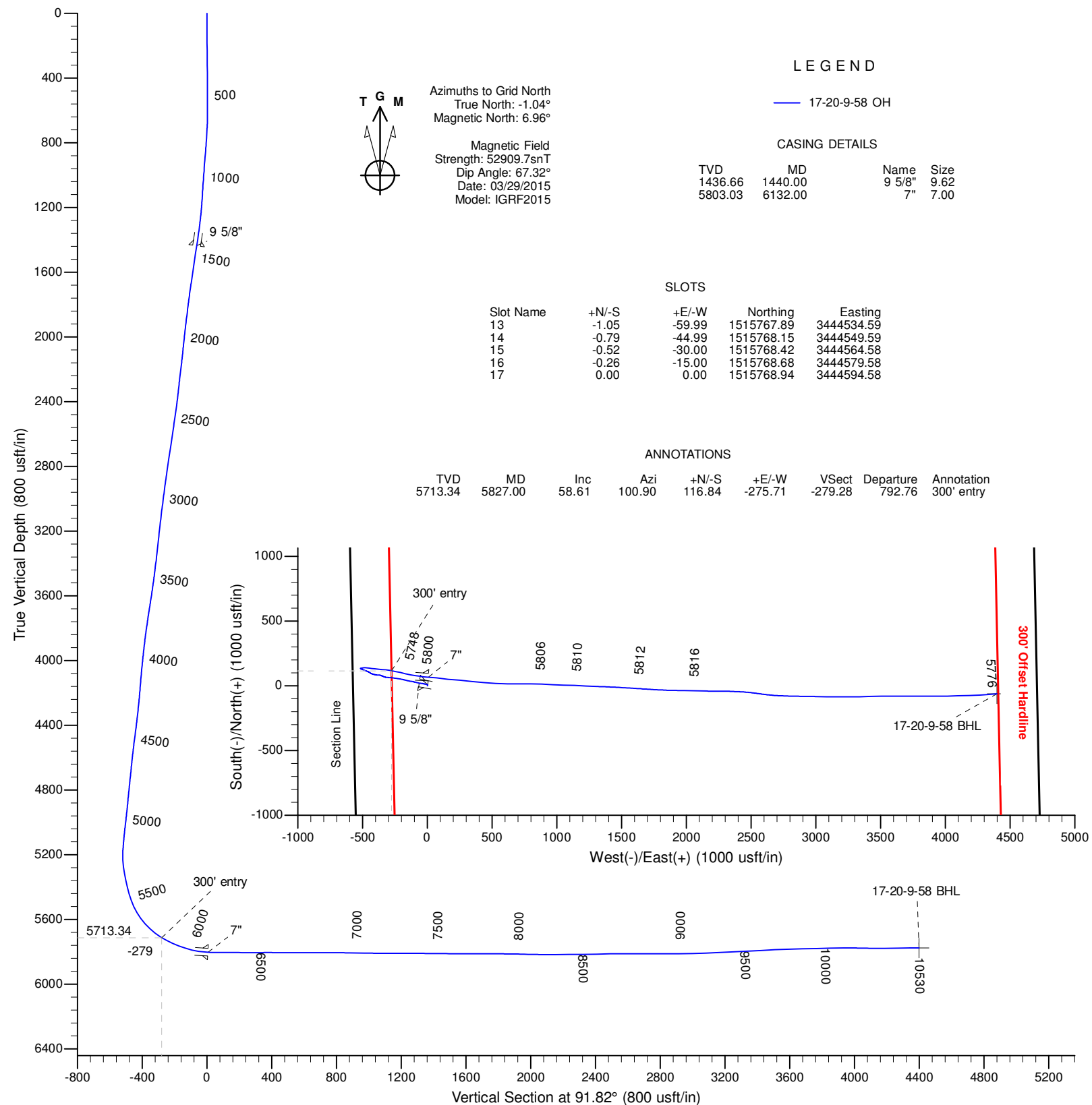




Project: Niobrara CON'83
County: Weld
Site: Bringelson 20-9-58 Pad
Well: 17-20-9-58
Wellbore: 17-20-9-58 OH
Design: 17-20-9-58 OH



DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Shape
17-20-9-58 BHL	5776.05	-61.75	4399.27	1515707.19	3448993.82	40° 44' 15.88 N	103° 52' 46.96 W	Point

Titan Directional Drilling, LLC

Survey Report

Company:	Carrizo Oil & Gas, Inc.	Local Co-ordinate Reference:	Well 17-20-9-58 - Slot 17
Project:	Niobrara CON'83	TVD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Site:	Bringelson 20-9-58 Pad	MD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Well:	17-20-9-58	North Reference:	Grid
Wellbore:	17-20-9-58 OH	Survey Calculation Method:	Minimum Curvature
Design:	17-20-9-58 OH	Database:	EDM 5000.1 Single User Db

Project	Niobrara CON'83, Weld County, CO		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Northern Zone		Using geodetic scale factor

Site	Bringelson 20-9-58 Pad, Centered on 17-20-9-58		
Site Position:		Northing:	1,515,768.94 usft
From:	Map	Easting:	3,444,594.58 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13.20 in
		Latitude:	40° 44' 17.28 N
		Longitude:	103° 53' 44.09 W
		Grid Convergence:	1.04 °

Well	17-20-9-58 - Slot 17		
Well Position	+N/-S	0.00 usft	Northing:
	+E/-W	0.00 usft	Easting:
Position Uncertainty	0.00 usft		Wellhead Elevation:
			Latitude:
			Longitude:
			Ground Level:

Wellbore	17-20-9-58 OH		
Magnetics	Model Name	Sample Date	Declination (°)
	IGRF2015	03/29/15	8.00
			Dip Angle (°)
			67.32
			Field Strength (nT)
			52,910

Design	17-20-9-58 OH		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)
	0.00	0.00	0.00
			Direction (°)
			91.82

Survey Program	Date	04/06/15		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
136.00	10,468.00	Survey #1 (17-20-9-58 OH)	MWD	MWD - Standard
10,530.00	10,530.00	Survey #2 (17-20-9-58 OH)	ZERO-ERROR	Zero Error

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	
136.00	0.70	31.20	136.00	0.71	0.43	0.41	0.51	0.51	0.00	
229.00	0.80	22.10	228.99	1.80	0.97	0.91	0.17	0.11	-9.78	
320.00	0.90	19.80	319.98	3.06	1.45	1.35	0.12	0.11	-2.53	
411.00	1.00	29.10	410.97	4.43	2.08	1.94	0.20	0.11	10.22	
500.00	1.00	20.50	499.95	5.83	2.73	2.54	0.17	0.00	-9.66	
592.00	1.00	14.50	591.94	7.36	3.21	2.97	0.11	0.00	-6.52	
683.00	2.00	295.40	682.91	8.81	1.97	1.69	2.26	1.10	-86.92	
774.00	4.20	283.80	773.78	10.29	-2.70	-3.02	2.50	2.42	-12.75	
865.00	4.70	284.70	864.50	12.03	-9.54	-9.92	0.55	0.55	0.99	

Titan Directional Drilling, LLC

Survey Report

Company:	Carrizo Oil & Gas, Inc.	Local Co-ordinate Reference:	Well 17-20-9-58 - Slot 17
Project:	Niobrara CON'83	TVD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Site:	Bringelson 20-9-58 Pad	MD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Well:	17-20-9-58	North Reference:	Grid
Wellbore:	17-20-9-58 OH	Survey Calculation Method:	Minimum Curvature
Design:	17-20-9-58 OH	Database:	EDM 5000.1 Single User Db

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
957.00	4.40	285.20	956.21	13.91	-16.59	-17.02	0.33	-0.33	0.54
1,049.00	4.00	281.40	1,047.96	15.47	-23.14	-23.62	0.53	-0.43	-4.13
1,141.00	3.60	285.70	1,139.76	16.88	-29.07	-29.59	0.53	-0.43	4.67
1,233.00	5.50	275.60	1,231.47	18.10	-36.24	-36.79	2.23	2.07	-10.98
1,323.00	7.80	278.40	1,320.86	19.41	-46.57	-47.17	2.58	2.56	3.11
1,403.00	8.40	279.90	1,400.06	21.21	-57.70	-58.34	0.80	0.75	1.88
1,440.00	8.44	280.43	1,436.66	22.16	-63.03	-63.70	0.24	0.11	1.44
9 5/8"									
1,494.00	8.50	281.20	1,490.07	23.66	-70.84	-71.56	0.24	0.11	1.42
1,580.00	8.70	282.60	1,575.10	26.31	-83.43	-84.22	0.34	0.23	1.63
1,665.00	8.70	285.20	1,659.13	29.40	-95.90	-96.79	0.46	0.00	3.06
1,750.00	7.80	283.30	1,743.25	32.41	-107.72	-108.70	1.11	-1.06	-2.24
1,835.00	7.10	278.70	1,827.53	34.53	-118.53	-119.56	1.08	-0.82	-5.41
1,920.00	6.80	278.40	1,911.90	36.06	-128.70	-129.78	0.36	-0.35	-0.35
2,005.00	6.40	280.30	1,996.34	37.64	-138.34	-139.46	0.54	-0.47	2.24
2,090.00	5.70	281.70	2,080.87	39.35	-147.13	-148.31	0.84	-0.82	1.65
2,175.00	6.90	283.30	2,165.35	41.38	-156.23	-157.47	1.43	1.41	1.88
2,261.00	6.90	284.00	2,250.73	43.82	-166.27	-167.58	0.10	0.00	0.81
2,346.00	6.20	284.90	2,335.17	46.23	-175.66	-177.04	0.83	-0.82	1.06
2,430.00	8.00	283.10	2,418.53	48.72	-185.74	-187.20	2.16	2.14	-2.14
2,514.00	8.10	279.80	2,501.70	51.05	-197.27	-198.79	0.56	0.12	-3.93
2,598.00	8.50	279.80	2,584.82	53.12	-209.22	-210.80	0.48	0.48	0.00
2,682.00	8.40	279.10	2,667.91	55.15	-221.39	-223.03	0.17	-0.12	-0.83
2,767.00	8.40	278.40	2,752.00	57.03	-233.66	-235.36	0.12	0.00	-0.82
2,852.00	8.40	278.00	2,836.08	58.81	-245.95	-247.70	0.07	0.00	-0.47
2,937.00	7.90	278.70	2,920.23	60.55	-257.88	-259.67	0.60	-0.59	0.82
3,021.00	7.20	278.70	3,003.50	62.22	-268.79	-270.63	0.83	-0.83	0.00
3,105.00	6.90	275.40	3,086.86	63.49	-279.01	-280.89	0.60	-0.36	-3.93
3,189.00	6.40	272.90	3,170.30	64.21	-288.71	-290.61	0.69	-0.60	-2.98
3,274.00	6.10	273.80	3,254.79	64.74	-297.95	-299.86	0.37	-0.35	1.06
3,359.00	6.70	275.20	3,339.26	65.49	-307.39	-309.32	0.73	0.71	1.65
3,444.00	7.00	275.40	3,423.65	66.43	-317.49	-319.44	0.35	0.35	0.24
3,529.00	8.00	288.00	3,507.93	68.75	-328.27	-330.29	2.26	1.18	14.82
3,613.00	9.00	293.30	3,591.01	73.15	-339.87	-342.02	1.51	1.19	6.31
3,697.00	10.00	293.70	3,673.86	78.68	-352.58	-354.90	1.19	1.19	0.48
3,782.00	8.30	281.90	3,757.78	82.91	-365.34	-367.79	2.97	-2.00	-13.88
3,866.00	7.60	273.40	3,840.97	84.49	-376.82	-379.31	1.63	-0.83	-10.12
3,951.00	6.50	266.60	3,925.33	84.54	-387.23	-389.72	1.62	-1.29	-8.00
4,036.00	5.90	284.30	4,009.84	85.34	-396.27	-398.78	2.35	-0.71	20.82
4,121.00	5.10	281.70	4,094.45	87.18	-404.20	-406.77	0.99	-0.94	-3.06
4,207.00	4.50	278.00	4,180.15	88.43	-411.29	-413.89	0.78	-0.70	-4.30
4,292.00	6.10	288.70	4,264.78	90.34	-418.87	-421.53	2.20	1.88	12.59
4,377.00	6.80	289.40	4,349.25	93.46	-427.89	-430.65	0.83	0.82	0.82

Titan Directional Drilling, LLC

Survey Report

Company:	Carrizo Oil & Gas, Inc.	Local Co-ordinate Reference:	Well 17-20-9-58 - Slot 17
Project:	Niobrara CON'83	TVD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Site:	Bringelson 20-9-58 Pad	MD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Well:	17-20-9-58	North Reference:	Grid
Wellbore:	17-20-9-58 OH	Survey Calculation Method:	Minimum Curvature
Design:	17-20-9-58 OH	Database:	EDM 5000.1 Single User Db

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,462.00	8.50	302.30	4,433.49	98.49	-437.95	-440.86	2.83	2.00	15.18
4,546.00	8.30	301.90	4,516.59	105.01	-448.35	-451.45	0.25	-0.24	-0.48
4,631.00	6.90	294.40	4,600.84	110.36	-458.20	-461.48	2.02	-1.65	-8.82
4,716.00	5.60	285.40	4,685.34	113.57	-466.85	-470.22	1.91	-1.53	-10.59
4,801.00	6.50	287.20	4,769.87	116.09	-475.45	-478.89	1.08	1.06	2.12
4,886.00	5.50	291.50	4,854.40	119.01	-483.83	-487.37	1.29	-1.18	5.06
4,971.00	6.80	295.80	4,938.91	122.69	-492.15	-495.80	1.62	1.53	5.06
5,056.00	7.50	296.80	5,023.25	127.38	-501.64	-505.43	0.84	0.82	1.18
5,140.00	5.50	295.20	5,106.70	131.57	-510.17	-514.09	2.39	-2.38	-1.90
5,182.00	4.90	291.50	5,148.53	133.08	-513.66	-517.63	1.64	-1.43	-8.81
5,225.00	2.40	303.70	5,191.44	134.26	-516.12	-520.13	6.06	-5.81	28.37
5,267.00	2.80	62.70	5,233.42	135.22	-515.94	-519.98	10.68	0.95	283.33
5,309.00	7.00	80.30	5,275.26	136.12	-512.51	-516.57	10.51	10.00	41.90
5,352.00	11.00	78.30	5,317.72	137.39	-505.90	-510.01	9.33	9.30	-4.65
5,394.00	13.30	76.40	5,358.78	139.34	-497.28	-501.46	5.56	5.48	-4.52
5,437.00	13.80	83.10	5,400.58	141.12	-487.38	-491.62	3.83	1.16	15.58
5,479.00	14.90	96.30	5,441.28	141.13	-477.04	-481.28	8.20	2.62	31.43
5,522.00	19.60	98.40	5,482.34	139.47	-464.40	-468.60	11.02	10.93	4.88
5,564.00	25.00	97.50	5,521.18	137.28	-448.62	-452.76	12.88	12.86	-2.14
5,607.00	31.00	97.00	5,559.13	134.74	-428.61	-432.67	13.96	13.95	-1.16
5,649.00	36.60	96.40	5,594.02	132.03	-405.41	-409.40	13.36	13.33	-1.43
5,691.00	42.20	94.50	5,626.46	129.52	-378.88	-382.80	13.64	13.33	-4.52
5,734.00	46.80	95.40	5,657.12	126.91	-348.86	-352.72	10.80	10.70	2.09
5,776.00	52.20	96.80	5,684.39	123.50	-317.12	-320.89	13.10	12.86	3.33
5,819.00	57.60	100.70	5,709.11	118.12	-282.38	-285.99	14.58	12.56	9.07
5,827.00	58.61	100.90	5,713.34	116.84	-275.71	-279.28	12.79	12.61	2.49
300' entry									
5,861.00	62.90	101.70	5,729.95	111.03	-246.63	-250.03	12.79	12.62	2.36
5,904.00	66.60	102.10	5,748.29	103.01	-208.58	-211.75	8.65	8.60	0.93
5,946.00	69.60	102.10	5,763.95	94.84	-170.48	-173.41	7.14	7.14	0.00
5,989.00	72.20	101.00	5,778.02	86.71	-130.67	-133.36	6.51	6.05	-2.56
6,031.00	76.90	99.80	5,789.21	79.41	-90.87	-93.34	11.52	11.19	-2.86
6,074.00	81.70	97.10	5,797.19	73.21	-49.09	-51.39	12.75	11.16	-6.28
6,088.00	83.30	96.30	5,799.02	71.59	-35.30	-37.56	12.76	11.43	-5.71
6,132.00	86.23	93.58	5,803.03	67.82	8.34	6.18	9.07	6.66	-6.18
7"									
6,148.00	87.30	92.60	5,803.93	66.96	24.29	22.15	9.07	6.68	-6.14
6,194.00	91.10	98.20	5,804.57	62.63	70.06	68.03	14.71	8.26	12.17
6,285.00	89.30	95.60	5,804.26	51.70	160.39	158.66	3.47	-1.98	-2.86
6,377.00	89.60	95.20	5,805.14	43.04	251.97	250.48	0.54	0.33	-0.43
6,469.00	90.70	95.90	5,804.90	34.14	343.54	342.28	1.42	1.20	0.76
6,561.00	88.80	93.80	5,805.30	26.37	435.20	434.14	3.08	-2.07	-2.28
6,653.00	90.50	94.50	5,805.86	19.71	526.95	526.06	2.00	1.85	0.76
6,743.00	89.50	89.80	5,805.86	16.33	616.86	616.03	5.34	-1.11	-5.22

Titan Directional Drilling, LLC

Survey Report

Company:	Carrizo Oil & Gas, Inc.	Local Co-ordinate Reference:	Well 17-20-9-58 - Slot 17
Project:	Niobrara CON'83	TVD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Site:	Bringelson 20-9-58 Pad	MD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Well:	17-20-9-58	North Reference:	Grid
Wellbore:	17-20-9-58 OH	Survey Calculation Method:	Minimum Curvature
Design:	17-20-9-58 OH	Database:	EDM 5000.1 Single User Db

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
6,834.00	90.40	89.90	5,805.94	16.57	707.86	706.98	1.00	0.99	0.11	
6,925.00	89.60	91.20	5,805.94	15.70	798.85	797.95	1.68	-0.88	1.43	
7,010.00	89.30	92.00	5,806.76	13.33	883.82	882.95	1.01	-0.35	0.94	
7,097.00	89.20	92.60	5,807.90	9.83	970.74	969.94	0.70	-0.11	0.69	
7,179.00	88.70	91.70	5,809.40	6.76	1,052.67	1,051.92	1.26	-0.61	-1.10	
7,264.00	90.20	92.90	5,810.22	3.35	1,137.59	1,136.91	2.26	1.76	1.41	
7,349.00	89.90	92.60	5,810.14	-0.73	1,222.49	1,221.90	0.50	-0.35	-0.35	
7,434.00	89.90	92.40	5,810.29	-4.44	1,307.41	1,306.89	0.24	0.00	-0.24	
7,519.00	89.70	91.70	5,810.59	-7.48	1,392.36	1,391.89	0.86	-0.24	-0.82	
7,604.00	89.60	93.30	5,811.11	-11.19	1,477.27	1,476.88	1.89	-0.12	1.88	
7,688.00	89.30	93.60	5,811.91	-16.24	1,561.11	1,560.84	0.51	-0.36	0.36	
7,773.00	89.80	94.00	5,812.58	-21.87	1,645.92	1,645.79	0.75	0.59	0.47	
7,857.00	90.20	93.30	5,812.58	-27.22	1,729.75	1,729.74	0.96	0.48	-0.83	
7,942.00	89.70	92.70	5,812.65	-31.67	1,814.64	1,814.73	0.92	-0.59	-0.71	
8,026.00	88.90	91.00	5,813.68	-34.38	1,898.58	1,898.72	2.24	-0.95	-2.02	
8,086.00	88.50	91.30	5,815.04	-35.59	1,958.55	1,958.70	0.83	-0.67	0.50	
8,111.00	88.50	91.20	5,815.70	-36.13	1,983.54	1,983.69	0.40	0.00	-0.40	
8,196.00	89.80	91.20	5,816.96	-37.91	2,068.51	2,068.67	1.53	1.53	0.00	
8,281.00	90.30	91.20	5,816.88	-39.69	2,153.49	2,153.66	0.59	0.59	0.00	
8,365.00	90.10	90.30	5,816.59	-40.79	2,237.48	2,237.65	1.10	-0.24	-1.07	
8,450.00	90.00	91.00	5,816.52	-41.75	2,322.48	2,322.63	0.83	-0.12	0.82	
8,535.00	92.00	92.90	5,815.03	-44.65	2,407.41	2,407.61	3.25	2.35	2.24	
8,619.00	91.10	96.10	5,812.76	-51.23	2,491.10	2,491.47	3.96	-1.07	3.81	
8,704.00	89.30	98.20	5,812.46	-61.81	2,575.43	2,576.10	3.25	-2.12	2.47	
8,789.00	91.20	95.00	5,812.09	-71.58	2,659.86	2,660.79	4.38	2.24	-3.76	
8,874.00	89.60	92.00	5,811.50	-76.77	2,744.68	2,745.74	4.00	-1.88	-3.53	
8,958.00	89.50	91.20	5,812.16	-79.11	2,828.65	2,829.73	0.96	-0.12	-0.95	
9,043.00	90.10	91.00	5,812.45	-80.75	2,913.63	2,914.72	0.74	0.71	-0.24	
9,128.00	92.00	90.80	5,810.90	-82.08	2,998.60	2,999.70	2.25	2.24	-0.24	
9,213.00	92.50	90.80	5,807.56	-83.27	3,083.53	3,084.62	0.59	0.59	0.00	
9,297.00	92.70	90.60	5,803.75	-84.29	3,167.43	3,168.51	0.34	0.24	-0.24	
9,382.00	92.90	89.60	5,799.60	-84.44	3,252.33	3,253.37	1.20	0.24	-1.18	
9,467.00	92.50	89.20	5,795.59	-83.55	3,337.23	3,338.20	0.67	-0.47	-0.47	
9,552.00	93.30	88.50	5,791.29	-81.85	3,422.11	3,422.98	1.25	0.94	-0.82	
9,637.00	93.10	88.90	5,786.55	-79.92	3,506.95	3,507.72	0.53	-0.24	0.47	
9,722.00	91.40	89.00	5,783.21	-78.37	3,591.87	3,592.54	2.00	-2.00	0.12	
9,807.00	90.70	90.80	5,781.65	-78.22	3,676.85	3,677.48	2.27	-0.82	2.12	
9,891.00	91.50	90.50	5,780.04	-79.17	3,760.83	3,761.44	1.02	0.95	-0.36	
9,976.00	91.50	90.30	5,777.82	-79.76	3,845.80	3,846.39	0.24	0.00	-0.24	
10,061.00	90.70	89.60	5,776.18	-79.69	3,930.78	3,931.33	1.25	-0.94	-0.82	
10,146.00	88.40	88.90	5,776.85	-78.58	4,015.76	4,016.23	2.83	-2.71	-0.82	
10,230.00	89.10	88.90	5,778.68	-76.96	4,099.73	4,100.10	0.83	0.83	0.00	
10,315.00	91.10	88.20	5,778.53	-74.81	4,184.70	4,184.96	2.49	2.35	-0.82	

Titan Directional Drilling, LLC

Survey Report

Company:	Carrizo Oil & Gas, Inc.	Local Co-ordinate Reference:	Well 17-20-9-58 - Slot 17
Project:	Niobrara CON'83	TVD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Site:	Bringelson 20-9-58 Pad	MD Reference:	4872'GL+17'KB @ 4889.00usft (Xtreme 19)
Well:	17-20-9-58	North Reference:	Grid
Wellbore:	17-20-9-58 OH	Survey Calculation Method:	Minimum Curvature
Design:	17-20-9-58 OH	Database:	EDM 5000.1 Single User Db

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
10,400.00	90.50	86.10	5,777.35	-70.59	4,269.58	4,269.66	2.57	-0.71	-2.47	
10,468.00	90.60	86.10	5,776.70	-65.96	4,337.42	4,337.32	0.15	0.15	0.00	
10,530.00	90.60	86.10	5,776.05	-61.75	4,399.27	4,399.01	0.00	0.00	0.00	
17-20-9-58 PBHL										

Design Targets										
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude	
- hit/miss target										
- Shape										
17-20-9-58 BHL	0.00	0.00	5,776.05	-61.75	4,399.27	1,515,707.19	3,448,993.82	40° 44' 15.88 N	103° 52' 46.96 W	
- actual wellpath misses target center by 0.01usft at 10530.00usft MD (5776.05 TVD, -61.75 N, 4399.27 E)										
- Point										

Casing Points						
Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (in)	Hole Diameter (in)		
1,440.00	1,436.66	9 5/8"	9.63	12.25		
6,132.00	5,803.03	7"	7.00	8.75		

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
5,827.00	5,713.34	116.84	-275.71	300' entry	