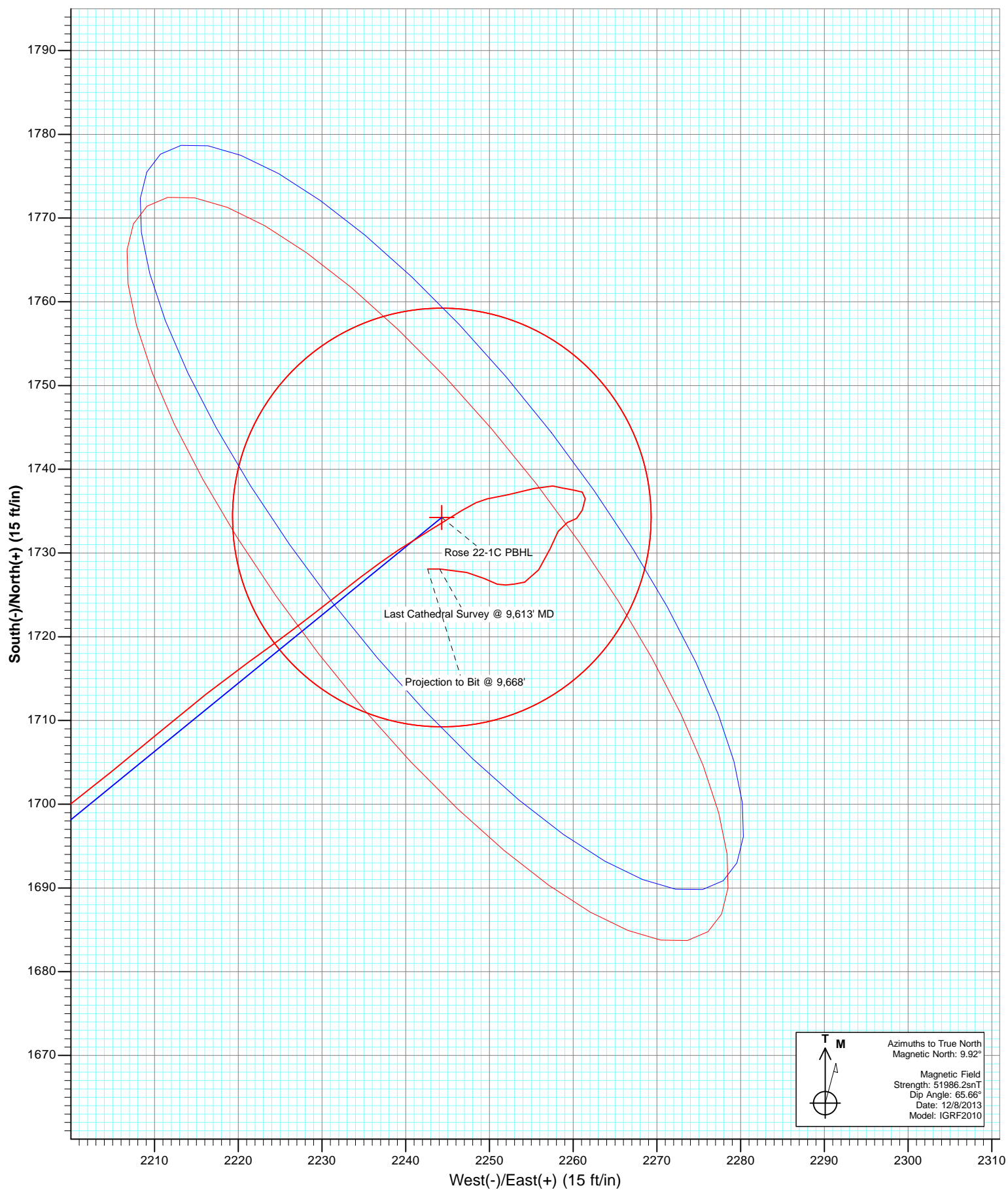


T M
 Azimuths to True North
 Magnetic North: 9.92°
 Magnetic Field
 Strength: 51986.2snT
 Dip Angle: 65.66°
 Date: 12/8/2013
 Model: IGRF2010



Cathedral Energy Services

Survey Report

Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well Rose 22-1C
Project:	Mamm Creek	TVD Reference:	KB=22' @ 6967.0ft (Patterson #303)
Site:	K22W Pad	MD Reference:	KB=22' @ 6967.0ft (Patterson #303)
Well:	Rose 22-1C	North Reference:	True
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Project	Mamm Creek		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Central Zone		

Site		K22W Pad			
Site Position:		Northing:	1,589,615.65 ft	Latitude:	39.430424
From:	Lat/Long	Easting:	2,361,269.29 ft	Longitude:	-107.761537
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	-1.43 °

Well	Rose 22-1C					
Well Position	+N/-S	0.0 ft	Northing:	1,589,628.81 ft	Latitude:	39.430460
	+E/-W	0.0 ft	Easting:	2,361,266.23 ft	Longitude:	-107.761549
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	6,945.0 ft

Wellbore	OH				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	12/8/2013	9.92	65.66	51,986

Design	FINAL				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.0	0.0	0.0	52.31	

Survey Program	Date	12/16/2013			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
145.0	9,668.0	Survey #1 (OH)	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		
145.0	1.20	145.30	145.0	-1.2	0.9	-0.1	0.83	0.83		
175.0	1.50	128.80	175.0	-1.8	1.3	0.0	1.63	1.00		
205.0	2.30	110.90	205.0	-2.2	2.2	0.4	3.29	2.67		
235.0	2.90	103.90	234.9	-2.6	3.5	1.2	2.26	2.00		
266.0	3.70	94.40	265.9	-2.9	5.3	2.4	3.12	2.58		
296.0	4.30	88.90	295.8	-2.9	7.4	4.0	2.37	2.00		
387.0	6.40	82.60	386.4	-2.2	15.8	11.2	2.39	2.31		
479.0	7.60	83.10	477.7	-0.8	26.9	20.8	1.31	1.30		
570.0	9.80	83.80	567.7	0.7	40.6	32.6	2.42	2.42		
661.0	12.60	84.80	656.9	2.5	58.2	47.6	3.08	3.08		
753.0	14.90	81.00	746.3	5.2	79.9	66.4	2.68	2.50		
844.0	16.50	74.70	833.9	10.5	103.9	88.6	2.57	1.76		

Cathedral Energy Services

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Site:	K22W Pad	MD Reference:	KB=22' @ 6967.0ft (Patterson #303)
Well:	Rose 22-1C	North Reference:	True
Wellbore:	OH	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
934.0	17.60	67.60	919.9	19.0	128.8	113.6	2.61	1.22	
1,024.0	19.80	60.20	1,005.2	31.8	154.6	141.8	3.59	2.44	
1,116.0	22.10	53.40	1,091.1	49.9	182.0	174.5	3.63	2.50	
1,207.0	25.30	49.30	1,174.4	72.8	210.5	211.1	3.95	3.52	
1,243.0	26.30	48.50	1,206.9	83.1	222.3	226.7	2.94	2.78	
1,337.0	28.80	51.30	1,290.2	111.0	255.6	270.2	2.99	2.66	
1,429.0	29.10	49.50	1,370.7	139.4	289.9	314.7	1.00	0.33	
1,521.0	29.40	48.90	1,451.0	168.8	324.0	359.5	0.46	0.33	
1,612.0	29.40	51.10	1,530.3	197.5	358.2	404.2	1.19	0.00	
1,703.0	29.60	50.40	1,609.5	225.8	392.9	449.0	0.44	0.22	
1,795.0	28.80	50.00	1,689.8	254.6	427.4	493.8	0.90	-0.87	
1,887.0	29.30	49.00	1,770.2	283.6	461.3	538.4	0.76	0.54	
1,978.0	28.60	50.50	1,849.8	312.1	494.9	582.4	1.11	-0.77	
2,070.0	29.50	50.20	1,930.2	340.6	529.3	627.1	0.99	0.98	
2,161.0	30.30	48.50	2,009.1	370.1	563.7	672.4	1.28	0.88	
2,253.0	29.80	51.00	2,088.8	399.9	598.9	718.4	1.47	-0.54	
2,344.0	29.00	51.90	2,168.1	427.7	633.8	763.1	1.00	-0.88	
2,436.0	28.20	51.20	2,248.8	455.1	668.3	807.1	0.94	-0.87	
2,527.0	26.90	52.10	2,329.5	481.2	701.3	849.2	1.50	-1.43	
2,619.0	27.50	51.90	2,411.3	507.1	734.4	891.2	0.66	0.65	
2,710.0	27.90	51.50	2,491.9	533.3	767.6	933.5	0.48	0.44	
2,802.0	27.00	51.40	2,573.5	559.8	800.8	975.9	0.98	-0.98	
2,894.0	27.50	50.20	2,655.3	586.4	833.4	1,018.0	0.81	0.54	
2,985.0	28.00	50.10	2,735.9	613.5	866.0	1,060.4	0.55	0.55	
3,076.0	26.70	50.70	2,816.7	640.2	898.2	1,102.2	1.46	-1.43	
3,168.0	27.10	50.90	2,898.7	666.5	930.4	1,143.8	0.45	0.43	
3,259.0	27.30	50.00	2,979.7	693.0	962.5	1,185.3	0.50	0.22	
3,350.0	27.80	49.40	3,060.4	720.2	994.6	1,227.4	0.63	0.55	
3,442.0	27.90	48.20	3,141.7	748.5	1,027.0	1,270.3	0.62	0.11	
3,533.0	27.60	50.40	3,222.2	776.1	1,059.1	1,312.6	1.17	-0.33	
3,625.0	27.70	50.10	3,303.7	803.4	1,091.9	1,355.3	0.19	0.11	
3,716.0	27.80	49.70	3,384.3	830.7	1,124.3	1,397.6	0.23	0.11	
3,808.0	27.60	52.00	3,465.7	857.7	1,157.5	1,440.3	1.18	-0.22	
3,899.0	28.10	51.80	3,546.2	884.0	1,190.9	1,482.8	0.56	0.55	
3,990.0	28.30	50.70	3,626.4	910.9	1,224.4	1,525.8	0.61	0.22	
4,081.0	28.50	50.40	3,706.4	938.4	1,257.9	1,569.1	0.27	0.22	
4,173.0	28.70	49.40	3,787.2	966.7	1,291.6	1,613.1	0.56	0.22	
4,265.0	28.50	51.80	3,868.0	994.7	1,325.6	1,657.1	1.27	-0.22	
4,356.0	28.70	50.90	3,947.9	1,021.9	1,359.6	1,700.7	0.52	0.22	
4,448.0	27.90	52.50	4,028.9	1,048.9	1,393.8	1,744.3	1.20	-0.87	
4,539.0	28.30	51.40	4,109.2	1,075.4	1,427.6	1,787.1	0.72	0.44	
4,631.0	28.40	51.20	4,190.1	1,102.7	1,461.7	1,830.8	0.15	0.11	
4,722.0	28.40	51.90	4,270.2	1,129.6	1,495.6	1,874.1	0.37	0.00	
4,814.0	27.90	51.90	4,351.3	1,156.4	1,529.7	1,917.5	0.54	-0.54	
4,906.0	27.10	52.50	4,432.9	1,182.4	1,563.3	1,960.0	0.92	-0.87	
4,997.0	27.50	51.60	4,513.8	1,208.1	1,596.2	2,001.7	0.63	0.44	
5,089.0	27.50	50.80	4,595.4	1,234.7	1,629.3	2,044.2	0.40	0.00	
5,180.0	27.20	50.60	4,676.2	1,261.2	1,661.6	2,086.0	0.34	-0.33	
5,272.0	27.00	50.30	4,758.1	1,287.9	1,694.0	2,127.9	0.26	-0.22	
5,364.0	27.20	50.30	4,840.0	1,314.6	1,726.2	2,169.7	0.22	0.22	
5,455.0	27.20	50.90	4,920.9	1,341.0	1,758.3	2,211.3	0.30	0.00	
5,547.0	27.20	49.80	5,002.8	1,367.9	1,790.7	2,253.4	0.55	0.00	
5,639.0	27.90	50.20	5,084.3	1,395.2	1,823.3	2,295.9	0.79	0.76	

Cathedral Energy Services

Survey Report

Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well Rose 22-1C
Project:	Mamm Creek	TVD Reference:	KB=22' @ 6967.0ft (Patterson #303)
Site:	K22W Pad	MD Reference:	KB=22' @ 6967.0ft (Patterson #303)
Well:	Rose 22-1C	North Reference:	True
Wellbore:	OH	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
5,731.0	27.90	49.30	5,165.6	1,423.0	1,856.2	2,338.9	0.46	0.00	
5,822.0	27.80	48.20	5,246.1	1,451.1	1,888.1	2,381.3	0.58	-0.11	
5,914.0	27.90	47.10	5,327.4	1,480.0	1,919.9	2,424.1	0.57	0.11	
6,005.0	26.50	48.40	5,408.4	1,508.0	1,950.7	2,465.6	1.67	-1.54	
6,097.0	24.80	49.90	5,491.3	1,534.0	1,980.8	2,505.4	1.98	-1.85	
6,188.0	23.20	51.30	5,574.4	1,557.5	2,009.4	2,542.3	1.87	-1.76	
6,280.0	22.40	55.00	5,659.2	1,578.9	2,037.9	2,578.0	1.78	-0.87	
6,372.0	20.00	55.90	5,745.0	1,597.8	2,065.3	2,611.2	2.63	-2.61	
6,463.0	18.10	55.40	5,831.0	1,614.6	2,089.8	2,640.8	2.10	-2.09	
6,555.0	16.30	54.20	5,918.9	1,630.2	2,112.0	2,668.0	1.99	-1.96	
6,646.0	14.90	50.90	6,006.6	1,645.1	2,131.5	2,692.5	1.82	-1.54	
6,738.0	14.90	50.30	6,095.5	1,660.1	2,149.8	2,716.1	0.17	0.00	
6,829.0	14.10	52.30	6,183.6	1,674.3	2,167.5	2,738.9	1.04	-0.88	
6,921.0	12.30	50.80	6,273.1	1,687.4	2,184.0	2,759.9	1.99	-1.96	
7,012.0	10.80	52.50	6,362.3	1,698.7	2,198.3	2,778.1	1.69	-1.65	
7,104.0	9.30	49.80	6,452.9	1,708.8	2,210.8	2,794.2	1.71	-1.63	
7,195.0	7.50	54.40	6,542.9	1,717.0	2,221.2	2,807.5	2.11	-1.98	
7,286.0	4.80	51.80	6,633.4	1,722.8	2,229.0	2,817.2	2.98	-2.97	
7,377.0	4.10	52.40	6,724.1	1,727.1	2,234.6	2,824.3	0.77	-0.77	
7,469.0	2.90	57.20	6,815.9	1,730.4	2,239.2	2,829.9	1.34	-1.30	
7,561.0	2.70	58.70	6,907.8	1,732.8	2,243.0	2,834.3	0.23	-0.22	
7,654.0	2.70	57.70	7,000.7	1,735.1	2,246.7	2,838.7	0.05	0.00	
7,746.0	1.50	79.30	7,092.6	1,736.5	2,249.7	2,841.9	1.54	-1.30	
7,837.0	1.80	78.20	7,183.6	1,737.0	2,252.3	2,844.3	0.33	0.33	
7,929.0	2.10	74.70	7,275.5	1,737.7	2,255.3	2,847.1	0.35	0.33	
8,020.0	0.80	103.80	7,366.5	1,738.0	2,257.6	2,849.1	1.60	-1.43	
8,112.0	0.70	99.90	7,458.5	1,737.8	2,258.7	2,849.8	0.12	-0.11	
8,203.0	0.80	99.90	7,549.5	1,737.5	2,259.9	2,850.7	0.11	0.11	
8,294.0	0.70	106.90	7,640.5	1,737.3	2,261.1	2,851.4	0.15	-0.11	
8,386.0	0.80	195.80	7,732.5	1,736.5	2,261.4	2,851.2	1.14	0.11	
8,477.0	1.00	192.40	7,823.5	1,735.1	2,261.1	2,850.1	0.23	0.22	
8,569.0	0.70	248.90	7,915.5	1,734.1	2,260.4	2,848.9	0.92	-0.33	
8,660.0	0.80	244.70	8,006.5	1,733.6	2,259.3	2,847.8	0.13	0.11	
8,751.0	1.20	213.60	8,097.4	1,732.6	2,258.2	2,846.3	0.73	0.44	
8,843.0	1.70	198.70	8,189.4	1,730.5	2,257.2	2,844.2	0.68	0.54	
8,935.0	1.90	217.40	8,281.4	1,728.0	2,255.9	2,841.6	0.67	0.22	
9,026.0	1.00	250.50	8,372.3	1,726.5	2,254.2	2,839.4	1.31	-0.99	
9,117.0	0.60	274.20	8,463.3	1,726.3	2,253.0	2,838.3	0.56	-0.44	
9,209.0	0.70	254.60	8,555.3	1,726.2	2,252.0	2,837.4	0.26	0.11	
9,300.0	0.70	296.10	8,646.3	1,726.3	2,250.9	2,836.6	0.55	0.00	
9,392.0	1.40	292.50	8,738.3	1,727.0	2,249.4	2,835.8	0.76	0.76	
9,483.0	1.40	285.40	8,829.3	1,727.7	2,247.3	2,834.6	0.19	0.00	
9,613.0	1.50	270.00	8,959.2	1,728.1	2,244.0	2,832.3	0.31	0.08	Last Cathedral Survey @ 9,613' MD Projection to Bit @ 9,668'
9,668.0	1.50	270.00	9,014.2	1,728.1	2,242.6	2,831.2	0.00	0.00	

Cathedral Energy Services

Survey Report

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Project:	Mamm Creek	TVD Reference:	KB=22' @ 6967.0ft (Patterson #303)
Site:	K22W Pad	MD Reference:	KB=22' @ 6967.0ft (Patterson #303)
Well:	Rose 22-1C	North Reference:	True
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	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									
Rose 22-1C PBHL	0.00	0.00	8,947.0	1,734.2	2,244.3	1,591,306.65	2,363,553.01	39.435221	-107.753603
- actual wellpath misses target center by 6.2ft at 9600.8ft MD (8947.0 TVD, 1728.1 N, 2244.4 E)									
- Circle (radius 25.0)									
Rose 22-1C TGT	0.00	0.00	6,869.0	1,734.2	2,244.3	1,591,306.65	2,363,553.01	39.435221	-107.753603
- actual wellpath misses target center by 3.8ft at 7522.3ft MD (6869.2 TVD, 1731.8 N, 2241.4 E)									
- Point									

Design Annotations					
Measured Depth	Vertical Depth	Local Coordinates			
(ft)	(ft)	+N/-S	+E/-W		
		(ft)	(ft)	Comment	
9,613.0	8,959.2	1,728.1	2,244.0	Last Cathedral Survey @ 9,613' MD	
9,668.0	9,014.2	1,728.1	2,242.6	Projection to Bit @ 9,668'	

Checked By: _____ Approved By: _____ Date: _____