

COG OPERATING, LLC

Eddy /Lea County, NM (NAD27) NMEZ

Branex-COG Federal COM 17H

#17H SL - 990'FSL, 25'FEL Sec 8/T17S/R32E/UnitP

PP - 971'FSL, 384'FWL, Sec 9/T17S/R32E/UnitP

Lateral

Planned BHL - 970'FSL, 1310'FWL Sec10/ UnitM

Actual BHL - 963FSL, 1302FWL Sec10/UnitM

HOBBS OCD
NOV 20 2017
RECEIVED



Survey Report

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Branex-COG Federal COM 17H
Well: #17H
Wellbore: Lateral
Design: Lateral

Local Co-ordinate Reference: Well #17H
TVD Reference: 4055+18 @ 4073.00ft (Planning)
MD Reference: 4055+18 @ 4073.00ft (Planning)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

Project Eddy /Lea County, NM (NAD27) NMEZ

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 17H

Site Position:
From: Map
Position Uncertainty: 0.00 ft
Northing: 671,390.10 ft
Easting: 670,054.50 ft
Slot Radius: 13.20 in
Latitude: 32° 50' 40.228 N
Longitude: 103° 46' 46.683 W
Grid Convergence: 0.30 °

Well #17H

Well Position +N/-S 0.00 ft
+E/-W 0.00 ft
Position Uncertainty 0.00 ft
Northing: 671,390.10 ft
Easting: 670,054.50 ft
Wellhead Elevation: ft
Latitude: 32° 50' 40.228 N
Longitude: 103° 46' 46.683 W
Ground Level: 4,055.00 ft

Wellbore Lateral

Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	07/07/17	7.09	60.60	48,274

Design Lateral

Audit Notes:

Version: 1.0
Phase: ACTUAL
Tie On Depth: 0.00

Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
	0.00	0.00	0.00	89.82

Survey Program Date 09/05/17

From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
100.00	2,173.00	Survey #1 (Lateral)	GYD_DP_MS	Gyrodata gyro-compassing and drop
2,295.00	12,235.00	Survey #2 (Lateral)	MWD	MWD v3:standard declination
12,317.00	12,317.00	Survey #3 (Lateral)	Projection	Projection

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)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BranexCOG 17H SL									
100.00	0.39	171.86	100.00	-0.34	0.05	0.05	0.39	0.39	0.00
200.00	0.86	174.87	199.99	-1.42	0.16	0.16	0.47	0.47	3.01
300.00	0.91	183.16	299.98	-2.96	0.19	0.18	0.14	0.05	8.29
400.00	0.99	187.25	399.97	-4.61	0.03	0.02	0.10	0.08	4.09
500.00	1.07	189.38	499.95	-6.39	-0.23	-0.25	0.09	0.08	2.13
600.00	1.24	191.02	599.93	-8.37	-0.59	-0.61	0.17	0.17	1.64
700.00	1.18	197.88	699.91	-10.41	-1.11	-1.14	0.16	-0.06	6.86



Survey Report

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Branex-COG Federal COM 17H
Well: #17H
Wellbore: Lateral
Design: Lateral

Local Co-ordinate Reference: Well #17H
TVD Reference: 4055+18 @ 4073.00ft (Planning)
MD Reference: 4055+18 @ 4073.00ft (Planning)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

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)
800.00	1.46	215.99	799.88	-12.43	-2.17	-2.21	0.50	0.28	18.11
900.00	1.54	227.08	899.85	-14.37	-3.91	-3.95	0.30	0.08	11.09
1,000.00	1.20	227.37	999.82	-16.00	-5.66	-5.71	0.34	-0.34	0.29
1,100.00	1.27	240.25	1,099.80	-17.25	-7.39	-7.45	0.29	0.07	12.88
1,200.00	0.93	245.55	1,199.78	-18.14	-9.09	-9.15	0.35	-0.34	5.30
1,300.00	1.16	248.66	1,299.76	-18.84	-10.78	-10.84	0.24	0.23	3.11
1,400.00	1.16	250.84	1,399.74	-19.55	-12.68	-12.74	0.04	0.00	2.18
1,500.00	0.48	268.81	1,499.73	-19.89	-14.05	-14.11	0.72	-0.68	17.97
1,600.00	0.38	314.36	1,599.73	-19.66	-14.71	-14.77	0.35	-0.10	45.55
1,700.00	0.36	350.34	1,699.73	-19.12	-15.00	-15.06	0.23	-0.02	35.98
1,800.00	0.79	18.78	1,799.72	-18.16	-14.83	-14.88	0.50	0.43	28.44
1,900.00	1.22	35.21	1,899.71	-16.64	-13.99	-14.04	0.51	0.43	16.43
2,000.00	1.31	52.69	1,999.68	-15.07	-12.47	-12.52	0.39	0.09	17.48
2,100.00	1.96	59.51	2,099.64	-13.51	-10.08	-10.13	0.68	0.65	6.82
2,173.00	2.08	63.29	2,172.59	-12.28	-7.83	-7.86	0.25	0.16	5.18
2,295.00	2.03	59.38	2,294.52	-10.19	-3.99	-4.02	0.12	-0.04	-3.20
2,390.00	0.33	351.78	2,389.49	-9.06	-2.58	-2.61	2.03	-1.79	-71.16
2,484.00	1.88	262.47	2,483.48	-9.00	-4.15	-4.18	2.03	1.65	-95.01
2,579.00	3.60	271.07	2,578.37	-9.14	-8.67	-8.70	1.86	1.81	9.05
2,673.00	4.72	269.43	2,672.12	-9.13	-15.49	-15.52	1.20	1.19	-1.74
2,768.00	4.49	269.43	2,766.81	-9.20	-23.12	-23.15	0.24	-0.24	0.00
2,862.00	5.14	266.45	2,860.48	-9.50	-31.00	-31.03	0.74	0.69	-3.17
2,956.00	6.04	264.10	2,954.03	-10.27	-40.12	-40.16	0.99	0.96	-2.50
3,051.00	5.19	265.39	3,048.57	-11.13	-49.38	-49.41	0.90	-0.89	1.36
3,146.00	6.51	266.42	3,143.08	-11.81	-59.04	-59.07	1.39	1.39	1.08
3,244.00	7.73	267.90	3,240.32	-12.40	-71.17	-71.21	1.26	1.24	1.51
3,339.00	6.92	269.00	3,334.54	-12.73	-83.27	-83.31	0.87	-0.85	1.16
3,433.00	6.23	270.88	3,427.92	-12.75	-94.04	-94.08	0.77	-0.73	2.00
3,528.00	7.77	269.89	3,522.21	-12.69	-105.61	-105.65	1.63	1.62	-1.04
3,623.00	7.47	270.48	3,616.37	-12.65	-118.21	-118.25	0.33	-0.32	0.62
3,718.00	6.99	270.51	3,710.62	-12.54	-130.17	-130.20	0.51	-0.51	0.03
3,812.00	8.61	269.70	3,803.75	-12.53	-142.92	-142.96	1.73	1.72	-0.86
3,907.00	8.65	271.01	3,897.67	-12.44	-157.18	-157.21	0.21	0.04	1.38
4,002.00	8.45	272.52	3,991.61	-12.01	-171.29	-171.33	0.32	-0.21	1.59
4,097.00	8.32	272.78	4,085.60	-11.37	-185.13	-185.17	0.14	-0.14	0.27
4,192.00	8.45	273.81	4,179.58	-10.57	-198.96	-198.99	0.21	0.14	1.08
4,286.00	8.57	273.86	4,272.55	-9.64	-212.84	-212.87	0.13	0.13	0.05
4,381.00	7.07	269.15	4,366.66	-9.25	-225.75	-225.78	1.72	-1.58	-4.96
4,475.00	5.75	262.94	4,460.07	-9.92	-236.21	-236.24	1.58	-1.40	-6.61
4,570.00	3.93	257.63	4,554.73	-11.20	-244.11	-244.14	1.97	-1.92	-5.59
4,664.00	2.59	260.93	4,648.58	-12.22	-249.35	-249.39	1.44	-1.43	3.51
4,759.00	0.73	228.28	4,743.54	-12.96	-251.93	-251.96	2.12	-1.96	-34.37
4,854.00	0.16	19.75	4,838.53	-13.24	-252.33	-252.37	0.92	-0.60	159.44



Survey Report

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Branex-COG Federal COM 17H
Well: #17H
Wellbore: Lateral
Design: Lateral

Local Co-ordinate Reference: Well #17H
TVD Reference: 4055+18 @ 4073.00ft (Planning)
MD Reference: 4055+18 @ 4073.00ft (Planning)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

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)
4,949.00	0.28	26.38	4,933.53	-12.91	-252.18	-252.22	0.13	0.13	6.98
5,044.00	0.36	29.66	5,028.53	-12.44	-251.93	-251.97	0.09	0.08	3.45
5,075.00	0.49	42.49	5,059.53	-12.26	-251.80	-251.83	0.52	0.42	41.39
5,107.00	1.66	66.94	5,091.52	-11.98	-251.28	-251.31	3.85	3.66	76.41
5,138.00	4.05	74.89	5,122.48	-11.52	-249.81	-249.84	7.80	7.71	25.65
5,170.00	7.31	79.31	5,154.32	-10.84	-246.71	-246.75	10.27	10.19	13.81
5,202.00	10.88	79.42	5,185.92	-9.91	-241.74	-241.77	11.16	11.16	0.34
5,234.00	14.84	76.86	5,217.11	-8.42	-234.78	-234.81	12.50	12.38	-8.00
5,266.00	18.74	75.47	5,247.74	-6.20	-225.81	-225.83	12.25	12.19	-4.34
5,297.00	22.78	76.79	5,276.72	-3.58	-215.14	-215.15	13.12	13.03	4.26
5,329.00	26.50	78.60	5,305.80	-0.75	-202.11	-202.11	11.86	11.63	5.66
5,361.00	30.27	81.97	5,333.95	1.79	-187.12	-187.11	12.80	11.78	10.53
5,392.00	33.84	85.17	5,360.22	3.61	-170.77	-170.76	12.75	11.52	10.32
5,424.00	36.59	89.09	5,386.37	4.51	-152.35	-152.34	11.12	8.59	12.25
5,456.00	39.89	92.31	5,411.50	4.25	-132.56	-132.54	12.04	10.31	10.06
5,487.00	42.19	93.15	5,434.88	3.27	-112.23	-112.22	7.63	7.42	2.71
5,519.00	43.73	93.31	5,458.30	2.04	-90.46	-90.45	4.82	4.81	0.50
5,551.00	44.05	93.35	5,481.36	0.75	-68.31	-68.31	1.00	1.00	0.13
5,583.00	44.55	93.04	5,504.26	-0.49	-45.99	-46.00	1.70	1.56	-0.97
5,614.00	45.46	92.41	5,526.18	-1.53	-24.10	-24.10	3.27	2.94	-2.03
5,646.00	46.21	91.99	5,548.47	-2.41	-1.16	-1.17	2.53	2.34	-1.31
5,677.00	46.85	91.83	5,569.80	-3.16	21.33	21.32	2.10	2.06	-0.52
5,682.00	47.10	91.85	5,573.21	-3.28	24.98	24.97	5.04	5.03	0.38
Wellpath Crosses Section Line @ Heel									
5,709.00	48.46	91.95	5,591.35	-3.94	44.96	44.95	5.04	5.03	0.37
5,741.00	50.70	92.96	5,612.10	-4.99	69.30	69.28	7.40	7.00	3.16
5,772.00	52.98	93.27	5,631.25	-6.31	93.64	93.62	7.40	7.35	1.00
5,804.00	55.49	93.39	5,649.96	-7.82	119.56	119.53	7.85	7.84	0.38
5,835.00	59.00	93.47	5,666.73	-9.38	145.58	145.55	11.32	11.32	0.26
5,867.00	62.80	92.68	5,682.29	-10.88	173.49	173.46	12.07	11.88	-2.47
5,899.00	65.34	92.06	5,696.28	-12.07	202.24	202.20	8.13	7.94	-1.94
5,930.00	67.32	90.91	5,708.72	-12.80	230.62	230.58	7.23	6.39	-3.71
5,962.00	69.55	89.93	5,720.48	-13.02	260.38	260.34	7.53	6.97	-3.06
5,993.00	72.10	89.48	5,730.66	-12.87	289.66	289.62	8.34	8.23	-1.45
6,025.00	75.82	88.93	5,739.51	-12.44	320.40	320.36	11.74	11.63	-1.72
6,056.00	79.75	88.60	5,746.06	-11.78	350.69	350.65	12.72	12.68	-1.06
6,088.00	83.41	88.62	5,750.75	-11.02	382.33	382.29	11.44	11.44	0.06
6,114.27	86.93	89.34	5,752.96	-10.55	408.50	408.47	13.68	13.41	2.72
BranexCOG 17H LP									
6,120.00	87.70	89.49	5,753.23	-10.49	414.22	414.19	13.68	13.41	2.71
6,151.00	91.78	91.97	5,753.37	-10.89	445.21	445.17	15.40	13.16	8.00
6,183.00	93.29	93.19	5,751.95	-12.32	477.14	477.10	6.06	4.72	3.81
6,249.00	93.85	92.96	5,747.84	-15.86	542.92	542.87	0.92	0.85	-0.35
6,313.00	90.11	92.10	5,745.63	-18.68	606.81	606.75	6.00	-5.84	-1.34



Survey Report

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Branex-COG Federal COM 17H
Well: #17H
Wellbore: Lateral
Design: Lateral

Local Co-ordinate Reference: Well #17H
TVD Reference: 4055+18 @ 4073.00ft (Planning)
MD Reference: 4055+18 @ 4073.00ft (Planning)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

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)
6,407.00	88.28	90.09	5,746.95	-20.48	700.77	700.71	2.89	-1.95	-2.14
6,502.00	90.15	89.51	5,748.25	-20.15	795.76	795.69	2.06	1.97	-0.61
6,596.00	89.96	89.55	5,748.16	-19.37	889.76	889.69	0.21	-0.20	0.04
6,690.00	91.05	87.95	5,747.34	-17.32	983.73	983.67	2.06	1.16	-1.70
6,785.00	91.28	88.87	5,745.40	-14.69	1,078.67	1,078.62	1.00	0.24	0.97
6,879.00	91.66	89.50	5,742.99	-13.35	1,172.63	1,172.58	0.78	0.40	0.67
6,973.00	91.83	90.15	5,740.13	-13.07	1,266.58	1,266.54	0.71	0.18	0.69
7,068.00	89.92	89.85	5,738.68	-13.06	1,361.57	1,361.52	2.04	-2.01	-0.32
7,163.00	89.92	90.37	5,738.81	-13.25	1,456.57	1,456.52	0.55	0.00	0.55
7,258.00	90.33	89.20	5,738.60	-12.89	1,551.56	1,551.52	1.31	0.43	-1.23
7,353.00	90.60	89.34	5,737.83	-11.68	1,646.55	1,646.51	0.32	0.28	0.15
7,448.00	90.58	89.52	5,736.86	-10.74	1,741.54	1,741.50	0.19	-0.02	0.19
7,543.00	90.64	90.40	5,735.84	-10.67	1,836.54	1,836.49	0.93	0.06	0.93
7,637.00	90.29	89.14	5,735.08	-10.29	1,930.53	1,930.49	1.39	-0.37	-1.34
7,732.00	90.29	88.88	5,734.60	-8.65	2,025.52	2,025.48	0.27	0.00	-0.27
7,827.00	90.38	89.53	5,734.05	-7.33	2,120.50	2,120.47	0.69	0.09	0.68
7,922.00	90.86	89.68	5,733.02	-6.68	2,215.50	2,215.46	0.53	0.51	0.16
8,016.00	90.58	89.90	5,731.84	-6.33	2,309.49	2,309.46	0.38	-0.30	0.23
8,111.00	91.36	89.87	5,730.23	-6.14	2,404.47	2,404.44	0.82	0.82	-0.03
8,205.00	91.06	90.12	5,728.24	-6.13	2,498.45	2,498.42	0.42	-0.32	0.27
8,300.00	90.70	91.20	5,726.78	-7.23	2,593.43	2,593.40	1.20	-0.38	1.14
8,395.00	90.30	90.30	5,725.95	-8.47	2,688.42	2,688.38	1.04	-0.42	-0.95
8,489.00	91.17	88.75	5,724.75	-7.69	2,782.41	2,782.37	1.89	0.93	-1.65
8,583.00	91.22	88.83	5,722.79	-5.71	2,876.36	2,876.33	0.10	0.05	0.09
8,678.00	91.40	88.73	5,720.62	-3.69	2,971.32	2,971.29	0.22	0.19	-0.11
8,773.00	91.29	88.96	5,718.39	-1.77	3,066.27	3,066.25	0.27	-0.12	0.24
8,868.00	90.96	89.86	5,716.52	-0.79	3,161.25	3,161.23	1.01	-0.35	0.95
8,963.00	90.50	90.19	5,715.31	-0.84	3,256.24	3,256.22	0.60	-0.48	0.35
9,058.00	90.59	90.08	5,714.41	-1.06	3,351.23	3,351.21	0.15	0.09	-0.12
9,153.00	91.54	88.20	5,712.64	0.37	3,446.20	3,446.19	2.22	1.00	-1.98
9,248.00	90.97	88.00	5,710.56	3.52	3,541.13	3,541.12	0.64	-0.60	-0.21
9,343.00	92.91	88.90	5,707.34	6.08	3,636.03	3,636.03	2.25	2.04	0.95
9,438.00	91.31	90.97	5,703.85	6.19	3,730.96	3,730.96	2.75	-1.68	2.18
9,533.00	90.65	91.17	5,702.22	4.42	3,825.93	3,825.92	0.73	-0.69	0.21
9,628.00	89.66	91.43	5,701.96	2.26	3,920.90	3,920.89	1.08	-1.04	0.27
9,709.00	89.75	90.41	5,702.38	0.96	4,001.89	4,001.87	1.26	0.11	-1.26
9,740.00	90.05	90.37	5,702.44	0.75	4,032.89	4,032.87	0.98	0.97	-0.13
9,835.00	91.06	90.10	5,701.52	0.36	4,127.88	4,127.86	1.10	1.06	-0.28
9,930.00	91.61	89.88	5,699.30	0.38	4,222.86	4,222.84	0.62	0.58	-0.23
10,024.00	91.43	90.78	5,696.81	-0.16	4,316.82	4,316.80	0.98	-0.19	0.96
10,119.00	90.76	91.21	5,694.99	-1.81	4,411.79	4,411.76	0.84	-0.71	0.45
10,213.00	91.35	90.81	5,693.26	-3.47	4,505.76	4,505.72	0.76	0.63	-0.43
10,308.00	90.97	89.27	5,691.34	-3.54	4,600.73	4,600.70	1.67	-0.40	-1.62

Survey Report

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Branex-COG Federal COM 17H
Well: #17H
Wellbore: Lateral
Design: Lateral

Local Co-ordinate Reference: Well #17H
TVD Reference: 4055+18 @ 4073.00ft (Planning)
MD Reference: 4055+18 @ 4073.00ft (Planning)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

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)
10,403.00	92.12	88.89	5,688.78	-2.01	4,695.69	4,695.66	1.27	1.21	-0.40
10,498.00	91.62	89.23	5,685.68	-0.45	4,790.62	4,790.60	0.64	-0.53	0.36
10,593.00	91.23	89.05	5,683.32	0.97	4,885.58	4,885.56	0.45	-0.41	-0.19
10,689.00	90.97	89.66	5,681.47	2.05	4,981.56	4,981.54	0.69	-0.27	0.64
10,783.00	90.85	90.95	5,679.98	1.55	5,075.54	5,075.52	1.38	-0.13	1.37
10,877.00	90.68	91.73	5,678.72	-0.65	5,169.51	5,169.48	0.85	-0.18	0.83
10,972.00	91.07	92.31	5,677.27	-3.99	5,264.44	5,264.40	0.74	0.41	0.61
11,014.00	90.73	91.59	5,676.61	-5.42	5,306.41	5,306.36	1.89	-0.80	-1.72
Wellpath Crosses Section Line @ Toe									
11,067.00	90.31	90.68	5,676.13	-6.47	5,359.39	5,359.35	1.89	-0.80	-1.72
11,163.00	91.17	88.74	5,674.89	-5.99	5,455.38	5,455.33	2.21	0.90	-2.02
11,257.00	91.36	87.63	5,672.81	-3.01	5,549.31	5,549.27	1.20	0.20	-1.18
11,352.00	90.85	87.97	5,670.98	0.64	5,644.22	5,644.19	0.65	-0.54	0.36
11,447.00	92.50	88.75	5,668.21	3.35	5,739.14	5,739.12	1.92	1.74	0.82
11,540.00	92.07	89.17	5,664.50	5.04	5,832.05	5,832.03	0.65	-0.46	0.45
11,635.00	91.45	89.74	5,661.58	5.94	5,927.00	5,926.99	0.89	-0.65	0.60
11,730.00	91.21	90.20	5,659.38	5.99	6,021.97	6,021.96	0.55	-0.25	0.48
11,825.00	91.38	90.82	5,657.23	5.15	6,116.94	6,116.93	0.68	0.18	0.65
11,920.00	91.21	92.17	5,655.08	2.67	6,211.88	6,211.86	1.43	-0.18	1.42
12,015.00	90.74	89.94	5,653.46	0.92	6,306.85	6,306.82	2.40	-0.49	-2.35
12,110.00	89.84	90.64	5,652.98	0.44	6,401.84	6,401.81	1.20	-0.95	0.74
12,204.00	91.31	91.46	5,652.04	-1.28	6,495.82	6,495.78	1.79	1.56	0.87
12,235.00	91.44	91.62	5,651.30	-2.12	6,526.80	6,526.76	0.66	0.42	0.52
12,317.00	91.44	91.62	5,649.24	-4.43	6,608.74	6,608.69	0.00	0.00	0.00

TD @ 963FSL, 1302FWL - BranexCOG 17H PBHL p4

Design Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
- hit/miss target									
- Shape									
BranexCOG 17H SL	0.00	0.00	0.00	0.00	0.00	671,390.10	670,054.50	32° 50' 40.228 N	103° 46' 46.683 W
- actual wellpath hits target center									
- Point									
BranexCOG 17H BHL	0.00	0.00	5,649.24	-4.43	6,608.74	671,385.67	676,663.24	32° 50' 39.834 N	103° 45' 29.220 W
- actual wellpath misses target center by 0.01ft at 12317.00ft MD (5649.24 TVD, -4.43 N, 6608.74 E)									
- Point									
BranexCOG 17H LP	0.00	0.00	5,750.00	-17.76	408.85	671,372.34	670,463.35	32° 50' 40.031 N	103° 46' 41.891 W
- actual wellpath misses target center by 7.80ft at 6114.41ft MD (5752.97 TVD, -10.55 N, 408.64 E)									
- Point									



Survey Report

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Branex-COG Federal COM 17H
Well: #17H
Wellbore: Lateral
Design: Lateral

Local Co-ordinate Reference: Well #17H
TVD Reference: 4055+18 @ 4073.00ft (Planning)
MD Reference: 4055+18 @ 4073.00ft (Planning)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
5,682.00	5,573.21	-3.28	24.98	Wellpath Crosses Section Line @ Heel
11,014.00	5,676.61	-5.42	5,306.41	Wellpath Crosses Section Line @ Toe
12,317.00	5,649.24	-4.43	6,608.74	TD @ 963FSL, 1302FWL

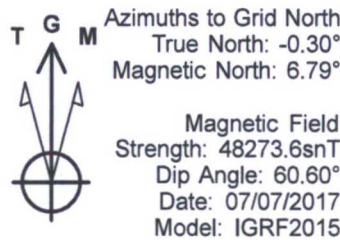
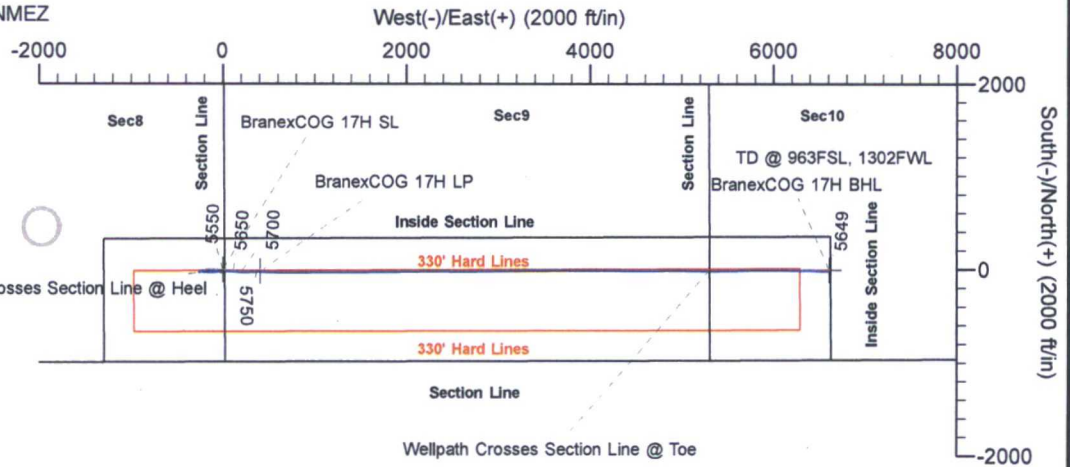
Checked By: _____ Approved By: _____ Date: _____

COG OPERATING, LLC

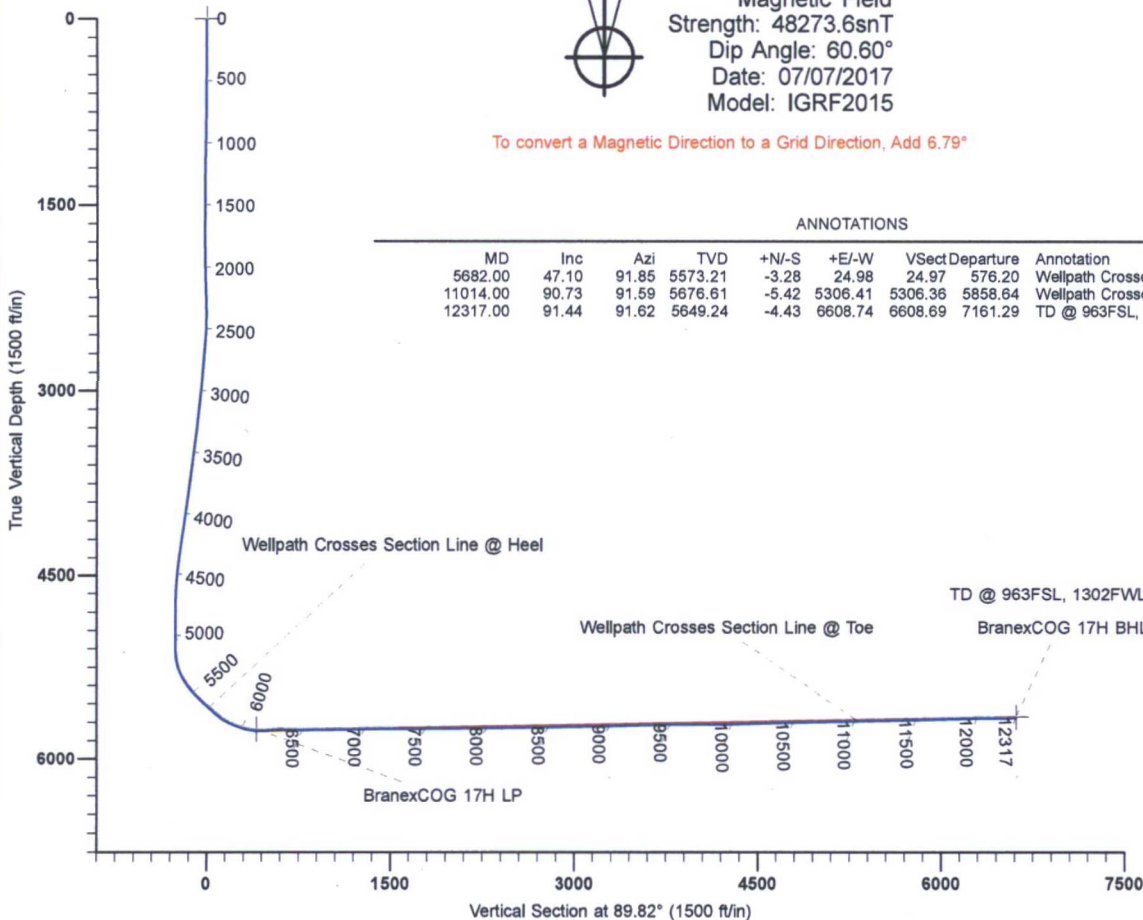
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Branex-COG Federal COM 17H
Well: #17H
Wellbore: Lateral
Design: Lateral



4055+18 @ 4073.00ft (Planning)
NAD 1927 (NADCON CONU)



To convert a Magnetic Direction to a Grid Direction, Add 6.79°



ANNOTATIONS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Departure	Annotation
5682.00	47.10	91.85	5573.21	-3.28	24.98	24.97	576.20	Wellpath Crosses Section Line @ Heel
11014.00	90.73	91.59	5676.61	-5.42	5306.41	5306.36	5858.64	Wellpath Crosses Section Line @ Toe
12317.00	91.44	91.62	5649.24	-4.43	6608.74	6608.69	7161.29	TD @ 963FSL, 1302FWL

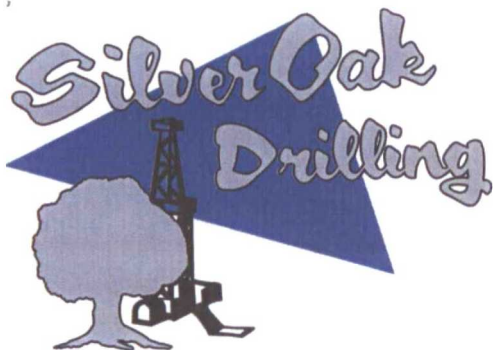
TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Shape
BranexCOG 17H SL	0.00	0.00	0.00	671390.10	670054.50	Point
BranexCOG 17H BHL	5649.24	-4.43	6608.74	671385.67	676663.24	Point
BranexCOG 17H LP	5750.00	-17.76	408.85	671372.34	670463.35	Point

Design: Lateral (#17H/Lateral)
Created By: Mekka Williams
eSomnia Well Design
mekka@esominawell.com
15:35, September 05 2017

VON DIRECTIONAL
12074 FM 3083 Conroe, Texas 77301
936-756-2400





PO Box 1370
Artesia, NM 88211-1370
(575) 748-1288

September 5, 2017

COG, LLC
One Concho Center
600 W. Illinois Ave.
Midland, TX 79701

RE: Brane-COG Fed Com 17H
990' FSL & 25' FEL
Sec. 10, T17S, R32E
Lea County, New Mexico

Dear Sir,

The attached is the Deviation Survey for the above captioned well.

Very truly yours,

A handwritten signature in black ink, appearing to read "Chris Graham".

Chris Graham
Asst. Operations Manager

State of New Mexico }
County of Eddy }

The foregoing was acknowledged before me this 5th day of September, 2017.

A handwritten signature in black ink, appearing to read "Regina L. Garner".

Notary Public

Branex-COG Fed Com 17H

Date	Depth	Deviation	Direction	TVD
8/17/2017	495	0.90		
8/17/2017	702	1.40		
8/17/2017	872	1.60		
8/19/2017	1034	1.30		
8/19/2017	1539	0.70		
8/19/2017	1971	1.40		
8/21/2017	2484	1.88	262.00	2483.00
8/21/2017	2579	3.60	271.00	2578.00
8/21/2017	2862	5.14	266.00	2860.00
8/21/2017	2956	6.04	264.00	2954.00
8/21/2017	3244	7.73	267.90	3240.32
8/21/2017	3339	6.92	269.00	3334.54
8/21/2017	3433	6.23	270.88	3427.92
8/21/2017	3528	7.77	269.89	3522.21
8/21/2017	3623	7.47	270.48	3616.37
8/21/2017	3718	6.99	270.50	3710.62
8/22/2017	3907	8.65	271.00	3897.00
8/22/2017	4192	8.45	273.00	4179.00
8/22/2017	4286	8.57	273.00	4272.00
8/22/2017	4475	5.75	262.94	4460.07
8/22/2017	4570	3.93	257.63	4554.73
8/22/2017	4664	2.59	260.93	4648.58
8/22/2017	4759	0.73	228.28	4743.54
8/22/2017	4854	0.16	19.75	4838.53
8/22/2017	4949	0.28	26.38	4933.53
8/23/2017	5138	4.05	74.89	5122.00
8/23/2017	5170	7.31	79.31	5154.00
8/23/2017	5456	39.89	92.31	5411.00
8/23/2017	5487	42.19	93.15	5434.00
8/23/2017	5677	46.85	91.83	5569.80
8/23/2017	5709	48.46	91.95	5591.35
8/23/2017	5772	52.98	93.27	5631.25
8/23/2017	5835	59.00	93.47	5666.73
8/23/2017	5899	65.34	92.06	5696.28
8/24/2017	6183	93.29	93.19	
8/24/2017	6249	93.85	92.96	
8/24/2017	6313	90.11	92.10	
8/25/2017	6407	88.28	90.09	
8/25/2017	6502	90.15	89.51	
8/25/2017	6596	89.96	89.55	
8/25/2017	6690	91.05	87.95	
8/25/2017	6785	91.28	88.87	

Date	Depth	Deviation	Direction	TVD
------	-------	-----------	-----------	-----

8/25/2017	6879	91.66	89.55	
8/25/2017	7068	89.92	89.85	
8/25/2017	7163	89.92	90.37	
8/25/2017	7353	90.60	89.34	
8/25/2017	7543	90.60	90.40	
8/25/2017	7637	90.29	89.14	
8/25/2017	7732	90.28	88.88	
8/26/2017	7827	90.38	89.53	
8/26/2017	7922	90.86	89.68	
8/26/2017	8016	90.58	89.90	
8/26/2017	8111	91.36	89.87	
8/26/2017	8205	91.06	90.12	
8/26/2017	8300	90.70	91.20	
8/26/2017	8489	91.17	88.75	
8/26/2017	8583	91.22	88.83	
8/27/2017	8773	91.29	88.96	
8/27/2017	8868	90.96	89.86	
8/27/2017	8963	90.50	90.15	
8/27/2017	9058	90.59	90.08	
8/27/2017	9153	91.54	88.20	
8/27/2017	9248	90.97	88.00	
8/28/2017	9343	92.91	88.90	
8/28/2017	9430	91.31	90.97	
8/28/2017	9533	90.65	91.17	
8/28/2017	9628	89.66	91.43	
8/29/2017	9709	89.75	90.41	
8/29/2017	9835	91.06	90.10	
8/30/2017	9930	91.61	89.88	
8/30/2017	10024	91.43	90.78	
8/30/2017	10119	90.76	91.21	
8/30/2017	10213	91.35	90.81	
8/30/2017	10308	90.97	87.27	
8/30/2017	10498	91.62	89.23	
8/30/2017	10593	91.23	89.05	
8/30/2017	10689	90.97	89.66	
8/30/2017	10783	90.85	80.95	
8/30/2017	10877	90.68	91.73	
8/30/2017	10972	91.07	92.31	
8/31/2017	11067	90.31	90.68	5676.13
8/31/2017	11163	90.17	88.74	5674.89
8/31/2017	11257	91.36	87.63	5672.81
8/31/2017	11352	90.85	87.97	5670.98
8/31/2017	11447	92.50	88.70	5668.00
8/31/2017	11825	91.30	90.80	5657.00
8/31/2017	11920	91.20	92.10	5655.00

Date	Depth	Deviation	Direction	TVD
8/31/2017	12015	90.70	89.90	5653.00
9/1/2017	12110	89.84	90.64	5652.98
9/1/2017	12204	91.31	91.46	5652.04

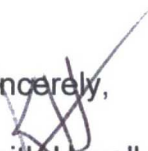
August 23, 2017

Concho Resources, Inc.
One Concho Center
600 W. Illinois Avenue
Midland, Texas 79701

Attn: Kanicia Castillo

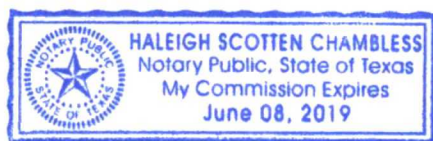
RE: **Branex-COG Federal Com 17H**

Please find enclosed a copy of the survey from 0' to 2173' ran on the above referenced well.

Sincerely,

Keith Havelka
Operations

STATE OF TEXAS §
 §
COUNTY OF NUECES §

This instrument was acknowledged before me on the 23rd day of August,
A.D., 2017, by Keith Havelka.




Haleigh Chambless
Notary Public, State of Texas



Company: COG OPERATING
Lease/Well: BRANEX-COG FEDERAL COM/17H



Rig Name: SILVER OAK 3
State/County: NEW MEXICO/LEA
VS-Azi: 89.82 Degrees
Latitude: 32.84451, Longitude: -103.77962
Grid North = True North -0.30 degs (NAD 27)
Grid Correction Applied = -0.30 degs



Depth Reference : RKB 18 FEET

DRILLOG HA GYRO SURVEY CALCULATIONS

Filename: e-line gyro-de_01.ut
Minimum Curvature Method
Report Date/Time: 8/23/2017 / 14:28

VES Survey International
Midland, TX
432-563-5444

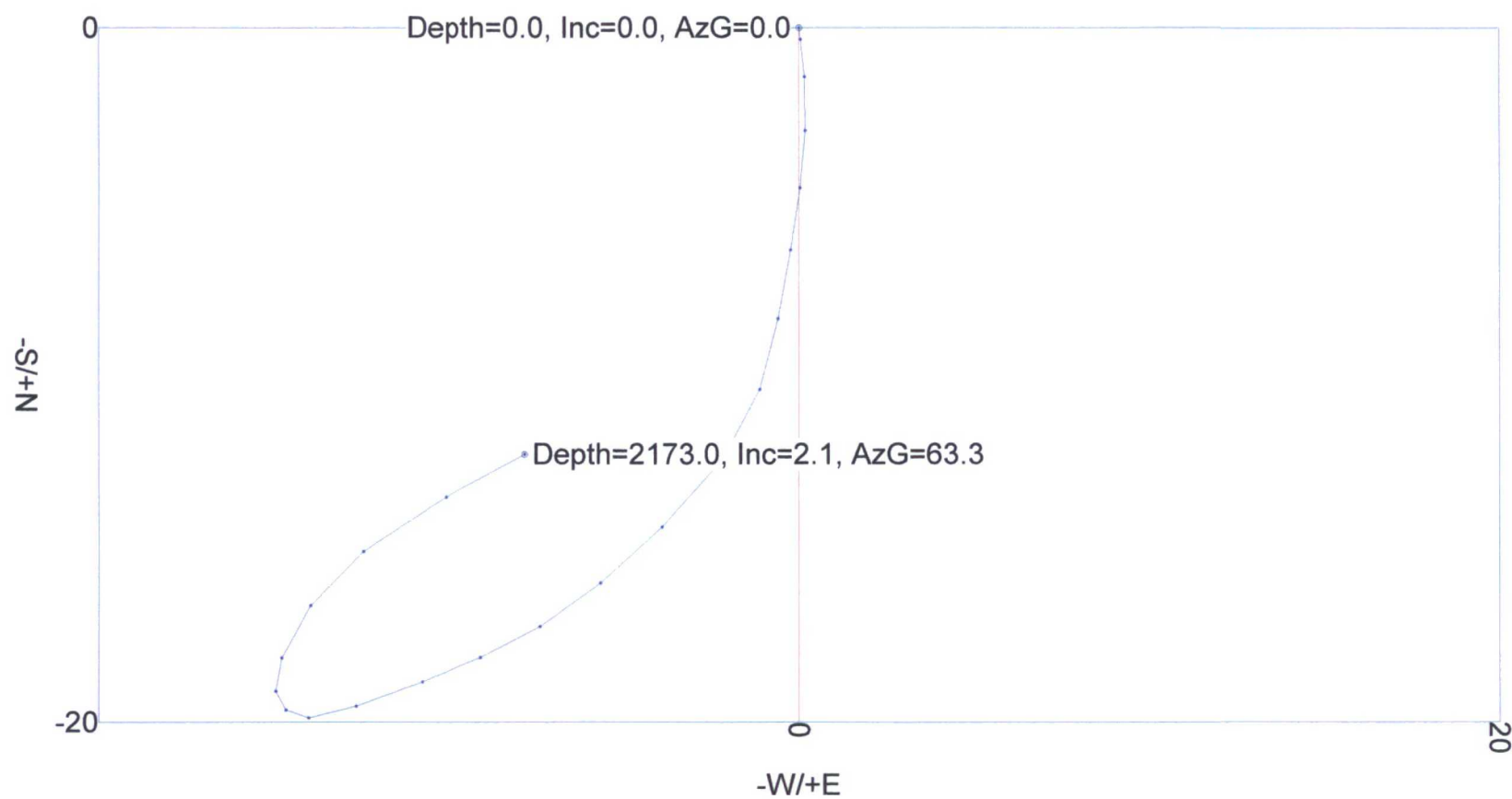
Surveyor: Andrew Meadville
Branex-COG Federal Com 17H / API 30-025-43743

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	0.39	171.86	100.00	-0.33	0.05	0.05	0.34	171.86	0.39
200.00	0.86	174.87	199.99	-1.41	0.16	0.16	1.42	173.44	0.47
300.00	0.91	183.16	299.98	-2.95	0.19	0.18	2.96	176.41	0.14
400.00	0.99	187.25	399.97	-4.61	0.03	0.02	4.61	179.60	0.10
500.00	1.07	189.38	499.95	-6.39	-0.23	-0.25	6.39	182.06	0.09
600.00	1.24	191.02	599.93	-8.37	-0.59	-0.62	8.39	184.02	0.17
700.00	1.18	197.88	699.91	-10.41	-1.11	-1.14	10.47	186.09	0.16
800.00	1.46	215.99	799.88	-12.42	-2.18	-2.21	12.61	189.93	0.50
900.00	1.54	227.08	899.85	-14.36	-3.91	-3.95	14.88	195.21	0.30
1000.00	1.20	227.37	999.82	-15.98	-5.66	-5.71	16.95	199.49	0.34
1100.00	1.27	240.25	1099.80	-17.24	-7.39	-7.44	18.76	203.19	0.29
1200.00	0.93	245.55	1199.78	-18.13	-9.09	-9.15	20.28	206.64	0.36
1300.00	1.16	248.66	1299.76	-18.83	-10.78	-10.84	21.70	209.78	0.24
1400.00	1.16	250.84	1399.74	-19.54	-12.68	-12.74	23.29	212.99	0.04
1500.00	0.48	268.81	1499.73	-19.88	-14.06	-14.12	24.34	215.27	0.72
1600.00	0.38	314.36	1599.73	-19.65	-14.71	-14.77	24.55	216.82	0.35

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
1700.00	0.36	350.34	1699.73	-19.11	-15.00	-15.06	24.30	218.13	0.23
1800.00	0.79	18.78	1799.72	-18.15	-14.83	-14.89	23.44	219.25	0.50
1900.00	1.22	35.21	1899.71	-16.63	-14.00	-14.05	21.74	220.08	0.51
2000.00	1.31	52.69	1999.68	-15.07	-12.47	-12.52	19.56	219.62	0.40
2100.00	1.96	59.51	2099.64	-13.50	-10.09	-10.13	16.86	216.76	0.67
2173.00	2.08	63.29	2172.59	-12.28	-7.83	-7.87	14.56	212.53	0.25



VES Survey International
Midland, TX
432-563-5444
Surveyor: Andrew Meadville
Branex-COG Federal Com 17H / API 30-025-43743





I Andrew Meadville certify that I am employed by VES Survey International. That I did on the day(s) of 08/19/17 through 08/19/17 conduct or supervise the taking of a Rate Gyro survey from a depth of 0.00 feet to a depth of 2,173.00 feet; that the data is true, correct, complete and within the limitations of the tool as set forth by Vaughn Energy Services, that I am authorized and qualified to make this report; that this survey was conducted at the request of COG Operating for the Branex-COG Federal Com Well # 17H API # 30-025-43743 in Lea County / Parish New Mexico; and that I have reviewed this report and find that it conforms to the principles and procedures as set forth by VES Survey International.

A handwritten signature in blue ink, appearing to read "A. Meadville", is written over a horizontal line.

Andrew Meadville
Service Technician
VES Survey International



I Andrew Meadville certify that I am employed by VES Survey International. That I did on the day(s) of 08/19/17 through 08/19/17 conduct or supervise the taking of a Rate Gyro survey from a depth of 0.00 feet to a depth of 2,173.00 feet; that the data is true, correct, complete and within the limitations of the tool as set forth by Vaughn Energy Services, that I am authorized and qualified to make this report; that this survey was conducted at the request of COG Operating for the Branex-COG Federal Com Well # 17H API # 30-025-43743 in Lea County / Parish New Mexico; and that I have reviewed this report and find that it conforms to the principles and procedures as set forth by VES Survey International.

A handwritten signature in blue ink, appearing to read "A. Meadville", is written over a horizontal line.

Andrew Meadville
Service Technician
VES Survey International