



Well: Keith Stern S-11 HM (slot M)
 Site: Keith Stern
 Project: Marshall County, West Virginia.
 Design: rev3
 Rig: Nabors X08
 DESIGN TARGET DETAILS

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Annotation
1	0.00	0.00	0.000	0.00	0.00	0.00	0.000	0.00	0.00	
2	1437.00	0.00	0.000	1437.00	0.00	0.00	0.000	0.00	0.00	KOP Begin 2°/100' build
3	1687.00	5.00	130.000	1686.68	-7.01	8.35	2.000	130.00	10.47	Begin 5.00° tangent
4	3544.39	5.00	130.000	3537.00	-111.06	132.36	0.000	0.00	165.92	Begin 2°/100' build/turn
5	4449.80	22.89	114.721	4412.35	-210.89	324.11	2.000	-19.25	355.53	Begin 22.89° tangent
6	6038.18	22.89	114.721	5875.70	-469.22	885.22	0.000	0.00	882.33	Begin 8°/100' build/turn
7	6415.24	50.00	138.607	6177.57	-611.53	1051.16	8.000	38.12	1092.90	Begin 10°/100' build/turn
8	6819.86	89.00	150.469	6317.00	-916.58	1262.18	10.000	18.46	1463.78	Begin 89.00° lateral
9	14068.08	89.00	150.469	6444.00	-7222.19	4834.28	0.000	0.00	8690.81	PBHL/TD 14068.08 MD 6444.00 TVD

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
LP Keith Stern S-11 HM 50E r3	6317.00	-916.58	1262.18	14443930.66	1728173.52	39.77218275	-80.68767541
BHL Keith Stern S-11 HM r3	6444.00	-7222.19	4834.28	144437625.05	1731745.62	39.75483100	-80.67504400

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
194.00	0.79	296.900	193.99	0.61	-1.19	-1.17	MWD surveys
13976.00	88.48	151.180	6449.65	-7165.12	4808.02	8628.78	Survey @ 13976.00 MD 6449.65 TVD
14035.00	88.48	151.180	6451.21	-7216.79	4836.45	8687.54	Survey Proj. to 14035.00 MD 6451.21 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 @ 761.00usft (Nabors X08)

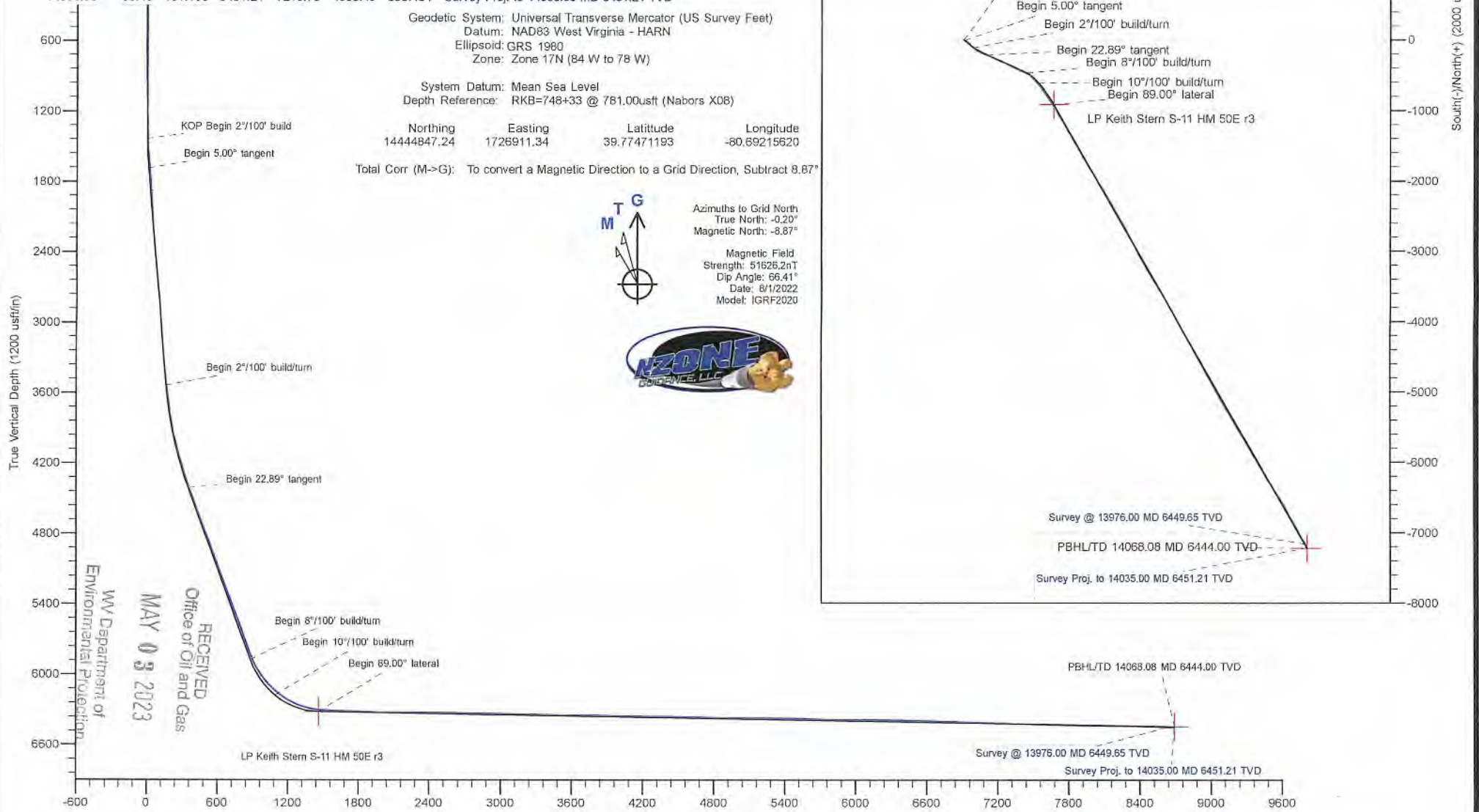
Northing	Easting	Latitude	Longitude
14444847.24	1726911.34	39.77471193	-80.69215620

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: 51625.2nT
 Dip Angle: 66.41°
 Date: 8/1/2022
 Model: IGRF2020



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 Environmental Protection

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-11 HM (slot M)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Well:	Keith Stern S-11 HM (slot M)	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-11 HM (slot M)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,847.25 usft	Latitude:	39.77471193
	+E/-W	0.00 usft	Easting:	1,726,911.34 usft	Longitude:	-80.69215620
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	8/1/2022	-8.67	66.41	51,626.21146909

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	146.203	

Survey Program	Date	8/13/2022			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
194.00	533.00	MWD surf (Original Hole)	MWD	MWD - Standard	
586.00	2,221.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,301.00	13,976.00	MWD (Original Hole)	MWD	MWD - Standard	
14,035.00	14,035.00	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	0.000	0.00	0.00	0.00	14,444,847.25	1,726,911.34	39.77471193	-80.69215620	
194.00	0.79	296.900	193.99	0.61	-1.19	14,444,847.85	1,726,910.15	39.77471360	-80.69216044	
MWD surveys										
224.00	0.80	289.460	223.99	0.77	-1.57	14,444,848.01	1,726,909.77	39.77471406	-80.69216180	
254.00	0.72	291.960	253.99	0.91	-1.95	14,444,848.15	1,726,909.40	39.77471445	-80.69216312	
284.00	0.66	303.630	283.99	1.07	-2.27	14,444,848.32	1,726,909.08	39.77471491	-80.69216425	
315.00	0.54	300.730	314.98	1.25	-2.54	14,444,848.49	1,726,908.80	39.77471538	-80.69216522	
345.00	0.55	303.030	344.98	1.40	-2.78	14,444,848.65	1,726,908.56	39.77471580	-80.69216608	
375.00	0.56	308.690	374.98	1.57	-3.02	14,444,848.82	1,726,908.33	39.77471627	-80.69216692	

Company: Tug Hill Operating LLC
 Project: Marshall County, West Virginia.
 Site: Keith Stern
 Well: Keith Stern S-11 HM (slot M)
 Wellbore: Original Hole
 Design: Surveys Original Hole

Local Co-ordinate Reference: Well Keith Stern S-11 HM (slot M)
 TVD Reference: RKB=748+33 @ 781.00usft (Nabors X08)
 MD Reference: RKB=748+33 @ 781.00usft (Nabors X08)
 North Reference: Grid
 Survey Calculation Method: Minimum Curvature
 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	0.58	307.780	404.98	1.75	-3.25	14,444,849.00	1,726,908.09	39.77471678	-80.69216775
435.00	0.60	305.390	434.98	1.94	-3.50	14,444,849.18	1,726,907.84	39.77471729	-80.69216863
465.00	1.10	306.140	464.98	2.20	-3.86	14,444,849.44	1,726,907.48	39.77471801	-80.69216991
496.00	1.05	308.900	495.97	2.55	-4.32	14,444,849.80	1,726,907.02	39.77471898	-80.69217155
533.00	1.03	316.610	532.96	3.01	-4.81	14,444,850.25	1,726,906.53	39.77472024	-80.69217330
586.00	0.71	311.680	585.96	3.57	-5.39	14,444,850.82	1,726,905.96	39.77472179	-80.69217533
616.00	0.38	280.350	615.96	3.71	-5.62	14,444,850.96	1,726,905.72	39.77472218	-80.69217617
648.00	0.44	159.200	647.96	3.62	-5.68	14,444,850.86	1,726,905.66	39.77472192	-80.69217639
679.00	0.88	148.160	678.95	3.30	-5.52	14,444,850.55	1,726,905.83	39.77472106	-80.69217579
710.00	1.02	152.070	709.95	2.86	-5.26	14,444,850.10	1,726,906.08	39.77471983	-80.69217489
742.00	0.96	151.840	741.94	2.37	-5.00	14,444,849.62	1,726,906.34	39.77471849	-80.69217397
773.00	0.76	132.660	772.94	2.00	-4.73	14,444,849.25	1,726,906.62	39.77471747	-80.69217300
804.00	0.60	104.690	803.94	1.82	-4.42	14,444,849.07	1,726,906.92	39.77471697	-80.69217191
836.00	0.66	88.340	835.94	1.78	-4.07	14,444,849.03	1,726,907.27	39.77471687	-80.69217067
867.00	0.72	94.690	866.93	1.77	-3.70	14,444,849.02	1,726,907.64	39.77471684	-80.69216935
898.00	0.74	82.130	897.93	1.78	-3.31	14,444,849.03	1,726,908.03	39.77471686	-80.69216795
930.00	0.79	84.700	929.93	1.83	-2.88	14,444,849.08	1,726,908.46	39.77471699	-80.69216644
961.00	0.85	94.540	960.93	1.83	-2.44	14,444,849.08	1,726,908.90	39.77471699	-80.69216487
993.00	0.97	95.210	992.92	1.79	-1.94	14,444,849.04	1,726,909.41	39.77471687	-80.69216307
1,024.00	1.05	101.710	1,023.92	1.71	-1.40	14,444,848.96	1,726,909.95	39.77471664	-80.69216115
1,055.00	0.97	119.730	1,054.91	1.52	-0.89	14,444,848.77	1,726,910.45	39.77471612	-80.69215935
1,087.00	1.11	145.150	1,086.91	1.13	-0.48	14,444,848.38	1,726,910.87	39.77471505	-80.69215789
1,118.00	1.11	147.120	1,117.90	0.63	-0.14	14,444,847.88	1,726,911.20	39.77471368	-80.69215670
1,149.00	0.94	142.550	1,148.90	0.18	0.17	14,444,847.43	1,726,911.52	39.77471243	-80.69215558
1,181.00	0.70	131.910	1,180.89	-0.16	0.48	14,444,847.09	1,726,911.82	39.77471149	-80.69215449
1,213.00	0.50	137.640	1,212.89	-0.39	0.72	14,444,846.85	1,726,912.06	39.77471085	-80.69215365
1,243.00	0.54	137.190	1,242.89	-0.59	0.90	14,444,846.65	1,726,912.25	39.77471030	-80.69215299
1,275.00	0.44	141.120	1,274.89	-0.80	1.08	14,444,846.45	1,726,912.43	39.77470973	-80.69215236
1,369.00	0.40	164.120	1,368.89	-1.40	1.40	14,444,845.85	1,726,912.74	39.77470809	-80.69215124
1,463.00	2.02	135.060	1,462.86	-2.88	2.66	14,444,844.36	1,726,914.00	39.77470399	-80.69214677
1,557.00	4.03	133.240	1,556.73	-6.32	6.24	14,444,840.93	1,726,917.58	39.77469452	-80.69213408
1,652.00	4.90	131.420	1,651.44	-11.29	11.71	14,444,835.96	1,726,923.05	39.77468081	-80.69211466
1,747.00	5.28	133.110	1,746.06	-16.96	17.94	14,444,830.28	1,726,929.29	39.77466518	-80.69209254
1,840.00	4.49	129.230	1,838.73	-22.19	23.89	14,444,825.06	1,726,935.23	39.77465077	-80.69207145
1,934.00	3.30	123.040	1,932.51	-25.99	29.01	14,444,821.26	1,726,940.35	39.77464028	-80.69205328
2,028.00	3.95	119.410	2,026.32	-29.06	34.10	14,444,818.19	1,726,945.44	39.77463182	-80.69203521
2,123.00	4.38	112.940	2,121.07	-32.08	40.29	14,444,815.17	1,726,951.63	39.77462346	-80.69201321
2,221.00	4.63	120.450	2,218.77	-35.54	47.14	14,444,811.71	1,726,958.49	39.77461389	-80.69198885
2,301.00	4.89	125.320	2,298.49	-39.15	52.71	14,444,808.10	1,726,964.05	39.77460393	-80.69196909
2,395.00	5.45	135.460	2,392.11	-44.65	59.11	14,444,802.60	1,726,970.45	39.77458877	-80.69194638
2,489.00	5.12	131.140	2,485.71	-50.59	65.40	14,444,796.66	1,726,976.74	39.77457239	-80.69192406
2,586.00	4.57	119.310	2,582.37	-55.33	72.03	14,444,791.92	1,726,983.37	39.77455931	-80.69190053
2,681.00	4.84	126.680	2,677.05	-59.57	78.54	14,444,787.67	1,726,989.88	39.77454759	-80.69187739
2,775.00	5.92	155.410	2,770.65	-66.35	83.74	14,444,780.90	1,726,995.08	39.77452892	-80.69185898
2,869.00	5.04	147.550	2,864.22	-74.24	87.97	14,444,773.00	1,726,999.32	39.77450721	-80.69184401
2,964.00	4.63	139.420	2,958.88	-80.68	92.71	14,444,766.57	1,727,004.05	39.77448950	-80.69182724
3,058.00	4.39	131.250	3,052.59	-85.93	97.88	14,444,761.32	1,727,009.22	39.77447502	-80.69180689
3,153.00	3.87	125.110	3,147.34	-90.17	103.24	14,444,757.07	1,727,014.56	39.77446332	-80.69178988
3,247.00	5.66	123.000	3,241.02	-94.52	109.72	14,444,752.72	1,727,021.06	39.77445132	-80.69176686
3,342.00	5.73	119.670	3,335.55	-99.42	117.77	14,444,747.83	1,727,029.11	39.77443779	-80.69173827
3,436.00	6.34	124.420	3,429.03	-104.68	126.13	14,444,742.57	1,727,037.47	39.77442327	-80.69170859
3,531.00	8.11	115.430	3,523.27	-110.52	136.51	14,444,736.73	1,727,047.85	39.77440713	-80.69167172
3,625.00	6.73	126.390	3,616.49	-116.64	146.93	14,444,730.61	1,727,058.27	39.77439023	-80.69163470
3,719.00	6.93	135.890	3,709.82	-123.98	155.31	14,444,723.27	1,727,066.65	39.77437000	-80.69160496
3,813.00	9.55	135.900	3,802.84	-133.65	164.89	14,444,713.60	1,727,076.03	39.77434334	-80.69157171

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-11 HM (slot M)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Well:	Keith Stern S-11 HM (slot M)	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
3,906.00	11.28	129.160	3,894.31	-144.93	177.11	14,444,702.31	1,727,088.45	39.77431223	-80.69152763
4,000.00	13.47	123.160	3,986.13	-156.73	193.41	14,444,690.52	1,727,104.75	39.77427968	-80.69146978
4,095.00	16.48	116.930	4,077.90	-168.89	214.69	14,444,678.36	1,727,126.03	39.77424609	-80.69139418
4,189.00	19.28	111.840	4,167.35	-180.73	240.98	14,444,666.52	1,727,152.32	39.77421333	-80.69130077
4,284.00	19.71	113.890	4,256.91	-193.08	270.17	14,444,654.17	1,727,181.52	39.77417914	-80.69119701
4,377.00	21.84	115.200	4,343.85	-206.79	300.17	14,444,640.45	1,727,211.51	39.77414118	-80.69109043
4,471.00	23.10	111.720	4,430.72	-221.06	333.12	14,444,626.18	1,727,244.46	39.77410168	-80.69097332
4,565.00	22.87	112.750	4,517.26	-234.95	367.10	14,444,612.29	1,727,278.44	39.77406322	-80.69085257
4,663.00	22.61	116.970	4,607.65	-250.86	401.45	14,444,596.39	1,727,312.79	39.77401920	-80.69073049
4,757.00	23.68	115.850	4,694.08	-267.29	434.54	14,444,579.96	1,727,345.89	39.77397378	-80.69061292
4,852.00	24.27	116.870	4,780.88	-284.43	469.13	14,444,562.82	1,727,380.47	39.77392637	-80.69049004
4,946.00	23.20	109.880	4,866.95	-299.46	503.78	14,444,547.79	1,727,415.13	39.77388477	-80.69036689
5,040.00	23.31	111.120	4,953.31	-312.46	538.54	14,444,534.79	1,727,449.89	39.77384874	-80.69024334
5,135.00	23.53	114.720	5,040.49	-327.16	573.30	14,444,520.08	1,727,484.65	39.77380803	-80.69011981
5,229.00	22.58	116.820	5,126.98	-343.15	606.46	14,444,504.09	1,727,517.80	39.77376380	-80.69000202
5,324.00	22.66	116.170	5,214.67	-359.45	639.16	14,444,487.79	1,727,550.50	39.77371873	-80.68988584
5,419.00	24.16	117.220	5,301.85	-376.42	672.87	14,444,470.83	1,727,584.21	39.77367182	-80.68976606
5,513.00	23.29	117.150	5,387.91	-393.70	706.51	14,444,453.55	1,727,617.86	39.77362405	-80.68964654
5,607.00	23.22	114.640	5,474.27	-409.90	739.89	14,444,437.35	1,727,651.23	39.77357922	-80.68952794
5,700.00	23.83	117.050	5,559.61	-426.02	773.16	14,444,421.23	1,727,684.50	39.77353464	-80.68940975
5,775.00	23.46	113.730	5,628.37	-438.87	800.21	14,444,408.38	1,727,711.55	39.77349911	-80.68931362
5,816.00	23.74	112.160	5,665.94	-445.26	815.33	14,444,401.98	1,727,726.67	39.77348139	-80.68925991
5,911.00	23.25	113.120	5,753.06	-459.84	850.28	14,444,387.41	1,727,761.62	39.77344103	-80.68913568
6,005.00	22.64	114.700	5,839.63	-474.68	883.78	14,444,372.56	1,727,795.12	39.77339994	-80.68901664
6,052.00	25.83	120.070	5,882.52	-483.56	900.80	14,444,363.69	1,727,812.15	39.77337540	-80.68895617
6,099.00	29.23	125.950	5,924.24	-495.40	918.90	14,444,351.85	1,727,830.24	39.77334272	-80.68889191
6,146.00	32.70	130.700	5,964.54	-510.42	937.82	14,444,336.63	1,727,849.17	39.77330129	-80.68882475
6,193.00	35.56	133.950	6,003.44	-528.19	957.29	14,444,319.06	1,727,868.64	39.77325230	-80.68875567
6,240.00	39.30	136.940	6,040.76	-548.56	977.30	14,444,298.69	1,727,888.65	39.77319617	-80.68868471
6,287.00	42.64	138.790	6,076.24	-571.42	997.96	14,444,275.83	1,727,909.30	39.77313320	-80.68861147
6,334.00	46.07	138.000	6,109.85	-595.98	1,019.78	14,444,251.27	1,727,931.12	39.77306554	-80.68853413
6,382.00	49.05	138.350	6,142.23	-622.37	1,043.40	14,444,224.87	1,727,954.74	39.77299283	-80.68845040
6,429.00	52.57	140.370	6,171.93	-650.02	1,067.10	14,444,197.23	1,727,978.45	39.77291668	-80.68836637
6,476.00	56.88	142.570	6,199.07	-680.03	1,090.98	14,444,167.21	1,728,002.32	39.77283401	-80.68828176
6,523.00	60.88	143.970	6,223.36	-712.28	1,115.03	14,444,134.96	1,728,026.37	39.77274523	-80.68819657
6,571.00	64.40	145.550	6,245.41	-747.10	1,139.62	14,444,100.15	1,728,050.96	39.77264938	-80.68810950
6,618.00	69.23	146.170	6,263.91	-782.85	1,163.85	14,444,064.40	1,728,075.20	39.77255097	-80.68802369
6,665.00	73.89	146.870	6,278.77	-820.03	1,188.44	14,444,027.22	1,728,099.78	39.77244862	-80.68793665
6,712.00	78.46	148.720	6,290.00	-858.64	1,212.75	14,443,988.61	1,728,124.09	39.77234236	-80.68785061
6,759.00	81.01	148.630	6,298.38	-898.14	1,236.79	14,443,949.11	1,728,148.13	39.77223365	-80.68776554
6,806.00	84.00	148.720	6,304.51	-937.94	1,261.01	14,443,909.30	1,728,172.36	39.77212411	-80.68767982
6,854.00	87.38	149.330	6,308.11	-978.97	1,285.64	14,443,868.27	1,728,196.99	39.77201119	-80.68759268
6,949.00	88.09	149.510	6,311.87	-1,060.70	1,333.94	14,443,786.55	1,728,245.28	39.77178629	-80.68742183
7,043.00	88.31	149.950	6,314.82	-1,141.84	1,381.29	14,443,705.41	1,728,292.64	39.77156300	-80.68725429
7,138.00	88.00	149.680	6,317.88	-1,223.92	1,429.04	14,443,623.33	1,728,340.38	39.77133714	-80.68708540
7,232.00	88.13	150.040	6,321.05	-1,305.16	1,476.21	14,443,542.08	1,728,387.55	39.77111357	-80.68691853
7,326.00	87.96	150.830	6,324.26	-1,386.87	1,522.56	14,443,460.37	1,728,433.90	39.77088672	-80.68675459
7,420.00	89.98	150.740	6,325.95	-1,468.90	1,568.43	14,443,378.35	1,728,479.77	39.77066301	-80.68659236
7,514.00	90.51	150.830	6,325.55	-1,550.94	1,614.31	14,443,296.31	1,728,525.65	39.77043726	-80.68643010
7,608.00	90.99	149.770	6,324.32	-1,632.58	1,660.88	14,443,214.66	1,728,572.22	39.77021260	-80.68626539
7,703.00	89.32	149.600	6,324.06	-1,714.59	1,708.83	14,443,132.66	1,728,620.17	39.76998693	-80.68609577
7,798.00	88.97	149.600	6,325.48	-1,796.52	1,756.90	14,443,050.73	1,728,668.24	39.76976147	-80.68592573
7,892.00	88.57	149.600	6,327.50	-1,877.58	1,804.45	14,442,969.67	1,728,715.79	39.76953840	-80.68575750
7,987.00	88.53	149.070	6,329.90	-1,959.27	1,852.89	14,442,887.98	1,728,764.23	39.76931360	-80.68558615
8,081.00	88.13	148.100	6,332.64	-2,039.45	1,901.86	14,442,807.79	1,728,813.21	39.76909291	-80.68541286

Company: Tug Hill Operating LLC
 Project: Marshall County, West Virginia
 Site: Keith Stern
 Well: Keith Stern S-11 HM (slot M)
 Wellbore: Original Hole
 Design: Surveys Original Hole

Local Co-ordinate Reference: Well Keith Stern S-11 HM (slot M)
 TVD Reference: RKB=748+33 @ 781.00usft (Nabors X08)
 MD Reference: RKB=748+33 @ 781.00usft (Nabors X08)
 North Reference: Grid
 Survey Calculation Method: Minimum Curvature
 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
8,176.00	89.05	150.300	6,334.98	-2,121.02	1,950.49	14,442,726.22	1,728,861.83	39.76886843	-80.68524083
8,270.00	89.36	149.420	6,336.28	-2,202.31	1,997.68	14,442,644.94	1,728,909.02	39.76864475	-80.68507390
8,364.00	89.32	148.540	6,337.37	-2,282.86	2,046.12	14,442,564.39	1,728,957.46	39.76842307	-80.68490253
8,458.00	88.88	150.390	6,338.84	-2,363.81	2,093.87	14,442,483.44	1,729,005.21	39.76820030	-80.68473361
8,552.00	88.48	151.270	6,341.01	-2,445.86	2,139.67	14,442,401.38	1,729,051.02	39.76797451	-80.68457164
8,645.00	88.48	151.180	6,343.47	-2,527.35	2,184.42	14,442,319.90	1,729,095.77	39.76775029	-80.68441340
8,739.00	88.09	150.120	6,346.29	-2,609.25	2,230.48	14,442,238.00	1,729,141.82	39.76752494	-80.68425055
8,833.00	88.18	151.880	6,349.35	-2,691.41	2,276.02	14,442,155.83	1,729,187.37	39.76729884	-80.68408949
8,927.00	89.67	153.020	6,351.11	-2,774.74	2,319.49	14,442,072.51	1,729,230.83	39.76706959	-80.68393585
9,022.00	89.80	153.200	6,351.55	-2,859.46	2,362.46	14,441,987.78	1,729,273.80	39.76683649	-80.68378402
9,116.00	90.29	153.110	6,351.48	-2,943.33	2,404.90	14,441,903.91	1,729,316.25	39.76660575	-80.68363401
9,211.00	88.53	151.790	6,352.45	-3,027.55	2,448.84	14,441,819.69	1,729,360.18	39.76637404	-80.68347872
9,306.00	88.48	151.710	6,354.93	-3,111.21	2,493.79	14,441,736.04	1,729,405.13	39.76614386	-80.68331982
9,400.00	88.26	150.830	6,357.61	-3,193.60	2,538.95	14,441,653.64	1,729,450.30	39.76591715	-80.68316013
9,494.00	89.67	150.300	6,359.30	-3,275.45	2,585.14	14,441,571.79	1,729,496.48	39.76569192	-80.68299680
9,587.00	89.85	149.420	6,359.69	-3,355.88	2,631.84	14,441,491.37	1,729,543.18	39.76547060	-80.68283164
9,681.00	89.71	148.630	6,360.06	-3,436.47	2,680.21	14,441,410.78	1,729,591.56	39.76524880	-80.68266050
9,775.00	88.70	149.160	6,361.36	-3,516.95	2,728.77	14,441,330.30	1,729,640.11	39.76502732	-80.68248873
9,868.00	88.70	148.100	6,363.47	-3,596.33	2,777.17	14,441,250.92	1,729,688.51	39.76480884	-80.68231750
9,962.00	88.26	150.830	6,365.96	-3,677.26	2,824.91	14,441,169.99	1,729,736.25	39.76458612	-80.68214865
10,055.00	87.78	150.740	6,369.18	-3,758.38	2,870.27	14,441,088.87	1,729,781.61	39.76436290	-80.68198824
10,150.00	88.75	151.000	6,372.05	-3,841.32	2,916.49	14,441,005.92	1,729,827.84	39.76413466	-80.68182480
10,244.00	89.63	151.620	6,373.38	-3,923.77	2,961.62	14,440,923.47	1,729,872.96	39.76390779	-80.68166528
10,338.00	89.14	150.040	6,374.39	-4,005.84	3,007.43	14,440,841.40	1,729,918.77	39.76368195	-80.68150330
10,433.00	90.15	150.210	6,374.98	-4,088.22	3,054.75	14,440,759.03	1,729,966.09	39.76345527	-80.68133596
10,528.00	90.68	150.040	6,374.31	-4,168.86	3,101.07	14,440,678.39	1,730,012.41	39.76323336	-80.68117214
10,620.00	89.85	151.270	6,373.87	-4,250.79	3,147.13	14,440,596.45	1,730,058.48	39.76300790	-80.68100926
10,714.00	89.63	151.530	6,374.30	-4,333.32	3,192.13	14,440,513.92	1,730,103.47	39.76278081	-80.68085019
10,809.00	88.48	151.350	6,375.86	-4,416.75	3,237.54	14,440,430.50	1,730,148.88	39.76255125	-80.68068965
10,903.00	88.18	151.180	6,378.60	-4,499.14	3,282.71	14,440,348.11	1,730,194.06	39.76232455	-80.68052996
10,997.00	87.87	150.830	6,381.84	-4,581.31	3,328.25	14,440,265.94	1,730,239.59	39.76209844	-80.68036896
11,091.00	89.36	151.090	6,384.12	-4,663.46	3,373.86	14,440,183.78	1,730,285.21	39.76187237	-80.68020769
11,186.00	90.02	151.970	6,384.63	-4,746.97	3,419.15	14,440,100.27	1,730,330.49	39.76164259	-80.68004761
11,280.00	90.07	150.830	6,384.56	-4,829.50	3,464.15	14,440,017.74	1,730,375.49	39.76141551	-80.67988854
11,373.00	90.24	150.830	6,384.30	-4,910.71	3,509.47	14,439,936.54	1,730,420.82	39.76119205	-80.67972828
11,468.00	88.84	151.440	6,385.07	-4,993.90	3,555.33	14,439,853.35	1,730,466.68	39.76096313	-80.67956616
11,562.00	88.48	150.210	6,387.26	-5,075.95	3,601.14	14,439,771.30	1,730,512.48	39.76073735	-80.67940420
11,656.00	88.79	151.180	6,389.50	-5,157.90	3,647.14	14,439,689.35	1,730,558.48	39.76051185	-80.67924158
11,750.00	87.82	149.420	6,392.28	-5,239.51	3,693.69	14,439,607.74	1,730,605.03	39.76028727	-80.67907698
11,844.00	88.26	150.040	6,395.50	-5,320.64	3,741.04	14,439,526.60	1,730,652.39	39.76006398	-80.67891951
11,939.00	88.26	150.210	6,398.38	-5,402.98	3,788.34	14,439,444.27	1,730,699.68	39.75983739	-80.67874226
12,034.00	88.00	149.510	6,401.48	-5,485.09	3,836.02	14,439,362.15	1,730,747.36	39.75961142	-80.67857366
12,128.00	88.66	150.040	6,404.22	-5,566.28	3,883.31	14,439,280.97	1,730,794.66	39.75938600	-80.67840640
12,223.00	89.05	150.740	6,406.12	-5,648.86	3,930.24	14,439,198.39	1,730,841.59	39.75916076	-80.67824047
12,316.00	87.38	149.680	6,409.02	-5,729.52	3,976.42	14,439,117.72	1,730,887.77	39.75893677	-80.67807718
12,411.00	87.78	150.210	6,413.03	-5,811.68	4,023.96	14,439,035.57	1,730,935.30	39.75871269	-80.67790909
12,504.00	88.48	150.480	6,416.06	-5,892.45	4,069.95	14,438,954.80	1,730,981.29	39.75849040	-80.67774648
12,599.00	88.79	150.480	6,418.33	-5,975.09	4,116.74	14,438,872.15	1,731,028.09	39.75826298	-80.67758103
12,692.00	88.22	149.950	6,420.75	-6,055.78	4,162.93	14,438,791.47	1,731,074.27	39.75804093	-80.67741774
12,787.00	88.48	149.250	6,423.49	-6,137.69	4,210.98	14,438,709.56	1,731,122.32	39.75781553	-80.67724781
12,881.00	88.22	148.280	6,426.20	-6,216.03	4,259.70	14,438,629.22	1,731,171.04	39.75759441	-80.67707547
12,975.00	88.66	148.100	6,428.76	-6,297.88	4,309.23	14,438,549.37	1,731,220.57	39.75737463	-80.67690026
13,068.00	89.54	147.750	6,430.22	-6,376.67	4,358.81	14,438,470.58	1,731,269.95	39.75715775	-80.67672558
13,162.00	88.31	148.890	6,431.98	-6,456.65	4,407.97	14,438,390.60	1,731,319.31	39.75693763	-80.67655099
13,257.00	88.48	148.010	6,434.64	-6,537.57	4,457.65	14,438,309.67	1,731,369.00	39.75671489	-80.67637523

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern S-11 HM (slot M)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Well:	Keith Stern S-11 HM (slot M)	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
13,351.00	88.53	150.390	6,437.09	-6,618.28	4,505.77	14,438,228.97	1,731,417.11	39.75649277	-80.67620508
13,445.00	89.14	151.790	6,439.00	-6,700.55	4,551.20	14,438,146.70	1,731,462.54	39.75626639	-80.67604449
13,539.00	90.11	152.150	6,439.62	-6,783.52	4,595.37	14,438,063.73	1,731,506.71	39.75603809	-80.67588838
13,633.00	88.70	150.480	6,440.60	-6,865.97	4,640.48	14,437,981.27	1,731,551.83	39.75581120	-80.67572893
13,727.00	89.36	151.000	6,442.19	-6,947.97	4,686.42	14,437,899.28	1,731,597.77	39.75558557	-80.67556653
13,822.00	87.91	150.650	6,444.45	-7,030.89	4,732.72	14,437,816.36	1,731,644.06	39.75535738	-80.67540288
13,916.00	88.00	150.560	6,447.80	-7,112.73	4,778.83	14,437,734.51	1,731,690.17	39.75513215	-80.67523988
13,976.00	88.48	151.180	6,449.65	-7,165.12	4,808.02	14,437,682.13	1,731,719.36	39.75498799	-80.67513668
Survey @ 13976.00 MD 6449.65 TVD									
14,035.00	88.48	151.180	6,451.21	-7,216.79	4,836.45	14,437,630.45	1,731,747.79	39.75484580	-80.67503619
Survey Proj. to 14035.00 MD 6451.21 TVD									

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
194.00	193.99	0.61	-1.19	MWD surveys	
13,976.00	6,449.65	-7,165.12	4,808.02	Survey @ 13976.00 MD 6449.65 TVD	
14,035.00	6,451.21	-7,216.79	4,836.45	Survey Proj. to 14035.00 MD 6451.21 TVD	

Checked By: _____ Approved By: _____ Date: _____

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