



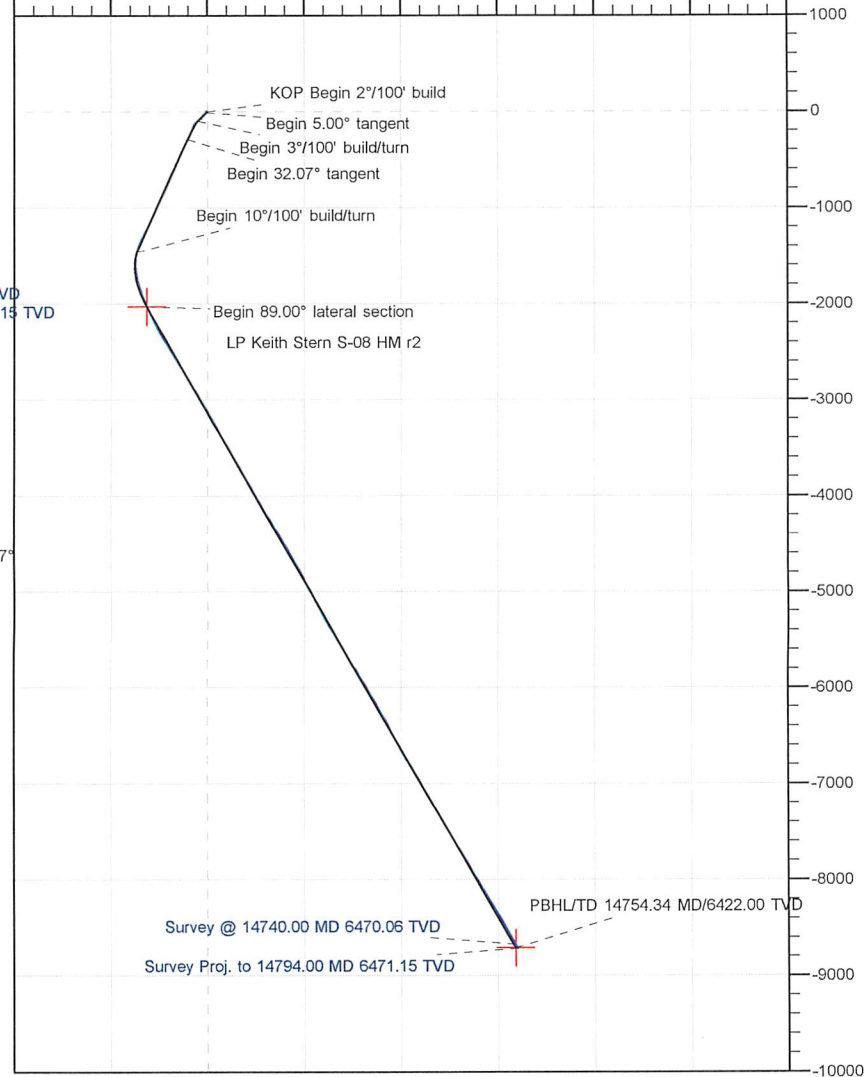
Well: Keith Stern S-08 HM (slot B)
 Site: Keith Stern
 Project: Marshall County, West Virginia.
 Design: rev2

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
LP Keith Stern S-08 HM r2 - plan hits target center	6300.00	-2029.46	-630.28	14442827.03	1726262.22	39.76917000	-80.69449100
BHL Keith Stern S-08 HM r2 - plan hits target center	6434.00	-8711.45	3180.22	14436145.04	1730072.71	39.75078300	-80.68101500

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Annotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	1437.00	0.00	0.00	1437.00	0.00	0.00	0.00	0.00	0.00	KOP Begin 2°/100' build
3	1687.00	5.00	225.00	1686.68	-7.71	-7.71	2.00	225.00	4.60	Begin 5.00° tangent
4	3142.86	5.00	225.00	3137.00	-97.43	-97.43	0.00	0.00	58.11	Begin 3°/100' build/turn
5	4671.77	35.21	204.15	4557.04	-557.67	-330.40	2.00	-23.79	410.55	
6	6350.30	35.21	204.15	5928.55	-1440.68	-726.28	0.00	0.00	1104.26	
7	6631.52	50.00	178.67	6136.50	-1624.70	-757.34	8.00	-59.45	1266.47	
8	7099.03	89.00	150.31	6300.00	-2029.46	-630.28	10.00	-40.70	1690.26	Begin 89.00° lateral section
9	14792.32	89.00	150.31	6434.00	-8711.45	3180.22	0.00	0.00	9273.78	PBHL/TD 14754.34 MD/6422.00 TVD



ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
192.00	0.53	331.11	192.00	0.78	-0.43	-0.88	MWD surveys
14740.00	88.85	150.99	6470.06	-8671.65	3179.11	9236.02	Survey @ 14740.00 MD 6470.06 TVD
14794.00	88.85	150.99	6471.15	-8718.86	3205.29	9289.35	Survey Proj. to 14794.00 MD 6471.15 TVD

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

System Datum: Mean Sea Level
 Depth Reference: RKB=748+33 @ 781.00usft

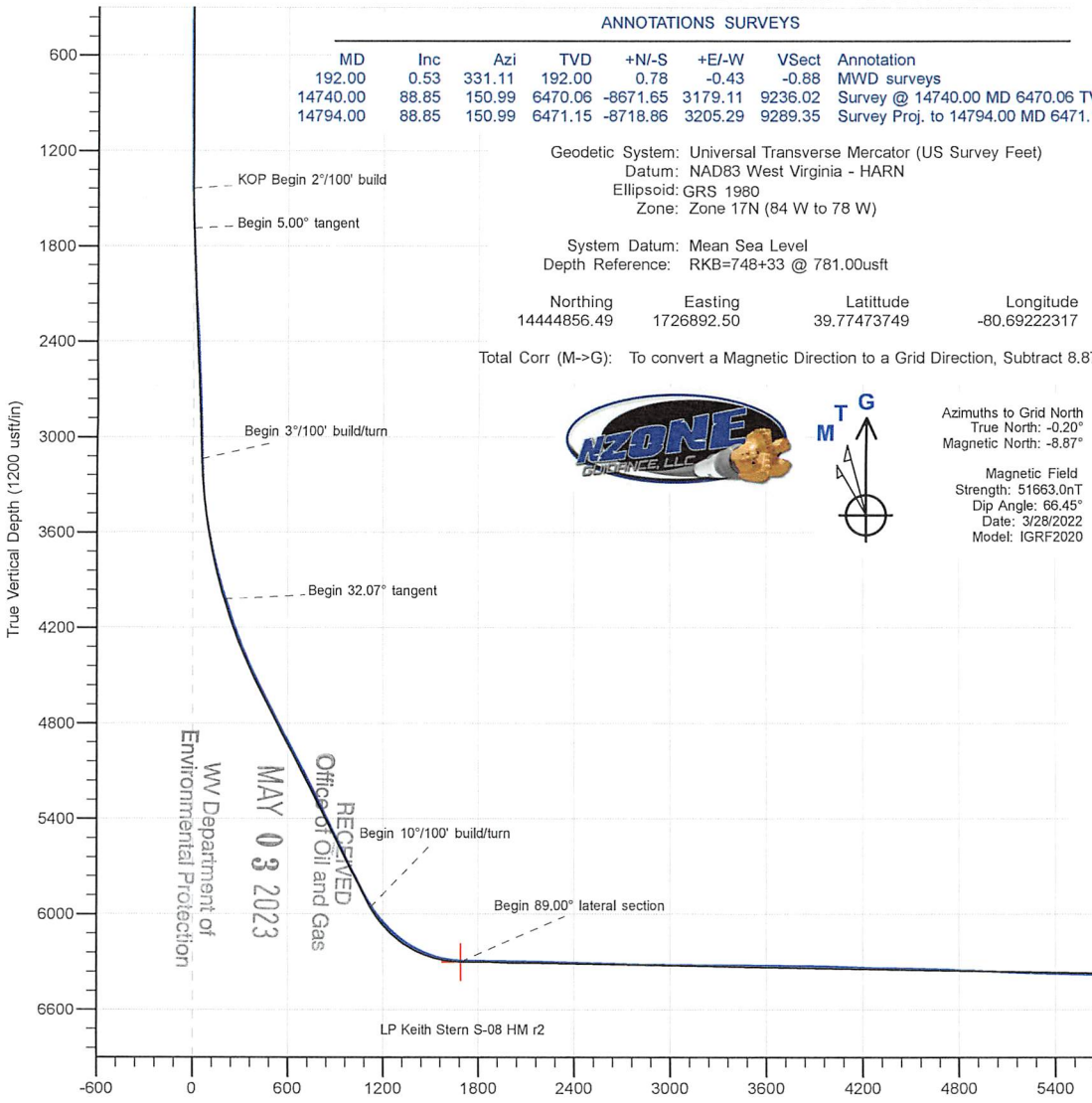
Northing: 14444856.49 Easting: 1726892.50 Latitude: 39.77473749 Longitude: -80.69222317

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.87°



Azimuths to Grid North
 True North: -0.20°
 Magnetic North: -8.87°

Magnetic Field
 Strength: 51663.0nT
 Dip Angle: 66.45°
 Date: 3/28/2022
 Model: IGRF2020



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 MAY 03 2023
 Office of Oil and Gas
 WV Department of
 Environmental Protection

South(-)/North(+) (2000 usft/in)

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-08 HM (slot B)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=748+33 @ 781.00usft
Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft
Well:	Keith Stern S-08 HM (slot B)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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:	0.20 °

Well	Keith Stern S-08 HM (slot B)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,856.49 usft	Latitude:	39.77473749
	+E/-W	0.00 usft	Easting:	1,726,892.49 usft	Longitude:	-80.69222317
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	748.00 usft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	3/28/2022	-8.67	66.45	51,663.02047045

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	159.94	

Survey Program	Date	4/10/2022			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
192.00	548.00	MWD surf (Original Hole)	MWD	MWD - Standard	
548.00	2,213.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,303.00	14,740.00	MWD (Original Hole)	MWD	MWD - Standard	
14,794.00	14,794.00	Projection (Original Hole)	MWD	MWD - Standard	

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Survey	MAY 03 2023									
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	14,444,856.49	1,726,892.49	39.77473749	-80.69222317	
192.00	0.53	331.11	192.00	0.78	-0.43	14,444,857.27	1,726,892.07	39.77473963	-80.69222469	
MWD surveys										
222.00	0.54	330.50	222.00	1.02	-0.57	14,444,857.51	1,726,891.93	39.77474030	-80.69222517	
253.00	0.60	315.97	252.99	1.27	-0.75	14,444,857.75	1,726,891.74	39.77474098	-80.69222583	
283.00	0.60	318.76	282.99	1.50	-0.96	14,444,857.99	1,726,891.53	39.77474161	-80.69222658	
313.00	0.68	325.98	312.99	1.76	-1.17	14,444,858.25	1,726,891.33	39.77474234	-80.69222730	
343.00	0.62	326.46	342.99	2.05	-1.36	14,444,858.53	1,726,891.14	39.77474312	-80.69222797	
374.00	0.60	319.54	373.99	2.31	-1.55	14,444,858.80	1,726,890.94	39.77474385	-80.69222867	

WV Department of Environmental Protection

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-08 HM (slot B)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=748+33 @ 781.00usft
Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft
Well:	Keith Stern S-08 HM (slot B)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
403.00	0.63	318.12	402.99	2.54	-1.76	14,444,859.03	1,726,890.74	39.77474449	-80.69222940
433.00	0.66	313.46	432.98	2.78	-1.99	14,444,859.27	1,726,890.50	39.77474516	-80.69223023
464.00	1.15	309.30	463.98	3.10	-2.36	14,444,859.59	1,726,890.13	39.77474604	-80.69223155
494.00	1.14	315.30	493.97	3.51	-2.81	14,444,860.00	1,726,889.69	39.77474715	-80.69223312
524.00	1.12	320.36	523.97	3.95	-3.20	14,444,860.43	1,726,889.29	39.77474836	-80.69223453
548.00	1.01	316.26	547.96	4.28	-3.50	14,444,860.77	1,726,888.99	39.77474927	-80.69223558
585.00	0.87	317.74	584.96	4.72	-3.91	14,444,861.21	1,726,888.58	39.77475050	-80.69223704
615.00	0.79	311.70	614.96	5.03	-4.22	14,444,861.52	1,726,888.27	39.77475134	-80.69223814
645.00	0.19	296.16	644.95	5.19	-4.42	14,444,861.68	1,726,888.07	39.77475178	-80.69223884
676.00	0.56	118.45	675.95	5.14	-4.33	14,444,861.63	1,726,888.16	39.77475164	-80.69223853
706.00	1.22	131.64	705.95	4.86	-3.97	14,444,861.34	1,726,888.53	39.77475087	-80.69223723
737.00	1.50	131.79	736.94	4.37	-3.42	14,444,860.86	1,726,889.08	39.77474952	-80.69223528
768.00	1.44	139.55	767.93	3.80	-2.86	14,444,860.29	1,726,889.63	39.77474795	-80.69223331
800.00	1.47	138.87	799.92	3.18	-2.33	14,444,859.67	1,726,890.16	39.77474626	-80.69223143
831.00	1.13	142.81	830.91	2.64	-1.88	14,444,859.13	1,726,890.61	39.77474476	-80.69222985
862.00	0.66	157.36	861.91	2.23	-1.63	14,444,858.72	1,726,890.86	39.77474364	-80.69222895
894.00	0.27	180.63	893.91	1.99	-1.56	14,444,858.48	1,726,890.93	39.77474297	-80.69222870
925.00	0.22	283.67	924.91	1.93	-1.62	14,444,858.42	1,726,890.87	39.77474280	-80.69222891
956.00	0.48	283.33	955.91	1.97	-1.80	14,444,858.46	1,726,890.69	39.77474293	-80.69222957
988.00	0.46	279.66	987.91	2.03	-2.06	14,444,858.51	1,726,890.43	39.77474307	-80.69223048
1,019.00	0.54	291.62	1,018.91	2.10	-2.32	14,444,858.59	1,726,890.17	39.77474328	-80.69223140
1,050.00	0.54	299.60	1,049.90	2.23	-2.58	14,444,858.71	1,726,889.91	39.77474363	-80.69223233
1,082.00	0.47	291.65	1,081.90	2.35	-2.84	14,444,858.84	1,726,889.66	39.77474397	-80.69223323
1,114.00	0.46	248.94	1,113.90	2.35	-3.08	14,444,858.84	1,726,889.42	39.77474398	-80.69223409
1,145.00	0.73	212.56	1,144.90	2.14	-3.30	14,444,858.63	1,726,889.19	39.77474340	-80.69223489
1,176.00	1.35	201.26	1,175.89	1.63	-3.54	14,444,858.12	1,726,888.96	39.77474201	-80.69223574
1,208.00	1.60	198.50	1,207.88	0.86	-3.82	14,444,857.35	1,726,888.68	39.77473988	-80.69223674
1,239.00	1.46	211.63	1,238.87	0.11	-4.16	14,444,856.60	1,726,888.33	39.77473784	-80.69223798
1,271.00	1.06	231.11	1,270.87	-0.42	-4.61	14,444,856.07	1,726,887.89	39.77473638	-80.69223957
1,303.00	0.87	249.42	1,302.86	-0.69	-5.06	14,444,855.80	1,726,887.43	39.77473564	-80.69224120
1,334.00	0.98	262.26	1,333.86	-0.81	-5.55	14,444,855.68	1,726,886.95	39.77473532	-80.69224292
1,365.00	1.26	257.16	1,364.85	-0.92	-6.14	14,444,855.57	1,726,886.35	39.77473502	-80.69224504
1,397.00	1.41	247.38	1,396.84	-1.15	-6.85	14,444,855.34	1,726,885.65	39.77473439	-80.69224756
1,459.00	2.26	227.49	1,458.81	-2.27	-8.45	14,444,854.22	1,726,884.04	39.77473133	-80.69225328
1,553.00	3.91	221.97	1,552.67	-5.91	-11.96	14,444,850.58	1,726,880.53	39.77472138	-80.69226582
1,647.00	5.69	219.09	1,646.34	-11.91	-17.04	14,444,844.58	1,726,875.45	39.77470495	-80.69228398
1,742.00	3.90	220.85	1,741.00	-18.01	-22.13	14,444,838.48	1,726,870.37	39.77468825	-80.69230215
1,836.00	2.78	215.44	1,834.84	-22.28	-25.54	14,444,834.21	1,726,866.95	39.77467654	-80.69231434
1,931.00	3.75	218.86	1,929.69	-26.58	-28.83	14,444,829.91	1,726,863.67	39.77466477	-80.69232609
2,025.00	5.78	224.44	2,023.36	-32.35	-34.07	14,444,824.14	1,726,858.42	39.77464897	-80.69234482
2,119.00	6.96	223.99	2,116.77	-39.83	-41.34	14,444,816.66	1,726,851.16	39.77462850	-80.69237079
2,213.00	5.79	218.03	2,210.19	-47.66	-48.22	14,444,808.83	1,726,844.28	39.77460705	-80.69239536
2,303.00	4.34	203.96	2,299.84	-54.35	-52.40	14,444,802.14	1,726,840.10	39.77458873	-80.69241032
2,397.00	5.01	222.31	2,393.53	-60.64	-56.60	14,444,795.85	1,726,835.89	39.77457150	-80.69242537
2,491.00	4.56	228.24	2,487.21	-66.16	-62.15	14,444,790.33	1,726,830.34	39.77455638	-80.69244519
2,585.00	4.16	220.81	2,580.94	-71.23	-67.17	14,444,785.26	1,726,825.32	39.77454251	-80.69246310
2,680.00	5.57	234.94	2,675.59	-76.49	-73.20	14,444,780.00	1,726,819.30	39.77452813	-80.69248461
2,774.00	5.85	237.19	2,769.13	-81.70	-80.96	14,444,774.79	1,726,811.54	39.77451388	-80.69251230
2,868.00	5.66	218.77	2,862.66	-87.91	-87.89	14,444,768.58	1,726,804.61	39.77449689	-80.69253704
2,963.00	4.40	225.70	2,957.29	-94.11	-93.43	14,444,762.38	1,726,799.07	39.77447992	-80.69255684
3,057.00	3.89	224.57	3,051.05	-98.90	-98.25	14,444,757.59	1,726,794.25	39.77446681	-80.69257404
3,155.00	5.28	229.54	3,148.73	-104.20	-104.01	14,444,752.29	1,726,788.48	39.77445232	-80.69259462
3,249.00	7.43	225.66	3,242.15	-111.25	-111.65	14,444,745.24	1,726,780.85	39.77443302	-80.69262189
3,344.00	9.22	222.44	3,336.15	-121.16	-121.18	14,444,735.33	1,726,771.32	39.77440589	-80.69265593
3,438.00	10.58	211.43	3,428.75	-134.08	-130.76	14,444,722.40	1,726,761.73	39.77437050	-80.69269020

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-08 HM (slot B)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=748+33 @ 781.00usft
Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft
Well:	Keith Stern S-08 HM (slot B)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
3,532.00	12.07	201.49	3,520.93	-150.59	-138.86	14,444,705.89	1,726,753.63	39.77432523	-80.69271923
3,627.00	13.78	203.04	3,613.52	-170.25	-146.93	14,444,686.24	1,726,745.56	39.77427133	-80.69274818
3,721.00	16.40	205.12	3,704.27	-192.57	-156.95	14,444,663.92	1,726,735.55	39.77421012	-80.69278411
3,814.00	18.57	205.61	3,792.97	-217.82	-168.92	14,444,638.67	1,726,723.57	39.77414091	-80.69282704
3,908.00	20.65	204.94	3,881.51	-246.34	-182.38	14,444,610.14	1,726,710.11	39.77406268	-80.69287529
4,002.00	22.88	206.35	3,968.80	-277.75	-197.49	14,444,578.73	1,726,695.01	39.77397657	-80.69292942
4,096.00	24.50	207.42	4,054.88	-311.43	-214.57	14,444,545.06	1,726,677.92	39.77388424	-80.69299065
4,191.00	26.38	206.98	4,140.67	-347.73	-233.22	14,444,508.76	1,726,659.27	39.77378474	-80.69305746
4,286.00	28.08	206.67	4,225.13	-386.52	-252.83	14,444,469.97	1,726,639.66	39.77367839	-80.69312773
4,379.00	29.52	204.91	4,306.63	-426.86	-272.31	14,444,429.63	1,726,620.19	39.77356778	-80.69319754
4,473.00	31.05	203.95	4,387.80	-470.02	-291.91	14,444,386.47	1,726,600.59	39.77344944	-80.69326781
4,567.00	32.67	201.84	4,467.64	-515.73	-311.19	14,444,340.76	1,726,581.31	39.77332409	-80.69333699
4,662.00	34.71	201.94	4,546.68	-564.63	-330.83	14,444,291.86	1,726,561.66	39.77319000	-80.69340750
4,756.00	34.55	203.99	4,624.03	-613.80	-351.67	14,444,242.68	1,726,540.82	39.77305514	-80.69348226
4,851.00	35.13	204.62	4,702.00	-663.26	-374.01	14,444,193.22	1,726,518.48	39.77291952	-80.69356237
4,945.00	35.14	204.37	4,778.87	-712.49	-396.44	14,444,144.00	1,726,496.05	39.77278453	-80.69364280
5,039.00	35.73	203.11	4,855.46	-762.38	-418.38	14,444,094.11	1,726,474.12	39.77264774	-80.69372147
5,134.00	35.91	203.77	4,932.49	-813.39	-440.49	14,444,043.10	1,726,452.00	39.77250786	-80.69380080
5,228.00	35.54	206.12	5,008.81	-863.15	-463.63	14,443,993.34	1,726,428.86	39.77237142	-80.69388376
5,323.00	36.28	206.51	5,085.75	-913.09	-488.33	14,443,943.40	1,726,404.16	39.77223450	-80.69397228
5,417.00	35.36	204.73	5,161.98	-962.69	-512.13	14,443,893.80	1,726,380.37	39.77209852	-80.69405756
5,512.00	35.12	202.28	5,239.57	-1,012.94	-533.99	14,443,843.55	1,726,358.51	39.77196071	-80.69413598
5,606.00	33.88	203.69	5,317.04	-1,061.96	-554.77	14,443,794.53	1,726,337.73	39.77182629	-80.69421053
5,699.00	35.05	205.33	5,393.71	-1,109.84	-576.61	14,443,746.65	1,726,315.89	39.77169502	-80.69428884
5,793.00	34.71	203.54	5,470.83	-1,158.77	-598.85	14,443,697.72	1,726,293.65	39.77156084	-80.69436857
5,888.00	34.24	205.94	5,549.15	-1,207.60	-621.34	14,443,648.89	1,726,271.15	39.77142694	-80.69444922
5,981.00	35.30	206.40	5,625.54	-1,255.20	-644.73	14,443,601.29	1,726,247.76	39.77129645	-80.69453305
6,076.00	34.47	205.57	5,703.47	-1,304.04	-668.54	14,443,552.45	1,726,223.95	39.77116255	-80.69461838
6,099.00	34.45	205.58	5,722.43	-1,315.78	-674.16	14,443,540.71	1,726,218.33	39.77113036	-80.69463851
6,193.00	35.54	204.17	5,799.44	-1,364.68	-696.83	14,443,491.80	1,726,195.67	39.77099626	-80.69471977
6,287.00	35.92	202.54	5,875.75	-1,415.08	-718.58	14,443,441.41	1,726,173.91	39.77085807	-80.69479781
6,334.00	36.65	200.27	5,913.63	-1,440.97	-728.73	14,443,415.52	1,726,163.77	39.77078706	-80.69483423
6,382.00	38.35	194.90	5,951.72	-1,468.81	-737.52	14,443,387.68	1,726,154.97	39.77071068	-80.69486587
6,429.00	40.02	189.47	5,988.16	-1,497.82	-743.76	14,443,358.67	1,726,148.73	39.77063108	-80.69488842
6,476.00	42.44	184.65	6,023.52	-1,528.54	-747.53	14,443,327.95	1,726,144.96	39.77054674	-80.69490222
6,523.00	44.18	181.97	6,057.72	-1,560.72	-749.38	14,443,295.77	1,726,143.11	39.77045838	-80.69490919
6,571.00	46.40	179.13	6,091.49	-1,594.82	-749.69	14,443,261.67	1,726,142.80	39.77036473	-80.69491071
6,618.00	49.65	175.69	6,122.92	-1,629.71	-748.09	14,443,226.78	1,726,144.40	39.77026890	-80.69490542
6,665.00	52.82	173.41	6,152.35	-1,666.18	-744.59	14,443,190.30	1,726,147.90	39.77016871	-80.69489343
6,712.00	56.14	170.95	6,179.66	-1,704.07	-739.37	14,443,152.42	1,726,153.12	39.77006462	-80.69487531
6,759.00	60.22	167.77	6,204.44	-1,743.30	-731.98	14,443,113.19	1,726,160.52	39.76995682	-80.69484947
6,806.00	63.75	164.52	6,226.51	-1,783.57	-722.03	14,443,072.92	1,726,170.47	39.76984614	-80.69481454
6,854.00	67.99	162.75	6,246.13	-1,825.58	-709.68	14,443,030.91	1,726,182.82	39.76973064	-80.69477110
6,901.00	72.21	160.80	6,262.13	-1,867.54	-695.85	14,442,988.95	1,726,196.64	39.76961527	-80.69472240
6,949.00	75.96	159.47	6,275.29	-1,910.95	-680.16	14,442,945.54	1,726,212.33	39.76949593	-80.69466710
6,996.00	80.63	156.71	6,284.82	-1,953.62	-662.99	14,442,902.86	1,726,229.51	39.76937856	-80.69460649
7,043.00	85.09	155.23	6,290.66	-1,996.20	-644.00	14,442,860.28	1,726,248.49	39.76926144	-80.69453944
7,090.00	88.48	153.94	6,293.30	-2,038.58	-623.86	14,442,817.91	1,726,268.63	39.76914488	-80.69446829
7,137.00	89.09	153.17	6,294.30	-2,080.65	-602.94	14,442,775.83	1,726,289.56	39.76902914	-80.69439433
7,232.00	89.78	153.24	6,295.23	-2,165.45	-560.11	14,442,691.04	1,726,332.38	39.76879587	-80.69424296
7,326.00	89.47	151.30	6,295.85	-2,248.65	-516.38	14,442,607.84	1,726,376.12	39.76856698	-80.69408833
7,420.00	88.94	150.25	6,297.15	-2,330.67	-470.49	14,442,525.82	1,726,422.01	39.76834128	-80.69392602
7,514.00	88.00	149.28	6,299.66	-2,411.85	-423.17	14,442,444.63	1,726,469.32	39.76811789	-80.69375862
7,608.00	88.29	148.99	6,302.71	-2,492.50	-374.97	14,442,363.99	1,726,517.52	39.76789596	-80.69358808
7,703.00	88.56	148.50	6,305.32	-2,573.68	-325.70	14,442,282.81	1,726,566.79	39.76767256	-80.69341372

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-08 HM (slot B)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=748+33 @ 781.00usft
Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft
Well:	Keith Stern S-08 HM (slot B)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
7,798.00	89.51	148.87	6,306.92	-2,654.83	-276.34	14,442,201.66	1,726,616.16	39.76744924	-80.69323903	
7,892.00	88.47	149.02	6,308.57	-2,735.34	-227.85	14,442,121.15	1,726,664.64	39.76722767	-80.69306747	
7,986.00	88.20	148.38	6,311.30	-2,815.63	-179.04	14,442,040.86	1,726,713.46	39.76700673	-80.69289474	
8,081.00	88.38	149.41	6,314.14	-2,896.93	-129.98	14,441,959.56	1,726,762.51	39.76678298	-80.69272116	
8,175.00	88.31	150.00	6,316.85	-2,978.06	-82.58	14,441,878.43	1,726,809.91	39.76655974	-80.69255348	
8,270.00	88.91	149.95	6,319.16	-3,060.29	-35.06	14,441,796.20	1,726,857.43	39.76633347	-80.69238537	
8,364.00	89.56	149.98	6,320.41	-3,141.66	11.98	14,441,714.83	1,726,904.48	39.76610956	-80.69221895	
8,458.00	89.40	150.77	6,321.27	-3,223.37	58.45	14,441,633.12	1,726,950.94	39.76588473	-80.69205460	
8,552.00	89.65	151.49	6,322.05	-3,305.68	103.83	14,441,550.81	1,726,996.32	39.76565825	-80.69189411	
8,645.00	89.75	150.24	6,322.53	-3,386.91	149.11	14,441,469.58	1,727,041.60	39.76543474	-80.69173398	
8,739.00	90.14	150.54	6,322.62	-3,468.63	195.55	14,441,387.85	1,727,088.05	39.76520986	-80.69156970	
8,833.00	89.78	150.19	6,322.69	-3,550.34	242.03	14,441,306.15	1,727,134.53	39.76498504	-80.69140530	
8,927.00	89.60	150.17	6,323.20	-3,631.89	288.78	14,441,224.60	1,727,181.27	39.76476064	-80.69123996	
9,022.00	89.96	150.49	6,323.56	-3,714.43	335.80	14,441,142.05	1,727,228.29	39.76453350	-80.69107364	
9,116.00	89.19	151.00	6,324.26	-3,796.44	381.74	14,441,060.05	1,727,274.23	39.76430785	-80.69091118	
9,211.00	89.19	151.22	6,325.60	-3,879.61	427.63	14,440,976.88	1,727,320.12	39.76407902	-80.69074889	
9,305.00	88.73	149.45	6,327.31	-3,961.27	474.14	14,440,895.22	1,727,366.64	39.76385431	-80.69058438	
9,400.00	89.43	150.67	6,328.83	-4,043.58	521.55	14,440,812.91	1,727,414.04	39.76362781	-80.69041669	
9,493.00	87.57	149.98	6,331.27	-4,124.35	567.57	14,440,732.13	1,727,460.07	39.76340556	-80.69025391	
9,587.00	87.20	149.07	6,335.56	-4,205.28	615.20	14,440,651.21	1,727,507.69	39.76318285	-80.69008544	
9,681.00	88.94	149.44	6,338.72	-4,286.02	663.22	14,440,570.47	1,727,555.71	39.76296066	-80.68991554	
9,775.00	89.35	148.92	6,340.13	-4,366.74	711.38	14,440,489.75	1,727,603.87	39.76273854	-80.68974518	
9,868.00	88.87	149.32	6,341.57	-4,446.54	759.10	14,440,409.94	1,727,651.59	39.76251892	-80.68957633	
9,962.00	88.90	149.51	6,343.40	-4,527.45	806.92	14,440,329.04	1,727,699.41	39.76229627	-80.68940717	
10,055.00	88.54	151.76	6,345.48	-4,608.48	852.51	14,440,248.01	1,727,745.00	39.76207332	-80.68924594	
10,149.00	87.38	151.65	6,348.82	-4,691.19	897.04	14,440,165.30	1,727,789.53	39.76184574	-80.68908851	
10,243.00	87.73	151.36	6,352.83	-4,773.73	941.84	14,440,082.76	1,727,834.34	39.76161864	-80.68893010	
10,338.00	87.53	152.69	6,356.76	-4,857.55	986.37	14,439,998.93	1,727,878.86	39.76138801	-80.68877270	
10,432.00	87.33	152.29	6,360.98	-4,940.84	1,029.74	14,439,915.65	1,727,922.24	39.76115886	-80.68861939	
10,526.00	87.70	152.39	6,365.05	-5,024.02	1,073.34	14,439,832.47	1,727,965.83	39.76093002	-80.68846529	
10,620.00	87.84	151.76	6,368.71	-5,107.01	1,117.33	14,439,749.48	1,728,009.82	39.76070168	-80.68830979	
10,714.00	88.82	151.22	6,371.45	-5,189.58	1,162.17	14,439,666.91	1,728,054.67	39.76047451	-80.68815123	
10,808.00	89.65	150.34	6,372.71	-5,271.61	1,208.06	14,439,584.88	1,728,100.55	39.76024879	-80.68798898	
10,903.00	88.81	148.39	6,373.98	-5,353.34	1,256.46	14,439,503.15	1,728,148.95	39.76002388	-80.68781777	
10,997.00	88.24	149.91	6,376.40	-5,434.01	1,304.64	14,439,422.48	1,728,197.14	39.75980187	-80.68764731	
11,091.00	88.62	149.65	6,378.98	-5,515.20	1,351.94	14,439,341.29	1,728,244.43	39.75957844	-80.68748003	
11,185.00	88.82	149.04	6,381.08	-5,596.04	1,399.85	14,439,260.44	1,728,292.35	39.75935596	-80.68731054	
11,280.00	88.47	149.82	6,383.32	-5,677.82	1,448.16	14,439,178.67	1,728,340.65	39.75913093	-80.68713968	
11,373.00	88.46	149.30	6,385.81	-5,757.97	1,495.26	14,439,098.52	1,728,387.75	39.75891036	-80.68697309	
11,468.00	88.71	148.91	6,388.16	-5,839.46	1,544.02	14,439,017.02	1,728,436.51	39.75868609	-80.68680058	
11,562.00	89.37	148.69	6,389.74	-5,919.86	1,592.71	14,438,936.63	1,728,485.20	39.75846484	-80.68662834	
11,656.00	88.90	149.18	6,391.15	-6,000.37	1,641.21	14,438,856.12	1,728,533.70	39.75824327	-80.68645678	
11,750.00	88.77	150.36	6,393.07	-6,081.56	1,688.52	14,438,774.92	1,728,581.02	39.75801983	-80.68628943	
11,844.00	89.13	151.49	6,394.79	-6,163.70	1,734.19	14,438,692.79	1,728,626.69	39.75779381	-80.68612795	
11,939.00	89.37	150.59	6,396.03	-6,246.82	1,780.19	14,438,609.67	1,728,672.68	39.75756512	-80.68596533	
12,033.00	88.88	151.41	6,397.47	-6,329.02	1,825.75	14,438,527.47	1,728,718.25	39.75733892	-80.68580422	
12,128.00	89.33	151.79	6,398.95	-6,412.58	1,870.93	14,438,443.91	1,728,763.43	39.75710902	-80.68564451	
12,223.00	88.66	150.94	6,400.62	-6,495.94	1,916.45	14,438,360.55	1,728,808.95	39.75687964	-80.68548359	
12,316.00	88.94	150.97	6,402.57	-6,577.23	1,961.59	14,438,279.26	1,728,854.09	39.75665597	-80.68532398	
12,411.00	89.65	151.58	6,403.73	-6,660.53	2,007.25	14,438,195.96	1,728,899.74	39.75642670	-80.68516258	
12,504.00	88.17	148.96	6,405.50	-6,741.27	2,053.35	14,438,115.22	1,728,945.85	39.75620459	-80.68499954	
12,599.00	87.99	149.06	6,408.69	-6,822.66	2,102.24	14,438,033.83	1,728,994.73	39.75598059	-80.68482662	
12,692.00	87.12	149.69	6,412.65	-6,902.61	2,149.57	14,437,953.88	1,729,042.07	39.75576056	-80.68465921	
12,786.00	87.77	150.09	6,416.84	-6,983.85	2,196.68	14,437,872.64	1,729,089.17	39.75553701	-80.68449261	
12,881.00	87.57	150.55	6,420.71	-7,066.32	2,243.68	14,437,790.17	1,729,136.18	39.75531008	-80.68432641	

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 Oil and Gas
 MAY 03 2023
 WV Department of Environmental Protection

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-08 HM (slot B)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=748+33 @ 781.00usft
Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft
Well:	Keith Stern S-08 HM (slot B)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
12,975.00	87.54	150.59	6,424.72	-7,148.11	2,289.83	14,437,708.38	1,729,182.32	39.75508500	-80.68416325
13,068.00	88.02	150.70	6,428.32	-7,229.11	2,335.38	14,437,627.38	1,729,227.88	39.75486212	-80.68400217
13,162.00	87.41	150.28	6,432.07	-7,310.85	2,381.65	14,437,545.64	1,729,274.14	39.75463719	-80.68383859
13,257.00	87.14	149.95	6,436.58	-7,393.12	2,428.93	14,437,463.37	1,729,321.42	39.75441078	-80.68367139
13,351.00	88.35	150.84	6,440.28	-7,474.79	2,475.33	14,437,381.70	1,729,367.82	39.75418606	-80.68350733
13,445.00	88.02	149.85	6,443.26	-7,556.43	2,521.81	14,437,300.06	1,729,414.31	39.75396139	-80.68334296
13,539.00	89.09	148.87	6,445.63	-7,637.28	2,569.70	14,437,219.21	1,729,462.20	39.75373890	-80.68317359
13,633.00	89.17	148.44	6,447.06	-7,717.55	2,618.60	14,437,138.94	1,729,511.09	39.75351797	-80.68300064
13,727.00	89.99	149.48	6,447.75	-7,798.09	2,667.06	14,437,058.40	1,729,559.56	39.75329633	-80.68282921
13,822.00	89.62	150.36	6,448.07	-7,880.29	2,714.68	14,436,976.20	1,729,607.17	39.75307011	-80.68266084
13,916.00	88.31	150.12	6,449.77	-7,961.88	2,761.33	14,436,894.61	1,729,653.82	39.75284560	-80.68249589
14,011.00	88.12	149.15	6,452.73	-8,043.81	2,809.33	14,436,812.68	1,729,701.82	39.75262013	-80.68232614
14,106.00	88.54	149.02	6,455.50	-8,125.28	2,858.11	14,436,731.21	1,729,750.61	39.75239592	-80.68215359
14,200.00	89.00	148.31	6,457.51	-8,205.55	2,906.99	14,436,650.94	1,729,799.48	39.75217501	-80.68198072
14,295.00	89.22	147.69	6,458.99	-8,286.10	2,957.32	14,436,570.39	1,729,849.82	39.75195329	-80.68180265
14,389.00	89.21	149.46	6,460.28	-8,366.30	3,006.32	14,436,490.19	1,729,898.82	39.75173256	-80.68162932
14,484.00	88.11	149.95	6,462.50	-8,448.30	3,054.23	14,436,408.18	1,729,946.73	39.75150689	-80.68145990
14,577.00	87.98	151.10	6,465.67	-8,529.22	3,099.97	14,436,327.27	1,729,992.46	39.75128423	-80.68129821
14,672.00	88.57	150.83	6,468.53	-8,612.24	3,146.05	14,436,244.25	1,730,038.55	39.75105578	-80.68113530
14,740.00	88.85	150.99	6,470.06	-8,671.65	3,179.11	14,436,184.84	1,730,071.60	39.75089230	-80.68101845
Survey @ 14740.00 MD 6470.06 TVD									
14,794.00	88.85	150.99	6,471.15	-8,718.86	3,205.29	14,436,137.62	1,730,097.78	39.75076238	-80.68092590
Survey Proj. to 14794.00 MD 6471.15 TVD									

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
192.00	192.00	0.78	-0.43	MWD surveys	
14,740.00	6,470.06	-8,671.65	3,179.11	Survey @ 14740.00 MD 6470.06 TVD	
14,794.00	6,471.15	-8,718.86	3,205.29	Survey Proj. to 14794.00 MD 6471.15 TVD	