



Survey Report - Geographic



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Woodford 05HM (E)
<b>Project:</b>	Marshall County, West Virginia	<b>TVD Reference:</b>	RKB=1235+33 @ 1268.00ft (Nabors X08)
<b>Site:</b>	Woodford	<b>MD Reference:</b>	RKB=1235+33 @ 1268.00ft (Nabors X08)
<b>Well:</b>	Woodford 05HM (E)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Original Hole	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Original Hole	<b>Database:</b>	DB_Jul2216ct_v14.lt

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

<b>Site</b>	Woodford
<b>Site Position:</b>	Northing: 14,455,471.78 usft    Latitude: 39.80414597
<b>From:</b>	Easting: 1,693,217.70 usft    Longitude: -80.81199526
<b>Position Uncertainty:</b>	Slot Radius: 0.00 ft    Grid Convergence: 0.120 °

<b>Well</b>	Woodford 05HM (E)
<b>Well Position</b>	+N/-S    0.00 ft    Northing: 14,455,471.29 usft    Latitude: 39.80414463
	+E/-W    0.00 ft    Easting: 1,693,217.66 usft    Longitude: -80.81199542
<b>Position Uncertainty</b>	Wellhead Elevation: 0.00 ft    Ground Level: 1,235.00 ft

<b>Wellbore</b>	Original Hole
<b>Magnetics</b>	Model Name    Sample Date    Declination (°)    Dip Angle (°)    Field Strength (nT)
	IGRF2015    8/2/2019    -8.687    66.806    51,948,74054671

<b>Design</b>	Surveys Original Hole
<b>Audit Notes:</b>	
<b>Version:</b>	1.0    Phase: ACTUAL    Tie On Depth: 0.00
<b>Vertical Section:</b>	Depth From (TVDD)    +N/-S (ft)    +E/-W (ft)    Direction (°)
	0.00    0.00    0.00    143.05

<b>Survey Program</b>	Date	8/13/2019
<b>From (ft)</b>	To (ft)	Survey (Wellbore)
158.00	903.00	MWD surf (Original Hole)
981.00	2,605.00	MWD int (Original Hole)
2,684.00	17,851.00	MWD (Original Hole)
17,911.00	17,911.00	Projection (Original Hole)
		Tool Name    Description
		MWD    MWD - Standard
		MWD    MWD - Standard
		MWD    MWD - Standard
		MWD    MWD - Standard

<b>Survey</b>	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	0.00	0.00	0.00	0.00	14,455,471.29	1,693,217.66	39.80414463	-80.81199542
	158.00	0.94	153.93	157.99	-1.16	0.57	14,455,470.12	1,693,218.23	39.80414143	-80.81199340
	<b>MWD surveys</b>									
	189.00	0.94	198.00	188.99	-1.63	0.60	14,455,469.65	1,693,218.26	39.80414014	-80.81199329
	218.00	0.72	200.87	217.99	-2.03	0.46	14,455,469.26	1,693,218.12	39.80413905	-80.81199378
	247.00	0.44	197.17	246.98	-2.31	0.37	14,455,468.98	1,693,218.02	39.80413829	-80.81199413
	277.00	0.40	190.17	276.98	-2.52	0.31	14,455,468.77	1,693,217.97	39.80413771	-80.81199432
	307.00	0.26	177.24	306.98	-2.69	0.30	14,455,468.60	1,693,217.96	39.80413724	-80.81199438
	337.00	0.55	167.53	336.98	-2.90	0.33	14,455,468.39	1,693,217.99	39.80413666	-80.81199426



**TUG HILL**  
OPERATING

Survey Report - Geographic



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia  
**Site:** Woodford  
**Well:** Woodford 05HM (E)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:**  
**TVD Reference:** Well Woodford 05HM (E)  
**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\_Jul2216dt\_V14.lt

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (ustf)	Map Easting (ustf)	Latitude	Longitude
368.00	0.45	152.04	367.98	-3.15	0.42	14,455,468.13	1,693,218.08	39.80413597	-80.81199394
398.00	0.10	208.59	397.98	-3.28	0.47	14,455,468.01	1,693,218.12	39.80413562	-80.81199379
427.00	0.45	279.93	426.98	-3.28	0.34	14,455,468.01	1,693,218.00	39.80413561	-80.81199423
457.00	0.19	122.16	456.98	-3.29	0.27	14,455,468.00	1,693,217.92	39.80413560	-80.81199450
487.00	0.17	284.75	486.98	-3.30	0.27	14,455,467.98	1,693,217.92	39.80413556	-80.81199450
517.00	0.22	193.21	516.98	-3.35	0.21	14,455,467.94	1,693,217.87	39.80413543	-80.81199470
547.00	0.07	329.69	546.98	-3.39	0.19	14,455,467.90	1,693,217.84	39.80413532	-80.81199478
577.00	0.21	245.83	576.98	-3.40	0.13	14,455,467.89	1,693,217.79	39.80413531	-80.81199499
606.00	0.13	58.72	605.98	-3.40	0.11	14,455,467.89	1,693,217.77	39.80413529	-80.81199506
638.00	0.27	49.12	637.98	-3.33	0.20	14,455,467.95	1,693,217.85	39.80413548	-80.81199475
670.00	0.06	86.49	669.98	-3.28	0.27	14,455,468.00	1,693,217.93	39.80413561	-80.81199448
701.00	0.24	204.91	700.98	-3.34	0.26	14,455,467.95	1,693,217.92	39.80413546	-80.81199452
733.00	0.19	93.99	732.98	-3.41	0.28	14,455,467.88	1,693,217.94	39.80413528	-80.81199444
765.00	0.51	250.29	764.98	-3.46	0.20	14,455,467.83	1,693,217.86	39.80413514	-80.81199473
796.00	0.57	318.69	795.98	-3.39	-0.03	14,455,467.90	1,693,217.63	39.80413533	-80.81199555
827.00	0.17	262.94	826.98	-3.28	-0.18	14,455,468.01	1,693,217.48	39.80413563	-80.81199607
859.00	0.12	115.95	858.98	-3.30	-0.19	14,455,467.99	1,693,217.46	39.80413558	-80.81199614
890.00	0.43	297.71	889.98	-3.26	-0.27	14,455,468.03	1,693,217.39	39.80413569	-80.81199640
903.00	0.51	240.18	902.98	-3.26	-0.36	14,455,468.02	1,693,217.30	39.80413567	-80.81199673
981.00	1.15	244.18	980.97	-3.78	-1.37	14,455,467.51	1,693,216.29	39.80413426	-80.81200032
1,075.00	1.12	280.44	1,074.95	-4.02	-3.12	14,455,467.27	1,693,214.54	39.80413360	-80.81200656
1,170.00	1.56	345.99	1,169.93	-2.60	-4.35	14,455,468.69	1,693,213.31	39.80413752	-80.81201091
1,265.00	1.91	8.06	1,264.89	0.22	-4.44	14,455,471.51	1,693,213.22	39.80413752	-80.81201122
1,360.00	2.71	349.64	1,359.81	4.00	-4.62	14,455,475.29	1,693,213.04	39.80415564	-80.81201184
1,454.00	3.29	342.58	1,453.68	8.76	-5.83	14,455,480.05	1,693,211.83	39.80416872	-80.81201610
1,549.00	3.65	339.79	1,548.51	14.20	-7.69	14,455,485.49	1,693,209.97	39.80418367	-80.81202288
1,643.00	3.96	334.35	1,642.30	19.93	-10.13	14,455,491.22	1,693,207.53	39.80419943	-80.81203132
1,738.00	4.07	336.54	1,737.07	25.98	-12.89	14,455,497.27	1,693,204.77	39.80421606	-80.81204111
1,833.00	3.23	337.22	1,831.87	31.54	-15.27	14,455,502.83	1,693,202.39	39.80423134	-80.81204954
1,927.00	3.19	349.58	1,925.73	36.56	-16.76	14,455,507.84	1,693,200.89	39.80424512	-80.81205484
2,022.00	4.64	1.93	2,020.50	43.00	-17.11	14,455,514.28	1,693,201.13	39.80426281	-80.81205603
2,117.00	6.10	5.23	2,115.09	51.86	-16.52	14,455,523.15	1,693,201.13	39.80428716	-80.81205387
2,212.00	6.66	1.81	2,209.50	62.40	-15.89	14,455,533.68	1,693,201.77	39.80431608	-80.81205153
2,306.00	7.39	353.38	2,302.79	73.85	-16.41	14,455,545.14	1,693,201.24	39.80434754	-80.81205331
2,401.00	6.11	347.23	2,397.13	84.85	-18.24	14,455,556.14	1,693,199.42	39.80437776	-80.81205972
2,496.00	4.27	343.71	2,491.74	93.18	-20.35	14,455,564.46	1,693,197.31	39.80440064	-80.81206717
2,590.00	3.15	348.55	2,585.54	99.07	-21.84	14,455,570.35	1,693,195.82	39.80441682	-80.81207244
2,684.00	3.23	355.51	2,679.38	104.48	-22.59	14,455,571.20	1,693,195.66	39.80441916	-80.81207301
2,778.00	4.27	7.01	2,773.18	110.60	-22.37	14,455,575.77	1,693,195.07	39.80443170	-80.81207506
2,873.00	5.99	6.82	2,867.80	119.03	-21.35	14,455,581.88	1,693,195.29	39.80444949	-80.81207424
2,968.00	5.72	3.45	2,962.30	128.68	-20.47	14,455,590.32	1,693,196.31	39.80447164	-80.81207054
3,066.00	5.35	3.42	3,059.85	138.11	-20.47	14,455,599.96	1,693,197.18	39.80449813	-80.81206736
3,160.00	8.05	357.48	3,153.20	149.06	-19.93	14,455,609.40	1,693,197.75	39.80452404	-80.81206527
3,255.00	11.93	353.23	3,246.74	165.47	-21.39	14,455,636.75	1,693,196.27	39.80459917	-80.81207033
3,350.00	15.85	352.01	3,338.94	188.07	-24.35	14,455,659.36	1,693,193.31	39.80466127	-80.81208071
3,444.00	21.91	354.34	3,427.85	218.27	-27.86	14,455,689.55	1,693,189.79	39.80474421	-80.81209300
3,538.00	28.09	354.21	3,513.00	257.78	-31.83	14,455,729.06	1,693,185.83	39.80485273	-80.81210693
3,633.00	33.69	355.32	3,594.49	306.33	-36.24	14,455,777.61	1,693,181.42	39.80498609	-80.81212217
3,728.00	40.98	356.30	3,669.97	363.75	-40.41	14,455,835.04	1,693,177.25	39.80514382	-80.81213657
3,822.00	40.33	359.47	3,741.29	424.93	-42.68	14,455,896.22	1,693,174.98	39.80531185	-80.81214420
3,917.00	40.20	3.62	3,813.80	486.28	-41.03	14,455,957.57	1,693,176.63	39.80548033	-80.81213786
4,011.00	40.85	3.75	3,895.25	547.23	-37.10	14,456,018.52	1,693,180.56	39.80564770	-80.81212343
4,106.00	38.64	359.99	3,958.30	607.91	-35.07	14,456,079.20	1,693,182.59	39.80581433	-80.81211575
4,201.00	37.78	359.74	4,032.95	666.67	-35.21	14,456,137.96	1,693,182.45	39.80597570	-80.81211580



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**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:**  
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**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\_Jul2216ct\_v14 It

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (ustf)	Map Easting (ustf)	Latitude	Longitude
4,295.00	37.72	0.09	4,107.27	724.22	-35.29	14,456,195.51	1,693,182.36	39.80613374	-80.81211568
4,390.00	38.34	359.84	4,182.10	782.75	-35.33	14,456,254.04	1,693,182.33	39.80629447	-80.81211537
4,484.00	39.08	358.69	4,255.45	841.53	-36.09	14,456,312.81	1,693,181.57	39.80645590	-80.81211763
4,579.00	39.16	356.76	4,329.16	901.41	-38.47	14,456,372.70	1,693,179.19	39.80662037	-80.81212566
4,673.00	39.42	355.10	4,401.91	960.78	-42.70	14,456,432.07	1,693,174.96	39.80678345	-80.81214027
4,768.00	39.40	354.53	4,475.31	1,020.85	-48.15	14,456,492.13	1,693,169.51	39.80694843	-80.81215922
4,863.00	39.63	354.79	4,548.60	1,081.03	-53.77	14,456,552.32	1,693,163.89	39.8071374	-80.81217880
4,957.00	39.69	356.94	4,620.97	1,140.86	-58.10	14,456,612.15	1,693,159.56	39.80727808	-80.81219376
5,051.00	40.08	358.70	4,693.10	1,201.09	-60.39	14,456,672.38	1,693,157.27	39.80744350	-80.81220146
5,145.00	40.51	359.11	4,764.80	1,261.87	-61.55	14,456,733.16	1,693,156.11	39.80761042	-80.81220514
5,240.00	39.92	358.08	4,837.34	1,323.19	-63.05	14,456,794.47	1,693,154.61	39.80777882	-80.81221002
5,335.00	38.90	356.85	4,910.74	1,383.44	-65.71	14,456,854.72	1,693,151.95	39.80794430	-80.81221904
5,430.00	39.02	356.08	4,984.61	1,443.06	-69.39	14,456,914.34	1,693,148.27	39.80810805	-80.81223172
5,524.00	39.05	354.86	5,057.63	1,502.07	-74.07	14,456,973.36	1,693,143.59	39.80827015	-80.81224792
5,619.00	38.68	355.35	5,131.60	1,561.46	-79.15	14,457,032.75	1,693,138.50	39.80843328	-80.81226560
5,713.00	36.88	354.13	5,205.89	1,618.81	-84.42	14,457,090.09	1,693,133.24	39.80859079	-80.81228392
5,739.00	36.22	353.30	5,226.78	1,634.20	-86.12	14,457,105.48	1,693,131.54	39.80863306	-80.81228984
5,832.00	35.34	351.72	5,302.23	1,688.10	-93.19	14,457,159.39	1,693,124.46	39.80878115	-80.81229984
5,926.00	31.91	357.69	5,380.51	1,739.86	-98.11	14,457,211.14	1,693,119.54	39.80892331	-80.81233177
6,020.00	25.93	9.21	5,462.81	1,785.05	-95.82	14,457,256.33	1,693,121.84	39.80904739	-80.81232328
6,114.00	23.21	25.91	5,548.40	1,822.05	-84.42	14,457,293.33	1,693,133.23	39.80914894	-80.81228241
6,209.00	22.95	41.73	5,635.88	1,852.74	-63.89	14,457,324.02	1,693,153.76	39.80923710	-80.81220908
6,304.00	24.00	60.27	5,723.13	1,876.17	-34.75	14,457,347.46	1,693,182.91	39.80929330	-80.81210512
6,399.00	24.88	77.59	5,809.73	1,890.07	1.59	14,457,361.35	1,693,219.25	39.80933525	-80.81197561
6,493.00	24.84	98.33	5,895.19	1,891.46	40.52	14,457,362.74	1,693,258.17	39.80933884	-80.81183700
6,549.00	25.89	106.50	5,945.80	1,886.28	63.88	14,457,357.56	1,693,281.54	39.80933249	-80.81175383
6,588.00	27.56	113.18	5,980.64	1,880.31	80.35	14,457,351.59	1,693,298.00	39.80930799	-80.81169525
6,635.00	29.67	120.57	6,021.91	1,870.11	100.37	14,457,341.33	1,693,318.02	39.80927986	-80.81162404
6,683.00	30.90	129.35	6,063.38	1,856.24	120.14	14,457,327.53	1,693,337.79	39.80924166	-80.81155375
6,730.00	32.97	134.72	6,103.28	1,839.59	138.56	14,457,310.87	1,693,356.22	39.80919563	-80.81148826
6,777.00	36.35	137.44	6,141.93	1,820.32	157.08	14,457,291.61	1,693,374.73	39.80914281	-80.81142248
6,825.00	40.18	138.76	6,179.61	1,798.19	176.91	14,457,269.48	1,693,394.57	39.80908192	-80.81135201
6,872.00	43.69	139.55	6,214.57	1,774.43	197.45	14,457,245.72	1,693,415.10	39.80901655	-80.81127907
6,919.00	47.78	141.57	6,247.37	1,748.43	218.81	14,457,219.72	1,693,436.46	39.80894503	-80.81120321
6,966.00	52.13	143.07	6,277.60	1,719.96	240.78	14,457,191.24	1,693,458.44	39.80886669	-80.81112518
7,013.00	57.45	143.15	6,304.69	1,689.25	263.82	14,457,160.54	1,693,481.48	39.80878224	-80.81104336
7,061.00	62.24	142.63	6,328.80	1,656.17	288.86	14,457,127.45	1,693,506.52	39.80869124	-80.81095445
7,108.00	67.30	143.42	6,348.83	1,622.21	314.42	14,457,093.49	1,693,532.08	39.80859783	-80.81077106
7,155.00	72.35	144.03	6,365.03	1,586.65	340.51	14,457,057.94	1,693,558.17	39.80850033	-80.81067778
7,202.00	77.49	145.17	6,377.25	1,549.67	366.78	14,457,020.96	1,693,584.44	39.80839832	-80.81067778
7,250.00	82.33	145.53	6,385.66	1,510.81	393.64	14,456,982.09	1,693,611.30	39.80829143	-80.81058243
7,344.00	90.20	143.68	6,391.78	1,434.41	447.93	14,456,905.69	1,693,665.59	39.80808130	-80.81038969
7,439.00	89.71	143.42	6,391.86	1,357.99	504.38	14,456,829.28	1,693,722.03	39.80787112	-80.81018929
7,534.00	90.11	146.14	6,392.00	1,280.39	559.16	14,456,751.68	1,693,776.81	39.80765768	-80.80999480
7,628.00	89.54	146.14	6,392.29	1,202.33	611.53	14,456,673.62	1,693,829.19	39.80744301	-80.80980890
7,722.00	89.58	147.20	6,393.01	1,123.80	663.18	14,456,595.08	1,693,880.83	39.80722703	-80.80962560
7,817.00	89.76	147.72	6,393.56	1,043.71	714.28	14,456,515.00	1,693,931.93	39.80700680	-80.80944425
7,911.00	89.49	147.46	6,394.18	964.36	764.66	14,456,435.64	1,693,982.31	39.80678857	-80.80926547
8,006.00	89.98	149.48	6,394.62	883.39	814.33	14,456,354.67	1,694,031.99	39.80656592	-80.80908920
8,101.00	89.36	149.31	6,395.16	801.62	862.70	14,456,272.91	1,694,080.35	39.80634109	-80.80891760
8,195.00	89.19	149.39	6,396.35	720.76	910.62	14,456,192.05	1,694,128.27	39.80611874	-80.80874760
8,290.00	91.30	149.13	6,395.95	639.12	959.17	14,456,110.40	1,694,176.83	39.80589423	-80.80857533
8,385.00	91.12	149.22	6,393.94	557.55	1,007.84	14,456,028.84	1,694,225.49	39.80566995	-80.80840266
8,479.00	89.32	148.51	6,393.58	477.10	1,056.44	14,455,948.39	1,694,274.10	39.80544872	-80.80823022
8,573.00	89.01	148.07	6,394.95	397.14	1,105.84	14,455,868.43	1,694,323.50	39.80522884	-80.80805492



Survey Report - Geographic



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia  
**Site:** Woodford  
**Well:** Woodford 05HM (E)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:**  
**TVD Reference:** Well Woodford 05HM (E)  
**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\_Jul2216dt\_v14.lt

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (ustf)	Map Easting (ustf)	Latitude	Longitude
8,668.00	88.40	147.64	6,397.10	316.72	1,156.38	14,455,788.01	1,694,374.03	39.80500770	-80.80787561
8,762.00	87.69	148.07	6,400.30	237.18	1,206.36	14,455,708.47	1,694,424.02	39.80478896	-80.80769824
8,857.00	88.84	148.07	6,403.18	156.59	1,256.58	14,455,627.88	1,694,474.24	39.80456734	-80.80752004
8,952.00	88.40	148.69	6,405.47	75.72	1,306.37	14,455,547.01	1,694,524.03	39.80434495	-80.80734337
9,046.00	89.58	148.51	6,407.12	-4.50	1,355.34	14,455,466.79	1,694,572.99	39.80412436	-80.80716964
9,141.00	89.36	147.81	6,408.00	-85.20	1,405.45	14,455,386.09	1,694,623.11	39.80390244	-80.80699182
9,236.00	90.99	151.77	6,407.71	-167.28	1,453.24	14,455,304.01	1,694,670.90	39.80367674	-80.80682229
9,330.00	90.99	152.03	6,406.09	-250.19	1,497.51	14,455,221.10	1,694,715.17	39.80344880	-80.80666531
9,424.00	90.46	152.21	6,404.90	-333.27	1,541.46	14,455,138.02	1,694,759.12	39.80322037	-80.80650945
9,519.00	90.11	152.41	6,404.43	-417.31	1,585.76	14,455,053.98	1,694,803.41	39.80298930	-80.80635239
9,613.00	89.27	152.27	6,404.93	-500.56	1,629.39	14,454,970.72	1,694,847.05	39.80276040	-80.80620766
9,708.00	91.08	150.89	6,404.64	-584.19	1,674.46	14,454,887.10	1,694,892.11	39.80185619	-80.80603786
9,802.00	90.90	150.36	6,403.02	-666.09	1,720.56	14,454,805.20	1,694,938.21	39.80230529	-80.80587435
9,897.00	90.55	149.66	6,401.82	-748.36	1,768.04	14,454,722.93	1,694,985.69	39.80207906	-80.80570592
9,991.00	89.76	149.74	6,401.35	-829.41	1,815.65	14,454,641.88	1,695,033.30	39.80185619	-80.80563704
10,085.00	89.66	149.74	6,401.53	-910.50	1,863.20	14,454,560.79	1,695,080.85	39.80163323	-80.80536836
10,179.00	89.36	149.83	6,402.25	-991.72	1,910.50	14,454,479.57	1,695,128.16	39.80140987	-80.80520056
10,274.00	88.88	149.74	6,403.71	-1,073.81	1,958.31	14,454,397.48	1,695,175.96	39.80118416	-80.80486015
10,369.00	88.18	149.31	6,406.15	-1,155.66	2,006.47	14,454,315.63	1,695,224.13	39.80095910	-80.8046015
10,463.00	90.11	148.69	6,407.55	-1,236.22	2,054.88	14,454,235.07	1,695,272.53	39.80073757	-80.80436843
10,558.00	89.49	148.78	6,407.88	-1,317.42	2,104.18	14,454,153.87	1,695,321.83	39.80051427	-80.80411352
10,652.00	88.75	148.34	6,409.33	-1,397.61	2,153.21	14,454,073.68	1,695,370.86	39.80029375	-80.80433959
10,747.00	87.87	148.60	6,412.13	-1,478.55	2,202.86	14,453,992.74	1,695,420.52	39.80007117	-80.80416342
10,842.00	89.76	150.62	6,414.09	-1,560.47	2,250.91	14,453,910.82	1,695,468.56	39.79984591	-80.80399301
10,937.00	89.71	150.80	6,414.53	-1,643.32	2,297.38	14,453,827.97	1,695,515.04	39.79961809	-80.80382818
11,031.00	89.45	150.36	6,415.22	-1,725.20	2,343.56	14,453,746.09	1,695,561.21	39.79939296	-80.80366443
11,125.00	91.82	151.68	6,414.18	-1,807.42	2,389.09	14,453,663.88	1,695,606.75	39.79916889	-80.80350295
11,220.00	91.30	151.24	6,411.59	-1,890.84	2,434.46	14,453,580.45	1,695,652.12	39.79893754	-80.80334206
11,315.00	90.64	150.89	6,409.99	-1,973.97	2,480.42	14,453,497.32	1,695,698.07	39.79870891	-80.80317910
11,407.00	90.42	150.54	6,409.13	-2,054.21	2,525.42	14,453,417.08	1,695,743.07	39.79848831	-80.80301951
11,502.00	89.67	149.83	6,409.06	-2,136.63	2,572.65	14,453,334.66	1,695,790.31	39.79826167	-80.80285199
11,597.00	88.84	150.01	6,410.29	-2,218.83	2,620.26	14,453,252.46	1,695,837.92	39.79803564	-80.80268313
11,691.00	88.35	149.13	6,412.60	-2,299.86	2,667.86	14,453,171.44	1,695,885.51	39.79781284	-80.80251432
11,786.00	87.78	149.04	6,415.81	-2,381.31	2,716.64	14,453,089.98	1,695,934.29	39.79758884	-80.80234129
11,881.00	86.99	148.69	6,420.14	-2,462.54	2,765.71	14,453,008.75	1,695,983.36	39.79736546	-80.80199316
11,975.00	89.85	148.34	6,422.73	-2,542.66	2,814.78	14,452,928.63	1,696,032.43	39.79714513	-80.80181988
12,069.00	90.33	149.04	6,422.59	-2,622.97	2,863.63	14,452,848.32	1,696,081.28	39.79692428	-80.80164653
12,164.00	89.63	149.04	6,422.62	-2,704.44	2,912.50	14,452,766.85	1,696,130.15	39.79670026	-80.80147590
12,259.00	88.62	150.10	6,424.07	-2,786.34	2,960.61	14,452,684.95	1,696,178.26	39.79650504	-80.80131085
12,353.00	90.07	150.54	6,425.14	-2,868.00	3,007.15	14,452,603.29	1,696,224.80	39.79625050	-80.80114583
12,448.00	89.32	150.80	6,425.65	-2,950.82	3,053.68	14,452,520.47	1,696,271.33	39.79602277	-80.80114583
12,542.00	90.02	150.98	6,426.15	-3,032.95	3,099.41	14,452,438.35	1,696,317.06	39.79579595	-80.80098368
12,637.00	90.02	150.80	6,426.08	-3,115.95	3,145.62	14,452,355.35	1,696,363.28	39.79556873	-80.80081980
12,731.00	89.14	150.71	6,426.78	-3,197.96	3,191.55	14,452,273.33	1,696,409.20	39.79534321	-80.80065696
12,826.00	89.63	150.71	6,427.78	-3,280.81	3,238.02	14,452,190.48	1,696,455.67	39.79511540	-80.80049217
12,920.00	89.98	150.71	6,428.10	-3,362.79	3,284.01	14,452,108.50	1,696,501.66	39.79488997	-80.80032910
13,015.00	89.10	149.66	6,428.87	-3,445.21	3,331.24	14,452,026.08	1,696,548.89	39.79466333	-80.80016160
13,110.00	88.35	149.31	6,430.98	-3,527.04	3,379.46	14,451,944.26	1,696,597.11	39.79443833	-80.79999057
13,205.00	89.27	149.66	6,432.96	-3,608.86	3,427.69	14,451,862.44	1,696,645.34	39.79421303	-80.79981953
13,299.00	90.15	149.83	6,433.43	-3,690.05	3,475.05	14,451,781.24	1,696,692.70	39.79399006	-80.79965156
13,394.00	89.67	149.48	6,433.58	-3,772.04	3,523.05	14,451,699.26	1,696,740.70	39.79376461	-80.79948136
13,489.00	89.05	149.22	6,434.64	-3,853.76	3,571.47	14,451,617.53	1,696,789.12	39.79353988	-80.79930960
13,583.00	88.70	148.51	6,436.49	-3,934.20	3,620.07	14,451,537.09	1,696,837.72	39.79331866	-80.79913725
13,678.00	88.92	148.69	6,438.46	-4,015.27	3,669.55	14,451,456.02	1,696,887.20	39.79309572	-80.79896173
13,772.00	89.32	148.60	6,439.90	-4,095.54	3,718.46	14,451,375.76	1,696,936.11	39.79287499	-80.79878827



Survey Report - Geographic



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia  
**Site:** Woodford  
**Well:** Woodford 05HM (E)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:**  
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**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\_Jul2216dt\_v14.lt

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
13,867.00	89.32	149.48	6,441.03	-4,176.99	3,767.33	14,451,294.30	1,696,984.98	39.79265098	-80.79861495
13,962.00	89.10	149.83	6,442.34	-4,258.97	3,815.32	14,451,212.32	1,697,032.96	39.79242556	-80.79844476
14,057.00	88.57	149.04	6,444.27	-4,340.75	3,863.61	14,451,130.54	1,697,081.26	39.79220066	-80.79827348
14,152.00	89.41	150.71	6,445.95	-4,422.91	3,911.28	14,451,048.39	1,697,128.93	39.79197475	-80.79810443
14,246.00	88.88	150.89	6,447.35	-4,504.95	3,957.14	14,450,966.35	1,697,174.79	39.79174915	-80.79794185
14,341.00	91.25	151.24	6,447.24	-4,588.09	4,003.10	14,450,883.21	1,697,220.75	39.79152055	-80.79777891
14,436.00	90.77	150.98	6,445.57	-4,671.25	4,048.99	14,450,800.05	1,697,266.64	39.79129188	-80.79761621
14,530.00	90.15	150.80	6,444.81	-4,753.37	4,094.71	14,450,717.92	1,697,312.36	39.79106606	-80.79745408
14,625.00	89.58	150.89	6,445.04	-4,836.34	4,141.00	14,450,634.96	1,697,358.64	39.79083793	-80.79729000
14,719.00	89.27	149.92	6,445.98	-4,918.07	4,187.42	14,450,553.23	1,697,402.06	39.79061319	-80.79712540
14,814.00	88.57	149.66	6,447.77	-5,000.15	4,235.21	14,450,471.15	1,697,452.86	39.79038747	-80.79695593
14,909.00	87.82	149.31	6,450.76	-5,081.95	4,283.42	14,450,389.35	1,697,501.07	39.79016252	-80.79678496
15,004.00	88.57	150.71	6,453.75	-5,164.19	4,330.88	14,450,307.11	1,697,548.53	39.78993638	-80.79661667
15,098.00	89.58	150.80	6,455.27	-5,246.20	4,376.80	14,450,225.10	1,697,594.45	39.78971088	-80.79645388
15,193.00	89.27	150.54	6,456.22	-5,329.01	4,423.33	14,450,142.28	1,697,640.98	39.78948315	-80.79628890
15,288.00	90.24	151.59	6,456.63	-5,412.15	4,469.29	14,450,059.15	1,697,686.94	39.78925454	-80.79612596
15,382.00	90.42	152.29	6,456.09	-5,495.10	4,513.51	14,449,976.20	1,697,731.16	39.78902647	-80.79596923
15,476.00	89.58	151.85	6,456.09	-5,578.15	4,557.54	14,449,893.15	1,697,775.18	39.78879811	-80.79581317
15,571.00	89.27	150.98	6,457.04	-5,661.57	4,602.99	14,449,809.73	1,697,820.64	39.78856875	-80.79566205
15,666.00	88.84	150.62	6,458.61	-5,744.48	4,649.33	14,449,726.82	1,697,866.98	39.78834075	-80.79548776
15,760.00	89.38	150.62	6,459.58	-5,826.39	4,695.44	14,449,644.91	1,697,913.09	39.78811553	-80.79532428
15,855.00	91.30	150.89	6,458.52	-5,909.27	4,741.85	14,449,562.03	1,697,959.50	39.78788776	-80.79515975
15,950.00	89.36	150.45	6,457.97	-5,992.09	4,788.38	14,449,479.21	1,698,006.03	39.78765988	-80.79499479
16,044.00	88.66	150.62	6,459.59	-6,073.92	4,834.61	14,449,397.38	1,698,052.26	39.78743487	-80.79483088
16,139.00	87.69	150.54	6,462.62	-6,156.62	4,881.25	14,449,314.68	1,698,098.90	39.78720744	-80.79466553
16,233.00	89.85	151.24	6,464.64	-6,238.73	4,926.97	14,449,232.58	1,698,144.61	39.78698168	-80.79450348
16,328.00	89.36	150.98	6,465.29	-6,321.90	4,972.86	14,449,149.40	1,698,190.51	39.78675297	-80.79434077
16,422.00	88.84	150.54	6,466.77	-6,403.91	5,018.77	14,449,067.39	1,698,236.42	39.78652745	-80.79417801
16,517.00	90.86	150.10	6,467.02	-6,486.44	5,065.81	14,448,984.86	1,698,283.46	39.78630050	-80.79401125
16,612.00	90.42	149.57	6,465.96	-6,568.57	5,113.54	14,448,902.73	1,698,331.19	39.78607465	-80.79384201
16,706.00	89.80	149.31	6,465.78	-6,649.62	5,161.34	14,448,821.79	1,698,378.98	39.78585205	-80.79367255
16,801.00	89.01	148.87	6,466.76	-6,731.02	5,210.13	14,448,740.28	1,698,427.78	39.78562792	-80.79349951
16,895.00	88.22	148.60	6,469.03	-6,811.34	5,258.91	14,448,659.96	1,698,476.55	39.78540701	-80.79332657
16,989.00	89.19	149.66	6,471.16	-6,892.00	5,307.12	14,448,579.30	1,698,524.77	39.78518519	-80.79315559
17,084.00	91.12	150.80	6,470.90	-6,974.46	5,354.29	14,448,496.84	1,698,571.94	39.78495844	-80.79298838
17,178.00	90.68	150.62	6,469.42	-7,056.43	5,400.27	14,448,414.87	1,698,617.92	39.78473303	-80.79282538
17,273.00	90.02	150.27	6,468.84	-7,139.07	5,447.13	14,448,332.23	1,698,664.78	39.78450579	-80.79265926
17,368.00	89.27	150.62	6,469.43	-7,221.71	5,493.99	14,448,249.60	1,698,711.63	39.78427855	-80.79249315
17,462.00	88.62	150.01	6,471.16	-7,303.35	5,540.53	14,448,167.95	1,698,758.18	39.78405403	-80.79232815
17,557.00	89.85	149.48	6,472.43	-7,385.41	5,588.39	14,448,085.90	1,698,806.04	39.78382839	-80.79215846
17,652.00	90.15	148.69	6,472.43	-7,466.91	5,637.20	14,448,004.39	1,698,854.84	39.78360425	-80.79198540
17,746.00	89.41	148.87	6,472.79	-7,547.29	5,685.92	14,447,924.01	1,698,903.57	39.78338317	-80.79181264
17,851.00	88.53	148.60	6,474.68	-7,637.03	5,740.41	14,447,834.27	1,698,958.05	39.78313639	-80.79161944
<b>Survey @ 17851.00 MD 6474.68 TVD</b>									
17,911.00	88.53	148.60	6,476.22	-7,688.23	5,771.66	14,447,763.08	1,698,989.30	39.78299559	-80.79150863
<b>Survey Projected to 17911.00 MD 6476.22 TVD</b>									



**Company:**

Tug Hill Operating LLC  
Marshall County, West Virginia  
Woodford  
Woodford 05HM (E)  
Original Hole  
Surveys Original Hole

**Project:**

Wellbore:  
Design:

**Local Co-ordinate Reference:**

TVD Reference: Well Woodford 05HM (E)  
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\_Jul2216ct\_v14 It

**Design Annotations**

Measured Depth (ft)	Vertical Depth (ft)	+N/-S (ft)	Local Coordinates +E/-W (ft)	Comment
158.00	157.99	-1.16	0.57	MWD surveys
17,651.00	6,474.68	-7,637.03	5,740.41	Survey @ 17851.00 MD 6474.68 TVD
17,911.00	6,476.22	-7,688.23	5,771.66	Survey Projected to 17911.00 MD 6476.22 TVD