



CONCHO

NM OIL CONSERVATION

ARTESIA DISTRICT

NOV 01 2017

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COG OPERATING, LLC

Eddy /Lea County, NM (NAD27) NMEZ

Burch Keely Unit #955H 30-015-44150

#955H SLOT 222'FWL, 1035'FNL, Sec 24/T17S/R29E/UnitD

PP - 970'FNL, 691'FWL, Sec 24/T17S/R29E/UnitD

Lateral

PLANNED BHL 970'FNL, 350'FWL, Sec 19/T17S/R30E/UnitD

ACTUAL BHL 967'FNL, 344'FWL, Sec 19/T17S/R30E/UnitD

Please provide signature
page for directional survey



Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Burch Keely Unit #955H
Well: #955H SLOT 222'FWL, 1035'FNL
Wellbore: Lateral
Design: Lateral PLANNED BHL 350'FWL, 970'FNL

Local Co-ordinate Reference: Well #955H SLOT 222'FWL, 1035'FNL - Slot 955H
TVD Reference: 3602+18 @ 3620.00ft (SilverOak#3)
MD Reference: 3602+18 @ 3620.00ft (SilverOak#3)
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	Burch Keely Unit #955H		
Site Position:		Northing:	663,730.90 ft
From:	Map	Easting:	591,453.10 ft
Position Uncertainty:	0.00 ft	Slot Radius:	13.20 in
		Latitude:	32° 49' 27.572 N
		Longitude:	104° 2' 8.263 W
		Grid Convergence:	0.16 °

Well	#955H SLOT 222'FWL, 1035'FNL - Slot 955H		
Well Position	+N/-S	0.00 ft	Northing: 663,730.90 ft
	+E/-W	0.00 ft	Easting: 591,453.10 ft
Position Uncertainty	0.00 ft	Wellhead Elevation:	ft
		Latitude:	32° 49' 27.572 N
		Longitude:	104° 2' 8.263 W
		Ground Level:	3,602.00 ft

Wellbore	Lateral		
Magnetics	Model Name	Sample Date	Declination
	IGRF2015	05/23/17	(°)
			7.22
			Dip Angle (°)
			60.54
			Field Strength (nT)
			48,250

Design	Lateral PLANNED BHL 350'FWL, 970'FNL		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(ft)	(ft)	(ft)
	0.00	0.00	0.00
			Direction (°)
			89.87

Survey Program	Date 06/10/17		
From	To	Survey (Wellbore)	Tool Name
(ft)	(ft)		
100.00	1,019.00	Survey #1 (Lateral)	GYD_DP_MS
1,096.00	10,152.00	Survey #2 (Lateral)	MWD
10,241.00	10,241.00	Survey #3 (Lateral)	Projection
			Description
			Gyrodata gyro-compassing and drop
			MWD v3:standard declination
			Projection

Survey										
Measured Depth	Inclination	Azimuth	Vertical Depth	+N/-S	+E/-W	Vertical Section	Dogleg Rate	Build Rate	Turn Rate	
(ft)	(°)	(°)	(ft)	(ft)	(ft)	(ft)	(°/100ft)	(°/100ft)	(°/100ft)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
BKU 955H SL										
100.00	0.30	191.17	100.00	-0.26	-0.05	-0.05	0.30	0.30	0.00	
200.00	0.26	124.28	200.00	-0.64	0.09	0.08	0.31	-0.04	-66.89	
300.00	0.46	30.96	300.00	-0.43	0.48	0.48	0.54	0.20	-93.32	
400.00	0.52	32.96	399.99	0.30	0.93	0.93	0.06	0.06	2.00	
500.00	0.76	34.59	499.99	1.23	1.56	1.56	0.24	0.24	1.63	
600.00	0.89	28.01	599.98	2.46	2.30	2.30	0.16	0.13	-6.58	

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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)
700.00	1.21	29.46	699.96	4.06	3.18	3.19	0.32	0.32	1.45
800.00	1.57	38.63	799.93	6.05	4.56	4.57	0.42	0.36	9.17
900.00	1.75	53.17	899.89	8.04	6.63	6.65	0.46	0.18	14.54
1,000.00	1.58	55.96	999.85	9.73	9.00	9.02	0.19	-0.17	2.79
1,019.00	1.60	56.25	1,018.84	10.02	9.44	9.46	0.11	0.11	1.53
1,096.00	1.13	42.87	1,095.82	11.17	10.85	10.87	0.73	-0.61	-17.38
1,159.00	2.30	261.51	1,158.80	11.44	10.02	10.04	5.17	1.86	-224.38
1,254.00	2.67	317.39	1,253.73	12.79	6.63	6.66	2.47	0.39	58.82
1,349.00	3.60	304.61	1,348.58	16.11	2.68	2.72	1.22	0.98	-13.45
1,443.00	3.61	304.43	1,442.40	19.46	-2.19	-2.14	0.02	0.01	-0.19
1,538.00	3.44	310.86	1,537.22	23.02	-6.81	-6.76	0.45	-0.18	6.77
1,633.00	2.66	305.93	1,632.08	26.17	-10.75	-10.69	0.87	-0.82	-5.19
1,728.00	3.68	288.37	1,726.94	28.43	-15.43	-15.37	1.47	1.07	-18.48
1,823.00	5.10	279.21	1,821.66	30.07	-22.49	-22.42	1.66	1.49	-9.64
1,917.00	5.16	276.65	1,915.28	31.22	-30.81	-30.74	0.25	0.06	-2.72
2,012.00	4.91	275.75	2,009.92	32.13	-39.10	-39.03	0.28	-0.26	-0.95
2,107.00	4.76	274.35	2,104.58	32.83	-47.08	-47.00	0.20	-0.16	-1.47
2,202.00	4.44	272.84	2,199.27	33.31	-54.68	-54.61	0.36	-0.34	-1.59
2,297.00	5.29	277.35	2,293.93	34.06	-62.70	-62.62	0.98	0.89	4.75
2,391.00	5.53	276.97	2,387.51	35.16	-71.49	-71.41	0.26	0.26	-0.40
2,485.00	5.41	276.18	2,481.08	36.19	-80.39	-80.31	0.15	-0.13	-0.84
2,580.00	5.48	276.29	2,575.65	37.17	-89.35	-89.27	0.07	0.07	0.12
2,674.00	6.15	282.53	2,669.17	38.75	-98.73	-98.64	0.98	0.71	6.64
2,769.00	6.26	283.17	2,763.61	41.03	-108.74	-108.65	0.14	0.12	0.67
2,864.00	5.02	283.04	2,858.15	43.15	-117.83	-117.74	1.31	-1.31	-0.14
2,958.00	5.10	283.68	2,951.79	45.07	-125.90	-125.80	0.10	0.09	0.68
3,053.00	5.06	283.21	3,046.41	47.02	-134.08	-133.97	0.06	-0.04	-0.49
3,148.00	5.13	281.92	3,141.04	48.86	-142.32	-142.20	0.14	0.07	-1.36
3,242.00	5.40	281.68	3,234.64	50.62	-150.76	-150.64	0.29	0.29	-0.26
3,337.00	4.33	285.66	3,329.30	52.50	-158.59	-158.47	1.18	-1.13	4.19
3,432.00	4.34	286.90	3,424.03	54.51	-165.48	-165.36	0.10	0.01	1.31
3,526.00	4.40	285.10	3,517.75	56.48	-172.37	-172.24	0.16	0.06	-1.91
3,621.00	4.30	285.87	3,612.48	58.40	-179.31	-179.18	0.12	-0.11	0.81
3,716.00	4.33	284.15	3,707.21	60.26	-186.21	-186.08	0.14	0.03	-1.81
3,810.00	3.30	286.86	3,801.00	61.91	-192.24	-192.10	1.11	-1.10	2.88
3,905.00	2.30	283.04	3,895.89	63.13	-196.72	-196.57	1.07	-1.05	-4.02
4,000.00	0.95	305.50	3,990.85	64.02	-199.22	-199.07	1.54	-1.42	23.64
4,009.20	0.93	304.20	4,000.04	64.10	-199.34	-199.19	0.29	-0.18	-14.10
BKU 955H Tgt									
4,094.00	0.81	290.04	4,084.84	64.70	-200.48	-200.33	0.29	-0.15	-16.70
4,189.00	0.85	275.34	4,179.83	64.99	-201.81	-201.66	0.23	0.04	-15.47
4,252.00	0.74	281.06	4,242.82	65.12	-202.67	-202.52	0.22	-0.17	9.08
4,283.00	0.87	71.64	4,273.82	65.23	-202.65	-202.50	5.02	0.42	485.74

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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)
4,315.00	3.73	81.91	4,305.79	65.45	-201.38	-201.24	8.99	8.94	32.09
4,347.00	7.13	79.24	4,337.64	65.97	-198.40	-198.25	10.65	10.63	-8.34
4,376.00	10.59	77.63	4,366.29	66.88	-194.03	-193.88	11.96	11.93	-5.55
4,408.00	14.03	76.07	4,397.55	68.44	-187.39	-187.23	10.80	10.75	-4.88
4,439.00	18.03	75.40	4,427.34	70.56	-179.10	-178.94	12.92	12.90	-2.16
4,470.00	22.02	76.79	4,456.46	73.09	-168.79	-168.63	12.96	12.87	4.48
4,502.00	25.76	79.22	4,485.71	75.77	-156.12	-155.94	12.08	11.69	7.59
4,533.00	29.03	82.20	4,513.23	78.05	-142.04	-141.87	11.44	10.55	9.61
4,565.00	32.75	84.48	4,540.69	79.93	-125.73	-125.55	12.19	11.63	7.13
4,597.00	36.75	86.22	4,566.98	81.40	-107.55	-107.37	12.88	12.50	5.44
4,628.00	39.50	87.89	4,591.36	82.37	-88.44	-88.26	9.47	8.87	5.39
4,660.00	42.06	89.43	4,615.59	82.85	-67.55	-67.36	8.59	8.00	4.81
4,754.00	45.57	90.37	4,683.41	82.95	-2.48	-2.29	3.80	3.73	1.00
4,849.00	46.43	90.17	4,749.40	82.63	65.85	66.04	0.92	0.91	-0.21
4,880.00	46.56	90.20	4,770.75	82.56	88.34	88.52	0.43	0.42	0.10
4,911.00	48.46	90.20	4,791.68	82.48	111.20	111.38	6.13	6.13	0.00
4,943.00	52.28	90.34	4,812.09	82.36	135.84	136.02	11.94	11.94	0.44
4,975.00	56.08	91.33	4,830.81	81.98	161.78	161.96	12.14	11.88	3.09
5,006.00	59.30	92.15	4,847.38	81.18	187.96	188.14	10.62	10.39	2.65
5,037.00	62.05	92.02	4,862.56	80.20	214.97	215.15	8.88	8.87	-0.42
5,069.00	64.36	91.39	4,876.99	79.35	243.52	243.70	7.43	7.22	-1.97
5,100.00	66.37	90.71	4,889.91	78.83	271.69	271.87	6.78	6.48	-2.19
5,132.00	68.82	90.94	4,902.11	78.41	301.27	301.45	7.69	7.66	0.72
5,163.00	71.90	90.94	4,912.52	77.93	330.46	330.63	9.94	9.94	0.00
5,194.00	74.48	90.50	4,921.49	77.56	360.13	360.30	8.43	8.32	-1.42
5,226.00	77.04	90.56	4,929.36	77.27	391.14	391.31	8.00	8.00	0.19
5,257.00	79.64	90.73	4,935.62	76.93	421.50	421.67	8.40	8.39	0.55
5,289.00	82.30	90.73	4,940.65	76.52	453.09	453.27	8.31	8.31	0.00
5,305.52	83.72	90.70	4,942.66	76.32	469.49	469.66	8.60	8.59	-0.16
BKU 955H LP p1									
5,321.00	85.05	90.68	4,944.17	76.13	484.89	485.07	8.60	8.59	-0.16
5,427.00	90.22	90.57	4,948.54	74.98	590.76	590.93	4.88	4.88	-0.10
5,515.00	91.09	90.08	4,947.54	74.48	678.75	678.92	1.13	0.99	-0.56
5,610.00	91.41	89.54	4,945.46	74.79	773.73	773.90	0.66	0.34	-0.57
5,704.00	92.13	89.38	4,942.56	75.68	867.68	867.85	0.78	0.77	-0.17
5,799.00	92.26	90.37	4,938.92	75.89	962.61	962.78	1.05	0.14	1.04
5,894.00	91.96	91.37	4,935.42	74.44	1,057.53	1,057.70	1.10	-0.32	1.05
5,989.00	89.89	91.89	4,933.89	71.74	1,152.48	1,152.64	2.25	-2.18	0.55
6,083.00	90.55	91.71	4,933.53	68.79	1,246.43	1,246.58	0.73	0.70	-0.19
6,178.00	90.99	91.17	4,932.25	66.40	1,341.39	1,341.54	0.73	0.46	-0.57
6,273.00	91.44	90.35	4,930.24	65.14	1,436.36	1,436.50	0.98	0.47	-0.86
6,368.00	92.25	90.17	4,927.18	64.71	1,531.31	1,531.45	0.87	0.85	-0.19

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6,462.00	90.92	91.11	4,924.58	63.66	1,625.26	1,625.40	1.73	-1.41	1.00
6,556.00	89.92	91.21	4,923.89	61.76	1,719.24	1,719.37	1.07	-1.06	0.11
6,651.00	90.68	90.76	4,923.39	60.13	1,814.22	1,814.35	0.93	0.80	-0.47
6,746.00	89.70	90.23	4,923.08	59.31	1,909.22	1,909.35	1.17	-1.03	-0.56
6,841.00	90.49	90.23	4,922.92	58.92	2,004.22	2,004.34	0.83	0.83	0.00
6,936.00	89.40	88.89	4,923.01	59.65	2,099.21	2,099.34	1.82	-1.15	-1.41
7,031.00	90.13	88.71	4,923.40	61.64	2,194.19	2,194.32	0.79	0.77	-0.19
7,125.00	90.89	88.37	4,922.57	64.04	2,288.15	2,288.29	0.89	0.81	-0.36
7,220.00	91.63	88.47	4,920.48	66.66	2,383.09	2,383.24	0.79	0.78	0.11
7,315.00	92.13	88.26	4,917.36	69.37	2,478.00	2,478.15	0.57	0.53	-0.22
7,409.00	91.35	89.05	4,914.51	71.57	2,571.93	2,572.09	1.18	-0.83	0.84
7,504.00	92.06	88.59	4,911.68	73.53	2,666.87	2,667.03	0.89	0.75	-0.48
7,599.00	90.62	89.06	4,909.46	75.47	2,761.82	2,761.98	1.59	-1.52	0.49
7,693.00	91.13	88.57	4,908.02	77.42	2,855.79	2,855.96	0.75	0.54	-0.52
7,788.00	90.23	90.24	4,906.89	78.40	2,950.77	2,950.94	2.00	-0.95	1.76
7,882.00	90.81	89.83	4,906.04	78.35	3,044.77	3,044.94	0.76	0.62	-0.44
7,977.00	89.90	91.36	4,905.45	77.36	3,139.76	3,139.92	1.87	-0.96	1.61
8,071.00	90.80	91.16	4,904.88	75.29	3,233.73	3,233.89	0.98	0.96	-0.21
8,165.00	91.56	90.80	4,902.94	73.69	3,327.70	3,327.85	0.89	0.81	-0.38
8,260.00	92.59	90.82	4,899.50	72.34	3,422.62	3,422.78	1.08	1.08	0.02
8,354.00	91.29	91.40	4,896.32	70.52	3,516.55	3,516.70	1.51	-1.38	0.62
8,449.00	89.99	91.18	4,895.26	68.39	3,611.52	3,611.66	1.39	-1.37	-0.23
8,544.00	90.76	90.90	4,894.64	66.66	3,706.50	3,706.64	0.86	0.81	-0.29
8,638.00	91.54	90.81	4,892.75	65.26	3,800.47	3,800.61	0.84	0.83	-0.10
8,733.00	89.99	89.34	4,891.48	65.13	3,895.45	3,895.59	2.25	-1.63	-1.55
8,827.00	90.80	89.21	4,890.84	66.32	3,989.44	3,989.58	0.87	0.86	-0.14
8,922.00	89.41	89.27	4,890.66	67.58	4,084.43	4,084.58	1.46	-1.46	0.06
9,017.00	90.23	89.02	4,890.96	69.00	4,179.42	4,179.57	0.90	0.86	-0.26
9,112.00	91.58	89.10	4,889.46	70.56	4,274.39	4,274.54	1.42	1.42	0.08
9,206.00	90.47	89.84	4,887.78	71.43	4,368.37	4,368.52	1.42	-1.18	0.79
9,300.00	91.55	89.89	4,886.12	71.65	4,462.36	4,462.51	1.15	1.15	0.05
9,395.00	91.31	89.70	4,883.75	71.99	4,557.33	4,557.48	0.32	-0.25	-0.20
9,490.00	91.13	89.46	4,881.73	72.69	4,652.30	4,652.46	0.32	-0.19	-0.25
9,584.00	90.33	89.67	4,880.53	73.40	4,746.29	4,746.45	0.88	-0.85	0.22
9,679.00	91.33	89.08	4,879.15	74.44	4,841.27	4,841.43	1.22	1.05	-0.62
9,774.00	89.88	89.55	4,878.15	75.57	4,936.26	4,936.42	1.60	-1.53	0.49
9,868.00	90.78	89.51	4,877.61	76.34	5,030.25	5,030.41	0.96	0.96	-0.04
9,963.00	91.95	89.35	4,875.35	77.29	5,125.22	5,125.38	1.24	1.23	-0.17
10,057.00	90.71	89.83	4,873.16	77.96	5,219.19	5,219.35	1.41	-1.32	0.51
10,152.00	91.82	89.38	4,871.07	78.61	5,314.16	5,314.33	1.26	1.17	-0.47
10,241.00	91.82	89.38	4,868.24	79.58	5,403.11	5,403.28	0.00	0.00	0.00

TD is @ 968'FNL, 344'FWL - BKU 955H PBHL - BKU 955H BHL

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Burch Keely Unit #955H
Well: #955H SLOT 222'FWL, 1035'FNL
Wellbore: Lateral
Design: Lateral PLANNED BHL 350'FWL, 970'FNL

Local Co-ordinate Reference: Well #955H SLOT 222'FWL, 1035'FNL - Slot 955H
TVD Reference: 3602+18 @ 3620.00ft (SilverOak#3)
MD Reference: 3602+18 @ 3620.00ft (SilverOak#3)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
BKU 955H SL - actual wellpath hits target center - Point	0.00	0.00	0.00	0.00	0.00	663,730.90	591,453.10	32° 49' 27.572 N	104° 2' 8.263 W
BKU 955H BHL - actual wellpath hits target center - Point	0.00	0.00	4,868.24	79.58	5,403.11	663,810.48	596,856.21	32° 49' 28.205 N	104° 1' 4.941 W

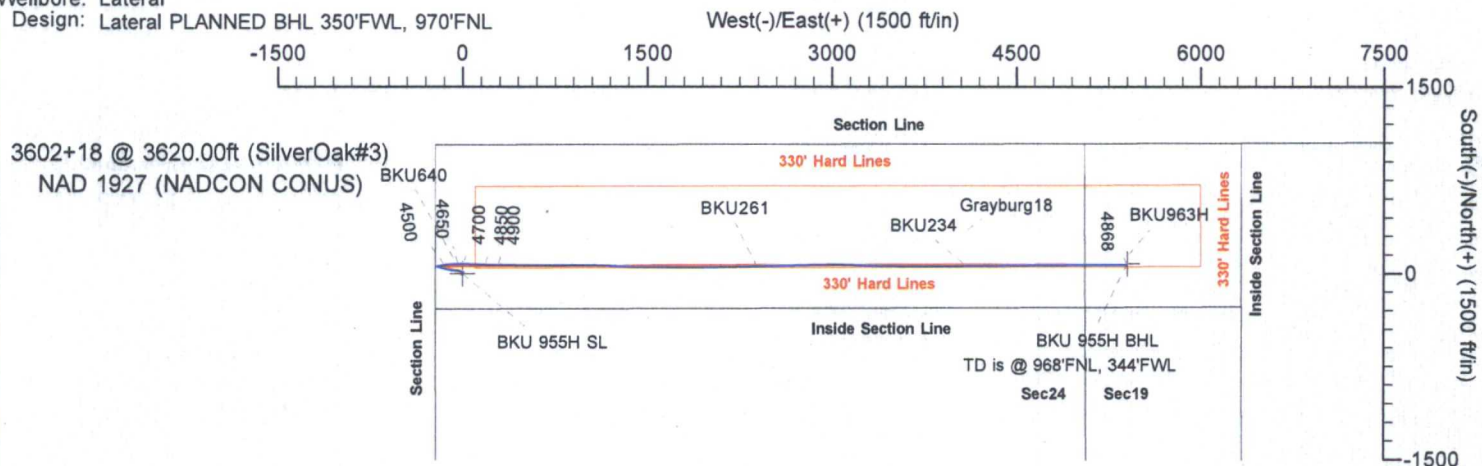
Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
10,241.00	4,868.24	79.58	5,403.11	TD is @ 968'FNL, 344'FWL

Checked By: _____ Approved By: _____ Date: _____

COG OPERATING, LLC

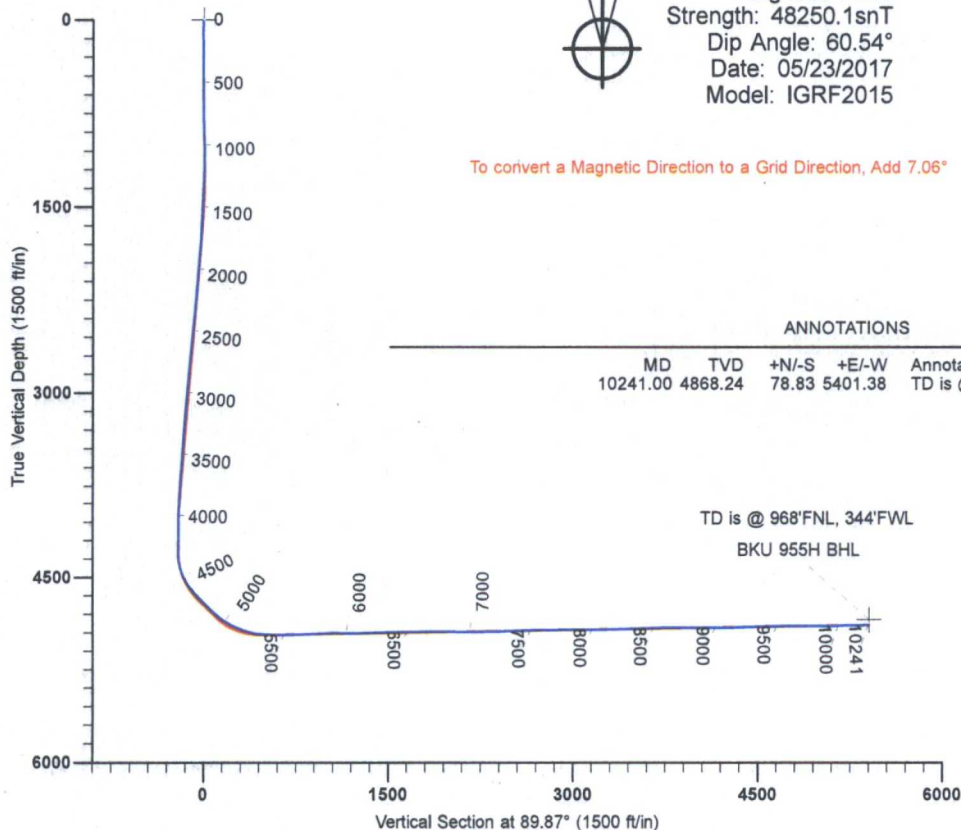
Project: Eddy /Lea County, NM (NAD27) NMEZ
 Site: Burch Keely Unit #955H
 Well: #955H SLOT 222'FWL, 1035'FNL
 Wellbore: Lateral
 Design: Lateral PLANNED BHL 350'FWL, 970'FNL



Azimuths to Grid North
 True North: -0.16°
 Magnetic North: 7.06°

Magnetic Field
 Strength: 48250.1snT
 Dip Angle: 60.54°
 Date: 05/23/2017
 Model: IGRF2015

To convert a Magnetic Direction to a Grid Direction, Add 7.06°



ANNOTATIONS

MD	TVD	+N/-S	+E/-W	Annotation
10241.00	4868.24	78.83	5401.38	TD is @ 968'FNL, 344'FWL

TD is @ 968'FNL, 344'FWL
 BKU 955H BHL

TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Shape
BKU 955H SL	0.00	0.00	0.00	663730.90	591453.10	Point
BKU 955H BHL	4868.24	79.58	5403.11	663810.48	596856.21	Point

Design: Lateral PLANNED BHL 350'FWL, 970'FNL (#955H SLOT 222'FWL, 1035'FNL/Lateral)

Created By: Mekka Williams

eSomina Well Design

mekka@esominawell.com

13:03, June 10 2017

VON DIRECTIONAL

12074 FM 3083 Conroe, Texas 77301

936-756-2400

