



TUG HILL
OPERATING

Survey Report - Geographic



Company: Tug Hill Operating LLC	Local Co-ordinate Reference: Well Heaven Hill 3-5 HM (H)
Project: Marshall County, West Virginia	TVD Reference: RKB=1326+26 @ 1352.00usft
Site: Heaven Hill 3	MD Reference: RKB=1326+26 @ 1352.00usft
Well: Heaven Hill 3-5 HM (H)	North Reference: Grid
Wellbore: Original Hole	Survey Calculation Method: Minimum Curvature
Design: Surveys Original Hole	Database: DB_Jul2216ct_v14

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

WV Department of
Environmental Protection

Site Heaven Hill 3	
Site Position: Northing: 14,457,178.77 usft	Latitude: 39.80865060
From: Lat/Long	Longitude: -80.69321360
Position Uncertainty: Easting: 1,726,571.98 usft	Grid Convergence: 0.20 °
	Slot Radius: 13-3/16 "

Well Heaven Hill 3-5 HM (H)		
Well Position +N/-S 0.00 usft	Northing: 14,457,197.78 usft	Latitude: 39.80863272
+E/W 0.00 usft	Easting: 1,726,582.97 usft	Longitude: -80.69317425
Position Uncertainty Wellhead Elevation: 0.00 usft	Ground Level: 1,326.00 usft	

Wellbore Original Hole

Magnetics Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
IGRF2015	9/18/2018	-8.74	66.87	52,037.66752881

Design Surveys Original Hole

Audit Notes:

Version: 1.0	Phase: ACTUAL	Tie On Depth: 0.00	
Vertical Section: Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
0.00	0.00	0.00	146.98

Survey Program	From (usft)	To (usft)	Date	9/27/2018	Survey (Wellbore)	Tool Name	Description
	159.00	1,153.00	MWD surf (Original Hole)		MWD	MWD - Standard	
	1,193.00	6,653.00	MWD Int (Original Hole)		MWD	MWD - Standard	
	6,729.00	17,885.00	MWD lat (Original Hole)		MWD	MWD - Standard	
	17,936.00	17,936.00	Projection (Original Hole)		CB_Film_MMS	OWSG Camera Based Film Magnetic Multi-Shot	

Survey	Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
	0.00	0.00	0.00	0.00	0.00	0.00	14,457,197.78	1,726,582.97	39.80863272	-80.69317425
	159.00	0.64	222.09	159.00	-0.66	-0.60	14,457,197.12	1,726,582.37	39.80863092	-80.69317638
MWD surveys										
	190.00	0.56	253.92	190.00	-0.83	-0.86	14,457,196.95	1,726,582.11	39.80863045	-80.69317731
	220.00	0.54	221.59	219.99	-0.98	-1.09	14,457,196.81	1,726,581.88	39.80863005	-80.69317815
	250.00	0.70	280.14	249.99	-1.05	-1.37	14,457,196.73	1,726,581.60	39.80862985	-80.69317913
	281.00	0.54	270.74	280.99	-1.01	-1.70	14,457,196.77	1,726,581.27	39.80862995	-80.69318031
	311.00	0.78	228.47	310.99	-1.15	-1.99	14,457,196.63	1,726,580.98	39.80862959	-80.69318136
	342.00	0.35	282.22	341.99	-1.30	-2.24	14,457,196.48	1,726,580.72	39.80862917	-80.69318226



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Database:

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Survey
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Table with columns: Measured Depth (usft), Inclination (°), Azimuth (°), Vertical Depth (usft), +N/S (usft), +E/W (usft), Map Northing (usft), Map Easting (usft), Latitude, Longitude. Contains 40 rows of survey data.



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Survey	Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
	4,103.00	24.89	123.05	4,031.92	-277.27	367.60	14,456,920.52	1,726,950.57	39.80786781	-80.68186869
	4,197.00	23.75	122.41	4,117.58	-296.20	400.16	14,456,899.58	1,726,983.13	39.80781002	-80.68175300
	4,292.00	23.59	125.72	4,204.59	-319.55	431.75	14,456,878.23	1,727,014.72	39.80775108	-80.68164080
	4,387.00	23.36	125.63	4,291.73	-341.82	462.49	14,456,858.16	1,727,045.46	39.80769018	-80.68153161
	4,482.00	24.54	127.10	4,378.55	-364.49	493.53	14,456,833.29	1,727,076.50	39.80762707	-80.68142135
	4,577.00	25.47	126.16	4,464.65	-388.45	525.76	14,456,809.33	1,727,108.73	39.80756098	-80.68130689
	4,671.00	26.05	126.53	4,549.30	-412.86	558.67	14,456,785.12	1,727,141.83	39.80749418	-80.68119002
	4,765.00	25.44	125.26	4,633.97	-436.60	591.74	14,456,761.18	1,727,174.71	39.80742812	-80.68107255
	4,859.00	25.21	127.30	4,718.94	-460.39	624.15	14,456,737.39	1,727,207.12	39.80736248	-80.68095744
	4,954.00	25.04	127.84	4,804.95	-484.98	658.12	14,456,712.80	1,727,239.09	39.80729484	-80.68084390
	5,049.00	26.66	128.04	4,890.44	-510.45	688.78	14,456,687.33	1,727,271.75	39.80722439	-80.68072790
	5,144.00	26.94	128.75	4,975.24	-537.05	722.35	14,456,660.73	1,727,305.32	39.80715101	-80.68060670
	5,239.00	26.78	126.00	5,059.99	-563.10	756.45	14,456,634.68	1,727,339.42	39.80707914	-80.68048760
	5,335.00	26.10	122.08	5,145.96	-587.03	791.85	14,456,610.75	1,727,374.81	39.80701309	-80.68036187
	5,429.00	23.92	123.26	5,231.14	-608.47	825.30	14,456,589.31	1,727,408.27	39.80695391	-80.68024300
	5,523.00	24.07	128.08	5,317.02	-630.75	856.33	14,456,567.04	1,727,439.30	39.80689243	-80.68013280
	5,618.00	25.64	126.48	5,403.22	-655.49	887.67	14,456,542.30	1,727,470.64	39.80682240	-80.68002150
	5,713.00	25.48	126.05	5,488.93	-680.30	920.29	14,456,517.48	1,727,503.25	39.80675574	-80.68990569
	5,806.00	25.00	125.61	5,573.05	-703.52	952.44	14,456,494.27	1,727,535.40	39.80669168	-80.68979149
	5,900.00	23.85	129.79	5,658.64	-727.25	983.19	14,456,470.54	1,727,566.16	39.80662621	-80.68969228
	5,984.00	25.17	129.87	5,744.17	-752.22	1,013.14	14,456,445.56	1,727,596.11	39.80655733	-80.68957596
	6,079.00	24.93	128.25	5,828.42	-777.04	1,043.71	14,456,420.75	1,727,626.68	39.80648890	-80.68946741
	6,161.00	25.85	126.90	5,913.34	-801.61	1,075.65	14,456,396.18	1,727,658.82	39.80642112	-80.68935396
	6,275.00	24.06	125.96	5,998.56	-825.17	1,107.55	14,456,372.82	1,727,690.52	39.80635612	-80.68924066
	6,369.00	23.63	124.74	6,084.54	-847.15	1,138.55	14,456,350.63	1,727,721.51	39.80629544	-80.68913059
	6,464.00	24.09	127.14	6,171.42	-869.71	1,169.85	14,456,328.07	1,727,752.82	39.80623320	-80.68902012
	6,559.00	25.13	128.21	6,257.79	-893.89	1,200.95	14,456,303.89	1,727,783.92	39.80616649	-80.68890895
	6,653.00	26.96	126.40	6,342.24	-918.89	1,233.79	14,456,278.90	1,727,816.76	39.80609753	-80.68879233
	6,731.00	30.10	125.00	6,410.77	-940.60	1,264.05	14,456,257.18	1,727,847.02	39.80603761	-80.68868485
	6,778.00	32.40	128.30	6,450.95	-955.17	1,283.59	14,456,242.61	1,727,866.56	39.80599741	-80.68861546
	6,825.00	34.90	132.10	6,490.07	-971.99	1,303.46	14,456,225.79	1,727,886.43	39.80595103	-80.68854494
	6,873.00	37.80	135.20	6,528.73	-991.64	1,324.07	14,456,206.14	1,727,906.99	39.80589687	-80.68847198
	6,920.00	41.10	137.70	6,565.02	-1,013.30	1,344.57	14,456,184.49	1,727,927.54	39.80583720	-80.68839906
	6,966.00	43.70	139.60	6,598.99	-1,036.59	1,365.05	14,456,161.20	1,727,948.02	39.80577305	-80.68832643
	7,013.00	46.30	140.50	6,632.22	-1,062.06	1,386.38	14,456,135.72	1,727,969.35	39.80570288	-80.68825079
	7,061.00	48.90	141.20	6,664.58	-1,089.55	1,408.75	14,456,108.23	1,727,991.72	39.80562717	-80.68817147
	7,108.00	50.10	143.90	6,695.11	-1,117.92	1,430.48	14,456,079.86	1,728,013.45	39.80554905	-80.68809447
	7,155.00	52.50	145.90	6,724.50	-1,147.94	1,451.56	14,456,049.85	1,728,034.52	39.80546643	-80.68801979
	7,202.00	54.80	148.30	6,752.36	-1,179.72	1,472.10	14,456,018.06	1,728,055.07	39.80537895	-80.68794702
	7,250.00	57.10	149.00	6,779.23	-1,213.68	1,492.79	14,455,984.10	1,728,075.76	39.80528548	-80.68787379
	7,297.00	61.30	148.60	6,803.29	-1,248.20	1,513.70	14,455,949.58	1,728,096.67	39.80519047	-80.68779976
	7,345.00	65.50	148.00	6,824.78	-1,284.71	1,536.25	14,455,913.07	1,728,119.22	39.80509000	-80.68771992
	7,393.00	68.80	148.30	6,843.41	-1,322.28	1,558.59	14,455,875.50	1,728,142.56	39.80498660	-80.68763729
	7,440.00	71.60	148.80	6,859.33	-1,360.00	1,582.96	14,455,837.78	1,728,165.63	39.80488279	-80.68755562
	7,487.00	74.00	149.60	6,873.23	-1,398.56	1,605.64	14,455,799.22	1,728,188.61	39.80477666	-80.68747425
	7,534.00	75.80	149.60	6,885.47	-1,437.70	1,628.61	14,455,760.08	1,728,211.58	39.80466896	-80.68739296
	7,581.00	77.80	149.70	6,896.21	-1,477.19	1,651.73	14,455,720.60	1,728,234.99	39.80456033	-80.68731115
	7,629.00	80.10	149.10	6,905.41	-1,517.73	1,675.71	14,455,680.05	1,728,258.67	39.80444873	-80.68722627
	7,676.00	82.40	149.20	6,912.56	-1,557.61	1,699.52	14,455,640.17	1,728,282.49	39.80433898	-80.68714196
	7,724.00	86.30	150.00	6,917.28	-1,598.80	1,723.69	14,455,598.98	1,728,306.66	39.80422583	-80.68705643
	7,755.00	87.90	151.00	6,918.85	-1,625.75	1,738.94	14,455,572.03	1,728,321.90	39.80415148	-80.68700249
	7,787.00	89.70	150.30	6,919.80	-1,653.63	1,754.91	14,455,546.15	1,728,337.58	39.80407477	-80.68694701
	7,818.00	89.80	153.40	6,920.20	-1,680.95	1,769.23	14,455,516.83	1,728,352.20	39.80399958	-80.68689529
	7,912.00	90.10	151.60	6,920.29	-1,764.33	1,812.64	14,455,433.45	1,728,395.61	39.80377019	-80.68674179
	8,007.00	89.80	147.00	6,920.37	-1,845.99	1,861.13	14,455,351.79	1,728,444.09	39.80354546	-80.68657016



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	13,206.00	90.60	149.90	6,902.02	-6,345.73	4,450.03	14,450,852.05	1,731,033.00	39.79116280	-80.67741001	
	13,300.00	90.40	147.60	6,901.20	-6,426.09	4,498.79	14,450,771.70	1,731,081.76	39.79094165	-80.67723746	
	13,395.00	90.20	148.10	6,900.71	-6,506.52	4,549.34	14,450,691.26	1,731,132.31	39.79072027	-80.67705854	
	13,490.00	91.90	150.00	6,898.97	-6,587.97	4,598.19	14,450,609.81	1,731,181.15	39.79049609	-80.67688570	
	13,584.00	91.20	151.00	6,896.42	-6,669.75	4,644.46	14,450,528.03	1,731,227.42	39.79027104	-80.67672203	
	13,679.00	90.90	150.60	6,894.68	-6,752.67	4,690.79	14,450,445.12	1,731,273.76	39.79004288	-80.67655814	
	13,773.00	90.50	150.70	6,893.53	-6,834.59	4,736.86	14,450,363.19	1,731,319.83	39.78981743	-80.67639519	
	13,868.00	89.90	149.30	6,893.20	-6,916.86	4,784.36	14,450,280.92	1,731,367.33	39.78959102	-80.67622717	
	13,963.00	90.40	150.70	6,892.95	-6,999.13	4,831.86	14,450,198.65	1,731,414.83	39.78936462	-80.67605914	
	14,058.00	90.30	151.40	6,892.37	-7,082.26	4,877.84	14,450,115.52	1,731,460.81	39.78913587	-80.67589652	
	14,153.00	89.80	152.30	6,892.29	-7,166.02	4,922.66	14,450,031.76	1,731,505.63	39.78890540	-80.67573806	
	14,248.00	90.40	152.20	6,892.12	-7,250.10	4,966.90	14,449,947.69	1,731,549.86	39.78867407	-80.67558168	
	14,342.00	91.30	150.90	6,890.73	-7,332.57	5,011.96	14,449,865.21	1,731,594.93	39.78844712	-80.67542233	
	14,436.00	90.80	150.30	6,889.01	-7,414.29	5,058.38	14,449,783.49	1,731,641.35	39.78822223	-80.67525814	
	14,532.00	90.50	149.90	6,887.92	-7,497.51	5,106.23	14,449,700.27	1,731,689.20	39.78799322	-80.67508887	
	14,625.00	89.00	150.10	6,888.32	-7,578.05	5,152.73	14,449,619.74	1,731,735.70	39.78777158	-80.67492439	
	14,720.00	89.00	150.40	6,889.98	-7,660.51	5,199.86	14,449,537.27	1,731,782.83	39.78754464	-80.67475768	
	14,815.00	88.80	150.20	6,891.81	-7,743.02	5,246.92	14,449,454.77	1,731,829.89	39.78731759	-80.67459122	
	14,910.00	88.90	148.50	6,893.71	-7,824.73	5,295.34	14,449,373.06	1,731,878.31	39.78709272	-80.67441993	
	15,003.00	89.10	149.80	6,895.34	-7,904.55	5,343.02	14,449,293.23	1,731,925.99	39.78687301	-80.67425123	
	15,098.00	89.50	149.80	6,896.51	-7,987.02	5,391.31	14,449,210.26	1,731,974.28	39.78664469	-80.67408042	
	15,194.00	90.40	150.90	6,896.59	-8,070.58	5,438.30	14,449,127.71	1,732,021.27	39.78641749	-80.67391420	
	15,287.00	90.20	150.70	6,896.10	-8,151.26	5,483.67	14,449,046.53	1,732,068.64	39.78619410	-80.67375375	
	15,380.00	89.30	151.30	6,896.51	-8,232.59	5,528.76	14,448,965.19	1,732,111.73	39.78597027	-80.67359432	
	15,475.00	90.90	151.00	6,896.43	-8,315.80	5,574.60	14,448,881.98	1,732,157.57	39.78574131	-80.67343223	
	15,569.00	90.50	150.70	6,895.36	-8,397.89	5,620.38	14,448,799.89	1,732,203.35	39.78551541	-80.67327032	
	15,663.00	90.10	150.00	6,894.87	-8,479.58	5,666.88	14,448,718.20	1,732,249.85	39.78529060	-80.67310586	
	15,757.00	89.90	149.80	6,894.87	-8,560.90	5,714.03	14,448,636.88	1,732,296.99	39.78506679	-80.67293911	
	15,852.00	88.70	150.90	6,896.03	-8,643.29	5,761.31	14,448,554.49	1,732,344.27	39.78484006	-80.67277189	
	15,947.00	88.60	150.30	6,896.27	-8,725.87	5,808.22	14,448,471.91	1,732,391.19	39.78461281	-80.67260598	
	16,042.00	87.90	150.20	6,901.17	-8,808.31	5,855.34	14,448,389.47	1,732,438.30	39.78438593	-80.67243933	
	16,136.00	88.80	149.90	6,903.87	-8,889.72	5,902.24	14,448,308.06	1,732,485.21	39.78416188	-80.67227342	
	16,231.00	89.50	150.30	6,905.28	-8,972.07	5,949.60	14,448,225.71	1,732,532.56	39.78393592	-80.67210594	
	16,326.00	91.30	153.10	6,904.62	-9,055.70	5,994.63	14,448,142.08	1,732,577.60	39.78370514	-80.67194674	
	16,420.00	90.80	151.20	6,902.90	-9,138.80	6,038.53	14,448,058.99	1,732,621.50	39.78347650	-80.67179155	
	16,515.00	90.20	150.70	6,902.07	-9,221.84	6,084.66	14,447,975.94	1,732,667.63	39.78324797	-80.67162845	
	16,609.00	89.50	150.60	6,902.32	-9,303.77	6,130.73	14,447,894.01	1,732,713.70	39.78302250	-80.67146552	
	16,704.00	89.50	150.60	6,903.14	-9,386.54	6,177.36	14,447,811.25	1,732,760.33	39.78279474	-80.67130061	
	16,799.00	89.40	149.10	6,904.06	-9,468.88	6,225.08	14,447,729.10	1,732,808.04	39.78256868	-80.67113185	
	16,893.00	89.80	148.80	6,904.71	-9,549.21	6,273.56	14,447,648.58	1,732,856.53	39.78234704	-80.67096034	
	16,988.00	89.20	149.70	6,905.54	-9,630.85	6,322.13	14,447,566.94	1,732,905.10	39.78212235	-80.67078852	
	17,083.00	89.90	149.60	6,907.12	-9,712.82	6,370.12	14,447,484.97	1,732,953.09	39.78189875	-80.67061876	
	17,177.00	88.60	148.40	6,909.17	-9,793.37	6,418.52	14,447,404.41	1,733,001.49	39.78167505	-80.67044754	
	17,272.00	88.60	149.00	6,911.49	-9,874.52	6,467.86	14,447,323.26	1,733,050.83	39.78145169	-80.67027298	
	17,366.00	88.70	149.30	6,913.70	-9,955.20	6,516.05	14,447,242.59	1,733,099.02	39.78122964	-80.67010251	
	17,461.00	89.80	150.90	6,914.95	-10,037.54	6,563.40	14,447,160.24	1,733,146.37	39.78100302	-80.66993506	
	17,556.00	89.40	151.10	6,915.61	-10,120.63	6,609.46	14,447,077.16	1,733,192.43	39.78077438	-80.66977222	
	17,650.00	88.80	150.90	6,917.09	-10,202.83	6,655.02	14,446,994.95	1,733,237.99	39.78054817	-80.66961111	
	17,745.00	88.00	151.10	6,919.74	-10,285.69	6,701.06	14,446,911.90	1,733,284.03	39.78031961	-80.66944894	
	17,839.00	87.60	150.20	6,923.35	-10,367.76	6,747.10	14,446,830.02	1,733,330.07	39.78009430	-80.66928554	
	17,885.00	87.20	150.40	6,925.43	-10,407.87	6,769.87	14,446,790.11	1,733,352.84	39.77998445	-80.66920503	
	Survey @ 17885.00 MD 6925.40 TVD				-10,451.97	6,795.03	14,446,745.82	1,733,378.00			
	17,936.00	87.20	150.40	6,927.93	-10,451.97	6,795.03	14,446,745.82	1,733,378.00			
	Survey projected to 17936.00 MD 6927.89 TVD										



Company: Tug Hill Operating LLC	Well Heaven Hill 3-5 HM (H)
Project: Marshall County, West Virginia	RKB=1326+26 @ 1352.00usft
Site: Heaven Hill 3	RKB=1326+26 @ 1352.00usft
Well: Heaven Hill 3-5 HM (H)	Grid
Wellbore: Original Hole	Minimum Curvature
Design: Surveys Original Hole	DB_Jul2216ct_v14

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JUL 10 2020

Local Co-ordinate Reference:
TVD Reference:
MD Reference:
North Reference:
Survey Calculation Method:
Database:

WV Department of
Environmental Protection

Design Annotations	Measured Depth (usft)	Vertical Depth (usft)	+N/-S (usft)	Local Coordinates +E/-W (usft)	Comment
	159.00	159.00	-0.66	-0.60	MWD surveys
	17,885.00	6,925.43	-10,407.67	6,769.87	Survey @ 17885.00 MD 6925.40 TVD
	17,936.00	6,927.93	-10,451.97	6,795.03	Survey projected to 17936.00 MD 6927.89 TVD