



A GYRO TECHNOLOGIES INC. COMPANY

P.O. Box 261021
Corpus Christi, Texas 78426
(361) 767-0602 • (800) 606-GYRO • Fax (361) 767-0612

30-015-41779

February 20, 2014

COG Operating LLC (Concho)
One Concho Center
600 W. Illinois Avenue
Midland, TX 79701

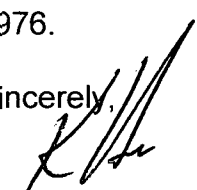
Attn: Kanicia Castillo

Re: **SRO State Unit No 048H**

Please find enclosed a copy of the survey from 0' to 8,743' ran on the above referenced well.

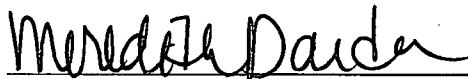
If I can be of any further service, please do not hesitate to call me at 800-606-4976.

Sincerely,

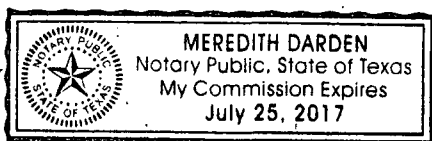

Keith Havelka
Operations

STATE OF TEXAS §
§
COUNTY OF NUECES §

This instrument was acknowledged before me on the 20th day of February A.D., 2014, by Keith Havelka.



Meredith Darden
Notary Public, State of Texas



Company: COG OPERATING-CONCHO

Lease/Well: SRO STATE UNIT/No 048H



Rig Name: SCAN FREEDOM

State/County: NEW MEXICO /EDDY

Latitude: 32.06, Longitude: -104.12

GRID North is 0.11 Degrees East of True North

VS-Azi: 179.32 Degrees



DRILLOG HA GYRO SURVEY CALCULATIONS

Filename: SEO STATE 48H.ut

Minimum Curvature Method

Report Date/Time: 2/20/2014 / 09:45

VAUGHN ENERGY SERVICES

MIDLAND, TX

432-563-5444

SURVEYOR : JAVIER ESTRADA

SRO STATE UNIT NO 048H / API 30-015-41779

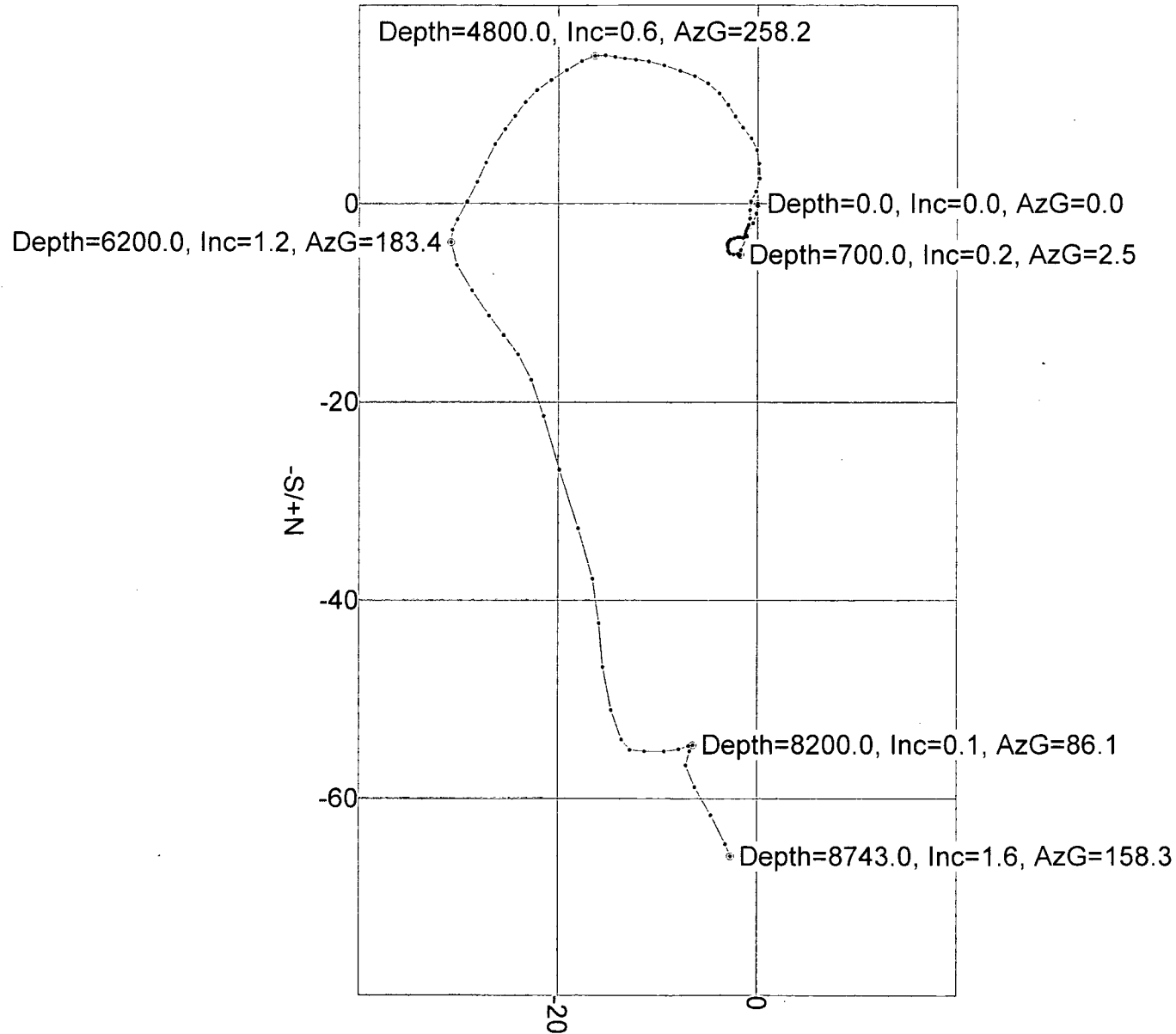
Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
100.00	0.28	185.16	100.00	-0.24	-0.02	0.24	0.24	185.16	0.28
200.00	0.58	191.76	200.00	-0.98	-0.15	0.98	0.99	188.51	0.30
300.00	0.64	205.11	299.99	-1.97	-0.49	1.97	2.03	193.80	0.15
400.00	1.03	203.97	399.98	-3.30	-1.09	3.29	3.47	198.22	0.39
500.00	0.69	204.60	499.97	-4.67	-1.70	4.65	4.97	200.03	0.34
600.00	0.11	109.86	599.97	-5.25	-1.86	5.22	5.57	199.54	0.71
700.00	0.15	2.48	699.97	-5.14	-1.77	5.12	5.44	198.94	0.21
800.00	0.31	259.64	799.97	-5.06	-2.02	5.04	5.45	201.79	0.37
900.00	0.19	268.94	899.96	-5.11	-2.45	5.08	5.67	205.65	0.12
1000.00	0.25	293.34	999.96	-5.03	-2.82	4.99	5.77	209.32	0.11
1100.00	0.21	8.63	1099.96	-4.76	-3.00	4.73	5.63	212.19	0.28
1200.00	0.22	343.90	1199.96	-4.39	-3.02	4.36	5.33	214.54	0.09
1300.00	0.08	15.81	1299.96	-4.13	-3.06	4.10	5.14	216.49	0.16
1400.00	0.06	3.22	1399.96	-4.01	-3.04	3.97	5.03	217.12	0.03
1500.00	0.05	64.69	1499.96	-3.94	-2.99	3.90	4.94	217.20	0.06
1600.00	0.14	18.28	1599.96	-3.80	-2.91	3.76	4.78	217.43	0.11
1700.00	0.16	59.50	1699.96	-3.61	-2.74	3.57	4.53	217.27	0.11
1800.00	0.27	83.27	1799.96	-3.50	-2.38	3.48	4.24	214.20	0.14
1900.00	0.16	52.80	1899.96	-3.39	-2.03	3.37	3.96	210.93	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
2000.00	0.18	124.86	1999.96	-3.40	-1.79	3.38	3.84	207.80	0.20
2100.00	0.20	82.23	2099.96	-3.47	-1.49	3.45	3.77	203.21	0.14
2200.00	0.17	4.68	2199.96	-3.29	-1.30	3.28	3.54	201.54	0.24
2300.00	0.11	21.26	2299.96	-3.05	-1.25	3.03	3.30	202.31	0.07
2400.00	0.26	10.71	2399.96	-2.73	-1.17	2.72	2.97	203.24	0.16
2500.00	0.10	54.40	2499.96	-2.45	-1.06	2.44	2.67	203.33	0.20
2600.00	0.31	13.96	2599.96	-2.14	-0.92	2.12	2.33	203.28	0.24
2700.00	0.46	8.37	2699.95	-1.48	-0.80	1.47	1.68	208.29	0.15
2800.00	0.49	353.85	2799.95	-0.66	-0.78	0.65	1.02	229.90	0.12
2900.00	0.55	16.34	2899.95	0.23	-0.69	-0.23	0.73	288.07	0.21
3000.00	0.74	33.22	2999.94	1.23	-0.20	-1.23	1.25	350.68	0.27
3100.00	0.87	2.63	3099.93	2.53	0.19	-2.53	2.54	4.26	0.44
3200.00	0.86	353.19	3199.92	4.04	0.14	-4.03	4.04	1.92	0.14
3300.00	0.75	346.81	3299.91	5.42	-0.10	-5.42	5.42	358.91	0.14
3400.00	0.78	322.88	3399.90	6.60	-0.66	-6.61	6.63	354.25	0.32
3500.00	0.80	319.00	3499.89	7.67	-1.53	-7.69	7.82	348.70	0.06
3600.00	0.76	331.76	3599.88	8.78	-2.30	-8.80	9.07	345.31	0.18
3700.00	0.82	324.34	3699.87	9.94	-3.03	-9.97	10.39	343.05	0.12
3800.00	0.86	321.35	3799.86	11.10	-3.91	-11.15	11.77	340.58	0.06
3900.00	0.91	303.71	3899.85	12.13	-5.05	-12.19	13.14	337.41	0.28
4000.00	0.83	291.47	3999.84	12.84	-6.39	-12.92	14.35	333.55	0.20
4100.00	0.95	289.42	4099.83	13.39	-7.85	-13.48	15.52	329.61	0.13
4200.00	0.97	287.83	4199.81	13.92	-9.44	-14.03	16.82	325.85	0.03
4300.00	0.88	279.54	4299.80	14.31	-11.00	-14.44	18.05	322.44	0.16
4400.00	0.62	276.67	4399.79	14.50	-12.30	-14.64	19.01	319.70	0.26
4500.00	0.60	273.74	4499.79	14.60	-13.36	-14.75	19.79	317.53	0.04
4600.00	0.56	287.38	4599.78	14.78	-14.35	-14.95	20.60	315.84	0.15
4700.00	0.58	274.06	4699.78	14.96	-15.32	-15.14	21.41	314.31	0.13
4800.00	0.64	258.24	4799.77	14.88	-16.37	-15.07	22.12	312.26	0.18
4900.00	1.00	242.58	4899.76	14.36	-17.70	-14.57	22.79	309.07	0.42
5000.00	1.01	235.42	4999.74	13.46	-19.19	-13.69	23.44	305.05	0.13
5100.00	1.10	238.14	5099.73	12.46	-20.73	-12.70	24.19	301.00	0.11
5200.00	0.89	230.33	5199.71	11.45	-22.15	-11.71	24.93	297.34	0.25
5300.00	1.04	219.02	5299.70	10.25	-23.32	-10.52	25.47	293.72	0.24
5400.00	0.95	212.53	5399.68	8.84	-24.34	-9.13	25.90	289.96	0.15
5500.00	0.95	220.66	5499.67	7.52	-25.33	-7.82	26.42	286.53	0.13
5600.00	1.16	207.07	5599.65	5.98	-26.33	-6.29	27.00	282.80	0.33
5700.00	1.20	204.31	5699.63	4.12	-27.22	-4.44	27.53	278.61	0.07
5800.00	1.26	204.21	5799.61	2.16	-28.11	-2.50	28.19	274.40	0.05
5900.00	1.26	210.10	5899.58	0.21	-29.11	-0.56	29.11	270.42	0.13

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
6000.00	1.08	207.88	5999.56	-1.57	-30.10	1.21	30.14	267.02	0.19
6100.00	0.29	196.31	6099.56	-2.64	-30.61	2.28	30.72	265.07	0.79
6200.00	1.17	183.36	6199.55	-3.90	-30.74	3.54	30.98	262.77	0.89
6300.00	1.65	152.60	6299.52	-6.20	-30.13	5.84	30.76	258.38	0.88
6400.00	1.76	145.75	6399.47	-8.74	-28.61	8.40	29.92	253.02	0.23
6500.00	1.73	146.70	6499.43	-11.27	-26.92	10.95	29.18	247.29	0.04
6600.00	1.12	137.47	6599.40	-13.25	-25.43	12.95	28.67	242.48	0.66
6700.00	1.64	148.49	6699.37	-15.19	-24.02	14.90	28.42	237.70	0.58
6800.00	1.72	156.44	6799.32	-17.78	-22.68	17.51	28.82	231.90	0.24
6900.00	2.69	164.76	6899.25	-21.42	-21.46	21.16	30.32	225.05	1.03
7000.00	3.74	162.89	6999.09	-26.81	-19.88	26.57	33.38	216.57	1.05
7100.00	3.38	161.52	7098.90	-32.72	-17.99	32.50	37.34	208.80	0.37
7200.00	2.72	167.92	7198.75	-37.84	-16.56	37.64	41.30	203.63	0.74
7300.00	2.45	175.97	7298.65	-42.29	-15.91	42.10	45.18	200.62	0.46
7400.00	2.67	173.94	7398.55	-46.73	-15.51	46.54	49.24	198.37	0.24
7500.00	2.41	163.95	7498.46	-51.07	-14.69	50.89	53.14	196.05	0.51
7600.00	1.22	153.59	7598.40	-54.04	-13.63	53.87	55.73	194.16	1.23
7700.00	0.41	105.51	7698.39	-55.08	-12.81	54.93	56.56	193.10	0.99
7800.00	1.27	91.74	7798.38	-55.21	-11.36	55.08	56.37	191.62	0.88
7900.00	1.00	89.75	7898.36	-55.24	-9.37	55.13	56.03	189.63	0.28
8000.00	0.76	70.77	7998.35	-55.02	-7.87	54.92	55.58	188.14	0.37
8100.00	0.40	72.36	8098.35	-54.70	-6.91	54.61	55.13	187.20	0.36
8200.00	0.14	86.13	8198.34	-54.58	-6.46	54.50	54.96	186.75	0.27
8300.00	0.90	214.77	8298.34	-55.22	-6.79	55.14	55.64	187.01	0.99
8400.00	0.88	175.29	8398.33	-56.63	-7.17	56.54	57.08	187.22	0.60
8500.00	1.94	149.99	8498.30	-58.85	-6.27	58.77	59.18	186.08	1.20
8600.00	1.81	150.01	8598.25	-61.68	-4.63	61.62	61.86	184.29	0.13
8700.00	1.96	157.06	8698.19	-64.63	-3.18	64.58	64.70	182.81	0.28
8743.00	1.59	158.27	8741.17	-65.86	-2.67	65.82	65.91	182.32	0.86



VAUGHN ENERGY SERVICES
MIDLAND, TX
432-563-5444
SURVEYOR : JAVIER ESTRADA
SRO STATE UNIT NO 048H / API 30-015-41779



VES Survey Date: 02/03/2014



COG Operating LLC

Eddy County, NM (NAD 27 NME)

SRO State Com

#48H

WB2/Job #1410026

Survey: Phoenix MWD Survey

Survey Report

21 February, 2014





Phoenix Technology Services
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well #48H
Project:	Eddy County, NM (NAD 27 NME)	TVD Reference:	KB @ 3091.00usft (Scandrift Freedom)
Site:	SRO State Com	MD Reference:	KB @ 3091.00usft (Scandrift Freedom)
Well:	#48H	North Reference:	Grid
Wellbore:	WB2/Job #1410026	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Scandrift Freedom)	Database:	Compass 5000 GCR DB

Project	Eddy County, NM (NAD 27 NME)		
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	SRO State Com		
Site Position:		Northing:	386,965.90 usft
From:	Map	Easting:	564,751.00 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 3' 49.36391 N
		Longitude:	104° 7' 27.51995 W
		Grid Convergence:	0.11 °

Well	#48H		
Well Position	+N/-S	0.00 usft	Northing:
	+E/-W	0.00 usft	Easting:
Position Uncertainty	0.00 usft		Wellhead Elevation:
			Latitude:
			Longitude:
			Ground Level:

Wellbore	WB2/Job #1410026				
Magnetics	Model Name	Sample Date	Declination	Dip Angle	Field Strength
			(°)	(°)	(nT)
	IGRF2010_14	01/02/14	7.51	59.88	48,207

Design	Surveys (Scandrift Freedom)			
Audit Notes:				
Version:	1.0	Phase:	ACTUAL	Tie On Depth:
				7,400.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction
	(usft)	(usft)	(usft)	(°)
	0.00	0.00	0.00	179.32



Phoenix Technology Services
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well #48H
Project:	Eddy County, NM (NAD 27 NME)	TVD Reference:	KB @ 3091.00usft (Scandril Freedom)
Site:	SRO State Com	MD Reference:	KB @ 3091.00usft (Scandril Freedom)
Well:	#48H	North Reference:	Grid
Wellbore:	WB2/Job #1410026	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Scandril Freedom)	Database:	Compass 5000 GCR DB

Survey Program		Date	02/21/14		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	7,400.00	PH/VES Gyro (WB1/Job #1410026)	CB-GYRO-MS	Camera based gyro multishot	
7,400.00	17,660.00	Phoenix MWD Survey (WB2/Job #141002)	MWD	MWD - Standard	

MD (usft)	Inc (°)	Azi (azimuth) (°)	TVDSS (usft)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)	Northing (usft)	Easting (usft)
7,400.00	2.67	173.94	4,307.55	7,398.55	-46.73	-15.51	46.54	0.00	386,919.17	564,735.49
Tie-on to Gyro										
7,443.00	15.90	169.50	4,349.90	7,440.90	-53.55	-14.33	53.37	30.79	386,912.35	564,736.67
First Phoenix MWD survey										
7,474.00	21.90	164.90	4,379.21	7,470.21	-63.31	-12.04	63.17	19.93	386,902.59	564,738.96
7,506.00	25.50	162.10	4,408.51	7,499.51	-75.64	-8.37	75.53	11.78	386,890.26	564,742.63
7,538.00	27.30	162.10	4,437.17	7,528.17	-89.17	-4.00	89.12	5.62	386,876.73	564,747.00
7,569.00	29.30	163.10	4,464.47	7,555.47	-103.20	0.39	103.20	6.63	386,862.70	564,751.39
7,601.00	31.70	163.80	4,492.04	7,583.04	-118.77	5.02	118.82	7.58	386,847.13	564,756.02
7,632.00	33.70	164.50	4,518.12	7,609.12	-134.88	9.59	134.98	6.57	386,831.02	564,760.59
7,664.00	35.50	164.70	4,544.46	7,635.46	-152.39	14.41	152.56	5.64	386,813.51	564,765.41
7,696.00	37.90	165.70	4,570.12	7,661.12	-170.88	19.29	171.10	7.73	386,795.02	564,770.29
7,727.00	40.80	168.30	4,594.09	7,685.09	-190.03	23.70	190.30	10.76	386,775.87	564,774.70
7,759.00	43.30	170.70	4,617.85	7,708.85	-211.10	27.59	211.42	9.29	386,754.80	564,778.59
7,791.00	45.60	172.50	4,640.69	7,731.69	-233.27	30.86	233.62	8.20	386,732.63	564,781.86
7,822.00	49.10	174.80	4,661.69	7,752.69	-255.93	33.37	256.30	12.54	386,709.97	564,784.37
7,854.00	52.30	176.70	4,681.96	7,772.96	-280.62	35.19	281.01	11.00	386,685.28	564,786.19
7,885.00	55.50	178.20	4,700.22	7,791.22	-305.64	36.30	306.04	11.04	386,660.26	564,787.30
7,917.00	58.50	180.00	4,717.65	7,808.65	-332.46	36.71	332.88	10.49	386,633.44	564,787.71
7,934.00	60.40	180.20	4,726.29	7,817.29	-347.10	36.69	347.52	11.22	386,618.80	564,787.69
7,966.00	64.40	179.90	4,741.11	7,832.11	-375.46	36.66	375.87	12.53	386,590.44	564,787.66
7,997.00	66.80	179.80	4,753.92	7,844.92	-403.69	36.74	404.09	7.75	386,562.21	564,787.74



Phoenix Technology Services
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well #48H
Project:	Eddy County, NM (NAD 27 NME)	TVD Reference:	KB @ 3091.00usft (Scandrift Freedom)
Site:	SRO State Com	MD Reference:	KB @ 3091.00usft (Scandrift Freedom)
Well:	#48H	North Reference:	Grid
Wellbore:	WB2/Job #1410026	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Scandrift Freedom)	Database:	Compass 5000 GCR DB

Survey											
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVDSS (usft)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)	Northing (usft)	Easting (usft)	
8,029.00	69.20	180.80	4,765.91	7,856.91	-433.35	36.58	433.76	8.04	386,532.55	564,787.58	
8,092.00	74.80	180.10	4,785.37	7,876.37	-493.24	36.12	493.64	8.95	386,472.66	564,787.12	
8,124.00	78.00	179.90	4,792.89	7,883.89	-524.34	36.12	524.73	10.02	386,441.56	564,787.12	
8,155.00	80.30	180.20	4,798.72	7,889.72	-554.79	36.09	555.18	7.48	386,411.11	564,787.09	
8,186.00	81.60	181.10	4,803.60	7,894.60	-585.40	35.74	585.78	5.08	386,380.50	564,786.74	
8,218.00	82.90	181.10	4,807.92	7,898.92	-617.10	35.13	617.47	4.06	386,348.80	564,786.13	
8,280.00	85.00	179.80	4,814.45	7,905.45	-678.75	34.65	679.11	3.98	386,287.15	564,785.65	
8,312.00	85.70	179.50	4,817.04	7,908.04	-710.64	34.85	711.00	2.38	386,255.26	564,785.85	
8,344.00	86.80	179.10	4,819.14	7,910.14	-742.57	35.24	742.93	3.66	386,223.33	564,786.24	
8,407.00	87.90	179.60	4,822.05	7,913.05	-805.50	35.95	805.87	1.92	386,160.40	564,786.95	
8,500.00	91.60	179.60	4,822.46	7,913.46	-898.48	36.60	898.85	3.98	386,067.42	564,787.60	
8,595.00	91.80	179.40	4,819.64	7,910.64	-993.43	37.43	993.81	0.30	385,972.47	564,788.43	
8,690.00	91.40	180.60	4,816.99	7,907.99	-1,088.39	37.43	1,088.76	1.33	385,877.51	564,788.43	
8,785.00	92.00	180.60	4,814.17	7,905.17	-1,183.34	36.43	1,183.69	0.63	385,782.56	564,787.43	
8,879.00	90.70	182.00	4,811.95	7,902.95	-1,277.29	34.30	1,277.61	2.03	385,688.61	564,785.30	
8,975.00	91.20	182.10	4,810.36	7,901.36	-1,373.22	30.87	1,373.48	0.53	385,592.68	564,781.87	
9,069.00	90.50	182.40	4,808.97	7,899.97	-1,467.13	27.18	1,467.35	0.81	385,498.77	564,778.18	
9,164.00	89.90	181.80	4,808.63	7,899.63	-1,562.07	23.70	1,562.24	0.89	385,403.83	564,774.70	
9,259.00	90.70	181.20	4,808.14	7,899.14	-1,657.03	21.21	1,657.17	1.05	385,308.87	564,772.21	
9,353.00	90.10	182.20	4,807.48	7,898.48	-1,750.99	18.42	1,751.08	1.24	385,214.91	564,769.42	
9,448.00	90.90	182.50	4,806.65	7,897.65	-1,845.90	14.53	1,845.94	0.90	385,120.00	564,765.53	
9,544.00	89.90	181.70	4,805.98	7,896.98	-1,941.83	11.01	1,941.83	1.33	385,024.07	564,762.01	
9,639.00	89.10	181.40	4,806.81	7,897.81	-2,036.79	8.44	2,036.75	0.90	384,929.11	564,759.44	
9,733.00	89.80	180.70	4,807.71	7,898.71	-2,130.77	6.72	2,130.70	1.05	384,835.13	564,757.72	
9,828.00	90.60	180.50	4,807.38	7,898.38	-2,225.77	5.72	2,225.68	0.87	384,740.13	564,756.72	
9,922.00	89.60	180.10	4,807.22	7,898.22	-2,319.76	5.23	2,319.66	1.15	384,646.14	564,756.23	
10,017.00	90.00	180.10	4,807.55	7,898.55	-2,414.76	5.06	2,414.65	0.42	384,551.14	564,756.06	



Phoenix Technology Services
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well #48H
Project:	Eddy County, NM (NAD 27 NME)	TVD Reference:	KB @ 3091.00usft (Scandril Freedom)
Site:	SRO State Com	MD Reference:	KB @ 3091.00usft (Scandril Freedom)
Well:	#48H	North Reference:	Grid
Wellbore:	WB2/Job #1410026	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Scandril Freedom)	Database:	Compass 5000 GCR DB

Survey											
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVDSS (usft)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)	Northing (usft)	Easting (usft)	
10,112.00	90.80	179.80	4,806.89	7,897.89	-2,509.76	5.15	2,509.64	0.90	384,456.14	564,756.15	
10,206.00	91.20	179.60	4,805.25	7,896.25	-2,603.74	5.64	2,603.63	0.48	384,362.16	564,756.64	
10,301.00	90.20	179.50	4,804.08	7,895.08	-2,698.73	6.38	2,698.62	1.06	384,267.17	564,757.38	
10,396.00	90.70	178.90	4,803.34	7,894.34	-2,793.72	7.71	2,793.61	0.82	384,172.18	564,758.71	
10,491.00	89.30	179.20	4,803.34	7,894.34	-2,888.70	9.29	2,888.61	1.51	384,077.20	564,760.29	
10,586.00	89.80	179.30	4,804.08	7,895.08	-2,983.69	10.53	2,983.61	0.54	383,982.21	564,761.53	
10,681.00	89.70	177.90	4,804.50	7,895.50	-3,078.66	12.85	3,078.60	1.48	383,887.24	564,763.85	
10,775.00	90.30	177.90	4,804.50	7,895.50	-3,172.60	16.29	3,172.57	0.64	383,793.30	564,767.29	
10,870.00	90.90	177.80	4,803.50	7,894.50	-3,267.52	19.86	3,267.53	0.64	383,698.38	564,770.86	
10,964.00	89.50	179.20	4,803.18	7,894.18	-3,361.49	22.32	3,361.51	2.11	383,604.41	564,773.32	
11,058.00	90.10	179.10	4,803.50	7,894.50	-3,455.48	23.71	3,455.51	0.65	383,510.42	564,774.71	
11,152.00	90.70	179.10	4,802.85	7,893.85	-3,549.46	25.19	3,549.51	0.64	383,416.44	564,776.19	
11,247.00	91.60	178.30	4,800.94	7,891.94	-3,644.42	27.34	3,644.48	1.27	383,321.48	564,778.34	
11,341.00	90.90	179.30	4,798.89	7,889.89	-3,738.37	29.31	3,738.46	1.30	383,227.53	564,780.31	
11,435.00	89.00	180.10	4,798.97	7,889.97	-3,832.36	29.80	3,832.45	2.19	383,133.54	564,780.80	
11,529.00	89.60	180.20	4,800.12	7,891.12	-3,926.36	29.56	3,926.43	0.65	383,039.54	564,780.56	
11,623.00	90.00	179.70	4,800.45	7,891.45	-4,020.36	29.64	4,020.42	0.68	382,945.54	564,780.64	
11,717.00	90.20	179.20	4,800.29	7,891.29	-4,114.35	30.54	4,114.42	0.57	382,851.55	564,781.54	
11,811.00	90.90	178.50	4,799.38	7,890.38	-4,208.33	32.43	4,208.41	1.05	382,757.57	564,783.43	
11,905.00	92.00	178.30	4,797.00	7,888.00	-4,302.26	35.05	4,302.37	1.19	382,663.64	564,786.05	
11,999.00	91.10	179.90	4,794.46	7,885.46	-4,396.21	36.53	4,396.33	1.95	382,569.69	564,787.53	
12,093.00	89.10	179.90	4,794.30	7,885.30	-4,490.20	36.69	4,490.32	2.13	382,475.70	564,787.69	
12,191.00	89.20	179.80	4,795.75	7,886.75	-4,588.19	36.95	4,588.31	0.14	382,377.71	564,787.95	
12,285.00	89.70	179.70	4,796.65	7,887.65	-4,682.19	37.36	4,682.30	0.54	382,283.71	564,788.36	
12,379.00	90.00	179.00	4,796.90	7,887.90	-4,776.18	38.43	4,776.30	0.81	382,189.72	564,789.43	
12,473.00	90.30	178.30	4,796.65	7,887.65	-4,870.15	40.64	4,870.29	0.81	382,095.75	564,791.64	
12,567.00	90.40	177.90	4,796.08	7,887.08	-4,964.10	43.76	4,964.27	0.44	382,001.80	564,794.76	



Phoenix Technology Services
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well #48H
Project:	Eddy County, NM (NAD 27 NME)	TVD Reference:	KB @ 3091.00usft (Scandrill Freedom)
Site:	SRO State Com	MD Reference:	KB @ 3091.00usft (Scandrill Freedom)
Well:	#48H	North Reference:	Grid
Wellbore:	WB2/Job #1410026	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Scandrill Freedom)	Database:	Compass 5000 GCR DB

Survey											
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVDSS (usft)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)	Northing (usft)	Easting (usft)	
12,661.00	90.80	177.50	4,795.10	7,886.10	-5,058.02	47.53	5,058.23	0.60	381,907.88	564,798.53	
12,755.00	91.10	177.20	4,793.54	7,884.54	-5,151.90	51.87	5,152.16	0.45	381,814.00	564,802.87	
12,849.00	91.40	176.70	4,791.49	7,882.49	-5,245.75	56.87	5,246.05	0.62	381,720.15	564,807.87	
12,943.00	90.40	177.20	4,790.01	7,881.01	-5,339.60	61.88	5,339.96	1.19	381,626.30	564,812.88	
13,038.00	89.10	177.30	4,790.42	7,881.42	-5,434.49	66.43	5,434.89	1.37	381,531.41	564,817.43	
13,132.00	89.50	177.10	4,791.57	7,882.57	-5,528.37	71.03	5,528.82	0.48	381,437.53	564,822.03	
13,226.00	90.20	179.20	4,791.82	7,882.82	-5,622.31	74.06	5,622.80	2.35	381,343.59	564,825.06	
13,320.00	90.60	179.30	4,791.16	7,882.16	-5,716.30	75.29	5,716.79	0.44	381,249.60	564,826.29	
13,414.00	90.60	179.30	4,790.18	7,881.18	-5,810.29	76.44	5,810.79	0.00	381,155.61	564,827.44	
13,508.00	91.30	179.10	4,788.62	7,879.62	-5,904.27	77.75	5,904.78	0.77	381,061.63	564,828.75	
13,602.00	91.50	178.80	4,786.32	7,877.32	-5,998.23	79.47	5,998.75	0.38	380,967.67	564,830.47	
13,696.00	90.60	179.10	4,784.60	7,875.60	-6,092.19	81.19	6,092.73	1.01	380,873.71	564,832.19	
13,790.00	91.00	179.30	4,783.29	7,874.29	-6,186.17	82.51	6,186.72	0.48	380,779.73	564,833.51	
13,885.00	88.80	181.20	4,783.45	7,874.45	-6,281.16	82.09	6,281.69	3.06	380,684.74	564,833.09	
13,979.00	89.10	180.80	4,785.18	7,876.18	-6,375.13	80.45	6,375.64	0.53	380,590.77	564,831.45	
14,072.00	89.40	180.80	4,786.39	7,877.39	-6,468.12	79.15	6,468.60	0.32	380,497.78	564,830.15	
14,166.00	89.70	180.50	4,787.13	7,878.13	-6,562.11	78.09	6,562.57	0.45	380,403.79	564,829.09	
14,261.00	90.20	180.60	4,787.21	7,878.21	-6,657.10	77.18	6,657.55	0.54	380,308.80	564,828.18	
14,355.00	90.50	180.60	4,786.64	7,877.64	-6,751.09	76.19	6,751.52	0.32	380,214.81	564,827.19	
14,449.00	90.90	180.30	4,785.49	7,876.49	-6,845.08	75.45	6,845.50	0.53	380,120.82	564,826.45	
14,543.00	91.10	180.10	4,783.85	7,874.85	-6,939.07	75.13	6,939.47	0.30	380,026.83	564,826.13	
14,638.00	91.60	180.30	4,781.61	7,872.61	-7,034.04	74.79	7,034.43	0.57	379,931.86	564,825.79	
14,732.00	90.30	179.80	4,780.05	7,871.05	-7,128.03	74.71	7,128.41	1.48	379,837.87	564,825.71	
14,826.00	90.60	179.80	4,779.32	7,870.32	-7,222.02	75.04	7,222.40	0.32	379,743.88	564,826.04	
14,920.00	90.90	179.60	4,778.09	7,869.09	-7,316.01	75.53	7,316.39	0.38	379,649.89	564,826.53	
15,014.00	91.30	179.60	4,776.28	7,867.28	-7,409.99	76.19	7,410.38	0.43	379,555.91	564,827.19	
15,108.00	89.50	180.00	4,775.63	7,866.63	-7,503.99	76.52	7,504.37	1.96	379,461.91	564,827.52	



Phoenix Technology Services
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well #48H
Project:	Eddy County, NM (NAD 27 NME)	TVD Reference:	KB @ 3091.00usft (Scandrill Freedom)
Site:	SRO State Com	MD Reference:	KB @ 3091.00usft (Scandrill Freedom)
Well:	#48H	North Reference:	Grid
Wellbore:	WB2/Job #1410026	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Scandrill Freedom)	Database:	Compass 5000 GCR DB

Survey											
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVDSS (usft)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)	Northing (usft)	Easting (usft)	
15,202.00	89.70	179.40	4,776.28	7,867.28	-7,597.98	77.01	7,598.36	0.67	379,367.92	564,828.01	
15,296.00	89.90	179.20	4,776.61	7,867.61	-7,691.97	78.16	7,692.36	0.30	379,273.93	564,829.16	
15,390.00	90.20	178.90	4,776.53	7,867.53	-7,785.96	79.72	7,786.36	0.45	379,179.94	564,830.72	
15,484.00	90.80	178.70	4,775.71	7,866.71	-7,879.94	81.68	7,880.35	0.67	379,085.96	564,832.68	
15,579.00	91.00	178.70	4,774.22	7,865.22	-7,974.90	83.84	7,975.33	0.21	378,991.00	564,834.84	
15,673.00	90.90	177.70	4,772.66	7,863.66	-8,068.84	86.79	8,069.30	1.07	378,897.06	564,837.79	
15,767.00	90.60	177.80	4,771.43	7,862.43	-8,162.76	90.48	8,163.26	0.34	378,803.14	564,841.48	
15,861.00	90.80	177.50	4,770.28	7,861.28	-8,256.67	94.33	8,257.21	0.38	378,709.23	564,845.33	
15,955.00	91.30	177.70	4,768.56	7,859.56	-8,350.57	98.27	8,351.15	0.57	378,615.33	564,849.27	
16,049.00	91.60	178.20	4,766.18	7,857.18	-8,444.48	101.63	8,445.10	0.62	378,521.42	564,852.63	
16,143.00	90.40	179.00	4,764.54	7,855.54	-8,538.44	103.93	8,539.07	1.53	378,427.46	564,854.93	
16,237.00	90.50	178.60	4,763.80	7,854.80	-8,632.42	105.90	8,633.06	0.44	378,333.48	564,856.90	
16,331.00	90.70	178.40	4,762.81	7,853.81	-8,726.38	108.36	8,727.05	0.30	378,239.52	564,859.36	
16,425.00	89.60	178.90	4,762.57	7,853.57	-8,820.35	110.57	8,821.04	1.29	378,145.55	564,861.57	
16,519.00	89.90	178.70	4,762.98	7,853.98	-8,914.33	112.54	8,915.04	0.38	378,051.57	564,863.54	
16,613.00	90.30	178.70	4,762.81	7,853.81	-9,008.30	114.67	9,009.03	0.43	377,957.60	564,865.67	
16,713.00	90.80	178.80	4,761.85	7,852.85	-9,108.28	116.85	9,109.02	0.51	377,857.62	564,867.85	
16,807.00	91.00	177.80	4,760.38	7,851.38	-9,202.22	119.64	9,202.99	1.08	377,763.68	564,870.64	
16,901.00	91.70	177.70	4,758.16	7,849.16	-9,296.12	123.33	9,296.93	0.75	377,669.78	564,874.33	
16,995.00	92.10	176.50	4,755.05	7,846.05	-9,389.95	128.08	9,390.81	1.34	377,575.95	564,879.08	
17,089.00	92.90	176.70	4,750.95	7,841.95	-9,483.69	133.65	9,484.61	0.88	377,482.21	564,884.65	
17,183.00	93.20	176.30	4,745.94	7,836.94	-9,577.38	139.38	9,578.36	0.53	377,388.52	564,890.38	
17,278.00	92.90	175.40	4,740.89	7,831.89	-9,672.00	146.25	9,673.05	1.00	377,293.90	564,897.25	
17,372.00	93.20	174.60	4,735.89	7,826.89	-9,765.51	154.43	9,766.65	0.91	377,200.39	564,905.43	
17,466.00	93.60	174.00	4,730.31	7,821.31	-9,858.88	163.75	9,860.13	0.77	377,107.02	564,914.75	
17,560.00	94.30	173.90	4,723.84	7,814.84	-9,952.13	173.63	9,953.49	0.75	377,013.77	564,924.63	



Phoenix Technology Services
Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD 27 NME)
Site: SRO State Com
Well: #48H
Wellbore: WB2/Job #1410026
Design: Surveys (Scandrill Freedom)

Local Co-ordinate Reference: Well #48H
TVD Reference: KB @ 3091.00usft (Scandrill Freedom)
MD Reference: KB @ 3091.00usft (Scandrill Freedom)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: Compass 5000 GCR DB

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVDSS (usft)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)	Northing (usft)	Easting (usft)
17,608.00	94.80	173.50	4,720.03	7,811.03	-9,999.69	178.88	10,001.11	1.33	376,966.21	564,929.88
Final Phoenix MWD survey										
17,660.00	94.80	173.50	4,715.68	7,806.68	-10,051.18	184.75	10,052.66	0.00	376,914.72	564,935.75
Projection to TD										

Survey Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
7,400.00	7,398.55	-46.73	-15.51	Tie-on to Gyro
7,443.00	7,440.90	-53.55	-14.33	First Phoenix MWD survey
17,608.00	7,811.03	-9,999.69	178.88	Final Phoenix MWD survey
17,660.00	7,806.68	-10,051.18	184.75	Projection to TD

Checked By: _____ Approved By: _____ Date: _____



Project: Eddy County, NM (NAD 27 NME)
Site: SRO State Com
Well: #48H
Wellbore: WB2/Job #1410026
Design: Plan #3R 02-01-14
Rig: Scandril Freedom



PHOENIX
TECHNOLOGY SERVICES



Azimuths to Grid North
True North: -0.11°
Magnetic North: 7.40°
Magnetic Field
Strength: 48206.8nT
Dip Angle: 59.88°
Date: 01/02/2014
Model: IGRF2010_14

