



COG Operating LLC

Lea County, NM (NAD-27 2015)

Branex-COG Federal Com #15H

API #: 30-025-42906

SHL: 2310' FSL, 150' FWL, Sec 9, T17S, R32E, Unit L

PP: 2268' FSL, 330' FWL, Sec 9, T17S, R32E, Unit L

BHL: 2287' FSL, 351' FEL, Sec 9, T17S, R32E, Unit I

Design: BHL: 2292' FSL, 350' FEL, Sec 9, T17S, R32E, Unit I

Standard Survey Report

22 September, 2016

HOBBS OCD

DEC 12 2016

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TDS
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Branex-COG Federal Com #15H
Project:	Lea County, NM (NAD-27 2015)	TVD Reference:	KB @ 4085.00usft (Patriot 6)
Site:	Branex-COG Federal Com #15H	MD Reference:	KB @ 4085.00usft (Patriot 6)
Well:	SHL: 2310' FSL, 150' FWL, Sec 9, T17S, R32E, Unit L	North Reference:	Grid
Wellbore:	BHL: 2292' FSL, 350' FEL, Sec 9, T17S, R32E, Unit I	Survey Calculation Method:	Minimum Curvature
Design:	BHL: 2292' FSL, 350' FEL, Sec 9, T17S, R32E, Unit I	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		Branex-COG Federal Com #15H			
Site Position:		Northing:	672,710.00 usft	Latitude:	32° 50' 53.293 N
From:	Map	Easting:	670,220.40 usft	Longitude:	103° 46' 44.641 W
Position Uncertainty:	0.00 usft	Slot Radius:	13.20 in	Grid Convergence:	0.30 °

Well	SHL: 2310' FSL, 150' FWL, Sec 9, T17S, R32E, Unit L					
Well Position	+N/-S	0.00 usft	Northing:	672,710.00 usft	Latitude:	32° 50' 53.293 N
	+E/-W	0.00 usft	Easting:	670,220.40 usft	Longitude:	103° 46' 44.641 W
Position Uncertainty		0.00 usft	Wellhead Elevation:	0.00 usft	Ground Level:	4,067.00 usft

Wellbore	BHL: 2292' FSL, 350' FEL, Sec 9, T17S, R32E, Unit I				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	8/22/2016	7.19	60.61	48,366

Design		BHL: 2292' FSL, 350' FEL, Sec 9, T17S, R32E, Unit I			
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	90.05	

Survey Program	Date	9/22/2016			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	2,115.00	VES Gyro #1 (BHL: 2292' FSL, 350' FEL,	VES-ISCWSA-GYRO-3	Biaxial Semi-Cont. Gyro	
2,193.00	10,343.00	TDS MWD #2 (BHL: 2292' FSL, 350' FEL,	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	
100.00	0.34	231.74	100.00	-0.18	-0.23	-0.23	0.34	0.34	0.00	
200.00	0.20	18.46	200.00	-0.20	-0.41	-0.41	0.52	-0.14	146.72	
300.00	0.11	343.74	300.00	0.06	-0.38	-0.38	0.13	-0.09	-34.72	
400.00	0.39	306.03	400.00	0.35	-0.68	-0.68	0.31	0.28	-37.71	
500.00	0.66	8.71	499.99	1.12	-0.87	-0.87	0.59	0.27	62.68	
600.00	0.46	16.58	599.99	2.07	-0.67	-0.67	0.21	-0.20	7.87	



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Design:	BHL: 2292' FSL, 350' FEL, Sec 9, T17S, R32E, Unit I	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)
700.00	0.33	350.07	699.99	2.74	-0.61	-0.61	0.22	-0.13	-26.51
800.00	0.70	314.41	799.98	3.45	-1.09	-1.09	0.47	0.37	-35.66
900.00	0.53	311.45	899.98	4.18	-1.87	-1.88	0.17	-0.17	-2.96
1,000.00	0.96	275.21	999.97	4.57	-3.06	-3.06	0.62	0.43	-36.24
1,100.00	0.67	259.85	1,099.96	4.54	-4.47	-4.47	0.36	-0.29	-15.36
1,200.00	0.82	292.38	1,199.95	4.71	-5.70	-5.71	0.44	0.15	32.53
1,300.00	1.01	283.46	1,299.94	5.19	-7.22	-7.23	0.24	0.19	-8.92
1,400.00	0.84	258.22	1,399.93	5.24	-8.80	-8.80	0.44	-0.17	-25.24
1,500.00	0.86	268.31	1,499.91	5.07	-10.26	-10.27	0.15	0.02	10.09
1,600.00	0.70	259.76	1,599.91	4.94	-11.62	-11.62	0.20	-0.16	-8.55
1,700.00	0.61	277.23	1,699.90	4.90	-12.74	-12.75	0.22	-0.09	17.47
1,800.00	0.88	308.98	1,799.89	5.45	-13.87	-13.87	0.48	0.27	31.75
1,900.00	0.72	313.60	1,899.88	6.36	-14.92	-14.93	0.17	-0.16	4.62
2,000.00	0.98	319.24	1,999.87	7.45	-15.93	-15.94	0.27	0.26	5.64
2,100.00	0.87	329.68	2,099.86	8.75	-16.88	-16.88	0.20	-0.11	10.44
2,115.00	0.94	323.77	2,114.85	8.95	-17.01	-17.01	0.78	0.47	-39.40
Tie-In to VES Gyro									
2,193.00	0.90	318.70	2,192.84	9.92	-17.79	-17.80	0.12	-0.05	-6.50
First TDS MWD Survey									
2,288.00	1.00	308.10	2,287.83	10.99	-18.93	-18.94	0.21	0.11	-11.16
2,384.00	3.10	265.70	2,383.77	11.32	-22.18	-22.19	2.56	2.19	-44.17
2,479.00	3.00	258.60	2,478.63	10.63	-27.18	-27.19	0.41	-0.11	-7.47
2,574.00	2.70	252.00	2,573.52	9.45	-31.75	-31.75	0.47	-0.32	-6.95
2,669.00	2.40	251.70	2,668.42	8.13	-35.76	-35.77	0.32	-0.32	-0.32
2,764.00	2.10	250.10	2,763.35	6.92	-39.29	-39.29	0.32	-0.32	-1.68
2,859.00	2.60	254.70	2,858.27	5.76	-43.00	-43.01	0.56	0.53	4.84
2,955.00	2.50	257.10	2,954.17	4.71	-47.14	-47.15	0.15	-0.10	2.50
3,050.00	1.90	259.50	3,049.10	3.96	-50.71	-50.71	0.64	-0.63	2.53
3,145.00	2.70	265.20	3,144.03	3.49	-54.49	-54.49	0.87	0.84	6.00
3,240.00	3.30	252.50	3,238.90	2.48	-59.33	-59.33	0.94	0.63	-13.37
3,335.00	2.90	251.90	3,333.76	0.91	-64.22	-64.22	0.42	-0.42	-0.63
3,430.00	2.60	252.10	3,428.65	-0.50	-68.55	-68.55	0.32	-0.32	0.21
3,526.00	2.20	252.40	3,524.56	-1.72	-72.38	-72.38	0.42	-0.42	0.31
3,621.00	1.90	255.80	3,619.50	-2.66	-75.65	-75.64	0.34	-0.32	3.58
3,716.00	2.90	250.20	3,714.42	-3.86	-79.44	-79.43	1.08	1.05	-5.89
3,812.00	3.00	252.40	3,810.29	-5.44	-84.11	-84.11	0.16	0.10	2.29
3,907.00	2.80	253.30	3,905.17	-6.86	-88.71	-88.70	0.22	-0.21	0.95
4,002.00	2.80	254.40	4,000.06	-8.15	-93.16	-93.16	0.06	0.00	1.16
4,097.00	2.60	265.60	4,094.95	-8.94	-97.55	-97.54	0.59	-0.21	11.79
4,193.00	2.60	266.10	4,190.85	-9.26	-101.89	-101.88	0.02	0.00	0.52
4,288.00	2.40	267.20	4,285.76	-9.50	-106.03	-106.02	0.22	-0.21	1.16
4,383.00	2.30	271.20	4,380.68	-9.56	-109.92	-109.91	0.20	-0.11	4.21



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4,478.00	3.50	253.10	4,475.56	-10.36	-114.60	-114.59	1.57	1.26	-19.05
4,573.00	3.80	253.10	4,570.37	-12.12	-120.39	-120.38	0.32	0.32	0.00
4,668.00	2.30	247.30	4,665.23	-13.77	-125.16	-125.15	1.61	-1.58	-6.11
4,764.00	2.30	246.60	4,761.15	-15.28	-128.70	-128.69	0.03	0.00	-0.73
4,859.00	0.70	270.60	4,856.12	-16.03	-131.03	-131.02	1.77	-1.68	25.26
4,954.00	0.40	284.20	4,951.11	-15.94	-131.93	-131.92	0.34	-0.32	14.32
5,049.00	1.00	90.10	5,046.11	-15.86	-131.43	-131.41	1.46	0.63	174.63
5,081.00	4.20	94.20	5,078.07	-15.95	-129.98	-129.96	10.01	10.00	12.81
5,112.00	7.30	95.20	5,108.91	-16.21	-126.88	-126.87	10.00	10.00	3.23
5,144.00	10.40	94.90	5,140.53	-16.64	-121.98	-121.97	9.69	9.69	-0.94
5,176.00	14.10	91.70	5,171.80	-17.00	-115.20	-115.19	11.75	11.56	-10.00
5,208.00	17.70	89.50	5,202.57	-17.08	-106.44	-106.43	11.40	11.25	-6.88
5,239.00	20.80	90.10	5,231.83	-17.05	-96.22	-96.21	10.02	10.00	1.94
5,271.00	24.00	93.30	5,261.41	-17.43	-84.04	-84.02	10.70	10.00	10.00
5,303.00	27.00	97.90	5,290.29	-18.80	-70.34	-70.33	11.23	9.38	14.38
5,335.00	29.80	100.10	5,318.44	-21.20	-55.32	-55.30	9.34	8.75	6.88
5,366.00	33.20	100.90	5,344.87	-24.15	-39.39	-39.37	11.05	10.97	2.58
5,398.00	36.80	99.50	5,371.08	-27.39	-21.33	-21.31	11.53	11.25	-4.38
5,430.00	39.60	98.10	5,396.22	-30.41	-1.78	-1.75	9.16	8.75	-4.38
5,461.00	41.90	96.70	5,419.71	-33.01	18.29	18.32	7.98	7.42	-4.52
5,490.00	43.80	95.90	5,440.97	-35.17	37.89	37.92	6.81	6.55	-2.76
5,522.00	44.30	95.40	5,463.97	-37.36	60.03	60.06	1.90	1.56	-1.56
5,554.00	44.10	94.70	5,486.91	-39.33	82.25	82.29	1.65	-0.63	-2.19
5,585.00	44.10	92.60	5,509.17	-40.70	103.78	103.82	4.71	0.00	-6.77
5,617.00	43.90	91.20	5,532.19	-41.44	126.00	126.03	3.10	-0.63	-4.38
5,648.00	44.00	90.40	5,554.51	-41.74	147.51	147.54	1.82	0.32	-2.58
5,680.00	44.30	89.30	5,577.47	-41.68	169.80	169.83	2.57	0.94	-3.44
5,694.94	45.09	88.97	5,588.09	-41.52	180.30	180.34	5.53	5.31	-2.22
As-Drilled PP									
5,712.00	46.00	88.60	5,600.04	-41.26	192.48	192.51	5.53	5.32	-2.16
5,744.00	49.00	89.20	5,621.65	-40.81	216.06	216.10	9.48	9.38	1.88
5,775.00	52.20	88.70	5,641.33	-40.37	240.01	240.05	10.40	10.32	-1.61
5,807.00	55.70	87.50	5,660.16	-39.51	265.86	265.90	11.35	10.94	-3.75
5,839.00	59.30	86.30	5,677.35	-38.04	292.81	292.84	11.69	11.25	-3.75
5,870.00	62.80	85.30	5,692.35	-36.05	319.86	319.89	11.64	11.29	-3.23
5,902.00	66.50	85.50	5,706.05	-33.73	348.68	348.71	11.58	11.56	0.63
5,934.00	70.20	86.70	5,717.85	-31.72	378.34	378.37	12.08	11.56	3.75
5,965.00	73.50	87.90	5,727.51	-30.33	407.77	407.79	11.26	10.65	3.87
5,997.00	77.30	89.10	5,735.58	-29.52	438.72	438.74	12.42	11.88	3.75
6,029.00	81.10	89.80	5,741.57	-29.22	470.14	470.17	12.07	11.88	2.19
6,060.00	84.20	90.20	5,745.54	-29.22	500.88	500.91	10.08	10.00	1.29
6,092.00	87.80	89.80	5,747.77	-29.22	532.80	532.82	11.32	11.25	-1.25

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6,124.00	89.70	89.20	5,748.47	-28.94	564.79	564.81	6.23	5.94	-1.88
6,219.00	89.70	88.80	5,748.96	-27.29	659.77	659.80	0.42	0.00	-0.42
6,313.00	90.20	89.10	5,749.05	-25.56	753.76	753.78	0.62	0.53	0.32
6,408.00	91.40	89.30	5,747.72	-24.24	848.74	848.76	1.28	1.26	0.21
6,502.00	91.40	89.50	5,745.42	-23.25	942.70	942.72	0.21	0.00	0.21
6,598.00	90.70	89.30	5,743.66	-22.25	1,038.68	1,038.70	0.76	-0.73	-0.21
6,693.00	90.30	89.40	5,742.83	-21.17	1,133.67	1,133.69	0.43	-0.42	0.11
6,788.00	90.90	89.40	5,741.84	-20.18	1,228.66	1,228.68	0.63	0.63	0.00
6,883.00	92.00	89.80	5,739.44	-19.51	1,323.63	1,323.64	1.23	1.16	0.42
6,978.00	91.90	90.20	5,736.20	-19.51	1,418.57	1,418.59	0.43	-0.11	0.42
7,073.00	91.00	90.40	5,733.80	-20.01	1,513.54	1,513.55	0.97	-0.95	0.21
7,168.00	90.90	89.30	5,732.22	-19.76	1,608.52	1,608.54	1.16	-0.11	-1.16
7,265.00	90.50	88.80	5,731.04	-18.15	1,705.50	1,705.52	0.66	-0.41	-0.52
7,360.00	90.60	89.00	5,730.13	-16.33	1,800.48	1,800.49	0.24	0.11	0.21
7,456.00	90.60	89.40	5,729.12	-14.99	1,896.47	1,896.48	0.42	0.00	0.42
7,551.00	90.60	89.70	5,728.13	-14.24	1,991.46	1,991.47	0.32	0.00	0.32
7,644.00	90.60	89.80	5,727.15	-13.84	2,084.45	2,084.46	0.11	0.00	0.11
7,739.00	91.10	89.80	5,725.74	-13.51	2,179.44	2,179.45	0.53	0.53	0.00
7,834.00	91.50	89.10	5,723.59	-12.59	2,274.41	2,274.42	0.85	0.42	-0.74
7,929.00	91.80	89.10	5,720.85	-11.10	2,369.36	2,369.37	0.32	0.32	0.00
8,024.00	91.80	89.00	5,717.87	-9.53	2,464.30	2,464.31	0.11	0.00	-0.11
8,119.00	91.00	90.00	5,715.55	-8.70	2,559.26	2,559.27	1.35	-0.84	1.05
8,214.00	90.90	90.10	5,713.97	-8.78	2,654.25	2,654.26	0.15	-0.11	0.11
8,311.00	90.80	90.30	5,712.53	-9.12	2,751.24	2,751.25	0.23	-0.10	0.21
8,405.00	90.50	90.60	5,711.47	-9.86	2,845.23	2,845.24	0.45	-0.32	0.32
8,501.00	90.20	90.70	5,710.88	-10.95	2,941.22	2,941.23	0.33	-0.31	0.10
8,596.00	91.30	90.60	5,709.64	-12.03	3,036.21	3,036.22	1.16	1.16	-0.11
8,691.00	91.60	90.80	5,707.23	-13.19	3,131.17	3,131.18	0.38	0.32	0.21
8,785.00	91.50	91.70	5,704.69	-15.24	3,225.11	3,225.12	0.96	-0.11	0.96
8,880.00	92.60	90.70	5,701.29	-17.22	3,320.03	3,320.04	1.56	1.16	-1.05
8,975.00	92.60	89.20	5,696.98	-17.14	3,414.93	3,414.94	1.58	0.00	-1.58
9,070.00	90.80	89.00	5,694.16	-15.65	3,509.87	3,509.88	1.91	-1.89	-0.21
9,165.00	90.50	89.30	5,693.09	-14.24	3,604.85	3,604.86	0.45	-0.32	0.32
9,261.00	90.10	89.50	5,692.58	-13.24	3,700.85	3,700.86	0.47	-0.42	0.21
9,356.00	90.30	89.00	5,692.25	-11.99	3,795.84	3,795.85	0.57	0.21	-0.53
9,451.00	90.10	88.90	5,691.92	-10.25	3,890.82	3,890.83	0.24	-0.21	-0.11
9,546.00	91.50	89.90	5,690.59	-9.26	3,985.80	3,985.81	1.81	1.47	1.05
9,641.00	91.30	90.60	5,688.27	-9.67	4,080.77	4,080.78	0.77	-0.21	0.74
9,736.00	91.20	89.80	5,686.20	-10.00	4,175.75	4,175.76	0.85	-0.11	-0.84
9,831.00	91.60	90.20	5,683.88	-10.00	4,270.72	4,270.73	0.60	0.42	0.42
9,926.00	90.70	89.20	5,681.97	-9.51	4,365.70	4,365.70	1.42	-0.95	-1.05
10,021.00	91.00	89.70	5,680.56	-8.59	4,460.68	4,460.69	0.61	0.32	0.53



TDS
Survey Report



Company: COG Operating LLC
Project: Lea County, NM (NAD-27 2015)
Site: Branex-COG Federal Corn #15H
Well: SHL: 2310' FSL, 150' FWL, Sec 9, T17S, R32E, Unit L
Wellbore: BHL: 2292' FSL, 350' FEL, Sec 9, T17S, R32E, Unit I
Design: BHL: 2292' FSL, 350' FEL, Sec 9, T17S, R32E, Unit I

Local Co-ordinate Reference: Site Branex-COG Federal Corn #15H
TVD Reference: KB @ 4085.00usft (Patriot 6)
MD Reference: KB @ 4085.00usft (Patriot 6)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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)
10,116.00	90.50	89.80	5,679.32	-8.18	4,555.67	4,555.68	0.54	-0.53	0.11
10,211.00	90.30	90.30	5,678.66	-8.26	4,650.67	4,650.68	0.57	-0.21	0.53
10,270.00	90.10	90.70	5,678.45	-8.78	4,709.67	4,709.67	0.76	-0.34	0.68
Last TDS MWD Survey									
10,343.00	90.10	90.70	5,678.32	-9.67	4,782.66	4,782.67	0.00	0.00	0.00
Projection to Bit/TD									

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
2,115.00	2,114.85	8.95	-17.01	Tie-In to VES Gyro
2,193.00	2,192.84	9.92	-17.79	First TDS MWD Survey
5,694.94	5,588.09	-41.52	180.30	As-Drilled PP
10,270.00	5,678.45	-8.78	4,709.67	Last TDS MWD Survey
10,343.00	5,678.32	-9.67	4,782.66	Projection to Bit/TD

Checked By:

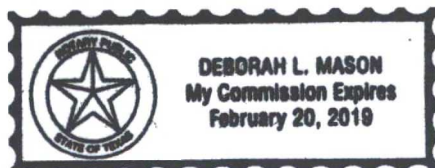
Deborah L. Mason

Approved By:

Samuel

Date:

11/2/2016





11/2/16

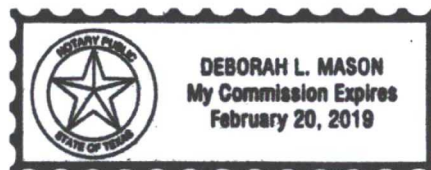
State of New Mexico
County of Lea

I, Donald D. Mason, certify that: I am employed by Terra Directional Services LLC; that I did on the day(s) of 09/08/2016 through 09/21/2016 conduct or supervise the taking of a MWD survey from a depth of 2193 feet to a depth of 10343 feet; that the data is true, correct, complete and within the limitations of the tool as set forth by Terra Directional Services LLC; that I am authorized and qualified to make this report; that this survey was conducted at the request of COG Operating LLC for the Branex-COG Federal Com #15H Well API 30-025-42906 in Lea County, New Mexico; and that I have reviewed this report and find that it conforms to the principles and procedures as set forth by Terra Directional Services LLC.

Donald D. Mason
President

State of Texas
County of Burnet

Before me, a notary public, on this day personally appeared Donald D mason, known to me to be the person whose name is subscribed to the foregoing document and, being by me first duly sworn, declared that the statements therein contained are true and correct.



Notary Public's Signature