



OCD – HOBBS
10/20/2016
RECEIVED

October 19, 2016

Manzano, LLC.

PO Box 2107

Roswell, NM 88202-2107

CATHEDRAL ENERGY SERVICES

The Trinity Building
Suite 300, 1801 Broadway Street
Denver, Colorado, United States
80202

303.825.1001 Office
877.825.1002 Toll-Free
303.825.1991 Fax

CathedralEnergyServices.com

Drilling + Completions

Re: Certified Final Directional Survey

Dear Sir/ Madam,

Please find enclosed Cathedral Energy Services Certificate Final Survey for Manzano, LLC.

Rig: Norton #4

Well: Dog Bar 11 Fee #3H

API # 30-025-42622

County: Lea County, NM

The data and calculations included in this survey have been reviewed and conform to the operational standards as outlined by the State of New Mexico EMNRD. Should you have any questions please do not hesitate to contact Cathedral Energy Services.

Sincerely,

Cathedral Energy Services

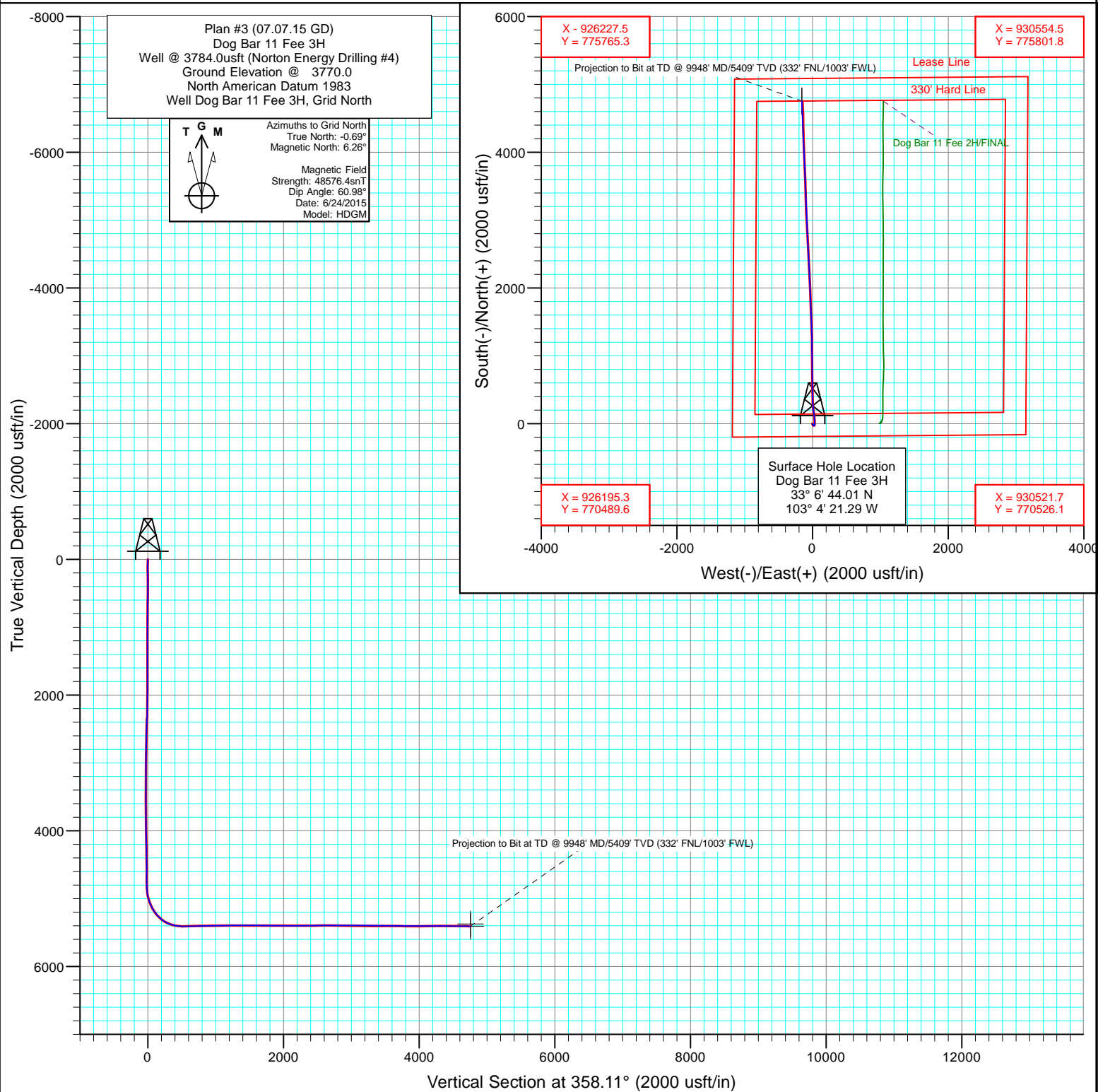
Randy Burns

Well Planner Print Name

Well Planner Signature

MANZANO LLC

Project: Lea Co., NM
Site: Sec 11-T14S-R38E
Well: Dog Bar 11 Fee 3H
Wellbore: HZ
Design: Plan #3 (07.07.15 GD)



Cathedral Energy Services

Survey Report

Company:	Manzano LLC	Local Co-ordinate Reference:	Well Dog Bar 11 Fee 3H
Project:	Lea Co., NM	TVD Reference:	Well @ 3784.0usft (Norton Energy Drilling #4)
Site:	Sec 11-T14S-R38E	MD Reference:	Well @ 3784.0usft (Norton Energy Drilling #4)
Well:	Dog Bar 11 Fee 3H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL (07.09.15)	Database:	USA EDM 5000 Multi Users DB

Project	Lea Co., NM		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site		Sec 11-T14S-R38E			
Site Position:		Northing:	770,708.00 usft	Latitude:	33° 6' 44.09 N
From:	Map	Easting:	928,396.60 usft	Longitude:	103° 4' 9.31 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.69 °

Well	Dog Bar 11 Fee 3H					
Well Position	+N/-S	0.0 usft	Northing:	770,687.20 usft	Latitude:	33° 6' 44.01 N
	+E/-W	0.0 usft	Easting:	927,377.20 usft	Longitude:	103° 4' 21.29 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	0.0 usft	Ground Level:	3,770.0 usft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	6/24/2015	6.95	60.98	48,576

Design	FINAL (07.09.15)				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	4,761.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.0	0.0	0.0	358.11	

Survey Program	Date	7/9/2015			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
114.0	4,761.0	WINK surveys (WINK surveys)	NS-GYRO-SS	NS Gyro single shots	
4,794.0	9,948.0	Survey #1 (HZ)	MWD+HDGM	OWSG MWD + HDGM	

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	
114.0	0.10	99.20	114.0	0.0	0.1	0.0	0.09	0.09	
309.0	0.30	303.50	309.0	0.2	-0.2	0.2	0.20	0.10	
488.0	0.30	151.30	488.0	0.1	-0.3	0.1	0.33	0.00	
665.0	0.30	220.40	665.0	-0.7	-0.4	-0.7	0.19	0.00	
855.0	0.40	199.20	855.0	-1.7	-0.9	-1.6	0.09	0.05	
935.0	0.50	169.70	935.0	-2.3	-1.0	-2.3	0.31	0.12	
1,031.0	0.30	159.10	1,031.0	-2.9	-0.8	-2.9	0.22	-0.21	
1,124.0	0.20	124.60	1,124.0	-3.3	-0.6	-3.2	0.19	-0.11	
1,223.0	0.40	164.00	1,223.0	-3.7	-0.4	-3.7	0.28	0.20	
1,314.0	0.10	130.20	1,314.0	-4.0	-0.2	-4.0	0.35	-0.33	
1,413.0	0.20	286.60	1,413.0	-4.0	-0.3	-4.0	0.30	0.10	

Cathedral Energy Services

Survey Report

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Site:	Sec 11-T14S-R38E	MD Reference:	Well @ 3784.0usft (Norton Energy Drilling #4)
Well:	Dog Bar 11 Fee 3H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL (07.09.15)	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
1,600.8	0.30	153.50	1,600.8	-4.4	-0.4	-4.4	0.25	0.05	
1,695.5	0.00	176.70	1,695.5	-4.6	-0.3	-4.6	0.32	-0.32	
1,790.6	0.20	119.60	1,790.6	-4.7	-0.1	-4.7	0.21	0.21	
1,885.6	0.30	111.90	1,885.6	-4.9	0.2	-4.9	0.11	0.11	
1,980.8	0.30	125.30	1,980.8	-5.1	0.7	-5.1	0.07	0.00	
2,075.7	0.20	121.00	2,075.7	-5.3	1.0	-5.4	0.11	-0.11	
2,171.2	0.60	144.30	2,171.2	-5.8	1.4	-5.9	0.44	0.42	
2,201.0	0.70	133.70	2,201.0	-6.1	1.7	-6.1	0.52	0.34	
2,254.2	0.00	137.20	2,254.2	-6.3	1.9	-6.4	1.32	-1.32	
2,263.1	1.00	101.30	2,263.1	-6.3	2.0	-6.4	11.24	11.24	
2,357.6	7.00	159.80	2,357.3	-11.9	4.8	-12.0	6.91	6.35	
2,453.1	0.40	158.40	2,452.6	-17.7	6.9	-17.9	6.91	-6.91	
2,548.2	0.90	142.20	2,547.7	-18.6	7.5	-18.8	0.56	0.53	
2,643.5	0.90	151.30	2,642.9	-19.8	8.3	-20.1	0.15	0.00	
2,738.1	1.00	130.90	2,737.5	-21.0	9.3	-21.3	0.37	0.11	
2,833.2	1.10	157.00	2,832.6	-22.4	10.3	-22.7	0.51	0.11	
2,928.1	1.10	145.70	2,927.5	-24.0	11.1	-24.3	0.23	0.00	
3,023.4	1.10	128.80	3,022.8	-25.3	12.4	-25.7	0.34	0.00	
3,117.6	0.70	113.30	3,117.0	-26.1	13.6	-26.5	0.49	-0.42	
3,213.1	0.70	113.30	3,212.5	-26.6	14.7	-27.0	0.00	0.00	
3,308.4	0.80	134.40	3,307.8	-27.3	15.7	-27.8	0.31	0.10	
3,403.2	0.70	145.00	3,402.5	-28.2	16.5	-28.7	0.18	-0.11	
3,497.7	0.50	131.60	3,497.0	-28.9	17.1	-29.5	0.26	-0.21	
3,688.1	1.00	70.30	3,687.4	-28.9	19.3	-29.6	0.46	0.26	
3,783.7	1.00	69.60	3,783.0	-28.4	20.9	-29.0	0.01	0.00	
3,878.2	1.60	41.40	3,877.5	-27.1	22.5	-27.8	0.91	0.63	
3,973.1	1.80	36.50	3,972.3	-24.9	24.3	-25.7	0.26	0.21	
4,068.2	1.80	28.80	4,067.4	-22.4	25.9	-23.2	0.25	0.00	
4,163.9	1.20	35.10	4,163.1	-20.3	27.2	-21.1	0.65	-0.63	
4,258.5	1.30	44.30	4,257.6	-18.7	28.5	-19.6	0.24	0.11	
4,352.4	1.10	35.10	4,351.5	-17.2	29.8	-18.1	0.30	-0.21	
4,449.0	0.70	47.10	4,448.1	-16.0	30.8	-17.0	0.46	-0.41	
4,543.8	0.40	352.80	4,542.9	-15.3	31.1	-16.3	0.60	-0.32	
4,639.0	0.20	322.50	4,638.1	-14.8	31.0	-15.8	0.26	-0.21	
4,734.4	0.40	295.10	4,733.5	-14.6	30.6	-15.6	0.25	0.21	
4,761.0	0.40	292.20	4,760.1	-14.5	30.4	-15.5	0.08	0.00	
4,794.0	0.20	10.20	4,793.1	-14.4	30.3	-15.4	1.24	-0.61	
4,823.0	1.30	0.90	4,822.1	-14.0	30.3	-15.0	3.80	3.79	
4,853.0	3.20	357.90	4,852.1	-12.8	30.3	-13.8	6.34	6.33	
4,883.0	5.80	0.90	4,882.0	-10.5	30.3	-11.5	8.70	8.67	
4,915.0	8.40	0.60	4,913.7	-6.5	30.4	-7.5	8.13	8.13	
4,947.0	11.00	0.80	4,945.3	-1.1	30.4	-2.1	8.13	8.13	
4,978.0	13.40	0.00	4,975.6	5.4	30.5	4.4	7.76	7.74	
5,010.0	16.00	0.80	5,006.5	13.5	30.5	12.5	8.15	8.13	
5,042.0	18.40	0.80	5,037.1	23.0	30.7	22.0	7.50	7.50	
5,073.0	20.80	1.30	5,066.3	33.4	30.8	32.4	7.76	7.74	
5,105.0	23.70	0.60	5,095.9	45.5	31.0	44.5	9.10	9.06	
5,137.0	26.60	357.80	5,124.9	59.1	30.8	58.1	9.79	9.06	
5,168.0	29.70	355.60	5,152.2	73.7	30.0	72.7	10.54	10.00	
5,200.0	32.70	353.20	5,179.6	90.2	28.3	89.2	10.15	9.37	
5,232.0	36.10	352.50	5,206.0	108.1	26.1	107.2	10.70	10.62	
5,263.0	39.50	352.30	5,230.5	127.0	23.6	126.1	10.97	10.97	
5,295.0	42.80	352.00	5,254.6	147.8	20.7	147.1	10.33	10.31	

Cathedral Energy Services

Survey Report

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Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL (07.09.15)	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
5,316.0	45.00	351.90	5,269.7	162.2	18.7	161.5	10.48	10.48	
5,359.0	49.50	352.20	5,298.9	193.5	14.3	192.9	10.48	10.47	
5,390.0	53.60	352.30	5,318.1	217.6	11.0	217.1	13.23	13.23	
5,422.0	58.10	355.10	5,336.1	243.9	8.1	243.5	15.82	14.06	
5,454.0	62.40	356.30	5,352.0	271.6	6.1	271.2	13.83	13.44	
5,485.0	66.30	358.00	5,365.4	299.5	4.7	299.2	13.52	12.58	
5,517.0	69.70	357.20	5,377.4	329.1	3.4	328.8	10.87	10.62	
5,549.0	73.70	358.00	5,387.4	359.5	2.2	359.2	12.72	12.50	
5,580.0	77.40	357.70	5,395.2	389.4	1.0	389.2	11.97	11.94	
5,612.0	81.00	358.50	5,401.2	420.9	0.0	420.6	11.51	11.25	
5,644.0	83.80	359.10	5,405.4	452.6	-0.7	452.3	8.95	8.75	
5,675.0	86.80	0.10	5,407.9	483.5	-0.9	483.2	10.20	9.68	
5,707.0	89.30	0.30	5,409.0	515.4	-0.8	515.2	7.84	7.81	
5,766.0	90.10	358.40	5,409.3	574.4	-1.4	574.2	3.49	1.36	
5,861.0	91.80	0.40	5,407.7	669.4	-2.4	669.1	2.76	1.79	
5,955.0	91.40	359.40	5,405.1	763.4	-2.6	763.0	1.15	-0.43	
6,050.0	91.40	358.80	5,402.8	858.3	-4.1	858.0	0.63	0.00	
6,145.0	90.80	359.00	5,401.0	953.3	-5.9	953.0	0.67	-0.63	
6,241.0	91.10	358.40	5,399.4	1,049.3	-8.1	1,048.9	0.70	0.31	
6,336.0	90.20	359.50	5,398.3	1,144.2	-9.8	1,143.9	1.50	-0.95	
6,431.0	90.80	0.70	5,397.5	1,239.2	-9.7	1,238.9	1.41	0.63	
6,526.0	89.90	357.90	5,396.9	1,334.2	-10.8	1,333.8	3.10	-0.95	
6,621.0	90.40	358.60	5,396.7	1,429.2	-13.7	1,428.8	0.91	0.53	
6,717.0	90.20	357.70	5,396.1	1,525.1	-16.8	1,524.8	0.96	-0.21	
6,812.0	89.40	357.50	5,396.5	1,620.0	-20.8	1,619.8	0.87	-0.84	
6,907.0	89.70	358.30	5,397.2	1,715.0	-24.3	1,714.8	0.90	0.32	
7,001.0	89.20	357.70	5,398.1	1,808.9	-27.6	1,808.8	0.83	-0.53	
7,096.0	89.10	357.70	5,399.5	1,903.8	-31.4	1,903.8	0.11	-0.11	
7,191.0	89.00	357.30	5,401.1	1,998.7	-35.5	1,998.8	0.43	-0.11	
7,286.0	90.20	357.70	5,401.8	2,093.6	-39.7	2,093.8	1.33	1.26	
7,381.0	90.60	356.90	5,401.1	2,188.5	-44.1	2,188.8	0.94	0.42	
7,476.0	90.40	357.10	5,400.3	2,283.4	-49.1	2,283.7	0.30	-0.21	
7,571.0	90.40	356.70	5,399.6	2,378.2	-54.2	2,378.7	0.42	0.00	
7,666.0	90.50	356.90	5,398.9	2,473.1	-59.5	2,473.7	0.24	0.11	
7,761.0	91.10	357.40	5,397.5	2,567.9	-64.3	2,568.7	0.82	0.63	
7,856.0	89.90	358.50	5,396.7	2,662.9	-67.7	2,663.7	1.71	-1.26	
7,951.0	89.00	356.70	5,397.6	2,757.8	-71.6	2,758.6	2.12	-0.95	
8,046.0	88.80	356.60	5,399.5	2,852.6	-77.2	2,853.6	0.24	-0.21	
8,141.0	89.10	355.50	5,401.2	2,947.4	-83.7	2,948.5	1.20	0.32	
8,236.0	89.40	358.00	5,402.4	3,042.2	-89.1	3,043.5	2.65	0.32	
8,331.0	89.50	357.20	5,403.4	3,137.1	-93.1	3,138.5	0.85	0.11	
8,426.0	89.50	357.50	5,404.2	3,232.0	-97.5	3,233.5	0.32	0.00	
8,521.0	89.70	358.50	5,404.8	3,326.9	-100.8	3,328.4	1.07	0.21	
8,616.0	89.90	359.20	5,405.2	3,421.9	-102.7	3,423.4	0.77	0.21	
8,711.0	90.60	359.30	5,404.8	3,516.9	-104.0	3,518.4	0.74	0.74	
8,807.0	89.30	358.00	5,404.8	3,612.9	-106.2	3,614.4	1.92	-1.35	
8,901.0	89.30	356.90	5,406.0	3,706.8	-110.4	3,708.4	1.17	0.00	
8,995.0	89.00	357.00	5,407.4	3,800.6	-115.4	3,802.4	0.34	-0.32	
9,091.0	90.00	356.90	5,408.2	3,896.5	-120.5	3,898.3	1.05	1.04	
9,185.0	90.30	358.10	5,408.0	3,990.4	-124.6	3,992.3	1.32	0.32	
9,281.0	91.00	358.60	5,406.9	4,086.3	-127.4	4,088.3	0.90	0.73	
9,376.0	90.50	357.70	5,405.6	4,181.3	-130.4	4,183.3	1.08	-0.53	
9,471.0	89.60	359.50	5,405.6	4,276.3	-132.8	4,278.3	2.12	-0.95	

Cathedral Energy Services

Survey Report

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Project:	Lea Co., NM	TVD Reference:	Well @ 3784.0usft (Norton Energy Drilling #4)
Site:	Sec 11-T14S-R38E	MD Reference:	Well @ 3784.0usft (Norton Energy Drilling #4)
Well:	Dog Bar 11 Fee 3H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL (07.09.15)	Database:	USA EDM 5000 Multi Users DB

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments	
9,566.0	90.00	359.10	5,405.9	4,371.2	-133.9	4,373.3	0.60	0.42		
9,661.0	90.40	359.10	5,405.6	4,466.2	-135.4	4,468.3	0.42	0.42		
9,756.0	89.00	357.40	5,406.1	4,561.2	-138.3	4,563.3	2.32	-1.47		
9,851.0	89.30	356.90	5,407.5	4,656.1	-143.0	4,658.2	0.61	0.32		
9,891.0	89.30	356.50	5,408.0	4,696.0	-145.3	4,698.2	1.00	0.00		
9,948.0	89.30	356.50	5,408.7	4,752.9	-148.8	4,755.2	0.00	0.00	Projection to Bit at TD @ 9948' MD/5409' TVD (3	

Targets										
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude Longitude		
- hit/miss target										
- Shape										
PBHL - Dog Bar 11 Fee	0.00	0.00	5,408.0	4,756.5	-156.6	775,443.70	927,220.60	33° 7' 31.08 N 103° 4' 22.46 W		
- actual wellpath misses target center by 8.6usft at 9948.0usft MD (5408.7 TVD, 4752.9 N, -148.8 E)										
- Point										
PBHL - Dog Bar 11 Fee	0.00	0.00	5,374.0	4,756.5	-156.6	775,443.70	927,220.60	33° 7' 31.08 N 103° 4' 22.46 W		
- actual wellpath misses target center by 35.7usft at 9948.0usft MD (5408.7 TVD, 4752.9 N, -148.8 E)										
- Point										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
9,948.0	5,408.7	4,752.9	-148.8	Projection to Bit at TD @ 9948' MD/5409' TVD (332' FNL/1003' FWL)	

Checked By: _____ Approved By: _____ Date: _____