

Noble Energy

Weld County, CO (NAD 83)

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

Remora LC34-735

05-123-40591

Plan A

Design: Actual Surveys

Sperry Drilling Services

Final Survey Report

17 February, 2016

Surface UWI : 05-123-40591

Well Coordinates: 1,505,952.25 N, 3,426,993.33 E (40° 42' 43.38" N, 103° 57' 34.92" W)

Ground Level: 4,816.00 usft

Local Coordinate Origin:

Centered on Well Remora LC34-735

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 LC34-735
 Wellbore: Plan A
 Design: Actual Surveys



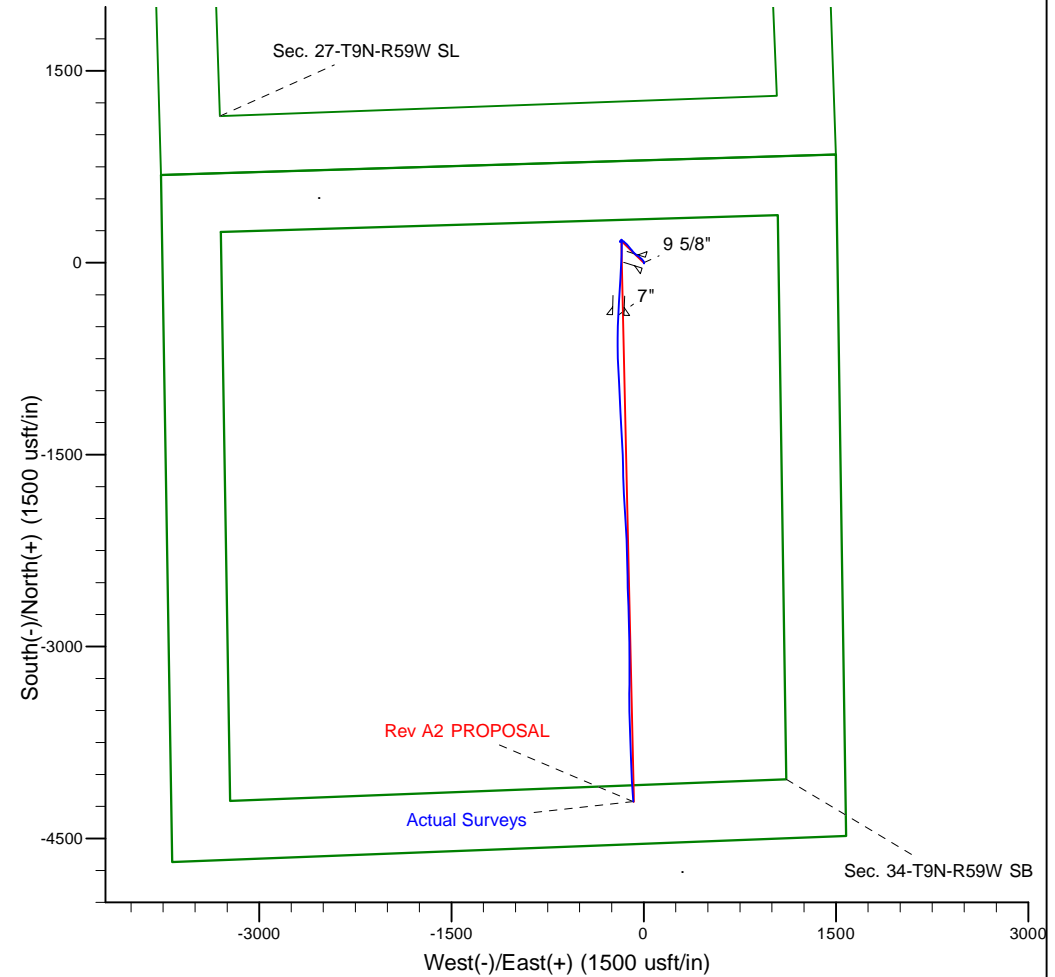
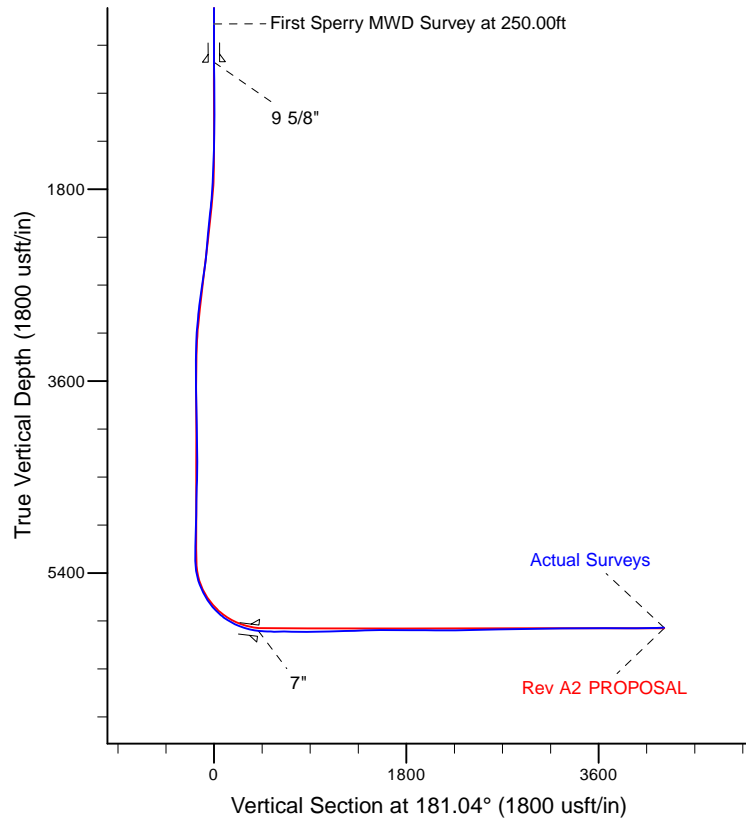
Platted SHL: 810' FNL, 1512' FEL
 Platted Lat/Long: 40.71205 N, -103.9597 W
 Location: Sec. 34-T9N-R59W

~7" Casing: 1200' FNL, 1713' FEL
 Lat/Long: 40.710936 N, -103.960440 W
 State Planes - CO Northern: 1,505,542.75 N, 3,426,795.21 E
 Sec. 34-T9N-R59W

Platted BHL: 330' FSL, 1650' FEL
 Platted Lat/Long: 40.700681 N, -103.960271 W
 State Planes - CO Northern: 1,501,808.22 N, 3,426,906.96 E
 Location: Sec. 34-T9N-R59W

LEGEND

- △ Remora LC34-735, Plan A, Rev A2 PROPOSAL V0
- Actual Surveys



WELL DETAILS: Remora LC34-735

Ground Level: 4816.00

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

Created By: Tatiana Gomez
 Created On: 2-17-2016

Design Report for Remora LC34-735 - 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 LC34-735_Rev A0_SHL							
250.00	0.07	107.42	250.00	-0.05	0.15	0.04	0.03
First Sperry MWD Survey at 250.00ft							
500.00	0.13	107.42	500.00	-0.18	0.56	0.17	0.02
609.00	0.17	107.42	609.00	-0.26	0.83	0.25	0.03
9 5/8"							
618.00	0.17	107.42	618.00	-0.27	0.86	0.25	0.03
631.00	0.17	107.42	631.00	-0.28	0.89	0.26	0.00
726.00	0.21	143.88	726.00	-0.46	1.13	0.44	0.13
820.00	0.31	165.78	820.00	-0.85	1.29	0.83	0.15
1,008.00	0.83	164.87	1,007.99	-2.66	1.78	2.62	0.28
1,103.00	0.92	148.09	1,102.98	-3.97	2.36	3.92	0.28
1,194.00	1.10	6.34	1,193.97	-3.72	2.84	3.67	2.10
1,378.00	1.77	350.94	1,377.91	0.84	2.59	-0.89	0.42
1,470.00	1.89	336.56	1,469.87	3.64	1.76	-3.67	0.51
1,561.00	2.04	331.67	1,560.81	6.44	0.40	-6.45	0.25
1,652.00	1.96	332.30	1,651.76	9.24	-1.10	-9.22	0.09
1,744.00	3.23	324.66	1,743.66	12.75	-3.33	-12.69	1.43
1,836.00	5.40	322.25	1,835.40	18.29	-7.48	-18.15	2.37
1,927.00	8.14	319.26	1,925.75	26.56	-14.30	-26.29	3.03
2,018.00	9.67	311.86	2,015.66	36.54	-24.20	-36.09	2.10
2,109.00	9.86	305.70	2,105.34	46.19	-36.22	-45.52	1.17
2,201.00	9.91	304.03	2,195.97	55.21	-49.18	-54.31	0.32
2,293.00	8.00	306.25	2,286.85	63.43	-60.90	-62.31	2.11
2,385.00	7.62	314.01	2,378.00	71.45	-70.45	-70.16	1.22
2,476.00	8.83	318.38	2,468.06	80.87	-79.43	-79.41	1.50
2,568.00	10.33	321.08	2,558.78	92.56	-89.31	-90.93	1.70
2,660.00	10.89	321.20	2,649.20	105.75	-99.93	-103.92	0.61
2,751.00	10.82	320.67	2,738.57	119.06	-110.73	-117.03	0.13
2,846.00	10.91	319.38	2,831.87	132.78	-122.24	-130.54	0.27
2,940.00	8.84	316.09	2,924.47	144.74	-133.04	-142.30	2.28
3,035.00	7.63	312.78	3,018.49	154.28	-142.73	-151.66	1.37
3,130.00	7.04	309.32	3,112.72	162.25	-151.86	-159.47	0.78
3,224.00	4.40	304.14	3,206.24	167.93	-159.31	-165.01	2.86
3,319.00	4.09	303.07	3,300.98	171.82	-165.16	-168.79	0.34
3,414.00	2.47	292.15	3,395.82	174.44	-169.90	-171.33	1.82
3,508.00	2.03	239.04	3,489.76	174.35	-173.20	-171.18	2.18
3,697.00	1.45	208.03	3,678.68	170.52	-177.20	-167.27	0.57
3,792.00	1.36	215.66	3,773.65	168.54	-178.42	-165.27	0.22
3,887.00	1.09	214.30	3,868.62	166.88	-179.58	-163.59	0.29
3,982.00	1.00	235.44	3,963.61	165.66	-180.78	-162.35	0.41
4,076.00	0.79	231.69	4,057.60	164.79	-181.96	-161.46	0.23
4,171.00	0.93	232.08	4,152.59	163.91	-183.08	-160.56	0.15
4,265.00	0.62	237.42	4,246.58	163.17	-184.11	-159.80	0.34
4,360.00	0.59	285.18	4,341.57	163.02	-185.02	-159.64	0.52
4,455.00	0.74	295.30	4,436.57	163.41	-186.04	-160.01	0.20
4,549.00	1.08	332.08	4,530.56	164.46	-187.01	-161.03	0.70
4,739.00	2.14	44.86	4,720.49	168.55	-185.34	-165.16	1.10
4,833.00	1.78	54.35	4,814.44	170.65	-182.92	-167.30	0.51

Design Report for Remora LC34-735 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
4,927.00	1.85	62.50	4,908.39	172.20	-180.39	-168.89	0.28
5,022.00	1.69	33.23	5,003.35	174.08	-178.26	-170.81	0.96
5,116.00	1.92	39.51	5,097.30	176.45	-176.50	-173.22	0.32
5,210.00	1.72	34.61	5,191.25	178.83	-174.70	-175.63	0.27
5,305.00	1.60	97.19	5,286.22	179.84	-172.57	-176.67	1.82
5,399.00	8.97	178.88	5,379.82	172.33	-171.12	-169.19	9.45
5,493.00	17.33	181.37	5,471.27	150.97	-171.31	-147.83	8.91
5,587.00	24.70	180.48	5,558.96	117.29	-171.81	-114.15	7.85
5,682.00	32.40	183.28	5,642.35	71.96	-173.44	-68.80	8.22
5,776.00	39.90	182.27	5,718.20	16.61	-176.08	-13.41	8.00
5,870.00	48.53	181.52	5,785.51	-48.84	-178.21	52.07	9.20
5,964.00	57.56	183.56	5,841.96	-123.79	-181.61	127.07	9.76
6,058.00	65.42	184.28	5,886.80	-206.14	-187.28	209.50	8.39
6,153.00	73.91	182.83	5,919.78	-294.96	-192.76	298.41	9.05
6,225.00	80.25	182.75	5,935.87	-365.02	-196.18	368.52	8.81
6,255.36	82.25	182.42	5,940.49	-394.99	-197.53	398.51	6.66
Remora LC34-735_CSG PT							
6,270.00	83.21	182.26	5,942.34	-409.50	-198.12	413.03	6.66
7"							
6,324.00	86.76	181.69	5,947.06	-463.26	-199.98	466.81	6.66
6,419.00	89.51	181.64	5,950.15	-558.16	-202.74	561.75	2.90
6,513.00	90.74	179.42	5,949.95	-652.14	-203.61	655.74	2.70
6,608.00	89.14	177.75	5,950.05	-747.11	-201.26	750.64	2.43
6,703.00	88.77	177.29	5,951.78	-842.00	-197.15	845.45	0.62
6,797.00	91.08	177.38	5,951.90	-935.90	-192.78	939.24	2.46
6,892.00	91.29	177.43	5,949.94	-1,030.78	-188.48	1,034.03	0.23
6,987.00	92.16	176.86	5,947.08	-1,125.62	-183.75	1,128.77	1.09
7,081.00	91.23	176.82	5,944.30	-1,219.43	-178.57	1,222.47	0.99
7,176.00	92.13	176.95	5,941.51	-1,314.25	-173.41	1,317.18	0.96
7,271.00	90.86	177.32	5,939.04	-1,409.10	-168.66	1,411.93	1.39
7,365.00	92.00	177.80	5,936.69	-1,502.98	-164.66	1,505.72	1.32
7,460.00	90.00	178.79	5,935.03	-1,597.92	-161.84	1,600.59	2.35
7,555.00	89.41	177.96	5,935.52	-1,692.88	-159.14	1,695.49	1.07
7,649.00	89.63	177.22	5,936.31	-1,786.79	-155.19	1,789.31	0.82
7,744.00	89.88	176.99	5,936.72	-1,881.67	-150.39	1,884.09	0.36
7,838.00	89.78	176.30	5,936.99	-1,975.50	-144.89	1,977.81	0.74
7,933.00	89.48	176.13	5,937.61	-2,070.30	-138.62	2,072.47	0.36
8,027.00	89.91	177.83	5,938.11	-2,164.16	-133.67	2,166.23	1.87
8,122.00	90.49	178.86	5,937.78	-2,259.12	-130.93	2,261.12	1.24
8,217.00	91.08	178.79	5,936.47	-2,354.09	-128.98	2,356.04	0.63
8,311.00	91.32	178.87	5,934.51	-2,448.05	-127.06	2,449.95	0.27
8,406.00	91.11	178.45	5,932.49	-2,543.00	-124.84	2,544.85	0.49
8,500.00	91.20	177.44	5,930.60	-2,636.92	-121.47	2,638.69	1.08
8,594.00	92.19	178.12	5,927.82	-2,730.81	-117.83	2,732.50	1.28
8,689.00	90.77	178.83	5,925.36	-2,825.74	-115.30	2,827.37	1.67
8,783.00	90.92	178.49	5,923.98	-2,919.70	-113.10	2,921.27	0.40
8,877.00	90.65	180.36	5,922.69	-3,013.68	-112.16	3,015.22	2.01
8,971.00	91.39	179.95	5,921.02	-3,107.67	-112.41	3,109.20	0.90
9,066.00	89.91	179.85	5,919.94	-3,202.66	-112.25	3,204.17	1.56
9,160.00	90.99	180.26	5,919.20	-3,296.65	-112.34	3,298.15	1.23
9,254.00	89.26	180.04	5,918.99	-3,390.65	-112.58	3,392.14	1.86

Design Report for Remora LC34-735 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
9,348.00	89.69	179.17	5,919.86	-3,484.64	-111.94	3,486.10	1.03
9,442.00	90.12	178.29	5,920.01	-3,578.62	-109.85	3,580.02	1.04
9,536.00	90.71	177.78	5,919.33	-3,672.56	-106.63	3,673.89	0.83
9,631.00	89.78	177.97	5,918.92	-3,767.49	-103.11	3,768.74	1.00
9,725.00	90.15	178.36	5,918.98	-3,861.44	-100.10	3,862.63	0.57
9,819.00	90.68	177.40	5,918.30	-3,955.38	-96.62	3,956.48	1.17
9,913.00	90.83	176.98	5,917.06	-4,049.25	-92.01	4,050.26	0.47
10,008.00	91.42	176.20	5,915.20	-4,144.07	-86.36	4,144.95	1.03
Final Sperry MWD Survey at 10008.00ft							
10,076.00	91.42	176.20	5,913.51	-4,211.90	-81.86	4,212.69	0.00
Straight Line Projection to TD at 10076.00ft - Remora LC34-735_Rev A1_BHL - Remora LC34-735_Rev A2_BHL - Remora							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
250.00	250.00	-0.05	0.15	First Sperry MWD Survey at 250.00ft
10,008.00	5,915.20	-4,144.07	-86.36	Final Sperry MWD Survey at 10008.00ft
10,076.00	5,913.51	-4,211.90	-81.86	Straight Line Projection to TD at 10076.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	+N/_S (usft)	+E/-W (usft)	Start TVD (usft)
Target	Remora LC34-735_Rev A2_BHL	181.04	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
250.00	6,225.00	Intermediate Sperry MWD Surveys	MWD
6,324.00	10,076.00	Production Sperry MWD Surveys	MWD

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
609.00	609.00	9 5/8"	9-5/8	13-3/4
6,270.00	5,942.34	7"	7	8-3/4

Design Report for Remora LC34-735 - 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 LC34-735_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	1,505,952.25	3,426,993.33	40.712050	-103.959700
Remora LC34-735_CS - actual wellpath misses target center by 43.63usft at 6255.87usft MD (5940.56 TVD, -395.50 N, -197.55 E) - Point	0.00	0.00	5,917.00	-400.00	-161.11	1,505,552.25	3,426,832.22	40.710960	-103.960306
Remora LC34-735_Re - actual wellpath misses target center by 7.16usft at 10076.00usft MD (5913.51 TVD, -4211.90 N, -81.86 E) - Point	0.00	0.00	5,918.00	-4,213.62	-76.55	1,501,738.67	3,426,916.77	40.700490	-103.960240
Remora LC34-735_Re - actual wellpath misses target center by 7.16usft at 10076.00usft MD (5913.51 TVD, -4211.90 N, -81.86 E) - Point	0.00	0.00	5,918.00	-4,213.62	-76.55	1,501,738.67	3,426,916.77	40.700490	-103.960240
Remora LC34-735_Re - actual wellpath misses target center by 47.81usft at 10076.00usft MD (5913.51 TVD, -4211.90 N, -81.86 E) - Point	0.00	0.00	5,961.00	-4,213.62	-76.55	1,501,738.67	3,426,916.77	40.700490	-103.960240

Directional Difficulty Index

Average Dogleg over Survey:	1.72 °/100usft	Maximum Dogleg over Survey:	9.76 °/100usft at 5,964.00 usft
Net Tortousity applicable to Plans:	0.63 °/100usft	Directional Difficulty Index:	6.139

Audit Info

North Reference Sheet for Sec. 34-T9N-R59W (FAITH, ANN LC34, REMORA) -
Remora LC34-735 - 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 LC34-735
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: 1,505,952.25 usft N, 3,426,993.33 usft E
Geographical Coordinates of Well: 40° 42' 43.38" N, 103° 57' 34.92" W
Grid Convergence at Surface is: 1.00°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,076.00usft
the Bottom Hole Displacement is 4,212.69usft in the Direction of 181.11° (Grid).
Magnetic Convergence at surface is: -7.04° (22 January 2016, , BGGM2015)

