





Cathedral Energy Services

Survey Report

Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well lone 1F-10H
Project:	DJ Wattenberg	TVD Reference:	WELL @ 5012.0ft (Ensign 124)
Site:	S10-T2N-R66W (lone)	MD Reference:	WELL @ 5012.0ft (Ensign 124)
Well:	lone 1F-10H	North Reference:	True
Wellbore:	Hz	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

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

Site		S10-T2N-R66W (lone)			
Site Position:		Northing:	1,297,164.02 ft	Latitude:	40.146710
From:	Lat/Long	Easting:	3,207,875.24 ft	Longitude:	-104.756410
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	0.48 °

Well	lone 1F-10H					
Well Position	+N/-S	0.0 ft	Northing:	1,301,209.67 ft	Latitude:	40.157830
	+E/-W	0.0 ft	Easting:	3,207,248.74 ft	Longitude:	-104.758530
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,999.0 ft

Wellbore	Hz				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	7/9/2013	8.56	66.78	52,786

Design	FINAL				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction	
	(ft)	(ft)	(ft)	(°)	
	0.0	0.0	0.0	180.00	

Survey Program	Date	7/29/2013			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
169.0	11,935.0	Survey #1 (Hz)	Geolink MWD	Geolink MWD	

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		
169.0	0.20	253.90	169.0	-0.1	-0.3	0.1	0.12	0.12		
262.0	0.20	315.10	262.0	0.0	-0.6	0.0	0.22	0.00		
355.0	0.80	27.20	355.0	0.7	-0.4	-0.7	0.82	0.65		
448.0	1.90	19.30	448.0	2.7	0.4	-2.7	1.20	1.18		
541.0	3.10	54.20	540.9	5.6	3.0	-5.6	2.03	1.29		
572.0	3.60	62.90	571.8	6.6	4.5	-6.6	2.30	1.61		
603.0	3.60	58.60	602.8	7.5	6.2	-7.5	0.87	0.00		
634.0	4.20	54.60	633.7	8.7	8.0	-8.7	2.12	1.94		
665.0	4.60	72.80	664.6	9.7	10.1	-9.7	4.66	1.29		
696.0	4.60	58.70	695.5	10.7	12.3	-10.7	3.64	0.00		
727.0	4.90	62.30	726.4	12.0	14.6	-12.0	1.36	0.97		
758.0	5.10	64.30	757.3	13.2	17.0	-13.2	0.86	0.65		

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Wellbore:	Hz	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	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
820.0	5.40	62.90	819.0	15.7	22.1	-15.7	0.53	0.48	
913.0	5.60	62.20	911.6	19.8	30.0	-19.8	0.23	0.22	
966.0	5.90	70.00	964.3	22.0	34.8	-22.0	1.58	0.57	
1,016.0	6.60	62.00	1,014.0	24.2	39.8	-24.2	2.23	1.40	
1,109.0	8.30	67.90	1,106.2	29.2	50.7	-29.2	2.00	1.83	
1,202.0	10.10	63.10	1,198.1	35.5	64.2	-35.5	2.10	1.94	
1,295.0	11.60	48.90	1,289.4	45.3	78.5	-45.3	3.28	1.61	
1,388.0	14.30	41.00	1,380.0	60.1	93.1	-60.1	3.47	2.90	
1,481.0	14.30	39.80	1,470.2	77.6	108.0	-77.6	0.32	0.00	
1,574.0	14.20	36.10	1,560.3	95.6	122.1	-95.6	0.99	-0.11	
1,667.0	16.80	38.50	1,649.9	115.4	137.2	-115.4	2.88	2.80	
1,760.0	16.10	45.80	1,739.1	134.9	154.8	-134.9	2.35	-0.75	
1,853.0	15.80	40.80	1,828.5	153.5	172.3	-153.5	1.51	-0.32	
1,946.0	15.20	43.90	1,918.2	171.8	189.0	-171.8	1.10	-0.65	
2,041.0	15.20	45.70	2,009.8	189.5	206.6	-189.5	0.50	0.00	
2,136.0	15.60	50.00	2,101.4	206.4	225.3	-206.4	1.27	0.42	
2,230.0	16.60	49.30	2,191.7	223.3	245.1	-223.3	1.08	1.06	
2,325.0	15.20	48.20	2,283.1	240.4	264.7	-240.4	1.51	-1.47	
2,420.0	15.10	49.80	2,374.8	256.7	283.5	-256.7	0.45	-0.11	
2,514.0	17.00	53.90	2,465.1	272.7	303.9	-272.7	2.35	2.02	
2,609.0	14.70	53.50	2,556.5	288.1	324.8	-288.1	2.42	-2.42	
2,704.0	16.10	54.30	2,648.1	302.9	345.2	-302.9	1.49	1.47	
2,799.0	17.10	50.10	2,739.1	319.6	366.6	-319.6	1.64	1.05	
2,895.0	16.70	48.30	2,831.0	337.8	387.7	-337.8	0.69	-0.42	
2,989.0	18.30	46.40	2,920.6	357.0	408.5	-357.0	1.81	1.70	
3,084.0	19.20	47.70	3,010.6	377.8	430.9	-377.8	1.04	0.95	
3,179.0	18.20	46.00	3,100.6	398.6	453.1	-398.6	1.20	-1.05	
3,274.0	16.70	45.60	3,191.2	418.5	473.5	-418.5	1.58	-1.58	
3,369.0	16.70	44.90	3,282.2	437.7	492.9	-437.7	0.21	0.00	
3,464.0	18.20	46.00	3,372.8	457.7	513.2	-457.7	1.62	1.58	
3,559.0	18.20	50.00	3,463.1	477.5	535.3	-477.5	1.31	0.00	
3,654.0	15.30	45.80	3,554.0	495.8	555.6	-495.8	3.31	-3.05	
3,749.0	15.70	49.20	3,645.6	512.9	574.3	-512.9	1.04	0.42	
3,844.0	16.70	51.10	3,736.8	529.9	594.7	-529.9	1.19	1.05	
3,939.0	15.90	49.30	3,828.0	546.9	615.2	-546.9	1.00	-0.84	
4,034.0	16.40	53.80	3,919.2	563.4	635.9	-563.4	1.42	0.53	
4,129.0	16.80	50.00	4,010.3	580.1	657.2	-580.1	1.22	0.42	
4,224.0	16.50	49.40	4,101.3	597.7	678.0	-597.7	0.36	-0.32	
4,319.0	18.40	46.60	4,191.9	616.8	699.1	-616.8	2.19	2.00	
4,414.0	17.20	44.20	4,282.4	637.2	719.8	-637.2	1.48	-1.26	
4,509.0	14.50	40.00	4,373.8	656.3	737.2	-656.3	3.09	-2.84	
4,604.0	12.50	36.40	4,466.1	673.7	751.0	-673.7	2.28	-2.11	
4,699.0	13.10	42.90	4,558.8	689.9	764.4	-689.9	1.64	0.63	
4,793.0	10.10	47.50	4,650.9	703.3	777.7	-703.3	3.34	-3.19	
4,888.0	8.30	53.60	4,744.6	713.0	789.4	-713.0	2.15	-1.89	
4,984.0	7.90	51.10	4,839.7	721.2	800.1	-721.2	0.56	-0.42	
5,078.0	5.50	58.10	4,933.0	727.7	809.0	-727.7	2.69	-2.55	
5,173.0	4.60	60.80	5,027.7	731.9	816.2	-731.9	0.98	-0.95	
5,268.0	4.20	61.50	5,122.4	735.4	822.5	-735.4	0.42	-0.42	
5,363.0	3.10	78.40	5,217.2	737.6	828.1	-737.6	1.61	-1.16	
5,458.0	2.00	104.90	5,312.1	737.7	832.2	-737.7	1.67	-1.16	
5,553.0	1.40	50.20	5,407.1	738.0	834.7	-738.0	1.74	-0.63	
5,648.0	0.90	336.00	5,502.0	739.5	835.3	-739.5	1.52	-0.53	

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Wellbore:	Hz	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
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5,743.0	0.60	310.60	5,597.0	740.5	834.6	-740.5	0.46	-0.32	
5,838.0	0.40	290.00	5,692.0	740.9	833.9	-740.9	0.28	-0.21	
5,933.0	0.60	263.40	5,787.0	740.9	833.1	-740.9	0.32	0.21	
6,028.0	0.70	234.00	5,882.0	740.6	832.2	-740.6	0.36	0.11	
6,123.0	0.80	250.60	5,977.0	740.0	831.1	-740.0	0.25	0.11	
6,218.0	0.90	257.60	6,072.0	739.6	829.7	-739.6	0.15	0.11	
6,313.0	0.70	156.30	6,167.0	738.9	829.2	-738.9	1.31	-0.21	
6,407.0	0.30	140.90	6,261.0	738.2	829.6	-738.2	0.45	-0.43	
6,502.0	0.20	291.30	6,356.0	738.1	829.6	-738.1	0.51	-0.11	
6,597.0	0.90	301.10	6,451.0	738.5	828.8	-738.5	0.74	0.74	
6,692.0	1.00	190.30	6,546.0	738.1	828.0	-738.1	1.65	0.11	
6,787.0	0.80	234.50	6,641.0	736.9	827.4	-736.9	0.74	-0.21	
6,819.0	1.00	234.40	6,673.0	736.6	826.9	-736.6	0.63	0.62	
6,851.0	2.80	192.30	6,704.9	735.7	826.5	-735.7	6.76	5.62	
6,882.0	6.00	182.70	6,735.9	733.3	826.3	-733.3	10.56	10.32	
6,914.0	9.00	179.90	6,767.6	729.1	826.2	-729.1	9.44	9.37	
6,946.0	12.20	182.10	6,799.0	723.2	826.1	-723.2	10.08	10.00	
6,977.0	15.60	184.90	6,829.1	715.8	825.6	-715.8	11.18	10.97	
7,009.0	18.90	185.00	6,859.7	706.4	824.8	-706.4	10.31	10.31	
7,040.0	22.00	182.60	6,888.7	695.6	824.1	-695.6	10.36	10.00	
7,072.0	24.80	180.40	6,918.1	682.9	823.8	-682.9	9.16	8.75	
7,103.0	28.00	179.30	6,945.8	669.1	823.8	-669.1	10.44	10.32	
7,135.0	31.30	178.60	6,973.7	653.3	824.1	-653.3	10.37	10.31	
7,167.0	35.20	178.70	7,000.4	635.7	824.6	-635.7	12.19	12.19	
7,198.0	38.20	179.50	7,025.3	617.2	824.8	-617.2	9.80	9.68	
7,230.0	41.90	178.60	7,049.7	596.6	825.2	-596.6	11.70	11.56	
7,262.0	45.60	177.00	7,072.9	574.5	826.0	-574.5	12.07	11.56	
7,293.0	47.20	177.20	7,094.2	552.1	827.2	-552.1	5.18	5.16	
7,325.0	49.90	176.10	7,115.4	528.1	828.6	-528.1	8.82	8.44	
7,356.0	52.40	176.00	7,134.9	504.1	830.3	-504.1	8.07	8.06	
7,388.0	54.90	177.30	7,153.8	478.3	831.8	-478.3	8.47	7.81	
7,420.0	57.60	178.50	7,171.6	451.7	832.7	-451.7	8.99	8.44	
7,451.0	59.90	179.60	7,187.7	425.3	833.2	-425.3	8.02	7.42	
7,483.0	63.30	180.70	7,202.9	397.1	833.1	-397.1	11.05	10.62	
7,515.0	68.00	181.40	7,216.1	368.0	832.5	-368.0	14.82	14.69	
7,546.0	72.00	182.00	7,226.7	338.9	831.7	-338.9	13.03	12.90	
7,578.0	75.90	181.90	7,235.5	308.1	830.6	-308.1	12.19	12.19	
7,610.0	78.70	181.80	7,242.6	276.9	829.6	-276.9	8.76	8.75	
7,641.0	80.90	181.30	7,248.1	246.4	828.8	-246.4	7.27	7.10	
7,679.0	85.00	181.70	7,252.7	208.7	827.8	-208.7	10.84	10.79	
7,729.0	91.00	181.70	7,254.5	158.8	826.3	-158.8	12.00	12.00	
7,760.0	91.70	181.50	7,253.7	127.8	825.5	-127.8	2.35	2.26	
7,855.0	89.70	180.70	7,252.6	32.9	823.6	-32.9	2.27	-2.11	
7,950.0	89.00	179.20	7,253.7	-62.1	823.7	62.1	1.74	-0.74	
8,045.0	88.50	178.30	7,255.7	-157.1	825.8	157.1	1.08	-0.53	
8,140.0	90.20	179.30	7,256.8	-252.1	827.8	252.1	2.08	1.79	
8,235.0	89.80	178.80	7,256.8	-347.0	829.4	347.0	0.67	-0.42	
8,330.0	90.90	180.90	7,256.2	-442.0	829.6	442.0	2.50	1.16	
8,425.0	91.30	177.90	7,254.4	-537.0	830.6	537.0	3.19	0.42	
8,520.0	90.50	178.60	7,252.9	-631.9	833.5	631.9	1.12	-0.84	
8,615.0	90.50	178.40	7,252.1	-726.9	836.0	726.9	0.21	0.00	
8,710.0	90.50	178.00	7,251.3	-821.9	839.0	821.9	0.42	0.00	
8,804.0	90.80	177.70	7,250.2	-915.8	842.5	915.8	0.45	0.32	

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8,900.0	90.20	180.50	7,249.4	-1,011.8	844.0	1,011.8	2.98	-0.62	
8,995.0	90.30	180.00	7,248.9	-1,106.8	843.6	1,106.8	0.54	0.11	
9,090.0	90.00	182.00	7,248.7	-1,201.7	841.9	1,201.7	2.13	-0.32	
9,185.0	88.90	181.70	7,249.6	-1,296.7	838.9	1,296.7	1.20	-1.16	
9,280.0	90.30	182.00	7,250.3	-1,391.6	835.8	1,391.6	1.51	1.47	
9,375.0	91.40	181.40	7,248.9	-1,486.6	833.0	1,486.6	1.32	1.16	
9,470.0	90.40	181.00	7,247.4	-1,581.5	831.0	1,581.5	1.13	-1.05	
9,565.0	90.20	181.20	7,246.9	-1,676.5	829.2	1,676.5	0.30	-0.21	
9,659.0	91.00	181.80	7,245.9	-1,770.5	826.7	1,770.5	1.06	0.85	
9,755.0	91.60	182.80	7,243.7	-1,866.4	822.9	1,866.4	1.21	0.62	
9,849.0	91.10	182.40	7,241.5	-1,960.3	818.6	1,960.3	0.68	-0.53	
9,944.0	90.40	181.90	7,240.2	-2,055.2	815.0	2,055.2	0.91	-0.74	
10,039.0	89.90	181.30	7,240.0	-2,150.1	812.4	2,150.1	0.82	-0.53	
10,134.0	90.40	180.60	7,239.7	-2,245.1	810.8	2,245.1	0.91	0.53	
10,229.0	89.30	180.60	7,240.0	-2,340.1	809.8	2,340.1	1.16	-1.16	
10,324.0	89.40	178.90	7,241.1	-2,435.1	810.2	2,435.1	1.79	0.11	
10,419.0	90.40	175.90	7,241.2	-2,530.0	814.5	2,530.0	3.33	1.05	
10,514.0	90.90	175.70	7,240.2	-2,624.7	821.5	2,624.7	0.57	0.53	
10,609.0	90.20	177.40	7,239.3	-2,719.5	827.2	2,719.5	1.94	-0.74	
10,704.0	90.80	179.10	7,238.4	-2,814.5	830.1	2,814.5	1.90	0.63	
10,798.0	91.10	179.20	7,236.9	-2,908.5	831.5	2,908.5	0.34	0.32	
10,893.0	91.20	178.50	7,235.0	-3,003.4	833.4	3,003.4	0.74	0.11	
10,988.0	91.40	178.50	7,232.8	-3,098.4	835.9	3,098.4	0.21	0.21	
11,083.0	89.80	178.90	7,231.8	-3,193.3	838.0	3,193.3	1.74	-1.68	
11,177.0	89.10	177.80	7,232.7	-3,287.3	840.8	3,287.3	1.39	-0.74	
11,272.0	90.20	180.30	7,233.3	-3,382.3	842.3	3,382.3	2.87	1.16	
11,367.0	90.00	180.00	7,233.1	-3,477.3	842.1	3,477.3	0.38	-0.21	
11,462.0	89.80	179.90	7,233.3	-3,572.3	842.2	3,572.3	0.24	-0.21	
11,557.0	90.50	183.40	7,233.0	-3,667.2	839.4	3,667.2	3.76	0.74	
11,652.0	91.30	183.60	7,231.5	-3,762.0	833.6	3,762.0	0.87	0.84	
11,747.0	91.40	183.60	7,229.3	-3,856.8	827.7	3,856.8	0.11	0.11	
11,842.0	91.10	182.90	7,227.2	-3,951.6	822.3	3,951.6	0.80	-0.32	
11,885.0	91.30	182.90	7,226.3	-3,994.6	820.1	3,994.6	0.47	0.47	Last Cathedral Survey @ 11,885' MD
11,935.0	91.30	182.90	7,225.2	-4,044.5	817.6	4,044.5	0.00	0.00	Projection to Bit @ 11,935'

Cathedral Energy Services

Survey Report

Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well lone 1F-10H
Project:	DJ Wattenberg	TVD Reference:	WELL @ 5012.0ft (Ensign 124)
Site:	S10-T2N-R66W (lone)	MD Reference:	WELL @ 5012.0ft (Ensign 124)
Well:	lone 1F-10H	North Reference:	True
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)		
lone 1F-10H PBHL	0.00	0.00	7,256.0	-4,058.0	869.4	1,297,159.08	3,208,152.04	40.146690	-104.755420
- actual wellpath misses target center by 61.8ft at 11935.0ft MD (7225.2 TVD, -4044.5 N, 817.6 E)									
- Point									
lone 1F-10H PBHL NEV	0.00	0.00	7,256.0	-4,058.0	827.0	1,297,158.72	3,208,109.64	40.146690	-104.755572
- actual wellpath misses target center by 34.9ft at 11935.0ft MD (7225.2 TVD, -4044.5 N, 817.6 E)									
- Circle (radius 25.0)									
lone 1F-10H TGT	0.00	0.00	7,251.0	-3,035.9	828.4	1,298,180.82	3,208,102.49	40.149496	-104.755567
- actual wellpath misses target center by 17.7ft at 10924.9ft MD (7234.3 TVD, -3035.4 N, 834.2 E)									
- Point									
lone 1F-10H PBHL (2.13	0.00	0.00	7,290.0	-4,058.0	827.0	1,297,158.72	3,208,109.64	40.146690	-104.755572
- actual wellpath misses target center by 66.9ft at 11935.0ft MD (7225.2 TVD, -4044.5 N, 817.6 E)									
- Circle (radius 25.0)									
lone 1F-10H PBHL P4	0.00	0.00	7,251.0	-4,058.0	827.0	1,297,158.72	3,208,109.64	40.146690	-104.755572
- actual wellpath misses target center by 30.6ft at 11935.0ft MD (7225.2 TVD, -4044.5 N, 817.6 E)									
- Circle (radius 25.0)									

Design Annotations					
Measured Depth	Vertical Depth	Local Coordinates			
(ft)	(ft)	+N/-S (ft)	+E/-W (ft)	Comment	
11,885.0	7,226.3	-3,994.6	820.1	Last Cathedral Survey @ 11,885' MD	
11,935.0	7,225.2	-4,044.5	817.6	Projection to Bit @ 11,935'	

Checked By: _____ Approved By: _____ Date: _____