

HOBBS OCD
MAR 15 2017
RECEIVED

COG OPERATING LLC

**LEA COUNTY, NM
BULLDOG
COLUMBUS FEDERAL COM #21H**

OWB

Plan: PWP0

Survey Report - Geographic

24 October, 2016

COG Operating LLC

Survey Report - Geographic

Company:	COG OPERATING LLC	Local Co-ordinate Reference:	Well COLUMBUS FEDERAL COM #21H
Project:	LEA COUNTY, NM	TVD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Site:	BULLDOG	MD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Well:	COLUMBUS FEDERAL COM #21H	North Reference:	Grid
Wellbore:	OWB	Survey Calculation Method:	Minimum Curvature
Design:	PWP0	Database:	EDM_Users

Project	LEA COUNTY, NM		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site		BULLDOG			
Site Position:		Northing:	398,637.10 usft	Latitude:	32° 5' 36.820 N
From:	Map	Easting:	741,887.40 usft	Longitude:	103° 33' 8.116 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.42 °

Well		COLUMBUS FEDERAL COM #21H				
Well Position	+N/-S	0.0 usft	Northing:	398,637.10 usf	Latitude:	32° 5' 36.820 N
	+E/-W	0.0 usft	Easting:	741,887.40 usf	Longitude:	103° 33' 8.116 W
Position Uncertainty		3.0 usft	Wellhead Elevation:	0.0 usf	Ground Level:	3,324.0 usf

Wellbore		OWB			
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	WMM2015	10/24/2016	7.02	59.94	47,920

Design		PWP0			
Audit Notes:					
Version:		Phase:	PROTOTYPE	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.0	0.0	0.0	179.58	

Survey Tool Program		Date 10/24/2016			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
0.0	11,900.0	PWP0 (OWB)	Standard Keeper 104	Standard Wireline Keeper ver 1.0.4	
11,900.0	22,396.8	PWP0 (OWB)	MWD	OWSG MWD - Standard	

Planned Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.0	0.00	0.00	0.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	
100.0	0.00	0.00	100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	
200.0	0.00	0.00	200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	
300.0	0.00	0.00	300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	
400.0	0.00	0.00	400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	
500.0	0.00	0.00	500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	
600.0	0.00	0.00	600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	
700.0	0.00	0.00	700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	
800.0	0.00	0.00	800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W	

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Site:	BULLDOG	MD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Well:	COLUMBUS FEDERAL COM #21H	North Reference:	Grid
Wellbore:	OWB	Survey Calculation Method:	Minimum Curvature
Design:	PWP0	Database:	EDM_Users

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
900.0	0.00	0.00	900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,000.0	0.00	0.00	1,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,100.0	0.00	0.00	1,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,200.0	0.00	0.00	1,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,300.0	0.00	0.00	1,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,400.0	0.00	0.00	1,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,500.0	0.00	0.00	1,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,600.0	0.00	0.00	1,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,700.0	0.00	0.00	1,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,800.0	0.00	0.00	1,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
1,900.0	0.00	0.00	1,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,000.0	0.00	0.00	2,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,100.0	0.00	0.00	2,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,200.0	0.00	0.00	2,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,300.0	0.00	0.00	2,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,400.0	0.00	0.00	2,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,500.0	0.00	0.00	2,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,600.0	0.00	0.00	2,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,700.0	0.00	0.00	2,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,800.0	0.00	0.00	2,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
2,900.0	0.00	0.00	2,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,000.0	0.00	0.00	3,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,100.0	0.00	0.00	3,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,200.0	0.00	0.00	3,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,300.0	0.00	0.00	3,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,400.0	0.00	0.00	3,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,500.0	0.00	0.00	3,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,600.0	0.00	0.00	3,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,700.0	0.00	0.00	3,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,800.0	0.00	0.00	3,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
3,900.0	0.00	0.00	3,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,000.0	0.00	0.00	4,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,100.0	0.00	0.00	4,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,200.0	0.00	0.00	4,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,300.0	0.00	0.00	4,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,400.0	0.00	0.00	4,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,500.0	0.00	0.00	4,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,600.0	0.00	0.00	4,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,700.0	0.00	0.00	4,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,800.0	0.00	0.00	4,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
4,900.0	0.00	0.00	4,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,000.0	0.00	0.00	5,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,100.0	0.00	0.00	5,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,200.0	0.00	0.00	5,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,300.0	0.00	0.00	5,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,400.0	0.00	0.00	5,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,500.0	0.00	0.00	5,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,600.0	0.00	0.00	5,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,700.0	0.00	0.00	5,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,800.0	0.00	0.00	5,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
5,900.0	0.00	0.00	5,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,000.0	0.00	0.00	6,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,100.0	0.00	0.00	6,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W

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6,200.0	0.00	0.00	6,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,300.0	0.00	0.00	6,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,400.0	0.00	0.00	6,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,500.0	0.00	0.00	6,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,600.0	0.00	0.00	6,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,700.0	0.00	0.00	6,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,800.0	0.00	0.00	6,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
6,900.0	0.00	0.00	6,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,000.0	0.00	0.00	7,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,100.0	0.00	0.00	7,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,200.0	0.00	0.00	7,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,300.0	0.00	0.00	7,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,400.0	0.00	0.00	7,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,500.0	0.00	0.00	7,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,600.0	0.00	0.00	7,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,700.0	0.00	0.00	7,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,800.0	0.00	0.00	7,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
7,900.0	0.00	0.00	7,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,000.0	0.00	0.00	8,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,100.0	0.00	0.00	8,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,200.0	0.00	0.00	8,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,300.0	0.00	0.00	8,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,400.0	0.00	0.00	8,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,500.0	0.00	0.00	8,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,600.0	0.00	0.00	8,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,700.0	0.00	0.00	8,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,800.0	0.00	0.00	8,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
8,900.0	0.00	0.00	8,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,000.0	0.00	0.00	9,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,100.0	0.00	0.00	9,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,200.0	0.00	0.00	9,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,300.0	0.00	0.00	9,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,400.0	0.00	0.00	9,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,500.0	0.00	0.00	9,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,600.0	0.00	0.00	9,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,700.0	0.00	0.00	9,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,800.0	0.00	0.00	9,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
9,900.0	0.00	0.00	9,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,000.0	0.00	0.00	10,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,100.0	0.00	0.00	10,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,200.0	0.00	0.00	10,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,300.0	0.00	0.00	10,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,400.0	0.00	0.00	10,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,500.0	0.00	0.00	10,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,600.0	0.00	0.00	10,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,700.0	0.00	0.00	10,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,800.0	0.00	0.00	10,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
10,900.0	0.00	0.00	10,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,000.0	0.00	0.00	11,000.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,100.0	0.00	0.00	11,100.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,200.0	0.00	0.00	11,200.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,300.0	0.00	0.00	11,300.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,400.0	0.00	0.00	11,400.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W

COG Operating LLC

Survey Report - Geographic

Company:	COG OPERATING LLC	Local Co-ordinate Reference:	Well COLUMBUS FEDERAL COM #21H
Project:	LEA COUNTY, NM	TVD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Site:	BULLDOG	MD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Well:	COLUMBUS FEDERAL COM #21H	North Reference:	Grid
Wellbore:	OWB	Survey Calculation Method:	Minimum Curvature
Design:	PWP0	Database:	EDM_Users

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
11,500.0	0.00	0.00	11,500.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,600.0	0.00	0.00	11,600.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,700.0	0.00	0.00	11,700.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,800.0	0.00	0.00	11,800.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,900.0	0.00	0.00	11,900.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
11,977.0	0.00	0.00	11,977.0	0.0	0.0	398,637.10	741,887.40	32° 5' 36.820 N	103° 33' 8.116 W
12,000.0	2.76	179.58	12,000.0	-0.6	0.0	398,636.54	741,887.40	32° 5' 36.815 N	103° 33' 8.116 W
12,100.0	14.77	179.58	12,098.6	-15.8	0.1	398,621.33	741,887.51	32° 5' 36.664 N	103° 33' 8.116 W
12,200.0	26.79	179.58	12,192.0	-51.2	0.4	398,585.92	741,887.77	32° 5' 36.314 N	103° 33' 8.116 W
12,300.0	38.80	179.58	12,275.9	-105.2	0.8	398,531.86	741,888.17	32° 5' 35.779 N	103° 33' 8.116 W
12,400.0	50.81	179.58	12,346.7	-175.6	1.3	398,461.52	741,888.68	32° 5' 35.083 N	103° 33' 8.116 W
12,500.0	62.82	179.58	12,401.3	-259.1	1.9	398,377.98	741,889.30	32° 5' 34.256 N	103° 33' 8.116 W
12,600.0	74.83	179.58	12,437.4	-352.2	2.6	398,284.91	741,889.98	32° 5' 33.335 N	103° 33' 8.116 W
12,700.0	86.84	179.58	12,453.3	-450.7	3.3	398,186.37	741,890.70	32° 5' 32.360 N	103° 33' 8.116 W
12,726.3	90.00	179.58	12,454.0	-477.0	3.5	398,160.11	741,890.89	32° 5' 32.100 N	103° 33' 8.116 W
12,732.9	90.27	179.58	12,454.0	-483.7	3.5	398,153.44	741,890.94	32° 5' 32.034 N	103° 33' 8.116 W
12,800.0	90.27	179.58	12,453.7	-550.7	4.0	398,086.38	741,891.43	32° 5' 31.370 N	103° 33' 8.116 W
12,900.0	90.27	179.58	12,453.2	-650.7	4.8	397,986.39	741,892.16	32° 5' 30.381 N	103° 33' 8.115 W
13,000.0	90.27	179.58	12,452.7	-750.7	5.5	397,886.39	741,892.89	32° 5' 29.391 N	103° 33' 8.115 W
13,100.0	90.27	179.58	12,452.3	-850.7	6.2	397,786.40	741,893.62	32° 5' 28.401 N	103° 33' 8.115 W
13,200.0	90.27	179.58	12,451.8	-950.7	7.0	397,686.40	741,894.35	32° 5' 27.412 N	103° 33' 8.115 W
13,300.0	90.27	179.58	12,451.3	-1,050.7	7.7	397,586.40	741,895.08	32° 5' 26.422 N	103° 33' 8.115 W
13,400.0	90.27	179.58	12,450.9	-1,150.7	8.4	397,486.41	741,895.81	32° 5' 25.433 N	103° 33' 8.115 W
13,500.0	90.27	179.58	12,450.4	-1,250.7	9.1	397,386.41	741,896.54	32° 5' 24.443 N	103° 33' 8.115 W
13,600.0	90.27	179.58	12,449.9	-1,350.7	9.9	397,286.41	741,897.27	32° 5' 23.454 N	103° 33' 8.115 W
13,700.0	90.27	179.58	12,449.5	-1,450.7	10.6	397,186.42	741,898.00	32° 5' 22.464 N	103° 33' 8.115 W
13,800.0	90.27	179.58	12,449.0	-1,550.7	11.3	397,086.42	741,898.73	32° 5' 21.474 N	103° 33' 8.115 W
13,900.0	90.27	179.58	12,448.6	-1,650.7	12.1	396,986.43	741,899.46	32° 5' 20.485 N	103° 33' 8.115 W
14,000.0	90.27	179.58	12,448.1	-1,750.7	12.8	396,886.43	741,900.19	32° 5' 19.495 N	103° 33' 8.115 W
14,100.0	90.27	179.58	12,447.6	-1,850.7	13.5	396,786.43	741,900.92	32° 5' 18.506 N	103° 33' 8.115 W
14,200.0	90.27	179.58	12,447.2	-1,950.7	14.3	396,686.44	741,901.65	32° 5' 17.516 N	103° 33' 8.115 W
14,300.0	90.27	179.58	12,446.7	-2,050.7	15.0	396,586.44	741,902.38	32° 5' 16.526 N	103° 33' 8.114 W
14,400.0	90.27	179.58	12,446.2	-2,150.7	15.7	396,486.44	741,903.11	32° 5' 15.537 N	103° 33' 8.114 W
14,500.0	90.27	179.58	12,445.8	-2,250.7	16.4	396,386.45	741,903.84	32° 5' 14.547 N	103° 33' 8.114 W
14,600.0	90.27	179.58	12,445.3	-2,350.6	17.2	396,286.45	741,904.57	32° 5' 13.558 N	103° 33' 8.114 W
14,700.0	90.27	179.58	12,444.8	-2,450.6	17.9	396,186.46	741,905.30	32° 5' 12.568 N	103° 33' 8.114 W
14,800.0	90.27	179.58	12,444.4	-2,550.6	18.6	396,086.46	741,906.03	32° 5' 11.579 N	103° 33' 8.114 W
14,900.0	90.27	179.58	12,443.9	-2,650.6	19.4	395,986.46	741,906.76	32° 5' 10.589 N	103° 33' 8.114 W
15,000.0	90.27	179.58	12,443.4	-2,750.6	20.1	395,886.47	741,907.49	32° 5' 9.599 N	103° 33' 8.114 W
15,100.0	90.27	179.58	12,443.0	-2,850.6	20.8	395,786.47	741,908.22	32° 5' 8.610 N	103° 33' 8.114 W
15,200.0	90.27	179.58	12,442.5	-2,950.6	21.6	395,686.47	741,908.95	32° 5' 7.620 N	103° 33' 8.114 W
15,300.0	90.27	179.58	12,442.0	-3,050.6	22.3	395,586.48	741,909.68	32° 5' 6.631 N	103° 33' 8.114 W
15,400.0	90.27	179.58	12,441.6	-3,150.6	23.0	395,486.48	741,910.41	32° 5' 5.641 N	103° 33' 8.114 W
15,500.0	90.27	179.58	12,441.1	-3,250.6	23.7	395,386.49	741,911.14	32° 5' 4.651 N	103° 33' 8.114 W
15,600.0	90.27	179.58	12,440.6	-3,350.6	24.5	395,286.49	741,911.87	32° 5' 3.662 N	103° 33' 8.114 W
15,700.0	90.27	179.58	12,440.2	-3,450.6	25.2	395,186.49	741,912.60	32° 5' 2.672 N	103° 33' 8.114 W
15,800.0	90.27	179.58	12,439.7	-3,550.6	25.9	395,086.50	741,913.33	32° 5' 1.683 N	103° 33' 8.113 W
15,900.0	90.27	179.58	12,439.2	-3,650.6	26.7	394,986.50	741,914.06	32° 5' 0.693 N	103° 33' 8.113 W
16,000.0	90.27	179.58	12,438.8	-3,750.6	27.4	394,886.50	741,914.79	32° 4' 59.704 N	103° 33' 8.113 W
16,100.0	90.27	179.58	12,438.3	-3,850.6	28.1	394,786.51	741,915.52	32° 4' 58.714 N	103° 33' 8.113 W
16,200.0	90.27	179.58	12,437.8	-3,950.6	28.9	394,686.51	741,916.25	32° 4' 57.724 N	103° 33' 8.113 W
16,300.0	90.27	179.58	12,437.4	-4,050.6	29.6	394,586.52	741,916.98	32° 4' 56.735 N	103° 33' 8.113 W
16,400.0	90.27	179.58	12,436.9	-4,150.6	30.3	394,486.52	741,917.71	32° 4' 55.745 N	103° 33' 8.113 W

COG Operating LLC
Survey Report - Geographic

Company:	COG OPERATING LLC	Local Co-ordinate Reference:	Well COLUMBUS FEDERAL COM #21H
Project:	LEA COUNTY, NM	TVD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Site:	BULLDOG	MD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Well:	COLUMBUS FEDERAL COM #21H	North Reference:	Grid
Wellbore:	OWB	Survey Calculation Method:	Minimum Curvature
Design:	PWP0	Database:	EDM_Users

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
16,500.0	90.27	179.58	12,436.4	-4,250.6	31.0	394,386.52	741,918.44	32° 4' 54.756 N	103° 33' 8.113 W
16,600.0	90.27	179.58	12,436.0	-4,350.6	31.8	394,286.53	741,919.17	32° 4' 53.766 N	103° 33' 8.113 W
16,700.0	90.27	179.58	12,435.5	-4,450.6	32.5	394,186.53	741,919.90	32° 4' 52.776 N	103° 33' 8.113 W
16,800.0	90.27	179.58	12,435.1	-4,550.6	33.2	394,086.53	741,920.63	32° 4' 51.787 N	103° 33' 8.113 W
16,900.0	90.27	179.58	12,434.6	-4,650.6	34.0	393,986.54	741,921.36	32° 4' 50.797 N	103° 33' 8.113 W
17,000.0	90.27	179.58	12,434.1	-4,750.6	34.7	393,886.54	741,922.10	32° 4' 49.808 N	103° 33' 8.113 W
17,100.0	90.27	179.58	12,433.7	-4,850.6	35.4	393,786.55	741,922.83	32° 4' 48.818 N	103° 33' 8.113 W
17,200.0	90.27	179.58	12,433.2	-4,950.5	36.2	393,686.55	741,923.56	32° 4' 47.829 N	103° 33' 8.112 W
17,300.0	90.27	179.58	12,432.7	-5,050.5	36.9	393,586.55	741,924.29	32° 4' 46.839 N	103° 33' 8.112 W
17,400.0	90.27	179.58	12,432.3	-5,150.5	37.6	393,486.56	741,925.02	32° 4' 45.849 N	103° 33' 8.112 W
17,500.0	90.27	179.58	12,431.8	-5,250.5	38.3	393,386.56	741,925.75	32° 4' 44.860 N	103° 33' 8.112 W
17,600.0	90.27	179.58	12,431.3	-5,350.5	39.1	393,286.56	741,926.48	32° 4' 43.870 N	103° 33' 8.112 W
17,700.0	90.27	179.58	12,430.9	-5,450.5	39.8	393,186.57	741,927.21	32° 4' 42.881 N	103° 33' 8.112 W
17,800.0	90.27	179.58	12,430.4	-5,550.5	40.5	393,086.57	741,927.94	32° 4' 41.891 N	103° 33' 8.112 W
17,900.0	90.27	179.58	12,429.9	-5,650.5	41.3	392,986.58	741,928.67	32° 4' 40.901 N	103° 33' 8.112 W
18,000.0	90.27	179.58	12,429.5	-5,750.5	42.0	392,886.58	741,929.40	32° 4' 39.912 N	103° 33' 8.112 W
18,100.0	90.27	179.58	12,429.0	-5,850.5	42.7	392,786.58	741,930.13	32° 4' 38.922 N	103° 33' 8.112 W
18,200.0	90.27	179.58	12,428.5	-5,950.5	43.5	392,686.59	741,930.86	32° 4' 37.933 N	103° 33' 8.112 W
18,300.0	90.27	179.58	12,428.1	-6,050.5	44.2	392,586.59	741,931.59	32° 4' 36.943 N	103° 33' 8.112 W
18,400.0	90.27	179.58	12,427.6	-6,150.5	44.9	392,486.59	741,932.32	32° 4' 35.953 N	103° 33' 8.112 W
18,500.0	90.27	179.58	12,427.1	-6,250.5	45.6	392,386.60	741,933.05	32° 4' 34.964 N	103° 33' 8.112 W
18,600.0	90.27	179.58	12,426.7	-6,350.5	46.4	392,286.60	741,933.78	32° 4' 33.974 N	103° 33' 8.111 W
18,700.0	90.27	179.58	12,426.2	-6,450.5	47.1	392,186.61	741,934.51	32° 4' 32.985 N	103° 33' 8.111 W
18,800.0	90.27	179.58	12,425.7	-6,550.5	47.8	392,086.61	741,935.24	32° 4' 31.995 N	103° 33' 8.111 W
18,900.0	90.27	179.58	12,425.3	-6,650.5	48.6	391,986.61	741,935.97	32° 4' 31.006 N	103° 33' 8.111 W
19,000.0	90.27	179.58	12,424.8	-6,750.5	49.3	391,886.62	741,936.70	32° 4' 30.016 N	103° 33' 8.111 W
19,100.0	90.27	179.58	12,424.3	-6,850.5	50.0	391,786.62	741,937.43	32° 4' 29.026 N	103° 33' 8.111 W
19,200.0	90.27	179.58	12,423.9	-6,950.5	50.8	391,686.62	741,938.16	32° 4' 28.037 N	103° 33' 8.111 W
19,300.0	90.27	179.58	12,423.4	-7,050.5	51.5	391,586.63	741,938.89	32° 4' 27.047 N	103° 33' 8.111 W
19,400.0	90.27	179.58	12,422.9	-7,150.5	52.2	391,486.63	741,939.62	32° 4' 26.058 N	103° 33' 8.111 W
19,500.0	90.27	179.58	12,422.5	-7,250.5	53.0	391,386.64	741,940.35	32° 4' 25.068 N	103° 33' 8.111 W
19,600.0	90.27	179.58	12,422.0	-7,350.5	53.7	391,286.64	741,941.08	32° 4' 24.078 N	103° 33' 8.111 W
19,700.0	90.27	179.58	12,421.6	-7,450.5	54.4	391,186.64	741,941.81	32° 4' 23.089 N	103° 33' 8.111 W
19,800.0	90.27	179.58	12,421.1	-7,550.5	55.1	391,086.65	741,942.54	32° 4' 22.099 N	103° 33' 8.111 W
19,900.0	90.27	179.58	12,420.6	-7,650.4	55.9	390,986.65	741,943.27	32° 4' 21.110 N	103° 33' 8.111 W
20,000.0	90.27	179.58	12,420.2	-7,750.4	56.6	390,886.65	741,944.00	32° 4' 20.120 N	103° 33' 8.110 W
20,100.0	90.27	179.58	12,419.7	-7,850.4	57.3	390,786.66	741,944.73	32° 4' 19.131 N	103° 33' 8.110 W
20,200.0	90.27	179.58	12,419.2	-7,950.4	58.1	390,686.66	741,945.46	32° 4' 18.141 N	103° 33' 8.110 W
20,300.0	90.27	179.58	12,418.8	-8,050.4	58.8	390,586.67	741,946.19	32° 4' 17.151 N	103° 33' 8.110 W
20,400.0	90.27	179.58	12,418.3	-8,150.4	59.5	390,486.67	741,946.92	32° 4' 16.162 N	103° 33' 8.110 W
20,500.0	90.27	179.58	12,417.8	-8,250.4	60.3	390,386.67	741,947.65	32° 4' 15.172 N	103° 33' 8.110 W
20,600.0	90.27	179.58	12,417.4	-8,350.4	61.0	390,286.68	741,948.38	32° 4' 14.183 N	103° 33' 8.110 W
20,700.0	90.27	179.58	12,416.9	-8,450.4	61.7	390,186.68	741,949.11	32° 4' 13.193 N	103° 33' 8.110 W
20,800.0	90.27	179.58	12,416.4	-8,550.4	62.4	390,086.68	741,949.84	32° 4' 12.203 N	103° 33' 8.110 W
20,900.0	90.27	179.58	12,416.0	-8,650.4	63.2	389,986.69	741,950.57	32° 4' 11.214 N	103° 33' 8.110 W
21,000.0	90.27	179.58	12,415.5	-8,750.4	63.9	389,886.69	741,951.30	32° 4' 10.224 N	103° 33' 8.110 W
21,100.0	90.27	179.58	12,415.0	-8,850.4	64.6	389,786.70	741,952.03	32° 4' 9.235 N	103° 33' 8.110 W
21,200.0	90.27	179.58	12,414.6	-8,950.4	65.4	389,686.70	741,952.76	32° 4' 8.245 N	103° 33' 8.110 W
21,300.0	90.27	179.58	12,414.1	-9,050.4	66.1	389,586.70	741,953.49	32° 4' 7.256 N	103° 33' 8.110 W
21,400.0	90.27	179.58	12,413.6	-9,150.4	66.8	389,486.71	741,954.22	32° 4' 6.266 N	103° 33' 8.109 W
21,500.0	90.27	179.58	12,413.2	-9,250.4	67.6	389,386.71	741,954.95	32° 4' 5.276 N	103° 33' 8.109 W
21,600.0	90.27	179.58	12,412.7	-9,350.4	68.3	389,286.71	741,955.68	32° 4' 4.287 N	103° 33' 8.109 W
21,700.0	90.27	179.58	12,412.2	-9,450.4	69.0	389,186.72	741,956.41	32° 4' 3.297 N	103° 33' 8.109 W

COG Operating LLC
Survey Report - Geographic

Company:	COG OPERATING LLC	Local Co-ordinate Reference:	Well COLUMBUS FEDERAL COM #21H
Project:	LEA COUNTY, NM	TVD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Site:	BULLDOG	MD Reference:	RKB=3324+27 @ 3351.0usft (SCANDRILL FREEDOM)
Well:	COLUMBUS FEDERAL COM #21H	North Reference:	Grid
Wellbore:	OWB	Survey Calculation Method:	Minimum Curvature
Design:	PWP0	Database:	EDM_Users

Planned Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
21,800.0	90.27	179.58	12,411.8	-9,550.4	69.7	389,086.72	741,957.14	32° 4' 2.308 N	103° 33' 8.109 W
21,900.0	90.27	179.58	12,411.3	-9,650.4	70.5	388,986.73	741,957.87	32° 4' 1.318 N	103° 33' 8.109 W
22,000.0	90.27	179.58	12,410.8	-9,750.4	71.2	388,886.73	741,958.60	32° 4' 0.328 N	103° 33' 8.109 W
22,100.0	90.27	179.58	12,410.4	-9,850.4	71.9	388,786.73	741,959.33	32° 3' 59.339 N	103° 33' 8.109 W
22,200.0	90.27	179.58	12,409.9	-9,950.4	72.7	388,686.74	741,960.06	32° 3' 58.349 N	103° 33' 8.109 W
22,300.0	90.27	179.58	12,409.5	-10,050.4	73.4	388,586.74	741,960.79	32° 3' 57.360 N	103° 33' 8.109 W
22,396.8	90.27	179.58	12,409.0	-10,147.2	74.1	388,489.90	741,961.50	32° 3' 56.401 N	103° 33' 8.109 W

Design 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-Columbus - plan hits target center - Point	0.00	0.00	12,409.0	-10,147.2	74.1	388,489.90	741,961.50	32° 3' 56.401 N	103° 33' 8.109 W

Checked By: _____ Approved By: _____ Date: _____