

# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 7-T2N-R65W

Thomsen 2N-31HZ

API: 05-123-40547 :: Job #: 901927441

Plan B

Design: Actual Surveys

## Sperry Drilling Services

### Final Report

23 March, 2015

Surface UWI : API: 05-123-40547 :: Job #: 901927441

Well Coordinates: 1,299,838.99 N, 3,220,638.58 E (40° 09' 13.53" N, 104° 42' 38.33" W)

Ground Level: 4,948.00 usft

Local Coordinate Origin:

Centered on Well Thomsen 2N-31HZ

Viewing Datum:

RKB = 25' @ 4973.00usft (H&P 308)

TVDs to System:

N

North Reference:

True

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. 7-T2N-R65W  
 Well: Thomsen 2N-31HZ  
 Wellbore: Plan B  
 Design: Actual Surveys



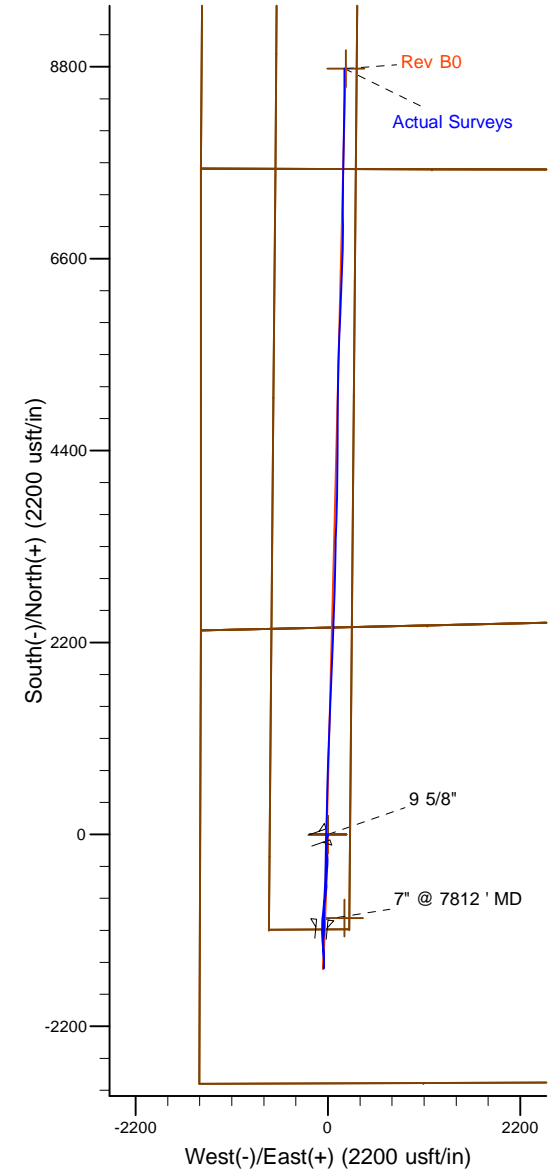
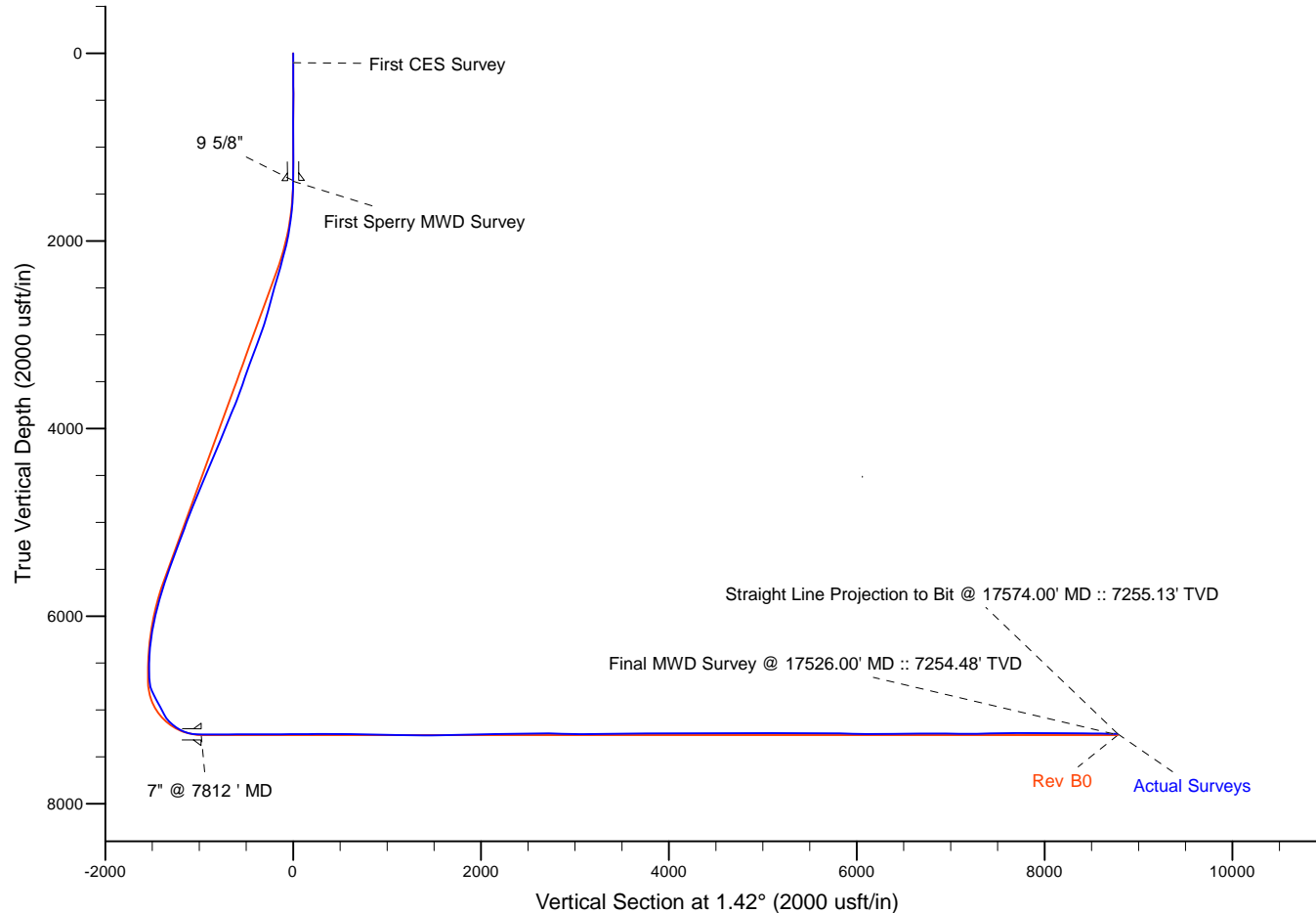
Platted SHL: 2370' FNL, 1461' FWL  
 Platted Lat/Long: 40.153757N, 104.710647W  
 Location: Sec. 7-T2N-R65W

~ 7" Casing: 3341.8' FNL 1403.6' FWL  
 Lat/Long: 40.151071N, 104.710875W  
 State Planes - CO Northern: 1298859.94N, 3220583.60E  
 Location: Sec. 7-T2N-R65W

~ BHL: 1148.4' FSL, 1654.4' FWL  
 Lat/Long: 40.177852N, 104.709969W  
 State Planes - CO Northern: 1308617.62N, 3220749.89E  
 Location: Sec. 31-T3N-R65W

# LEGEND

- Thomsen 2N-31HZ, Plan B, Rev B0 V0
- Actual Surveys



WELL DETAILS: Thomsen 2N-31HZ	
Ground Level:	4948.00
RKB = 25' @ 4973.00usft (H&P 308)	
Created By:	Gordy Roth
Created On:	3/16/15

**Design Report for Thomsen 2N-31HZ - 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
101.00	0.40	324.80	101.00	0.29	-0.20	0.28	0.40
<b>First CES Survey</b>							
180.00	0.40	319.70	180.00	0.72	-0.54	0.71	0.05
269.00	0.50	328.50	268.99	1.29	-0.94	1.27	0.14
349.00	0.70	308.10	348.99	1.89	-1.51	1.85	0.36
429.00	0.10	199.00	428.99	2.13	-1.92	2.08	0.92
509.00	0.40	204.40	508.99	1.81	-2.06	1.75	0.38
589.00	0.10	98.40	588.99	1.54	-2.10	1.49	0.55
669.00	0.30	135.00	668.99	1.38	-1.89	1.34	0.28
749.00	0.60	111.00	748.98	1.09	-1.35	1.05	0.44
829.00	0.40	62.00	828.98	1.07	-0.71	1.05	0.57
909.00	0.60	98.40	908.98	1.14	-0.05	1.13	0.46
989.00	0.50	113.30	988.97	0.94	0.69	0.95	0.22
1,069.00	0.40	78.10	1,068.97	0.86	1.28	0.89	0.36
1,149.00	0.20	111.00	1,148.97	0.86	1.68	0.91	0.32
1,229.00	0.40	98.40	1,228.97	0.77	2.09	0.82	0.26
1,309.00	0.50	82.20	1,308.97	0.78	2.71	0.85	0.20
1,324.00	0.50	82.90	1,323.97	0.80	2.84	0.87	0.04
<b>Last CES Survey</b>							
1,366.00	0.35	69.69	1,365.97	0.86	3.14	0.94	0.42
<b>First Sperry MWD Survey</b>							
1,458.00	1.65	192.60	1,457.95	-0.33	3.12	-0.25	2.03
1,550.00	3.37	193.02	1,549.86	-4.26	2.22	-4.20	1.87
1,643.00	4.90	193.91	1,642.62	-10.78	0.65	-10.76	1.65
1,734.00	7.33	196.85	1,733.09	-20.11	-1.97	-20.15	2.69
1,826.00	8.44	202.25	1,824.22	-31.97	-6.22	-32.12	1.45
1,917.00	10.10	193.01	1,914.04	-45.93	-10.55	-46.18	2.44
2,011.00	12.88	184.14	2,006.15	-64.42	-13.16	-64.72	3.50
2,105.00	14.63	180.66	2,097.45	-86.74	-14.06	-87.06	2.06
2,200.00	14.02	174.67	2,189.50	-110.19	-13.13	-110.49	1.69
2,294.00	15.58	179.52	2,280.39	-134.16	-11.96	-134.41	2.12
2,388.00	16.34	184.79	2,370.77	-159.96	-12.96	-160.23	1.74
2,483.00	16.80	183.80	2,461.82	-186.97	-14.99	-187.29	0.57
2,577.00	16.21	176.36	2,551.96	-213.63	-15.05	-213.93	2.33
2,671.00	15.79	170.60	2,642.32	-239.34	-12.13	-239.57	1.75
2,765.00	14.18	164.39	2,733.13	-263.05	-6.94	-263.14	2.42
2,860.00	17.07	177.36	2,824.64	-288.20	-3.17	-288.19	4.76
2,954.00	18.32	182.69	2,914.19	-316.74	-3.23	-316.72	2.18
3,048.00	19.63	188.33	3,003.09	-347.12	-6.21	-347.17	2.40
3,142.00	20.50	185.90	3,091.39	-379.12	-10.19	-379.25	1.28
3,237.00	21.58	184.86	3,180.05	-413.07	-13.38	-413.28	1.20
3,331.00	19.23	185.08	3,268.15	-445.72	-16.21	-445.99	2.50
3,426.00	20.05	180.39	3,357.63	-477.59	-17.71	-477.88	1.87
3,520.00	18.43	181.31	3,446.37	-508.56	-18.16	-508.86	1.75
3,614.00	19.67	178.66	3,535.22	-539.24	-18.13	-539.52	1.61
3,709.00	20.52	178.23	3,624.44	-571.86	-17.24	-572.11	0.91
3,803.00	20.98	183.34	3,712.35	-605.13	-17.71	-605.39	1.99
3,897.00	22.17	187.22	3,799.77	-639.53	-20.92	-639.85	1.98
3,992.00	23.49	186.78	3,887.32	-676.11	-25.41	-676.54	1.40

**Design Report for Thomsen 2N-31HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
4,086.00	21.11	185.48	3,974.29	-711.57	-29.24	-712.08	2.59
4,181.00	23.49	186.13	4,062.18	-747.43	-32.89	-748.02	2.52
4,275.00	22.82	185.22	4,148.60	-784.21	-36.55	-784.88	0.81
4,369.00	21.39	185.40	4,235.69	-819.43	-39.82	-820.17	1.52
4,463.00	23.63	183.09	4,322.53	-855.31	-42.45	-856.10	2.56
4,558.00	21.48	182.73	4,410.25	-891.70	-44.31	-892.53	2.27
4,652.00	24.62	179.57	4,496.74	-928.48	-44.98	-929.31	3.59
4,746.00	22.89	178.33	4,582.78	-966.34	-44.30	-967.14	1.92
4,841.00	21.56	177.27	4,670.72	-1,002.25	-42.93	-1,003.00	1.46
4,935.00	22.41	183.68	4,757.89	-1,037.38	-43.26	-1,038.14	2.71
5,030.00	20.80	183.25	4,846.22	-1,072.30	-45.38	-1,073.09	1.70
5,124.00	21.57	182.59	4,933.86	-1,106.22	-47.11	-1,107.05	0.86
5,218.00	20.13	182.70	5,021.70	-1,139.64	-48.65	-1,140.50	1.53
5,313.00	21.59	180.99	5,110.48	-1,173.45	-49.72	-1,174.32	1.66
5,407.00	20.83	181.60	5,198.11	-1,207.45	-50.49	-1,208.33	0.84
5,502.00	19.52	181.26	5,287.28	-1,240.20	-51.31	-1,241.09	1.38
5,596.00	20.85	179.96	5,375.50	-1,272.63	-51.64	-1,273.52	1.49
5,690.00	19.26	180.69	5,463.80	-1,304.87	-51.82	-1,305.75	1.71
5,784.00	17.39	180.13	5,553.03	-1,334.42	-52.03	-1,335.30	2.00
5,879.00	18.16	176.95	5,643.50	-1,363.40	-51.28	-1,364.25	1.30
5,973.00	18.25	177.75	5,732.79	-1,392.73	-49.92	-1,393.54	0.28
6,067.00	16.74	176.10	5,822.44	-1,420.95	-48.42	-1,421.71	1.69
6,162.00	15.02	174.31	5,913.81	-1,446.85	-46.27	-1,447.55	1.88
6,256.00	12.59	176.26	6,005.09	-1,469.20	-44.39	-1,469.85	2.63
6,351.00	10.20	184.28	6,098.22	-1,487.92	-44.35	-1,488.56	3.01
6,445.00	9.29	183.38	6,190.86	-1,503.79	-45.42	-1,504.46	0.98
6,539.00	5.85	185.58	6,284.03	-1,516.14	-46.33	-1,516.82	3.67
6,633.00	3.98	186.53	6,377.68	-1,524.15	-47.17	-1,524.85	1.99
6,728.00	2.94	191.52	6,472.50	-1,529.81	-48.03	-1,530.53	1.14
6,822.00	0.26	93.29	6,566.46	-1,532.19	-48.30	-1,532.91	3.18
6,916.00	2.03	350.07	6,660.44	-1,530.56	-48.37	-1,531.29	2.24
6,963.00	6.52	0.16	6,707.30	-1,527.07	-48.51	-1,527.80	9.65
7,011.00	15.63	4.85	6,754.36	-1,517.88	-47.95	-1,518.60	19.06
7,058.00	23.99	2.97	6,798.54	-1,502.00	-46.92	-1,502.70	17.84
7,105.00	28.13	359.65	6,840.75	-1,481.37	-46.49	-1,482.07	9.34
7,152.00	27.80	358.95	6,882.26	-1,459.33	-46.76	-1,460.04	0.99
7,199.00	27.40	358.34	6,923.92	-1,437.56	-47.27	-1,438.29	1.04
7,246.00	26.78	359.81	6,965.76	-1,416.17	-47.62	-1,416.91	1.94
7,293.00	27.58	359.72	7,007.57	-1,394.70	-47.71	-1,395.45	1.70
7,340.00	28.37	0.40	7,049.08	-1,372.65	-47.69	-1,373.41	1.81
7,387.00	36.00	350.62	7,088.85	-1,347.80	-49.86	-1,348.62	19.61
7,434.00	44.24	353.61	7,124.77	-1,317.83	-53.95	-1,318.76	18.00
7,482.00	50.66	354.44	7,157.21	-1,282.68	-57.61	-1,283.71	13.44
7,529.00	55.82	356.17	7,185.33	-1,245.16	-60.67	-1,246.28	11.37
7,576.00	60.58	356.43	7,210.09	-1,205.31	-63.25	-1,206.51	10.14
7,623.00	66.26	359.10	7,231.11	-1,163.33	-64.86	-1,164.58	13.11
7,671.00	75.27	358.93	7,246.91	-1,118.06	-65.64	-1,119.35	18.77
7,718.00	82.14	359.10	7,256.11	-1,072.01	-66.43	-1,073.33	14.62
7,765.00	86.02	1.03	7,260.96	-1,025.27	-66.38	-1,026.60	9.21
7,818.00	90.12	5.72	7,262.74	-972.42	-63.26	-973.69	11.75
7,913.00	90.62	5.96	7,262.13	-877.91	-53.59	-878.97	0.58

**Design Report for Thomsen 2N-31HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
8,007.00	89.48	5.06	7,262.05	-784.35	-44.57	-785.22	1.55
8,101.00	90.40	3.69	7,262.14	-690.63	-37.40	-691.34	1.76
8,195.00	91.02	2.36	7,260.98	-596.77	-32.44	-597.39	1.56
8,290.00	89.26	1.09	7,260.75	-501.82	-29.58	-502.40	2.28
8,385.00	89.72	1.31	7,261.59	-406.84	-27.59	-407.40	0.54
8,479.00	89.97	1.03	7,261.85	-312.86	-25.67	-313.40	0.40
8,573.00	90.00	1.34	7,261.87	-218.88	-23.72	-219.40	0.33
8,667.00	90.62	1.31	7,261.36	-124.91	-21.55	-125.41	0.66
8,762.00	91.14	1.42	7,259.90	-29.95	-19.29	-30.42	0.56
8,856.00	90.06	1.12	7,258.92	64.02	-17.21	63.57	1.19
8,950.00	90.52	0.96	7,258.44	158.00	-15.50	157.57	0.52
9,045.00	91.20	1.23	7,257.02	252.98	-13.68	252.56	0.77
9,139.00	89.63	1.34	7,256.34	346.95	-11.58	346.55	1.67
9,233.00	88.55	1.65	7,257.83	440.90	-9.12	440.54	1.20
9,328.00	88.98	1.71	7,259.88	535.84	-6.34	535.52	0.46
9,422.00	89.60	1.73	7,261.04	629.79	-3.52	629.51	0.66
9,517.00	90.28	2.24	7,261.14	724.73	-0.23	724.50	0.89
9,611.00	88.71	1.19	7,261.97	818.68	2.59	818.49	2.01
9,706.00	88.64	1.75	7,264.17	913.62	5.02	913.47	0.59
9,800.00	88.74	1.81	7,266.32	1,007.55	7.94	1,007.44	0.12
9,894.00	89.14	1.56	7,268.06	1,101.50	10.70	1,101.42	0.50
9,989.00	89.23	1.77	7,269.41	1,196.45	13.46	1,196.41	0.24
10,083.00	88.95	2.46	7,270.90	1,290.37	16.93	1,290.39	0.79
10,177.00	89.04	2.12	7,272.55	1,384.28	20.69	1,384.37	0.37
10,271.00	91.29	3.15	7,272.28	1,478.17	25.01	1,478.34	2.63
10,366.00	91.36	2.77	7,270.08	1,573.02	29.91	1,573.28	0.41
10,460.00	91.51	3.00	7,267.73	1,666.87	34.64	1,667.22	0.29
10,554.00	91.42	2.95	7,265.32	1,760.71	39.52	1,761.15	0.11
10,646.00	90.65	1.98	7,263.66	1,852.61	43.48	1,853.12	1.35
10,737.00	90.46	2.01	7,262.78	1,943.55	46.64	1,944.11	0.21
10,829.00	90.96	2.00	7,261.64	2,035.49	49.86	2,036.10	0.54
10,921.00	90.93	2.20	7,260.12	2,127.41	53.23	2,128.08	0.22
11,012.00	90.80	2.09	7,258.75	2,218.34	56.64	2,219.06	0.19
11,103.00	90.77	2.09	7,257.50	2,309.27	59.96	2,310.05	0.03
11,195.00	91.14	2.08	7,255.97	2,401.20	63.30	2,402.03	0.40
11,286.00	91.39	1.64	7,253.96	2,492.13	66.26	2,493.00	0.56
11,378.00	91.14	1.94	7,251.93	2,584.06	69.13	2,584.98	0.42
11,470.00	89.69	1.74	7,251.26	2,676.01	72.08	2,676.97	1.59
11,562.00	88.55	1.41	7,252.68	2,767.96	74.61	2,768.96	1.29
11,655.00	88.86	1.67	7,254.78	2,860.90	77.11	2,861.94	0.44
11,748.00	89.11	1.79	7,256.42	2,953.85	79.92	2,954.92	0.30
11,841.00	88.80	1.57	7,258.12	3,046.79	82.64	3,047.90	0.41
11,932.00	90.00	0.81	7,259.07	3,137.76	84.53	3,138.89	1.56
12,024.00	90.37	0.95	7,258.78	3,229.75	85.95	3,230.89	0.43
12,117.00	90.22	1.08	7,258.30	3,322.74	87.59	3,323.89	0.21
12,209.00	90.62	2.22	7,257.62	3,414.69	90.24	3,415.88	1.31
12,300.00	90.80	3.86	7,256.50	3,505.56	95.07	3,506.83	1.81
12,392.00	91.48	1.62	7,254.67	3,597.43	99.47	3,598.79	2.54
12,486.00	90.15	0.31	7,253.33	3,691.40	101.05	3,692.77	1.99
12,581.00	90.37	0.50	7,252.90	3,786.40	101.72	3,787.75	0.31
12,675.00	90.68	0.74	7,252.04	3,880.39	102.74	3,881.74	0.42

**Design Report for Thomsen 2N-31HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
12,769.00	91.05	0.88	7,250.62	3,974.37	104.07	3,975.72	0.42
12,864.00	91.17	1.06	7,248.78	4,069.33	105.67	4,070.70	0.23
12,958.00	91.02	0.53	7,246.98	4,163.31	106.98	4,164.68	0.59
13,053.00	89.69	0.58	7,246.39	4,258.30	107.90	4,259.66	1.40
13,148.00	89.78	0.54	7,246.83	4,353.29	108.83	4,354.65	0.10
13,242.00	89.85	0.50	7,247.13	4,447.29	109.68	4,448.64	0.09
13,337.00	89.82	0.32	7,247.41	4,542.29	110.36	4,543.63	0.19
13,431.00	90.03	0.73	7,247.53	4,636.28	111.22	4,637.61	0.49
13,526.00	89.45	0.33	7,247.96	4,731.28	112.10	4,732.60	0.74
13,620.00	89.54	0.32	7,248.79	4,825.27	112.63	4,826.58	0.10
13,715.00	89.97	0.36	7,249.20	4,920.27	113.20	4,921.56	0.45
13,809.00	90.25	0.33	7,249.02	5,014.27	113.76	5,015.55	0.30
13,903.00	89.48	0.69	7,249.24	5,108.26	114.60	5,109.53	0.90
13,998.00	89.41	0.81	7,250.16	5,203.25	115.84	5,204.52	0.15
14,092.00	90.74	0.63	7,250.03	5,297.24	117.02	5,298.51	1.43
14,186.00	89.26	1.94	7,250.03	5,391.21	119.13	5,392.51	2.10
14,280.00	90.09	1.95	7,250.57	5,485.15	122.32	5,486.50	0.88
14,374.00	90.28	1.71	7,250.26	5,579.11	125.32	5,580.50	0.33
14,469.00	89.48	2.06	7,250.46	5,674.05	128.45	5,675.49	0.92
14,563.00	89.85	2.05	7,251.01	5,767.99	131.82	5,769.49	0.39
14,658.00	88.34	2.83	7,252.51	5,862.89	135.86	5,864.46	1.79
14,753.00	88.49	3.07	7,255.14	5,957.73	140.75	5,959.39	0.30
14,848.00	90.15	1.99	7,256.27	6,052.62	144.94	6,054.36	2.08
14,943.00	90.00	1.85	7,256.14	6,147.57	148.13	6,149.35	0.22
15,037.00	90.00	1.99	7,256.14	6,241.52	151.28	6,243.35	0.15
15,132.00	90.15	2.48	7,256.02	6,336.44	154.98	6,338.34	0.54
15,226.00	90.06	2.03	7,255.85	6,430.37	158.68	6,432.33	0.49
15,321.00	90.71	2.31	7,255.21	6,525.30	162.28	6,527.32	0.74
15,415.00	90.83	2.81	7,253.95	6,619.20	166.47	6,621.29	0.55
15,510.00	90.25	0.11	7,253.05	6,714.15	168.89	6,716.28	2.91
15,604.00	89.75	0.23	7,253.05	6,808.15	169.17	6,810.25	0.55
15,698.00	89.54	0.06	7,253.63	6,902.15	169.41	6,904.23	0.29
15,793.00	89.45	0.05	7,254.47	6,997.15	169.50	6,999.20	0.10
15,887.00	89.32	359.86	7,255.48	7,091.14	169.43	7,093.16	0.24
15,982.00	90.43	1.14	7,255.69	7,186.13	170.26	7,188.15	1.78
16,076.00	90.80	0.71	7,254.68	7,280.12	171.77	7,282.14	0.60
16,171.00	91.20	0.59	7,253.02	7,375.09	172.85	7,377.11	0.44
16,266.00	91.42	0.13	7,250.85	7,470.07	173.45	7,472.07	0.54
16,360.00	91.76	0.12	7,248.24	7,564.03	173.65	7,566.01	0.36
16,454.00	89.88	0.79	7,246.89	7,658.01	174.40	7,659.98	2.12
16,549.00	90.55	0.64	7,246.54	7,753.01	175.59	7,754.98	0.72
16,643.00	89.17	1.43	7,246.77	7,846.99	177.28	7,848.97	1.69
16,737.00	89.72	1.29	7,247.68	7,940.96	179.51	7,942.97	0.60
16,832.00	89.85	1.52	7,248.03	8,035.93	181.84	8,037.96	0.28
16,926.00	89.51	0.68	7,248.56	8,129.91	183.65	8,131.96	0.96
17,021.00	89.35	0.59	7,249.50	8,224.90	184.70	8,226.95	0.19
17,115.00	89.41	1.19	7,250.52	8,318.88	186.16	8,320.94	0.64
17,210.00	89.35	0.59	7,251.55	8,413.86	187.64	8,415.93	0.63
17,304.00	89.41	0.70	7,252.57	8,507.85	188.69	8,509.91	0.13
17,398.00	89.69	0.29	7,253.31	8,601.84	189.51	8,603.90	0.53
17,492.00	89.38	359.72	7,254.07	8,695.84	189.52	8,697.87	0.69

**Design Report for Thomsen 2N-31HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
17,526.00	89.23	359.90	7,254.48	8,729.84	189.40	8,731.85	0.69
<b>Final MWD Survey @ 17526.00' MD :: 7254.48' TVD</b>							
17,574.00	89.23	359.90	7,255.13	8,777.83	189.32	8,779.83	0.00
<b>Straight Line Projection to Bit @ 17574.00' MD :: 7255.13' TVD</b>							

**Design Annotations**

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
101.00	101.00	0.29	-0.20	First CES Survey
1,324.00	1,323.97	0.80	2.84	Last CES Survey
1,366.00	1,365.97	0.86	3.14	First Sperry MWD Survey
17,526.00	7,254.48	8,729.84	189.40	Final MWD Survey @ 17526.00' MD :: 7254.48' TVD
17,574.00	7,255.13	8,777.83	189.32	Straight Line Projection to Bit @ 17574.00' MD :: 7255.13' TVD

**Vertical Section Information**

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
User	No Target (Freehand)	1.42	Slot	0.00	0.00	0.00

**Survey tool program**

From (usft)	To (usft)	Survey/Plan	Survey Tool
101.00	1,324.00	Surface Surveys	MWD
1,366.00	7,765.00	MWD Vertical/Build Surveys	MWD+IFR1+SC
7,818.00	17,574.00	MWD Lateral Surveys	MWD+IFR1+SC

**Casing Details**

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,358.00	1,357.97	9 5/8"	9-5/8	12-1/4
7,812.00		7" @ 7812' MD	7	8-3/4

## Design Report for Thomsen 2N-31HZ - 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
THOMSEN 6-7HZ_SE	0.00	0.00	0.00	0.00	0.00	1,299,839.00	3,220,638.58	40.153757	-104.710647
- actual wellpath hits target center									
- Polygon									
Point 1				0.00	7,632.35	-1,453.02	1,307,457.79	3,219,117.74	
Point 2				0.00	10,270.52	-1,436.96	1,310,095.89	3,219,110.32	
Point 3				0.00	12,908.29	-1,421.76	1,312,733.58	3,219,102.04	
Point 4				0.00	12,909.69	1,226.98	1,312,758.56	3,221,750.55	
Point 5				0.00	12,907.78	3,891.66	1,312,780.37	3,224,415.03	
Point 6				0.00	10,263.87	3,871.46	1,310,136.49	3,224,418.37	
Point 7				0.00	7,620.17	3,852.05	1,307,492.83	3,224,422.49	
Point 8				0.00	7,625.89	1,190.53	1,307,474.86	3,221,761.13	
THOMSEN 6-7HZ_SE	0.00	0.00	0.00	0.00	0.00	1,299,839.00	3,220,638.58	40.153757	-104.710647
- actual wellpath hits target center									
- Polygon									
Point 1				0.00	2,337.85	-1,452.93	1,302,163.72	3,219,164.96	
Point 2				0.00	4,984.95	-1,452.83	1,304,810.61	3,219,141.50	
Point 3				0.00	7,632.39	-1,453.13	1,307,457.83	3,219,117.63	
Point 4				0.00	7,625.93	1,190.41	1,307,474.90	3,221,761.01	
Point 5				0.00	7,620.09	3,852.17	1,307,492.76	3,224,422.61	
Point 6				0.00	5,105.30	3,824.17	1,304,977.92	3,224,417.00	
Point 7				0.00	2,455.93	3,788.69	1,302,328.45	3,224,405.10	
Point 8				0.00	2,396.13	1,138.03	1,302,245.06	3,221,755.19	
THOMSEN 2N-31HZ_	0.00	0.00	0.00	0.00	0.00	1,299,839.00	3,220,638.58	40.153757	-104.710647
- actual wellpath hits target center									
- Polygon									
Point 1				0.00	7,630.26	-600.26	1,307,463.29	3,219,970.45	
Point 2				0.00	8,949.95	-591.20	1,308,782.96	3,219,967.76	
Point 3				0.00	9,809.62	-585.31	1,309,642.61	3,219,966.00	
Point 4				0.00	9,808.67	334.74	1,309,649.85	3,220,885.98	
Point 5				0.00	7,628.01	319.79	1,307,469.23	3,220,890.45	
Point 6				0.00	6,337.36	308.27	1,306,178.59	3,220,890.42	
Point 7				0.00	5,024.56	296.56	1,304,865.79	3,220,890.39	
Point 8				0.00	2,376.73	272.93	1,302,217.96	3,220,890.33	
Point 9				0.00	-238.97	251.76	1,299,602.29	3,220,892.45	
Point 10				0.00	-1,086.57	244.93	1,298,754.70	3,220,893.16	
Point 11				0.00	-1,094.60	-675.21	1,298,738.48	3,219,973.17	
Point 12				0.00	-251.29	-668.40	1,299,581.78	3,219,972.47	
Point 13				0.00	2,356.03	-647.32	1,302,189.07	3,219,970.34	
Point 14				0.00	5,003.70	-623.70	1,304,836.74	3,219,970.39	
THOMSEN 6-7HZ_SE	0.00	0.00	0.00	0.00	0.00	1,299,839.00	3,220,638.58	40.153757	-104.710647
- actual wellpath hits target center									
- Polygon									
Point 1				0.00	-2,861.17	-1,471.43	1,296,964.96	3,219,192.74	
Point 2				0.00	-261.92	-1,462.21	1,299,564.08	3,219,178.82	
Point 3				0.00	2,337.91	-1,452.89	1,302,163.78	3,219,165.00	
Point 4				0.00	2,396.19	1,138.12	1,302,245.12	3,221,755.28	
Point 5				0.00	2,455.95	3,788.77	1,302,328.47	3,224,405.18	
Point 6				0.00	-191.92	3,764.35	1,299,680.60	3,224,404.33	
Point 7				0.00	-2,840.33	3,739.98	1,297,032.19	3,224,403.54	
Point 8				0.00	-2,850.81	1,094.07	1,296,998.16	3,221,757.94	
THOMSEN 2N-31HZ_	0.00	0.00	0.00	0.00	0.00	1,299,839.00	3,220,638.58	40.153757	-104.710647
- actual wellpath hits target center									
- Point									
THOMSEN 2N-31HZ_	0.00	0.00	7,268.00	-960.00	189.00	1,298,880.76	3,220,836.11	40.151122	-104.709971
- actual wellpath misses target center by 249.79usft at 7855.99usft MD (7262.60 TVD, -934.62 N, -59.44 E)									
- Point									
THOMSEN 2N-31HZ_	0.00	0.00	7,268.00	8,778.47	203.99	1,308,618.56	3,220,764.41	40.177854	-104.709917
- actual wellpath misses target center by 19.53usft at 17574.00usft MD (7255.13 TVD, 8777.83 N, 189.32 E)									
- Point									



**Design Report for Thomsen 2N-31HZ - Actual Surveys**

**Directional Difficulty Index**

Average Dogleg over Survey:	1.63 °/100usft	Maximum Dogleg over Survey:	19.61 °/100usft at 7,387.00 usft
Net Tortosity applicable to Plans:	0.86 °/100usft	Directional Difficulty Index:	6.913

**Audit Info**

## North Reference Sheet for Sec. 7-T2N-R65W - Thomsen 2N-31HZ - Plan B

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

Vertical Depths are relative to RKB = 25' @ 4973.00usft (H&P 308). Northing and Easting are relative to Thomsen 2N-31HZ

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: 0.99995827

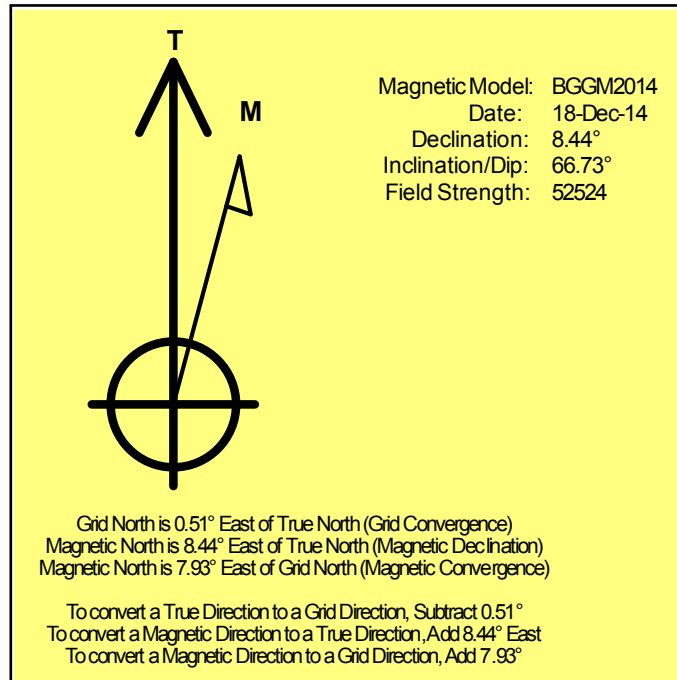
Grid Coordinates of Well: 1,299,838.99 usft N, 3,220,638.58 usft E

Geographical Coordinates of Well: 40° 09' 13.53" N, 104° 42' 38.33" W

Grid Convergence at Surface is: 0.51°

Based upon Minimum Curvature type calculations, at a Measured Depth of 17,574.00usft  
the Bottom Hole Displacement is 8,779.87usft in the Direction of 1.24° (True).

Magnetic Convergence at surface is: -7.93° (18 December 2014, , BGGM2014)



# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 7-T2N-R65W

Thomsen 2N-31HZ

API: 05-123-40547 :: Job #: 901927441

Plan B

Design: Actual Surveys

## Sperry Drilling Services

### Geodetic Report

23 March, 2015

Well Coordinates: 1,299,838.99 N, 3,220,638.58 E (40° 09' 13.53" N, 104° 42' 38.33" W)

Ground Level: 4,948.00 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 Thomsen 2N-31HZ

RKB = 25' @ 4973.00usft (H&P 308)

N

True

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

## Design Report for Thomsen 2N-31HZ - 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	40.153757	-104.710647	1,299,838.99	3,220,638.58
101.00	0.40	324.80	101.00	0.29	-0.20	40.153758	-104.710648	1,299,839.28	3,220,638.38
180.00	0.40	319.70	180.00	0.72	-0.54	40.153759	-104.710649	1,299,839.71	3,220,638.03
269.00	0.50	328.50	268.99	1.29	-0.94	40.153761	-104.710651	1,299,840.28	3,220,637.63
349.00	0.70	308.10	348.99	1.89	-1.51	40.153762	-104.710653	1,299,840.87	3,220,637.05
429.00	0.10	199.00	428.99	2.13	-1.92	40.153763	-104.710654	1,299,841.10	3,220,636.64
509.00	0.40	204.40	508.99	1.81	-2.06	40.153762	-104.710655	1,299,840.78	3,220,636.51
589.00	0.10	98.40	588.99	1.54	-2.10	40.153761	-104.710655	1,299,840.52	3,220,636.46
669.00	0.30	135.00	668.99	1.38	-1.89	40.153761	-104.710654	1,299,840.36	3,220,636.68
749.00	0.60	111.00	748.98	1.09	-1.35	40.153760	-104.710652	1,299,840.07	3,220,637.22
829.00	0.40	62.00	828.98	1.07	-0.71	40.153760	-104.710650	1,299,840.05	3,220,637.86
909.00	0.60	98.40	908.98	1.14	-0.05	40.153760	-104.710647	1,299,840.13	3,220,638.52
989.00	0.50	113.30	988.97	0.94	0.69	40.153760	-104.710645	1,299,839.94	3,220,639.26
1,069.00	0.40	78.10	1,068.97	0.86	1.28	40.153759	-104.710643	1,299,839.86	3,220,639.85
1,149.00	0.20	111.00	1,148.97	0.86	1.68	40.153759	-104.710641	1,299,839.87	3,220,640.26
1,229.00	0.40	98.40	1,228.97	0.77	2.09	40.153759	-104.710640	1,299,839.78	3,220,640.66
1,309.00	0.50	82.20	1,308.97	0.78	2.71	40.153759	-104.710638	1,299,839.80	3,220,641.29
1,324.00	0.50	82.90	1,323.97	0.80	2.84	40.153759	-104.710637	1,299,839.81	3,220,641.42
1,366.00	0.35	69.69	1,365.97	0.86	3.14	40.153759	-104.710636	1,299,839.88	3,220,641.72
1,458.00	1.65	192.60	1,457.95	-0.33	3.12	40.153756	-104.710636	1,299,838.69	3,220,641.70
1,550.00	3.37	193.02	1,549.86	-4.26	2.22	40.153745	-104.710639	1,299,834.75	3,220,640.84
1,643.00	4.90	193.91	1,642.62	-10.78	0.65	40.153727	-104.710645	1,299,828.22	3,220,639.33
1,734.00	7.33	196.85	1,733.09	-20.11	-1.97	40.153702	-104.710654	1,299,818.87	3,220,636.79
1,826.00	8.44	202.25	1,824.22	-31.97	-6.22	40.153669	-104.710670	1,299,806.97	3,220,632.64
1,917.00	10.10	193.01	1,914.04	-45.93	-10.55	40.153631	-104.710685	1,299,792.97	3,220,628.44
2,011.00	12.88	184.14	2,006.15	-64.42	-13.16	40.153580	-104.710694	1,299,774.46	3,220,625.99
2,105.00	14.63	180.66	2,097.45	-86.74	-14.06	40.153519	-104.710698	1,299,752.14	3,220,625.30
2,200.00	14.02	174.67	2,189.50	-110.19	-13.13	40.153455	-104.710694	1,299,728.69	3,220,626.44
2,294.00	15.58	179.52	2,280.39	-134.16	-11.96	40.153389	-104.710690	1,299,704.74	3,220,627.81
2,388.00	16.34	184.79	2,370.77	-159.96	-12.96	40.153318	-104.710694	1,299,678.93	3,220,627.05
2,483.00	16.80	183.80	2,461.82	-186.97	-14.99	40.153244	-104.710701	1,299,651.90	3,220,625.26
2,577.00	16.21	176.36	2,551.96	-213.63	-15.05	40.153171	-104.710701	1,299,625.25	3,220,625.43
2,671.00	15.79	170.60	2,642.32	-239.34	-12.13	40.153100	-104.710691	1,299,599.57	3,220,628.58
2,765.00	14.18	164.39	2,733.13	-263.05	-6.94	40.153035	-104.710672	1,299,575.90	3,220,633.98
2,860.00	17.07	177.36	2,824.64	-288.20	-3.17	40.152966	-104.710659	1,299,550.79	3,220,637.98
2,954.00	18.32	182.69	2,914.19	-316.74	-3.23	40.152888	-104.710659	1,299,522.25	3,220,638.17
3,048.00	19.63	188.33	3,003.09	-347.12	-6.21	40.152804	-104.710669	1,299,491.84	3,220,635.46
3,142.00	20.50	185.90	3,091.39	-379.12	-10.19	40.152716	-104.710684	1,299,459.81	3,220,631.77
3,237.00	21.58	184.86	3,180.05	-413.07	-13.38	40.152623	-104.710695	1,299,425.83	3,220,628.88
3,331.00	19.23	185.08	3,268.15	-445.72	-16.21	40.152534	-104.710705	1,299,393.16	3,220,626.34
3,426.00	20.05	180.39	3,357.63	-477.59	-17.71	40.152446	-104.710711	1,299,361.28	3,220,625.12
3,520.00	18.43	181.31	3,446.37	-508.56	-18.16	40.152361	-104.710712	1,299,330.31	3,220,624.95

## Design Report for Thomsen 2N-31HZ - 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)
3,614.00	19.67	178.66	3,535.22	-539.24	-18.13	40.152277	-104.710712	1,299,299.64	3,220,625.25
3,709.00	20.52	178.23	3,624.44	-571.86	-17.24	40.152187	-104.710709	1,299,267.02	3,220,626.43
3,803.00	20.98	183.34	3,712.35	-605.13	-17.71	40.152096	-104.710711	1,299,233.75	3,220,626.26
3,897.00	22.17	187.22	3,799.77	-639.53	-20.92	40.152002	-104.710722	1,299,199.33	3,220,623.35
3,992.00	23.49	186.78	3,887.32	-676.11	-25.41	40.151901	-104.710738	1,299,162.71	3,220,619.19
4,086.00	21.11	185.48	3,974.29	-711.57	-29.24	40.151804	-104.710752	1,299,127.22	3,220,615.68
4,181.00	23.49	186.13	4,062.18	-747.43	-32.89	40.151705	-104.710765	1,299,091.33	3,220,612.34
4,275.00	22.82	185.22	4,148.60	-784.21	-36.55	40.151604	-104.710778	1,299,054.52	3,220,609.01
4,369.00	21.39	185.40	4,235.69	-819.43	-39.82	40.151508	-104.710790	1,299,019.27	3,220,606.05
4,463.00	23.63	183.09	4,322.53	-855.31	-42.45	40.151409	-104.710799	1,298,983.37	3,220,603.74
4,558.00	21.48	182.73	4,410.25	-891.70	-44.31	40.151309	-104.710806	1,298,946.97	3,220,602.21
4,652.00	24.62	179.57	4,496.74	-928.48	-44.98	40.151208	-104.710808	1,298,910.18	3,220,601.87
4,746.00	22.89	178.33	4,582.78	-966.34	-44.30	40.151104	-104.710806	1,298,872.34	3,220,602.88
4,841.00	21.56	177.27	4,670.72	-1,002.25	-42.93	40.151006	-104.710801	1,298,836.45	3,220,604.57
4,935.00	22.41	183.68	4,757.89	-1,037.38	-43.26	40.150909	-104.710802	1,298,801.31	3,220,604.56
5,030.00	20.80	183.25	4,846.22	-1,072.30	-45.38	40.150814	-104.710810	1,298,766.38	3,220,602.75
5,124.00	21.57	182.59	4,933.86	-1,106.22	-47.11	40.150720	-104.710816	1,298,732.44	3,220,601.33
5,218.00	20.13	182.70	5,021.70	-1,139.64	-48.65	40.150629	-104.710821	1,298,699.01	3,220,600.08
5,313.00	21.59	180.99	5,110.48	-1,173.45	-49.72	40.150536	-104.710825	1,298,665.20	3,220,599.31
5,407.00	20.83	181.60	5,198.11	-1,207.45	-50.49	40.150443	-104.710828	1,298,631.19	3,220,598.85
5,502.00	19.52	181.26	5,287.28	-1,240.20	-51.31	40.150353	-104.710831	1,298,598.43	3,220,598.32
5,596.00	20.85	179.96	5,375.50	-1,272.63	-51.64	40.150264	-104.710832	1,298,566.00	3,220,598.27
5,690.00	19.26	180.69	5,463.80	-1,304.87	-51.82	40.150175	-104.710833	1,298,533.77	3,220,598.38
5,784.00	17.39	180.13	5,553.03	-1,334.42	-52.03	40.150094	-104.710833	1,298,504.22	3,220,598.43
5,879.00	18.16	176.95	5,643.50	-1,363.40	-51.28	40.150014	-104.710831	1,298,475.25	3,220,599.44
5,973.00	18.25	177.75	5,732.79	-1,392.73	-49.92	40.149934	-104.710826	1,298,445.93	3,220,601.06
6,067.00	16.74	176.10	5,822.44	-1,420.95	-48.42	40.149857	-104.710820	1,298,417.73	3,220,602.81
6,162.00	15.02	174.31	5,913.81	-1,446.85	-46.27	40.149785	-104.710813	1,298,391.85	3,220,605.19
6,256.00	12.59	176.26	6,005.09	-1,469.20	-44.39	40.149724	-104.710806	1,298,369.52	3,220,607.27
6,351.00	10.20	184.28	6,098.22	-1,487.92	-44.35	40.149673	-104.710806	1,298,350.80	3,220,607.48
6,445.00	9.29	183.38	6,190.86	-1,503.79	-45.42	40.149629	-104.710810	1,298,334.92	3,220,606.55
6,539.00	5.85	185.58	6,284.03	-1,516.14	-46.33	40.149595	-104.710813	1,298,322.56	3,220,605.75
6,633.00	3.98	186.53	6,377.68	-1,524.15	-47.17	40.149573	-104.710816	1,298,314.55	3,220,604.99
6,728.00	2.94	191.52	6,472.50	-1,529.81	-48.03	40.149558	-104.710819	1,298,308.88	3,220,604.17
6,822.00	0.26	93.29	6,566.46	-1,532.19	-48.30	40.149551	-104.710820	1,298,306.50	3,220,603.93
6,916.00	2.03	350.07	6,660.44	-1,530.56	-48.37	40.149556	-104.710820	1,298,308.13	3,220,603.84
6,963.00	6.52	0.16	6,707.30	-1,527.07	-48.51	40.149565	-104.710821	1,298,311.62	3,220,603.67
7,011.00	15.63	4.85	6,754.36	-1,517.88	-47.95	40.149590	-104.710819	1,298,320.81	3,220,604.14
7,058.00	23.99	2.97	6,798.54	-1,502.00	-46.92	40.149634	-104.710815	1,298,336.70	3,220,605.04
7,105.00	28.13	359.65	6,840.75	-1,481.37	-46.49	40.149691	-104.710814	1,298,357.33	3,220,605.28
7,152.00	27.80	358.95	6,882.26	-1,459.33	-46.76	40.149751	-104.710815	1,298,379.36	3,220,604.81
7,199.00	27.40	358.34	6,923.92	-1,437.56	-47.27	40.149811	-104.710816	1,298,401.12	3,220,604.11

## Design Report for Thomsen 2N-31HZ - 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)
7,246.00	26.78	359.81	6,965.76	-1,416.17	-47.62	40.149870	-104.710818	1,298,422.52	3,220,603.57
7,293.00	27.58	359.72	7,007.57	-1,394.70	-47.71	40.149929	-104.710818	1,298,443.98	3,220,603.29
7,340.00	28.37	0.40	7,049.08	-1,372.65	-47.69	40.149989	-104.710818	1,298,466.03	3,220,603.12
7,387.00	36.00	350.62	7,088.85	-1,347.80	-49.86	40.150057	-104.710826	1,298,490.86	3,220,600.72
7,434.00	44.24	353.61	7,124.77	-1,317.83	-53.95	40.150140	-104.710840	1,298,520.79	3,220,596.37
7,482.00	50.66	354.44	7,157.21	-1,282.68	-57.61	40.150236	-104.710853	1,298,555.91	3,220,592.39
7,529.00	55.82	356.17	7,185.33	-1,245.16	-60.67	40.150339	-104.710864	1,298,593.39	3,220,588.99
7,576.00	60.58	356.43	7,210.09	-1,205.31	-63.25	40.150448	-104.710874	1,298,633.22	3,220,586.07
7,623.00	66.26	359.10	7,231.11	-1,163.33	-64.86	40.150564	-104.710879	1,298,675.18	3,220,584.08
7,671.00	75.27	358.93	7,246.91	-1,118.06	-65.64	40.150688	-104.710882	1,298,720.43	3,220,582.89
7,718.00	82.14	359.10	7,256.11	-1,072.01	-66.43	40.150814	-104.710885	1,298,766.48	3,220,581.69
7,765.00	86.02	1.03	7,260.96	-1,025.27	-66.38	40.150943	-104.710885	1,298,813.21	3,220,581.33
7,818.00	90.12	5.72	7,262.74	-972.42	-63.26	40.151088	-104.710874	1,298,866.09	3,220,583.98
7,913.00	90.62	5.96	7,262.13	-877.91	-53.59	40.151347	-104.710839	1,298,960.67	3,220,592.81
8,007.00	89.48	5.06	7,262.05	-784.35	-44.57	40.151604	-104.710807	1,299,054.31	3,220,601.00
8,101.00	90.40	3.69	7,262.14	-690.63	-37.40	40.151861	-104.710781	1,299,148.09	3,220,607.33
8,195.00	91.02	2.36	7,260.98	-596.77	-32.44	40.152119	-104.710763	1,299,241.98	3,220,611.46
8,290.00	89.26	1.09	7,260.75	-501.82	-29.58	40.152380	-104.710753	1,299,336.95	3,220,613.47
8,385.00	89.72	1.31	7,261.59	-406.84	-27.59	40.152640	-104.710746	1,299,431.94	3,220,614.62
8,479.00	89.97	1.03	7,261.85	-312.86	-25.67	40.152898	-104.710739	1,299,525.93	3,220,615.70
8,573.00	90.00	1.34	7,261.87	-218.88	-23.72	40.153156	-104.710732	1,299,619.92	3,220,616.81
8,667.00	90.62	1.31	7,261.36	-124.91	-21.55	40.153414	-104.710724	1,299,713.90	3,220,618.14
8,762.00	91.14	1.42	7,259.90	-29.95	-19.29	40.153675	-104.710716	1,299,808.87	3,220,619.56
8,856.00	90.06	1.12	7,258.92	64.02	-17.21	40.153933	-104.710709	1,299,902.86	3,220,620.81
8,950.00	90.52	0.96	7,258.44	158.00	-15.50	40.154191	-104.710703	1,299,996.85	3,220,621.68
9,045.00	91.20	1.23	7,257.02	252.98	-13.68	40.154451	-104.710696	1,300,091.83	3,220,622.65
9,139.00	89.63	1.34	7,256.34	346.95	-11.58	40.154709	-104.710689	1,300,185.81	3,220,623.92
9,233.00	88.55	1.65	7,257.83	440.90	-9.12	40.154967	-104.710680	1,300,279.78	3,220,625.53
9,328.00	88.98	1.71	7,259.88	535.84	-6.34	40.155228	-104.710670	1,300,374.73	3,220,627.47
9,422.00	89.60	1.73	7,261.04	629.79	-3.52	40.155486	-104.710660	1,300,468.70	3,220,629.46
9,517.00	90.28	2.24	7,261.14	724.73	-0.23	40.155746	-104.710648	1,300,563.66	3,220,631.90
9,611.00	88.71	1.19	7,261.97	818.68	2.59	40.156004	-104.710638	1,300,657.63	3,220,633.88
9,706.00	88.64	1.75	7,264.17	913.62	5.02	40.156265	-104.710629	1,300,752.59	3,220,635.47
9,800.00	88.74	1.81	7,266.32	1,007.55	7.94	40.156523	-104.710619	1,300,846.53	3,220,637.55
9,894.00	89.14	1.56	7,268.06	1,101.50	10.70	40.156781	-104.710609	1,300,940.49	3,220,639.48
9,989.00	89.23	1.77	7,269.41	1,196.45	13.46	40.157041	-104.710599	1,301,035.46	3,220,641.39
10,083.00	88.95	2.46	7,270.90	1,290.37	16.93	40.157299	-104.710587	1,301,129.41	3,220,644.03
10,177.00	89.04	2.12	7,272.55	1,384.28	20.69	40.157557	-104.710573	1,301,223.34	3,220,646.95
10,271.00	91.29	3.15	7,272.28	1,478.17	25.01	40.157815	-104.710558	1,301,317.27	3,220,650.43
10,366.00	91.36	2.77	7,270.08	1,573.02	29.91	40.158075	-104.710540	1,301,412.15	3,220,654.49
10,460.00	91.51	3.00	7,267.73	1,666.87	34.64	40.158333	-104.710523	1,301,506.04	3,220,658.38
10,554.00	91.42	2.95	7,265.32	1,760.71	39.52	40.158590	-104.710506	1,301,599.92	3,220,662.43

## Design Report for Thomsen 2N-31HZ - 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)
10,646.00	90.65	1.98	7,263.66	1,852.61	43.48	40.158843	-104.710492	1,301,691.84	3,220,665.56
10,737.00	90.46	2.01	7,262.78	1,943.55	46.64	40.159092	-104.710480	1,301,782.80	3,220,667.92
10,829.00	90.96	2.00	7,261.64	2,035.49	49.86	40.159345	-104.710469	1,301,874.76	3,220,670.32
10,921.00	90.93	2.20	7,260.12	2,127.41	53.23	40.159597	-104.710457	1,301,966.71	3,220,672.87
11,012.00	90.80	2.09	7,258.75	2,218.34	56.64	40.159846	-104.710445	1,302,057.66	3,220,675.47
11,103.00	90.77	2.09	7,257.50	2,309.27	59.96	40.160096	-104.710433	1,302,148.61	3,220,677.98
11,195.00	91.14	2.08	7,255.97	2,401.20	63.30	40.160348	-104.710421	1,302,240.56	3,220,680.51
11,286.00	91.39	1.64	7,253.96	2,492.13	66.26	40.160598	-104.710410	1,302,331.51	3,220,682.65
11,378.00	91.14	1.94	7,251.93	2,584.06	69.13	40.160850	-104.710400	1,302,423.46	3,220,684.70
11,470.00	89.69	1.74	7,251.26	2,676.01	72.08	40.161103	-104.710389	1,302,515.42	3,220,686.84
11,562.00	88.55	1.41	7,252.68	2,767.96	74.61	40.161355	-104.710380	1,302,607.39	3,220,688.55
11,655.00	88.86	1.67	7,254.78	2,860.90	77.11	40.161610	-104.710371	1,302,700.35	3,220,690.22
11,748.00	89.11	1.79	7,256.42	2,953.85	79.92	40.161865	-104.710361	1,302,793.31	3,220,692.20
11,841.00	88.80	1.57	7,258.12	3,046.79	82.64	40.162121	-104.710352	1,302,886.27	3,220,694.10
11,932.00	90.00	0.81	7,259.07	3,137.76	84.53	40.162370	-104.710345	1,302,977.25	3,220,695.18
12,024.00	90.37	0.95	7,258.78	3,229.75	85.95	40.162623	-104.710340	1,303,069.25	3,220,695.77
12,117.00	90.22	1.08	7,258.30	3,322.74	87.59	40.162878	-104.710334	1,303,162.24	3,220,696.59
12,209.00	90.62	2.22	7,257.62	3,414.69	90.24	40.163130	-104.710324	1,303,254.21	3,220,698.42
12,300.00	90.80	3.86	7,256.50	3,505.56	95.07	40.163380	-104.710307	1,303,345.11	3,220,702.44
12,392.00	91.48	1.62	7,254.67	3,597.43	99.47	40.163632	-104.710291	1,303,437.01	3,220,706.02
12,486.00	90.15	0.31	7,253.33	3,691.40	101.05	40.163890	-104.710286	1,303,530.99	3,220,706.76
12,581.00	90.37	0.50	7,252.90	3,786.40	101.72	40.164151	-104.710283	1,303,625.99	3,220,706.59
12,675.00	90.68	0.74	7,252.04	3,880.39	102.74	40.164409	-104.710280	1,303,719.98	3,220,706.77
12,769.00	91.05	0.88	7,250.62	3,974.37	104.07	40.164667	-104.710275	1,303,813.96	3,220,707.26
12,864.00	91.17	1.06	7,248.78	4,069.33	105.67	40.164927	-104.710269	1,303,908.94	3,220,708.02
12,958.00	91.02	0.53	7,246.98	4,163.31	106.98	40.165185	-104.710264	1,304,002.91	3,220,708.49
13,053.00	89.69	0.58	7,246.39	4,258.30	107.90	40.165446	-104.710261	1,304,097.91	3,220,708.57
13,148.00	89.78	0.54	7,246.83	4,353.29	108.83	40.165707	-104.710258	1,304,192.90	3,220,708.65
13,242.00	89.85	0.50	7,247.13	4,447.29	109.68	40.165965	-104.710255	1,304,286.90	3,220,708.67
13,337.00	89.82	0.32	7,247.41	4,542.29	110.36	40.166226	-104.710252	1,304,381.89	3,220,708.50
13,431.00	90.03	0.73	7,247.53	4,636.28	111.22	40.166484	-104.710249	1,304,475.89	3,220,708.52
13,526.00	89.45	0.33	7,247.96	4,731.28	112.10	40.166744	-104.710246	1,304,570.88	3,220,708.56
13,620.00	89.54	0.32	7,248.79	4,825.27	112.63	40.167003	-104.710244	1,304,664.87	3,220,708.25
13,715.00	89.97	0.36	7,249.20	4,920.27	113.20	40.167263	-104.710242	1,304,759.87	3,220,707.97
13,809.00	90.25	0.33	7,249.02	5,014.27	113.76	40.167521	-104.710240	1,304,853.86	3,220,707.70
13,903.00	89.48	0.69	7,249.24	5,108.26	114.60	40.167779	-104.710237	1,304,947.86	3,220,707.70
13,998.00	89.41	0.81	7,250.16	5,203.25	115.84	40.168040	-104.710233	1,305,042.85	3,220,708.10
14,092.00	90.74	0.63	7,250.03	5,297.24	117.02	40.168298	-104.710229	1,305,136.84	3,220,708.44
14,186.00	89.26	1.94	7,250.03	5,391.21	119.13	40.168556	-104.710221	1,305,230.83	3,220,709.71
14,280.00	90.09	1.95	7,250.57	5,485.15	122.32	40.168814	-104.710210	1,305,324.79	3,220,712.07
14,374.00	90.28	1.71	7,250.26	5,579.11	125.32	40.169072	-104.710199	1,305,418.76	3,220,714.23
14,469.00	89.48	2.06	7,250.46	5,674.05	128.45	40.169332	-104.710188	1,305,513.73	3,220,716.51

## Design Report for Thomsen 2N-31HZ - 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)
14,563.00	89.85	2.05	7,251.01	5,767.99	131.82	40.169590	-104.710176	1,305,607.69	3,220,719.05
14,658.00	88.34	2.83	7,252.51	5,862.89	135.86	40.169851	-104.710161	1,305,702.61	3,220,722.25
14,753.00	88.49	3.07	7,255.14	5,957.73	140.75	40.170111	-104.710144	1,305,797.49	3,220,726.29
14,848.00	90.15	1.99	7,256.27	6,052.62	144.94	40.170372	-104.710129	1,305,892.41	3,220,729.64
14,943.00	90.00	1.85	7,256.14	6,147.57	148.13	40.170632	-104.710117	1,305,987.38	3,220,731.97
15,037.00	90.00	1.99	7,256.14	6,241.52	151.28	40.170890	-104.710106	1,306,081.35	3,220,734.29
15,132.00	90.15	2.48	7,256.02	6,336.44	154.98	40.171151	-104.710093	1,306,176.30	3,220,737.15
15,226.00	90.06	2.03	7,255.85	6,430.37	158.68	40.171409	-104.710079	1,306,270.25	3,220,740.01
15,321.00	90.71	2.31	7,255.21	6,525.30	162.28	40.171669	-104.710067	1,306,365.21	3,220,742.76
15,415.00	90.83	2.81	7,253.95	6,619.20	166.47	40.171927	-104.710052	1,306,459.13	3,220,746.12
15,510.00	90.25	0.11	7,253.05	6,714.15	168.89	40.172188	-104.710043	1,306,554.10	3,220,747.70
15,604.00	89.75	0.23	7,253.05	6,808.15	169.17	40.172446	-104.710042	1,306,648.10	3,220,747.14
15,698.00	89.54	0.06	7,253.63	6,902.15	169.41	40.172704	-104.710041	1,306,742.09	3,220,746.54
15,793.00	89.45	0.05	7,254.47	6,997.15	169.50	40.172964	-104.710041	1,306,837.08	3,220,745.79
15,887.00	89.32	359.86	7,255.48	7,091.14	169.43	40.173222	-104.710041	1,306,931.06	3,220,744.88
15,982.00	90.43	1.14	7,255.69	7,186.13	170.26	40.173483	-104.710038	1,307,026.06	3,220,744.86
16,076.00	90.80	0.71	7,254.68	7,280.12	171.77	40.173741	-104.710033	1,307,120.05	3,220,745.54
16,171.00	91.20	0.59	7,253.02	7,375.09	172.85	40.174002	-104.710029	1,307,215.03	3,220,745.77
16,266.00	91.42	0.13	7,250.85	7,470.07	173.45	40.174263	-104.710027	1,307,310.00	3,220,745.52
16,360.00	91.76	0.12	7,248.24	7,564.03	173.65	40.174520	-104.710026	1,307,403.95	3,220,744.89
16,454.00	89.88	0.79	7,246.89	7,658.01	174.40	40.174778	-104.710023	1,307,497.94	3,220,744.80
16,549.00	90.55	0.64	7,246.54	7,753.01	175.59	40.175039	-104.710019	1,307,592.93	3,220,745.14
16,643.00	89.17	1.43	7,246.77	7,846.99	177.28	40.175297	-104.710013	1,307,686.92	3,220,746.00
16,737.00	89.72	1.29	7,247.68	7,940.96	179.51	40.175555	-104.710005	1,307,780.90	3,220,747.40
16,832.00	89.85	1.52	7,248.03	8,035.93	181.84	40.175816	-104.709997	1,307,875.88	3,220,748.88
16,926.00	89.51	0.68	7,248.56	8,129.91	183.65	40.176074	-104.709990	1,307,969.87	3,220,749.85
17,021.00	89.35	0.59	7,249.50	8,224.90	184.70	40.176335	-104.709986	1,308,064.86	3,220,750.06
17,115.00	89.41	1.19	7,250.52	8,318.88	186.16	40.176593	-104.709981	1,308,158.85	3,220,750.68
17,210.00	89.35	0.59	7,251.55	8,413.86	187.64	40.176853	-104.709976	1,308,253.84	3,220,751.31
17,304.00	89.41	0.70	7,252.57	8,507.85	188.69	40.177111	-104.709972	1,308,347.83	3,220,751.53
17,398.00	89.69	0.29	7,253.31	8,601.84	189.51	40.177369	-104.709969	1,308,441.82	3,220,751.51
17,492.00	89.38	359.72	7,254.07	8,695.84	189.52	40.177627	-104.709969	1,308,535.81	3,220,750.68
17,526.00	89.23	359.90	7,254.48	8,729.84	189.40	40.177721	-104.709969	1,308,569.80	3,220,750.26
17,574.00	89.23	359.90	7,255.13	8,777.83	189.32	40.177852	-104.709970	1,308,617.80	3,220,749.75



## Design Report for Thomsen 2N-31HZ - Actual Surveys

### Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
101.00	101.00	0.29	-0.20	First CES Survey
1,324.00	1,323.97	0.80	2.84	Last CES Survey
1,366.00	1,365.97	0.86	3.14	First Sperry MWD Survey
17,526.00	7,254.48	8,729.84	189.40	Final MWD Survey @ 17526.00' MD :: 7254.48' TVD
17,574.00	7,255.13	8,777.83	189.32	Straight Line Projection to Bit @ 17574.00' MD :: 7255.13' TVD

### Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
User	No Target (Freehand)	1.42	Slot	0.00	0.00	0.00

### Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
101.00	1,324.00	Surface Surveys	MWD
1,366.00	7,765.00	MWD Vertical/Build Surveys	MWD+IFR1+SC
7,818.00	17,574.00	MWD Lateral Surveys	MWD+IFR1+SC

### Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,358.00	1,357.97	9 5/8"	9-5/8	12-1/4
7,812.00		7" @ 7812' MD	7	8-3/4

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Design Report for Thomsen 2N-31HZ - Actual Surveys

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***Design Targets***

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

Average Dogleg over Survey:	1.63 °/100usft	Maximum Dogleg over Survey:	19.61 °/100usft at 7,387.00 usft
Net Tortosity applicable to Plans:	0.86 °/100usft	Directional Difficulty Index:	6.913

**Audit Info**

**North Reference Sheet for Sec. 7-T2N-R65W - Thomsen 2N-31HZ - Plan B**

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

Vertical Depths are relative to RKB = 25' @ 4973.00usft (H&P 308). Northing and Easting are relative to Thomsen 2N-31HZ

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: 0.99995827

Grid Coordinates of Well: 1,299,838.99 usft N, 3,220,638.58 usft E

Geographical Coordinates of Well: 40° 09' 13.53" N, 104° 42' 38.33" W

Grid Convergence at Surface is: 0.51°

Based upon Minimum Curvature type calculations, at a Measured Depth of 17,574.00usft

the Bottom Hole Displacement is 8,779.87usft in the Direction of 1.24° (True).

Magnetic Convergence at surface is: -7.93° (18 December 2014, , BGGM2014)

