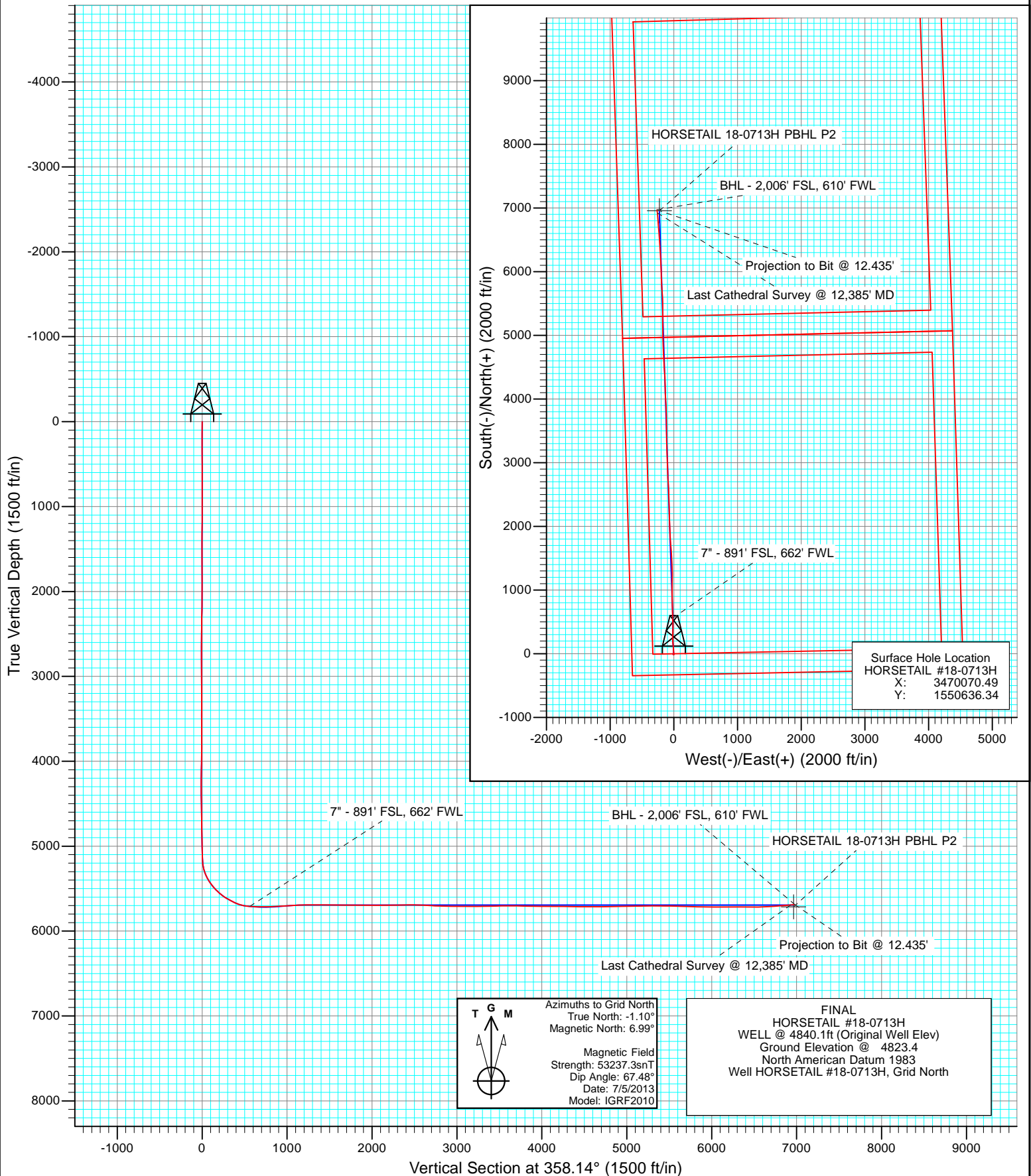


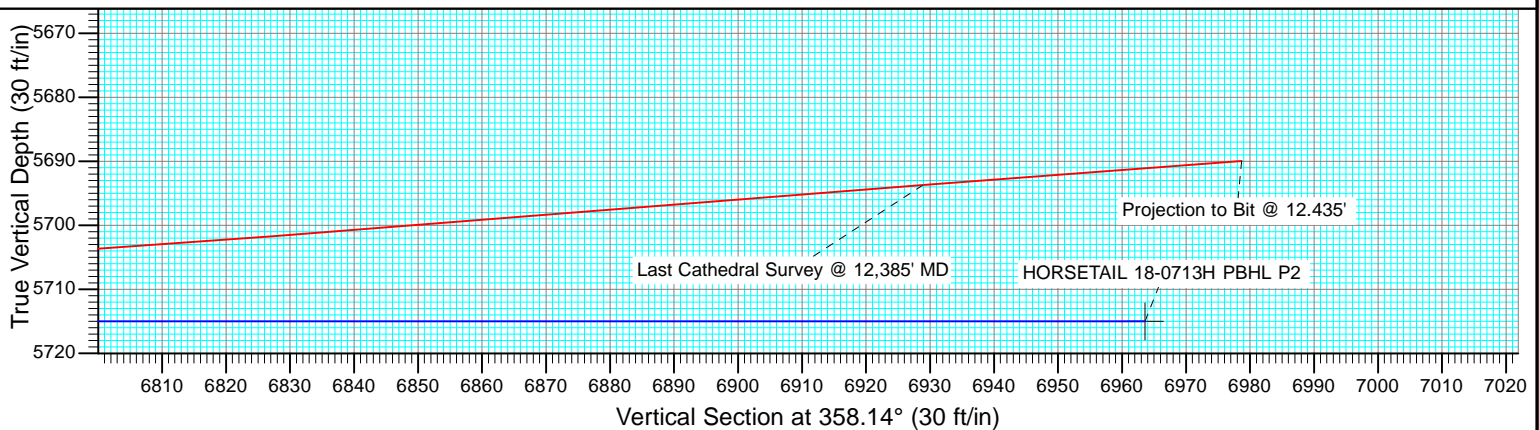
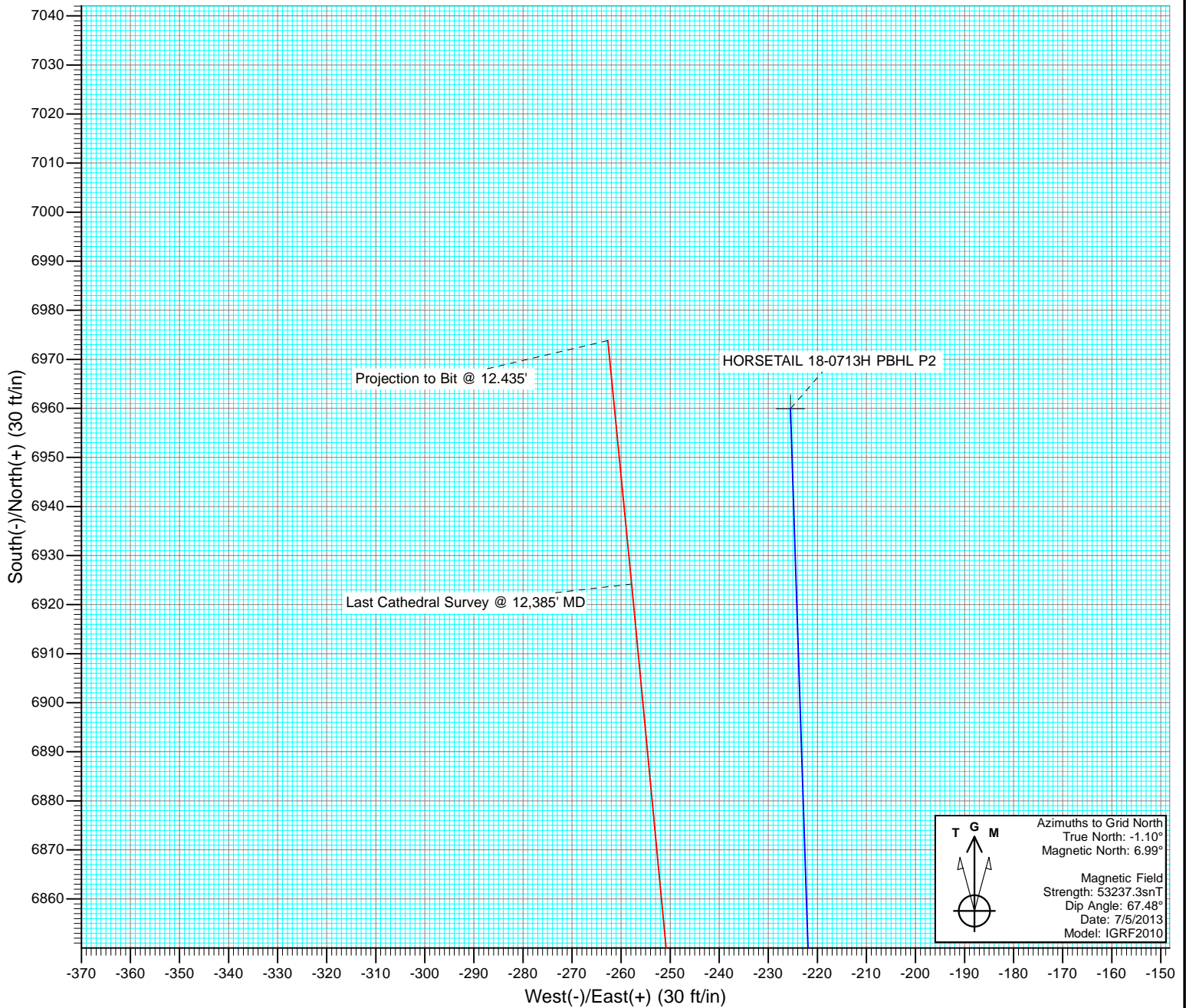


Project: Weld County, CO
Site: S18-T10N-R57W
Well: HORSETAIL #18-0713H
Wellbore: HZ
Design: FINAL





Project: Weld County, CO
Site: S18-T10N-R57W
Well: HORSETAIL #18-0713H
Wellbore: HZ
Design: FINAL



Cathedral Energy Services

Survey Report

Company:	Whiting Petroleum Corporation	Local Co-ordinate Reference:	Well HORSETAIL #18-0713H
Project:	Weld County, CO	TVD Reference:	WELL @ 4840.1ft (Original Well Elev)
Site:	S18-T10N-R57W	MD Reference:	WELL @ 4840.1ft (Original Well Elev)
Well:	HORSETAIL #18-0713H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Project	Weld County, CO		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Northern Zone		

Site		S18-T10N-R57W			
Site Position:		Northing:	1,550,636.34 ft	Latitude:	40° 49' 57.03 N
From:	Lat/Long	Easting:	3,470,070.49 ft	Longitude:	103° 48' 4.61 W
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	1.10 °

Well	HORSETAIL #18-0713H					
Well Position	+N/-S	0.0 ft	Northing:	1,550,636.34 ft	Latitude:	40° 49' 57.03 N
	+E/-W	0.0 ft	Easting:	3,470,070.49 ft	Longitude:	103° 48' 4.61 W
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,823.4 ft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	7/5/2013	8.09	67.48	53,237

Design	FINAL				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.0	0.0	0.0	358.14	

Survey Program	Date	7/25/2013			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
158.0	12,435.0	Survey #1 (HZ)	ISCWSA MWD	MWD - ISCWSA	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Formations / Comments	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00		
158.0	0.70	257.60	158.0	-0.2	-0.9	-0.2	0.44	0.44		
342.0	0.60	289.60	342.0	-0.1	-2.9	0.0	0.20	-0.05		
526.0	0.60	282.10	526.0	0.4	-4.8	0.6	0.04	0.00		
801.0	0.30	212.40	801.0	0.1	-6.6	0.3	0.21	-0.11		
1,169.0	0.50	286.80	1,169.0	-0.3	-8.6	0.0	0.14	0.05		
1,358.0	0.80	211.00	1,358.0	-1.1	-10.1	-0.8	0.44	0.16		
1,453.0	0.90	238.00	1,452.9	-2.1	-11.1	-1.8	0.43	0.11		
1,643.0	0.60	81.10	1,642.9	-2.7	-11.4	-2.4	0.77	-0.16		
1,707.0	1.10	81.20	1,706.9	-2.6	-10.4	-2.3	0.78	0.78		
1,849.0	1.10	72.40	1,848.9	-2.0	-7.8	-1.7	0.12	0.00		
1,941.0	1.70	63.40	1,940.9	-1.1	-5.7	-0.9	0.69	0.65		
2,033.0	1.30	109.50	2,032.8	-0.8	-3.5	-0.7	1.34	-0.43		

Cathedral Energy Services

Survey Report

Company:	Whiting Petroleum Corporation	Local Co-ordinate Reference:	Well HORSETAIL #18-0713H
Project:	Weld County, CO	TVD Reference:	WELL @ 4840.1ft (Original Well Elev)
Site:	S18-T10N-R57W	MD Reference:	WELL @ 4840.1ft (Original Well Elev)
Well:	HORSETAIL #18-0713H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Formations / Comments
2,125.0	2.00	96.30	2,124.8	-1.4	-0.9	-1.3	0.86	0.76	
2,224.0	1.80	139.30	2,223.8	-2.7	1.8	-2.8	1.42	-0.20	
2,319.0	1.00	213.30	2,318.7	-4.6	2.3	-4.6	1.90	-0.84	
2,414.0	0.80	214.80	2,413.7	-5.8	1.5	-5.8	0.21	-0.21	
2,508.0	1.00	208.60	2,507.7	-7.1	0.7	-7.1	0.24	0.21	
2,603.0	1.30	211.90	2,602.7	-8.7	-0.3	-8.7	0.32	0.32	
2,698.0	1.00	321.00	2,697.7	-9.0	-1.4	-8.9	1.98	-0.32	
2,793.0	0.80	312.90	2,792.7	-7.9	-2.4	-7.8	0.25	-0.21	
2,888.0	0.70	296.90	2,887.7	-7.2	-3.4	-7.0	0.24	-0.11	
2,983.0	0.90	280.70	2,982.7	-6.8	-4.6	-6.6	0.32	0.21	
3,077.0	0.90	288.00	3,076.6	-6.4	-6.0	-6.2	0.12	0.00	
3,172.0	0.70	279.00	3,171.6	-6.1	-7.3	-5.8	0.25	-0.21	
3,267.0	0.60	253.40	3,266.6	-6.1	-8.4	-5.8	0.32	-0.11	
3,362.0	0.50	265.00	3,361.6	-6.3	-9.3	-6.0	0.16	-0.11	
3,457.0	0.40	251.20	3,456.6	-6.4	-10.0	-6.1	0.15	-0.11	
3,552.0	0.60	48.00	3,551.6	-6.2	-9.9	-5.9	1.03	0.21	
3,647.0	0.70	66.10	3,646.6	-5.7	-9.0	-5.4	0.24	0.11	
3,741.0	0.50	78.90	3,740.6	-5.3	-8.1	-5.1	0.25	-0.21	
3,836.0	0.90	109.60	3,835.6	-5.5	-7.0	-5.3	0.56	0.42	
4,026.0	1.10	140.80	4,025.6	-7.4	-4.4	-7.3	0.30	0.11	
4,120.0	2.10	158.90	4,119.5	-9.7	-3.2	-9.6	1.18	1.06	
4,215.0	1.10	116.20	4,214.5	-11.8	-1.8	-11.7	1.57	-1.05	
4,310.0	0.10	308.30	4,309.5	-12.1	-1.0	-12.1	1.26	-1.05	
4,405.0	1.50	25.40	4,404.5	-10.9	-0.6	-10.9	1.56	1.47	
4,500.0	1.40	8.80	4,499.5	-8.7	0.1	-8.7	0.45	-0.11	
4,595.0	0.70	355.90	4,594.4	-6.9	0.3	-6.9	0.77	-0.74	
4,689.0	1.10	311.70	4,688.4	-5.8	-0.4	-5.7	0.82	0.43	
4,784.0	0.70	283.30	4,783.4	-5.0	-1.7	-5.0	0.62	-0.42	
4,879.0	1.70	5.70	4,878.4	-3.5	-2.1	-3.4	1.84	1.05	
4,974.0	1.10	355.40	4,973.4	-1.2	-2.1	-1.1	0.68	-0.63	
5,069.0	1.00	354.10	5,068.4	0.6	-2.2	0.6	0.11	-0.11	
5,163.0	2.90	359.30	5,162.3	3.8	-2.3	3.8	2.03	2.02	
5,195.0	5.80	14.50	5,194.2	6.1	-1.9	6.2	9.67	9.06	
5,227.0	8.90	11.60	5,225.9	10.1	-1.0	10.1	9.75	9.69	
5,258.0	12.30	2.70	5,256.4	15.8	-0.4	15.8	12.14	10.97	
5,290.0	16.60	355.20	5,287.4	23.7	-0.6	23.7	14.63	13.44	
5,322.0	20.30	352.30	5,317.7	33.8	-1.7	33.8	11.91	11.56	
5,353.0	24.00	355.60	5,346.4	45.4	-2.9	45.5	12.59	11.94	
5,385.0	27.80	357.70	5,375.2	59.4	-3.7	59.5	12.21	11.87	
5,416.0	31.40	357.90	5,402.2	74.7	-4.3	74.8	11.62	11.61	
5,448.0	34.30	355.40	5,429.1	92.0	-5.4	92.1	10.00	9.06	
5,479.0	37.90	353.90	5,454.1	110.2	-7.1	110.3	11.96	11.61	
5,511.0	40.20	354.10	5,478.9	130.2	-9.2	130.4	7.20	7.19	
5,543.0	43.40	353.40	5,502.8	151.4	-11.5	151.7	10.11	10.00	
5,574.0	45.50	354.90	5,524.9	173.0	-13.7	173.4	7.57	6.77	
5,606.0	47.30	356.10	5,547.0	196.1	-15.5	196.5	6.25	5.62	
5,638.0	50.40	358.80	5,568.1	220.2	-16.6	220.6	11.58	9.69	
5,669.0	54.50	358.90	5,586.9	244.7	-17.1	245.2	13.23	13.23	
5,701.0	57.70	0.70	5,604.8	271.3	-17.2	271.7	11.04	10.00	
5,732.0	59.90	1.30	5,620.8	297.8	-16.7	298.2	7.29	7.10	
5,764.0	61.10	2.10	5,636.6	325.6	-15.9	326.0	4.34	3.75	
5,795.0	62.60	2.30	5,651.2	353.0	-14.8	353.2	4.87	4.84	
5,827.0	64.50	1.80	5,665.5	381.6	-13.8	381.8	6.10	5.94	

Cathedral Energy Services

Survey Report

Company:	Whiting Petroleum Corporation	Local Co-ordinate Reference:	Well HORSETAIL #18-0713H
Project:	Weld County, CO	TVD Reference:	WELL @ 4840.1ft (Original Well Elev)
Site:	S18-T10N-R57W	MD Reference:	WELL @ 4840.1ft (Original Well Elev)
Well:	HORSETAIL #18-0713H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Formations / Comments
5,859.0	68.60	1.30	5,678.2	410.9	-13.0	411.1	12.89	12.81	
5,890.0	72.20	0.50	5,688.6	440.1	-12.5	440.3	11.86	11.61	
5,922.0	76.70	359.30	5,697.2	470.9	-12.6	471.1	14.52	14.06	
5,953.0	81.50	358.80	5,703.0	501.4	-13.1	501.5	15.56	15.48	
5,973.0	84.50	358.20	5,705.5	521.2	-13.6	521.4	15.29	15.00	
6,013.0	85.59	357.85	5,708.9	561.0	-15.0	561.2	2.87	2.73	7" - 891' FSL, 662' FWL
6,112.0	88.30	357.00	5,714.2	659.8	-19.4	660.1	2.87	2.73	
6,207.0	91.60	358.10	5,714.3	754.7	-23.5	755.0	3.66	3.47	
6,302.0	92.00	359.40	5,711.3	849.6	-25.6	850.0	1.43	0.42	
6,397.0	94.70	0.40	5,705.8	944.4	-25.7	944.8	3.03	2.84	
6,492.0	93.20	1.00	5,699.2	1,039.2	-24.6	1,039.5	1.70	-1.58	
6,587.0	92.40	0.80	5,694.6	1,134.1	-23.1	1,134.2	0.87	-0.84	
6,681.0	90.30	359.30	5,692.4	1,228.0	-23.0	1,228.1	2.75	-2.23	
6,776.0	90.10	357.90	5,692.0	1,323.0	-25.3	1,323.1	1.49	-0.21	
6,871.0	90.00	357.60	5,691.9	1,417.9	-29.1	1,418.1	0.33	-0.11	
6,966.0	89.60	356.80	5,692.3	1,512.8	-33.7	1,513.1	0.94	-0.42	
7,061.0	89.10	356.30	5,693.4	1,607.6	-39.4	1,608.1	0.74	-0.53	
7,156.0	88.80	355.30	5,695.1	1,702.4	-46.4	1,703.0	1.10	-0.32	
7,247.0	89.40	356.40	5,696.5	1,793.1	-53.0	1,793.9	1.38	0.66	
7,339.0	89.40	357.30	5,697.5	1,885.0	-58.0	1,885.9	0.98	0.00	
7,430.0	90.50	358.00	5,697.6	1,975.9	-61.7	1,976.9	1.43	1.21	
7,522.0	90.20	357.50	5,697.0	2,067.8	-65.4	2,068.9	0.63	-0.33	
7,614.0	91.00	358.60	5,696.0	2,159.8	-68.5	2,160.8	1.48	0.87	
7,705.0	90.80	358.60	5,694.6	2,250.7	-70.7	2,251.8	0.22	-0.22	
7,796.0	90.70	358.70	5,693.4	2,341.7	-72.9	2,342.8	0.16	-0.11	
7,887.0	90.40	358.80	5,692.5	2,432.7	-74.8	2,433.8	0.35	-0.33	
7,978.0	88.00	357.00	5,693.8	2,523.6	-78.2	2,524.8	3.30	-2.64	
8,070.0	87.50	356.90	5,697.4	2,615.4	-83.1	2,616.7	0.55	-0.54	
8,161.0	86.80	356.10	5,702.0	2,706.1	-88.6	2,707.5	1.17	-0.77	
8,252.0	87.90	357.90	5,706.2	2,796.9	-93.4	2,798.4	2.32	1.21	
8,343.0	89.80	358.40	5,708.0	2,887.8	-96.3	2,889.4	2.16	2.09	
8,435.0	89.80	358.30	5,708.3	2,979.8	-99.0	2,981.4	0.11	0.00	
8,526.0	88.80	357.40	5,709.4	3,070.7	-102.4	3,072.4	1.48	-1.10	
8,617.0	89.40	357.10	5,710.9	3,161.6	-106.7	3,163.4	0.74	0.66	
8,709.0	90.70	359.00	5,710.8	3,253.5	-109.9	3,255.4	2.50	1.41	
8,800.0	92.40	359.60	5,708.3	3,344.5	-111.0	3,346.3	1.98	1.87	
8,893.0	90.00	359.60	5,704.5	3,527.4	-112.2	3,529.2	1.31	-1.31	
9,074.0	90.60	359.40	5,704.0	3,618.4	-113.0	3,620.2	0.70	0.66	
9,166.0	89.50	358.70	5,703.9	3,710.4	-114.6	3,712.2	1.42	-1.20	
9,256.0	88.80	357.80	5,705.3	3,800.3	-117.3	3,802.1	1.27	-0.78	
9,348.0	88.30	357.00	5,707.6	3,892.2	-121.5	3,894.1	1.03	-0.54	
9,439.0	89.70	357.00	5,709.2	3,983.1	-126.2	3,985.1	1.54	1.54	
9,530.0	89.70	357.30	5,709.6	4,074.0	-130.8	4,076.1	0.33	0.00	
9,621.0	89.70	358.80	5,710.1	4,164.9	-133.9	4,167.1	1.65	0.00	
9,713.0	89.20	358.50	5,711.0	4,256.9	-136.0	4,259.1	0.63	-0.54	
9,804.0	90.10	357.60	5,711.6	4,347.8	-139.1	4,350.1	1.40	0.99	
9,896.0	88.70	356.10	5,712.5	4,439.7	-144.2	4,442.0	2.23	-1.52	
9,987.0	89.70	356.20	5,713.8	4,530.5	-150.3	4,533.0	1.10	1.10	
10,079.0	90.60	357.20	5,713.6	4,622.3	-155.6	4,624.9	1.46	0.98	
10,170.0	90.70	356.60	5,712.5	4,713.2	-160.5	4,715.9	0.67	0.11	
10,262.0	90.80	357.40	5,711.3	4,805.0	-165.3	4,807.9	0.88	0.11	
10,353.0	91.00	358.50	5,709.9	4,896.0	-168.6	4,898.9	1.23	0.22	
10,444.0	91.40	358.90	5,708.0	4,986.9	-170.6	4,989.8	0.62	0.44	

Cathedral Energy Services

Survey Report

Company:	Whiting Petroleum Corporation	Local Co-ordinate Reference:	Well HORSETAIL #18-0713H
Project:	Weld County, CO	TVD Reference:	WELL @ 4840.1ft (Original Well Elev)
Site:	S18-T10N-R57W	MD Reference:	WELL @ 4840.1ft (Original Well Elev)
Well:	HORSETAIL #18-0713H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Formations / Comments
10,536.0	90.40	359.70	5,706.5	5,078.9	-171.8	5,081.8	1.39	-1.09	
10,628.0	90.60	359.60	5,705.7	5,170.9	-172.3	5,173.8	0.24	0.22	
10,720.0	90.80	0.00	5,704.6	5,262.9	-172.7	5,265.7	0.49	0.22	
10,812.0	89.90	0.10	5,704.1	5,354.9	-172.6	5,357.7	0.98	-0.98	
10,904.0	89.50	0.00	5,704.5	5,446.9	-172.5	5,449.6	0.45	-0.43	
10,995.0	88.80	357.40	5,705.9	5,537.9	-174.6	5,540.6	2.96	-0.77	
11,087.0	87.50	356.40	5,708.9	5,629.7	-179.5	5,632.5	1.78	-1.41	
11,178.0	88.60	356.60	5,711.9	5,720.4	-185.1	5,723.4	1.23	1.21	
11,269.0	88.30	356.40	5,714.4	5,811.2	-190.6	5,814.4	0.40	-0.33	
11,360.0	89.70	358.30	5,716.0	5,902.1	-194.8	5,905.3	2.59	1.54	
11,453.0	89.50	357.90	5,716.6	5,995.1	-197.9	5,998.3	0.48	-0.22	
11,545.0	90.70	357.80	5,716.5	6,087.0	-201.4	6,090.3	1.31	1.30	
11,636.0	90.20	357.30	5,715.8	6,177.9	-205.3	6,181.3	0.78	-0.55	
11,727.0	89.60	357.10	5,715.9	6,268.8	-209.7	6,272.3	0.70	-0.66	
11,818.0	89.00	356.30	5,717.0	6,359.6	-215.0	6,363.3	1.10	-0.66	
11,910.0	89.90	355.80	5,717.9	6,451.4	-221.3	6,455.2	1.12	0.98	
12,002.0	91.20	356.00	5,717.0	6,543.2	-227.9	6,547.1	1.43	1.41	
12,093.0	93.00	356.40	5,713.7	6,633.9	-233.9	6,638.0	2.03	1.98	
12,188.0	93.40	355.70	5,708.4	6,728.5	-240.4	6,732.8	0.85	0.42	
12,283.0	94.70	354.80	5,701.7	6,823.0	-248.3	6,827.4	1.66	1.37	
12,385.0	94.30	354.40	5,693.7	6,924.2	-257.8	6,928.9	0.55	-0.39	Last Cathedral Survey @ 12,385' MD
12,435.0	94.30	354.40	5,689.9	6,973.8	-262.7	6,978.7	0.00	0.00	PTB @ 12,435' - BHL - 2,006' FSL, 610' FWL

Cathedral Energy Services

Survey Report

Company:	Whiting Petroleum Corporation	Local Co-ordinate Reference:	Well HORSETAIL #18-0713H
Project:	Weld County, CO	TVD Reference:	WELL @ 4840.1ft (Original Well Elev)
Site:	S18-T10N-R57W	MD Reference:	WELL @ 4840.1ft (Original Well Elev)
Well:	HORSETAIL #18-0713H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Targets									
Target Name									
- hit/miss target	Dip Angle	Dip Dir.	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
- Shape	(°)	(°)	(ft)	(ft)	(ft)	(ft)	(ft)		
HORSETAIL 18-0713H F	0.00	0.00	5,715.0	6,959.9	-225.5	1,557,596.28	3,469,845.00	40° 51' 5.83 N	103° 48' 5.81 W
- actual wellpath misses target center by 42.8ft at 12415.7ft MD (5691.4 TVD, 6954.7 N, -260.8 E)									
- Point									
HORSETAIL 18-0713H F	0.00	0.00	5,693.0	6,959.9	-225.5	1,557,596.28	3,469,845.00	40° 51' 5.83 N	103° 48' 5.81 W
- actual wellpath misses target center by 35.7ft at 12417.4ft MD (5691.3 TVD, 6956.3 N, -261.0 E)									
- Point									
HORSETAIL 18-0713H F	0.00	0.00	5,739.0	6,959.9	-225.5	1,557,596.28	3,469,845.00	40° 51' 5.83 N	103° 48' 5.81 W
- actual wellpath misses target center by 59.5ft at 12413.9ft MD (5691.5 TVD, 6952.9 N, -260.7 E)									
- Point									
HORSETAIL 18-0713H F	0.00	0.00	5,693.0	1,199.3	-38.9	1,551,835.64	3,470,031.59	40° 50' 8.88 N	103° 48' 4.82 W
- actual wellpath misses target center by 16.1ft at 6652.2ft MD (5692.7 TVD, 1199.3 N, -22.8 E)									
- Point									

Design Annotations				
Measured Depth	Vertical Depth	Local Coordinates		Comment
(ft)	(ft)	+N/-S (ft)	+E/-W (ft)	
6,013.0	5,708.9	561.0	-15.0	7" - 891' FSL, 662' FWL
12,385.0	5,693.7	6,924.2	-257.8	Last Cathedral Survey @ 12,385' MD
12,435.0	5,689.9	6,973.8	-262.7	PTB @ 12.435'
12,435.0	5,689.9	6,973.8	-262.7	BHL - 2,006' FSL, 610' FWL

Checked By: _____ Approved By: _____ Date: _____