





# Cathedral Energy Services

## Survey Report

<b>Company:</b>	EnCana Oil & Gas (USA) Inc	<b>Local Co-ordinate Reference:</b>	Well Billings 1D-34H
<b>Project:</b>	DJ Wattenberg	<b>TVD Reference:</b>	WELL @ 5008.0ft (Ensign 135)
<b>Site:</b>	S34-T2N-R68W (Billings)	<b>MD Reference:</b>	WELL @ 5008.0ft (Ensign 135)
<b>Well:</b>	Billings 1D-34H	<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		S34-T2N-R68W (Billings)			
Site Position:		Northing:	1,280,284.39 ft	Latitude:	40.101620
From:	Lat/Long	Easting:	3,143,887.76 ft	Longitude:	-104.985650
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	0.33 °

Well	Billings 1D-34H					
Well Position	+N/-S	0.0 ft	Northing:	1,280,266.35 ft	Latitude:	40.101570
	+E/-W	0.0 ft	Easting:	3,143,918.64 ft	Longitude:	-104.985540
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,995.0 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	11/14/2013	8.63	66.69	52,695

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	180.00

<b>Survey Program</b>	<b>Date</b>	11/25/2013			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
144.0	12,072.0	Survey #1 (Hz)	Geolink 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	
144.0	0.20	222.30	144.0	-0.2	-0.2	0.2	0.14	0.14	
236.0	1.00	238.50	236.0	-0.7	-1.0	0.7	0.88	0.87	
328.0	1.60	252.90	328.0	-1.5	-2.9	1.5	0.74	0.65	
420.0	1.40	224.80	419.9	-2.7	-4.9	2.7	0.82	-0.22	
512.0	1.80	177.10	511.9	-4.9	-5.6	4.9	1.46	0.43	
604.0	2.60	153.00	603.8	-8.2	-4.6	8.2	1.31	0.87	
696.0	3.40	130.90	695.7	-11.9	-1.6	11.9	1.51	0.87	
788.0	3.60	111.30	787.5	-14.7	3.2	14.7	1.31	0.22	
879.0	3.60	79.50	878.4	-15.2	8.6	15.2	2.17	0.00	
971.0	4.00	46.40	970.2	-12.5	13.8	12.5	2.39	0.43	
992.0	4.00	37.90	991.1	-11.4	14.8	11.4	2.82	0.00	
1,099.0	4.10	24.90	1,097.9	-5.0	18.7	5.0	0.86	0.09	

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<b>Site:</b>	S34-T2N-R68W (Billings)	<b>MD Reference:</b>	WELL @ 5008.0ft (Ensign 135)
<b>Well:</b>	Billings 1D-34H	<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
1,191.0	6.30	27.60	1,189.5	2.5	22.4	-2.5	2.41	2.39	
1,283.0	6.70	48.10	1,280.9	10.5	28.7	-10.5	2.55	0.43	
1,375.0	6.00	44.30	1,372.3	17.5	36.1	-17.5	0.89	-0.76	
1,467.0	7.30	53.60	1,463.7	24.5	44.2	-24.5	1.83	1.41	
1,559.0	7.50	63.00	1,555.0	30.6	54.2	-30.6	1.33	0.22	
1,651.0	7.10	71.70	1,646.2	35.2	65.0	-35.2	1.28	-0.43	
1,743.0	8.00	71.70	1,737.4	39.0	76.4	-39.0	0.98	0.98	
1,835.0	9.40	76.00	1,828.4	42.8	89.8	-42.8	1.68	1.52	
1,926.0	9.50	72.90	1,918.1	46.8	104.2	-46.8	0.57	0.11	
2,021.0	9.80	75.40	2,011.8	51.1	119.5	-51.1	0.54	0.32	
2,116.0	10.10	74.60	2,105.4	55.4	135.4	-55.4	0.35	0.32	
2,211.0	10.70	75.50	2,198.8	59.8	151.9	-59.8	0.65	0.63	
2,305.0	9.80	77.90	2,291.3	63.7	168.2	-63.7	1.06	-0.96	
2,400.0	9.80	76.00	2,384.9	67.3	184.0	-67.3	0.34	0.00	
2,495.0	9.30	72.50	2,478.6	71.6	199.1	-71.6	0.81	-0.53	
2,589.0	10.00	74.70	2,571.3	76.0	214.2	-76.0	0.84	0.74	
2,684.0	10.30	73.60	2,664.8	80.6	230.3	-80.6	0.38	0.32	
2,779.0	10.00	81.10	2,758.3	84.3	246.6	-84.3	1.43	-0.32	
2,873.0	9.60	74.30	2,850.9	87.6	262.3	-87.6	1.30	-0.43	
2,968.0	9.70	81.10	2,944.6	91.0	277.8	-91.0	1.20	0.11	
3,063.0	10.20	77.50	3,038.2	94.1	293.9	-94.1	0.84	0.53	
3,157.0	10.30	79.40	3,130.7	97.4	310.3	-97.4	0.38	0.11	
3,252.0	10.50	79.80	3,224.1	100.5	327.2	-100.5	0.22	0.21	
3,347.0	10.70	81.10	3,317.5	103.4	344.4	-103.4	0.33	0.21	
3,442.0	9.20	77.80	3,411.0	106.4	360.5	-106.4	1.69	-1.58	
3,536.0	9.20	77.90	3,503.8	109.6	375.2	-109.6	0.02	0.00	
3,631.0	8.80	78.30	3,597.7	112.6	389.8	-112.6	0.43	-0.42	
3,726.0	9.50	75.00	3,691.5	116.1	404.5	-116.1	0.92	0.74	
3,821.0	9.60	77.80	3,785.1	119.8	419.8	-119.8	0.50	0.11	
3,915.0	10.10	72.50	3,877.8	124.0	435.3	-124.0	1.10	0.53	
4,010.0	9.20	72.20	3,971.4	128.8	450.5	-128.8	0.95	-0.95	
4,105.0	11.40	72.70	4,064.9	133.9	466.7	-133.9	2.32	2.32	
4,200.0	13.00	77.90	4,157.7	138.9	486.1	-138.9	2.04	1.68	
4,295.0	12.40	80.30	4,250.4	142.9	506.6	-142.9	0.84	-0.63	
4,389.0	8.60	75.00	4,342.8	146.4	523.3	-146.4	4.17	-4.04	
4,484.0	10.00	80.50	4,436.6	149.6	538.3	-149.6	1.74	1.47	
4,579.0	11.30	78.90	4,529.9	152.8	555.6	-152.8	1.40	1.37	
4,673.0	11.40	84.50	4,622.1	155.4	573.9	-155.4	1.18	0.11	
4,768.0	11.30	83.00	4,715.2	157.5	592.5	-157.5	0.33	-0.11	
4,863.0	9.80	77.90	4,808.6	160.3	609.6	-160.3	1.86	-1.58	
4,958.0	10.00	78.10	4,902.2	163.7	625.6	-163.7	0.21	0.21	
5,052.0	9.10	69.60	4,994.9	168.0	640.5	-168.0	1.78	-0.96	
5,147.0	9.50	75.80	5,088.7	172.5	655.2	-172.5	1.13	0.42	
5,242.0	8.70	71.10	5,182.5	176.8	669.6	-176.8	1.15	-0.84	
5,336.0	8.20	62.40	5,275.5	182.2	682.2	-182.2	1.46	-0.53	
5,431.0	8.10	62.30	5,369.5	188.4	694.2	-188.4	0.11	-0.11	
5,526.0	8.00	63.30	5,463.6	194.5	706.0	-194.5	0.18	-0.11	
5,621.0	5.90	73.90	5,557.9	198.8	716.6	-198.8	2.58	-2.21	
5,716.0	4.00	64.40	5,652.5	201.6	724.3	-201.6	2.17	-2.00	
5,810.0	4.30	60.60	5,746.3	204.8	730.3	-204.8	0.43	0.32	
5,905.0	1.80	106.50	5,841.1	206.1	734.8	-206.1	3.48	-2.63	
6,000.0	0.60	140.50	5,936.1	205.3	736.6	-205.3	1.42	-1.26	
6,095.0	0.80	61.30	6,031.1	205.2	737.5	-205.2	0.95	0.21	

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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
6,189.0	1.10	47.00	6,125.1	206.1	738.7	-206.1	0.40	0.32	
6,284.0	0.70	101.20	6,220.1	206.7	740.0	-206.7	0.94	-0.42	
6,379.0	1.70	332.90	6,315.1	207.8	739.9	-207.8	2.32	1.05	
6,473.0	1.10	332.10	6,409.0	209.8	738.8	-209.8	0.64	-0.64	
6,568.0	0.90	357.00	6,504.0	211.4	738.4	-211.4	0.50	-0.21	
6,662.0	0.90	2.80	6,598.0	212.9	738.4	-212.9	0.10	0.00	
6,758.0	0.50	117.30	6,694.0	213.4	738.8	-213.4	1.25	-0.42	
6,821.0	1.00	205.80	6,757.0	212.8	738.8	-212.8	1.76	0.79	
6,853.0	1.40	216.50	6,789.0	212.2	738.4	-212.2	1.43	1.25	
6,884.0	1.80	221.00	6,820.0	211.6	737.9	-211.6	1.35	1.29	
6,916.0	3.30	215.90	6,851.9	210.4	737.0	-210.4	4.74	4.69	
6,947.0	5.40	211.30	6,882.9	208.5	735.7	-208.5	6.86	6.77	
6,979.0	7.60	209.60	6,914.6	205.3	733.9	-205.3	6.90	6.87	
7,010.0	9.40	204.60	6,945.3	201.3	731.8	-201.3	6.27	5.81	
7,042.0	10.60	201.10	6,976.8	196.1	729.7	-196.1	4.20	3.75	
7,074.0	11.80	199.80	7,008.2	190.3	727.5	-190.3	3.83	3.75	
7,105.0	13.80	195.80	7,038.4	183.8	725.4	-183.8	7.05	6.45	
7,137.0	15.40	188.60	7,069.4	175.9	723.8	-175.9	7.55	5.00	
7,168.0	17.80	185.30	7,099.1	167.1	722.7	-167.1	8.31	7.74	
7,200.0	19.80	185.70	7,129.4	156.8	721.7	-156.8	6.26	6.25	
7,231.0	22.20	183.30	7,158.3	145.8	720.9	-145.8	8.22	7.74	
7,263.0	24.50	179.60	7,187.7	133.1	720.6	-133.1	8.52	7.19	
7,294.0	26.90	176.20	7,215.7	119.7	721.1	-119.7	9.08	7.74	
7,326.0	31.60	174.90	7,243.6	104.1	722.3	-104.1	14.82	14.69	
7,358.0	37.80	176.40	7,269.9	85.9	723.7	-85.9	19.56	19.37	
7,389.0	44.30	179.20	7,293.2	65.6	724.4	-65.6	21.79	20.97	
7,420.0	49.40	181.00	7,314.4	43.0	724.3	-43.0	16.99	16.45	
7,452.0	53.10	181.80	7,334.5	18.0	723.7	-18.0	11.73	11.56	
7,483.0	56.70	180.80	7,352.3	-7.3	723.2	7.3	11.91	11.61	
7,515.0	60.40	179.10	7,369.0	-34.6	723.2	34.6	12.42	11.56	
7,546.0	63.80	178.10	7,383.5	-62.0	723.9	62.0	11.33	10.97	
7,578.0	66.30	177.50	7,397.0	-91.0	725.0	91.0	8.00	7.81	
7,609.0	69.60	177.30	7,408.6	-119.7	726.3	119.7	10.66	10.65	
7,641.0	73.50	177.80	7,418.7	-150.0	727.6	150.0	12.28	12.19	
7,673.0	76.90	178.60	7,426.9	-180.9	728.6	180.9	10.90	10.62	
7,704.0	78.90	179.10	7,433.4	-211.2	729.2	211.2	6.64	6.45	
7,736.0	81.20	178.40	7,438.9	-242.7	729.8	242.7	7.50	7.19	
7,767.0	84.70	178.40	7,442.7	-273.5	730.7	273.5	11.29	11.29	
7,783.0	87.10	178.70	7,443.9	-289.4	731.1	289.4	15.12	15.00	
7,851.0	89.30	178.80	7,446.0	-357.4	732.6	357.4	3.24	3.24	
7,914.0	89.70	177.60	7,446.6	-420.3	734.6	420.3	2.01	0.63	
7,977.0	89.10	177.00	7,447.2	-483.3	737.5	483.3	1.35	-0.95	
8,040.0	88.60	177.40	7,448.5	-546.2	740.6	546.2	1.02	-0.79	
8,103.0	89.20	177.30	7,449.7	-609.1	743.5	609.1	0.97	0.95	
8,166.0	89.70	177.00	7,450.3	-672.0	746.7	672.0	0.93	0.79	
8,229.0	89.70	177.70	7,450.6	-734.9	749.6	734.9	1.11	0.00	
8,293.0	88.40	177.90	7,451.7	-798.9	752.0	798.9	2.06	-2.03	
8,356.0	88.20	178.00	7,453.6	-861.8	754.3	861.8	0.35	-0.32	
8,419.0	88.10	179.00	7,455.6	-924.8	755.9	924.8	1.59	-0.16	
8,482.0	87.90	178.90	7,457.8	-987.7	757.1	987.7	0.35	-0.32	
8,577.0	88.40	179.80	7,460.9	-1,082.7	758.2	1,082.7	1.08	0.53	
8,672.0	88.50	180.60	7,463.4	-1,177.6	757.8	1,177.6	0.85	0.11	
8,766.0	89.30	181.50	7,465.2	-1,271.6	756.1	1,271.6	1.28	0.85	

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<b>Site:</b>	S34-T2N-R68W (Billings)	<b>MD Reference:</b>	WELL @ 5008.0ft (Ensign 135)
<b>Well:</b>	Billings 1D-34H	<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
8,861.0	89.80	181.80	7,466.0	-1,366.5	753.4	1,366.5	0.61	0.53	
8,956.0	89.70	181.50	7,466.4	-1,461.5	750.6	1,461.5	0.33	-0.11	
9,051.0	88.40	181.60	7,468.0	-1,556.5	748.1	1,556.5	1.37	-1.37	
9,145.0	88.40	180.40	7,470.6	-1,650.4	746.4	1,650.4	1.28	0.00	
9,240.0	88.70	179.90	7,473.0	-1,745.4	746.2	1,745.4	0.61	0.32	
9,335.0	89.80	179.60	7,474.2	-1,840.4	746.6	1,840.4	1.20	1.16	
9,429.0	88.40	180.70	7,475.7	-1,934.3	746.3	1,934.3	1.89	-1.49	
9,524.0	88.90	180.80	7,478.0	-2,029.3	745.1	2,029.3	0.54	0.53	
9,619.0	90.50	178.80	7,478.5	-2,124.3	745.4	2,124.3	2.70	1.68	
9,714.0	88.60	179.10	7,479.2	-2,219.3	747.2	2,219.3	2.02	-2.00	
9,808.0	88.90	179.90	7,481.3	-2,313.3	748.0	2,313.3	0.91	0.32	
9,903.0	89.90	180.80	7,482.2	-2,408.2	747.4	2,408.2	1.42	1.05	
9,998.0	92.30	180.60	7,480.4	-2,503.2	746.3	2,503.2	2.54	2.53	
10,093.0	91.90	181.00	7,476.9	-2,598.1	744.9	2,598.1	0.60	-0.42	
10,188.0	90.50	181.40	7,475.0	-2,693.1	742.9	2,693.1	1.53	-1.47	
10,282.0	88.20	182.10	7,476.0	-2,787.0	740.1	2,787.0	2.56	-2.45	
10,377.0	90.20	180.30	7,477.3	-2,882.0	738.1	2,882.0	2.83	2.11	
10,472.0	89.60	180.90	7,477.5	-2,977.0	737.1	2,977.0	0.89	-0.63	
10,567.0	89.10	182.80	7,478.6	-3,071.9	734.0	3,071.9	2.07	-0.53	
10,661.0	88.80	183.20	7,480.3	-3,165.8	729.1	3,165.8	0.53	-0.32	
10,756.0	89.90	183.20	7,481.4	-3,260.6	723.8	3,260.6	1.16	1.16	
10,851.0	86.90	180.90	7,484.0	-3,355.5	720.4	3,355.5	3.98	-3.16	
10,945.0	89.00	180.90	7,487.4	-3,449.4	718.9	3,449.4	2.23	2.23	
11,040.0	89.60	179.50	7,488.6	-3,544.4	718.6	3,544.4	1.60	0.63	
11,135.0	90.90	178.50	7,488.2	-3,639.4	720.3	3,639.4	1.73	1.37	
11,230.0	90.30	178.50	7,487.2	-3,734.4	722.7	3,734.4	0.63	-0.63	
11,324.0	88.60	177.30	7,488.1	-3,828.3	726.2	3,828.3	2.21	-1.81	
11,419.0	87.90	176.50	7,491.0	-3,923.1	731.3	3,923.1	1.12	-0.74	
11,514.0	88.50	178.00	7,493.9	-4,018.0	735.9	4,018.0	1.70	0.63	
11,798.0	91.60	177.20	7,493.7	-4,301.7	747.8	4,301.7	1.13	1.09	
11,892.0	92.40	178.20	7,490.4	-4,395.5	751.5	4,395.5	1.36	0.85	Last Cathedral Survey @ 11,892' MD
12,072.0	92.40	178.20	7,482.9	-4,575.3	757.2	4,575.3	0.00	0.00	Projection to Bit @ 12,072'

# Cathedral Energy Services

## Survey Report

<b>Company:</b>	EnCana Oil & Gas (USA) Inc	<b>Local Co-ordinate Reference:</b>	Well Billings 1D-34H
<b>Project:</b>	DJ Wattenberg	<b>TVD Reference:</b>	WELL @ 5008.0ft (Ensign 135)
<b>Site:</b>	S34-T2N-R68W (Billings)	<b>MD Reference:</b>	WELL @ 5008.0ft (Ensign 135)
<b>Well:</b>	Billings 1D-34H	<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									
Billings 1D-34H PBHL	0.00	0.00	7,385.0	-4,600.8	741.4	1,275,669.91	3,144,686.76	40.088940	-104.982890
- actual wellpath misses target center by 102.4ft at 12072.0ft MD (7482.9 TVD, -4575.3 N, 757.2 E)									
- Point									
Billings 1D-34H 10800'	0.00	0.00	7,481.0	-3,394.2	741.4	1,276,876.46	3,144,679.76	40.092252	-104.982890
- actual wellpath misses target center by 22.2ft at 10889.3ft MD (7485.8 TVD, -3393.7 N, 719.8 E)									
- Point									
Billings 1D-34H 9500'	0.00	0.00	7,481.0	-2,094.2	741.4	1,278,176.44	3,144,672.22	40.095821	-104.982890
- actual wellpath misses target center by 4.3ft at 9588.9ft MD (7478.6 TVD, -2094.2 N, 745.0 E)									
- Point									
Billings 1D-34H PBHL P:	0.00	0.00	7,495.0	-4,600.8	741.4	1,275,669.91	3,144,686.76	40.088940	-104.982890
- actual wellpath misses target center by 32.4ft at 12072.0ft MD (7482.9 TVD, -4575.3 N, 757.2 E)									
- Point									

Design Annotations					
Measured Depth	Vertical Depth	Local Coordinates			
(ft)	(ft)	+N/-S (ft)	+E/-W (ft)	Comment	
11,892.0	7,490.4	-4,395.5	751.5	Last Cathedral Survey @ 11,892' MD	
12,072.0	7,482.9	-4,575.3	757.2	Projection to Bit @ 12,072'	

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