

# Cathedral Energy Services

## Survey Report

<b>Company:</b> Chesapeake Energy Corp	<b>Local Co-ordinate Reference:</b> Well Thomas Parkinson BRK 8H	
<b>Project:</b> Brooke County, WV	<b>TVD Reference:</b> WELL @ 1178.0usft (Nomac 37)	
<b>Site:</b> Thomas Parkinson	<b>MD Reference:</b> WELL @ 1178.0usft (Nomac 37)	
<b>Well:</b> Thomas Parkinson BRK 8H	<b>North Reference:</b> Grid	
<b>Wellbore:</b> HZ	<b>Survey Calculation Method:</b> Minimum Curvature	
<b>Design:</b> HZ	<b>Database:</b> USA EDM 5000 Multi Users DB	

<b>Project:</b> Brooke County, WV		
<b>Map System:</b> US State Plane 1927 (Exact solution)	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b> NAD 1927 (NADCON CONUS)		
<b>Map Zone:</b> West Virginia North 4701		Using geodetic scale factor

<b>Site:</b> Thomas Parkinson			
<b>Site Position:</b>	<b>Northing:</b>	625,613.82 usft	<b>Latitude:</b> 40° 12' 46.000 N
<b>From:</b> Lat/Long	<b>Easting:</b>	1,702,749.67 usft	<b>Longitude:</b> 80° 33' 51.500 W
<b>Position Uncertainty:</b> 0.0 usft	<b>Slot Radius:</b>	13-3/16"	<b>Grid Convergence:</b> -0.68 °

<b>Well:</b> Thomas Parkinson BRK 8H				
<b>Well Position</b>	<b>+N/-S</b>	0.0 usft	<b>Northing:</b> 625,598.76 usft	<b>Latitude:</b> 40° 12' 45.849 N
	<b>+E/-W</b>	0.0 usft	<b>Easting:</b> 1,702,735.40 usft	<b>Longitude:</b> 80° 33' 51.682 W
<b>Position Uncertainty</b>	0.0 usft		<b>Wellhead Elevation:</b> usft	<b>Ground Level:</b> 1,160.0 usft

<b>Wellbore:</b> HZ					
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	2/28/2013	-8.79	67.63	52,892

<b>Design:</b> HZ					
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.0
Vertical Section:	Depth From (FVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.0	0.0	0.0	159.00	

<b>Survey Program</b> Date: 3/20/2013					
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.0	5,350.0	Gyro 2 (HZ)	Gyro	Gyro	
5,429.0	12,671.0	Survey #4 (HZ)	MWD	Geolink MWD	

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	
100.0	0.23	285.71	100.0	0.1	-0.2	-0.1	0.23	0.23	
200.0	0.18	299.70	200.0	0.2	-0.5	-0.4	0.07	-0.05	
300.0	0.19	309.58	300.0	0.4	-0.8	-0.6	0.03	0.01	
400.0	0.20	318.52	400.0	0.6	-1.0	-0.9	0.03	0.01	
500.0	0.26	49.66	500.0	0.9	-1.0	-1.2	0.33	0.06	
600.0	1.29	77.62	600.0	1.3	0.3	-1.1	1.07	1.03	
700.0	2.76	81.06	699.9	1.9	3.8	-0.4	1.47	1.47	
800.0	4.70	87.72	799.7	2.4	10.2	1.4	1.98	1.94	
900.0	4.88	89.36	899.4	2.6	18.6	4.2	0.23	0.18	
1,000.0	4.87	88.59	999.0	2.8	27.1	7.1	0.07	-0.01	
1,100.0	5.14	87.28	1,098.6	3.1	35.8	9.9	0.29	0.27	

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WV GEOLOGICAL SURVEY  
MORGANTOWN, WV

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Project:	Brooke County, WV	TVD Reference:	WELL @ 1178.0usft (Nomac 37)
Site:	Thomas Parkinson	MD Reference:	WELL @ 1178.0usft (Nomac 37)
Well:	Thomas Parkinson BRK 8H	North Reference:	Grid
Wellbore Design:	HZ	Survey Calculation Method:	Minimum Curvature
	HZ	Database:	USA EDM 5000 Multi Users DB

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate ("/100)	Formations/Comments
1,200.0	5.62	84.30	1,198.2	3.8	45.2	12.6	0.56	0.48	
1,300.0	5.73	81.87	1,297.7	5.0	55.0	15.0	0.26	0.11	
1,400.0	5.59	81.49	1,397.2	6.4	64.7	17.2	0.14	-0.14	
1,500.0	4.38	84.41	1,496.8	7.5	73.3	19.3	1.24	-1.21	
1,600.0	3.16	91.57	1,596.6	7.8	79.9	21.3	1.31	-1.22	
1,700.0	1.88	101.04	1,696.5	7.4	84.3	23.3	1.34	-1.28	
1,800.0	1.56	103.16	1,796.5	6.8	87.2	24.9	0.33	-0.32	
1,900.0	0.70	106.68	1,896.4	6.3	89.1	26.0	0.86	-0.86	
2,000.0	0.17	118.18	1,996.4	6.1	89.8	26.5	0.53	-0.53	
2,100.0	0.05	239.04	2,096.4	6.0	89.9	26.6	0.20	-0.12	
2,200.0	0.18	287.47	2,196.4	6.0	89.7	26.6	0.15	0.13	
2,300.0	0.35	284.57	2,296.4	6.1	89.3	26.3	0.17	0.17	
2,400.0	0.28	294.06	2,396.4	6.3	88.8	25.9	0.09	-0.07	
2,500.0	0.40	288.11	2,496.4	6.5	88.2	25.5	0.12	0.12	
2,600.0	0.36	297.79	2,596.4	6.8	87.6	25.1	0.08	-0.04	
2,700.0	0.40	292.52	2,696.4	7.0	87.0	24.6	0.05	0.04	
2,800.0	0.43	302.11	2,796.4	7.4	86.4	24.1	0.08	0.03	
2,900.0	0.47	302.40	2,896.4	7.8	85.7	23.4	0.04	0.04	
3,000.0	0.46	303.90	2,996.4	8.2	85.0	22.8	0.02	-0.01	
3,100.0	0.43	308.37	3,096.4	8.7	84.4	22.1	0.05	-0.03	
3,200.0	0.48	301.79	3,196.4	9.1	83.7	21.5	0.07	0.05	
3,300.0	0.54	310.38	3,296.4	9.7	83.0	20.7	0.10	0.06	
3,400.0	0.60	308.57	3,396.4	10.3	82.3	19.9	0.06	0.06	
3,500.0	0.60	327.01	3,496.4	11.1	81.6	18.9	0.19	0.00	
3,600.0	0.80	348.72	3,596.4	12.2	81.1	17.7	0.33	0.20	
3,700.0	0.82	347.93	3,696.4	13.6	80.9	16.3	0.02	0.02	
3,800.0	0.59	332.13	3,796.4	14.7	80.5	15.1	0.30	-0.23	
3,900.0	0.46	334.42	3,896.4	15.6	80.1	14.2	0.13	-0.13	
4,000.0	0.36	354.66	3,996.4	16.2	79.9	13.5	0.17	-0.10	
4,100.0	0.35	336.50	4,096.4	16.8	79.7	12.9	0.11	-0.01	
4,200.0	0.43	355.30	4,196.3	17.5	79.6	12.2	0.15	0.08	
4,300.0	0.37	351.51	4,296.3	18.2	79.5	11.5	0.07	-0.06	
4,400.0	0.36	355.80	4,396.3	18.8	79.4	10.9	0.03	-0.01	
4,500.0	0.54	341.72	4,496.3	19.6	79.2	10.1	0.21	0.18	
4,600.0	0.54	333.96	4,596.3	20.4	78.9	9.2	0.07	0.00	
4,700.0	0.49	328.20	4,696.3	21.2	78.4	8.3	0.07	-0.05	
4,800.0	0.64	316.81	4,796.3	22.0	77.8	7.4	0.19	0.15	
4,900.0	0.65	316.97	4,896.3	22.8	77.1	6.3	0.01	0.01	
5,000.0	0.70	324.58	4,996.3	23.7	76.3	5.2	0.10	0.05	
5,100.0	0.67	329.56	5,096.3	24.7	75.7	4.0	0.07	-0.03	
5,200.0	0.75	329.70	5,196.3	25.8	75.0	2.8	0.08	0.08	
5,300.0	0.63	338.42	5,296.3	26.9	74.5	1.6	0.16	-0.12	
5,350.0	0.48	339.71	5,346.3	27.3	74.3	1.1	0.30	-0.30	Last Gyro Survey @ 5350' MD
5,429.0	0.20	338.30	5,425.3	27.8	74.2	0.7	0.35	-0.35	
5,461.0	2.70	154.70	5,457.3	27.1	74.5	1.4	9.06	7.81	
5,492.0	5.70	153.80	5,488.2	25.1	75.5	3.6	9.68	9.68	
5,524.0	8.20	151.40	5,519.9	21.7	77.3	7.5	7.86	7.81	
5,555.0	11.60	148.60	5,550.5	17.1	79.9	12.7	11.07	10.97	
5,587.0	14.60	147.00	5,581.6	10.9	83.8	19.8	9.44	9.38	
5,618.0	17.50	147.50	5,611.4	3.7	88.5	28.2	9.37	9.35	
5,650.0	20.30	147.50	5,641.7	-5.0	94.0	38.4	8.75	8.75	
5,681.0	22.70	148.90	5,670.5	-14.7	100.0	49.5	7.92	7.74	
5,712.0	25.70	148.50	5,698.8	-25.5	106.6	62.0	9.69	9.68	

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<b>Company</b>	Chesapeake Energy Corp	<b>Local Co-ordinate Reference</b>	Well Thomas Parkinson BRK 8H
<b>Project</b>	Brooke County, WV	<b>TV D Reference</b>	WELL @ 1178.0usft (Nomac 37)
<b>Site</b>	Thomas Parkinson	<b>MD Reference</b>	WELL @ 1178.0usft (Nomac 37)
<b>Well</b>	Thomas Parkinson BRK 8H	<b>North Reference</b>	Grid
<b>Wellbore Design</b>	HZ	<b>Survey Calculation Method</b>	Minimum Curvature
		<b>Database</b>	USA EDM 5000 Multi Users DB

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/1000)	Formations/Comments
5,744.0	28.40	148.50	5,727.3	-37.9	114.2	76.4	8.44	8.44	
5,776.0	31.60	147.50	5,755.0	-51.5	122.7	92.1	10.12	10.00	
5,808.0	34.40	148.20	5,781.9	-66.3	132.0	109.2	8.83	8.75	
5,839.0	37.40	147.50	5,807.0	-81.6	141.6	127.0	9.77	9.68	
5,870.0	40.70	146.90	5,831.0	-98.1	152.2	146.1	10.71	10.65	
5,902.0	45.00	145.40	5,854.5	-116.1	164.3	167.3	13.81	13.44	
5,933.0	49.10	145.00	5,875.6	-134.7	177.3	189.3	13.26	13.23	
5,964.0	53.60	145.60	5,895.0	-154.7	191.1	212.9	14.59	14.52	
5,995.0	58.00	147.40	5,912.4	-176.0	205.2	237.9	14.98	14.19	
6,026.0	62.10	148.30	5,927.9	-198.8	219.5	264.2	13.46	13.23	
6,057.0	66.10	148.70	5,941.4	-222.5	234.1	291.6	12.96	12.90	
6,089.0	69.50	148.60	5,953.5	-247.8	249.5	320.8	10.63	10.63	
6,121.0	72.10	149.50	5,964.0	-273.8	265.0	350.5	8.55	8.13	
6,153.0	74.80	150.60	5,973.1	-300.3	280.3	380.8	9.06	8.44	
6,184.0	76.10	151.20	5,980.9	-326.5	294.9	410.5	4.59	4.19	
6,215.0	76.30	151.20	5,988.3	-352.9	309.4	440.4	0.65	0.65	
6,246.0	78.10	152.30	5,995.2	-379.6	323.7	470.4	6.76	5.81	
6,277.0	80.10	152.60	6,001.0	-406.5	337.8	500.6	6.52	6.45	
6,308.0	82.80	153.00	6,005.7	-433.8	351.8	531.1	8.80	8.71	
6,339.0	85.00	152.30	6,008.9	-461.2	366.0	561.7	7.44	7.10	
6,371.0	87.00	152.40	6,011.2	-489.5	380.8	593.4	6.26	6.25	
6,402.0	89.30	152.60	6,012.2	-516.9	395.1	624.2	7.45	7.42	
6,433.0	89.90	152.80	6,012.4	-544.5	409.3	655.0	2.04	1.94	
6,496.0	90.10	152.40	6,012.4	-600.4	438.3	717.6	0.71	0.32	
6,621.0	88.90	151.90	6,013.5	-710.9	496.7	841.7	1.04	-0.96	
6,747.0	89.30	149.50	6,015.5	-820.8	558.3	966.4	1.93	0.32	
6,873.0	89.10	149.00	6,017.2	-929.1	622.8	1,090.5	0.43	-0.16	
6,997.0	89.30	150.70	6,019.0	-1,036.3	685.0	1,212.9	1.38	0.16	
7,122.0	90.00	151.80	6,019.7	-1,145.9	745.2	1,336.8	1.04	0.56	
7,247.0	89.50	154.50	6,020.3	-1,257.4	801.6	1,461.1	2.20	-0.40	
7,374.0	89.00	157.70	6,021.9	-1,373.5	853.0	1,587.9	2.55	-0.39	
7,499.0	89.40	159.90	6,023.7	-1,490.0	898.2	1,712.9	1.79	0.32	
7,625.0	89.60	159.20	6,024.8	-1,608.0	942.3	1,838.9	0.58	0.16	
7,750.0	89.00	161.10	6,026.3	-1,725.6	984.7	1,963.9	1.59	-0.48	
7,875.0	88.70	161.30	6,028.8	-1,843.9	1,025.0	2,088.7	0.29	-0.24	
8,000.0	89.40	160.00	6,030.9	-1,961.8	1,066.4	2,213.7	1.18	0.56	
8,124.0	89.70	158.30	6,031.9	-2,077.7	1,110.5	2,337.7	1.39	0.24	
8,250.0	89.50	158.70	6,032.7	-2,194.9	1,156.7	2,463.7	0.35	-0.16	
8,376.0	89.70	158.40	6,033.6	-2,312.2	1,202.8	2,589.7	0.29	0.16	
8,502.0	89.70	156.30	6,034.3	-2,428.5	1,251.3	2,715.6	1.67	0.00	
8,628.0	89.00	157.30	6,035.7	-2,544.3	1,300.9	2,841.5	0.97	-0.56	
8,755.0	89.50	158.10	6,037.4	-2,661.8	1,349.1	2,968.4	0.74	0.39	
8,879.0	89.30	157.90	6,038.7	-2,776.7	1,395.6	3,092.4	0.23	-0.16	
9,005.0	89.50	158.80	6,040.0	-2,893.8	1,442.0	3,218.4	0.73	0.16	
9,130.0	89.60	157.70	6,041.0	-3,009.9	1,488.4	3,343.4	0.88	0.08	
9,256.0	89.80	157.90	6,041.6	-3,126.6	1,536.0	3,469.4	0.22	0.16	
9,381.0	89.70	158.40	6,042.2	-3,242.6	1,582.5	3,594.3	0.41	-0.08	
9,508.0	89.40	159.20	6,043.2	-3,361.0	1,628.4	3,721.3	0.67	-0.24	
9,634.0	89.20	160.70	6,044.7	-3,479.3	1,671.6	3,847.3	1.20	-0.16	
9,760.0	90.30	161.80	6,045.3	-3,598.7	1,712.1	3,973.2	1.23	0.87	
9,884.0	90.00	160.90	6,044.9	-3,716.1	1,751.8	4,097.1	0.77	-0.24	
10,009.0	89.00	160.80	6,046.0	-3,834.2	1,792.8	4,222.0	0.80	-0.80	
10,135.0	88.60	160.50	6,048.7	-3,953.1	1,834.5	4,347.9	0.40	-0.32	

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<b>Project</b>	Brooke County, WV	<b>TVD Reference</b>	WELL @ 1178.0usft (Nomac 37)
<b>Site</b>	Thomas Parkinson	<b>MD Reference</b>	WELL @ 1178.0usft (Nomac 37)
<b>Well</b>	Thomas Parkinson BRK 8H	<b>North Reference</b>	Grid
<b>Wellbore</b>	HZ	<b>Survey Calculation Method</b>	Minimum Curvature
<b>Design</b>	HZ	<b>Database</b>	USA EDM 5000 Multi Users DB

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100)	Formations / Comments
10,259.0	88.20	160.90	6,052.1	-4,070.1	1,875.5	4,471.8	0.46	-0.32	
10,385.0	88.90	160.00	6,055.3	-4,188.8	1,917.6	4,597.8	0.90	0.56	
10,512.0	89.20	158.40	6,057.4	-4,307.5	1,962.7	4,724.7	1.28	0.24	
10,639.0	89.00	158.00	6,059.4	-4,425.4	2,009.9	4,851.7	0.35	-0.16	
10,764.0	89.30	159.10	6,061.3	-4,541.7	2,055.6	4,976.7	0.91	0.24	
10,888.0	90.20	157.80	6,061.8	-4,657.0	2,101.1	5,100.7	1.28	0.73	
11,014.0	89.50	158.90	6,062.1	-4,774.1	2,147.6	5,226.7	1.03	-0.56	
11,139.0	90.90	158.00	6,061.7	-4,890.4	2,193.5	5,351.6	1.33	1.12	
11,264.0	90.40	158.40	6,060.3	-5,006.4	2,239.9	5,476.6	0.51	-0.40	
11,392.0	89.00	158.70	6,061.0	-5,125.6	2,286.7	5,604.6	1.12	-1.09	
11,518.0	88.30	158.40	6,063.9	-5,242.8	2,332.8	5,730.6	0.60	-0.56	
11,643.0	88.90	157.10	6,067.0	-5,358.5	2,380.1	5,855.5	1.15	0.48	
11,770.0	91.40	157.30	6,066.6	-5,475.5	2,429.3	5,982.4	1.97	1.97	
11,894.0	91.40	157.40	6,063.6	-5,589.9	2,477.1	6,106.3	0.08	0.00	
12,021.0	90.00	158.10	6,062.1	-5,707.5	2,525.2	6,233.3	1.23	-1.10	
12,146.0	89.70	157.50	6,062.4	-5,823.2	2,572.4	6,358.3	0.54	-0.24	
12,272.0	89.70	160.00	6,063.1	-5,940.6	2,618.0	6,484.3	1.98	0.00	
12,398.0	88.60	161.10	6,064.9	-6,059.4	2,660.0	6,610.2	1.23	-0.87	
12,523.0	88.80	159.90	6,067.8	-6,177.2	2,701.7	6,735.1	0.97	0.16	
12,623.0	88.40	160.60	6,070.2	-6,271.3	2,735.5	6,835.1	0.81	-0.40	Last Cathedral Survey @ 12623' MD
12,671.0	88.40	160.60	6,071.5	-6,316.5	2,751.4	6,883.0	0.00	0.00	PTB @ 12671' MD

Target Name	Hit/miss target Shape	Dip Angle (°)	Dip Dir (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Thomas Parkinson BRK	- actual wellpath misses target center by 0.6usft at 12670.9usft MD (6071.5 TVD, -6316.5 N, 2751.4 E)	0.00	360.00	6,072.1	-6,316.5	2,751.2	619,282.26	1,705,486.55	40° 11' 43.753 N	80° 33' 15.268 W
Thomas Parkinson BRK	- actual wellpath misses target center by 10.6usft at 12671.0usft MD (6071.5 TVD, -6316.5 N, 2751.4 E)	0.00	360.00	6,082.1	-6,316.5	2,751.2	619,282.26	1,705,486.55	40° 11' 43.753 N	80° 33' 15.268 W

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
5,350.0	5,346.3	27.3	74.3	Last Gyro Survey @ 5350' MD
12,623.0	6,070.2	-6,271.3	2,735.5	Last Cathedral Survey @ 12623' MD
12,671.0	6,071.5	-6,316.5	2,751.4	PTB @ 12671' MD

Checked By: \_\_\_\_\_ Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

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COMPASS 5000.1 Build 62