

# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 2-T2N-R65W

GREENLEAF 4N-2HZ

Plan C

Design: Actual Surveys

## Sperry Drilling Services

### Final Report

25 March, 2015

Well Coordinates: 1,302,935.66 N, 3,241,892.17 E (40° 09' 42.17" N, 104° 38' 04.23" W)

Ground Level: 4,854.00 usft

Local Coordinate Origin:

Viewing Datum:

TVDs to System:

North Reference:

Unit System:

Geodetic Scale Factor Applied

Version: 5000.1 Build: 73

Centered on Well GREENLEAF 4N-2HZ

RKB = 13' @ 4867.00usft (Ensign 145)

N

True

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

Project: Weld County, CO (NAD 83)  
 Site: Sec. 2-T2N-R65W  
 Well: GREENLEAF 4N-2HZ  
 Wellbore: Plan C  
 Design: Actual Surveys



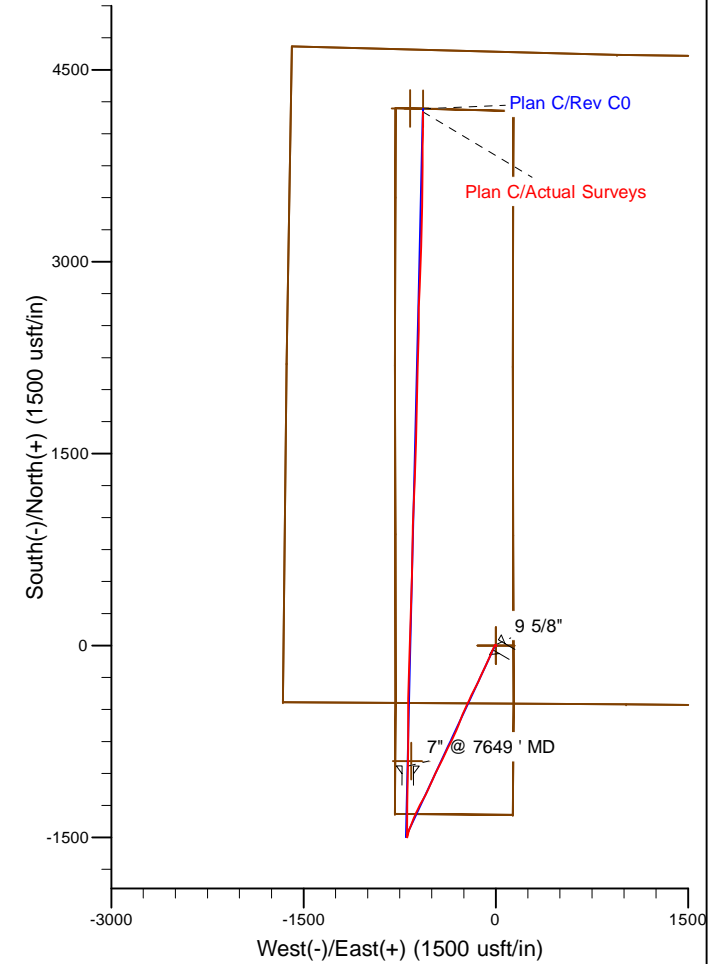
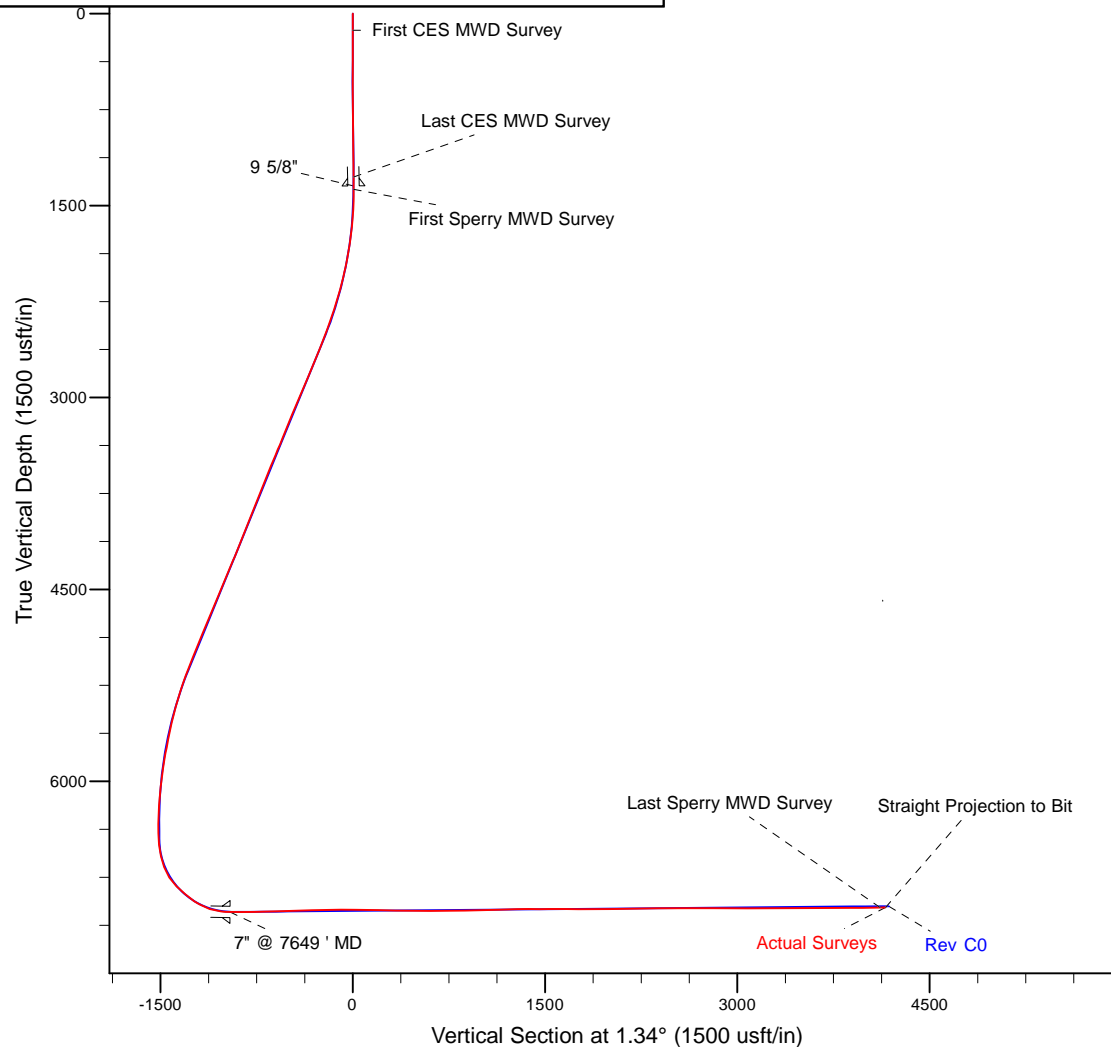
Platted SHL: 453' FSL, 1656' FWL  
 Platted Lat/Long: 40.161713N, 104.634507W  
 Location: Sec. 2-T2N-R65W

~ 7" Casing: 495' FNL 986' FWL  
 Lat/Long: 40.159127N, 104.636960W  
 State Planes - CO Northern: 1301987.13N, 3241215.90E  
 Location: Sec. 11-T2N-R65W

~ BHL: 485' FNL, 1038' FWL  
 Lat/Long: 40.173161N, 104.636544W  
 State Planes - CO Northern: 1307100.39N, 3241282.34E  
 Location: Sec. 2-T2N-R65W

# LEGEND

- GREENLEAF 4N-2HZ, Plan C, Rev C0 V0
- Actual Surveys



WELL DETAILS: GREENLEAF 4N-2HZ

Ground Level: 4854.00  
 RKB = 13' @ 4867.00usft (Ensign 145)

Created By: Gordy Roth  
 Created On: 3/25/15

**Design Report for GREENLEAF 4N-2HZ - 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
129.00	0.50	96.50	129.00	-0.06	0.56	-0.05	0.39
<b>First CES MWD Survey</b>							
208.00	0.70	98.30	207.99	-0.17	1.38	-0.14	0.25
287.00	0.60	115.30	286.99	-0.42	2.23	-0.37	0.27
367.00	0.70	85.60	366.98	-0.56	3.10	-0.49	0.43
447.00	0.20	147.90	446.98	-0.64	3.66	-0.56	0.79
527.00	0.30	106.40	526.98	-0.82	3.93	-0.73	0.25
607.00	0.20	164.00	606.98	-1.01	4.17	-0.91	0.32
687.00	0.60	311.40	686.98	-0.87	3.90	-0.78	0.97
767.00	0.90	344.80	766.97	0.01	3.42	0.09	0.65
847.00	0.80	3.40	846.96	1.18	3.29	1.25	0.36
927.00	1.00	2.80	926.95	2.43	3.35	2.51	0.25
1,007.00	0.60	266.00	1,006.95	3.10	2.97	3.17	1.53
1,087.00	1.00	305.50	1,086.94	3.48	1.98	3.52	0.82
1,167.00	1.20	289.60	1,166.93	4.16	0.63	4.18	0.45
1,247.00	0.90	305.30	1,246.91	4.81	-0.68	4.79	0.52
1,277.00	1.30	289.40	1,276.91	5.06	-1.19	5.03	1.67
<b>Last CES MWD Survey</b>							
1,373.00	1.16	304.78	1,372.89	5.97	-3.01	5.90	0.37
<b>First Sperry MWD Survey</b>							
1,467.00	1.71	223.03	1,466.86	5.49	-4.75	5.38	2.05
1,560.00	3.66	211.90	1,559.76	1.96	-7.27	1.78	2.16
1,653.00	6.94	205.99	1,652.35	-5.62	-11.30	-5.88	3.57
1,747.00	8.43	203.93	1,745.50	-17.02	-16.58	-17.40	1.61
1,841.00	9.63	205.10	1,838.34	-30.44	-22.71	-30.96	1.29
1,934.00	11.48	201.49	1,929.76	-46.10	-29.41	-46.77	2.11
2,028.00	13.73	203.74	2,021.49	-65.01	-37.32	-65.87	2.45
2,121.00	15.69	205.55	2,111.44	-86.46	-47.19	-87.54	2.16
2,215.00	16.77	203.71	2,201.69	-110.35	-58.13	-111.68	1.27
2,308.00	18.51	203.22	2,290.31	-136.20	-69.34	-137.79	1.88
2,492.00	22.59	206.05	2,462.57	-194.82	-96.39	-197.02	2.28
2,582.00	24.14	204.61	2,545.19	-227.08	-111.65	-229.63	1.84
2,672.00	22.79	203.94	2,627.75	-259.75	-126.38	-262.63	1.53
2,762.00	24.83	206.89	2,710.08	-292.54	-142.01	-295.78	2.62
2,852.00	24.23	207.21	2,791.96	-325.82	-159.00	-329.44	0.68
2,942.00	25.40	206.14	2,873.65	-359.57	-175.95	-363.59	1.39
3,032.00	24.80	205.95	2,955.15	-393.87	-192.71	-398.27	0.67
3,122.00	23.52	204.49	3,037.27	-427.19	-208.42	-431.94	1.57
3,212.00	25.11	205.32	3,119.28	-460.79	-224.03	-465.91	1.81
3,302.00	23.67	204.49	3,201.25	-494.50	-239.68	-499.97	1.64
3,392.00	24.64	203.15	3,283.37	-528.19	-254.55	-534.00	1.24
3,482.00	22.89	201.26	3,365.73	-561.75	-268.27	-567.87	2.12
3,572.00	24.66	201.89	3,448.09	-595.49	-281.62	-601.91	1.99
3,662.00	24.01	200.18	3,530.10	-630.10	-294.94	-636.83	1.07
3,752.00	23.61	203.14	3,612.44	-663.86	-308.34	-670.89	1.40
3,842.00	22.79	205.01	3,695.16	-696.23	-322.79	-703.59	1.22
3,932.00	22.39	206.44	3,778.26	-727.38	-337.79	-735.08	0.75
4,022.00	24.19	206.57	3,860.92	-759.22	-353.67	-767.28	2.00
4,112.00	24.34	205.43	3,942.97	-792.46	-369.89	-800.89	0.55

**Design Report for GREENLEAF 4N-2HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
4,202.00	24.31	205.33	4,024.98	-825.95	-385.78	-834.75	0.06
4,292.00	22.91	204.85	4,107.44	-858.60	-401.06	-867.74	1.57
4,382.00	23.18	207.33	4,190.26	-890.23	-416.56	-899.73	1.12
4,472.00	25.35	207.67	4,272.31	-923.03	-433.64	-932.92	2.42
4,562.00	24.98	205.58	4,353.77	-957.24	-450.79	-967.52	1.07
4,652.00	24.16	204.68	4,435.62	-991.11	-466.69	-1,001.76	1.00
4,742.00	23.66	204.54	4,517.89	-1,024.28	-481.88	-1,035.27	0.56
4,832.00	25.19	204.34	4,599.84	-1,058.16	-497.27	-1,069.50	1.70
4,922.00	25.37	204.54	4,681.22	-1,093.15	-513.18	-1,104.85	0.22
5,012.00	23.82	203.92	4,763.05	-1,127.30	-528.55	-1,139.35	1.75
5,102.00	24.03	207.87	4,845.32	-1,160.12	-544.49	-1,172.53	1.79
5,192.00	23.97	210.71	4,927.54	-1,192.03	-562.39	-1,204.86	1.29
5,282.00	24.68	206.83	5,009.56	-1,224.52	-580.21	-1,237.76	1.94
5,372.00	24.24	206.30	5,091.48	-1,257.85	-596.88	-1,271.47	0.55
5,461.00	22.34	206.51	5,173.22	-1,289.37	-612.52	-1,303.34	2.14
5,551.00	19.51	203.60	5,257.28	-1,318.45	-626.18	-1,332.74	3.35
5,641.00	18.58	203.76	5,342.36	-1,345.35	-637.97	-1,359.90	1.03
5,732.00	16.34	201.84	5,429.16	-1,370.50	-648.58	-1,385.30	2.54
5,821.00	13.53	200.91	5,515.14	-1,391.85	-656.95	-1,406.84	3.17
5,912.00	12.36	200.97	5,603.83	-1,410.89	-664.24	-1,426.04	1.29
6,002.00	12.05	200.09	5,691.79	-1,428.71	-670.91	-1,444.01	0.40
6,092.00	10.54	198.60	5,780.05	-1,445.34	-676.76	-1,460.77	1.71
6,182.00	9.09	195.60	5,868.73	-1,459.99	-681.30	-1,475.52	1.71
6,272.00	7.89	191.11	5,957.74	-1,472.90	-684.40	-1,488.50	1.52
6,362.00	6.00	196.75	6,047.08	-1,483.46	-686.95	-1,499.12	2.23
6,452.00	5.04	194.91	6,136.66	-1,491.79	-689.32	-1,507.50	1.08
6,542.00	2.75	190.11	6,226.45	-1,497.73	-690.72	-1,513.48	2.57
6,632.00	0.82	203.94	6,316.40	-1,500.45	-691.36	-1,516.20	2.18
6,722.00	0.40	31.54	6,406.40	-1,500.77	-691.46	-1,516.53	1.35
6,812.00	5.27	350.80	6,496.26	-1,496.42	-691.95	-1,512.19	5.53
6,902.00	13.06	357.77	6,585.05	-1,482.15	-693.01	-1,497.96	8.73
6,992.00	20.90	1.56	6,671.06	-1,455.90	-692.97	-1,471.71	8.79
7,082.00	32.80	2.81	6,751.21	-1,415.36	-691.33	-1,431.14	13.24
7,172.00	44.33	358.18	6,821.48	-1,359.39	-691.13	-1,375.18	13.20
7,262.00	50.53	0.32	6,882.34	-1,293.15	-691.94	-1,308.98	7.11
7,352.00	55.65	0.98	6,936.37	-1,221.22	-691.11	-1,237.04	5.72
7,397.00	60.26	1.64	6,960.24	-1,183.09	-690.23	-1,198.91	10.32
7,487.00	70.94	1.65	6,997.37	-1,101.28	-687.88	-1,117.07	11.87
7,577.00	82.90	0.88	7,017.70	-1,013.80	-685.97	-1,029.56	13.31
7,613.00	88.67	0.14	7,020.34	-977.91	-685.65	-993.68	16.16
7,726.00	90.31	0.53	7,021.35	-864.93	-684.99	-880.71	1.49
7,816.00	90.71	0.54	7,020.55	-774.93	-684.15	-790.72	0.44
7,906.00	91.23	0.31	7,019.02	-684.95	-683.48	-700.74	0.63
7,997.00	91.32	0.18	7,017.00	-593.97	-683.09	-609.78	0.17
8,087.00	92.03	359.60	7,014.37	-504.01	-683.26	-519.85	1.02
8,177.00	91.91	0.95	7,011.27	-414.07	-682.83	-429.92	1.51
8,267.00	91.88	1.93	7,008.30	-324.15	-680.57	-339.97	1.09
8,356.00	91.23	1.09	7,005.88	-235.21	-678.23	-251.01	1.19
8,446.00	90.86	1.01	7,004.24	-145.24	-676.58	-161.02	0.42
8,536.00	90.25	2.89	7,003.37	-55.30	-673.51	-71.04	2.20
8,627.00	89.66	2.55	7,003.44	35.59	-669.20	19.94	0.75

**Design Report for GREENLEAF 4N-2HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
8,717.00	88.98	1.83	7,004.51	125.52	-665.76	109.92	1.10
8,807.00	89.05	1.62	7,006.06	215.47	-663.05	199.90	0.25
8,897.00	89.01	1.59	7,007.58	305.42	-660.53	289.89	0.06
9,077.00	88.67	1.13	7,011.22	485.33	-656.26	469.85	0.32
9,257.00	90.31	1.08	7,012.83	665.28	-652.79	649.84	0.91
9,347.00	90.43	1.18	7,012.25	755.26	-651.01	739.83	0.17
9,437.00	91.42	1.28	7,010.79	845.23	-649.08	829.82	1.11
9,527.00	91.14	1.50	7,008.78	935.18	-646.90	919.80	0.40
9,617.00	91.39	2.00	7,006.80	1,025.12	-644.15	1,009.77	0.62
9,707.00	91.36	2.71	7,004.64	1,115.01	-640.45	1,099.73	0.79
9,887.00	91.88	2.95	6,999.55	1,294.72	-631.57	1,279.60	0.32
9,977.00	89.78	1.54	6,998.24	1,384.64	-628.04	1,369.57	2.81
10,067.00	89.78	1.22	6,998.59	1,474.61	-625.88	1,459.57	0.36
10,157.00	90.86	0.91	6,998.09	1,564.59	-624.20	1,549.57	1.25
10,247.00	89.38	1.87	6,997.90	1,654.56	-622.02	1,639.56	1.96
10,337.00	89.66	1.63	6,998.65	1,744.52	-619.27	1,729.56	0.41
10,426.00	90.09	1.40	6,998.85	1,833.48	-616.92	1,818.56	0.55
10,606.00	90.25	0.74	6,998.31	2,013.45	-613.56	1,998.55	0.38
10,696.00	90.43	1.80	6,997.78	2,103.43	-611.56	2,088.55	1.19
10,786.00	90.98	1.63	6,996.67	2,193.38	-608.87	2,178.54	0.64
10,876.00	90.92	1.75	6,995.18	2,283.33	-606.22	2,268.53	0.15
10,966.00	91.36	1.50	6,993.39	2,373.27	-603.66	2,358.51	0.56
11,056.00	90.34	1.39	6,992.05	2,463.23	-601.39	2,448.50	1.14
11,146.00	90.25	359.49	6,991.59	2,553.23	-600.70	2,538.48	2.11
11,236.00	89.75	1.30	6,991.59	2,643.22	-600.08	2,628.46	2.09
11,326.00	90.71	1.31	6,991.23	2,733.19	-598.03	2,718.46	1.07
11,416.00	89.11	2.78	6,991.37	2,823.13	-594.82	2,808.45	2.41
11,506.00	89.42	2.60	6,992.52	2,913.02	-590.60	2,898.42	0.40
11,596.00	90.00	2.50	6,992.98	3,002.93	-586.59	2,988.39	0.65
11,686.00	90.37	2.47	6,992.69	3,092.85	-582.69	3,078.38	0.41
11,776.00	90.00	1.67	6,992.40	3,182.79	-579.44	3,168.37	0.98
11,866.00	90.15	1.18	6,992.28	3,272.76	-577.20	3,258.37	0.57
11,956.00	89.72	0.79	6,992.38	3,362.75	-575.66	3,348.37	0.65
12,046.00	90.12	0.30	6,992.51	3,452.74	-574.80	3,438.36	0.70
12,136.00	90.46	0.45	6,992.05	3,542.74	-574.21	3,528.34	0.41
12,316.00	91.29	0.32	6,989.30	3,722.71	-573.00	3,708.29	0.47
12,406.00	89.69	1.28	6,988.53	3,812.70	-571.74	3,798.28	2.07
12,496.00	90.06	0.82	6,988.73	3,902.68	-570.10	3,888.28	0.66
12,586.00	90.40	0.53	6,988.37	3,992.67	-569.04	3,978.27	0.50
12,722.00	90.74	359.60	6,987.02	4,128.66	-568.88	4,114.23	0.73
<b>Last Sperry MWD Survey</b>							
12,764.00	90.74	359.60	6,986.47	4,170.66	-569.17	4,156.21	0.00
<b>Straight Projection to Bit</b>							

## Design Report for GREENLEAF 4N-2HZ - Actual Surveys

### Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
129.00	129.00	-0.06	0.56	First CES MWD Survey
1,277.00	1,276.91	5.06	-1.19	Last CES MWD Survey
1,373.00	1,372.89	5.97	-3.01	First Sperry MWD Survey
12,722.00	6,987.02	4,128.66	-568.88	Last Sperry MWD Survey
12,764.00	6,986.47	4,170.66	-569.17	Straight Projection to Bit

### Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/-S (usft)	+E/-W (usft)	
User	No Target (Freehand)	1.34	Slot	0.00	0.00	0.00

### Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
129.00	1,277.00	Surface Gyro Surveys	MWD
1,373.00	7,613.00	MWD Vertical/Build Surveys	MWD+IFR1+SC
7,726.00	12,764.00	MWD Lateral Survey	MWD+IFR1+SC

### Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,348.00	1,347.89	9 5/8"	9-5/8	13-3/4
7,649.00	7,021.01	7" @ 7649 ' MD	7	8-3/4

**Design Report for GREENLEAF 4N-2HZ - 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
GREENLEAF 4N-2HZ - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,302,935.66	3,241,892.17	40.161713	-104.634507
Point 1				0.00	-448.47	-782.02	1,302,479.60	3,241,114.60	
Point 2				0.00	872.43	-784.29	1,303,800.36	3,241,099.43	
Point 3				0.00	2,193.37	-786.56	1,305,121.16	3,241,084.27	
Point 4				0.00	3,505.98	-784.15	1,306,433.68	3,241,073.87	
Point 5				0.00	4,201.96	-782.88	1,307,129.61	3,241,068.35	
Point 6				0.00	4,177.86	137.12	1,307,114.49	3,241,988.50	
Point 7				0.00	3,493.88	135.87	1,306,430.56	3,241,993.93	
Point 8				0.00	2,181.79	133.48	1,305,118.56	3,242,004.34	
Point 9				0.00	863.77	135.74	1,303,800.68	3,242,019.47	
Point 10				0.00	-454.30	138.02	1,302,482.75	3,242,034.61	
Point 11				0.00	-1,322.91	132.59	1,301,614.17	3,242,037.66	
Point 12				0.00	-1,315.83	-787.42	1,301,612.27	3,241,117.66	
GREENLEAF 4N-2HZ - actual wellpath hits target center - Point	0.00	0.00	0.00	0.00	0.00	1,302,935.66	3,241,892.17	40.161713	-104.634507
GREENLEAF 4N-2HZ - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,302,935.66	3,241,892.17	40.161713	-104.634507
Point 1				0.00	4,683.29	-1,590.16	1,307,603.01	3,240,256.44	
Point 2				0.00	4,616.85	946.08	1,307,561.33	3,242,793.10	
Point 3				0.00	4,583.09	3,555.44	1,307,553.04	3,245,402.56	
Point 4				0.00	2,137.89	3,622.56	1,305,108.72	3,245,493.54	
Point 5				0.00	-477.11	3,694.38	1,302,494.65	3,245,590.87	
Point 6				0.00	-459.86	1,016.58	1,302,485.77	3,242,913.15	
Point 7				0.00	-442.91	-1,660.60	1,302,476.59	3,240,236.04	
Point 8				0.00	2,204.02	-1,633.10	1,305,123.55	3,240,237.70	
GREENLEAF 4N-2HZ - actual wellpath misses target center by 27.34usft at 12764.00usft MD (6986.47 TVD, 4170.66 N, -569.17 E) - Point	0.00	0.00	6,976.00	4,195.90	-568.45	1,307,125.64	3,241,282.82	40.173231	-104.636541
GREENLEAF 4N-2HZ - actual wellpath misses target center by 103.75usft at 12764.00usft MD (6986.47 TVD, 4170.66 N, -569.17 E) - Point	0.00	0.00	6,976.00	4,198.90	-668.45	1,307,127.66	3,241,182.79	40.173239	-104.636899
GREENLEAF 4N-2HZ - actual wellpath misses target center by 25.30usft at 7688.07usft MD (7021.37 TVD, -902.85 N, -685.29 E) - Point	0.00	0.00	7,021.00	-903.00	-660.00	1,302,026.30	3,241,241.04	40.159234	-104.636868

**Directional Difficulty Index**

Average Dogleg over Survey:	1.79 °/100usft	Maximum Dogleg over Survey:	16.16 °/100usft at 7,613.00 usft
Net Tortousity applicable to Plans:	0.63 °/100usft	Directional Difficulty Index:	6.484

**Audit Info**

North Reference Sheet for Sec. 2-T2N-R65W - GREENLEAF 4N-2HZ - Plan C

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

Vertical Depths are relative to RKB = 13' @ 4867.00usft (Ensign 145). Northing and Easting are relative to GREENLEAF 4N-2HZ

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: 0.99995805

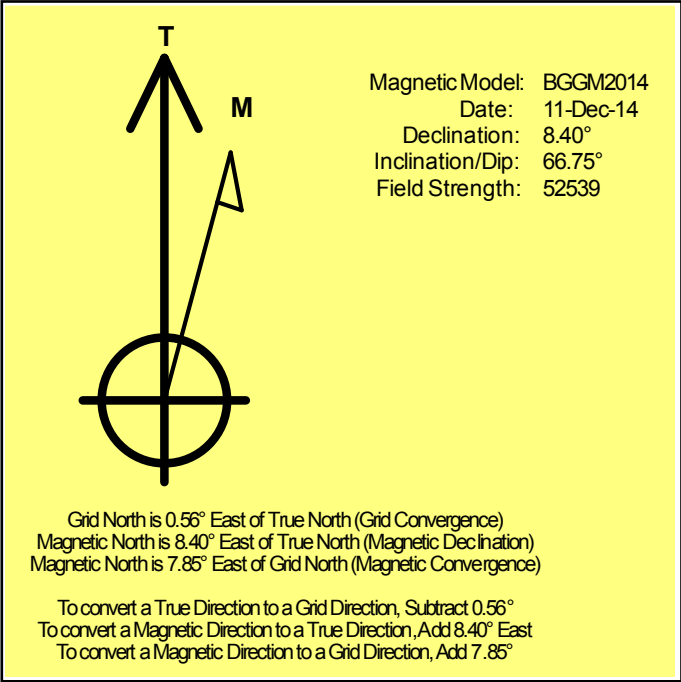
Grid Coordinates of Well: 1,302,935.66 usft N, 3,241,892.17 usft E

Geographical Coordinates of Well: 40° 09' 42.17" N, 104° 38' 04.23" W

Grid Convergence at Surface is: 0.56°

Based upon Minimum Curvature type calculations, at a Measured Depth of 12,764.00usft  
the Bottom Hole Displacement is 4,209.32usft in the Direction of 352.23° ( True).

Magnetic Convergence at surface is: -7.85° ( 11 December 2014, , BGGM2014)





# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 2-T2N-R65W

GREENLEAF 4N-2HZ

Plan C

Design: Actual Surveys

## Sperry Drilling Services

### Geodetic Report

25 March, 2015

Well Coordinates: 1,302,935.66 N, 3,241,892.17 E (40° 09' 42.17" N, 104° 38' 04.23" W)

Ground Level: 4,854.00 usft

Local Coordinate Origin:

Viewing Datum:

TVDs to System:

North Reference:

Unit System:

Geodetic Scale Factor Applied

Version: 5000.1 Build: 73

Centered on Well GREENLEAF 4N-2HZ

RKB = 13' @ 4867.00usft (Ensign 145)

N

True

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

## Design Report for GREENLEAF 4N-2HZ - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (usft)	+E/-W (usft)	Latitude (usft)	Longitude (usft)	Northing (usft)	Easting (usft)
0.00	0.00	0.00	0.00	0.00	0.00	40.161713	-104.634507	1,302,935.66	3,241,892.17
129.00	0.50	96.50	129.00	-0.06	0.56	40.161713	-104.634505	1,302,935.60	3,241,892.73
208.00	0.70	98.30	207.99	-0.17	1.38	40.161713	-104.634502	1,302,935.50	3,241,893.55
287.00	0.60	115.30	286.99	-0.42	2.23	40.161712	-104.634499	1,302,935.26	3,241,894.40
367.00	0.70	85.60	366.98	-0.56	3.10	40.161712	-104.634496	1,302,935.13	3,241,895.27
447.00	0.20	147.90	446.98	-0.64	3.66	40.161711	-104.634494	1,302,935.05	3,241,895.83
527.00	0.30	106.40	526.98	-0.82	3.93	40.161711	-104.634493	1,302,934.88	3,241,896.11
607.00	0.20	164.00	606.98	-1.01	4.17	40.161710	-104.634492	1,302,934.69	3,241,896.35
687.00	0.60	311.40	686.98	-0.87	3.90	40.161711	-104.634493	1,302,934.83	3,241,896.07
767.00	0.90	344.80	766.97	0.01	3.42	40.161713	-104.634495	1,302,935.71	3,241,895.59
847.00	0.80	3.40	846.96	1.18	3.29	40.161716	-104.634496	1,302,936.87	3,241,895.44
927.00	1.00	2.80	926.95	2.43	3.35	40.161720	-104.634495	1,302,938.12	3,241,895.50
1,007.00	0.60	266.00	1,006.95	3.10	2.97	40.161722	-104.634497	1,302,938.79	3,241,895.11
1,087.00	1.00	305.50	1,086.94	3.48	1.98	40.161723	-104.634500	1,302,939.16	3,241,894.12
1,167.00	1.20	289.60	1,166.93	4.16	0.63	40.161724	-104.634505	1,302,939.83	3,241,892.75
1,247.00	0.90	305.30	1,246.91	4.81	-0.68	40.161726	-104.634510	1,302,940.46	3,241,891.45
1,277.00	1.30	289.40	1,276.91	5.06	-1.19	40.161727	-104.634512	1,302,940.70	3,241,890.93
1,373.00	1.16	304.78	1,372.89	5.97	-3.01	40.161729	-104.634518	1,302,941.60	3,241,889.10
1,467.00	1.71	223.03	1,466.86	5.49	-4.75	40.161728	-104.634524	1,302,941.10	3,241,887.36
1,560.00	3.66	211.90	1,559.76	1.96	-7.27	40.161718	-104.634533	1,302,937.54	3,241,884.88
1,653.00	6.94	205.99	1,652.35	-5.62	-11.30	40.161698	-104.634548	1,302,929.93	3,241,880.92
1,747.00	8.43	203.93	1,745.50	-17.02	-16.58	40.161666	-104.634567	1,302,918.48	3,241,875.75
1,841.00	9.63	205.10	1,838.34	-30.44	-22.71	40.161630	-104.634589	1,302,905.00	3,241,869.75
1,934.00	11.48	201.49	1,929.76	-46.10	-29.41	40.161587	-104.634612	1,302,889.28	3,241,863.22
2,028.00	13.73	203.74	2,021.49	-65.01	-37.32	40.161535	-104.634641	1,302,870.29	3,241,855.48
2,121.00	15.69	205.55	2,111.44	-86.46	-47.19	40.161476	-104.634676	1,302,848.74	3,241,845.82
2,215.00	16.77	203.71	2,201.69	-110.35	-58.13	40.161410	-104.634715	1,302,824.75	3,241,835.12
2,308.00	18.51	203.22	2,290.31	-136.20	-69.34	40.161339	-104.634755	1,302,798.79	3,241,824.16
2,492.00	22.59	206.05	2,462.57	-194.82	-96.39	40.161178	-104.634852	1,302,739.92	3,241,797.69
2,582.00	24.14	204.61	2,545.19	-227.08	-111.65	40.161090	-104.634907	1,302,707.51	3,241,782.75
2,672.00	22.79	203.94	2,627.75	-259.75	-126.38	40.161000	-104.634959	1,302,674.70	3,241,768.33
2,762.00	24.83	206.89	2,710.08	-292.54	-142.01	40.160910	-104.635015	1,302,641.76	3,241,753.03
2,852.00	24.23	207.21	2,791.96	-325.82	-159.00	40.160819	-104.635076	1,302,608.32	3,241,736.36
2,942.00	25.40	206.14	2,873.65	-359.57	-175.95	40.160726	-104.635137	1,302,574.41	3,241,719.75
3,032.00	24.80	205.95	2,955.15	-393.87	-192.71	40.160632	-104.635197	1,302,539.94	3,241,703.32
3,122.00	23.52	204.49	3,037.27	-427.19	-208.42	40.160540	-104.635253	1,302,506.48	3,241,687.94
3,212.00	25.11	205.32	3,119.28	-460.79	-224.03	40.160448	-104.635309	1,302,472.72	3,241,672.66
3,302.00	23.67	204.49	3,201.25	-494.50	-239.68	40.160356	-104.635365	1,302,438.87	3,241,657.33
3,392.00	24.64	203.15	3,283.37	-528.19	-254.55	40.160263	-104.635418	1,302,405.03	3,241,642.80
3,482.00	22.89	201.26	3,365.73	-561.75	-268.27	40.160171	-104.635467	1,302,371.34	3,241,629.40
3,572.00	24.66	201.89	3,448.09	-595.49	-281.62	40.160078	-104.635515	1,302,337.47	3,241,616.38
3,662.00	24.01	200.18	3,530.10	-630.10	-294.94	40.159983	-104.635562	1,302,302.74	3,241,603.41

## Design Report for GREENLEAF 4N-2HZ - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (usft)	+E/-W (usft)	Latitude (usft)	Longitude (usft)	Northing (usft)	Easting (usft)
3,752.00	23.61	203.14	3,612.44	-663.86	-308.34	40.159891	-104.635610	1,302,268.85	3,241,590.34
3,842.00	22.79	205.01	3,695.16	-696.23	-322.79	40.159802	-104.635662	1,302,236.34	3,241,576.20
3,932.00	22.39	206.44	3,778.26	-727.38	-337.79	40.159716	-104.635716	1,302,205.05	3,241,561.51
4,022.00	24.19	206.57	3,860.92	-759.22	-353.67	40.159629	-104.635773	1,302,173.06	3,241,545.94
4,112.00	24.34	205.43	3,942.97	-792.46	-369.89	40.159538	-104.635831	1,302,139.66	3,241,530.05
4,202.00	24.31	205.33	4,024.98	-825.95	-385.78	40.159446	-104.635887	1,302,106.01	3,241,514.49
4,292.00	22.91	204.85	4,107.44	-858.60	-401.06	40.159356	-104.635942	1,302,073.23	3,241,499.52
4,382.00	23.18	207.33	4,190.26	-890.23	-416.56	40.159269	-104.635998	1,302,041.44	3,241,484.34
4,472.00	25.35	207.67	4,272.31	-923.03	-433.64	40.159179	-104.636059	1,302,008.48	3,241,467.58
4,562.00	24.98	205.58	4,353.77	-957.24	-450.79	40.159085	-104.636120	1,301,974.11	3,241,450.76
4,652.00	24.16	204.68	4,435.62	-991.11	-466.69	40.158992	-104.636177	1,301,940.08	3,241,435.20
4,742.00	23.66	204.54	4,517.89	-1,024.28	-481.88	40.158901	-104.636231	1,301,906.77	3,241,420.33
4,832.00	25.19	204.34	4,599.84	-1,058.16	-497.27	40.158808	-104.636286	1,301,872.74	3,241,405.27
4,922.00	25.37	204.54	4,681.22	-1,093.15	-513.18	40.158712	-104.636343	1,301,837.60	3,241,389.71
5,012.00	23.82	203.92	4,763.05	-1,127.30	-528.55	40.158619	-104.636398	1,301,803.30	3,241,374.66
5,102.00	24.03	207.87	4,845.32	-1,160.12	-544.49	40.158528	-104.636455	1,301,770.33	3,241,359.05
5,192.00	23.97	210.71	4,927.54	-1,192.03	-562.39	40.158441	-104.636519	1,301,738.24	3,241,341.46
5,282.00	24.68	206.83	5,009.56	-1,224.52	-580.21	40.158352	-104.636583	1,301,705.58	3,241,323.96
5,372.00	24.24	206.30	5,091.48	-1,257.85	-596.88	40.158260	-104.636643	1,301,672.10	3,241,307.62
5,461.00	22.34	206.51	5,173.22	-1,289.37	-612.52	40.158174	-104.636699	1,301,640.43	3,241,292.28
5,551.00	19.51	203.60	5,257.28	-1,318.45	-626.18	40.158094	-104.636747	1,301,611.21	3,241,278.91
5,641.00	18.58	203.76	5,342.36	-1,345.35	-637.97	40.158020	-104.636790	1,301,584.20	3,241,267.38
5,732.00	16.34	201.84	5,429.16	-1,370.50	-648.58	40.157951	-104.636828	1,301,558.95	3,241,257.03
5,821.00	13.53	200.91	5,515.14	-1,391.85	-656.95	40.157892	-104.636858	1,301,537.52	3,241,248.86
5,912.00	12.36	200.97	5,603.83	-1,410.89	-664.24	40.157840	-104.636884	1,301,518.41	3,241,241.76
6,002.00	12.05	200.09	5,691.79	-1,428.71	-670.91	40.157791	-104.636908	1,301,500.53	3,241,235.26
6,092.00	10.54	198.60	5,780.05	-1,445.34	-676.76	40.157746	-104.636928	1,301,483.85	3,241,229.57
6,182.00	9.09	195.60	5,868.73	-1,459.99	-681.30	40.157705	-104.636945	1,301,469.16	3,241,225.18
6,272.00	7.89	191.11	5,957.74	-1,472.90	-684.40	40.157670	-104.636956	1,301,456.22	3,241,222.20
6,362.00	6.00	196.75	6,047.08	-1,483.46	-686.95	40.157641	-104.636965	1,301,445.63	3,241,219.76
6,452.00	5.04	194.91	6,136.66	-1,491.79	-689.32	40.157618	-104.636973	1,301,437.28	3,241,217.47
6,542.00	2.75	190.11	6,226.45	-1,497.73	-690.72	40.157602	-104.636978	1,301,431.32	3,241,216.13
6,632.00	0.82	203.94	6,316.40	-1,500.45	-691.36	40.157594	-104.636981	1,301,428.60	3,241,215.52
6,722.00	0.40	31.54	6,406.40	-1,500.77	-691.46	40.157593	-104.636981	1,301,428.28	3,241,215.42
6,812.00	5.27	350.80	6,496.26	-1,496.42	-691.95	40.157605	-104.636983	1,301,432.62	3,241,214.88
6,902.00	13.06	357.77	6,585.05	-1,482.15	-693.01	40.157644	-104.636987	1,301,446.87	3,241,213.68
6,992.00	20.90	1.56	6,671.06	-1,455.90	-692.97	40.157717	-104.636986	1,301,473.12	3,241,213.47
7,082.00	32.80	2.81	6,751.21	-1,415.36	-691.33	40.157828	-104.636981	1,301,513.68	3,241,214.71
7,172.00	44.33	358.18	6,821.48	-1,359.39	-691.13	40.157981	-104.636980	1,301,569.65	3,241,214.36
7,262.00	50.53	0.32	6,882.34	-1,293.15	-691.94	40.158163	-104.636983	1,301,635.87	3,241,212.91
7,352.00	55.65	0.98	6,936.37	-1,221.22	-691.11	40.158361	-104.636980	1,301,707.81	3,241,213.04
7,397.00	60.26	1.64	6,960.24	-1,183.09	-690.23	40.158465	-104.636977	1,301,745.94	3,241,213.54

## Design Report for GREENLEAF 4N-2HZ - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (usft)	+E/-W (usft)	Latitude (usft)	Longitude (usft)	Northing (usft)	Easting (usft)
7,487.00	70.94	1.65	6,997.37	-1,101.28	-687.88	40.158690	-104.636968	1,301,827.76	3,241,215.10
7,577.00	82.90	0.88	7,017.70	-1,013.80	-685.97	40.158930	-104.636961	1,301,915.25	3,241,216.16
7,613.00	88.67	0.14	7,020.34	-977.91	-685.65	40.159029	-104.636960	1,301,951.14	3,241,216.13
7,726.00	90.31	0.53	7,021.35	-864.93	-684.99	40.159339	-104.636958	1,302,064.13	3,241,215.68
7,816.00	90.71	0.54	7,020.55	-774.93	-684.15	40.159586	-104.636955	1,302,154.12	3,241,215.65
7,906.00	91.23	0.31	7,019.02	-684.95	-683.48	40.159833	-104.636953	1,302,244.10	3,241,215.44
7,997.00	91.32	0.18	7,017.00	-593.97	-683.09	40.160083	-104.636951	1,302,335.07	3,241,214.94
8,087.00	92.03	359.60	7,014.37	-504.01	-683.26	40.160330	-104.636952	1,302,425.02	3,241,213.89
8,177.00	91.91	0.95	7,011.27	-414.07	-682.83	40.160576	-104.636950	1,302,514.96	3,241,213.44
8,267.00	91.88	1.93	7,008.30	-324.15	-680.57	40.160823	-104.636942	1,302,604.90	3,241,214.82
8,356.00	91.23	1.09	7,005.88	-235.21	-678.23	40.161067	-104.636934	1,302,693.85	3,241,216.30
8,446.00	90.86	1.01	7,004.24	-145.24	-676.58	40.161314	-104.636928	1,302,783.83	3,241,217.07
8,536.00	90.25	2.89	7,003.37	-55.30	-673.51	40.161561	-104.636917	1,302,873.79	3,241,219.25
8,627.00	89.66	2.55	7,003.44	35.59	-669.20	40.161811	-104.636902	1,302,964.72	3,241,222.68
8,717.00	88.98	1.83	7,004.51	125.52	-665.76	40.162058	-104.636889	1,303,054.67	3,241,225.25
8,807.00	89.05	1.62	7,006.06	215.47	-663.05	40.162304	-104.636880	1,303,144.64	3,241,227.08
8,897.00	89.01	1.59	7,007.58	305.42	-660.53	40.162551	-104.636871	1,303,234.60	3,241,228.72
9,077.00	88.67	1.13	7,011.22	485.33	-656.26	40.163045	-104.636855	1,303,414.54	3,241,231.23
9,257.00	90.31	1.08	7,012.83	665.28	-652.79	40.163539	-104.636843	1,303,594.51	3,241,232.95
9,347.00	90.43	1.18	7,012.25	755.26	-651.01	40.163786	-104.636837	1,303,684.50	3,241,233.84
9,437.00	91.42	1.28	7,010.79	845.23	-649.08	40.164033	-104.636830	1,303,774.48	3,241,234.90
9,527.00	91.14	1.50	7,008.78	935.18	-646.90	40.164280	-104.636822	1,303,864.44	3,241,236.20
9,617.00	91.39	2.00	7,006.80	1,025.12	-644.15	40.164527	-104.636812	1,303,954.40	3,241,238.07
9,707.00	91.36	2.71	7,004.64	1,115.01	-640.45	40.164774	-104.636799	1,304,044.32	3,241,240.89
9,887.00	91.88	2.95	6,999.55	1,294.72	-631.57	40.165267	-104.636767	1,304,224.10	3,241,248.02
9,977.00	89.78	1.54	6,998.24	1,384.64	-628.04	40.165514	-104.636754	1,304,314.04	3,241,250.67
10,067.00	89.78	1.22	6,998.59	1,474.61	-625.88	40.165761	-104.636747	1,304,404.03	3,241,251.96
10,157.00	90.86	0.91	6,998.09	1,564.59	-624.20	40.166008	-104.636741	1,304,494.02	3,241,252.75
10,247.00	89.38	1.87	6,997.90	1,654.56	-622.02	40.166255	-104.636733	1,304,584.00	3,241,254.06
10,337.00	89.66	1.63	6,998.65	1,744.52	-619.27	40.166502	-104.636723	1,304,673.98	3,241,255.93
10,426.00	90.09	1.40	6,998.85	1,833.48	-616.92	40.166746	-104.636715	1,304,762.96	3,241,257.41
10,606.00	90.25	0.74	6,998.31	2,013.45	-613.56	40.167240	-104.636703	1,304,942.94	3,241,259.02
10,696.00	90.43	1.80	6,997.78	2,103.43	-611.56	40.167487	-104.636696	1,305,032.93	3,241,260.13
10,786.00	90.98	1.63	6,996.67	2,193.38	-608.87	40.167734	-104.636686	1,305,122.90	3,241,261.95
10,876.00	90.92	1.75	6,995.18	2,283.33	-606.22	40.167981	-104.636676	1,305,212.87	3,241,263.72
10,966.00	91.36	1.50	6,993.39	2,373.27	-603.66	40.168228	-104.636667	1,305,302.83	3,241,265.40
11,056.00	90.34	1.39	6,992.05	2,463.23	-601.39	40.168475	-104.636659	1,305,392.80	3,241,266.79
11,146.00	90.25	359.49	6,991.59	2,553.23	-600.70	40.168722	-104.636657	1,305,482.79	3,241,266.60
11,236.00	89.75	1.30	6,991.59	2,643.22	-600.08	40.168969	-104.636654	1,305,572.78	3,241,266.34
11,326.00	90.71	1.31	6,991.23	2,733.19	-598.03	40.169216	-104.636647	1,305,662.77	3,241,267.51
11,416.00	89.11	2.78	6,991.37	2,823.13	-594.82	40.169463	-104.636636	1,305,752.73	3,241,269.85
11,506.00	89.42	2.60	6,992.52	2,913.02	-590.60	40.169709	-104.636621	1,305,842.66	3,241,273.19

## Design Report for GREENLEAF 4N-2HZ - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (usft)	+E/-W (usft)	Latitude (usft)	Longitude (usft)	Northing (usft)	Easting (usft)
11,596.00	90.00	2.50	6,992.98	3,002.93	-586.59	40.169956	-104.636606	1,305,932.60	3,241,276.32
11,686.00	90.37	2.47	6,992.69	3,092.85	-582.69	40.170203	-104.636592	1,306,022.54	3,241,279.34
11,776.00	90.00	1.67	6,992.40	3,182.79	-579.44	40.170450	-104.636581	1,306,112.51	3,241,281.72
11,866.00	90.15	1.18	6,992.28	3,272.76	-577.20	40.170697	-104.636573	1,306,202.49	3,241,283.08
11,956.00	89.72	0.79	6,992.38	3,362.75	-575.66	40.170944	-104.636567	1,306,292.49	3,241,283.74
12,046.00	90.12	0.30	6,992.51	3,452.74	-574.80	40.171191	-104.636564	1,306,382.48	3,241,283.72
12,136.00	90.46	0.45	6,992.05	3,542.74	-574.21	40.171438	-104.636562	1,306,472.48	3,241,283.43
12,316.00	91.29	0.32	6,989.30	3,722.71	-573.00	40.171932	-104.636558	1,306,652.45	3,241,282.89
12,406.00	89.69	1.28	6,988.53	3,812.70	-571.74	40.172179	-104.636553	1,306,742.43	3,241,283.26
12,496.00	90.06	0.82	6,988.73	3,902.68	-570.10	40.172426	-104.636547	1,306,832.43	3,241,284.03
12,586.00	90.40	0.53	6,988.37	3,992.67	-569.04	40.172673	-104.636543	1,306,922.42	3,241,284.22
12,722.00	90.74	359.60	6,987.02	4,128.66	-568.88	40.173046	-104.636543	1,307,058.40	3,241,283.04
12,764.00	90.74	359.60	6,986.47	4,170.66	-569.17	40.173162	-104.636544	1,307,100.39	3,241,282.34

### Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
129.00	129.00	-0.06	0.56	First CES MWD Survey
1,277.00	1,276.91	5.06	-1.19	Last CES MWD Survey
1,373.00	1,372.89	5.97	-3.01	First Sperry MWD Survey
12,722.00	6,987.02	4,128.66	-568.88	Last Sperry MWD Survey
12,764.00	6,986.47	4,170.66	-569.17	Straight Projection to Bit

### Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
User	No Target (Freehand)	1.34	Slot	0.00	0.00	0.00

### Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
129.00	1,277.00	Surface Gyro Surveys	MWD
1,373.00	7,613.00	MWD Vertical/Build Surveys	MWD+IFR1+SC
7,726.00	12,764.00	MWD Lateral Survey	MWD+IFR1+SC

---

Design Report for GREENLEAF 4N-2HZ - Actual Surveys

---

**Casing Details**

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,348.00	1,347.89	9 5/8"	9-5/8	13-3/4
7,649.00	7,021.01	7" @ 7649 ' MD	7	8-3/4

**Design Targets**

Shape	Target Name	TVD ( )	Northing ( )	Easting ( )	+N/-S	+E/-W	Created	Updated
-------	-------------	------------	-----------------	----------------	-------	-------	---------	---------

**Directional Difficulty Index**

Average Dogleg over Survey:	1.79 °/100usft	Maximum Dogleg over Survey:	16.16 °/100usft at 7,613.00 usft
Net Tortousity applicable to Plans:	0.63 °/100usft	Directional Difficulty Index:	6.484

**Audit Info**

**North Reference Sheet for Sec. 2-T2N-R65W - GREENLEAF 4N-2HZ - Plan C**

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

Vertical Depths are relative to RKB = 13' @ 4867.00usft (Ensign 145). Northing and Easting are relative to GREENLEAF 4N-2HZ

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: 0.99995805

Grid Coordinates of Well: 1,302,935.66 usft N, 3,241,892.17 usft E

Geographical Coordinates of Well: 40° 09' 42.17" N, 104° 38' 04.23" W

Grid Convergence at Surface is: 0.56°

Based upon Minimum Curvature type calculations, at a Measured Depth of 12,764.00usft

the Bottom Hole Displacement is 4,209.32usft in the Direction of 352.23° ( True).

Magnetic Convergence at surface is: -7.85° (11 December 2014, , BGGM2014)

