

Noble Energy

Weld County, CO (NAD 83)
Sec. 4-T6N-R63W (Mahalo State PAD)
Mahalo State AA09-78HNC
05-123-39099
Plan C

Design: Actual Surveys

Sperry Drilling Services

Final Survey Report

21 January, 2015

Surface UWI : 05-123-39099

Well Coordinates: 1,429,913.44 N, 3,292,527.15 E (40° 30' 31.50" N, 104° 26' 52.66" W)
Ground Level: 4,698.00 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 Mahalo State AA09-78HNC

KB=24 @ 4722.00usft (H&P 322)

N

Grid

Dec-Deg - API - US Survey Feet - Custom

HALLIBURTON

Project: Weld County, CO (NAD 83)
 Site: Sec. 4-T6N-R63W (Mahalo State PAD)
 Well: Mahalo State AA09-78HNC
 Wellbore: Plan C
 Design: Actual Surveys



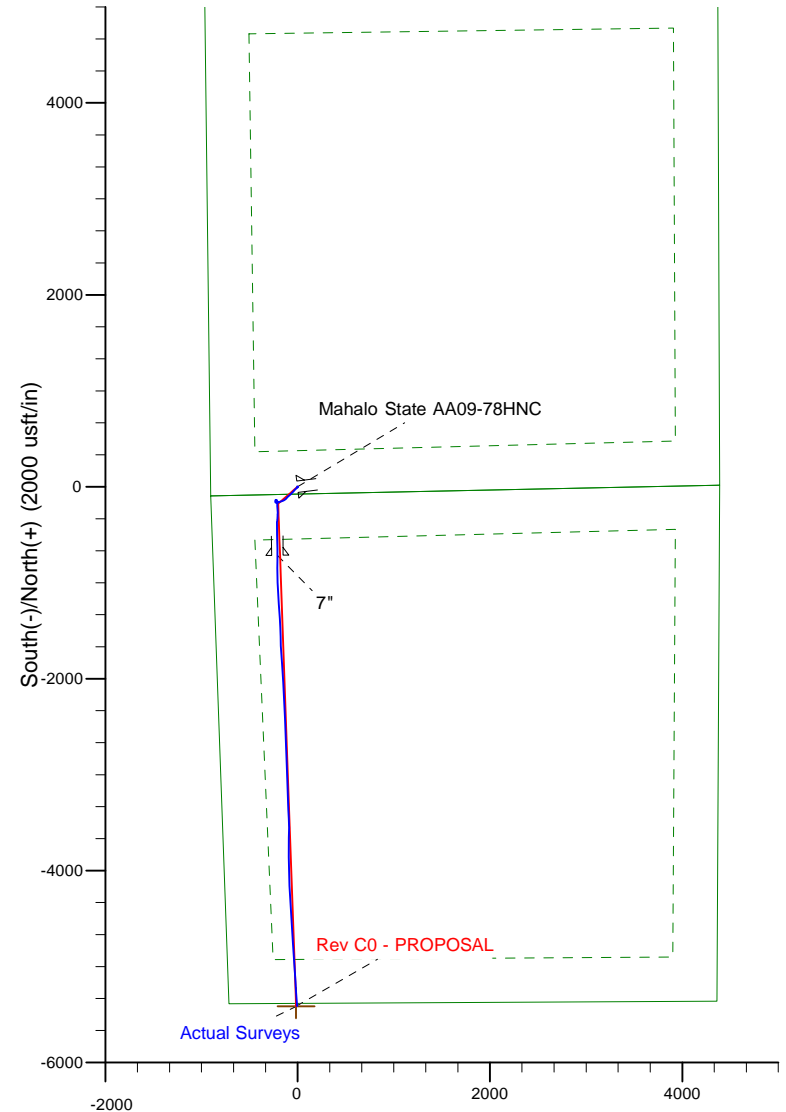
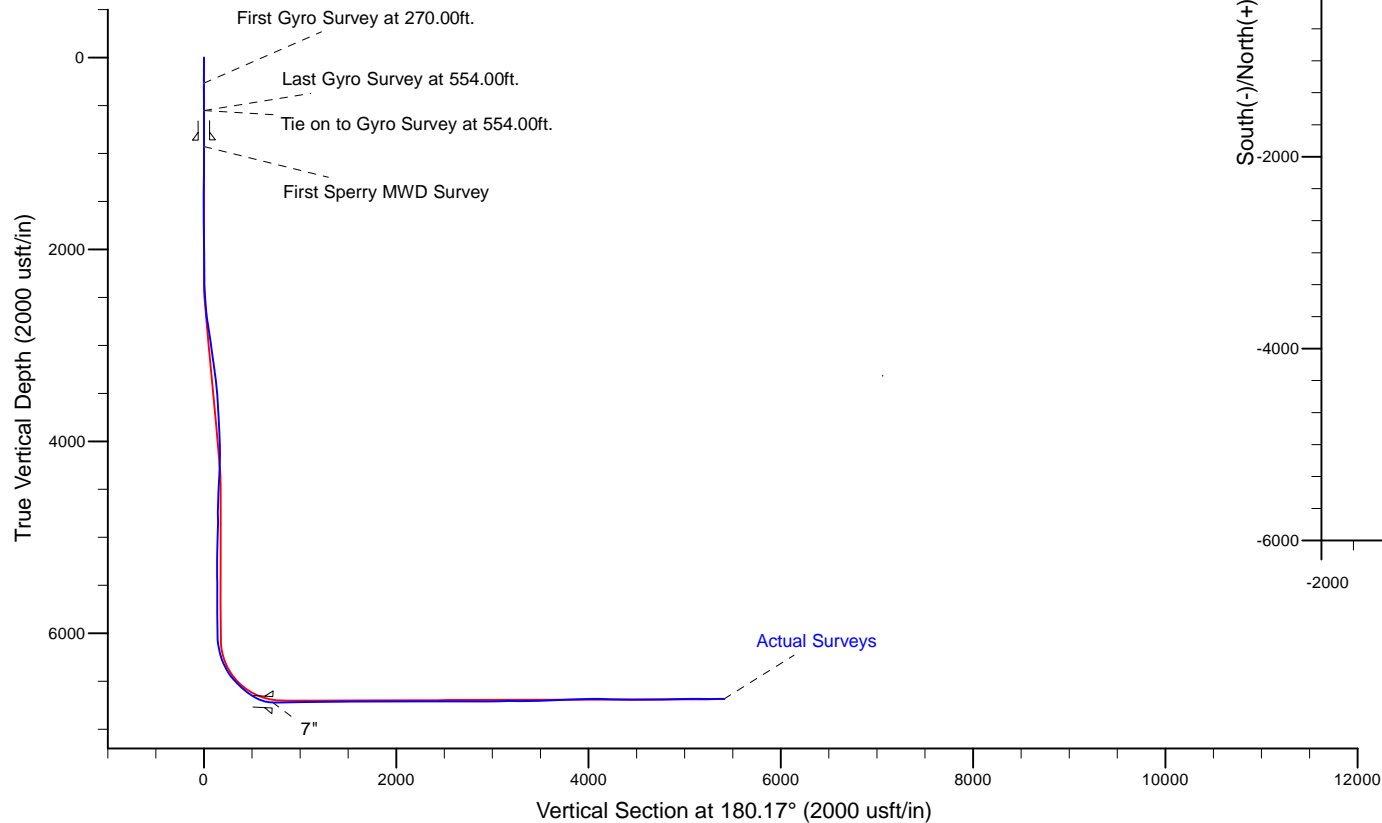
Platted SHL: 75' FSL, 908' FWL
 Platted Lat/Long: 40.508750 N, 104.447960 W
 Location: Sec. 4-T6N-R63W

~7" Casing: 650' FNL, 677' FWL
 Lat/Long: 40.506794 N, 104.448750 W
 State Planes - CO Northern: 1,429,198.37 N, 3,292,315.97 E
 Location: Sec. 9-T6N-R63W

Platted BHL: 30' FNL, 700' FWL
 Lat/Long: 40.493890 N, 104.448250 W
 State Planes - CO Northern: 1,424,567.13 N, 3,292,516.54 E
 Location: Sec. 16-T6N-R63W

LEGEND

- ◆ Mahalo State AA09-78HNC, Plan C, Rev C0 - PROPOSAL V0
- Actual Surveys



WELL DETAILS: Mahalo State AA09-78HNC

Ground Level: 4698.00
 KB=24 @ 4722.00usft (H&P 322)

Created By: Tatiana Gomez
 Created On: 1/21/2015

Design Report for Mahalo State AA09-78HNC - Actual 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
270.00	0.10	3.85	270.00	0.24	0.02	-0.24	0.04
First Gyro Survey at 270.00ft.							
554.00	0.40	208.24	554.00	-0.39	-0.44	0.39	0.17
Last Gyro Survey at 554.00ft. - Tie on to Gyro Survey at 554.00ft.							
861.00	0.31	262.53	860.99	-1.44	-1.78	1.45	0.11
9 5/8"							
929.00	0.34	274.74	928.99	-1.45	-2.16	1.46	0.11
First Sperry MWD Survey							
1,207.00	0.62	327.12	1,206.98	-0.12	-3.80	0.13	0.18
1,300.00	0.59	322.70	1,299.98	0.68	-4.37	-0.67	0.06
1,393.00	0.66	318.97	1,392.97	1.47	-5.01	-1.45	0.09
1,485.00	0.64	16.22	1,484.97	2.36	-5.21	-2.34	0.68
1,578.00	0.91	126.58	1,577.96	2.42	-4.47	-2.41	1.38
1,671.00	1.05	116.58	1,670.95	1.60	-3.12	-1.59	0.24
1,764.00	0.89	124.47	1,763.94	0.81	-1.76	-0.80	0.22
1,949.00	0.86	140.32	1,948.91	-1.07	0.31	1.07	0.13
2,042.00	0.78	139.35	2,041.90	-2.09	1.17	2.09	0.09
2,228.00	0.64	143.39	2,227.89	-3.89	2.61	3.88	0.08
2,321.00	1.63	236.14	2,320.88	-5.04	1.82	5.03	1.91
2,507.00	6.55	233.42	2,506.35	-12.84	-8.90	12.87	2.65
2,694.00	8.96	223.60	2,691.63	-29.75	-27.51	29.83	1.47
2,789.00	11.31	220.50	2,785.14	-42.19	-38.66	42.31	2.54
2,979.00	11.85	223.84	2,971.28	-70.43	-64.28	70.62	0.45
3,073.00	11.47	231.11	3,063.34	-83.26	-78.24	83.49	1.61
3,263.00	11.41	224.42	3,249.57	-108.54	-106.10	108.86	0.70
3,358.00	9.38	222.78	3,343.01	-120.94	-117.93	121.29	2.16
3,453.00	9.71	231.57	3,436.70	-131.60	-129.47	131.99	1.57
3,643.00	8.28	250.80	3,624.40	-146.06	-154.95	146.53	1.74
3,927.00	9.55	251.63	3,904.96	-160.21	-196.62	160.81	0.45
4,022.00	7.84	257.60	3,998.87	-164.09	-210.43	164.72	2.03
4,117.00	5.72	262.69	4,093.20	-166.08	-221.45	166.75	2.32
4,212.00	3.49	292.40	4,187.90	-165.58	-228.82	166.27	3.36
4,401.00	3.62	15.94	4,376.65	-157.65	-232.50	158.35	2.51
4,496.00	3.89	18.13	4,471.44	-151.70	-230.68	152.40	0.32
4,591.00	2.05	65.87	4,566.32	-147.94	-228.12	148.63	3.09
4,686.00	0.10	323.84	4,661.30	-147.18	-226.62	147.87	2.18
4,781.00	0.80	311.16	4,756.30	-146.68	-227.17	147.37	0.74
4,876.00	1.31	313.84	4,851.28	-145.49	-228.45	146.18	0.54
4,971.00	1.91	321.90	4,946.24	-143.49	-230.21	144.19	0.67
5,160.00	1.52	27.24	5,135.18	-138.78	-231.01	139.48	0.99
5,255.00	1.51	25.52	5,230.14	-136.53	-229.89	137.23	0.05
5,445.00	2.21	137.39	5,420.09	-136.97	-226.33	137.66	1.63
5,539.00	0.99	84.77	5,514.05	-138.23	-224.30	138.91	1.91
5,634.00	1.37	81.67	5,609.03	-137.99	-222.36	138.67	0.41
5,729.00	1.07	129.88	5,704.01	-138.40	-220.55	139.06	1.09
5,823.00	0.61	121.17	5,798.00	-139.22	-219.45	139.88	0.51
5,918.00	0.69	114.24	5,892.99	-139.71	-218.50	140.38	0.12
6,013.00	1.08	92.42	5,987.98	-139.99	-217.08	140.64	0.54
6,060.00	1.81	135.21	6,034.97	-140.53	-216.12	141.19	2.67

Design Report for Mahalo State AA09-78HNC - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
6,108.00	6.39	168.09	6,082.84	-143.69	-215.03	144.34	10.35
6,155.00	10.28	172.93	6,129.33	-150.41	-213.97	151.06	8.40
6,203.00	12.46	179.45	6,176.39	-159.84	-213.40	160.49	5.27
6,250.00	14.10	182.08	6,222.13	-170.63	-213.56	171.28	3.72
6,297.00	18.65	178.38	6,267.22	-183.87	-213.55	184.52	9.93
6,344.00	23.87	175.02	6,311.00	-200.87	-212.51	201.51	11.40
6,392.00	26.97	175.76	6,354.35	-221.40	-210.86	222.04	6.49
6,439.00	30.90	175.26	6,395.48	-244.07	-209.08	244.70	8.38
6,488.00	35.80	179.39	6,436.40	-270.96	-207.88	271.59	11.02
6,535.00	41.31	184.56	6,473.15	-300.20	-208.97	300.83	13.57
6,583.00	44.14	184.80	6,508.41	-332.65	-211.63	333.29	5.91
6,630.00	46.05	183.53	6,541.59	-365.85	-214.04	366.50	4.49
6,677.00	46.86	181.16	6,573.97	-399.89	-215.43	400.54	4.04
6,724.00	50.90	180.20	6,604.87	-435.28	-215.84	435.94	8.73
6,772.00	55.54	179.01	6,633.60	-473.71	-215.57	474.37	9.87
6,867.00	63.14	178.66	6,682.01	-555.36	-213.90	556.00	8.01
6,962.00	77.77	178.67	6,713.71	-644.62	-211.82	645.26	15.40
7,002.00	85.53	179.76	6,719.51	-684.16	-211.28	684.80	19.59
7,033.00	87.07	179.88	6,721.51	-715.09	-211.18	715.73	4.97
7"							
7,086.00	89.69	180.08	6,723.02	-768.07	-211.16	768.70	4.97
7,133.00	91.17	180.60	6,722.66	-815.06	-211.44	815.70	3.34
7,226.00	92.10	179.38	6,720.01	-908.02	-211.42	908.66	1.65
7,319.00	90.86	177.80	6,717.61	-1,000.96	-209.14	1,001.59	2.16
7,412.00	90.00	176.52	6,716.91	-1,093.84	-204.53	1,094.45	1.66
7,505.00	89.45	175.46	6,717.36	-1,186.61	-198.02	1,187.20	1.28
7,598.00	90.49	176.51	6,717.40	-1,279.38	-191.51	1,279.95	1.59
7,692.00	90.77	176.42	6,716.37	-1,373.19	-185.72	1,373.75	0.31
7,787.00	91.39	177.72	6,714.58	-1,468.05	-180.86	1,468.59	1.52
7,882.00	91.08	178.68	6,712.53	-1,562.98	-177.88	1,563.51	1.06
7,977.00	89.69	177.07	6,711.89	-1,657.91	-174.36	1,658.43	2.24
8,072.00	91.08	176.55	6,711.26	-1,752.75	-169.07	1,753.26	1.56
8,167.00	90.89	177.09	6,709.62	-1,847.59	-163.80	1,848.08	0.60
8,262.00	90.37	176.48	6,708.58	-1,942.44	-158.47	1,942.91	0.84
8,357.00	89.75	175.53	6,708.48	-2,037.20	-151.86	2,037.66	1.19
8,451.00	88.92	176.55	6,709.57	-2,130.97	-145.36	2,131.40	1.40
8,546.00	88.77	177.39	6,711.48	-2,225.82	-140.34	2,226.23	0.90
8,641.00	89.26	177.04	6,713.12	-2,320.69	-135.73	2,321.09	0.63
8,736.00	90.65	177.62	6,713.19	-2,415.59	-131.30	2,415.97	1.59
8,830.00	90.22	178.35	6,712.48	-2,509.52	-128.00	2,509.90	0.90
8,926.00	91.57	178.08	6,710.98	-2,605.46	-125.01	2,605.83	1.43
9,021.00	90.15	177.79	6,709.55	-2,700.39	-121.59	2,700.75	1.53
9,116.00	89.51	176.96	6,709.83	-2,795.29	-117.24	2,795.63	1.10
9,210.00	89.26	178.03	6,710.84	-2,889.19	-113.13	2,889.52	1.17
9,305.00	90.22	178.30	6,711.27	-2,984.14	-110.09	2,984.46	1.05
9,399.00	91.42	178.89	6,709.93	-3,078.10	-107.78	3,078.41	1.42
9,494.00	91.11	177.63	6,707.83	-3,173.03	-104.90	3,173.33	1.37
9,589.00	90.03	177.19	6,706.89	-3,267.93	-100.60	3,268.22	1.23
9,684.00	89.97	177.82	6,706.89	-3,362.84	-96.47	3,363.11	0.67
9,779.00	90.59	177.15	6,706.42	-3,457.74	-92.30	3,458.01	0.96
9,874.00	91.88	179.22	6,704.38	-3,552.67	-89.29	3,552.92	2.57

Design Report for Mahalo State AA09-78HNC - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
9,969.00	93.73	180.94	6,699.73	-3,647.54	-89.42	3,647.80	2.66
10,064.00	93.02	181.09	6,694.13	-3,742.36	-91.10	3,742.62	0.76
10,159.00	92.56	180.55	6,689.51	-3,837.24	-92.46	3,837.50	0.75
10,253.00	91.29	179.05	6,686.35	-3,931.18	-92.13	3,931.44	2.09
10,348.00	90.06	178.68	6,685.23	-4,026.16	-90.25	4,026.41	1.35
10,443.00	89.04	177.52	6,685.98	-4,121.10	-87.10	4,121.34	1.63
10,537.00	87.97	176.87	6,688.43	-4,214.95	-82.50	4,215.18	1.33
10,633.00	88.92	177.09	6,691.04	-4,310.78	-77.45	4,311.00	1.02
10,727.00	89.35	177.68	6,692.45	-4,404.67	-73.16	4,404.87	0.78
10,822.00	90.25	175.88	6,692.79	-4,499.52	-67.82	4,499.70	2.12
10,917.00	90.52	175.50	6,692.15	-4,594.25	-60.68	4,594.41	0.49
11,012.00	90.18	174.71	6,691.57	-4,688.90	-52.58	4,689.03	0.91
11,107.00	91.60	176.63	6,690.09	-4,783.61	-45.41	4,783.72	2.51
11,201.00	90.00	176.82	6,688.78	-4,877.44	-40.04	4,877.54	1.71
11,296.00	91.23	176.28	6,687.76	-4,972.26	-34.32	4,972.34	1.41
11,391.00	90.96	176.45	6,685.94	-5,067.05	-28.30	5,067.12	0.34
11,486.00	89.32	176.60	6,685.71	-5,161.88	-22.54	5,161.92	1.73
11,581.00	89.88	176.41	6,686.38	-5,256.70	-16.75	5,256.72	0.62
11,671.00	90.92	175.76	6,685.75	-5,346.48	-10.60	5,346.49	1.36
Final Sperry MWD Survey at 11671.00ft.							
11,736.00	90.92	175.76	6,684.70	-5,411.30	-5.80	5,411.29	0.00
Straight Line Projection to TD at 11736.00ft - Mahalo St AA09-78HNC_BHL							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
270.00	270.00	0.24	0.02	First Gyro Survey at 270.00ft.
554.00	554.00	-0.39	-0.44	Last Gyro Survey at 554.00ft.
554.00	554.00	-0.39	-0.44	Tie on to Gyro Survey at 554.00ft.
929.00	928.99	-1.45	-2.16	First Sperry MWD Survey
11,671.00	6,685.75	-5,346.48	-10.60	Final Sperry MWD Survey at 11671.00ft.
11,736.00	6,684.70	-5,411.30	-5.80	Straight Line Projection to TD at 11736.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/-S (usft)	+E/-W (usft)	
Target	Mahalo St AA09-78HNC_BHL	180.17	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
270.00	554.00	Surface Survey	Flexi-Shot
929.00	7,002.00	Intermediate Surveys	MWD+IFR1+MS_WY
7,086.00	11,736.00	Production Survey	MWD+IFR1+MS_WY

Design Report for Mahalo State AA09-78HNC - Actual Surveys

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
861.00	9 5/8"		9-5/8	13-3/4
7,033.00	6,721.51 7"		7	8-3/4

Wellbore Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
Mahalo St AA09-78HN	0.00	0.00	6,687.63	-5,414.30	-16.43	1,424,499.31	3,292,510.72	40.493890	-104.448250
- actual wellpath misses target center by 11.42usft at 11736.00usft MD (6684.70 TVD, -5411.30 N, -5.80 E)									
- Point									

Directional Difficulty Index

Average Dogleg over Survey:	1.80 °/100usft	Maximum Dogleg over Survey:	19.59 °/100usft at 7,002.00 usft
Net Tortousity applicable to Plans:	0.08 °/100usft	Directional Difficulty Index:	6.318

Audit Info

North Reference Sheet for Sec. 4-T6N-R63W (Mahalo State PAD) - Mahalo State
AA09-78HNC - Plan C

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

Vertical Depths are relative to KB=24 @ 4722.00usft (H&P 322). Northing and Easting are relative to Mahalo State AA09-78HNC

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: 0.99996696

Grid Coordinates of Well: 1,429,913.44 usft N, 3,292,527.15 usft E

Geographical Coordinates of Well: 40° 30' 31.50" N, 104° 26' 52.66" W

Grid Convergence at Surface is: 0.68°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,736.00usft
the Bottom Hole Displacement is 5,411.30usft in the Direction of 180.06° (Grid).

Magnetic Convergence at surface is: -7.65° (18 November 2014, , BGGM2014)

