



Company: Chesapeake
Lease/Well: Richard Bone/3H

4700900104



Rig Name: Nomac 241
State/County: West Virginia/Brooke
Latitude: 40.22
GRID North is 0.70 Degrees West of True North
VS-Azi: 0.00 Degrees

FIELD COPY ONLY (NOT DEFINITIVE)

Depth Reference : RKB=16 Feet

DRILLOG HA GYRO SURVEY CALCULATIONS

Filename: robert bone 3h 5800_ed.ut

Minimum Curvature Method

Report Date/Time: 10/13/2011 / 10:33

Vaughn Energy Services
Morgantown, WV
304-777-2189
Brian Silcox

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
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
100.00	0.24	95.76	100.00	-0.02	0.21	-0.02	0.21	95.76	0.24
200.00	0.63	316.68	200.00	0.36	0.04	0.36	0.36	6.55	0.83
300.00	0.30	337.31	299.99	1.01	-0.44	1.01	1.10	336.38	0.37
400.00	0.13	351.49	399.99	1.36	-0.56	1.36	1.47	337.67	0.18
500.00	0.73	14.74	499.99	2.08	-0.41	2.08	2.12	348.85	0.62
600.00	0.69	3.10	599.98	3.30	-0.22	3.30	3.31	356.26	0.15
700.00	0.29	25.01	699.98	4.14	-0.08	4.14	4.14	358.96	0.43
800.00	0.53	28.81	799.98	4.78	0.26	4.78	4.78	3.09	0.24
900.00	0.29	21.26	899.97	5.42	0.57	5.42	5.45	6.05	0.25
1000.00	0.41	12.75	999.97	6.00	0.74	6.00	6.05	7.07	0.13
1100.00	0.46	349.88	1099.97	6.75	0.75	6.75	6.79	6.37	0.18
1200.00	0.60	341.70	1199.96	7.64	0.52	7.64	7.66	3.89	0.16
1300.00	0.28	344.66	1299.96	8.37	0.29	8.37	8.37	1.99	0.33
1400.00	0.35	338.73	1399.96	8.88	0.12	8.88	8.88	0.75	0.08
1500.00	0.42	357.55	1499.96	9.54	-0.01	9.54	9.54	359.95	0.15
1600.00	0.18	355.45	1599.96	10.06	-0.04	10.06	10.06	359.79	0.25
1700.00	0.29	283.25	1699.96	10.27	-0.30	10.27	10.27	358.35	0.29
1800.00	0.61	297.80	1799.95	10.58	-1.02	10.58	10.63	354.51	0.34
1900.00	0.30	261.25	1899.95	10.79	-1.75	10.79	10.93	350.80	0.41
2000.00	0.48	312.27	1999.95	11.03	-2.32	11.03	11.27	348.14	0.37
2100.00	0.28	310.79	2099.95	11.47	-2.81	11.47	11.81	346.23	0.20
2200.00	0.76	307.54	2199.94	12.04	-3.52	12.04	12.54	343.68	0.49
2300.00	0.56	280.60	2299.93	12.53	-4.53	12.53	13.33	340.11	0.37
2400.00	0.29	295.26	2399.93	12.73	-5.25	12.73	13.77	337.60	0.29
2500.00	0.81	306.47	2499.93	13.26	-6.05	13.26	14.58	335.49	0.53
2600.00	0.36	320.03	2599.92	13.93	-6.82	13.93	15.50	333.91	0.46
2700.00	0.66	322.00	2699.92	14.62	-7.38	14.62	16.38	333.23	0.30
2800.00	0.65	336.64	2799.91	15.60	-7.96	15.60	17.51	332.97	0.17
2900.00	0.78	318.36	2899.90	16.63	-8.63	16.63	18.74	332.56	0.26
3000.00	0.62	343.26	2999.90	17.65	-9.24	17.65	19.92	332.37	0.34
3100.00	0.64	351.65	3099.89	18.72	-9.48	18.72	20.98	333.15	0.09
3200.00	0.66	340.77	3199.88	19.81	-9.74	19.81	22.08	333.81	0.12
3300.00	0.78	307.80	3299.88	20.77	-10.47	20.77	23.26	333.24	0.42
3400.00	0.51	342.64	3399.87	21.61	-11.14	21.61	24.31	332.72	0.47

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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
3500.00	0.47	323.23	3499.87	22.36	-11.52	22.36	25.15	332.74	0.17
3600.00	0.75	316.59	3599.86	23.16	-12.21	23.16	26.18	332.20	0.28
3700.00	0.33	309.91	3699.86	23.81	-12.88	23.81	27.07	331.60	0.42
3800.00	0.55	306.85	3799.85	24.28	-13.48	24.28	27.77	330.97	0.22
3900.00	0.61	304.96	3899.85	24.88	-14.30	24.88	28.69	330.11	0.07
4000.00	0.97	285.62	3999.84	25.41	-15.55	25.41	29.79	328.53	0.44
4100.00	0.80	251.18	4099.83	25.41	-17.03	25.41	30.59	326.17	0.55
4200.00	1.11	275.11	4199.81	25.27	-18.66	25.27	31.41	323.57	0.50
4300.00	1.13	277.41	4299.79	25.49	-20.60	25.49	32.77	321.06	0.05
4400.00	0.82	279.69	4399.78	25.74	-22.28	25.74	34.04	319.11	0.31
4500.00	1.24	290.11	4499.76	26.23	-24.01	26.23	35.56	317.53	0.46
4600.00	1.23	292.65	4599.74	27.01	-26.02	27.01	37.51	316.08	0.06
4700.00	0.69	306.25	4699.73	27.79	-27.50	27.79	39.09	315.30	0.58
4800.00	0.77	277.76	4799.72	28.24	-28.65	28.24	40.23	314.58	0.37
4900.00	0.95	302.01	4899.71	28.77	-30.02	28.77	41.58	313.78	0.41
5000.00	0.59	310.56	4999.70	29.54	-31.12	29.54	42.91	313.51	0.38
5100.00	0.84	280.09	5099.69	30.01	-32.23	30.01	44.04	312.95	0.45
5200.00	0.44	267.49	5199.68	30.12	-33.34	30.12	44.93	312.09	0.43
5300.00	0.62	267.15	5299.68	30.07	-34.26	30.07	45.59	311.28	0.18
5400.00	0.27	291.17	5399.68	30.13	-35.02	30.13	46.20	310.71	0.39
5500.00	0.80	283.45	5499.67	30.38	-35.92	30.38	47.05	310.22	0.53
5584.00	0.90	295.32	5583.66	30.80	-37.09	30.80	48.21	309.71	0.24

HORIZONTAL DISPLACEMENT IS
48.21 FEET AT 309.71 DEGREES

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WV GEOLOGICAL SURVEY
MORCANTOWN, WV



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SURVEY REPORT

Report Date: **10/23/2011**
 Customer: **Chesapeake** Field: **Brooke County**
 Job Name: **402xxxx** Rig: **Nomac 241**
 Well Name: **Robert Bone BRK 3H ST02** Rig Loc: **Brooke County**

Survey Calculation Method: Minimum Curvature						
Magnetic Reference	Target Direction	Total Magnetic Field	Magnetic Dip Angle	Magnetic Declination	Grid Convergence	Total Correction
Grid North	352.96 deg	53077 nT	67.77 deg	-8.72 deg	-0.70 deg	-8.02 deg
Survey Tie-On	Depth	INC	AZ	TVD	NS	EW
	4800.00 ft	0.77 deg	277.76 deg	4799.72 ft	28.24 ft	-28.65 ft

Depth (ft)	Inc (deg)	Azm (deg)	TVD (ft)	Well Head		VSect (ft)	Dogleg (deg/100ft)
				NS (ft)	EW (ft)		
4887.00	0.89	298.32	4886.71	28.64	-29.82	32.08	0.37
4929.00	0.60	294.59	4928.71	28.89	-30.31	32.38	0.69
4972.00	0.71	312.38	4971.70	29.16	-30.71	32.70	0.53
5015.00	2.13	334.86	5014.69	30.06	-31.25	33.66	3.48
5057.00	6.38	338.48	5056.57	32.94	-32.43	36.66	10.13
5100.00	7.75	338.36	5099.24	37.85	-34.38	41.78	3.20
5142.00	7.00	339.36	5140.89	42.88	-36.33	47.01	1.81
5185.00	4.81	349.48	5183.66	47.10	-37.58	51.35	5.62
5227.00	4.60	348.93	5225.52	50.49	-38.23	54.79	0.51
5270.00	4.38	345.86	5268.39	53.77	-38.96	58.14	0.77
5313.00	4.88	347.36	5311.25	57.15	-39.76	61.59	1.20
5355.00	6.81	354.23	5353.03	61.37	-40.40	65.86	4.90
5398.00	11.19	358.86	5395.49	68.08	-40.74	72.56	10.30
5440.00	15.94	357.61	5436.31	77.92	-41.06	82.37	11.33
5483.00	19.54	355.79	5477.25	91.00	-41.84	95.44	8.48
5525.00	24.13	356.73	5516.23	106.58	-42.84	111.03	10.94
5568.00	28.69	356.86	5554.73	125.67	-43.91	130.10	10.61
5610.00	33.81	355.98	5590.63	147.40	-45.28	151.84	12.25
5653.00	39.06	354.73	5625.21	172.85	-47.37	177.35	12.33
5695.00	43.38	354.11	5656.80	200.39	-50.07	205.01	10.31
5738.00	47.88	352.11	5686.86	230.89	-53.78	235.74	10.98
5781.00	53.28	351.84	5714.16	263.76	-58.41	268.93	12.57
5823.00	58.00	352.11	5737.86	298.09	-63.25	303.59	11.25
5866.00	62.81	352.98	5759.09	335.15	-68.10	340.97	11.33
5909.00	67.13	353.86	5777.28	373.84	-72.56	379.92	10.20
5951.00	70.44	354.48	5792.48	412.79	-76.53	419.06	8.01
5994.00	72.69	355.36	5806.07	453.42	-80.14	459.82	5.58
6037.00	76.19	355.23	5817.61	494.70	-83.54	501.21	8.14
6079.00	79.00	355.48	5826.63	535.58	-86.86	542.18	6.72
6122.00	84.06	355.36	5832.96	577.96	-90.26	584.66	11.78
6164.00	88.94	355.48	5835.53	619.73	-93.61	626.53	11.61
6207.00	91.30	355.29	5835.44	662.59	-97.07	669.49	5.51
6240.00	91.63	354.61	5834.59	695.45	-99.98	702.46	2.28
6283.00	91.86	354.05	5833.28	738.22	-104.22	745.43	1.39
6325.00	92.14	353.59	5831.82	779.95	-108.74	787.40	1.30

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MORGANTOWN, WV

Depth (ft)	Inc (deg)	Azm (deg)	TVD (ft)	Well Head		VSect (ft)	Dogleg (deg/100ft)
				NS (ft)	EW (ft)		
6368.00	92.37	353.87	5830.13	822.66	-113.43	830.36	0.83
6411.00	91.40	353.81	5828.71	865.39	-118.04	873.33	2.25
6453.00	91.52	353.48	5827.64	907.12	-122.69	915.32	0.82
6496.00	91.74	353.23	5826.42	949.81	-127.66	958.30	0.79
6539.00	91.91	353.07	5825.05	992.48	-132.79	1001.27	0.55
6581.00	92.25	353.24	5823.52	1034.16	-137.79	1043.25	0.90
6624.00	92.60	353.05	5821.70	1076.81	-142.92	1086.21	0.93
6666.00	91.34	351.88	5820.26	1118.42	-148.43	1128.18	4.09
6709.00	90.66	349.89	5819.51	1160.87	-155.24	1171.14	4.90
6751.00	89.91	347.59	5819.30	1202.06	-163.44	1213.03	5.74
6794.00	90.09	348.60	5819.30	1244.13	-172.31	1255.87	2.38
6837.00	90.71	350.38	5819.00	1286.41	-180.15	1298.79	4.39
6879.00	91.34	353.25	5818.25	1327.97	-186.12	1340.77	6.99
6922.00	90.88	353.65	5817.41	1370.68	-191.02	1383.76	1.42
6964.00	90.09	351.27	5817.06	1412.31	-196.53	1425.75	5.99
7007.00	90.83	351.10	5816.71	1454.80	-203.12	1468.73	1.77
7050.00	91.52	351.35	5815.83	1497.29	-209.68	1511.70	1.70
7092.00	92.83	353.24	5814.24	1538.88	-215.31	1553.66	5.47
7135.00	92.20	355.01	5812.36	1581.61	-219.71	1596.61	4.38
7177.00	91.69	355.26	5810.93	1623.43	-223.27	1638.56	1.35
7220.00	90.54	355.39	5810.10	1666.28	-226.77	1681.51	2.67
7262.00	90.71	355.51	5809.64	1708.15	-230.10	1723.47	0.51
7305.00	90.94	355.84	5809.02	1751.02	-233.34	1766.42	0.94
7348.00	91.45	355.76	5808.12	1793.89	-236.49	1809.36	1.20
7390.00	90.37	355.71	5807.45	1835.77	-239.61	1851.30	2.58
7433.00	89.29	355.44	5807.58	1878.64	-242.93	1894.25	2.60
7476.00	89.46	355.43	5808.05	1921.50	-246.35	1937.21	0.40
7518.00	89.12	353.15	5808.57	1963.29	-250.53	1979.19	5.48
7561.00	89.63	354.17	5809.04	2006.02	-255.28	2022.19	2.65
7603.00	89.57	353.59	5809.33	2047.78	-259.76	2064.18	1.39
7646.00	89.97	351.62	5809.51	2090.42	-265.29	2107.18	4.66
7689.00	90.26	350.70	5809.42	2132.91	-271.90	2150.16	2.24
7731.00	90.54	350.68	5809.13	2174.36	-278.69	2192.12	0.68
7774.00	90.88	351.18	5808.59	2216.82	-285.47	2235.09	1.41
7816.00	91.57	350.22	5807.69	2258.25	-292.26	2277.05	2.81
7859.00	90.43	350.84	5806.94	2300.66	-299.33	2320.00	3.03
7902.00	89.57	349.28	5806.94	2343.01	-306.76	2362.95	4.15
7945.00	90.48	347.72	5806.92	2385.15	-315.33	2405.81	4.20
7987.00	90.94	347.98	5806.40	2426.20	-324.17	2447.64	1.24
8030.00	91.34	348.36	5805.55	2468.28	-332.99	2490.48	1.29
8072.00	91.68	348.50	5804.44	2509.41	-341.41	2532.34	0.88
8115.00	91.97	347.18	5803.07	2551.42	-350.47	2575.14	3.15
8157.00	90.83	347.69	5802.05	2592.41	-359.60	2616.93	2.98
8200.00	90.89	347.08	5801.41	2634.36	-368.99	2659.73	1.42
8243.00	90.09	346.34	5801.04	2676.21	-378.88	2702.47	2.54
8285.00	89.74	347.37	5801.10	2717.11	-388.43	2744.23	2.57
8328.00	89.91	346.68	5801.23	2759.01	-398.08	2787.00	1.64
8413.00	90.26	347.34	5801.11	2841.83	-417.18	2871.54	0.88
8499.00	90.77	347.83	5800.34	2925.82	-435.67	2957.16	0.83
8584.00	91.23	348.27	5798.86	3008.97	-453.26	3041.83	0.74

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Depth (ft)	Inc (deg)	Azm (deg)	TVD (ft)	Well Head		VSect (ft)	Dogleg (deg/100ft)
				NS (ft)	EW (ft)		
8669.00	91.45	349.54	5796.87	3092.35	-469.62	3126.60	1.52
8754.00	91.34	347.98	5794.80	3175.69	-486.18	3211.34	1.84
8797.00	90.54	347.61	5794.09	3217.72	-495.27	3254.16	2.05
8882.00	89.34	346.39	5794.18	3300.53	-514.40	3338.70	2.01
8967.00	89.46	343.71	5795.07	3382.64	-536.32	3422.87	3.15
9052.00	90.03	341.64	5795.45	3463.78	-561.63	3506.50	2.52
9138.00	91.45	343.25	5794.34	3545.77	-587.56	3591.05	2.50
9223.00	89.80	342.30	5793.41	3626.95	-612.73	3674.70	2.25
9308.00	89.63	340.56	5793.83	3707.52	-639.80	3757.98	2.06
9393.00	88.72	338.65	5795.06	3787.18	-669.41	3840.67	2.49
9479.00	89.52	337.95	5796.38	3867.07	-701.21	3923.86	1.23
9564.00	91.23	338.02	5795.83	3945.87	-733.06	4005.97	2.01
9649.00	92.93	338.88	5792.74	4024.87	-764.26	4088.20	2.24
9735.00	93.05	340.13	5788.26	4105.32	-794.33	4171.72	1.46
9820.00	91.85	340.97	5784.63	4185.39	-822.61	4254.66	1.72
9906.00	92.20	341.82	5781.59	4266.85	-850.03	4338.86	1.06
9991.00	92.25	341.96	5778.29	4347.57	-876.43	4422.21	0.17
10076.00	92.59	342.33	5774.71	4428.41	-902.47	4505.63	0.60
10162.00	91.51	342.73	5771.63	4510.39	-928.27	4590.15	1.33
10247.00	90.88	344.31	5769.86	4591.87	-952.38	4673.98	2.00
10332.00	90.88	343.20	5768.55	4673.47	-976.16	4757.87	1.30
10418.00	90.82	343.48	5767.27	4755.85	-1000.81	4842.66	0.33
10503.00	90.94	344.26	5765.96	4837.49	-1024.42	4926.58	0.93
10589.00	91.16	342.51	5764.38	4919.88	-1049.01	5011.36	2.05
10674.00	90.71	340.79	5762.99	5000.55	-1075.77	5094.69	2.09
10759.00	90.65	340.68	5761.97	5080.78	-1103.82	5177.76	0.14
10844.00	91.05	339.34	5760.70	5160.65	-1132.87	5260.59	1.65
10937.00	91.56	339.56	5758.58	5247.71	-1165.51	5350.99	0.60

Vertical Section is 5438.06 ft along the target direction of 352.96 deg at a measured depth of 11026.54 ft.
Horizontal Displacement is 5464.25 ft along the well bore azimuth of 347.35 deg.
The total correction is -8.02 deg relative to Grid North.

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WV GEOLOGICAL SURVEY
MORGANTOWN, WV

Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date:	6/14/2012
State:	WEST VIRGINIA
County:	BROOKE
API Number:	47009900104
Operator Name:	CHESAPEAKE APPALACHIA LLC
Well Name and Number:	ROBERT BONE BRK 3H
Longitude:	-80.602389
Latitude:	40.218718
Long/Lat Projection:	NAD27
Production Type:	GAS
True Vertical Depth (TVD):	5,836
Total Water Volume (gall):	3,638,040

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MORGANTOWN, WV

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (%) by Mass ¹	Maximum Ingredient Concentration in HF Fluid (%) by Mass ²	Comments
Fresh Water		Carrier/Base Fluid	Crystalline Silica (Quartz Sand, Silicon Dioxide)	014808-60-7	100.00%	85.64129%	
Ottawa Sand		Proppant	Crystalline Silica (Quartz Sand, Silicon Dioxide)	014808-60-7	100.00%	9.49243%	
100 Mesh Sand		Proppant	Crystalline Silica (Quartz Sand, Silicon Dioxide)	014808-60-7	100.00%	4.05117%	
Acid, Hydrochloric 15pct	SCHLUMBE RGER	Acid	Water	007732-18-5	85.00%	0.64042%	
L058	SCHLUMBE RGER	Iron Control Agent	Hydrogen Chloride	007647-01-0	15.00%	0.11301%	
A264	SCHLUMBE RGER	Corrosion Inhibitor	Sodium Erythorbate	006381-77-7	100.00%	0.00050%	
EC6110A	NALCO	Anti-Bacterial Agent	Methanol (Methyl Alcohol)	000067-56-1	40.00%	0.00045%	
			Aliphatic acid	N/A	30.00%	0.00033%	
			Aliphatic alcohols, ethoxylated # 1	N/A	30.00%	0.00033%	
			Propargyl Alcohol (2-Propynol)	000107-19-7	10.00%	0.00011%	
			Glutaraldehyde	000111-30-8	60.00%	0.01703%	
			Quaternary Ammonium Compounds	N/A	10.00%	0.00284%	
			Ethanol	000064-17-5	5.00%	0.00142%	
EC6629A	NALCO	Scale Inhibitor	No Hazardous Components	NONE		0.00000%	

B315	SCHLUMBE RGER	Friction Reducer	Petroleum Distillate Hydro-treated Light	064742-47-8	30.00%	0.00789%
			Aliphatic alcohol polyglycol ether	N/A	1.50%	0.00039%

* Total Water Volume sources may include fresh water, produced water, and/or recycled water
 ** Information is based on the maximum potential for concentration and thus the total may be over 100%

"Additional Ingredients Not Listed on MSDS" component information were obtained directly from the supplier. As such, the Operator is not responsible for inaccurate and/or incomplete information. Any questions regarding the content of this information should be directed to the supplier who provided it.

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