





Cathedral Energy Services

Survey Report

Company:	Anadarko Petroleum Corporation	Local Co-ordinate Reference:	Well Berger 31-2
Project:	DJ Wattenberg	TVD Reference:	15' KB @ 4977.0ft (Original Well Elev)
Site:	S2-T1N R67W (Berger 8 Pad)	MD Reference:	15' KB @ 4977.0ft (Original Well Elev)
Well:	Berger 31-2	North Reference:	True
Wellbore:	DD	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		S2-T1N R67W (Berger 8 Pad)			
Site Position:		Northing:	1,274,043.57 ft	Latitude:	40.083880
From:	Lat/Long	Easting:	3,178,047.58 ft	Longitude:	-104.863699
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	0.41 °

Well		Berger 31-2				
Well Position	+N/-S	0.0 ft	Northing:	1,273,978.10 ft	Latitude:	40.083701
	+E/-W	0.0 ft	Easting:	3,178,010.84 ft	Longitude:	-104.863832
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,962.0 ft

Wellbore	DD				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	5/21/2012	8.76	66.75	52,855

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	271.04	

Survey Program	Date	7/11/2012			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
61.0	8,277.0	Survey #1 (DD)	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		
61.0	0.70	291.70	61.0	0.1	-0.3	0.3	1.15	1.15		
149.0	1.80	262.90	149.0	0.2	-2.2	2.2	1.40	1.25		
238.0	2.90	271.80	237.9	0.1	-5.9	5.9	1.30	1.24		
325.0	4.20	279.20	324.7	0.6	-11.2	11.2	1.58	1.49		
401.0	5.30	275.10	400.5	1.4	-17.4	17.5	1.51	1.45		
492.0	7.40	267.50	490.9	1.5	-27.5	27.5	2.48	2.31		
583.0	9.10	271.30	581.0	1.4	-40.5	40.6	1.96	1.87		
674.0	10.30	270.60	670.7	1.7	-55.9	55.9	1.33	1.32		
764.0	11.00	271.30	759.1	2.0	-72.5	72.5	0.79	0.78		
855.0	11.00	269.00	848.4	2.0	-89.9	89.9	0.48	0.00		
894.0	10.90	267.50	886.7	1.8	-97.3	97.3	0.77	-0.26		
1,005.0	10.50	269.40	995.8	1.2	-117.9	117.9	0.48	-0.36		

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Well:	Berger 31-2	North Reference:	True
Wellbore:	DD	Survey Calculation Method:	Minimum Curvature
Design:	Final	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
1,095.0	12.10	266.20	1,084.1	0.5	-135.5	135.5	1.91	1.78	
1,186.0	12.90	272.40	1,172.9	0.3	-155.1	155.1	1.72	0.88	
1,277.0	11.70	272.40	1,261.8	1.1	-174.5	174.5	1.32	-1.32	
1,368.0	13.00	272.10	1,350.7	1.9	-194.0	194.0	1.43	1.43	
1,458.0	12.50	270.60	1,438.5	2.3	-213.8	213.8	0.67	-0.56	
1,549.0	12.30	268.00	1,527.4	2.1	-233.3	233.3	0.65	-0.22	
1,640.0	13.30	272.80	1,616.1	2.3	-253.5	253.5	1.60	1.10	
1,731.0	12.70	272.30	1,704.8	3.2	-273.9	274.0	0.67	-0.66	
1,822.0	12.40	272.50	1,793.6	4.0	-293.7	293.7	0.33	-0.33	
1,912.0	12.30	278.90	1,881.5	5.9	-312.8	312.9	1.52	-0.11	
2,003.0	11.80	278.30	1,970.5	8.8	-331.6	331.7	0.57	-0.55	
2,094.0	11.10	274.70	2,059.7	10.8	-349.5	349.7	1.10	-0.77	
2,185.0	12.30	277.40	2,148.8	12.8	-367.9	368.1	1.45	1.32	
2,275.0	11.40	277.90	2,236.9	15.2	-386.2	386.4	1.01	-1.00	
2,366.0	12.80	280.20	2,325.9	18.3	-405.0	405.3	1.63	1.54	
2,457.0	11.90	280.20	2,414.8	21.7	-424.2	424.5	0.99	-0.99	
2,548.0	12.80	279.70	2,503.7	25.1	-443.4	443.7	1.00	0.99	
2,639.0	12.20	279.60	2,592.5	28.4	-462.8	463.2	0.66	-0.66	
2,729.0	12.30	272.40	2,680.4	30.4	-481.7	482.2	1.70	0.11	
2,820.0	11.50	271.10	2,769.5	30.9	-500.5	501.0	0.93	-0.88	
2,911.0	12.50	272.30	2,858.5	31.5	-519.4	519.9	1.13	1.10	
3,002.0	11.50	270.70	2,947.5	32.0	-538.3	538.8	1.16	-1.10	
3,093.0	12.30	275.10	3,036.6	33.0	-557.0	557.5	1.33	0.88	
3,184.0	11.10	274.50	3,125.7	34.5	-575.4	576.0	1.33	-1.32	
3,274.0	12.20	267.90	3,213.8	34.9	-593.6	594.1	1.92	1.22	
3,365.0	13.10	273.30	3,302.6	35.1	-613.5	614.0	1.63	0.99	
3,456.0	11.30	271.90	3,391.6	36.0	-632.7	633.2	2.00	-1.98	
3,547.0	11.20	278.00	3,480.8	37.5	-650.3	650.9	1.31	-0.11	
3,638.0	12.70	272.30	3,569.8	39.2	-669.1	669.7	2.10	1.65	
3,729.0	12.70	270.80	3,658.6	39.7	-689.1	689.7	0.36	0.00	
3,819.0	13.40	272.80	3,746.3	40.3	-709.4	710.0	0.93	0.78	
3,910.0	11.70	272.30	3,835.1	41.2	-729.1	729.8	1.87	-1.87	
4,001.0	12.00	268.80	3,924.2	41.4	-747.8	748.5	0.86	0.33	
4,092.0	12.30	272.30	4,013.1	41.6	-767.0	767.6	0.87	0.33	
4,183.0	12.60	276.90	4,102.0	43.2	-786.5	787.2	1.14	0.33	
4,273.0	12.40	273.00	4,189.9	44.9	-805.9	806.6	0.96	-0.22	
4,364.0	11.50	273.60	4,278.9	45.9	-824.7	825.4	1.00	-0.99	
4,455.0	9.80	271.00	4,368.3	46.6	-841.5	842.2	1.94	-1.87	
4,546.0	11.10	275.10	4,457.8	47.6	-858.0	858.7	1.64	1.43	
4,637.0	9.30	272.30	4,547.4	48.6	-874.1	874.8	2.05	-1.98	
4,728.0	9.70	273.00	4,637.1	49.3	-889.1	889.8	0.46	0.44	
4,818.0	10.60	278.80	4,725.7	51.0	-904.8	905.6	1.51	1.00	
4,909.0	10.00	279.40	4,815.2	53.6	-920.9	921.7	0.67	-0.66	
5,000.0	10.10	279.00	4,904.8	56.1	-936.5	937.4	0.13	0.11	
5,091.0	8.70	278.00	4,994.6	58.3	-951.2	952.2	1.55	-1.54	
5,181.0	7.90	274.50	5,083.7	59.7	-964.2	965.1	1.05	-0.89	
5,272.0	7.90	265.30	5,173.8	59.7	-976.6	977.5	1.39	0.00	
5,363.0	6.20	270.50	5,264.1	59.3	-987.8	988.7	1.99	-1.87	
5,454.0	3.40	275.10	5,354.8	59.5	-995.4	996.3	3.10	-3.08	
5,544.0	2.20	269.90	5,444.7	59.8	-999.8	1,000.7	1.36	-1.33	
5,635.0	0.50	214.20	5,535.7	59.4	-1,001.7	1,002.6	2.16	-1.87	
5,726.0	0.20	185.90	5,626.7	59.0	-1,002.0	1,002.9	0.37	-0.33	
5,817.0	0.10	292.70	5,717.7	58.8	-1,002.1	1,003.0	0.27	-0.11	

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Design:	Final	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
5,907.0	0.40	28.40	5,807.7	59.1	-1,002.0	1,002.9	0.47	0.33	
5,998.0	0.50	339.00	5,898.7	59.8	-1,002.0	1,002.9	0.43	0.11	
6,089.0	0.60	344.40	5,989.7	60.6	-1,002.2	1,003.2	0.12	0.11	
6,180.0	0.90	326.40	6,080.6	61.7	-1,002.8	1,003.7	0.42	0.33	
6,270.0	1.10	315.10	6,170.6	62.9	-1,003.8	1,004.7	0.31	0.22	
6,361.0	0.60	228.60	6,261.6	63.2	-1,004.7	1,005.7	1.34	-0.55	
6,452.0	0.60	270.40	6,352.6	62.9	-1,005.6	1,006.6	0.47	0.00	
6,543.0	0.70	259.70	6,443.6	62.8	-1,006.6	1,007.6	0.17	0.11	
6,633.0	1.40	110.80	6,533.6	62.3	-1,006.1	1,007.1	2.26	0.78	
6,724.0	1.30	112.00	6,624.6	61.5	-1,004.1	1,005.1	0.11	-0.11	
6,815.0	1.20	115.80	6,715.6	60.7	-1,002.3	1,003.2	0.14	-0.11	
6,906.0	1.10	120.10	6,806.5	59.8	-1,000.7	1,001.6	0.15	-0.11	
6,997.0	0.90	114.70	6,897.5	59.1	-999.3	1,000.2	0.24	-0.22	
7,088.0	0.60	105.10	6,988.5	58.7	-998.2	999.1	0.36	-0.33	
7,178.0	0.40	41.80	7,078.5	58.8	-997.5	998.4	0.61	-0.22	
7,269.0	0.50	28.40	7,169.5	59.4	-997.1	998.0	0.16	0.11	
7,360.0	0.30	328.90	7,260.5	59.9	-997.0	998.0	0.48	-0.22	
7,450.0	0.10	11.70	7,350.5	60.2	-997.1	998.1	0.26	-0.22	
7,541.0	0.30	1.20	7,441.5	60.5	-997.1	998.1	0.22	0.22	
7,632.0	0.50	62.50	7,532.5	60.9	-996.8	997.7	0.49	0.22	
7,723.0	0.50	80.10	7,623.5	61.2	-996.0	997.0	0.17	0.00	
7,814.0	0.70	77.70	7,714.5	61.4	-995.1	996.0	0.22	0.22	
7,904.0	0.70	98.80	7,804.5	61.4	-994.0	995.0	0.28	0.00	
7,995.0	0.60	91.60	7,895.5	61.3	-993.0	993.9	0.14	-0.11	
8,086.0	0.70	76.90	7,986.5	61.4	-992.0	992.9	0.21	0.11	
8,177.0	1.10	80.10	8,077.5	61.7	-990.6	991.5	0.44	0.44	
8,222.0	1.20	80.50	8,122.5	61.9	-989.7	990.6	0.22	0.22	Last Cathedral Survey @ 8222' MD - Berger 31-2 Projection to Bit @ 8,277' MD
8,277.0	1.20	80.50	8,177.5	62.1	-988.5	989.5	0.00	0.00	

Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
Berger 31-2 BHL	0.00	0.41	8,147.0	65.6	-998.9	1,274,036.54	3,177,011.47	40.083881	-104.867402
- actual wellpath misses target center by 26.5ft at 8222.0ft MD (8122.5 TVD, 61.9 N, -989.7 E)									
- Circle (radius 50.0)									

Design Annotations					
Measured Depth (ft)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Comment	
8,222.0	8,122.5	61.9	-989.7	Last Cathedral Survey @ 8222' MD	
8,277.0	8,177.5	62.1	-988.5	Projection to Bit @ 8,277' MD	

Checked By: _____ Approved By: _____ Date: _____