



Well: Keith Stern N-13 HU (slot C)
Site: Keith Stern
Project: Marshall County, West Virginia.
Design: rev6
Rig: Nabors X08

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
14444867.26	1726897.78	39.77476702	-80.69220424

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 6.981°

M T G
 Azimuths to Grid North
 True North: -0.20°
 Magnetic North: -8.98°
 Magnetic Field
 Strength: 51844.8snT
 Dip Angle: 66.71°
 Date: 4/12/2020
 Model: IGRF2015



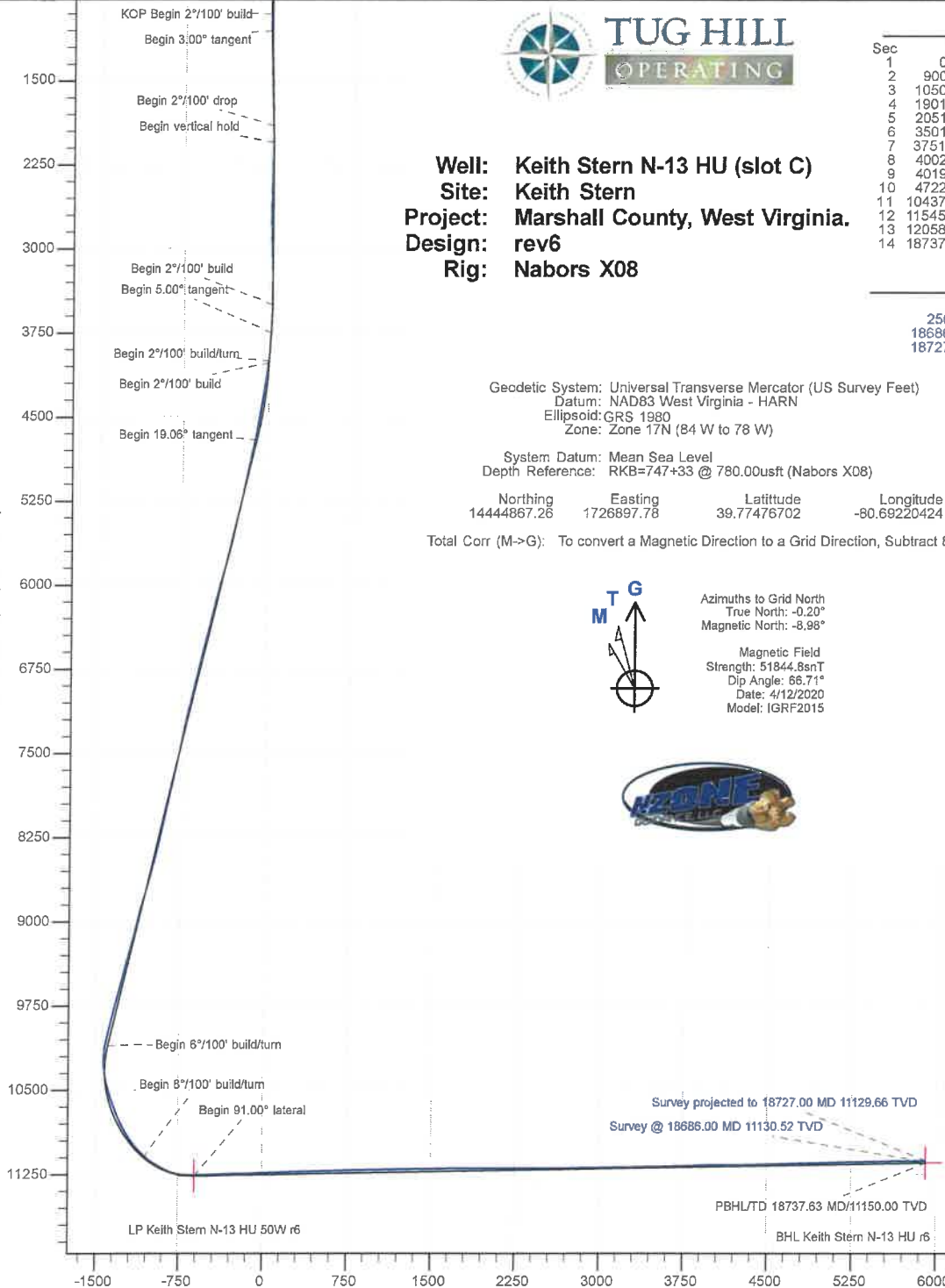
SECTION DETAILS

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	900.00	0.00	0.00	900.00	0.00	0.00	0.00	0.00	0.00	KOP Begin 2°/100' build
3	1050.00	3.00	260.00	1049.93	-0.68	-3.87	2.00	260.000	2.09	Begin 3.00° tangent
4	1901.24	3.00	260.00	1900.00	-8.42	-47.74	0.00	0.000	25.81	Begin 2°/100' drop
5	2051.24	0.00	0.00	2049.93	-9.10	-51.61	2.00	180.000	27.90	Begin vertical hold
6	3501.30	0.00	0.00	3500.00	-9.10	-51.61	0.00	0.000	27.90	Begin 2°/100' build
7	3751.31	5.00	180.00	3749.69	-20.00	-51.61	2.00	180.000	19.82	Begin 5.00° tangent
8	4002.58	5.00	180.00	4000.00	-41.90	-51.61	0.00	0.000	3.58	Begin 2°/100' build/turn
9	4019.66	5.00	183.92	4017.01	-43.39	-51.66	2.00	91.988	2.51	Begin 2°/100' build
10	4722.62	19.06	183.92	4702.82	-189.19	-61.65	2.00	0.003	-98.85	Begin 19.06° tangent
11	10437.67	19.06	183.92	10104.57	-2051.05	-189.29	0.00	0.000	-1393.23	Begin 6°/100' build/turn
12	11545.74	50.00	330.43	11098.51	-1837.96	-439.83	6.00	152.553	-1067.10	Begin 8°/100' build/turn
13	12058.24	91.00	330.43	11266.00	-1426.68	-673.15	8.00	0.000	-605.64	Begin 91.00° lateral
14	18737.63	91.00	330.43	11150.00	4382.10	-3968.44	0.00	0.000	5911.96	PBHL/TD 18737.63 MD/11150.00 TVD

ANNOTATIONS SURVEYS

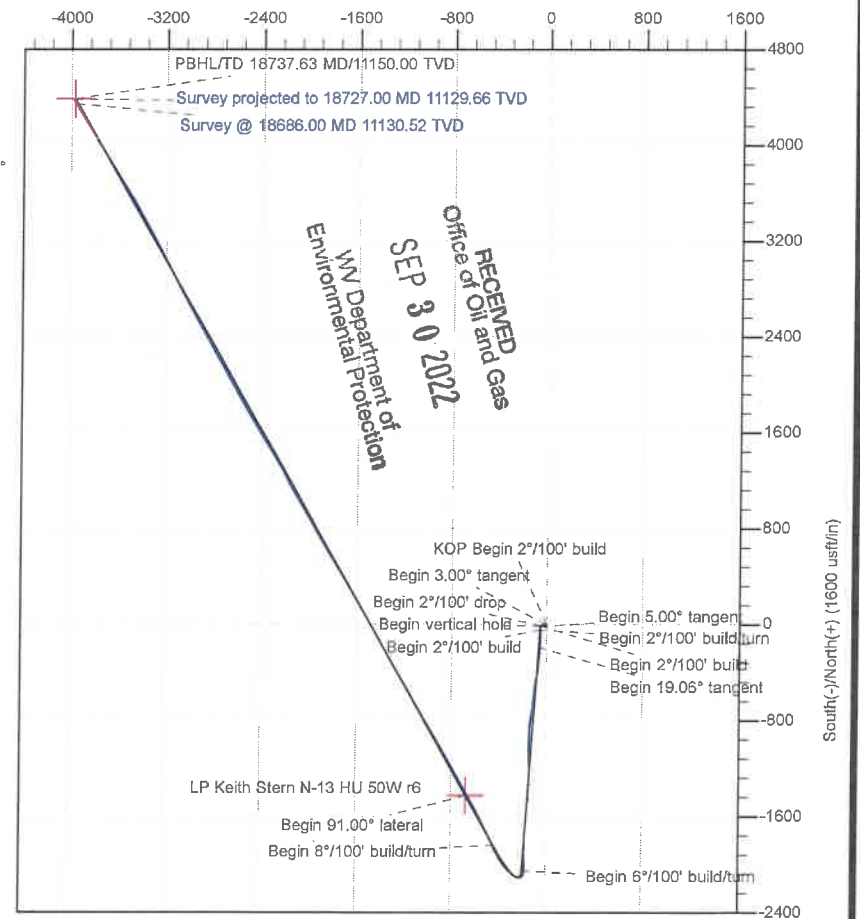
MD	Inc	Azi	TVD	+N/-S	+E/-W	VSec	Annotation
256.00	0.57	282.55	256.00	0.28	-1.24	1.04	MWD surveys
18686.00	91.21	329.93	11130.52	4338.27	-3956.33	5871.35	Survey @ 18686.00 MD 11130.52 TVD
18727.00	91.21	329.93	11129.66	4373.75	-3976.87	5911.43	Survey projected to 18727.00 MD 11129.66 TVD

True Vertical Depth (1500 usft/in)



Vertical Section at 317.84° (1500 usft/in)

West(-)/East(+) (1600 usft/in)



South(-)/North(+) (1600 usft/in)

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	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.			System Datum:	Mean Sea Level	SEP 30 2022
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)					

WV Department of
Environmental Protection

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 N-13 HU (slot C)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,867.26 usft	Latitude:	39.77476702
	+E/-W	0.00 usft	Easting:	1,726,897.78 usft	Longitude:	-80.69220424
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	
	IGRF2015	4/12/2020	(°)	(°)	(nT)	
			-8.784	66.708	51,844.76037232	

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	317.84		

Survey Program	Date 5/24/2020				
From	To	Survey (Wellbore)	Tool Name	Description	
(usft)	(usft)				
256.00	2,204.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,316.00	10,323.00	MWD (Original Hole)	MWD	MWD - Standard	
10,369.00	18,686.00	MWD lat (Original Hole)	MWD	MWD - Standard	
18,727.00	18,727.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Vertical	Dogleg	Build	Turn	
Depth	(°)	(°)	Depth	(usft)	(usft)	Section	Rate	Rate	Rate	
(usft)			(usft)			(usft)	(°/100usft)	(°/100usft)	(°/100usft)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
256.00	0.57	282.55	256.00	0.28	-1.24	1.04	0.22	0.22	0.00	
MWD surveys										
293.00	0.57	317.62	292.99	0.45	-1.55	1.37	0.93	0.00	94.78	
319.00	0.65	327.37	318.99	0.67	-1.71	1.65	0.50	0.31	37.50	
351.00	0.79	307.16	350.99	0.96	-1.99	2.04	0.90	0.44	-63.16	
382.00	0.83	322.90	381.99	1.27	-2.29	2.48	0.73	0.13	50.77	

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Survey

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)
414.00	0.92	321.75	413.98	1.65	-2.59	2.97	0.29	0.28	-3.59
445.00	1.09	317.36	444.98	2.07	-2.95	3.51	0.60	0.55	-14.16
477.00	1.53	327.11	476.97	2.65	-3.38	4.23	1.54	1.38	30.47
492.00	1.27	332.83	491.97	2.96	-3.57	4.59	1.97	-1.73	38.13
539.00	1.88	324.12	538.95	4.05	-4.26	5.86	1.39	1.30	-18.53
570.00	1.80	320.52	569.93	4.84	-4.87	6.85	0.45	-0.26	-11.61
602.00	1.80	327.72	601.92	5.65	-5.45	7.85	0.71	0.00	22.50
634.00	0.87	299.69	633.91	6.20	-5.93	8.58	3.47	-2.91	-87.59
665.00	0.74	281.41	664.90	6.35	-6.33	8.96	0.92	-0.42	-58.97
697.00	0.87	273.58	696.90	6.41	-6.78	9.30	0.53	0.41	-24.47
728.00	1.05	252.67	727.90	6.34	-7.28	9.59	1.26	0.58	-67.45
791.00	1.18	251.96	790.88	5.97	-8.45	10.10	0.21	0.21	-1.13
885.00	1.71	229.46	884.86	4.76	-10.44	10.53	0.82	0.56	-23.94
980.00	2.02	235.53	979.81	2.89	-12.90	10.80	0.39	0.33	6.39
1,074.00	2.11	245.02	1,073.74	1.22	-15.83	11.53	0.38	0.10	10.10
1,169.00	2.42	229.64	1,168.67	-0.82	-18.94	12.11	0.72	0.33	-16.19
1,263.00	2.72	247.22	1,262.58	-2.97	-22.51	12.91	0.89	0.32	18.70
1,358.00	2.99	257.42	1,357.46	-4.38	-27.01	14.88	0.60	0.28	10.74
1,452.00	3.56	256.19	1,451.31	-5.61	-32.24	17.48	0.61	0.61	-1.31
1,547.00	3.69	258.56	1,546.12	-6.92	-38.10	20.44	0.21	0.14	2.49
1,642.00	3.03	258.82	1,640.95	-8.01	-43.56	23.29	0.69	-0.69	0.27
1,736.00	2.63	251.17	1,734.84	-9.19	-48.03	25.43	0.58	-0.43	-8.14
1,832.00	2.29	236.50	1,830.75	-10.96	-51.72	26.59	0.74	-0.35	-15.28
1,927.00	1.36	216.02	1,925.70	-12.92	-53.96	26.64	1.18	-0.98	-21.56
2,021.00	0.39	143.57	2,019.69	-14.08	-54.43	26.10	1.38	-1.03	-77.07
2,116.00	0.57	99.56	2,114.69	-14.42	-53.77	25.40	0.42	0.19	-46.33
2,204.00	0.79	108.44	2,202.68	-14.68	-52.77	24.53	0.28	0.25	10.09
2,316.00	1.05	91.30	2,314.67	-14.95	-51.01	23.15	0.34	0.23	-15.30
2,410.00	1.27	95.08	2,408.65	-15.06	-49.11	21.80	0.25	0.23	4.02
2,504.00	1.23	96.40	2,502.63	-15.27	-47.07	20.27	0.05	-0.04	1.40
2,598.00	0.75	96.84	2,596.61	-15.45	-45.45	19.05	0.51	-0.51	0.47
2,693.00	0.26	295.39	2,691.61	-15.43	-45.03	18.78	1.05	-0.52	-169.95
2,788.00	0.88	291.78	2,786.60	-15.07	-45.90	19.64	0.65	0.65	-3.80
2,882.00	1.23	294.51	2,880.59	-14.39	-47.49	21.21	0.38	0.37	2.90
2,977.00	1.27	299.43	2,975.57	-13.45	-49.34	23.15	0.12	0.04	5.18
3,075.00	1.32	302.77	3,073.54	-12.30	-51.23	25.27	0.09	0.05	3.41
3,169.00	1.54	299.25	3,167.51	-11.10	-53.24	27.51	0.25	0.23	-3.74
3,264.00	1.01	302.15	3,262.49	-10.03	-55.07	29.53	0.56	-0.56	3.05
3,358.00	0.35	298.63	3,356.48	-9.45	-56.02	30.60	0.70	-0.70	-3.74
3,453.00	0.57	151.77	3,451.48	-9.73	-56.05	30.41	0.93	0.23	-154.59



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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)	WV Department of Environmental Protection
3,547.00	1.40	159.41	3,545.46	-11.21	-55.43	28.89	0.89	0.88	8.13	
3,642.00	2.85	161.00	3,640.40	-14.53	-54.25	25.64	1.53	1.53	1.67	
3,736.00	4.21	163.28	3,734.22	-20.05	-52.50	20.37	1.45	1.45	2.43	
3,831.00	4.83	172.42	3,828.92	-27.35	-50.97	13.93	1.00	0.65	9.62	
3,925.00	5.93	176.29	3,922.51	-36.12	-50.13	6.87	1.23	1.17	4.12	
4,020.00	7.34	173.22	4,016.87	-47.04	-49.10	-1.92	1.53	1.48	-3.23	
4,114.00	9.32	176.00	4,109.87	-60.60	-47.86	-12.80	2.15	2.11	2.96	
4,209.00	11.51	180.86	4,203.30	-77.75	-47.46	-25.78	2.48	2.31	5.12	
4,303.00	12.74	182.62	4,295.20	-97.49	-48.08	-40.00	1.37	1.31	1.87	
4,398.00	13.58	181.22	4,387.71	-119.10	-48.79	-55.54	0.95	0.88	-1.47	
4,493.00	13.67	182.97	4,480.04	-141.46	-49.61	-71.56	0.44	0.09	1.84	
4,587.00	13.54	184.47	4,571.40	-163.53	-51.04	-86.96	0.40	-0.14	1.60	
4,682.00	13.67	181.30	4,663.73	-185.84	-52.17	-102.74	0.80	0.14	-3.34	
4,776.00	16.44	183.24	4,754.50	-210.23	-53.17	-120.15	2.99	2.95	2.06	
4,871.00	18.90	186.66	4,845.01	-238.94	-55.71	-139.72	2.81	2.59	3.60	
4,966.00	18.59	184.99	4,934.98	-269.30	-58.82	-160.15	0.65	-0.33	-1.76	
5,060.00	17.93	185.96	5,024.24	-298.62	-61.62	-180.00	0.77	-0.70	1.03	
5,155.00	17.97	185.70	5,114.62	-327.75	-64.60	-199.59	0.09	0.04	-0.27	
5,250.00	18.37	186.93	5,204.88	-357.19	-67.86	-219.23	0.58	0.42	1.29	
5,345.00	19.86	187.72	5,294.64	-388.04	-71.83	-239.43	1.59	1.57	0.83	
5,440.00	21.05	188.51	5,383.65	-420.91	-76.52	-260.64	1.29	1.25	0.83	
5,535.00	19.03	186.66	5,472.89	-453.17	-80.85	-281.66	2.23	-2.13	-1.95	
5,630.00	18.41	186.66	5,562.87	-483.45	-84.38	-301.73	0.65	-0.65	0.00	
5,725.00	20.17	189.60	5,652.53	-514.50	-88.85	-321.75	2.12	1.85	3.09	
5,820.00	21.53	188.60	5,741.31	-547.89	-94.19	-342.92	1.48	1.43	-1.05	
5,917.00	22.98	184.29	5,831.09	-584.38	-98.27	-367.22	2.25	1.49	-4.44	
6,012.00	21.88	183.23	5,918.90	-620.54	-100.65	-392.43	1.23	-1.16	-1.12	
6,107.00	20.43	182.89	6,007.49	-654.78	-102.49	-416.58	1.53	-1.53	-0.36	
6,199.00	20.92	187.19	6,093.57	-687.11	-105.35	-438.62	1.73	0.53	4.67	
6,293.00	23.25	188.16	6,180.67	-722.13	-110.09	-461.41	2.51	2.48	1.03	
6,388.00	21.88	190.27	6,268.40	-758.11	-115.91	-484.17	1.67	-1.44	2.22	
6,484.00	20.43	188.69	6,357.93	-792.28	-121.63	-505.66	1.62	-1.51	-1.65	
6,578.00	20.30	188.86	6,446.05	-824.61	-126.62	-526.27	0.15	-0.14	0.18	
6,673.00	19.51	186.49	6,535.38	-856.65	-130.95	-547.12	1.19	-0.83	-2.49	
6,768.00	19.25	186.40	6,624.99	-887.98	-134.49	-567.97	0.28	-0.27	-0.09	
6,862.00	18.68	182.89	6,713.89	-918.41	-136.97	-588.86	1.36	-0.61	-3.73	
6,955.00	18.72	181.83	6,801.98	-948.20	-138.20	-610.12	0.37	0.04	-1.14	
7,050.00	18.19	180.60	6,892.10	-978.27	-138.84	-631.97	0.69	-0.56	-1.29	
7,144.00	18.41	180.25	6,981.34	-1,007.78	-139.06	-653.70	0.26	0.23	-0.37	
7,239.00	17.31	179.98	7,071.77	-1,036.92	-139.12	-675.26	1.16	-1.16	-0.28	

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								Build Rate (°/100usft)	Turn Rate (°/100usft)	Rate (°/100usft)
7,334.00	15.78	177.08	7,162.83	-1,063.95	-138.46	-695.75	1.83	-1.61	-3.05	
7,429.00	15.29	176.73	7,254.36	-1,089.36	-137.09	-715.50	0.53	-0.52	-0.37	
7,523.00	15.56	176.47	7,344.97	-1,114.32	-135.60	-735.00	0.30	0.29	-0.28	
7,617.00	15.34	175.85	7,435.58	-1,139.30	-133.93	-754.64	0.29	-0.23	-0.66	
7,712.00	15.78	178.58	7,527.10	-1,164.75	-132.70	-774.33	0.90	0.46	2.87	
7,806.00	16.22	178.05	7,617.45	-1,190.65	-131.93	-794.04	0.49	0.47	-0.56	
7,901.00	16.26	179.72	7,708.66	-1,217.21	-131.42	-814.08	0.49	0.04	1.76	
7,995.00	16.96	183.68	7,798.74	-1,244.05	-132.23	-833.43	1.42	0.74	4.21	
8,089.00	17.75	185.26	7,888.47	-1,272.00	-134.43	-852.67	0.98	0.84	1.68	
8,183.00	18.24	182.71	7,977.87	-1,300.96	-136.44	-872.79	0.99	0.52	-2.71	
8,278.00	17.62	183.15	8,068.25	-1,330.17	-137.93	-893.44	0.67	-0.65	0.46	
8,373.00	17.67	183.85	8,158.78	-1,358.91	-139.69	-913.57	0.23	0.05	0.74	
8,469.00	19.12	184.47	8,249.88	-1,389.13	-141.89	-934.49	1.52	1.51	0.65	
8,564.00	20.65	183.94	8,339.21	-1,421.35	-144.25	-956.79	1.62	1.61	-0.56	
8,658.00	20.17	183.76	8,427.31	-1,454.06	-146.46	-979.55	0.51	-0.51	-0.19	
8,752.00	21.14	184.38	8,515.27	-1,487.13	-148.81	-1,002.49	1.06	1.03	0.66	
8,847.00	22.76	183.94	8,603.38	-1,522.55	-151.38	-1,027.01	1.71	1.71	-0.46	
8,941.00	22.76	183.50	8,690.06	-1,558.84	-153.74	-1,052.33	0.18	0.00	-0.47	
9,041.00	23.20	183.76	8,782.12	-1,597.80	-156.22	-1,079.55	0.45	0.44	0.26	
9,135.00	20.92	184.82	8,869.23	-1,633.00	-158.84	-1,103.89	2.46	-2.43	1.13	
9,227.00	19.16	185.79	8,955.66	-1,664.39	-161.74	-1,125.21	1.95	-1.91	1.05	
9,322.00	19.47	185.87	9,045.31	-1,695.65	-164.94	-1,146.24	0.33	0.33	0.08	
9,416.00	20.39	184.99	9,133.68	-1,727.55	-167.96	-1,167.85	1.03	0.98	-0.94	
9,510.00	20.96	184.12	9,221.63	-1,760.63	-170.60	-1,190.61	0.69	0.61	-0.93	
9,605.00	21.53	182.53	9,310.17	-1,795.00	-172.59	-1,214.74	0.85	0.60	-1.67	
9,700.00	20.30	182.01	9,398.91	-1,828.88	-173.93	-1,238.96	1.31	-1.29	-0.55	
9,794.00	20.00	181.57	9,487.16	-1,861.25	-174.95	-1,262.27	0.36	-0.32	-0.47	
9,888.00	19.47	179.81	9,575.64	-1,892.98	-175.33	-1,285.53	0.85	-0.56	-1.87	
9,982.00	19.34	179.90	9,664.30	-1,924.21	-175.26	-1,308.73	0.14	-0.14	0.10	
10,077.00	18.94	178.84	9,754.05	-1,955.36	-174.92	-1,332.05	0.56	-0.42	-1.12	
10,172.00	18.28	177.70	9,844.08	-1,985.66	-174.01	-1,355.12	0.79	-0.69	-1.20	
10,266.00	17.71	177.44	9,933.48	-2,014.67	-172.78	-1,377.46	0.61	-0.61	-0.28	
10,323.00	17.36	176.38	9,987.83	-2,031.82	-171.85	-1,390.79	0.83	-0.61	-1.86	
10,369.00	17.85	175.15	10,031.68	-2,045.69	-170.82	-1,401.76	1.34	1.07	-2.67	
10,416.00	16.26	182.97	10,076.61	-2,059.44	-170.55	-1,412.14	5.93	-3.38	16.64	
10,463.00	16.22	195.72	10,121.75	-2,072.34	-172.67	-1,420.27	7.57	-0.09	27.13	
10,510.00	15.21	210.13	10,167.01	-2,083.99	-177.55	-1,425.64	8.55	-2.15	30.66	
10,557.00	13.98	224.28	10,212.51	-2,093.39	-184.61	-1,427.87	8.00	-2.62	30.11	
10,604.00	11.87	238.78	10,258.33	-2,099.97	-192.71	-1,427.30	8.20	-4.49	30.85	
10,652.00	10.33	251.18	10,305.44	-2,103.92	-201.01	-1,424.66	5.90	-3.21	25.83	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Survey									
WV Department of Environmental Protection									
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)
10,699.00	11.43	264.53	10,351.60	-2,105.72	-209.63	-1,420.21	5.83	2.34	28.40
10,747.00	13.32	276.22	10,398.49	-2,105.57	-219.87	-1,413.23	6.52	3.94	24.35
10,794.00	15.08	286.42	10,444.06	-2,103.26	-231.12	-1,403.96	6.50	3.74	21.70
10,841.00	17.19	292.57	10,489.21	-2,098.86	-243.40	-1,392.46	5.77	4.49	13.09
10,888.00	18.37	300.66	10,533.97	-2,092.42	-256.18	-1,379.10	5.82	2.51	17.21
10,936.00	20.00	308.39	10,579.31	-2,083.46	-269.13	-1,363.78	6.28	3.40	16.10
10,983.00	21.05	317.62	10,623.34	-2,072.23	-281.12	-1,347.40	7.23	2.23	19.64
11,031.00	20.31	316.39	10,668.24	-2,059.83	-292.68	-1,330.45	1.79	-1.54	-2.56
11,078.00	21.32	316.92	10,712.18	-2,047.69	-304.14	-1,313.76	2.19	2.15	1.13
11,125.00	24.09	318.06	10,755.53	-2,034.31	-316.39	-1,295.62	5.97	5.89	2.43
11,172.00	27.34	318.68	10,797.87	-2,019.06	-329.93	-1,275.23	6.94	6.91	1.32
11,220.00	29.67	320.26	10,840.05	-2,001.65	-344.80	-1,252.34	5.10	4.85	3.29
11,267.00	31.12	322.89	10,880.59	-1,983.01	-359.57	-1,228.61	4.19	3.09	5.60
11,314.00	32.26	327.46	10,920.59	-1,962.75	-373.65	-1,204.14	5.65	2.43	9.72
11,361.00	35.65	329.13	10,959.57	-1,940.41	-387.43	-1,178.34	7.48	7.21	3.55
11,409.00	39.78	330.45	10,997.53	-1,915.04	-402.18	-1,149.62	8.77	8.60	2.75
11,456.00	44.31	331.33	11,032.42	-1,887.54	-417.48	-1,118.97	9.72	9.64	1.87
11,504.00	46.86	333.88	11,066.02	-1,857.10	-433.24	-1,085.83	6.53	5.31	5.31
11,551.00	50.68	333.97	11,096.99	-1,825.35	-448.77	-1,051.87	8.13	8.13	0.19
11,598.00	54.02	332.83	11,125.69	-1,792.09	-465.44	-1,016.02	7.36	7.11	-2.43
11,645.00	57.76	332.03	11,152.05	-1,757.60	-483.45	-978.37	8.08	7.96	-1.70
11,693.00	61.49	331.68	11,176.31	-1,721.10	-502.98	-938.20	7.80	7.77	-0.73
11,740.00	64.26	332.30	11,197.74	-1,684.17	-522.62	-897.64	6.01	5.89	1.32
11,787.00	67.21	333.00	11,217.05	-1,646.11	-542.30	-856.22	6.42	6.28	1.49
11,834.00	71.38	332.65	11,233.67	-1,607.01	-562.38	-813.76	8.90	8.87	-0.74
11,881.00	77.63	332.65	11,246.22	-1,566.80	-583.18	-770.00	13.30	13.30	0.00
11,928.00	82.86	333.53	11,254.18	-1,525.51	-604.13	-725.32	11.28	11.13	1.87
11,976.00	87.03	333.12	11,258.41	-1,482.80	-625.59	-679.26	8.73	8.69	-0.85
12,071.00	92.48	330.19	11,258.81	-1,399.23	-670.68	-587.05	6.51	5.74	-3.08
12,166.00	92.35	329.66	11,254.81	-1,317.09	-718.24	-494.24	0.57	-0.14	-0.56
12,260.00	91.91	329.57	11,251.32	-1,236.06	-765.75	-402.28	0.48	-0.47	-0.10
12,360.00	91.74	328.78	11,248.13	-1,150.23	-816.97	-304.28	0.81	-0.17	-0.79
12,455.00	91.69	329.22	11,245.29	-1,068.83	-865.88	-211.12	0.47	-0.05	0.46
12,549.00	91.65	329.75	11,242.55	-987.89	-913.58	-119.09	0.57	-0.04	0.56
12,644.00	91.74	329.75	11,239.74	-905.86	-961.42	-26.18	0.09	0.09	0.00
12,738.00	91.69	329.75	11,236.93	-824.70	-1,008.76	65.75	0.05	-0.05	0.00
12,833.00	91.69	330.10	11,234.12	-742.52	-1,056.34	158.61	0.37	0.00	0.37
12,927.00	91.78	330.10	11,231.28	-661.07	-1,103.18	250.42	0.10	0.10	0.00
13,022.00	91.65	329.84	11,228.44	-578.86	-1,150.70	343.26	0.31	-0.14	-0.27
13,116.00	91.82	330.10	11,225.59	-497.52	-1,197.72	435.12	0.33	0.18	0.28

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Survey

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		
								Rate (°/100usft)	Rate (°/100usft)	Rate (°/100usft)
13,211.00	91.78	330.45	11,222.61	-415.06	-1,244.80	527.84	0.37	-0.04	0.37	
13,305.00	91.43	330.28	11,219.97	-333.39	-1,291.27	619.57	0.41	-0.37	-0.18	
13,400.00	91.21	330.28	11,217.78	-250.90	-1,338.35	712.32	0.23	-0.23	0.00	
13,495.00	91.21	330.19	11,215.78	-168.46	-1,385.50	805.08	0.09	0.00	-0.09	
13,589.00	91.25	330.19	11,213.76	-86.91	-1,432.22	896.89	0.04	0.04	0.00	
13,684.00	91.16	329.93	11,211.76	-4.61	-1,479.62	989.71	0.29	-0.09	-0.27	
13,779.00	91.16	329.93	11,209.84	77.59	-1,527.21	1,082.59	0.00	0.00	0.00	
13,873.00	91.21	329.84	11,207.90	158.88	-1,574.37	1,174.50	0.11	0.05	-0.10	
13,968.00	91.60	330.45	11,205.57	241.25	-1,621.65	1,267.29	0.76	0.41	0.64	
14,062.00	90.86	329.66	11,203.55	322.68	-1,668.56	1,359.14	1.15	-0.79	-0.84	
14,156.00	90.20	329.66	11,202.68	403.80	-1,716.04	1,451.14	0.70	-0.70	0.00	
14,251.00	90.29	329.75	11,202.27	485.83	-1,763.96	1,544.11	0.13	0.09	0.09	
14,346.00	90.24	329.66	11,201.83	567.86	-1,811.88	1,637.08	0.11	-0.05	-0.09	
14,441.00	90.20	329.66	11,201.47	649.84	-1,859.87	1,730.06	0.04	-0.04	0.00	
14,535.00	90.24	329.66	11,201.11	730.97	-1,907.35	1,822.07	0.04	0.04	0.00	
14,629.00	90.24	329.75	11,200.71	812.13	-1,954.77	1,914.06	0.10	0.00	0.10	
14,723.00	90.33	329.93	11,200.25	893.41	-2,001.99	2,006.00	0.21	0.10	0.19	
14,818.00	90.20	329.66	11,199.81	975.51	-2,049.79	2,098.94	0.32	-0.14	-0.28	
14,912.00	90.24	329.75	11,199.45	1,056.67	-2,097.21	2,190.93	0.10	0.04	0.10	
15,007.00	90.24	329.57	11,199.05	1,138.66	-2,145.19	2,283.92	0.19	0.00	-0.19	
15,101.00	90.42	335.20	11,198.51	1,221.91	-2,188.75	2,374.87	5.99	0.19	5.99	
15,196.00	90.24	329.75	11,197.96	1,306.13	-2,232.63	2,466.75	5.74	-0.19	-5.74	
15,291.00	90.20	329.49	11,197.59	1,388.08	-2,280.68	2,559.75	0.28	-0.04	-0.27	
15,385.00	90.42	329.93	11,197.08	1,469.25	-2,328.09	2,651.73	0.52	0.23	0.47	
15,480.00	90.46	329.93	11,196.36	1,551.46	-2,375.69	2,744.62	0.04	0.04	0.00	
15,574.00	92.00	329.13	11,194.34	1,632.46	-2,423.34	2,836.65	1.85	1.64	-0.85	
15,668.00	90.33	329.31	11,192.43	1,713.20	-2,471.43	2,928.78	1.79	-1.78	0.19	
15,763.00	90.77	330.10	11,191.51	1,795.22	-2,519.35	3,021.74	0.95	0.46	0.83	
15,858.00	91.47	330.89	11,189.66	1,877.88	-2,566.13	3,114.42	1.11	0.74	0.83	
15,953.00	90.86	329.49	11,187.73	1,960.29	-2,613.35	3,207.20	1.61	-0.64	-1.47	
16,047.00	91.12	330.10	11,186.10	2,041.52	-2,660.63	3,299.14	0.71	0.28	0.65	
16,142.00	90.95	330.28	11,184.39	2,123.93	-2,707.85	3,391.93	0.26	-0.18	0.19	
16,237.00	90.64	330.80	11,183.07	2,206.64	-2,754.57	3,484.60	0.64	-0.33	0.55	
16,331.00	91.43	332.74	11,181.37	2,289.44	-2,799.02	3,575.81	2.23	0.84	2.06	
16,426.00	90.73	331.33	11,179.58	2,373.33	-2,843.56	3,667.89	1.66	-0.74	-1.48	
16,521.00	90.73	332.12	11,178.37	2,456.99	-2,888.56	3,760.11	0.83	0.00	0.83	
16,615.00	92.04	331.68	11,176.10	2,539.88	-2,932.82	3,851.26	1.47	1.39	-0.47	
16,710.00	93.05	330.98	11,171.88	2,623.15	-2,978.35	3,943.55	1.29	1.06	-0.74	
16,805.00	90.59	330.89	11,168.86	2,706.14	-3,024.47	4,036.03	2.59	-2.59	-0.09	
16,899.00	90.20	331.60	11,168.21	2,788.55	-3,069.69	4,127.46	0.86	-0.41	0.76	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	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)	
16,994.00	90.55	332.21	11,167.59	2,872.35	-3,114.43	4,219.61	0.74	0.37	0.64	
17,089.00	90.73	333.18	11,166.53	2,956.76	-3,158.01	4,311.43	1.04	0.19	1.02	
17,183.00	91.30	333.70	11,164.87	3,040.82	-3,200.03	4,401.95	0.82	0.61	0.55	
17,278.00	91.16	332.74	11,162.83	3,125.61	-3,242.82	4,493.53	1.02	-0.15	-1.01	
17,372.00	91.03	331.42	11,161.03	3,208.66	-3,286.83	4,584.62	1.41	-0.14	-1.40	
17,467.00	91.74	331.51	11,158.73	3,292.09	-3,332.20	4,676.92	0.75	0.75	0.09	
17,562.00	92.75	332.03	11,155.01	3,375.73	-3,377.10	4,769.05	1.20	1.06	0.55	
17,655.00	91.65	331.33	11,151.44	3,457.53	-3,421.18	4,859.29	1.40	-1.18	-0.75	
17,750.00	91.38	329.13	11,148.93	3,539.96	-3,468.33	4,952.03	2.33	-0.28	-2.32	
17,845.00	92.00	329.05	11,146.13	3,621.43	-3,517.11	5,045.17	0.66	0.65	-0.08	
17,940.00	90.73	327.99	11,143.87	3,702.42	-3,566.70	5,138.49	1.74	-1.34	-1.12	
18,034.00	91.21	328.26	11,142.27	3,782.24	-3,616.34	5,230.97	0.59	0.51	0.29	
18,129.00	92.48	327.90	11,139.22	3,862.83	-3,666.54	5,324.40	1.39	1.34	-0.38	
18,223.00	90.20	327.02	11,137.02	3,942.04	-3,717.08	5,417.05	2.60	-2.43	-0.94	
18,318.00	90.68	329.31	11,136.29	4,022.75	-3,767.19	5,510.50	2.46	0.51	2.41	
18,413.00	90.73	331.16	11,135.12	4,105.20	-3,814.34	5,603.28	1.95	0.05	1.95	
18,507.00	91.78	327.46	11,133.06	4,186.00	-3,862.30	5,695.36	4.09	1.12	-3.94	
18,602.00	90.11	327.99	11,131.49	4,266.31	-3,913.02	5,788.93	1.84	-1.76	0.56	
18,686.00	91.21	329.93	11,130.52	4,338.27	-3,956.33	5,871.35	2.65	1.31	2.31	
Survey @ 18686.00 MD 11130.52 TVD										
18,727.00	91.21	329.93	11,129.66	4,373.75	-3,976.87	5,911.43	0.00	0.00	0.00	
Survey projected to 18727.00 MD 11129.66 TVD										

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
256.00	256.00	0.28	-1.24	MWD surveys
18,686.00	11,130.52	4,338.27	-3,956.33	Survey @ 18686.00 MD 11130.52 TVD

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	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 N-13 HU (slot C)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,867.26 usft	Latitude:	39.77476702
	+E/-W	0.00 usft	Easting:	1,726,897.78 usft	Longitude:	-80.69220424
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
	IGRF2015	4/12/2020	(°) -8.784	(°) 66.708	(nT) 51,844.76037232

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	317.84	

Survey Program	Date	5/24/2020			
From	To	Survey (Wellbore)	Tool Name	Description	<p style="text-align: center;">RECEIVED Office of Oil and Gas</p> <p style="text-align: center;">SEP 30 2022</p> <p style="text-align: center;">WV Department of Environmental Protection</p>
(usft)	(usft)				
256.00	2,204.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,316.00	10,323.00	MWD (Original Hole)	MWD	MWD - Standard	
10,369.00	18,686.00	MWD lat (Original Hole)	MWD	MWD - Standard	
18,727.00	18,727.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Map	Map	Latitude	Longitude	
Depth	(°)	(°)	Depth	(usft)	(usft)	Northing	Easting			
(usft)			(usft)			(usft)	(usft)			
0.00	0.00	0.00	0.00	0.00	0.00	14,444,867.26	1,726,897.78	39.77476702	-80.69220424	
256.00	0.57	282.55	256.00	0.28	-1.24	14,444,867.54	1,726,896.53	39.77476779	-80.69220866	
MWD surveys										
293.00	0.57	317.62	292.99	0.45	-1.55	14,444,867.71	1,726,896.23	39.77476828	-80.69220974	
319.00	0.65	327.37	318.99	0.67	-1.71	14,444,867.93	1,726,896.06	39.77476888	-80.69221033	
351.00	0.79	307.16	350.99	0.96	-1.99	14,444,868.22	1,726,895.79	39.77476967	-80.69221130	
382.00	0.83	322.90	381.99	1.27	-2.29	14,444,868.53	1,726,895.48	39.77477052	-80.69221239	
414.00	0.92	321.75	413.98	1.65	-2.59	14,444,868.91	1,726,895.18	39.77477159	-80.69221344	
445.00	1.09	317.36	444.98	2.07	-2.95	14,444,869.33	1,726,894.83	39.77477272	-80.69221470	



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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 Environmental Protection

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
477.00	1.53	327.11	476.97	2.65	-3.38	14,444,869.91	1,726,894.39	39.77477433	-80.69221625
492.00	1.27	332.83	491.97	2.96	-3.57	14,444,870.22	1,726,894.21	39.77477520	-80.69221690
539.00	1.88	324.12	538.95	4.05	-4.26	14,444,871.31	1,726,893.52	39.77477819	-80.69221935
570.00	1.80	320.52	569.93	4.84	-4.87	14,444,872.10	1,726,892.91	39.77478036	-80.69222150
602.00	1.80	327.72	601.92	5.65	-5.45	14,444,872.91	1,726,892.32	39.77478260	-80.69222358
634.00	0.87	299.69	633.91	6.20	-5.93	14,444,873.46	1,726,891.84	39.77478410	-80.69222528
665.00	0.74	281.41	664.90	6.35	-6.33	14,444,873.61	1,726,891.44	39.77478453	-80.69222670
697.00	0.87	273.58	696.90	6.41	-6.78	14,444,873.67	1,726,891.00	39.77478469	-80.69222829
728.00	1.05	252.67	727.90	6.34	-7.28	14,444,873.60	1,726,890.49	39.77478450	-80.69223009
791.00	1.18	251.96	790.88	5.97	-8.45	14,444,873.23	1,726,889.32	39.77478349	-80.69223425
885.00	1.71	229.46	884.86	4.76	-10.44	14,444,872.02	1,726,887.34	39.77478018	-80.69224133
980.00	2.02	235.53	979.81	2.89	-12.90	14,444,870.15	1,726,884.88	39.77477507	-80.69225010
1,074.00	2.11	245.02	1,073.74	1.22	-15.83	14,444,868.48	1,726,881.95	39.77477052	-80.69226057
1,169.00	2.42	229.64	1,168.67	-0.82	-18.94	14,444,866.44	1,726,878.83	39.77476495	-80.69227167
1,263.00	2.72	247.22	1,262.58	-2.97	-22.51	14,444,864.29	1,726,875.26	39.77475909	-80.69228440
1,358.00	2.99	257.42	1,357.46	-4.38	-27.01	14,444,862.88	1,726,870.77	39.77475525	-80.69230042
1,452.00	3.56	256.19	1,451.31	-5.61	-32.24	14,444,861.65	1,726,865.54	39.77475192	-80.69231904
1,547.00	3.69	258.56	1,546.12	-6.92	-38.10	14,444,860.34	1,726,859.68	39.77474838	-80.69233991
1,642.00	3.03	258.82	1,640.95	-8.01	-43.56	14,444,859.25	1,726,854.22	39.77474542	-80.69235936
1,736.00	2.63	251.17	1,734.84	-9.19	-48.03	14,444,858.07	1,726,849.74	39.77474223	-80.69237531
1,832.00	2.29	236.50	1,830.75	-10.96	-51.72	14,444,856.30	1,726,846.06	39.77473741	-80.69238844
1,927.00	1.36	216.02	1,925.70	-12.92	-53.96	14,444,854.34	1,726,843.81	39.77473205	-80.69239646
2,021.00	0.39	143.57	2,019.69	-14.08	-54.43	14,444,853.18	1,726,843.35	39.77472887	-80.69239813
2,116.00	0.57	99.56	2,114.69	-14.42	-53.77	14,444,852.84	1,726,844.00	39.77472793	-80.69239580
2,204.00	0.79	108.44	2,202.68	-14.68	-52.77	14,444,852.58	1,726,845.01	39.77472719	-80.69239222
2,316.00	1.05	91.30	2,314.67	-14.95	-51.01	14,444,852.31	1,726,846.77	39.77472644	-80.69238596
2,410.00	1.27	95.08	2,408.65	-15.06	-49.11	14,444,852.20	1,726,848.67	39.77472612	-80.69237920
2,504.00	1.23	96.40	2,502.63	-15.27	-47.07	14,444,851.99	1,726,850.71	39.77472554	-80.69237195
2,598.00	0.75	96.84	2,596.61	-15.45	-45.45	14,444,851.81	1,726,852.32	39.77472501	-80.69236621
2,693.00	0.26	295.39	2,691.61	-15.43	-45.03	14,444,851.82	1,726,852.74	39.77472506	-80.69236470
2,788.00	0.88	291.78	2,786.60	-15.07	-45.90	14,444,852.19	1,726,851.87	39.77472606	-80.69236780
2,882.00	1.23	294.51	2,880.59	-14.39	-47.49	14,444,852.87	1,726,850.28	39.77472796	-80.69237344
2,977.00	1.27	299.43	2,975.57	-13.45	-49.34	14,444,853.81	1,726,848.44	39.77473056	-80.69238000
3,075.00	1.32	302.77	3,073.54	-12.30	-51.23	14,444,854.96	1,726,846.54	39.77473372	-80.69238673
3,169.00	1.54	299.25	3,167.51	-11.10	-53.24	14,444,856.16	1,726,844.53	39.77473705	-80.69239388
3,264.00	1.01	302.15	3,262.49	-10.03	-55.07	14,444,857.23	1,726,842.71	39.77474000	-80.69240035
3,358.00	0.35	298.63	3,356.48	-9.45	-56.02	14,444,857.81	1,726,841.76	39.77474160	-80.69240374
3,453.00	0.57	151.77	3,451.48	-9.73	-56.05	14,444,857.53	1,726,841.72	39.77474084	-80.69240385
3,547.00	1.40	159.41	3,545.46	-11.21	-55.43	14,444,856.05	1,726,842.35	39.77473675	-80.69240165
3,642.00	2.85	161.00	3,640.40	-14.53	-54.25	14,444,852.73	1,726,843.53	39.77472762	-80.69239750
3,736.00	4.21	163.28	3,734.22	-20.05	-52.50	14,444,847.21	1,726,845.28	39.77471246	-80.69239132
3,831.00	4.83	172.42	3,828.92	-27.35	-50.97	14,444,839.91	1,726,846.81	39.77469239	-80.69238596
3,925.00	5.93	176.29	3,922.51	-36.12	-50.13	14,444,831.14	1,726,847.65	39.77466830	-80.69238309
4,020.00	7.34	173.22	4,016.87	-47.04	-49.10	14,444,820.21	1,726,848.68	39.77463829	-80.69237955
4,114.00	9.32	176.00	4,109.87	-60.60	-47.86	14,444,806.66	1,726,849.92	39.77460105	-80.69237530
4,209.00	11.51	180.86	4,203.30	-77.75	-47.46	14,444,789.50	1,726,850.32	39.77455393	-80.69237411
4,303.00	12.74	182.62	4,295.20	-97.49	-48.08	14,444,769.77	1,726,849.70	39.77449975	-80.69237654
4,398.00	13.58	181.22	4,387.71	-119.10	-48.79	14,444,748.16	1,726,848.98	39.77444040	-80.69237935
4,493.00	13.67	182.97	4,480.04	-141.46	-49.61	14,444,725.80	1,726,848.17	39.77437900	-80.69238254
4,587.00	13.54	184.47	4,571.40	-163.53	-51.04	14,444,703.73	1,726,846.73	39.77431842	-80.69238791
4,682.00	13.67	181.30	4,663.73	-185.84	-52.17	14,444,681.42	1,726,845.61	39.77425716	-80.69239217
4,776.00	16.44	183.24	4,754.50	-210.23	-53.17	14,444,657.03	1,726,844.61	39.77419019	-80.69239604
4,871.00	18.90	186.66	4,845.01	-238.94	-55.71	14,444,628.32	1,726,842.06	39.77411137	-80.69240545
4,966.00	18.59	184.99	4,934.98	-269.30	-58.82	14,444,597.96	1,726,838.96	39.77402800	-80.69241686
5,060.00	17.93	185.96	5,024.24	-298.62	-61.62	14,444,568.64	1,726,836.15	39.77394751	-80.69242720

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	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 (°)	Depth (usft)	+N-S (usft)	+E-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,155.00	17.97	185.70	5,114.62	-327.75	-64.60	14,444,539.51	1,726,833.18	39.77386755	-80.69243814
5,250.00	18.37	186.93	5,204.88	-357.19	-67.86	14,444,510.07	1,726,829.92	39.77378673	-80.69245011
5,345.00	19.86	187.72	5,294.64	-388.04	-71.83	14,444,479.22	1,726,825.94	39.77370203	-80.69246463
5,440.00	21.05	188.51	5,383.65	-420.91	-76.52	14,444,446.35	1,726,821.25	39.77361182	-80.69248174
5,535.00	19.03	186.66	5,472.89	-453.17	-80.85	14,444,414.09	1,726,816.93	39.77352327	-80.69249751
5,630.00	18.41	186.66	5,562.87	-483.45	-84.38	14,444,383.81	1,726,813.39	39.77344013	-80.69251047
5,725.00	20.17	189.60	5,652.53	-514.50	-88.85	14,444,352.76	1,726,808.92	39.77335490	-80.69252676
5,820.00	21.53	188.60	5,741.31	-547.89	-94.19	14,444,319.37	1,726,803.58	39.77326326	-80.69254617
5,917.00	22.98	184.29	5,831.09	-584.38	-98.27	14,444,282.88	1,726,799.51	39.77316310	-80.69256113
6,012.00	21.88	183.23	5,918.90	-620.54	-100.65	14,444,246.72	1,726,797.12	39.77306380	-80.69257006
6,107.00	20.43	182.89	6,007.49	-654.78	-102.49	14,444,212.48	1,726,795.29	39.77296980	-80.69257700
6,199.00	20.92	187.19	6,093.57	-687.11	-105.35	14,444,180.15	1,726,792.42	39.77288103	-80.69258759
6,293.00	23.25	188.16	6,180.67	-722.13	-110.09	14,444,145.13	1,726,787.69	39.77278490	-80.69260487
6,388.00	21.88	190.27	6,268.40	-758.11	-115.91	14,444,109.15	1,726,781.87	39.77268614	-80.69262602
6,484.00	20.43	188.69	6,357.93	-792.28	-121.63	14,444,074.98	1,726,776.15	39.77259236	-80.69264679
6,578.00	20.30	188.86	6,446.05	-824.61	-126.62	14,444,042.65	1,726,771.16	39.77250363	-80.69266495
6,673.00	19.51	186.49	6,535.38	-856.65	-130.95	14,444,010.61	1,726,766.83	39.77241566	-80.69268076
6,768.00	19.25	186.40	6,624.99	-887.98	-134.49	14,443,979.28	1,726,763.29	39.77232967	-80.69269373
6,862.00	18.68	182.89	6,713.89	-918.41	-136.97	14,443,948.85	1,726,760.80	39.77224611	-80.69270295
6,955.00	18.72	181.83	6,801.98	-948.20	-138.20	14,443,919.06	1,726,759.58	39.77216431	-80.69270768
7,050.00	18.19	180.60	6,892.10	-978.27	-138.84	14,443,888.99	1,726,758.93	39.77208175	-80.69271034
7,144.00	18.41	180.25	6,981.34	-1,007.78	-139.06	14,443,859.48	1,726,758.71	39.77200070	-80.69271147
7,239.00	17.31	179.98	7,071.77	-1,036.92	-139.12	14,443,830.34	1,726,758.65	39.77192069	-80.69271205
7,334.00	15.78	177.08	7,162.83	-1,063.95	-138.46	14,443,803.31	1,726,759.32	39.77184643	-80.69271002
7,429.00	15.29	176.73	7,254.36	-1,089.36	-137.09	14,443,777.90	1,726,760.69	39.77177665	-80.69270544
7,523.00	15.56	176.47	7,344.97	-1,114.32	-135.60	14,443,752.94	1,726,762.17	39.77170809	-80.69270047
7,617.00	15.34	175.85	7,435.58	-1,139.30	-133.93	14,443,727.96	1,726,763.85	39.77163946	-80.69269481
7,712.00	15.78	178.58	7,527.10	-1,164.75	-132.70	14,443,702.51	1,726,765.08	39.77156957	-80.69269074
7,806.00	16.22	178.05	7,617.45	-1,190.65	-131.93	14,443,676.61	1,726,765.84	39.77149844	-80.69268834
7,901.00	16.26	179.72	7,708.66	-1,217.21	-131.42	14,443,650.05	1,726,766.36	39.77142549	-80.69268683
7,995.00	16.96	183.68	7,798.74	-1,244.05	-132.23	14,443,623.21	1,726,765.54	39.77135178	-80.69269006
8,089.00	17.75	185.26	7,888.47	-1,272.00	-134.43	14,443,595.26	1,726,763.35	39.77127504	-80.69269821
8,183.00	18.24	182.71	7,977.87	-1,300.96	-136.44	14,443,566.30	1,726,761.34	39.77119552	-80.69270571
8,278.00	17.62	183.15	8,068.25	-1,330.17	-137.93	14,443,537.09	1,726,759.85	39.77111532	-80.69271138
8,373.00	17.67	183.85	8,158.78	-1,358.91	-139.69	14,443,508.35	1,726,758.09	39.77103641	-80.69271799
8,469.00	19.12	184.47	8,249.88	-1,389.13	-141.89	14,443,478.13	1,726,755.89	39.77095345	-80.69272620
8,564.00	20.65	183.94	8,339.21	-1,421.35	-144.25	14,443,445.91	1,726,753.52	39.77086498	-80.69273501
8,658.00	20.17	183.76	8,427.31	-1,454.06	-146.46	14,443,413.20	1,726,751.32	39.77077518	-80.69274324
8,752.00	21.14	184.38	8,515.27	-1,487.13	-148.81	14,443,380.13	1,726,748.96	39.77068437	-80.69275203
8,847.00	22.76	183.94	8,603.38	-1,522.55	-151.38	14,443,344.71	1,726,746.39	39.77058713	-80.69276162
8,941.00	22.76	183.50	8,690.06	-1,558.84	-153.74	14,443,308.42	1,726,744.03	39.77048750	-80.69277046
9,041.00	23.20	183.76	8,782.12	-1,597.80	-156.22	14,443,269.46	1,726,741.56	39.77038052	-80.69277973
9,135.00	20.92	184.82	8,869.23	-1,633.00	-158.84	14,443,234.26	1,726,738.93	39.77028387	-80.69278950
9,227.00	19.16	185.79	8,955.66	-1,664.39	-161.74	14,443,202.87	1,726,736.03	39.77019769	-80.69280022
9,322.00	19.47	185.87	9,045.31	-1,695.65	-164.94	14,443,171.61	1,726,732.84	39.77011187	-80.69281196
9,416.00	20.39	184.99	9,133.68	-1,727.55	-167.96	14,443,139.71	1,726,729.81	39.77002430	-80.69282312
9,510.00	20.96	184.12	9,221.63	-1,760.63	-170.60	14,443,106.63	1,726,727.18	39.76993347	-80.69283289
9,605.00	21.53	182.53	9,310.17	-1,795.00	-172.59	14,443,072.26	1,726,725.19	39.76983912	-80.69284039
9,700.00	20.30	182.01	9,398.91	-1,828.88	-173.93	14,443,038.38	1,726,723.84	39.76974608	-80.69284560
9,794.00	20.00	181.57	9,487.16	-1,861.25	-174.95	14,443,006.01	1,726,722.83	39.76965720	-80.69284960
9,888.00	19.47	179.81	9,575.64	-1,892.98	-175.33	14,442,974.28	1,726,722.44	39.76957005	-80.69285137
9,982.00	19.34	179.90	9,664.30	-1,924.21	-175.26	14,442,943.05	1,726,722.52	39.76948429	-80.69285147
10,077.00	18.94	178.84	9,754.05	-1,955.36	-174.92	14,442,911.90	1,726,722.86	39.76939875	-80.69285064
10,172.00	18.28	177.70	9,844.08	-1,985.66	-174.01	14,442,881.60	1,726,723.77	39.76931552	-80.69284777
10,266.00	17.71	177.44	9,933.48	-2,014.67	-172.78	14,442,852.59	1,726,725.00	39.76923583	-80.69284375

WVA Department of Environmental Protection



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical			Map		Map Easting (usft)	Latitude	Longitude
			Depth (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)				
10,323.00	17.36	176.38	9,987.83	-2,031.82	-171.85	14,442,835.44	1,726,725.92	39.76918873	-80.69284067	
10,369.00	17.85	175.15	10,031.68	-2,045.69	-170.82	14,442,821.57	1,726,726.95	39.76911285	-80.69283718	
10,416.00	16.26	182.97	10,076.61	-2,059.44	-170.55	14,442,807.81	1,726,727.22	-80.69283639	-80.69284409	
10,463.00	16.22	195.72	10,121.75	-2,072.34	-172.67	14,442,794.92	1,726,725.10	39.76907746	-80.69286158	
10,510.00	15.21	210.13	10,167.01	-2,083.99	-177.55	14,442,783.26	1,726,720.23	39.76904550	-80.69288683	
10,557.00	13.98	224.28	10,212.51	-2,093.39	-184.61	14,442,773.86	1,726,713.17	39.76901975	-80.69291573	
10,604.00	11.87	238.78	10,258.33	-2,099.97	-192.71	14,442,767.29	1,726,705.07	39.76899101	-80.69294531	
10,652.00	10.33	251.18	10,305.44	-2,103.92	-201.01	14,442,763.34	1,726,696.77	39.76898614	-80.69297603	
10,699.00	11.43	264.53	10,351.60	-2,105.72	-209.63	14,442,761.54	1,726,688.14	39.76898664	-80.69301245	
10,747.00	13.32	276.22	10,398.49	-2,105.57	-219.87	14,442,761.69	1,726,677.91	39.76899310	-80.69305245	
10,794.00	15.08	286.42	10,444.06	-2,103.26	-231.12	14,442,764.00	1,726,666.66	39.76900529	-80.69309610	
10,841.00	17.19	292.57	10,489.21	-2,098.86	-243.40	14,442,768.40	1,726,654.38	39.76902310	-80.69314153	
10,888.00	18.37	300.66	10,533.97	-2,092.42	-256.18	14,442,774.84	1,726,641.59	39.76904782	-80.69318748	
10,936.00	20.00	308.39	10,579.31	-2,083.46	-269.13	14,442,783.80	1,726,628.65	39.76907878	-80.69323002	
10,983.00	21.05	317.62	10,623.34	-2,072.23	-281.12	14,442,795.03	1,726,616.66	39.76911294	-80.69327100	
11,031.00	20.31	316.39	10,668.24	-2,059.83	-292.68	14,442,807.43	1,726,605.10	39.76914640	-80.69331164	
11,078.00	21.32	316.92	10,712.18	-2,047.69	-304.14	14,442,819.57	1,726,593.64	39.76918326	-80.69335507	
11,125.00	24.09	318.06	10,755.53	-2,034.31	-316.39	14,442,832.95	1,726,581.39	39.76922525	-80.69340307	
11,172.00	27.34	318.68	10,797.87	-2,019.06	-329.93	14,442,848.20	1,726,567.85	39.76927322	-80.69345560	
11,220.00	29.67	320.26	10,840.05	-2,001.65	-344.80	14,442,865.61	1,726,552.97	39.76932453	-80.69350812	
11,267.00	31.12	322.89	10,880.59	-1,983.01	-359.57	14,442,884.24	1,726,538.21	39.76938031	-80.69355797	
11,314.00	32.26	327.46	10,920.59	-1,962.75	-373.65	14,442,904.51	1,726,524.13	39.76944179	-80.69360674	
11,361.00	35.65	329.13	10,959.57	-1,940.41	-387.43	14,442,926.85	1,726,510.35	39.76951162	-80.69365895	
11,409.00	39.78	330.45	10,997.53	-1,915.04	-402.18	14,442,952.22	1,726,495.59	39.76958728	-80.69371306	
11,456.00	44.31	331.33	11,032.42	-1,887.54	-417.48	14,442,979.72	1,726,480.29	39.76967102	-80.69376876	
11,504.00	46.86	333.88	11,066.02	-1,857.10	-433.24	14,443,010.16	1,726,464.54	39.76975835	-80.69382366	
11,551.00	50.68	333.97	11,096.99	-1,825.35	-448.77	14,443,041.91	1,726,449.00	39.76984986	-80.69388257	
11,598.00	54.02	332.83	11,125.69	-1,792.09	-465.44	14,443,075.17	1,726,432.34	39.76994473	-80.69394625	
11,645.00	57.76	332.03	11,152.05	-1,757.60	-483.45	14,443,109.66	1,726,414.32	39.77004517	-80.69401532	
11,693.00	61.49	331.68	11,176.31	-1,721.10	-502.98	14,443,146.16	1,726,394.79	39.77025147	-80.69415434	
11,740.00	64.26	332.30	11,197.74	-1,684.17	-522.62	14,443,183.09	1,726,375.15	39.77035904	-80.69422532	
11,787.00	67.21	333.00	11,217.05	-1,646.11	-542.30	14,443,221.15	1,726,355.47	39.77046966	-80.69429884	
11,834.00	71.38	332.65	11,233.67	-1,607.01	-562.38	14,443,260.25	1,726,335.40	39.77058325	-80.69437291	
11,881.00	77.63	332.65	11,246.22	-1,566.80	-583.18	14,443,300.46	1,726,314.60	39.77070076	-80.69444877	
11,928.00	82.86	333.53	11,254.18	-1,525.51	-604.13	14,443,341.75	1,726,293.64	39.77093068	-80.69460820	
11,976.00	87.03	333.12	11,258.41	-1,482.80	-625.59	14,443,384.46	1,726,272.18	39.77115670	-80.69477648	
12,071.00	92.48	330.19	11,258.81	-1,399.23	-670.68	14,443,468.03	1,726,227.10	39.77137968	-80.69494459	
12,166.00	92.35	329.66	11,254.81	-1,317.09	-718.24	14,443,550.17	1,726,179.54	39.77161587	-80.69512582	
12,260.00	91.91	329.57	11,251.32	-1,236.06	-765.75	14,443,631.20	1,726,132.02	39.77183985	-80.69529889	
12,360.00	91.74	328.78	11,248.13	-1,150.23	-816.97	14,443,717.03	1,726,080.81	39.77206260	-80.69546770	
12,455.00	91.69	329.22	11,245.29	-1,068.83	-865.88	14,443,798.42	1,726,031.90	39.77228832	-80.69563696	
12,549.00	91.65	329.75	11,242.55	-987.89	-913.58	14,443,879.37	1,725,984.19	39.77251166	-80.69580444	
12,644.00	91.74	329.75	11,239.74	-905.86	-961.42	14,443,961.40	1,725,936.35	39.77273777	-80.69597280	
12,738.00	91.69	329.75	11,236.93	-824.70	-1,008.76	14,444,042.56	1,725,889.02	39.77296189	-80.69613851	
12,833.00	91.69	330.10	11,234.12	-742.52	-1,056.34	14,444,124.74	1,725,841.43	39.77318811	-80.69630664	
12,927.00	91.78	330.10	11,231.28	-661.07	-1,103.18	14,444,206.19	1,725,794.60	39.77341194	-80.69647301	
13,022.00	91.65	329.84	11,228.44	-578.86	-1,150.70	14,444,288.40	1,725,747.07	39.77363883	-80.69663958	
13,116.00	91.82	330.10	11,225.59	-497.52	-1,197.72	14,444,369.74	1,725,700.05	39.77386355	-80.69680395	
13,211.00	91.78	330.45	11,222.61	-415.06	-1,244.80	14,444,452.20	1,725,652.97	39.77409051	-80.69697053	
13,305.00	91.43	330.28	11,219.97	-333.39	-1,291.27	14,444,533.87	1,725,606.51	39.77431737	-80.69713736	
13,400.00	91.21	330.28	11,217.78	-250.90	-1,338.35	14,444,616.36	1,725,559.43	39.77454174	-80.69730265	
13,495.00	91.21	330.19	11,215.78	-168.46	-1,385.50	14,444,698.80	1,725,512.27	39.77476821	-80.69747037	
13,589.00	91.25	330.19	11,213.76	-86.91	-1,432.22	14,444,780.35	1,725,465.55	39.77499439	-80.69763876	
13,684.00	91.16	329.93	11,211.76	-4.61	-1,479.62	14,444,862.65	1,725,418.15			
13,779.00	91.16	329.93	11,209.84	77.59	-1,527.21	14,444,944.85	1,725,370.56			

WV Department of
Environmental Protection

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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WV Department of Environmental Protection

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
13,873.00	91.21	329.84	11,207.90	158.88	-1,574.37	14,445,026.14	1,725,323.41	39.77521808	-80.69780561
13,968.00	91.60	330.45	11,205.57	241.25	-1,621.65	14,445,108.51	1,725,276.13	39.77544472	-80.69797288
14,062.00	90.86	329.66	11,203.55	322.68	-1,668.56	14,445,189.94	1,725,229.22	39.77566879	-80.69813886
14,156.00	90.20	329.66	11,202.68	403.80	-1,716.04	14,445,271.06	1,725,181.74	39.77589201	-80.69830688
14,251.00	90.29	329.75	11,202.27	485.83	-1,763.96	14,445,353.09	1,725,133.82	39.77611772	-80.69847646
14,346.00	90.24	329.66	11,201.83	567.86	-1,811.88	14,445,435.11	1,725,085.90	39.77634342	-80.69864604
14,441.00	90.20	329.66	11,201.47	649.84	-1,859.87	14,445,517.10	1,725,037.91	39.77656903	-80.69881585
14,535.00	90.24	329.66	11,201.11	730.97	-1,907.35	14,445,598.23	1,724,990.43	39.77679226	-80.69898387
14,629.00	90.24	329.75	11,200.71	812.13	-1,954.77	14,445,679.39	1,724,943.01	39.77701559	-80.69898387
14,723.00	90.33	329.93	11,200.25	893.41	-2,001.99	14,445,760.67	1,724,895.78	39.77723923	-80.69915167
14,818.00	90.20	329.66	11,199.81	975.51	-2,049.79	14,445,842.77	1,724,847.99	39.77746514	-80.69931879
14,912.00	90.24	329.75	11,199.45	1,056.67	-2,097.21	14,445,923.93	1,724,800.57	39.77768847	-80.69948791
15,007.00	90.24	329.57	11,199.05	1,138.66	-2,145.19	14,446,005.92	1,724,752.58	39.77791407	-80.69965572
15,101.00	90.42	335.20	11,198.51	1,221.91	-2,188.75	14,446,089.17	1,724,709.03	39.77814312	-80.69982553
15,196.00	90.24	329.75	11,197.96	1,306.13	-2,232.63	14,446,173.39	1,724,665.14	39.77837479	-80.69997956
15,291.00	90.20	329.49	11,197.59	1,388.08	-2,280.68	14,446,255.34	1,724,617.10	39.77860030	-80.70013475
15,385.00	90.42	329.93	11,197.08	1,469.25	-2,328.09	14,446,336.51	1,724,569.69	39.77882364	-80.70030478
15,480.00	90.46	329.93	11,196.36	1,551.46	-2,375.69	14,446,418.72	1,724,522.09	39.77904986	-80.70047256
15,574.00	92.00	329.13	11,194.34	1,632.46	-2,423.34	14,446,499.72	1,724,474.44	39.77927273	-80.70064100
15,668.00	90.33	329.31	11,192.43	1,713.20	-2,471.43	14,446,580.46	1,724,426.34	39.77949490	-80.70080965
15,763.00	90.77	330.10	11,191.51	1,795.22	-2,519.35	14,446,662.48	1,724,378.42	39.77972060	-80.70097986
15,858.00	91.47	330.89	11,189.66	1,877.88	-2,566.13	14,446,745.14	1,724,331.65	39.77994804	-80.70114945
15,953.00	90.86	329.49	11,187.73	1,960.29	-2,613.35	14,446,827.55	1,724,284.43	39.77994804	-80.70131497
16,047.00	91.12	330.10	11,186.10	2,041.52	-2,660.63	14,446,908.78	1,724,237.15	39.78017479	-80.70148204
16,142.00	90.95	330.28	11,184.39	2,123.93	-2,707.85	14,446,991.19	1,724,189.93	39.78039829	-80.70164938
16,237.00	90.64	330.80	11,183.07	2,206.64	-2,754.57	14,447,073.90	1,724,143.21	39.78062506	-80.70181647
16,331.00	91.43	332.74	11,181.37	2,289.44	-2,799.02	14,447,156.70	1,724,098.76	39.78085262	-80.70198178
16,426.00	90.73	331.33	11,179.58	2,373.33	-2,843.56	14,447,240.59	1,724,052.22	39.78108042	-80.70213903
16,521.00	90.73	332.12	11,178.37	2,456.99	-2,888.56	14,447,324.25	1,724,009.22	39.78113121	-80.70229657
16,615.00	92.04	331.68	11,176.10	2,539.88	-2,932.82	14,447,407.14	1,723,964.96	39.78154137	-80.70245574
16,710.00	93.05	330.98	11,171.88	2,623.15	-2,978.35	14,447,490.41	1,723,919.43	39.78176942	-80.70261231
16,805.00	90.59	330.89	11,168.86	2,706.14	-3,024.47	14,447,573.40	1,723,873.30	39.78199851	-80.70277339
16,899.00	90.20	331.60	11,168.21	2,788.55	-3,069.69	14,447,655.81	1,723,828.08	39.78222684	-80.70293658
16,994.00	90.55	332.21	11,167.59	2,872.35	-3,114.43	14,447,739.61	1,723,783.35	39.78245356	-80.70309657
17,089.00	90.73	333.18	11,166.53	2,956.76	-3,158.01	14,447,824.02	1,723,739.77	39.78268411	-80.70325482
17,183.00	91.30	333.70	11,164.87	3,040.82	-3,200.03	14,447,908.08	1,723,697.75	39.78291632	-80.70340893
17,278.00	91.16	332.74	11,162.83	3,125.61	-3,242.82	14,447,992.87	1,723,654.95	39.78314757	-80.70355752
17,372.00	91.03	331.42	11,161.03	3,208.66	-3,286.83	14,448,075.92	1,723,610.95	39.78338081	-80.70370885
17,467.00	91.74	331.51	11,158.73	3,292.09	-3,332.20	14,448,159.35	1,723,565.58	39.78360926	-80.70386451
17,562.00	92.75	332.03	11,155.01	3,375.73	-3,377.10	14,448,242.98	1,723,520.68	39.78383881	-80.70402501
17,655.00	91.65	331.33	11,151.44	3,457.53	-3,421.18	14,448,324.79	1,723,476.59	39.78406890	-80.70418386
17,750.00	91.38	329.13	11,148.93	3,539.96	-3,468.33	14,448,407.22	1,723,432.44	39.78429396	-80.70433982
17,845.00	92.00	329.05	11,146.13	3,621.43	-3,517.11	14,448,488.69	1,723,388.66	39.78452076	-80.70450668
17,940.00	90.73	327.99	11,143.87	3,702.42	-3,566.70	14,448,569.68	1,723,345.07	39.78474494	-80.70467936
18,034.00	91.21	328.26	11,142.27	3,782.24	-3,616.34	14,448,649.50	1,723,301.07	39.78496782	-80.70485494
18,129.00	92.48	327.90	11,139.22	3,862.83	-3,666.54	14,448,730.09	1,723,257.14	39.78518746	-80.70503067
18,223.00	90.20	327.02	11,137.02	3,942.04	-3,717.08	14,448,809.30	1,723,213.24	39.78540923	-80.70520843
18,318.00	90.68	329.31	11,136.29	4,022.75	-3,767.19	14,448,890.01	1,723,169.69	39.78562724	-80.70538742
18,413.00	90.73	331.16	11,135.12	4,105.20	-3,814.34	14,448,972.46	1,723,126.59	39.78584932	-80.70556483
18,507.00	91.78	327.46	11,133.06	4,186.00	-3,862.30	14,449,053.26	1,723,083.43	39.78607619	-80.70573172
18,602.00	90.11	327.99	11,131.49	4,266.31	-3,913.02	14,449,133.57	1,723,040.48	39.78629852	-80.70590149
18,686.00	91.21	329.93	11,130.52	4,338.27	-3,956.33	14,449,215.53	1,722,997.45	39.78651952	-80.70608109
								39.78671754	-80.70623441

Survey @ 18686.00 MD 11130.52 TVD

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-13 HU (slot C)
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 N-13 HU (slot C)	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)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
18,727.00	91.21	329.93	11,129.66	4,373.75	-3,976.87	14,449,241.01	1,722,920.91	39.78681515	-80.70630711
Survey projected to 18727.00 MD 11129.66 TVD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
256.00	256.00	0.28	-1.24	MWD surveys
18,686.00	11,130.52	4,338.27	-3,956.33	Survey @ 18686.00 MD 11130.52 TVD
18,727.00	11,129.66	4,373.75	-3,976.87	Survey projected to 18727.00 MD 11129.66 TVD

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