



Company/Rig: Noble Energy Inc/Production
WELL/API#: Howard A 27-5/05-123-23474
DECLINATION: 8.23 Degrees
TD AS DRILLED: 7094 Feet
COUNTY/STATE: Weld/Colorado
VS-Azi: 0.000 Degrees
Latitude: 40.45894, Longitude: -104.54303
Grid North = True North -0.62 degs (NAD 27)
Grid Correction Applied = -0.62 degs



DEPTH REFERENCE : RKB=GL/Elevation=4688'

DRILLOG MS GYRO SURVEY CALCULATIONS

Filename: msgyro_run01-01-de_01.ut

Minimum Curvature Method

Report Date/Time: 2/29/2016 / 13:54

Lat/Long Obtained By Handheld GPS at Wellhead

North Reference: Grid

Denver, Colorado

303-853-4976

Surveyor: Jason Kinchelow / Howard A 27-5

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	0.816	291.829	99.997	0.265	-0.661	0.265	0.712	291.829	0.816
200.000	1.495	306.445	199.976	1.305	-2.372	1.305	2.707	298.813	0.734
300.000	1.908	310.276	299.932	3.156	-4.691	3.156	5.654	303.928	0.429
400.000	2.261	317.157	399.865	5.679	-7.303	5.679	9.251	307.867	0.432
500.000	2.045	318.092	499.795	8.453	-9.836	8.453	12.969	310.674	0.218
600.000	1.437	319.902	599.748	10.740	-11.836	10.740	15.982	312.221	0.611
700.000	0.995	290.979	699.726	12.010	-13.454	12.010	18.034	311.754	0.743
800.000	1.282	257.100	799.708	12.071	-15.355	12.071	19.532	308.171	0.718
900.000	1.902	238.765	899.669	10.960	-17.865	10.960	20.959	301.530	0.795
1000.000	1.768	229.131	999.618	9.090	-20.451	9.090	22.380	293.965	0.336
1100.000	2.001	234.796	1099.564	7.074	-23.044	7.074	24.105	287.066	0.298
1200.000	2.002	233.928	1199.503	5.039	-25.882	5.039	26.368	281.017	0.030
1300.000	1.955	233.887	1299.443	3.005	-28.672	3.005	28.830	275.983	0.047
1400.000	2.067	238.181	1399.382	1.049	-31.583	1.049	31.600	271.902	0.187
1500.000	1.789	235.051	1499.325	-0.796	-34.395	-0.796	34.404	268.674	0.296
1600.000	1.686	243.964	1599.279	-2.336	-36.996	-2.336	37.070	266.387	0.289
1700.000	1.624	247.330	1699.238	-3.528	-39.626	-3.528	39.783	264.912	0.115
1800.000	1.311	247.725	1799.205	-4.508	-41.992	-4.508	42.233	263.873	0.314

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
1900.000	0.794	241.660	1899.187	-5.270	-43.660	-5.270	43.977	263.117	0.527
2000.000	0.517	232.040	1999.181	-5.877	-44.626	-5.877	45.011	262.498	0.297
2100.000	0.089	207.119	2099.179	-6.223	-45.017	-6.223	45.445	262.129	0.438
2200.000	0.191	3.849	2199.179	-6.126	-45.041	-6.126	45.456	262.255	0.275
2300.000	0.968	353.565	2299.173	-5.120	-45.124	-5.120	45.414	263.527	0.781
2400.000	1.112	347.878	2399.157	-3.332	-45.423	-3.332	45.545	265.805	0.177
2500.000	0.983	342.608	2499.140	-1.564	-45.883	-1.564	45.910	268.047	0.160
2600.000	1.203	330.571	2599.122	0.169	-46.655	0.169	46.656	270.207	0.317
2700.000	1.473	337.803	2699.095	2.273	-47.657	2.273	47.711	272.731	0.318
2800.000	1.490	336.330	2799.061	4.654	-48.664	4.654	48.886	275.463	0.042
2900.000	1.576	332.923	2899.025	7.070	-49.813	7.070	50.312	278.078	0.125
3000.000	1.177	331.296	2998.996	9.196	-50.932	9.196	51.756	280.235	0.401
3100.000	0.898	296.847	3098.981	10.451	-52.125	10.451	53.162	281.338	0.670
3200.000	1.093	278.589	3198.966	10.947	-53.767	10.947	54.870	281.509	0.370
3300.000	1.480	245.809	3298.942	10.561	-55.888	10.561	56.877	280.700	0.816
3400.000	2.034	221.434	3398.896	8.701	-58.240	8.701	58.887	278.497	0.918
3500.000	2.210	219.157	3498.827	5.876	-60.632	5.876	60.916	275.535	0.195
3600.000	1.734	215.366	3598.768	3.147	-62.725	3.147	62.804	272.872	0.493
3700.000	1.431	215.833	3698.729	0.901	-64.331	0.901	64.338	270.803	0.303
3800.000	1.318	216.694	3798.701	-1.033	-65.750	-1.033	65.758	269.100	0.115
3900.000	1.461	223.736	3898.671	-2.877	-67.318	-2.877	67.380	267.553	0.222
4000.000	0.769	225.587	3998.652	-4.267	-68.679	-4.267	68.811	266.444	0.693
4100.000	0.644	241.599	4098.644	-5.004	-69.652	-5.004	69.832	265.891	0.232
4200.000	0.361	179.602	4198.641	-5.586	-70.144	-5.586	70.366	265.446	0.571
4300.000	0.549	107.935	4298.638	-6.049	-69.686	-6.049	69.948	265.039	0.554
4400.000	0.790	75.304	4398.632	-6.022	-68.564	-6.022	68.828	264.981	0.442
4500.000	0.416	69.803	4498.626	-5.721	-67.556	-5.721	67.798	265.159	0.379
4600.000	0.592	32.549	4598.622	-5.161	-66.937	-5.161	67.136	265.591	0.363
4700.000	0.903	321.581	4698.616	-4.108	-67.149	-4.108	67.274	266.499	0.904
4800.000	1.331	277.126	4798.598	-3.347	-68.791	-3.347	68.872	267.215	0.933
4900.000	1.544	264.073	4898.567	-3.342	-71.283	-3.342	71.361	267.316	0.389
5000.000	1.414	265.088	4998.534	-3.587	-73.852	-3.587	73.939	267.220	0.133
5100.000	1.556	251.832	5098.500	-4.116	-76.371	-4.116	76.481	266.915	0.370
5200.000	1.393	239.664	5198.467	-5.153	-78.709	-5.153	78.878	266.255	0.352
5300.000	1.295	225.365	5298.440	-6.561	-80.563	-6.561	80.829	265.344	0.348
5400.000	1.130	193.173	5398.419	-8.315	-81.592	-8.315	82.014	264.181	0.691
5500.000	0.993	205.206	5498.402	-10.060	-82.186	-10.060	82.799	263.021	0.261
5600.000	0.736	233.065	5598.391	-11.230	-83.068	-11.230	83.824	262.301	0.485
5700.000	0.477	289.924	5698.386	-11.474	-83.973	-11.474	84.753	262.219	0.621
5800.000	0.418	307.262	5798.383	-11.112	-84.654	-11.112	85.381	262.522	0.147

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
5900.000	0.039	287.691	5898.382	-10.881	-84.977	-10.881	85.671	262.703	0.381
6000.000	0.247	275.230	5998.382	-10.851	-85.223	-10.851	85.911	262.744	0.209
6100.000	0.291	50.200	6098.381	-10.669	-85.242	-10.669	85.907	262.866	0.497
6200.000	0.361	248.209	6198.380	-10.623	-85.340	-10.623	85.998	262.904	0.645
6300.000	0.127	80.466	6298.380	-10.722	-85.523	-10.722	86.193	262.854	0.486
6400.000	0.137	214.193	6398.380	-10.802	-85.482	-10.802	86.161	262.798	0.242
6500.000	0.242	167.525	6498.379	-11.107	-85.503	-11.107	86.222	262.599	0.178
6600.000	0.575	160.134	6598.377	-11.785	-85.287	-11.785	86.097	262.133	0.337
6700.000	0.346	173.230	6698.373	-12.557	-85.081	-12.557	86.002	261.605	0.251
6800.000	0.807	141.657	6798.368	-13.408	-84.608	-13.408	85.664	260.995	0.543