

30-015-39575

COG OPERATING

Grayburg Jackson

Eddy County, NM

Burch Keely Unit 18 Federal #6H

VH - Job #32K0112015

Survey: Gyro

SDI Standard Survey Report

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

Fluorhart

Notarized this date 17th of February, 2012.

Carrie Reed

Notary Signature
County of Midland
State of Texas



Scientific Drilling International, Inc.

SDI Standard Survey Report



Company:	COG OPERATING	Local Co-ordinate Reference:	Well Burch Keely Unit 18 Federal #6H
Project:	Grayburg Jackson	TVD Reference:	WELL @ 0.0usft (Original Well Elev)
Site:	Eddy County, NM	MD Reference:	WELL @ 0.0usft (Original Well Elev)
Well:	Burch Keely Unit 18 Federal #6H	North Reference:	Grid
Wellbore:	VH - Job #32K0112015	Survey Calculation Method:	Minimum Curvature
Design:	VH - Job #32K0112015	Database:	EDM-Regulatory

Project	Grayburg Jackson		
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	Eddy County, NM		
Site Position:	Northing:	665,097.06 usft	Latitude: 32° 49' 40.800 N
From: Lat/Long	Easting:	601,778.12 usft	Longitude: 104° 0' 7.200 W
Position Uncertainty: 0.0 usft	Slot Radius: 0"	Grid Convergence:	0.18 °

Well	Burch Keely Unit 18 Federal #6H, Directional (Crestor)		
Well Position	+N/-S 0.0 usft	Northing: 666,427.67 usft	Latitude: 32° 49' 54.116 N
	+E/-W 0.0 usft	Easting: 596,834.37 usft	Longitude: 104° 1' 5.092 W
Position Uncertainty 0.0 usft	Wellhead Elevation:	usft	Ground Level: 0.0 usft

Wellbore	VH - Job #32K0112015				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	1/1/2012	7 77	60 66	48,904

Design		VH - Job #32K0112015		
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	89 78

Survey Program		Date 2/15/2012		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
100 0	4,100 0	Gyro (VH - Job #32K0112015)	Keeper	Keeper Gyro

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 19	50 07	100 0	0 1	0 1	50 07	0 2
200 0	0 67	42 61	200 0	0 6	0 7	45 31	0 9
300 0	1 09	33 42	300 0	1 9	1 6	40 05	2 4
400 0	1 20	35 29	400 0	3 5	2 7	37 51	4 4
500 0	1 03	41 76	499 9	5 0	3 9	37 74	6 4
600 0	1 04	37 04	599 9	6 4	5 0	38 11	8 2
700 0	1 49	35 06	699 9	8 2	6 3	37 63	10 4
800 0	1 69	40 78	799 9	10 4	8 1	37 73	13 2
900 0	1 80	46 48	899 8	12 6	10 2	38 85	16 2
1,000 0	1 69	44 67	999 8	14 7	12 3	39 92	19 2
1,100 0	1 60	44 76	1,099 7	16 8	14 3	40 54	22 1

Scientific Drilling International, Inc.

SDI Standard Survey Report



Company:	COG OPERATING	Local Co-ordinate Reference:	Well Burch Keely Unit 18 Federal #6H
Project:	Grayburg Jackson	TVD Reference:	WELL @ 0.0usft (Original Well Elev)
Site:	Eddy County, NM	MD Reference:	WELL @ 0.0usft (Original Well Elev)
Well:	Burch Keely Unit 18 Federal #6H	North Reference:	Grid
Wellbore:	VH - Job #32K0112015	Survey Calculation Method:	Minimum Curvature
Design:	VH - Job #32K0112015	Database:	EDM-Regulatory

Survey								
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)	
1,200.0	0.97	50.53	1,199.7	18.3	16.0	41.13	24.3	
1,300.0	1.00	42.21	1,299.7	19.5	17.2	41.47	26.0	
1,400.0	0.92	50.09	1,399.7	20.6	18.4	41.74	27.7	
1,500.0	0.70	54.16	1,499.7	21.5	19.5	42.23	29.1	
1,600.0	0.58	53.52	1,599.7	22.2	20.4	42.66	30.2	
1,700.0	0.59	48.93	1,699.7	22.8	21.2	42.94	31.2	
1,800.0	0.66	43.40	1,799.7	23.6	22.0	43.04	32.3	
1,900.0	0.66	49.19	1,899.6	24.4	22.9	43.16	33.4	
2,000.0	0.38	51.00	1,999.6	25.0	23.5	43.33	34.3	
2,100.0	0.31	66.93	2,099.6	25.3	24.1	43.58	34.9	
2,200.0	0.27	37.87	2,199.6	25.6	24.4	43.72	35.4	
2,300.0	0.26	42.09	2,299.6	25.9	24.7	43.67	35.8	
2,400.0	0.14	61.97	2,399.6	26.1	25.0	43.72	36.2	
2,500.0	0.07	53.92	2,499.6	26.2	25.2	43.80	36.3	
2,600.0	0.27	39.26	2,599.6	26.5	25.4	43.79	36.6	
2,700.0	0.13	54.27	2,699.6	26.7	25.6	43.79	37.0	
2,800.0	0.23	47.14	2,799.6	26.9	25.8	43.84	37.3	
2,900.0	0.38	46.05	2,899.6	27.3	26.2	43.88	37.8	
3,000.0	0.31	54.34	2,999.6	27.7	26.7	43.97	38.4	
3,100.0	0.22	53.44	3,099.6	27.9	27.1	44.09	38.9	
3,200.0	0.05	55.25	3,199.6	28.1	27.2	44.14	39.1	
3,300.0	0.25	31.89	3,299.6	28.3	27.4	44.09	39.4	
3,400.0	0.41	10.15	3,399.6	28.8	27.6	43.74	39.9	
3,500.0	0.30	27.14	3,499.6	29.4	27.8	43.35	40.4	
3,600.0	0.50	356.28	3,599.6	30.1	27.8	42.80	41.0	
3,700.0	0.49	2.26	3,699.6	30.9	27.8	41.98	41.6	
3,800.0	0.37	16.24	3,799.6	31.7	27.9	41.42	42.2	
3,900.0	0.32	24.45	3,899.6	32.2	28.1	41.13	42.8	
4,000.0	0.44	12.88	3,999.6	32.9	28.4	40.78	43.4	
4,100.0	0.53	15.26	4,099.6	33.7	28.6	40.29	44.2	



Scientific Drilling
Directional Drilling Operations

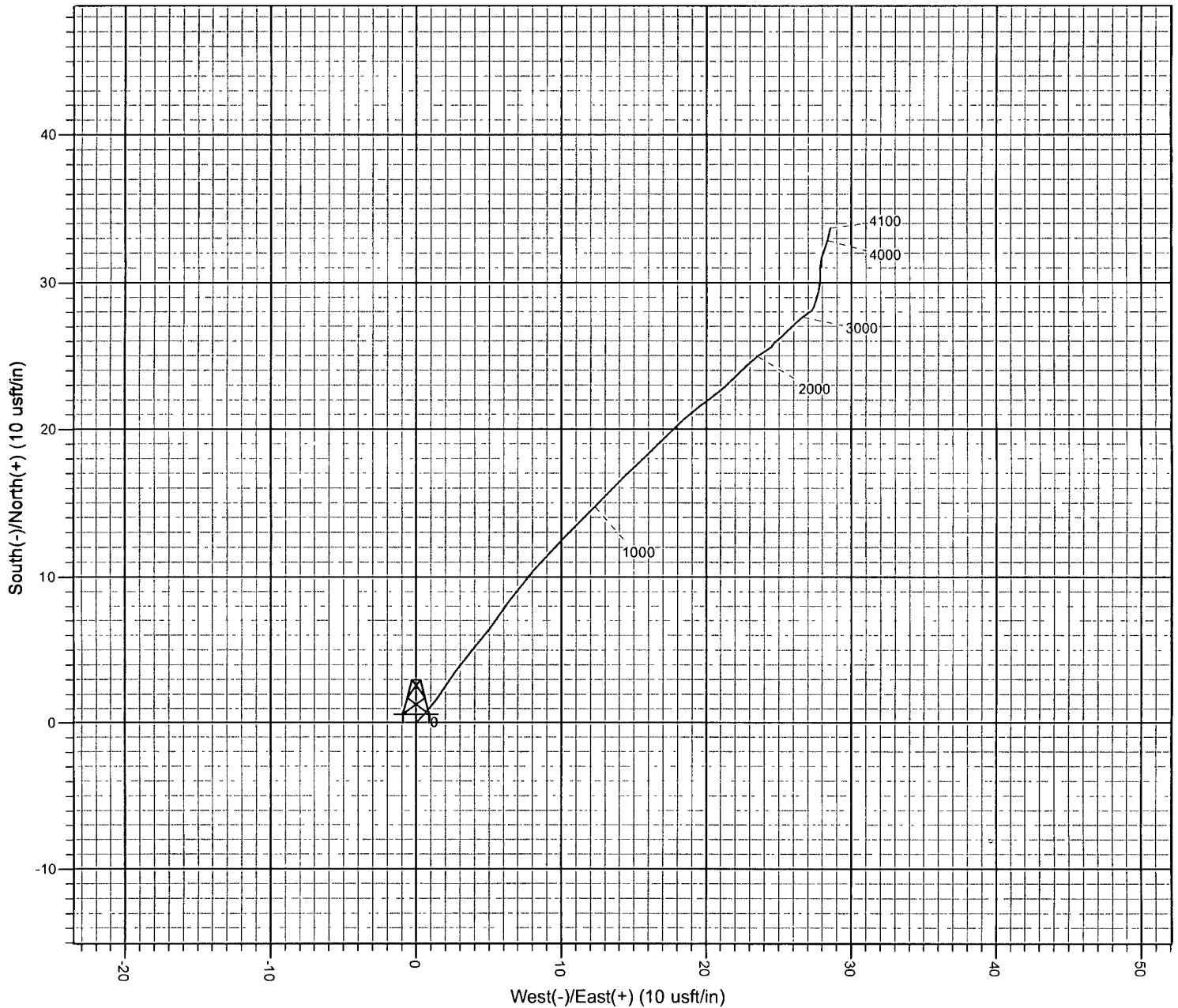
Project: Grayburg Jackson
Eddy County, NM
Well: Burch Keely Unit 18 Federal #6H
Wellbore: VH - Job #32K0112015
Design: VH - Job #32K0112015



Azimuths to Grid North
True North -0 17°
Magnetic North 7 60°
Magnetic Field
Strength 48903 7snT
Dip Angle: 60 66°
Date 1/1/2012
Model IGRF2010

WELL DETAILS: Burch Keely Unit 18 Federal #6H
WELL @ 0.0usft (Original Well Elev)
Ground Level: 0.0

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	666427.67	596834.37	32° 49' 54 116 N	104° 1' 5.092 W	



PROJECT DETAILS: Grayburg Jackson
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: Eddy County, NM
Site Centre Latitude: 32° 49' 40.800 N
Longitude: 104° 0' 7.200 W
Positional Uncertainty: 0.0
Convergence: 0.18
Local North: Grid

COG Operating LLC

Eddy County, NM

Burch Keely Unit 18 Federal 6H

Burch Keely Unit 18 Federal 6H

Wellbore #1

Survey: MWD Surveys

Standard Survey Report

17 January, 2012

Crescent Directional Drilling

Survey Report

Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Burch Keely Unit 18 Federal 6H
Project:	Eddy County, NM	TVD Reference:	WELL @ 3650 00ft (Silver Oak #8)
Site:	Burch Keely Unit 18 Federal 6H	MD Reference:	WELL @ 3650 00ft (Silver Oak #8)
Well:	Burch Keely Unit 18 Federal 6H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass R5000 DB Server

Project:	Eddy County, NM		
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:	Burch Keely Unit 18 Federal 6H			
Site Position:		Northing:	666,427 60 ft	Latitude: 32° 49' 54 10 N
From:	Map	Easting:	596,834 40 ft	Longitude: 104° 1' 5 11 W
Position Uncertainty:	0 00 ft	Slot Radius:	13 200 in	Grid Convergence: 0 17 °

Well:	Burch Keely Unit 18 Federal 6H			
Well Position	+N/-S	0 00 ft	Northing:	666,427 60 ft
	+E/-W	0 00 ft	Easting:	596,834 40 ft
Position Uncertainty		0 00 ft	Wellhead Elevation:	ft
			Ground Level:	3,633 00 ft

Wellbore:	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination	Dip Angle	Field Strength
			(°)	(°)	(nT)
	IGRF2010	12/14/2011	7 78	60 66	48,881

Design:	Wellbore #1			
Audit Notes:				
Version:	1 0	Phase:	ACTUAL	Tie On Depth: 0 00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction
	(ft)	(ft)	(ft)	(°)
	0.00	0 00	0 00	89 15

Survey Program	Date: 1/17/2012			
From	To	Survey (Wellbore)	Tool Name	Description
(ft)	(ft)			
100 00	4,100 00	Gyro Surveys (Wellbore #1)	Good__mag	Good Magnetic
4,100 00	9,130 00	MWD Surveys (Wellbore #1)	Good__mag	Good Magnetic

Survey										
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Vertical	Dogleg	Build	Turn	
Depth	(°)	(°)	Depth	(ft)	(ft)	Section	Rate	Rate	Rate	
(ft)			(ft)			(ft)	(°/100ft)	(°/100ft)	(°/100ft)	
4,100 00	0 53	15 26	4,099 61	33.69	28 56	29 05	0 00	0 00	0 00	
4,289 00	0 50	335 60	4,288 60	35 28	28 45	28 97	0 19	-0 02	-20 98	
4,321 00	1.00	37 00	4,320.60	35 63	28 56	29 08	2 74	1 56	191 88	
4,352 00	3 30	51 90	4,351 58	36 40	29 42	29.96	7 57	7 42	48 06	
4,383 00	6 20	58 70	4,382 47	37 82	31 56	32 11	9 51	9 35	21 94	
4,414 00	9 20	63 40	4,413 18	39 80	35.20	35 79	9 88	9 68	15 16	
4,445 00	12.30	64 80	4,443 64	42 31	40 41	41 03	10 03	10.00	4 52	
4,477 00	15 60	64 30	4,474.69	45.63	47 37	48 04	10.32	10.31	-1 56	
4,508 00	18 90	64 70	4,504 29	49 59	55 67	56 40	10 65	10 65	1 29	
4,539 00	22 00	65 40	4,533 33	54 15	65 49	66 29	10 03	10 00	2 26	

Crescent Directional Drilling

Survey Report

Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Burch Keely Unit 18 Federal 6H
Project:	Eddy County, NM	TVD Reference:	WELL @ 3650 00ft (Silver Oak #8)
Site:	Burch Keely Unit 18 Federal 6H	MD Reference:	WELL @ 3650 00ft (Silver Oak #8)
Well:	Burch Keely Unit 18 Federal 6H	North Reference:	Grd
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass R5000 DB Server

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
4,570.00	25.30	66.30	4,561.72	59.23	76.84	77.71	10.71	10.65	2.90
4,602.00	28.20	67.60	4,590.30	64.86	90.09	91.04	9.24	9.06	4.06
4,633.00	31.10	71.10	4,617.24	70.25	104.44	105.47	10.89	9.35	11.29
4,664.00	33.90	75.00	4,643.38	75.08	120.37	121.47	11.28	9.03	12.58
4,695.00	37.00	75.90	4,668.63	79.59	137.77	138.94	10.14	10.00	2.90
4,726.00	40.60	77.00	4,692.79	84.13	156.66	157.89	11.82	11.61	3.55
4,757.00	44.80	77.90	4,715.57	88.70	177.17	178.47	13.69	13.55	2.90
4,788.00	48.80	77.40	4,736.78	93.53	199.24	200.61	12.96	12.90	-1.61
4,820.00	53.10	77.50	4,756.94	98.93	223.49	224.94	13.44	13.44	0.31
4,851.00	57.40	78.20	4,774.60	104.28	248.39	249.91	13.99	13.87	2.26
4,882.00	61.60	79.40	4,790.33	109.47	274.59	276.18	13.95	13.55	3.87
4,913.00	65.50	80.90	4,804.14	114.21	301.93	303.59	13.31	12.58	4.84
4,944.00	68.70	82.70	4,816.20	118.27	330.19	331.91	11.63	10.32	5.81
4,975.00	72.00	84.90	4,826.63	121.42	359.21	360.97	12.57	10.65	7.10
5,006.00	75.40	86.40	4,835.33	123.67	388.87	390.66	11.91	10.97	4.84
5,038.00	79.30	88.10	4,842.33	125.17	420.05	421.86	13.24	12.19	5.31
5,069.00	83.20	89.80	4,847.05	125.73	450.68	452.49	13.70	12.58	5.48
5,100.00	87.40	91.50	4,849.59	125.37	481.56	483.37	14.61	13.55	5.48
5,194.00	91.10	92.10	4,850.82	122.42	575.49	577.24	3.99	3.94	0.64
5,287.00	92.50	91.10	4,847.90	119.83	668.41	670.11	1.85	1.51	-1.08
5,381.00	92.50	92.60	4,843.80	116.79	762.26	763.91	1.59	0.00	1.60
5,476.00	91.50	93.90	4,840.48	111.41	857.05	858.61	1.73	-1.05	1.37
5,568.00	90.00	93.30	4,839.28	105.64	948.86	950.32	1.76	-1.63	-0.65
5,662.00	90.90	93.00	4,838.54	100.47	1,042.71	1,044.09	1.01	0.96	-0.32
5,755.00	89.40	92.50	4,838.30	96.01	1,135.60	1,136.90	1.70	-1.61	-0.54
5,848.00	88.80	93.00	4,839.76	91.55	1,228.48	1,229.70	0.84	-0.65	0.54
5,942.00	90.00	93.20	4,840.74	86.46	1,322.34	1,323.47	1.29	1.28	0.21
6,036.00	89.30	93.00	4,841.31	81.38	1,416.20	1,417.25	0.77	-0.74	-0.21
6,129.00	90.20	92.80	4,841.72	76.68	1,509.08	1,510.05	0.99	0.97	-0.22
6,223.00	90.30	92.60	4,841.31	72.25	1,602.97	1,603.87	0.24	0.11	-0.21
6,316.00	90.20	93.00	4,840.90	67.71	1,695.86	1,696.68	0.44	-0.11	0.43
6,410.00	90.00	91.90	4,840.74	63.69	1,789.77	1,790.52	1.19	-0.21	-1.17
6,503.00	88.60	90.60	4,841.88	61.66	1,882.74	1,883.45	2.05	-1.51	-1.40
6,597.00	88.90	90.20	4,843.93	61.00	1,976.71	1,977.40	0.53	0.32	-0.43
6,691.00	88.70	88.40	4,845.90	62.15	2,070.68	2,071.38	1.93	-0.21	-1.91
6,784.00	89.40	87.80	4,847.44	65.23	2,163.62	2,164.35	0.99	0.75	-0.65
6,878.00	89.60	86.60	4,848.26	69.83	2,257.50	2,258.29	1.29	0.21	-1.28
6,972.00	89.80	86.50	4,848.75	75.48	2,351.33	2,352.19	0.24	0.21	-0.11
7,066.00	89.60	88.10	4,849.24	79.91	2,445.22	2,446.14	1.72	-0.21	1.70
7,160.00	89.90	89.30	4,849.65	82.04	2,539.19	2,540.13	1.32	0.32	1.28
7,254.00	90.90	88.70	4,849.00	83.68	2,633.17	2,634.13	1.24	1.06	-0.64
7,347.00	91.20	89.70	4,847.29	84.98	2,726.15	2,727.11	1.12	0.32	1.08
7,441.00	90.70	89.70	4,845.73	85.47	2,820.13	2,821.09	0.53	-0.53	0.00

Crescent Directional Drilling Survey Report

Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Burch Keely Unit 18 Federal 6H
Project:	Eddy County, NM	TVD Reference:	WELL @ 3650 00ft (Silver Oak #8)
Site:	Burch Keely Unit 18 Federal 6H	MD Reference:	WELL @ 3650 00ft (Silver Oak #8)
Well:	Burch Keely Unit 18 Federal 6H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass R5000 DB Server

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
7,535 00	90 00	89.90	4,845 16	85 80	2,914 13	2,915 08	0 77	-0 74	0 21
7,628 00	89.70	90 80	4,845 40	85 23	3,007 13	3,008 06	1 02	-0 32	0 97
7,722 00	91 00	90 30	4,844 83	84 33	3,101.12	3,102 03	1 48	1 38	-0 53
7,815 00	91.00	89 50	4,843 21	84 49	3,194.10	3,195 01	0 86	0 00	-0 86
7,909 00	90.30	90 10	4,842 14	84 82	3,288.10	3,288 99	0 98	-0 74	0 64
8,003 00	88 50	90 10	4,843 12	84 66	3,382 09	3,382 97	1 91	-1 91	0 00
8,096 00	88 00	89 60	4,845 96	84 90	3,475 04	3,475 92	0 76	-0 54	-0 54
8,190 00	87 40	89 70	4,849 74	85 47	3,568 96	3,569 84	0 65	-0 64	0 11
8,282 00	86 90	89.30	4,854 31	86 28	3,660 85	3,661 72	0 70	-0 54	-0 43
8,377 00	86 50	89 20	4,859 78	87 52	3,755 68	3,756 57	0 43	-0.42	-0.11
8,472 00	86 80	89 90	4,865 33	88 26	3,850 52	3,851 40	0 80	0 32	0 74
8,568 00	87 50	90 50	4,870 10	87 93	3,946 39	3,947 26	0 96	0 73	0 63
8,663 00	89 00	90 90	4,873 00	86 77	4,041.34	4,042 18	1 63	1 58	0 42
8,758 00	90 00	91 20	4,873 83	85 03	4,136 32	4,137 13	1 10	1 05	0 32
8,852 00	91 10	91 50	4,872 93	82 81	4,230 29	4,231 05	1 21	1 17	0 32
8,946 00	92 00	91 90	4,870 39	80 02	4,324 21	4,324 92	1 05	0 96	0 43
9,073 00	93 60	91 60	4,864 19	76 15	4,451 00	4,451 64	1 28	1 26	-0 24
Last Survey @ 9073.00 MD, 4864.18 TVD, 93.60 INC, 91.60 AZ.									
9,130 00	93.60	91 60	4,860 61	74.56	4,507 86	4,508 47	0 00	0 00	0 00
Straight line Projection to TD @ 9130.00' MD, 4860.61' TVD.									

Survey Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
9,073 00	4,864 19	76 15	4,451 00	Last Survey @ 9073 00 MD, 4864 18 TVD, 93 60 INC, 91 60 AZ
9,130.00	4,860.61	74 56	4,507 86	Straight line Projection to TD @ 9130 00' MD, 4860.61' TVD

Checked By _____ Approved By: _____ Date: _____