Vertical Depths are relative to KB=16' @ 4954.00usft (Precision 829). Northing and Easting are relative to Bethyl GW30-16

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: 0.99997834

Grid Coordinates of Well: 1,472,845.19 usft N, 3,286,174.34 usft E

Geographical Coordinates of Well: 40° 37' 36.44" N, 104° 28' 08.44" W

Grid Convergence at Surface is: 0.67°

Based upon Minimum Curvature type calculations, at a Measured Depth of 9,150.00usft
the Bottom Hole Displacement is 516.45usft in the Direction of 243.35° (Grid).

Magnetic Convergence at surface is: -7.80° (23 July 2013, , BGGM2013)

