



Well: Keith Stern S-17 HU (slot O)
Site: Keith Stern
Project: Marshall County, West Virginia.
Design: rev4
Rig: Nabors X08

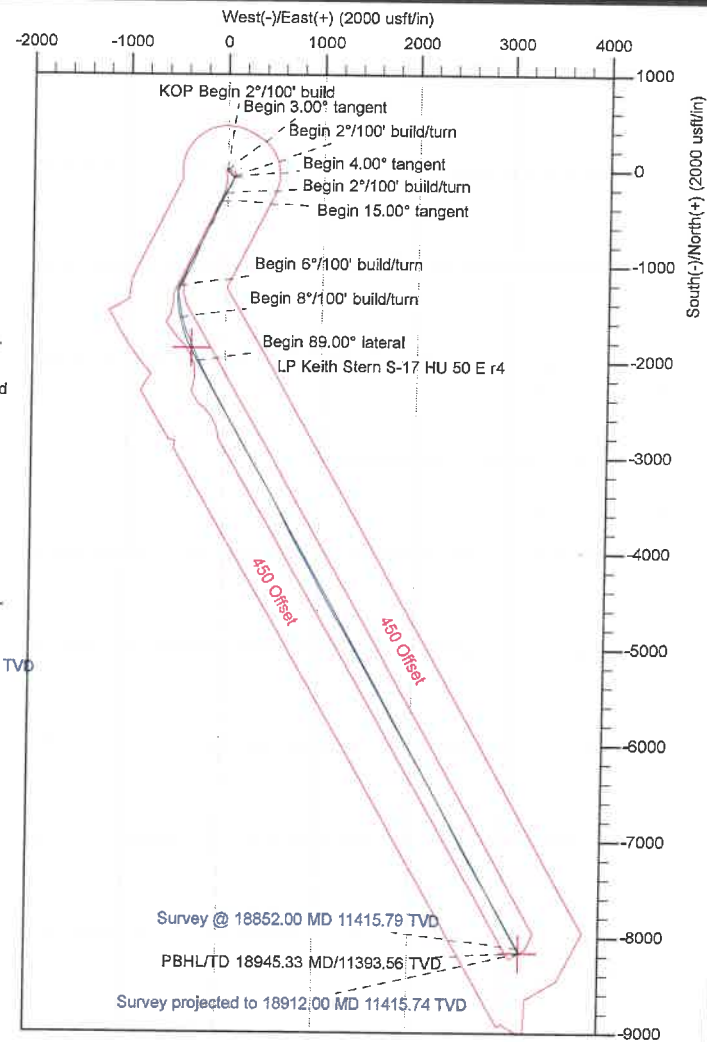
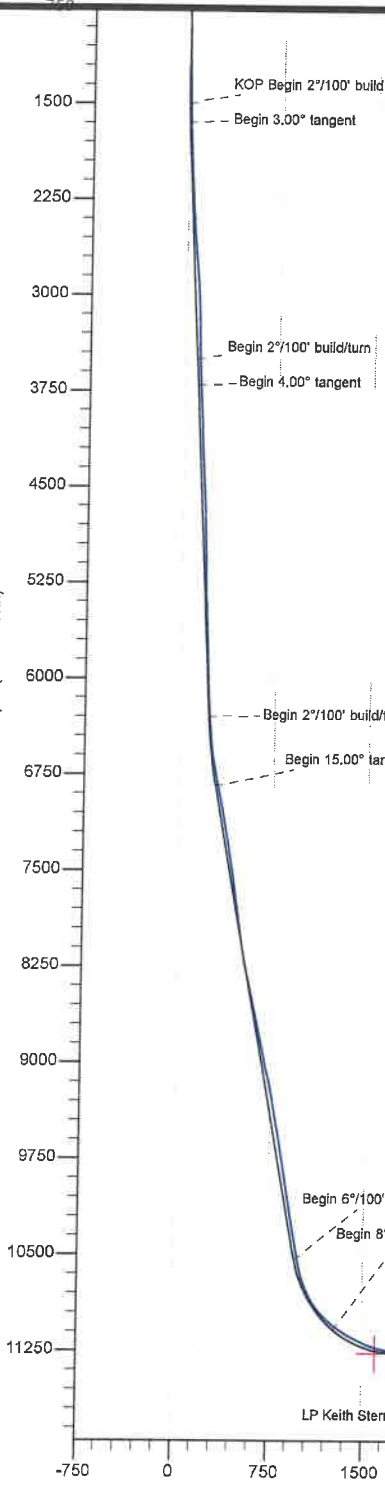
SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSec	Annotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	1500.00	0.00	0.00	1500.00	0.00	0.00	0.00	0.00	0.00	KOP Begin 2°/100' build
3	1650.00	3.00	135.00	1649.93	-2.78	2.78	2.00	135.000	3.59	Begin 3.00° tangent
4	2500.00	3.00	135.00	2498.77	-34.23	34.23	0.00	0.000	44.32	
5	3502.61	3.00	135.00	3500.00	-71.34	71.34	0.00	0.000	92.36	Begin 2°/100' build/turn
6	3709.81	4.00	206.00	3706.90	-81.67	72.00	2.00	114.118	102.23	Begin 4.00° tangent
7	6309.24	4.00	206.00	6300.00	-244.65	-7.49	0.00	0.000	225.25	Begin 2°/100' build/turn
8	6859.24	15.00	206.00	6841.62	-326.11	-47.22	2.00	0.000	286.74	Begin 15.00° tangent
9	10692.60	15.00	206.00	10544.36	-1217.84	-482.15	0.00	0.000	959.82	Begin 6°/100' build/turn
10	11341.99	50.00	188.20	11087.81	-1549.74	-467.56	6.00	-48.301	1274.39	Begin 8°/100' build/turn
11	11868.78	89.00	150.64	11270.00	-1997.14	-289.06	8.00	-26.712	1756.06	Begin 89.00° lateral
12	18945.33	89.00	150.64	11393.56	-8163.97	3179.73	0.00	0.000	8761.34	PBHLTD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	VSec	Annotation
234.00	0.75	356.81	233.99	1.53	-0.09	-1.46	MWD surveys
18852.00	90.04	148.86	11415.79	-8112.74	3164.09	8707.93	Survey @ 18852.00 MD 11415.79 TVD
18912.00	90.04	148.86	11415.74	-8164.09	3195.12	8767.04	Survey projected to 18912.00 MD 11415.74 TVD

True Vertical Depth (1500 usft/in)



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

System Datum: Mean Sea Level
 Depth Reference: RKB=747+33 @ 780.00usft (Nabors X08)

Northing	Easting	Latitude	Longitude
14444868.79	1726921.91	39.77477099	-80.69211834

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.99°

PBHLTD 18945.33 MD/11393.56 TVD

Survey @ 18852.00 MD 11415.79 TVD
 Survey projected to 18912.00 MD 11415.74 TVD



Azimuths to Grid North
 True North: -0.20°
 Magnetic North: -8.99°

Magnetic Field
 Strength: 51812.3snT
 Dip Angle: 66.68°
 Date: 7/24/2020
 Model: IGRF2015



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-17 HU (slot O)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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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)		

SEP 30 2022

 WV Department of
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Site	Keith Stern				
Site Position:		Northing:	14,444,890.33 usft	Latitude:	39.77483004
From:	Lat/Long	Easting:	1,726,932.47 usft	Longitude:	-80.69208048
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.197 °

Well	Keith Stern S-17 HU (slot O)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,868.79 usft	Latitude:	39.77477099
	+E/-W	0.00 usft	Easting:	1,726,921.91 usft	Longitude:	-80.69211834
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	747.00 usft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	7/24/2020	-8.793	66.684	51,812.34274225

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	158.72	

Survey Program	Date	8/30/2020			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
234.00	2,202.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,309.00	7,237.00	MWD int (Original Hole)	MWD	MWD - Standard	
7,426.00	18,852.00	MWD lat (Original Hole)	MWD	MWD - Standard	
18,912.00	18,912.00	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	0.00
234.00	0.75	356.81	233.99	1.53	-0.09	-1.46	0.32	0.32	0.00	
MWD surveys										
294.00	0.88	342.05	293.99	2.36	-0.25	-2.29	0.41	0.22	-24.60	
323.00	1.10	355.67	322.98	2.85	-0.34	-2.78	1.11	0.76	46.97	
413.00	0.75	332.29	412.97	4.23	-0.68	-4.19	0.56	-0.39	-25.98	
470.00	0.31	293.18	469.97	4.62	-0.99	-4.67	0.96	-0.77	-68.61	
539.00	0.40	12.63	538.97	4.93	-1.11	-5.00	0.67	0.13	115.14	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem S-17 HU (slot O)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	WV Department of Environmental Protection	
								Build Rate (°/100usft)	Turn Rate (°/100usft)
602.00	0.57	153.43	601.97	4.87	-0.92	-4.87	1.45	0.27	223.49
633.00	1.58	176.55	632.96	4.30	-0.83	-4.31	3.48	3.26	74.58
665.00	2.37	171.80	664.94	3.21	-0.71	-3.24	2.52	2.47	-14.84
697.00	2.77	166.62	696.91	1.80	-0.43	-1.83	1.44	1.25	-16.19
792.00	1.10	171.45	791.85	-1.34	0.23	1.33	1.76	-1.76	5.08
886.00	1.10	130.93	885.84	-2.82	1.05	3.01	0.81	0.00	-43.11
980.00	1.01	77.58	979.82	-3.23	2.54	3.93	1.01	-0.10	-56.76
1,075.00	1.27	82.50	1,074.80	-2.92	4.40	4.31	0.29	0.27	5.18
1,169.00	1.58	95.25	1,168.77	-2.90	6.72	5.14	0.47	0.33	13.56
1,231.00	1.32	127.33	1,230.76	-3.41	8.14	6.13	1.35	-0.42	51.74
1,263.00	1.19	150.80	1,262.75	-3.92	8.60	6.78	1.64	-0.41	73.34
1,326.00	1.36	190.08	1,325.73	-5.23	8.79	8.06	1.38	0.27	62.35
1,357.00	1.10	175.58	1,356.73	-5.89	8.74	8.66	1.30	-0.84	-46.77
1,388.00	1.67	195.00	1,387.72	-6.62	8.65	9.31	2.36	1.84	62.65
1,420.00	1.76	195.27	1,419.70	-7.55	8.40	10.08	0.28	0.28	0.84
1,452.00	1.93	202.21	1,451.69	-8.52	8.07	10.87	0.88	0.53	21.69
1,499.00	1.71	194.65	1,498.66	-9.93	7.59	12.01	0.69	-0.47	-16.09
1,546.00	1.58	180.68	1,545.64	-11.26	7.41	13.18	0.89	-0.28	-29.72
1,641.00	1.85	162.92	1,640.60	-14.03	7.84	15.92	0.62	0.28	-18.69
1,735.00	2.42	142.53	1,734.54	-17.06	9.49	19.34	1.00	0.61	-21.69
1,830.00	2.90	143.06	1,829.44	-20.57	12.16	23.58	0.51	0.51	0.56
1,925.00	3.47	135.06	1,924.29	-24.53	15.63	28.53	0.76	0.60	-8.42
2,019.00	4.22	126.89	2,018.08	-28.62	20.41	34.07	0.99	0.80	-8.69
2,114.00	3.82	126.80	2,112.84	-32.61	25.74	39.73	0.42	-0.42	-0.09
2,202.00	2.42	134.80	2,200.71	-35.68	29.40	43.91	1.66	-1.59	9.09
2,309.00	3.16	141.65	2,307.58	-39.58	32.84	48.80	0.76	0.69	6.40
2,403.00	3.82	144.29	2,401.41	-44.15	36.27	54.31	0.72	0.70	2.81
2,498.00	4.26	141.30	2,496.17	-49.48	40.33	60.74	0.51	0.46	-3.15
2,591.00	4.88	143.06	2,588.88	-55.33	44.86	67.84	0.68	0.67	1.89
2,686.00	6.28	139.72	2,683.42	-62.53	50.65	76.65	1.51	1.47	-3.52
2,780.00	5.93	139.11	2,776.89	-70.12	57.15	86.08	0.38	-0.37	-0.65
2,875.00	5.19	143.50	2,871.44	-77.29	62.92	94.85	0.90	-0.78	4.62
2,970.00	3.69	138.14	2,966.16	-83.02	67.52	101.86	1.64	-1.58	-5.64
3,064.00	2.15	146.84	3,060.03	-86.75	70.50	106.42	1.70	-1.64	9.26
3,159.00	1.63	160.64	3,154.98	-89.51	71.92	109.51	0.72	-0.55	14.53
3,254.00	1.76	200.19	3,249.94	-92.16	71.87	111.96	1.21	0.14	41.63
3,348.00	1.54	202.12	3,343.90	-94.68	70.89	113.96	0.24	-0.23	2.05
3,442.00	2.33	212.93	3,437.85	-97.46	69.38	115.99	0.92	0.84	11.50
3,537.00	3.25	204.50	3,532.74	-101.53	67.21	119.00	1.06	0.97	-8.87
3,632.00	3.82	204.76	3,627.55	-106.85	64.77	123.07	0.60	0.60	0.27
3,726.00	4.17	203.09	3,721.33	-112.84	62.12	127.69	0.39	0.37	-1.78
3,821.00	5.01	201.33	3,816.02	-119.88	59.26	133.21	0.90	0.88	-1.85
3,915.00	4.00	204.41	3,909.73	-126.69	56.41	138.52	1.10	-1.07	3.28


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Site:	Keith Stern	MDR Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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)
4,010.00	3.87	207.22	4,004.51	-132.56	53.57	142.96	0.24	-0.14	2.96
4,107.00	2.99	204.76	4,101.33	-137.77	51.01	146.89	0.92	-0.91	-2.54
4,202.00	3.30	202.21	4,196.19	-142.55	48.94	150.59	0.36	0.33	-2.68
4,296.00	4.39	193.16	4,289.98	-148.55	47.10	155.52	1.32	1.16	-9.63
4,391.00	4.88	201.51	4,384.67	-155.85	44.79	161.48	0.88	0.52	8.79
4,485.00	4.70	201.68	4,478.34	-163.15	41.90	167.24	0.19	-0.19	0.18
4,580.00	3.74	202.39	4,573.08	-169.63	39.29	172.33	1.01	-1.01	0.75
4,675.00	3.16	214.78	4,667.91	-174.65	36.61	176.03	0.99	-0.61	13.04
4,769.00	3.74	218.56	4,761.74	-179.18	33.22	179.02	0.66	0.62	4.02
4,864.00	4.22	216.98	4,856.51	-184.39	29.19	182.41	0.52	0.51	-1.66
4,959.00	3.87	226.21	4,951.27	-189.40	24.77	185.48	0.78	-0.37	9.72
5,053.00	2.94	228.05	5,045.10	-193.21	20.69	187.54	1.00	-0.99	1.96
5,148.00	3.38	228.84	5,139.96	-196.68	16.77	189.36	0.47	0.46	0.83
5,242.00	2.86	223.66	5,233.82	-200.20	13.06	191.29	0.63	-0.55	-5.51
5,338.00	3.34	224.45	5,329.68	-203.93	9.45	193.46	0.50	0.50	0.82
5,433.00	5.01	215.83	5,424.43	-209.27	5.08	196.85	1.87	1.76	-9.07
5,528.00	5.14	214.60	5,519.05	-216.13	0.24	201.49	0.18	0.14	-1.29
5,623.00	4.13	207.31	5,613.74	-222.68	-3.75	206.14	1.23	-1.06	-7.67
5,717.00	2.77	208.98	5,707.57	-227.67	-6.40	209.83	1.45	-1.45	1.78
5,812.00	2.77	214.34	5,802.46	-231.58	-8.81	212.59	0.27	0.00	5.64
5,907.00	3.03	217.59	5,897.34	-235.46	-11.63	215.18	0.32	0.27	3.42
6,002.00	4.22	207.57	5,992.15	-240.55	-14.78	218.78	1.41	1.25	-10.55
6,096.00	5.36	213.99	6,085.82	-247.26	-18.84	223.56	1.34	1.21	6.83
6,191.00	5.49	212.14	6,180.39	-254.78	-23.74	228.80	0.23	0.14	-1.95
6,289.00	4.70	214.34	6,278.00	-262.07	-28.50	233.86	0.83	-0.81	2.24
6,386.00	6.50	205.81	6,374.54	-270.29	-33.13	239.84	2.04	1.86	-8.79
6,482.00	8.79	207.05	6,469.68	-281.72	-38.83	248.42	2.39	2.39	1.29
6,576.00	10.37	204.58	6,562.36	-295.81	-45.62	259.08	1.74	1.68	-2.63
6,671.00	13.36	202.83	6,655.32	-313.70	-53.43	272.92	3.17	3.15	-1.84
6,766.00	15.25	203.44	6,747.38	-335.29	-62.66	289.68	2.00	1.99	0.64
6,860.00	16.17	203.27	6,837.86	-358.65	-72.75	307.80	0.98	0.98	-0.18
6,953.00	17.84	205.20	6,926.79	-383.44	-83.93	326.84	1.90	1.80	2.08
7,048.00	17.49	203.62	7,017.32	-409.69	-95.85	346.97	0.62	-0.37	-1.66
7,142.00	13.80	200.45	7,107.82	-433.14	-105.43	365.35	4.03	-3.93	-3.37
7,237.00	12.35	194.96	7,200.36	-453.58	-112.01	382.00	2.01	-1.53	-5.78
7,426.00	11.87	199.93	7,385.16	-491.38	-123.86	412.92	0.61	-0.25	2.63
7,521.00	11.21	197.11	7,478.24	-509.39	-129.90	427.51	0.91	-0.69	-2.97
7,615.00	11.47	193.42	7,570.40	-527.21	-134.76	442.36	0.82	0.28	-3.93
7,710.00	11.56	199.49	7,663.49	-545.37	-140.13	457.33	1.28	0.09	6.39
7,804.00	12.00	216.19	7,755.54	-562.14	-149.04	469.72	3.64	0.47	17.77
7,899.00	13.67	219.09	7,848.16	-578.83	-161.95	480.59	1.88	1.76	3.05
7,993.00	14.81	218.56	7,939.27	-596.85	-176.45	492.11	1.22	1.21	-0.56
8,087.00	15.21	214.69	8,030.07	-616.38	-190.95	505.05	1.15	0.43	-4.12
8,186.00	13.05	207.13	8,126.08	-637.01	-203.44	519.74	2.87	-2.18	-7.64

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Site:	Keith Stem		MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem S-17 HU (slot O)		North Reference:	Grid
Wellbore:	Original Hole		Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole		Database:	DB_Aug1919_v14

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)
8,281.00	14.85	204.06	8,218.27	-657.67	-213.30	535.42	2.05	1.89	-3.23
8,375.00	16.52	200.19	8,308.77	-681.22	-222.82	553.90	2.10	1.78	-4.12
8,469.00	17.75	202.04	8,398.60	-707.04	-232.81	574.34	1.43	1.31	1.97
8,563.00	17.09	201.33	8,488.29	-733.19	-243.21	594.93	0.74	-0.70	-0.76
8,657.00	16.44	201.51	8,578.29	-758.43	-253.12	614.86	0.69	-0.69	0.19
8,752.00	16.08	200.54	8,669.49	-783.26	-262.66	634.53	0.47	-0.38	-1.02
8,846.00	16.04	199.84	8,759.82	-807.67	-271.64	654.01	0.21	-0.04	-0.74
8,941.00	15.64	201.42	8,851.21	-831.93	-280.77	673.31	0.62	-0.42	1.66
9,032.00	16.57	201.51	8,938.64	-855.42	-290.01	691.85	1.02	1.02	0.10
9,126.00	17.09	201.24	9,028.62	-880.77	-299.92	711.87	0.56	0.55	-0.29
9,219.00	17.18	200.63	9,117.49	-906.36	-309.71	732.16	0.22	0.10	-0.66
9,313.00	17.01	200.80	9,207.33	-932.21	-319.49	752.70	0.19	-0.18	0.18
9,407.00	16.00	202.12	9,297.46	-957.06	-329.25	772.31	1.15	-1.07	1.40
9,502.00	14.72	206.96	9,389.07	-979.95	-339.65	789.87	1.91	-1.35	5.09
9,597.00	13.84	204.06	9,481.13	-1,001.08	-349.76	805.89	1.19	-0.93	-3.05
9,691.00	14.46	205.02	9,572.28	-1,021.98	-359.30	821.90	0.71	0.66	1.02
9,785.00	14.90	206.52	9,663.21	-1,043.43	-369.66	838.13	0.62	0.47	1.60
9,879.00	14.81	208.98	9,754.07	-1,064.76	-380.88	853.93	0.68	-0.10	2.62
9,974.00	14.15	210.30	9,846.05	-1,085.40	-392.62	868.91	0.78	-0.69	1.39
10,068.00	14.46	211.62	9,937.14	-1,105.32	-404.57	883.13	0.48	0.33	1.40
10,140.00	14.77	210.56	10,006.81	-1,120.88	-413.95	894.22	0.57	0.43	-1.47
10,180.00	14.25	211.44	10,045.53	-1,129.47	-419.11	900.35	1.41	-1.30	2.20
10,274.00	15.66	210.74	10,136.35	-1,150.24	-431.63	915.17	1.51	1.50	-0.74
10,368.00	14.96	209.68	10,227.01	-1,171.69	-444.12	930.62	0.80	-0.74	-1.13
10,462.00	14.60	205.46	10,317.90	-1,192.93	-455.22	946.38	1.21	-0.38	-4.49
10,557.00	14.25	207.57	10,409.91	-1,214.10	-465.78	962.28	0.66	-0.37	2.22
10,652.00	14.60	201.60	10,501.92	-1,235.60	-475.60	978.75	1.61	0.37	-6.28
10,699.00	14.43	198.08	10,547.42	-1,246.68	-479.60	987.61	1.91	-0.36	-7.49
10,746.00	14.68	193.33	10,592.91	-1,258.04	-482.79	997.04	2.59	0.53	-10.11
10,793.00	16.00	189.64	10,638.24	-1,270.22	-485.25	1,007.50	3.49	2.81	-7.85
10,841.00	18.64	178.57	10,684.07	-1,284.42	-486.17	1,020.40	8.77	5.50	-23.06
10,888.00	20.84	171.01	10,728.31	-1,300.19	-484.67	1,035.64	7.16	4.68	-16.09
10,936.00	24.18	170.83	10,772.65	-1,318.33	-481.77	1,053.60	6.96	6.96	-0.38
10,983.00	28.23	170.83	10,814.81	-1,338.82	-478.46	1,073.89	8.62	8.62	0.00
11,030.00	32.18	171.36	10,855.42	-1,362.17	-474.81	1,096.98	8.42	8.40	1.13
11,077.00	36.49	171.19	10,894.22	-1,388.37	-470.79	1,122.84	9.17	9.17	-0.36
11,125.00	39.92	172.24	10,931.94	-1,417.74	-466.52	1,151.76	7.27	7.15	2.19
11,172.00	43.53	171.19	10,967.01	-1,448.69	-462.00	1,182.24	7.82	7.68	-2.23
11,219.00	47.57	169.08	10,999.92	-1,481.73	-456.24	1,215.12	9.17	8.60	-4.49
11,266.00	50.74	167.32	11,030.66	-1,516.52	-448.96	1,250.19	7.31	6.74	-3.74
11,314.00	53.99	166.62	11,059.96	-1,553.55	-440.38	1,287.80	6.87	6.77	-1.46
11,361.00	56.37	165.21	11,086.80	-1,590.97	-430.99	1,326.08	5.63	5.06	-3.00
11,408.00	57.33	162.05	11,112.50	-1,628.71	-419.89	1,365.28	5.99	2.04	-6.72


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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem S-17 HU (slot O)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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)
11,455.00	60.76	159.58	11,136.68	-1,666.77	-406.64	1,405.54	8.58	7.30	-5.26
11,503.00	63.49	158.35	11,159.12	-1,706.36	-391.40	1,447.97	6.12	5.69	-2.56
11,550.00	66.30	157.65	11,179.06	-1,745.82	-375.46	1,490.52	6.13	5.98	-1.49
11,597.00	68.41	157.30	11,197.15	-1,785.88	-358.84	1,533.88	4.54	4.49	-0.74
11,644.00	70.96	157.30	11,213.47	-1,826.54	-341.83	1,577.94	5.43	5.43	0.00
11,692.00	74.48	156.77	11,227.72	-1,868.73	-323.95	1,623.75	7.41	7.33	-1.10
11,739.00	76.77	156.60	11,239.39	-1,910.54	-305.93	1,669.25	4.88	4.87	-0.36
11,786.00	78.52	156.77	11,249.45	-1,952.70	-287.76	1,715.13	3.74	3.72	0.36
11,833.00	81.07	156.42	11,257.77	-1,995.15	-269.39	1,761.35	5.47	5.43	-0.74
11,881.00	84.15	153.78	11,263.95	-2,038.32	-249.35	1,808.84	8.42	6.42	-5.50
11,928.00	87.14	151.50	11,267.52	-2,079.93	-227.81	1,855.44	7.99	6.36	-4.85
11,975.00	88.02	152.03	11,269.50	-2,121.30	-205.60	1,902.05	2.19	1.87	1.13
12,071.00	90.04	151.85	11,271.13	-2,206.00	-160.45	1,997.36	2.11	2.10	-0.19
12,165.00	89.87	151.67	11,271.20	-2,288.81	-115.97	2,090.67	0.26	-0.18	-0.19
12,259.00	88.55	151.50	11,272.50	-2,371.48	-71.25	2,183.93	1.42	-1.40	-0.18
12,354.00	88.64	151.15	11,274.83	-2,454.80	-25.67	2,278.11	0.38	0.09	-0.37
12,448.00	89.25	151.50	11,276.56	-2,537.26	19.42	2,371.31	0.75	0.65	0.37
12,543.00	87.05	150.27	11,279.62	-2,620.20	65.62	2,465.37	2.65	-2.32	-1.29
12,638.00	87.41	150.62	11,284.22	-2,702.75	112.42	2,559.27	0.53	0.38	0.37
12,732.00	88.11	150.97	11,287.89	-2,784.73	158.25	2,652.30	0.83	0.74	0.37
12,827.00	88.81	151.32	11,290.44	-2,867.91	204.08	2,746.43	0.82	0.74	0.37
12,921.00	89.25	150.80	11,292.03	-2,950.16	249.56	2,839.58	0.72	0.47	-0.55
13,016.00	87.85	150.62	11,294.44	-3,032.98	296.02	2,933.62	1.49	-1.47	-0.19
13,110.00	88.20	150.62	11,297.68	-3,114.84	342.11	3,026.63	0.37	0.37	0.00
13,205.00	89.08	151.15	11,299.93	-3,197.82	388.32	3,120.71	1.08	0.93	0.56
13,299.00	89.52	151.15	11,301.08	-3,280.14	433.67	3,213.89	0.47	0.47	0.00
13,394.00	90.04	150.97	11,301.44	-3,363.28	479.64	3,308.04	0.58	0.55	-0.19
13,488.00	90.66	151.50	11,300.87	-3,445.68	524.88	3,401.24	0.87	0.66	0.56
13,583.00	88.37	151.32	11,301.67	-3,529.09	570.33	3,495.45	2.42	-2.41	-0.19
13,678.00	89.08	152.55	11,303.79	-3,612.89	615.02	3,589.76	1.49	0.75	1.29
13,773.00	89.69	151.85	11,304.81	-3,696.92	659.32	3,684.14	0.98	0.64	-0.74
13,867.00	90.40	152.20	11,304.73	-3,779.94	703.41	3,777.50	0.84	0.76	0.37
13,961.00	88.90	150.80	11,305.31	-3,862.54	748.26	3,870.75	2.18	-1.60	-1.49
14,056.00	87.41	150.62	11,308.37	-3,945.35	794.72	3,964.77	1.58	-1.57	-0.19
14,150.00	88.11	150.44	11,312.04	-4,027.12	840.92	4,057.74	0.77	0.74	-0.19
14,245.00	88.11	151.85	11,315.17	-4,110.28	886.74	4,151.86	1.48	0.00	1.48
14,340.00	88.72	151.67	11,317.80	-4,193.94	931.68	4,246.12	0.67	0.64	-0.19
14,434.00	88.11	151.15	11,320.40	-4,276.45	976.64	4,339.32	0.85	-0.65	-0.55
14,529.00	88.90	151.85	11,322.88	-4,359.91	1,021.96	4,433.53	1.11	0.83	0.74
14,623.00	88.90	151.85	11,324.69	-4,442.77	1,066.30	4,526.84	0.00	0.00	0.00
14,717.00	89.08	150.62	11,326.34	-4,525.16	1,111.52	4,620.02	1.32	0.19	-1.31
14,812.00	89.34	149.39	11,327.65	-4,607.42	1,159.01	4,713.92	1.32	0.27	-1.29
14,907.00	89.87	149.04	11,328.31	-4,689.04	1,207.63	4,807.61	0.67	0.56	-0.37

Company:	Tug Hill Operating LLC	RECEIVED Office of Oil and Gas SEP 30 2022 WV Department of Environmental Protection	Local Co-ordinate Reference:	Well Keith Stem S-17 HU (slot O)
Project:	Marshall County, West Virginia.		TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem		MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem S-17 HU (slot O)		North Reference:	Grid
Wellbore:	Original Hole		Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14	

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)
15,001.00	88.55	148.86	11,329.60	-4,769.56	1,256.11	4,900.23	1.42	-1.40	-0.19
15,095.00	88.90	150.09	11,331.69	-4,850.51	1,303.84	4,992.99	1.36	0.37	1.31
15,190.00	87.14	150.80	11,334.98	-4,933.09	1,350.67	5,086.94	2.00	-1.85	0.75
15,285.00	88.20	150.44	11,338.84	-5,015.81	1,397.24	5,180.91	1.18	1.12	-0.38
15,379.00	87.58	150.09	11,342.30	-5,097.37	1,443.83	5,273.83	0.76	-0.66	-0.37
15,473.00	88.29	149.92	11,345.69	-5,178.73	1,490.79	5,366.68	0.78	0.76	-0.18
15,568.00	89.08	149.92	11,347.87	-5,260.91	1,538.39	5,460.54	0.83	0.83	0.00
15,663.00	87.05	150.62	11,351.08	-5,343.36	1,585.48	5,554.45	2.26	-2.14	0.74
15,757.00	87.67	150.44	11,355.40	-5,425.11	1,631.67	5,647.39	0.69	0.66	-0.19
15,852.00	88.81	150.44	11,358.32	-5,507.70	1,678.52	5,741.35	1.20	1.20	0.00
15,947.00	89.78	150.80	11,359.49	-5,590.48	1,725.12	5,835.40	1.09	1.02	0.38
16,042.00	88.29	150.62	11,361.09	-5,673.32	1,771.59	5,929.45	1.58	-1.57	-0.19
16,136.00	88.55	150.44	11,363.68	-5,755.12	1,817.81	6,022.46	0.34	0.28	-0.19
16,231.00	89.25	150.27	11,365.51	-5,837.67	1,864.80	6,116.43	0.76	0.74	-0.18
16,325.00	88.90	149.56	11,367.02	-5,919.00	1,911.91	6,209.31	0.84	-0.37	-0.76
16,420.00	89.69	149.92	11,368.19	-6,001.05	1,959.78	6,303.14	0.91	0.83	0.38
16,515.00	88.37	150.80	11,369.80	-6,083.60	2,006.75	6,397.11	1.67	-1.39	0.93
16,609.00	88.37	150.44	11,372.48	-6,165.48	2,052.85	6,490.14	0.38	0.00	-0.38
16,704.00	89.34	150.80	11,374.37	-6,248.24	2,099.45	6,584.17	1.09	1.02	0.38
16,799.00	89.34	150.97	11,375.47	-6,331.23	2,145.67	6,678.28	0.18	0.00	0.18
16,894.00	88.20	150.27	11,377.51	-6,413.99	2,192.26	6,772.30	1.41	-1.20	-0.74
16,988.00	86.97	149.74	11,381.47	-6,495.33	2,239.21	6,865.13	1.42	-1.31	-0.56
17,083.00	87.93	149.92	11,385.69	-6,577.38	2,286.91	6,958.90	1.03	1.01	0.19
17,177.00	86.61	151.15	11,390.17	-6,659.12	2,333.09	7,051.83	1.92	-1.40	1.31
17,272.00	87.58	151.50	11,394.99	-6,742.36	2,378.62	7,145.92	1.09	1.02	0.37
17,367.00	88.46	151.67	11,398.27	-6,825.87	2,423.80	7,240.13	0.94	0.93	0.18
17,461.00	89.34	152.03	11,400.07	-6,908.73	2,468.14	7,333.43	1.01	0.94	0.38
17,555.00	90.40	152.03	11,400.29	-6,991.75	2,512.22	7,426.79	1.13	1.13	0.00
17,649.00	89.16	150.80	11,400.65	-7,074.29	2,557.19	7,520.02	1.86	-1.32	-1.31
17,744.00	89.08	150.27	11,402.11	-7,156.99	2,603.92	7,614.04	0.56	-0.08	-0.56
17,839.00	90.13	150.44	11,402.76	-7,239.56	2,650.91	7,708.03	1.12	1.11	0.18
17,933.00	89.96	149.74	11,402.69	-7,321.04	2,697.78	7,800.97	0.77	-0.18	-0.74
18,028.00	90.84	149.21	11,402.02	-7,402.87	2,746.03	7,894.73	1.08	0.93	-0.56
18,123.00	89.34	149.74	11,401.88	-7,484.70	2,794.28	7,988.49	1.67	-1.58	0.56
18,217.00	88.55	149.21	11,403.61	-7,565.65	2,842.01	8,081.25	1.01	-0.84	-0.56
18,312.00	89.34	149.39	11,405.36	-7,647.33	2,890.51	8,174.96	0.85	0.83	0.19
18,407.00	87.93	149.56	11,407.62	-7,729.13	2,938.74	8,268.69	1.49	-1.48	0.18
18,501.00	88.29	149.74	11,410.72	-7,810.21	2,986.21	8,361.47	0.43	0.38	0.19
18,596.00	89.43	149.74	11,412.61	-7,892.25	3,034.08	8,455.28	1.20	1.20	0.00
18,691.00	88.99	149.92	11,413.92	-7,974.37	3,081.82	8,549.13	0.50	-0.46	0.19
18,786.00	89.25	149.04	11,415.38	-8,056.20	3,130.05	8,642.89	0.97	0.27	-0.93
18,852.00	90.04	148.86	11,415.79	-8,112.74	3,164.09	8,707.93	1.23	1.20	-0.27
Survey @ 18852.00 MD 11415.79 TVD									
18,912.00	90.04	148.86	11,415.74	-8,164.09	3,195.12	8,767.04	0.00	0.00	0.00



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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem S-17 HU (slot O)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Buld Rate (°/100usft)	Turn Rate (°/100usft)
Survey projected to 18912.00 MD 11415.74 TVD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
234.00	233.99	1.53	-0.09	MWD surveys
18,852.00	11,415.79	-8,112.74	3,164.09	Survey @ 18852.00 MD 11415.79 TVD
18,912.00	11,415.74	-8,164.09	3,195.12	Survey projected to 18912.00 MD 11415.74 TVD

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-17 HU (slot O)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern S-17 HU (slot O)	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)	System Datum:	Mean Sea Level
Geo Datum:	NAD83 West Virginia - HARN		
Map Zone:	Zone 17N (84 W to 78 W)		

Site	Keith Stern				
Site Position:		Northing:	14,444,890.33 usft	Latitude:	39.77483004
From:	Lat/Long	Easting:	1,726,932.47 usft	Longitude:	-80.69208048
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.197 °

Well	Keith Stern S-17 HU (slot O)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,868.79 usft	Latitude:	39.77477099
	+E/-W	0.00 usft	Easting:	1,726,921.91 usft	Longitude:	-80.69211834
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	747.00 usft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	7/24/2020	-8.793	66.684	51,812.34274225

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	158.72	

Survey Program	Date	8/30/2020			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
234.00	2,202.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,309.00	7,237.00	MWD int (Original Hole)	MWD	MWD - Standard	
7,426.00	18,852.00	MWD lat (Original Hole)	MWD	MWD - Standard	
18,912.00	18,912.00	Projection (Original Hole)	MWD	MWD - Standard	

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	14,444,868.79	1,726,921.91	39.77477099	-80.69211834
234.00	0.75	356.81	233.99	1.53	-0.09	14,444,870.32	1,726,921.82	39.77477519	-80.69211863
MWD surveys									
294.00	0.88	342.05	293.99	2.36	-0.25	14,444,871.15	1,726,921.66	39.77477747	-80.69211920
323.00	1.10	355.67	322.98	2.85	-0.34	14,444,871.64	1,726,921.57	39.77477882	-80.69211951
413.00	0.75	332.29	412.97	4.23	-0.68	14,444,873.02	1,726,921.23	39.77478262	-80.69212070
470.00	0.31	293.18	469.97	4.62	-0.99	14,444,873.41	1,726,920.91	39.77478370	-80.69212182
539.00	0.40	12.63	538.97	4.93	-1.11	14,444,873.72	1,726,920.79	39.77478454	-80.69212224
602.00	0.57	153.43	601.97	4.87	-0.92	14,444,873.65	1,726,920.98	39.77478436	-80.69212157

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-17 HU (slot O)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
633.00	1.58	176.55	632.96	4.30	-0.83	14,444,873.09	1,726,921.08	39.77478281	-80.69212124
665.00	2.37	171.80	664.94	3.21	-0.71	14,444,871.99	1,726,921.20	39.77477980	-80.69212082
697.00	2.77	166.62	696.91	1.80	-0.43	14,444,870.59	1,726,921.47	39.77477594	-80.69211987
792.00	1.10	171.45	791.85	-1.34	0.23	14,444,867.45	1,726,922.14	39.77476732	-80.69211753
886.00	1.10	130.93	885.84	-2.82	1.05	14,444,865.97	1,726,922.95	39.77476324	-80.69211465
980.00	1.01	77.58	979.82	-3.23	2.54	14,444,865.56	1,726,924.44	39.77476209	-80.69210934
1,075.00	1.27	82.50	1,074.80	-2.92	4.40	14,444,865.87	1,726,926.31	39.77476294	-80.69210272
1,169.00	1.58	95.25	1,168.77	-2.90	6.72	14,444,865.89	1,726,928.63	39.77476297	-80.69209445
1,231.00	1.32	127.33	1,230.76	-3.41	8.14	14,444,865.38	1,726,930.05	39.77476155	-80.69208940
1,263.00	1.19	150.80	1,262.75	-3.92	8.60	14,444,864.87	1,726,930.50	39.77476014	-80.69208779
1,326.00	1.36	190.08	1,325.73	-5.23	8.79	14,444,863.56	1,726,930.69	39.77475655	-80.69208713
1,357.00	1.10	175.58	1,356.73	-5.89	8.74	14,444,862.90	1,726,930.65	39.77475474	-80.69208729
1,388.00	1.67	195.00	1,387.72	-6.62	8.65	14,444,862.17	1,726,930.56	39.77475272	-80.69208763
1,420.00	1.76	195.27	1,419.70	-7.55	8.40	14,444,861.24	1,726,930.31	39.77475019	-80.69208854
1,452.00	1.93	202.21	1,451.69	-8.52	8.07	14,444,860.27	1,726,929.97	39.77474752	-80.69208973
1,499.00	1.71	194.65	1,498.66	-9.93	7.59	14,444,858.86	1,726,929.50	39.77474365	-80.69209145
1,546.00	1.58	180.68	1,545.64	-11.26	7.41	14,444,857.53	1,726,929.31	39.77474001	-80.69209212
1,641.00	1.85	162.92	1,640.60	-14.03	7.84	14,444,854.76	1,726,929.75	39.77473238	-80.69209061
1,735.00	2.42	142.53	1,734.54	-17.06	9.49	14,444,851.73	1,726,931.40	39.77472406	-80.69208476
1,830.00	2.90	143.06	1,829.44	-20.57	12.16	14,444,848.22	1,726,934.06	39.77471439	-80.69207532
1,925.00	3.47	135.06	1,924.29	-24.53	15.63	14,444,844.26	1,726,937.54	39.77470349	-80.69206300
2,019.00	4.22	126.89	2,018.08	-28.62	20.41	14,444,840.17	1,726,942.31	39.77469221	-80.69204606
2,114.00	3.82	126.80	2,112.84	-32.61	25.74	14,444,836.18	1,726,947.64	39.77468119	-80.69202714
2,202.00	2.42	134.80	2,200.71	-35.68	29.40	14,444,833.11	1,726,951.31	39.77467274	-80.69201413
2,309.00	3.16	141.65	2,307.58	-39.58	32.84	14,444,829.21	1,726,954.74	39.77466199	-80.69200196
2,403.00	3.82	144.29	2,401.41	-44.15	36.27	14,444,824.63	1,726,958.18	39.77464939	-80.69198979
2,498.00	4.26	141.30	2,496.17	-49.48	40.33	14,444,819.31	1,726,962.23	39.77463473	-80.69197543
2,591.00	4.88	143.06	2,588.88	-55.33	44.86	14,444,813.45	1,726,966.77	39.77461860	-80.69195935
2,686.00	6.28	139.72	2,683.42	-62.53	50.65	14,444,806.26	1,726,972.56	39.77459879	-80.69193884
2,780.00	5.93	139.11	2,776.89	-70.12	57.15	14,444,798.67	1,726,979.06	39.77457788	-80.69191579
2,875.00	5.19	143.50	2,871.44	-77.29	62.92	14,444,791.50	1,726,984.83	39.77455815	-80.69189535
2,970.00	3.69	138.14	2,966.16	-83.02	67.52	14,444,785.77	1,726,989.42	39.77454237	-80.69187906
3,064.00	2.15	146.84	3,060.03	-86.75	70.50	14,444,782.04	1,726,992.41	39.77453210	-80.69186849
3,159.00	1.63	160.64	3,154.98	-89.51	71.92	14,444,779.28	1,726,993.83	39.77452449	-80.69186346
3,254.00	1.76	200.19	3,249.94	-92.16	71.87	14,444,776.63	1,726,993.77	39.77451723	-80.69186369
3,348.00	1.54	202.12	3,343.90	-94.68	70.89	14,444,774.11	1,726,992.80	39.77451030	-80.69186719
3,442.00	2.33	212.93	3,437.85	-97.46	69.38	14,444,771.33	1,726,991.29	39.77450270	-80.69187261
3,537.00	3.25	204.50	3,532.74	-101.53	67.21	14,444,767.26	1,726,989.12	39.77449154	-80.69188037
3,632.00	3.82	204.76	3,627.55	-106.85	64.77	14,444,761.94	1,726,986.68	39.77447694	-80.69188913
3,726.00	4.17	203.09	3,721.33	-112.84	62.12	14,444,755.95	1,726,984.02	39.77446052	-80.69189864
3,821.00	5.01	201.33	3,816.02	-119.88	59.26	14,444,748.91	1,726,981.16	39.77444121	-80.69190892
3,915.00	4.00	204.41	3,909.73	-126.69	56.41	14,444,742.10	1,726,978.31	39.77442254	-80.69191913
4,010.00	3.87	207.22	4,004.51	-132.56	53.57	14,444,736.23	1,726,975.48	39.77440645	-80.69192930
4,107.00	2.99	204.76	4,101.33	-137.77	51.01	14,444,731.02	1,726,972.92	39.77439217	-80.69193846
4,202.00	3.30	202.21	4,196.19	-142.55	48.94	14,444,726.24	1,726,970.85	39.77437906	-80.69194589
4,296.00	4.39	193.16	4,289.98	-148.55	47.10	14,444,720.23	1,726,969.01	39.77436258	-80.69195252
4,391.00	4.88	201.51	4,384.67	-155.85	44.79	14,444,712.93	1,726,966.70	39.77434255	-80.69196083
4,485.00	4.70	201.68	4,478.34	-163.15	41.90	14,444,705.63	1,726,963.81	39.77432253	-80.69197120
4,580.00	3.74	202.39	4,573.08	-169.63	39.29	14,444,699.15	1,726,961.19	39.77430476	-80.69198060
4,675.00	3.16	214.78	4,667.91	-174.65	36.61	14,444,694.14	1,726,958.52	39.77429101	-80.69199018
4,769.00	3.74	218.56	4,761.74	-179.18	33.22	14,444,689.61	1,726,955.13	39.77427861	-80.69200229
4,864.00	4.22	216.98	4,856.51	-184.39	29.19	14,444,684.40	1,726,951.09	39.77426433	-80.69201671
4,959.00	3.87	226.21	4,951.27	-189.40	24.77	14,444,679.39	1,726,946.68	39.77425061	-80.69203249
5,053.00	2.94	228.05	5,045.10	-193.21	20.69	14,444,675.58	1,726,942.60	39.77424020	-80.69204707
5,148.00	3.38	228.84	5,139.96	-196.68	16.77	14,444,672.11	1,726,938.67	39.77423070	-80.69206107

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-17 HU (slot O)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,242.00	2.86	223.66	5,233.82	-200.20	13.06	14,444,668.59	1,726,934.97	39.77422107	-80.69207430
5,338.00	3.34	224.45	5,329.68	-203.93	9.45	14,444,664.86	1,726,931.36	39.77421086	-80.69208720
5,433.00	5.01	215.83	5,424.43	-209.27	5.08	14,444,659.52	1,726,926.99	39.77419624	-80.69210280
5,528.00	5.14	214.60	5,519.05	-216.13	0.24	14,444,652.65	1,726,922.15	39.77417743	-80.69212013
5,623.00	4.13	207.31	5,613.74	-222.68	-3.75	14,444,646.11	1,726,918.16	39.77415950	-80.69213440
5,717.00	2.77	208.98	5,707.57	-227.67	-6.40	14,444,641.12	1,726,915.51	39.77414580	-80.69214390
5,812.00	2.77	214.34	5,802.46	-231.58	-8.81	14,444,637.21	1,726,913.10	39.77413511	-80.69215252
5,907.00	3.03	217.59	5,897.34	-235.46	-11.63	14,444,633.33	1,726,910.27	39.77412446	-80.69216262
6,002.00	4.22	207.57	5,992.15	-240.55	-14.78	14,444,628.24	1,726,907.12	39.77411052	-80.69217390
6,096.00	5.36	213.99	6,085.82	-247.26	-18.84	14,444,621.53	1,726,903.07	39.77409214	-80.69218841
6,191.00	5.49	212.14	6,180.39	-254.78	-23.74	14,444,614.01	1,726,898.17	39.77407152	-80.69220594
6,289.00	4.70	214.34	6,278.00	-262.07	-28.50	14,444,606.72	1,726,893.41	39.77405156	-80.69222296
6,386.00	6.50	205.81	6,374.54	-270.29	-33.13	14,444,598.50	1,726,888.78	39.77402901	-80.69223955
6,482.00	8.79	207.05	6,469.68	-281.72	-38.83	14,444,587.07	1,726,883.08	39.77399769	-80.69225998
6,576.00	10.37	204.58	6,562.36	-295.81	-45.62	14,444,572.98	1,726,876.29	39.77395905	-80.69228431
6,671.00	13.36	202.83	6,655.32	-313.70	-53.43	14,444,555.08	1,726,868.47	39.77390998	-80.69231235
6,766.00	15.25	203.44	6,747.38	-335.29	-62.66	14,444,533.50	1,726,859.24	39.77385080	-80.69234546
6,860.00	16.17	203.27	6,837.86	-358.65	-72.75	14,444,510.14	1,726,849.16	39.77378673	-80.69238165
6,953.00	17.84	205.20	6,926.79	-383.44	-83.93	14,444,485.35	1,726,837.97	39.77371876	-80.69242175
7,048.00	17.49	203.62	7,017.32	-409.69	-95.85	14,444,459.10	1,726,826.06	39.77364679	-80.69246448
7,142.00	13.80	200.45	7,107.82	-433.14	-105.43	14,444,435.65	1,726,816.48	39.77358246	-80.69249886
7,237.00	12.35	194.96	7,200.36	-453.58	-112.01	14,444,415.21	1,726,809.89	39.77352641	-80.69252254
7,426.00	11.87	199.93	7,385.16	-491.38	-123.86	14,444,377.41	1,726,798.05	39.77342271	-80.69256515
7,521.00	11.21	197.11	7,478.24	-509.39	-129.90	14,444,359.40	1,726,792.00	39.77337330	-80.69258690
7,615.00	11.47	193.42	7,570.40	-527.21	-134.76	14,444,341.58	1,726,787.15	39.77332440	-80.69260440
7,710.00	11.56	199.49	7,663.49	-545.37	-140.13	14,444,323.41	1,726,781.78	39.77327457	-80.69262373
7,804.00	12.00	216.19	7,755.54	-562.14	-149.04	14,444,306.64	1,726,772.86	39.77322860	-80.69265566
7,899.00	13.67	219.09	7,848.16	-578.83	-161.95	14,444,289.96	1,726,759.95	39.77318290	-80.69270181
7,993.00	14.81	218.56	7,939.27	-596.85	-176.45	14,444,271.94	1,726,745.46	39.77313356	-80.69275361
8,087.00	15.21	214.69	8,030.07	-616.38	-190.95	14,444,252.41	1,726,730.95	39.77308005	-80.69280548
8,186.00	13.05	207.13	8,126.08	-637.01	-203.44	14,444,231.78	1,726,718.46	39.77302352	-80.69285019
8,281.00	14.85	204.06	8,218.27	-657.67	-213.30	14,444,211.12	1,726,708.61	39.77296686	-80.69288551
8,375.00	16.52	200.19	8,308.77	-681.22	-222.82	14,444,187.57	1,726,699.08	39.77290229	-80.69291970
8,469.00	17.75	202.04	8,398.60	-707.04	-232.81	14,444,161.74	1,726,689.09	39.77283146	-80.69295557
8,563.00	17.09	201.33	8,488.29	-733.19	-243.21	14,444,135.60	1,726,678.69	39.77275975	-80.69299290
8,657.00	16.44	201.51	8,578.29	-758.43	-253.12	14,444,110.36	1,726,668.79	39.77269052	-80.69302845
8,752.00	16.08	200.54	8,669.49	-783.26	-262.66	14,444,085.53	1,726,659.25	39.77262243	-80.69306272
8,846.00	16.04	199.84	8,759.82	-807.67	-271.64	14,444,061.12	1,726,650.27	39.77255549	-80.69309496
8,941.00	15.64	201.42	8,851.21	-831.93	-280.77	14,444,036.86	1,726,641.14	39.77248893	-80.69312775
9,032.00	16.57	201.51	8,938.64	-855.42	-290.01	14,444,013.36	1,726,631.90	39.77242451	-80.69316092
9,126.00	17.09	201.24	9,028.62	-880.77	-299.92	14,443,988.02	1,726,621.98	39.77235500	-80.69319653
9,219.00	17.18	200.63	9,117.49	-906.36	-309.71	14,443,962.43	1,726,612.19	39.77228481	-80.69323168
9,313.00	17.01	200.80	9,207.33	-932.21	-319.49	14,443,936.58	1,726,602.42	39.77221392	-80.69326678
9,407.00	16.00	202.12	9,297.46	-957.06	-329.25	14,443,911.73	1,726,592.66	39.77214576	-80.69330182
9,502.00	14.72	206.96	9,389.07	-979.95	-339.65	14,443,888.84	1,726,582.26	39.77208299	-80.69333912
9,597.00	13.84	204.06	9,481.13	-1,001.08	-349.76	14,443,867.70	1,726,572.15	39.77202505	-80.69337534
9,691.00	14.46	205.02	9,572.28	-1,021.98	-359.30	14,443,846.80	1,726,562.60	39.77196774	-80.69340957
9,785.00	14.90	206.52	9,663.21	-1,043.43	-369.66	14,443,825.35	1,726,552.24	39.77190893	-80.69344671
9,879.00	14.81	208.98	9,754.07	-1,064.76	-380.88	14,443,804.03	1,726,541.03	39.77185048	-80.69348689
9,974.00	14.15	210.30	9,846.05	-1,085.40	-392.62	14,443,783.38	1,726,529.28	39.77179389	-80.69352892
10,068.00	14.46	211.62	9,937.14	-1,105.32	-404.57	14,443,763.47	1,726,517.33	39.77173931	-80.69357170
10,140.00	14.77	210.56	10,006.81	-1,120.88	-413.95	14,443,747.91	1,726,507.96	39.77169667	-80.69360526
10,180.00	14.25	211.44	10,045.53	-1,129.47	-419.11	14,443,739.32	1,726,502.80	39.77167313	-80.69362373
10,274.00	15.66	210.74	10,136.35	-1,150.24	-431.63	14,443,718.55	1,726,490.28	39.77161619	-80.69366854
10,368.00	14.96	209.68	10,227.01	-1,171.69	-444.12	14,443,697.10	1,726,477.78	39.77155741	-80.69371327

WV Department of Environmental Protection

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-17 HU (slot O)
Project:	Marshall County, West Virginia Gas	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
10,462.00	14.60	205.46	10,317.90	-1,192.93	-455.22	14,443,675.86	1,726,466.68	39.77149919	-80.69375303
10,557.00	14.25	207.57	10,409.91	-1,214.10	-465.78	14,443,654.69	1,726,456.12	39.77144114	-80.69379087
10,652.00	14.60	201.60	10,501.92	-1,235.60	-475.60	14,443,633.19	1,726,446.30	39.77138219	-80.69382608
10,699.00	14.43	198.08	10,547.42	-1,246.68	-479.60	14,443,622.11	1,726,442.31	39.77135181	-80.69384044
10,746.00	14.68	193.33	10,592.91	-1,258.04	-482.79	14,443,610.75	1,726,439.11	39.77132064	-80.69385193
10,793.00	16.00	189.64	10,638.24	-1,270.22	-485.25	14,443,598.57	1,726,436.66	39.77128721	-80.69386083
10,841.00	18.64	178.57	10,684.07	-1,284.42	-486.17	14,443,584.37	1,726,435.74	39.77124823	-80.69386426
10,888.00	20.84	171.01	10,728.31	-1,300.19	-484.67	14,443,568.60	1,726,437.23	39.77120490	-80.69385914
10,936.00	24.18	170.83	10,772.65	-1,318.33	-481.77	14,443,550.46	1,726,440.14	39.77115505	-80.69384903
10,983.00	28.23	170.83	10,814.81	-1,338.82	-478.46	14,443,529.97	1,726,443.44	39.77109876	-80.69383751
11,030.00	32.18	171.36	10,855.42	-1,362.17	-474.81	14,443,506.62	1,726,447.10	39.77103458	-80.69382479
11,077.00	36.49	171.19	10,894.22	-1,388.37	-470.79	14,443,480.42	1,726,451.12	39.77096260	-80.69381080
11,125.00	39.92	172.24	10,931.94	-1,417.74	-466.52	14,443,451.05	1,726,455.38	39.77088190	-80.69379597
11,172.00	43.53	171.19	10,967.01	-1,448.69	-462.00	14,443,420.10	1,726,459.90	39.77079686	-80.69378027
11,219.00	47.57	169.08	10,999.92	-1,481.73	-456.24	14,443,387.06	1,726,465.67	39.77070607	-80.69376015
11,266.00	50.74	167.32	11,030.66	-1,516.52	-448.96	14,443,352.26	1,726,472.95	39.77061045	-80.69373466
11,314.00	53.99	166.62	11,059.96	-1,553.55	-440.38	14,443,315.24	1,726,481.53	39.77050868	-80.69370459
11,361.00	56.37	165.21	11,086.80	-1,590.97	-430.99	14,443,277.82	1,726,490.92	39.77040583	-80.69367161
11,408.00	57.33	162.05	11,112.50	-1,628.71	-419.89	14,443,240.07	1,726,502.01	39.77030207	-80.69363259
11,455.00	60.76	159.58	11,136.68	-1,666.77	-406.64	14,443,202.02	1,726,515.27	39.77019745	-80.69358588
11,503.00	63.49	158.35	11,159.12	-1,706.36	-391.40	14,443,162.43	1,726,530.50	39.77008856	-80.69353215
11,550.00	66.30	157.65	11,179.06	-1,745.82	-375.46	14,443,122.97	1,726,546.45	39.76998006	-80.69347588
11,597.00	68.41	157.30	11,197.15	-1,785.88	-358.84	14,443,082.91	1,726,563.07	39.76986987	-80.69341723
11,644.00	70.96	157.30	11,213.47	-1,826.54	-341.83	14,443,042.25	1,726,580.07	39.76975805	-80.69335720
11,692.00	74.48	156.77	11,227.72	-1,868.73	-323.95	14,443,000.05	1,726,597.96	39.76964201	-80.69329408
11,739.00	76.77	156.60	11,239.39	-1,910.54	-305.93	14,442,958.25	1,726,615.97	39.76952702	-80.69323046
11,786.00	78.52	156.77	11,249.45	-1,952.70	-287.76	14,442,916.08	1,726,634.14	39.76941107	-80.69316631
11,833.00	81.07	156.42	11,257.77	-1,995.15	-269.39	14,442,873.64	1,726,652.52	39.76929433	-80.69310144
11,881.00	84.15	153.78	11,263.95	-2,038.32	-249.35	14,442,830.47	1,726,672.56	39.76917559	-80.69303065
11,928.00	87.14	151.50	11,267.52	-2,079.93	-227.81	14,442,788.86	1,726,694.09	39.76906111	-80.69295452
11,975.00	88.02	152.03	11,269.50	-2,121.30	-205.60	14,442,747.49	1,726,716.31	39.76894729	-80.69287596
12,021.00	90.04	151.85	11,271.13	-2,206.00	-160.45	14,442,662.79	1,726,761.46	39.76871425	-80.69271632
12,165.00	89.87	151.67	11,271.20	-2,288.81	-115.97	14,442,579.98	1,726,805.94	39.76848641	-80.69255905
12,259.00	88.55	151.50	11,272.50	-2,371.48	-71.25	14,442,497.31	1,726,850.66	39.76825897	-80.69240089
12,354.00	88.64	151.15	11,274.83	-2,454.80	-25.67	14,442,413.99	1,726,896.23	39.76802971	-80.69223974
12,448.00	89.25	151.50	11,276.56	-2,537.26	19.42	14,442,331.53	1,726,941.33	39.76780284	-80.69208026
12,543.00	87.05	150.27	11,279.62	-2,620.20	65.62	14,442,248.58	1,726,987.52	39.76757461	-80.69191688
12,638.00	87.41	150.62	11,284.22	-2,702.75	112.42	14,442,166.04	1,727,034.33	39.76734748	-80.69175133
12,732.00	88.11	150.97	11,287.89	-2,784.73	158.25	14,442,084.06	1,727,080.16	39.76712189	-80.69158924
12,827.00	88.81	151.32	11,290.44	-2,867.91	204.08	14,442,000.88	1,727,125.99	39.76689304	-80.69142716
12,921.00	89.25	150.80	11,292.03	-2,950.16	249.56	14,441,918.63	1,727,171.47	39.76666673	-80.69126633
13,016.00	87.85	150.62	11,294.44	-3,032.98	296.02	14,441,835.81	1,727,217.93	39.76643883	-80.69110201
13,110.00	88.20	150.62	11,297.68	-3,114.84	342.11	14,441,753.94	1,727,264.02	39.76621358	-80.69093900
13,205.00	89.08	151.15	11,299.93	-3,197.82	388.32	14,441,670.97	1,727,310.23	39.76598528	-80.69077557
13,299.00	89.52	151.15	11,301.08	-3,280.14	433.67	14,441,588.65	1,727,355.58	39.76575875	-80.69061519
13,394.00	90.04	150.97	11,301.44	-3,363.28	479.64	14,441,505.51	1,727,401.55	39.76553000	-80.69045263
13,488.00	90.66	151.50	11,300.87	-3,445.68	524.88	14,441,423.11	1,727,446.78	39.76530329	-80.69029267
13,583.00	88.37	151.32	11,301.67	-3,529.09	570.33	14,441,339.70	1,727,492.24	39.76507380	-80.69013194
13,678.00	89.08	152.55	11,303.79	-3,612.89	615.02	14,441,255.90	1,727,536.92	39.76484322	-80.68997397
13,773.00	89.69	151.85	11,304.81	-3,696.92	659.32	14,441,171.87	1,727,581.23	39.76461203	-80.68981735
13,867.00	90.40	152.20	11,304.73	-3,779.94	703.41	14,441,088.85	1,727,625.32	39.76438363	-80.68966146
13,961.00	88.90	150.80	11,305.31	-3,862.54	748.26	14,441,006.25	1,727,670.17	39.76415635	-80.68950288
14,056.00	87.41	150.62	11,308.37	-3,945.35	794.72	14,440,923.44	1,727,716.62	39.76392849	-80.68933860
14,150.00	88.11	150.44	11,312.04	-4,027.12	840.92	14,440,841.66	1,727,762.83	39.76370348	-80.68917518
14,245.00	88.11	151.85	11,315.17	-4,110.28	886.74	14,440,758.51	1,727,808.65	39.76347467	-80.68901315

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-17 HU (slot O)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern S-17 HU (slot O) of Oil and Gas	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
14,340.00	88.72	151.67	11,317.80	-4,193.94	931.68	14,440,674.85	1,727,853.58	39.76324448	-80.68885429
14,434.00	88.11	151.15	11,320.40	-4,276.45	976.64	14,440,592.34	1,727,898.55	39.76301747	-80.68869531
14,529.00	88.90	151.85	11,322.88	-4,359.91	1,021.96	14,440,508.88	1,727,943.86	39.76278784	-80.68853509
14,623.00	88.90	151.85	11,324.69	-4,442.77	1,066.30	14,440,426.02	1,727,988.20	39.76255985	-80.68837834
14,717.00	89.08	150.62	11,326.34	-4,525.16	1,111.52	14,440,343.63	1,728,033.43	39.76233316	-80.68821842
14,812.00	89.34	149.39	11,327.65	-4,607.42	1,159.01	14,440,261.36	1,728,080.92	39.76210678	-80.68805046
14,907.00	89.87	149.04	11,328.31	-4,689.04	1,207.63	14,440,179.75	1,728,129.54	39.76188219	-80.68787846
15,001.00	88.55	148.86	11,329.60	-4,769.56	1,256.11	14,440,099.23	1,728,178.02	39.76166059	-80.68770696
15,095.00	88.90	150.09	11,331.69	-4,850.51	1,303.84	14,440,018.28	1,728,225.75	39.76143782	-80.68753811
15,190.00	87.14	150.80	11,334.98	-4,933.09	1,350.67	14,439,935.69	1,728,272.58	39.76121057	-80.68737250
15,285.00	88.20	150.44	11,338.84	-5,015.81	1,397.24	14,439,852.98	1,728,319.14	39.76098297	-80.68720783
15,379.00	87.58	150.09	11,342.30	-5,097.37	1,443.83	14,439,771.41	1,728,365.74	39.76075852	-80.68704305
15,473.00	88.29	149.92	11,345.69	-5,178.73	1,490.79	14,439,690.06	1,728,412.70	39.76053464	-80.68687696
15,568.00	89.08	149.92	11,347.87	-5,260.91	1,538.39	14,439,607.87	1,728,460.30	39.76030849	-80.68670860
15,663.00	87.05	150.62	11,351.08	-5,343.36	1,585.48	14,439,525.43	1,728,507.38	39.76008162	-80.68654209
15,757.00	87.67	150.44	11,355.40	-5,425.11	1,631.67	14,439,443.68	1,728,553.58	39.75985667	-80.68637873
15,852.00	88.81	150.44	11,358.32	-5,507.70	1,678.52	14,439,361.09	1,728,600.42	39.75962939	-80.68621307
15,947.00	89.78	150.80	11,359.49	-5,590.48	1,725.12	14,439,278.31	1,728,647.02	39.75940163	-80.68604828
16,042.00	88.29	150.62	11,361.09	-5,673.32	1,771.59	14,439,195.47	1,728,693.49	39.75917368	-80.68588397
16,136.00	88.55	150.44	11,363.68	-5,755.12	1,817.81	14,439,113.66	1,728,739.72	39.75894857	-80.68572050
16,231.00	89.25	150.27	11,365.51	-5,837.67	1,864.80	14,439,031.12	1,728,786.70	39.75872141	-80.68555436
16,325.00	88.90	149.56	11,367.02	-5,919.00	1,911.91	14,438,949.79	1,728,833.82	39.75849762	-80.68538773
16,420.00	89.69	149.92	11,368.19	-6,001.05	1,959.78	14,438,867.74	1,728,881.68	39.75827183	-80.68521843
16,515.00	88.37	150.80	11,369.80	-6,083.60	2,006.75	14,438,785.19	1,728,928.66	39.75804466	-80.68505232
16,609.00	88.37	150.44	11,372.48	-6,165.48	2,052.85	14,438,703.31	1,728,974.76	39.75781936	-80.68488932
16,704.00	89.34	150.80	11,374.37	-6,248.24	2,099.45	14,438,620.55	1,729,021.35	39.75759161	-80.68472456
16,799.00	89.34	150.97	11,375.47	-6,331.23	2,145.67	14,438,537.55	1,729,067.57	39.75736325	-80.68456114
16,894.00	88.20	150.27	11,377.51	-6,413.99	2,192.26	14,438,454.79	1,729,114.17	39.75713552	-80.68439638
16,988.00	86.97	149.74	11,381.47	-6,495.33	2,239.21	14,438,373.46	1,729,161.12	39.75691169	-80.68423035
17,083.00	87.93	149.92	11,385.69	-6,577.38	2,286.91	14,438,291.41	1,729,208.81	39.75668590	-80.68406167
17,177.00	86.61	151.15	11,390.17	-6,659.12	2,333.09	14,438,209.66	1,729,255.00	39.75646096	-80.68389836
17,272.00	87.58	151.50	11,394.99	-6,742.36	2,378.62	14,438,128.42	1,729,300.52	39.75623192	-80.68373742
17,367.00	88.46	151.67	11,398.27	-6,825.87	2,423.80	14,438,042.92	1,729,345.70	39.75600216	-80.68357772
17,461.00	89.34	152.03	11,400.07	-6,908.73	2,468.14	14,437,960.05	1,729,390.04	39.75577416	-80.68342100
17,555.00	90.40	152.03	11,400.29	-6,991.75	2,512.22	14,437,877.04	1,729,434.13	39.75554574	-80.68326519
17,649.00	89.16	150.80	11,400.65	-7,074.29	2,557.19	14,437,794.50	1,729,479.10	39.75531863	-80.68310621
17,744.00	89.08	150.27	11,402.11	-7,156.99	2,603.92	14,437,711.79	1,729,525.82	39.75509105	-80.68294100
17,839.00	90.13	150.44	11,402.76	-7,239.56	2,650.91	14,437,629.23	1,729,572.81	39.75486386	-80.68277486
17,933.00	89.96	149.74	11,402.69	-7,321.04	2,697.78	14,437,547.75	1,729,619.68	39.75463664	-80.68260911
18,028.00	90.84	149.21	11,402.02	-7,402.87	2,746.03	14,437,465.92	1,729,667.93	39.75441444	-80.68244387
18,123.00	89.34	149.74	11,401.88	-7,484.70	2,794.28	14,437,384.09	1,729,716.18	39.75419224	-80.68227873
18,217.00	88.55	149.21	11,403.61	-7,566.65	2,842.01	14,437,303.13	1,729,763.92	39.75396644	-80.68209901
18,312.00	89.34	149.39	11,405.36	-7,647.33	2,890.51	14,437,221.46	1,729,812.41	39.75374168	-80.68192750
18,407.00	87.93	149.56	11,407.62	-7,729.13	2,938.74	14,437,139.65	1,729,860.65	39.75351654	-80.68175691
18,501.00	88.29	149.74	11,410.72	-7,810.21	2,986.21	14,437,058.58	1,729,908.12	39.75329343	-80.68158904
18,596.00	89.43	149.74	11,412.61	-7,892.25	3,034.08	14,436,976.54	1,729,955.98	39.75306766	-80.68141978
18,691.00	88.99	149.92	11,413.92	-7,974.37	3,081.82	14,436,894.42	1,730,003.72	39.75284166	-80.68125097
18,786.00	89.25	149.04	11,415.38	-8,056.20	3,130.05	14,436,812.59	1,730,051.96	39.75261647	-80.68108038
18,852.00	90.04	148.86	11,415.79	-8,112.74	3,164.09	14,436,756.05	1,730,086.00	39.75246086	-80.68095998
Survey @ 18852.00 MD 11415.79 TVD									
18,912.00	90.04	148.86	11,415.74	-8,164.09	3,195.12	14,436,704.70	1,730,117.03	39.75231952	-80.68085023
Survey projected to 18912.00 MD 11415.74 TVD									



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem S-17 HU (slot O)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem S-17 HU (slot O)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
234.00	233.99	1.53	-0.09	MWD surveys
18,852.00	11,415.79	-8,112.74	3,164.09	Survey @ 18852.00 MD 11415.79 TVD
18,912.00	11,415.74	-8,164.09	3,195.12	Survey projected to 18912.00 MD 11415.74 TVD

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