



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Woodford 09HU (I)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=1235+33 @ 1268.00ft (Nabors X08)
Site:	Woodford	MD Reference:	RKB=1235+33 @ 1268.00ft (Nabors X08)
Well:	Woodford 09HU (I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Project	Marshall County, West Virginia
Map System:	Universal Transverse Mercator (US Survey Feet)
Geo Datum:	NAD83 West Virginia - HARN
Map Zone:	Zone 17N (84 W to 78 W)
System Datum:	Mean Sea Level

Site	Woodford
Site Position:	Latitude: 39.80414597
From:	Longitude: -80.81195526
Position Uncertainty:	Slot Radius: 0.00 ft
	Grid Convergence: 0.120 °
	Latitude: 14,455,471.78 usft
	Longitude: 1,693,217.70 usft
	Grid Convergence: 13-3/16 "

Well	Woodford 09HU (I)
Well Position	+N-S 0.00 ft
	+E-W 0.00 ft
Position Uncertainty	0.00 ft
	Wellhead Elevation:
	Northings: 14,455,517.99 usft
	Eastings: 1,693,228.66 usft
	Latitude: 39.80427283
	Longitude: -80.81195590
	Ground Level: 1,235.00 ft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	6/29/2018	-8.652	66.898	52,074.92294194

Design	Surveys Original Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (ft)	+N-S (ft)	+E-W (ft)	Direction (°)	
	0.00	0.00	0.00		138.830

Survey Program	From (ft)	To (ft)	Date	10/19/2019
	194.00	895.00 MWD surf (Original Hole)		
	983.00	2,722.00 MWD int (Original Hole)		
	2,776.00	18,804.00 MWD (Original Hole)		
	18,860.00	18,860.00 Projection (Original Hole)		
		Survey (Wellbore)		
		Tool Name	Description	
		MWD	MWD - Standard	
		MWD	MWD - Standard	
		MWD	MWD - Standard	
		MWD	MWD - Standard	

Survey	Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
	0.00	0.00	0.000	0.00	0.00	0.00	14,455,517.99	1,693,228.66	39.80427283	-80.81195590	
	194.00	0.16	171.220	194.00	-0.27	0.04	14,455,517.72	1,693,228.70	39.80427210	-80.81195576	
	MWD surveys										
	247.00	0.15	202.500	247.00	-0.40	0.03	14,455,517.59	1,693,228.68	39.80427172	-80.81195581	
	277.00	0.18	193.890	277.00	-0.49	0.00	14,455,517.51	1,693,228.66	39.80427149	-80.81195591	
	307.00	0.10	141.510	307.00	-0.55	0.00	14,455,517.44	1,693,228.66	39.80427131	-80.81195589	
	337.00	0.18	104.780	337.00	-0.59	0.07	14,455,517.41	1,693,228.73	39.80427122	-80.81195567	
	367.00	0.35	189.430	367.00	-0.69	0.10	14,455,517.30	1,693,228.76	39.80427094	-80.81195556	
	397.00	0.27	181.180	397.00	-0.85	0.08	14,455,517.14	1,693,228.74	39.80427050	-80.81195562	



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Well: Woodford 09HU (f)
Wellbore: Original Hole
Design: Surveys Original Hole

Local Co-ordinate Reference:
TVD Reference: Well Woodford 09HU (f)
MD Reference: RKB=1235+33 @ 1268.00ft (Nabors X08)
North Reference: RKB=1235+33 @ 1268.00ft (Nabors X08)
Survey Calculation Method: Grid
Database: Minimum Curvature
 DB_Aug1919_v14

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/S (ft)	+E/W (ft)	Map Northing (ustf)	Map Easting (ustf)	Latitude	Longitude
427.00	0.08	236.770	427.00	-0.93	0.06	14,455,517.06	1,693,228.72	39.80427027	-80.81195569
457.00	0.14	127.920	457.00	-0.97	0.07	14,455,517.03	1,693,228.73	39.80427018	-80.81195565
487.00	0.23	173.870	487.00	-1.05	0.11	14,455,516.94	1,693,228.77	39.80426995	-80.81195552
517.00	0.14	121.240	517.00	-1.13	0.15	14,455,516.87	1,693,228.80	39.80426974	-80.81195539
577.00	0.07	140.470	577.00	-1.19	0.23	14,455,516.80	1,693,228.89	39.80426955	-80.81195508
643.00	0.22	217.700	643.00	-1.32	0.18	14,455,516.67	1,693,228.84	39.80426919	-80.81195527
706.00	0.23	275.930	706.00	-1.41	-0.02	14,455,516.59	1,693,228.64	39.80426897	-80.81195598
800.00	0.31	264.290	800.00	-1.41	-0.46	14,455,516.58	1,693,228.20	39.80426895	-80.81195558
895.00	0.87	269.040	894.99	-1.45	-1.44	14,455,516.54	1,693,227.22	39.80426886	-80.81196103
983.00	1.40	260.890	982.97	-1.63	-3.17	14,455,516.36	1,693,225.49	39.80426837	-80.81196719
1,077.00	0.58	263.650	1,076.96	-1.87	-4.77	14,455,516.13	1,693,223.89	39.80426773	-80.81197291
1,172.00	0.38	277.360	1,171.96	-1.88	-5.56	14,455,516.11	1,693,223.10	39.80426770	-80.81197572
1,267.00	0.15	241.460	1,266.95	-1.90	-5.99	14,455,516.09	1,693,222.67	39.80426765	-80.81197723
1,361.00	0.43	16.190	1,360.95	-1.82	-5.99	14,455,516.37	1,693,222.66	39.80426842	-80.81197728
1,456.00	0.58	8.850	1,455.95	-0.80	-5.82	14,455,517.19	1,693,222.84	39.80427067	-80.81197663
1,550.00	0.39	29.070	1,549.95	-0.05	-5.59	14,455,517.94	1,693,223.07	39.80427272	-80.81197582
1,644.00	0.41	28.280	1,643.94	0.52	-5.28	14,455,518.52	1,693,223.38	39.80427430	-80.81197469
1,739.00	0.08	112.790	1,738.94	0.80	-5.06	14,455,518.79	1,693,223.60	39.80427505	-80.81197390
1,833.00	0.97	160.910	1,832.94	0.02	-4.74	14,455,518.01	1,693,223.92	39.80427292	-80.81197012
1,928.00	1.52	157.480	1,927.92	-1.90	-3.99	14,455,516.09	1,693,224.67	39.80426763	-80.81197012
2,022.00	1.16	131.110	2,021.89	-3.68	-2.80	14,455,514.31	1,693,225.86	39.80426274	-80.81196588
2,117.00	1.31	50.870	2,116.87	-3.63	-1.23	14,455,515.37	1,693,227.43	39.80426288	-80.81196030
2,211.00	1.00	49.750	2,210.86	-2.42	0.23	14,455,515.15	1,693,228.89	39.80426619	-80.81195510
2,305.00	0.42	10.690	2,304.85	-1.55	0.92	14,455,516.44	1,693,229.58	39.80426657	-80.81195263
2,399.00	0.53	333.370	2,398.85	-0.82	0.79	14,455,517.17	1,693,229.45	39.80427057	-80.81195309
2,494.00	0.95	298.680	2,493.84	-0.05	-0.10	14,455,517.94	1,693,228.56	39.80427269	-80.81195625
2,589.00	0.66	297.950	2,588.83	0.58	-1.27	14,455,518.52	1,693,227.39	39.80427444	-80.81196042
2,683.00	0.71	314.830	2,682.82	1.25	-2.16	14,455,519.24	1,693,226.50	39.80427627	-80.81196359
2,722.00	0.58	321.870	2,721.82	1.57	-2.46	14,455,519.56	1,693,226.20	39.80427716	-80.81196463
2,776.00	0.91	353.390	2,775.81	2.21	-2.67	14,455,520.21	1,693,225.98	39.80427892	-80.81196541
2,871.00	1.21	8.080	2,870.80	3.96	-2.62	14,455,521.95	1,693,226.04	39.80428371	-80.81196520
2,966.00	0.62	4.320	2,965.79	5.46	-2.44	14,455,523.45	1,693,226.22	39.80428784	-80.81196455
3,060.00	0.68	256.990	3,059.78	5.84	-2.95	14,455,523.84	1,693,225.71	39.80428889	-80.81196635
3,155.00	1.52	236.020	3,154.76	5.01	-4.54	14,455,523.00	1,693,224.12	39.80428662	-80.81197203
3,250.00	1.19	264.900	3,249.74	4.22	-6.57	14,455,522.21	1,693,222.09	39.80428446	-80.81197925
3,344.00	1.41	322.040	3,343.72	5.04	-8.25	14,455,523.04	1,693,220.41	39.80428673	-80.81198524
3,439.00	2.87	1.540	3,438.65	8.34	-8.91	14,455,526.34	1,693,219.75	39.80429580	-80.81198755
3,534.00	4.60	10.230	3,533.45	14.47	-8.17	14,455,532.46	1,693,220.49	39.80431262	-80.81198487
3,626.00	6.33	20.410	3,625.03	22.86	-5.74	14,455,540.85	1,693,222.92	39.80433563	-80.81197617
3,720.00	7.75	23.930	3,718.32	33.51	-1.36	14,455,551.50	1,693,227.30	39.80436486	-80.81196050
3,815.00	8.51	26.780	3,812.36	45.64	4.40	14,455,563.63	1,693,233.06	39.80439814	-80.81193988
3,910.00	9.60	25.290	3,906.18	59.07	10.95	14,455,577.07	1,693,239.61	39.80443500	-80.81191646
4,004.00	10.72	22.270	3,998.70	74.25	17.62	14,455,592.24	1,693,246.27	39.80447665	-80.81189262
4,099.00	11.75	17.700	4,091.88	91.64	23.91	14,455,609.64	1,693,252.56	39.80452437	-80.81187010
4,193.00	12.16	14.930	4,183.85	110.33	29.37	14,455,628.32	1,693,258.02	39.80457565	-80.81185052
4,288.00	13.90	13.710	4,276.40	131.08	34.65	14,455,649.08	1,693,263.31	39.80463262	-80.81183155
4,382.00	15.54	11.980	4,367.31	154.37	39.94	14,455,672.36	1,693,268.60	39.80469655	-80.81181254
4,480.00	16.95	8.590	4,461.40	181.34	44.80	14,455,699.33	1,693,273.46	39.80477658	-80.81179504
4,575.00	17.25	7.410	4,552.20	209.00	48.68	14,455,726.99	1,693,277.34	39.80484653	-80.81178100
4,669.00	17.33	6.490	4,641.95	236.73	52.06	14,455,754.73	1,693,280.72	39.80492266	-80.81176875
4,763.00	15.72	6.360	4,732.06	263.30	55.06	14,455,781.29	1,693,283.71	39.80499561	-80.81175790
4,858.00	14.63	7.940	4,823.75	287.97	58.14	14,455,805.97	1,693,286.80	39.80506335	-80.81174674
4,953.00	14.78	14.370	4,915.64	311.60	62.80	14,455,829.59	1,693,291.46	39.80512820	-80.81172995
5,047.00	15.32	16.330	5,006.42	335.13	69.27	14,455,853.12	1,693,297.93	39.80519279	-80.81170674
5,142.00	15.32	15.960	5,098.04	359.24	76.25	14,455,877.23	1,693,304.91	39.80525896	-80.81168171



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Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,237.00	15.83	13.450	5,189.56	383.91	82.72	14,455,901.90	1,693,311.37	39.80532667	-80.81165851
5,332.00	15.79	10.500	5,280.96	409.22	88.08	14,455,927.21	1,693,316.74	39.80539615	-80.81163920
5,426.00	15.47	7.230	5,371.49	434.23	91.99	14,455,952.22	1,693,320.65	39.80546482	-80.81162510
5,521.00	12.53	11.990	5,463.66	456.89	95.73	14,455,974.88	1,693,324.39	39.80552701	-80.81161162
5,615.00	11.85	19.580	5,555.55	475.96	101.08	14,455,993.95	1,693,329.74	39.80557935	-80.81159242
5,710.00	13.82	20.520	5,648.17	495.77	108.33	14,456,013.77	1,693,336.99	39.80563373	-80.81156647
5,805.00	16.51	17.140	5,739.85	519.30	116.29	14,456,037.30	1,693,344.94	39.80569831	-80.81153796
5,900.00	18.11	13.310	5,830.55	546.57	123.66	14,456,064.57	1,693,352.32	39.80577316	-80.81151148
5,994.00	18.72	10.290	5,919.74	575.63	129.72	14,456,093.63	1,693,358.38	39.80585293	-80.81148969
6,089.00	18.15	10.450	6,009.86	605.19	135.13	14,456,123.18	1,693,363.79	39.80593405	-80.81147022
6,183.00	16.59	8.520	6,099.58	632.86	139.77	14,456,150.85	1,693,368.43	39.80601002	-80.81145348
6,278.00	14.60	8.280	6,191.07	658.12	143.51	14,456,176.11	1,693,372.17	39.80607938	-80.81143999
6,373.00	13.54	11.460	6,283.22	680.87	147.44	14,456,198.86	1,693,376.10	39.80614183	-80.81142581
6,468.00	12.44	12.910	6,375.79	701.74	151.94	14,456,219.73	1,693,380.60	39.80619913	-80.81140965
6,563.00	12.55	11.580	6,468.54	721.83	156.30	14,456,239.82	1,693,384.95	39.80625426	-80.81139398
6,657.00	13.15	14.930	6,560.19	742.16	161.10	14,456,260.16	1,693,389.76	39.80631008	-80.81137672
6,752.00	13.68	16.300	6,652.60	763.39	167.04	14,456,281.38	1,693,395.70	39.80636633	-80.81135542
6,847.00	14.60	13.890	6,744.72	785.79	173.06	14,456,303.78	1,693,401.72	39.80642983	-80.81133379
6,941.00	15.43	12.740	6,835.51	809.49	178.67	14,456,327.48	1,693,407.32	39.80649488	-80.81131366
7,036.00	16.21	11.200	6,926.91	834.83	184.03	14,456,352.82	1,693,412.69	39.80656443	-80.81129438
7,131.00	17.24	13.620	7,017.89	861.52	189.92	14,456,379.51	1,693,418.58	39.80663769	-80.81127320
7,225.00	17.15	14.930	7,107.69	888.45	196.77	14,456,406.44	1,693,425.43	39.80671161	-80.81124861
7,320.00	16.05	20.510	7,198.73	914.28	204.98	14,456,432.27	1,693,433.64	39.80678251	-80.81121918
7,415.00	16.08	25.100	7,290.03	938.50	215.16	14,456,456.49	1,693,443.82	39.80684895	-80.81118274
7,510.00	13.53	21.460	7,381.87	960.76	224.81	14,456,478.75	1,693,453.47	39.80691003	-80.81114821
7,604.00	11.91	7.990	7,473.58	980.60	230.19	14,456,498.59	1,693,458.84	39.80696450	-80.81112893
7,698.00	12.19	0.270	7,565.51	1,000.14	231.58	14,456,518.13	1,693,460.24	39.80701813	-80.81112479
7,793.00	13.92	358.170	7,658.06	1,021.59	231.26	14,456,539.58	1,693,459.92	39.80707705	-80.81112472
7,888.00	14.99	1.560	7,750.05	1,045.29	231.23	14,456,563.28	1,693,459.89	39.80714214	-80.81116697
7,982.00	15.95	8.350	7,840.65	1,070.22	233.44	14,456,588.21	1,693,462.10	39.80721060	-80.81116697
8,077.00	16.80	12.510	7,931.80	1,096.54	238.31	14,456,614.53	1,693,466.97	39.80728285	-80.81109914
8,171.00	16.93	13.200	8,021.76	1,123.13	244.38	14,456,641.12	1,693,473.03	39.80735583	-80.81107733
8,266.00	16.50	12.070	8,112.74	1,149.79	250.36	14,456,667.78	1,693,479.01	39.80742901	-80.81105594
8,360.00	16.18	16.200	8,202.95	1,175.42	256.80	14,456,693.41	1,693,485.46	39.80749937	-80.81103269
8,455.00	15.52	19.940	8,294.34	1,200.08	264.83	14,456,718.07	1,693,493.49	39.80756704	-80.81100392
8,550.00	15.68	19.150	8,385.84	1,224.16	273.38	14,456,742.15	1,693,502.03	39.80763311	-80.81097331
8,644.00	16.30	17.390	8,476.20	1,248.74	281.48	14,456,766.73	1,693,510.14	39.80770059	-80.81094425
8,742.00	13.93	15.590	8,570.80	1,273.23	288.77	14,456,791.22	1,693,517.42	39.80776780	-80.81091814
8,836.00	14.18	13.750	8,661.99	1,295.32	294.54	14,456,813.31	1,693,523.20	39.80782841	-80.81089740
8,931.00	13.01	8.190	8,754.33	1,317.20	298.83	14,456,835.19	1,693,527.49	39.80788850	-80.81088196
9,025.00	13.36	4.990	8,845.85	1,338.50	301.29	14,456,856.49	1,693,529.94	39.80794695	-80.81087307
9,120.00	14.28	3.730	8,938.10	1,361.12	303.00	14,456,879.11	1,693,531.66	39.80800908	-80.81086679
9,214.00	15.70	2.780	9,028.90	1,385.40	304.37	14,456,902.69	1,693,533.03	39.80807573	-80.81086172
9,308.00	15.55	4.890	9,119.43	1,410.65	306.06	14,456,928.64	1,693,534.72	39.80814509	-80.81085551
9,403.00	15.09	6.490	9,211.05	1,435.63	308.55	14,456,953.62	1,693,537.21	39.80821366	-80.81084648
9,498.00	14.29	15.330	9,302.96	1,459.22	313.05	14,456,977.21	1,693,541.70	39.80827844	-80.81083029
9,592.00	14.25	16.800	9,394.06	1,481.49	319.46	14,456,999.48	1,693,548.11	39.80833954	-80.81080729
9,687.00	14.93	15.150	9,486.00	1,504.49	326.03	14,457,022.48	1,693,554.69	39.80840269	-80.81078370
9,781.00	15.12	16.330	9,576.78	1,527.95	332.65	14,457,045.94	1,693,561.30	39.80846706	-80.81075998
9,876.00	14.19	19.050	9,668.69	1,550.85	339.93	14,457,068.83	1,693,568.59	39.80852990	-80.81073386
9,970.00	14.69	17.490	9,759.72	1,573.10	347.27	14,457,091.09	1,693,575.93	39.80859098	-80.81070755
10,023.00	15.01	17.280	9,810.95	1,586.07	351.33	14,457,104.06	1,693,579.99	39.80862656	-80.81069300
10,087.00	15.69	17.240	9,872.67	1,602.25	356.36	14,457,120.23	1,693,585.02	39.80867096	-80.81067498
10,181.00	14.68	19.700	9,963.39	1,625.59	364.14	14,457,143.59	1,693,592.80	39.80873503	-80.81064709
10,276.00	16.18	43.260	10,055.05	1,646.59	377.28	14,457,164.58	1,693,605.94	39.80879263	-80.81060014



TUG HILL
OPERATING

Survey Report - Geographic



Company: Tug Hill Operating LLC
Project: Marshall County, West Virginia
 Woodford
Site: Woodford 09HU (I)
Well: Original Hole
Wellbore: Surveys Original Hole
Design:

Local Co-ordinate Reference:
TVD Reference: Well Woodford 09HU (I)
MD Reference: RKB=1235+33 @ 1268.00ft (Nabors X08)
North Reference: RKB=1235+33 @ 1268.00ft (Nabors X08)
Survey Calculation Method: Grid
Database: Minimum Curvature
 DB_Aug1919_v14

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/S (ft)	+E/W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
10,370.00	15.78	58.290	10,145.46	1,662.86	397.14	14,457,180.85	1,693,625.80	39.80883718	-80.81052931
10,466.00	17.45	61.800	10,237.45	1,676.52	420.93	14,457,194.51	1,693,649.59	39.80887456	-80.81044448
10,559.00	24.13	89.930	10,324.55	1,683.16	452.34	14,457,201.15	1,693,681.00	39.80889260	-80.81033259
10,652.00	24.97	112.520	10,409.33	1,675.64	489.57	14,457,193.63	1,693,718.23	39.80887176	-80.81020009
10,747.00	29.27	129.480	10,494.00	1,653.15	526.09	14,457,171.14	1,693,754.75	39.80880978	-80.81007022
10,841.00	31.16	136.950	10,575.25	1,620.76	560.44	14,457,138.75	1,693,789.10	39.80872061	-80.80994813
10,935.00	35.03	137.830	10,653.99	1,592.98	595.17	14,457,100.97	1,693,823.82	39.80861665	-80.80982477
10,982.00	39.21	141.350	10,691.46	1,561.37	613.51	14,457,079.35	1,693,842.17	39.80855719	-80.80975961
11,030.00	43.12	144.250	10,727.59	1,536.19	632.58	14,457,054.18	1,693,861.24	39.80848795	-80.80969190
11,077.00	45.98	144.510	10,761.08	1,509.39	651.78	14,457,027.38	1,693,880.44	39.80841423	-80.80962373
11,125.00	50.11	144.330	10,793.16	1,480.36	672.55	14,456,998.35	1,693,901.20	39.80833440	-80.80955001
11,172.00	53.36	145.740	10,822.27	1,450.12	693.68	14,456,968.11	1,693,922.34	39.80825122	-80.80947498
11,220.00	56.79	146.530	10,849.75	1,417.45	715.60	14,456,935.44	1,693,944.26	39.80816136	-80.80939716
11,267.00	59.60	146.270	10,874.51	1,384.18	737.71	14,456,902.17	1,693,966.36	39.80806987	-80.80931871
11,315.00	62.95	145.390	10,897.58	1,349.36	761.35	14,456,867.35	1,693,990.01	39.80797412	-80.80929479
11,362.00	66.24	145.480	10,917.74	1,314.41	785.43	14,456,832.40	1,694,014.09	39.80787797	-80.80914930
11,409.00	69.89	145.120	10,935.29	1,278.57	810.25	14,456,796.56	1,694,038.91	39.80777941	-80.80906121
11,456.00	73.54	145.120	10,950.04	1,241.97	835.77	14,456,759.96	1,694,064.42	39.80767874	-80.80897063
11,504.00	76.53	145.630	10,962.43	1,203.77	862.04	14,456,721.76	1,694,090.70	39.80757368	-80.80887735
11,551.00	77.71	150.310	10,972.91	1,164.89	886.26	14,456,682.88	1,694,114.92	39.80746677	-80.80879140
11,598.00	80.92	152.680	10,981.63	1,124.31	908.30	14,456,642.30	1,694,136.95	39.80735520	-80.80871326
11,645.00	84.13	152.420	10,991.88	1,040.70	952.14	14,456,558.69	1,694,180.80	39.80712532	-80.80855777
11,693.00	85.98	151.800	10,999.46	958.45	997.30	14,456,476.44	1,694,225.96	39.80689918	-80.80839759
11,787.00	87.21	150.660	10,997.46	875.69	1,043.74	14,456,393.68	1,694,272.39	39.80667163	-80.80823289
11,882.00	87.34	150.750	11,001.98	793.91	1,089.95	14,456,311.90	1,694,318.60	39.80644677	-80.80806896
11,976.00	86.40	150.310	11,005.47	711.08	1,136.42	14,456,229.07	1,694,365.08	39.80621902	-80.80790412
12,071.00	89.19	151.100	11,007.47	628.76	1,181.78	14,456,146.75	1,694,410.43	39.80599269	-80.80774324
12,165.00	88.84	151.190	11,009.09	545.58	1,227.62	14,456,063.57	1,694,456.27	39.80576396	-80.80759067
12,260.00	89.79	151.100	11,011.05	463.23	1,272.91	14,455,981.22	1,694,501.56	39.80553755	-80.80742004
12,354.00	89.97	150.750	11,014.68	380.14	1,318.93	14,455,898.13	1,694,547.59	39.80530910	-80.80725679
12,448.00	89.89	148.200	11,015.61	299.18	1,366.67	14,455,817.17	1,694,595.33	39.80508647	-80.80708743
12,543.00	89.89	147.760	11,015.80	218.63	1,417.04	14,455,736.63	1,694,645.70	39.80486477	-80.80690870
12,638.00	89.23	146.350	11,016.52	139.75	1,468.16	14,455,657.75	1,694,696.81	39.80464805	-80.80672730
12,732.00	90.68	146.620	11,016.59	60.55	1,520.61	14,455,578.54	1,694,749.27	39.80443022	-80.80654114
12,827.00	92.13	149.080	11,014.26	-19.85	1,571.14	14,455,498.14	1,694,799.80	39.80420912	-80.80636183
13,016.00	90.51	151.540	11,012.10	-101.48	1,617.68	14,455,416.52	1,694,846.34	39.80398467	-80.80619675
13,111.00	90.20	151.010	11,011.51	-184.78	1,663.34	14,455,333.21	1,694,892.00	39.80375562	-80.80603482
13,205.00	89.89	151.190	11,011.43	-267.08	1,708.77	14,455,250.92	1,694,937.42	39.80352935	-80.80587371
13,302.00	89.67	152.070	11,011.81	-352.43	1,754.86	14,455,165.57	1,694,983.51	39.80329468	-80.80571026
13,394.00	89.67	153.210	11,012.34	-434.13	1,797.14	14,455,083.86	1,695,025.79	39.80307004	-80.80556035
13,489.00	88.92	152.510	11,013.51	-518.66	1,840.47	14,454,999.33	1,695,069.13	39.80283764	-80.80540672
13,583.00	88.79	151.980	11,015.38	-601.83	1,884.24	14,454,916.16	1,695,112.89	39.80260897	-80.80525154
13,678.00	88.66	152.160	11,017.50	-685.75	1,928.72	14,454,832.25	1,695,157.38	39.80237826	-80.80509379
13,772.00	90.07	150.570	11,018.54	-768.24	1,973.77	14,454,749.75	1,695,202.42	39.80215144	-80.80493406
13,867.00	89.76	150.310	11,018.68	-850.87	2,020.63	14,454,667.12	1,695,249.29	39.80192422	-80.80476783
13,962.00	89.85	150.570	11,019.00	-933.51	2,067.50	14,454,584.49	1,695,296.15	39.80169701	-80.80460161
14,056.00	89.58	150.400	11,019.47	-1,015.31	2,113.81	14,454,502.69	1,695,342.46	39.80147209	-80.80443736
14,150.00	89.76	150.050	11,020.01	-1,096.90	2,160.49	14,454,421.10	1,695,389.14	39.80124774	-80.80427180
14,245.00	89.85	150.220	11,020.34	-1,179.28	2,207.79	14,454,338.71	1,695,436.45	39.80102121	-80.80410401
14,339.00	89.14	151.190	11,021.16	-1,261.25	2,253.78	14,454,256.74	1,695,482.44	39.80079581	-80.80394090
14,433.00	89.01	152.070	11,022.68	-1,343.95	2,298.44	14,454,174.04	1,695,527.10	39.80056843	-80.80378254
14,528.00	87.91	149.960	11,025.24	-1,427.02	2,344.46	14,454,090.98	1,695,573.11	39.80034003	-80.80361936
14,623.00	88.09	149.340	11,028.55	-1,508.95	2,392.43	14,454,009.05	1,695,621.08	39.80011474	-80.80344920
14,716.00	88.66	149.260	11,031.19	-1,588.88	2,439.89	14,453,929.11	1,695,668.55	39.79989494	-80.80328084



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Woodford 09HU (I)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=1235+33 @ 1268.00ft (Nabors X08)
Site:	Woodford	MD Reference:	RKB=1235+33 @ 1268.00ft (Nabors X08)
Well:	Woodford 09HU (I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
14,811.00	89.10	147.060	11,033.05	-1,669.57	2,490.00	14,453,848.43	1,695,718.65	39.79967305	-80.80310308	
14,905.00	91.69	148.110	11,032.40	-1,748.91	2,540.38	14,453,769.09	1,695,769.03	39.79945485	-80.80292432	
15,000.00	91.78	147.850	11,029.52	-1,829.42	2,590.73	14,453,688.58	1,695,819.38	39.79923344	-80.80274570	
15,095.00	91.60	147.590	11,026.72	-1,909.70	2,641.44	14,453,608.29	1,695,870.09	39.79901266	-80.80256577	
15,189.00	90.55	148.820	11,024.96	-1,989.58	2,690.96	14,453,528.42	1,695,919.61	39.79879299	-80.80239011	
15,284.00	90.37	148.990	11,024.19	-2,070.93	2,740.02	14,453,447.07	1,695,968.67	39.79856829	-80.80221607	
15,378.00	89.89	150.660	11,023.98	-2,152.19	2,787.26	14,453,365.81	1,696,015.92	39.79834585	-80.80204850	
15,473.00	89.85	151.190	11,024.20	-2,235.21	2,833.43	14,453,282.78	1,696,062.08	39.79811755	-80.80188479	
15,568.00	89.49	151.190	11,024.74	-2,318.45	2,879.21	14,453,199.54	1,696,107.86	39.79788867	-80.80172246	
15,663.00	89.01	150.750	11,025.99	-2,401.51	2,925.31	14,453,116.49	1,696,153.96	39.79766030	-80.80155900	
15,757.00	89.01	151.280	11,027.61	-2,483.73	2,970.85	14,453,034.27	1,696,199.50	39.79743424	-80.80139750	
15,851.00	89.63	151.800	11,028.73	-2,566.36	3,015.64	14,452,951.64	1,696,244.29	39.79720703	-80.80123868	
15,946.00	89.54	152.160	11,029.41	-2,650.22	3,060.27	14,452,867.78	1,696,288.92	39.79697645	-80.80108046	
16,041.00	90.11	150.750	11,029.70	-2,733.67	3,105.66	14,452,784.33	1,696,334.32	39.79674700	-80.80091951	
16,133.00	89.63	150.840	11,029.91	-2,813.97	3,150.55	14,452,704.02	1,696,379.21	39.79652619	-80.80076033	
16,228.00	89.41	150.050	11,030.71	-2,896.61	3,197.41	14,452,621.39	1,696,426.06	39.79629896	-80.80059416	
16,322.00	89.05	150.130	11,031.97	-2,978.08	3,244.28	14,452,539.92	1,696,472.93	39.79607493	-80.80042795	
16,417.00	88.97	149.430	11,033.61	-3,060.16	3,292.09	14,452,457.84	1,696,520.74	39.79584923	-80.80025839	
16,512.00	88.48	148.780	11,035.73	-3,142.08	3,340.14	14,452,375.92	1,696,568.79	39.79562396	-80.80008796	
16,607.00	89.93	149.520	11,037.04	-3,224.05	3,388.14	14,452,293.95	1,696,616.79	39.79539855	-80.79991774	
16,701.00	89.93	149.960	11,037.16	-3,305.24	3,435.51	14,452,212.76	1,696,664.16	39.79517528	-80.79974975	
16,795.00	89.63	149.690	11,037.49	-3,386.51	3,482.75	14,452,131.49	1,696,711.41	39.79495183	-80.79958219	
16,890.00	89.19	149.610	11,038.43	-3,468.48	3,530.75	14,452,049.52	1,696,759.40	39.79472640	-80.79941196	
16,985.00	89.32	149.520	11,039.67	-3,550.38	3,578.87	14,451,967.61	1,696,807.52	39.79450118	-80.79924130	
17,079.00	89.10	149.340	11,040.96	-3,631.31	3,626.67	14,451,886.69	1,696,855.33	39.79427864	-80.79907177	
17,173.00	88.75	149.170	11,042.73	-3,712.09	3,674.72	14,451,805.91	1,696,903.37	39.79405652	-80.79890137	
17,268.00	89.01	148.260	11,044.58	-3,793.68	3,723.33	14,451,724.32	1,696,951.99	39.79383212	-80.79872895	
17,363.00	89.01	148.460	11,046.23	-3,874.98	3,772.45	14,451,643.02	1,697,001.10	39.79360855	-80.79855473	
17,457.00	88.57	148.200	11,048.21	-3,954.97	3,821.80	14,451,563.03	1,697,050.45	39.79338859	-80.79837972	
17,552.00	88.92	149.260	11,050.29	-4,036.14	3,871.09	14,451,481.86	1,697,099.74	39.79316535	-80.79820486	
17,646.00	89.10	148.820	11,051.92	-4,116.74	3,919.44	14,451,401.26	1,697,148.09	39.79294371	-80.79803338	
17,741.00	89.45	148.990	11,053.12	-4,198.08	3,968.50	14,451,319.92	1,697,197.15	39.79272002	-80.79785938	
17,836.00	90.20	149.430	11,053.41	-4,279.69	4,017.13	14,451,238.31	1,697,245.78	39.79249560	-80.79768692	
17,931.00	89.63	149.870	11,053.55	-4,361.67	4,065.13	14,451,156.33	1,697,293.78	39.79227016	-80.79751669	
18,025.00	88.97	150.930	11,054.70	-4,443.40	4,111.56	14,451,074.60	1,697,340.21	39.79204543	-80.79735208	
18,120.00	87.69	151.190	11,057.47	-4,526.50	4,157.51	14,450,991.50	1,697,386.16	39.79181693	-80.79718917	
18,214.00	88.31	151.280	11,060.75	-4,608.85	4,202.72	14,450,909.16	1,697,431.37	39.79159050	-80.79702890	
18,309.00	87.91	151.630	11,063.88	-4,692.25	4,248.09	14,450,825.75	1,697,476.74	39.79136116	-80.79686805	
18,404.00	87.60	151.720	11,067.60	-4,775.81	4,293.13	14,450,742.19	1,697,521.78	39.79113139	-80.79670839	
18,498.00	87.52	152.160	11,071.60	-4,858.69	4,337.30	14,450,659.31	1,697,565.95	39.79090352	-80.79655179	
18,593.00	87.30	152.240	11,075.90	-4,942.64	4,381.57	14,450,575.36	1,697,610.22	39.79067270	-80.79639491	
18,688.00	88.00	151.630	11,079.79	-5,026.40	4,426.22	14,450,491.61	1,697,654.87	39.79044240	-80.79623661	
18,783.00	87.69	151.360	11,083.36	-5,109.82	4,471.53	14,450,408.18	1,697,700.18	39.79021301	-80.79607600	
18,804.00	87.78	151.800	11,084.19	-5,128.28	4,481.51	14,450,389.73	1,697,710.16	39.79016226	-80.79604060	
Survey @ 18804.00 MD 11084.19 TVD										
18,860.00	87.78	151.800	11,086.36	-5,177.59	4,507.96	14,450,340.41	1,697,736.61	39.79002666	-80.79594687	
Survey projected to 18860.00 MD 11086.36 TVD										



Company:

Tug Hill Operating LLC
Marshall County, West Virginia
Woodford
Woodford 09HU (I)
Original Hole
Surveys Original Hole

Project:

Well Woodford 09HU (I)
RKB=1235+33 @ 1268.00ft (Nabors X08)
RKB=1235+33 @ 1268.00ft (Nabors X08)
Grid

Site:

Well:

Wellbore:

Design:

Local Co-ordinate Reference:

TVD Reference:

MD Reference:

North Reference:

Survey Calculation Method:

Database:

Minimum Curvature
DB_Aug1919_v14

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	+N/-S (ft)	Local Coordinates +E/-W (ft)	Comment
194.00	194.00	-0.27	0.04	MWD surveys
18,804.00	11,084.19	-5,128.28	4,481.51	Survey @ 18804.00 MD 11084.19 TVD
18,860.00	11,086.36	-5,177.59	4,507.96	Survey projected to 18860.00 MD 11086.36 TVD