

# Noble Energy

Weld County, CO (NAD 83)

Sec. 17-T5N-R63W (70 Ranch State BB18 PAD)

70 Ranch State BB18-681

05-123-41529

Plan A

Design: Actual Surveys

## Sperry Drilling Services

### Final Survey Report

05 August, 2015

Surface UWI : 05-123-41529

Well Coordinates: 1,392,152.20 N, 3,291,401.59 E (40° 24' 18.50" N, 104° 27' 13.00" W)

Ground Level: 4,699.00 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 70 Ranch State BB18-681

KB = 24' @ 4723.00usft (H&P 273)

N

Grid

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

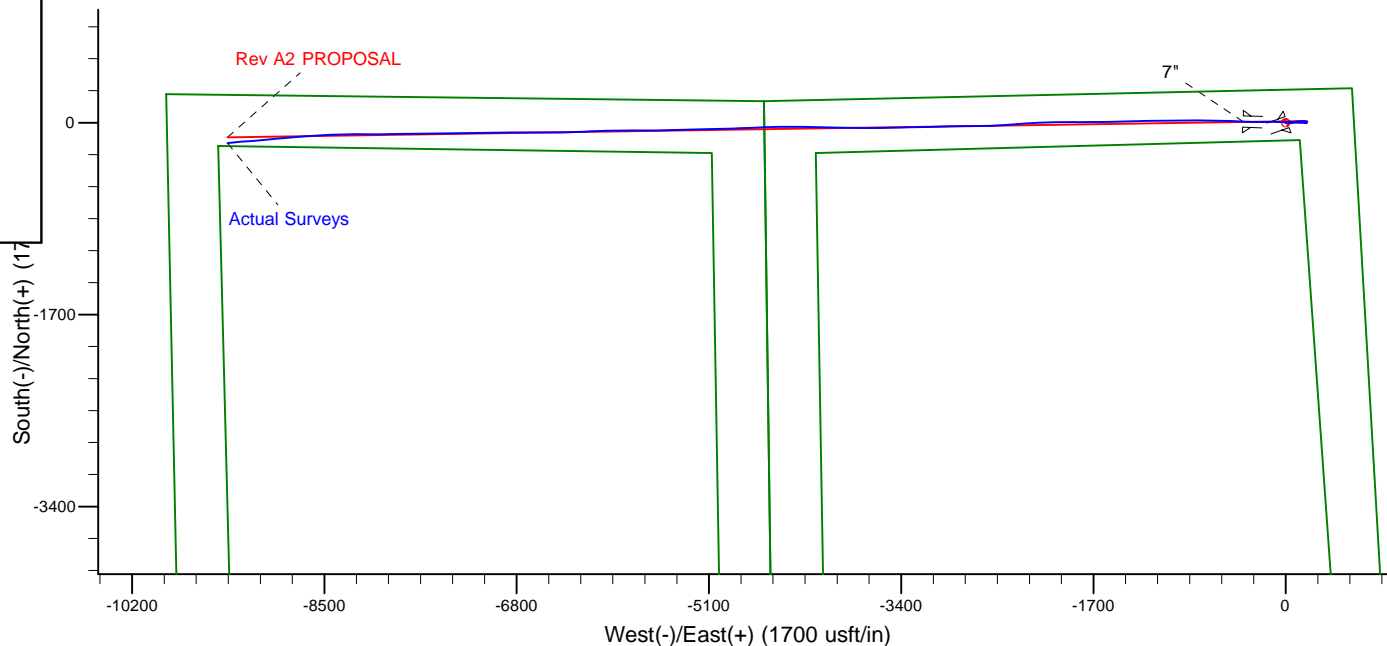
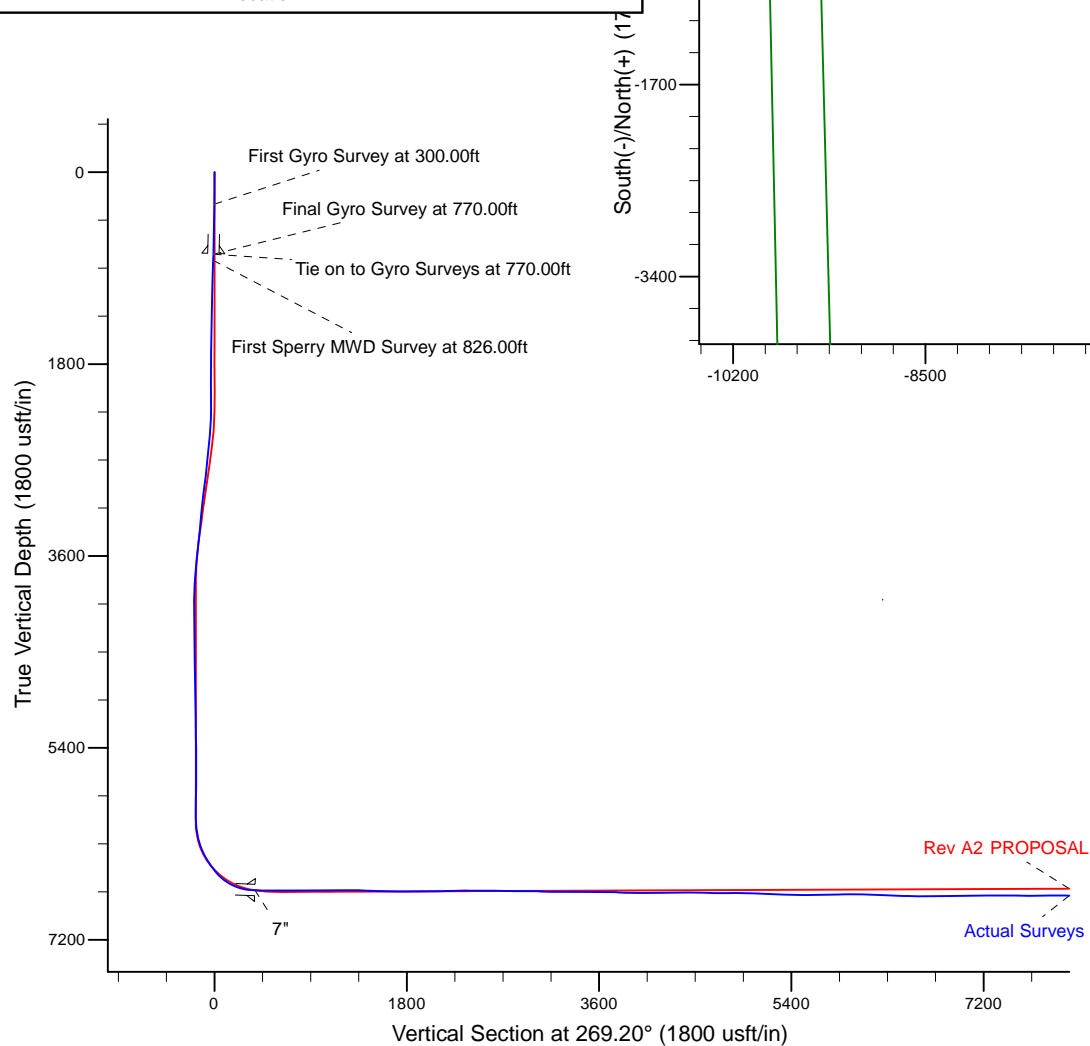
Project: Weld County, CO (NAD 83)  
 Site: Sec. 17-T5N-R63W (70 Ranch State BB18 PAD)  
 Well: 70 Ranch State BB18-681  
 Wellbore: Plan A  
 Design: Actual Surveys



Platted SHL: 293' FNL, 600' FEL  
 Platted Lat/Long: 40.40514, -104.45361  
 Location: Sec. 17-T5N-R63W

~7" Casing: 974' FEL, 274' FNL  
 Lat/Long: 40.405178 N, -104.454967 W  
 State Planes - CO Northern: 1,392,161.61 N, 3,291,023.65 E  
 Sec. 17-T5N-R63W

Platted BHL: 380' FNL, 535' FWL  
 Platted Lat/Long: 40.404944 N, -104.487196 W  
 State Planes - CO Northern: 1,391,972.27 N, 3,282,049.77 E  
 Location: Sec. 18-T5N-R63W



#### LEGEND

- 70 Ranch State BB18-681, Plan A, Rev A2 PROPOSAL V0
- Actual Surveys

WELL DETAILS: 70 Ranch State BB18-681

Ground Level: 4699.00

KB = 24' @ 4723.00usft (H&P 273)

Created By: Tatiana Gomez  
 Created On: 8/5/2015

**Design Report for 70 Ranch State BB18-681 - 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
300.00	0.71	70.11	299.99	0.63	1.75	-1.76	0.24
<b>First Gyro Survey at 300.00ft</b>							
600.00	1.42	70.11	599.94	2.53	6.99	-7.03	0.24
763.00	1.81	70.11	762.87	4.09	11.32	-11.37	0.24
<b>9 5/8"</b>							
770.00	1.83	70.11	769.87	4.17	11.52	-11.58	0.24
<b>Tie on to Gyro Surveys at 770.00ft - Final Gyro Survey at 770.00ft</b>							
826.00	1.96	70.11	825.84	4.80	13.27	-13.33	0.23
<b>First Sperry MWD Survey at 826.00ft</b>							
1,015.00	1.81	71.28	1,014.74	6.86	19.13	-19.23	0.08
1,201.00	1.36	18.02	1,200.67	9.90	22.60	-22.73	0.79
1,293.00	1.65	105.84	1,292.65	10.58	24.21	-24.35	2.28
1,384.00	1.36	98.15	1,383.62	10.07	26.54	-26.68	0.39
1,475.00	1.55	96.59	1,474.59	9.77	28.83	-28.96	0.21
1,567.00	1.67	98.18	1,566.56	9.44	31.39	-31.52	0.14
1,750.00	1.25	199.65	1,749.52	7.18	33.36	-33.46	1.24
1,841.00	0.95	218.76	1,840.50	5.65	32.56	-32.63	0.52
1,933.00	0.92	185.70	1,932.49	4.32	32.00	-32.06	0.58
2,025.00	0.97	186.98	2,024.48	2.82	31.84	-31.87	0.06
2,116.00	0.84	184.88	2,115.47	1.39	31.69	-31.70	0.15
2,208.00	0.69	182.85	2,207.46	0.16	31.60	-31.60	0.17
2,301.00	2.40	97.90	2,300.43	-0.66	33.50	-33.49	2.62
2,392.00	4.15	83.85	2,391.28	-0.57	38.66	-38.65	2.10
2,484.00	5.76	80.69	2,482.93	0.53	46.53	-46.53	1.77
2,576.00	5.12	83.11	2,574.52	1.77	55.16	-55.18	0.74
2,760.00	6.44	79.55	2,757.58	4.63	73.46	-73.52	0.74
2,851.00	6.57	78.55	2,847.99	6.59	83.58	-83.67	0.19
2,942.00	7.17	89.67	2,938.34	7.65	94.36	-94.46	1.60
3,036.00	6.81	82.16	3,031.65	8.45	105.75	-105.86	1.04
3,131.00	6.05	79.77	3,126.05	10.10	116.26	-116.39	0.85
3,226.00	5.47	75.73	3,220.57	12.11	125.57	-125.73	0.74
3,320.00	5.61	94.47	3,314.14	12.85	134.50	-134.66	1.92
3,415.00	4.99	87.20	3,408.73	12.69	143.25	-143.42	0.96
3,510.00	6.33	94.50	3,503.27	12.49	152.60	-152.76	1.60
3,604.00	5.86	92.25	3,596.73	11.89	162.56	-162.71	0.56
3,699.00	6.11	93.51	3,691.22	11.39	172.45	-172.60	0.30
3,794.00	4.19	87.92	3,785.83	11.21	180.97	-181.11	2.09
3,888.00	2.59	97.87	3,879.66	11.04	186.51	-186.64	1.81
4,078.00	0.44	218.00	4,069.60	9.88	190.31	-190.43	1.49
4,267.00	1.30	212.42	4,258.58	7.50	188.71	-188.80	0.46
4,362.00	1.45	207.72	4,353.55	5.52	187.58	-187.64	0.20
4,457.00	1.46	210.32	4,448.52	3.41	186.41	-186.44	0.07
4,551.00	1.68	196.10	4,542.49	1.06	185.42	-185.42	0.47
4,645.00	1.91	194.30	4,636.44	-1.79	184.65	-184.61	0.25
4,739.00	1.84	187.46	4,730.39	-4.80	184.07	-183.98	0.25
4,834.00	1.80	269.73	4,825.35	-6.32	182.38	-182.27	2.52
4,928.00	1.50	266.32	4,919.32	-6.41	179.67	-179.57	0.34
5,023.00	1.15	322.33	5,014.29	-5.73	177.85	-177.75	1.35
5,118.00	0.83	293.57	5,109.28	-4.70	176.64	-176.55	0.61

## Design Report for 70 Ranch State BB18-681 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,307.00	0.77	281.29	5,298.26	-3.90	174.14	-174.07	0.10
5,402.00	1.04	352.54	5,393.25	-2.93	173.40	-173.34	1.13
5,496.00	0.56	303.75	5,487.24	-1.82	172.91	-172.86	0.84
5,591.00	0.23	139.89	5,582.24	-1.71	172.64	-172.60	0.82
5,686.00	0.31	82.41	5,677.24	-1.82	173.02	-172.98	0.28
5,780.00	0.56	72.59	5,771.24	-1.65	173.71	-173.67	0.28
5,875.00	0.40	102.35	5,866.24	-1.58	174.48	-174.44	0.31
5,970.00	0.49	87.83	5,961.23	-1.64	175.21	-175.17	0.15
6,065.00	0.37	95.76	6,056.23	-1.66	175.92	-175.88	0.14
6,159.00	6.16	268.64	6,150.06	-1.81	171.17	-171.13	6.94
6,254.00	14.37	272.73	6,243.46	-1.36	154.27	-154.24	8.67
6,349.00	20.73	272.83	6,333.99	0.03	125.68	-125.66	6.69
6,444.00	28.29	270.00	6,420.37	0.86	86.31	-86.32	8.05
6,538.00	34.05	271.99	6,500.77	1.77	37.70	-37.72	6.22
6,633.00	42.15	272.81	6,575.47	4.26	-20.82	20.76	8.54
6,727.00	52.66	270.37	6,639.00	6.06	-89.89	89.79	11.34
6,822.00	64.37	269.52	6,688.53	5.94	-170.76	170.66	12.35
6,917.00	76.25	270.66	6,720.49	6.12	-260.04	259.93	12.56
7,002.00	87.35	272.08	6,732.59	8.14	-344.02	343.87	13.16
7,036.00	87.82	272.22	6,734.02	9.41	-377.96	377.79	1.43
7"							
7,155.00	89.45	272.69	6,736.86	14.50	-496.81	496.56	1.43
7,250.00	89.32	270.87	6,737.88	17.45	-591.76	591.46	1.92
7,344.00	91.82	270.84	6,736.95	18.86	-685.74	685.41	2.66
7,439.00	89.41	269.93	6,735.93	19.49	-780.72	780.37	2.71
7,534.00	90.49	270.08	6,736.01	19.50	-875.72	875.36	1.15
7,629.00	89.08	269.20	6,736.37	18.91	-970.71	970.36	1.75
7,723.00	90.80	269.10	6,736.47	17.51	-1,064.70	1,064.35	1.83
7,818.00	91.02	268.65	6,734.96	15.65	-1,159.67	1,159.34	0.53
7,913.00	89.20	269.12	6,734.77	13.80	-1,254.65	1,254.33	1.98
8,007.00	89.57	269.22	6,735.78	12.44	-1,348.63	1,348.33	0.41
8,102.00	88.12	268.52	6,737.70	10.56	-1,443.59	1,443.30	1.69
8,197.00	87.94	268.70	6,740.96	8.26	-1,538.51	1,538.24	0.27
8,292.00	88.46	269.23	6,743.95	6.54	-1,633.44	1,633.19	0.78
8,387.00	88.80	269.51	6,746.22	5.50	-1,728.41	1,728.16	0.46
8,481.00	89.60	269.82	6,747.53	4.95	-1,822.40	1,822.15	0.91
8,576.00	90.40	269.96	6,747.53	4.77	-1,917.40	1,917.14	0.85
8,670.00	92.19	270.18	6,745.41	4.88	-2,011.37	2,011.11	1.92
8,765.00	91.91	267.97	6,742.01	3.35	-2,106.29	2,106.04	2.34
8,860.00	91.79	266.15	6,738.94	-1.52	-2,201.11	2,200.92	1.92
8,955.00	90.15	265.69	6,737.33	-8.28	-2,295.85	2,295.75	1.79
9,050.00	89.14	266.08	6,737.92	-15.09	-2,390.61	2,390.58	1.14
9,144.00	90.34	265.77	6,738.35	-21.77	-2,484.36	2,484.43	1.32
9,239.00	89.45	267.45	6,738.52	-27.39	-2,579.19	2,579.33	2.00
9,334.00	88.27	269.24	6,740.41	-30.13	-2,674.13	2,674.29	2.26
9,428.00	89.88	269.69	6,741.93	-31.01	-2,768.11	2,768.27	1.78
9,523.00	88.58	269.37	6,743.21	-31.79	-2,863.10	2,863.26	1.41
9,618.00	90.59	269.06	6,743.89	-33.09	-2,958.08	2,958.25	2.14
9,712.00	87.72	268.36	6,745.28	-35.21	-3,052.04	3,052.23	3.14
9,804.00	88.03	268.53	6,748.69	-37.70	-3,143.94	3,144.16	0.38
9,895.00	89.29	268.81	6,750.82	-39.81	-3,234.89	3,235.13	1.42

## Design Report for 70 Ranch State BB18-681 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
9,987.00	91.66	269.17	6,750.06	-41.44	-3,326.86	3,327.12	2.61
10,078.00	88.49	268.77	6,749.94	-43.07	-3,417.84	3,418.10	3.51
10,169.00	90.37	268.80	6,750.84	-45.00	-3,508.81	3,509.09	2.07
10,261.00	89.20	269.31	6,751.19	-46.52	-3,600.79	3,601.09	1.39
10,352.00	89.45	270.83	6,752.26	-46.41	-3,691.78	3,692.07	1.69
10,444.00	86.67	269.79	6,755.38	-45.91	-3,783.72	3,783.99	3.23
10,535.00	88.83	270.69	6,758.95	-45.53	-3,874.64	3,874.90	2.57
10,719.00	89.85	271.14	6,761.07	-42.59	-4,058.60	4,058.80	0.61
10,811.00	90.80	271.09	6,760.55	-40.80	-4,150.58	4,150.75	1.03
10,903.00	92.65	271.47	6,757.78	-38.75	-4,242.51	4,242.64	2.05
10,995.00	90.34	270.72	6,755.38	-36.99	-4,334.46	4,334.55	2.64
11,087.00	89.69	270.24	6,755.35	-36.22	-4,426.46	4,426.53	0.88
11,179.00	88.24	268.54	6,757.01	-37.20	-4,518.43	4,518.51	2.43
11,270.00	87.91	267.44	6,760.07	-40.39	-4,609.32	4,609.44	1.26
11,362.00	90.06	267.53	6,761.70	-44.42	-4,701.21	4,701.37	2.34
11,453.00	89.69	267.23	6,761.90	-48.58	-4,792.12	4,792.33	0.52
11,544.00	89.88	268.38	6,762.24	-52.07	-4,883.05	4,883.30	1.28
11,639.00	89.75	268.67	6,762.55	-54.51	-4,978.02	4,978.29	0.33
11,734.00	88.30	268.61	6,764.16	-56.77	-5,072.97	5,073.27	1.53
11,828.00	87.22	268.53	6,767.84	-59.11	-5,166.87	5,167.19	1.15
11,923.00	87.25	268.34	6,772.42	-61.70	-5,261.72	5,262.07	0.20
12,018.00	87.93	268.52	6,776.42	-64.30	-5,356.60	5,356.98	0.74
12,113.00	88.98	268.83	6,778.98	-66.50	-5,451.54	5,451.94	1.15
12,208.00	90.22	269.34	6,779.64	-68.02	-5,546.53	5,546.93	1.41
12,302.00	91.45	270.04	6,778.27	-68.52	-5,640.51	5,640.92	1.51
12,397.00	90.71	269.80	6,776.48	-68.66	-5,735.49	5,735.89	0.82
12,491.00	91.85	269.83	6,774.38	-68.96	-5,829.47	5,829.86	1.21
12,586.00	90.22	268.82	6,772.66	-70.08	-5,924.44	5,924.84	2.02
12,681.00	90.43	267.97	6,772.12	-72.74	-6,019.40	6,019.83	0.92
12,870.00	86.15	267.36	6,777.76	-80.43	-6,208.12	6,208.63	2.29
12,965.00	87.04	269.00	6,783.41	-83.45	-6,302.90	6,303.45	1.96
13,060.00	87.99	269.11	6,787.52	-85.01	-6,397.79	6,398.36	1.01
13,155.00	89.29	270.16	6,789.78	-85.62	-6,492.76	6,493.32	1.76
13,249.00	89.23	269.65	6,790.99	-85.77	-6,586.75	6,587.31	0.55
13,344.00	89.66	269.38	6,791.91	-86.58	-6,681.74	6,682.30	0.53
13,439.00	91.14	269.59	6,791.25	-87.43	-6,776.74	6,777.30	1.57
13,533.00	92.44	269.97	6,788.31	-87.79	-6,870.69	6,871.24	1.44
13,628.00	90.31	269.47	6,786.04	-88.25	-6,965.65	6,966.21	2.30
13,723.00	90.71	269.07	6,785.19	-89.46	-7,060.64	7,061.20	0.60
13,763.20	90.53	269.17	6,784.76	-90.08	-7,100.83	7,101.40	0.51
70 Ranch State BB18-681_Rev A0_BHL							
13,818.00	90.28	269.30	6,784.37	-90.82	-7,155.63	7,156.20	0.51
13,912.00	90.71	269.02	6,783.56	-92.19	-7,249.61	7,250.19	0.55
14,007.00	89.23	269.20	6,783.61	-93.67	-7,344.60	7,345.19	1.57
14,102.00	89.41	269.13	6,784.73	-95.05	-7,439.58	7,440.19	0.20
14,197.00	89.20	269.26	6,785.89	-96.39	-7,534.57	7,535.18	0.26
14,291.00	89.85	269.34	6,786.67	-97.54	-7,628.56	7,629.17	0.70
14,386.00	90.99	269.23	6,785.97	-98.72	-7,723.54	7,724.17	1.21
14,481.00	90.99	269.38	6,784.33	-99.87	-7,818.52	7,819.16	0.16
14,575.00	89.94	269.20	6,783.56	-101.04	-7,912.51	7,913.15	1.13
14,670.00	88.49	269.59	6,784.87	-102.04	-8,007.49	8,008.14	1.58

## Design Report for 70 Ranch State BB18-681 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
14,765.00	89.48	269.80	6,786.55	-102.55	-8,102.48	8,103.12	1.07
14,860.00	89.81	269.56	6,787.14	-103.08	-8,197.47	8,198.11	0.43
14,954.00	91.33	270.02	6,786.20	-103.42	-8,291.47	8,292.10	1.69
15,048.00	89.14	267.46	6,785.82	-105.49	-8,385.43	8,386.08	3.58
15,143.00	88.70	267.25	6,787.61	-109.87	-8,480.31	8,481.02	0.51
15,237.00	89.97	267.84	6,788.70	-113.90	-8,574.21	8,574.97	1.49
15,332.00	89.75	264.60	6,788.93	-120.16	-8,669.00	8,669.83	3.42
15,427.00	89.97	264.62	6,789.16	-129.08	-8,763.57	8,764.52	0.23
15,521.00	90.77	264.54	6,788.56	-137.96	-8,857.15	8,858.21	0.86
15,616.00	88.89	265.39	6,788.84	-146.30	-8,951.78	8,952.95	2.17
15,711.00	88.70	265.28	6,790.84	-154.03	-9,046.44	9,047.71	0.23
15,806.00	88.40	265.38	6,793.24	-161.76	-9,141.10	9,142.46	0.33
15,901.00	89.02	265.12	6,795.38	-169.62	-9,235.75	9,237.21	0.71
15,956.00	89.85	264.88	6,795.92	-174.42	-9,290.53	9,292.06	1.57
Final Sperry MWD Survey at 15956.00ft							
16,017.79	89.85	264.88	6,796.08	-179.93	-9,352.08	9,353.68	0.00
70 Ranch State BB18-681_Rev A2_BHL							
16,017.90	89.85	264.88	6,796.08	-179.94	-9,352.19	9,353.79	0.00
70 Ranch State BB18-681_Rev A1_BHL							
16,023.00	89.85	264.88	6,796.10	-180.39	-9,357.27	9,358.87	0.00
Straight Line Projection to TD at 16023.00ft							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
300.00	299.99	0.63	1.75	First Gyro Survey at 300.00ft
770.00	769.87	4.17	11.52	Tie on to Gyro Surveys at 770.00ft
770.00	769.87	4.17	11.52	Final Gyro Survey at 770.00ft
826.00	825.84	4.80	13.27	First Sperry MWD Survey at 826.00ft
15,956.00	6,795.92	-174.42	-9,290.53	Final Sperry MWD Survey at 15956.00ft
16,023.00	6,796.10	-180.39	-9,357.27	Straight Line Projection to TD at 16023.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/-S (usft)	+E/-W (usft)	
Target	70 Ranch State BB18-681_Rev A2_BHL	269.20	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
300.00	770.00	Surface Surveys	Flexi-Shot
826.00	7,002.00	Intermediate Survey	MWD
7,155.00	16,023.00	Production Surveys	MWD+IFR1+MS_WY

## Design Report for 70 Ranch State BB18-681 - Actual Surveys

**Casing Details**

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
763.00	762.87	9 5/8"	9-5/8	13-3/4
7,036.00	6,734.02	7"	7	8-3/4

**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
70 Ranch State BB18- - actual wellpath misses target center by 0.01usft at 0.00usft MD (0.00 TVD, 0.00 N, 0.00 E) - Point	0.00	0.00	0.00	0.01	0.00	1,392,152.21	3,291,401.59	40.405140	-104.453610
70 Ranch State BB18- - actual wellpath misses target center by 0.01usft at 0.00usft MD (0.00 TVD, 0.00 N, 0.00 E) - Point	0.00	0.00	0.00	0.01	0.00	1,392,152.21	3,291,401.59	40.405140	-104.453610
70 Ranch State BB18- - actual wellpath misses target center by 95.93usft at 16017.79usft MD (6796.08 TVD, -179.93 N, -9352.08 E) - Point	0.00	0.00	6,714.00	-130.49	-9,356.73	1,392,021.71	3,282,045.24	40.405080	-104.487210
70 Ranch State BB18- - actual wellpath misses target center by 50.19usft at 13763.20usft MD (6784.76 TVD, -90.08 N, -7100.83 E) - Point	0.00	0.00	6,755.00	-130.49	-7,100.00	1,392,021.71	3,284,301.87	40.405009	-104.479107
70 Ranch State BB18- - actual wellpath misses target center by 64.45usft at 16017.90usft MD (6796.08 TVD, -179.94 N, -9352.19 E) - Point	0.00	0.00	6,755.00	-130.49	-9,356.73	1,392,021.71	3,282,045.23	40.405080	-104.487210

**Directional Difficulty Index**

Average Dogleg over Survey:	1.62 °/100usft	Maximum Dogleg over Survey:	13.16 °/100usft at 7,002.00 usft
Net Tortousity applicable to Plans:	0.95 °/100usft	Directional Difficulty Index:	6.776

**Audit Info**

North Reference Sheet for Sec. 17-T5N-R63W (70 Ranch State BB18 PAD) - 70  
Ranch State BB18-681 - Plan A

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

Vertical Depths are relative to KB = 24' @ 4723.00usft (H&P 273). Northing and Easting are relative to 70 Ranch State BB18-681

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: 0.99996047

Grid Coordinates of Well: 1,392,152.20 usft N, 3,291,401.59 usft E

Geographical Coordinates of Well: 40° 24' 18.50" N, 104° 27' 13.00" W

Grid Convergence at Surface is: 0.68°

Based upon Minimum Curvature type calculations, at a Measured Depth of 16,023.00usft the Bottom Hole Displacement is 9,359.01usft in the Direction of 268.90° (Grid).

Magnetic Convergence at surface is: -7.70° (20 July 2015, , BGGM2015)

