

Azimuths to True North
Magnetic North: 10.22°

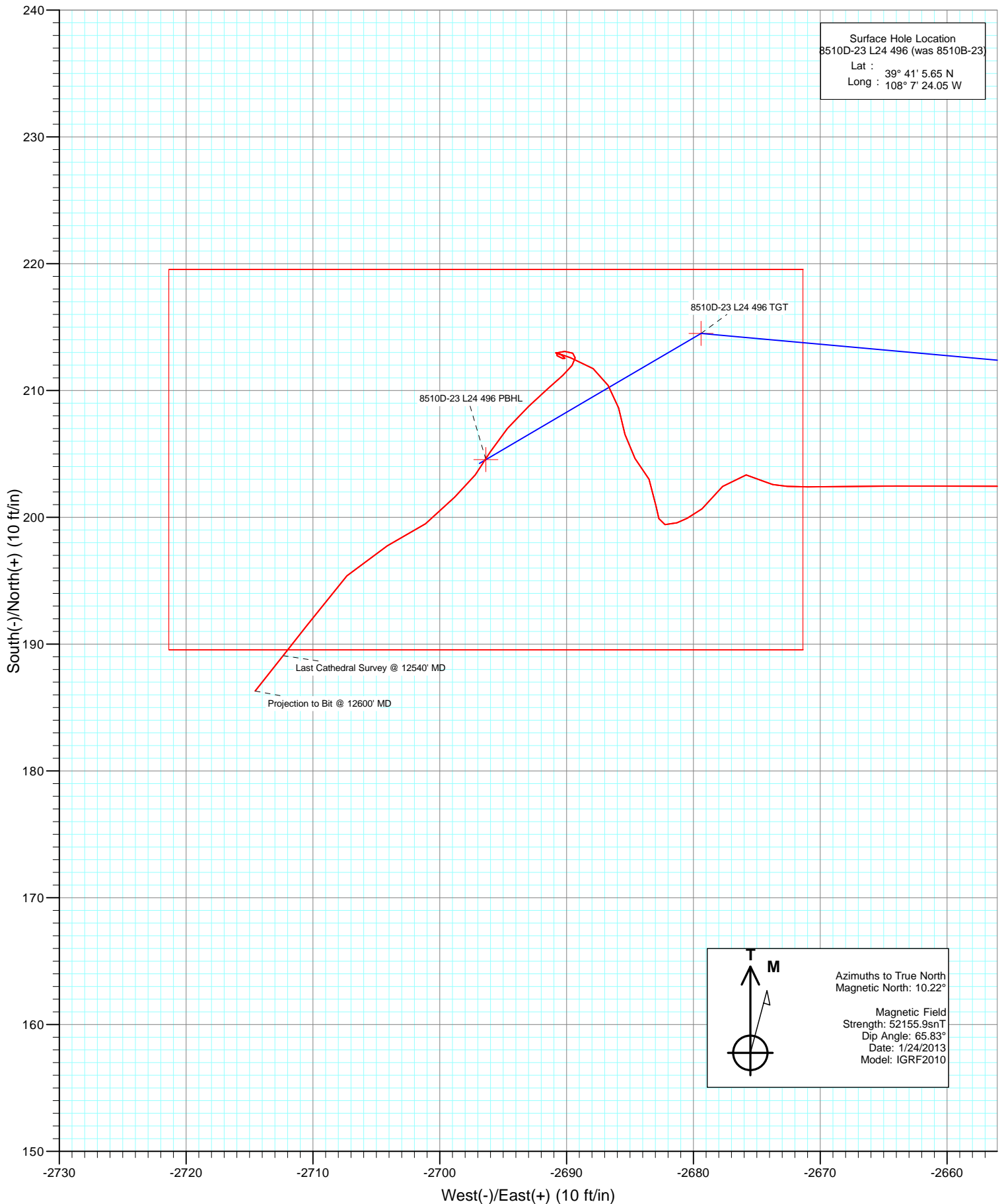
Magnetic Field
Strength: 52155.9nT
Dip Angle: 65.83°
Date: 1/24/2013
Model: IGRF2010

FORMATION TOP DETAILS

No formation data is available

DD
8510D-23 L24 496 (was 8510B-23)
125596/193555 (SH) 135028/203355 (MH); SC
KB @ 8208.0ft (Original Well Elev)
North American Datum 1983
Well 8510D-23 L24 496 (was 8510B-23), True North

Type Target	Target	Azimuth	Origin Type	N/S	E/W	From TVD
No Target (Freehand)		273.17	Slot	0.0	0.0	0.0
Name	TVD	+N/-S	+E/-W	Latitude	Longitude	
8510D-23 L24 496 TGT	8661.0	214.5	-2679.4	39° 41' 7.77 N 108° 7' 58.32 W		
8510D-23 L24 496 PBHL	12878.0	204.6	-2696.4	39° 41' 7.67 N 108° 7' 58.54 W		





Cathedral Energy Services

Survey Report

Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well 8510D-23 L24 496 (was 8510B-23)
Project:	Story Gulch	TVD Reference:	KB @ 8208.0ft (Original Well Elev)
Site:	L24 496	MD Reference:	KB @ 8208.0ft (Original Well Elev)
Well:	8510D-23 L24 496 (was 8510B-23)	North Reference:	True
Wellbore:	DD	Survey Calculation Method:	Minimum Curvature
Design:	DD	Database:	USA EDM 5000 Multi Users DB

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

Site	L24 496			
Site Position:		Northing:	1,685,024.52 ft	Latitude: 39° 41' 5.72 N
From:	Lat/Long	Easting:	2,261,789.15 ft	Longitude: 108° 7' 23.99 W
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence: -1.65 °

Well	8510D-23 L24 496 (was 8510B-23)			
Well Position	+N/-S	0.0 ft	Northing:	1,685,017.56 ft
	+E/-W	0.0 ft	Easting:	2,261,784.26 ft
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft
			Ground Level:	8,193.0 ft

Wellbore	DD				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	1/24/2013	10.22	65.83	52,156

Design	DD			
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	273.17

Survey Program	Date	2/7/2013		
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
181.0	12,600.0	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	
181.0	0.50	65.90	181.0	0.3	0.7	-0.7	0.28	0.28	
211.0	0.10	101.10	211.0	0.4	0.9	-0.8	1.41	-1.33	
242.0	0.20	100.30	242.0	0.4	0.9	-0.9	0.32	0.32	
272.0	0.30	335.40	272.0	0.4	1.0	-0.9	1.49	0.33	
303.0	1.20	282.00	303.0	0.6	0.6	-0.6	3.38	2.90	
333.0	1.50	318.10	333.0	0.9	0.0	0.0	2.95	1.00	
364.0	2.80	282.10	364.0	1.4	-1.0	1.0	5.85	4.19	
394.0	3.30	288.10	393.9	1.8	-2.5	2.6	1.98	1.67	
425.0	4.00	279.40	424.9	2.3	-4.4	4.5	2.87	2.26	
455.0	4.90	269.00	454.8	2.4	-6.7	6.9	4.02	3.00	
486.0	6.10	272.40	485.6	2.4	-9.7	9.8	4.01	3.87	
516.0	6.80	270.20	515.4	2.5	-13.1	13.2	2.47	2.33	



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Site:	L24 496	MD Reference:	KB @ 8208.0ft (Original Well Elev)
Well:	8510D-23 L24 496 (was 8510B-23)	North Reference:	True
Wellbore:	DD	Survey Calculation Method:	Minimum Curvature
Design:	DD	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
565.0	8.20	268.80	564.0	2.5	-19.5	19.6	2.88	2.86	
611.0	8.70	269.20	609.5	2.3	-26.2	26.3	1.09	1.09	
657.0	9.40	268.70	654.9	2.2	-33.5	33.5	1.53	1.52	
702.0	10.70	272.30	699.3	2.3	-41.3	41.4	3.21	2.89	
748.0	12.60	273.80	744.3	2.8	-50.6	50.7	4.18	4.13	
794.0	13.80	274.50	789.1	3.6	-61.1	61.2	2.63	2.61	
840.0	14.90	276.20	833.7	4.6	-72.4	72.6	2.56	2.39	
886.0	16.10	278.20	878.0	6.2	-84.6	84.8	2.86	2.61	
932.0	17.40	278.30	922.0	8.1	-97.7	98.0	2.83	2.83	
977.0	19.60	278.90	964.7	10.2	-111.8	112.2	4.91	4.89	
1,069.0	21.90	273.80	1,050.7	13.7	-144.2	144.7	3.18	2.50	
1,160.0	22.20	271.70	1,135.1	15.4	-178.3	178.9	0.93	0.33	
1,252.0	21.80	269.50	1,220.4	15.7	-212.8	213.3	1.00	-0.43	
1,344.0	21.60	272.20	1,305.9	16.2	-246.8	247.3	1.11	-0.22	
1,435.0	21.00	273.40	1,390.6	17.9	-279.8	280.4	0.81	-0.66	
1,527.0	21.30	278.40	1,476.5	21.3	-312.8	313.5	1.99	0.33	
1,619.0	20.80	281.40	1,562.3	26.9	-345.3	346.3	1.29	-0.54	
1,710.0	21.40	280.40	1,647.2	33.1	-377.5	378.8	0.77	0.66	
1,802.0	21.90	280.20	1,732.7	39.2	-410.9	412.4	0.55	0.54	
1,893.0	20.70	278.70	1,817.5	44.6	-443.5	445.3	1.45	-1.32	
1,985.0	21.00	278.50	1,903.5	49.5	-475.9	477.9	0.34	0.33	
2,077.0	20.00	277.00	1,989.7	53.9	-507.8	510.0	1.23	-1.09	
2,168.0	19.20	275.90	2,075.4	57.3	-538.1	540.5	0.97	-0.88	
2,260.0	19.50	272.70	2,162.2	59.6	-568.5	570.9	1.20	0.33	
2,352.0	19.70	269.60	2,248.9	60.2	-599.4	601.8	1.15	0.22	
2,443.0	20.00	271.00	2,334.5	60.4	-630.3	632.6	0.62	0.33	
2,534.0	19.80	270.70	2,420.0	60.8	-661.2	663.6	0.25	-0.22	
2,626.0	19.10	268.90	2,506.8	60.7	-691.9	694.2	1.00	-0.76	
2,718.0	18.60	269.30	2,593.8	60.3	-721.6	723.8	0.56	-0.54	
2,809.0	18.70	269.20	2,680.1	59.9	-750.7	752.8	0.12	0.11	
2,901.0	18.70	263.60	2,767.2	58.0	-780.1	782.1	1.95	0.00	
2,975.0	17.80	263.60	2,837.5	55.5	-803.1	805.0	1.22	-1.22	
3,072.0	15.60	258.10	2,930.4	51.1	-830.6	832.2	2.79	-2.27	
3,167.0	12.90	261.40	3,022.5	46.9	-853.6	854.9	2.97	-2.84	
3,262.0	11.40	268.40	3,115.3	45.1	-873.5	874.6	2.21	-1.58	
3,357.0	15.00	274.40	3,207.8	45.7	-895.1	896.3	4.05	3.79	
3,452.0	16.90	279.90	3,299.2	49.1	-921.0	922.3	2.55	2.00	
3,547.0	19.20	277.80	3,389.5	53.5	-950.1	951.6	2.52	2.42	
3,642.0	19.60	278.60	3,479.1	58.0	-981.3	983.0	0.51	0.42	
3,737.0	19.50	282.40	3,568.6	63.8	-1,012.5	1,014.5	1.34	-0.11	
3,832.0	19.40	277.00	3,658.2	69.2	-1,043.7	1,045.9	1.90	-0.11	
3,927.0	20.30	277.10	3,747.6	73.1	-1,075.7	1,078.1	0.95	0.95	
3,991.0	19.10	276.30	3,807.8	75.6	-1,097.1	1,099.6	1.92	-1.87	
4,086.0	18.20	273.60	3,897.8	78.3	-1,127.4	1,130.0	1.31	-0.95	
4,181.0	17.50	273.40	3,988.2	80.1	-1,156.5	1,159.1	0.74	-0.74	
4,307.0	21.20	274.90	4,107.1	83.1	-1,198.1	1,200.8	2.96	2.94	
4,402.0	21.60	273.40	4,195.6	85.6	-1,232.7	1,235.5	0.71	0.42	
4,497.0	20.50	272.70	4,284.2	87.5	-1,266.7	1,269.6	1.19	-1.16	
4,592.0	21.40	273.20	4,372.9	89.2	-1,300.6	1,303.6	0.97	0.95	
4,687.0	21.00	274.90	4,461.5	91.6	-1,334.9	1,337.9	0.77	-0.42	
4,782.0	20.60	274.40	4,550.3	94.4	-1,368.5	1,371.7	0.46	-0.42	
4,877.0	21.10	276.10	4,639.1	97.5	-1,402.2	1,405.4	0.83	0.53	
4,972.0	22.20	277.10	4,727.4	101.5	-1,437.0	1,440.4	1.22	1.16	



Cathedral Energy Services

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Site:	L24 496	MD Reference:	KB @ 8208.0ft (Original Well Elev)
Well:	8510D-23 L24 496 (was 8510B-23)	North Reference:	True
Wellbore:	DD	Survey Calculation Method:	Minimum Curvature
Design:	DD	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
5,067.0	21.30	277.90	4,815.6	106.1	-1,471.9	1,475.5	1.00	-0.95	
5,162.0	21.70	277.00	4,904.0	110.6	-1,506.4	1,510.3	0.55	0.42	
5,257.0	21.20	275.30	4,992.4	114.3	-1,541.0	1,544.9	0.84	-0.53	
5,352.0	21.00	274.30	5,081.1	117.2	-1,575.1	1,579.1	0.43	-0.21	
5,448.0	22.30	276.30	5,170.3	120.5	-1,610.3	1,614.5	1.56	1.35	
5,543.0	21.50	275.70	5,258.4	124.2	-1,645.6	1,649.9	0.87	-0.84	
5,638.0	19.70	274.90	5,347.4	127.3	-1,678.8	1,683.3	1.92	-1.89	
5,733.0	20.40	275.50	5,436.6	130.2	-1,711.3	1,715.9	0.77	0.74	
5,796.0	20.20	276.10	5,495.7	132.4	-1,733.0	1,737.7	0.46	-0.32	
5,891.0	20.20	275.70	5,584.9	135.8	-1,765.6	1,770.5	0.15	0.00	
5,986.0	18.10	277.10	5,674.6	139.3	-1,796.6	1,801.6	2.26	-2.21	
6,081.0	18.80	275.60	5,764.7	142.6	-1,826.5	1,831.6	0.89	0.74	
6,176.0	18.60	276.60	5,854.7	145.8	-1,856.8	1,862.0	0.40	-0.21	
6,271.0	18.20	275.90	5,944.8	149.1	-1,886.6	1,891.9	0.48	-0.42	
6,367.0	17.40	274.10	6,036.2	151.7	-1,915.8	1,921.3	1.01	-0.83	
6,493.0	19.10	273.90	6,155.9	154.4	-1,955.2	1,960.7	1.35	1.35	
6,588.0	19.90	274.50	6,245.4	156.7	-1,986.8	1,992.4	0.87	0.84	
6,684.0	19.40	271.00	6,335.9	158.3	-2,019.0	2,024.7	1.33	-0.52	
6,779.0	19.10	275.30	6,425.6	160.0	-2,050.3	2,056.0	1.52	-0.32	
6,874.0	17.10	278.20	6,515.8	163.4	-2,079.6	2,085.4	2.31	-2.11	
6,969.0	17.10	276.50	6,606.6	167.0	-2,107.3	2,113.3	0.53	0.00	
7,064.0	17.40	275.00	6,697.4	169.8	-2,135.3	2,141.4	0.56	0.32	
7,159.0	17.70	274.10	6,788.0	172.1	-2,163.9	2,170.1	0.43	0.32	
7,254.0	20.00	274.00	6,877.9	174.3	-2,194.5	2,200.8	2.42	2.42	
7,349.0	21.50	273.50	6,966.7	176.5	-2,228.1	2,234.4	1.59	1.58	
7,444.0	20.40	274.20	7,055.4	178.7	-2,262.0	2,268.4	1.19	-1.16	
7,539.0	22.00	274.70	7,144.0	181.4	-2,296.2	2,302.7	1.69	1.68	
7,635.0	21.10	275.70	7,233.3	184.6	-2,331.3	2,338.0	1.01	-0.94	
7,730.0	19.80	274.50	7,322.3	187.6	-2,364.4	2,371.1	1.44	-1.37	
7,825.0	18.90	274.80	7,411.9	190.1	-2,395.8	2,402.6	0.95	-0.95	
7,920.0	20.40	274.60	7,501.4	192.7	-2,427.6	2,434.5	1.58	1.58	
8,015.0	19.90	274.50	7,590.6	195.3	-2,460.2	2,467.3	0.53	-0.53	
8,110.0	19.00	274.60	7,680.1	197.8	-2,491.7	2,498.9	0.95	-0.95	
8,205.0	18.50	275.70	7,770.1	200.6	-2,522.2	2,529.4	0.64	-0.53	
8,300.0	17.60	274.40	7,860.4	203.2	-2,551.5	2,558.8	1.04	-0.95	
8,395.0	16.40	272.40	7,951.3	204.8	-2,579.2	2,586.6	1.40	-1.26	
8,491.0	14.20	268.30	8,043.9	205.0	-2,604.5	2,611.9	2.55	-2.29	
8,585.0	11.50	266.90	8,135.5	204.2	-2,625.4	2,632.7	2.89	-2.87	
8,680.0	8.50	264.70	8,229.0	203.0	-2,641.8	2,649.0	3.18	-3.16	
8,776.0	6.50	270.80	8,324.2	202.5	-2,654.3	2,661.5	2.24	-2.08	
8,871.0	5.20	269.10	8,418.7	202.5	-2,664.0	2,671.2	1.38	-1.37	
8,965.0	3.30	270.10	8,512.5	202.4	-2,671.0	2,678.1	2.02	-2.02	
9,061.0	0.90	303.20	8,608.4	202.8	-2,674.4	2,681.5	2.70	-2.50	
9,156.0	1.00	278.40	8,703.4	203.3	-2,675.8	2,683.0	0.44	0.11	
9,250.0	1.80	225.50	8,797.4	202.4	-2,677.7	2,684.8	1.53	0.85	
9,345.0	1.10	218.10	8,892.3	200.7	-2,679.3	2,686.3	0.76	-0.74	
9,441.0	0.70	268.40	8,988.3	199.9	-2,680.5	2,687.4	0.88	-0.42	
9,536.0	0.50	213.70	9,083.3	199.6	-2,681.3	2,688.2	0.61	-0.21	
9,641.0	0.80	289.20	9,188.3	199.4	-2,682.2	2,689.2	0.79	0.29	
9,736.0	1.50	356.10	9,283.3	200.9	-2,682.9	2,690.0	1.47	0.74	
9,831.0	1.20	332.20	9,378.3	203.0	-2,683.5	2,690.6	0.66	-0.32	
9,926.0	1.20	319.40	9,473.2	204.6	-2,684.6	2,691.8	0.28	0.00	
10,021.0	1.40	353.10	9,568.2	206.5	-2,685.4	2,692.7	0.82	0.21	



Cathedral Energy Services

Survey Report

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Project: Story Gulch
Site: L24 496
Well: 8510D-23 L24 496 (was 8510B-23)
Wellbore: DD
Design: DD

Local Co-ordinate Reference: Well 8510D-23 L24 496 (was 8510B-23)
TVD Reference: KB @ 8208.0ft (Original Well Elev)
MD Reference: KB @ 8208.0ft (Original Well Elev)
North Reference: True
Survey Calculation Method: Minimum Curvature
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
10,116.0	1.20	338.90	9,663.2	208.6	-2,685.9	2,693.3	0.40	-0.21	
10,210.0	1.20	331.00	9,757.2	210.4	-2,686.7	2,694.3	0.18	0.00	
10,305.0	1.00	303.00	9,852.2	211.7	-2,687.9	2,695.5	0.60	-0.21	
10,400.0	1.40	290.20	9,947.1	212.6	-2,689.7	2,697.3	0.50	0.42	
10,495.0	0.10	262.20	10,042.1	213.0	-2,690.9	2,698.5	1.38	-1.37	
10,590.0	0.20	104.40	10,137.1	212.9	-2,690.8	2,698.4	0.31	0.11	
10,685.0	0.30	109.30	10,232.1	212.8	-2,690.4	2,698.0	0.11	0.11	
10,780.0	0.20	171.00	10,327.1	212.5	-2,690.1	2,697.8	0.28	-0.11	
10,875.0	0.30	302.90	10,422.1	212.5	-2,690.3	2,697.9	0.48	0.11	
10,970.0	0.30	290.30	10,517.1	212.7	-2,690.7	2,698.4	0.07	0.00	
11,064.0	0.30	55.90	10,611.1	213.0	-2,690.8	2,698.4	0.57	0.00	
11,160.0	0.50	93.20	10,707.1	213.1	-2,690.1	2,697.8	0.33	0.21	
11,255.0	0.30	118.50	10,802.1	212.9	-2,689.5	2,697.2	0.28	-0.21	
11,349.0	0.30	184.70	10,896.1	212.6	-2,689.3	2,697.0	0.35	0.00	
11,444.0	0.50	213.30	10,991.1	212.0	-2,689.6	2,697.2	0.29	0.21	
11,539.0	0.80	228.20	11,086.1	211.2	-2,690.3	2,697.9	0.36	0.32	
11,634.0	1.10	229.20	11,181.1	210.2	-2,691.5	2,699.0	0.32	0.32	
11,729.0	1.40	225.30	11,276.1	208.7	-2,693.0	2,700.4	0.33	0.32	
11,824.0	1.50	222.60	11,371.0	207.0	-2,694.7	2,702.0	0.13	0.11	
11,919.0	1.30	209.00	11,466.0	205.2	-2,696.0	2,703.2	0.41	-0.21	
12,014.0	1.30	217.10	11,561.0	203.4	-2,697.2	2,704.3	0.19	0.00	
12,109.0	1.60	227.50	11,656.0	201.6	-2,698.8	2,705.8	0.42	0.32	
12,203.0	2.20	227.70	11,749.9	199.5	-2,701.1	2,708.0	0.64	0.64	
12,298.0	2.10	252.70	11,844.8	197.8	-2,704.1	2,710.9	0.98	-0.11	
12,393.0	2.90	219.60	11,939.8	195.4	-2,707.3	2,714.0	1.70	0.84	
12,488.0	3.20	218.10	12,034.6	191.4	-2,710.5	2,716.9	0.33	0.32	
12,540.0	3.40	218.30	12,086.5	189.1	-2,712.3	2,718.7	0.39	0.38	Last Cathedral Survey @ 12540' MD
12,600.0	3.40	218.30	12,146.4	186.3	-2,714.6	2,720.7	0.00	0.00	Projection to Bit @ 12600' MD

Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
8510D-23 L24 496 PBHI - survey misses target center by 732.0ft at 12600.0ft MD (12146.4 TVD, 186.3 N, -2714.6 E) - Rectangle (sides W30.0 H50.0 D0.0)	0.00	0.00	12,878.0	204.6	-2,696.4	1,685,299.88	2,259,094.92	39° 41' 7.67 N	108° 7' 58.54 W
8510D-23 L24 496 TGT - survey misses target center by 12.1ft at 9113.7ft MD (8661.1 TVD, 203.2 N, -2675.1 E) - Point	0.00	0.00	8,661.0	214.5	-2,679.4	1,685,309.34	2,259,112.17	39° 41' 7.77 N	108° 7' 58.32 W

Survey Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates +N/-S (ft)	+E/-W (ft)	Comment
12,540.0	12,086.5	189.1	-2,712.3	Last Cathedral Survey @ 12540' MD
12,600.0	12,146.4	186.3	-2,714.6	Projection to Bit @ 12600' MD

Checked By: _____ Approved By: _____ Date: _____