



Well: Keith Stern N-03 HM (slot I)
Site: Keith Stern
Project: Marshall County, West Virginia.
Design: rev3
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	Easting	Latitude	Longitude
14444931.88	1726929.47	39.77494419	-80.69209065

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: 51650.0nT
 Dip Angle: 66.44°
 Date: 5/10/2022
 Model: IGRF2020

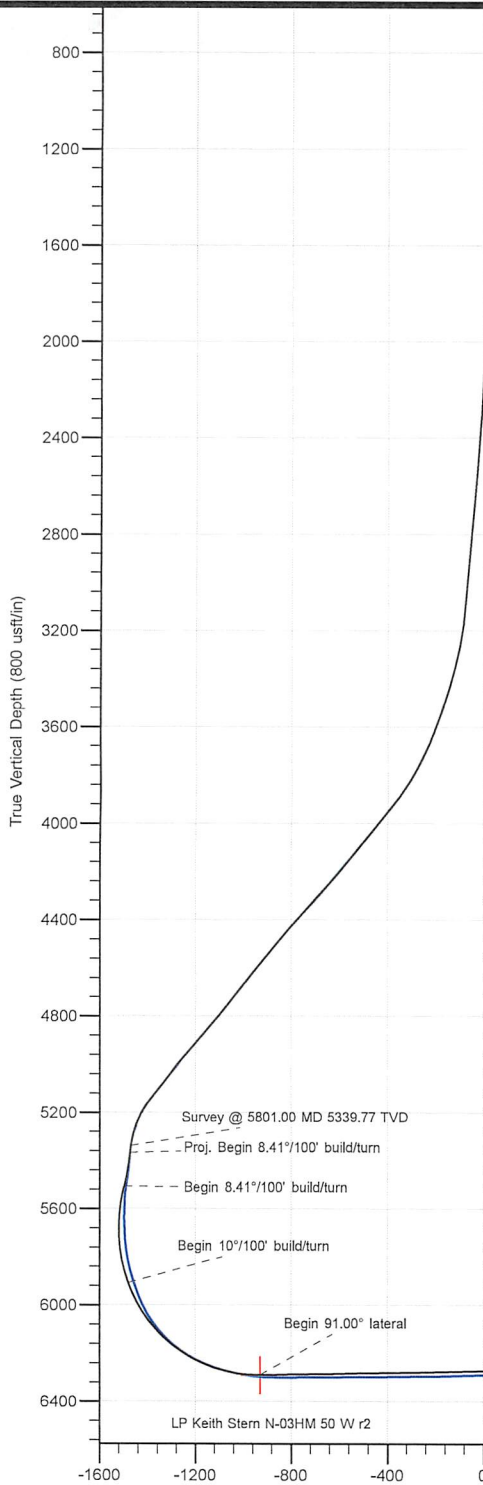
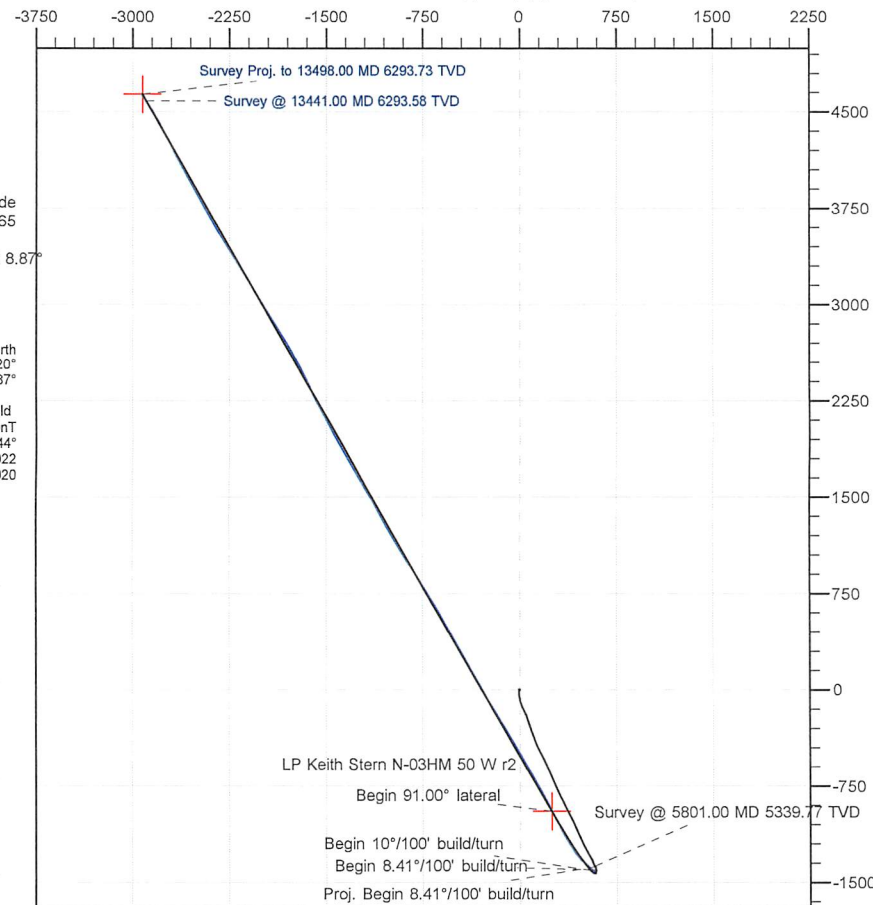
SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Annotation
1	5801.00	8.08	147.310	5339.77	-1372.70	577.52	0.00	0.00	-1469.18	Survey @ 5801.00 MD 5339.77 TVD
2	5830.00	4.90	143.270	5368.58	-1375.41	579.36	11.07	-173.83	-1472.45	Proj. Begin 8.41°/100' build/turn
3	5971.27	16.04	170.229	5507.35	-1399.57	586.31	8.41	37.49	-1496.59	Begin 8.41°/100' build/turn
4	6380.73	20.00	316.142	5908.63	-1405.00	546.18	8.41	160.18	-1479.78	Begin 10°/100' build/turn
5	7097.11	91.00	330.416	6290.00	-943.46	244.06	10.00	15.06	-928.24	Begin 91.00° lateral
6	13517.71	91.00	330.416	6178.00	4639.27	-2925.26	0.00	0.00	5484.53	PBHL/TD 13517.76 MD 6178.00 TVD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
161.00	0.42	302.670	161.00	0.32	-0.50	0.53	MWD surveys
13441.00	89.85	329.250	6293.58	4585.72	-2897.09	5424.20	Survey @ 13441.00 MD 6293.58 TVD
13498.00	89.85	329.250	6293.73	4634.70	-2926.23	5481.18	Survey Proj. to 13498.00 MD 6293.73 TVD

West(-)/East(+) (1500 usft/in)



Vertical Section at 327.767° (800 usft/in)

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-03 HM (slot I)
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-03 HM (slot I)	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-03 HM (slot I)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,931.88 usft	Latitude:	39.77494419
	+E/-W	0.00 usft	Easting:	1,726,929.47 usft	Longitude:	-80.69209065
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	5/10/2022	-8.67	66.44	51,649.96017880

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	327.770	

Survey Program	Date	5/23/2022			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
161.00	559.00	MWD surf (Original Hole)	MWD	MWD - Standard	
589.00	2,217.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,309.00	13,441.00	MWD (Original Hole)	MWD	MWD - Standard	
13,498.00	13,498.00	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	14,444,931.88	1,726,929.47	39.77494419	-80.69209065	
161.00	0.42	302.670	161.00	0.32	-0.50	14,444,932.20	1,726,928.97	39.77494507	-80.69209241	
MWD surveys										
191.00	0.44	316.100	191.00	0.46	-0.67	14,444,932.34	1,726,928.80	39.77494546	-80.69209303	
222.00	0.48	307.680	222.00	0.63	-0.85	14,444,932.51	1,726,928.62	39.77494592	-80.69209368	
252.00	0.44	311.010	252.00	0.78	-1.04	14,444,932.66	1,726,928.43	39.77494634	-80.69209435	
282.00	0.39	318.290	281.99	0.93	-1.20	14,444,932.81	1,726,928.27	39.77494676	-80.69209489	
312.00	0.32	309.020	311.99	1.06	-1.33	14,444,932.94	1,726,928.14	39.77494711	-80.69209537	
342.00	0.26	327.600	341.99	1.17	-1.43	14,444,933.05	1,726,928.04	39.77494742	-80.69209573	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-03 HM (slot I)
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Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-03 HM (slot I)	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	
372.00	0.31	314.390	371.99	1.28	-1.52	14,444,933.17	1,726,927.94	39.77494773	-80.69209606	
403.00	0.36	307.070	402.99	1.40	-1.66	14,444,933.28	1,726,927.81	39.77494806	-80.69209655	
433.00	0.22	319.430	432.99	1.50	-1.78	14,444,933.38	1,726,927.69	39.77494833	-80.69209695	
463.00	0.83	351.130	462.99	1.76	-1.85	14,444,933.64	1,726,927.62	39.77494904	-80.69209720	
493.00	0.58	315.840	492.99	2.08	-1.99	14,444,933.97	1,726,927.48	39.77494993	-80.69209769	
523.00	0.38	304.060	522.99	2.25	-2.17	14,444,934.13	1,726,927.30	39.77495039	-80.69209836	
546.00	0.19	325.670	545.99	2.32	-2.26	14,444,934.20	1,726,927.21	39.77495059	-80.69209866	
559.00	0.09	14.110	558.99	2.35	-2.27	14,444,934.23	1,726,927.20	39.77495067	-80.69209869	
589.00	0.23	181.380	588.99	2.31	-2.26	14,444,934.19	1,726,927.21	39.77495056	-80.69209868	
620.00	0.15	99.060	619.99	2.24	-2.22	14,444,934.13	1,726,927.24	39.77495038	-80.69209854	
650.00	0.66	1.730	649.99	2.41	-2.18	14,444,934.29	1,726,927.29	39.77495083	-80.69209838	
680.00	0.80	7.240	679.98	2.79	-2.15	14,444,934.67	1,726,927.32	39.77495188	-80.69209827	
710.00	0.97	356.620	709.98	3.25	-2.14	14,444,935.13	1,726,927.33	39.77495314	-80.69209822	
742.00	0.97	337.080	741.98	3.77	-2.26	14,444,935.65	1,726,927.21	39.77495457	-80.69209865	
773.00	1.01	321.980	772.97	4.23	-2.53	14,444,936.11	1,726,926.94	39.77495583	-80.69209960	
804.00	1.12	307.830	803.97	4.63	-2.94	14,444,936.51	1,726,926.53	39.77495694	-80.69210105	
836.00	1.06	294.650	835.96	4.95	-3.45	14,444,936.83	1,726,926.02	39.77495781	-80.69210288	
867.00	0.64	265.510	866.96	5.05	-3.89	14,444,936.93	1,726,925.58	39.77495810	-80.69210442	
898.00	0.71	220.190	897.96	4.89	-4.18	14,444,936.77	1,726,925.29	39.77495766	-80.69210548	
930.00	0.70	169.020	929.95	4.55	-4.27	14,444,936.43	1,726,925.20	39.77495672	-80.69210581	
961.00	0.81	137.110	960.95	4.20	-4.09	14,444,936.08	1,726,925.38	39.77495577	-80.69210515	
992.00	0.91	121.090	991.95	3.91	-3.73	14,444,935.80	1,726,925.74	39.77495498	-80.69210387	
1,024.00	1.26	119.210	1,023.94	3.61	-3.20	14,444,935.49	1,726,926.27	39.77495414	-80.69210201	
1,055.00	1.11	126.100	1,054.94	3.27	-2.66	14,444,935.15	1,726,926.81	39.77495319	-80.69210009	
1,087.00	0.90	153.740	1,086.93	2.86	-2.30	14,444,934.74	1,726,927.17	39.77495207	-80.69209881	
1,118.00	0.68	171.170	1,117.93	2.46	-2.17	14,444,934.34	1,726,927.30	39.77495097	-80.69209833	
1,149.00	0.84	162.540	1,148.92	2.06	-2.07	14,444,933.94	1,726,927.40	39.77494987	-80.69209799	
1,181.00	0.95	154.600	1,180.92	1.60	-1.89	14,444,933.48	1,726,927.58	39.77494860	-80.69209734	
1,212.00	1.07	172.160	1,211.92	1.08	-1.74	14,444,932.96	1,726,927.73	39.77494717	-80.69209682	
1,243.00	0.73	190.320	1,242.91	0.60	-1.73	14,444,932.48	1,726,927.74	39.77494585	-80.69209681	
1,275.00	0.59	222.540	1,274.91	0.28	-1.88	14,444,932.16	1,726,927.59	39.77494497	-80.69209734	
1,307.00	1.03	274.880	1,306.91	0.18	-2.28	14,444,932.06	1,726,927.19	39.77494470	-80.69209876	
1,337.00	1.32	289.850	1,336.90	0.32	-2.87	14,444,932.20	1,726,926.60	39.77494510	-80.69210087	
1,369.00	1.78	291.050	1,368.89	0.62	-3.68	14,444,932.50	1,726,925.79	39.77494594	-80.69210375	
1,400.00	1.74	292.630	1,399.87	0.98	-4.57	14,444,932.86	1,726,924.90	39.77494692	-80.69210689	
1,432.00	1.32	292.530	1,431.86	1.31	-5.35	14,444,933.19	1,726,924.11	39.77494783	-80.69210969	
1,463.00	1.14	294.240	1,462.86	1.57	-5.97	14,444,933.45	1,726,923.50	39.77494856	-80.69211186	
1,510.00	0.81	294.080	1,509.85	1.90	-6.70	14,444,933.78	1,726,922.77	39.77494946	-80.69211446	
1,557.00	0.58	125.040	1,556.85	1.89	-6.80	14,444,933.78	1,726,922.67	39.77494946	-80.69211484	
1,604.00	0.99	120.980	1,603.84	1.55	-6.26	14,444,933.43	1,726,923.21	39.77494851	-80.69211291	
1,652.00	0.58	103.770	1,651.84	1.28	-5.67	14,444,933.16	1,726,923.80	39.77494776	-80.69211081	
1,683.00	0.33	14.760	1,682.84	1.33	-5.49	14,444,933.21	1,726,923.98	39.77494789	-80.69211019	
1,714.00	0.83	340.440	1,713.84	1.62	-5.55	14,444,933.51	1,726,923.92	39.77494871	-80.69211037	
1,746.00	1.47	324.200	1,745.83	2.18	-5.86	14,444,934.06	1,726,923.60	39.77495022	-80.69211150	
1,793.00	1.91	314.630	1,792.81	3.22	-6.77	14,444,935.10	1,726,922.69	39.77495309	-80.69211472	
1,841.00	1.32	300.780	1,840.79	4.06	-7.82	14,444,935.94	1,726,921.65	39.77495542	-80.69211843	
1,934.00	1.18	177.410	1,933.78	3.65	-8.70	14,444,935.53	1,726,920.77	39.77495430	-80.69212156	
2,028.00	2.71	146.180	2,027.72	0.84	-7.42	14,444,932.72	1,726,922.05	39.77494656	-80.69211703	
2,122.00	2.36	156.220	2,121.63	-2.78	-5.40	14,444,929.10	1,726,924.07	39.77493661	-80.69210990	
2,217.00	3.16	186.520	2,216.53	-7.17	-4.91	14,444,924.71	1,726,924.56	39.77492455	-80.69210820	
2,309.00	4.40	187.420	2,308.33	-13.19	-5.65	14,444,918.69	1,726,923.82	39.77490802	-80.69211092	
2,403.00	5.53	182.560	2,401.97	-21.29	-6.32	14,444,910.59	1,726,923.15	39.77488578	-80.69211340	
2,497.00	5.67	179.980	2,495.52	-30.46	-6.52	14,444,901.42	1,726,922.95	39.77486061	-80.69211422	
2,591.00	5.00	171.970	2,589.12	-39.16	-5.95	14,444,892.72	1,726,923.52	39.77483671	-80.69211229	
2,685.00	5.85	167.440	2,682.70	-47.89	-4.33	14,444,883.99	1,726,925.14	39.77481271	-80.69210665	

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Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-03 HM (slot I)	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	
2,780.00	6.06	160.730	2,777.18	-57.35	-1.62	14,444,874.53	1,726,927.85	39.77478671	-80.69209713	
2,874.00	5.43	178.070	2,870.72	-66.48	0.16	14,444,865.40	1,726,929.63	39.77476162	-80.69209088	
2,969.00	4.91	173.410	2,965.33	-75.01	0.78	14,444,856.87	1,726,930.25	39.77473819	-80.69208879	
3,066.00	5.96	167.950	3,061.89	-84.06	2.31	14,444,847.82	1,726,931.78	39.77471332	-80.69208346	
3,161.00	5.93	161.480	3,156.38	-93.54	4.90	14,444,838.35	1,726,934.37	39.77468727	-80.69207436	
3,255.00	10.58	161.360	3,249.39	-106.32	9.20	14,444,825.56	1,726,938.67	39.77465211	-80.69205920	
3,349.00	14.19	156.270	3,341.19	-125.06	16.60	14,444,806.83	1,726,946.07	39.77460060	-80.69203311	
3,444.00	16.88	153.970	3,432.71	-148.11	27.34	14,444,783.77	1,726,956.81	39.77453718	-80.69199516	
3,538.00	19.04	154.440	3,522.12	-174.21	39.95	14,444,757.67	1,726,969.41	39.77446538	-80.69195062	
3,633.00	21.39	158.910	3,611.27	-204.36	52.87	14,444,727.52	1,726,982.34	39.77438247	-80.69190499	
3,727.00	25.62	162.070	3,697.45	-239.71	65.30	14,444,692.17	1,726,994.77	39.77428528	-80.69186119	
3,820.00	29.62	161.400	3,779.84	-280.64	78.82	14,444,651.25	1,727,008.29	39.77417275	-80.69181355	
3,914.00	34.97	161.870	3,859.27	-328.29	94.63	14,444,603.59	1,727,024.10	39.77404174	-80.69175789	
4,008.00	39.79	160.980	3,933.94	-382.36	112.82	14,444,549.52	1,727,042.29	39.77389307	-80.69169379	
4,102.00	38.61	154.380	4,006.82	-437.26	135.32	14,444,494.62	1,727,064.79	39.77374207	-80.69161440	
4,196.00	38.56	152.740	4,080.30	-489.75	161.42	14,444,442.13	1,727,090.89	39.77359767	-80.69152215	
4,291.00	39.04	154.960	4,154.34	-543.18	187.65	14,444,388.70	1,727,117.11	39.77345069	-80.69142947	
4,385.00	41.17	156.890	4,226.23	-598.47	212.32	14,444,333.41	1,727,141.79	39.77329863	-80.69134232	
4,478.00	42.61	155.890	4,295.47	-655.36	237.20	14,444,276.52	1,727,166.67	39.77314215	-80.69125449	
4,573.00	41.88	156.570	4,365.79	-713.81	262.94	14,444,218.07	1,727,192.41	39.77298139	-80.69116358	
4,668.00	41.76	155.090	4,436.59	-771.60	288.88	14,444,160.28	1,727,218.35	39.77282244	-80.69107199	
4,762.00	40.19	155.390	4,507.56	-827.57	314.69	14,444,104.31	1,727,244.16	39.77266849	-80.69098079	
4,856.00	39.35	153.210	4,579.81	-881.75	340.76	14,444,050.13	1,727,270.23	39.77251945	-80.69088870	
4,950.00	37.88	150.330	4,653.26	-933.43	368.48	14,443,998.45	1,727,297.95	39.77237725	-80.69079068	
5,045.00	38.37	155.470	4,728.02	-985.61	395.16	14,443,946.27	1,727,324.63	39.77223370	-80.69069635	
5,139.00	40.49	158.730	4,800.63	-1,040.61	418.35	14,443,891.28	1,727,347.82	39.77208246	-80.69061450	
5,234.00	40.98	156.030	4,872.62	-1,097.82	442.20	14,443,834.07	1,727,371.67	39.77192512	-80.69053034	
5,329.00	41.08	155.410	4,944.28	-1,154.66	467.84	14,443,777.22	1,727,397.31	39.77176876	-80.69043977	
5,425.00	37.52	151.790	5,017.18	-1,212.15	503.22	14,443,705.73	1,727,432.69	39.77157210	-80.69031474	
5,519.00	39.50	150.120	5,115.34	-1,277.30	531.65	14,443,654.58	1,727,461.12	39.77143135	-80.69021419	
5,596.00	38.01	153.200	5,151.99	-1,303.19	545.62	14,443,628.70	1,727,475.09	39.77136014	-80.69016478	
5,644.00	29.75	156.450	5,191.81	-1,327.34	557.07	14,443,604.54	1,727,486.54	39.77129370	-80.69012436	
5,675.00	24.74	159.000	5,219.36	-1,340.45	562.47	14,443,591.43	1,727,491.94	39.77125763	-80.69010529	
5,707.00	20.43	157.500	5,248.90	-1,351.87	567.01	14,443,580.01	1,727,496.48	39.77122623	-80.69008928	
5,738.00	16.25	155.310	5,278.32	-1,360.81	570.89	14,443,571.07	1,727,500.36	39.77120163	-80.69007557	
5,769.00	12.91	149.240	5,308.32	-1,367.73	574.48	14,443,564.15	1,727,503.95	39.77118260	-80.69006290	
5,801.00	8.08	147.310	5,339.77	-1,372.70	577.52	14,443,559.18	1,727,506.99	39.77116893	-80.69005212	
5,832.00	5.09	130.870	5,370.57	-1,375.43	579.74	14,443,556.45	1,727,509.21	39.77116140	-80.69004427	
5,864.00	5.58	146.600	5,402.43	-1,377.66	581.67	14,443,554.22	1,727,511.14	39.77115526	-80.69003743	
5,895.00	7.16	167.170	5,433.24	-1,380.80	582.93	14,443,551.08	1,727,512.40	39.77114662	-80.69003298	
5,927.00	9.09	177.190	5,464.92	-1,385.27	583.49	14,443,546.61	1,727,512.96	39.77113434	-80.69003102	
5,958.00	11.29	185.450	5,495.43	-1,390.74	583.32	14,443,541.14	1,727,512.79	39.77111932	-80.69003169	
5,990.00	9.84	191.960	5,526.89	-1,396.54	582.46	14,443,535.35	1,727,511.93	39.77110342	-80.69003483	
6,021.00	6.54	207.150	5,557.57	-1,400.70	581.11	14,443,531.18	1,727,510.58	39.77109200	-80.69003971	
6,052.00	5.01	229.490	5,588.42	-1,403.15	579.27	14,443,528.73	1,727,508.74	39.77108529	-80.69004627	
6,084.00	5.62	231.770	5,620.28	-1,405.03	576.98	14,443,526.85	1,727,506.45	39.77108015	-80.69005445	
6,115.00	6.37	233.440	5,651.11	-1,406.99	574.40	14,443,524.89	1,727,503.87	39.77107478	-80.69006364	
6,146.00	6.63	257.440	5,681.92	-1,408.41	571.28	14,443,523.48	1,727,500.74	39.77107093	-80.69007479	
6,178.00	6.94	285.740	5,713.70	-1,408.28	567.61	14,443,523.60	1,727,497.08	39.77107130	-80.69008783	
6,209.00	7.99	300.590	5,744.44	-1,406.68	563.95	14,443,525.20	1,727,493.42	39.77107575	-80.69010083	
6,241.00	9.89	305.950	5,776.05	-1,403.93	559.81	14,443,527.95	1,727,489.28	39.77108332	-80.69011553	
6,272.00	11.51	305.770	5,806.51	-1,400.56	555.15	14,443,531.32	1,727,484.62	39.77109263	-80.69013209	
6,303.00	13.00	307.180	5,836.81	-1,396.65	549.86	14,443,535.24	1,727,479.33	39.77110343	-80.69015086	
6,335.00	15.02	312.100	5,867.85	-1,391.69	543.91	14,443,540.19	1,727,473.38	39.77111709	-80.69017195	
6,366.00	17.66	315.620	5,897.60	-1,385.64	537.64	14,443,546.25	1,727,467.11	39.77113378	-80.69019420	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-03 HM (slot I)
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-03 HM (slot I)	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	
6,398.00	20.30	317.990	5,927.86	-1,378.04	530.53	14,443,553.84	1,727,460.00	39.77115471	-80.69021941	
6,429.00	22.67	318.170	5,956.70	-1,369.59	522.95	14,443,562.29	1,727,452.42	39.77117798	-80.69024630	
6,461.00	24.91	316.410	5,985.98	-1,360.11	514.19	14,443,571.77	1,727,443.66	39.77120409	-80.69027736	
6,476.00	26.11	316.060	5,999.52	-1,355.45	509.72	14,443,576.43	1,727,439.19	39.77121695	-80.69029320	
6,523.00	31.16	316.330	6,040.76	-1,339.20	494.14	14,443,592.68	1,727,423.61	39.77126173	-80.69034846	
6,571.00	36.75	317.910	6,080.56	-1,319.54	475.92	14,443,612.34	1,727,405.39	39.77131588	-80.69041305	
6,618.00	42.11	320.280	6,116.85	-1,296.97	456.41	14,443,634.91	1,727,385.88	39.77137806	-80.69048220	
6,666.00	47.87	323.800	6,150.79	-1,270.20	435.59	14,443,661.68	1,727,365.06	39.77145177	-80.69055596	
6,713.00	52.62	326.960	6,180.84	-1,240.46	415.11	14,443,691.42	1,727,344.57	39.77153363	-80.69062851	
6,759.00	58.90	328.810	6,206.71	-1,208.26	394.92	14,443,723.62	1,727,324.39	39.77162226	-80.69069995	
6,806.00	65.63	330.040	6,228.57	-1,172.46	373.78	14,443,759.42	1,727,303.25	39.77172078	-80.69077474	
6,854.00	69.10	330.210	6,247.04	-1,134.05	351.72	14,443,797.83	1,727,281.19	39.77182648	-80.69085279	
6,901.00	72.31	330.300	6,262.57	-1,095.54	329.71	14,443,836.35	1,727,259.18	39.77193244	-80.69093063	
6,949.00	76.09	331.440	6,275.64	-1,055.20	307.24	14,443,876.68	1,727,236.71	39.77204344	-80.69101012	
6,996.00	79.87	331.620	6,285.42	-1,014.79	285.33	14,443,917.09	1,727,214.80	39.77215460	-80.69108760	
7,044.00	83.96	331.970	6,292.17	-972.92	262.88	14,443,958.96	1,727,192.34	39.77226980	-80.69116700	
7,091.00	85.76	332.060	6,296.38	-931.59	240.91	14,444,000.29	1,727,170.38	39.77238353	-80.69124466	
7,138.00	89.32	331.620	6,298.40	-890.20	218.75	14,444,041.69	1,727,148.22	39.77249741	-80.69132301	
7,233.00	91.08	331.620	6,298.07	-806.62	173.60	14,444,125.26	1,727,103.07	39.77272737	-80.69148268	
7,327.00	90.20	330.480	6,297.02	-724.37	128.10	14,444,207.51	1,727,057.57	39.77295367	-80.69164360	
7,420.00	90.81	330.830	6,296.20	-643.31	82.53	14,444,288.57	1,727,012.00	39.77317672	-80.69180480	
7,514.00	90.02	331.180	6,295.52	-561.09	36.97	14,444,370.79	1,726,966.44	39.77340294	-80.69196595	
7,609.00	89.98	330.830	6,295.52	-478.00	-9.08	14,444,453.88	1,726,920.39	39.77363157	-80.69212883	
7,704.00	90.42	330.210	6,295.19	-395.30	-55.83	14,444,536.58	1,726,873.64	39.77385912	-80.69229420	
7,798.00	90.86	328.630	6,294.14	-314.38	-103.65	14,444,617.50	1,726,825.82	39.77408180	-80.69246339	
7,893.00	91.91	327.310	6,291.84	-233.87	-154.02	14,444,698.01	1,726,775.45	39.77430338	-80.69264167	
7,987.00	92.31	329.070	6,288.38	-154.05	-203.53	14,444,777.84	1,726,725.94	39.77452306	-80.69281691	
8,082.00	90.15	331.270	6,286.34	-71.66	-250.77	14,444,860.22	1,726,678.70	39.77474975	-80.69298403	
8,176.00	90.42	331.180	6,285.87	10.73	-296.02	14,444,942.61	1,726,633.45	39.77497645	-80.69314407	
8,270.00	90.55	330.560	6,285.08	92.84	-341.77	14,445,024.72	1,726,587.70	39.77520237	-80.69330592	
8,364.00	89.32	330.740	6,285.18	174.77	-387.85	14,445,106.65	1,726,541.62	39.77542781	-80.69346890	
8,458.00	89.32	330.650	6,286.30	256.73	-433.85	14,445,188.62	1,726,495.62	39.77565334	-80.69363164	
8,553.00	90.11	331.090	6,286.77	339.72	-480.10	14,445,271.60	1,726,449.37	39.77588166	-80.69379521	
8,646.00	90.07	331.090	6,286.63	421.13	-525.06	14,445,353.01	1,726,404.41	39.77610566	-80.69395424	
8,740.00	90.64	331.180	6,286.04	503.45	-570.43	14,445,435.33	1,726,359.04	39.77633216	-80.69411474	
8,834.00	89.32	330.040	6,286.08	585.35	-616.56	14,445,517.23	1,726,312.91	39.77655750	-80.69427793	
8,928.00	89.10	329.770	6,287.37	666.67	-663.69	14,445,598.55	1,726,265.78	39.77678127	-80.69444468	
9,023.00	87.82	329.250	6,289.92	748.50	-711.88	14,445,680.38	1,726,217.59	39.77700646	-80.69461518	
9,117.00	88.00	328.720	6,293.35	829.00	-760.28	14,445,760.89	1,726,169.19	39.77722800	-80.69478648	
9,212.00	90.15	328.370	6,294.89	910.03	-809.84	14,445,841.91	1,726,119.63	39.77745098	-80.69496191	
9,306.00	91.38	328.720	6,293.63	990.21	-858.89	14,445,922.09	1,726,070.58	39.77767163	-80.69513550	
9,400.00	90.86	329.420	6,291.79	1,070.82	-907.19	14,446,002.71	1,726,022.28	39.77789347	-80.69530645	
9,494.00	89.49	328.890	6,291.51	1,151.53	-955.39	14,446,083.41	1,725,974.08	39.77811555	-80.69547701	
9,588.00	89.63	329.510	6,292.23	1,232.26	-1,003.52	14,446,164.15	1,725,925.95	39.77833773	-80.69564734	
9,682.00	90.99	332.230	6,291.72	1,314.36	-1,049.27	14,446,246.25	1,725,880.20	39.77856363	-80.69580919	
9,776.00	91.43	332.150	6,289.74	1,397.49	-1,093.12	14,446,329.37	1,725,836.35	39.77879232	-80.69596424	
9,869.00	90.07	330.120	6,288.52	1,478.92	-1,138.00	14,446,410.80	1,725,791.46	39.77901637	-80.69612303	
9,962.00	90.02	327.750	6,288.44	1,558.58	-1,185.99	14,446,490.46	1,725,743.48	39.77923557	-80.69629286	
10,056.00	89.71	330.480	6,288.67	1,639.24	-1,234.24	14,446,571.12	1,725,695.23	39.77945754	-80.69646361	
10,150.00	89.41	329.330	6,289.39	1,720.56	-1,281.37	14,446,652.45	1,725,648.10	39.77968132	-80.69663039	
10,244.00	88.88	328.190	6,290.79	1,800.92	-1,330.11	14,446,732.81	1,725,599.36	39.77990246	-80.69680292	
10,339.00	90.59	330.480	6,291.23	1,882.63	-1,378.56	14,446,814.51	1,725,550.91	39.78012730	-80.69697437	
10,433.00	90.29	332.060	6,290.51	1,965.05	-1,423.74	14,446,896.94	1,725,505.73	39.78035407	-80.69713419	
10,527.00	91.52	332.230	6,289.02	2,048.15	-1,467.66	14,446,980.03	1,725,461.81	39.78058269	-80.69728950	
10,621.00	90.64	332.500	6,287.25	2,131.41	-1,511.25	14,447,063.29	1,725,418.22	39.78081175	-80.69744366	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-03 HM (slot I)
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-03 HM (slot I)	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	
10,715.00	89.19	331.620	6,287.39	2,214.45	-1,555.29	14,447,146.33	1,725,374.18	39.78104021	-80.69759942	
10,809.00	90.73	331.970	6,287.46	2,297.29	-1,599.72	14,447,229.17	1,725,329.75	39.78126811	-80.69775656	
10,903.00	90.33	336.890	6,286.59	2,382.05	-1,640.27	14,447,313.93	1,725,289.20	39.78150127	-80.69789990	
10,997.00	89.63	332.590	6,286.62	2,467.04	-1,680.37	14,447,398.92	1,725,249.09	39.78173504	-80.69804162	
11,092.00	90.86	332.410	6,286.21	2,551.31	-1,724.24	14,447,483.19	1,725,205.23	39.78196686	-80.69819674	
11,186.00	89.63	329.680	6,285.81	2,633.55	-1,769.74	14,447,565.43	1,725,159.73	39.78219313	-80.69835772	
11,281.00	89.41	329.070	6,286.61	2,715.29	-1,818.13	14,447,647.17	1,725,111.34	39.78241808	-80.69852899	
11,374.00	88.48	327.750	6,288.32	2,794.50	-1,866.84	14,447,726.38	1,725,062.63	39.78263604	-80.69870141	
11,469.00	89.32	328.010	6,290.14	2,874.94	-1,917.34	14,447,806.82	1,725,012.13	39.78285742	-80.69888020	
11,562.00	90.46	329.330	6,290.32	2,954.37	-1,965.70	14,447,886.26	1,724,963.77	39.78307602	-80.69905137	
11,657.00	90.07	329.680	6,289.88	3,036.23	-2,013.91	14,447,968.11	1,724,915.56	39.78330127	-80.69922199	
11,751.00	90.73	330.480	6,289.23	3,117.70	-2,060.79	14,448,049.58	1,724,868.68	39.78352544	-80.69938790	
11,845.00	89.89	329.420	6,288.72	3,199.06	-2,107.86	14,448,130.95	1,724,821.61	39.78374931	-80.69955447	
11,939.00	89.98	329.250	6,288.82	3,279.92	-2,155.80	14,448,211.80	1,724,773.67	39.78397180	-80.69972416	
12,034.00	90.51	329.330	6,288.42	3,361.60	-2,204.32	14,448,293.48	1,724,725.15	39.78419656	-80.69989588	
12,129.00	90.37	329.250	6,287.69	3,443.27	-2,252.83	14,448,375.15	1,724,676.64	39.78442130	-80.70006759	
12,223.00	89.23	327.220	6,288.02	3,523.18	-2,302.31	14,448,455.07	1,724,627.16	39.78464122	-80.70024277	
12,317.00	90.11	329.330	6,288.56	3,603.13	-2,351.74	14,448,535.01	1,724,577.73	39.78486124	-80.70041775	
12,412.00	90.46	331.180	6,288.09	3,685.61	-2,398.87	14,448,617.49	1,724,530.60	39.78508818	-80.70058453	
12,505.00	89.58	331.790	6,288.05	3,767.33	-2,443.26	14,448,699.21	1,724,486.21	39.78531300	-80.70074160	
12,599.00	90.37	331.440	6,288.09	3,850.03	-2,487.95	14,448,781.91	1,724,441.52	39.78554052	-80.70089968	
12,693.00	90.15	332.060	6,287.67	3,932.83	-2,532.44	14,448,864.71	1,724,397.03	39.78576832	-80.70105707	
12,787.00	90.15	330.390	6,287.42	4,015.22	-2,577.69	14,448,947.10	1,724,351.78	39.78599500	-80.70121715	
12,881.00	89.71	331.090	6,287.54	4,097.22	-2,623.63	14,449,029.11	1,724,305.84	39.78622063	-80.70137972	
12,975.00	90.07	331.440	6,287.72	4,179.65	-2,668.82	14,449,111.53	1,724,260.64	39.78644740	-80.70153961	
13,069.00	88.97	332.410	6,288.50	4,262.58	-2,713.06	14,449,194.46	1,724,216.41	39.78667556	-80.70169609	
13,163.00	90.15	331.440	6,289.23	4,345.52	-2,757.30	14,449,277.40	1,724,172.17	39.78690373	-80.70185258	
13,257.00	88.44	330.480	6,290.38	4,427.69	-2,802.92	14,449,359.57	1,724,126.55	39.78712981	-80.70201401	
13,351.00	88.88	328.540	6,292.58	4,508.66	-2,850.60	14,449,440.54	1,724,078.87	39.78735263	-80.70218277	
13,441.00	89.85	329.250	6,293.58	4,585.72	-2,897.09	14,449,517.60	1,724,032.38	39.78756466	-80.70234736	
Survey @ 13441.00 MD 6293.58 TVD										
13,498.00	89.85	329.250	6,293.73	4,634.70	-2,926.23	14,449,566.58	1,724,003.23	39.78769945	-80.70245052	
Survey Proj. to 13498.00 MD 6293.73 TVD										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
161.00	161.00	0.32	-0.50	MWD surveys	
13,441.00	6,293.58	4,585.72	-2,897.09	Survey @ 13441.00 MD 6293.58 TVD	
13,498.00	6,293.73	4,634.70	-2,926.23	Survey Proj. to 13498.00 MD 6293.73 TVD	

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