



## Titan Directional Drilling, LLC

## Survey Report

<b>Company:</b>	Carrizo Oil & Gas, Inc.	<b>Local Co-ordinate Reference:</b>	Well 2-30-9-59
<b>Project:</b>	Niobrara CON'83	<b>TVD Reference:</b>	GL+KB @ 4934.00usft (Xtreme 19)
<b>Site:</b>	Ptasnik 1-30-9-59 Pad	<b>MD Reference:</b>	GL+KB @ 4934.00usft (Xtreme 19)
<b>Well:</b>	2-30-9-59	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	2-30-9-59 OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	2-30-9-59 OH	<b>Database:</b>	EDM 5000.1 Single User Db

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

<b>Site</b>	Ptasnik 1-30-9-59 Pad,		
<b>Site Position:</b>		<b>Northing:</b>	1,506,771.07 usft
<b>From:</b>	Map	<b>Easting:</b>	3,407,796.03 usft
<b>Position Uncertainty:</b>	0.00 usft	<b>Slot Radius:</b>	13.20 in
		<b>Latitude:</b>	40° 42' 54.69 N
		<b>Longitude:</b>	104° 1' 44.00 W
		<b>Grid Convergence:</b>	0.95 °

<b>Well</b>	2-30-9-59		
<b>Well Position</b>	<b>+N/-S</b>	0.00 usft	<b>Northing:</b>
	<b>+E/-W</b>	0.00 usft	<b>Easting:</b>
<b>Position Uncertainty</b>	0.00 usft	<b>Wellhead Elevation:</b>	0.00 usft
		<b>Latitude:</b>	40° 42' 54.69 N
		<b>Longitude:</b>	104° 1' 43.80 W
		<b>Ground Level:</b>	4,917.00 usft

<b>Wellbore</b>	2-30-9-59 OH		
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination</b>
			(°)
	IGRF2015	04/19/15	8.07
			<b>Dip Angle</b>
			(°)
			67.28
			<b>Field Strength</b>
			(nT)
			52,878

<b>Design</b>	2-30-9-59 OH		
<b>Audit Notes:</b>			
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL
		<b>Tie On Depth:</b>	0.00
<b>Vertical Section:</b>	<b>Depth From (TVD)</b>	<b>+N/-S</b>	<b>+E/-W</b>
	(usft)	(usft)	(usft)
	0.00	0.00	0.00
			<b>Direction</b>
			(°)
			359.09

<b>Survey Program</b>	<b>Date</b>	04/27/15		
<b>From</b>	<b>To</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>
(usft)	(usft)			
136.00	10,778.00	Survey #1 (2-30-9-59 OH)	MWD	MWD - Standard
10,832.00	10,832.00	Survey #2 (2-30-9-59 OH)	ZERO-ERROR	Zero Error

<b>Survey</b>										
<b>Measured</b>	<b>Inclination</b>	<b>Azimuth</b>	<b>Vertical</b>	<b>+N/-S</b>	<b>+E/-W</b>	<b>Vertical</b>	<b>Dogleg</b>	<b>Build</b>	<b>Turn</b>	
<b>Depth</b>	<b>(°)</b>	<b>(°)</b>	<b>Depth</b>	<b>(usft)</b>	<b>(usft)</b>	<b>Section</b>	<b>Rate</b>	<b>Rate</b>	<b>Rate</b>	
<b>(usft)</b>			<b>(usft)</b>			<b>(usft)</b>	<b>(°/100usft)</b>	<b>(°/100usft)</b>	<b>(°/100usft)</b>	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
136.00	0.30	34.40	136.00	0.29	0.20	0.29	0.22	0.22	0.00	
229.00	0.30	67.80	229.00	0.59	0.56	0.58	0.19	0.00	35.91	
324.00	0.30	56.90	324.00	0.82	1.00	0.80	0.06	0.00	-11.47	
414.00	0.30	59.50	414.00	1.06	1.40	1.04	0.02	0.00	2.89	
504.00	0.10	22.40	504.00	1.26	1.64	1.23	0.25	-0.22	-41.22	
595.00	2.60	186.90	594.96	-0.72	1.42	-0.74	2.96	2.75	180.77	
686.00	3.40	187.80	685.84	-5.44	0.80	-5.45	0.88	0.88	0.99	
776.00	3.50	186.20	775.68	-10.82	0.15	-10.82	0.15	0.11	-1.78	
866.00	3.70	182.50	865.50	-16.45	-0.28	-16.44	0.34	0.22	-4.11	

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<b>Well:</b>	2-30-9-59	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	2-30-9-59 OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	2-30-9-59 OH	<b>Database:</b>	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)
954.00	3.80	178.50	953.31	-22.20	-0.33	-22.19	0.32	0.11	-4.55
1,045.00	3.80	177.50	1,044.11	-28.23	-0.12	-28.22	0.07	0.00	-1.10
1,135.00	3.50	176.90	1,133.93	-33.95	0.16	-33.95	0.34	-0.33	-0.67
1,227.00	5.90	179.40	1,225.61	-41.48	0.36	-41.48	2.62	2.61	2.72
1,319.00	6.70	181.80	1,317.06	-51.58	0.25	-51.57	0.92	0.87	2.61
1,411.00	6.70	184.00	1,408.43	-62.29	-0.30	-62.28	0.28	0.00	2.39
1,502.00	4.50	187.10	1,498.99	-71.13	-1.11	-71.11	2.44	-2.42	3.41
1,588.00	4.10	186.90	1,584.75	-77.53	-1.90	-77.49	0.47	-0.47	-0.23
1,630.00	4.30	186.80	1,626.63	-80.59	-2.26	-80.54	0.48	0.48	-0.24
1,648.00	4.24	187.26	1,644.58	-81.92	-2.43	-81.87	0.38	-0.32	2.56
9 5/8"									
1,661.00	4.20	187.60	1,657.55	-82.87	-2.55	-82.82	0.38	-0.32	2.62
1,746.00	4.20	188.40	1,742.32	-89.03	-3.42	-88.97	0.07	0.00	0.94
1,831.00	3.90	182.40	1,827.11	-95.00	-3.99	-94.92	0.61	-0.35	-7.06
1,916.00	3.40	182.00	1,911.93	-100.41	-4.20	-100.33	0.59	-0.59	-0.47
2,001.00	4.70	181.50	1,996.72	-106.41	-4.38	-106.32	1.53	1.53	-0.59
2,086.00	4.80	180.30	2,081.43	-113.44	-4.49	-113.36	0.17	0.12	-1.41
2,171.00	4.70	180.40	2,166.14	-120.48	-4.53	-120.40	0.12	-0.12	0.12
2,256.00	4.40	179.00	2,250.87	-127.23	-4.50	-127.14	0.38	-0.35	-1.65
2,341.00	4.20	180.40	2,335.63	-133.60	-4.46	-133.51	0.27	-0.24	1.65
2,425.00	3.50	175.30	2,419.44	-139.23	-4.28	-139.14	0.93	-0.83	-6.07
2,510.00	5.10	169.50	2,504.20	-145.53	-3.38	-145.46	1.95	1.88	-6.82
2,595.00	4.90	171.80	2,588.87	-152.84	-2.17	-152.78	0.33	-0.24	2.71
2,681.00	4.70	172.40	2,674.57	-159.97	-1.18	-159.93	0.24	-0.23	0.70
2,766.00	4.80	174.80	2,759.28	-166.96	-0.40	-166.93	0.26	0.12	2.82
2,851.00	5.30	176.20	2,843.95	-174.42	0.19	-174.40	0.61	0.59	1.65
2,936.00	5.50	176.70	2,928.57	-182.40	0.68	-182.39	0.24	0.24	0.59
3,021.00	5.40	177.50	3,013.19	-190.46	1.09	-190.46	0.15	-0.12	0.94
3,105.00	5.00	176.70	3,096.84	-198.07	1.47	-198.07	0.48	-0.48	-0.95
3,189.00	3.80	174.50	3,180.59	-204.49	1.95	-204.50	1.44	-1.43	-2.62
3,274.00	5.30	183.10	3,265.33	-211.22	2.01	-211.22	1.93	1.76	10.12
3,359.00	5.20	184.70	3,349.97	-218.98	1.48	-218.97	0.21	-0.12	1.88
3,444.00	5.50	185.50	3,434.60	-226.87	0.77	-226.85	0.36	0.35	0.94
3,529.00	6.10	185.50	3,519.16	-235.42	-0.05	-235.39	0.71	0.71	0.00
3,613.00	6.20	189.10	3,602.68	-244.34	-1.19	-244.29	0.47	0.12	4.29
3,698.00	5.50	179.40	3,687.24	-252.95	-1.88	-252.89	1.42	-0.82	-11.41
3,783.00	5.90	175.20	3,771.82	-261.37	-1.47	-261.32	0.68	0.47	-4.94
3,868.00	6.30	173.90	3,856.34	-270.36	-0.61	-270.32	0.50	0.47	-1.53
3,953.00	5.00	170.10	3,940.92	-278.65	0.52	-278.62	1.59	-1.53	-4.47
4,038.00	5.10	160.20	4,025.59	-285.86	2.44	-285.86	1.03	0.12	-11.65
4,123.00	4.30	179.90	4,110.31	-292.60	3.73	-292.62	2.11	-0.94	23.18
4,208.00	3.70	165.50	4,195.11	-298.44	4.42	-298.47	1.37	-0.71	-16.94
4,293.00	4.60	178.20	4,279.89	-304.50	5.21	-304.55	1.51	1.06	14.94

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<b>Wellbore:</b>	2-30-9-59 OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	2-30-9-59 OH	<b>Database:</b>	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)
4,377.00	4.30	170.10	4,363.63	-310.97	5.86	-311.02	0.83	-0.36	-9.64
4,462.00	3.80	165.10	4,448.42	-316.83	7.13	-316.90	0.72	-0.59	-5.88
4,547.00	4.40	178.50	4,533.21	-322.81	7.94	-322.90	1.33	0.71	15.76
4,631.00	3.80	173.80	4,616.99	-328.80	8.33	-328.89	0.82	-0.71	-5.60
4,716.00	4.90	171.80	4,701.74	-335.19	9.15	-335.30	1.31	1.29	-2.35
4,800.00	4.70	164.80	4,785.45	-342.07	10.56	-342.19	0.74	-0.24	-8.33
4,885.00	4.10	159.70	4,870.20	-348.28	12.53	-348.43	0.84	-0.71	-6.00
4,969.00	5.10	179.00	4,953.93	-354.83	13.64	-355.00	2.18	1.19	22.98
5,053.00	4.40	182.40	5,037.64	-361.78	13.57	-361.95	0.90	-0.83	4.05
5,138.00	3.70	182.00	5,122.43	-367.78	13.33	-367.94	0.82	-0.82	-0.47
5,223.00	4.90	177.30	5,207.19	-374.15	13.41	-374.31	1.47	1.41	-5.53
5,307.00	4.40	170.90	5,290.91	-380.91	14.09	-381.09	0.86	-0.60	-7.62
5,391.00	3.30	160.40	5,374.72	-386.37	15.41	-386.57	1.55	-1.31	-12.50
5,434.00	3.00	150.00	5,417.66	-388.51	16.39	-388.72	1.50	-0.70	-24.19
5,476.00	2.10	119.30	5,459.62	-389.84	17.61	-390.07	3.82	-2.14	-73.10
5,519.00	5.00	41.40	5,502.55	-388.82	19.54	-389.08	11.63	6.74	-181.16
5,561.00	9.50	25.80	5,544.21	-384.32	22.26	-384.63	11.60	10.71	-37.14
5,604.00	11.90	18.70	5,586.46	-376.93	25.22	-377.28	6.36	5.58	-16.51
5,646.00	13.80	14.00	5,627.41	-367.96	27.82	-368.36	5.16	4.52	-11.19
5,689.00	16.40	7.50	5,668.92	-356.97	29.86	-357.40	7.21	6.05	-15.12
5,731.00	19.80	5.50	5,708.84	-344.00	31.31	-344.46	8.23	8.10	-4.76
5,773.00	24.10	6.60	5,747.78	-328.40	32.98	-328.88	10.28	10.24	2.62
5,816.00	28.40	8.00	5,786.34	-309.54	35.41	-310.06	10.10	10.00	3.26
5,858.00	33.50	8.90	5,822.35	-288.18	38.60	-288.76	12.19	12.14	2.14
5,901.00	37.80	7.80	5,857.28	-263.39	42.23	-264.03	10.11	10.00	-2.56
5,943.00	41.20	8.00	5,889.69	-236.94	45.90	-237.63	8.10	8.10	0.48
5,985.00	47.00	6.40	5,919.84	-207.95	49.54	-208.71	14.06	13.81	-3.81
6,028.00	53.30	4.30	5,947.38	-175.10	52.59	-175.91	15.12	14.65	-4.88
6,065.00	56.47	2.71	5,968.66	-144.89	54.43	-145.74	9.26	8.57	-4.31
300' entry									
6,070.00	56.90	2.50	5,971.40	-140.72	54.62	-141.57	9.26	8.60	-4.12
6,113.00	60.90	1.80	5,993.61	-103.93	55.99	-104.81	9.41	9.30	-1.63
6,155.00	64.00	2.40	6,013.04	-66.73	57.36	-67.63	7.49	7.38	1.43
6,198.00	67.00	2.70	6,030.86	-27.64	59.10	-28.58	7.01	6.98	0.70
6,240.00	70.30	2.20	6,046.15	11.43	60.77	10.47	7.93	7.86	-1.19
6,283.00	75.30	2.00	6,058.86	52.47	62.28	51.48	11.64	11.63	-0.47
6,301.00	76.90	1.70	6,063.19	69.93	62.84	68.93	9.03	8.89	-1.67
6,335.00	80.40	0.90	6,069.88	103.26	63.60	102.23	10.54	10.29	-2.34
7"									
6,370.00	84.00	0.10	6,074.63	137.92	63.90	136.89	10.54	10.29	-2.29
6,416.00	88.40	359.00	6,077.68	183.81	63.54	182.78	9.86	9.57	-2.39
6,461.00	88.80	359.00	6,078.78	228.79	62.75	227.76	0.89	0.89	0.00
6,551.00	87.80	358.30	6,081.45	318.72	60.63	317.72	1.36	-1.11	-0.78
6,642.00	90.70	359.40	6,082.64	409.69	58.81	408.70	3.41	3.19	1.21

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<b>Wellbore:</b>	2-30-9-59 OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	2-30-9-59 OH	<b>Database:</b>	EDM 5000.1 Single User Db

Survey									
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6,733.00	90.80	359.90	6,081.45	500.68	58.25	499.69	0.56	0.11	0.55
6,824.00	89.60	358.70	6,081.13	591.67	57.14	590.68	1.86	-1.32	-1.32
6,917.00	88.80	357.80	6,082.43	684.61	54.30	683.66	1.29	-0.86	-0.97
7,001.00	90.20	359.70	6,083.16	768.58	52.47	767.65	2.81	1.67	2.26
7,086.00	90.20	0.80	6,082.86	853.58	52.84	852.63	1.29	0.00	1.29
7,170.00	90.80	1.70	6,082.13	937.55	54.67	936.57	1.29	0.71	1.07
7,254.00	91.20	0.40	6,080.67	1,021.53	56.21	1,020.50	1.62	0.48	-1.55
7,338.00	90.70	359.70	6,079.27	1,105.51	56.28	1,104.48	1.02	-0.60	-0.83
7,423.00	91.40	0.40	6,077.71	1,190.50	56.36	1,189.45	1.16	0.82	0.82
7,507.00	88.40	355.50	6,077.86	1,274.41	53.35	1,273.40	6.84	-3.57	-5.83
7,591.00	88.60	357.80	6,080.06	1,358.23	48.45	1,357.29	2.75	0.24	2.74
7,675.00	89.50	359.40	6,081.45	1,442.19	46.40	1,441.27	2.19	1.07	1.90
7,760.00	88.60	358.70	6,082.86	1,527.17	44.99	1,526.26	1.34	-1.06	-0.82
7,845.00	90.40	359.20	6,083.60	1,612.15	43.43	1,611.25	2.20	2.12	0.59
7,930.00	92.80	359.40	6,081.23	1,697.10	42.39	1,696.21	2.83	2.82	0.24
8,015.00	90.60	358.20	6,078.71	1,782.04	40.61	1,781.17	2.95	-2.59	-1.41
8,100.00	91.90	359.40	6,076.86	1,866.99	38.83	1,866.14	2.08	1.53	1.41
8,185.00	90.70	358.70	6,074.93	1,951.96	37.42	1,951.12	1.63	-1.41	-0.82
8,270.00	90.70	358.30	6,073.89	2,036.92	35.20	2,036.11	0.47	0.00	-0.47
8,355.00	92.00	358.70	6,071.89	2,121.87	32.97	2,121.08	1.60	1.53	0.47
8,440.00	88.90	358.90	6,071.22	2,206.84	31.19	2,206.06	3.65	-3.65	0.24
8,524.00	90.00	2.20	6,072.03	2,290.82	32.00	2,290.02	4.14	1.31	3.93
8,609.00	87.60	0.60	6,073.81	2,375.76	34.08	2,374.92	3.39	-2.82	-1.88
8,694.00	86.50	359.70	6,078.18	2,460.65	34.30	2,459.79	1.67	-1.29	-1.06
8,779.00	88.50	358.50	6,081.89	2,545.55	32.96	2,544.71	2.74	2.35	-1.41
8,864.00	91.50	2.20	6,081.89	2,630.52	33.48	2,629.66	5.60	3.53	4.35
8,948.00	90.90	1.70	6,080.13	2,714.46	36.34	2,713.54	0.93	-0.71	-0.60
9,032.00	90.10	358.70	6,079.40	2,798.44	36.63	2,797.51	3.70	-0.95	-3.57
9,117.00	90.60	356.20	6,078.88	2,883.35	32.85	2,882.46	3.00	0.59	-2.94
9,201.00	91.30	356.00	6,077.48	2,967.14	27.14	2,966.34	0.87	0.83	-0.24
9,285.00	91.50	355.90	6,075.43	3,050.91	21.21	3,050.19	0.27	0.24	-0.12
9,370.00	91.50	357.30	6,073.21	3,135.73	16.17	3,135.08	1.65	0.00	1.65
9,455.00	90.70	358.30	6,071.57	3,220.65	12.91	3,220.04	1.51	-0.94	1.18
9,540.00	89.60	359.60	6,071.35	3,305.63	11.35	3,305.03	2.00	-1.29	1.53
9,624.00	89.80	359.20	6,071.79	3,389.62	10.47	3,389.03	0.53	0.24	-0.48
9,709.00	89.50	358.20	6,072.31	3,474.60	8.54	3,474.03	1.23	-0.35	-1.18
9,794.00	88.60	357.50	6,073.72	3,559.53	5.35	3,558.99	1.34	-1.06	-0.82
9,879.00	90.50	359.40	6,074.39	3,644.49	3.06	3,643.98	3.16	2.24	2.24
9,963.00	90.20	358.50	6,073.87	3,728.47	1.52	3,727.97	1.13	-0.36	-1.07
10,048.00	90.10	358.30	6,073.65	3,813.44	-0.86	3,812.97	0.26	-0.12	-0.24
10,134.00	89.90	357.10	6,073.65	3,899.36	-4.31	3,898.94	1.41	-0.23	-1.40
10,218.00	89.50	356.00	6,074.09	3,983.21	-9.36	3,982.86	1.39	-0.48	-1.31
10,303.00	90.30	359.70	6,074.24	4,068.13	-12.55	4,067.82	4.45	0.94	4.35

# Titan Directional Drilling, LLC

## Survey Report

<b>Company:</b>	Carrizo Oil & Gas, Inc.	<b>Local Co-ordinate Reference:</b>	Well 2-30-9-59
<b>Project:</b>	Niobrara CON'83	<b>TVD Reference:</b>	GL+KB @ 4934.00usft (Xtreme 19)
<b>Site:</b>	Ptasnik 1-30-9-59 Pad	<b>MD Reference:</b>	GL+KB @ 4934.00usft (Xtreme 19)
<b>Well:</b>	2-30-9-59	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	2-30-9-59 OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	2-30-9-59 OH	<b>Database:</b>	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)	
10,388.00	89.20	358.70	6,074.61	4,153.12	-13.74	4,152.82	1.75	-1.29	-1.18	
10,473.00	91.70	1.80	6,073.94	4,238.10	-13.37	4,237.78	4.68	2.94	3.65	
10,558.00	90.60	0.80	6,072.24	4,323.06	-11.44	4,322.70	1.75	-1.29	-1.18	
10,643.00	90.50	0.30	6,071.42	4,408.05	-10.62	4,407.67	0.60	-0.12	-0.59	
10,727.00	90.10	359.40	6,070.98	4,492.05	-10.84	4,491.66	1.17	-0.48	-1.07	
10,778.00	90.00	358.90	6,070.94	4,543.04	-11.60	4,542.66	1.00	-0.20	-0.98	
10,832.00	90.00	358.90	6,070.94	4,597.03	-12.64	4,596.66	0.00	0.00	0.00	

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										
BHL 2-30	0.00	0.00	6,070.94	4,597.03	-12.64	1,511,368.06	3,407,798.39	40° 43' 40.11 N	104° 1' 42.98 W	
- actual wellpath hits target center										
- Point										

Casing Points						
Measured Depth (usft)	Vertical Depth (usft)	Name			Casing Diameter (in)	Hole Diameter (in)
1,648.00	1,644.58	9 5/8"			9.62	12.25
6,335.00	6,069.88	7"			7.00	7.50

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
6,065.00	5,968.66	-144.89	54.43	300' entry	