



Vanguard Natural Resources

Garfield County, CO

GGU 13-28

Federal GGU 23A-28-691

Wellbore #1

Design: Actual

End of Well Report

11 December, 2017





Payzone Directional

End of Well Report



Company:	Vanguard Natural Resources	Local Co-ordinate Reference:	Well Federal GGU 23A-28-691
Project:	Garfield County, CO	TVD Reference:	Federal GGU 23A-28-691 @ 6147.6usft (Est KB)
Site:	GGU 13-28	MD Reference:	Federal GGU 23A-28-691 @ 6147.6usft (Est KB)
Well:	Federal GGU 23A-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

Project	Garfield County, CO		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Central Zone		Using geodetic scale factor

Site	GGU 13-28		
Site Position:		Northing:	1,611,635.73 usft
From:	Lat/Long	Easting:	2,416,896.90 usft
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "
		Latitude:	39° 29' 40.232 N
		Longitude:	107° 33' 59.065 W
		Grid Convergence:	-1.30 °

Well		Federal GGU 23A-28-691				
Well Position	+N/-S	0.0 usft	Northing:	1,611,635.73 usft	Latitude:	39° 29' 40.232 N
	+E/-W	0.0 usft	Easting:	2,416,896.90 usft	Longitude:	107° 33' 59.065 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	6,147.6 usft	Ground Level:	6,130.6 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	12/11/2017	9.46	65.65	51,527

Design	Actual			
Audit Notes:				
Version:	1.0	Phase:	ACTUAL	Tie On Depth: 0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.0	0.0	0.0	68.68

Survey Program	Date	12/11/2017		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
136.0	7,665.0	Actual (Wellbore #1)	MWD	MWD v3:standard declination



Payzone Directional End of Well Report



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Site:	GGU 13-28	MD Reference:	Federal GGU 23A-28-691 @ 6147.6usft (Est KB)
Well:	Federal GGU 23A-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00	
136.0	0.88	130.06	136.0	0.5	-0.7	0.8	0.65	0.65	0.00	
167.0	0.92	123.20	167.0	0.8	-1.0	1.2	0.37	0.13	-22.13	
197.0	0.53	117.17	197.0	1.0	-1.2	1.5	1.32	-1.30	-20.10	
227.0	0.70	87.34	227.0	1.3	-1.2	1.8	1.19	0.57	-99.43	
256.0	0.55	44.40	256.0	1.6	-1.1	2.1	1.65	-0.52	-148.07	
286.0	1.01	18.48	286.0	1.9	-0.8	2.3	1.90	1.53	-86.40	
316.0	1.36	0.77	316.0	2.2	-0.1	2.4	1.68	1.17	-59.03	
347.0	1.36	356.64	347.0	2.4	0.6	2.4	0.32	0.00	-13.32	
377.0	0.92	340.11	377.0	2.5	1.2	2.2	1.82	-1.47	-55.10	
407.0	0.75	328.16	407.0	2.5	1.6	2.1	0.81	-0.57	-39.83	
437.0	0.53	311.77	437.0	2.4	1.8	1.9	0.95	-0.73	-54.63	
467.0	0.22	290.68	467.0	2.3	1.9	1.7	1.11	-1.03	-70.30	
497.0	0.18	274.81	497.0	2.2	2.0	1.6	0.23	-0.13	-52.90	
527.0	0.48	244.05	527.0	2.0	1.9	1.4	1.13	1.00	-102.53	
557.0	0.31	216.41	557.0	1.8	1.8	1.3	0.84	-0.57	-92.13	
587.0	0.25	225.21	587.0	1.7	1.7	1.2	0.25	-0.20	29.33	
617.0	0.48	240.53	617.0	1.5	1.6	1.0	0.83	0.77	51.07	
648.0	0.35	227.53	648.0	1.3	1.4	0.8	0.52	-0.42	-41.94	
678.0	0.35	277.27	678.0	1.1	1.4	0.7	0.98	0.00	165.80	
708.0	0.22	244.45	708.0	1.0	1.4	0.5	0.68	-0.43	-109.40	
738.0	0.13	267.74	738.0	0.9	1.4	0.5	0.38	-0.30	77.63	
768.0	0.18	243.00	768.0	0.8	1.3	0.4	0.27	0.17	-82.47	
785.0	0.26	233.94	785.0	0.8	1.3	0.3	0.51	0.47	-53.29	
Last PZD Surface Survey										
853.0	0.70	224.78	852.9	0.2	0.9	-0.1	0.65	0.65	-13.47	
937.0	1.05	105.18	936.9	0.4	0.3	0.3	1.81	0.42	-142.38	



Payzone Directional End of Well Report



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Site:	GGU 13-28	MD Reference:	Federal GGU 23A-28-691 @ 6147.6usft (Est KB)
Well:	Federal GGU 23A-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)	
1,024.0	4.88	79.65	1,023.8	4.7	0.8	4.7	4.55	4.40	-29.34	
1,108.0	8.04	74.07	1,107.3	14.0	3.1	13.9	3.83	3.76	-6.64	
1,196.0	10.85	72.93	1,194.1	28.4	7.2	27.7	3.20	3.19	-1.30	
1,280.0	13.34	70.81	1,276.2	46.0	12.7	44.4	3.01	2.96	-2.52	
1,364.0	15.73	70.86	1,357.5	67.1	19.6	64.3	2.85	2.85	0.06	
1,449.0	19.12	69.37	1,438.6	92.5	28.3	88.3	4.02	3.99	-1.75	
1,537.0	22.63	69.89	1,520.8	123.8	39.2	117.6	3.99	3.99	0.59	
1,621.0	25.14	66.12	1,597.6	157.8	52.0	149.1	3.50	2.99	-4.49	
1,705.0	24.87	65.02	1,673.7	193.3	66.7	181.5	0.64	-0.32	-1.31	
1,790.0	26.24	71.30	1,750.4	229.9	80.2	215.5	3.57	1.61	7.39	
1,874.0	27.55	70.03	1,825.3	267.9	92.8	251.3	1.70	1.56	-1.51	
1,958.0	28.56	69.54	1,899.5	307.4	106.5	288.4	1.23	1.20	-0.58	
2,043.0	28.17	69.01	1,974.3	347.8	120.8	326.2	0.55	-0.46	-0.62	
2,127.0	27.77	68.84	2,048.5	387.1	134.9	362.9	0.49	-0.48	-0.20	
2,215.0	27.69	68.09	2,126.3	428.1	150.0	401.0	0.41	-0.09	-0.85	
2,301.0	27.55	67.92	2,202.5	468.0	164.9	438.0	0.19	-0.16	-0.20	
2,388.0	27.26	67.85	2,279.8	508.0	180.0	475.1	0.34	-0.33	-0.08	
2,475.0	27.38	68.53	2,357.1	547.9	194.8	512.2	0.38	0.14	0.78	
2,559.0	27.16	67.35	2,431.7	586.4	209.3	547.8	0.69	-0.26	-1.40	
2,645.0	27.51	68.22	2,508.1	625.9	224.2	584.4	0.62	0.41	1.01	
2,729.0	27.47	67.61	2,582.7	664.7	238.8	620.3	0.34	-0.05	-0.73	
2,813.0	28.08	69.81	2,657.0	703.8	253.0	656.8	1.42	0.73	2.62	
2,898.0	27.69	69.59	2,732.1	743.6	266.8	694.1	0.47	-0.46	-0.26	
2,982.0	27.38	68.53	2,806.6	782.4	280.6	730.3	0.69	-0.37	-1.26	
3,066.0	26.98	66.73	2,881.3	820.7	295.2	765.8	1.09	-0.48	-2.14	
3,152.0	27.25	71.70	2,957.9	859.9	309.1	802.4	2.65	0.31	5.78	
3,237.0	27.38	70.95	3,033.4	898.9	321.6	839.4	0.43	0.15	-0.88	



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Design:	Actual	Database:	EDM 5000.1 Single User Db

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)	
3,321.0	27.38	69.41	3,108.0	937.5	334.7	875.7	0.84	0.00	-1.83	
3,407.0	26.85	69.74	3,184.5	976.7	348.4	912.5	0.64	-0.62	0.38	
3,494.0	26.24	67.61	3,262.4	1,015.5	362.5	948.7	1.30	-0.70	-2.45	
3,582.0	25.22	70.13	3,341.6	1,053.7	376.3	984.3	1.70	-1.16	2.86	
3,667.0	24.83	70.20	3,418.7	1,089.7	388.5	1,018.1	0.46	-0.46	0.08	
3,751.0	23.60	69.06	3,495.3	1,124.1	400.5	1,050.4	1.57	-1.46	-1.36	
3,835.0	24.61	70.20	3,572.0	1,158.4	412.4	1,082.6	1.32	1.20	1.36	
3,920.0	24.26	69.06	3,649.3	1,193.6	424.7	1,115.5	0.69	-0.41	-1.34	
4,006.0	23.61	67.76	3,727.9	1,228.5	437.5	1,148.0	0.97	-0.76	-1.51	
4,092.0	24.04	69.81	3,806.6	1,263.2	450.1	1,180.4	1.08	0.50	2.38	
4,178.0	23.60	69.19	3,885.3	1,297.9	462.2	1,212.9	0.59	-0.51	-0.72	
4,263.0	22.24	68.05	3,963.6	1,331.0	474.3	1,243.7	1.68	-1.60	-1.34	
4,347.0	21.18	66.64	4,041.6	1,362.1	486.2	1,272.4	1.41	-1.26	-1.68	
4,431.0	18.40	70.50	4,120.7	1,390.5	496.7	1,298.8	3.66	-3.31	4.60	
4,516.0	16.35	69.46	4,201.8	1,415.9	505.4	1,322.7	2.44	-2.41	-1.22	
4,600.0	15.56	69.02	4,282.5	1,439.0	513.5	1,344.3	0.95	-0.94	-0.52	
4,684.0	13.40	73.41	4,363.9	1,460.0	520.4	1,364.1	2.88	-2.57	5.23	
4,768.0	12.30	72.65	4,445.8	1,478.6	525.8	1,382.0	1.32	-1.31	-0.90	
4,853.0	9.84	72.40	4,529.2	1,494.9	530.7	1,397.6	2.89	-2.89	-0.29	
4,939.0	7.73	71.74	4,614.2	1,508.0	534.7	1,410.1	2.46	-2.45	-0.77	
5,022.0	4.88	76.18	4,696.6	1,517.1	537.3	1,418.8	3.48	-3.43	5.35	
5,064.4	3.70	74.21	4,739.0	1,520.2	538.1	1,421.9	2.80	-2.78	-4.65	
GGU 23A-28-691 TGT										
5,106.0	2.55	70.51	4,780.5	1,522.5	538.8	1,424.0	2.80	-2.76	-8.89	
5,190.0	2.24	60.71	4,864.4	1,526.0	540.2	1,427.2	0.61	-0.37	-11.67	
5,276.0	2.22	62.89	4,950.3	1,529.3	541.8	1,430.2	0.10	-0.02	2.53	
5,363.0	1.93	70.77	5,037.3	1,532.4	543.1	1,433.0	0.47	-0.33	9.06	



Payzone Directional End of Well Report



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Well:	Federal GGU 23A-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)	
5,447.0	2.15	70.51	5,121.2	1,535.4	544.0	1,435.9	0.26	0.26	-0.31	
5,531.0	1.76	73.85	5,205.2	1,538.3	544.9	1,438.6	0.48	-0.46	3.98	
5,616.0	1.58	76.49	5,290.1	1,540.7	545.6	1,441.0	0.23	-0.21	3.11	
5,700.0	1.19	95.91	5,374.1	1,542.6	545.8	1,443.0	0.72	-0.46	23.12	
5,784.0	0.94	82.31	5,458.1	1,544.1	545.8	1,444.5	0.42	-0.30	-16.19	
5,868.0	1.62	29.03	5,542.1	1,545.7	546.9	1,445.8	1.55	0.81	-63.43	
5,955.0	1.27	27.66	5,629.0	1,547.4	548.8	1,446.8	0.40	-0.40	-1.57	
6,041.0	0.74	36.22	5,715.0	1,548.5	550.1	1,447.6	0.64	-0.62	9.95	
6,125.0	0.50	33.65	5,799.0	1,549.3	550.8	1,448.1	0.29	-0.29	-3.06	
6,210.0	0.40	19.14	5,884.0	1,549.8	551.4	1,448.4	0.18	-0.12	-17.07	
6,294.0	0.31	12.90	5,968.0	1,550.1	551.9	1,448.6	0.12	-0.11	-7.43	
6,378.0	0.18	340.16	6,052.0	1,550.2	552.3	1,448.6	0.22	-0.15	-38.98	
6,462.0	0.35	323.90	6,136.0	1,550.2	552.6	1,448.4	0.22	0.20	-19.36	
6,547.0	0.40	283.82	6,221.0	1,549.9	552.9	1,447.9	0.31	0.06	-47.15	
6,631.0	0.35	279.56	6,305.0	1,549.4	553.0	1,447.4	0.07	-0.06	-5.07	
6,715.0	0.44	294.54	6,389.0	1,549.0	553.2	1,446.9	0.16	0.11	17.83	
6,801.0	0.22	298.37	6,475.0	1,548.6	553.4	1,446.4	0.26	-0.26	4.45	
6,886.0	0.53	332.03	6,560.0	1,548.5	553.8	1,446.1	0.43	0.36	39.60	
6,970.0	0.44	300.61	6,644.0	1,548.2	554.3	1,445.6	0.33	-0.11	-37.40	
7,056.0	0.53	277.67	6,730.0	1,547.7	554.6	1,444.9	0.25	0.10	-26.67	
7,143.0	0.57	282.06	6,817.0	1,547.0	554.7	1,444.1	0.07	0.05	5.05	
7,227.0	0.44	275.03	6,901.0	1,546.3	554.8	1,443.4	0.17	-0.15	-8.37	
7,311.0	0.92	291.77	6,985.0	1,545.6	555.1	1,442.4	0.61	0.57	19.93	
7,398.0	1.49	299.20	7,072.0	1,544.3	555.9	1,440.8	0.68	0.66	8.54	
7,484.0	1.89	292.13	7,157.9	1,542.6	557.0	1,438.5	0.52	0.47	-8.22	
7,569.0	1.98	292.65	7,242.9	1,540.5	558.1	1,435.9	0.11	0.11	0.61	



Payzone Directional End of Well Report



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Site:	GGU 13-28	MD Reference:	Federal GGU 23A-28-691 @ 6147.6usft (Est KB)
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Design:	Actual	Database:	EDM 5000.1 Single User Db

Survey										
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7,610.0	1.89	294.28	7,283.9	1,539.5	558.6	1,434.6	0.26	-0.22	3.98	
Last PZD Survey										
7,660.6	1.89	294.28	7,334.4	1,538.4	559.3	1,433.1	0.00	0.00	0.00	
GGU 23A-28-691 BHL										
7,665.0	1.89	294.28	7,338.8	1,538.3	559.4	1,432.9	0.00	0.00	0.00	
Straightline Projection to TD										

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
785.0	785.0	1.3	0.3	Last PZD Surface Survey
7,610.0	7,283.9	558.6	1,434.6	Last PZD Survey
7,665.0	7,338.8	559.4	1,432.9	Straightline Projection to TD

Checked By: _____

Approved By: _____

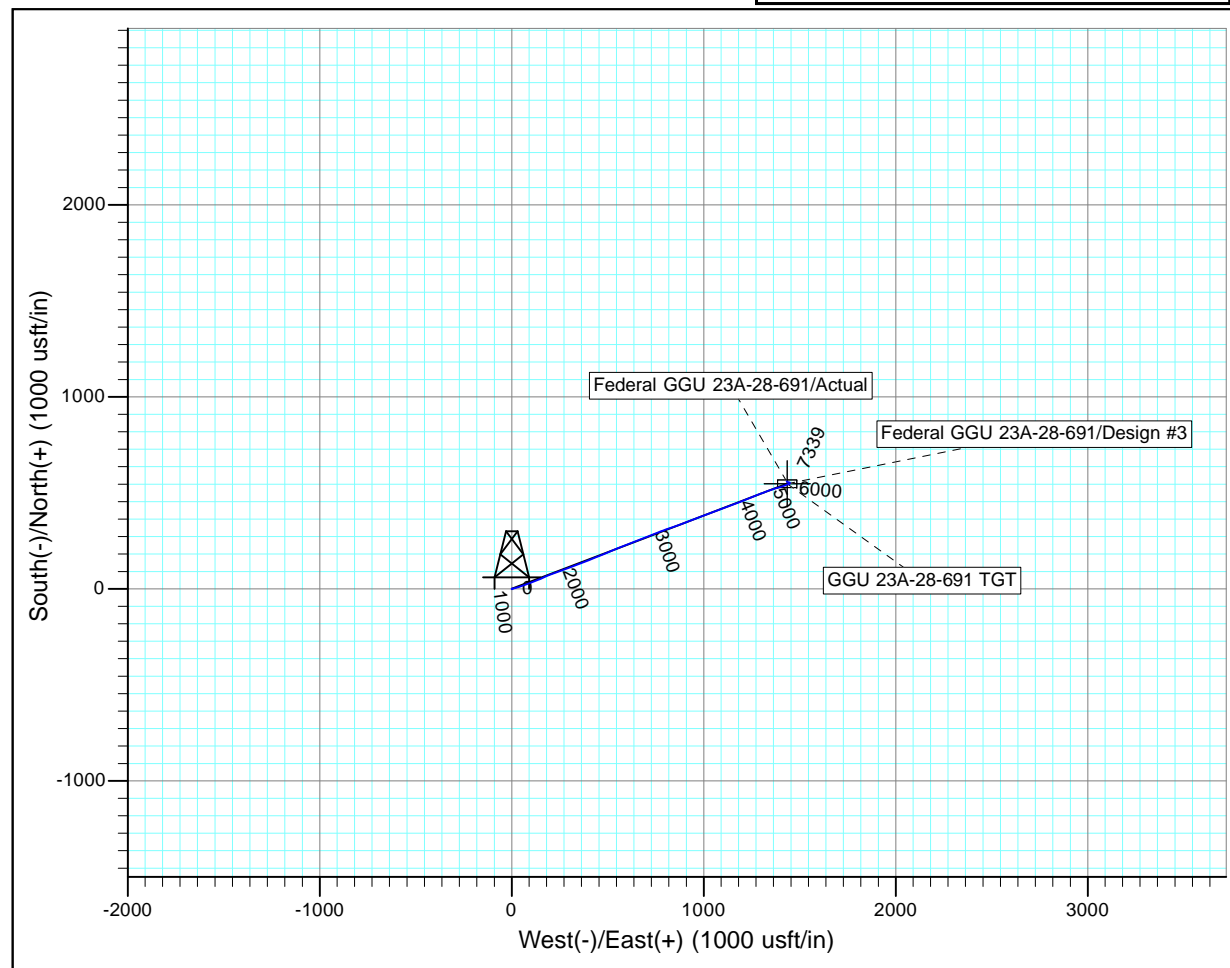
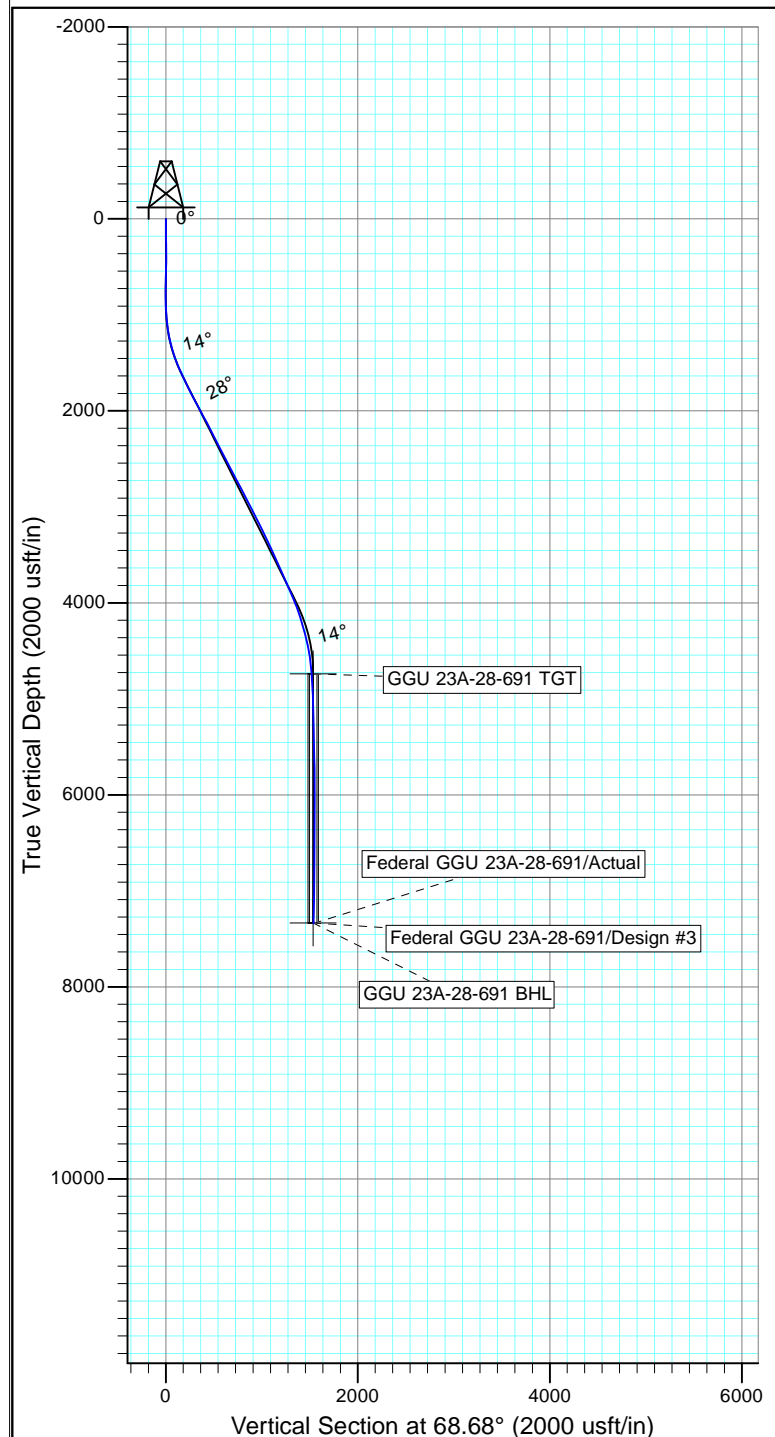
Date: _____



Project: Garfield County, CO
 Site: GGU 13-28
 Well: Federal GGU 23A-28-691
 Wellbore: Wellbore #1
 Design: Actual

Azimuths to True North
 Magnetic North: 9.45°

Magnetic Field
 Strength: 51526.9nT
 Dip Angle: 65.65°
 Date: 12/11/2017
 Model: IGRF2015



Design: Actual (Federal GGU 23A-28-691/Wellbore #1)

Created By: Derek Stephens Date: 8:36, December 11 2017

THIS SURVEY IS CORRECT TO THE BEST OF
 MY KNOWLEDGE AND IS SUPPORTED
 BY ACTUAL FIELD DATA



Corporate Office

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Denver, CO 80202

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