



PHOENIX
TECHNOLOGY SERVICES

HOBBS OCD

DEC 16 2019

RECEIVED

COG Operating LLC

Lea County, NM (NAD27 NME)

Huckleberry State Com

503H

OH / 64598

Design: Surveys (McVay 8)

Standard Survey Report

28 May, 2019





Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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		Huckleberry State Com			
Site Position:		Northing:	530,679.80 usft	Latitude:	32° 27' 23.5760 N
From:	Map	Easting:	739,901.70 usft	Longitude:	103° 33' 20.0715 W
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.42 °

Well	503H					
Well Position	+N/-S	0.00 usft	Northing:	530,673.10 usft	Latitude:	32° 27' 23.6028 N
	+E/-W	0.00 usft	Easting:	738,606.70 usft	Longitude:	103° 33' 35.1850 W
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	3,743.90 usft

Wellbore	OH / 64598				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	MVHD	5/1/2019	6.66	60.26	48,110.13847139

Design		Surveys (McVay 8)			
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	1.24	

Survey Program	Date 5/28/2019			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
100.00	10,090.00	SDI Gyros (OH / 64598)	Scientific Keeper	Scientific Drilling Intl. Standard Wireline Keeper
10,183.00	21,129.00	Phoenix MWD Surveys (OH / 64598)	MWD+HRGM	OWSG MWD + HRGM

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	0.47	321.19	100.00	0.32	-0.26	0.31	0.47	0.47	0.00
125.00	0.45	324.74	125.00	0.48	-0.38	0.47	0.14	-0.08	14.20
150.00	0.36	323.00	150.00	0.62	-0.48	0.61	0.36	-0.36	-6.96
175.00	0.49	316.32	175.00	0.76	-0.60	0.75	0.56	0.52	-26.72
200.00	0.35	331.24	200.00	0.91	-0.71	0.89	0.71	-0.56	59.68
225.00	0.37	333.67	225.00	1.05	-0.79	1.03	0.10	0.08	9.72
250.00	0.41	335.40	250.00	1.20	-0.86	1.18	0.17	0.16	6.92
275.00	0.25	359.48	274.99	1.34	-0.90	1.32	0.83	-0.64	96.32
300.00	0.54	338.32	299.99	1.50	-0.94	1.48	1.28	1.16	-84.64



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Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
325.00	0.61	337.08	324.99	1.73	-1.04	1.71	0.28	0.28	-4.96
350.00	0.55	334.10	349.99	1.96	-1.14	1.94	0.27	-0.24	-11.92
375.00	0.48	325.88	374.99	2.16	-1.25	2.13	0.41	-0.28	-32.88
400.00	0.35	333.40	399.99	2.31	-1.34	2.28	0.56	-0.52	30.08
425.00	0.22	330.47	424.99	2.42	-1.40	2.39	0.52	-0.52	-11.72
450.00	0.12	346.79	449.99	2.49	-1.43	2.46	0.44	-0.40	65.28
475.00	0.18	341.79	474.99	2.55	-1.45	2.52	0.25	0.24	-20.00
500.00	0.19	352.77	499.99	2.63	-1.47	2.60	0.15	0.04	43.92
525.00	0.20	14.87	524.99	2.71	-1.46	2.68	0.30	0.04	88.40
550.00	0.26	9.22	549.99	2.81	-1.44	2.78	0.26	0.24	-22.60
575.00	0.30	26.35	574.99	2.93	-1.40	2.90	0.37	0.16	68.52
600.00	0.36	71.00	599.99	3.01	-1.30	2.98	1.03	0.24	178.60
625.00	0.26	36.26	624.99	3.08	-1.19	3.06	0.83	-0.40	-138.96
650.00	0.36	34.00	649.99	3.19	-1.11	3.17	0.40	0.40	-9.04
675.00	0.48	58.29	674.99	3.31	-0.98	3.29	0.85	0.48	97.16
700.00	0.56	54.44	699.99	3.44	-0.79	3.42	0.35	0.32	-15.40
725.00	0.54	63.43	724.98	3.56	-0.59	3.55	0.35	-0.08	35.96
750.00	0.47	44.53	749.98	3.69	-0.41	3.68	0.72	-0.28	-75.60
775.00	0.47	48.12	774.98	3.83	-0.26	3.82	0.12	0.00	14.36
800.00	0.53	55.64	799.98	3.96	-0.09	3.96	0.36	0.24	30.08
825.00	0.53	58.78	824.98	4.09	0.10	4.09	0.12	0.00	12.56
850.00	0.48	51.22	849.98	4.21	0.28	4.22	0.33	-0.20	-30.24
875.00	0.60	50.99	874.98	4.36	0.47	4.37	0.48	0.48	-0.92
900.00	0.63	50.44	899.98	4.53	0.67	4.55	0.12	0.12	-2.20
925.00	0.69	52.72	924.98	4.71	0.90	4.73	0.26	0.24	9.12
950.00	0.81	64.60	949.97	4.88	1.18	4.90	0.78	0.48	47.52
975.00	0.75	52.55	974.97	5.05	1.47	5.08	0.70	-0.24	-48.20
1,000.00	0.75	45.77	999.97	5.27	1.72	5.30	0.35	0.00	-27.12
1,025.00	0.83	36.77	1,024.97	5.53	1.94	5.57	0.59	0.32	-36.00
1,050.00	0.73	30.42	1,049.96	5.81	2.13	5.85	0.53	-0.40	-25.40
1,075.00	0.89	32.38	1,074.96	6.11	2.32	6.16	0.65	0.64	7.84
1,100.00	1.01	35.18	1,099.96	6.45	2.55	6.51	0.51	0.48	11.20
1,125.00	1.03	33.89	1,124.95	6.82	2.80	6.88	0.12	0.08	-5.16
1,150.00	1.10	35.97	1,149.95	7.20	3.07	7.27	0.32	0.28	8.32
1,175.00	1.02	35.20	1,174.95	7.58	3.33	7.65	0.33	-0.32	-3.08
1,200.00	1.06	31.94	1,199.94	7.96	3.58	8.03	0.29	0.16	-13.04
1,225.00	1.03	34.71	1,224.94	8.34	3.84	8.42	0.23	-0.12	11.08
1,250.00	1.04	36.98	1,249.93	8.70	4.10	8.79	0.17	0.04	9.08
1,275.00	1.11	60.15	1,274.93	9.00	4.45	9.10	1.75	0.28	92.68
1,300.00	0.96	29.59	1,299.93	9.31	4.76	9.41	2.26	-0.60	-122.24
1,325.00	0.88	25.38	1,324.92	9.66	4.95	9.77	0.42	-0.32	-16.84
1,350.00	0.77	25.34	1,349.92	9.99	5.10	10.10	0.44	-0.44	-0.16
1,375.00	0.78	13.36	1,374.92	10.30	5.21	10.42	0.65	0.04	-47.92

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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)
1,400.00	0.73	12.95	1,399.92	10.63	5.29	10.74	0.20	-0.20	-1.64
1,425.00	0.56	17.38	1,424.91	10.90	5.36	11.01	0.71	-0.68	17.72
1,450.00	0.54	13.68	1,449.91	11.13	5.42	11.24	0.16	-0.08	-14.80
1,475.00	0.47	6.33	1,474.91	11.34	5.46	11.46	0.38	-0.28	-29.40
1,500.00	0.36	14.64	1,499.91	11.52	5.49	11.64	0.50	-0.44	33.24
1,525.00	0.54	30.22	1,524.91	11.70	5.57	11.82	0.86	0.72	62.32
1,550.00	0.51	23.43	1,549.91	11.90	5.68	12.02	0.28	-0.12	-27.16
1,575.00	0.60	8.59	1,574.91	12.14	5.74	12.26	0.68	0.36	-59.36
1,600.00	0.57	19.64	1,599.91	12.38	5.80	12.51	0.47	-0.12	44.20
1,625.00	0.54	19.90	1,624.91	12.61	5.88	12.74	0.12	-0.12	1.04
1,650.00	0.57	26.04	1,649.90	12.83	5.98	12.96	0.27	0.12	24.56
1,675.00	0.65	29.88	1,674.90	13.07	6.10	13.20	0.36	0.32	15.36
1,700.00	0.60	45.23	1,699.90	13.28	6.27	13.42	0.70	-0.20	61.40
1,725.00	0.93	0.36	1,724.90	13.58	6.36	13.71	2.64	1.32	-179.48
1,750.00	0.95	6.56	1,749.90	13.99	6.38	14.12	0.41	0.08	24.80
1,775.00	0.82	68.71	1,774.89	14.26	6.58	14.40	3.68	-0.52	248.60
1,800.00	0.84	10.30	1,799.89	14.50	6.77	14.65	3.24	0.08	-233.64
1,825.00	0.86	4.44	1,824.89	14.87	6.82	15.01	0.36	0.08	-23.44
1,850.00	1.02	14.40	1,849.88	15.27	6.89	15.42	0.91	0.64	39.84
1,875.00	1.21	18.61	1,874.88	15.74	7.03	15.89	0.83	0.76	16.84
1,900.00	1.22	29.81	1,899.87	16.22	7.25	16.37	0.95	0.04	44.80
1,925.00	1.53	29.08	1,924.87	16.74	7.54	16.90	1.24	1.24	-2.92
1,950.00	1.48	32.05	1,949.86	17.31	7.88	17.47	0.37	-0.20	11.88
1,975.00	1.55	35.43	1,974.85	17.86	8.24	18.03	0.45	0.28	13.52
2,000.00	1.58	39.71	1,999.84	18.40	8.66	18.58	0.48	0.12	17.12
2,025.00	1.65	40.43	2,024.83	18.94	9.11	19.13	0.29	0.28	2.88
2,050.00	1.69	45.80	2,049.82	19.47	9.61	19.67	0.65	0.16	21.48
2,075.00	1.68	48.52	2,074.81	19.97	10.15	20.18	0.32	-0.04	10.88
2,100.00	1.58	56.18	2,099.80	20.40	10.71	20.63	0.96	-0.40	30.64
2,125.00	1.58	74.89	2,124.79	20.68	11.33	20.92	2.05	0.00	74.84
2,150.00	1.79	91.70	2,149.78	20.76	12.05	21.02	2.14	0.84	67.24
2,175.00	1.82	94.72	2,174.77	20.72	12.84	20.99	0.40	0.12	12.08
2,200.00	1.75	94.06	2,199.75	20.66	13.62	20.95	0.29	-0.28	-2.64
2,225.00	1.87	96.84	2,224.74	20.58	14.40	20.89	0.59	0.48	11.12
2,250.00	1.98	102.04	2,249.73	20.44	15.23	20.77	0.83	0.44	20.80
2,275.00	1.97	101.83	2,274.71	20.27	16.07	20.61	0.05	-0.04	-0.84
2,300.00	2.05	102.72	2,299.70	20.08	16.93	20.44	0.34	0.32	3.56
2,325.00	2.42	106.42	2,324.68	19.83	17.87	20.21	1.59	1.48	14.80
2,350.00	2.57	108.16	2,349.66	19.51	18.91	19.91	0.67	0.60	6.96
2,375.00	2.73	109.92	2,374.63	19.13	20.00	19.56	0.72	0.64	7.04
2,400.00	2.92	110.35	2,399.60	18.71	21.16	19.16	0.76	0.76	1.72
2,425.00	3.12	110.84	2,424.56	18.24	22.39	18.72	0.81	0.80	1.96
2,450.00	3.08	111.37	2,449.53	17.76	23.65	18.26	0.20	-0.16	2.12



Survey Report



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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)
2,475.00	2.99	109.68	2,474.49	17.29	24.89	17.83	0.51	-0.36	-6.76
2,500.00	3.07	106.87	2,499.46	16.88	26.15	17.44	0.67	0.32	-11.24
2,525.00	2.73	98.74	2,524.42	16.59	27.38	17.18	2.13	-1.36	-32.52
2,550.00	2.40	89.93	2,549.40	16.50	28.49	17.12	2.05	-1.32	-35.24
2,575.00	2.56	89.67	2,574.38	16.51	29.57	17.14	0.64	0.64	-1.04
2,600.00	2.84	92.37	2,599.35	16.48	30.75	17.15	1.23	1.12	10.80
2,625.00	2.59	90.54	2,624.32	16.45	31.93	17.14	1.06	-1.00	-7.32
2,650.00	2.56	89.62	2,649.30	16.45	33.05	17.16	0.20	-0.12	-3.68
2,675.00	2.60	87.42	2,674.27	16.48	34.18	17.22	0.43	0.16	-8.80
2,700.00	2.37	83.64	2,699.25	16.56	35.26	17.32	1.13	-0.92	-15.12
2,725.00	2.12	77.15	2,724.23	16.72	36.22	17.51	1.42	-1.00	-25.96
2,750.00	2.14	77.60	2,749.21	16.93	37.13	17.73	0.10	0.08	1.80
2,775.00	2.34	83.78	2,774.19	17.08	38.09	17.90	1.25	0.80	24.72
2,800.00	1.99	71.54	2,799.17	17.27	39.01	18.12	2.31	-1.40	-48.96
2,825.00	2.00	71.32	2,824.16	17.55	39.84	18.41	0.05	0.04	-0.88
2,850.00	1.93	69.33	2,849.14	17.84	40.64	18.72	0.39	-0.28	-7.96
2,875.00	2.14	70.38	2,874.13	18.15	41.48	19.04	0.85	0.84	4.20
2,900.00	2.35	73.07	2,899.11	18.45	42.41	19.37	0.94	0.84	10.76
2,925.00	2.51	70.27	2,924.09	18.79	43.41	19.72	0.80	0.64	-11.20
2,950.00	2.52	70.44	2,949.06	19.15	44.45	20.11	0.05	0.04	0.68
2,975.00	2.77	73.29	2,974.04	19.51	45.54	20.50	1.13	1.00	11.40
3,000.00	3.11	75.31	2,999.00	19.86	46.78	20.87	1.42	1.36	8.08
3,025.00	3.15	75.87	3,023.97	20.20	48.10	21.24	0.20	0.16	2.24
3,050.00	3.29	77.05	3,048.93	20.53	49.46	21.59	0.62	0.56	4.72
3,075.00	3.32	80.79	3,073.88	20.80	50.88	21.90	0.87	0.12	14.96
3,100.00	3.41	84.18	3,098.84	20.99	52.33	22.12	0.87	0.36	13.56
3,125.00	3.40	86.68	3,123.80	21.11	53.81	22.27	0.60	-0.04	10.00
3,150.00	3.43	87.91	3,148.75	21.18	55.30	22.38	0.32	0.12	4.92
3,175.00	3.71	91.00	3,173.70	21.20	56.86	22.42	1.36	1.12	12.36
3,200.00	3.91	93.76	3,198.65	21.13	58.52	22.39	1.09	0.80	11.04
3,225.00	3.86	93.28	3,223.59	21.02	60.21	22.32	0.24	-0.20	-1.92
3,250.00	3.57	93.33	3,248.54	20.93	61.82	22.26	1.16	-1.16	0.20
3,275.00	3.34	94.10	3,273.49	20.83	63.33	22.20	0.94	-0.92	3.08
3,300.00	3.21	94.75	3,298.45	20.72	64.75	22.12	0.54	-0.52	2.60
3,325.00	2.80	100.20	3,323.42	20.55	66.05	21.98	2.00	-1.64	21.80
3,350.00	2.14	108.74	3,348.39	20.30	67.09	21.75	3.02	-2.64	34.16
3,375.00	1.98	116.80	3,373.38	19.95	67.92	21.42	1.32	-0.64	32.24
3,400.00	1.80	124.11	3,398.37	19.54	68.63	21.02	1.20	-0.72	29.24
3,425.00	1.73	132.12	3,423.35	19.06	69.23	20.56	1.02	-0.28	32.04
3,450.00	1.70	138.36	3,448.34	18.53	69.76	20.04	0.76	-0.12	24.96
3,475.00	1.86	141.85	3,473.33	17.94	70.26	19.46	0.77	0.64	13.96
3,500.00	1.78	141.89	3,498.32	17.31	70.75	18.84	0.32	-0.32	0.16
3,525.00	1.82	140.95	3,523.30	16.70	71.24	18.24	0.20	0.16	-3.76
3,550.00	1.90	142.86	3,548.29	16.06	71.74	17.61	0.40	0.32	7.64

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Design:	Surveys (McVay 8)	Database:	USA Compass

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)
3,575.00	1.92	145.70	3,573.28	15.38	72.22	16.95	0.39	0.08	11.36
3,600.00	1.94	145.28	3,598.26	14.69	72.70	16.26	0.10	0.08	-1.68
3,625.00	1.98	145.59	3,623.25	13.99	73.19	15.57	0.17	0.16	1.24
3,650.00	2.28	143.64	3,648.23	13.23	73.73	14.83	1.23	1.20	-7.80
3,675.00	1.85	150.61	3,673.22	12.48	74.22	14.08	1.99	-1.72	27.88
3,700.00	2.01	150.07	3,698.20	11.75	74.64	13.36	0.64	0.64	-2.16
3,725.00	2.05	152.04	3,723.19	10.97	75.06	12.60	0.32	0.16	7.88
3,750.00	2.05	152.24	3,748.17	10.18	75.48	11.81	0.03	0.00	0.80
3,775.00	2.03	151.47	3,773.15	9.40	75.90	11.04	0.14	-0.08	-3.08
3,800.00	2.14	152.69	3,798.14	8.59	76.33	10.24	0.47	0.44	4.88
3,825.00	2.28	150.81	3,823.12	7.74	76.78	9.41	0.63	0.56	-7.52
3,850.00	2.24	149.43	3,848.10	6.89	77.27	8.56	0.27	-0.16	-5.52
3,875.00	2.37	148.60	3,873.08	6.03	77.79	7.71	0.54	0.52	-3.32
3,900.00	2.37	148.57	3,898.06	5.14	78.33	6.84	0.00	0.00	-0.12
3,925.00	2.22	148.80	3,923.04	4.29	78.85	6.00	0.60	-0.60	0.92
3,950.00	2.31	148.03	3,948.02	3.45	79.37	5.17	0.38	0.36	-3.08
3,975.00	2.47	147.95	3,973.00	2.56	79.92	4.30	0.64	0.64	-0.32
4,000.00	2.53	147.86	3,997.97	1.64	80.50	3.38	0.24	0.24	-0.36
4,025.00	2.49	148.09	4,022.95	0.71	81.08	2.47	0.16	-0.16	0.92
4,050.00	2.41	148.72	4,047.93	-0.20	81.64	1.57	0.34	-0.32	2.52
4,075.00	2.25	151.65	4,072.90	-1.08	82.15	0.70	0.80	-0.64	11.72
4,100.00	2.41	150.41	4,097.88	-1.97	82.64	-0.18	0.67	0.64	-4.96
4,125.00	2.59	149.52	4,122.86	-2.91	83.19	-1.11	0.74	0.72	-3.56
4,150.00	2.64	148.00	4,147.83	-3.89	83.78	-2.07	0.34	0.20	-6.08
4,175.00	2.66	148.92	4,172.81	-4.87	84.38	-3.04	0.19	0.08	3.68
4,200.00	2.64	150.38	4,197.78	-5.87	84.97	-4.03	0.28	-0.08	5.84
4,225.00	2.69	148.68	4,222.75	-6.87	85.56	-5.02	0.37	0.20	-6.80
4,250.00	2.62	149.76	4,247.73	-7.87	86.15	-6.00	0.34	-0.28	4.32
4,275.00	2.65	150.07	4,272.70	-8.86	86.73	-6.98	0.13	0.12	1.24
4,300.00	2.85	149.64	4,297.67	-9.90	87.33	-8.00	0.80	0.80	-1.72
4,325.00	2.53	152.42	4,322.64	-10.92	87.90	-9.02	1.38	-1.28	11.12
4,350.00	2.66	152.63	4,347.62	-11.93	88.42	-10.01	0.52	0.52	0.84
4,375.00	2.79	155.23	4,372.59	-13.00	88.94	-11.06	0.72	0.52	10.40
4,400.00	2.87	156.35	4,397.56	-14.12	89.45	-12.18	0.39	0.32	4.48
4,425.00	2.84	155.67	4,422.53	-15.26	89.95	-13.31	0.18	-0.12	-2.72
4,450.00	2.99	155.47	4,447.50	-16.42	90.48	-14.45	0.60	0.60	-0.80
4,475.00	3.07	155.02	4,472.46	-17.62	91.03	-15.64	0.33	0.32	-1.80
4,500.00	3.03	154.88	4,497.43	-18.82	91.60	-16.83	0.16	-0.16	-0.56
4,525.00	2.95	157.35	4,522.39	-20.01	92.12	-18.01	0.61	-0.32	9.88
4,550.00	3.07	151.86	4,547.36	-21.20	92.69	-19.18	1.25	0.48	-21.96
4,575.00	3.11	151.12	4,572.32	-22.38	93.33	-20.35	0.23	0.16	-2.96
4,600.00	3.12	148.99	4,597.28	-23.56	94.01	-21.51	0.46	0.04	-8.52
4,625.00	3.23	142.67	4,622.25	-24.70	94.79	-22.64	1.47	0.44	-25.28

Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
4,650.00	3.30	139.28	4,647.21	-25.81	95.68	-23.73	0.82	0.28	-13.56
4,675.00	3.28	139.23	4,672.16	-26.89	96.62	-24.79	0.08	-0.08	-0.20
4,700.00	3.30	140.11	4,697.12	-27.99	97.55	-25.87	0.22	0.08	3.52
4,725.00	3.33	139.25	4,722.08	-29.09	98.48	-26.95	0.23	0.12	-3.44
4,750.00	3.39	137.53	4,747.04	-30.19	99.46	-28.02	0.47	0.24	-6.88
4,775.00	3.18	140.92	4,772.00	-31.27	100.39	-29.08	1.14	-0.84	13.56
4,800.00	3.02	142.81	4,796.96	-32.33	101.23	-30.13	0.76	-0.64	7.56
4,825.00	3.06	143.13	4,821.93	-33.39	102.03	-31.17	0.17	0.16	1.28
4,850.00	3.03	143.77	4,846.89	-34.46	102.82	-32.22	0.18	-0.12	2.56
4,875.00	3.06	142.39	4,871.85	-35.52	103.61	-33.26	0.32	0.12	-5.52
4,900.00	2.92	139.87	4,896.82	-36.53	104.43	-34.26	0.77	-0.56	-10.08
4,925.00	2.96	138.67	4,921.79	-37.51	105.27	-35.21	0.29	0.16	-4.80
4,950.00	2.88	140.90	4,946.76	-38.48	106.09	-36.17	0.56	-0.32	8.92
4,975.00	2.92	139.98	4,971.72	-39.45	106.90	-37.13	0.25	0.16	-3.68
5,000.00	2.94	138.95	4,996.69	-40.42	107.73	-38.08	0.23	0.08	-4.12
5,025.00	2.84	139.37	5,021.66	-41.38	108.55	-39.01	0.41	-0.40	1.68
5,050.00	2.97	138.50	5,046.63	-42.33	109.38	-39.95	0.55	0.52	-3.48
5,075.00	3.02	136.63	5,071.59	-43.30	110.27	-40.90	0.44	0.20	-7.48
5,100.00	3.07	133.82	5,096.56	-44.24	111.20	-41.82	0.63	0.20	-11.24
5,125.00	2.93	134.69	5,121.52	-45.15	112.14	-42.71	0.59	-0.56	3.48
5,150.00	2.88	134.84	5,146.49	-46.04	113.04	-43.58	0.20	-0.20	0.60
5,175.00	2.86	133.95	5,171.46	-46.92	113.93	-44.44	0.20	-0.08	-3.56
5,200.00	2.92	131.39	5,196.43	-47.77	114.86	-45.27	0.57	0.24	-10.24
5,225.00	3.32	128.12	5,221.39	-48.64	115.91	-46.12	1.75	1.60	-13.08
5,250.00	2.81	135.18	5,246.36	-49.52	116.91	-46.98	2.53	-2.04	28.24
5,275.00	2.74	134.14	5,271.33	-50.37	117.77	-47.81	0.34	-0.28	-4.16
5,300.00	2.84	132.42	5,296.30	-51.21	118.65	-48.62	0.52	0.40	-6.88
5,325.00	2.97	133.73	5,321.26	-52.07	119.58	-49.47	0.58	0.52	5.24
5,350.00	2.95	133.94	5,346.23	-52.97	120.51	-50.34	0.09	-0.08	0.84
5,375.00	3.11	132.52	5,371.20	-53.87	121.47	-51.23	0.71	0.64	-5.68
5,400.00	3.06	133.21	5,396.16	-54.79	122.46	-52.12	0.25	-0.20	2.76
5,425.00	3.20	131.77	5,421.12	-55.71	123.47	-53.02	0.64	0.56	-5.76
5,450.00	3.30	129.99	5,446.08	-56.64	124.54	-53.92	0.57	0.40	-7.12
5,475.00	3.51	127.49	5,471.04	-57.56	125.70	-54.82	1.03	0.84	-10.00
5,500.00	3.91	122.13	5,495.99	-58.48	127.03	-55.71	2.12	1.60	-21.44
5,525.00	4.74	115.07	5,520.91	-59.37	128.68	-56.57	3.94	3.32	-28.24
5,550.00	4.70	115.39	5,545.83	-60.25	130.54	-57.41	0.19	-0.16	1.28
5,575.00	4.77	114.90	5,570.74	-61.13	132.41	-58.24	0.32	0.28	-1.96
5,600.00	4.79	115.74	5,595.66	-62.02	134.30	-59.09	0.29	0.08	3.36
5,625.00	4.86	113.95	5,620.57	-62.90	136.20	-59.93	0.66	0.28	-7.16
5,650.00	5.00	115.00	5,645.48	-63.79	138.16	-60.78	0.67	0.56	4.20
5,675.00	4.96	115.03	5,670.38	-64.71	140.13	-61.66	0.16	-0.16	0.12
5,700.00	4.95	115.19	5,695.29	-65.63	142.08	-62.53	0.07	-0.04	0.64



Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
5,725.00	4.87	114.27	5,720.20	-66.52	144.02	-63.38	0.45	-0.32	-3.68
5,750.00	4.77	113.66	5,745.11	-67.38	145.94	-64.19	0.45	-0.40	-2.44
5,775.00	4.70	109.27	5,770.02	-68.13	147.86	-64.91	1.48	-0.28	-17.56
5,800.00	4.83	100.61	5,794.94	-68.66	149.86	-65.40	2.92	0.52	-34.64
5,825.00	4.78	99.98	5,819.85	-69.04	151.92	-65.73	0.29	-0.20	-2.52
5,850.00	4.79	99.54	5,844.76	-69.39	153.98	-66.03	0.15	0.04	-1.76
5,875.00	4.83	101.27	5,869.67	-69.77	156.04	-66.37	0.60	0.16	6.92
5,900.00	4.97	100.78	5,894.58	-70.18	158.14	-66.73	0.58	0.56	-1.96
5,925.00	5.00	100.28	5,919.49	-70.57	160.27	-67.08	0.21	0.12	-2.00
5,950.00	4.93	100.20	5,944.39	-70.96	162.40	-67.42	0.28	-0.28	-0.32
5,975.00	5.12	100.01	5,969.30	-71.34	164.56	-67.76	0.76	0.76	-0.76
6,000.00	5.02	99.73	5,994.20	-71.72	166.73	-68.09	0.41	-0.40	-1.12
6,025.00	4.89	100.38	6,019.11	-72.10	168.86	-68.42	0.57	-0.52	2.60
6,050.00	4.93	99.94	6,044.02	-72.48	170.97	-68.75	0.22	0.16	-1.76
6,075.00	4.88	100.69	6,068.92	-72.86	173.07	-69.09	0.33	-0.20	3.00
6,100.00	5.01	101.48	6,093.83	-73.27	175.18	-69.46	0.59	0.52	3.16
6,125.00	4.99	100.64	6,118.74	-73.69	177.32	-69.83	0.30	-0.08	-3.36
6,150.00	5.50	100.41	6,143.63	-74.11	179.57	-70.20	2.04	2.04	-0.92
6,175.00	4.99	100.53	6,168.53	-74.52	181.82	-70.56	2.04	-2.04	0.48
6,200.00	4.83	100.46	6,193.43	-74.91	183.92	-70.91	0.64	-0.64	-0.28
6,225.00	4.95	100.48	6,218.34	-75.30	186.02	-71.25	0.48	0.48	0.08
6,250.00	5.07	101.06	6,243.25	-75.71	188.16	-71.61	0.52	0.48	2.32
6,275.00	4.95	100.99	6,268.15	-76.13	190.30	-71.98	0.48	-0.48	-0.28
6,300.00	5.28	100.99	6,293.05	-76.55	192.49	-72.36	1.32	1.32	0.00
6,325.00	5.16	100.31	6,317.95	-76.97	194.73	-72.73	0.54	-0.48	-2.72
6,350.00	5.25	100.69	6,342.85	-77.39	196.96	-73.09	0.39	0.36	1.52
6,375.00	5.15	100.47	6,367.74	-77.80	199.19	-73.46	0.41	-0.40	-0.88
6,400.00	5.22	101.21	6,392.64	-78.23	201.40	-73.84	0.39	0.28	2.96
6,425.00	5.17	101.81	6,417.54	-78.68	203.62	-74.24	0.30	-0.20	2.40
6,450.00	5.28	102.36	6,442.43	-79.15	205.85	-74.67	0.48	0.44	2.20
6,475.00	5.35	101.35	6,467.33	-79.63	208.11	-75.10	0.47	0.28	-4.04
6,500.00	5.35	100.66	6,492.22	-80.08	210.40	-75.49	0.26	0.00	-2.76
6,525.00	5.43	100.44	6,517.11	-80.51	212.71	-75.87	0.33	0.32	-0.88
6,550.00	5.44	100.61	6,541.99	-80.94	215.04	-76.25	0.08	0.04	0.68
6,575.00	5.45	101.61	6,566.88	-81.39	217.37	-76.66	0.38	0.04	4.00
6,600.00	5.41	102.37	6,591.77	-81.89	219.68	-77.10	0.33	-0.16	3.04
6,625.00	5.34	102.70	6,616.66	-82.39	221.97	-77.56	0.31	-0.28	1.32
6,650.00	5.50	102.05	6,641.55	-82.90	224.27	-78.02	0.69	0.64	-2.60
6,675.00	5.41	101.56	6,666.43	-83.39	226.60	-78.45	0.41	-0.36	-1.96
6,700.00	5.27	102.15	6,691.33	-83.86	228.88	-78.88	0.60	-0.56	2.36
6,725.00	5.42	102.49	6,716.22	-84.36	231.15	-79.33	0.61	0.60	1.36
6,750.00	5.51	102.12	6,741.10	-84.87	233.48	-79.78	0.39	0.36	-1.48
6,775.00	5.40	102.40	6,765.99	-85.37	235.80	-80.24	0.45	-0.44	1.12
6,800.00	5.46	102.87	6,790.88	-85.89	238.11	-80.71	0.30	0.24	1.88

Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
6,825.00	5.73	102.11	6,815.76	-86.42	240.49	-81.18	1.12	1.08	-3.04
6,850.00	5.69	102.65	6,840.64	-86.95	242.92	-81.66	0.27	-0.16	2.16
6,875.00	5.36	102.57	6,865.52	-87.48	245.27	-82.14	1.32	-1.32	-0.32
6,900.00	5.48	103.35	6,890.41	-88.01	247.57	-82.62	0.56	0.48	3.12
6,925.00	5.53	103.47	6,915.29	-88.56	249.90	-83.12	0.21	0.20	0.48
6,950.00	5.56	103.66	6,940.18	-89.13	252.25	-83.64	0.14	0.12	0.76
6,975.00	5.40	103.64	6,965.06	-89.69	254.57	-84.15	0.64	-0.64	-0.08
7,000.00	5.53	103.56	6,989.95	-90.25	256.88	-84.66	0.52	0.52	-0.32
7,025.00	5.43	104.87	7,014.83	-90.84	259.20	-85.19	0.64	-0.40	5.24
7,050.00	5.27	105.58	7,039.72	-91.45	261.45	-85.76	0.69	-0.64	2.84
7,075.00	5.37	106.65	7,064.62	-92.09	263.67	-86.35	0.56	0.40	4.28
7,100.00	5.48	107.04	7,089.50	-92.78	265.94	-86.99	0.46	0.44	1.56
7,125.00	5.43	107.24	7,114.39	-93.48	268.21	-87.64	0.21	-0.20	0.80
7,150.00	5.37	106.59	7,139.28	-94.16	270.46	-88.28	0.34	-0.24	-2.60
7,175.00	5.28	107.13	7,164.17	-94.84	272.68	-88.90	0.41	-0.36	2.16
7,200.00	5.41	107.30	7,189.06	-95.53	274.90	-89.54	0.52	0.52	0.68
7,225.00	5.31	106.99	7,213.95	-96.21	277.13	-90.18	0.42	-0.40	-1.24
7,250.00	5.27	107.06	7,238.85	-96.89	279.34	-90.81	0.16	-0.16	0.28
7,275.00	5.37	107.05	7,263.74	-97.57	281.55	-91.44	0.40	0.40	-0.04
7,300.00	5.21	107.65	7,288.63	-98.26	283.75	-92.08	0.68	-0.64	2.40
7,325.00	5.11	107.99	7,313.53	-98.94	285.90	-92.72	0.42	-0.40	1.36
7,350.00	5.13	107.77	7,338.43	-99.63	288.02	-93.36	0.11	0.08	-0.88
7,375.00	5.03	108.75	7,363.33	-100.32	290.12	-94.01	0.53	-0.40	3.92
7,400.00	5.06	108.69	7,388.24	-101.03	292.20	-94.67	0.12	0.12	-0.24
7,425.00	5.13	108.62	7,413.14	-101.74	294.31	-95.33	0.28	0.28	-0.28
7,450.00	5.13	108.92	7,438.04	-102.46	296.42	-96.00	0.11	0.00	1.20
7,475.00	5.06	108.97	7,462.94	-103.18	298.52	-96.68	0.28	-0.28	0.20
7,500.00	5.06	109.60	7,487.84	-103.91	300.60	-97.36	0.22	0.00	2.52
7,525.00	5.09	109.55	7,512.74	-104.65	302.69	-98.06	0.12	0.12	-0.20
7,550.00	4.99	109.58	7,537.65	-105.38	304.76	-98.75	0.40	-0.40	0.12
7,575.00	4.65	110.91	7,562.56	-106.11	306.73	-99.43	1.43	-1.36	5.32
7,600.00	4.89	111.29	7,587.47	-106.86	308.67	-100.14	0.97	0.96	1.52
7,625.00	4.85	111.75	7,612.38	-107.64	310.64	-100.87	0.22	-0.16	1.84
7,650.00	4.85	110.96	7,637.29	-108.41	312.61	-101.60	0.27	0.00	-3.16
7,675.00	4.81	111.94	7,662.20	-109.18	314.57	-102.33	0.37	-0.16	3.92
7,700.00	4.81	112.66	7,687.12	-109.97	316.51	-103.08	0.24	0.00	2.88
7,725.00	4.81	112.95	7,712.03	-110.78	318.44	-103.85	0.10	0.00	1.16
7,750.00	4.71	112.65	7,736.94	-111.59	320.35	-104.61	0.41	-0.40	-1.20
7,775.00	4.16	111.14	7,761.87	-112.31	322.15	-105.30	2.25	-2.20	-6.04
7,800.00	2.99	101.58	7,786.82	-112.77	323.63	-105.72	5.24	-4.68	-38.24
7,825.00	2.72	96.91	7,811.79	-112.97	324.86	-105.90	1.42	-1.08	-18.68
7,850.00	2.62	96.48	7,836.76	-113.11	326.02	-106.01	0.41	-0.40	-1.72
7,875.00	2.06	86.62	7,861.74	-113.14	327.03	-106.02	2.75	-2.24	-39.44



Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
7,900.00	1.19	57.70	7,886.73	-112.98	327.70	-105.84	4.68	-3.48	-115.68
7,925.00	1.05	47.77	7,911.72	-112.69	328.09	-105.54	0.96	-0.56	-39.72
7,950.00	1.22	52.94	7,936.72	-112.37	328.47	-105.22	0.79	0.68	20.68
7,975.00	1.14	40.84	7,961.71	-112.02	328.85	-104.86	1.04	-0.32	-48.40
8,000.00	1.06	46.66	7,986.71	-111.68	329.18	-104.51	0.55	-0.32	23.28
8,025.00	1.24	47.34	8,011.70	-111.33	329.54	-104.16	0.72	0.72	2.72
8,050.00	1.19	51.69	8,036.70	-110.99	329.95	-103.81	0.42	-0.20	17.40
8,075.00	1.12	47.73	8,061.69	-110.66	330.33	-103.47	0.42	-0.28	-15.84
8,100.00	1.06	43.48	8,086.69	-110.33	330.67	-103.13	0.40	-0.24	-17.00
8,125.00	1.14	53.63	8,111.68	-110.02	331.03	-102.81	0.84	0.32	40.60
8,150.00	1.06	43.46	8,136.68	-109.70	331.39	-102.49	0.84	-0.32	-40.68
8,175.00	1.14	62.85	8,161.68	-109.42	331.77	-102.20	1.52	0.32	77.56
8,200.00	1.29	65.82	8,186.67	-109.19	332.25	-101.96	0.65	0.60	11.88
8,225.00	0.83	50.93	8,211.67	-108.96	332.65	-101.72	2.13	-1.84	-59.56
8,250.00	0.57	18.64	8,236.66	-108.73	332.83	-101.49	1.85	-1.04	-129.16
8,275.00	0.53	338.65	8,261.66	-108.50	332.82	-101.26	1.51	-0.16	-159.96
8,300.00	0.53	345.92	8,286.66	-108.28	332.75	-101.04	0.27	0.00	29.08
8,325.00	0.55	339.04	8,311.66	-108.06	332.68	-100.82	0.27	0.08	-27.52
8,350.00	0.53	348.58	8,336.66	-107.84	332.62	-100.60	0.37	-0.08	38.16
8,375.00	0.53	335.02	8,361.66	-107.62	332.54	-100.38	0.50	0.00	-54.24
8,400.00	0.59	340.94	8,386.66	-107.39	332.45	-100.15	0.33	0.24	23.68
8,425.00	0.49	341.40	8,411.66	-107.17	332.38	-99.93	0.40	-0.40	1.84
8,450.00	0.59	337.35	8,436.66	-106.95	332.29	-99.71	0.43	0.40	-16.20
8,475.00	0.52	334.01	8,461.65	-106.73	332.19	-99.50	0.31	-0.28	-13.36
8,500.00	0.54	345.51	8,486.65	-106.51	332.12	-99.28	0.43	0.08	46.00
8,525.00	0.54	334.88	8,511.65	-106.29	332.04	-99.06	0.40	0.00	-42.52
8,550.00	0.57	336.17	8,536.65	-106.07	331.94	-98.85	0.13	0.12	5.16
8,575.00	0.50	334.20	8,561.65	-105.86	331.84	-98.64	0.29	-0.28	-7.88
8,600.00	0.42	347.98	8,586.65	-105.67	331.77	-98.45	0.54	-0.32	55.12
8,625.00	0.40	336.61	8,611.65	-105.50	331.72	-98.28	0.33	-0.08	-45.48
8,650.00	0.42	353.83	8,636.65	-105.33	331.67	-98.11	0.50	0.08	68.88
8,675.00	0.38	334.92	8,661.65	-105.16	331.63	-97.95	0.55	-0.16	-75.64
8,700.00	0.42	343.67	8,686.65	-105.00	331.57	-97.78	0.29	0.16	35.00
8,725.00	0.39	341.23	8,711.65	-104.83	331.51	-97.62	0.14	-0.12	-9.76
8,750.00	0.39	7.50	8,736.64	-104.67	331.50	-97.45	0.71	0.00	105.08
8,775.00	0.38	337.69	8,761.64	-104.51	331.48	-97.29	0.79	-0.04	-119.24
8,800.00	0.38	333.58	8,786.64	-104.35	331.41	-97.14	0.11	0.00	-16.44
8,825.00	0.18	344.70	8,811.64	-104.24	331.36	-97.03	0.83	-0.80	44.48
8,850.00	0.39	8.24	8,836.64	-104.12	331.36	-96.91	0.94	0.84	94.16
8,875.00	0.31	357.39	8,861.64	-103.97	331.37	-96.76	0.41	-0.32	-43.40
8,900.00	0.34	351.85	8,886.64	-103.83	331.36	-96.62	0.17	0.12	-22.16
8,925.00	0.31	339.15	8,911.64	-103.69	331.32	-96.48	0.31	-0.12	-50.80
8,950.00	0.19	10.25	8,936.64	-103.59	331.31	-96.38	0.71	-0.48	124.40



Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
8,975.00	0.21	328.68	8,961.64	-103.51	331.29	-96.30	0.57	0.08	-166.28
9,000.00	0.19	359.62	8,986.64	-103.43	331.27	-96.22	0.43	-0.08	123.76
9,025.00	0.17	317.44	9,011.64	-103.36	331.24	-96.15	0.52	-0.08	-168.72
9,050.00	0.30	329.80	9,036.64	-103.27	331.18	-96.07	0.56	0.52	49.44
9,075.00	0.21	309.92	9,061.64	-103.19	331.12	-95.98	0.50	-0.36	-79.52
9,100.00	0.24	318.97	9,086.64	-103.12	331.05	-95.91	0.19	0.12	36.20
9,125.00	0.21	44.97	9,111.64	-103.05	331.04	-95.84	1.23	-0.12	344.00
9,150.00	0.29	82.51	9,136.64	-103.01	331.14	-95.80	0.71	0.32	150.16
9,175.00	0.51	82.15	9,161.64	-102.98	331.31	-95.77	0.88	0.88	-1.44
9,200.00	0.84	84.98	9,186.64	-102.95	331.61	-95.73	1.33	1.32	11.32
9,225.00	0.91	88.61	9,211.64	-102.93	331.99	-95.71	0.36	0.28	14.52
9,250.00	0.94	88.27	9,236.63	-102.92	332.39	-95.69	0.12	0.12	-1.36
9,275.00	1.00	82.57	9,261.63	-102.89	332.81	-95.64	0.45	0.24	-22.80
9,300.00	1.00	85.29	9,286.62	-102.84	333.24	-95.59	0.19	0.00	10.88
9,325.00	1.03	83.73	9,311.62	-102.80	333.69	-95.53	0.16	0.12	-6.24
9,350.00	1.22	65.42	9,336.62	-102.66	334.15	-95.39	1.62	0.76	-73.24
9,375.00	1.29	53.15	9,361.61	-102.38	334.62	-95.10	1.11	0.28	-49.08
9,400.00	1.37	42.73	9,386.60	-101.99	335.05	-94.70	1.02	0.32	-41.68
9,425.00	1.25	34.95	9,411.60	-101.55	335.41	-94.25	0.86	-0.48	-31.12
9,450.00	1.05	30.79	9,436.59	-101.13	335.68	-93.83	0.87	-0.80	-16.64
9,475.00	1.05	23.35	9,461.59	-100.72	335.89	-93.41	0.54	0.00	-29.76
9,500.00	1.12	25.45	9,486.58	-100.29	336.08	-92.98	0.32	0.28	8.40
9,525.00	1.19	23.80	9,511.58	-99.83	336.29	-92.52	0.31	0.28	-6.60
9,550.00	1.19	24.22	9,536.57	-99.36	336.50	-92.04	0.03	0.00	1.68
9,575.00	1.34	25.32	9,561.57	-98.86	336.74	-91.53	0.61	0.60	4.40
9,600.00	1.26	25.53	9,586.56	-98.35	336.98	-91.01	0.32	-0.32	0.84
9,625.00	1.25	23.23	9,611.55	-97.85	337.20	-90.51	0.21	-0.04	-9.20
9,650.00	1.29	28.34	9,636.55	-97.35	337.45	-90.01	0.48	0.16	20.44
9,675.00	1.39	29.02	9,661.54	-96.84	337.73	-89.49	0.41	0.40	2.72
9,700.00	1.42	30.11	9,686.53	-96.30	338.03	-88.95	0.16	0.12	4.36
9,725.00	1.49	29.49	9,711.53	-95.75	338.34	-88.39	0.29	0.28	-2.48
9,750.00	1.54	31.10	9,736.52	-95.18	338.68	-87.81	0.26	0.20	6.44
9,775.00	1.52	28.67	9,761.51	-94.60	339.01	-87.23	0.27	-0.08	-9.72
9,800.00	1.70	30.37	9,786.50	-93.99	339.36	-86.61	0.74	0.72	6.80
9,825.00	1.76	32.83	9,811.49	-93.35	339.75	-85.96	0.38	0.24	9.84
9,850.00	1.75	33.04	9,836.47	-92.71	340.17	-85.31	0.05	-0.04	0.84
9,875.00	1.73	31.22	9,861.46	-92.07	340.57	-84.66	0.24	-0.08	-7.28
9,900.00	1.83	30.90	9,886.45	-91.40	340.97	-83.98	0.40	0.40	-1.28
9,925.00	1.83	32.57	9,911.44	-90.72	341.39	-83.29	0.21	0.00	6.68
9,950.00	1.73	31.33	9,936.43	-90.06	341.80	-82.63	0.43	-0.40	-4.96
9,975.00	1.87	30.41	9,961.41	-89.39	342.21	-81.94	0.57	0.56	-3.68
10,000.00	1.82	31.18	9,986.40	-88.70	342.62	-81.24	0.22	-0.20	3.08
10,025.00	1.68	28.25	10,011.39	-88.03	343.00	-80.57	0.66	-0.56	-11.72
10,050.00	1.83	29.38	10,036.38	-87.36	343.37	-79.90	0.62	0.60	4.52



Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Corn	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
10,075.00	1.64	33.95	10,061.37	-86.72	343.76	-79.24	0.94	-0.76	18.28
10,090.00	1.63	32.19	10,076.36	-86.36	344.00	-78.88	0.34	-0.07	-11.73
Tie In									
10,183.00	1.49	33.46	10,169.33	-84.23	345.37	-76.72	0.16	-0.15	1.37
First Phoenix MWD Survey									
10,214.00	2.00	29.96	10,200.31	-83.43	345.86	-75.91	1.68	1.65	-11.29
10,246.00	5.47	9.75	10,232.24	-81.44	346.40	-73.91	11.43	10.84	-63.16
10,278.00	9.33	358.89	10,263.97	-77.34	346.61	-69.81	12.78	12.06	-33.94
10,310.00	12.59	1.79	10,295.38	-71.26	346.66	-63.72	10.33	10.19	9.06
10,341.00	15.35	1.97	10,325.46	-63.78	346.91	-56.24	8.90	8.90	0.58
10,373.00	18.50	0.16	10,356.07	-54.47	347.07	-46.93	9.98	9.84	-5.66
10,404.00	20.95	359.19	10,385.25	-44.01	347.01	-36.47	7.97	7.90	-3.13
10,436.00	23.38	0.70	10,414.88	-31.94	347.00	-24.40	7.80	7.59	4.72
10,468.00	27.25	358.92	10,443.81	-18.26	346.94	-10.73	12.32	12.09	-5.56
10,499.00	30.42	358.22	10,470.96	-3.31	346.56	4.20	10.28	10.23	-2.26
10,531.00	34.37	357.38	10,497.97	13.81	345.90	21.31	12.42	12.34	-2.63
10,562.00	36.69	357.36	10,523.20	31.81	345.07	39.29	7.48	7.48	-0.06
10,594.00	37.47	359.24	10,548.73	51.09	344.50	58.55	4.30	2.44	5.88
10,626.00	40.23	359.05	10,573.65	71.16	344.20	78.61	8.63	8.63	-0.59
10,658.00	42.09	359.27	10,597.74	92.22	343.90	99.66	5.83	5.81	0.69
10,689.00	44.10	358.83	10,620.38	113.39	343.54	120.82	6.56	6.48	-1.42
10,721.00	48.22	358.75	10,642.54	136.46	343.05	143.87	12.88	12.88	-0.25
10,753.00	51.59	359.23	10,663.14	160.94	342.63	168.33	10.59	10.53	1.50
10,785.00	54.92	359.14	10,682.28	186.57	342.26	193.95	10.41	10.41	-0.28
10,817.00	58.74	357.90	10,699.79	213.34	341.56	220.70	12.37	11.94	-3.88
10,848.00	62.63	355.93	10,714.96	240.33	340.10	247.65	13.72	12.55	-6.35
10,879.00	66.60	354.22	10,728.25	268.22	337.69	275.48	13.74	12.81	-5.52
10,911.00	72.13	352.03	10,739.53	297.94	334.10	305.12	18.43	17.28	-6.84
10,942.00	76.78	351.50	10,747.83	327.49	329.82	334.56	15.09	15.00	-1.71
10,974.00	78.25	351.83	10,754.75	358.40	325.29	365.37	4.70	4.59	1.03
11,006.00	78.00	352.07	10,761.33	389.41	320.90	396.28	1.07	-0.78	0.75
11,038.00	79.49	352.38	10,767.58	420.50	316.66	427.27	4.75	4.66	0.97
11,070.00	81.25	352.61	10,772.93	451.78	312.54	458.45	5.55	5.50	0.72
11,095.34	81.27	352.58	10,776.78	476.62	309.31	483.21	0.16	0.10	-0.13
FTP: 11095.34' MD									
11,101.00	81.28	352.57	10,777.64	482.16	308.59	488.74	0.16	0.10	-0.13
11,133.00	81.07	352.19	10,782.55	513.51	304.39	519.99	1.34	-0.66	-1.19
11,165.00	80.99	351.66	10,787.54	544.80	299.95	551.18	1.65	-0.25	-1.66
11,196.00	81.62	353.60	10,792.23	575.19	296.02	581.48	6.51	2.03	6.26
11,228.00	82.46	356.43	10,796.66	606.76	293.27	612.98	9.14	2.63	8.84
11,260.00	83.73	358.53	10,800.51	638.49	291.87	644.67	7.63	3.97	6.56
11,297.00	87.34	1.72	10,803.39	675.37	291.96	681.54	13.00	9.76	8.62
11,393.00	89.61	2.28	10,805.94	771.27	295.31	777.49	2.44	2.36	0.58



Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
11,488.00	90.53	1.92	10,805.83	866.21	298.79	872.48	1.04	0.97	-0.38
11,583.00	91.48	1.79	10,804.16	961.14	301.86	967.46	1.01	1.00	-0.14
11,679.00	92.80	1.50	10,800.57	1,057.03	304.62	1,063.39	1.41	1.38	-0.30
11,774.00	94.43	0.95	10,794.59	1,151.82	306.64	1,158.20	1.81	1.72	-0.58
11,869.00	92.21	0.54	10,789.08	1,246.64	307.88	1,253.03	2.38	-2.34	-0.43
11,964.00	92.41	359.97	10,785.25	1,341.57	308.30	1,347.94	0.64	0.21	-0.60
12,060.00	90.62	359.73	10,782.72	1,437.53	308.05	1,443.87	1.88	-1.86	-0.25
12,155.00	91.18	359.05	10,781.22	1,532.51	307.04	1,538.81	0.93	0.59	-0.72
12,251.00	89.19	359.08	10,780.91	1,628.49	305.47	1,634.73	2.07	-2.07	0.03
12,347.00	88.57	358.58	10,782.79	1,724.45	303.51	1,730.63	0.83	-0.65	-0.52
12,442.00	89.89	358.54	10,784.07	1,819.41	301.12	1,825.51	1.39	1.39	-0.04
12,538.00	91.12	357.97	10,783.22	1,915.36	298.20	1,921.38	1.41	1.28	-0.59
12,633.00	89.92	358.46	10,782.36	2,010.31	295.24	2,016.24	1.36	-1.26	0.52
12,729.00	88.88	359.58	10,783.36	2,106.29	293.60	2,112.16	1.59	-1.08	1.17
12,824.00	90.14	359.43	10,784.18	2,201.28	292.78	2,207.11	1.34	1.33	-0.16
12,919.00	90.90	358.83	10,783.31	2,296.26	291.34	2,302.04	1.02	0.80	-0.63
13,014.00	91.82	358.35	10,781.06	2,391.21	289.00	2,396.91	1.09	0.97	-0.51
13,109.00	92.35	357.97	10,777.60	2,486.09	285.95	2,491.71	0.69	0.56	-0.40
13,204.00	90.39	359.38	10,775.33	2,581.03	283.75	2,586.58	2.54	-2.06	1.48
13,300.00	90.50	0.74	10,774.59	2,677.03	283.86	2,682.56	1.42	0.11	1.42
13,395.00	90.81	1.34	10,773.50	2,772.01	285.58	2,777.55	0.71	0.33	0.63
13,490.00	91.23	1.02	10,771.81	2,866.97	287.54	2,872.53	0.56	0.44	-0.34
13,585.00	91.68	0.21	10,769.40	2,961.93	288.55	2,967.49	0.98	0.47	-0.85
13,681.00	90.76	359.56	10,767.35	3,057.91	288.36	3,063.44	1.17	-0.96	-0.68
13,776.00	90.98	0.84	10,765.91	3,152.90	288.69	3,158.42	1.37	0.23	1.35
13,871.00	91.68	0.62	10,763.71	3,247.86	289.90	3,253.39	0.77	0.74	-0.23
13,966.00	93.25	0.74	10,759.62	3,342.76	291.03	3,348.29	1.66	1.65	0.13
14,061.00	92.80	359.95	10,754.61	3,437.63	291.60	3,443.15	0.96	-0.47	-0.83
14,157.00	93.53	359.07	10,749.31	3,533.48	290.78	3,538.95	1.19	0.76	-0.92
14,252.00	95.52	358.35	10,741.81	3,628.15	288.65	3,633.56	2.23	2.09	-0.76
14,347.00	93.81	358.13	10,734.09	3,722.79	285.74	3,728.11	1.81	-1.80	-0.23
14,442.00	94.46	358.98	10,727.24	3,817.51	283.35	3,822.76	1.12	0.68	0.89
14,538.00	91.18	0.65	10,722.51	3,913.38	283.05	3,918.60	3.83	-3.42	1.74
14,633.00	89.38	0.73	10,722.05	4,008.37	284.19	4,013.59	1.90	-1.89	0.08
14,728.00	89.92	0.23	10,722.63	4,103.36	284.99	4,108.58	0.77	0.57	-0.53
14,822.00	90.39	359.07	10,722.37	4,197.36	284.41	4,202.54	1.33	0.50	-1.23
14,916.00	90.56	358.73	10,721.60	4,291.33	282.61	4,296.45	0.40	0.18	-0.36
15,009.00	90.84	1.09	10,720.46	4,384.32	282.46	4,389.42	2.56	0.30	2.54
15,103.00	90.31	0.23	10,719.52	4,478.31	283.54	4,483.41	1.07	-0.56	-0.91
15,198.00	92.24	0.75	10,717.40	4,573.28	284.35	4,578.37	2.10	2.03	0.55
15,292.00	93.22	0.40	10,712.92	4,667.16	285.30	4,672.25	1.11	1.04	-0.37
15,388.00	93.53	0.44	10,707.27	4,763.00	286.00	4,768.08	0.33	0.32	0.04
15,483.00	93.45	359.43	10,701.49	4,857.82	285.89	4,862.88	1.06	-0.08	-1.06
15,577.00	92.30	359.42	10,696.78	4,951.69	284.95	4,956.71	1.22	-1.22	-0.01



Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3769.90usft (McVay 8)
Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
15,670.00	92.66	359.00	10,692.75	5,044.60	283.67	5,049.56	0.59	0.39	-0.45
15,766.00	93.28	358.75	10,687.78	5,140.45	281.79	5,145.35	0.70	0.65	-0.26
15,861.00	92.21	358.35	10,683.23	5,235.31	279.39	5,240.14	1.20	-1.13	-0.42
15,955.00	91.68	358.76	10,680.04	5,329.22	277.02	5,333.98	0.71	-0.56	0.44
16,041.00	91.51	358.53	10,677.64	5,415.17	274.98	5,419.86	0.33	-0.20	-0.27
16,134.00	91.88	357.67	10,674.89	5,508.07	271.90	5,512.67	1.01	0.40	-0.92
16,229.00	90.36	358.70	10,673.04	5,603.00	268.89	5,607.52	1.93	-1.60	1.08
16,323.00	92.13	358.57	10,670.99	5,696.95	266.66	5,701.39	1.89	1.88	-0.14
16,418.00	91.85	358.56	10,667.69	5,791.86	264.28	5,796.23	0.29	-0.29	-0.01
16,513.00	91.34	358.37	10,665.05	5,886.79	261.73	5,891.08	0.57	-0.54	-0.20
16,606.00	89.55	357.53	10,664.33	5,979.73	258.41	5,983.92	2.13	-1.92	-0.90
16,702.00	89.13	357.81	10,665.43	6,075.64	254.50	6,079.73	0.53	-0.44	0.29
16,795.00	89.86	359.02	10,666.25	6,168.60	251.93	6,172.61	1.52	0.78	1.30
16,889.00	88.80	359.70	10,667.35	6,262.58	250.88	6,266.55	1.34	-1.13	0.72
16,985.00	88.15	0.77	10,669.91	6,358.55	251.28	6,362.50	1.30	-0.68	1.11
17,079.00	88.82	359.99	10,672.39	6,452.51	251.90	6,456.46	1.09	0.71	-0.83
17,174.00	89.38	359.16	10,673.88	6,547.49	251.19	6,551.40	1.05	0.59	-0.87
17,268.00	88.07	359.75	10,675.98	6,641.46	250.30	6,645.33	1.53	-1.39	0.63
17,362.00	87.56	359.78	10,679.56	6,735.40	249.92	6,739.23	0.54	-0.54	0.03
17,457.00	87.93	359.19	10,683.30	6,830.32	249.06	6,834.11	0.73	0.39	-0.62
17,551.00	88.91	358.97	10,685.89	6,924.27	247.55	6,928.01	1.07	1.04	-0.23
17,645.00	88.54	0.88	10,687.98	7,018.24	247.43	7,021.96	2.07	-0.39	2.03
17,740.00	88.71	1.06	10,690.26	7,113.20	249.04	7,116.93	0.26	0.18	0.19
17,835.00	89.10	0.77	10,692.08	7,208.17	250.55	7,211.91	0.51	0.41	-0.31
17,928.00	89.58	0.31	10,693.15	7,301.16	251.43	7,304.89	0.71	0.52	-0.49
18,024.00	88.71	0.51	10,694.58	7,397.14	252.12	7,400.87	0.93	-0.91	0.21
18,119.00	89.22	359.95	10,696.30	7,492.13	252.50	7,495.84	0.80	0.54	-0.59
18,214.00	90.36	359.36	10,696.64	7,587.12	251.93	7,590.80	1.35	1.20	-0.62
18,309.00	89.33	359.46	10,696.90	7,682.12	250.95	7,685.75	1.09	-1.08	0.11
18,404.00	90.14	358.95	10,697.34	7,777.11	249.63	7,780.69	1.01	0.85	-0.54
18,499.00	90.00	359.45	10,697.23	7,872.10	248.30	7,875.63	0.55	-0.15	0.53
18,593.00	88.80	359.39	10,698.21	7,966.08	247.35	7,969.58	1.28	-1.28	-0.06
18,689.00	87.73	0.07	10,701.12	8,062.04	246.90	8,065.50	1.32	-1.11	0.71
18,783.00	87.76	0.38	10,704.81	8,155.96	247.27	8,159.41	0.33	0.03	0.33
18,879.00	88.26	0.50	10,708.15	8,251.90	248.01	8,255.34	0.54	0.52	0.13
18,974.00	89.36	0.23	10,710.12	8,346.88	248.61	8,350.31	1.19	1.16	-0.28
19,069.00	87.93	0.57	10,712.37	8,441.85	249.27	8,445.27	1.55	-1.51	0.36
19,163.00	88.60	0.58	10,715.21	8,535.80	250.22	8,539.22	0.71	0.71	0.01
19,259.00	89.24	0.69	10,717.02	8,631.78	251.28	8,635.19	0.68	0.67	0.11
19,354.00	88.49	0.15	10,718.90	8,726.75	251.98	8,730.17	0.97	-0.79	-0.57
19,449.00	88.60	359.84	10,721.32	8,821.72	251.97	8,825.11	0.35	0.12	-0.33
19,545.00	88.46	359.57	10,723.78	8,917.69	251.47	8,921.05	0.32	-0.15	-0.28
19,640.00	89.58	359.88	10,725.40	9,012.67	251.02	9,016.00	1.22	1.18	0.33

Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 503H
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Site:	Huckleberry State Com	MD Reference:	KB=26' @ 3769.90usft (McVay 8)
Well:	503H	North Reference:	Grid
Wellbore:	OH / 64598	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (McVay 8)	Database:	USA Compass

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)
19,736.00	88.60	359.41	10,726.93	9,108.66	250.42	9,111.95	1.13	-1.02	-0.49
19,831.00	89.08	359.46	10,728.85	9,203.63	249.49	9,206.88	0.51	0.51	0.05
19,926.00	87.45	359.08	10,731.73	9,298.58	248.28	9,301.78	1.76	-1.72	-0.40
20,021.00	87.06	358.75	10,736.28	9,393.45	246.48	9,396.59	0.54	-0.41	-0.35
20,116.00	88.43	358.91	10,740.02	9,488.36	244.54	9,491.43	1.45	1.44	0.17
20,211.00	89.58	358.11	10,741.67	9,583.31	242.07	9,586.30	1.47	1.21	-0.84
20,305.00	89.72	358.13	10,742.24	9,677.26	238.99	9,680.16	0.15	0.15	0.02
20,400.00	90.00	358.17	10,742.47	9,772.21	235.92	9,775.02	0.30	0.29	0.04
20,496.00	88.26	357.78	10,743.93	9,868.13	232.53	9,870.85	1.86	-1.81	-0.41
20,591.00	87.76	357.85	10,747.23	9,963.00	228.91	9,965.63	0.53	-0.53	0.07
20,687.00	88.35	357.50	10,750.49	10,058.87	225.02	10,061.38	0.71	0.61	-0.36
20,781.00	88.60	357.08	10,752.99	10,152.73	220.58	10,155.13	0.52	0.27	-0.45
20,875.00	89.22	356.53	10,754.78	10,246.57	215.34	10,248.83	0.88	0.66	-0.59
20,971.00	90.17	355.92	10,755.29	10,342.36	209.02	10,344.46	1.18	0.99	-0.64
20,998.65	90.51	355.81	10,755.12	10,369.93	207.02	10,371.98	1.30	1.24	-0.38
LTP: 20998.65' MD									
21,065.00	91.34	355.56	10,754.05	10,436.09	202.04	10,438.01	1.30	1.24	-0.38
Final Phoenix MWD Survey									
21,129.00	91.34	355.56	10,752.55	10,499.88	197.08	10,501.68	0.00	0.00	0.00
Projection to TD									

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
10,090.00	10,076.36	-86.36	344.00	Tie In
10,183.00	10,169.33	-84.23	345.37	First Phoenix MWD Survey
11,095.34	10,776.78	476.62	309.31	FTP: 11095.34' MD
20,998.65	10,755.12	10,369.93	207.02	LTP: 20998.65' MD
21,065.00	10,754.05	10,436.09	202.04	Final Phoenix MWD Survey
21,129.00	10,752.55	10,499.88	197.08	Projection to TD