

Noble Energy

Weld County, CO (NAD 83)

Sec. 34-T9N-R59W (FAITH, ANN LC34, REMORA)

Remora LC34-745

05-123-40599

Plan A

Design: Actual Surveys

Sperry Drilling Services

Final Survey Report

17 February, 2016

Surface UWI : 05-123-40599

Well Coordinates: 1,505,951.62 N, 3,426,957.29 E (40° 42' 43.38" N, 103° 57' 35.39" W)

Ground Level: 4,816.00 usft

Local Coordinate Origin:

Centered on Well Remora LC34-745

Viewing Datum:

KB = 24' @ 4840.00usft (H&P 273)

TVDs to System:

N

North Reference:

Grid

Unit System:

Dec-Deg - API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 5000.1 Build: 73

HALLIBURTON

Project: Weld County, CO (NAD 83)
 Site: Sec. 34-T9N-R59W (FAITH, ANN LC34, REMORA)
 Well: Remora LC34-745
 Wellbore: Plan A
 Design: Actual Surveys



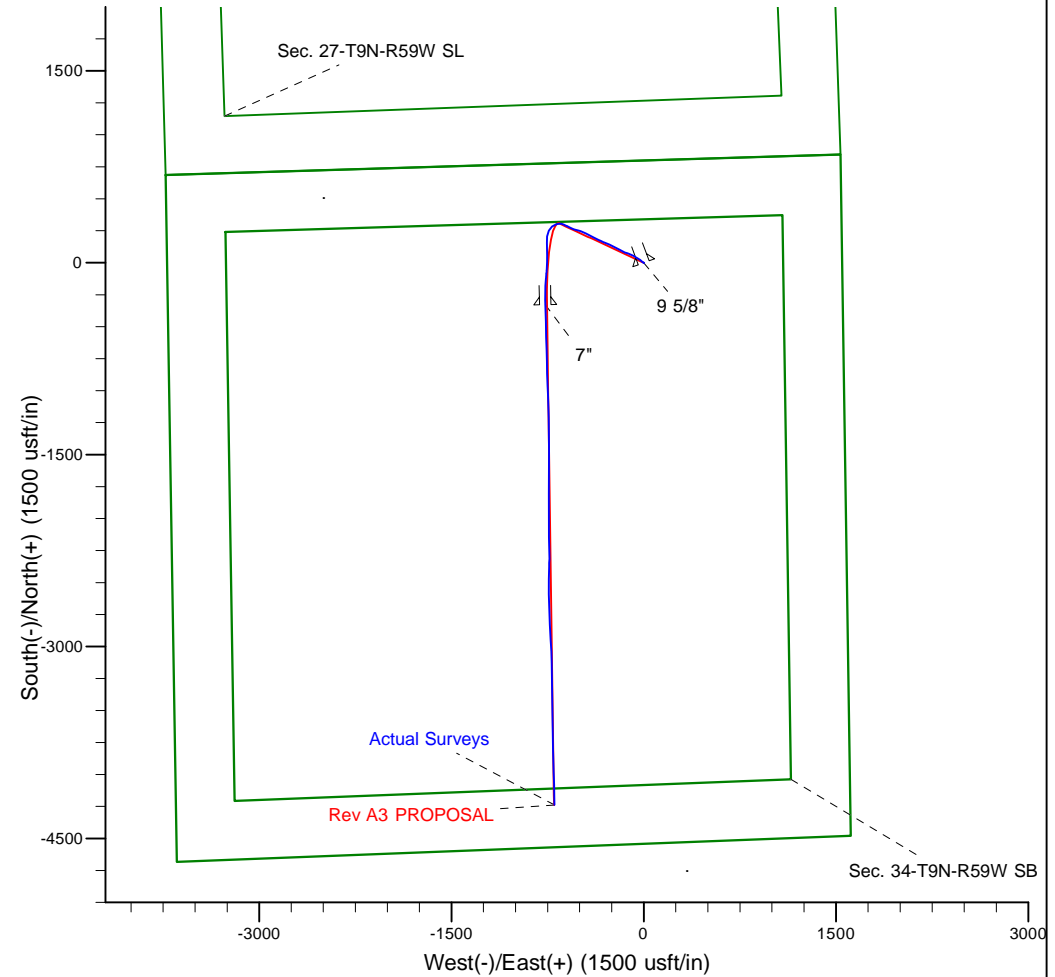
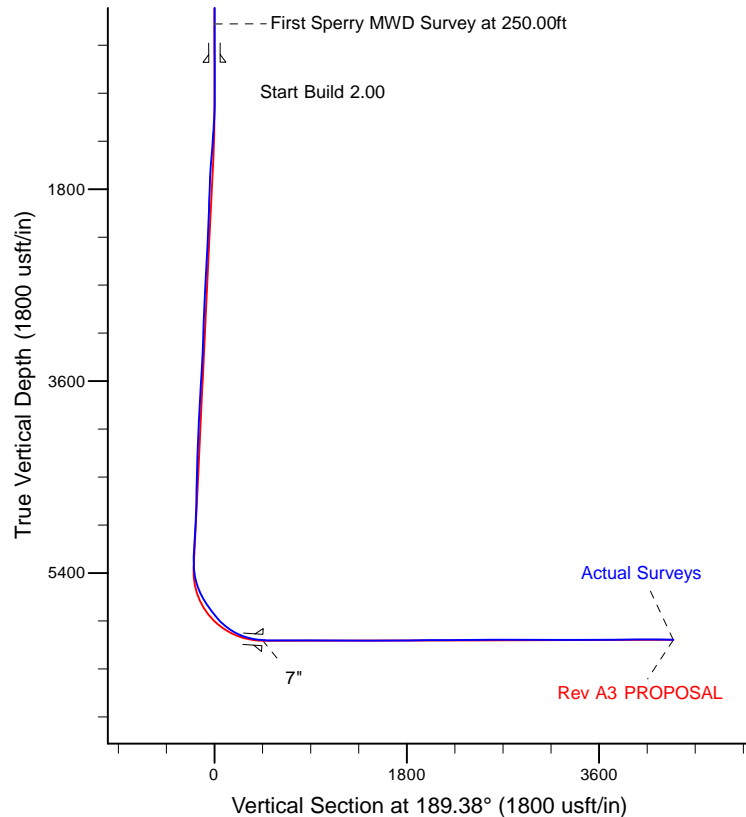
Platted SHL: 810' FNL, 1550' FEL
 Platted Lat/Long: 40.71205 N, -103.95983 W
 Location: Sec. 34-T9N-R59W

~7" Casing: 1083' FNL, 2313 FEL
 Lat/Long: 40.711186 N, -103.962620 W
 State Planes - CO Northern: 1,505,623.39 N, 3,426,189.45 E
 Location: Sec. 34-T9N-R59W

Platted BHL: 330' FSL, 2310 FEL
 Platted Lat/Long: 40.700640 N, -103.962610 W
 State Planes - CO Northern: 1,501,781.92 N, 3,426,258.87 E
 Location: Sec. 34-T9N-R59W

LEGEND

- Remora LC34-745, Plan A, Rev A3 PROPOSAL V0
- Actual Surveys



WELL DETAILS: Remora LC34-745	
Ground Level:	4816.00
KB = 24' @ 4840.00usft (H&P 273)	
Created By:	Tatiana Gomez
Created On:	2-17-2016

Design Report for Remora LC34-745 - 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
Remora LC34-745_Rev A0_SHL							
250.00	0.07	159.97	250.00	-0.14	0.05	0.13	0.03
First Sperry MWD Survey at 250.00ft							
500.00	0.14	159.97	500.00	-0.57	0.21	0.53	0.03
611.00	0.17	159.97	611.00	-0.85	0.31	0.79	0.03
9 5/8"							
618.00	0.17	159.97	618.00	-0.87	0.32	0.81	0.03
632.00	0.22	159.78	632.00	-0.92	0.33	0.85	0.36
726.00	0.28	158.86	726.00	-1.30	0.48	1.21	0.06
915.00	0.31	155.88	915.00	-2.20	0.86	2.03	0.02
1,009.00	2.87	309.91	1,008.96	-0.92	-0.85	1.05	3.35
1,103.00	5.11	307.43	1,102.73	3.13	-5.98	-2.12	2.39
1,195.00	6.37	311.12	1,194.26	8.98	-13.07	-6.73	1.43
1,287.00	7.95	309.75	1,285.54	16.41	-21.81	-12.63	1.73
1,379.00	10.66	302.82	1,376.33	25.09	-33.86	-19.24	3.18
1,470.00	10.54	304.06	1,465.77	34.31	-47.82	-26.06	0.28
1,562.00	10.36	301.97	1,556.25	43.40	-61.81	-32.75	0.46
1,653.00	10.06	302.14	1,645.81	51.96	-75.48	-38.97	0.33
1,745.00	10.09	291.76	1,736.40	59.23	-89.77	-43.81	1.97
1,836.00	9.60	290.45	1,826.06	64.83	-104.29	-46.97	0.59
1,927.00	9.34	290.78	1,915.82	70.10	-118.30	-49.89	0.29
2,019.00	8.70	290.32	2,006.68	75.17	-131.81	-52.69	0.70
2,110.00	8.43	290.00	2,096.66	79.84	-144.53	-55.22	0.30
2,202.00	10.61	297.50	2,187.39	86.06	-158.38	-59.10	2.72
2,293.00	9.77	297.87	2,276.96	93.54	-172.64	-64.16	0.93
2,385.00	9.42	298.30	2,367.67	100.75	-186.17	-69.07	0.39
2,477.00	8.80	298.46	2,458.51	107.68	-198.98	-73.81	0.67
2,568.00	9.89	295.37	2,548.30	114.34	-212.16	-78.24	1.32
2,660.00	9.80	295.76	2,638.95	121.13	-226.35	-82.63	0.12
2,752.00	9.66	296.22	2,729.62	127.94	-240.33	-87.07	0.17
2,846.00	9.51	296.97	2,822.31	134.95	-254.33	-91.71	0.21
2,941.00	8.92	296.82	2,916.08	141.83	-267.89	-96.28	0.62
3,036.00	7.96	295.97	3,010.05	148.04	-280.38	-100.37	1.02
3,130.00	9.14	289.25	3,103.01	153.35	-293.28	-103.51	1.64
3,225.00	8.25	289.06	3,196.92	158.06	-306.85	-105.95	0.94
3,320.00	9.81	295.67	3,290.74	163.79	-320.58	-109.37	1.97
3,414.00	10.72	296.34	3,383.23	171.14	-335.64	-114.16	0.98
3,509.00	10.98	295.73	3,476.54	178.99	-351.71	-119.29	0.30
3,604.00	11.00	296.11	3,569.79	186.91	-367.99	-124.45	0.08
3,793.00	10.53	296.09	3,755.47	202.44	-399.70	-134.60	0.25
3,887.00	10.33	296.92	3,847.91	210.03	-414.93	-139.61	0.27
3,982.00	9.16	297.46	3,941.54	217.37	-429.23	-144.53	1.24
4,077.00	8.09	298.67	4,035.47	224.07	-441.80	-149.08	1.14
4,172.00	8.62	294.95	4,129.46	230.28	-454.13	-153.20	0.80
4,266.00	8.64	296.25	4,222.39	236.37	-466.84	-157.14	0.21
4,360.00	9.66	293.45	4,315.20	242.63	-480.41	-161.11	1.18
4,455.00	8.65	289.04	4,408.99	248.14	-494.48	-164.25	1.29
4,550.00	9.48	281.51	4,502.80	252.03	-508.90	-165.74	1.52
4,644.00	9.98	285.56	4,595.45	255.76	-524.33	-166.90	0.90

Design Report for Remora LC34-745 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
4,739.00	9.09	286.94	4,689.14	260.15	-539.44	-168.78	0.97
4,834.00	8.84	291.01	4,782.98	264.96	-553.43	-171.24	0.72
4,928.00	9.00	295.50	4,875.84	270.71	-566.81	-174.73	0.76
5,022.00	10.39	298.56	4,968.50	277.93	-580.89	-179.56	1.58
5,117.00	12.48	294.58	5,061.61	286.30	-597.75	-185.07	2.35
5,211.00	10.97	290.99	5,153.65	293.73	-615.34	-189.53	1.78
5,305.00	11.85	296.09	5,245.79	301.17	-632.36	-194.11	1.42
5,399.00	15.50	270.78	5,337.19	305.59	-653.61	-195.01	7.37
5,494.00	21.00	252.87	5,427.45	300.75	-682.62	-185.50	8.21
5,588.00	24.99	230.87	5,514.12	283.22	-714.19	-163.05	10.01
5,682.00	28.43	208.52	5,598.29	250.93	-740.35	-126.94	11.23
5,777.00	31.48	186.03	5,680.85	206.24	-753.80	-80.66	12.18
5,871.00	37.09	178.47	5,758.52	153.44	-755.62	-28.26	7.48
5,965.00	42.20	178.21	5,830.88	93.51	-753.88	30.59	5.44
6,059.00	51.55	181.40	5,895.07	24.99	-753.79	98.17	10.25
6,153.00	58.93	183.59	5,948.64	-52.10	-757.22	174.79	8.08
6,248.00	69.27	184.85	5,990.08	-137.20	-763.54	259.78	10.95
6,342.00	78.20	181.68	6,016.38	-227.19	-768.61	349.40	10.04
6,399.00	83.45	178.78	6,025.47	-283.44	-768.83	404.93	10.49
6,444.00	86.02	178.73	6,029.60	-328.23	-767.85	448.96	5.70
7"							
6,512.97	89.95	178.65	6,032.03	-397.13	-766.28	516.68	5.70
Remora LC34-745_CSG PT							
6,516.00	90.12	178.65	6,032.03	-400.16	-766.21	519.66	5.70
6,698.00	89.97	178.21	6,031.89	-582.09	-761.22	698.35	0.26
6,793.00	90.03	178.38	6,031.89	-677.05	-758.40	791.58	0.19
6,887.00	89.91	178.48	6,031.94	-771.01	-755.82	883.86	0.17
6,982.00	90.09	178.57	6,031.94	-865.98	-753.38	977.17	0.21
7,076.00	90.09	177.61	6,031.79	-959.93	-750.24	1,069.35	1.02
7,171.00	89.75	177.22	6,031.92	-1,054.83	-745.96	1,162.28	0.54
7,360.00	89.35	179.50	6,033.40	-1,243.73	-740.55	1,347.78	1.22
7,455.00	88.98	178.98	6,034.79	-1,338.71	-739.29	1,441.29	0.67
7,549.00	90.31	180.17	6,035.37	-1,432.70	-738.59	1,533.91	1.90
7,643.00	90.89	180.57	6,034.39	-1,526.70	-739.20	1,626.74	0.75
7,738.00	91.11	180.34	6,032.73	-1,621.68	-739.95	1,720.58	0.34
7,833.00	90.65	180.40	6,031.27	-1,716.67	-740.57	1,814.40	0.49
7,927.00	91.08	179.89	6,029.85	-1,810.65	-740.81	1,907.17	0.71
8,022.00	89.63	179.73	6,029.26	-1,905.65	-740.49	2,000.84	1.54
8,117.00	89.85	179.82	6,029.69	-2,000.65	-740.12	2,094.51	0.25
8,211.00	89.91	179.24	6,029.89	-2,094.64	-739.35	2,187.12	0.62
8,306.00	90.52	178.76	6,029.53	-2,189.63	-737.69	2,280.57	0.82
8,400.00	90.28	179.55	6,028.88	-2,283.61	-736.30	2,373.07	0.88
8,494.00	91.91	181.88	6,027.08	-2,377.58	-737.47	2,465.97	3.02
8,588.00	90.25	180.97	6,025.31	-2,471.53	-739.81	2,559.05	2.01
8,683.00	90.03	179.15	6,025.08	-2,566.53	-739.91	2,652.79	1.93
8,777.00	89.54	178.66	6,025.43	-2,660.51	-738.11	2,745.22	0.74
8,872.00	89.14	177.67	6,026.52	-2,755.45	-735.07	2,838.40	1.12
8,966.00	89.11	177.32	6,027.96	-2,849.35	-730.96	2,930.38	0.37
9,061.00	89.72	176.71	6,028.93	-2,944.22	-726.02	3,023.17	0.91
9,156.00	89.57	177.34	6,029.52	-3,039.09	-721.09	3,115.97	0.68
9,251.00	90.55	179.18	6,029.42	-3,134.04	-718.20	3,209.18	2.19

Design Report for Remora LC34-745 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
9,345.00	91.51	179.07	6,027.73	-3,228.01	-716.77	3,301.66	1.03
9,440.00	90.46	179.56	6,026.10	-3,322.99	-715.63	3,395.18	1.22
9,534.00	90.18	178.42	6,025.57	-3,416.97	-713.98	3,487.64	1.25
9,723.00	90.25	179.35	6,024.86	-3,605.93	-710.30	3,673.48	0.49
9,817.00	89.94	179.40	6,024.71	-3,699.92	-709.27	3,766.05	0.33
9,911.00	90.46	178.83	6,024.38	-3,793.91	-707.82	3,858.54	0.82
10,006.00	91.39	177.94	6,022.84	-3,888.86	-705.14	3,951.79	1.35
10,101.00	89.17	178.63	6,022.38	-3,983.81	-702.30	4,045.00	2.45
10,195.00	89.23	179.13	6,023.69	-4,077.78	-700.46	4,137.42	0.54
10,287.00	89.01	178.34	6,025.11	-4,169.75	-698.43	4,227.83	0.89
Final Sperry MWD Survey at 10287.00ft							
10,355.00	89.01	178.34	6,026.28	-4,237.71	-696.46	4,294.56	0.00
Straight Line Projection to TD at 10355.00ft - Remora LC34-745_Rev A3_BHL - Remora LC34-745_Rev A0_BHL - Remora							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
250.00	250.00	-0.14	0.05	First Sperry MWD Survey at 250.00ft
10,287.00	6,025.11	-4,169.75	-698.43	Final Sperry MWD Survey at 10287.00ft
10,355.00	6,026.28	-4,237.71	-696.46	Straight Line Projection to TD at 10355.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
Target	Remora LC34-745_Rev A3_BHL	189.38	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
250.00	6,399.00	Intermediate Sperry MWD Surveys	MWD
6,516.00	10,355.00	Production Sperry MWD Surveys	MWD

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
611.00	611.00	9 5/8"	9-5/8	13-3/4
6,444.00	6,029.60	7"	7	8-3/4

Design Report for Remora LC34-745 - Actual 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
Remora LC34-745_Re - actual wellpath misses target center by 0.01usft at 0.00usft MD (0.00 TVD, 0.00 N, 0.00 E) - Point	0.00	0.00	0.00	0.01	0.00	1,505,951.63	3,426,957.29	40.712050	-103.959830
Remora LC34-745_Re - actual wellpath misses target center by 4.11usft at 10355.00usft MD (6026.28 TVD, -4237.71 N, -696.46 E) - Point	0.00	0.00	6,027.70	-4,239.01	-700.09	1,501,712.65	3,426,257.21	40.700450	-103.962620
Remora LC34-745_Re - actual wellpath misses target center by 4.22usft at 10355.00usft MD (6026.28 TVD, -4237.71 N, -696.46 E) - Point	0.00	0.00	6,028.00	-4,239.01	-700.09	1,501,712.65	3,426,257.21	40.700450	-103.962620
Remora LC34-745_Re - actual wellpath misses target center by 4.22usft at 10355.00usft MD (6026.28 TVD, -4237.71 N, -696.46 E) - Point	0.00	0.00	6,028.00	-4,239.01	-700.09	1,501,712.65	3,426,257.21	40.700450	-103.962620
Remora LC34-745_Re - actual wellpath misses target center by 4.22usft at 10355.00usft MD (6026.28 TVD, -4237.71 N, -696.46 E) - Point	0.00	0.00	6,028.00	-4,239.01	-700.09	1,501,712.65	3,426,257.21	40.700450	-103.962620
Remora LC34-745_CS - actual wellpath misses target center by 6.82usft at 6512.97usft MD (6032.03 TVD, -397.13 N, -766.28 E) - Point	0.00	0.00	6,038.00	-397.00	-769.57	1,505,554.62	3,426,187.73	40.710997	-103.962630

Directional Difficulty Index

Average Dogleg over Survey:	1.84 °/100usft	Maximum Dogleg over Survey:	12.18 °/100usft at 5,777.00 usft
Net Tortosity applicable to Plans:	0.77 °/100usft	Directional Difficulty Index:	6.242

Audit Info

North Reference Sheet for Sec. 34-T9N-R59W (FAITH, ANN LC34, REMORA) -
Remora LC34-745 - Plan A

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' @ 4840.00usft (H&P 273). Northing and Easting are relative to Remora LC34-745

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: 0.99998921

Grid Coordinates of Well: 1,505,951.62 usft N, 3,426,957.29 usft E

Geographical Coordinates of Well: 40° 42' 43.38" N, 103° 57' 35.39" W

Grid Convergence at Surface is: 1.00°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,355.00usft
the Bottom Hole Displacement is 4,294.56usft in the Direction of 189.33° (Grid).

Magnetic Convergence at surface is: -7.04° (22 January 2016, , BGGM2015)

