



COMPANY/RIG: Noble Energy/Production/CoreTech
WELL/API: Thistle Down B 31-17/05-123-30694
DECLINATION: 8.21 Degrees
TD AS DRILLED: 7185 Feet
COUNTY/STATE: Weld/Colorado
VS-Azi: 0.000 Degrees
Latitude: 40.35886, Longitude: -104.58784
Grid North = True North -0.59 degs (NAD 27)
Grid Correction Applied = -0.59 degs



DEPTH REFERENCE : RKB = GL Elevation = 4770

DRILLOG MS GYRO SURVEY CALCULATIONS

Filename: msgyrosurvey.ut

Minimum Curvature Method

Report Date/Time: 7/18/2016 / 14:05

LAT & LONG OBTAINED BY HANDHELD GPS AT WELLHEAD

NORTH REFERENCE: GRID

HENDERSON, COLORADO

303-853-4976

Surveyor: JUSTIN WILLIAMS / Thistle Down B 31-17

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	****
100.000	0.407	353.147	99.999	0.352	-0.042	0.352	0.355	353.147	0.407
200.000	0.123	341.118	199.998	0.806	-0.119	0.806	0.815	351.575	0.288
300.000	0.140	166.082	299.998	0.790	-0.125	0.790	0.799	351.016	0.262
400.000	0.219	153.658	399.997	0.500	-0.011	0.500	0.500	358.766	0.088
500.000	0.225	172.435	499.997	0.135	0.100	0.135	0.168	36.556	0.073
600.000	0.446	174.484	599.995	-0.447	0.163	-0.447	0.476	159.967	0.221
700.000	0.373	200.389	699.992	-1.140	0.087	-1.140	1.143	175.642	0.197
800.000	0.591	198.435	799.989	-1.935	-0.190	-1.935	1.944	185.603	0.218
900.000	0.546	189.571	899.984	-2.894	-0.432	-2.894	2.926	188.493	0.099
1000.000	0.653	192.991	999.978	-3.919	-0.639	-3.919	3.970	189.267	0.112
1100.000	0.782	193.388	1099.971	-5.138	-0.925	-5.138	5.220	190.211	0.130
1200.000	0.845	186.521	1199.961	-6.535	-1.167	-6.535	6.638	190.128	0.116
1300.000	0.923	188.330	1299.949	-8.064	-1.368	-8.064	8.179	189.626	0.083
1400.000	0.967	188.600	1399.935	-9.695	-1.611	-9.695	9.828	189.432	0.044
1500.000	0.898	178.432	1499.922	-11.313	-1.715	-11.313	11.442	188.622	0.179
1600.000	0.865	164.700	1599.910	-12.824	-1.495	-12.824	12.911	186.648	0.213

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
1700.000	0.838	158.556	1699.899	-14.233	-1.028	-14.233	14.270	184.133	0.095
1800.000	0.812	163.856	1799.889	-15.593	-0.564	-15.593	15.603	182.072	0.081
1900.000	1.038	136.625	1899.876	-16.932	0.255	-16.932	16.934	179.137	0.488
2000.000	0.434	66.283	1999.869	-17.438	1.224	-17.438	17.481	175.985	0.981
2100.000	0.972	346.623	2099.863	-16.461	1.374	-16.461	16.518	175.227	0.991
2200.000	1.628	312.357	2199.838	-14.679	0.128	-14.679	14.679	179.499	0.990
2300.000	1.696	314.519	2299.796	-12.684	-1.976	-12.684	12.837	188.856	0.092
2400.000	1.000	310.427	2399.768	-11.081	-3.696	-11.081	11.681	198.444	0.702
2500.000	0.869	294.166	2499.754	-10.204	-5.052	-10.204	11.386	206.337	0.294
2600.000	1.133	284.909	2599.739	-9.640	-6.699	-9.640	11.739	214.796	0.309
2700.000	1.153	278.515	2699.719	-9.236	-8.649	-9.236	12.653	223.118	0.129
2800.000	1.414	273.592	2799.694	-9.010	-10.875	-9.010	14.123	230.357	0.283
2900.000	1.341	265.121	2899.665	-9.032	-13.272	-9.032	16.054	235.763	0.216
3000.000	1.201	266.715	2999.641	-9.192	-15.484	-9.192	18.007	239.305	0.144
3100.000	1.139	259.644	3099.620	-9.431	-17.509	-9.431	19.887	241.692	0.157
3200.000	1.790	261.434	3199.587	-9.842	-20.031	-9.842	22.318	243.833	0.653
3300.000	2.959	263.428	3299.499	-10.370	-24.140	-10.370	26.273	246.752	1.171
3400.000	3.828	270.970	3399.323	-10.609	-30.042	-10.609	31.860	250.549	0.975
3500.000	4.464	277.970	3499.062	-10.013	-37.233	-10.013	38.556	254.948	0.812
3600.000	3.874	277.176	3598.797	-9.051	-44.439	-9.051	45.351	258.487	0.593
3700.000	3.258	275.117	3698.603	-8.376	-50.620	-8.376	51.309	260.605	0.629
3800.000	3.145	273.365	3798.447	-7.961	-56.189	-7.961	56.750	261.935	0.149
3900.000	3.180	268.839	3898.295	-7.857	-61.700	-7.857	62.199	262.743	0.252
4000.000	3.108	271.594	3998.144	-7.837	-67.184	-7.837	67.639	263.346	0.167
4100.000	2.676	266.529	4098.017	-7.903	-72.224	-7.903	72.655	263.755	0.501
4200.000	2.044	259.949	4197.931	-8.356	-76.311	-8.356	76.767	263.751	0.687
4300.000	2.412	239.984	4297.857	-9.720	-79.889	-9.720	80.478	263.063	0.853
4400.000	2.399	221.982	4397.771	-12.328	-83.111	-12.328	84.020	261.563	0.753
4500.000	1.880	221.858	4497.700	-15.106	-85.605	-15.106	86.928	259.993	0.520
4600.000	1.204	226.680	4597.664	-17.048	-87.464	-17.048	89.110	258.970	0.687
4700.000	1.305	223.086	4697.640	-18.601	-89.006	-18.601	90.929	258.196	0.128
4800.000	0.860	253.164	4797.622	-19.650	-90.502	-19.650	92.611	257.750	0.707
4900.000	1.091	311.017	4897.610	-19.242	-91.938	-19.242	93.930	258.179	0.965
5000.000	1.280	316.581	4997.589	-17.806	-93.424	-17.806	95.106	259.209	0.221
5100.000	0.979	298.618	5097.569	-16.586	-94.942	-16.586	96.380	260.091	0.461
5200.000	0.725	271.291	5197.559	-16.162	-96.325	-16.162	97.672	260.475	0.472
5300.000	0.514	169.219	5297.555	-16.588	-96.874	-16.588	98.284	260.283	0.973
5400.000	1.285	111.718	5397.544	-17.443	-95.749	-17.443	97.325	259.675	1.098
5500.000	1.885	99.773	5497.505	-18.137	-93.086	-18.137	94.837	258.974	0.682

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
5600.000	1.510	127.661	5597.463	-19.222	-90.422	-19.222	92.442	257.999	0.895
5700.000	1.545	146.533	5697.428	-21.151	-88.635	-21.151	91.124	256.578	0.502
5800.000	1.538	141.850	5797.392	-23.332	-87.063	-23.332	90.135	254.998	0.126
5900.000	1.653	147.048	5897.353	-25.598	-85.449	-25.598	89.201	253.324	0.185
6000.000	1.320	145.308	5997.319	-27.755	-84.009	-27.755	88.475	251.718	0.336
6100.000	1.149	153.567	6097.296	-29.599	-82.907	-29.599	88.033	250.353	0.246
6200.000	1.236	137.028	6197.275	-31.286	-81.726	-31.286	87.510	249.052	0.353
6300.000	1.269	132.659	6297.251	-32.826	-80.176	-32.826	86.636	247.735	0.101
6400.000	1.243	140.615	6397.227	-34.415	-78.673	-34.415	85.871	246.374	0.176
6500.000	1.087	145.030	6497.206	-36.030	-77.442	-36.030	85.413	245.049	0.181
6600.000	0.948	145.896	6597.190	-37.492	-76.435	-37.492	85.135	243.871	0.140
6700.000	1.123	133.074	6697.174	-38.846	-75.255	-38.846	84.690	242.698	0.290
6800.000	1.070	143.839	6797.156	-40.269	-73.988	-40.269	84.237	241.442	0.212
6900.000	0.784	135.345	6897.143	-41.510	-72.956	-41.510	83.939	240.361	0.316