

30-015-39151

COG Operating LLC

Eddy County, NM

Grave Digger 2 State Com #3H

Grave Digger 2 State Com #3H

Wellbore #1

Survey: MWD Surveys

Standard Survey Report

15 December, 2011

Crescent Directional Drilling

Survey Report

Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Grave Digger 2 State Com #3H
Project:	Eddy County, NM	TVD Reference:	WELL @ 3470 00ft (Silver Oak #8)
Site:	Grave Digger 2 State Com #3H	MD Reference:	WELL @ 3470 00ft (Silver Oak #8)
Well:	Grave Digger 2 State Com #3H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass R5000 DB Server

Project:	Eddy 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: Grave Digger 2 State Com #3H					
Site Position:		Northing:	585,274 50 ft	Latitude:	32° 36' 32 27 N
From:	Map	Easting:	463,340 80 ft	Longitude:	104° 27' 8 59 W
Position Uncertainty:	0 00 ft	Slot Radius:	13 200 in	Grid Convergence:	-0 06 °

Well:	Grave Digger 2 State Com #3H					
Well Position	+N/-S	0 00 ft	Northing:	585,274 50 ft	Latitude:	32° 36' 32 27 N
	+E/-W	0 00 ft	Easting:	463,340 80 ft	Longitude:	104° 27' 8 59 W
Position Uncertainty		0 00 ft	Wellhead Elevation:	ft	Ground Level:	3,453 00 ft

Wellbore					
Wellbore #1					
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	12/1/2011	7 96	60 38	48,702

Design:		Wellbore #1			
Audit Notes:					
Version:		1 0	Phase:		ACTUAL
			Tie On Depth:		0 00
Vertical Section:		Depth From (TVD)		+N/-S	+E/-W
		(ft)		(ft)	(ft)
		0 00		0 00	0 00
					180 14

Survey Program		Date	12/15/2011	
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
100 00	2,079 00	Gyro Surveys (Wellbore #1)	Good__mag	Good Magnetic
2,165 00	7,163 00	MWD Surveys (Wellbore #1)	Good__mag	Good Magnetic

Survey										
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Vertical	Dogleg	Build	Turn	
Depth	(°)	(°)	Depth	(ft)	(ft)	Section	Rate	Rate	Rate	
(ft)			(ft)			(ft)	(°/100ft)	(°/100ft)	(°/100ft)	
2,079 00	1 03	294 20	2,078 94	-3 33	-11 33	3 35	0 00	0 00	0 00	
2,165 00	0 90	296 30	2,164 93	-2 71	-12 64	2 74	0 16	-0 15	2 44	
2,197 00	2 00	208 10	2,196 92	-3 09	-13 12	3 12	6 77	3 44	-275 63	
2,228 00	5 20	187 90	2,227 86	-4 96	-13 57	4 99	10 95	10 32	-65 16	
2,259 00	9 10	182 40	2,258 61	-8 80	-13 87	8 84	12 76	12 58	-17 74	
2,290 00	13 10	181 50	2,289 02	-14 77	-14 06	14 80	12 91	12 90	-2 90	
2,322 00	16 60	179 90	2,319 95	-22 96	-14 15	23 00	11 01	10 94	-5 00	
2,353 00	19 80	181 40	2,349 40	-32 64	-14 27	32 68	10 43	10 32	4 84	
2,384 00	22 70	182 10	2,378 28	-43 87	-14 62	43 91	9 39	9 35	2 26	
2,415 00	25 90	183 30	2,406 53	-56 61	-15 23	56 65	10 44	10 32	3 87	

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Well:	Grave Digger 2 State Com #3H	North Reference:	Grd
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass R5000 DB Server

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
2,446.00	29.20	182.60	2,434.02	-70.93	-15.96	70.97	10.70	10.65	-2.26
2,478.00	32.50	180.50	2,461.48	-87.33	-16.39	87.37	10.85	10.31	-6.56
2,509.00	36.10	179.40	2,487.09	-104.80	-16.37	104.83	11.78	11.61	-3.55
2,540.00	39.50	178.90	2,511.58	-123.79	-16.08	123.83	11.01	10.97	-1.61
2,571.00	42.50	178.90	2,534.97	-144.12	-15.69	144.16	9.68	9.68	0.00
2,602.00	45.80	179.20	2,557.21	-165.71	-15.33	165.75	10.67	10.65	0.97
2,633.00	49.40	179.60	2,578.11	-188.60	-15.10	188.63	11.65	11.61	1.29
2,665.00	52.70	180.50	2,598.23	-213.48	-15.12	213.51	10.54	10.31	2.81
2,696.00	57.00	180.30	2,616.07	-238.82	-15.30	238.86	13.88	13.87	-0.65
2,727.00	61.30	179.80	2,631.96	-265.43	-15.32	265.46	13.94	13.87	-1.61
2,758.00	65.50	180.10	2,645.84	-293.14	-15.30	293.18	13.58	13.55	0.97
2,789.00	69.60	179.90	2,657.68	-321.78	-15.30	321.82	13.24	13.23	-0.65
2,821.00	71.90	181.00	2,668.23	-351.99	-15.54	352.03	7.89	7.19	3.44
2,852.00	75.70	180.10	2,676.87	-381.75	-15.82	381.79	12.57	12.26	-2.90
2,883.00	79.10	179.80	2,683.64	-412.00	-15.79	412.04	11.01	10.97	-0.97
2,914.00	82.80	180.30	2,688.51	-442.61	-15.82	442.65	12.04	11.94	1.61
2,945.00	84.20	179.90	2,692.02	-473.41	-15.87	473.45	4.69	4.52	-1.29
2,976.00	85.40	179.40	2,694.83	-504.28	-15.68	504.32	4.19	3.87	-1.61
3,039.00	89.30	178.40	2,697.74	-567.19	-14.48	567.22	6.39	6.19	-1.59
3,133.00	88.70	178.40	2,699.38	-661.14	-11.85	661.16	0.64	-0.64	0.00
3,226.00	90.30	179.10	2,700.19	-754.11	-9.82	754.13	1.88	1.72	0.75
3,320.00	89.80	178.90	2,700.11	-848.09	-8.18	848.11	0.57	-0.53	-0.21
3,413.00	89.40	178.40	2,700.76	-941.07	-5.99	941.08	0.69	-0.43	-0.54
3,507.00	91.40	178.50	2,700.11	-1,035.02	-3.45	1,035.03	2.13	2.13	0.11
3,600.00	91.70	179.80	2,697.59	-1,127.98	-2.07	1,127.98	1.43	0.32	1.40
3,693.00	90.90	181.90	2,695.48	-1,220.94	-3.45	1,220.94	2.42	-0.86	2.26
3,787.00	90.40	181.20	2,694.41	-1,314.90	-5.99	1,314.91	0.92	-0.53	-0.74
3,880.00	90.00	180.60	2,694.09	-1,407.88	-7.45	1,407.90	0.78	-0.43	-0.65
3,974.00	90.20	180.50	2,693.92	-1,501.88	-8.35	1,501.89	0.24	0.21	-0.11
4,068.00	90.30	180.30	2,693.51	-1,595.88	-9.01	1,595.89	0.24	0.11	-0.21
4,161.00	90.00	180.10	2,693.27	-1,688.87	-9.34	1,688.89	0.39	-0.32	-0.22
4,256.00	90.10	179.90	2,693.19	-1,783.87	-9.34	1,783.89	0.24	0.11	-0.21
4,349.00	90.20	179.60	2,692.94	-1,876.87	-8.93	1,876.89	0.34	0.11	-0.32
4,443.00	91.70	180.30	2,691.39	-1,970.86	-8.85	1,970.87	1.76	1.60	0.74
4,537.00	92.10	180.30	2,688.27	-2,064.80	-9.34	2,064.82	0.43	0.43	0.00
4,630.00	91.80	180.10	2,685.11	-2,157.75	-9.66	2,157.77	0.39	-0.32	-0.22
4,724.00	91.60	180.30	2,682.32	-2,251.71	-9.99	2,251.72	0.30	-0.21	0.21
4,817.00	91.60	179.90	2,679.72	-2,344.67	-10.15	2,344.69	0.43	0.00	-0.43
4,911.00	91.50	179.90	2,677.18	-2,438.64	-9.99	2,438.65	0.11	-0.11	0.00
4,960.00	91.50	179.90	2,675.89	-2,487.62	-9.90	2,487.64	0.00	0.00	0.00
5,004.00	91.50	179.60	2,674.74	-2,531.60	-9.71	2,531.62	0.68	0.00	-0.68
5,098.00	91.40	179.40	2,672.36	-2,625.57	-8.89	2,625.58	0.24	-0.11	-0.21
5,191.00	91.40	179.40	2,670.09	-2,718.54	-7.92	2,718.55	0.00	0.00	0.00

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Well:	Grave Digger 2 State Com #3H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass R5000 DB Server

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
5,285 00	91 00	179 10	2,668 12	-2,812 51	-6 69	2,812 52	0 53	-0 43	-0 32	
5,378 00	90 80	179 20	2,666 66	-2,905 49	-5 31	2,905 49	0 24	-0 22	0 11	
5,472 00	90 40	179 40	2,665 68	-2,999 47	-4 16	2,999 47	0 48	-0 43	0 21	
5,565 00	91 50	179 10	2,664 14	-3,092 45	-2 94	3,092 45	1 23	1 18	-0 32	
5,659 00	91 30	178 70	2,661 84	-3,186 41	-1 14	3,186 40	0 48	-0 21	-0 43	
5,752 00	90 60	180 10	2,660 30	-3,279 39	-0 17	3,279 38	1 68	-0 75	1 51	
5,846 00	90 00	180 50	2,659 81	-3,373 38	-0 66	3,373 37	0 77	-0 64	0 43	
5,941 00	89 80	179 50	2,659 97	-3,468 38	-0 66	3,468 37	1 07	-0 21	-1 05	
6,035 00	89 50	179 20	2,660 55	-3,562 37	0 41	3,562 36	0 45	-0 32	-0 32	
6,128 00	90 50	180 10	2,660 55	-3,655 37	0 98	3,655 36	1 45	1 08	0 97	
6,222 00	90 20	179 80	2,659 97	-3,749 37	1 06	3,749 35	0 45	-0 32	-0 32	
6,316 00	89 40	179 20	2,660 30	-3,843 36	1 88	3,843 35	1 06	-0 85	-0 64	
6,409 00	89 10	179 10	2,661 52	-3,936 34	3 26	3,936 32	0 34	-0 32	-0 11	
6,503 00	87 80	180 10	2,664 06	-4,030 30	3 91	4,030 28	1 74	-1 38	1 06	
6,596 00	87 70	179 90	2,667 71	-4,123 23	3 91	4,123 21	0 24	-0 11	-0 22	
6,690 00	87 70	179 80	2,671 48	-4,217 16	4 16	4,217 13	0 11	0 00	-0 11	
6,784 00	88 20	179 40	2,674 85	-4,311 09	4 82	4,311 07	0 68	0 53	-0 43	
6,877 00	89 20	179 40	2,676 96	-4,404 06	5 79	4,404 03	1 08	1 08	0 00	
6,971 00	89 20	179 40	2,678 27	-4,498 05	6 77	4,498 02	0 00	0 00	0 00	
7,064 00	89 30	179 10	2,679 49	-4,591 03	7 99	4,591 00	0 34	0 11	-0 32	
7,114 00	89 60	178 40	2,679 97	-4,641 02	9 08	4,640 98	1 52	0 60	-1 40	
Last Survey @ 7114 00 MD, 2679 97 TVD, 89 60 INC, 178 40 AZ										
7,163 00	89 60	178 40	2,680 31	-4,690 00	10 45	4,689 96	0 00	0 00	0 00	
Straight line Projection to TD @ 7163 00 MD, 2680 31 TVD										

Survey Annotations					
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates			
		+N/-S (ft)	+E/-W (ft)	Comment	
7,114 00	2,679 97	-4,641 02	9 08	Last Survey @ 7114 00 MD, 2679 97 TVD, 89 60 INC, 178 40 AZ	
7,163 00	2,680 31	-4,690 00	10 45	Straight line Projection to TD @ 7163 00 MD, 2680 31 TVD	

Checked By _____ Approved By: _____ Date: _____

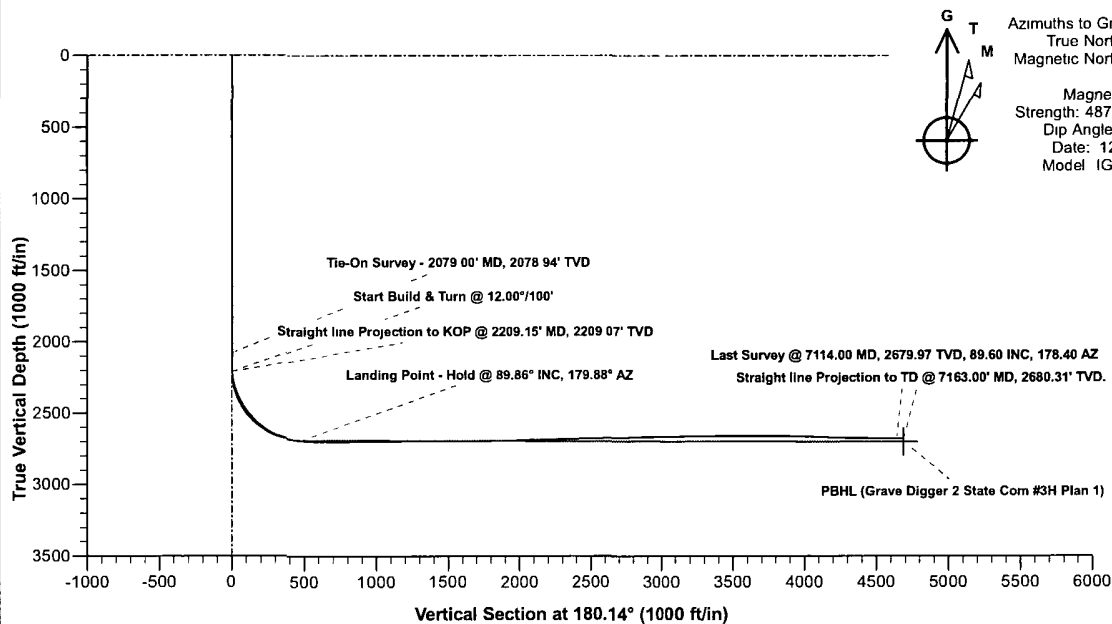


COG Operating LLC
Grave Digger 2 State Com #3H
Eddy County, NM
Plan #2



Surface Location		Ground Elev: 3453.00 WELL @ 3470.00ft (Silver Oak #8)			
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
0.00	0.00	585274.50	463340.80	32° 36' 32.27 N	104° 27' 8.59 W

TARGET DETAILS							
Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
PBHL (Grave Digger 2 State Com #3H Plan 1)	2700.00	-4688.80	-11.70	580585.70	463329.10	32° 35' 45.87 N	104° 27' 8.67 W



SECTION DETAILS											
Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Annotation	
1	2079.00	1.03	294.20	2078.94	-3.33	-11.33	0.00	0.00	3.35	Tie-On Survey - 2079.00' MD, 2078.94' TVD	
2	2209.15	1.03	294.20	2209.07	-2.37	-13.46	0.00	0.00	2.40	Start Build & Turn @ 12.00°/100°	
3	2961.56	89.86	179.88	2690.01	-478.70	-20.34	12.00	-114.32	478.75	Landing Point - Hold @ 89.86° INC, 179.88° AZ	
4	7171.68	89.86	179.88	2700.00	-4688.80	-11.70	0.00	0.00	4688.81	TD @ 7171.68' MD, 2700.00' TVD	

