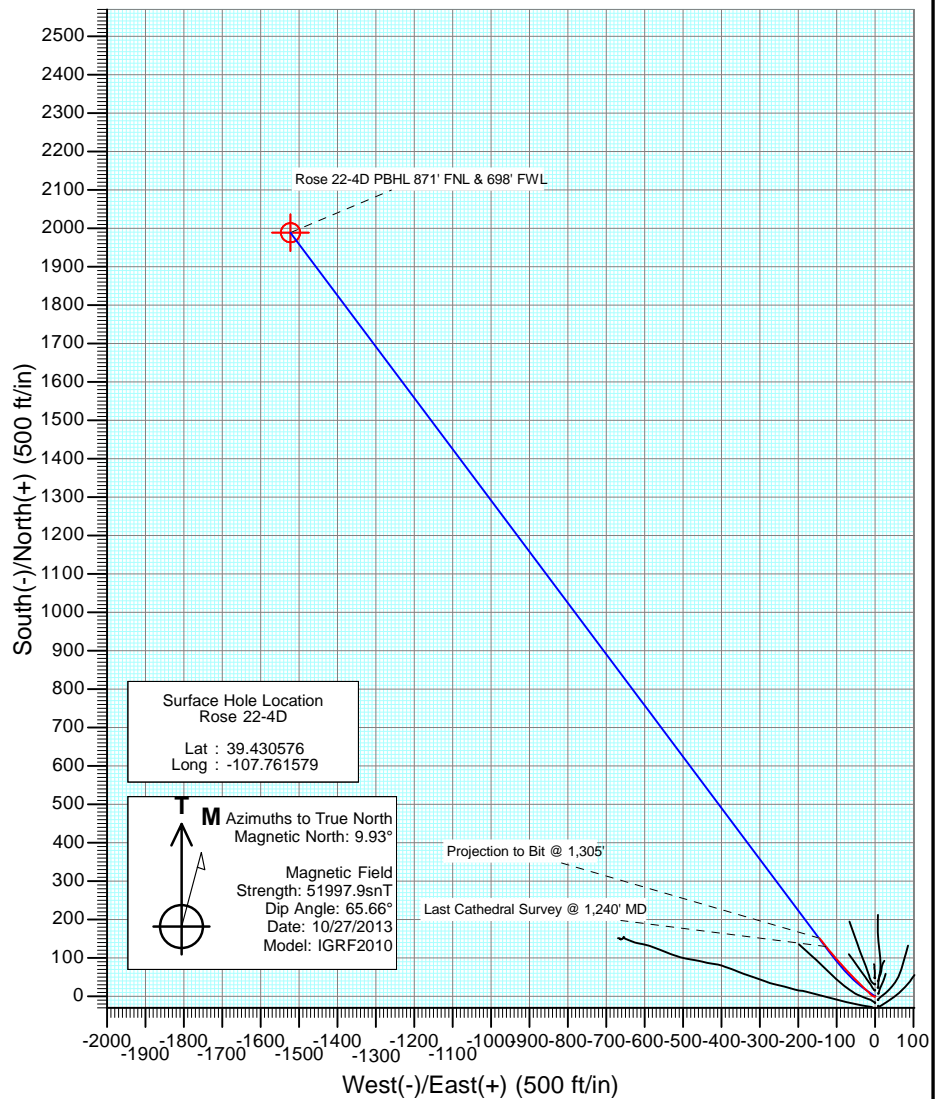
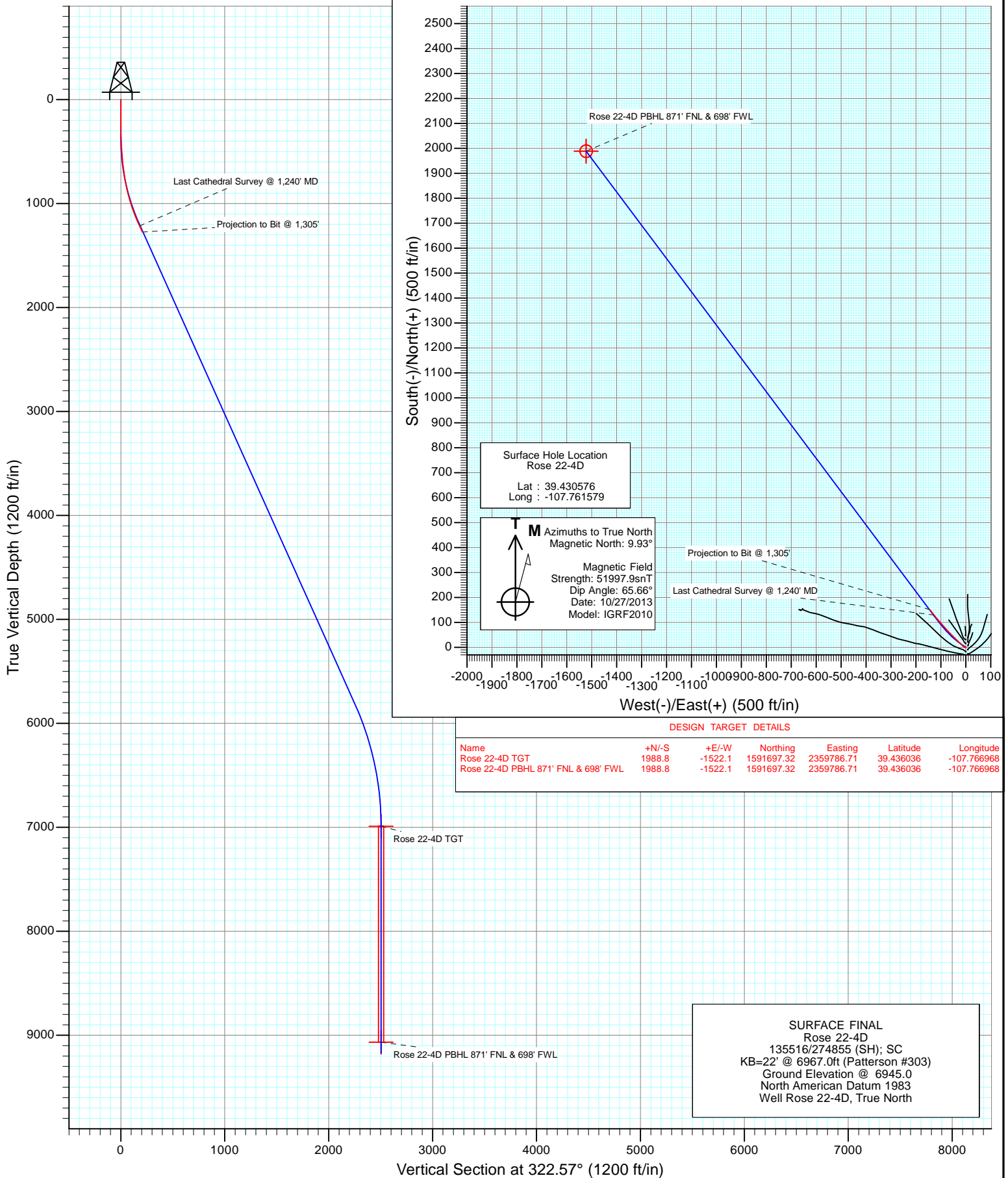




Project: Mamm Creek  
 Site: K22W Pad  
 Well: Rose 22-4D  
 Wellbore: OH  
 Design: SURFACE FINAL



DESIGN TARGET DETAILS						
Name	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
Rose 22-4D TGT	1988.8	-1522.1	1591697.32	2359786.71	39.436036	-107.766968
Rose 22-4D PBHL 871' FNL & 698' FWL	1988.8	-1522.1	1591697.32	2359786.71	39.436036	-107.766968

**SURFACE FINAL**  
 Rose 22-4D  
 135516/274855 (SH); SC  
 KB=22' @ 6967.0ft (Patterson #303)  
 Ground Elevation @ 6945.0  
 North American Datum 1983  
 Well Rose 22-4D, True North

# Cathedral Energy Services

## Survey Report

<b>Company:</b>	EnCana Oil & Gas (USA) Inc	<b>Local Co-ordinate Reference:</b>	Well Rose 22-4D
<b>Project:</b>	Mamm Creek	<b>TVD Reference:</b>	KB=22' @ 6967.0ft (Patterson #303)
<b>Site:</b>	K22W Pad	<b>MD Reference:</b>	KB=22' @ 6967.0ft (Patterson #303)
<b>Well:</b>	Rose 22-4D	<b>North Reference:</b>	True
<b>Wellbore:</b>	OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	SURFACE FINAL	<b>Database:</b>	USA EDM 5000 Multi Users DB

<b>Project</b>	Mamm Creek		
<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 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 22-4D					
Well Position	+N/-S	0.0 ft	Northing:	1,589,671.26 ft	Latitude:	39.430576
	+E/-W	0.0 ft	Easting:	2,361,258.81 ft	Longitude:	-107.761579
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	6,945.0 ft

<b>Wellbore</b>	OH				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2010	10/27/2013	9.93	65.66	51,998

<b>Design</b>	SURFACE FINAL				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.0
<b>Vertical Section:</b>	<b>Depth From (TVD)</b>	<b>+N/-S</b>	<b>+E/-W</b>	<b>Direction</b>	
	(ft)	(ft)	(ft)	(°)	
	0.0	0.0	0.0	322.57	

<b>Survey Program</b>	<b>Date</b>	12/16/2013			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
115.0	1,305.0	Survey #1 (OH)	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		
115.0	0.50	252.50	115.0	-0.2	-0.5	0.2	0.43	0.43		
176.0	0.40	252.50	176.0	-0.3	-0.9	0.3	0.16	-0.16		
206.0	0.50	239.50	206.0	-0.4	-1.1	0.4	0.47	0.33		
236.0	0.60	254.00	236.0	-0.5	-1.4	0.5	0.57	0.33		
297.0	0.70	271.80	297.0	-0.6	-2.1	0.8	0.37	0.16		
327.0	1.00	277.60	327.0	-0.5	-2.5	1.1	1.04	1.00		
358.0	1.60	296.00	358.0	-0.3	-3.2	1.7	2.33	1.94		
388.0	2.20	299.40	388.0	0.2	-4.1	2.6	2.03	2.00		
419.0	2.70	300.30	418.9	0.8	-5.2	3.8	1.62	1.61		
449.0	3.20	303.40	448.9	1.6	-6.5	5.3	1.75	1.67		
480.0	3.70	308.30	479.8	2.7	-8.0	7.0	1.87	1.61		
510.0	4.20	306.60	509.8	4.0	-9.7	9.0	1.71	1.67		

# Cathedral Energy Services

## Survey Report

<b>Company:</b>	EnCana Oil & Gas (USA) Inc	<b>Local Co-ordinate Reference:</b>	Well Rose 22-4D
<b>Project:</b>	Mamm Creek	<b>TVD Reference:</b>	KB=22' @ 6967.0ft (Patterson #303)
<b>Site:</b>	K22W Pad	<b>MD Reference:</b>	KB=22' @ 6967.0ft (Patterson #303)
<b>Well:</b>	Rose 22-4D	<b>North Reference:</b>	True
<b>Wellbore:</b>	OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	SURFACE 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
540.0	4.70	313.00	539.7	5.5	-11.5	11.3	2.35	1.67	
571.0	5.10	316.10	570.6	7.3	-13.3	13.9	1.55	1.29	
662.0	7.10	312.90	661.0	14.1	-20.3	23.5	2.23	2.20	
753.0	9.80	314.40	751.0	23.3	-29.9	36.7	2.98	2.97	
844.0	12.30	314.60	840.4	35.6	-42.4	54.0	2.75	2.75	
934.0	14.80	315.40	927.8	50.5	-57.3	74.9	2.79	2.78	
1,025.0	18.10	317.00	1,015.1	69.1	-75.1	100.5	3.66	3.63	
1,117.0	21.40	318.90	1,101.7	92.2	-95.8	131.5	3.65	3.59	
1,208.0	24.50	320.60	1,185.5	119.3	-118.7	166.9	3.48	3.41	
1,240.0	25.10	321.20	1,214.5	129.7	-127.2	180.3	2.03	1.87	Last Cathedral Survey @ 1,240' MD Projection to Bit @ 1,305'
1,305.0	25.10	321.20	1,273.4	151.2	-144.5	207.9	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
Rose 22-4D PBHL 871' I	0.00	0.00	9,067.0	1,988.8	-1,522.1	1,591,697.32	2,359,786.71	39.436036	-107.766968
- hit/miss target									
- Shape									
- actual wellpath misses target center by 8125.0ft at 1305.0ft MD (1273.4 TVD, 151.2 N, -144.5 E)									
- Circle (radius 25.0)									
Rose 22-4D TGT	0.00	0.00	6,989.0	1,988.8	-1,522.1	1,591,697.32	2,359,786.71	39.436036	-107.766968
- actual wellpath misses target center by 6159.8ft at 1305.0ft MD (1273.4 TVD, 151.2 N, -144.5 E)									
- Point									

Design Annotations				
Measured Depth (ft)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Comment
1,240.0	1,214.5	129.7	-127.2	Last Cathedral Survey @ 1,240' MD
1,305.0	1,273.4	151.2	-144.5	Projection to Bit @ 1,305'

Checked By: _____	Approved By: _____	Date: _____
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