



Cathedral Energy Services

Survey Report

Company: EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference: Well Sprague 3B-9H-N267
Project: DJ Wattenberg	TVD Reference: 28.5' KB @ 5010.5ft (272)
Site: S9-T2N-R67W (Sprague)	MD Reference: 28.5' KB @ 5010.5ft (272)
Well: Sprague 3B-9H-N267	North Reference: True
Wellbore: Hz	Survey Calculation Method: Minimum Curvature
Design: SURVEYS	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 S9-T2N-R67W (Sprague)				
Site Position:	Northing: 1,298,443.90 ft	Latitude: 40.151070		
From: Lat/Long	Easting: 3,167,093.12 ft	Longitude: -104.902260		
Position Uncertainty: 0.0 ft	Slot Radius: 13.200 in	Grid Convergence: 0.39 °		

Well Sprague 3B-9H-N267				
Well Position	+N/-S 0.0 ft	Northing: 1,296,974.06 ft	Latitude: 40.147016	
	+E/-W 0.0 ft	Easting: 3,168,128.16 ft	Longitude: -104.898593	
Position Uncertainty	0.0 ft	Wellhead Elevation: ft	Ground Level: 4,982.0 ft	

Wellbore Hz					
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	1/16/2015	8.43	66.70	52,605

Design SURVEYS				
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	0.00

Survey Program		Date 2/1/2015			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
135.0	12,950.0	Survey #1 (Hz)	Geolink MWD	Geolink MWD	

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	
135.0	0.40	321.80	135.0	0.4	-0.3	0.4	0.30	0.30	
230.0	0.40	261.20	230.0	0.6	-0.8	0.6	0.42	0.00	
324.0	1.10	220.40	324.0	-0.2	-1.7	-0.2	0.89	0.74	
417.0	2.90	225.60	416.9	-2.5	-4.0	-2.5	1.94	1.94	
512.0	3.60	236.40	511.8	-5.8	-8.2	-5.8	0.98	0.74	
605.0	5.20	241.70	604.5	-9.4	-14.3	-9.4	1.77	1.72	
699.0	7.20	242.10	697.9	-14.2	-23.3	-14.2	2.13	2.13	
802.0	9.50	241.40	799.8	-21.3	-36.5	-21.3	2.24	2.23	
887.0	10.20	237.50	883.6	-28.7	-49.0	-28.7	1.14	0.82	
982.0	9.50	248.60	977.2	-36.1	-63.4	-36.1	2.13	-0.74	
1,076.0	11.30	249.00	1,069.7	-42.2	-79.2	-42.2	1.92	1.91	
1,169.0	11.00	245.00	1,160.9	-49.2	-95.7	-49.2	0.89	-0.32	
1,263.0	10.90	243.20	1,253.2	-57.0	-111.8	-57.0	0.38	-0.11	

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Wellbore: Hz	Survey Calculation Method: Minimum Curvature
Design: SURVEYS	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
1,356.0	10.70	240.00	1,344.5	-65.3	-127.1	-65.3	0.68	-0.22	
1,450.0	11.50	252.40	1,436.8	-72.5	-143.6	-72.5	2.67	0.85	
1,543.0	10.80	247.80	1,528.0	-78.6	-160.5	-78.6	1.22	-0.75	
1,637.0	10.00	242.80	1,620.5	-85.7	-175.9	-85.7	1.28	-0.85	
1,730.0	9.40	237.80	1,712.2	-93.4	-189.5	-93.4	1.11	-0.65	
1,824.0	9.10	233.80	1,804.9	-101.9	-202.0	-101.9	0.75	-0.32	
1,917.0	8.10	246.30	1,896.9	-108.9	-214.0	-108.9	2.27	-1.08	
2,011.0	9.50	250.30	1,989.8	-114.1	-227.3	-114.1	1.62	1.49	
2,105.0	11.10	249.00	2,082.3	-120.0	-243.1	-120.0	1.72	1.70	
2,198.0	10.50	243.10	2,173.6	-127.0	-259.0	-127.0	1.35	-0.65	
2,292.0	10.80	241.30	2,266.0	-135.1	-274.4	-135.1	0.48	0.32	
2,385.0	10.90	237.90	2,357.4	-144.0	-289.5	-144.0	0.70	0.11	
2,479.0	10.30	233.60	2,449.8	-153.7	-303.8	-153.7	1.06	-0.64	
2,572.0	9.60	243.20	2,541.4	-162.1	-317.4	-162.1	1.93	-0.75	
2,666.0	9.70	240.30	2,634.0	-169.6	-331.2	-169.6	0.53	0.11	
2,759.0	9.80	239.30	2,725.7	-177.5	-344.9	-177.5	0.21	0.11	
2,853.0	9.40	241.70	2,818.4	-185.2	-358.5	-185.2	0.60	-0.43	
2,947.0	9.30	239.80	2,911.1	-192.7	-371.8	-192.7	0.35	-0.11	
3,042.0	9.10	238.30	3,004.9	-200.5	-384.8	-200.5	0.33	-0.21	
3,136.0	9.70	245.00	3,097.6	-207.8	-398.3	-207.8	1.33	0.64	
3,231.0	9.70	243.50	3,191.3	-214.7	-412.8	-214.7	0.27	0.00	
3,325.0	9.30	242.30	3,284.0	-221.8	-426.6	-221.8	0.47	-0.43	
3,420.0	8.70	239.70	3,377.8	-229.0	-439.6	-229.0	0.76	-0.63	
3,514.0	9.20	250.00	3,470.7	-235.1	-452.8	-235.1	1.78	0.53	
3,609.0	9.80	251.30	3,564.4	-240.3	-467.6	-240.3	0.67	0.63	
3,703.0	10.50	248.70	3,656.9	-246.0	-483.1	-246.0	0.89	0.74	
3,798.0	9.80	248.40	3,750.4	-252.1	-498.7	-252.1	0.74	-0.74	
3,892.0	10.80	240.20	3,842.9	-259.4	-513.8	-259.4	1.89	1.06	
3,986.0	9.90	241.30	3,935.4	-267.7	-528.5	-267.7	0.98	-0.96	
4,081.0	10.40	242.70	4,028.9	-275.5	-543.3	-275.5	0.59	0.53	
4,175.0	10.30	243.40	4,121.4	-283.2	-558.4	-283.2	0.17	-0.11	
4,270.0	9.60	244.90	4,214.9	-290.4	-573.1	-290.4	0.79	-0.74	
4,364.0	10.20	248.50	4,307.5	-296.7	-588.0	-296.7	0.92	0.64	
4,459.0	10.30	245.20	4,401.0	-303.4	-603.5	-303.4	0.63	0.11	
4,554.0	9.40	246.10	4,494.6	-310.1	-618.3	-310.1	0.96	-0.95	
4,648.0	10.50	239.60	4,587.2	-317.5	-632.7	-317.5	1.67	1.17	
4,743.0	10.40	239.90	4,680.6	-326.2	-647.6	-326.2	0.12	-0.11	
4,837.0	9.90	240.30	4,773.2	-334.5	-662.0	-334.5	0.54	-0.53	
4,932.0	9.10	240.40	4,866.9	-342.2	-675.6	-342.2	0.84	-0.84	
5,026.0	10.50	238.30	4,959.5	-350.4	-689.3	-350.4	1.54	1.49	
5,121.0	10.40	237.90	5,052.9	-359.5	-704.0	-359.5	0.13	-0.11	
5,215.0	10.20	243.30	5,145.4	-367.8	-718.6	-367.8	1.05	-0.21	
5,310.0	9.20	242.80	5,239.0	-375.0	-732.9	-375.0	1.06	-1.05	
5,405.0	8.80	237.20	5,332.9	-382.4	-745.7	-382.4	1.01	-0.42	
5,499.0	11.00	245.30	5,425.5	-390.1	-759.9	-390.1	2.76	2.34	
5,593.0	11.50	244.00	5,517.7	-397.9	-776.5	-397.9	0.60	0.53	
5,688.0	9.00	244.80	5,611.1	-405.2	-791.7	-405.2	2.64	-2.63	
5,782.0	8.40	243.70	5,704.1	-411.4	-804.5	-411.4	0.66	-0.64	
5,877.0	8.50	238.10	5,798.0	-418.2	-816.7	-418.2	0.87	0.11	
5,971.0	8.40	240.80	5,891.0	-425.2	-828.6	-425.2	0.44	-0.11	
6,066.0	8.60	242.80	5,985.0	-431.8	-841.0	-431.8	0.38	0.21	
6,160.0	10.50	245.90	6,077.7	-438.6	-855.0	-438.6	2.09	2.02	
6,255.0	9.10	248.00	6,171.3	-444.9	-869.9	-444.9	1.52	-1.47	
6,349.0	11.10	247.80	6,263.8	-451.1	-885.2	-451.1	2.13	2.13	

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6,444.0	11.50	244.60	6,357.0	-458.6	-902.2	-458.6	0.78	0.42	
6,538.0	10.60	256.40	6,449.2	-464.7	-919.1	-464.7	2.58	-0.96	
6,585.0	11.80	271.00	6,495.3	-465.6	-928.1	-465.6	6.53	2.55	
6,632.0	13.50	282.50	6,541.2	-464.3	-938.2	-464.3	6.45	3.62	
6,679.0	15.00	292.20	6,586.8	-460.9	-949.2	-460.9	5.99	3.19	
6,727.0	14.80	302.20	6,633.2	-455.2	-960.2	-455.2	5.37	-0.42	
6,774.0	15.10	309.70	6,678.6	-448.1	-970.0	-448.1	4.16	0.64	
6,821.0	14.80	318.50	6,724.0	-439.7	-978.7	-439.7	4.87	-0.64	
6,868.0	15.20	328.30	6,769.4	-430.0	-985.9	-430.0	5.46	0.85	
6,916.0	16.70	332.40	6,815.6	-418.5	-992.4	-418.5	3.91	3.12	
6,963.0	18.30	334.80	6,860.4	-405.9	-998.6	-405.9	3.73	3.40	
7,011.0	20.00	336.30	6,905.7	-391.5	-1,005.2	-391.5	3.69	3.54	
7,058.0	22.50	338.40	6,949.5	-375.8	-1,011.7	-375.8	5.56	5.32	
7,105.0	25.20	343.20	6,992.5	-357.8	-1,017.9	-357.8	7.07	5.74	
7,152.0	26.90	348.70	7,034.7	-337.8	-1,022.9	-337.8	6.28	3.62	
7,199.0	28.40	349.30	7,076.4	-316.4	-1,027.0	-316.4	3.25	3.19	
7,246.0	30.60	348.10	7,117.3	-293.7	-1,031.6	-293.7	4.85	4.68	
7,293.0	33.80	349.50	7,157.0	-269.2	-1,036.4	-269.2	6.99	6.81	
7,340.0	36.70	350.60	7,195.4	-242.5	-1,041.1	-242.5	6.32	6.17	
7,388.0	38.60	350.10	7,233.4	-213.6	-1,046.0	-213.6	4.01	3.96	
7,435.0	40.50	351.30	7,269.7	-184.0	-1,050.9	-184.0	4.36	4.04	
7,482.0	44.70	351.20	7,304.2	-152.6	-1,055.7	-152.6	8.94	8.94	
7,529.0	48.00	352.40	7,336.7	-118.9	-1,060.5	-118.9	7.26	7.02	
7,577.0	52.40	352.30	7,367.4	-82.4	-1,065.4	-82.4	9.17	9.17	
7,624.0	55.50	351.20	7,395.1	-44.8	-1,070.9	-44.8	6.86	6.60	
7,671.0	58.00	353.20	7,420.8	-5.8	-1,076.2	-5.8	6.40	5.32	
7,718.0	61.30	354.90	7,444.6	34.5	-1,080.4	34.5	7.68	7.02	
7,765.0	63.60	356.30	7,466.3	76.0	-1,083.6	76.0	5.56	4.89	
7,812.0	67.30	356.80	7,485.8	118.7	-1,086.2	118.7	7.93	7.87	
7,860.0	71.30	357.10	7,502.8	163.5	-1,088.6	163.5	8.35	8.33	
7,907.0	75.70	357.00	7,516.1	208.5	-1,090.9	208.5	9.36	9.36	
7,954.0	80.70	358.20	7,525.8	254.5	-1,092.8	254.5	10.93	10.64	
7,975.0	83.30	357.60	7,528.7	275.2	-1,093.6	275.2	12.70	12.38	
8,053.0	88.10	358.40	7,534.5	353.0	-1,096.3	353.0	6.24	6.15	
8,084.0	88.90	357.80	7,535.3	383.9	-1,097.3	383.9	3.23	2.58	
8,178.0	91.50	358.00	7,535.0	477.9	-1,100.8	477.9	2.77	2.77	
8,273.0	91.40	358.50	7,532.6	572.8	-1,103.7	572.8	0.54	-0.11	
8,368.0	91.30	357.90	7,530.4	667.7	-1,106.6	667.7	0.64	-0.11	
8,463.0	91.80	359.60	7,527.8	762.6	-1,108.7	762.6	1.86	0.53	
8,558.0	90.70	0.50	7,525.7	857.6	-1,108.6	857.6	1.50	-1.16	
8,652.0	89.90	359.60	7,525.2	951.6	-1,108.5	951.6	1.28	-0.85	
8,747.0	89.90	359.10	7,525.4	1,046.6	-1,109.6	1,046.6	0.53	0.00	
8,842.0	90.30	359.30	7,525.2	1,141.6	-1,110.9	1,141.6	0.47	0.42	
8,937.0	90.80	0.40	7,524.3	1,236.6	-1,111.2	1,236.6	1.27	0.53	
9,032.0	91.40	0.30	7,522.5	1,331.6	-1,110.6	1,331.6	0.64	0.63	
9,126.0	90.30	1.30	7,521.1	1,425.6	-1,109.3	1,425.6	1.58	-1.17	
9,221.0	90.20	0.30	7,520.7	1,520.5	-1,108.0	1,520.5	1.06	-0.11	
9,315.0	90.80	0.90	7,519.9	1,614.5	-1,107.0	1,614.5	0.90	0.64	
9,410.0	90.20	1.40	7,519.0	1,709.5	-1,105.1	1,709.5	0.82	-0.63	
9,504.0	89.40	2.20	7,519.4	1,803.5	-1,102.1	1,803.5	1.20	-0.85	
9,598.0	89.30	0.90	7,520.4	1,897.4	-1,099.6	1,897.4	1.39	-0.11	
9,692.0	88.70	0.30	7,522.1	1,991.4	-1,098.6	1,991.4	0.90	-0.64	
9,787.0	89.40	358.90	7,523.6	2,086.4	-1,099.3	2,086.4	1.65	0.74	
9,881.0	90.80	358.80	7,523.5	2,180.4	-1,101.2	2,180.4	1.49	1.49	

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9,944.0	90.80	359.80	7,522.6	2,243.3	-1,101.9	2,243.3	1.59	0.00	
10,007.0	90.80	1.10	7,521.7	2,306.3	-1,101.4	2,306.3	2.06	0.00	
10,070.0	91.00	2.50	7,520.7	2,369.3	-1,099.5	2,369.3	2.24	0.32	
10,164.0	89.90	3.20	7,520.0	2,463.2	-1,094.8	2,463.2	1.39	-1.17	
10,258.0	90.00	3.00	7,520.1	2,557.0	-1,089.7	2,557.0	0.24	0.11	
10,352.0	90.10	4.40	7,520.0	2,650.8	-1,083.6	2,650.8	1.49	0.11	
10,447.0	89.10	2.00	7,520.7	2,745.7	-1,078.3	2,745.7	2.74	-1.05	
10,541.0	90.90	2.80	7,520.7	2,839.6	-1,074.4	2,839.6	2.10	1.91	
10,604.0	90.80	3.60	7,519.7	2,902.5	-1,070.9	2,902.5	1.28	-0.16	
10,635.0	89.70	1.70	7,519.6	2,933.5	-1,069.4	2,933.5	7.08	-3.55	
10,705.0	89.90	2.00	7,519.8	3,003.4	-1,067.2	3,003.4	0.52	0.29	
10,761.0	90.50	3.50	7,519.6	3,059.4	-1,064.5	3,059.4	2.88	1.07	
10,824.0	90.20	5.00	7,519.3	3,122.2	-1,059.8	3,122.2	2.43	-0.48	
10,886.0	90.20	3.90	7,519.0	3,184.0	-1,055.0	3,184.0	1.77	0.00	
10,949.0	90.00	5.10	7,518.9	3,246.8	-1,050.1	3,246.8	1.93	-0.32	
11,012.0	89.80	4.70	7,519.0	3,309.6	-1,044.7	3,309.6	0.71	-0.32	
11,075.0	90.00	4.80	7,519.1	3,372.3	-1,039.5	3,372.3	0.35	0.32	
11,138.0	89.90	4.10	7,519.2	3,435.2	-1,034.6	3,435.2	1.12	-0.16	
11,201.0	89.80	5.20	7,519.4	3,497.9	-1,029.5	3,497.9	1.75	-0.16	
11,264.0	89.90	5.40	7,519.5	3,560.7	-1,023.7	3,560.7	0.35	0.16	
11,326.0	90.00	4.90	7,519.6	3,622.4	-1,018.1	3,622.4	0.82	0.16	
11,389.0	90.20	4.90	7,519.5	3,685.2	-1,012.7	3,685.2	0.32	0.32	
11,452.0	89.50	4.00	7,519.6	3,748.0	-1,007.8	3,748.0	1.81	-1.11	
11,515.0	88.90	2.50	7,520.5	3,810.9	-1,004.3	3,810.9	2.56	-0.95	
11,578.0	88.50	1.00	7,522.0	3,873.8	-1,002.3	3,873.8	2.46	-0.63	
11,640.0	88.80	359.60	7,523.4	3,935.8	-1,002.0	3,935.8	2.31	0.48	
11,703.0	90.50	359.20	7,523.8	3,998.8	-1,002.7	3,998.8	2.77	2.70	
11,766.0	91.00	358.80	7,523.0	4,061.8	-1,003.8	4,061.8	1.02	0.79	
11,861.0	91.00	358.90	7,521.3	4,156.8	-1,005.7	4,156.8	0.11	0.00	
11,924.0	90.30	358.20	7,520.6	4,219.7	-1,007.3	4,219.7	1.57	-1.11	
11,987.0	89.50	357.50	7,520.7	4,282.7	-1,009.6	4,282.7	1.69	-1.27	
12,050.0	89.60	357.50	7,521.2	4,345.6	-1,012.4	4,345.6	0.16	0.16	
12,144.0	90.50	357.40	7,521.1	4,439.5	-1,016.6	4,439.5	0.96	0.96	
12,239.0	90.00	356.30	7,520.7	4,534.4	-1,021.8	4,534.4	1.27	-0.53	
12,333.0	90.20	355.90	7,520.5	4,628.2	-1,028.2	4,628.2	0.48	0.21	
12,427.0	90.50	355.70	7,520.0	4,721.9	-1,035.1	4,721.9	0.38	0.32	
12,522.0	90.70	355.50	7,519.0	4,816.6	-1,042.3	4,816.6	0.30	0.21	
12,616.0	91.20	355.10	7,517.4	4,910.3	-1,050.0	4,910.3	0.68	0.53	
12,711.0	89.80	354.50	7,516.6	5,004.9	-1,058.7	5,004.9	1.60	-1.47	
12,805.0	90.10	353.50	7,516.7	5,098.4	-1,068.5	5,098.4	1.11	0.32	
12,895.0	90.30	353.10	7,516.4	5,187.8	-1,079.0	5,187.8	0.50	0.22	Last CES Survey @ 12,895' MD
12,950.0	90.30	353.10	7,516.1	5,242.4	-1,085.6	5,242.4	0.00	0.00	PTB @ 12,950' MD

Cathedral Energy Services

Survey Report

Company: EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference: Well Sprague 3B-9H-N267
Project: DJ Wattenberg	TVD Reference: 28.5' KB @ 5010.5ft (272)
Site: S9-T2N-R67W (Sprague)	MD Reference: 28.5' KB @ 5010.5ft (272)
Well: Sprague 3B-9H-N267	North Reference: True
Wellbore: Hz	Survey Calculation Method: Minimum Curvature
Design: SURVEYS	Database: 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									
Sprague 3B-9H-N267 PI - survey misses target center by 12.4ft at 12943.8ft MD (7516.1 TVD, 5236.2 N, -1084.8 E) - Point	0.00	0.00	7,528.5	5,236.2	-1,085.5	1,302,202.79	3,167,007.17	40.161390	-104.902477
Sprague 3B-9H-N267 PI - survey misses target center by 91.3ft at 12950.0ft MD (7516.1 TVD, 5242.4 N, -1085.6 E) - Point	0.00	0.00	7,528.5	5,236.2	-1,175.8	1,302,202.18	3,166,916.86	40.161390	-104.902800
Sprague 3B-9H TGT 0' \\ - survey misses target center by 92.9ft at 7729.2ft MD (7449.9 TVD, 44.3 N, -1081.3 E) - Point	0.00	0.00	7,528.0	1.4	-1,107.8	1,296,967.99	3,167,020.37	40.147020	-104.902556
Sprague 3B-9H-N267 PI - survey misses target center by 2.1ft at 12942.4ft MD (7516.1 TVD, 5234.8 N, -1084.7 E) - Point	0.00	0.00	7,518.0	5,234.8	-1,085.5	1,302,201.34	3,167,007.18	40.161386	-104.902477
Interp @ 7529.0 (Spragu - survey misses target center by 4.5ft at 9201.9ft MD (7520.8 TVD, 1501.4 N, -1108.1 E) - Point	0.00	0.00	7,525.1	1,501.5	-1,109.2	1,298,467.95	3,167,008.84	40.151138	-104.902561
Sprague 3B-9H 45° - survey misses target center by 4.3ft at 7493.3ft MD (7312.2 TVD, -144.7 N, -1056.9 E) - Point	0.00	0.00	7,314.7	-146.6	-1,053.9	1,296,820.27	3,167,075.26	40.146613	-104.902363

Survey Annotations				
Measured Depth	Vertical Depth	Local Coordinates		Comment
(ft)	(ft)	+N/-S (ft)	+E/-W (ft)	
12,895.0	7,516.4	5,187.8	-1,079.0	Last CES Survey @ 12,895' MD
12,950.0	7,516.1	5,242.4	-1,085.6	PTB @ 12,950' MD

Checked By: _____	Approved By: _____	Date: _____
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