



Well: Keith Stern N-04 HM (slot J)
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=748+33 @ 781.00usft (Nabors X08)

Northing 14444942.65 Easting 1726934.75 Latitude 39.77497372 Longitude -80.69207172

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



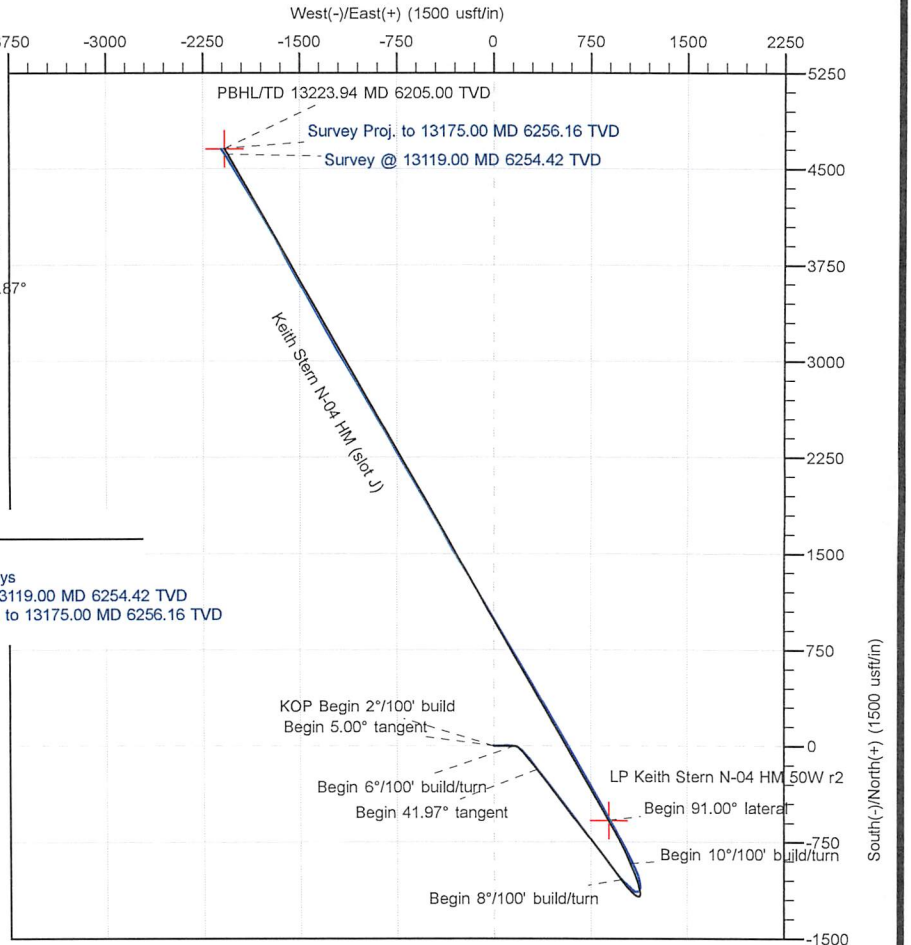
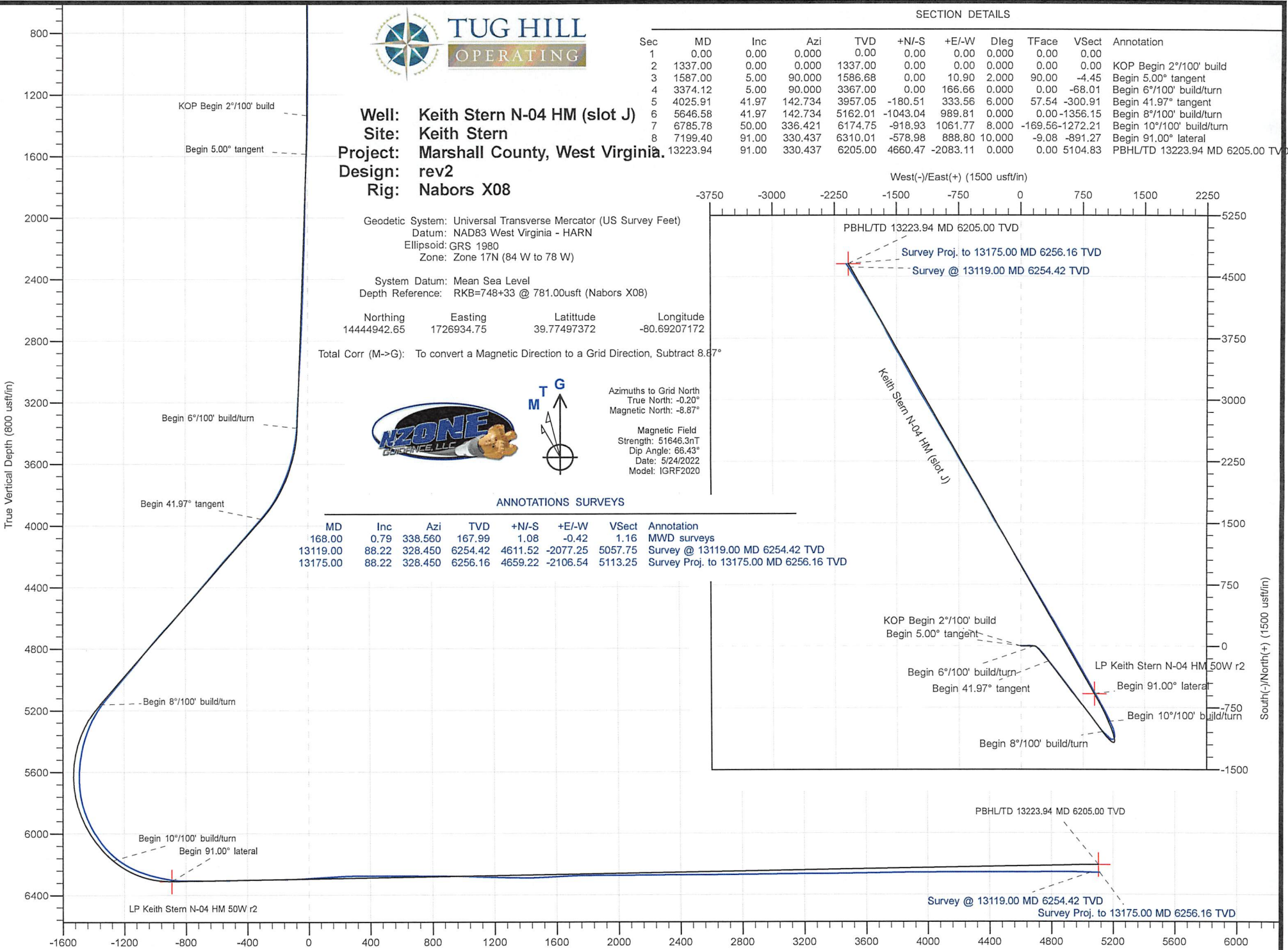
Azimuths to Grid North
 True North: -0.20°
 Magnetic North: -8.87°
 Magnetic Field
 Strength: 51646.3nT
 Dip Angle: 66.43°
 Date: 5/24/2022
 Model: IGRF2020

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	VSect	Annotation
168.00	0.79	338.560	167.99	1.08	-0.42	1.16	MWD surveys
13119.00	88.22	328.450	6254.42	4611.52	-2077.25	5057.75	Survey @ 13119.00 MD 6254.42 TVD
13175.00	88.22	328.450	6256.16	4659.22	-2106.54	5113.25	Survey Proj. to 13175.00 MD 6256.16 TVD

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	1337.00	0.00	0.000	1337.00	0.00	0.00	0.000	0.00	0.00	KOP Begin 2°/100' build
3	1587.00	5.00	90.000	1586.68	0.00	10.90	2.000	90.00	-4.45	Begin 5.00° tangent
4	3374.12	5.00	90.000	3367.00	0.00	166.66	0.000	0.00	-68.01	Begin 6°/100' build/turn
5	4025.91	41.97	142.734	3957.05	-180.51	333.56	6.000	57.54	-300.91	Begin 41.97° tangent
6	5646.58	41.97	142.734	5162.01	-1043.04	989.81	0.000	0.00	-1356.15	Begin 8°/100' build/turn
7	6785.78	50.00	336.421	6174.75	-918.93	1061.77	8.000	-169.56	-1272.21	Begin 10°/100' build/turn
8	7199.40	91.00	330.437	6310.01	-578.98	888.80	10.000	-9.08	-891.27	Begin 91.00° lateral
	13223.94	91.00	330.437	6205.00	4660.47	-2083.11	0.000	0.00	5104.83	PBHL/TD 13223.94 MD 6205.00 TVD



Vertical Section at 335.917° (800 usft/in)



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-04 HM (slot J)
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 N-04 HM (slot J)	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-04 HM (slot J)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,942.65 usft	Latitude:	39.77497372
	+E/-W	0.00 usft	Easting:	1,726,934.75 usft	Longitude:	-80.69207172
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	5/24/2022	-8.67	66.43	51,646.28439255

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	335.917	

Survey Program	Date	6/3/2022			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
168.00	529.00	MWD surf (Original Hole)	MWD	MWD - Standard	
551.00	2,220.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,308.00	13,119.00	MWD (Original Hole)	MWD	MWD - Standard	
13,175.00	13,175.00	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	14,444,942.65	1,726,934.75	39.77497372	-80.69207172	
168.00	0.79	338.560	167.99	1.08	-0.42	14,444,943.73	1,726,934.33	39.77497669	-80.69207321	
MWD surveys										
198.00	0.57	335.350	197.99	1.41	-0.56	14,444,944.06	1,726,934.19	39.77497759	-80.69207370	
228.00	0.61	334.570	227.99	1.69	-0.69	14,444,944.34	1,726,934.06	39.77497836	-80.69207416	
258.00	0.68	338.970	257.99	2.00	-0.82	14,444,944.65	1,726,933.93	39.77497921	-80.69207463	
288.00	0.66	329.040	287.99	2.31	-0.98	14,444,944.96	1,726,933.77	39.77498008	-80.69207517	
318.00	0.50	334.720	317.99	2.58	-1.12	14,444,945.23	1,726,933.63	39.77498081	-80.69207568	
348.00	0.37	334.720	347.98	2.78	-1.22	14,444,945.44	1,726,933.53	39.77498138	-80.69207603	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-04 HM (slot J)
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 N-04 HM (slot J)	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	
379.00	0.40	327.520	378.98	2.96	-1.32	14,444,945.62	1,726,933.43	39.77498188	-80.69207638	
409.00	0.50	331.840	408.98	3.17	-1.44	14,444,945.82	1,726,933.31	39.77498244	-80.69207680	
439.00	0.49	332.690	438.98	3.40	-1.56	14,444,946.05	1,726,933.19	39.77498307	-80.69207723	
469.00	0.89	323.090	468.98	3.70	-1.76	14,444,946.35	1,726,932.99	39.77498390	-80.69207793	
499.00	0.73	326.640	498.98	4.04	-2.00	14,444,946.70	1,726,932.75	39.77498485	-80.69207880	
529.00	0.54	336.270	528.97	4.33	-2.16	14,444,946.99	1,726,932.59	39.77498564	-80.69207937	
551.00	0.40	328.330	550.97	4.49	-2.25	14,444,947.15	1,726,932.50	39.77498608	-80.69207966	
589.00	0.45	62.660	588.97	4.68	-2.18	14,444,947.33	1,726,932.57	39.77498658	-80.69207944	
620.00	0.69	69.560	619.97	4.80	-1.90	14,444,947.45	1,726,932.85	39.77498691	-80.69207843	
650.00	0.91	80.090	649.97	4.90	-1.50	14,444,947.55	1,726,933.25	39.77498719	-80.69207699	
680.00	0.89	89.110	679.97	4.94	-1.03	14,444,947.60	1,726,933.72	39.77498731	-80.69207532	
710.00	0.75	71.260	709.96	5.01	-0.61	14,444,947.66	1,726,934.14	39.77498749	-80.69207383	
742.00	0.50	78.400	741.96	5.11	-0.28	14,444,947.76	1,726,934.48	39.77498775	-80.69207264	
773.00	0.24	79.090	772.96	5.15	-0.08	14,444,947.80	1,726,934.67	39.77498786	-80.69207194	
804.00	0.36	78.770	803.96	5.18	0.08	14,444,947.83	1,726,934.83	39.77498794	-80.69207137	
836.00	0.21	73.560	835.96	5.21	0.24	14,444,947.87	1,726,934.99	39.77498804	-80.69207082	
867.00	0.04	218.390	866.96	5.22	0.28	14,444,947.87	1,726,935.03	39.77498806	-80.69207065	
898.00	0.14	18.410	897.96	5.25	0.29	14,444,947.90	1,726,935.04	39.77498813	-80.69207063	
930.00	0.18	341.430	929.96	5.33	0.28	14,444,947.99	1,726,935.04	39.77498837	-80.69207064	
961.00	0.17	296.820	960.96	5.40	0.23	14,444,948.05	1,726,934.98	39.77498855	-80.69207084	
992.00	0.11	224.720	991.96	5.40	0.17	14,444,948.05	1,726,934.92	39.77498855	-80.69207106	
1,087.00	0.30	257.070	1,086.96	5.28	-0.14	14,444,947.93	1,726,934.61	39.77498822	-80.69207216	
1,181.00	0.18	131.860	1,180.96	5.13	-0.27	14,444,947.78	1,726,934.48	39.77498780	-80.69207262	
1,275.00	0.12	136.070	1,274.96	4.96	-0.09	14,444,947.61	1,726,934.66	39.77498733	-80.69207199	
1,369.00	1.44	104.120	1,368.95	4.60	1.12	14,444,947.25	1,726,935.87	39.77498634	-80.69206767	
1,463.00	3.93	99.920	1,462.84	3.75	5.44	14,444,946.41	1,726,940.19	39.77498398	-80.69205231	
1,557.00	6.10	93.710	1,556.47	2.88	13.60	14,444,945.53	1,726,948.35	39.77498149	-80.69202329	
1,651.00	5.47	88.380	1,649.99	2.68	23.06	14,444,945.33	1,726,957.81	39.77498086	-80.69198961	
1,746.00	4.12	92.990	1,744.66	2.63	31.00	14,444,945.28	1,726,965.75	39.77498065	-80.69196137	
1,841.00	3.65	90.680	1,839.44	2.42	37.43	14,444,945.07	1,726,972.18	39.77498000	-80.69193848	
1,934.00	4.72	88.690	1,932.19	2.47	44.21	14,444,945.12	1,726,978.96	39.77498008	-80.69191433	
2,028.00	6.10	77.790	2,025.77	3.61	52.96	14,444,946.27	1,726,987.71	39.77498314	-80.69188318	
2,122.00	4.96	70.550	2,119.33	6.02	61.68	14,444,948.67	1,726,996.43	39.77498968	-80.69185214	
2,220.00	3.89	94.200	2,217.05	7.19	68.99	14,444,949.84	1,727,003.74	39.77499282	-80.69182610	
2,308.00	4.30	107.390	2,304.83	5.99	75.11	14,444,948.64	1,727,009.86	39.77498945	-80.69180432	
2,402.00	4.69	81.100	2,398.55	5.53	82.27	14,444,948.18	1,727,017.02	39.77498812	-80.69177884	
2,496.00	5.28	88.660	2,492.19	6.22	90.39	14,444,948.87	1,727,025.14	39.77498996	-80.69174993	
2,593.00	4.73	81.330	2,588.82	6.93	98.81	14,444,949.58	1,727,033.56	39.77499182	-80.69171997	
2,688.00	5.75	99.740	2,683.43	6.71	107.37	14,444,949.37	1,727,042.12	39.77499115	-80.69168949	
2,782.00	5.73	89.390	2,776.96	5.97	116.71	14,444,948.62	1,727,051.46	39.77498901	-80.69165628	
2,876.00	5.59	99.430	2,870.51	5.27	125.91	14,444,947.92	1,727,060.67	39.77498700	-80.69162352	
2,971.00	5.22	91.590	2,965.08	4.39	134.80	14,444,947.04	1,727,069.55	39.77498450	-80.69159191	
3,065.00	5.07	108.600	3,058.71	2.95	143.01	14,444,945.60	1,727,077.76	39.77498046	-80.69156270	
3,160.00	5.04	105.290	3,153.34	0.51	151.01	14,444,943.16	1,727,085.77	39.77497369	-80.69153424	
3,254.00	4.69	95.790	3,247.00	-0.97	158.82	14,444,941.68	1,727,093.57	39.77496956	-80.69150648	
3,349.00	4.15	89.660	3,341.72	-1.34	166.12	14,444,941.31	1,727,100.87	39.77496847	-80.69148050	
3,443.00	9.93	119.930	3,435.00	-5.37	176.56	14,444,937.28	1,727,111.31	39.77495731	-80.69144340	
3,537.00	15.26	121.190	3,526.71	-15.83	194.18	14,444,926.83	1,727,128.93	39.77492842	-80.69138082	
3,632.00	19.16	131.610	3,617.46	-32.66	216.54	14,444,909.99	1,727,151.29	39.77488197	-80.69130143	
3,726.00	24.27	137.880	3,704.77	-57.26	241.05	14,444,885.40	1,727,175.80	39.77481420	-80.69121450	
3,820.00	28.58	140.680	3,788.93	-89.00	268.27	14,444,853.66	1,727,203.02	39.77472678	-80.69111802	
3,913.00	34.75	142.870	3,868.05	-127.38	298.40	14,444,815.28	1,727,233.15	39.77462109	-80.69101127	
4,007.00	42.00	143.640	3,941.69	-174.12	333.26	14,444,768.53	1,727,268.01	39.77449238	-80.69088777	
4,101.00	41.04	141.300	4,012.08	-223.54	371.20	14,444,719.11	1,727,305.95	39.77435632	-80.69075334	
4,196.00	41.44	142.680	4,083.51	-272.88	409.76	14,444,669.77	1,727,344.51	39.77422044	-80.69061671	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-04 HM (slot J)
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Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-04 HM (slot J)	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	
4,294.00	42.29	142.470	4,156.50	-324.82	449.51	14,444,617.83	1,727,384.26	39.77407743	-80.69047588	
4,387.00	42.82	141.170	4,225.00	-374.25	488.39	14,444,568.40	1,727,423.14	39.77394133	-80.69033812	
4,481.00	41.02	142.540	4,294.95	-423.63	527.18	14,444,519.02	1,727,461.93	39.77380533	-80.69020065	
4,575.00	41.16	144.000	4,365.79	-473.14	564.13	14,444,469.51	1,727,498.88	39.77366900	-80.69006978	
4,670.00	40.87	143.790	4,437.47	-523.51	600.86	14,444,419.14	1,727,535.62	39.77353032	-80.68993965	
4,764.00	41.97	143.460	4,507.96	-573.58	637.75	14,444,369.07	1,727,572.50	39.77339247	-80.68980900	
4,858.00	42.60	142.820	4,577.50	-624.18	675.69	14,444,318.47	1,727,610.44	39.77325314	-80.68967460	
4,953.00	42.75	142.520	4,647.35	-675.39	714.74	14,444,267.27	1,727,649.49	39.77311216	-80.68953626	
5,047.00	41.61	145.090	4,717.01	-726.30	752.01	14,444,216.35	1,727,686.77	39.77297197	-80.68940421	
5,142.00	41.57	144.150	4,788.06	-777.72	788.53	14,444,164.93	1,727,723.28	39.77283042	-80.68927491	
5,236.00	39.10	141.830	4,859.72	-826.31	825.12	14,444,116.34	1,727,759.87	39.77269663	-80.68914528	
5,331.00	40.23	142.610	4,932.85	-874.24	862.26	14,444,068.41	1,727,797.01	39.77256465	-80.68901368	
5,392.00	41.02	142.590	4,979.14	-905.79	886.38	14,444,036.86	1,727,821.13	39.77247777	-80.68892822	
5,443.00	42.90	143.010	5,017.07	-932.95	907.00	14,444,009.70	1,727,841.75	39.77240298	-80.68885519	
5,537.00	41.14	141.070	5,086.90	-982.57	945.68	14,443,960.09	1,727,880.43	39.77226636	-80.68871813	
5,568.00	40.53	140.900	5,110.35	-998.32	958.44	14,443,944.34	1,727,893.19	39.77222298	-80.68867291	
5,631.00	38.95	140.720	5,158.80	-1,029.53	983.89	14,443,913.12	1,727,918.64	39.77213701	-80.68858273	
5,678.00	34.24	138.080	5,196.52	-1,050.82	1,002.09	14,443,891.83	1,727,936.84	39.77207838	-80.68851822	
5,725.00	30.33	135.270	5,236.25	-1,069.10	1,019.28	14,443,873.56	1,727,954.03	39.77202802	-80.68845726	
5,772.00	27.08	131.140	5,277.47	-1,084.57	1,035.70	14,443,858.08	1,727,970.45	39.77198537	-80.68839903	
5,820.00	23.52	130.090	5,320.86	-1,097.93	1,051.26	14,443,844.72	1,727,986.01	39.77194853	-80.68834382	
5,867.00	20.40	131.140	5,364.45	-1,109.36	1,064.60	14,443,833.29	1,727,999.35	39.77191701	-80.68829646	
5,914.00	17.49	130.260	5,408.90	-1,119.32	1,076.16	14,443,823.33	1,728,010.92	39.77188955	-80.68825544	
5,961.00	14.15	124.200	5,454.11	-1,127.12	1,086.31	14,443,815.54	1,728,021.06	39.77186805	-80.68821943	
6,008.00	11.96	113.830	5,499.90	-1,132.31	1,095.52	14,443,810.34	1,728,030.27	39.77185368	-80.68818673	
6,055.00	10.37	101.340	5,546.02	-1,135.11	1,104.12	14,443,807.54	1,728,038.87	39.77184591	-80.68815614	
6,103.00	8.84	82.710	5,593.36	-1,135.49	1,112.02	14,443,807.16	1,728,046.77	39.77184479	-80.68812804	
6,150.00	8.35	65.310	5,639.84	-1,133.61	1,118.70	14,443,809.04	1,728,053.45	39.77184990	-80.68810423	
6,196.00	9.85	46.590	5,685.26	-1,129.51	1,124.60	14,443,813.14	1,728,059.35	39.77186110	-80.68808320	
6,243.00	12.09	30.240	5,731.41	-1,122.49	1,130.00	14,443,820.16	1,728,064.75	39.77188032	-80.68806389	
6,290.00	14.64	16.270	5,777.15	-1,112.53	1,134.14	14,443,830.12	1,728,068.89	39.77190763	-80.68804902	
6,337.00	17.89	6.070	5,822.27	-1,099.65	1,136.57	14,443,843.00	1,728,071.32	39.77194300	-80.68804021	
6,385.00	20.70	357.460	5,867.58	-1,083.84	1,136.98	14,443,858.82	1,728,071.73	39.77198642	-80.68803858	
6,432.00	24.00	351.570	5,911.05	-1,066.08	1,135.21	14,443,876.58	1,728,069.96	39.77203521	-80.68804466	
6,479.00	27.60	346.030	5,953.36	-1,046.05	1,131.17	14,443,896.61	1,728,065.93	39.77209026	-80.68805876	
6,526.00	31.43	342.430	5,994.26	-1,023.79	1,124.84	14,443,918.87	1,728,059.59	39.77215144	-80.68808101	
6,574.00	34.86	338.560	6,034.45	-999.08	1,116.05	14,443,943.58	1,728,050.80	39.77221939	-80.68811201	
6,621.00	38.99	336.100	6,072.01	-973.04	1,105.14	14,443,969.61	1,728,039.89	39.77229099	-80.68815050	
6,669.00	43.25	335.310	6,108.17	-944.28	1,092.15	14,443,998.37	1,728,026.90	39.77237009	-80.68819638	
6,716.00	48.00	334.520	6,141.03	-913.87	1,077.90	14,444,028.78	1,728,012.65	39.77245375	-80.68824671	
6,762.00	52.88	334.260	6,170.31	-881.90	1,062.58	14,444,060.75	1,727,997.33	39.77254169	-80.68830086	
6,809.00	58.29	334.080	6,196.87	-847.02	1,045.69	14,444,095.64	1,727,980.44	39.77263766	-80.68836054	
6,857.00	62.90	332.230	6,220.43	-809.73	1,026.80	14,444,132.93	1,727,961.55	39.77274025	-80.68842731	
6,904.00	67.56	332.230	6,240.12	-771.98	1,006.92	14,444,170.68	1,727,941.67	39.77284411	-80.68849759	
6,952.00	70.86	331.790	6,257.15	-732.36	985.86	14,444,210.30	1,727,920.61	39.77295312	-80.68857204	
6,999.00	74.46	331.180	6,271.16	-692.94	964.44	14,444,249.71	1,727,899.19	39.77306156	-80.68864778	
7,047.00	76.57	331.090	6,283.16	-652.25	942.01	14,444,290.41	1,727,876.76	39.77317354	-80.68872711	
7,094.00	79.78	331.270	6,292.79	-611.95	919.84	14,444,330.71	1,727,854.59	39.77328443	-80.68880553	
7,141.00	83.30	331.440	6,299.71	-571.15	897.55	14,444,371.50	1,727,832.30	39.77339667	-80.68888433	
7,188.00	87.38	331.350	6,303.52	-530.04	875.13	14,444,412.62	1,727,809.88	39.77350980	-80.68896362	
7,236.00	89.63	331.270	6,304.78	-487.95	852.10	14,444,454.71	1,727,786.85	39.77362561	-80.68904508	
7,330.00	89.23	330.480	6,305.71	-405.84	806.35	14,444,536.82	1,727,741.10	39.77385154	-80.68920688	
7,423.00	91.34	331.180	6,305.25	-324.64	761.02	14,444,618.02	1,727,695.77	39.77407497	-80.68936719	
7,517.00	91.03	330.560	6,303.31	-242.54	715.27	14,444,700.11	1,727,650.03	39.77430085	-80.68952900	
7,612.00	91.16	330.830	6,301.49	-159.72	668.78	14,444,782.94	1,727,603.54	39.77452876	-80.68969344	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-04 HM (slot J)
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 N-04 HM (slot J)	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	
7,707.00	91.03	331.180	6,299.67	-76.64	622.74	14,444,866.01	1,727,557.49	39.77475735	-80.68985628	
7,801.00	90.99	329.600	6,298.02	5.07	576.31	14,444,947.72	1,727,511.06	39.77498219	-80.69002054	
7,896.00	90.99	329.160	6,296.38	86.81	527.93	14,445,029.46	1,727,462.68	39.77520713	-80.69019172	
7,990.00	94.07	331.350	6,292.23	168.33	481.34	14,445,110.98	1,727,416.09	39.77543144	-80.69035652	
8,085.00	93.45	329.860	6,286.00	250.92	434.81	14,445,193.57	1,727,369.57	39.77565870	-80.69052110	
8,179.00	93.58	329.510	6,280.23	331.91	387.46	14,445,274.57	1,727,322.21	39.77588158	-80.69068865	
8,273.00	91.87	328.890	6,275.76	412.56	339.38	14,445,355.21	1,727,274.13	39.77610351	-80.69085877	
8,367.00	90.24	329.680	6,274.03	493.36	291.38	14,445,436.01	1,727,226.13	39.77632585	-80.69102862	
8,461.00	90.11	330.120	6,273.75	574.68	244.24	14,445,517.33	1,727,178.99	39.77654964	-80.69119541	
8,555.00	89.85	329.950	6,273.78	656.12	197.29	14,445,598.77	1,727,132.04	39.77677372	-80.69136151	
8,649.00	89.49	329.860	6,274.32	737.44	150.15	14,445,680.10	1,727,084.90	39.77699751	-80.69152827	
8,742.00	90.07	329.860	6,274.68	817.87	103.46	14,445,760.52	1,727,038.21	39.77721882	-80.69169349	
8,837.00	89.93	329.680	6,274.68	899.95	55.63	14,445,842.60	1,726,990.38	39.77744469	-80.69186272	
8,931.00	89.10	329.510	6,275.47	981.02	8.06	14,445,923.67	1,726,942.81	39.77766778	-80.69203104	
9,025.00	88.79	329.770	6,277.20	1,062.11	-39.45	14,446,004.77	1,726,895.30	39.77789093	-80.69219912	
9,120.00	88.31	329.600	6,279.61	1,144.10	-87.38	14,446,086.75	1,726,847.37	39.77811653	-80.69236874	
9,215.00	88.09	329.160	6,282.59	1,225.81	-135.75	14,446,168.46	1,726,799.00	39.77834140	-80.69253987	
9,309.00	89.05	329.770	6,284.94	1,306.75	-183.49	14,446,249.40	1,726,751.26	39.77856412	-80.69270881	
9,403.00	88.75	329.680	6,286.74	1,387.91	-230.87	14,446,330.56	1,726,703.88	39.77878747	-80.69287646	
9,497.00	91.87	330.040	6,286.23	1,469.19	-278.06	14,446,411.84	1,726,656.69	39.77901113	-80.69304344	
9,590.00	93.32	331.530	6,282.02	1,550.27	-323.41	14,446,492.93	1,726,611.34	39.77923423	-80.69320384	
9,684.00	92.22	331.180	6,277.48	1,632.67	-368.41	14,446,575.32	1,726,566.34	39.77946093	-80.69336304	
9,778.00	91.87	330.210	6,274.13	1,714.59	-414.39	14,446,657.24	1,726,520.36	39.77968633	-80.69352570	
9,871.00	91.03	329.860	6,271.77	1,795.13	-460.83	14,446,737.78	1,726,473.92	39.77990796	-80.69368999	
9,965.00	90.37	329.680	6,270.62	1,876.34	-508.15	14,446,818.99	1,726,426.60	39.78013143	-80.69385744	
10,059.00	89.85	330.040	6,270.44	1,957.63	-555.35	14,446,900.28	1,726,379.40	39.78035511	-80.69402445	
10,153.00	90.37	330.560	6,270.26	2,039.28	-601.92	14,446,981.93	1,726,332.83	39.78057978	-80.69418922	
10,247.00	90.59	330.740	6,269.48	2,121.21	-648.00	14,447,063.87	1,726,286.76	39.78080522	-80.69435221	
10,342.00	90.46	328.370	6,268.61	2,203.11	-696.13	14,447,145.76	1,726,238.62	39.78103057	-80.69452254	
10,436.00	90.29	330.740	6,267.99	2,284.14	-743.75	14,447,226.79	1,726,191.00	39.78125355	-80.69469108	
10,530.00	90.02	331.090	6,267.74	2,366.28	-789.45	14,447,308.94	1,726,145.30	39.78147957	-80.69485272	
10,624.00	89.27	329.680	6,268.32	2,448.00	-835.90	14,447,390.65	1,726,098.85	39.78170442	-80.69501707	
10,718.00	90.51	330.390	6,268.50	2,529.43	-882.85	14,447,472.08	1,726,051.91	39.78192849	-80.69518319	
10,812.00	90.77	330.920	6,267.45	2,611.36	-928.91	14,447,554.02	1,726,005.84	39.78215393	-80.69534616	
10,906.00	90.64	330.390	6,266.29	2,693.30	-974.97	14,447,635.95	1,725,959.78	39.78237937	-80.69550912	
11,000.00	90.77	329.860	6,265.14	2,774.80	-1,021.79	14,447,717.45	1,725,912.96	39.78260363	-80.69567478	
11,095.00	90.95	329.600	6,263.71	2,856.84	-1,069.67	14,447,799.49	1,725,865.08	39.78282938	-80.69584423	
11,189.00	90.68	328.630	6,262.37	2,937.50	-1,117.92	14,447,880.15	1,725,816.83	39.78305134	-80.69601498	
11,284.00	90.07	328.630	6,261.75	3,018.61	-1,167.37	14,447,961.26	1,725,767.38	39.78327456	-80.69619003	
11,377.00	89.98	330.740	6,261.71	3,098.89	-1,214.31	14,448,041.54	1,725,720.44	39.78349546	-80.69635614	
11,471.00	90.90	331.090	6,260.99	3,181.03	-1,260.00	14,448,123.68	1,725,674.75	39.78372147	-80.69651779	
11,565.00	90.24	331.090	6,260.05	3,263.31	-1,305.44	14,448,205.97	1,725,629.31	39.78394786	-80.69667854	
11,659.00	90.86	331.180	6,259.15	3,345.63	-1,350.82	14,448,288.28	1,725,583.93	39.78417435	-80.69683907	
11,753.00	91.56	331.970	6,257.17	3,428.28	-1,395.55	14,448,370.93	1,725,539.20	39.78440173	-80.69699731	
11,847.00	90.86	329.770	6,255.18	3,510.36	-1,441.30	14,448,453.02	1,725,493.45	39.78462759	-80.69715915	
11,942.00	90.55	330.480	6,254.01	3,592.73	-1,488.61	14,448,535.39	1,725,446.14	39.78485424	-80.69732659	
12,037.00	90.24	330.390	6,253.36	3,675.36	-1,535.49	14,448,618.01	1,725,399.26	39.78508159	-80.69749244	
12,132.00	89.85	331.620	6,253.28	3,758.45	-1,581.54	14,448,701.11	1,725,353.22	39.78531021	-80.69765536	
12,226.00	89.71	331.270	6,253.64	3,841.02	-1,626.47	14,448,783.67	1,725,308.28	39.78553737	-80.69781431	
12,319.00	90.68	333.380	6,253.33	3,923.37	-1,669.66	14,448,866.03	1,725,265.09	39.78576394	-80.69796706	
12,414.00	90.46	330.650	6,252.38	4,007.25	-1,714.23	14,448,949.90	1,725,220.52	39.78599470	-80.69812471	
12,508.00	89.85	329.070	6,252.13	4,088.54	-1,761.43	14,449,031.19	1,725,173.32	39.78621838	-80.69829174	
12,602.00	90.24	328.890	6,252.05	4,169.10	-1,809.87	14,449,111.75	1,725,124.88	39.78644005	-80.69846321	
12,696.00	90.07	329.160	6,251.80	4,249.69	-1,858.25	14,449,192.34	1,725,076.50	39.78666184	-80.69863445	
12,790.00	90.59	329.250	6,251.26	4,330.44	-1,906.37	14,449,273.09	1,725,028.38	39.78688403	-80.69880479	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-04 HM (slot J)
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 N-04 HM (slot J)	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
12,884.00	90.07	328.010	6,250.72	4,410.69	-1,955.30	14,449,353.34	1,724,979.45	39.78710488	-80.69897801
12,978.00	89.36	329.510	6,251.18	4,491.06	-2,004.05	14,449,433.71	1,724,930.70	39.78732604	-80.69915058
13,071.00	88.40	328.280	6,253.00	4,570.67	-2,052.08	14,449,513.32	1,724,882.67	39.78754511	-80.69932062
13,119.00	88.22	328.450	6,254.42	4,611.52	-2,077.25	14,449,554.17	1,724,857.50	39.78765753	-80.69940971
Survey @ 13119.00 MD 6254.42 TVD									
13,175.00	88.22	328.450	6,256.16	4,659.22	-2,106.54	14,449,601.87	1,724,828.21	39.78778879	-80.69951339
Survey Proj. to 13175.00 MD 6256.16 TVD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
168.00	167.99	1.08	-0.42	MWD surveys
13,119.00	6,254.42	4,611.52	-2,077.25	Survey @ 13119.00 MD 6254.42 TVD
13,175.00	6,256.16	4,659.22	-2,106.54	Survey Proj. to 13175.00 MD 6256.16 TVD

Checked By: _____ Approved By: _____ Date: _____

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