



# **Laramie Energy, LLC**

**Mesa County, CO**

**Gunderson 0993 21-05 Pad**

**BCU 0993-21-10E**

**Wellbore #1**

**Design: Wellbore #1**

## **QES Survey Report**

**23 August, 2018**





# Survey Report



<b>Company:</b>	Laramie Energy, LLC	<b>Local Co-ordinate Reference:</b>	Well BCU 0993-21-10E
<b>Project:</b>	Mesa County, CO	<b>TVD Reference:</b>	Well @ 7287.0usft (H&P #522)
<b>Site:</b>	Gunderson 0993 21-05 Pad	<b>MD Reference:</b>	Well @ 7287.0usft (H&P #522)
<b>Well:</b>	BCU 0993-21-10E	<b>North Reference:</b>	True
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<b>Database:</b>	EDM 5000.1 Single User Db

<b>Project</b>	Mesa 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 Central Zone		

Site		Gunderson 0993 21-05 Pad							
Site Position:		Northing:	1,529,627.90	usft	Latitude:	39.265321			
From:	Lat/Long	Easting:	2,354,508.90	usft	Longitude:	-107.780117			
Position Uncertainty:		0.0	usft	Slot Radius:	13-3/16	"	Grid Convergence:	-1.44	°

Well	BCU 0993-21-10E					
Well Position	+N/-S	0.0 usft	Northing:	1,529,627.88 usft	Latitude:	39.265321
	+E/-W	0.0 usft	Easting:	2,354,508.90 usft	Longitude:	-107.780117
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	7,257.0 usft

<b>Wellbore</b>	Wellbore #1				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	User Defined	8/9/2018	9.48	65.43	51,394.30000000

<b>Design</b>	Wellbore #1				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.0
<b>Vertical Section:</b>	<b>Depth From (TVD) (usft)</b>	<b>+N/-S (usft)</b>	<b>+E/-W (usft)</b>	<b>Direction (°)</b>	
	0.0	0.0	0.0	106.19	

<b>Survey Program</b>	<b>Date</b>	8/23/2018			
<b>From (usft)</b>	<b>To (usft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
161.0	8,473.0	QES MWD Surveys (Wellbore #1)	MWD default	MWD - Standard	

<b>Survey</b>									
<b>Measured Depth (usft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (usft)</b>	<b>+N/-S (usft)</b>	<b>+E/-W (usft)</b>	<b>Vertical Section (usft)</b>	<b>Dogleg Rate (°/100usft)</b>	<b>Build Rate (°/100usft)</b>	<b>Turn Rate (°/100usft)</b>
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00
<b>First MWD Survey @ 161.0' MD / 161.0' TVD</b>									
161.0	2.00	110.80	161.0	-1.0	2.6	2.8	1.24	1.24	0.00
205.0	3.30	116.20	204.9	-1.8	4.5	4.8	3.01	2.95	12.27
296.0	5.40	115.40	295.7	-4.8	10.7	11.6	2.31	2.31	-0.88
387.0	8.70	106.70	386.0	-8.6	21.2	22.7	3.80	3.63	-9.56
478.0	12.30	105.50	475.4	-13.2	37.1	39.3	3.96	3.96	-1.32
569.0	15.70	104.10	563.7	-18.8	58.4	61.3	3.75	3.74	-1.54
659.0	17.10	103.40	650.0	-24.8	83.1	86.7	1.57	1.56	-0.78
750.0	18.00	102.40	736.8	-31.0	109.8	114.1	1.04	0.99	-1.10
841.0	20.70	104.10	822.7	-37.9	139.2	144.2	3.03	2.97	1.87



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<b>Site:</b>	Gunderson 0993 21-05 Pad	<b>MD Reference:</b>	Well @ 7287.0usft (H&P #522)
<b>Well:</b>	BCU 0993-21-10E	<b>North Reference:</b>	True
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<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)
932.0	24.10	104.20	906.8	-46.4	172.8	178.9	3.74	3.74	0.11
1,026.0	27.20	104.30	991.5	-56.4	212.2	219.5	3.30	3.30	0.11
1,121.0	29.00	106.30	1,075.3	-68.2	255.4	264.2	2.14	1.89	2.11
1,215.0	32.90	106.60	1,155.9	-81.9	301.7	312.6	4.15	4.15	0.32
1,310.0	34.20	106.70	1,235.1	-97.0	352.0	365.1	1.37	1.37	0.11
1,404.0	35.20	106.10	1,312.4	-112.1	403.3	418.6	1.12	1.06	-0.64
1,505.0	36.10	105.50	1,394.4	-128.1	460.0	477.5	0.96	0.89	-0.59
1,606.0	36.70	104.10	1,475.7	-143.4	517.9	537.4	1.01	0.59	-1.39
1,701.0	36.60	103.90	1,551.9	-157.1	573.0	594.0	0.16	-0.11	-0.21
1,795.0	37.40	103.60	1,627.0	-170.5	627.9	650.6	0.87	0.85	-0.32
1,889.0	37.50	103.50	1,701.6	-183.9	683.5	707.7	0.12	0.11	-0.11
1,984.0	37.10	103.20	1,777.2	-197.2	739.5	765.1	0.46	-0.42	-0.32
2,078.0	37.00	102.90	1,852.2	-210.0	794.7	821.7	0.22	-0.11	-0.32
2,173.0	36.30	105.50	1,928.4	-223.9	849.6	878.4	1.79	-0.74	2.74
2,267.0	36.20	104.80	2,004.3	-238.4	903.3	933.9	0.45	-0.11	-0.74
2,361.0	35.00	107.20	2,080.7	-253.5	955.9	988.6	1.96	-1.28	2.55
2,456.0	33.80	108.40	2,159.1	-269.9	1,007.0	1,042.3	1.45	-1.26	1.26
2,550.0	34.20	107.70	2,237.0	-286.2	1,056.9	1,094.8	0.60	0.43	-0.74
2,645.0	32.00	106.90	2,316.6	-301.6	1,106.5	1,146.7	2.36	-2.32	-0.84
2,739.0	31.90	106.20	2,396.3	-315.8	1,154.2	1,196.4	0.41	-0.11	-0.74
2,833.0	31.30	105.60	2,476.4	-329.3	1,201.5	1,245.7	0.72	-0.64	-0.64
2,928.0	31.00	105.40	2,557.7	-342.4	1,248.9	1,294.8	0.33	-0.32	-0.21
3,023.0	32.40	107.10	2,638.5	-356.4	1,296.8	1,344.7	1.75	1.47	1.79
3,117.0	32.50	107.00	2,717.9	-371.2	1,345.0	1,395.2	0.12	0.11	-0.11
3,211.0	32.50	107.00	2,797.1	-386.0	1,393.3	1,445.7	0.00	0.00	0.00
3,306.0	32.20	106.90	2,877.4	-400.8	1,441.9	1,496.5	0.32	-0.32	-0.11
3,401.0	32.20	106.50	2,957.8	-415.3	1,490.4	1,547.1	0.22	0.00	-0.42
3,495.0	32.00	106.40	3,037.4	-429.5	1,538.3	1,597.1	0.22	-0.21	-0.11
3,589.0	31.40	105.90	3,117.4	-443.2	1,585.8	1,646.5	0.70	-0.64	-0.53
3,684.0	30.70	105.80	3,198.8	-456.6	1,632.9	1,695.5	0.74	-0.74	-0.11
3,779.0	32.70	106.00	3,279.6	-470.3	1,680.9	1,745.4	2.11	2.11	0.21
3,873.0	32.60	105.80	3,358.7	-484.2	1,729.7	1,796.1	0.16	-0.11	-0.21
3,968.0	31.90	105.50	3,439.1	-497.8	1,778.5	1,846.8	0.76	-0.74	-0.32
4,063.0	31.30	104.90	3,520.0	-510.9	1,826.5	1,896.6	0.71	-0.63	-0.63
4,157.0	30.60	104.80	3,600.6	-523.3	1,873.3	1,944.9	0.75	-0.74	-0.11
4,252.0	32.80	106.40	3,681.4	-536.7	1,921.3	1,994.8	2.48	2.32	1.68
4,346.0	31.70	105.70	3,760.9	-550.6	1,969.5	2,045.0	1.24	-1.17	-0.74
4,440.0	31.50	106.20	3,841.0	-564.1	2,016.9	2,094.2	0.35	-0.21	0.53
4,535.0	31.30	106.20	3,922.1	-578.0	2,064.4	2,143.7	0.21	-0.21	0.00
4,629.0	31.20	107.00	4,002.4	-591.9	2,111.2	2,192.5	0.45	-0.11	0.85
4,723.0	30.80	106.50	4,083.0	-605.8	2,157.5	2,240.9	0.51	-0.43	-0.53
4,818.0	32.60	107.00	4,163.8	-620.2	2,205.3	2,290.8	1.91	1.89	0.53
4,912.0	32.90	108.20	4,242.9	-635.6	2,253.8	2,341.6	0.76	0.32	1.28



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Survey									
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5,006.0	32.50	104.80	4,322.0	-650.0	2,302.5	2,392.4	2.00	-0.43	-3.62
5,101.0	31.60	104.30	4,402.5	-662.7	2,351.3	2,442.8	0.99	-0.95	-0.53
5,195.0	30.10	104.00	4,483.2	-674.5	2,398.0	2,491.0	1.60	-1.60	-0.32
5,290.0	28.80	103.30	4,566.0	-685.5	2,443.4	2,537.6	1.42	-1.37	-0.74
5,384.0	29.00	103.50	4,648.2	-696.0	2,487.6	2,583.0	0.24	0.21	0.21
5,478.0	27.00	104.60	4,731.2	-706.7	2,530.4	2,627.1	2.20	-2.13	1.17
5,573.0	24.00	104.90	4,817.0	-717.1	2,569.9	2,668.0	3.16	-3.16	0.32
5,667.0	20.80	104.20	4,903.9	-726.2	2,604.6	2,703.8	3.42	-3.40	-0.74
5,761.0	19.40	104.10	4,992.1	-734.1	2,635.9	2,736.0	1.49	-1.49	-0.11
5,855.0	17.90	103.10	5,081.2	-741.1	2,665.1	2,766.1	1.63	-1.60	-1.06
5,950.0	16.60	102.40	5,171.9	-747.4	2,692.6	2,794.2	1.39	-1.37	-0.74
6,044.0	16.00	102.90	5,262.2	-753.1	2,718.3	2,820.5	0.66	-0.64	0.53
6,138.0	13.90	104.80	5,353.0	-758.9	2,741.9	2,844.7	2.29	-2.23	2.02
6,232.0	10.90	106.30	5,444.8	-764.3	2,761.3	2,864.9	3.21	-3.19	1.60
6,326.0	7.40	108.60	5,537.6	-768.7	2,775.6	2,879.9	3.74	-3.72	2.45
6,420.0	4.40	110.20	5,631.0	-771.9	2,784.7	2,889.5	3.20	-3.19	1.70
6,514.0	3.20	90.30	5,724.8	-773.1	2,790.7	2,895.6	1.88	-1.28	-21.17
6,609.0	2.60	85.90	5,819.7	-773.0	2,795.5	2,900.2	0.67	-0.63	-4.63
6,703.0	2.50	85.20	5,913.6	-772.7	2,799.7	2,904.1	0.11	-0.11	-0.74
6,797.0	2.40	83.70	6,007.5	-772.3	2,803.7	2,907.9	0.13	-0.11	-1.60
6,891.0	2.10	89.00	6,101.5	-772.1	2,807.4	2,911.3	0.39	-0.32	5.64
6,985.0	1.10	47.90	6,195.4	-771.4	2,809.8	2,913.4	1.56	-1.06	-43.72
7,080.0	1.00	47.90	6,290.4	-770.2	2,811.1	2,914.4	0.11	-0.11	0.00
7,174.0	0.70	57.10	6,384.4	-769.4	2,812.2	2,915.2	0.35	-0.32	9.79
7,268.0	0.20	14.80	6,478.4	-768.9	2,812.7	2,915.5	0.60	-0.53	-45.00
7,362.0	0.40	272.00	6,572.4	-768.7	2,812.4	2,915.2	0.52	0.21	-109.36
7,457.0	0.60	266.80	6,667.4	-768.8	2,811.6	2,914.4	0.22	0.21	-5.47
7,551.0	0.90	270.30	6,761.4	-768.8	2,810.3	2,913.2	0.32	0.32	3.72
7,645.0	1.10	279.50	6,855.4	-768.6	2,808.7	2,911.6	0.27	0.21	9.79
7,739.0	1.10	244.90	6,949.4	-768.9	2,807.0	2,910.1	0.70	0.00	-36.81
7,833.0	1.10	219.60	7,043.3	-769.9	2,805.6	2,909.0	0.51	0.00	-26.91
7,928.0	1.60	247.20	7,138.3	-771.2	2,803.8	2,907.6	0.85	0.53	29.05
8,022.0	2.10	262.90	7,232.3	-771.9	2,800.9	2,905.0	0.75	0.53	16.70
8,116.0	2.30	261.90	7,326.2	-772.4	2,797.3	2,901.7	0.22	0.21	-1.06
8,211.0	2.20	266.70	7,421.1	-772.7	2,793.6	2,898.3	0.22	-0.11	5.05
8,305.0	2.50	267.80	7,515.0	-772.9	2,789.8	2,894.6	0.32	0.32	1.17
8,399.0	2.20	273.20	7,609.0	-772.9	2,785.9	2,890.9	0.40	-0.32	5.74
8,413.0	2.30	274.70	7,623.0	-772.9	2,785.4	2,890.4	0.83	0.71	10.71
Projection to TD @ 8473.0' MD / 7682.9' TVD									
8,473.0	2.30	274.70	7,682.9	-772.7	2,783.0	2,888.0	0.00	0.00	0.00



## Survey Report



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### Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
161.0	161.0	-1.0	2.6	First MWD Survey @ 161.0' MD / 161.0' TVD
8,473.0	7,682.9	-772.7	2,783.0	Projection to TD @ 8473.0' MD / 7682.9' TVD

Checked By: \_\_\_\_\_ Approved By: \_\_\_\_\_ Date: \_\_\_\_\_