



HOBBS OCD

JAN 27 2017

RECEIVED

COG Operating LLC

Lea County, NM (NAD-27 2015) Pan Head Fee #22H

API #: 30-025-42819

SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D

PP: 330' FNL, 985' FWL, Sec 11, T17S, R32E, Unit D

BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D

Design: BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D

Standard Survey Report

16 November, 2016



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4190.00usft (Silver Oak 3)
Site:	Pan Head Fee #22H	MD Reference:	KB @ 4190.00usft (Silver Oak 3)
Well:	SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Database:	EDM 5000.1 Single User Db

Project	Lea County, NM (NAD-27 2015)		
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	Pan Head Fee #22H		
Site Position:		Northing:	675,509.80 usft
From:	Map	Easting:	681,389.40 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13.20 in
		Latitude:	32° 51' 20.397 N
		Longitude:	103° 44' 33.538 W
		Grid Convergence:	0.32 °

Well	SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D		
Well Position	+N/-S	0.00 usft	Northing: 675,509.80 usft
	+E/-W	0.00 usft	Easting: 681,389.40 usft
Position Uncertainty	0.00 usft	Wellhead Elevation:	0.00 usft
		Ground Level:	4,172.00 usft

Wellbore	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D		
Magnetics	Model Name	Sample Date	Declination (°)
	IGRF2015	10/25/2016	7.15
			Dip Angle (°)
			60.62
			Field Strength (nT)
			48,356

Design	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)
	0.00	0.00	0.00
			Direction (°)
			177.89

Survey Program	Date 11/16/2016		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name
100.00	2,360.00	Scientific Gyro #1 (BHL: 968' FNL, 968' FW	Scientific Gyro
2,360.00	12,370.00	TDS MWD #2 (BHL: 968' FNL, 968' FWL,	MWD
			Description
			Scientific Drilling Intl
			MWD - Standard

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
100.00	0.17	10.60	100.00	0.15	0.03	-0.14	0.17	0.17	0.00	
125.00	0.16	16.29	125.00	0.22	0.04	-0.21	0.08	-0.04	22.76	
150.00	0.20	39.31	150.00	0.28	0.08	-0.28	0.33	0.16	92.08	
175.00	0.16	3.78	175.00	0.35	0.11	-0.35	0.47	-0.16	-142.12	
200.00	0.17	18.72	200.00	0.42	0.13	-0.42	0.18	0.04	59.76	
225.00	0.22	359.11	225.00	0.50	0.14	-0.50	0.33	0.20	-78.44	

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Site:	Pan Head Fee #22H	MD Reference:	KB @ 4190.00usft (Silver Oak 3)
Well:	SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Database:	EDM 5000.1 Single User Db

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
250.00	0.20	5.90	250.00	0.60	0.14	-0.59	0.13	-0.08	27.16
275.00	0.28	14.15	275.00	0.70	0.16	-0.69	0.35	0.32	33.00
300.00	0.15	358.30	300.00	0.79	0.17	-0.78	0.57	-0.52	-63.40
325.00	0.18	3.78	325.00	0.86	0.18	-0.86	0.14	0.12	21.92
350.00	0.23	9.38	350.00	0.95	0.19	-0.94	0.22	0.20	22.40
375.00	0.15	347.46	375.00	1.03	0.19	-1.03	0.43	-0.32	-87.68
400.00	0.18	359.76	400.00	1.10	0.18	-1.10	0.19	0.12	49.20
425.00	0.17	345.36	425.00	1.18	0.17	-1.17	0.18	-0.04	-57.60
450.00	0.17	19.11	450.00	1.25	0.17	-1.24	0.39	0.00	135.00
475.00	0.21	16.24	475.00	1.33	0.20	-1.32	0.16	0.16	-11.48
500.00	0.27	14.87	500.00	1.43	0.23	-1.42	0.24	0.24	-5.48
525.00	0.18	19.82	525.00	1.52	0.25	-1.51	0.37	-0.36	19.80
550.00	0.16	3.84	550.00	1.60	0.27	-1.58	0.20	-0.08	-63.92
575.00	0.20	331.11	575.00	1.67	0.25	-1.66	0.43	0.16	-130.92
600.00	0.31	303.65	600.00	1.74	0.17	-1.74	0.65	0.44	-109.84
625.00	0.35	309.39	625.00	1.83	0.06	-1.83	0.21	0.16	22.96
650.00	0.54	296.98	650.00	1.93	-0.11	-1.93	0.85	0.76	-49.64
675.00	0.49	294.24	674.99	2.03	-0.31	-2.04	0.22	-0.20	-10.96
700.00	0.50	291.33	699.99	2.11	-0.51	-2.13	0.11	0.04	-11.64
725.00	0.43	281.54	724.99	2.17	-0.70	-2.20	0.42	-0.28	-39.16
750.00	0.52	294.32	749.99	2.24	-0.90	-2.27	0.55	0.36	51.12
775.00	0.60	297.37	774.99	2.34	-1.12	-2.38	0.34	0.32	12.20
800.00	0.51	291.24	799.99	2.44	-1.34	-2.49	0.43	-0.36	-24.52
825.00	0.56	289.47	824.99	2.53	-1.55	-2.58	0.21	0.20	-7.08
850.00	0.58	291.02	849.99	2.61	-1.79	-2.68	0.10	0.08	6.20
875.00	0.57	289.20	874.99	2.70	-2.02	-2.77	0.08	-0.04	-7.28
900.00	0.57	286.01	899.98	2.77	-2.26	-2.85	0.13	0.00	-12.76
925.00	0.62	287.18	924.98	2.85	-2.51	-2.94	0.21	0.20	4.68
950.00	0.52	288.43	949.98	2.92	-2.75	-3.02	0.40	-0.40	5.00
975.00	0.49	289.73	974.98	3.00	-2.95	-3.10	0.13	-0.12	5.20
1,000.00	0.58	282.97	999.98	3.06	-3.18	-3.17	0.44	0.36	-27.04
1,025.00	0.64	283.46	1,024.98	3.12	-3.44	-3.24	0.24	0.24	1.96
1,050.00	0.64	292.51	1,049.98	3.21	-3.70	-3.34	0.40	0.00	36.20
1,075.00	0.60	291.28	1,074.98	3.31	-3.95	-3.45	0.17	-0.16	-4.92
1,100.00	0.59	283.58	1,099.97	3.39	-4.20	-3.54	0.32	-0.04	-30.80
1,125.00	0.59	295.70	1,124.97	3.47	-4.44	-3.63	0.50	0.00	48.48
1,150.00	0.62	285.88	1,149.97	3.56	-4.69	-3.73	0.43	0.12	-39.28
1,175.00	0.60	291.15	1,174.97	3.65	-4.94	-3.83	0.24	-0.08	21.08
1,200.00	0.59	291.70	1,199.97	3.74	-5.18	-3.93	0.05	-0.04	2.20
1,225.00	0.66	290.39	1,224.97	3.84	-5.44	-4.04	0.29	0.28	-5.24
1,250.00	0.54	296.91	1,249.97	3.94	-5.68	-4.15	0.55	-0.48	26.08



TDS
Survey Report



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Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
1,275.00	0.55	297.21	1,274.97	4.05	-5.89	-4.27	0.04	0.04	1.20
1,300.00	0.58	294.23	1,299.96	4.16	-6.11	-4.38	0.17	0.12	-11.92
1,325.00	0.66	291.95	1,324.96	4.26	-6.36	-4.50	0.33	0.32	-9.12
1,350.00	0.67	301.57	1,349.96	4.40	-6.62	-4.64	0.45	0.04	38.48
1,375.00	0.72	295.68	1,374.96	4.54	-6.88	-4.79	0.35	0.20	-23.56
1,400.00	0.75	296.69	1,399.96	4.68	-7.17	-4.94	0.13	0.12	4.04
1,425.00	0.62	302.99	1,424.96	4.83	-7.43	-5.10	0.60	-0.52	25.20
1,450.00	0.58	305.69	1,449.95	4.98	-7.65	-5.25	0.20	-0.16	10.80
1,475.00	0.56	303.33	1,474.95	5.12	-7.85	-5.40	0.12	-0.08	-9.44
1,500.00	0.57	304.82	1,499.95	5.26	-8.05	-5.55	0.07	0.04	5.96
1,525.00	0.60	311.99	1,524.95	5.41	-8.25	-5.71	0.32	0.12	28.68
1,550.00	0.51	309.41	1,549.95	5.57	-8.44	-5.88	0.37	-0.36	-10.32
1,575.00	0.55	322.87	1,574.95	5.74	-8.60	-6.05	0.52	0.16	53.84
1,600.00	0.54	320.32	1,599.95	5.92	-8.74	-6.24	0.10	-0.04	-10.20
1,625.00	0.55	336.69	1,624.95	6.13	-8.87	-6.45	0.62	0.04	65.48
1,650.00	0.53	336.14	1,649.94	6.34	-8.96	-6.67	0.08	-0.08	-2.20
1,675.00	0.40	344.86	1,674.94	6.53	-9.03	-6.86	0.59	-0.52	34.88
1,700.00	0.41	351.22	1,699.94	6.70	-9.07	-7.03	0.18	0.04	25.44
1,725.00	0.41	346.31	1,724.94	6.88	-9.10	-7.21	0.14	0.00	-19.64
1,750.00	0.39	350.08	1,749.94	7.05	-9.14	-7.38	0.13	-0.08	15.08
1,775.00	0.43	352.80	1,774.94	7.23	-9.16	-7.56	0.18	0.16	10.88
1,800.00	0.45	352.19	1,799.94	7.42	-9.19	-7.75	0.08	0.08	-2.44
1,825.00	0.41	354.84	1,824.94	7.60	-9.21	-7.94	0.18	-0.16	10.60
1,850.00	0.42	356.10	1,849.94	7.78	-9.22	-8.12	0.05	0.04	5.04
1,875.00	0.44	358.70	1,874.94	7.97	-9.23	-8.31	0.11	0.08	10.40
1,900.00	0.45	3.87	1,899.94	8.17	-9.23	-8.50	0.17	0.04	20.68
1,925.00	0.45	359.47	1,924.94	8.36	-9.22	-8.70	0.14	0.00	-17.60
1,950.00	0.40	7.38	1,949.94	8.55	-9.21	-8.88	0.31	-0.20	31.64
1,975.00	0.43	9.89	1,974.94	8.73	-9.18	-9.06	0.14	0.12	10.04
2,000.00	0.35	1.89	1,999.93	8.89	-9.17	-9.23	0.39	-0.32	-32.00
2,025.00	0.39	11.44	2,024.93	9.05	-9.15	-9.38	0.29	0.16	38.20
2,050.00	0.41	27.49	2,049.93	9.22	-9.09	-9.54	0.45	0.08	64.20
2,075.00	0.42	18.59	2,074.93	9.38	-9.02	-9.71	0.26	0.04	-35.60
2,100.00	0.35	20.19	2,099.93	9.54	-8.96	-9.86	0.28	-0.28	6.40
2,125.00	0.44	29.10	2,124.93	9.70	-8.89	-10.02	0.43	0.36	35.64
2,150.00	0.55	47.05	2,149.93	9.86	-8.76	-10.18	0.76	0.44	71.80
2,175.00	0.62	53.49	2,174.93	10.02	-8.56	-10.33	0.38	0.28	25.76
2,200.00	0.52	43.94	2,199.93	10.19	-8.37	-10.49	0.55	-0.40	-38.20
2,225.00	0.66	55.36	2,224.93	10.35	-8.17	-10.64	0.73	0.56	45.68
2,250.00	0.82	54.22	2,249.92	10.54	-7.91	-10.82	0.64	0.64	-4.56
2,275.00	0.75	70.34	2,274.92	10.70	-7.61	-10.97	0.92	-0.28	64.48

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2,300.00	0.69	62.09	2,299.92	10.82	-7.32	-11.08	0.48	-0.24	-33.00
2,325.00	0.69	63.01	2,324.92	10.96	-7.06	-11.21	0.04	0.00	3.68
2,350.00	0.70	67.16	2,349.92	11.09	-6.78	-11.33	0.21	0.04	16.60
2,360.00	0.80	68.25	2,359.92	11.14	-6.66	-11.38	1.01	1.00	10.90
Tie-In to Scientific Gyro									
2,473.00	0.70	56.80	2,472.91	11.81	-5.35	-12.00	0.16	-0.09	-10.13
First TDS MWD Survey									
2,536.00	1.80	39.80	2,535.89	12.78	-4.40	-12.93	1.82	1.75	-26.98
2,630.00	3.40	48.10	2,629.79	15.77	-1.38	-15.81	1.74	1.70	8.83
2,725.00	5.10	48.80	2,724.53	20.44	3.90	-20.28	1.79	1.79	0.74
2,819.00	5.10	49.50	2,818.15	25.90	10.22	-25.51	0.07	0.00	0.74
2,913.00	4.70	50.60	2,911.81	31.06	16.37	-30.44	0.44	-0.43	1.17
3,008.00	4.30	50.40	3,006.52	35.80	22.12	-34.96	0.42	-0.42	-0.21
3,102.00	5.20	45.90	3,100.19	41.01	27.90	-39.96	1.04	0.96	-4.79
3,196.00	4.80	45.30	3,193.84	46.74	33.75	-45.47	0.43	-0.43	-0.64
3,291.00	4.40	46.10	3,288.53	52.07	39.20	-50.59	0.43	-0.42	0.84
3,385.00	5.30	44.60	3,382.19	57.66	44.85	-55.97	0.97	0.96	-1.60
3,479.00	5.00	45.20	3,475.81	63.64	50.81	-61.72	0.32	-0.32	0.64
3,574.00	4.60	45.90	3,570.48	69.20	56.48	-67.08	0.43	-0.42	0.74
3,668.00	4.10	46.40	3,664.21	74.14	61.62	-71.82	0.53	-0.53	0.53
3,763.00	5.50	50.30	3,758.87	79.39	67.58	-76.85	1.51	1.47	4.11
3,857.00	5.70	51.40	3,852.42	85.18	74.70	-82.38	0.24	0.21	1.17
3,951.00	5.50	51.40	3,945.98	90.91	81.86	-87.83	0.21	-0.21	0.00
4,046.00	5.70	53.30	4,040.52	96.57	89.21	-93.22	0.29	0.21	2.00
4,140.00	5.80	53.00	4,134.05	102.21	96.74	-98.58	0.11	0.11	-0.32
4,235.00	6.10	53.90	4,228.54	108.08	104.65	-104.15	0.33	0.32	0.95
4,329.00	5.20	44.40	4,322.08	114.06	111.67	-109.88	1.38	-0.96	-10.11
4,424.00	5.20	42.70	4,416.69	120.30	117.60	-115.89	0.16	0.00	-1.79
4,518.00	5.30	42.20	4,510.30	126.65	123.41	-122.02	0.12	0.11	-0.53
4,612.00	5.50	44.50	4,603.88	133.08	129.48	-128.22	0.31	0.21	2.45
4,707.00	5.60	44.00	4,698.43	139.66	135.89	-134.56	0.12	0.11	-0.53
4,801.00	4.30	52.10	4,792.08	145.13	141.86	-139.80	1.57	-1.38	8.62
4,895.00	4.30	53.90	4,885.82	149.37	147.49	-143.83	0.14	0.00	1.91
4,989.00	4.20	54.70	4,979.56	153.43	153.14	-147.69	0.12	-0.11	0.85
5,083.00	4.30	55.30	5,073.30	157.43	158.85	-151.47	0.12	0.11	0.64
5,178.00	4.30	53.80	5,168.03	161.56	164.65	-155.39	0.12	0.00	-1.58
5,272.00	4.40	54.60	5,261.76	165.73	170.43	-159.34	0.12	0.11	0.85
5,366.00	4.40	53.10	5,355.49	169.98	176.26	-163.38	0.12	0.00	-1.60
5,461.00	4.40	56.20	5,450.21	174.20	182.20	-167.37	0.25	0.00	3.26
5,555.00	2.00	81.90	5,544.06	176.43	186.82	-169.44	2.91	-2.55	27.34
5,650.00	0.50	8.70	5,639.04	177.08	188.52	-170.02	2.02	-1.58	-77.05

Company:	COG Operating LLC	Local Co-ordinate Reference:	Well SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4190.00usft (Silver Oak 3)
Site:	Pan Head Fee #22H	MD Reference:	KB @ 4190.00usft (Silver Oak 3)
Well:	SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Database:	EDM 5000.1 Single User Db

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
5,744.00	0.50	340.60	5,733.03	177.87	188.45	-170.81	0.26	0.00	-29.89
5,776.00	0.60	339.80	5,765.03	178.16	188.35	-171.10	0.31	0.31	-2.50
5,807.00	0.60	144.10	5,796.03	178.18	188.38	-171.12	3.83	0.00	530.00
5,838.00	2.70	149.40	5,827.02	177.42	188.85	-170.35	6.78	6.77	17.10
5,870.00	5.70	150.70	5,858.93	175.38	190.01	-168.27	9.38	9.38	4.06
5,901.00	8.70	153.50	5,889.68	171.94	191.81	-164.76	9.74	9.68	9.03
5,933.00	11.90	154.50	5,921.16	166.80	194.31	-159.53	10.02	10.00	3.13
5,964.00	15.30	155.10	5,951.28	160.20	197.41	-152.82	10.98	10.97	1.94
5,995.00	18.80	155.20	5,980.92	151.95	201.23	-144.44	11.29	11.29	0.32
6,027.00	22.20	155.80	6,010.89	141.76	205.87	-134.08	10.65	10.63	1.88
6,058.00	25.90	158.90	6,039.19	130.09	210.71	-122.25	12.61	11.94	10.00
6,090.00	29.20	165.40	6,067.57	116.01	215.20	-108.01	13.94	10.31	20.31
6,121.00	32.60	171.60	6,094.17	100.43	218.33	-92.32	15.01	10.97	20.00
6,153.00	36.00	177.10	6,120.61	82.50	220.06	-74.34	14.37	10.63	17.19
6,184.00	40.00	181.30	6,145.03	63.42	220.30	-55.27	15.36	12.90	13.55
6,216.00	44.60	184.40	6,168.70	41.93	219.20	-33.83	15.78	14.38	9.69
6,247.00	48.60	184.60	6,189.99	19.48	217.43	-11.46	12.91	12.90	0.65
6,279.00	49.80	184.40	6,210.90	-4.67	215.53	12.60	3.78	3.75	-0.63
6,310.00	50.10	184.40	6,230.85	-28.33	213.71	36.18	0.97	0.97	0.00
6,341.00	49.90	184.40	6,250.78	-52.01	211.89	59.77	0.65	-0.65	0.00
6,373.00	50.00	184.50	6,271.37	-76.43	209.99	84.11	0.39	0.31	0.31
6,404.00	49.90	184.60	6,291.31	-100.09	208.11	107.68	0.41	-0.32	0.32
6,436.00	50.00	184.90	6,311.90	-124.50	206.08	132.00	0.78	0.31	0.94
6,438.82	50.15	184.83	6,313.71	-126.65	205.90	134.15	5.66	5.30	-2.56
As-Drilled PP									
6,468.00	51.70	184.10	6,332.11	-149.23	204.14	156.65	5.66	5.31	-2.49
6,499.00	54.70	182.00	6,350.68	-174.02	202.82	181.37	11.09	9.68	-6.77
6,531.00	57.70	180.30	6,368.48	-200.60	202.30	207.91	10.36	9.38	-5.31
6,562.00	61.30	180.20	6,384.21	-227.31	202.18	234.59	11.62	11.61	-0.32
6,594.00	66.00	180.30	6,398.41	-255.97	202.06	263.24	14.69	14.69	0.31
6,626.00	69.20	180.90	6,410.60	-285.55	201.74	292.79	10.15	10.00	1.88
6,657.00	71.50	182.60	6,421.02	-314.73	200.85	321.91	9.04	7.42	5.48
6,689.00	74.90	183.90	6,430.27	-345.31	199.11	352.41	11.31	10.63	4.06
6,720.00	78.20	184.80	6,437.48	-375.37	196.82	382.36	11.01	10.65	2.90
6,752.00	81.50	185.10	6,443.12	-406.74	194.10	413.62	10.35	10.31	0.94
6,783.00	84.80	184.60	6,446.82	-437.41	191.50	444.16	10.76	10.65	-1.61
6,819.00	88.00	181.70	6,449.08	-473.28	189.53	479.93	11.98	8.89	-8.06
6,850.00	88.50	180.20	6,450.02	-504.26	189.02	510.87	5.10	1.61	-4.84
6,945.00	88.80	180.70	6,452.26	-599.23	188.27	605.75	0.61	0.32	0.53
7,039.00	88.60	178.90	6,454.40	-693.20	188.60	699.67	1.93	-0.21	-1.91
7,134.00	88.70	179.10	6,456.63	-788.16	190.26	794.63	0.24	0.11	0.21

Company:	COG Operating LLC	Local Co-ordinate Reference:	Well SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4190.00usft (Silver Oak 3)
Site:	Pan Head Fee #22H	MD Reference:	KB @ 4190.00usft (Silver Oak 3)
Well:	SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Database:	EDM 5000.1 Single User Db

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
7,228.00	89.90	179.00	6,457.78	-882.13	191.81	888.60	1.28	1.28	-0.11
7,322.00	89.70	179.30	6,458.11	-976.12	193.21	982.58	0.38	-0.21	0.32
7,417.00	90.80	179.20	6,457.70	-1,071.11	194.45	1,077.55	1.16	1.16	-0.11
7,511.00	90.80	179.70	6,456.38	-1,165.10	195.35	1,171.50	0.53	0.00	0.53
7,606.00	90.40	179.70	6,455.39	-1,260.09	195.85	1,266.45	0.42	-0.42	0.00
7,700.00	90.40	180.10	6,454.73	-1,354.09	196.02	1,360.39	0.43	0.00	0.43
7,795.00	90.20	180.60	6,454.23	-1,449.09	195.44	1,455.30	0.57	-0.21	0.53
7,889.00	91.40	179.70	6,452.92	-1,543.07	195.19	1,549.21	1.60	1.28	-0.96
7,984.00	91.30	180.10	6,450.68	-1,638.05	195.36	1,644.13	0.43	-0.11	0.42
8,078.00	91.00	180.50	6,448.80	-1,732.03	194.86	1,738.03	0.53	-0.32	0.43
8,172.00	91.00	180.80	6,447.16	-1,826.01	193.80	1,831.90	0.32	0.00	0.32
8,267.00	90.50	178.90	6,445.91	-1,920.99	194.05	1,926.84	2.07	-0.53	-2.00
8,361.00	90.50	179.40	6,445.09	-2,014.98	195.44	2,020.81	0.53	0.00	0.53
8,455.00	90.40	179.40	6,444.36	-2,108.97	196.42	2,114.77	0.11	-0.11	0.00
8,550.00	90.50	179.90	6,443.61	-2,203.97	197.00	2,209.73	0.54	0.11	0.53
8,644.00	89.60	178.60	6,443.53	-2,297.95	198.24	2,303.70	1.68	-0.96	-1.38
8,739.00	89.70	178.70	6,444.11	-2,392.93	200.47	2,398.69	0.15	0.11	0.11
8,833.00	89.80	178.90	6,444.52	-2,486.91	202.44	2,492.67	0.24	0.11	0.21
8,927.00	90.00	179.30	6,444.68	-2,580.89	203.92	2,586.65	0.48	0.21	0.43
9,022.00	90.40	179.70	6,444.35	-2,675.89	204.75	2,681.61	0.60	0.42	0.42
9,116.00	90.90	180.20	6,443.28	-2,769.88	204.83	2,775.55	0.75	0.53	0.53
9,211.00	90.50	179.50	6,442.12	-2,864.87	205.08	2,870.48	0.85	-0.42	-0.74
9,305.00	90.20	179.10	6,441.55	-2,958.86	206.23	2,964.45	0.53	-0.32	-0.43
9,400.00	89.40	178.70	6,441.88	-3,053.85	208.05	3,059.44	0.94	-0.84	-0.42
9,495.00	89.50	179.00	6,442.79	-3,148.82	209.96	3,154.42	0.33	0.11	0.32
9,589.00	89.70	179.50	6,443.45	-3,242.81	211.19	3,248.39	0.57	0.21	0.53
9,683.00	89.60	179.80	6,444.02	-3,336.81	211.76	3,342.34	0.34	-0.11	0.32
9,778.00	89.90	180.30	6,444.44	-3,431.81	211.68	3,437.27	0.61	0.32	0.53
9,872.00	90.10	180.80	6,444.44	-3,525.80	210.78	3,531.17	0.57	0.21	0.53
9,967.00	90.40	180.20	6,444.02	-3,620.80	209.95	3,626.07	0.71	0.32	-0.63
10,061.00	90.60	180.40	6,443.20	-3,714.79	209.45	3,719.98	0.30	0.21	0.21
10,156.00	89.00	179.90	6,443.53	-3,809.79	209.21	3,814.91	1.76	-1.68	-0.53
10,251.00	89.30	180.40	6,444.94	-3,904.78	208.96	3,909.82	0.61	0.32	0.53
10,345.00	89.80	180.80	6,445.68	-3,998.77	207.97	4,003.71	0.68	0.53	0.43
10,439.00	88.70	179.80	6,446.91	-4,092.76	207.48	4,097.62	1.58	-1.17	-1.06
10,534.00	89.10	180.00	6,448.74	-4,187.74	207.65	4,192.54	0.47	0.42	0.21
10,628.00	88.40	178.00	6,450.79	-4,281.70	209.29	4,286.50	2.25	-0.74	-2.13
10,723.00	88.40	178.20	6,453.44	-4,376.61	212.43	4,381.46	0.21	0.00	0.21
10,817.00	88.70	178.40	6,455.82	-4,470.53	215.22	4,475.43	0.38	0.32	0.21
10,912.00	89.80	178.90	6,457.06	-4,565.50	217.46	4,570.41	1.27	1.16	0.53
11,006.00	90.40	179.40	6,456.90	-4,659.49	218.86	4,664.39	0.83	0.64	0.53



TDS
Survey Report

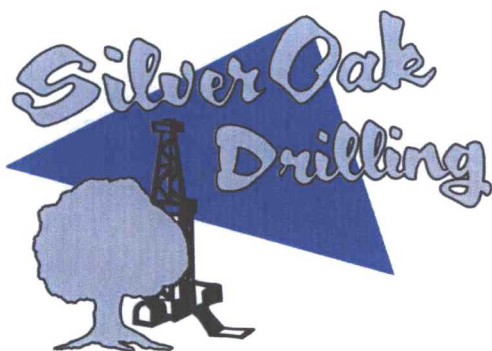


Company:	COG Operating LLC	Local Co-ordinate Reference:	Well SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4190.00usft (Silver Oak 3)
Site:	Pan Head Fee #22H	MD Reference:	KB @ 4190.00usft (Silver Oak 3)
Well:	SHL: 200' FNL, 780' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 968' FNL, 968' FWL, Sec 14, T17S, R32E, Unit D	Database:	EDM 5000.1 Single User Db

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
11,100.00	90.90	179.80	6,455.83	-4,753.48	219.51	4,758.34	0.68	0.53	0.43	
11,195.00	91.30	180.10	6,454.01	-4,848.46	219.59	4,853.26	0.53	0.42	0.32	
11,289.00	90.00	179.30	6,452.94	-4,942.45	220.09	4,947.20	1.62	-1.38	-0.85	
11,384.00	90.40	179.70	6,452.61	-5,037.45	220.92	5,042.16	0.60	0.42	0.42	
11,478.00	90.80	180.60	6,451.62	-5,131.44	220.67	5,136.08	1.05	0.43	0.96	
11,572.00	91.00	180.70	6,450.15	-5,225.42	219.60	5,229.96	0.24	0.21	0.11	
11,667.00	89.70	178.50	6,449.57	-5,320.41	220.27	5,324.91	2.69	-1.37	-2.32	
11,761.00	90.30	178.80	6,449.57	-5,414.38	222.48	5,418.90	0.71	0.64	0.32	
11,855.00	91.10	179.50	6,448.42	-5,508.36	223.88	5,512.87	1.13	0.85	0.74	
11,950.00	89.50	179.60	6,447.92	-5,603.36	224.62	5,607.83	1.69	-1.68	0.11	
12,044.00	90.20	180.40	6,448.17	-5,697.36	224.62	5,701.76	1.13	0.74	0.85	
12,139.00	90.30	180.50	6,447.75	-5,792.35	223.88	5,796.67	0.15	0.11	0.11	
12,233.00	90.50	180.70	6,447.10	-5,886.34	222.89	5,890.56	0.30	0.21	0.21	
12,296.00	91.00	181.20	6,446.27	-5,949.33	221.85	5,953.46	1.12	0.79	0.79	
Last TDS MWD Survey										
12,370.00	91.00	181.20	6,444.98	-6,023.30	220.30	6,027.33	0.00	0.00	0.00	
Projection to Bit/TD										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
2,360.00	2,359.92	11.14	-6.66	Tie-In to Scientific Gyro	
2,473.00	2,472.91	11.81	-5.35	First TDS MWD Survey	
6,438.82	6,313.71	-126.65	205.90	As-Drilled PP	
12,296.00	6,446.27	-5,949.33	221.85	Last TDS MWD Survey	
12,370.00	6,444.98	-6,023.30	220.30	Projection to Bit/TD	

Checked By: _____ Approved By: _____ Date: _____



PO Box 1370
Artesia, NM 88211-1370
(575) 748-1288

November 21, 2016

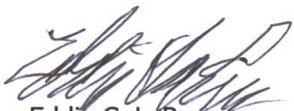
COG, LLC
One Concho Center
600 W. Illinois Ave.
Midland, TX 79701

RE: Pan Head Fee 22H
200' FNL & 780' FWL
Sec. 11, T17S, R32E
Lea County, New Mexico

Dear Sir,

The attached is the Deviation Survey for the above captioned well.

Very truly yours,


Eddie C. LaRue
Operations Manager

State of New Mexico }
County of Eddy }

The foregoing was acknowledged before me this 21st day of November, 2016.


Regina L. Garner
Notary Public



Pan Head Fee 22H

Date	Depth	Deviation	Direction
11/1/2016	269	0.04	
11/1/2016	535	0.70	
11/1/2016	801	0.40	
11/1/2016	1086	0.50	
11/3/2016	1347	0.70	
11/3/2016	1599	0.40	
11/3/2016	1624	0.40	
11/3/2016	2096	0.60	
11/4/2016	2473	0.70	56.80
11/4/2016	2536	1.80	39.80
11/4/2016	2630	3.40	48.10
11/5/2016	2725	5.10	48.80
11/5/2016	2725	5.10	48.80
11/5/2016	2819	5.10	49.50
11/5/2016	2913	4.70	50.60
11/5/2016	3008	4.30	50.40
11/5/2016	3102	5.20	45.90
11/5/2016	3196	4.80	45.30
11/5/2016	3291	4.40	46.10
11/5/2016	3385	5.30	44.60
11/5/2016	3479	5.00	45.20
11/5/2016	3574	4.60	45.90
11/5/2016	3668	4.10	46.40
11/5/2016	3763	5.50	50.30
11/5/2016	3857	5.70	51.40
11/5/2016	3951	5.50	51.40
11/6/2016	4046	5.70	53.30
11/6/2016	4140	5.80	53.00
11/6/2016	4235	6.10	53.90
11/6/2016	4329	5.20	44.40
11/6/2016	4424	5.20	42.70
11/6/2016	4518	5.30	42.20
11/6/2016	4612	5.50	44.50
11/6/2016	4707	5.60	44.00
11/6/2016	4801	4.30	52.10
11/6/2016	4895	4.30	53.90
11/6/2016	4989	4.20	54.70
11/6/2016	5083	4.30	55.30
11/6/2016	5178	4.30	53.80
11/6/2016	5272	4.40	54.60
11/6/2016	5366	4.40	53.10
11/7/2016	5461	4.40	56.20

Date	Depth	Deviation	Direction
11/7/2016	5555	2.00	81.90
11/7/2016	5658	0.50	8.70
11/7/2016	5744	0.50	340.60
11/7/2016	5776	0.60	339.80
11/7/2016	5808	0.60	144.10
11/7/2016	5838	2.70	149.40
11/7/2016	5870	5.70	150.70
11/7/2016	5901	8.70	153.50
11/7/2016	5933	11.90	154.50
11/7/2016	5964	15.30	155.10
11/7/2016	5995	18.80	155.20
11/8/2016	6027	22.20	155.80
11/8/2016	6090	29.20	165.40
11/8/2016	6121	32.60	171.60
11/8/2016	6216	44.60	184.40
11/8/2016	6279	49.80	184.40
11/8/2016	6341	49.90	184.40
11/8/2016	6436	50.00	184.90
11/8/2016	6499	54.70	182.00
11/8/2016	6531	57.70	180.30
11/8/2016	6594	66.00	180.30
11/8/2016	6626	69.20	180.90
11/8/2016	6689	74.90	183.90
11/8/2016	6769	78.20	184.80
11/9/2016	6819	88.00	181.70
11/9/2016	6945	88.80	180.70
11/9/2016	7079	88.60	178.90
11/9/2016	7228	89.90	179.00
11/9/2016	7322	89.70	179.30
11/9/2016	7417	90.80	179.20
11/9/2016	7511	90.80	179.70
11/9/2016	7606	90.40	179.70
11/9/2016	7700	90.40	180.10
11/10/2016	7795	90.20	180.60
11/10/2016	7889	91.40	179.70
11/10/2016	7984	91.30	180.10
11/10/2016	8078	91.00	180.50
11/10/2016	8172	91.00	180.80
11/10/2016	8267	90.50	178.90
11/10/2016	8361	90.50	179.40
11/10/2016	8455	90.40	179.40
11/10/2016	8550	90.80	179.90
11/10/2016	8644	89.60	178.60
11/10/2016	8739	89.70	178.70
11/10/2016	8833	89.80	178.90

Date	Depth	Deviation	Direction
11/11/2016	8927	90.00	179.30
11/11/2016	9022	90.40	179.70
11/11/2016	9116	90.90	180.20
11/11/2016	9211	90.50	179.50
11/11/2016	9305	90.20	179.10
11/11/2016	9400	89.40	178.70
11/11/2016	9495	89.50	179.00
11/12/2016	9589	89.70	179.50
11/12/2016	9683	89.60	179.80
11/12/2016	9778	89.90	180.30
11/12/2016	9872	90.10	180.80
11/12/2016	9967	90.40	180.20
11/12/2016	10061	90.60	180.40
11/12/2016	10156	89.00	179.90
11/12/2016	10251	89.30	180.40
11/12/2016	10345	89.80	180.80
11/12/2016	10439	88.70	179.80
11/12/2016	10534	89.10	180.00
11/12/2016	10628	88.40	178.00
11/13/2016	10723	88.40	178.20
11/13/2016	10817	88.70	178.40
11/13/2016	10912	89.80	178.90
11/13/2016	11006	90.90	179.40
11/13/2016	11100	90.90	179.80
11/13/2016	11195	91.30	182.10
11/13/2016	11289	90.00	179.30
11/13/2016	11384	90.40	179.70
11/13/2016	11478	90.80	180.60
11/13/2016	11572	91.00	180.70
11/13/2016	11667	89.70	178.50
11/13/2016	11761	90.30	178.80
11/13/2016	11855	91.10	179.50
11/14/2016	11950	89.50	179.60
11/14/2016	12044	90.20	180.40
11/14/2016	12139	90.30	180.50
11/14/2016	12233	90.50	180.70
11/14/2016	12296	91.00	181.20