



Well: Keith Stern N-02 HM (slot H)
Site: Keith Stern
Project: Marshall County, West Virginia.
Design: rev2
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=744+37 @ 781.00usft (Nabors X08)

Northing: 14444921.11 Easting: 1726924.19 Latitude: 39.77491466 Longitude: -80.69210958

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°

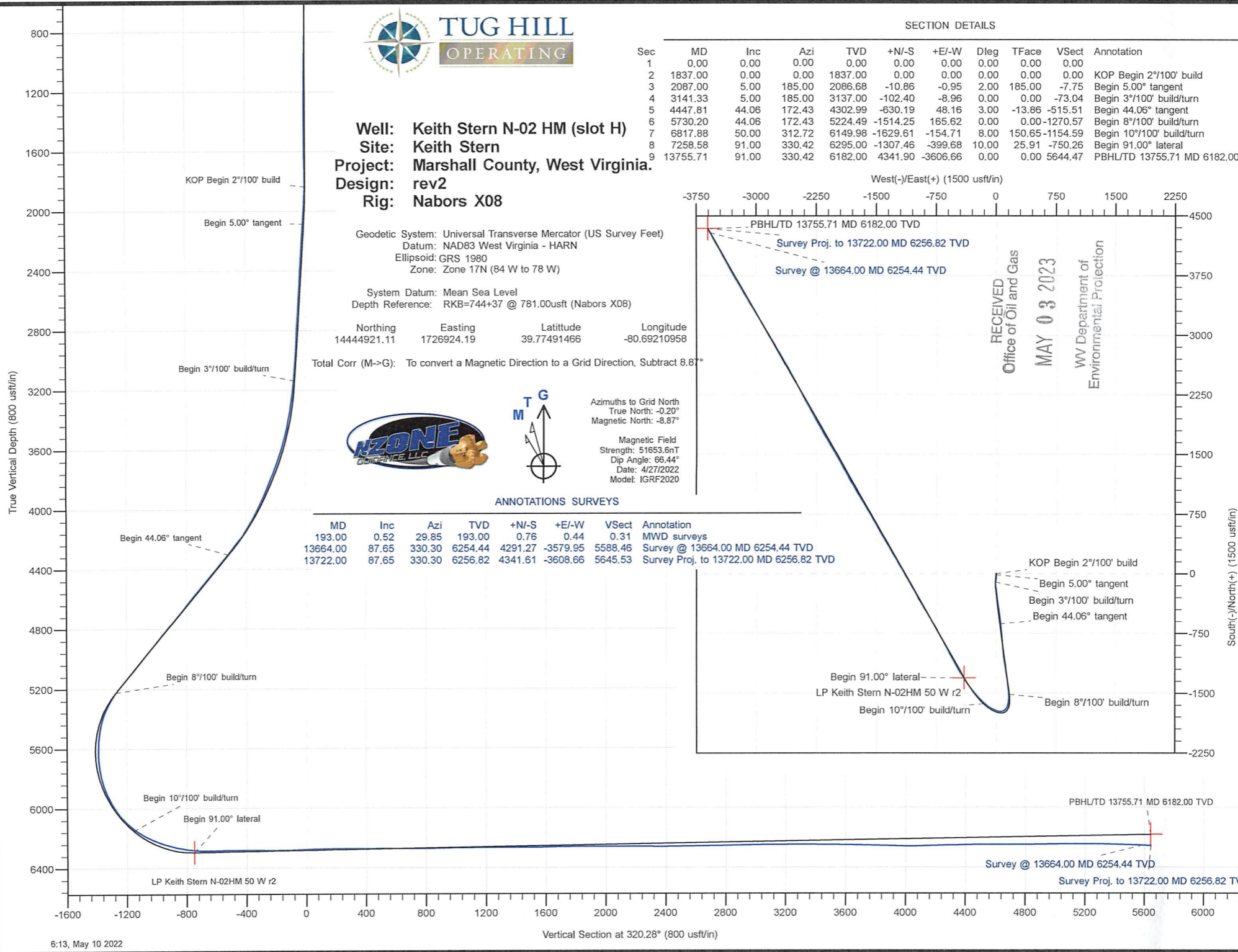
Magnetic Field
 Strength: 51653.6nT
 Dip Angle: 66.44°
 Date: 4/27/2022
 Model: IGRF2020

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
193.00	0.52	29.85	193.00	0.76	0.44	0.31	MWD surveys
13664.00	87.65	330.30	6254.44	4291.27	-3579.95	5588.46	Survey @ 13664.00 MD 6254.44 TVD
13722.00	87.65	330.30	6256.82	4341.61	-3608.66	5645.53	Survey Proj. to 13722.00 MD 6256.82 TVD

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	1837.00	0.00	0.00	1837.00	0.00	0.00	0.00	0.00	0.00	KOP Begin 2°/100' build
3	2087.00	5.00	185.00	2086.68	-10.86	-0.95	2.00	185.00	-7.75	Begin 5.00° tangent
4	3141.33	5.00	185.00	3137.00	-102.40	-8.96	0.00	0.00	-73.04	Begin 3°/100' build/turn
5	4447.81	44.06	172.43	4302.99	-630.19	48.16	3.00	-13.86	-515.51	Begin 44.06° tangent
6	5730.20	44.06	172.43	5224.49	-1514.25	165.62	0.00	0.00	-1270.57	Begin 8°/100' build/turn
7	6817.88	50.00	312.72	6149.98	-1629.61	-154.71	8.00	150.65	-1154.59	Begin 10°/100' build/turn
8	7258.58	91.00	330.42	6295.00	-1307.46	-399.68	10.00	25.91	-750.26	Begin 91.00° lateral
9	13755.71	91.00	330.42	6182.00	4341.90	-3606.66	0.00	0.00	5644.47	PBHL/TD 13755.71 MD 6182.00 TVD



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Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-02 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-02 HM (slot H)	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 N-02 HM (slot H)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,921.11 usft	Latitude:	39.77491466
	+E/-W	0.00 usft	Easting:	1,726,924.19 usft	Longitude:	-80.69210958
Position Uncertainty	0.00 usft		Wellhead Elevation:	usft	Ground Level:	744.00 usft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	4/27/2022	-8.67	66.44	51,653.64951596

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		320.28

Survey Program	Date	5/10/2022			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
193.00	545.00	MWD surf (Original Hole)	MWD	MWD - Standard	
619.00	2,214.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,332.00	13,664.00	MWD (Original Hole)	MWD	MWD - Standard	
13,722.00	13,722.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.00	0.00	0.00	0.00	14,444,921.11	1,726,924.19	39.77491466	-80.69210958	
193.00	0.52	29.85	193.00	0.76	0.44	14,444,921.87	1,726,924.62	39.77491674	-80.69210802	
MWD surveys										
224.00	0.47	36.00	224.00	0.98	0.58	14,444,922.10	1,726,924.77	39.77491736	-80.69210750	
254.00	0.38	40.08	254.00	1.16	0.72	14,444,922.27	1,726,924.90	39.77491784	-80.69210701	
284.00	0.31	50.51	283.99	1.29	0.84	14,444,922.40	1,726,925.03	39.77491819	-80.69210656	
314.00	0.37	29.85	313.99	1.42	0.95	14,444,922.53	1,726,925.14	39.77491856	-80.69210617	
344.00	0.40	46.76	343.99	1.58	1.08	14,444,922.69	1,726,925.27	39.77491899	-80.69210572	
374.00	0.44	34.56	373.99	1.75	1.22	14,444,922.86	1,726,925.41	39.77491944	-80.69210521	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-02 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-02 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
405.00	0.38	17.62	404.99	1.94	1.32	14,444,923.05	1,726,925.51	39.77491998	-80.69210486
435.00	0.42	7.25	434.99	2.15	1.36	14,444,923.26	1,726,925.55	39.77492054	-80.69210470
465.00	0.68	337.55	464.99	2.42	1.31	14,444,923.53	1,726,925.50	39.77492129	-80.69210489
495.00	0.52	356.04	494.99	2.72	1.23	14,444,923.83	1,726,925.42	39.77492212	-80.69210516
525.00	0.54	351.02	524.99	3.00	1.20	14,444,924.11	1,726,925.39	39.77492288	-80.69210527
545.00	0.54	358.16	544.99	3.18	1.18	14,444,924.29	1,726,925.37	39.77492339	-80.69210533
619.00	0.58	113.43	618.98	3.38	1.52	14,444,924.49	1,726,925.70	39.77492394	-80.69210415
649.00	0.77	130.72	648.98	3.19	1.81	14,444,924.30	1,726,925.99	39.77492341	-80.69210311
679.00	0.79	145.55	678.98	2.89	2.08	14,444,924.00	1,726,926.26	39.77492257	-80.69210215
710.00	0.62	157.49	709.98	2.56	2.26	14,444,923.67	1,726,926.45	39.77492166	-80.69210150
741.00	0.70	197.92	740.98	2.22	2.27	14,444,923.33	1,726,926.46	39.77492074	-80.69210148
772.00	0.81	192.88	771.97	1.83	2.16	14,444,922.94	1,726,926.35	39.77491966	-80.69210187
804.00	1.00	200.80	803.97	1.35	2.01	14,444,922.46	1,726,926.20	39.77491834	-80.69210241
835.00	1.07	188.51	834.96	0.81	1.87	14,444,921.92	1,726,926.06	39.77491686	-80.69210291
866.00	0.80	188.14	865.96	0.31	1.80	14,444,921.42	1,726,925.99	39.77491549	-80.69210317
898.00	0.73	175.65	897.96	-0.12	1.78	14,444,920.99	1,726,925.97	39.77491432	-80.69210324
929.00	0.56	178.34	928.95	-0.47	1.80	14,444,920.64	1,726,925.99	39.77491337	-80.69210317
961.00	0.62	163.38	960.95	-0.79	1.86	14,444,920.32	1,726,926.04	39.77491248	-80.69210298
992.00	0.61	160.07	991.95	-1.10	1.96	14,444,920.01	1,726,926.15	39.77491161	-80.69210262
1,023.00	0.60	169.38	1,022.95	-1.42	2.05	14,444,919.69	1,726,926.23	39.77491075	-80.69210231
1,054.00	0.64	168.26	1,053.95	-1.75	2.11	14,444,919.36	1,726,926.30	39.77490984	-80.69210209
1,086.00	0.71	168.60	1,085.95	-2.12	2.19	14,444,918.99	1,726,926.38	39.77490883	-80.69210182
1,117.00	0.70	162.73	1,116.94	-2.49	2.28	14,444,918.62	1,726,926.47	39.77490781	-80.69210149
1,149.00	0.66	128.51	1,148.94	-2.79	2.48	14,444,918.32	1,726,926.67	39.77490698	-80.69210077
1,180.00	0.52	97.95	1,179.94	-2.92	2.76	14,444,918.19	1,726,926.95	39.77490662	-80.69209978
1,211.00	0.60	90.02	1,210.94	-2.94	3.06	14,444,918.17	1,726,927.25	39.77490657	-80.69209871
1,242.00	0.69	80.88	1,241.94	-2.91	3.41	14,444,918.20	1,726,927.60	39.77490664	-80.69209748
1,274.00	0.67	75.51	1,273.93	-2.83	3.78	14,444,918.28	1,726,927.97	39.77490685	-80.69209615
1,306.00	0.64	81.63	1,305.93	-2.76	4.14	14,444,918.35	1,726,928.33	39.77490705	-80.69209488
1,337.00	0.68	58.46	1,336.93	-2.64	4.47	14,444,918.47	1,726,928.66	39.77490738	-80.69209371
1,368.00	0.66	65.45	1,367.93	-2.47	4.79	14,444,918.64	1,726,928.98	39.77490784	-80.69209257
1,399.00	0.52	67.75	1,398.93	-2.34	5.08	14,444,918.77	1,726,929.27	39.77490819	-80.69209153
1,431.00	0.36	91.86	1,430.92	-2.29	5.32	14,444,918.82	1,726,929.50	39.77490833	-80.69209069
1,462.00	0.30	126.40	1,461.92	-2.34	5.48	14,444,918.77	1,726,929.67	39.77490819	-80.69209011
1,493.00	0.40	189.96	1,492.92	-2.49	5.52	14,444,918.62	1,726,929.71	39.77490776	-80.69208995
1,525.00	0.62	241.03	1,524.92	-2.69	5.35	14,444,918.42	1,726,929.54	39.77490723	-80.69209056
1,556.00	1.15	249.85	1,555.92	-2.88	4.91	14,444,918.24	1,726,929.10	39.77490672	-80.69209212
1,588.00	1.30	254.56	1,587.91	-3.08	4.26	14,444,918.03	1,726,928.45	39.77490616	-80.69209444
1,619.00	1.09	266.28	1,618.90	-3.20	3.63	14,444,917.92	1,726,927.82	39.77490585	-80.69209670
1,651.00	0.95	285.76	1,650.90	-3.14	3.07	14,444,917.97	1,726,927.26	39.77490600	-80.69209869
1,682.00	0.99	318.46	1,681.90	-2.87	2.65	14,444,918.24	1,726,926.83	39.77490675	-80.69210020
1,714.00	1.05	338.01	1,713.89	-2.39	2.35	14,444,918.72	1,726,926.54	39.77490807	-80.69210123
1,745.00	1.06	341.22	1,744.89	-1.86	2.15	14,444,919.25	1,726,926.34	39.77490954	-80.69210194
1,777.00	0.84	347.57	1,776.88	-1.35	2.01	14,444,919.76	1,726,926.20	39.77491094	-80.69210245
1,808.00	0.32	19.17	1,807.88	-1.05	1.99	14,444,920.06	1,726,926.18	39.77491177	-80.69210252
1,840.00	0.56	160.85	1,839.88	-1.11	2.07	14,444,920.00	1,726,926.26	39.77491160	-80.69210223
1,933.00	3.58	178.23	1,932.81	-4.44	2.31	14,444,916.67	1,726,926.50	39.77490244	-80.69210142
2,027.00	5.04	175.64	2,026.54	-11.49	2.71	14,444,909.62	1,726,926.90	39.77488307	-80.69210007
2,121.00	5.00	180.41	2,120.18	-19.71	3.00	14,444,901.40	1,726,927.18	39.77486052	-80.69209916
2,214.00	5.04	187.33	2,212.82	-27.81	2.45	14,444,893.30	1,726,926.63	39.77483826	-80.69210121
2,332.00	4.86	182.19	2,330.38	-37.95	1.59	14,444,883.16	1,726,925.78	39.77481044	-80.69210437
2,404.00	4.40	181.63	2,402.15	-43.75	1.40	14,444,877.36	1,726,925.59	39.77479449	-80.69210514
2,498.00	5.11	190.49	2,495.83	-51.48	0.53	14,444,869.64	1,726,924.72	39.77477329	-80.69210831
2,592.00	5.15	189.96	2,589.45	-59.75	-0.96	14,444,861.36	1,726,923.23	39.77475059	-80.69211372
2,686.00	5.10	185.74	2,683.07	-68.06	-2.10	14,444,853.05	1,726,922.08	39.77472777	-80.69211790

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Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-02 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-02 HM (slot H)	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
2,781.00	4.55	179.46	2,777.74	-76.03	-2.49	14,444,845.08	1,726,921.70	39.77470589	-80.69211938
2,875.00	4.55	188.18	2,871.44	-83.45	-2.99	14,444,837.66	1,726,921.20	39.77468552	-80.69212123
2,970.00	4.73	184.14	2,966.13	-91.08	-3.81	14,444,830.03	1,726,920.38	39.77466456	-80.69212424
3,064.00	5.68	191.46	3,059.74	-99.51	-5.01	14,444,821.60	1,726,919.18	39.77464143	-80.69212863
3,159.00	8.15	184.89	3,154.05	-110.83	-6.52	14,444,810.28	1,726,917.67	39.77461036	-80.69213414
3,253.00	10.13	180.00	3,246.85	-125.73	-7.09	14,444,795.38	1,726,917.10	39.77456943	-80.69213634
3,348.00	11.43	176.26	3,340.17	-143.48	-6.47	14,444,777.63	1,726,917.72	39.77452068	-80.69213437
3,442.00	13.33	172.99	3,431.98	-163.53	-4.54	14,444,757.58	1,726,919.65	39.77446560	-80.69212775
3,539.00	16.74	172.96	3,525.65	-188.50	-1.46	14,444,732.61	1,726,922.72	39.77439699	-80.69211710
3,634.00	20.17	174.05	3,615.75	-218.38	1.91	14,444,702.73	1,726,926.10	39.77431491	-80.69210545
3,728.00	22.29	173.09	3,703.37	-252.20	5.74	14,444,668.91	1,726,929.92	39.77422200	-80.69209225
3,821.00	24.61	172.41	3,788.68	-288.91	10.42	14,444,632.20	1,726,934.60	39.77412114	-80.69207604
3,915.00	26.10	173.00	3,873.62	-328.84	15.52	14,444,592.27	1,726,939.71	39.77401144	-80.69205836
4,009.00	28.68	172.04	3,957.08	-371.71	21.17	14,444,549.40	1,726,945.35	39.77389366	-80.69203880
4,103.00	32.21	170.04	4,038.11	-418.74	28.63	14,444,502.37	1,726,952.81	39.77376443	-80.69201282
4,198.00	34.60	170.82	4,117.41	-470.31	37.31	14,444,450.80	1,726,961.50	39.77362272	-80.69198255
4,293.00	40.43	172.81	4,192.73	-527.55	45.48	14,444,393.56	1,726,969.66	39.77346545	-80.69195419
4,386.00	43.59	172.79	4,261.82	-589.29	53.28	14,444,331.82	1,726,977.46	39.77329581	-80.69192718
4,480.00	43.18	173.99	4,330.14	-653.43	60.71	14,444,267.68	1,726,984.90	39.77311961	-80.69190151
4,574.00	45.03	175.08	4,397.64	-718.55	66.93	14,444,202.56	1,726,991.12	39.77294071	-80.69188017
4,669.00	45.52	174.65	4,464.49	-785.77	72.97	14,444,135.34	1,726,997.16	39.77275603	-80.69185949
4,761.00	45.68	176.52	4,528.86	-851.30	78.03	14,444,069.81	1,727,002.22	39.77257602	-80.69184229
4,855.00	43.80	174.78	4,595.63	-917.27	83.03	14,444,003.84	1,727,007.22	39.77239481	-80.69182530
4,949.00	44.00	175.02	4,663.36	-982.19	88.83	14,443,938.92	1,727,013.01	39.77221646	-80.69180547
5,044.00	44.89	172.93	4,731.19	-1,048.34	95.82	14,443,872.77	1,727,020.00	39.77203474	-80.69178140
5,138.00	43.45	169.90	4,798.62	-1,113.09	105.57	14,443,808.02	1,727,029.76	39.77185683	-80.69174749
5,233.00	42.97	171.14	4,867.86	-1,177.24	116.28	14,443,743.87	1,727,040.47	39.77168055	-80.69171014
5,328.00	43.15	171.81	4,937.27	-1,241.39	125.90	14,443,679.72	1,727,050.09	39.77150430	-80.69167671
5,346.00	43.03	171.48	4,950.41	-1,253.55	127.69	14,443,667.56	1,727,051.87	39.77147087	-80.69167050
5,440.00	42.77	170.25	5,019.27	-1,316.73	137.84	14,443,604.38	1,727,062.03	39.77129728	-80.69163512
5,534.00	43.65	170.95	5,087.79	-1,380.22	148.35	14,443,540.89	1,727,072.54	39.77112281	-80.69159851
5,629.00	45.80	175.35	5,155.29	-1,446.57	156.27	14,443,474.55	1,727,080.46	39.77094054	-80.69157113
5,676.00	46.33	175.26	5,187.91	-1,480.30	159.04	14,443,440.81	1,727,083.23	39.77084787	-80.69156168
5,723.00	43.96	176.58	5,221.05	-1,513.53	161.42	14,443,407.58	1,727,085.61	39.77075660	-80.69155363
5,770.00	39.87	180.89	5,256.03	-1,544.89	162.16	14,443,376.22	1,727,086.35	39.77067045	-80.69155138
5,818.00	36.75	183.96	5,293.69	-1,574.61	160.93	14,443,346.50	1,727,085.12	39.77058884	-80.69155612
5,864.00	33.23	187.39	5,331.37	-1,600.85	158.36	14,443,320.26	1,727,082.54	39.77051681	-80.69156560
5,912.00	29.76	191.34	5,372.30	-1,625.58	154.32	14,443,295.53	1,727,078.51	39.77044892	-80.69158027
5,959.00	27.47	194.95	5,413.56	-1,647.50	149.23	14,443,273.61	1,727,073.42	39.77038879	-80.69159865
6,006.00	24.44	200.13	5,455.82	-1,667.11	143.08	14,443,254.00	1,727,067.27	39.77033499	-80.69162076
6,053.00	20.75	207.96	5,499.22	-1,683.60	135.83	14,443,237.51	1,727,060.02	39.77028977	-80.69164678
6,100.00	18.68	217.45	5,543.47	-1,696.93	127.35	14,443,224.18	1,727,051.53	39.77025323	-80.69167714
6,147.00	17.58	223.86	5,588.14	-1,708.03	117.85	14,443,213.08	1,727,042.04	39.77022285	-80.69171107
6,194.00	17.10	234.50	5,633.02	-1,717.16	107.30	14,443,203.95	1,727,031.49	39.77019787	-80.69174871
6,241.00	17.76	242.32	5,677.86	-1,724.51	95.33	14,443,196.60	1,727,019.52	39.77017782	-80.69179142
6,288.00	17.58	251.20	5,722.65	-1,730.12	82.26	14,443,190.99	1,727,006.45	39.77016251	-80.69183800
6,335.00	19.47	263.24	5,767.23	-1,733.34	67.76	14,443,187.78	1,726,991.94	39.77015383	-80.69188966
6,383.00	22.20	275.02	5,812.11	-1,733.48	50.77	14,443,187.63	1,726,974.96	39.77015358	-80.69195012
6,430.00	24.09	282.14	5,855.33	-1,730.69	32.54	14,443,190.42	1,726,956.73	39.77016143	-80.69201495
6,477.00	25.89	288.46	5,897.94	-1,725.42	13.42	14,443,195.69	1,726,937.61	39.77017608	-80.69208292
6,524.00	28.57	294.26	5,939.73	-1,717.55	-6.56	14,443,203.56	1,726,917.63	39.77019788	-80.69215395
6,572.00	33.01	297.60	5,980.96	-1,706.77	-28.63	14,443,214.34	1,726,895.56	39.77022769	-80.69223234
6,619.00	37.05	300.77	6,019.44	-1,693.59	-52.15	14,443,227.52	1,726,872.04	39.77026411	-80.69231589
6,666.00	41.27	303.41	6,055.88	-1,677.80	-77.27	14,443,243.31	1,726,846.92	39.77030771	-80.69240509
6,713.00	46.07	306.31	6,089.87	-1,659.23	-103.86	14,443,261.88	1,726,820.32	39.77035895	-80.69249951



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-02 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-02 HM (slot H)	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
6,760.00	50.51	309.56	6,121.14	-1,637.65	-131.50	14,443,283.46	1,726,792.69	39.77041850	-80.69259761
6,807.00	55.08	312.55	6,149.56	-1,613.05	-159.70	14,443,308.06	1,726,764.49	39.77048631	-80.69269765
6,855.00	59.91	315.71	6,175.35	-1,584.86	-188.72	14,443,336.25	1,726,735.47	39.77056401	-80.69280059
6,902.00	63.91	317.73	6,197.47	-1,554.67	-217.13	14,443,366.44	1,726,707.06	39.77064718	-80.69290132
6,950.00	66.77	318.96	6,217.50	-1,522.08	-246.11	14,443,399.03	1,726,678.08	39.77073696	-80.69300408
6,997.00	70.81	320.54	6,234.50	-1,488.64	-274.41	14,443,432.47	1,726,649.78	39.77082906	-80.69310437
7,045.00	74.20	322.04	6,248.93	-1,452.92	-303.03	14,443,468.19	1,726,621.16	39.77092743	-80.69320579
7,092.00	77.67	323.09	6,260.35	-1,416.72	-330.73	14,443,504.39	1,726,593.45	39.77102709	-80.69330395
7,139.00	78.86	326.08	6,269.91	-1,379.22	-357.40	14,443,541.89	1,726,566.79	39.77113033	-80.69339838
7,186.00	81.98	327.14	6,277.73	-1,340.53	-382.90	14,443,580.58	1,726,541.29	39.77123682	-80.69348866
7,233.00	85.54	327.40	6,282.84	-1,301.23	-408.15	14,443,619.88	1,726,516.04	39.77134498	-80.69357807
7,280.00	90.11	328.81	6,284.62	-1,261.37	-432.96	14,443,659.74	1,726,491.23	39.77145469	-80.69366587
7,328.00	90.46	328.89	6,284.38	-1,220.29	-457.79	14,443,700.82	1,726,466.40	39.77156774	-80.69375373
7,421.00	91.34	330.92	6,282.92	-1,139.84	-504.41	14,443,781.27	1,726,419.77	39.77178911	-80.69391869
7,515.00	90.55	332.23	6,281.37	-1,057.19	-549.15	14,443,863.92	1,726,375.04	39.77201651	-80.69407690
7,609.00	89.80	332.32	6,281.09	-973.98	-592.88	14,443,947.13	1,726,331.31	39.77224543	-80.69423152
7,704.00	89.54	332.06	6,281.63	-889.96	-637.20	14,444,031.16	1,726,286.99	39.77247661	-80.69438824
7,799.00	90.42	330.65	6,281.67	-806.59	-682.74	14,444,114.52	1,726,241.45	39.77270599	-80.69454930
7,893.00	91.56	330.48	6,280.04	-724.73	-728.93	14,444,196.38	1,726,195.26	39.77293121	-80.69471268
7,988.00	92.13	329.86	6,276.98	-642.36	-776.16	14,444,278.75	1,726,148.03	39.77315786	-80.69487978
8,082.00	91.16	329.33	6,274.29	-561.33	-823.71	14,444,359.78	1,726,100.47	39.77338085	-80.69504804
8,177.00	90.59	329.42	6,272.83	-479.59	-872.10	14,444,441.52	1,726,052.08	39.77360578	-80.69521926
8,271.00	90.51	329.86	6,271.93	-398.48	-919.61	14,444,522.63	1,726,004.58	39.77382896	-80.69538736
8,365.00	90.15	330.21	6,271.39	-317.05	-966.56	14,444,604.06	1,725,957.63	39.77405304	-80.69555347
8,459.00	89.98	330.48	6,271.28	-235.36	-1,013.07	14,444,685.75	1,725,911.12	39.77427781	-80.69571801
8,553.00	89.19	329.77	6,271.97	-153.85	-1,059.89	14,444,767.26	1,725,864.30	39.77450208	-80.69588366
8,646.00	89.36	330.21	6,273.14	-73.33	-1,106.40	14,444,847.78	1,725,817.79	39.77472366	-80.69604822
8,740.00	91.30	330.39	6,272.60	8.32	-1,152.97	14,444,929.43	1,725,771.22	39.77494832	-80.69621298
8,834.00	91.25	330.39	6,270.51	90.02	-1,199.40	14,445,011.13	1,725,724.78	39.77517313	-80.69637725
8,928.00	91.38	329.95	6,268.35	171.54	-1,246.15	14,445,092.66	1,725,678.04	39.77539745	-80.69654264
9,023.00	90.86	329.60	6,266.49	253.61	-1,293.96	14,445,174.72	1,725,630.23	39.77562328	-80.69671183
9,118.00	90.07	329.25	6,265.72	335.40	-1,342.28	14,445,256.51	1,725,581.90	39.77584834	-80.69688282
9,212.00	90.51	331.27	6,265.25	417.02	-1,388.91	14,445,338.13	1,725,535.28	39.77607290	-80.69704779
9,307.00	90.02	330.92	6,264.81	500.18	-1,434.83	14,445,421.29	1,725,489.36	39.77630172	-80.69721022
9,401.00	89.93	330.92	6,264.85	582.33	-1,480.52	14,445,503.44	1,725,443.67	39.77652775	-80.69737184
9,495.00	89.36	330.30	6,265.43	664.23	-1,526.65	14,445,585.34	1,725,397.54	39.77675310	-80.69753503
9,588.00	91.34	330.39	6,264.86	745.04	-1,572.66	14,445,666.15	1,725,351.53	39.77697546	-80.69769782
9,682.00	91.21	329.33	6,262.77	826.31	-1,619.84	14,445,747.42	1,725,304.34	39.77719908	-80.69786479
9,776.00	90.77	329.07	6,261.15	907.04	-1,667.97	14,445,828.15	1,725,256.22	39.77742124	-80.69803511
9,869.00	90.24	330.48	6,260.33	987.39	-1,714.78	14,445,908.51	1,725,209.41	39.77764234	-80.69820076
9,963.00	89.89	330.04	6,260.22	1,069.01	-1,761.41	14,445,990.12	1,725,162.78	39.77786691	-80.69836575
10,056.00	89.76	328.89	6,260.51	1,149.11	-1,808.66	14,446,070.22	1,725,115.53	39.77808733	-80.69853296
10,151.00	90.42	331.27	6,260.36	1,231.45	-1,856.04	14,446,152.56	1,725,068.15	39.77831387	-80.69870061
10,245.00	89.45	330.21	6,260.46	1,313.45	-1,901.98	14,446,234.56	1,725,022.20	39.77853950	-80.69886316
10,339.00	89.14	330.21	6,261.62	1,395.02	-1,948.68	14,446,316.13	1,724,975.51	39.77876395	-80.69902839
10,434.00	90.46	331.00	6,261.95	1,477.79	-1,995.31	14,446,398.90	1,724,928.88	39.77899168	-80.69919336
10,528.00	91.12	330.74	6,260.66	1,559.89	-2,041.06	14,446,481.00	1,724,883.13	39.77921757	-80.69935523
10,622.00	91.12	330.30	6,258.82	1,641.70	-2,087.31	14,446,562.82	1,724,836.87	39.77944268	-80.69951887
10,716.00	90.81	329.68	6,257.23	1,723.09	-2,134.32	14,446,644.20	1,724,789.87	39.77966662	-80.69968521
10,810.00	91.43	330.48	6,255.40	1,804.55	-2,181.20	14,446,725.66	1,724,742.99	39.77989075	-80.69985109
10,904.00	91.16	331.09	6,253.27	1,886.57	-2,227.07	14,446,807.68	1,724,697.12	39.78011643	-80.70001337
10,998.00	90.95	331.18	6,251.54	1,968.88	-2,272.44	14,446,889.99	1,724,651.75	39.78034288	-80.70017388
11,092.00	90.29	331.62	6,250.53	2,051.40	-2,317.43	14,446,972.51	1,724,606.76	39.78056993	-80.70033305
11,187.00	90.64	332.06	6,249.75	2,135.15	-2,362.26	14,447,056.26	1,724,561.93	39.78080035	-80.70049162
11,281.00	90.73	332.32	6,248.63	2,218.29	-2,406.11	14,447,139.40	1,724,518.07	39.78102906	-80.70064672



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-02 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=744+37 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-02 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
11,375.00	89.58	331.53	6,248.38	2,301.23	-2,450.35	14,447,222.34	1,724,473.84	39.78125724	-80.70080319
11,469.00	89.27	332.06	6,249.32	2,384.06	-2,494.78	14,447,305.17	1,724,429.41	39.78148513	-80.70096033
11,563.00	89.67	332.59	6,250.19	2,467.30	-2,538.43	14,447,388.41	1,724,385.76	39.78171413	-80.70111473
11,657.00	88.92	330.65	6,251.35	2,549.99	-2,583.11	14,447,471.10	1,724,341.08	39.78194164	-80.70127276
11,751.00	88.75	330.74	6,253.26	2,631.95	-2,629.11	14,447,553.06	1,724,295.08	39.78216712	-80.70143552
11,845.00	88.48	331.18	6,255.53	2,714.11	-2,674.72	14,447,635.22	1,724,249.47	39.78239317	-80.70159692
11,940.00	88.62	330.48	6,257.93	2,797.03	-2,721.01	14,447,718.14	1,724,203.18	39.78262132	-80.70176069
12,035.00	89.27	329.16	6,259.68	2,879.14	-2,768.76	14,447,800.25	1,724,155.43	39.78284725	-80.70192968
12,129.00	90.95	328.45	6,259.50	2,959.54	-2,817.44	14,447,880.65	1,724,106.74	39.78306850	-80.70210203
12,224.00	91.47	329.95	6,257.50	3,041.12	-2,866.08	14,447,962.23	1,724,058.11	39.78329299	-80.70227416
12,317.00	91.38	330.21	6,255.18	3,121.70	-2,912.45	14,448,042.81	1,724,011.74	39.78351471	-80.70243828
12,412.00	91.69	330.30	6,252.64	3,204.16	-2,959.57	14,448,125.27	1,723,964.62	39.78374157	-80.70260501
12,506.00	90.90	328.81	6,250.51	3,285.17	-3,007.18	14,448,206.28	1,723,917.00	39.78396450	-80.70277355
12,600.00	90.99	329.07	6,248.96	3,365.68	-3,055.67	14,448,286.79	1,723,868.51	39.78418605	-80.70294521
12,693.00	89.80	328.89	6,248.32	3,445.38	-3,103.60	14,448,366.49	1,723,820.59	39.78440535	-80.70311485
12,788.00	89.76	329.77	6,248.69	3,527.09	-3,152.06	14,448,448.20	1,723,772.13	39.78463019	-80.70328638
12,882.00	89.85	330.30	6,249.01	3,608.52	-3,199.01	14,448,529.63	1,723,725.18	39.78485425	-80.70345254
12,976.00	90.90	330.56	6,248.39	3,690.28	-3,245.39	14,448,611.39	1,723,678.80	39.78507919	-80.70361669
13,069.00	91.47	330.48	6,246.47	3,771.22	-3,291.15	14,448,692.33	1,723,633.04	39.78530190	-80.70377862
13,164.00	89.93	330.92	6,245.31	3,854.06	-3,337.64	14,448,775.17	1,723,586.55	39.78552981	-80.70394311
13,258.00	89.85	330.92	6,245.49	3,936.21	-3,383.32	14,448,857.32	1,723,540.87	39.78575583	-80.70410478
13,352.00	89.23	331.62	6,246.24	4,018.63	-3,428.50	14,448,939.74	1,723,495.68	39.78598260	-80.70426464
13,446.00	88.75	331.00	6,247.90	4,101.08	-3,473.62	14,449,022.19	1,723,450.56	39.78620943	-80.70442428
13,540.00	88.53	330.92	6,250.13	4,183.24	-3,519.24	14,449,104.35	1,723,404.95	39.78643547	-80.70458569
13,635.00	87.69	330.56	6,253.26	4,266.07	-3,565.65	14,449,187.18	1,723,358.54	39.78666337	-80.70474992
13,664.00	87.65	330.30	6,254.44	4,291.27	-3,579.95	14,449,212.38	1,723,344.24	39.78673271	-80.70480052
Survey @ 13664.00 MD 6254.44 TVD									
13,722.00	87.65	330.30	6,256.82	4,341.61	-3,608.66	14,449,262.72	1,723,315.53	39.78687122	-80.70490214
Survey Proj. to 13722.00 MD 6256.82 TVD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
193.00	193.00	0.76	0.44	MWD surveys
13,664.00	6,254.44	4,291.27	-3,579.95	Survey @ 13664.00 MD 6254.44 TVD
13,722.00	6,256.82	4,341.61	-3,608.66	Survey Proj. to 13722.00 MD 6256.82 TVD