



SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Annotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	3233.00	0.00	0.00	3233.00	0.00	0.00	0.00	0.00	0.00	KOP Begin 1°/100' build
3	3533.00	3.00	135.00	3532.86	-5.55	5.55	1.00	135.00	-6.72	Begin 3.00° tangent
4	4333.00	3.00	135.00	4331.77	-35.16	35.16	0.00	0.00	-42.57	Begin 2°/100' build/turn
5	4473.39	5.00	105.50	4471.82	-39.39	43.65	2.00	-61.18	-48.72	
6	6341.68	5.00	105.50	6333.00	-82.91	200.56	0.00	0.00	-128.61	Begin 2°/100' build/turn
7	7091.68	20.00	105.50	7063.13	-126.16	356.54	2.00	0.00	-208.03	Begin 20.00° tangent
8	10280.88	20.00	105.50	10060.00	-417.66	1407.64	0.00	0.00	-743.24	Casing @ 10060 TVD
9	10340.88	20.00	105.50	10116.38	-423.14	1427.42	0.00	0.00	-753.30	Begin 8.46°/100' build/turn
10	10686.38	48.02	89.26	10400.45	-437.59	1616.90	8.46	-25.19	-812.80	Begin 8.46°/100' build/turn
11	11841.84	71.00	329.11	11171.93	199.38	1817.02	8.46	-124.39	-242.46	Begin 8°/100' build/turn
12	12091.84	91.00	329.11	11210.84	410.20	1690.89	8.00	0.00	-7.53	Begin 91.00° lateral
13	18041.84	91.00	329.11	11107.00	5515.44	-1363.32	0.00	0.00	5681.44	PBHL/TD 18041.84 MD 11107.00 TVD

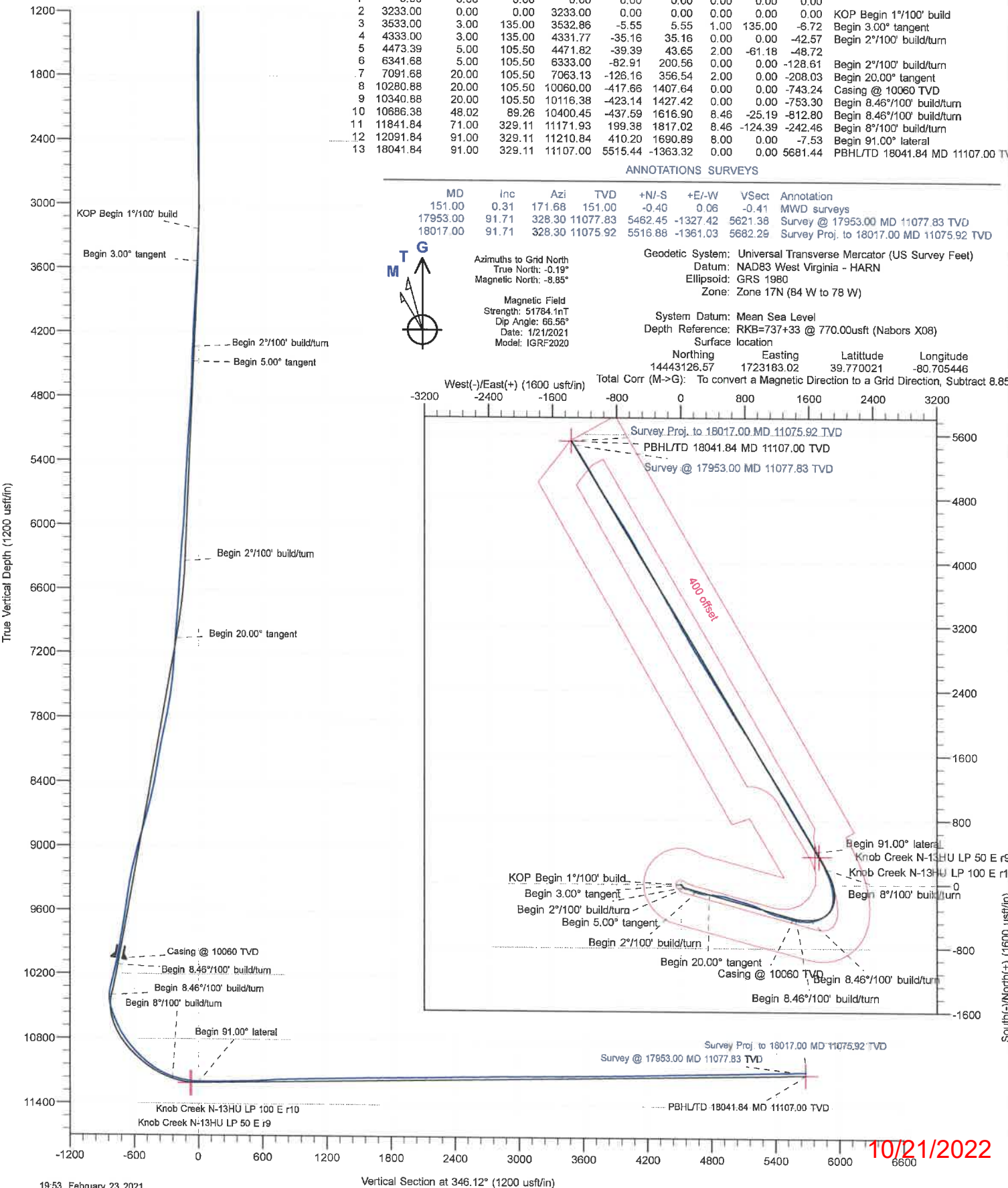
ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
151.00	0.31	171.68	151.00	-0.40	0.06	-0.41	MWD surveys
17953.00	91.71	328.30	11077.83	5462.45	-1327.42	5621.38	Survey @ 17953.00 MD 11077.83 TVD
18017.00	91.71	328.30	11075.92	5516.88	-1361.03	5682.29	Survey Proj. to 18017.00 MD 11075.92 TVD

Geodetic System: Universal Transverse Mercator (US Survey Feet)
Datum: NAD83 West Virginia - HARN
Ellipsoid: GRS 1980
Zone: Zone 17N (84 W to 78 W)

Magnetic Field
Strength: 51784.1nT
Dip Angle: 66.56°
Date: 1/21/2021
Model: IGRF2020

System Datum: Mean Sea Level
Depth Reference: RKB=737+33 @ 770.00usft (Nabors X08)
Surface location
Northing: 14443126.57 Easting: 1723183.02 Latitude: 39.770021 Longitude: -80.705446
Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.85



10/21/2022

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

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

Site	Knob Creek				
Site Position:		Northing:	14,443,053.74 usft	Latitude:	39.769822
From:	Lat/Long	Easting:	1,723,120.29 usft	Longitude:	-80.705670
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "		

Well	Knob Creek N-13HU (slot L)					
Well Position	+N/-S	0.00 usft	Northing:	14,443,126.57 usft	Latitude:	39.770021
	+E/-W	0.00 usft	Easting:	1,723,183.01 usft	Longitude:	-80.705446
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	737.00 usft
Grid Convergence:		0.19 °				

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination	Dip Angle	Field Strength
			(°)	(°)	(nT)
	IGRF2020	1/21/2021	-8.66	66.56	51,784.09641958

Design	Surveys Original Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction	
	(usft)	(usft)	(usft)	(°)	
	0.00	0.00	0.00	346.12	

Survey Program	Date	2/23/2021			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
151.00	514.00	MWD surf (Original Hole)	MWD	MWD - Standard	
610.00	2,246.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,303.00	10,205.00	MWD int2 (Original Hole)	MWD	MWD - Standard	
10,270.00	17,953.00	MWD lat (Original Hole)	MWD	MWD - Standard	
18,017.00	18,017.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
151.00	0.31	171.68	151.00	-0.40	0.06	-0.41	0.21	0.21	0.00	
MWD surveys										
243.00	0.62	81.15	243.00	-0.57	0.59	-0.70	0.76	0.34	-98.40	
273.00	0.62	81.15	273.00	-0.52	0.91	-0.73	0.00	0.00	0.00	
304.00	0.62	81.15	303.99	-0.47	1.24	-0.76	0.00	0.00	0.00	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
335.00	0.57	91.08	334.99	-0.45	1.56	-0.81	0.37	-0.16	32.03
365.00	0.62	105.94	364.99	-0.50	1.86	-0.93	0.54	0.17	49.53
396.00	0.62	114.64	395.99	-0.61	2.18	-1.12	0.30	0.00	28.06
427.00	0.62	112.18	426.99	-0.75	2.49	-1.32	0.09	0.00	-7.94
457.00	0.53	104.70	456.99	-0.84	2.77	-1.48	0.39	-0.30	-24.93
488.00	0.62	119.29	487.98	-0.96	3.06	-1.67	0.55	0.29	47.06
514.00	1.10	107.34	513.98	-1.10	3.42	-1.89	1.96	1.85	-45.96
610.00	0.79	109.89	609.97	-1.60	4.92	-2.74	0.33	-0.32	2.66
700.00	0.83	114.72	699.96	-2.09	6.09	-3.49	0.09	0.04	5.37
794.00	0.88	97.41	793.95	-2.47	7.43	-4.18	0.28	0.05	-18.41
889.00	0.70	97.85	888.94	-2.64	8.73	-4.66	0.19	-0.19	0.46
983.00	0.75	110.42	982.93	-2.93	9.87	-5.21	0.18	0.05	13.37
1,077.00	0.79	122.19	1,076.92	-3.49	11.00	-6.03	0.17	0.04	12.52
1,170.00	0.66	141.88	1,169.92	-4.25	11.87	-6.98	0.30	-0.14	21.17
1,264.00	0.57	158.76	1,263.91	-5.12	12.37	-7.94	0.21	-0.10	17.96
1,358.00	0.75	159.64	1,357.90	-6.13	12.76	-9.01	0.19	0.19	0.94
1,453.00	0.53	187.15	1,452.90	-7.15	12.92	-10.04	0.39	-0.23	28.96
1,547.00	0.83	182.22	1,546.89	-8.26	12.84	-11.10	0.32	0.32	-5.24
1,641.00	0.62	183.28	1,640.88	-9.45	12.78	-12.24	0.22	-0.22	1.13
1,735.00	0.31	32.55	1,734.88	-9.74	12.89	-12.55	0.96	-0.33	-160.35
1,830.00	0.70	38.52	1,829.88	-9.07	13.39	-12.02	0.41	0.41	6.28
1,925.00	1.01	40.46	1,924.87	-7.98	14.29	-11.18	0.33	0.33	2.04
2,019.00	1.67	28.15	2,018.84	-6.14	15.48	-9.68	0.76	0.70	-13.10
2,113.00	0.83	340.95	2,112.82	-4.29	15.90	-7.98	1.34	-0.89	-50.21
2,207.00	1.36	294.55	2,206.81	-3.18	14.67	-6.61	1.05	0.56	-49.36
2,246.00	1.45	270.55	2,245.79	-2.99	13.75	-6.20	1.51	0.23	-61.54
2,303.00	1.54	275.04	2,302.77	-2.91	12.27	-5.77	0.26	0.16	7.88
2,397.00	2.11	268.88	2,396.73	-2.83	9.28	-4.98	0.64	0.61	-6.55
2,491.00	1.71	277.50	2,490.67	-2.69	6.16	-4.08	0.52	-0.43	9.17
2,585.00	1.32	285.67	2,584.64	-2.21	3.73	-3.04	0.47	-0.41	8.69
2,679.00	1.67	298.68	2,678.61	-1.26	1.48	-1.58	0.52	0.37	13.84
2,774.00	1.45	301.84	2,773.57	0.04	-0.75	0.22	0.25	-0.23	3.33
2,868.00	1.23	337.88	2,867.55	1.60	-2.14	2.07	0.91	-0.23	38.34
2,962.00	1.49	33.95	2,961.53	3.55	-1.84	3.89	1.38	0.28	59.65
3,056.00	1.41	102.24	3,055.50	4.32	-0.03	4.20	1.73	-0.09	72.65
3,150.00	2.15	103.83	3,149.46	3.65	2.81	2.87	0.79	0.79	1.69
3,244.00	2.37	124.13	3,243.39	2.14	6.13	0.61	0.88	0.23	21.60
3,338.00	2.64	139.51	3,337.30	-0.60	9.15	-2.78	0.77	0.29	16.36
3,432.00	3.25	145.84	3,431.17	-4.45	12.05	-7.21	0.73	0.65	6.73
3,526.00	3.69	148.12	3,525.00	-9.22	15.14	-12.59	0.49	0.47	2.43
3,622.00	3.43	146.54	3,620.81	-14.24	18.36	-18.23	0.29	-0.27	-1.65
3,717.00	3.21	139.25	3,715.66	-18.63	21.66	-23.28	0.50	-0.23	-7.67
3,810.00	3.82	142.85	3,808.48	-23.07	25.23	-28.45	0.70	0.66	3.87
3,903.00	3.52	139.33	3,901.29	-27.70	28.96	-33.84	0.40	-0.32	-3.78

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Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
3,997.00	3.69	136.35	3,995.10	-32.08	32.93	-39.04	0.27	0.18	-3.17
4,091.00	3.78	136.43	4,088.90	-36.52	37.16	-44.36	0.10	0.10	0.09
4,184.00	3.25	134.06	4,181.73	-40.57	41.16	-49.26	0.59	-0.57	-2.55
4,279.00	3.34	135.20	4,276.57	-44.41	45.05	-53.92	0.12	0.09	1.20
4,373.00	3.47	126.94	4,370.41	-48.06	49.25	-58.47	0.54	0.14	-8.79
4,467.00	3.38	117.62	4,464.24	-51.05	53.98	-62.51	0.60	-0.10	-9.91
4,561.00	3.30	97.67	4,558.08	-52.70	59.12	-65.34	1.23	-0.09	-21.22
4,655.00	4.22	86.42	4,651.88	-52.84	65.25	-66.95	1.25	0.98	-11.97
4,750.00	5.49	93.63	4,746.54	-52.91	73.27	-68.95	1.48	1.34	7.59
4,844.00	7.21	102.07	4,839.96	-54.43	83.53	-72.88	2.08	1.83	8.98
4,939.00	8.17	109.63	4,934.11	-57.95	95.72	-79.22	1.47	1.01	7.96
5,034.00	7.69	114.11	5,028.20	-62.81	107.88	-86.86	0.82	-0.51	4.72
5,128.00	6.59	114.90	5,121.47	-67.65	118.51	-94.11	1.17	-1.17	0.84
5,222.00	5.76	112.79	5,214.92	-71.75	127.75	-100.30	0.92	-0.88	-2.24
5,317.00	5.45	107.78	5,309.47	-74.97	136.45	-105.52	0.61	-0.33	-5.27
5,411.00	5.49	108.92	5,403.04	-77.79	144.95	-110.29	0.12	0.04	1.21
5,505.00	5.41	113.05	5,496.62	-80.99	153.28	-115.39	0.43	-0.09	4.39
5,599.00	5.05	121.23	5,590.23	-84.87	160.90	-120.99	0.88	-0.38	8.70
5,693.00	4.70	120.26	5,683.89	-88.95	167.76	-126.60	0.38	-0.37	-1.03
5,787.00	4.66	103.12	5,777.58	-91.76	174.81	-131.02	1.48	-0.04	-18.23
5,880.00	6.02	100.05	5,870.17	-93.47	183.29	-134.71	1.49	1.46	-3.30
5,974.00	7.82	106.46	5,963.49	-96.14	194.28	-139.94	2.08	1.91	6.82
6,069.00	9.27	112.18	6,057.43	-100.86	207.56	-147.71	1.77	1.53	6.02
6,163.00	8.26	110.86	6,150.33	-106.12	220.88	-156.01	1.10	-1.07	-1.40
6,258.00	7.08	106.02	6,244.48	-110.17	232.89	-162.82	1.41	-1.24	-5.09
6,356.00	7.38	104.09	6,341.70	-113.37	244.79	-168.78	0.39	0.31	-1.97
6,450.00	8.22	101.72	6,434.83	-116.20	257.23	-174.52	0.96	0.89	-2.52
6,543.00	9.32	99.08	6,526.74	-118.74	271.18	-180.33	1.26	1.18	-2.84
6,636.00	9.98	94.07	6,618.43	-120.50	286.65	-185.75	1.15	0.71	-5.39
6,731.00	11.03	94.51	6,711.83	-121.80	303.92	-191.15	1.11	1.11	0.46
6,824.00	13.23	96.97	6,802.75	-123.79	323.36	-197.75	2.43	2.37	2.65
6,917.00	12.35	95.39	6,893.44	-126.02	343.82	-204.82	1.02	-0.95	-1.70
7,011.00	13.54	94.07	6,985.05	-127.74	364.81	-211.53	1.30	1.27	-1.40
7,104.00	11.87	91.43	7,075.77	-128.76	385.23	-217.41	1.90	-1.80	-2.84
7,199.00	12.35	94.42	7,168.66	-129.78	405.13	-223.18	0.83	0.51	3.15
7,327.00	13.10	94.16	7,293.52	-131.89	433.24	-231.97	0.59	0.59	-0.20
7,387.00	13.62	94.60	7,351.89	-132.95	447.07	-236.31	0.88	0.87	0.73
7,480.00	15.64	96.97	7,441.87	-135.35	470.43	-244.25	2.26	2.17	2.55
7,573.00	18.46	99.26	7,530.78	-139.24	497.41	-254.50	3.12	3.03	2.46
7,667.00	20.87	102.95	7,619.29	-145.39	528.42	-267.91	2.88	2.56	3.93
7,762.00	21.93	104.44	7,707.74	-153.61	562.09	-283.96	1.25	1.12	1.57
7,856.00	21.84	105.85	7,794.97	-162.76	595.91	-300.96	0.57	-0.10	1.50
7,950.00	21.88	106.45	7,882.21	-172.49	629.53	-318.47	0.24	0.04	0.64

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Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
8,044.00	22.32	107.43	7,969.30	-182.80	663.36	-336.59	0.61	0.47	1.04
8,138.00	20.87	106.64	8,056.70	-192.94	696.43	-354.37	1.57	-1.54	-0.84
8,232.00	18.06	106.11	8,145.32	-201.78	726.48	-370.16	3.00	-2.99	-0.56
8,327.00	17.36	105.67	8,235.82	-209.70	754.27	-384.51	0.75	-0.74	-0.46
8,421.00	19.86	105.67	8,324.90	-217.80	783.15	-399.31	2.66	2.66	0.00
8,515.00	21.31	106.29	8,412.89	-226.90	814.92	-415.77	1.56	1.54	0.66
8,609.00	23.55	106.46	8,499.78	-237.01	849.33	-433.84	2.38	2.38	0.18
8,703.00	24.17	110.51	8,585.75	-249.08	885.37	-454.20	1.86	0.66	4.31
8,797.00	24.39	112.53	8,671.44	-263.26	921.32	-476.59	0.91	0.23	2.15
8,891.00	24.21	113.67	8,757.11	-278.43	956.90	-499.85	0.53	-0.19	1.21
8,986.00	24.30	115.69	8,843.72	-294.73	992.36	-524.18	0.88	0.09	2.13
9,080.00	22.76	116.39	8,929.90	-311.19	1,026.08	-548.25	1.67	-1.64	0.74
9,174.00	21.88	116.04	9,016.86	-326.97	1,058.10	-571.25	0.95	-0.94	-0.37
9,269.00	21.75	115.96	9,105.06	-342.44	1,089.83	-593.88	0.14	-0.14	-0.08
9,362.00	21.05	111.56	9,191.65	-356.12	1,120.86	-614.61	1.88	-0.75	-4.73
9,456.00	19.73	109.19	9,279.76	-367.54	1,151.55	-633.05	1.66	-1.40	-2.52
9,549.00	17.67	107.17	9,367.85	-376.87	1,179.86	-648.90	2.32	-2.22	-2.17
9,643.00	18.02	103.04	9,457.33	-384.36	1,207.66	-662.84	1.40	0.37	-4.39
9,736.00	17.97	101.45	9,545.78	-390.46	1,235.73	-675.49	0.53	-0.05	-1.71
9,829.00	18.28	103.12	9,634.17	-396.62	1,264.00	-688.25	0.65	0.33	1.80
9,923.00	18.72	104.88	9,723.31	-403.84	1,292.93	-702.20	0.76	0.47	1.87
10,017.00	18.98	104.62	9,812.27	-411.57	1,322.30	-716.76	0.29	0.28	-0.28
10,110.00	17.75	104.00	9,900.53	-418.81	1,350.69	-730.60	1.34	-1.32	-0.67
10,205.00	18.06	108.84	9,990.93	-427.07	1,378.68	-745.33	1.60	0.33	5.09
10,270.00	19.61	109.45	10,052.45	-433.96	1,398.50	-756.77	2.40	2.38	0.94
10,317.00	23.74	105.06	10,096.12	-439.05	1,415.09	-765.69	9.43	8.79	-9.34
10,364.00	29.19	102.77	10,138.18	-444.04	1,435.41	-775.42	11.80	11.60	-4.87
10,411.00	32.98	99.43	10,178.43	-448.67	1,459.22	-785.62	8.86	8.06	-7.11
10,458.00	35.61	96.79	10,217.26	-452.39	1,485.43	-795.52	6.43	5.60	-5.62
10,505.00	37.81	93.45	10,254.94	-454.87	1,513.41	-804.64	6.32	4.68	-7.11
10,552.00	40.10	92.05	10,291.48	-456.28	1,542.92	-813.09	5.22	4.87	-2.98
10,599.00	43.88	89.06	10,326.41	-456.56	1,574.35	-820.89	9.10	8.04	-6.36
10,646.00	46.96	84.14	10,359.41	-454.53	1,607.74	-826.94	9.92	6.55	-10.47
10,694.00	48.63	80.45	10,391.66	-449.75	1,642.96	-830.75	6.67	3.48	-7.69
10,741.00	48.98	75.00	10,422.63	-442.24	1,677.49	-831.73	8.76	0.74	-11.60
10,788.00	47.57	69.20	10,453.92	-431.48	1,710.85	-829.30	9.68	-3.00	-12.34
10,835.00	45.55	64.45	10,486.25	-418.08	1,742.21	-823.81	8.50	-4.30	-10.11
10,882.00	44.23	61.46	10,519.55	-403.01	1,771.75	-816.27	5.30	-2.81	-6.36
10,929.00	42.91	56.01	10,553.61	-386.23	1,799.43	-806.62	8.47	-2.81	-11.60
10,977.00	41.77	47.75	10,589.12	-366.33	1,824.84	-793.39	11.82	-2.38	-17.21
11,024.00	37.02	42.65	10,625.44	-345.38	1,846.03	-778.14	12.22	-10.11	-10.85
11,070.00	35.09	35.27	10,662.65	-324.39	1,863.05	-761.84	10.33	-4.20	-16.04
11,117.00	34.12	27.71	10,701.35	-301.68	1,876.99	-743.14	9.36	-2.06	-16.09

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
11,164.00	34.38	19.28	10,740.22	-277.47	1,887.51	-722.16	10.10	0.55	-17.94
11,211.00	36.32	12.60	10,778.57	-251.34	1,894.93	-698.58	9.20	4.13	-14.21
11,258.00	38.16	7.15	10,815.99	-223.34	1,899.77	-672.56	8.03	3.91	-11.60
11,305.00	40.01	3.28	10,852.48	-193.85	1,902.45	-644.56	6.51	3.94	-8.23
11,351.00	42.03	359.76	10,887.19	-163.68	1,903.23	-615.46	6.67	4.39	-7.65
11,398.00	43.00	357.30	10,921.83	-131.93	1,902.41	-584.45	4.09	2.06	-5.23
11,445.00	45.11	353.96	10,955.61	-99.36	1,899.90	-552.22	6.68	4.49	-7.11
11,492.00	48.10	350.45	10,987.91	-65.54	1,895.24	-518.27	8.36	6.36	-7.47
11,539.00	51.35	348.16	11,018.29	-30.31	1,888.57	-482.48	7.85	6.91	-4.87
11,586.00	54.96	345.88	11,046.47	6.32	1,880.11	-444.88	8.61	7.68	-4.85
11,633.00	57.86	342.89	11,072.47	44.01	1,869.56	-405.76	8.13	6.17	-6.36
11,680.00	61.38	339.72	11,096.24	82.40	1,856.55	-365.37	9.48	7.49	-6.74
11,727.00	63.93	336.91	11,117.83	121.18	1,841.12	-324.02	7.59	5.43	-5.98
11,772.00	67.45	336.21	11,136.36	158.80	1,824.80	-283.59	7.95	7.82	-1.56
11,822.00	71.75	336.03	11,153.78	201.64	1,805.83	-237.45	8.61	8.60	-0.36
11,869.00	75.97	334.80	11,166.84	242.68	1,787.05	-193.10	9.32	8.98	-2.62
11,916.00	78.09	332.69	11,177.39	283.75	1,766.79	-148.37	6.28	4.51	-4.49
11,963.00	79.84	330.41	11,186.39	324.31	1,744.81	-103.72	6.04	3.72	-4.85
12,011.00	82.57	329.53	11,193.73	365.37	1,721.07	-58.17	5.97	5.69	-1.83
12,105.00	90.84	329.18	11,199.13	446.04	1,673.28	31.61	8.81	8.80	-0.37
12,199.00	91.28	329.88	11,197.39	527.04	1,625.62	121.68	0.88	0.47	0.74
12,293.00	91.01	329.70	11,195.51	608.26	1,578.33	211.87	0.35	-0.29	-0.19
12,388.00	90.48	329.53	11,194.27	690.20	1,530.29	302.95	0.59	-0.56	-0.18
12,482.00	90.75	329.35	11,193.27	771.14	1,482.50	392.99	0.35	0.29	-0.19
12,577.00	92.33	328.83	11,190.71	852.62	1,433.71	483.79	1.75	1.66	-0.55
12,670.00	94.26	330.06	11,185.37	932.56	1,386.52	572.72	2.46	2.08	1.32
12,764.00	92.77	328.83	11,179.60	1,013.36	1,338.82	662.60	2.05	-1.59	-1.31
12,858.00	92.59	328.65	11,175.21	1,093.62	1,290.10	752.21	0.27	-0.19	-0.19
12,952.00	92.07	328.83	11,171.39	1,173.91	1,241.36	841.84	0.59	-0.55	0.19
13,046.00	91.45	328.65	11,168.50	1,254.22	1,192.60	931.51	0.69	-0.66	-0.19
13,140.00	90.66	329.00	11,166.77	1,334.63	1,143.95	1,021.24	0.92	-0.84	0.37
13,234.00	91.98	329.00	11,164.60	1,415.18	1,095.55	1,111.05	1.40	1.40	0.00
13,328.00	91.71	328.30	11,161.58	1,495.42	1,046.67	1,200.67	0.80	-0.29	-0.74
13,422.00	91.28	328.47	11,159.13	1,575.44	997.42	1,290.17	0.49	-0.46	0.18
13,516.00	90.84	328.65	11,157.39	1,655.63	948.39	1,379.77	0.51	-0.47	0.19
13,610.00	90.48	328.65	11,156.30	1,735.90	899.49	1,469.43	0.38	-0.38	0.00
13,704.00	91.63	327.60	11,154.57	1,815.71	849.86	1,558.81	1.66	1.22	-1.12
13,798.00	91.28	327.60	11,152.19	1,895.05	799.51	1,647.92	0.37	-0.37	0.00
13,892.00	90.48	326.72	11,150.74	1,974.01	748.54	1,736.81	1.27	-0.85	-0.94
13,986.00	90.04	326.89	11,150.32	2,052.67	697.08	1,825.51	0.50	-0.47	0.18
14,080.00	90.92	328.47	11,149.53	2,132.10	646.83	1,914.68	1.92	0.94	1.68
14,174.00	90.48	328.83	11,148.38	2,212.37	597.93	2,004.34	0.60	-0.47	0.38
14,268.00	91.01	328.47	11,147.16	2,292.64	549.02	2,093.99	0.68	0.56	-0.38
14,362.00	90.40	327.77	11,146.00	2,372.46	499.38	2,183.38	0.99	-0.65	-0.74

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
14,456.00	91.71	328.30	11,144.27	2,452.19	449.63	2,272.72	1.50	1.39	0.56	
14,551.00	91.80	328.30	11,141.36	2,532.98	399.73	2,363.12	0.09	0.09	0.00	
14,645.00	91.19	328.65	11,138.91	2,613.08	350.60	2,452.67	0.75	-0.65	0.37	
14,739.00	90.75	328.65	11,137.32	2,693.34	301.70	2,542.32	0.47	-0.47	0.00	
14,832.00	91.01	329.00	11,135.89	2,772.90	253.57	2,631.11	0.47	0.28	0.38	
14,927.00	90.92	328.65	11,134.29	2,854.17	204.40	2,721.80	0.38	-0.09	-0.37	
15,020.00	90.40	328.47	11,133.22	2,933.51	155.89	2,810.46	0.59	-0.56	-0.19	
15,114.00	90.92	330.06	11,132.13	3,014.30	107.86	2,900.41	1.78	0.55	1.69	
15,208.00	90.66	330.41	11,130.84	3,095.89	61.19	2,990.81	0.46	-0.28	0.37	
15,302.00	90.22	330.76	11,130.12	3,177.77	15.03	3,081.37	0.60	-0.47	0.37	
15,397.00	91.36	331.29	11,128.81	3,260.87	-30.99	3,173.09	1.32	1.20	0.56	
15,491.00	91.01	331.11	11,126.86	3,343.22	-76.26	3,263.90	0.42	-0.37	-0.19	
15,586.00	90.40	330.76	11,125.69	3,426.25	-122.41	3,355.57	0.74	-0.64	-0.37	
15,680.00	90.48	330.94	11,124.97	3,508.35	-168.19	3,446.25	0.21	0.09	0.19	
15,775.00	90.04	331.11	11,124.54	3,591.45	-214.21	3,537.97	0.50	-0.46	0.18	
15,869.00	90.66	330.06	11,123.97	3,673.33	-260.38	3,628.53	1.30	0.66	-1.12	
15,963.00	91.28	329.53	11,122.38	3,754.56	-307.66	3,718.73	0.87	0.66	-0.56	
16,058.00	90.84	329.70	11,120.62	3,836.50	-355.71	3,809.80	0.50	-0.46	0.18	
16,152.00	91.71	330.06	11,118.53	3,917.78	-402.86	3,900.03	1.00	0.93	0.38	
16,246.00	91.63	330.41	11,115.79	3,999.35	-449.51	3,990.40	0.38	-0.09	0.37	
16,340.00	91.45	330.58	11,113.26	4,081.13	-495.79	4,080.89	0.26	-0.19	0.18	
16,435.00	91.28	330.58	11,111.00	4,163.85	-542.44	4,172.39	0.18	-0.18	0.00	
16,529.00	90.75	330.23	11,109.33	4,245.57	-588.86	4,262.87	0.68	-0.56	-0.37	
16,623.00	91.98	329.53	11,107.09	4,326.86	-636.01	4,353.09	1.51	1.31	-0.74	
16,717.00	91.71	329.18	11,104.07	4,407.69	-683.90	4,443.04	0.47	-0.29	-0.37	
16,811.00	91.10	328.12	11,101.76	4,487.94	-732.79	4,532.68	1.30	-0.65	-1.13	
16,905.00	90.66	327.24	11,100.32	4,567.36	-783.04	4,621.84	1.05	-0.47	-0.94	
16,999.00	90.57	326.89	11,099.31	4,646.25	-834.14	4,710.69	0.38	-0.10	-0.37	
17,093.00	91.10	328.30	11,097.94	4,725.60	-884.51	4,799.80	1.60	0.56	1.50	
17,187.00	90.92	328.30	11,096.28	4,805.57	-933.90	4,889.28	0.19	-0.19	0.00	
17,281.00	91.28	328.83	11,094.48	4,885.76	-982.91	4,978.88	0.68	0.38	0.56	
17,375.00	91.36	329.35	11,092.31	4,966.39	-1,031.19	5,068.74	0.56	0.09	0.55	
17,468.00	91.36	329.88	11,090.11	5,046.59	-1,078.21	5,157.88	0.57	0.00	0.57	
17,563.00	91.54	329.88	11,087.70	5,128.73	-1,125.87	5,249.06	0.19	0.19	0.00	
17,657.00	91.36	329.35	11,085.32	5,209.80	-1,173.40	5,339.16	0.60	-0.19	-0.56	
17,751.00	91.28	328.83	11,083.16	5,290.43	-1,221.67	5,429.01	0.56	-0.09	-0.55	
17,844.00	91.54	328.30	11,080.87	5,369.75	-1,270.16	5,517.65	0.63	0.28	-0.57	
17,937.00	91.63	328.30	11,078.30	5,448.85	-1,319.01	5,606.16	0.10	0.10	0.00	
17,953.00	91.71	328.30	11,077.83	5,462.45	-1,327.42	5,621.38	0.50	0.50	0.00	
Survey @ 17953.00 MD 11077.83 TVD										
18,017.00	91.71	328.30	11,075.92	5,516.88	-1,361.03	5,682.29	0.00	0.00	0.00	
Survey Proj. to 18017.00 MD 11075.92 TVD										



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
151.00	151.00	-0.40	0.06	MWD surveys
17,953.00	11,077.83	5,462.45	-1,327.42	Survey @ 17953.00 MD 11077.83 TVD
18,017.00	11,075.92	5,516.88	-1,361.03	Survey Proj. to 18017.00 MD 11075.92 TVD

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

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

Site	Knob Creek				
Site Position:		Northing:	14,443,053.74 usft	Latitude:	39.769822
From:	Lat/Long	Easting:	1,723,120.29 usft	Longitude:	-80.705670
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.19 °

Well	Knob Creek N-13HU (slot L)					
Well Position	+N/-S	0.00 usft	Northing:	14,443,126.57 usft	Latitude:	39.770021
	+E/-W	0.00 usft	Easting:	1,723,183.01 usft	Longitude:	-80.705446
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	737.00 usft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	1/21/2021	-8.66	66.56	51,784.09641958

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	346.12	

Survey Program	Date	2/23/2021			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
151.00	514.00	MWD surf (Original Hole)	MWD	MWD - Standard	
610.00	2,246.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,303.00	10,205.00	MWD int2 (Original Hole)	MWD	MWD - Standard	
10,270.00	17,953.00	MWD lat (Original Hole)	MWD	MWD - Standard	
18,017.00	18,017.00	Projection (Original Hole)	MWD	MWD - Standard	

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	14,443,126.57	1,723,183.01	39.770021	-80.705446	
151.00	0.31	171.68	151.00	-0.40	0.06	14,443,126.16	1,723,183.07	39.770020	-80.705446	
MWD surveys										
243.00	0.62	81.15	243.00	-0.57	0.59	14,443,125.99	1,723,183.60	39.770019	-80.705444	
273.00	0.62	81.15	273.00	-0.52	0.91	14,443,126.04	1,723,183.92	39.770020	-80.705443	
304.00	0.62	81.15	303.99	-0.47	1.24	14,443,126.10	1,723,184.25	39.770020	-80.705441	
335.00	0.57	91.08	334.99	-0.45	1.56	14,443,126.12	1,723,184.57	39.770020	-80.705440	
365.00	0.62	105.94	364.99	-0.50	1.86	14,443,126.07	1,723,184.88	39.770020	-80.705439	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
396.00	0.62	114.64	395.99	-0.61	2.18	14,443,125.96	1,723,185.19	39.770019	-80.705438	
427.00	0.62	112.18	426.99	-0.75	2.49	14,443,125.82	1,723,185.50	39.770019	-80.705437	
457.00	0.53	104.70	456.99	-0.84	2.77	14,443,125.73	1,723,185.79	39.770019	-80.705436	
488.00	0.62	119.29	487.98	-0.96	3.06	14,443,125.61	1,723,186.07	39.770018	-80.705435	
514.00	1.10	107.34	513.98	-1.10	3.42	14,443,125.46	1,723,186.43	39.770018	-80.705434	
610.00	0.79	109.89	609.97	-1.60	4.92	14,443,124.96	1,723,187.93	39.770017	-80.705428	
700.00	0.83	114.72	699.96	-2.09	6.09	14,443,124.48	1,723,189.11	39.770015	-80.705424	
794.00	0.88	97.41	793.95	-2.47	7.43	14,443,124.10	1,723,190.44	39.770014	-80.705419	
889.00	0.70	97.85	888.94	-2.64	8.73	14,443,123.93	1,723,191.74	39.770014	-80.705415	
983.00	0.75	110.42	982.93	-2.93	9.87	14,443,123.64	1,723,192.89	39.770013	-80.705411	
1,077.00	0.79	122.19	1,076.92	-3.49	11.00	14,443,123.08	1,723,194.01	39.770011	-80.705407	
1,170.00	0.66	141.88	1,169.92	-4.25	11.87	14,443,122.31	1,723,194.88	39.770009	-80.705404	
1,264.00	0.57	158.76	1,263.91	-5.12	12.37	14,443,121.45	1,723,195.39	39.770007	-80.705402	
1,358.00	0.75	159.64	1,357.90	-6.13	12.76	14,443,120.44	1,723,195.77	39.770004	-80.705401	
1,453.00	0.53	187.15	1,452.90	-7.15	12.92	14,443,119.42	1,723,195.93	39.770001	-80.705400	
1,547.00	0.83	182.22	1,546.89	-8.26	12.84	14,443,118.31	1,723,195.85	39.769998	-80.705400	
1,641.00	0.62	183.28	1,640.88	-9.45	12.78	14,443,117.12	1,723,195.80	39.769995	-80.705401	
1,735.00	0.31	32.55	1,734.88	-9.74	12.89	14,443,116.83	1,723,195.90	39.769994	-80.705400	
1,830.00	0.70	38.52	1,829.88	-9.07	13.39	14,443,117.50	1,723,196.40	39.769996	-80.705400	
1,925.00	1.01	40.46	1,924.87	-7.98	14.29	14,443,118.59	1,723,197.31	39.769999	-80.705395	
2,019.00	1.67	28.15	2,018.84	-6.14	15.48	14,443,120.43	1,723,198.49	39.770004	-80.705391	
2,113.00	0.83	340.95	2,112.82	-4.29	15.90	14,443,122.28	1,723,198.92	39.770009	-80.705389	
2,207.00	1.36	294.55	2,206.81	-3.18	14.67	14,443,123.39	1,723,197.68	39.770012	-80.705394	
2,246.00	1.45	270.55	2,245.79	-2.99	13.75	14,443,123.58	1,723,196.77	39.770013	-80.705397	
2,303.00	1.54	275.04	2,302.77	-2.91	12.27	14,443,123.66	1,723,195.28	39.770013	-80.705402	
2,397.00	2.11	268.88	2,396.73	-2.83	9.28	14,443,123.73	1,723,192.29	39.770013	-80.705413	
2,491.00	1.71	277.50	2,490.67	-2.69	6.16	14,443,123.88	1,723,189.17	39.770014	-80.705424	
2,585.00	1.32	285.67	2,584.64	-2.21	3.73	14,443,124.36	1,723,186.74	39.770015	-80.705433	
2,679.00	1.67	298.68	2,678.61	-1.26	1.48	14,443,125.31	1,723,184.50	39.770018	-80.705441	
2,774.00	1.45	301.84	2,773.57	0.04	-0.75	14,443,126.61	1,723,182.26	39.770021	-80.705449	
2,868.00	1.23	337.88	2,867.55	1.60	-2.14	14,443,128.17	1,723,180.87	39.770025	-80.705454	
2,962.00	1.49	33.95	2,961.53	3.55	-1.84	14,443,130.12	1,723,181.17	39.770031	-80.705452	
3,056.00	1.41	102.24	3,055.50	4.32	-0.03	14,443,130.89	1,723,182.99	39.770033	-80.705446	
3,150.00	2.15	103.83	3,149.46	3.65	2.81	14,443,130.22	1,723,185.83	39.770031	-80.705436	
3,244.00	2.37	124.13	3,243.39	2.14	6.13	14,443,128.71	1,723,189.15	39.770027	-80.705424	
3,338.00	2.64	139.51	3,337.30	-0.60	9.15	14,443,125.97	1,723,192.16	39.770019	-80.705413	
3,432.00	3.25	145.84	3,431.17	-4.45	12.05	14,443,122.12	1,723,195.06	39.770009	-80.705403	
3,526.00	3.69	148.12	3,525.00	-9.22	15.14	14,443,117.35	1,723,198.16	39.769996	-80.705392	
3,622.00	3.43	146.54	3,620.81	-14.24	18.36	14,443,112.33	1,723,201.37	39.769982	-80.705381	
3,717.00	3.21	139.25	3,715.66	-18.63	21.66	14,443,107.94	1,723,204.68	39.769970	-80.705369	
3,810.00	3.82	142.85	3,808.48	-23.07	25.23	14,443,103.50	1,723,208.25	39.769957	-80.705356	
3,903.00	3.52	139.33	3,901.29	-27.70	28.96	14,443,098.86	1,723,211.98	39.769945	-80.705343	
3,997.00	3.69	136.35	3,995.10	-32.08	32.93	14,443,094.49	1,723,215.95	39.769933	-80.705329	
4,091.00	3.78	136.43	4,088.90	-36.52	37.16	14,443,090.05	1,723,220.17	39.769920	-80.705314	
4,184.00	3.25	134.06	4,181.73	-40.57	41.16	14,443,086.00	1,723,224.18	39.769909	-80.705300	
4,279.00	3.34	135.20	4,276.57	-44.41	45.05	14,443,082.16	1,723,228.06	39.769899	-80.705286	
4,373.00	3.47	126.94	4,370.41	-48.06	49.25	14,443,078.51	1,723,232.27	39.769889	-80.705271	
4,467.00	3.38	117.62	4,464.24	-51.05	53.98	14,443,075.52	1,723,237.00	39.769880	-80.705254	
4,561.00	3.30	97.67	4,558.08	-52.70	59.12	14,443,073.87	1,723,242.13	39.769876	-80.705236	
4,655.00	4.22	86.42	4,651.88	-52.84	65.25	14,443,073.72	1,723,248.27	39.769875	-80.705214	
4,750.00	5.49	93.63	4,746.54	-52.91	73.27	14,443,073.66	1,723,256.29	39.769875	-80.705186	
4,844.00	7.21	102.07	4,839.96	-54.43	83.53	14,443,072.14	1,723,266.55	39.769871	-80.705149	
4,939.00	8.17	109.63	4,934.11	-57.95	95.72	14,443,068.62	1,723,278.73	39.769861	-80.705106	
5,034.00	7.69	114.11	5,028.20	-62.81	107.88	14,443,063.76	1,723,290.89	39.769848	-80.705063	
5,128.00	6.59	114.90	5,121.47	-67.65	118.51	14,443,058.92	1,723,301.53	39.769834	-80.705025	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,222.00	5.76	112.79	5,214.92	-71.75	127.75	14,443,054.82	1,723,310.77	39.769823	-80.704992
5,317.00	5.45	107.78	5,309.47	-74.97	136.45	14,443,051.60	1,723,319.46	39.769814	-80.704961
5,411.00	5.49	108.92	5,403.04	-77.79	144.95	14,443,048.77	1,723,327.96	39.769806	-80.704931
5,505.00	5.41	113.05	5,496.62	-80.99	153.28	14,443,045.58	1,723,336.30	39.769797	-80.704901
5,599.00	5.05	121.23	5,590.23	-84.87	160.90	14,443,041.70	1,723,343.91	39.769787	-80.704874
5,693.00	4.70	120.26	5,683.89	-88.95	167.76	14,443,037.62	1,723,350.78	39.769775	-80.704850
5,787.00	4.66	103.12	5,777.58	-91.76	174.81	14,443,034.81	1,723,357.82	39.769767	-80.704825
5,880.00	6.02	100.05	5,870.17	-93.47	183.29	14,443,033.10	1,723,366.30	39.769763	-80.704795
5,974.00	7.82	106.46	5,963.49	-96.14	194.28	14,443,030.43	1,723,377.29	39.769755	-80.704756
6,069.00	9.27	112.18	6,057.43	-100.86	207.56	14,443,025.71	1,723,390.57	39.769742	-80.704708
6,163.00	8.26	110.86	6,150.33	-106.12	220.88	14,443,020.44	1,723,403.90	39.769728	-80.704661
6,258.00	7.08	106.02	6,244.48	-110.17	232.89	14,443,016.40	1,723,415.90	39.769716	-80.704618
6,356.00	7.38	104.09	6,341.70	-113.37	244.79	14,443,013.20	1,723,427.81	39.769707	-80.704576
6,450.00	8.22	101.72	6,434.83	-116.20	257.23	14,443,010.36	1,723,440.24	39.769700	-80.704532
6,543.00	9.32	99.08	6,526.74	-118.74	271.18	14,443,007.83	1,723,454.19	39.769692	-80.704482
6,636.00	9.98	94.07	6,618.43	-120.50	286.65	14,443,006.06	1,723,469.67	39.769688	-80.704427
6,731.00	11.03	94.51	6,711.83	-121.80	303.92	14,443,004.77	1,723,486.94	39.769684	-80.704366
6,824.00	13.23	96.97	6,802.75	-123.79	323.36	14,443,002.77	1,723,506.37	39.769678	-80.704297
6,917.00	12.35	95.39	6,893.44	-126.02	343.82	14,443,000.55	1,723,526.84	39.769672	-80.704224
7,011.00	13.54	94.07	6,985.05	-127.74	364.81	14,442,998.82	1,723,547.82	39.769667	-80.704149
7,104.00	11.87	91.43	7,075.77	-128.76	385.23	14,442,997.81	1,723,568.25	39.769664	-80.704076
7,199.00	12.35	94.42	7,168.66	-129.78	405.13	14,442,996.79	1,723,588.14	39.769661	-80.704006
7,327.00	13.10	94.16	7,293.52	-131.89	433.24	14,442,994.68	1,723,616.26	39.769655	-80.703906
7,387.00	13.62	94.60	7,351.89	-132.95	447.07	14,442,993.62	1,723,630.08	39.769652	-80.703856
7,480.00	15.64	96.97	7,441.87	-135.35	470.43	14,442,991.22	1,723,653.44	39.769645	-80.703773
7,573.00	18.46	99.26	7,530.78	-139.24	497.41	14,442,987.33	1,723,680.42	39.769634	-80.703677
7,667.00	20.87	102.95	7,619.29	-145.39	528.42	14,442,981.18	1,723,711.44	39.769617	-80.703567
7,762.00	21.93	104.44	7,707.74	-153.61	562.09	14,442,972.96	1,723,745.11	39.769594	-80.703447
7,856.00	21.84	105.85	7,794.97	-162.76	595.91	14,442,963.81	1,723,778.93	39.769569	-80.703327
7,950.00	21.88	106.45	7,882.21	-172.49	629.53	14,442,954.07	1,723,812.54	39.769542	-80.703208
8,044.00	22.32	107.43	7,969.30	-182.80	663.36	14,442,943.77	1,723,846.37	39.769513	-80.703087
8,138.00	20.87	106.64	8,056.70	-192.94	696.43	14,442,933.63	1,723,879.45	39.769485	-80.702970
8,232.00	18.06	106.11	8,145.32	-201.78	726.48	14,442,924.79	1,723,909.49	39.769460	-80.702863
8,327.00	17.36	105.67	8,235.82	-209.70	754.27	14,442,916.87	1,723,937.29	39.769438	-80.702764
8,421.00	19.86	105.67	8,324.90	-217.80	783.15	14,442,908.77	1,723,966.17	39.769416	-80.702661
8,515.00	21.31	106.29	8,412.89	-226.90	814.92	14,442,899.67	1,723,997.94	39.769391	-80.702548
8,609.00	23.55	106.46	8,499.78	-237.01	849.33	14,442,889.55	1,724,032.35	39.769362	-80.702426
8,703.00	24.17	110.51	8,585.75	-249.08	885.37	14,442,877.49	1,724,068.38	39.769329	-80.702298
8,797.00	24.39	112.53	8,671.44	-263.26	921.32	14,442,863.31	1,724,104.34	39.769290	-80.702170
8,891.00	24.21	113.67	8,757.11	-278.43	956.90	14,442,848.14	1,724,139.91	39.769248	-80.702044
8,986.00	24.30	115.69	8,843.72	-294.73	992.36	14,442,831.84	1,724,175.37	39.769203	-80.701918
9,080.00	22.76	116.39	8,929.90	-311.19	1,026.08	14,442,815.37	1,724,209.09	39.769157	-80.701798
9,174.00	21.88	116.04	9,016.86	-326.97	1,058.10	14,442,799.60	1,724,241.12	39.769113	-80.701684
9,269.00	21.75	115.96	9,105.06	-342.44	1,089.83	14,442,784.13	1,724,272.85	39.769071	-80.701571
9,362.00	21.05	111.56	9,191.65	-356.12	1,120.86	14,442,770.44	1,724,303.87	39.769033	-80.701461
9,456.00	19.73	109.19	9,279.76	-367.54	1,151.55	14,442,759.03	1,724,334.56	39.769001	-80.701352
9,549.00	17.67	107.17	9,367.85	-376.87	1,179.86	14,442,749.70	1,724,362.88	39.768975	-80.701251
9,643.00	18.02	103.04	9,457.33	-384.36	1,207.66	14,442,742.21	1,724,390.67	39.768954	-80.701153
9,736.00	17.97	101.45	9,545.78	-390.46	1,235.73	14,442,736.11	1,724,418.75	39.768937	-80.701053
9,829.00	18.28	103.12	9,634.17	-396.62	1,264.00	14,442,729.95	1,724,447.01	39.768920	-80.700952
9,923.00	18.72	104.88	9,723.31	-403.84	1,292.93	14,442,722.73	1,724,475.95	39.768900	-80.700849
10,017.00	18.98	104.62	9,812.27	-411.57	1,322.30	14,442,715.00	1,724,505.32	39.768879	-80.700745
10,110.00	17.75	104.00	9,900.53	-418.81	1,350.69	14,442,707.75	1,724,533.71	39.768859	-80.700644
10,205.00	18.06	108.84	9,990.93	-427.07	1,378.68	14,442,699.49	1,724,561.70	39.768836	-80.700544
10,270.00	19.61	109.45	10,052.45	-433.96	1,398.50	14,442,692.61	1,724,581.52	39.768817	-80.700474

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
10,317.00	23.74	105.06	10,096.12	-439.05	1,415.09	14,442,687.52	1,724,598.10	39.768802	-80.700415
10,364.00	29.19	102.77	10,138.18	-444.04	1,435.41	14,442,682.53	1,724,618.43	39.768788	-80.700343
10,411.00	32.98	99.43	10,178.43	-448.67	1,459.22	14,442,677.90	1,724,642.24	39.768776	-80.700258
10,458.00	35.61	96.79	10,217.26	-452.39	1,485.43	14,442,674.18	1,724,668.45	39.768765	-80.700165
10,505.00	37.81	93.45	10,254.94	-454.87	1,513.41	14,442,671.70	1,724,696.42	39.768758	-80.700065
10,552.00	40.10	92.05	10,291.48	-456.28	1,542.92	14,442,670.29	1,724,725.94	39.768754	-80.699960
10,599.00	43.88	89.06	10,326.41	-456.56	1,574.35	14,442,670.01	1,724,757.36	39.768753	-80.699849
10,646.00	46.96	84.14	10,359.41	-454.53	1,607.74	14,442,672.03	1,724,790.76	39.768758	-80.699730
10,694.00	48.63	80.45	10,391.66	-449.75	1,642.96	14,442,676.81	1,724,825.98	39.768771	-80.699604
10,741.00	48.98	75.00	10,422.63	-442.24	1,677.49	14,442,684.33	1,724,860.51	39.768791	-80.699481
10,788.00	47.57	69.20	10,453.92	-431.48	1,710.85	14,442,695.09	1,724,893.87	39.768820	-80.699362
10,835.00	45.55	64.45	10,486.25	-418.08	1,742.21	14,442,708.49	1,724,925.23	39.768857	-80.699251
10,882.00	44.23	61.46	10,519.55	-403.01	1,771.75	14,442,723.56	1,724,954.77	39.768898	-80.699145
10,929.00	42.91	56.01	10,553.61	-386.23	1,799.43	14,442,740.34	1,724,982.45	39.768944	-80.699047
10,977.00	41.77	47.75	10,589.12	-366.33	1,824.84	14,442,760.24	1,725,007.85	39.768998	-80.698956
11,024.00	37.02	42.65	10,625.44	-345.38	1,846.03	14,442,781.19	1,725,029.04	39.769056	-80.698880
11,070.00	35.09	35.27	10,662.65	-324.39	1,863.05	14,442,802.18	1,725,046.07	39.769113	-80.698820
11,117.00	34.12	27.71	10,701.35	-301.68	1,876.99	14,442,824.89	1,725,060.01	39.769175	-80.698770
11,164.00	34.38	19.28	10,740.22	-277.47	1,887.51	14,442,849.10	1,725,070.52	39.769242	-80.698732
11,211.00	36.32	12.60	10,778.57	-251.34	1,894.93	14,442,875.22	1,725,077.94	39.769313	-80.698705
11,258.00	38.16	7.15	10,815.99	-223.34	1,899.77	14,442,903.23	1,725,082.79	39.769390	-80.698688
11,305.00	40.01	3.28	10,852.48	-193.85	1,902.45	14,442,932.72	1,725,085.46	39.769471	-80.698678
11,351.00	42.03	359.76	10,887.19	-163.68	1,903.23	14,442,962.89	1,725,086.24	39.769554	-80.698675
11,398.00	43.00	357.30	10,921.83	-131.93	1,902.41	14,442,994.64	1,725,085.42	39.769641	-80.698677
11,445.00	45.11	353.96	10,955.61	-99.36	1,899.90	14,443,027.21	1,725,082.91	39.769731	-80.698686
11,492.00	48.10	350.45	10,987.91	-65.54	1,895.24	14,443,061.03	1,725,078.26	39.769824	-80.698702
11,539.00	51.35	348.16	11,018.29	-30.31	1,888.57	14,443,096.25	1,725,071.59	39.769921	-80.698725
11,586.00	54.96	345.88	11,046.47	6.32	1,880.11	14,443,132.89	1,725,063.13	39.770021	-80.698755
11,633.00	57.86	342.89	11,072.47	44.01	1,869.56	14,443,170.58	1,725,052.57	39.770125	-80.698792
11,680.00	61.38	339.72	11,096.24	82.40	1,856.55	14,443,208.97	1,725,039.56	39.770230	-80.698838
11,727.00	63.93	336.91	11,117.83	121.18	1,841.12	14,443,247.75	1,725,024.13	39.770337	-80.698892
11,772.00	67.45	336.21	11,136.36	158.80	1,824.80	14,443,285.37	1,725,007.82	39.770440	-80.698950
11,822.00	71.75	336.03	11,153.78	201.64	1,805.83	14,443,328.21	1,724,988.85	39.770558	-80.699017
11,869.00	75.97	334.80	11,166.84	242.68	1,787.05	14,443,369.25	1,724,970.06	39.770671	-80.699083
11,916.00	78.09	332.69	11,177.39	283.75	1,766.79	14,443,410.32	1,724,949.80	39.770784	-80.699155
11,963.00	79.84	330.41	11,186.39	324.31	1,744.81	14,443,450.88	1,724,927.83	39.770896	-80.699233
12,011.00	82.57	329.53	11,193.73	365.37	1,721.07	14,443,491.94	1,724,904.09	39.771009	-80.699317
12,105.00	90.84	329.18	11,199.13	446.04	1,673.28	14,443,572.61	1,724,856.30	39.771231	-80.699486
12,199.00	91.28	329.88	11,197.39	527.04	1,625.62	14,443,653.61	1,724,808.64	39.771454	-80.699654
12,293.00	91.01	329.70	11,195.51	608.26	1,578.33	14,443,734.83	1,724,761.35	39.771677	-80.699822
12,388.00	90.48	329.53	11,194.27	690.20	1,530.29	14,443,816.77	1,724,713.30	39.771903	-80.699992
12,482.00	90.75	329.35	11,193.27	771.14	1,482.50	14,443,897.71	1,724,665.51	39.772125	-80.700161
12,577.00	92.33	328.83	11,190.71	852.62	1,433.71	14,443,979.18	1,724,616.73	39.772349	-80.700333
12,670.00	94.26	330.06	11,185.37	932.56	1,386.52	14,444,059.13	1,724,569.53	39.772569	-80.700500
12,764.00	92.77	328.83	11,179.60	1,013.36	1,338.82	14,444,139.92	1,724,521.84	39.772792	-80.700669
12,858.00	92.59	328.65	11,175.21	1,093.62	1,290.10	14,444,220.19	1,724,473.11	39.773013	-80.700842
12,952.00	92.07	328.83	11,171.39	1,173.91	1,241.36	14,444,300.48	1,724,424.37	39.773234	-80.701014
13,046.00	91.45	328.65	11,168.50	1,254.22	1,192.60	14,444,380.79	1,724,375.62	39.773455	-80.701187
13,140.00	90.66	329.00	11,166.77	1,334.63	1,143.95	14,444,461.20	1,724,326.97	39.773676	-80.701359
13,234.00	91.98	329.00	11,164.60	1,415.18	1,095.55	14,444,541.75	1,724,278.57	39.773898	-80.701530
13,328.00	91.71	328.30	11,161.58	1,495.42	1,046.67	14,444,621.99	1,724,229.69	39.774118	-80.701703
13,422.00	91.28	328.47	11,159.13	1,575.44	997.42	14,444,702.01	1,724,180.43	39.774339	-80.701878
13,516.00	90.84	328.65	11,157.39	1,655.63	948.39	14,444,782.19	1,724,131.41	39.774559	-80.702051
13,610.00	90.48	328.65	11,156.30	1,735.90	899.49	14,444,862.46	1,724,082.51	39.774780	-80.702224
13,704.00	91.63	327.60	11,154.57	1,815.71	849.86	14,444,942.27	1,724,032.88	39.775000	-80.702400

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
13,798.00	91.28	327.60	11,152.19	1,895.05	799.51	14,445,021.61	1,723,982.53	39.775218	-80.702578
13,892.00	90.48	326.72	11,150.74	1,974.01	748.54	14,445,100.58	1,723,931.56	39.775435	-80.702759
13,986.00	90.04	326.89	11,150.32	2,052.67	697.08	14,445,179.24	1,723,880.09	39.775652	-80.702941
14,080.00	90.92	328.47	11,149.53	2,132.10	646.83	14,445,258.67	1,723,829.84	39.775870	-80.703119
14,174.00	90.48	328.83	11,148.38	2,212.37	597.93	14,445,338.94	1,723,780.94	39.776091	-80.703292
14,268.00	91.01	328.47	11,147.16	2,292.64	549.02	14,445,419.21	1,723,732.04	39.776312	-80.703465
14,362.00	90.40	327.77	11,146.00	2,372.46	499.38	14,445,499.03	1,723,682.40	39.776532	-80.703641
14,456.00	91.71	328.30	11,144.27	2,452.19	449.63	14,445,578.76	1,723,632.64	39.776751	-80.703817
14,551.00	91.80	328.30	11,141.36	2,532.98	399.73	14,445,659.55	1,723,582.75	39.776974	-80.703994
14,645.00	91.19	328.65	11,138.91	2,613.08	350.60	14,445,739.64	1,723,533.62	39.777194	-80.704167
14,739.00	90.75	328.65	11,137.32	2,693.34	301.70	14,445,819.91	1,723,484.72	39.777415	-80.704341
14,832.00	91.01	329.00	11,135.89	2,772.90	253.57	14,445,899.47	1,723,436.58	39.777634	-80.704511
14,927.00	90.92	328.65	11,134.29	2,854.17	204.40	14,445,980.74	1,723,387.41	39.777857	-80.704685
15,020.00	90.40	328.47	11,133.22	2,933.51	155.89	14,446,060.08	1,723,338.91	39.778076	-80.704857
15,114.00	90.92	330.06	11,132.13	3,014.30	107.86	14,446,140.87	1,723,290.87	39.778298	-80.705027
15,208.00	90.66	330.41	11,130.84	3,095.89	61.19	14,446,222.46	1,723,244.21	39.778523	-80.705192
15,302.00	90.22	330.76	11,130.12	3,177.77	15.03	14,446,304.34	1,723,198.04	39.778748	-80.705355
15,397.00	91.36	331.29	11,128.81	3,260.87	-30.99	14,446,387.44	1,723,152.03	39.778977	-80.705518
15,491.00	91.01	331.11	11,126.86	3,343.22	-76.26	14,446,469.79	1,723,106.75	39.779203	-80.705678
15,586.00	90.40	330.76	11,125.69	3,426.25	-122.41	14,446,552.82	1,723,060.61	39.779432	-80.705841
15,680.00	90.48	330.94	11,124.97	3,508.35	-168.19	14,446,634.91	1,723,014.82	39.779657	-80.706003
15,775.00	90.04	331.11	11,124.54	3,591.45	-214.21	14,446,718.02	1,722,968.80	39.779886	-80.706166
15,869.00	90.66	330.06	11,123.97	3,673.33	-260.38	14,446,799.90	1,722,922.64	39.780111	-80.706330
15,963.00	91.28	329.53	11,122.38	3,754.56	-307.66	14,446,881.13	1,722,875.35	39.780335	-80.706497
16,058.00	90.84	329.70	11,120.62	3,836.50	-355.71	14,446,963.06	1,722,827.31	39.780560	-80.706667
16,152.00	91.71	330.06	11,118.53	3,917.78	-402.86	14,447,044.35	1,722,780.15	39.780784	-80.706834
16,246.00	91.63	330.41	11,115.79	3,999.35	-449.51	14,447,125.91	1,722,733.50	39.781008	-80.706999
16,340.00	91.45	330.58	11,113.26	4,081.13	-495.79	14,447,207.69	1,722,687.23	39.781233	-80.707163
16,435.00	91.28	330.58	11,111.00	4,163.85	-542.44	14,447,290.42	1,722,640.57	39.781461	-80.707328
16,529.00	90.75	330.23	11,109.33	4,245.57	-588.86	14,447,372.14	1,722,594.16	39.781686	-80.707492
16,623.00	91.98	329.53	11,107.09	4,326.86	-636.01	14,447,453.43	1,722,547.00	39.781909	-80.707659
16,717.00	91.71	329.18	11,104.07	4,407.69	-683.90	14,447,534.26	1,722,499.11	39.782132	-80.707829
16,811.00	91.10	328.12	11,101.76	4,487.94	-732.79	14,447,614.51	1,722,450.23	39.782353	-80.708002
16,905.00	90.66	327.24	11,100.32	4,567.36	-783.04	14,447,693.93	1,722,399.97	39.782571	-80.708180
16,999.00	90.57	326.89	11,099.31	4,646.25	-834.14	14,447,772.82	1,722,348.87	39.782788	-80.708361
17,093.00	91.10	328.30	11,097.94	4,725.60	-884.51	14,447,852.17	1,722,298.50	39.783007	-80.708539
17,187.00	90.92	328.30	11,096.28	4,805.57	-933.90	14,447,932.14	1,722,249.12	39.783227	-80.708714
17,281.00	91.28	328.83	11,094.48	4,885.76	-982.91	14,448,012.33	1,722,200.10	39.783447	-80.708887
17,375.00	91.36	329.35	11,092.31	4,966.39	-1,031.19	14,448,092.95	1,722,151.83	39.783669	-80.709058
17,468.00	91.36	329.88	11,090.11	5,046.59	-1,078.21	14,448,173.16	1,722,104.80	39.783890	-80.709225
17,563.00	91.54	329.88	11,087.70	5,128.73	-1,125.87	14,448,255.30	1,722,057.14	39.784116	-80.709393
17,657.00	91.36	329.35	11,085.32	5,209.80	-1,173.40	14,448,336.37	1,722,009.61	39.784339	-80.709562
17,751.00	91.28	328.83	11,083.16	5,290.43	-1,221.67	14,448,416.99	1,721,961.34	39.784561	-80.709733
17,844.00	91.54	328.30	11,080.87	5,369.75	-1,270.16	14,448,496.32	1,721,912.85	39.784779	-80.709904
17,937.00	91.63	328.30	11,078.30	5,448.85	-1,319.01	14,448,575.41	1,721,864.00	39.784997	-80.710077
17,953.00	91.71	328.30	11,077.83	5,462.45	-1,327.42	14,448,589.02	1,721,855.60	39.785034	-80.710107
Survey @ 17953.00 MD 11077.83 TVD									
18,017.00	91.71	328.30	11,075.92	5,516.88	-1,361.03	14,448,643.45	1,721,821.98	39.785184	-80.710226
Survey Proj. to 18017.00 MD 11075.92 TVD									

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Knob Creek N-13HU (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Site:	Knob Creek	MD Reference:	RKB=737+33 @ 770.00usft (Nabors X08)
Well:	Knob Creek N-13HU (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
151.00	151.00	-0.40	0.06	MWD surveys
17,953.00	11,077.83	5,462.45	-1,327.42	Survey @ 17953.00 MD 11077.83 TVD
18,017.00	11,075.92	5,516.88	-1,361.03	Survey Proj. to 18017.00 MD 11075.92 TVD