

Results of Directional Survey

DD

API number:	30-025-40240		
OGRID:		Operator:	COG OPERATING LLC
		Property:	MC FEDERAL # 62

surface	ULSTR:	L	21	T	17S	R	32E
				2012	FSL	553	FWL

BH Loc	ULSTR:	L	21	T	17S	R	32E
7130	MD	7105.4	TVD	1656	FSL	347	FWL

Top Perf/OH	ULSTR:	L	21	T	17S	R	32E
5450	MD	5433.1	TVD	1791	FSL	332	FWL

Bot Perf/OH	ULSTR:	L	21	T	17S	R	32E
6850	MD	6826.7	TVD	1680	FSL	360	FWL

	MD	N/S	E/W	VD
	5446	-220.50	-220.50	5429.1
TOP PERFS/OH	5450	-220.84	-220.84	5433.08
	5540	-228.50	-228.50	5522.70
	6847	-332.20	-192.40	6823.70
BOT PERFS/OH	6850	-332.45	-192.55	6826.68
	6941	-340.10	-197.00	6917.20

NEXT TO LAST	7081	-351.50	-203.30	7056.60
LAST READING	7130	-355.60	-205.60	7105.40
TD	7130	-355.60	-205.60	7105.40

Surface Location	2012	FS	553	FW
Projected BHL	1656	FS	347	FW
Location of				
Top Perfs/OH	1791	FS	332	FW
Bottom Perfs/OH	1680	FS	360	FW

SUMMARY of Subsurface Locations

Surface Location	L-21-17S-32E	2012	FS	553	FW	Vert. Depth
Top Perfs/OH	L-21-17S-32E	1791	FS	332	FW	5433.08
Bottom Perfs/OH	L-21-17S-32E	1680	FS	360	FW	6826.68
Projected TD	L-21-17S-32E	1656	FS	347	FW	7105.40

MAR 29 2012



COG OPERATING LLC

Lea County, NM (NAD27 NME)

MC Federal #62

MC Federal #62

OH - Job #32D0112080

SUR: L-21-17s-32e, 2012/S & 553/W
BHL: L-21-17s-32e, 1656/S & 347/W
API # 30-025-40240

Survey: MWD

SDI Standard Survey Report

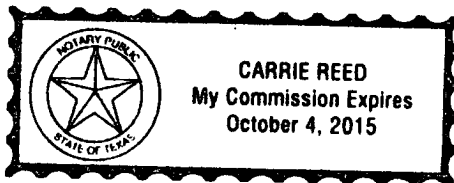
This survey is correct to the best of my knowledge and is supported by actual field data.

K. Wharton

Notarized this date 17th of February, 2012.

Carrie Reed

Notary Signature
County of Midland
State of Texas



Scientific Drilling
Directional Drilling Operations



Scientific Drilling International, Inc.
SDI Standard Survey Report



Company:	COG OPERATING LLC	Local Co-ordinate Reference:	Well MC Federal #62
Project:	Lea County, NM (NAD27-NME)	TVD Reference:	RF @ 4033.0usft (JW #4)
Site:	MC Federal #62	MD Reference:	RF @ 4033.0usft (JW #4)
Well:	MC Federal #62	North Reference:	Grid
Wellbore:	OH - Job #32D0112080	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Project:	Lea County, NM (NAD27 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:	MC Federal #62		
Site Position:		Northing:	661,858.26 usft
From:	Lat/Long	Easting:	670,690.21 usft
Position Uncertainty:	0.0 usft	Slot Radius:	0"
		Latitude:	32° 49' 5.891 N
		Longitude:	103° 46' 39.803 W
		Grid Convergence:	0.30 °

Well:	MC Federal #62		
Well Position	+N/-S	0.0 usft	Northing:
	+E/-W	0.0 usft	Easting:
Position Uncertainty	0.0 usft	Wellhead Elevation:	usft
		Latitude:	32° 49' 5.891 N
		Longitude:	103° 46' 39.803 W
		Ground Level:	4,020.0 usft

Wellbore:	OH - Job #32D0112080		
Magnetics	Model Name	Sample Date	Declination
			(°)
	IGRF2010	12/5/2011	7.67
			Dip Angle
			(°)
			60.69
			Field Strength
			(nT)
			48,900

Design:	Actual		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(usft)	(usft)	(usft)
	0.0	0.0	0.0
			Direction
			(°)
			210.85

Survey Program	Date 2/17/2012		
From	To	Survey (Wellbore)	Tool Name
(usft)	(usft)		
100.0	2,145.0	Gyro (OH - Job #32D0112080)	Keeper
2,243.0	7,130.0	MWD (OH - Job #32D0112080)	MWD
			Description
			Standard Wireline Keeper ver 1.0.2
			MWD - Standard

Survey							
Measured Depth	Inclination	Azimuth	True Vertical	North/South	East/West	Closure Azimuth	Closure Distance
(usft)	(°)	(°)	Depth	(usft)	(usft)	(°)	(usft)
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.0
100.0	0.22	155.51	100.0	-0.2	0.1	155.51	0.2
200.0	0.23	151.41	200.0	-0.5	0.3	154.10	0.6
300.0	0.35	142.32	300.0	-0.9	0.5	150.31	1.1
400.0	0.32	182.06	400.0	-1.5	0.7	153.99	1.6
500.0	0.34	174.60	500.0	-2.0	0.7	160.24	2.2
600.0	0.46	224.56	600.0	-2.6	0.5	169.65	2.7
700.0	0.49	242.27	700.0	-3.1	-0.2	183.34	3.1
800.0	0.50	244.84	800.0	-3.5	-1.0	195.30	3.6
900.0	0.66	268.32	900.0	-3.7	-1.9	207.54	4.2
1,000.0	0.34	264.67	1,000.0	-3.7	-2.8	216.81	4.7



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Site:	MC Federal #62	MD Reference:	RF @ 4033.0usft (JW #4)
Well:	MC Federal #62	North Reference:	Grid
Wellbore:	OH - Job #32D0112080	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Survey								
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)	
1,100.0	0.16	240.19	1,100.0	-3.8	-3.2	219.97	5.0	
1,200.0	0.25	95.84	1,200.0	-3.9	-3.1	218.46	5.0	
1,300.0	0.37	40.51	1,300.0	-3.7	-2.7	216.01	4.6	
1,400.0	0.72	37.05	1,400.0	-3.0	-2.1	215.43	3.6	
1,500.0	1.15	36.78	1,500.0	-1.6	-1.1	214.24	2.0	
1,600.0	1.75	44.02	1,599.9	0.3	0.5	64.95	0.6	
1,700.0	2.82	44.07	1,699.8	3.1	3.3	46.73	4.5	
1,800.0	3.87	47.68	1,799.7	7.2	7.5	46.41	10.4	
1,900.0	4.21	49.13	1,899.4	11.8	12.8	47.23	17.4	
2,000.0	3.33	46.71	1,999.2	16.2	17.7	47.46	24.0	
2,100.0	3.10	55.54	2,099.0	19.7	22.0	48.12	29.6	
2,145.0	2.94	45.88	2,144.0	21.2	23.9	48.32	31.9	



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Site:	MC Federal #62	MD Reference:	RF @ 4033 0usft (JW #4)
Well:	MC Federal #62	North Reference:	Grd
Wellbore:	OH - Job #32D0112080	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Project:	Lea County, NM (NAD27 NME)		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
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Position Uncertainty:	0 0 usft	Slot Radius:	0"
		Latitude:	32° 49' 5 891 N
		Longitude:	103° 46' 39 803 W
		Grid Convergence:	0 30 °

Well:	MC Federal #62		
Well Position	+N/-S	0.0 usft	Northing:
	+E/-W	0.0 usft	Easting:
Position Uncertainty	0 0 usft	Wellhead Elevation:	usft
		Latitude:	32° 49' 5 891 N
		Longitude:	103° 46' 39 803 W
		Ground Level:	4,020.0 usft

Wellbore:	OH - Job #32D0112080		
Magnetics	Model Name	Sample Date	Declination
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	IGRF2010	12/5/2011	7.67
			Dip Angle
			(°)
			60.69
			Field Strength
			(nT)
			48,900

Design:	Actual		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(usft)	(usft)	(usft)
	0.0	0.0	0.0
			Direction
			(°)
			210.85

Survey Program	Date: 2/17/2012		
From	To	Survey (Wellbore)	Tool Name
(usft)	(usft)		
100.0	2,145.0	Gyro (OH - Job #32D0112080)	Keeper
2,243.0	7,130.0	MWD (OH - Job #32D0112080)	MWD
			Description
			Standard Wireline Keeper ver 1.0.2
			MWD - Standard

Survey	Measured Depth	Inclination	Azimuth	True Vertical	North/South	East/West	Closure Azimuth	Closure Distance
	(usft)	(°)	(°)	Depth	(usft)	(usft)	(°)	(usft)
	2,145.0	2.94	45.88	2,144.0	21.2	23.9	48.32	31.9
	Gyro Tie-In							
	2,240.0	2.76	49.88	2,238.9	24.4	27.4	48.26	36.7
	2,302.0	2.36	56.48	2,300.8	26.1	29.6	48.58	39.4
	2,364.0	1.70	65.43	2,362.8	27.2	31.5	49.19	41.6
	2,427.0	1.17	78.61	2,425.7	27.7	32.9	49.96	43.0
	2,489.0	0.71	117.56	2,487.7	27.6	33.9	50.82	43.7
	2,552.0	0.70	179.75	2,550.7	27.1	34.2	51.69	43.6
	2,615.0	1.26	200.69	2,613.7	26.0	34.0	52.57	42.8
	2,677.0	2.07	209.86	2,675.7	24.4	33.2	53.67	41.2
	2,738.0	2.62	220.68	2,736.6	22.4	31.7	54.79	38.9



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Site:	MC Federal #62	MD Reference:	RF @ 4033.0usft (JW #4)
Well:	MC Federal #62	North Reference:	Grid
Wellbore:	OH - Job #32D0112080	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Survey								
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)	
2,801.0	3 31	220.62	2,799.6	19.9	29.6	56.07	35.7	
2,863.0	3 82	216.70	2,861.4	16.9	27.2	58.14	32.1	
2,925.0	4.30	214.45	2,923.3	13.3	24.7	61.60	28.1	
2,988.0	5 18	213.40	2,986.1	9.0	21.8	67.49	23.6	
3,051.0	5 64	216.52	3,048.8	4.2	18.4	77.24	18.8	
3,112.0	6 23	215.92	3,109.5	-0.9	14.6	93.63	14.7	
3,205.0	6 41	215.44	3,201.9	-9.2	8.7	136.83	12.7	
3,297.0	6 57	216.19	3,293.3	-17.7	2.6	171.68	17.9	
3,390.0	6.55	214.42	3,385.7	-26.3	-3.6	187.68	26.6	
3,484.0	7.10	211.03	3,479.0	-35.7	-9.6	195.00	37.0	
3,576.0	7.46	210.97	3,570.3	-45.7	-15.6	198.81	48.3	
3,669.0	7 16	208.99	3,662.5	-56.0	-21.5	201.01	60.0	
3,763.0	6 93	208.15	3,755.8	-66.1	-27.0	202.23	71.4	
3,857.0	6 64	209.81	3,849.2	-75.8	-32.4	203.13	82.5	
3,950.0	7 16	208.47	3,941.5	-85.6	-37.8	203.84	93.6	
4,042.0	6 14	212.05	4,032.9	-94.8	-43.2	204.48	104.2	
4,136.0	6 26	212.93	4,126.3	-103.4	-48.6	205.19	114.2	
4,229.0	6 54	213.90	4,218.7	-112.0	-54.3	205.88	124.5	
4,322.0	6 83	212.19	4,311.1	-121.1	-60.2	206.45	135.2	
4,417.0	6 80	214.12	4,405.4	-130.5	-66.4	206.96	146.4	
4,511.0	6 25	214.86	4,498.8	-139.3	-72.4	207.47	157.0	
4,605.0	5 90	212.21	4,592.3	-147.6	-77.9	207.84	166.9	
4,698.0	6 58	210.94	4,684.8	-156.2	-83.2	208.05	177.0	
4,791.0	6 27	210.86	4,777.2	-165.2	-88.6	208.21	187.4	
4,885.0	5 71	208.20	4,870.7	-173.7	-93.4	208.27	197.2	
4,979.0	5 25	211.17	4,964.2	-181.5	-97.9	208.33	206.2	
5,073.0	5.26	210.16	5,057.8	-188.9	-102.2	208.43	214.8	
5,167.0	5 38	209.06	5,151.4	-196.5	-106.6	208.47	223.5	
5,259.0	5 82	206.92	5,243.0	-204.4	-110.8	208.45	232.5	
5,352.0	5 45	208.73	5,335.5	-212.5	-115.0	208.43	241.6	
5,446.0	5 72	207.68	5,429.1	-220.5	-119.3	208.42	250.8	
5,540.0	5 23	205.65	5,522.7	-228.5	-123.4	208.36	259.7	
5,634.0	5 75	205.04	5,616.2	-236.7	-127.2	208.26	268.7	
5,728.0	5 26	212.16	5,709.8	-244.6	-131.5	208.26	277.7	
5,820.0	5 18	215.50	5,801.4	-251.5	-136.2	208.43	286.0	
5,914.0	5 25	217.58	5,895.0	-258.4	-141.2	208.66	294.5	
6,008.0	5 48	217.14	5,988.6	-265.4	-146.6	208.91	303.2	
6,101.0	5.10	217.40	6,081.2	-272.2	-151.8	209.14	311.7	
6,195.0	5 22	216.31	6,174.8	-279.0	-156.8	209.34	320.0	
6,287.0	5.33	217.11	6,266.4	-285.8	-161.9	209.53	328.4	
6,380.0	5.46	214.55	6,359.0	-292.8	-167.0	209.70	337.1	
6,474.0	5 68	215.65	6,452.6	-300.3	-172.3	209.84	346.2	
6,567.0	6 24	214.56	6,545.1	-308.2	-177.8	209.98	355.8	
6,661.0	5.59	210.44	6,638.6	-316.4	-183.0	210.05	365.5	
6,754.0	5 69	210.16	6,731.1	-324.3	-187.6	210.06	374.6	



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Site:	MC Federal #62	MD Reference:	RF @ 4033.0usft (JW #4)
Well:	MC Federal #62	North Reference:	Grid
Wellbore:	OH - Job #32D0112080	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Survey								
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)	
6,847.0	5.76	211.11	6,823.7	-332.2	-192.4	210.07	383.9	
6,941.0	5.41	209.62	6,917.2	-340.1	-197.0	210.08	393.1	
7,035.0	5.27	208.89	7,010.8	-347.8	-201.3	210.06	401.8	
7,081.0	5.47	208.88	7,056.6	-351.5	-203.3	210.05	406.1	
Last MWD Survey								
7,130.0	5.47	208.88	7,105.4	-355.6	-205.6	210.03	410.8	
Projection to Bit								

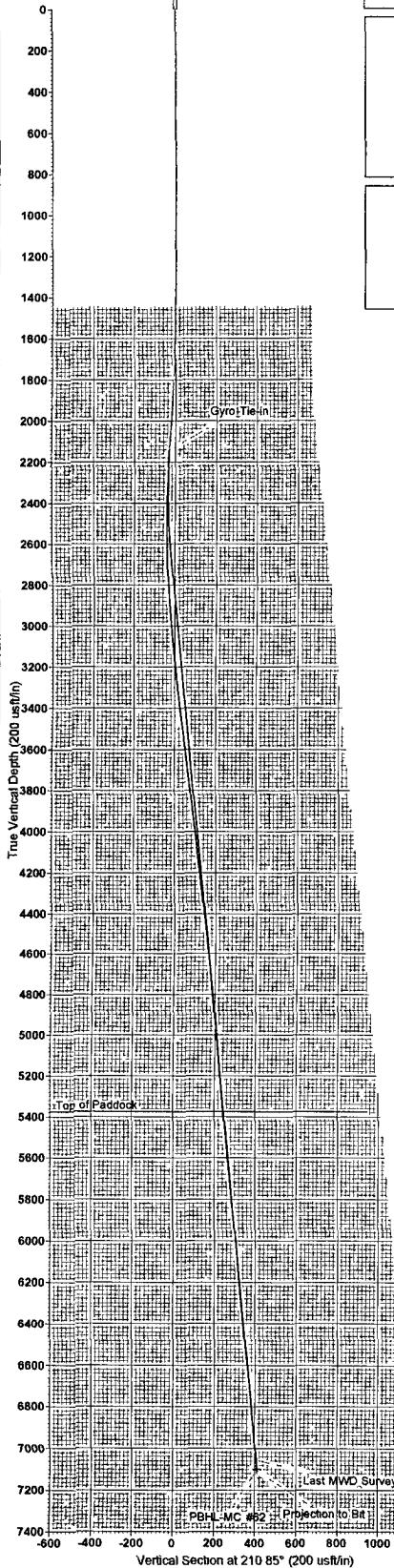
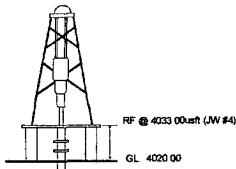
Survey Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		N-S (usft)	E-W (usft)	Comment	
2,145.0	2,144.0	21.2	23.9	Gyro Tie-in	
7,081.0	7,056.6	-351.5	-203.3	Last MWD Survey	
7,130.0	7,105.4	-355.6	-205.6	Projection to Bit	



MC Federal #62
Lea County, NM (NAD27 NME)
Northing (Y) 661858.26
Easting (X) 670690.21
Plan #4 vs Actual - 7-7/8" Hole



Azimuths to Grid North
True North -0.30
Magnetic North 7.37
Magnetic Field
Strength 48869.9nT
Dip Angle 60.69°
Date 2011/12/08
Model IGRF2010
To convert a Magnetic Direction to a Grid Direction Add 7.37°
To convert a True Direction to a Grid Direction Subtract 0.30°



WELL DETAILS- MC Federal #62						
+N-S	+E-W	Northing	Ground Level	4020 00	Latitude	Longitude
0 00	0 00	661858 26	670690 21	32° 48' 5 891 N	103° 46' 39 803 W	Slot

SECTION DETAILS										
Sec	MD	Inc	Azi	TVD	+N-S	+E-W	Diag	TFace	VFace	Target
1	2145 00	2 94	45 58	2143 99	21 24	23 88	0 00	0 00	-30 47	
2	2200 30	2 94	45 58	2188 61	23 30	25 88	0 00	0 00	-33 18	
3	2620 97	5 53	212 51	2619 39	13 59	22 72	2 00	171 24	-23 32	
4	7122 55	5 53	212 51	7100 00	-352 37	-210 48	0 00	0 00	410 45	PBHL-MC #62

DESIGN TARGET DETAILS										
Name	TVD	+N-S	+E-W	Northing	Easting	Latitude	Longitude	Shape		
East HL-MC #62	-1 00	-362 56	-220 51	661495 70	670489 70	32° 48' 2 315 N	103° 46' 42 409 W	Rectangle (Sides L200 00 W0 00)		
- plan misses target center by 2192 71 usf at 2145 00 usf MD (2143 99 TVD, 21 24 N, 23 85 E)										
South HL-MC #62	-1 00	-362 56	-220 51	661495 70	670489 70	32° 48' 2 315 N	103° 46' 42 409 W	Rectangle (Sides L0 00 W200 00)		
- plan misses target center by 2192 71 usf at 2145 00 usf MD (2143 99 TVD, 21 24 N, 23 85 E)										
PBHL-MC #62	7100 00	-352 37	-210 48	661505 89	670479 74	32° 48' 2 415 N	103° 46' 42 291 W	Circle (Radius 10 00)		
- plan hits target center										

FORMATION TOP DETAILS					CASING DETAILS			
TVDPath	MDPath	Formation	DipAngle	DipDir	TVD	MD	Name	Size
5375 00	5369 48	Top of Paddock	0 00		2100 00		8-5/8" Casing	8-5/8"

SITE DETAILS		MC Federal #62	
Site Centre Northing	661858 26	Site Centre Easting	670690 21
Positional Uncertainty	0 00	Convergence	0 30
Local North	Grid		

Map System: US State Plane 1927 (Exact solution)
Datum: NAD 1927 (NADCON CONUS)
Ellipsoid: Clarke 1866
Zone Name: New Mexico East 3001
Local Origin: Well MC Federal #62, Grid North
Latitude: 32° 48' 5 891 N
Longitude: 103° 46' 39 803 W
Grid East: 670690 21
Grid North: 661558 26
Scale Factor: 1 000
Geomagnetic Model: IGRF2010
Sample Date: 05-Dec-11
Magnetic Declination: 7.67°
Dip Angle from Horizontal: 60.69°
Magnetic Field Strength: 48869
To convert a Magnetic Direction to a Grid Direction, Add 7.37°
To convert a Magnetic Direction to a True Direction, Add 7.67° East
To convert a True Direction to a Grid Direction, Subtract 0.30°

PROJECT DETAILS		Lea County, NM (NAD27 NME)	
Geodetic System	US State Plane 1927 (Exact solution)	Datum	NAD 1927 (NADCON CONUS)
Ellipsoid	Clarke 1866	Zone	New Mexico East 3001
System Datum	Mean Sea Level		

