

COG OPERATING LLC

Eddy County, NM (NAN27 NME)

Skelly Unit #660

Skelly Unit #660

OH

Survey: MWD Survey

SDI Standard Survey Report

18 November, 2010

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

Richard

Notorized this date 19th of November, 2010.

Carré Reed

Notary Signature
County of Midland
State of Texas



Scientific Drilling International, Inc.
SDI Standard Survey Report

Company:	COG OPERATING LLC	Local Co-ordinate Reference:	Site Skelly Unit #660
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	KB Elev (12') @ 3926.0usft (Silver Oak #1)
Site:	Skelly Unit #660	MD Reference:	KB Elev (12') @ 3926.0usft (Silver Oak #1)
Well:	Skelly Unit #660	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Project	Eddy County, NM (NAN27 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						Skelly Unit #660					
Site Position:				Northing:		666,299.90 usft		Latitude:		32° 49' 50.710 N	
From:		Map		Easting:		653,070.80 usft		Longitude:		103° 50' 6.020 W	
Position Uncertainty:		0.0 usft		Slot Radius:		0"		Grid Convergence:		0.27 °	

Well	Skelly Unit #660					
Well Position	+N/-S	0.0 usft	Northing:	666,299.90 usft	Latitude:	32° 49' 50.710 N
	+E/-W	0.0 usft	Easting:	653,070.80 usft	Longitude:	103° 50' 6.020 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	3,914.0 usft

Wellbore	OH				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	10/28/2010	7.83	60.72	49,013

Design	Actual			
Audit Notes:				
Version:	1.0	Phase:	ACTUAL	Tie On Depth: 0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.0	0.0	0.0	146.51

Survey Program	Date	11/18/2010			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.0	1,563.0	Gyro Survey (OH)	Keeper	Standard Wireline Keeper ver 1.0.2	
1,677.0	5,754.0	MWD Survey (OH)	MWD	MWD - Standard	

Survey								
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)	
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.0	
100.0	0.32	183.48	100.0	-0.3	0.0	183.48	0.3	
200.0	0.21	169.19	200.0	-0.7	0.0	179.96	0.7	
300.0	0.30	174.79	300.0	-1.2	0.1	177.15	1.2	
400.0	0.34	170.22	400.0	-1.7	0.1	175.61	1.7	
500.0	0.38	168.90	500.0	-2.3	0.2	174.00	2.4	
600.0	0.43	181.78	600.0	-3.0	0.3	174.40	3.1	
700.0	0.46	190.24	700.0	-3.8	0.2	176.76	3.8	
800.0	0.46	186.25	800.0	-4.6	0.1	178.74	4.6	
900.0	0.47	181.20	900.0	-5.4	0.0	179.48	5.4	
1,000.0	0.52	188.66	1,000.0	-6.3	0.0	180.26	6.3	

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Site:	Skelly Unit #660	MD Reference:	KB Elev (12') @ 3926.0usft (Silver Oak #1)
Well:	Skelly Unit #660	North Reference:	Grid
Wellbore:	OH	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	0.14	179.73	1,100.0	-6.9	-0.1	180.80	6.9
1,200.0	0.20	158.95	1,200.0	-7.1	0.0	180.26	7.1
1,300.0	0.22	100.64	1,300.0	-7.3	0.2	178.29	7.3
1,400.0	0.84	32.38	1,400.0	-6.8	0.8	173.24	6.8
1,500.0	1.62	37.89	1,499.9	-5.0	2.1	157.67	5.4
1,563.0	2.21	35.64	1,562.9	-3.3	3.3	135.10	4.7

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Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	KB Elev (12') @ 3926.0usft (Silver Oak #1)
Site:	Skelly Unit #660	MD Reference:	KB Elev (12') @ 3926.0usft (Silver Oak #1)
Well:	Skelly Unit #660	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Project	Eddy County, NM (NAN27 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	Skelly Unit #660		
Site Position:		Northing:	666,299.90 usft
From:	Map	Easting:	653,070.80 usft
Position Uncertainty:	0.0 usft	Slot Radius:	0"
		Latitude:	32° 49' 50.710 N
		Longitude:	103° 50' 6.020 W
		Grid Convergence:	0.27 °

Well	Skelly Unit #660		
Well Position	+N/-S	0.0 usft	Northing: 666,299.90 usft
	+E/-W	0.0 usft	Easting: 653,070.80 usft
Position Uncertainty	0.0 usft	Wellhead Elevation:	usft
		Latitude:	32° 49' 50.710 N
		Longitude:	103° 50' 6.020 W
		Ground Level:	3,914.0 usft

Wellbore	OH		
Magnetics	Model Name	Sample Date	Declination
			(°)
	IGRF2010	10/28/2010	7.83
			Dip Angle
			(°)
			60.72
			Field Strength
			(nT)
			49,013

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	
		(°)	146.51

Survey Program	Date	11/18/2010		
From	To	Survey (Wellbore)	Tool Name	Description
(usft)	(usft)			
100.0	1,563.0	Gyro Survey (OH)	Keeper	Standard Wireline Keeper ver 1.0.2
1,677.0	5,687.0	MWD Survey (OH)	MWD	MWD - Standard

Survey							
Measured Depth	Inclination	Azimuth	True Vertical	North/South	East/West	Closure Azimuth	Closure Distance
(usft)	(°)	(°)	Depth	(usft)	(usft)	(°)	(usft)
1,563.0	2.21	35.64	1,562.9	-3.3	3.3	135.10	4.7
1,677.0	2.51	40.28	1,676.8	0.4	6.2	86.65	6.2
1,771.0	2.81	48.78	1,770.7	3.5	9.3	69.58	9.9
1,866.0	2.45	48.59	1,865.6	6.3	12.5	63.23	14.1
1,929.0	2.37	70.70	1,928.6	7.7	14.8	62.64	16.6
1,993.0	2.48	111.19	1,992.5	7.6	17.3	66.35	18.9
2,055.0	3.45	132.67	2,054.4	5.8	20.0	73.69	20.8
2,117.0	4.81	139.48	2,116.3	2.6	23.0	83.56	23.2
2,179.0	5.45	155.97	2,178.0	-2.1	25.9	94.56	26.0
2,273.0	5.88	159.88	2,271.6	-10.7	29.4	109.96	31.2
2,367.0	5.56	158.70	2,365.1	-19.4	32.7	120.73	38.0

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Site:	Skelly Unit #660	MD Reference:	KB Elev (12') @ 3926.0usft (Silver Oak #1)
Well:	Skelly Unit #660	North Reference:	Grid
Wellbore:	OH	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)
2,461.0	5.22	162.34	2,458.7	-27.7	35.6	127.91	45.2
2,524.0	5.39	150.77	2,521.4	-33.1	37.9	131.06	50.3
2,618.0	5.50	149.54	2,615.0	-40.8	42.4	133.90	58.8
2,712.0	4.67	154.43	2,708.6	-48.1	46.3	136.10	66.8
2,774.0	5.24	148.29	2,770.4	-52.8	48.9	137.20	72.0
2,868.0	5.06	150.70	2,864.0	-60.1	53.2	138.48	80.2
2,931.0	6.16	150.29	2,926.7	-65.4	56.2	139.33	86.3
3,025.0	5.97	151.13	3,020.2	-74.1	61.1	140.50	96.0
3,119.0	5.30	150.81	3,113.7	-82.2	65.6	141.42	105.1
3,182.0	6.38	150.65	3,176.4	-87.8	68.7	141.95	111.5
3,276.0	6.72	152.29	3,269.8	-97.2	73.8	142.78	122.0
3,370.0	6.44	154.16	3,363.2	-106.8	78.7	143.63	132.6
3,464.0	6.47	154.15	3,456.6	-116.3	83.3	144.40	143.0
3,527.0	6.63	143.62	3,519.2	-122.4	87.0	144.61	150.2
3,621.0	6.77	144.64	3,612.5	-131.3	93.4	144.58	161.2
3,715.0	6.37	145.36	3,705.9	-140.1	99.6	144.60	171.9
3,809.0	5.82	140.63	3,799.4	-148.1	105.6	144.52	181.9
3,903.0	5.93	137.68	3,892.9	-155.4	111.9	144.25	191.5
3,997.0	5.88	138.53	3,986.4	-162.6	118.3	143.96	201.1
4,091.0	6.15	136.81	4,079.9	-169.9	124.9	143.66	210.9
4,153.0	5.85	146.64	4,141.5	-174.9	129.0	143.60	217.3
4,247.0	5.74	146.05	4,235.0	-182.8	134.2	143.72	226.8
4,341.0	5.81	148.80	4,328.6	-190.8	139.3	143.86	236.2
4,435.0	5.70	147.60	4,422.1	-198.8	144.3	144.03	245.6
4,530.0	5.76	145.24	4,516.6	-206.7	149.5	144.12	255.1
4,592.0	5.79	154.96	4,578.3	-212.1	152.6	144.26	261.3
4,686.0	5.93	157.90	4,671.8	-220.9	156.4	144.69	270.7
4,780.0	5.87	157.22	4,765.3	-229.8	160.1	145.13	280.1
4,874.0	5.84	156.36	4,858.8	-238.6	163.9	145.51	289.5
4,937.0	5.88	155.19	4,921.5	-244.5	166.6	145.74	295.8
5,000.0	4.42	149.77	4,984.2	-249.5	169.1	145.87	301.4
5,062.0	3.03	146.85	5,046.1	-253.0	171.2	145.91	305.5
5,125.0	2.54	147.32	5,109.0	-255.5	172.9	145.92	308.5
5,187.0	2.64	144.62	5,171.0	-257.8	174.5	145.92	311.3
5,250.0	1.48	156.91	5,233.9	-259.8	175.6	145.94	313.6
5,312.0	0.77	209.57	5,295.9	-260.9	175.7	146.03	314.5
5,375.0	0.48	241.47	5,358.9	-261.4	175.3	146.15	314.7
5,468.0	0.53	232.56	5,451.9	-261.8	174.6	146.30	314.7
5,593.0	0.44	242.63	5,576.9	-262.4	173.7	146.49	314.7
5,687.0	0.42	221.09	5,670.9	-262.8	173.2	146.62	314.7

Scientific Drilling International, Inc.
SDI Standard Survey Report

Company:	COG OPERATING LLC	Local Co-ordinate Reference:	Site Skelly Unit #660
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	KB Elev (12') @ 3926.0usft (Silver Oak #1)
Site:	Skelly Unit #660	MD Reference:	KB Elev (12') @ 3926.0usft (Silver Oak #1)
Well:	Skelly Unit #660	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Survey Annotations

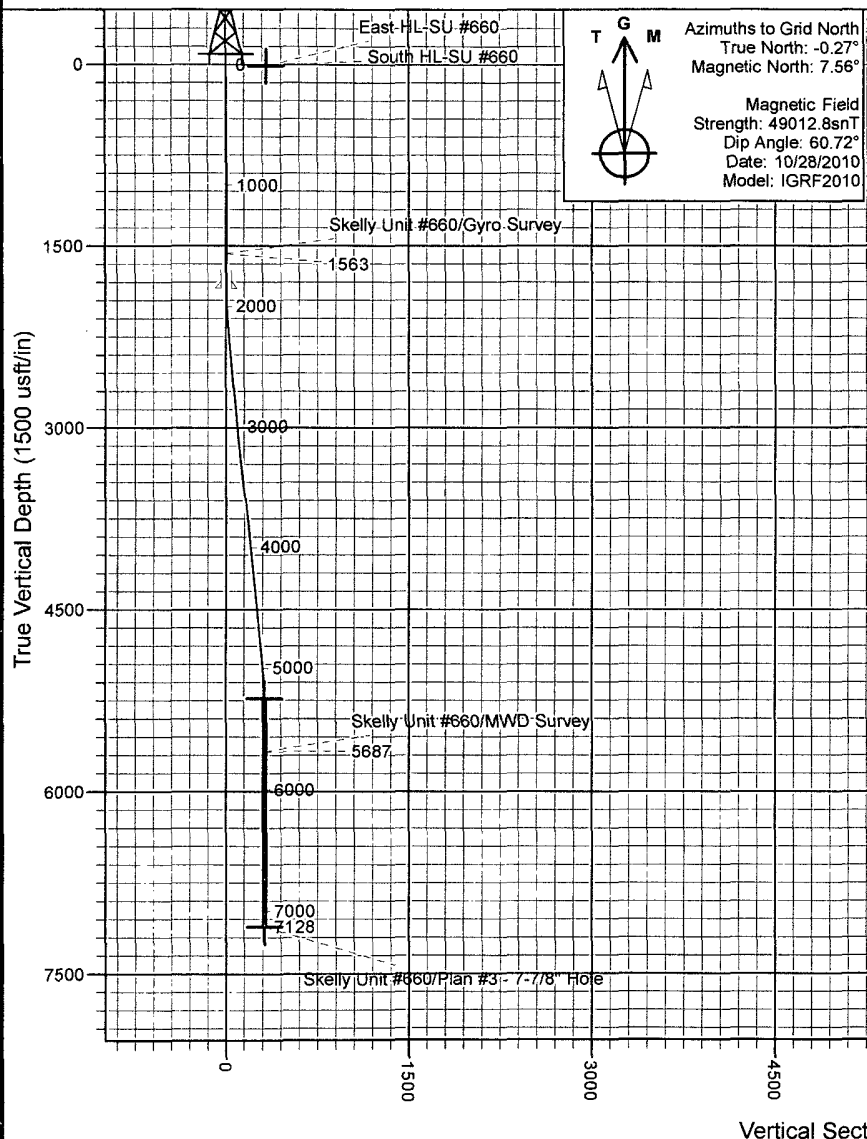
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,563.0	1,562.9	-3.3	3.3	Gyro Tie-in
5,687.0	5,670.9	-262.8	173.2	Last MWD Survey
5,754.0	5,737.9	-263.2	172.9	Projection to Bit

Checked By: _____ Approved By: _____ Date: _____



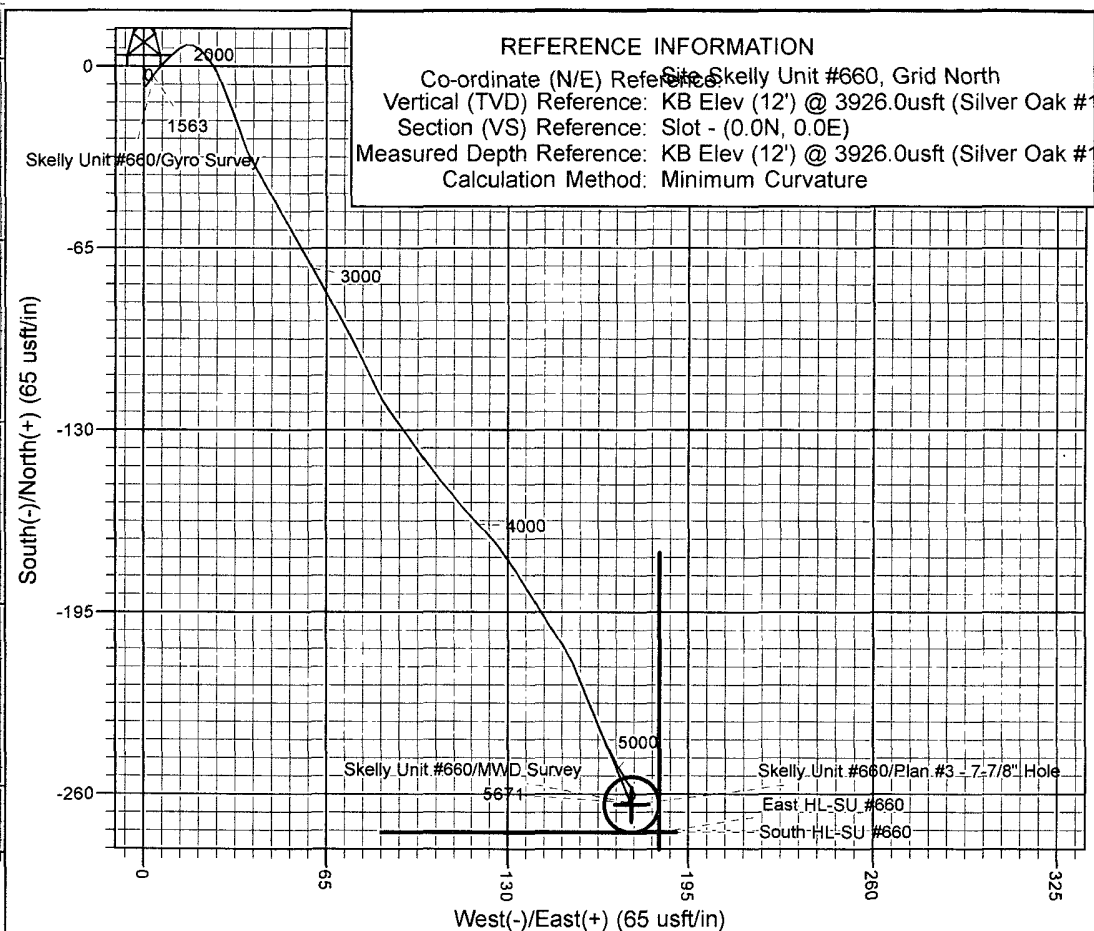
Scientific Drilling
Directional Drilling Operations

Project: Eddy County, NM (NAN27 NME)
Site: Skelly Unit #660
Well: Skelly Unit #660
Wellbore: OH
Design: Plan #3 - 7-7/8" Hole



WELL DETAILS: Skelly Unit #660
KB Elev (12') @ 3926.0usft (Silver Oak #1)
Ground Level: 3914.0
Easting: 653070.80
Latitude: 32° 49' 50.710 N
Longitude: 103° 50' 6.020 W
Slot

+N/-S +E/-W Northing Easting Latitude Longitude Slot
0.0 0.0 666299.90 653070.80 32° 49' 50.710 N 103° 50' 6.020 W



COMPANY DETAILS: COG OPERATING LLC
223032

Calculation Method: Minimum Curvature
Error System: ISCWSA
Scan Method: Closest Approach 3D
Error Surface: Elliptical Conic
Warning Method: Error Ratio

PROJECT DETAILS: Eddy County, NM (NAN27 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

SITE DETAILS: Skelly Unit #660
Site Centre Latitude: 32° 49' 50.710 N
Longitude: 103° 50' 6.020 W
Positional Uncertainty: 0.0
Convergence: 0.27
Local North: Grid