

# SPERRY-SUN DRILLING SERVICES

## CERTIFIED SURVEY WORK SHEET

Blank

<b>OPERATOR:</b>	Anadarko Petroleum Corp.
<b>WELL:</b>	Thomsen 5N-31HZ
<b>FIELD:</b>	DJ Basin
<b>RIG:</b>	H&P 308
<b>LEGALS:</b>	Sec. 7-T2N-R65W
<b>COUNTY:</b>	Weld
<b>STATE:</b>	Colorado
<b>CAL. METHOD:</b>	True N
<b>MAG. DECL. APPLIED:</b>	8.44
<b>VERTICAL SEC. DIR. :</b>	3.700

<b>SSDS Job Number :</b>	901929401
<b>Start Date of Job :</b>	1/8/2015
<b>End Date of Job :</b>	1/19/2015
<b>Directional Driller's:</b>	Jesse Kysar
	Brandon Watson
<b>Other SSDS DD's :</b>	
<b>SSDS MWD Engineers :</b>	James Ramsey
	Adam Sampson



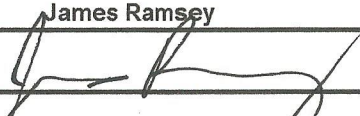
ESS Survey  
First Survey Depth  
Last Survey Depth

KOP Depth/Sidetrack MD

First Survey Depth  
Last Survey Depth  
Bit Extrapolation to TD

Main Hole =====>	1st Side Track =====>	2nd Side Track =====>	3rd Side Track =====>	4th Side Track =====>
Tie On	Tie On	Tie On	Tie On	Tie On
82 Gyro				
1050				
6785 KOP	KOP-ST1	KOP-ST2	KOP-ST3	KOP-ST4
1458 MWD	MWD	MWD	MWD	MWD
16845 MWD	MWD	MWD	MWD	MWD
16893 T.D.	T.D.	T.D.	T.D.	T.D.

The following Sperry Sun Drilling Services personnel listed below, do certify the above survey information to be accurate :

Print Name : Jesse Kysar	Print Name : Adam Sampson	Print Name :
Sign Name : 	Sign Name :	Sign Name :
Print Name : Brandon Watson	Print Name : James Ramsey	Print Name :
Sign Name : 	Sign Name : 	Sign Name :

Examples of Survey Types:

TieOn Tie On to Surface Casing (Assumed Vertical), Tie On to existing MWD Survey (prior drilled hole)

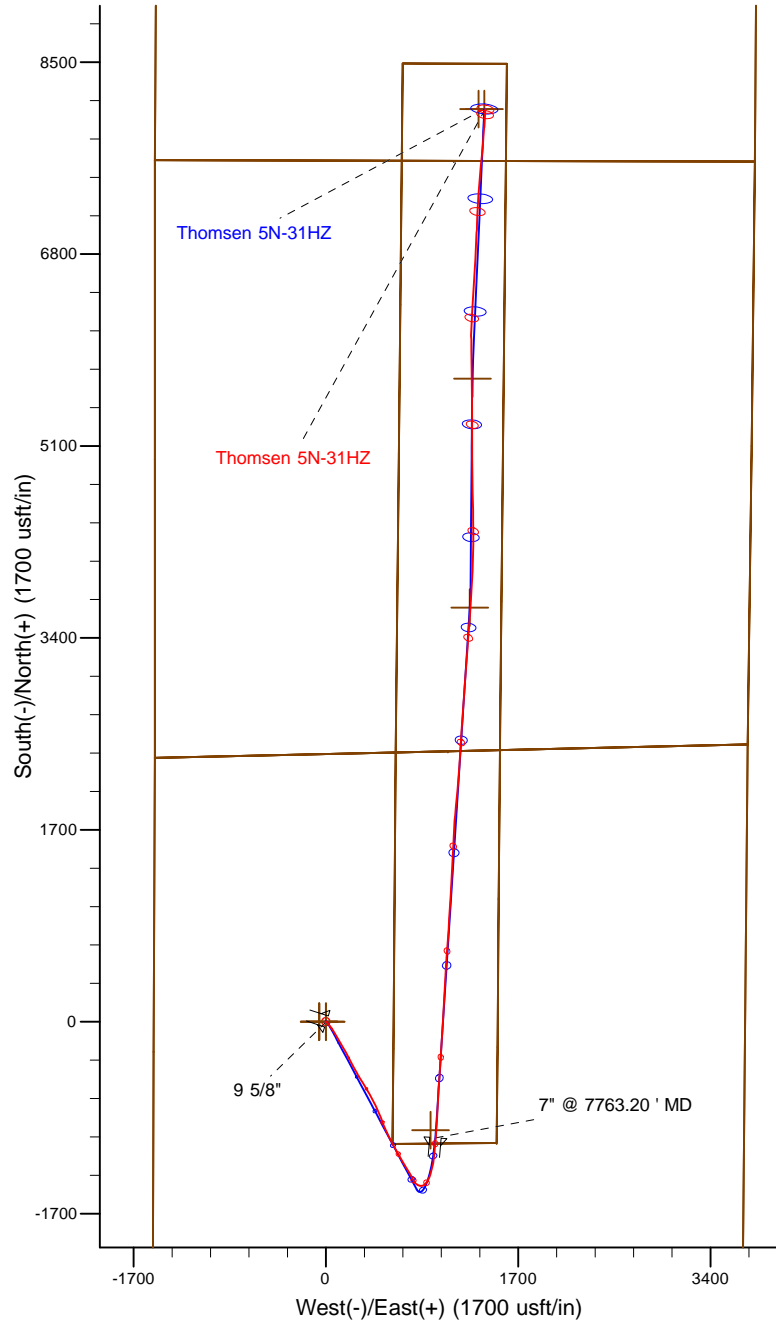
MWD Sperry Sun Drilling Services (SSDS) Measurement While Drilling (MWD) Survey's

ESS Sperry Sun Drilling Services (SSDS) Electronic Survey System (ESS) Survey's

Gyro Gyro Survey's ; Provided by third party vendor, or by Sperry Sun Drilling Services (SSDS)

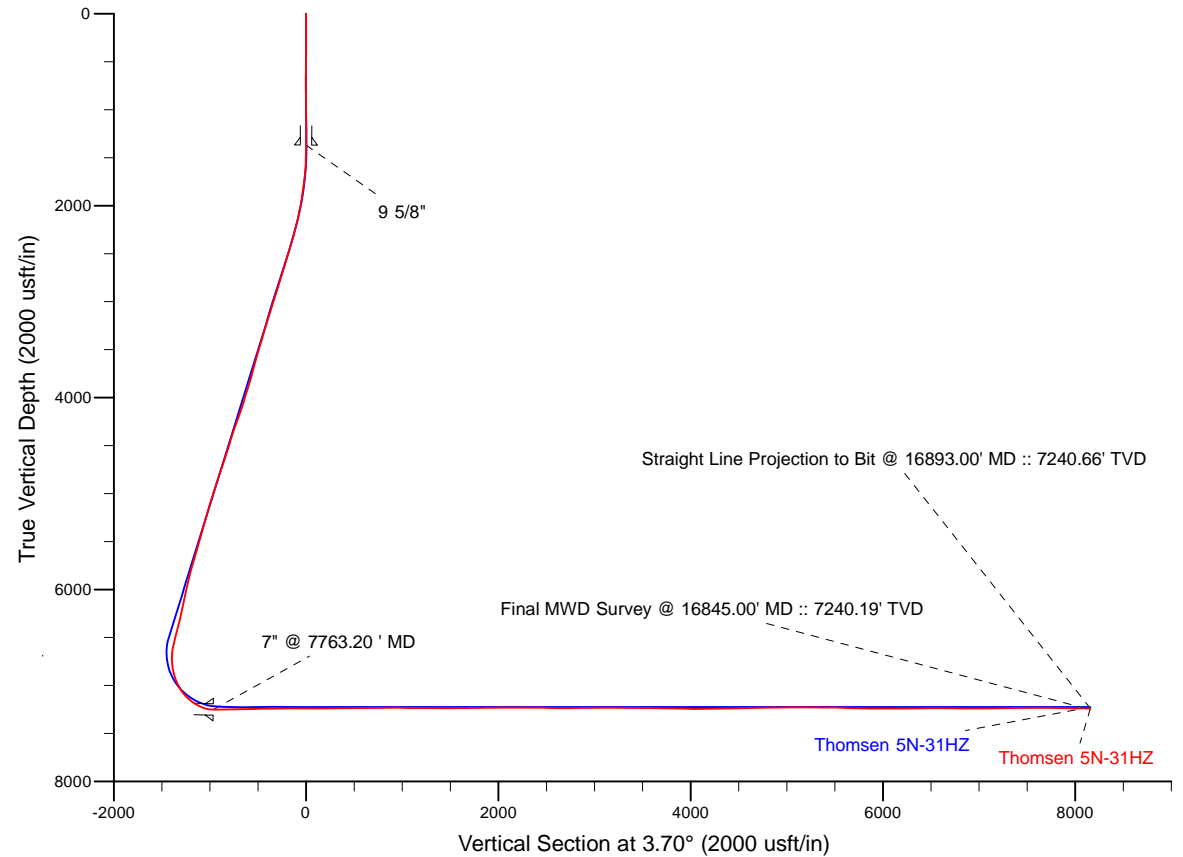
SS Single Shot (SS) Survey's ; Provided by Sperry Sun Drilling Services (SSDS) or third party vendor.

Project: Weld County, CO (NAD 83)  
 Site: Sec. 7-T2N-R65W  
 Well: Thomsen 5N-31HZ  
 Wellbore: Plan A  
 Design: Actual Surveys



LEGEND

- ◆ Thomsen 5N-31HZ, Plan A, Rev B0 V0
- Actual Surveys



7" Casing: ~1822.18' FSL, ~2494.78' FWL  
 Lat/Long: 40.150933 N, -104.706963 E  
 State Planes - CO Northern: 1,298,819.45' N, 3,221,677.62' E  
 Location: Sec. 7-T2N-R65W

BHL: ~459.20' FSL, ~2385.57' FEL  
 Lat/Long: 40.175949 N, -104.705388 E  
 State Planes - CO Northern: 1,307,935.93' N, 3,222,036.23' E  
 Location: Sec. 31-T3N-R65W

WELL DETAILS: Thomsen 5N-31HZ	
Ground Level: 4950.00	
RKB = 25' @ 4975.00usft (H&P 308)	
Design: Actual Surveys (Thomsen 5N-31HZ/Plan A)	
Created By: Katie Benner	Date: 1/27/2015
Reviewed: _____	Date: _____

# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 7-T2N-R65W

Thomsen 5N-31HZ

API: 05-123-40548 :: Job #: 901929401

Plan A

Design: Actual Surveys

## Sperry Drilling Services

### Standard Report

27 January, 2015

Surface UWI : API: 05-123-40548 :: Job #: 901929401

Well Coordinates: 1,299,839.53 N, 3,220,698.68 E (40° 09' 13.53" N, 104° 42' 37.56" W)

Ground Level: 4,950.00 usft

Local Coordinate Origin:

Centered on Well Thomsen 5N-31HZ

Viewing Datum:

RKB = 25' @ 4975.00usft (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: 70

**HALLIBURTON**

**Design Report for Thomsen 5N-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
<b>THOMSEN 5N-31HZ_SHL - THOMSEN 5N-31HZ_LD</b>							
2.01	0.01	305.90	2.01	0.00	0.00	0.00	0.61
<b>THOMSEN 6-7HZ_SEC 6</b>							
2.01	0.01	305.90	2.01	0.00	0.00	0.00	0.00
<b>THOMSEN 6-7HZ_SEC 7</b>							
2.21	0.01	305.90	2.21	0.00	0.00	0.00	0.63
<b>THOMSEN 6-7HZ_SEC 31</b>							
82.00	0.50	305.90	82.00	0.21	-0.29	0.19	0.61
161.00	0.60	278.40	161.00	0.47	-0.98	0.41	0.35
250.00	0.40	287.10	249.99	0.63	-1.74	0.52	0.24
330.00	0.40	272.60	329.99	0.73	-2.28	0.58	0.13
410.00	0.40	258.80	409.99	0.68	-2.83	0.50	0.12
490.00	0.10	215.20	489.99	0.57	-3.15	0.37	0.42
570.00	0.30	147.90	569.99	0.34	-3.08	0.14	0.35
650.00	0.30	177.40	649.99	-0.05	-2.96	-0.24	0.19
730.00	0.50	172.90	729.98	-0.60	-2.90	-0.79	0.25
810.00	0.30	82.00	809.98	-0.92	-2.65	-1.09	0.73
890.00	0.70	52.10	889.98	-0.59	-2.06	-0.72	0.58
970.00	0.80	57.90	969.97	0.01	-1.20	-0.07	0.16
1,050.00	0.80	44.60	1,049.96	0.70	-0.34	0.68	0.23
1,368.80	1.42	107.88	1,368.71	1.07	4.99	1.39	0.40
<b>9 5/8"</b>							
1,458.00	1.73	114.52	1,457.88	0.17	7.27	0.64	0.40
1,550.00	3.57	144.63	1,549.78	-2.74	10.19	-2.08	2.44
1,643.00	6.16	149.98	1,642.44	-9.42	14.36	-8.48	2.82
1,734.00	7.85	146.02	1,732.76	-18.80	20.28	-17.46	1.93
1,826.00	10.62	144.44	1,823.56	-30.91	28.72	-28.99	3.02
1,917.00	11.42	141.55	1,912.88	-44.79	39.20	-42.17	1.07
2,011.00	13.08	142.34	2,004.73	-60.50	51.49	-57.05	1.77
2,105.00	15.25	146.86	2,095.87	-79.27	64.75	-74.93	2.59
2,200.00	16.64	150.71	2,187.22	-101.60	78.23	-96.34	1.84
2,294.00	18.70	151.05	2,276.78	-126.53	92.11	-120.32	2.19
2,388.00	19.48	150.21	2,365.61	-153.32	107.19	-146.08	0.88
2,483.00	19.39	149.17	2,455.20	-180.60	123.14	-172.28	0.38
2,577.00	20.67	150.58	2,543.51	-208.46	139.29	-199.03	1.46
2,671.00	18.80	148.98	2,631.98	-235.89	155.25	-225.38	2.07
2,765.00	19.56	149.51	2,720.77	-262.43	171.04	-250.84	0.83
2,860.00	20.81	154.60	2,809.94	-291.38	186.35	-278.75	2.27
2,954.00	20.19	153.46	2,897.98	-320.98	200.76	-307.35	0.78
3,048.00	20.46	151.73	2,986.13	-349.96	215.79	-335.30	0.70
3,142.00	19.99	150.30	3,074.34	-378.38	231.53	-362.65	0.73
3,237.00	19.19	148.51	3,163.84	-405.80	247.73	-388.97	1.05
3,331.00	19.86	151.80	3,252.43	-433.05	263.35	-415.15	1.37
3,426.00	22.16	152.43	3,341.11	-463.16	279.27	-444.17	2.43
3,520.00	20.38	149.60	3,428.71	-492.99	295.75	-472.88	2.19
3,614.00	17.88	147.88	3,517.51	-519.34	311.71	-498.14	2.73
3,709.00	18.02	148.54	3,607.89	-544.22	327.14	-521.98	0.26
3,803.00	18.67	147.34	3,697.11	-569.29	342.84	-545.98	0.80
3,897.00	18.63	150.45	3,786.18	-595.02	358.37	-570.65	1.06

**Design Report for Thomsen 5N-31HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
3,992.00	19.60	150.12	3,875.94	-622.04	373.79	-596.62	1.03
4,086.00	21.34	150.98	3,964.00	-650.67	389.94	-624.15	1.88
4,181.00	19.90	148.78	4,052.91	-679.61	406.71	-651.95	1.72
4,275.00	21.72	151.52	4,140.78	-708.58	423.30	-679.79	2.20
4,369.00	23.12	157.90	4,227.68	-740.98	438.54	-711.13	2.98
4,463.00	21.02	155.66	4,314.79	-773.44	452.43	-742.63	2.41
4,558.00	19.19	154.54	4,404.00	-803.06	466.17	-771.31	1.97
4,652.00	19.17	159.10	4,492.79	-831.43	478.31	-798.83	1.59
4,746.00	20.37	160.34	4,581.25	-861.26	489.32	-827.88	1.35
4,841.00	18.96	158.75	4,670.70	-891.21	500.48	-857.06	1.59
4,935.00	21.02	157.27	4,759.04	-921.00	512.53	-886.00	2.26
5,030.00	20.42	156.88	4,847.89	-951.95	525.62	-916.05	0.65
5,124.00	18.64	153.72	4,936.48	-980.51	538.71	-943.70	2.20
5,218.00	20.73	155.67	5,024.98	-1,009.14	552.22	-971.40	2.33
5,313.00	18.60	154.15	5,114.44	-1,038.10	565.75	-999.42	2.31
5,407.00	19.80	152.16	5,203.21	-1,065.67	579.73	-1,026.04	1.45
5,502.00	17.79	151.00	5,293.14	-1,092.59	594.28	-1,051.96	2.15
5,596.00	18.55	151.29	5,382.45	-1,118.27	608.42	-1,076.67	0.81
5,690.00	20.04	151.01	5,471.17	-1,145.47	623.41	-1,102.85	1.59
5,784.00	18.01	147.19	5,560.03	-1,171.77	639.09	-1,128.09	2.53
5,879.00	19.23	150.82	5,650.06	-1,197.78	654.68	-1,153.03	1.77
5,973.00	20.33	151.64	5,738.51	-1,225.66	669.99	-1,179.87	1.21
6,067.00	16.67	149.10	5,827.64	-1,251.61	684.67	-1,204.82	3.99
6,162.00	14.67	147.70	5,919.11	-1,273.47	698.10	-1,225.77	2.14
6,256.00	15.49	150.33	6,009.87	-1,294.44	710.67	-1,245.88	1.14
6,351.00	15.26	148.79	6,101.47	-1,316.16	723.43	-1,266.73	0.49
6,445.00	14.21	147.32	6,192.38	-1,336.45	736.07	-1,286.16	1.19
6,539.00	14.53	150.07	6,283.44	-1,356.38	748.18	-1,305.27	0.80
6,633.00	16.86	150.76	6,373.93	-1,378.50	760.73	-1,326.53	2.49
6,728.00	17.66	152.88	6,464.65	-1,403.34	774.02	-1,350.47	1.07
6,775.00	17.64	151.97	6,509.44	-1,415.97	780.62	-1,362.65	0.59
6,822.00	17.45	140.06	6,554.27	-1,427.67	788.49	-1,373.81	7.64
6,869.00	17.39	128.95	6,599.12	-1,437.49	798.48	-1,382.96	7.07
6,916.00	18.52	118.45	6,643.85	-1,445.46	810.51	-1,390.15	7.28
6,963.00	19.00	105.56	6,688.37	-1,451.07	824.45	-1,394.85	8.86
7,011.00	17.99	89.52	6,733.92	-1,453.11	839.40	-1,395.91	10.77
7,058.00	17.24	75.35	6,778.73	-1,451.29	853.40	-1,393.19	9.24
7,105.00	17.54	59.97	6,823.61	-1,445.98	866.28	-1,387.06	9.77
7,152.00	19.04	45.79	6,868.26	-1,437.08	877.91	-1,377.43	9.96
7,199.00	21.79	38.26	6,912.31	-1,424.88	888.82	-1,364.55	8.08
<b>Current MWD Survey @ 7199.00' MD :: 6912.55' TVD</b>							
7,246.00	23.80	31.55	6,955.64	-1,409.95	899.18	-1,348.98	6.99
7,334.00	31.32	19.47	7,033.66	-1,373.17	916.13	-1,311.19	10.61
7,382.00	37.26	15.80	7,073.31	-1,347.40	924.26	-1,284.95	13.10
7,429.00	43.39	14.50	7,109.12	-1,318.05	932.18	-1,255.15	13.16
7,476.00	48.82	13.46	7,141.70	-1,285.20	940.35	-1,221.84	11.66
7,523.00	53.83	10.46	7,171.06	-1,249.31	947.91	-1,185.54	11.76
7,571.00	59.18	7.89	7,197.54	-1,209.81	954.26	-1,145.71	12.01
7,618.00	64.74	5.69	7,219.63	-1,168.64	959.15	-1,104.30	12.53
7,665.00	71.86	4.59	7,237.00	-1,125.17	963.05	-1,060.68	15.30
7,712.00	81.00	3.58	7,248.02	-1,079.65	966.29	-1,015.04	19.56

**Design Report for Thomsen 5N-31HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
7,730.00	84.41	3.81	7,250.30	-1,061.83	967.44	-997.19	18.99
7,763.20	88.15	4.59	7,252.46	-1,028.80	969.87	-964.07	11.50
<b>7" @ 7763.20 ' MD</b>							
7,784.00	90.49	5.08	7,252.70	-1,008.07	971.62	-943.27	11.50
7,819.00	90.56	4.13	7,252.38	-973.19	974.43	-908.28	2.72
7,829.23	90.58	4.03	7,252.28	-962.98	975.16	-898.05	0.96
<b>THOMSEN 5N-31HZ_PH</b>							
7,913.00	90.77	3.25	7,251.29	-879.39	980.48	-814.29	0.96
8,007.00	91.66	2.93	7,249.30	-785.55	985.54	-720.31	1.01
8,101.00	91.14	3.35	7,247.00	-691.72	990.69	-626.35	0.71
8,196.00	90.80	3.89	7,245.39	-596.92	996.69	-531.36	0.67
8,290.00	91.30	3.54	7,243.67	-503.14	1,002.78	-437.38	0.65
8,385.00	90.62	3.90	7,242.08	-408.35	1,008.94	-342.39	0.81
8,479.00	90.80	3.32	7,240.91	-314.55	1,014.86	-248.40	0.65
8,573.00	90.83	2.90	7,239.58	-220.69	1,019.96	-154.41	0.45
8,667.00	90.59	3.62	7,238.41	-126.85	1,025.30	-60.42	0.81
8,762.00	89.69	4.36	7,238.18	-32.09	1,031.91	34.57	1.23
8,856.00	90.03	3.37	7,238.41	61.70	1,038.25	128.57	1.11
8,950.00	90.15	3.24	7,238.26	155.54	1,043.67	222.57	0.19
9,045.00	89.85	2.53	7,238.26	250.42	1,048.45	317.56	0.81
9,139.00	90.12	2.44	7,238.29	344.33	1,052.53	411.54	0.30
9,234.00	91.48	3.99	7,236.96	439.17	1,057.85	506.52	2.17
9,328.00	90.43	4.10	7,235.39	532.92	1,064.48	600.50	1.12
9,422.00	90.77	3.84	7,234.41	626.69	1,070.99	694.50	0.46
9,517.00	90.43	4.34	7,233.41	721.44	1,077.77	789.49	0.64
9,612.00	89.82	3.85	7,233.21	816.20	1,084.55	884.49	0.82
9,706.00	89.48	3.32	7,233.78	910.01	1,090.43	978.48	0.67
9,800.00	89.91	3.40	7,234.28	1,003.85	1,095.94	1,072.48	0.47
9,895.00	89.72	2.48	7,234.59	1,098.72	1,100.81	1,167.47	0.99
9,986.00	89.78	4.16	7,234.99	1,189.57	1,106.08	1,258.46	1.85
10,077.00	89.35	3.11	7,235.68	1,280.38	1,111.85	1,349.46	1.25
10,169.00	90.09	3.14	7,236.13	1,372.24	1,116.86	1,441.45	0.81
10,261.00	90.03	2.78	7,236.03	1,464.12	1,121.61	1,533.45	0.40
10,352.00	90.25	2.72	7,235.81	1,555.01	1,125.98	1,624.43	0.25
10,444.00	89.88	1.93	7,235.70	1,646.94	1,129.71	1,716.41	0.95
10,535.00	90.46	3.80	7,235.43	1,737.82	1,134.26	1,807.39	2.15
10,626.00	91.11	5.56	7,234.19	1,828.50	1,141.68	1,898.36	2.06
10,718.00	90.96	4.59	7,232.52	1,920.12	1,149.82	1,990.32	1.07
10,810.00	90.43	5.00	7,231.41	2,011.79	1,157.51	2,082.30	0.73
10,903.00	90.09	5.30	7,230.99	2,104.42	1,165.86	2,175.27	0.49
10,995.00	89.44	5.15	7,231.36	2,196.03	1,174.24	2,267.23	0.73
11,088.00	89.20	4.19	7,232.47	2,288.72	1,181.81	2,360.21	1.06
11,181.00	89.44	4.16	7,233.57	2,381.46	1,188.58	2,453.20	0.26
11,273.00	89.23	3.22	7,234.64	2,473.27	1,194.50	2,545.20	1.05
11,365.00	88.43	2.55	7,236.52	2,565.13	1,199.13	2,637.17	1.13
11,457.00	90.22	3.85	7,237.60	2,656.97	1,204.26	2,729.15	2.40
11,549.00	91.11	3.60	7,236.53	2,748.77	1,210.24	2,821.14	1.00
11,641.00	90.49	4.91	7,235.25	2,840.51	1,217.07	2,913.13	1.58
11,732.00	90.86	4.46	7,234.18	2,931.20	1,224.50	3,004.11	0.64
11,827.00	91.02	4.08	7,232.62	3,025.92	1,231.57	3,099.09	0.43
11,921.00	89.82	4.32	7,231.93	3,119.66	1,238.45	3,193.08	1.30

**Design Report for Thomsen 5N-31HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
12,015.00	89.57	3.74	7,232.43	3,213.43	1,245.06	3,287.08	0.67
12,109.00	89.48	4.04	7,233.21	3,307.21	1,251.44	3,381.07	0.33
12,204.00	88.92	3.48	7,234.54	3,401.99	1,257.67	3,476.06	0.83
12,298.00	88.95	4.78	7,236.28	3,495.73	1,264.43	3,570.04	1.38
12,392.00	88.86	4.35	7,238.08	3,589.42	1,271.91	3,664.01	0.47
12,471.22	88.70	4.17	7,239.76	3,668.40	1,277.80	3,743.21	0.30
<b>THOMSEN 5N-31HZ_T1</b>							
12,487.00	88.67	4.14	7,240.13	3,684.13	1,278.95	3,758.99	0.30
12,581.00	89.48	3.17	7,241.64	3,777.93	1,284.94	3,852.97	1.34
12,675.00	89.17	2.92	7,242.75	3,871.79	1,289.93	3,946.96	0.42
12,770.00	88.86	2.34	7,244.38	3,966.67	1,294.29	4,041.93	0.69
12,864.00	91.36	2.40	7,244.20	4,060.59	1,298.17	4,135.90	2.66
12,959.00	90.80	0.70	7,242.41	4,155.53	1,300.74	4,230.81	1.88
13,053.00	90.59	0.76	7,241.27	4,249.52	1,301.94	4,324.68	0.23
13,149.00	91.08	359.48	7,239.87	4,345.50	1,302.14	4,420.48	1.43
13,243.00	91.60	359.25	7,237.68	4,439.47	1,301.10	4,514.18	0.60
13,337.00	90.68	359.46	7,235.81	4,533.45	1,300.04	4,607.89	1.00
13,432.00	91.36	359.13	7,234.11	4,628.42	1,298.87	4,702.60	0.80
13,526.00	90.77	358.98	7,232.37	4,722.39	1,297.32	4,796.27	0.65
13,621.00	91.79	359.07	7,230.25	4,817.36	1,295.71	4,890.93	1.08
13,715.00	90.37	358.19	7,228.47	4,911.31	1,293.46	4,984.54	1.78
13,809.00	90.19	359.34	7,228.01	5,005.28	1,291.44	5,078.19	1.24
13,904.00	89.88	0.16	7,227.96	5,100.28	1,291.02	5,172.96	0.92
13,998.00	89.11	1.10	7,228.78	5,194.27	1,292.05	5,266.82	1.29
14,092.00	89.38	0.33	7,230.02	5,288.25	1,293.23	5,360.69	0.87
14,186.00	89.69	359.46	7,230.79	5,382.25	1,293.05	5,454.48	0.98
14,280.00	88.06	357.92	7,232.63	5,476.20	1,290.91	5,548.09	2.39
14,375.00	88.95	0.63	7,235.11	5,571.15	1,289.71	5,642.77	3.00
14,469.00	88.21	359.48	7,237.44	5,665.12	1,289.80	5,736.55	1.45
14,500.56	88.36	359.40	7,238.38	5,696.67	1,289.49	5,768.01	0.55
<b>THOMSEN 5N-31HZ_T2</b>							
14,564.00	88.67	359.24	7,240.03	5,760.08	1,288.74	5,831.24	0.55
14,659.00	88.92	358.80	7,242.02	5,855.04	1,287.11	5,925.90	0.53
14,753.00	90.12	359.27	7,242.81	5,949.03	1,285.53	6,019.58	1.37
14,848.00	89.94	359.37	7,242.76	6,044.02	1,284.40	6,114.31	0.22
14,943.00	91.36	1.61	7,241.68	6,139.00	1,285.21	6,209.14	2.79
15,038.00	90.92	3.51	7,239.79	6,233.88	1,289.45	6,304.10	2.05
15,132.00	91.51	3.82	7,237.80	6,327.67	1,295.46	6,398.08	0.71
15,227.00	89.97	3.64	7,236.57	6,422.46	1,301.64	6,493.07	1.63
15,321.00	89.66	2.97	7,236.88	6,516.30	1,307.06	6,587.06	0.79
15,415.00	89.91	2.68	7,237.23	6,610.18	1,311.69	6,681.05	0.41
15,510.00	89.48	3.54	7,237.74	6,705.04	1,316.85	6,776.05	1.01
15,604.00	89.60	2.89	7,238.49	6,798.89	1,322.12	6,870.04	0.70
15,698.00	89.57	2.39	7,239.17	6,892.79	1,326.45	6,964.02	0.53
15,793.00	89.82	4.15	7,239.68	6,987.63	1,331.87	7,059.01	1.87
15,888.00	89.60	1.23	7,240.16	7,082.51	1,336.33	7,153.99	3.08
15,982.00	91.42	2.81	7,239.32	7,176.44	1,339.64	7,247.93	2.56
16,077.00	91.14	3.32	7,237.20	7,271.28	1,344.72	7,342.90	0.61
16,172.00	90.99	4.58	7,235.43	7,366.04	1,351.26	7,437.88	1.34
16,266.00	91.45	4.47	7,233.43	7,459.72	1,358.67	7,531.85	0.50
16,360.00	90.12	6.04	7,232.14	7,553.32	1,367.28	7,625.81	2.19

**Design Report for Thomsen 5N-31HZ - Actual Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
16,455.00	88.46	5.35	7,233.32	7,647.84	1,376.71	7,720.74	1.89
16,549.00	88.77	4.97	7,235.59	7,741.43	1,385.16	7,814.68	0.52
16,643.00	89.01	4.31	7,237.41	7,835.10	1,392.76	7,908.65	0.75
16,738.00	89.26	4.07	7,238.85	7,929.84	1,399.70	8,003.63	0.36
16,832.00	89.35	3.48	7,239.99	8,023.62	1,405.89	8,097.63	0.63
16,845.00	89.44	3.54	7,240.13	8,036.60	1,406.69	8,110.62	0.83
<b>Final MWD Survey @ 16845.00' MD :: 7240.19' TVD</b>							
16,890.28	89.44	3.54	7,240.57	8,081.79	1,409.48	8,155.90	0.00
<b>THOMSEN 5N-31HZ_BHL</b>							
16,893.00	89.44	3.54	7,240.60	8,084.51	1,409.65	8,158.62	0.00
<b>Straight Line Projection to Bit @ 16893.00' MD :: 7240.66' TVD - THOMSEN 5N-31HZ_PBHL</b>							

**Design Annotations**

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
7,199.00	6,912.31	-1,424.88	888.82	Current MWD Survey @ 7199.00' MD :: 6912.55' TVD
16,845.00	7,240.13	8,036.60	1,406.69	Final MWD Survey @ 16845.00' MD :: 7240.19' TVD
16,893.00	7,240.60	8,084.51	1,409.65	Straight Line Projection to Bit @ 16893.00' MD :: 7240.66' TVD

**Vertical Section Information**

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (usft)	Origin +E/-W (usft)	Start TVD (usft)
User	No Target (Freehand)	3.70	Slot	0.00	0.00	0.00

**Survey tool program**

From (usft)	To (usft)	Survey/Plan	Survey Tool
82.00	1,050.00	Surface Surveys	MWD
1,458.00	7,287.00	MWD Vertical/Build Surveys	MWD+IFR1+SC
7,334.00	16,893.00	MWD Lateral Surveys	MWD+IFR1+SC

**Casing Details**

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,368.80	1,368.71	9 5/8"	9-5/8	13-1/2
7,763.20	7,252.46	7" @ 7763.20' MD	7	8-3/4

**Design Report for Thomsen 5N-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 5N-31HZ_	0.00	0.00	0.00	0.00	0.00	1,299,839.53	3,220,698.68	40.153757	-104.710432
- actual wellpath hits target center									
- Point									
THOMSEN 5N-31HZ_	0.00	0.00	0.00	0.00	0.00	1,299,839.53	3,220,698.68	40.153757	-104.710432
- actual wellpath hits target center									
- Polygon									
Point 1				0.00	7,627.01	670.41	1,307,471.89	3,221,301.12	
Point 2				0.00	8,487.61	679.05	1,308,332.50	3,221,302.10	
Point 3				0.00	8,485.98	1,599.12	1,308,339.06	3,222,222.11	
Point 4				0.00	7,624.89	1,590.47	1,307,477.96	3,222,221.13	
Point 5				0.00	6,366.34	1,577.84	1,306,219.40	3,222,219.70	
Point 6				0.00	5,054.80	1,565.13	1,304,907.86	3,222,218.67	
Point 7				0.00	3,730.67	1,551.58	1,303,583.71	3,222,216.91	
Point 8				0.00	2,406.56	1,538.18	1,302,259.59	3,222,215.30	
Point 9				0.00	1,092.67	1,527.12	1,300,945.71	3,222,215.94	
Point 10				0.00	-221.19	1,518.71	1,299,631.88	3,222,219.23	
Point 11				0.00	-1,075.04	1,508.92	1,298,778.01	3,222,217.04	
Point 12				0.00	-1,083.02	588.77	1,298,761.84	3,221,297.04	
Point 13				0.00	-233.56	595.90	1,299,611.30	3,221,296.61	
Point 14				0.00	2,385.84	617.91	1,302,230.68	3,221,295.29	
Point 15				0.00	5,033.82	644.84	1,304,878.68	3,221,298.64	
Point 16				0.00	6,356.87	657.66	1,306,201.74	3,221,299.68	
THOMSEN 6-7HZ_SE	0.00	0.00	2.00	0.00	-60.10	1,299,839.00	3,220,638.58	40.153757	-104.710647
- actual wellpath misses target center by 60.10usft at 2.01usft MD (2.01 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				2.00	7,632.35	-1,453.02	1,307,457.79	3,219,117.72	
Point 2				2.00	10,270.52	-1,436.96	1,310,095.89	3,219,110.29	
Point 3				2.00	12,908.29	-1,421.76	1,312,733.58	3,219,102.01	
Point 4				2.00	12,909.69	1,226.98	1,312,758.56	3,221,750.52	
Point 5				2.00	12,907.78	3,891.66	1,312,780.38	3,224,415.00	
Point 6				2.00	10,263.87	3,871.46	1,310,136.50	3,224,418.34	
Point 7				2.00	7,620.17	3,852.05	1,307,492.84	3,224,422.47	
Point 8				2.00	7,625.89	1,190.53	1,307,474.87	3,221,761.12	
THOMSEN 6-7HZ_SE	0.00	0.00	2.00	0.00	-60.10	1,299,839.00	3,220,638.58	40.153757	-104.710647
- actual wellpath misses target center by 60.10usft at 2.01usft MD (2.01 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				2.00	2,337.85	-1,452.93	1,302,163.72	3,219,164.95	
Point 2				2.00	4,984.95	-1,452.83	1,304,810.61	3,219,141.49	
Point 3				2.00	7,632.39	-1,453.13	1,307,457.83	3,219,117.61	
Point 4				2.00	7,625.93	1,190.41	1,307,474.91	3,221,761.00	
Point 5				2.00	7,620.09	3,852.17	1,307,492.76	3,224,422.59	
Point 6				2.00	5,105.30	3,824.17	1,304,977.93	3,224,416.98	
Point 7				2.00	2,455.93	3,788.69	1,302,328.46	3,224,405.10	
Point 8				2.00	2,396.13	1,138.03	1,302,245.06	3,221,755.18	
THOMSEN 6-7HZ_SE	0.00	0.00	2.00	0.00	-60.10	1,299,839.00	3,220,638.58	40.153757	-104.710647
- actual wellpath misses target center by 60.10usft at 2.01usft MD (2.01 TVD, 0.00 N, 0.00 E)									
- Polygon									
Point 1				2.00	-2,861.17	-1,471.43	1,296,964.96	3,219,192.75	
Point 2				2.00	-261.92	-1,462.21	1,299,564.08	3,219,178.82	
Point 3				2.00	2,337.91	-1,452.89	1,302,163.78	3,219,164.99	
Point 4				2.00	2,396.19	1,138.12	1,302,245.13	3,221,755.27	
Point 5				2.00	2,455.95	3,788.77	1,302,328.48	3,224,405.18	
Point 6				2.00	-191.92	3,764.35	1,299,680.61	3,224,404.33	
Point 7				2.00	-2,840.33	3,739.98	1,297,032.20	3,224,403.55	
Point 8				2.00	-2,850.81	1,094.07	1,296,998.16	3,221,757.94	
THOMSEN 5N-31HZ_	0.00	0.00	7,225.00	3,669.13	1,272.22	1,303,519.69	3,221,938.12	40.163829	-104.705880
- actual wellpath misses target center by 15.80usft at 12471.22usft MD (7239.76 TVD, 3668.40 N, 1277.80 E)									
- Point									
THOMSEN 5N-31HZ_	0.00	0.00	7,225.00	-960.00	924.00	1,298,887.84	3,221,631.15	40.151122	-104.707127
- actual wellpath misses target center by 58.05usft at 7828.84usft MD (7252.28 TVD, -963.38 N, 975.13 E)									
- Point									

**Design Report for Thomsen 5N-31HZ - Actual Surveys**

THOMSEN 5N-31HZ_	0.00	0.00	7,225.00	8,085.60	1,350.27	1,307,936.50	3,221,976.84	40.175952	-104.705600
- actual wellpath misses target center by 61.35usft at 16890.28usft MD (7240.57 TVD, 8081.79 N, 1409.48 E)									
- Point									
THOMSEN 5N-31HZ_	0.00	0.00	7,225.00	8,085.60	1,400.27	1,307,936.94	3,222,026.84	40.175952	-104.705421
- actual wellpath misses target center by 18.23usft at 16893.00usft MD (7240.60 TVD, 8084.51 N, 1409.65 E)									
- Point									
THOMSEN 5N-31HZ_	0.00	0.00	7,225.00	5,697.09	1,294.65	1,305,547.69	3,221,942.50	40.169395	-104.705799
- actual wellpath misses target center by 14.35usft at 14500.53usft MD (7238.38 TVD, 5696.64 N, 1289.49 E)									
- Point									

**Directional Difficulty Index**

Average Dogleg over Survey:	1.79 °/100usft	Maximum Dogleg over Survey:	19.56 °/100usft at 7,712.00 usft
Net Tortosity applicable to Plans:	0.98 °/100usft	Directional Difficulty Index:	6.900

**Audit Info**

**North Reference Sheet for Sec. 7-T2N-R65W - Thomsen 5N-31HZ - Plan A**

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' @ 4975.00usft (H&P 308). Northing and Easting are relative to Thomsen 5N-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

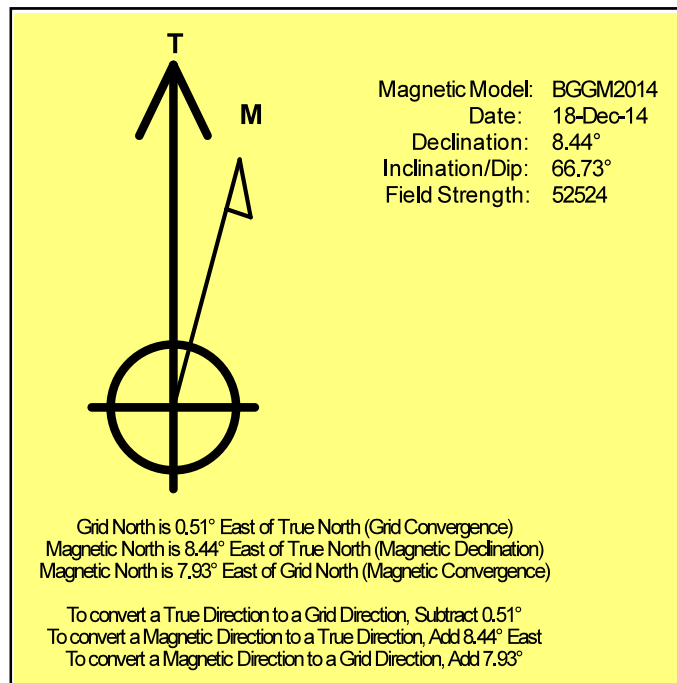
Grid Coordinates of Well: 1,299,839.53 usft N, 3,220,698.68 usft E

Geographical Coordinates of Well: 40° 09' 13.53" N, 104° 42' 37.56" W

Grid Convergence at Surface is: 0.51°

Based upon Minimum Curvature type calculations, at a Measured Depth of 16,893.00usft the Bottom Hole Displacement is 8,206.48usft in the Direction of 9.89° ( 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 5N-31HZ

API: 05-123-40548 :: Job #: 901929401

Plan A

Design: Actual Surveys

## Sperry Drilling Services

### Geodetic Report

27 January, 2015

Well Coordinates: 1,299,839.53 N, 3,220,698.68 E (40° 09' 13.53" N, 104° 42' 37.56" W)

Ground Level: 4,950.00 usft

Local Coordinate Origin:

Centered on Well Thomsen 5N-31HZ

Viewing Datum:

RKB = 25' @ 4975.00usft (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: 70

**HALLIBURTON**

**Design Report for Thomsen 5N-31HZ - Actual Surveys**

Measured			Vertical	Local Coordinates		Geographic Coordinates		UTM Coordinates	
Depth (usft)	Inclination (°)	Azimuth (°)	Depth (usft)	+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	-104.710432	1,299,839.53	3,220,698.68
2.01	0.01	305.90	2.01	0.00	0.00	40.153757	-104.710432	1,299,839.53	3,220,698.68
2.01	0.01	305.90	2.01	0.00	0.00	40.153757	-104.710432	1,299,839.53	3,220,698.68
2.21	0.01	305.90	2.21	0.00	0.00	40.153757	-104.710432	1,299,839.53	3,220,698.68
82.00	0.50	305.90	82.00	0.21	-0.29	40.153758	-104.710433	1,299,839.74	3,220,698.38
161.00	0.60	278.40	161.00	0.47	-0.98	40.153758	-104.710436	1,299,840.00	3,220,697.69
250.00	0.40	287.10	249.99	0.63	-1.74	40.153759	-104.710438	1,299,840.15	3,220,696.93
330.00	0.40	272.60	329.99	0.73	-2.28	40.153759	-104.710440	1,299,840.24	3,220,696.39
410.00	0.40	258.80	409.99	0.68	-2.83	40.153759	-104.710442	1,299,840.19	3,220,695.83
490.00	0.10	215.20	489.99	0.57	-3.15	40.153759	-104.710444	1,299,840.08	3,220,695.52
570.00	0.30	147.90	569.99	0.34	-3.08	40.153758	-104.710443	1,299,839.84	3,220,695.59
650.00	0.30	177.40	649.99	-0.05	-2.96	40.153757	-104.710443	1,299,839.46	3,220,695.72
730.00	0.50	172.90	729.98	-0.60	-2.90	40.153755	-104.710443	1,299,838.90	3,220,695.78
810.00	0.30	82.00	809.98	-0.92	-2.65	40.153755	-104.710442	1,299,838.59	3,220,696.03
890.00	0.70	52.10	889.98	-0.59	-2.06	40.153755	-104.710440	1,299,838.92	3,220,696.62
970.00	0.80	57.90	969.97	0.01	-1.20	40.153757	-104.710437	1,299,839.53	3,220,697.47
1,050.00	0.80	44.60	1,049.96	0.70	-0.34	40.153759	-104.710433	1,299,840.23	3,220,698.33
1,368.80	1.42	107.88	1,368.71	1.07	4.99	40.153760	-104.710414	1,299,840.65	3,220,703.65
1,458.00	1.73	114.52	1,457.88	0.17	7.27	40.153758	-104.710406	1,299,839.77	3,220,705.94
1,550.00	3.57	144.63	1,549.78	-2.74	10.19	40.153750	-104.710396	1,299,836.88	3,220,708.89
1,643.00	6.16	149.98	1,642.44	-9.42	14.36	40.153731	-104.710381	1,299,830.24	3,220,713.12
1,734.00	7.85	146.02	1,732.76	-18.80	20.28	40.153705	-104.710360	1,299,820.91	3,220,719.12
1,826.00	10.62	144.44	1,823.56	-30.91	28.72	40.153672	-104.710330	1,299,808.88	3,220,727.67
1,917.00	11.42	141.55	1,912.88	-44.79	39.20	40.153634	-104.710292	1,299,795.09	3,220,738.27
2,011.00	13.08	142.34	2,004.73	-60.50	51.49	40.153591	-104.710248	1,299,779.50	3,220,750.70
2,105.00	15.25	146.86	2,095.87	-79.27	64.75	40.153539	-104.710201	1,299,760.84	3,220,764.12
2,200.00	16.64	150.71	2,187.22	-101.60	78.23	40.153478	-104.710152	1,299,738.64	3,220,777.81
2,294.00	18.70	151.05	2,276.78	-126.53	92.11	40.153410	-104.710103	1,299,713.83	3,220,791.91
2,388.00	19.48	150.21	2,365.61	-153.32	107.19	40.153336	-104.710049	1,299,687.18	3,220,807.22
2,483.00	19.39	149.17	2,455.20	-180.60	123.14	40.153261	-104.709992	1,299,660.04	3,220,823.42
2,577.00	20.67	150.58	2,543.51	-208.46	139.29	40.153185	-104.709934	1,299,632.33	3,220,839.81
2,671.00	18.80	148.98	2,631.98	-235.89	155.25	40.153110	-104.709877	1,299,605.04	3,220,856.01
2,765.00	19.56	149.51	2,720.77	-262.43	171.04	40.153037	-104.709820	1,299,578.65	3,220,872.04
2,860.00	20.81	154.60	2,809.94	-291.38	186.35	40.152957	-104.709766	1,299,549.83	3,220,887.60
2,954.00	20.19	153.46	2,897.98	-320.98	200.76	40.152876	-104.709714	1,299,520.37	3,220,902.27
3,048.00	20.46	151.73	2,986.13	-349.96	215.79	40.152796	-104.709660	1,299,491.52	3,220,917.56
3,142.00	19.99	150.30	3,074.34	-378.38	231.53	40.152718	-104.709604	1,299,463.24	3,220,933.55
3,237.00	19.19	148.51	3,163.84	-405.80	247.73	40.152643	-104.709546	1,299,435.97	3,220,950.00
3,331.00	19.86	151.80	3,252.43	-433.05	263.35	40.152568	-104.709490	1,299,408.86	3,220,965.86
3,426.00	22.16	152.43	3,341.11	-463.16	279.27	40.152486	-104.709433	1,299,378.90	3,220,982.04
3,520.00	20.38	149.60	3,428.71	-492.99	295.75	40.152404	-104.709374	1,299,349.21	3,220,998.80
3,614.00	17.88	147.88	3,517.51	-519.34	311.71	40.152331	-104.709317	1,299,323.01	3,221,014.99

**Design Report for Thomsen 5N-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)
3,709.00	18.02	148.54	3,607.89	-544.22	327.14	40.152263	-104.709262	1,299,298.27	3,221,030.63
3,803.00	18.67	147.34	3,697.11	-569.29	342.84	40.152194	-104.709206	1,299,273.34	3,221,046.56
3,897.00	18.63	150.45	3,786.18	-595.02	358.37	40.152124	-104.709150	1,299,247.75	3,221,062.31
3,992.00	19.60	150.12	3,875.94	-622.04	373.79	40.152050	-104.709095	1,299,220.87	3,221,077.97
4,086.00	21.34	150.98	3,964.00	-650.67	389.94	40.151971	-104.709037	1,299,192.39	3,221,094.38
4,181.00	19.90	148.78	4,052.91	-679.61	406.71	40.151892	-104.708977	1,299,163.60	3,221,111.40
4,275.00	21.72	151.52	4,140.78	-708.58	423.30	40.151812	-104.708918	1,299,134.78	3,221,128.25
4,369.00	23.12	157.90	4,227.68	-740.98	438.54	40.151723	-104.708863	1,299,102.52	3,221,143.77
4,463.00	21.02	155.66	4,314.79	-773.44	452.43	40.151634	-104.708814	1,299,070.18	3,221,157.96
4,558.00	19.19	154.54	4,404.00	-803.06	466.17	40.151553	-104.708765	1,299,040.68	3,221,171.95
4,652.00	19.17	159.10	4,492.79	-831.43	478.31	40.151475	-104.708721	1,299,012.43	3,221,184.35
4,746.00	20.37	160.34	4,581.25	-861.26	489.32	40.151393	-104.708682	1,298,982.70	3,221,195.63
4,841.00	18.96	158.75	4,670.70	-891.21	500.48	40.151311	-104.708642	1,298,952.85	3,221,207.05
4,935.00	21.02	157.27	4,759.04	-921.00	512.53	40.151229	-104.708599	1,298,923.17	3,221,219.37
5,030.00	20.42	156.88	4,847.89	-951.95	525.62	40.151144	-104.708552	1,298,892.33	3,221,232.73
5,124.00	18.64	153.72	4,936.48	-980.51	538.71	40.151066	-104.708505	1,298,863.90	3,221,246.08
5,218.00	20.73	155.67	5,024.98	-1,009.14	552.22	40.150987	-104.708457	1,298,835.39	3,221,259.84
5,313.00	18.60	154.15	5,114.44	-1,038.10	565.75	40.150907	-104.708408	1,298,806.56	3,221,273.63
5,407.00	19.80	152.16	5,203.21	-1,065.67	579.73	40.150832	-104.708358	1,298,779.11	3,221,287.84
5,502.00	17.79	151.00	5,293.14	-1,092.59	594.28	40.150758	-104.708306	1,298,752.32	3,221,302.63
5,596.00	18.55	151.29	5,382.45	-1,118.27	608.42	40.150687	-104.708256	1,298,726.77	3,221,317.01
5,690.00	20.04	151.01	5,471.17	-1,145.47	623.41	40.150613	-104.708202	1,298,699.71	3,221,332.24
5,784.00	18.01	147.19	5,560.03	-1,171.77	639.09	40.150540	-104.708146	1,298,673.54	3,221,348.15
5,879.00	19.23	150.82	5,650.06	-1,197.78	654.68	40.150469	-104.708090	1,298,647.68	3,221,363.97
5,973.00	20.33	151.64	5,738.51	-1,225.66	669.99	40.150393	-104.708036	1,298,619.93	3,221,379.52
6,067.00	16.67	149.10	5,827.64	-1,251.61	684.67	40.150321	-104.707983	1,298,594.12	3,221,394.43
6,162.00	14.67	147.70	5,919.11	-1,273.47	698.10	40.150261	-104.707935	1,298,572.38	3,221,408.05
6,256.00	15.49	150.33	6,009.87	-1,294.44	710.67	40.150204	-104.707890	1,298,551.52	3,221,420.81
6,351.00	15.26	148.79	6,101.47	-1,316.16	723.43	40.150144	-104.707844	1,298,529.92	3,221,433.76
6,445.00	14.21	147.32	6,192.38	-1,336.45	736.07	40.150088	-104.707799	1,298,509.75	3,221,446.58
6,539.00	14.53	150.07	6,283.44	-1,356.38	748.18	40.150034	-104.707756	1,298,489.92	3,221,458.87
6,633.00	16.86	150.76	6,373.93	-1,378.50	760.73	40.149973	-104.707711	1,298,467.92	3,221,471.61
6,728.00	17.66	152.88	6,464.65	-1,403.34	774.02	40.149905	-104.707663	1,298,443.19	3,221,485.13
6,775.00	17.64	151.97	6,509.44	-1,415.97	780.62	40.149870	-104.707640	1,298,430.62	3,221,491.84
6,822.00	17.45	140.06	6,554.27	-1,427.67	788.49	40.149838	-104.707612	1,298,419.00	3,221,499.82
6,869.00	17.39	128.95	6,599.12	-1,437.49	798.48	40.149811	-104.707576	1,298,409.27	3,221,509.89
6,916.00	18.52	118.45	6,643.85	-1,445.46	810.51	40.149789	-104.707533	1,298,401.40	3,221,521.99
6,963.00	19.00	105.56	6,688.37	-1,451.07	824.45	40.149774	-104.707483	1,298,395.92	3,221,535.98
7,011.00	17.99	89.52	6,733.92	-1,453.11	839.40	40.149768	-104.707430	1,298,394.01	3,221,550.95
7,058.00	17.24	75.35	6,778.73	-1,451.29	853.40	40.149773	-104.707379	1,298,395.96	3,221,564.93
7,105.00	17.54	59.97	6,823.61	-1,445.98	866.28	40.149788	-104.707333	1,298,401.39	3,221,577.76
7,152.00	19.04	45.79	6,868.26	-1,437.08	877.91	40.149812	-104.707292	1,298,410.38	3,221,589.31

**Design Report for Thomsen 5N-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)
7,199.00	21.79	38.26	6,912.31	-1,424.88	888.82	40.149846	-104.707253	1,298,422.68	3,221,600.11
7,246.00	23.80	31.55	6,955.64	-1,409.95	899.18	40.149887	-104.707216	1,298,437.71	3,221,610.34
7,334.00	31.32	19.47	7,033.66	-1,373.17	916.13	40.149988	-104.707155	1,298,474.63	3,221,626.96
7,382.00	37.26	15.80	7,073.31	-1,347.40	924.26	40.150058	-104.707126	1,298,500.47	3,221,634.85
7,429.00	43.39	14.50	7,109.12	-1,318.05	932.18	40.150139	-104.707098	1,298,529.89	3,221,642.52
7,476.00	48.82	13.46	7,141.70	-1,285.20	940.35	40.150229	-104.707068	1,298,562.81	3,221,650.39
7,523.00	53.83	10.46	7,171.06	-1,249.31	947.91	40.150328	-104.707041	1,298,598.76	3,221,657.63
7,571.00	59.18	7.89	7,197.54	-1,209.81	954.26	40.150436	-104.707019	1,298,638.32	3,221,663.63
7,618.00	64.74	5.69	7,219.63	-1,168.64	959.15	40.150549	-104.707001	1,298,679.53	3,221,668.15
7,665.00	71.86	4.59	7,237.00	-1,125.17	963.05	40.150668	-104.706987	1,298,723.03	3,221,671.66
7,712.00	81.00	3.58	7,248.02	-1,079.65	966.29	40.150793	-104.706976	1,298,768.58	3,221,674.50
7,730.00	84.41	3.81	7,250.30	-1,061.83	967.44	40.150842	-104.706972	1,298,786.40	3,221,675.49
7,763.20	88.15	4.59	7,252.46	-1,028.80	969.87	40.150933	-104.706963	1,298,819.45	3,221,677.62
7,784.00	90.49	5.08	7,252.70	-1,008.07	971.62	40.150990	-104.706957	1,298,840.19	3,221,679.19
7,819.00	90.56	4.13	7,252.38	-973.19	974.43	40.151086	-104.706946	1,298,875.10	3,221,681.69
7,829.23	90.58	4.03	7,252.28	-962.98	975.16	40.151114	-104.706944	1,298,885.31	3,221,682.33
7,913.00	90.77	3.25	7,251.29	-879.39	980.48	40.151343	-104.706925	1,298,968.94	3,221,686.90
8,007.00	91.66	2.93	7,249.30	-785.55	985.54	40.151601	-104.706907	1,299,062.82	3,221,691.13
8,101.00	91.14	3.35	7,247.00	-691.72	990.69	40.151858	-104.706888	1,299,156.69	3,221,695.45
8,196.00	90.80	3.89	7,245.39	-596.92	996.69	40.152118	-104.706867	1,299,251.53	3,221,700.60
8,290.00	91.30	3.54	7,243.67	-503.14	1,002.78	40.152376	-104.706845	1,299,345.36	3,221,705.85
8,385.00	90.62	3.90	7,242.08	-408.35	1,008.94	40.152636	-104.706823	1,299,440.20	3,221,711.17
8,479.00	90.80	3.32	7,240.91	-314.55	1,014.86	40.152894	-104.706802	1,299,534.05	3,221,716.25
8,573.00	90.83	2.90	7,239.58	-220.69	1,019.96	40.153151	-104.706784	1,299,627.94	3,221,720.52
8,667.00	90.59	3.62	7,238.41	-126.85	1,025.30	40.153409	-104.706764	1,299,721.82	3,221,725.03
8,762.00	89.69	4.36	7,238.18	-32.09	1,031.91	40.153669	-104.706741	1,299,816.64	3,221,730.79
8,856.00	90.03	3.37	7,238.41	61.70	1,038.25	40.153926	-104.706718	1,299,910.47	3,221,736.29
8,950.00	90.15	3.24	7,238.26	155.54	1,043.67	40.154184	-104.706699	1,300,004.35	3,221,740.88
9,045.00	89.85	2.53	7,238.26	250.42	1,048.45	40.154444	-104.706682	1,300,099.27	3,221,744.81
9,139.00	90.12	2.44	7,238.29	344.33	1,052.53	40.154702	-104.706667	1,300,193.21	3,221,748.05
9,234.00	91.48	3.99	7,236.96	439.17	1,057.85	40.154963	-104.706648	1,300,288.08	3,221,752.53
9,328.00	90.43	4.10	7,235.39	532.92	1,064.48	40.155220	-104.706624	1,300,381.89	3,221,758.33
9,422.00	90.77	3.84	7,234.41	626.69	1,070.99	40.155477	-104.706601	1,300,475.71	3,221,764.00
9,517.00	90.43	4.34	7,233.41	721.44	1,077.77	40.155737	-104.706577	1,300,570.51	3,221,769.93
9,612.00	89.82	3.85	7,233.21	816.20	1,084.55	40.155997	-104.706552	1,300,665.32	3,221,775.87
9,706.00	89.48	3.32	7,233.78	910.01	1,090.43	40.156255	-104.706531	1,300,759.18	3,221,780.91
9,800.00	89.91	3.40	7,234.28	1,003.85	1,095.94	40.156513	-104.706512	1,300,853.06	3,221,785.59
9,895.00	89.72	2.48	7,234.59	1,098.72	1,100.81	40.156773	-104.706494	1,300,947.97	3,221,789.61
9,986.00	89.78	4.16	7,234.99	1,189.57	1,106.08	40.157022	-104.706475	1,301,038.85	3,221,794.07
10,077.00	89.35	3.11	7,235.68	1,280.38	1,111.85	40.157272	-104.706455	1,301,129.71	3,221,799.03
10,169.00	90.09	3.14	7,236.13	1,372.24	1,116.86	40.157524	-104.706437	1,301,221.60	3,221,803.23
10,261.00	90.03	2.78	7,236.03	1,464.12	1,121.61	40.157776	-104.706420	1,301,313.52	3,221,807.16

**Design Report for Thomsen 5N-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)
10,352.00	90.25	2.72	7,235.81	1,555.01	1,125.98	40.158026	-104.706404	1,301,404.44	3,221,810.72
10,444.00	89.88	1.93	7,235.70	1,646.94	1,129.71	40.158278	-104.706391	1,301,496.39	3,221,813.63
10,535.00	90.46	3.80	7,235.43	1,737.82	1,134.26	40.158527	-104.706374	1,301,587.31	3,221,817.37
10,626.00	91.11	5.56	7,234.19	1,828.50	1,141.68	40.158776	-104.706348	1,301,678.05	3,221,823.99
10,718.00	90.96	4.59	7,232.52	1,920.12	1,149.82	40.159028	-104.706319	1,301,769.74	3,221,831.31
10,810.00	90.43	5.00	7,231.41	2,011.79	1,157.51	40.159279	-104.706291	1,301,861.47	3,221,838.18
10,903.00	90.09	5.30	7,230.99	2,104.42	1,165.86	40.159534	-104.706261	1,301,954.16	3,221,845.70
10,995.00	89.44	5.15	7,231.36	2,196.03	1,174.24	40.159785	-104.706231	1,302,045.84	3,221,853.26
11,088.00	89.20	4.19	7,232.47	2,288.72	1,181.81	40.160040	-104.706204	1,302,138.59	3,221,860.01
11,181.00	89.44	4.16	7,233.57	2,381.46	1,188.58	40.160294	-104.706180	1,302,231.39	3,221,865.95
11,273.00	89.23	3.22	7,234.64	2,473.27	1,194.50	40.160546	-104.706159	1,302,323.23	3,221,871.06
11,365.00	88.43	2.55	7,236.52	2,565.13	1,199.13	40.160798	-104.706142	1,302,415.13	3,221,874.87
11,457.00	90.22	3.85	7,237.60	2,656.97	1,204.26	40.161050	-104.706124	1,302,507.01	3,221,879.18
11,549.00	91.11	3.60	7,236.53	2,748.77	1,210.24	40.161302	-104.706102	1,302,598.86	3,221,884.34
11,641.00	90.49	4.91	7,235.25	2,840.51	1,217.07	40.161554	-104.706078	1,302,690.64	3,221,890.35
11,732.00	90.86	4.46	7,234.18	2,931.20	1,224.50	40.161803	-104.706051	1,302,781.39	3,221,896.98
11,827.00	91.02	4.08	7,232.62	3,025.92	1,231.57	40.162063	-104.706026	1,302,876.17	3,221,903.20
11,921.00	89.82	4.32	7,231.93	3,119.66	1,238.45	40.162321	-104.706001	1,302,969.97	3,221,909.25
12,015.00	89.57	3.74	7,232.43	3,213.43	1,245.06	40.162578	-104.705978	1,303,063.78	3,221,915.02
12,109.00	89.48	4.04	7,233.21	3,307.21	1,251.44	40.162835	-104.705955	1,303,157.61	3,221,920.56
12,204.00	88.92	3.48	7,234.54	3,401.99	1,257.67	40.163096	-104.705932	1,303,252.45	3,221,925.95
12,298.00	88.95	4.78	7,236.28	3,495.73	1,264.43	40.163353	-104.705908	1,303,346.24	3,221,931.88
12,392.00	88.86	4.35	7,238.08	3,589.42	1,271.91	40.163610	-104.705881	1,303,439.98	3,221,938.53
12,471.22	88.70	4.17	7,239.76	3,668.40	1,277.80	40.163827	-104.705860	1,303,519.01	3,221,943.71
12,487.00	88.67	4.14	7,240.13	3,684.13	1,278.95	40.163870	-104.705856	1,303,534.75	3,221,944.71
12,581.00	89.48	3.17	7,241.64	3,777.93	1,284.94	40.164127	-104.705835	1,303,628.59	3,221,949.87
12,675.00	89.17	2.92	7,242.75	3,871.79	1,289.93	40.164385	-104.705817	1,303,722.49	3,221,954.03
12,770.00	88.86	2.34	7,244.38	3,966.67	1,294.29	40.164646	-104.705801	1,303,817.41	3,221,957.54
12,864.00	91.36	2.40	7,244.20	4,060.59	1,298.17	40.164903	-104.705787	1,303,911.35	3,221,960.59
12,959.00	90.80	0.70	7,242.41	4,155.53	1,300.74	40.165164	-104.705778	1,304,006.31	3,221,962.31
13,053.00	90.59	0.76	7,241.27	4,249.52	1,301.94	40.165422	-104.705774	1,304,100.29	3,221,962.68
13,149.00	91.08	359.48	7,239.87	4,345.50	1,302.14	40.165685	-104.705773	1,304,196.28	3,221,962.02
13,243.00	91.60	359.25	7,237.68	4,439.47	1,301.10	40.165943	-104.705777	1,304,290.23	3,221,960.14
13,337.00	90.68	359.46	7,235.81	4,533.45	1,300.04	40.166201	-104.705781	1,304,384.18	3,221,958.25
13,432.00	91.36	359.13	7,234.11	4,628.42	1,298.87	40.166462	-104.705785	1,304,479.14	3,221,956.23
13,526.00	90.77	358.98	7,232.37	4,722.39	1,297.32	40.166720	-104.705790	1,304,573.09	3,221,953.85
13,621.00	91.79	359.07	7,230.25	4,817.36	1,295.71	40.166981	-104.705796	1,304,668.03	3,221,951.39
13,715.00	90.37	358.19	7,228.47	4,911.31	1,293.46	40.167239	-104.705804	1,304,761.96	3,221,948.30
13,809.00	90.19	359.34	7,228.01	5,005.28	1,291.44	40.167497	-104.705811	1,304,855.91	3,221,945.44
13,904.00	89.88	0.16	7,227.96	5,100.28	1,291.02	40.167757	-104.705813	1,304,950.89	3,221,944.18
13,998.00	89.11	1.10	7,228.78	5,194.27	1,292.05	40.168015	-104.705809	1,305,044.88	3,221,944.38
14,092.00	89.38	0.33	7,230.02	5,288.25	1,293.23	40.168273	-104.705805	1,305,138.87	3,221,944.71

**Design Report for Thomsen 5N-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)
14,186.00	89.69	359.46	7,230.79	5,382.25	1,293.05	40.168531	-104.705806	1,305,232.86	3,221,943.70
14,280.00	88.06	357.92	7,232.63	5,476.20	1,290.91	40.168789	-104.705813	1,305,326.78	3,221,940.72
14,375.00	88.95	0.63	7,235.11	5,571.15	1,289.71	40.169050	-104.705817	1,305,421.71	3,221,938.67
14,469.00	88.21	359.48	7,237.44	5,665.12	1,289.80	40.169308	-104.705817	1,305,515.68	3,221,937.93
14,500.56	88.36	359.40	7,238.38	5,696.67	1,289.49	40.169394	-104.705818	1,305,547.22	3,221,937.34
14,564.00	88.67	359.24	7,240.03	5,760.08	1,288.74	40.169569	-104.705821	1,305,610.62	3,221,936.02
14,659.00	88.92	358.80	7,242.02	5,855.04	1,287.11	40.169829	-104.705827	1,305,705.56	3,221,933.55
14,753.00	90.12	359.27	7,242.81	5,949.03	1,285.53	40.170087	-104.705832	1,305,799.52	3,221,931.13
14,848.00	89.94	359.37	7,242.76	6,044.02	1,284.40	40.170348	-104.705836	1,305,894.49	3,221,929.16
14,943.00	91.36	1.61	7,241.68	6,139.00	1,285.21	40.170609	-104.705833	1,305,989.48	3,221,929.12
15,038.00	90.92	3.51	7,239.79	6,233.88	1,289.45	40.170869	-104.705818	1,306,084.39	3,221,932.52
15,132.00	91.51	3.82	7,237.80	6,327.67	1,295.46	40.171127	-104.705797	1,306,178.22	3,221,937.69
15,227.00	89.97	3.64	7,236.57	6,422.46	1,301.64	40.171387	-104.705775	1,306,273.06	3,221,943.03
15,321.00	89.66	2.97	7,236.88	6,516.30	1,307.06	40.171644	-104.705755	1,306,366.94	3,221,947.61
15,415.00	89.91	2.68	7,237.23	6,610.18	1,311.69	40.171902	-104.705739	1,306,460.86	3,221,951.41
15,510.00	89.48	3.54	7,237.74	6,705.04	1,316.85	40.172162	-104.705720	1,306,555.75	3,221,955.72
15,604.00	89.60	2.89	7,238.49	6,798.89	1,322.12	40.172420	-104.705701	1,306,649.64	3,221,960.15
15,698.00	89.57	2.39	7,239.17	6,892.79	1,326.45	40.172678	-104.705686	1,306,743.57	3,221,963.65
15,793.00	89.82	4.15	7,239.68	6,987.63	1,331.87	40.172938	-104.705666	1,306,838.45	3,221,968.22
15,888.00	89.60	1.23	7,240.16	7,082.51	1,336.33	40.173199	-104.705650	1,306,933.37	3,221,971.83
15,982.00	91.42	2.81	7,239.32	7,176.44	1,339.64	40.173456	-104.705638	1,307,027.32	3,221,974.31
16,077.00	91.14	3.32	7,237.20	7,271.28	1,344.72	40.173717	-104.705620	1,307,122.20	3,221,978.54
16,172.00	90.99	4.58	7,235.43	7,366.04	1,351.26	40.173977	-104.705597	1,307,217.00	3,221,984.24
16,266.00	91.45	4.47	7,233.43	7,459.72	1,358.67	40.174234	-104.705570	1,307,310.75	3,221,990.82
16,360.00	90.12	6.04	7,232.14	7,553.32	1,367.28	40.174491	-104.705539	1,307,404.41	3,221,998.59
16,455.00	88.46	5.35	7,233.32	7,647.84	1,376.71	40.174750	-104.705506	1,307,499.00	3,222,007.18
16,549.00	88.77	4.97	7,235.59	7,741.43	1,385.16	40.175007	-104.705475	1,307,592.66	3,222,014.80
16,643.00	89.01	4.31	7,237.41	7,835.10	1,392.76	40.175264	-104.705448	1,307,686.40	3,222,021.56
16,738.00	89.26	4.07	7,238.85	7,929.84	1,399.70	40.175524	-104.705423	1,307,781.18	3,222,027.66
16,832.00	89.35	3.48	7,239.99	8,023.62	1,405.89	40.175782	-104.705401	1,307,875.02	3,222,033.01
16,845.00	89.44	3.54	7,240.13	8,036.60	1,406.69	40.175818	-104.705398	1,307,888.00	3,222,033.69
16,890.28	89.44	3.54	7,240.57	8,081.79	1,409.48	40.175942	-104.705388	1,307,933.21	3,222,036.09
16,893.00	89.44	3.54	7,240.60	8,084.51	1,409.65	40.175949	-104.705388	1,307,935.93	3,222,036.23

**Design Report for Thomsen 5N-31HZ - Actual Surveys**

**Design Annotations**

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
7,199.00	6,912.31	-1,424.88	888.82	Current MWD Survey @ 7199.00' MD :: 6912.55' TVD
16,845.00	7,240.13	8,036.60	1,406.69	Final MWD Survey @ 16845.00' MD :: 7240.19' TVD
16,893.00	7,240.60	8,084.51	1,409.65	Straight Line Projection to Bit @ 16893.00' MD :: 7240.66' TVD

**Vertical Section Information**

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
User	No Target (Freehand)	3.70	Slot	0.00	0.00	0.00

**Survey tool program**

From (usft)	To (usft)	Survey/Plan	Survey Tool
82.00	1,050.00	Surface Surveys	MWD
1,458.00	7,287.00	MWD Vertical/Build Surveys	MWD+IFR1+SC
7,334.00	16,893.00	MWD Lateral Surveys	MWD+IFR1+SC

**Casing Details**

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,368.80	1,368.71	9 5/8"	9-5/8	13-1/2
7,763.20	7,252.46	7" @ 7763.20' MD	7	8-3/4

**Design Targets**

Shape	Target Name	TVD (')	Northing (')	Easting (')	+N/-S	+E/-W	Created	Updated
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**Design Report for Thomsen 5N-31HZ - Actual Surveys**

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**Directional Difficulty Index**

Average Dogleg over Survey: 1.79 °/100usft

Maximum Dogleg over Survey: 19.56 °/100usft at 7,712.00  
usft

Net Tortosity applicable to Plans: 0.98 °/100usft

Directional Difficulty Index: 6.900

**Audit Info**

**North Reference Sheet for Sec. 7-T2N-R65W - Thomsen 5N-31HZ - Plan A**

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' @ 4975.00usft (H&P 308). Northing and Easting are relative to Thomsen 5N-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: 1,299,839.53 usft N, 3,220,698.68 usft E

Geographical Coordinates of Well: 40° 09' 13.53" N, 104° 42' 37.56" W

Grid Convergence at Surface is: 0.51°

Based upon Minimum Curvature type calculations, at a Measured Depth of 16,893.00usft

the Bottom Hole Displacement is 8,206.48usft in the Direction of 9.89° ( True).

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

