

HOBBS OCD

DEC 30 2015

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I Jason Wilson certify that I am employed by Vaughn Energy Services. That I did on the day(s) of 09/27/15 through 09/27/15 conduct or supervise the taking of a Rate Gyro survey from a depth of 0 feet to a depth of 2270 feet; that the data is true, correct, complete and within the limitations of the tool as set forth by Vaughn Energy Services, that I am authorized and qualified to make this report; that this survey was conducted at the request of Concho for the Pan Head Fee ND Well # 021H API # 30-025-40886 in Lea County / Parish New Mexico; and that I have reviewed this report and find that it conforms to the principles and procedures as set forth by Vaughn Energy Services



Jason Wilson
Service Technician
Vaughn Energy Services

JAN 22 2016

~~JAN 20 2016~~

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HOBBS OCD

DEC 30 2015

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October 1, 2015

Concho Resources, Inc.
One Concho Center
600 W. Illinois Avenue
Midland, Texas 79701

Attn: Kanicia Castillo

RE: **Pan Head Fee No 021H**

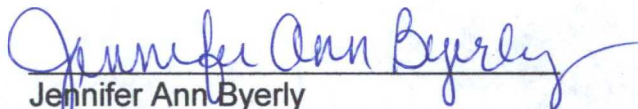
Please find enclosed a copy of the survey from 0' to 2270' ran on the above referenced well.

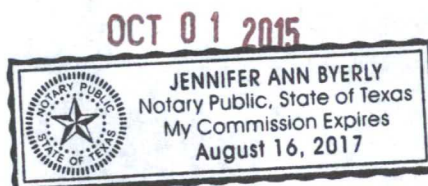
Sincerely,


Keith Havelka
Operations

STATE OF TEXAS §
 §
COUNTY OF NUECES §

This instrument was acknowledged before me on the 1 day of October, A.D., 2015, by Keith Havelka.


Jennifer Ann Byerly
Notary Public, State of Texas





Company: Concho
Lease/Well: Pan Head Fee No/021H
Location: D-11-17S-32-E330-N-330-W-LEA
Rig Name: Silver Oak 3
State/County: New Mexico/Lea
VS-Azi: 0.00 Degrees
Latitude: 32.85543, Longitude: -103.74462
Grid North = True North -0.32 degs

RKB : 18 Feet

DRILLOG HA GYRO SURVEY CALCULATIONS

Filename: gyro survey.ut
Minimum Curvature Method
Report Date/Time: 10/1/2015 / 12:46

VES Survey International
Fort Worth Tx

Surveyor: Jason Wilson
(817) 718-1320

Pan Head Fee No 021H / API 30-025-40886

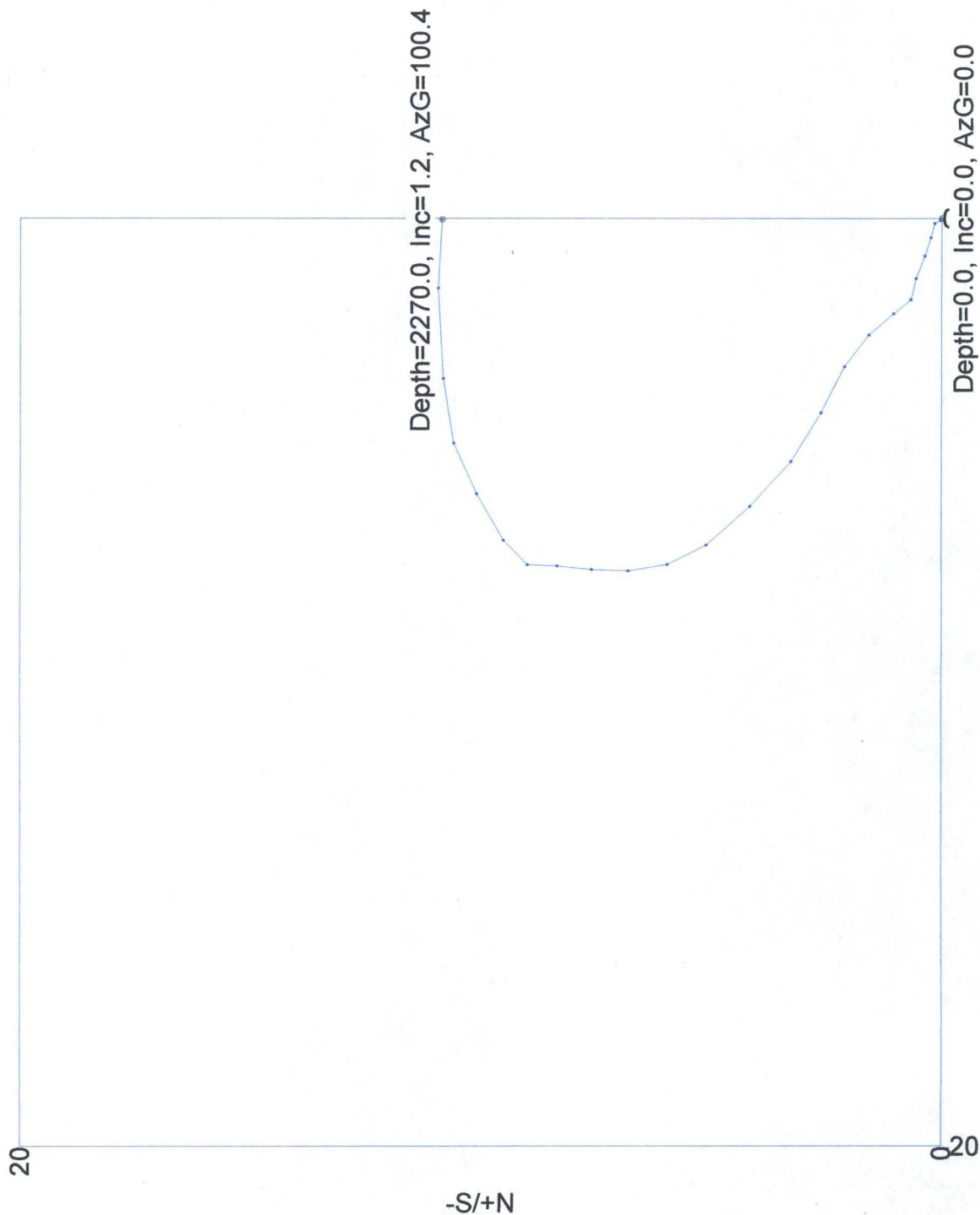
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Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
50.00	0.13	306.60	50.00	0.04	-0.05	0.04	0.06	306.60	0.27
100.00	0.19	349.63	100.00	0.15	-0.11	0.15	0.19	324.11	0.26
200.00	0.32	253.82	200.00	0.23	-0.41	0.23	0.47	299.67	0.39
300.00	0.28	328.93	300.00	0.36	-0.81	0.36	0.88	294.11	0.37
400.00	0.41	267.92	400.00	0.55	-1.29	0.55	1.41	293.21	0.37
500.00	0.18	322.78	500.00	0.66	-1.75	0.66	1.87	290.79	0.34
600.00	0.37	319.56	599.99	1.03	-2.05	1.03	2.29	296.74	0.20
700.00	0.44	320.43	699.99	1.58	-2.50	1.58	2.96	302.17	0.07
800.00	0.57	298.36	799.99	2.11	-3.18	2.11	3.82	303.48	0.23
900.00	0.71	296.29	899.98	2.62	-4.18	2.62	4.93	302.06	0.14
1000.00	0.71	307.90	999.97	3.27	-5.22	3.27	6.16	302.07	0.14
1100.00	0.80	317.27	1099.97	4.17	-6.19	4.17	7.46	303.97	0.15
1200.00	0.64	321.54	1199.96	5.12	-7.01	5.12	8.68	306.15	0.17
1300.00	0.48	350.44	1299.95	5.97	-7.43	5.97	9.53	308.80	0.32
1400.00	0.50	351.01	1399.95	6.81	-7.57	6.81	10.18	312.01	0.02
1500.00	0.44	14.77	1499.95	7.61	-7.54	7.61	10.71	315.29	0.20
1600.00	0.44	356.60	1599.94	8.36	-7.46	8.36	11.21	318.26	0.14
1700.00	0.31	11.52	1699.94	9.00	-7.43	9.00	11.67	320.47	0.16

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
1800.00	0.61	61.38	1799.94	9.52	-6.91	9.52	11.76	324.05	0.48
1900.00	0.70	58.31	1899.93	10.10	-5.92	10.10	11.71	329.65	0.09
2000.00	0.68	72.46	1999.92	10.60	-4.83	10.60	11.65	335.52	0.17
2100.00	0.94	86.97	2099.91	10.83	-3.44	10.83	11.36	342.36	0.33
2200.00	1.29	86.64	2199.89	10.93	-1.50	10.93	11.04	352.18	0.35
2270.00	1.16	100.41	2269.88	10.85	-0.02	10.85	10.85	359.89	0.46



VES Survey International
Fort Worth Tx
Surveyor: Jason Wilson
(817) 718-1320
Pan Head Fee No 021H / API 30-025-40886



-W/+E
VES Survey Date: 9/27/2015

DEC 30 2015



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

October 12, 2015

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

RE: Pan Head Fee 21H
330' FNL & 3e0' 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,

A handwritten signature in black ink, appearing to read "Eddie C. LaRue".

Eddie C. LaRue
Operations Manager

State of New Mexico }
County of Eddy }

The foregoing was acknowledged before me this 12th day of October, 2015.

A handwritten signature in black ink, appearing to read "Regina L. Garner".

Notary Public

Pan Head Fee #21H

Date	Depth	Deviation	Direction	TVD	Horiz Disp
9/24/2015	112	0.20	0.00	0.00	0.00
9/24/2015	358	0.20	0.00	0.00	0.00
9/24/2015	598	0.10	0.00	0.00	0.00
9/25/2015	752	0.60	0.00	0.00	0.00
9/25/2015	942	0.30	0.00	0.00	0.00
9/26/2015	1168	1.20	0.00	0.00	0.00
9/26/2015	1326	1.10	0.00	0.00	0.00
9/27/2015	1576	0.80	0.00	0.00	0.00
9/27/2015	1830	0.80	0.00	0.00	0.00
9/27/2015	2049	1.40	0.00	0.00	0.00
9/27/2015	2270	1.60	0.00	0.00	0.00
9/29/2015	2362	1.50	95.20	2362.00	0.00
9/29/2015	2455	2.90	30.20	2435.00	0.00
9/29/2015	2549	6.00	14.50	2549.00	0.00
9/29/2015	2642	6.40	12.00	2641.00	0.00
9/29/2015	2736	6.00	11.50	2734.00	0.00
9/29/2015	2830	5.40	9.30	0.00	0.00
9/29/2015	2925	5.10	4.00	0.00	0.00
9/29/2015	3109	4.40	358.40	0.00	0.00
9/29/2015	3115	6.00	3.60	0.00	0.00
9/29/2015	3207	5.80	1.50	0.00	0.00
9/29/2015	3396	5.10	353.10	3391.50	100.30
9/29/2015	3491	4.80	349.80	3486.10	108.40
9/29/2015	3586	4.40	345.00	3540.80	115.80
9/29/2015	3681	3.80	343.20	3675.60	122.40
9/29/2015	3775	4.80	356.10	3769.30	129.30
9/30/2015	3870	5.90	0.40	3863.00	0.00
9/30/2015	3965	5.60	359.00	3958.00	0.00
9/30/2015	4153	5.00	355.80	4145.00	0.00
9/30/2015	4248	4.80	354.20	4240.00	0.00
9/30/2015	4343	6.20	358.00	0.00	0.00
9/30/2015	4438	6.10	356.90	0.00	0.00
9/30/2015	4532	6.00	356.00	0.00	0.00
9/30/2015	4815	6.30	9.30	0.00	0.00
9/30/2015	4910	6.20	7.10	0.00	0.00
9/30/2015	5005	5.80	4.50	0.00	0.00
9/30/2015	5099	5.50	2.40	0.00	0.00
9/30/2015	5192	5.20	2.20	0.00	0.00
10/1/2015	5287	5.00	2.60	5273.00	0.00
10/1/2015	5382	4.70	359.90	5368.00	0.00
10/1/2015	5477	4.40	0.80	5463.00	0.00
10/1/2015	5572	3.20	8.60	5557.00	0.00
10/1/2015	5666	3.20	10.40	5651.00	0.00

Date	Depth	Deviation	Direction	TVD	Horiz Disp
10/1/2015	5761	1.40	35.50	0.00	0.00
10/2/2015	5823	1.40	41.10	0.00	0.00
10/2/2015	5855	1.20	110.20	0.00	0.00
10/2/2015	5886	3.40	1733.00	0.00	0.00
10/2/2015	5918	6.50	184.90	0.00	0.00
10/2/2015	5950	10.20	182.20	0.00	0.00
10/2/2015	5982	13.30	181.80	0.00	0.00
10/2/2015	6013	16.90	176.50	0.00	0.00
10/2/2015	6045	19.40	176.40	0.00	0.00
10/2/2015	6076	22.20	178.90	0.00	0.00
10/2/2015	6171	30.90	179.20	0.00	0.00
10/2/2015	6202	33.90	176.60	0.00	0.00
10/2/2015	6233	36.90	175.40	0.00	0.00
10/2/2015	6265	39.90	174.50	0.00	0.00
10/2/2015	6297	42.40	174.50	0.00	0.00
10/2/2015	6328	45.80	175.80	0.00	0.00
10/2/2015	6391	51.60	177.80	0.00	0.00
10/2/2015	6423	54.10	178.40	0.00	0.00
10/2/2015	6454	57.50	178.70	0.00	0.00
10/2/2015	6486	60.40	178.90	0.00	0.00
10/2/2015	6559	48.60	176.80	0.00	0.00
10/3/2015	6518	62.70	179.60	6373.00	0.00
10/3/2015	6549	65.00	180.10	6386.00	0.00
10/3/2015	6581	68.20	180.40	6399.00	0.00
10/3/2015	6612	71.40	179.90	6410.00	0.00
10/3/2015	6644	74.30	179.50	6419.00	0.00
10/3/2015	6675	77.30	179.90	6427.00	0.00
10/3/2015	6707	80.30	180.30	6433.00	0.00
10/3/2015	6739	83.20	181.10	6438.00	0.00
10/3/2015	6770	85.90	182.00	6440.00	0.00
10/3/2015	6896	90.20	181.00	0.00	0.00
10/3/2015	6990	92.60	181.20	0.00	0.00
10/3/2015	7084	91.70	180.40	0.00	0.00
10/3/2015	7179	89.70	179.80	0.00	0.00
10/3/2015	7273	89.40	179.60	0.00	0.00
10/3/2015	7368	86.90	179.20	0.00	0.00
10/3/2015	7462	87.70	179.30	0.00	0.00
10/4/2015	7556	89.10	179.00	6449.00	0.00
10/4/2015	7649	90.70	178.60	6450.00	0.00
10/4/2015	7744	90.70	180.70	6448.00	0.00
10/4/2015	7839	88.50	180.60	6449.00	0.00
10/4/2015	7932	89.50	180.50	6451.00	0.00
10/4/2015	8027	90.90	180.40	0.00	0.00
10/4/2015	8122	89.10	180.20	0.00	0.00
10/4/2015	8217	90.00	179.90	0.00	0.00

Date	Depth	Deviation	Direction	TVD	Horiz Disp
10/4/2015	8312	91.30	179.70	0.00	0.00
10/4/2015	8406	90.80	179.50	0.00	0.00
10/4/2015	8499	90.70	178.20	0.00	0.00
10/5/2015	8531	91.30	178.50	0.00	0.00
10/6/2015	8625	91.50	174.00	6444.00	0.00
10/6/2015	8720	90.90	178.70	6442.00	0.00
10/6/2015	8814	89.40	179.00	6442.00	0.00
10/6/2015	8908	89.50	179.20	6443.00	0.00
10/6/2015	9003	89.20	180.10	6444.00	0.00
10/6/2015	9096	90.40	180.00	0.00	0.00
10/6/2015	9191	90.80	180.10	0.00	0.00
10/6/2015	9285	90.20	180.20	0.00	0.00
10/6/2015	9379	89.90	179.40	0.00	0.00
10/6/2015	9474	89.40	179.00	0.00	0.00
10/6/2015	9568	88.60	179.10	0.00	0.00
10/7/2015	9662	89.80	179.30	0.00	0.00
10/7/2015	9757	89.00	178.70	0.00	0.00
10/7/2015	9851	89.40	178.70	0.00	0.00
10/7/2015	9946	89.50	179.10	0.00	0.00
10/7/2015	10040	89.10	179.70	0.00	0.00
10/7/2015	10135	90.40	179.70	0.00	0.00
10/7/2015	10230	89.80	179.60	0.00	0.00
10/7/2015	10325	89.50	179.00	0.00	0.00
10/7/2015	10420	91.00	179.00	0.00	0.00
10/7/2015	10515	90.50	178.50	0.00	0.00
10/7/2015	10610	89.70	178.90	0.00	0.00
10/7/2015	10799	88.70	180.40	0.00	0.00
10/7/2015	10891	90.00	180.50	0.00	0.00
10/8/2015	10986	91.50	180.90	0.00	0.00
10/8/2015	11081	90.80	180.70	0.00	0.00
10/8/2015	11175	90.40	180.80	11269.00	89.50
10/8/2015	11364	88.90	179.30	0.00	0.00
10/8/2015	11458	90.80	180.10	0.00	0.00
10/8/2015	11551	90.40	179.30	0.00	0.00
10/8/2015	11645	89.50	180.50	0.00	0.00
10/8/2015	11740	90.80	180.40	0.00	0.00
10/8/2015	11835	90.30	179.80	0.00	0.00
10/8/2015	11930	90.00	179.70	0.00	0.00
10/8/2015	12023	89.20	179.40	0.00	0.00
10/9/2015	12118	88.30	179.00	0.00	0.00
10/9/2015	12213	89.20	179.00	0.00	0.00
10/9/2015	12306	89.80	178.60	0.00	0.00

DEC 30 2015

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COG Operating LLC

Lea County, NM (NAD-27 2015)

Pan Head Fee #21H

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

PP: 330' FNL, 350' FWL, Sec 11, T17S, R32E, Unit D

30-025-40886

BHL: 988' FNL, 330' FWL, Sec 14, T17S, R32E, Unit D

Design: BHL: 988' FNL, 330' FWL, Sec 14, T17S, R32E, Unit D

Standard Survey Report

12 October, 2015



Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Pan Head Fee #21H
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4200.00usft (Silver Oak 3)
Site:	Pan Head Fee #21H	MD Reference:	KB @ 4200.00usft (Silver Oak 3)
Well:	SHL: 330' FNL, 330' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 988' FNL, 330' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 988' FNL, 330' 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 #21H			
Site Position:		Northing:	675,378.00 usft	Latitude:	32° 51' 19.118 N
From:	Map	Easting:	680,940.30 usft	Longitude:	103° 44' 38.811 W
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.32 °

Well	SHL: 330' FNL, 330' FWL, Sec 11, T17S, R32E, Unit D					
Well Position	+N/-S	0.00 usft	Northing:	675,378.00 usft	Latitude:	32° 51' 19.118 N
	+E/-W	0.00 usft	Easting:	680,940.30 usft	Longitude:	103° 44' 38.811 W
Position Uncertainty		0.00 usft	Wellhead Elevation:	0.00 usft	Ground Level:	4,182.00 usft

Wellbore	BHL: 988' FNL, 330' FWL, Sec 14, T17S, R32E, Unit D				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	9/8/2015	7.27	60.64	48,473

Design	BHL: 988' FNL, 330' 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)	Direction (°)	
	0.00	0.00	0.00	179.47	

Survey Program	Date 10/12/2015			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
50.00	2,270.00	VES Gyro #1 (BHL: 988' FNL, 330' FWL, S	VES-ISCWSA-GYRO-3	Biaxial Semi-Cont. Gyro
2,362.00	12,382.00	TDS MWD #2 (BHL: 988' FNL, 330' FWL,	MWD	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	
50.00	0.13	306.60	50.00	0.03	-0.05	-0.03	0.26	0.26	0.00	
100.00	0.19	349.63	100.00	0.15	-0.11	-0.15	0.26	0.12	86.06	
200.00	0.32	253.82	200.00	0.23	-0.40	-0.24	0.39	0.13	-95.81	
300.00	0.28	328.93	300.00	0.37	-0.80	-0.37	0.37	-0.04	75.11	
400.00	0.41	267.92	400.00	0.56	-1.28	-0.57	0.37	0.13	-61.01	
500.00	0.18	322.78	500.00	0.67	-1.73	-0.69	0.34	-0.23	54.86	

Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Pan Head Fee #21H
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4200.00usft (Silver Oak 3)
Site:	Pan Head Fee #21H	MD Reference:	KB @ 4200.00usft (Silver Oak 3)
Well:	SHL: 330' FNL, 330' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 988' FNL, 330' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 988' FNL, 330' 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)
600.00	0.37	319.56	599.99	1.05	-2.04	-1.06	0.19	0.19	-3.22
700.00	0.44	320.43	699.99	1.59	-2.49	-1.61	0.07	0.07	0.87
800.00	0.57	298.36	799.99	2.12	-3.18	-2.15	0.23	0.13	-22.07
900.00	0.71	296.29	899.98	2.63	-4.17	-2.67	0.14	0.14	-2.07
1,000.00	0.71	307.90	999.97	3.28	-5.21	-3.33	0.14	0.00	11.61
1,100.00	0.80	317.27	1,099.97	4.18	-6.18	-4.24	0.15	0.09	9.37
1,200.00	0.64	321.54	1,199.96	5.13	-7.00	-5.19	0.17	-0.16	4.27
1,300.00	0.48	350.44	1,299.95	5.98	-7.41	-6.05	0.32	-0.16	28.90
1,400.00	0.50	351.01	1,399.95	6.82	-7.55	-6.89	0.02	0.02	0.57
1,500.00	0.44	14.77	1,499.95	7.63	-7.52	-7.69	0.20	-0.06	23.76
1,600.00	0.44	356.60	1,599.94	8.38	-7.45	-8.45	0.14	0.00	-18.17
1,700.00	0.31	11.52	1,699.94	9.03	-7.42	-9.10	0.16	-0.13	14.92
1,800.00	0.61	61.38	1,799.94	9.55	-6.89	-9.61	0.47	0.30	49.86
1,900.00	0.70	58.31	1,899.93	10.12	-5.91	-10.18	0.10	0.09	-3.07
2,000.00	0.68	72.46	1,999.92	10.62	-4.82	-10.67	0.17	-0.02	14.15
2,100.00	0.94	86.97	2,099.91	10.85	-3.44	-10.88	0.33	0.26	14.51
2,200.00	1.29	86.64	2,199.90	10.96	-1.49	-10.97	0.35	0.35	-0.33
2,270.00	1.16	100.41	2,269.88	10.87	-0.01	-10.87	0.46	-0.19	19.67
TIE-IN to VES Gyro									
2,362.00	1.50	95.20	2,361.85	10.60	2.11	-10.58	0.39	0.37	-5.66
2,455.00	2.90	30.20	2,454.80	12.52	4.50	-12.48	2.84	1.51	-69.89
2,549.00	6.00	14.50	2,548.50	19.33	6.93	-19.27	3.51	3.30	-16.70
2,642.00	6.40	12.00	2,640.96	29.11	9.22	-29.02	0.52	0.43	-2.69
2,736.00	6.00	11.50	2,734.41	39.05	11.29	-38.94	0.43	-0.43	-0.53
2,830.00	5.40	9.30	2,827.94	48.23	12.99	-48.10	0.68	-0.64	-2.34
2,925.00	5.10	4.60	2,922.55	56.85	14.05	-56.71	0.55	-0.32	-4.95
3,019.00	4.40	358.40	3,016.22	64.62	14.28	-64.48	0.92	-0.74	-6.60
3,113.00	6.00	3.60	3,109.83	73.12	14.49	-72.99	1.77	1.70	5.53
3,207.00	5.80	1.50	3,203.34	82.78	14.92	-82.63	0.31	-0.21	-2.23
3,303.00	5.30	356.70	3,298.89	92.05	14.79	-91.91	0.71	-0.52	-5.00
3,396.00	5.10	353.10	3,391.50	100.44	14.05	-100.31	0.41	-0.22	-3.87
3,491.00	4.80	349.80	3,486.15	108.55	12.84	-108.42	0.44	-0.32	-3.47
3,586.00	4.40	345.00	3,580.84	115.98	11.19	-115.87	0.58	-0.42	-5.05
3,681.00	3.80	343.20	3,675.60	122.51	9.34	-122.42	0.65	-0.63	-1.89
3,775.00	4.80	356.10	3,769.34	129.42	8.17	-129.34	1.47	1.06	13.72
3,870.00	5.90	0.40	3,863.92	138.27	7.93	-138.19	1.23	1.16	4.53
3,965.00	5.60	359.00	3,958.44	147.78	7.89	-147.70	0.35	-0.32	-1.47
4,059.00	5.20	358.90	4,052.03	156.63	7.73	-156.55	0.43	-0.43	-0.11
4,153.00	5.00	355.80	4,145.65	164.97	7.34	-164.90	0.36	-0.21	-3.30
4,248.00	4.80	354.20	4,240.31	173.06	6.64	-172.99	0.25	-0.21	-1.68
4,343.00	6.20	358.00	4,334.87	182.14	6.06	-182.07	1.52	1.47	4.00
4,438.00	6.10	356.90	4,429.32	192.30	5.61	-192.24	0.16	-0.11	-1.16

Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Pan Head Fee #21H
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4200.00usft (Silver Oak 3)
Site:	Pan Head Fee #21H	MD Reference:	KB @ 4200.00usft (Silver Oak 3)
Well:	SHL: 330' FNL, 330' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 988' FNL, 330' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 988' FNL, 330' 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)	
4,532.00	6.00	356.00	4,522.80	202.19	4.99	-202.14	0.15	-0.11	-0.96	
4,626.00	6.60	8.40	4,616.23	212.44	5.44	-212.38	1.58	0.64	13.19	
4,721.00	6.50	9.40	4,710.61	223.14	7.12	-223.07	0.16	-0.11	1.05	
4,815.00	6.30	9.30	4,804.03	233.48	8.82	-233.39	0.21	-0.21	-0.11	
4,910.00	6.20	7.10	4,898.46	243.72	10.29	-243.61	0.27	-0.11	-2.32	
5,005.00	5.80	4.50	4,992.94	253.59	11.31	-253.48	0.51	-0.42	-2.74	
5,099.00	5.50	2.40	5,086.49	262.83	11.87	-262.71	0.39	-0.32	-2.23	
5,192.00	5.30	2.20	5,179.07	271.57	12.22	-271.45	0.22	-0.22	-0.22	
5,287.00	5.00	2.60	5,273.69	280.09	12.57	-279.97	0.32	-0.32	0.42	
5,382.00	4.70	359.90	5,368.35	288.12	12.76	-287.99	0.40	-0.32	-2.84	
5,477.00	4.40	0.80	5,463.05	295.66	12.80	-295.53	0.32	-0.32	0.95	
5,572.00	3.50	8.60	5,557.82	302.17	13.28	-302.03	1.10	-0.95	8.21	
5,666.00	3.20	10.40	5,651.66	307.59	14.19	-307.44	0.34	-0.32	1.91	
5,761.00	1.40	35.50	5,746.59	311.14	15.34	-310.98	2.13	-1.89	26.42	
5,823.00	1.40	41.10	5,808.57	312.33	16.28	-312.16	0.22	0.00	9.03	
5,855.00	1.20	110.20	5,840.56	312.51	16.85	-312.34	4.64	-0.63	215.94	
5,886.00	3.40	173.30	5,871.54	311.48	17.26	-311.31	9.84	7.10	203.55	
5,918.00	6.50	184.90	5,903.41	308.73	17.22	-308.56	10.13	9.69	36.25	
5,950.00	10.20	187.20	5,935.07	304.12	16.71	-303.95	11.61	11.56	7.19	
5,982.00	13.30	181.80	5,966.40	297.62	16.24	-297.46	10.27	9.69	-16.88	
6,013.00	16.90	176.50	5,996.32	289.56	16.40	-289.39	12.43	11.61	-17.10	
6,045.00	19.40	176.40	6,026.73	279.61	17.02	-279.44	7.81	7.81	-0.31	
6,076.00	22.30	178.90	6,055.70	268.59	17.45	-268.42	9.78	9.35	8.06	
6,108.00	25.70	181.90	6,084.93	255.58	17.34	-255.41	11.29	10.63	9.38	
6,140.00	28.10	181.00	6,113.46	241.11	16.98	-240.94	7.61	7.50	-2.81	
6,171.00	30.90	179.20	6,140.44	225.85	16.96	-225.68	9.47	9.03	-5.81	
6,202.00	33.90	176.60	6,166.61	209.25	17.59	-209.08	10.67	9.68	-8.39	
6,233.00	36.90	175.40	6,191.88	191.34	18.84	-191.16	9.93	9.68	-3.87	
6,265.00	39.90	174.50	6,216.95	171.55	20.60	-171.35	9.54	9.38	-2.81	
6,297.00	42.40	174.50	6,241.05	150.59	22.62	-150.37	7.81	7.81	0.00	
6,328.00	45.80	175.80	6,263.31	129.09	24.43	-128.86	11.35	10.97	4.19	
6,359.00	48.60	176.80	6,284.37	106.40	25.90	-106.15	9.34	9.03	3.23	
6,391.00	51.60	177.80	6,304.89	81.88	27.05	-81.63	9.68	9.38	3.13	
6,423.00	54.70	178.40	6,324.08	56.29	27.89	-56.03	9.80	9.69	1.88	
6,454.00	57.50	178.70	6,341.37	30.57	28.54	-30.31	9.07	9.03	0.97	
6,486.00	60.40	178.90	6,357.87	3.16	29.12	-2.90	9.08	9.06	0.63	
6,518.00	62.70	179.60	6,373.12	-24.97	29.48	25.24	7.44	7.19	2.19	
6,549.00	65.00	180.10	6,386.78	-52.79	29.56	53.06	7.56	7.42	1.61	
6,581.00	68.20	180.40	6,399.49	-82.15	29.43	82.42	10.04	10.00	0.94	
6,612.00	71.40	179.90	6,410.19	-111.24	29.35	111.51	10.43	10.32	-1.61	
6,644.00	74.30	179.50	6,419.62	-141.82	29.51	142.08	9.14	9.06	-1.25	
6,675.00	77.30	179.90	6,427.23	-171.87	29.67	172.13	9.76	9.68	1.29	

Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Pan Head Fee #21H
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4200.00usft (Silver Oak 3)
Site:	Pan Head Fee #21H	MD Reference:	KB @ 4200.00usft (Silver Oak 3)
Well:	SHL: 330' FNL, 330' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 988' FNL, 330' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 988' FNL, 330' 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)
6,707.00	80.30	180.30	6,433.44	-203.25	29.61	203.52	9.45	9.38	1.25
6,739.00	83.20	181.10	6,438.03	-234.92	29.23	235.18	9.39	9.06	2.50
6,770.00	85.90	182.00	6,440.98	-265.76	28.39	266.01	9.18	8.71	2.90
6,802.00	87.80	183.10	6,442.74	-297.68	26.97	297.92	6.86	5.94	3.44
6,896.00	90.20	181.00	6,444.38	-391.59	23.61	391.79	3.39	2.55	-2.23
6,990.00	92.60	181.20	6,442.08	-485.54	21.80	485.72	2.56	2.55	0.21
7,084.00	91.70	180.40	6,438.55	-579.46	20.49	579.63	1.28	-0.96	-0.85
7,179.00	88.70	179.80	6,438.22	-674.45	20.33	674.61	3.22	-3.16	-0.63
7,273.00	89.40	179.60	6,439.78	-768.44	20.82	768.60	0.77	0.74	-0.21
7,368.00	86.90	179.20	6,442.85	-863.37	21.81	863.54	2.67	-2.63	-0.42
7,462.00	87.70	179.30	6,447.27	-957.26	23.04	957.43	0.86	0.85	0.11
7,556.00	89.10	179.00	6,449.90	-1,051.21	24.44	1,051.39	1.52	1.49	-0.32
7,649.00	90.70	178.60	6,450.06	-1,144.19	26.38	1,144.38	1.77	1.72	-0.43
7,744.00	90.70	180.70	6,448.90	-1,239.17	26.96	1,239.37	2.21	0.00	2.21
7,839.00	88.50	180.60	6,449.56	-1,334.16	25.89	1,334.34	2.32	-2.32	-0.11
7,932.00	89.50	180.40	6,451.19	-1,427.14	25.08	1,427.31	1.10	1.08	-0.22
8,027.00	90.90	180.40	6,450.86	-1,522.14	24.41	1,522.30	1.47	1.47	0.00
8,122.00	89.10	180.20	6,450.86	-1,617.13	23.91	1,617.28	1.91	-1.89	-0.21
8,217.00	90.00	179.90	6,451.60	-1,712.13	23.83	1,712.27	1.00	0.95	-0.32
8,312.00	91.30	179.70	6,450.52	-1,807.12	24.16	1,807.26	1.38	1.37	-0.21
8,406.00	90.80	179.50	6,448.80	-1,901.10	24.82	1,901.25	0.57	-0.53	-0.21
8,499.00	90.70	178.20	6,447.58	-1,994.07	26.69	1,994.23	1.40	-0.11	-1.40
8,531.00	91.30	178.50	6,447.03	-2,026.05	27.61	2,026.22	2.10	1.88	0.94
8,625.00	91.50	179.00	6,444.73	-2,120.00	29.66	2,120.18	0.57	0.21	0.53
8,720.00	90.90	178.70	6,442.74	-2,214.96	31.56	2,215.16	0.71	-0.63	-0.32
8,814.00	89.40	179.00	6,442.49	-2,308.94	33.45	2,309.15	1.63	-1.60	0.32
8,908.00	89.50	179.20	6,443.40	-2,402.92	34.93	2,403.14	0.24	0.11	0.21
9,003.00	89.20	180.10	6,444.47	-2,497.91	35.51	2,498.14	1.00	-0.32	0.95
9,096.00	90.40	180.00	6,444.80	-2,590.91	35.43	2,591.13	1.29	1.29	-0.11
9,191.00	90.80	180.10	6,443.80	-2,685.91	35.34	2,686.12	0.43	0.42	0.11
9,285.00	90.20	180.20	6,442.98	-2,779.90	35.10	2,780.11	0.65	-0.64	0.11
9,379.00	89.90	179.40	6,442.90	-2,873.90	35.42	2,874.10	0.91	-0.32	-0.85
9,474.00	89.40	179.00	6,443.48	-2,968.89	36.75	2,969.10	0.67	-0.53	-0.42
9,568.00	88.60	179.10	6,445.12	-3,062.86	38.31	3,063.08	0.86	-0.85	0.11
9,662.00	89.80	179.30	6,446.43	-3,156.84	39.62	3,157.07	1.29	1.28	0.21
9,757.00	89.00	178.70	6,447.43	-3,251.82	41.28	3,252.06	1.05	-0.84	-0.63
9,851.00	89.40	178.70	6,448.74	-3,345.79	43.41	3,346.04	0.43	0.43	0.00
9,946.00	89.50	179.10	6,449.65	-3,440.76	45.24	3,441.04	0.43	0.11	0.42
10,040.00	89.10	179.70	6,450.80	-3,534.75	46.22	3,535.03	0.77	-0.43	0.64
10,135.00	90.40	179.70	6,451.22	-3,629.75	46.72	3,630.02	1.37	1.37	0.00
10,230.00	89.80	179.60	6,451.05	-3,724.74	47.30	3,725.02	0.64	-0.63	-0.11

Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Pan Head Fee #21H
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4200.00usft (Silver Oak 3)
Site:	Pan Head Fee #21H	MD Reference:	KB @ 4200.00usft (Silver Oak 3)
Well:	SHL: 330' FNL, 330' FWL, Sec 11, T17S, R32E, Unit D	North Reference:	Grid
Wellbore:	BHL: 988' FNL, 330' FWL, Sec 14, T17S, R32E, Unit D	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 988' FNL, 330' 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)	
10,325.00	89.50	179.00	6,451.63	-3,819.74	48.46	3,820.02	0.71	-0.32	-0.63	
10,420.00	91.00	179.00	6,451.22	-3,914.72	50.12	3,915.01	1.58	1.58	0.00	
10,515.00	90.50	178.50	6,449.97	-4,009.69	52.19	4,010.00	0.74	-0.53	-0.53	
10,610.00	89.70	178.90	6,449.81	-4,104.66	54.34	4,104.99	0.94	-0.84	0.42	
10,704.00	88.90	179.60	6,450.96	-4,198.64	55.57	4,198.98	1.13	-0.85	0.74	
10,799.00	88.70	180.40	6,452.94	-4,293.62	55.57	4,293.95	0.87	-0.21	0.84	
10,891.00	90.00	180.50	6,453.99	-4,385.61	54.85	4,385.93	1.42	1.41	0.11	
10,986.00	91.50	180.90	6,452.75	-4,480.59	53.69	4,480.90	1.63	1.58	0.42	
11,081.00	90.80	180.70	6,450.84	-4,575.56	52.36	4,575.85	0.77	-0.74	-0.21	
11,175.00	90.40	180.80	6,449.85	-4,669.55	51.13	4,669.82	0.44	-0.43	0.11	
11,269.00	89.50	180.50	6,449.94	-4,763.54	50.07	4,763.80	1.01	-0.96	-0.32	
11,364.00	88.90	179.30	6,451.26	-4,858.53	50.23	4,858.79	1.41	-0.63	-1.26	
11,458.00	90.80	180.10	6,451.51	-4,952.53	50.73	4,952.78	2.19	2.02	0.85	
11,551.00	90.40	179.30	6,450.53	-5,045.52	51.21	5,045.78	0.96	-0.43	-0.86	
11,645.00	89.50	180.50	6,450.62	-5,139.52	51.38	5,139.77	1.60	-0.96	1.28	
11,740.00	90.80	180.40	6,450.37	-5,234.51	50.63	5,234.75	1.37	1.37	-0.11	
11,835.00	90.30	179.80	6,449.46	-5,329.50	50.47	5,329.74	0.82	-0.53	-0.63	
11,930.00	90.00	179.70	6,449.21	-5,424.50	50.88	5,424.74	0.33	-0.32	-0.11	
12,023.00	89.20	179.40	6,449.86	-5,517.50	51.61	5,517.74	0.92	-0.86	-0.32	
12,118.00	88.30	179.00	6,451.93	-5,612.46	52.94	5,612.71	1.04	-0.95	-0.42	
12,213.00	89.20	179.00	6,454.00	-5,707.43	54.59	5,707.69	0.95	0.95	0.00	
12,306.00	89.80	178.60	6,454.81	-5,800.40	56.54	5,800.68	0.78	0.65	-0.43	
Final MWD Survey										
12,382.00	89.80	178.60	6,455.08	-5,876.38	58.40	5,876.67	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	
2,270.00	2,269.88	10.87	-0.01	TIE-IN to VES Gyro	
12,306.00	6,454.81	-5,800.40	56.54	Final MWD Survey	
12,382.00	6,455.08	-5,876.38	58.40	Projection to Bit/TD	

Checked By: _____ Approved By: _____ Date: _____