

# Cathedral Energy Services

## Survey Report

<b>Company:</b>	EnCana Oil & Gas (USA) Inc	<b>Local Co-ordinate Reference:</b>	Well State 1C-16H
<b>Project:</b>	DJ Wattenberg	<b>TVD Reference:</b>	WELL @ 5039.0ft (H&P 278)
<b>Site:</b>	S16-T3N-R68W (State)	<b>MD Reference:</b>	WELL @ 5039.0ft (H&P 278)
<b>Well:</b>	State 1C-16H	<b>North Reference:</b>	True
<b>Wellbore:</b>	Hz	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL	<b>Database:</b>	USA EDM 5000 Multi Users DB

<b>Project</b>	DJ Wattenberg		
<b>Map System:</b>	US State Plane 1983	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b>	North American Datum 1983		
<b>Map Zone:</b>	Colorado Northern Zone		

Site		S16-T3N-R68W (State)			
Site Position:		Northing:	1,326,575.12 ft	Latitude:	40.228760
From:	Lat/Long	Easting:	3,139,542.66 ft	Longitude:	-105.000250
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	0.32 °

Well	State 1C-16H					
Well Position	+N/-S	0.0 ft	Northing:	1,326,626.11 ft	Latitude:	40.228900
	+E/-W	0.0 ft	Easting:	3,139,542.37 ft	Longitude:	-105.000250
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	5,026.0 ft

<b>Wellbore</b>	Hz				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2010	3/17/2013	8.74	66.81	52,830

Design	FINAL			
Audit Notes:				
Version:	1.0	Phase:	ACTUAL	Tie On Depth: 0.0
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
	0.0	0.0	0.0	270.00

<b>Survey Program</b>	<b>Date</b>	6/17/2013			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
123.0	11,888.0	Survey #1 (Hz)	MWD	Geolink MWD	

<b>Survey</b>										
<b>Measured Depth (ft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Vertical Section (ft)</b>	<b>Dogleg Rate (°/100ft)</b>	<b>Build Rate (°/100ft)</b>	<b>Formations / Comments</b>	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00		
123.0	0.60	358.00	123.0	0.6	0.0	0.0	0.49	0.49		
215.0	0.80	353.90	215.0	1.8	-0.1	0.1	0.22	0.22		
276.0	1.60	2.00	276.0	3.0	-0.1	0.1	1.34	1.31		
338.0	2.00	13.00	337.9	5.0	0.2	-0.2	0.85	0.65		
399.0	2.50	20.50	398.9	7.2	0.9	-0.9	0.95	0.82		
460.0	2.50	13.10	459.8	9.8	1.6	-1.6	0.53	0.00		
521.0	2.60	26.10	520.8	12.3	2.5	-2.5	0.96	0.16		
583.0	2.50	39.30	582.7	14.6	4.0	-4.0	0.96	-0.16		
675.0	3.30	40.30	674.6	18.2	7.0	-7.0	0.87	0.87		
767.0	4.20	36.60	766.4	22.9	10.7	-10.7	1.01	0.98		
791.0	4.40	30.20	790.3	24.4	11.7	-11.7	2.16	0.83		
904.0	5.90	37.90	902.9	32.8	17.4	-17.4	1.46	1.33		

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<b>Well:</b>	State 1C-16H	<b>North Reference:</b>	True
<b>Wellbore:</b>	Hz	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL	<b>Database:</b>	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
995.0	6.70	34.30	993.3	40.8	23.3	-23.3	0.98	0.88	
1,088.0	6.90	30.30	1,085.7	50.1	29.2	-29.2	0.55	0.22	
1,180.0	8.80	28.80	1,176.8	61.1	35.4	-35.4	2.08	2.07	
1,273.0	10.30	24.90	1,268.5	74.9	42.3	-42.3	1.76	1.61	
1,365.0	9.70	13.60	1,359.1	89.8	47.6	-47.6	2.23	-0.65	
1,457.0	10.60	19.30	1,449.7	105.4	52.2	-52.2	1.46	0.98	
1,552.0	13.10	23.20	1,542.7	123.5	59.3	-59.3	2.76	2.63	
1,647.0	13.20	29.20	1,635.2	142.9	68.9	-68.9	1.44	0.11	
1,742.0	12.40	32.20	1,727.8	161.0	79.6	-79.6	1.09	-0.84	
1,837.0	13.40	28.70	1,820.4	179.3	90.3	-90.3	1.34	1.05	
1,932.0	12.80	33.40	1,912.9	197.7	101.4	-101.4	1.29	-0.63	
2,027.0	13.30	31.70	2,005.5	215.8	112.9	-112.9	0.66	0.53	
2,121.0	11.40	35.90	2,097.3	232.5	124.1	-124.1	2.23	-2.02	
2,216.0	11.70	33.60	2,190.4	248.1	134.9	-134.9	0.58	0.32	
2,311.0	12.10	31.90	2,283.3	264.6	145.5	-145.5	0.56	0.42	
2,405.0	12.60	34.80	2,375.2	281.4	156.5	-156.5	0.85	0.53	
2,500.0	13.00	34.30	2,467.8	298.7	168.5	-168.5	0.44	0.42	
2,594.0	12.80	31.50	2,559.4	316.4	179.9	-179.9	0.70	-0.21	
2,689.0	11.00	27.60	2,652.4	333.4	189.6	-189.6	2.07	-1.89	
2,784.0	11.50	26.10	2,745.6	349.9	197.9	-197.9	0.61	0.53	
2,878.0	10.70	28.70	2,837.8	366.0	206.3	-206.3	1.00	-0.85	
2,973.0	10.50	25.50	2,931.2	381.5	214.2	-214.2	0.65	-0.21	
3,068.0	10.50	24.70	3,024.6	397.2	221.6	-221.6	0.15	0.00	
3,162.0	11.60	33.90	3,116.9	412.8	230.4	-230.4	2.21	1.17	
3,257.0	11.50	37.50	3,209.9	428.3	241.5	-241.5	0.77	-0.11	
3,351.0	10.50	35.40	3,302.2	442.7	252.2	-252.2	1.15	-1.06	
3,446.0	10.50	40.60	3,395.6	456.3	262.8	-262.8	1.00	0.00	
3,541.0	12.00	33.20	3,488.8	471.1	273.9	-273.9	2.19	1.58	
3,635.0	9.30	34.60	3,581.2	485.6	283.5	-283.5	2.89	-2.87	
3,730.0	10.60	35.50	3,674.7	499.0	293.0	-293.0	1.38	1.37	
3,825.0	11.70	36.80	3,768.0	513.8	303.8	-303.8	1.19	1.16	
3,919.0	13.00	33.60	3,859.8	530.3	315.4	-315.4	1.56	1.38	
4,014.0	10.50	31.10	3,952.8	546.6	325.8	-325.8	2.68	-2.63	
4,109.0	8.10	28.90	4,046.5	559.9	333.5	-333.5	2.55	-2.53	
4,203.0	8.00	31.10	4,139.6	571.3	340.0	-340.0	0.34	-0.11	
4,298.0	9.50	32.10	4,233.5	583.6	347.6	-347.6	1.59	1.58	
4,392.0	11.00	35.30	4,326.0	597.5	356.9	-356.9	1.71	1.60	
4,487.0	9.20	32.80	4,419.5	611.2	366.3	-366.3	1.95	-1.89	
4,581.0	8.00	30.00	4,512.5	623.2	373.6	-373.6	1.35	-1.28	
4,676.0	8.10	24.70	4,606.5	635.0	379.7	-379.7	0.79	0.11	
4,771.0	9.90	27.10	4,700.3	648.4	386.2	-386.2	1.94	1.89	
4,865.0	9.80	28.20	4,793.0	662.6	393.7	-393.7	0.23	-0.11	
4,960.0	7.70	24.10	4,886.8	675.6	400.1	-400.1	2.30	-2.21	
5,054.0	6.10	20.10	4,980.2	686.0	404.4	-404.4	1.78	-1.70	
5,149.0	5.30	9.20	5,074.7	695.1	406.8	-406.8	1.41	-0.84	
5,243.0	4.40	3.60	5,168.4	703.0	407.8	-407.8	1.08	-0.96	
5,338.0	4.60	353.20	5,263.1	710.4	407.5	-407.5	0.88	0.21	
5,433.0	3.80	9.30	5,357.8	717.3	407.6	-407.6	1.49	-0.84	
5,527.0	2.50	32.80	5,451.7	722.1	409.2	-409.2	1.92	-1.38	
5,622.0	1.20	119.80	5,546.6	723.3	411.2	-411.2	2.86	-1.37	
5,716.0	1.00	107.00	5,640.6	722.6	412.8	-412.8	0.34	-0.21	
5,811.0	0.70	144.90	5,735.6	721.9	414.0	-414.0	0.65	-0.32	
5,905.0	0.70	170.40	5,829.6	720.8	414.4	-414.4	0.33	0.00	

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<b>Design:</b>	FINAL	<b>Database:</b>	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
6,000.0	0.80	199.30	5,924.6	719.6	414.3	-414.3	0.41	0.11	
6,095.0	0.70	122.50	6,019.6	718.7	414.5	-414.5	0.98	-0.11	
6,189.0	0.90	154.10	6,113.6	717.7	415.3	-415.3	0.51	0.21	
6,284.0	0.50	156.10	6,208.6	716.7	415.8	-415.8	0.42	-0.42	
6,378.0	0.70	165.60	6,302.6	715.7	416.1	-416.1	0.24	0.21	
6,473.0	1.10	168.50	6,397.6	714.3	416.5	-416.5	0.42	0.42	
6,568.0	1.80	166.10	6,492.5	711.9	417.0	-417.0	0.74	0.74	
6,665.0	1.80	176.90	6,589.5	708.9	417.5	-417.5	0.35	0.00	
6,760.0	1.50	188.30	6,684.4	706.2	417.4	-417.4	0.47	-0.32	
6,792.0	1.50	194.40	6,716.4	705.4	417.2	-417.2	0.50	0.00	
6,823.0	2.30	223.60	6,747.4	704.6	416.7	-416.7	3.97	2.58	
6,855.0	4.60	252.00	6,779.4	703.7	415.0	-415.0	8.75	7.19	
6,886.0	8.80	261.20	6,810.1	702.9	411.5	-411.5	13.94	13.55	
6,918.0	13.20	263.60	6,841.5	702.2	405.4	-405.4	13.82	13.75	
6,949.0	15.60	264.80	6,871.6	701.4	397.8	-397.8	7.80	7.74	
6,981.0	16.70	259.30	6,902.3	700.1	389.0	-389.0	5.88	3.44	
7,012.0	18.50	259.40	6,931.9	698.4	379.7	-379.7	5.81	5.81	
7,044.0	20.70	262.10	6,962.0	696.7	369.1	-369.1	7.43	6.87	
7,075.0	22.50	265.50	6,990.8	695.5	357.8	-357.8	7.07	5.81	
7,107.0	24.40	269.50	7,020.2	694.9	345.1	-345.1	7.74	5.94	
7,139.0	27.00	274.40	7,049.0	695.4	331.2	-331.2	10.49	8.12	
7,170.0	31.80	277.00	7,076.0	697.0	316.1	-316.1	16.02	15.48	
7,202.0	35.90	278.00	7,102.6	699.3	298.4	-298.4	12.93	12.81	
7,233.0	38.20	275.80	7,127.3	701.5	279.9	-279.9	8.56	7.42	
7,265.0	39.70	274.80	7,152.2	703.4	259.9	-259.9	5.08	4.69	
7,296.0	40.60	273.70	7,175.9	704.9	239.9	-239.9	3.70	2.90	
7,328.0	43.00	272.60	7,199.8	706.0	218.6	-218.6	7.84	7.50	
7,359.0	45.70	271.70	7,221.9	706.9	197.0	-197.0	8.94	8.71	
7,391.0	50.80	270.90	7,243.2	707.4	173.1	-173.1	16.05	15.94	
7,422.0	56.10	271.90	7,261.7	708.0	148.2	-148.2	17.29	17.10	
7,454.0	61.00	272.90	7,278.4	709.2	121.0	-121.0	15.54	15.31	
7,486.0	65.40	274.10	7,292.8	710.9	92.5	-92.5	14.15	13.75	
7,517.0	67.80	273.90	7,305.1	712.9	64.1	-64.1	7.76	7.74	
7,549.0	70.70	275.20	7,316.4	715.3	34.3	-34.3	9.83	9.06	
7,580.0	73.30	276.40	7,326.0	718.2	4.9	-4.9	9.16	8.39	
7,612.0	76.20	277.60	7,334.4	722.0	-25.7	25.7	9.76	9.06	
7,643.0	80.00	277.50	7,340.8	726.0	-55.8	55.8	12.26	12.26	
7,675.0	84.00	275.40	7,345.3	729.6	-87.2	87.2	14.09	12.50	
7,706.0	87.20	273.30	7,347.7	731.9	-118.1	118.1	12.34	10.32	
7,822.0	90.60	274.10	7,349.9	739.4	-233.8	233.8	3.01	2.93	
7,853.0	91.00	274.80	7,349.5	741.8	-264.7	264.7	2.60	1.29	
7,885.0	91.40	274.10	7,348.8	744.3	-296.6	296.6	2.52	1.25	
7,916.0	91.60	274.00	7,348.0	746.5	-327.5	327.5	0.72	0.65	
8,011.0	91.80	274.10	7,345.2	753.2	-422.2	422.2	0.24	0.21	
8,106.0	92.80	272.70	7,341.3	758.8	-517.0	517.0	1.81	1.05	
8,200.0	94.50	268.90	7,335.4	760.1	-610.7	610.7	4.42	1.81	
8,295.0	92.70	267.60	7,329.4	757.2	-705.5	705.5	2.34	-1.89	
8,390.0	93.20	266.90	7,324.5	752.7	-800.3	800.3	0.90	0.53	
8,484.0	92.10	267.00	7,320.2	747.7	-894.0	894.0	1.18	-1.17	
8,579.0	93.10	266.40	7,315.8	742.2	-988.8	988.8	1.23	1.05	
8,673.0	90.60	265.90	7,312.8	735.9	-1,082.5	1,082.5	2.71	-2.66	
8,768.0	91.90	267.50	7,310.7	730.4	-1,177.3	1,177.3	2.17	1.37	
8,862.0	89.00	267.60	7,310.0	726.4	-1,271.2	1,271.2	3.09	-3.09	

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<b>Well:</b>	State 1C-16H	<b>North Reference:</b>	True
<b>Wellbore:</b>	Hz	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL	<b>Database:</b>	USA EDM 5000 Multi Users DB

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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
8,957.0	87.60	267.00	7,312.8	721.9	-1,366.1	1,366.1	1.60	-1.47	
9,051.0	87.20	266.60	7,317.1	716.7	-1,459.8	1,459.8	0.60	-0.43	
9,146.0	88.60	265.40	7,320.6	710.1	-1,554.5	1,554.5	1.94	1.47	
9,241.0	91.00	267.30	7,320.9	704.0	-1,649.3	1,649.3	3.22	2.53	
9,335.0	90.60	268.00	7,319.6	700.2	-1,743.3	1,743.3	0.86	-0.43	
9,430.0	94.20	269.90	7,315.6	698.4	-1,838.1	1,838.1	4.28	3.79	
9,524.0	94.90	270.80	7,308.2	699.0	-1,931.8	1,931.8	1.21	0.74	
9,619.0	93.00	270.20	7,301.6	699.8	-2,026.6	2,026.6	2.10	-2.00	
9,713.0	92.00	271.20	7,297.5	701.0	-2,120.5	2,120.5	1.50	-1.06	
9,808.0	90.60	271.20	7,295.4	703.0	-2,215.5	2,215.5	1.47	-1.47	
9,903.0	91.40	272.50	7,293.7	706.0	-2,310.4	2,310.4	1.61	0.84	
9,997.0	90.50	272.70	7,292.1	710.3	-2,404.3	2,404.3	0.98	-0.96	
10,092.0	91.60	272.80	7,290.4	714.8	-2,499.2	2,499.2	1.16	1.16	
10,186.0	92.00	271.10	7,287.4	718.0	-2,593.1	2,593.1	1.86	0.43	
10,281.0	91.60	271.20	7,284.5	720.0	-2,688.0	2,688.0	0.43	-0.42	
10,370.5	89.53	269.50	7,283.6	720.5	-2,777.5	2,777.5	2.99	-2.32	State 1C-16H 10,300' TGT
10,376.0	89.40	269.40	7,283.6	720.4	-2,783.0	2,783.0	2.99	-2.32	
10,470.0	89.70	268.20	7,284.4	718.5	-2,876.9	2,876.9	1.32	0.32	
10,565.0	89.90	267.60	7,284.7	715.0	-2,971.9	2,971.9	0.67	0.21	
10,660.0	89.70	268.10	7,285.0	711.4	-3,066.8	3,066.8	0.57	-0.21	
10,754.0	90.10	268.90	7,285.2	709.0	-3,160.8	3,160.8	0.95	0.43	
10,849.0	91.30	270.00	7,284.0	708.1	-3,255.8	3,255.8	1.71	1.26	
10,943.0	90.70	271.70	7,282.4	709.5	-3,349.7	3,349.7	1.92	-0.64	
11,038.0	90.20	270.90	7,281.6	711.6	-3,444.7	3,444.7	0.99	-0.53	
11,133.0	90.40	270.60	7,281.1	712.9	-3,539.7	3,539.7	0.38	0.21	
11,227.0	91.10	270.50	7,279.9	713.8	-3,633.7	3,633.7	0.75	0.74	
11,322.0	90.90	270.00	7,278.3	714.2	-3,728.6	3,728.6	0.57	-0.21	
11,416.0	90.80	268.90	7,276.9	713.3	-3,822.6	3,822.6	1.17	-0.11	
11,511.0	91.00	269.10	7,275.4	711.6	-3,917.6	3,917.6	0.30	0.21	
11,606.0	92.00	269.20	7,272.9	710.2	-4,012.6	4,012.6	1.06	1.05	
11,700.0	92.50	269.50	7,269.2	709.1	-4,106.5	4,106.5	0.62	0.53	
11,794.0	93.30	269.20	7,264.4	708.1	-4,200.4	4,200.4	0.91	0.85	
11,838.0	93.40	269.20	7,261.9	707.5	-4,244.3	4,244.3	0.23	0.23	Last Cathedral Survey @ 11,838' MD
11,888.0	93.40	269.20	7,258.9	706.8	-4,294.2	4,294.2	0.00	0.00	Projection to Bit @ 11,888' - State 1C-16H PBHL

# Cathedral Energy Services

## Survey Report

<b>Company:</b>	EnCana Oil & Gas (USA) Inc	<b>Local Co-ordinate Reference:</b>	Well State 1C-16H
<b>Project:</b>	DJ Wattenberg	<b>TVD Reference:</b>	WELL @ 5039.0ft (H&P 278)
<b>Site:</b>	S16-T3N-R68W (State)	<b>MD Reference:</b>	WELL @ 5039.0ft (H&P 278)
<b>Well:</b>	State 1C-16H	<b>North Reference:</b>	True
<b>Wellbore:</b>	Hz	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL	<b>Database:</b>	USA EDM 5000 Multi Users DB

Targets									
Target Name	Dip Angle	Dip Dir.	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
- hit/miss target	(°)	(°)	(ft)	(ft)	(ft)	(ft)	(ft)		
- Shape									
State 1C-16H 10,300' T(	0.00	0.00	7,270.0	718.1	-2,777.4	1,327,328.55	3,136,761.01	40.230871	-105.010197
- actual wellpath misses target center by 13.8ft at 10370.5ft MD (7283.6 TVD, 720.5 N, -2777.5 E)									
- Point									
State 1C-16H PBHL 3	0.00	0.00	7,250.0	718.0	-4,347.2	1,327,319.63	3,135,191.16	40.230870	-105.015820
- actual wellpath misses target center by 55.0ft at 11888.0ft MD (7258.9 TVD, 706.8 N, -4294.2 E)									
- Point									
State 1C-16H PBHL	0.00	0.00	7,257.1	718.0	-4,347.2	1,327,319.63	3,135,191.16	40.230870	-105.015820
- actual wellpath misses target center by 54.3ft at 11888.0ft MD (7258.9 TVD, 706.8 N, -4294.2 E)									
- Point									

Design Annotations				
Measured Depth	Vertical Depth	Local Coordinates		Comment
(ft)	(ft)	+N/-S (ft)	+E/-W (ft)	
11,838.0	7,261.9	707.5	-4,244.3	Last Cathedral Survey @ 11,838' MD
11,888.0	7,258.9	706.8	-4,294.2	Projection to Bit @ 11,888'

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