



Well: Keith Stern N-07 HM (slot T)  
 Site: Keith Stern  
 Project: Marshall County, West Virginia.  
 Design: rev4  
 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 14444922.64 Easting 1726948.32 Latitude 39.77491853 Longitude -80.69202368

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



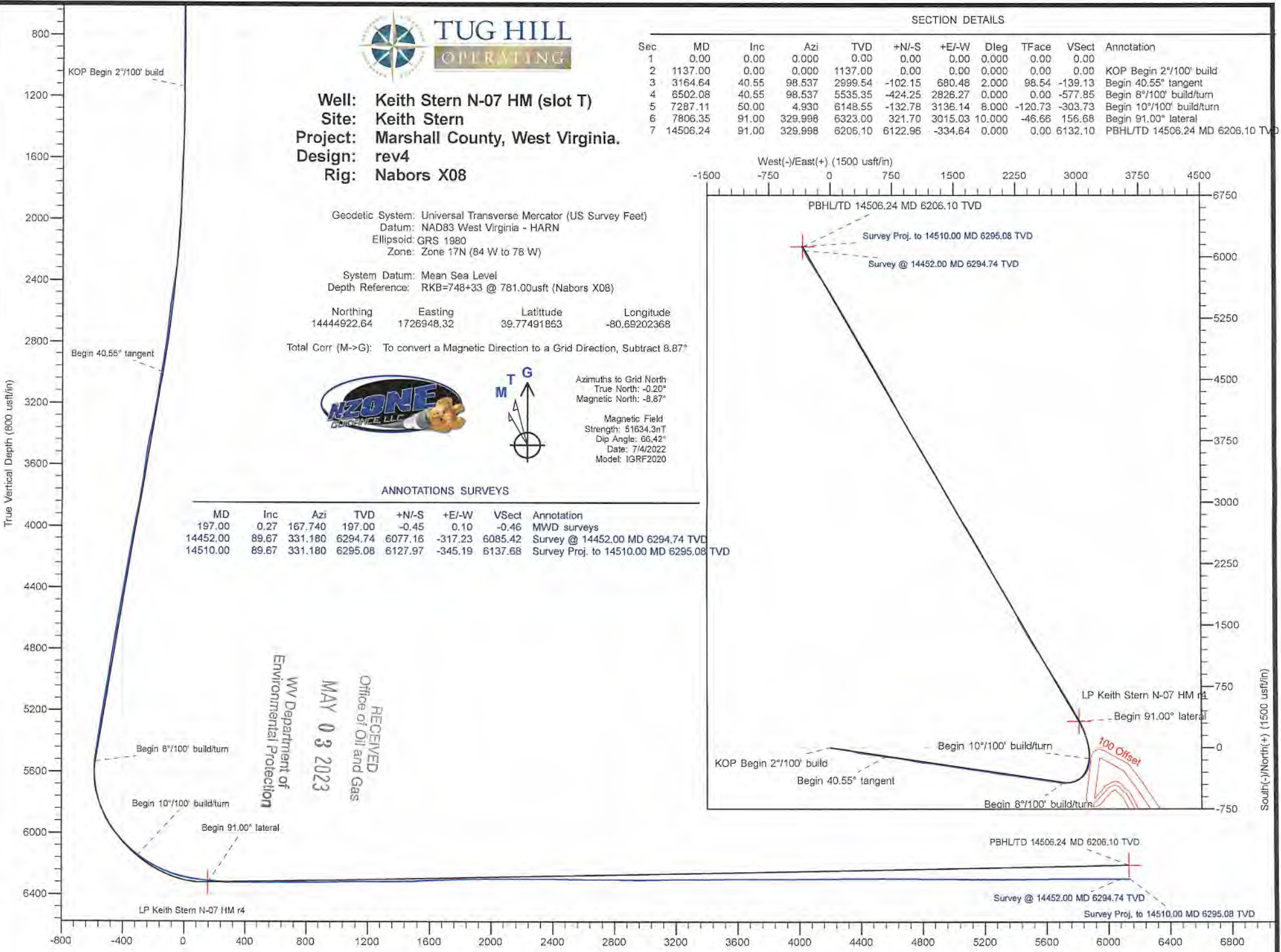
Azimuths to Grid North  
 True North: -0.20°  
 Magnetic North: -8.87°

Magnetic Field  
 Strength: 51634.3nT  
 Dip Angle: 66.42°  
 Date: 7/4/2022  
 Model: IGRF2020

ANNOTATIONS SURVEYS

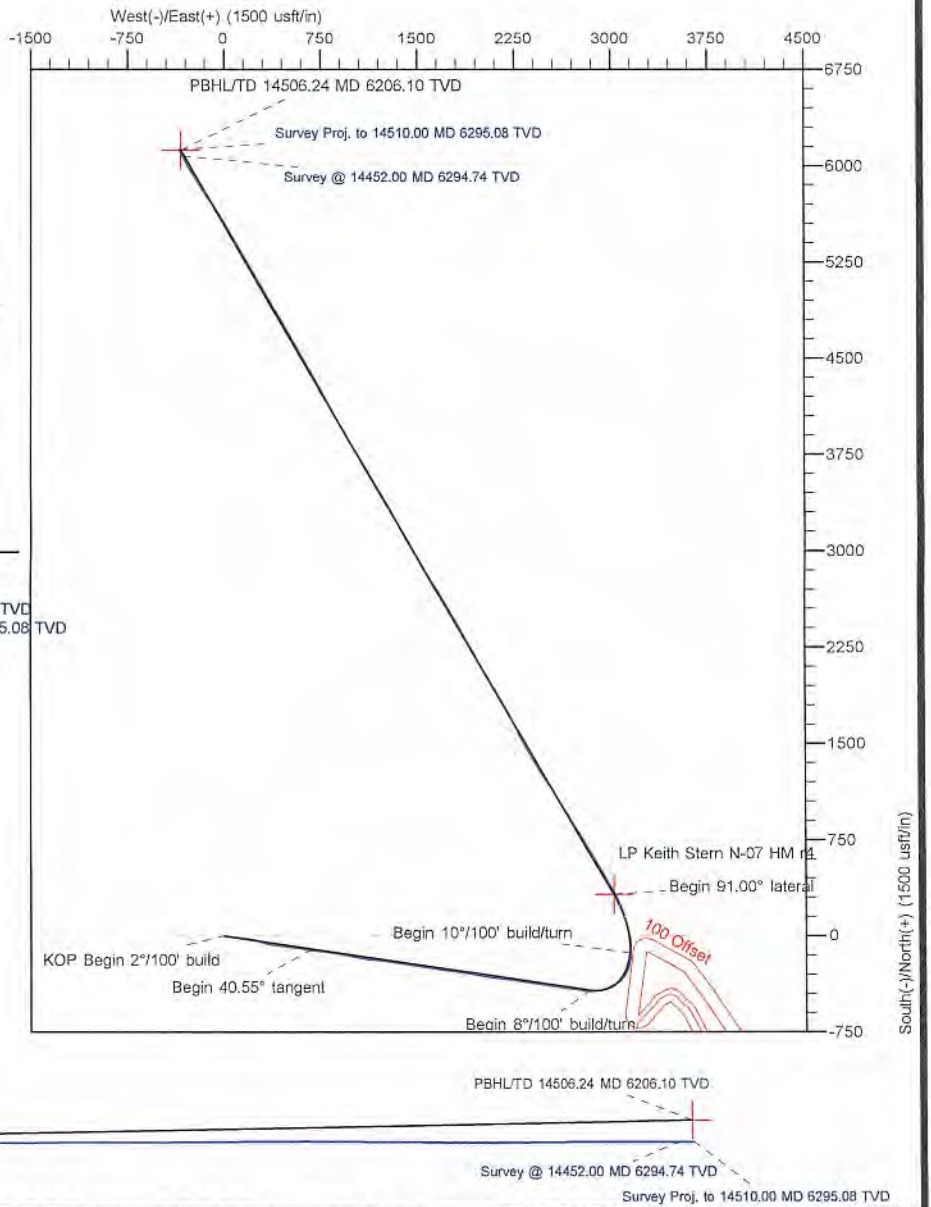
MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
197.00	0.27	167.740	197.00	-0.45	0.10	-0.46	MWD surveys
14452.00	89.67	331.180	6294.74	6077.16	-317.23	6085.42	Survey @ 14452.00 MD 6294.74 TVD
14510.00	89.67	331.180	6295.08	6127.97	-345.19	6137.68	Survey Proj. to 14510.00 MD 6295.08 TVD

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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	1137.00	0.00	0.000	1137.00	0.00	0.00	0.000	0.00	0.00	KOP Begin 2°/100' build
3	3164.64	40.55	98.537	2999.54	-102.15	680.48	2.000	98.54	-139.13	Begin 40.55° tangent
4	8502.08	40.55	98.537	5535.35	-424.25	2826.27	0.000	0.00	-577.85	Begin 8°/100' build/turn
5	7287.11	50.00	4.930	6148.55	-132.78	3136.14	8.000	-120.73	-303.73	Begin 10°/100' build/turn
6	7806.35	91.00	329.998	6323.00	321.70	3015.03	10.000	-46.66	156.68	Begin 91.00° lateral
7	14506.24	91.00	329.998	6206.10	6122.96	-334.64	0.000	0.00	6132.10	PBHLTD 14506.24 MD 6206.10 TVD





<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Keith Stern N-07 HM (slot T)
<b>Project:</b>	Marshall County, West Virginia.	<b>TVD Reference:</b>	RKB=748+33 @ 781.00usft (Nabors X08)
<b>Site:</b>	Keith Stern	<b>MD Reference:</b>	RKB=748+33 @ 781.00usft (Nabors X08)
<b>Well:</b>	Keith Stern N-07 HM (slot T)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Original Hole	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Original Hole	<b>Database:</b>	DB_Feb2822

<b>Project</b>	Marshall County, West Virginia.		
<b>Map System:</b>	Universal Transverse Mercator (US Survey Feet)	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b>	NAD83 West Virginia - HARN		
<b>Map Zone:</b>	Zone 17N (84 W to 78 W)		

<b>Site</b>	Keith Stern				
<b>Site Position:</b>		<b>Northing:</b>	14,444,890.33 usft	<b>Latitude:</b>	39.77483004
<b>From:</b>	Lat/Long	<b>Easting:</b>	1,726,932.47 usft	<b>Longitude:</b>	-80.69208048
<b>Position Uncertainty:</b>	0.00 usft	<b>Slot Radius:</b>	13-3/16 "	<b>Grid Convergence:</b>	0.20 °

<b>Well</b>	Keith Stern N-07 HM (slot T)					
<b>Well Position</b>	<b>+N-S</b>	0.00 usft	<b>Northing:</b>	14,444,922.64 usft	<b>Latitude:</b>	39.77491863
	<b>+E-W</b>	0.00 usft	<b>Easting:</b>	1,726,948.32 usft	<b>Longitude:</b>	-80.69202368
<b>Position Uncertainty</b>		0.00 usft	<b>Wellhead Elevation:</b>	usft	<b>Ground Level:</b>	748.00 usft

<b>Wellbore</b>	Original Hole				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2020	7/4/2022	-8.67	66.42	51,634.27651997

<b>Design</b>	Surveys Original Hole				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.00
<b>Vertical Section:</b>		<b>Depth From (TVD) (usft)</b>	<b>+N-S (usft)</b>	<b>+E-W (usft)</b>	<b>Direction (°)</b>
		0.00	0.00	0.00	356.872

<b>Survey Program</b>	<b>Date</b>	7/20/2022			
<b>From (usft)</b>	<b>To (usft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
197.00	529.00	MWD surf (Original Hole)	MWD	MWD - Standard	
550.00	2,268.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,324.00	14,452.00	MWD (Original Hole)	MWD	MWD - Standard	
14,510.00	14,510.00	Projection (Original Hole)	MWD	MWD - Standard	

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<b>Survey</b>	WV Department of Environmental Protection									
<b>Measured Depth (usft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (usft)</b>	<b>+N-S (usft)</b>	<b>+E-W (usft)</b>	<b>Map Northing (usft)</b>	<b>Map Easting (usft)</b>	<b>Latitude</b>	<b>Longitude</b>	
0.00	0.00	0.000	0.00	0.00	0.00	14,444,922.64	1,726,948.32	39.77491863	-80.69202368	
197.00	0.27	167.740	197.00	-0.45	0.10	14,444,922.19	1,726,948.42	39.77491739	-80.69202334	
<b>MWD surveys</b>										
227.00	0.20	178.420	227.00	-0.57	0.12	14,444,922.06	1,726,948.43	39.77491705	-80.69202328	
257.00	0.19	196.130	257.00	-0.68	0.10	14,444,921.96	1,726,948.42	39.77491678	-80.69202332	
288.00	0.24	201.240	288.00	-0.79	0.06	14,444,921.85	1,726,948.38	39.77491648	-80.69202346	
318.00	0.23	206.180	318.00	-0.90	0.02	14,444,921.74	1,726,948.33	39.77491617	-80.69202364	
348.00	0.16	218.370	348.00	-0.98	-0.04	14,444,921.65	1,726,948.28	39.77491593	-80.69202382	
378.00	0.19	233.120	378.00	-1.05	-0.10	14,444,921.59	1,726,948.22	39.77491576	-80.69202406	





Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-07 HM (slot T)
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-07 HM (slot T)	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
409.00	0.18	249.120	409.00	-1.10	-0.19	14,444,921.54	1,726,948.13	39.77491563	-80.69202437
439.00	0.17	277.910	439.00	-1.11	-0.28	14,444,921.53	1,726,948.04	39.77491560	-80.69202468
468.00	0.71	283.570	468.00	-1.06	-0.49	14,444,921.58	1,726,947.82	39.77491573	-80.69202545
499.00	0.80	283.500	498.99	-0.98	-0.84	14,444,921.66	1,726,947.48	39.77491596	-80.69202668
529.00	0.60	297.820	528.99	-0.87	-1.13	14,444,921.77	1,726,947.19	39.77491627	-80.69202772
550.00	0.44	291.540	549.99	-0.78	-1.30	14,444,921.86	1,726,947.01	39.77491649	-80.69202833
584.00	0.14	224.710	583.99	-0.77	-1.45	14,444,921.87	1,726,946.86	39.77491654	-80.69202886
614.00	0.29	136.370	613.99	-0.85	-1.43	14,444,921.79	1,726,946.89	39.77491632	-80.69202877
644.00	0.55	95.070	643.99	-0.91	-1.23	14,444,921.72	1,726,947.09	39.77491613	-80.69202807
674.00	1.01	101.630	673.99	-0.98	-0.83	14,444,921.66	1,726,947.49	39.77491595	-80.69202664
705.00	1.14	100.690	704.98	-1.09	-0.26	14,444,921.55	1,726,948.06	39.77491563	-80.69202461
799.00	1.76	118.210	798.95	-1.95	1.93	14,444,920.69	1,726,950.25	39.77491326	-80.69201683
893.00	1.65	105.570	892.91	-2.99	4.51	14,444,919.65	1,726,952.83	39.77491037	-80.69200767
987.00	1.02	30.180	986.89	-2.63	6.23	14,444,920.01	1,726,954.55	39.77491134	-80.69200153
1,081.00	1.51	4.120	1,080.87	-0.68	6.74	14,444,921.96	1,726,955.06	39.77491671	-80.69199969
1,175.00	0.87	56.750	1,174.85	0.95	7.43	14,444,923.59	1,726,955.75	39.77492117	-80.69199723
1,275.00	2.30	106.200	1,274.81	0.81	9.99	14,444,923.45	1,726,958.31	39.77492076	-80.69198812
1,368.00	4.32	104.090	1,367.65	-0.57	15.18	14,444,922.07	1,726,963.50	39.77491693	-80.69196966
1,462.00	6.75	104.630	1,461.21	-2.82	23.96	14,444,919.82	1,726,972.28	39.77491065	-80.69193844
1,557.00	9.41	100.920	1,555.26	-5.71	36.99	14,444,916.93	1,726,985.31	39.77490261	-80.69189210
1,651.00	11.45	102.850	1,647.70	-9.24	53.63	14,444,913.40	1,727,001.95	39.77489276	-80.69183291
1,746.00	13.88	93.760	1,740.43	-12.07	74.04	14,444,910.57	1,727,022.36	39.77488478	-80.69176031
1,840.00	14.27	91.470	1,831.65	-13.10	96.71	14,444,909.54	1,727,045.03	39.77488175	-80.69167963
1,934.00	13.34	95.550	1,922.93	-14.44	119.09	14,444,908.20	1,727,067.41	39.77487784	-80.69160001
2,027.00	14.78	99.660	2,013.15	-17.47	141.46	14,444,905.17	1,727,089.78	39.77486931	-80.69152041
2,122.00	17.56	101.130	2,104.38	-22.27	167.48	14,444,900.37	1,727,115.80	39.77485588	-80.69142789
2,216.00	20.28	100.070	2,193.29	-27.86	197.44	14,444,894.78	1,727,145.75	39.77484026	-80.69132133
2,288.00	21.63	102.130	2,241.85	-31.45	215.68	14,444,891.19	1,727,164.00	39.77483023	-80.69125645
2,324.00	23.24	100.210	2,293.61	-35.58	236.65	14,444,887.06	1,727,184.96	39.77481869	-80.69118188
2,400.00	24.79	107.020	2,363.05	-42.90	266.65	14,444,879.74	1,727,214.96	39.77479830	-80.69107520
2,494.00	28.05	105.510	2,447.22	-54.58	306.80	14,444,868.06	1,727,255.11	39.77476583	-80.69093244
2,591.00	32.24	99.230	2,531.10	-64.84	354.34	14,444,857.80	1,727,302.66	39.77473722	-80.69076334
2,685.00	33.73	96.900	2,609.95	-71.99	405.01	14,444,850.64	1,727,353.32	39.77471708	-80.69058312
2,779.00	34.29	96.920	2,687.87	-78.32	457.20	14,444,844.32	1,727,405.52	39.77469921	-80.69039743
2,874.00	33.73	97.110	2,766.62	-84.81	509.94	14,444,837.83	1,727,458.26	39.77468089	-80.69020981
2,968.00	35.53	98.770	2,843.96	-92.20	562.84	14,444,830.43	1,727,511.16	39.77466008	-80.69002164
3,063.00	38.94	99.990	2,919.59	-101.60	619.54	14,444,821.04	1,727,567.86	39.77463375	-80.68981995
3,158.00	39.60	98.110	2,993.14	-111.05	678.92	14,444,811.59	1,727,627.23	39.77460723	-80.68960874
3,252.00	40.08	96.050	3,065.32	-118.46	738.67	14,444,804.18	1,727,686.99	39.77458630	-80.68939616
3,346.00	40.83	96.870	3,136.84	-125.33	799.27	14,444,797.31	1,727,747.59	39.77456687	-80.68918055
3,441.00	40.39	98.090	3,208.97	-133.37	860.58	14,444,789.26	1,727,808.90	39.77454418	-80.68896246
3,535.00	40.27	100.670	3,280.63	-143.29	920.59	14,444,779.35	1,727,868.91	39.77451639	-80.68874900
3,629.00	41.94	102.050	3,351.46	-155.47	981.18	14,444,767.17	1,727,929.49	39.77448235	-80.68853354
3,724.00	41.13	99.490	3,422.57	-167.25	1,043.04	14,444,755.39	1,727,991.36	39.77444941	-80.68831349
3,817.00	41.01	98.120	3,492.69	-176.60	1,103.42	14,444,746.04	1,728,051.74	39.77442315	-80.68809872
3,911.00	40.83	95.870	3,563.72	-184.10	1,164.52	14,444,738.54	1,728,112.84	39.77440197	-80.68788134
4,005.00	39.51	96.020	3,635.55	-190.38	1,224.83	14,444,732.26	1,728,173.15	39.77438415	-80.68766678
4,099.00	39.02	97.770	3,708.33	-197.52	1,283.89	14,444,725.12	1,728,232.21	39.77436398	-80.68745668
4,193.00	40.33	98.920	3,780.68	-206.24	1,343.26	14,444,716.40	1,728,291.58	39.77433947	-80.68724548
4,288.00	40.95	99.820	3,852.77	-216.31	1,404.31	14,444,706.33	1,728,352.63	39.77431121	-80.68702834
4,382.00	40.89	99.350	3,923.79	-226.56	1,465.02	14,444,696.07	1,728,413.34	39.77428247	-80.68681240
4,475.00	40.78	98.680	3,994.16	-236.09	1,525.08	14,444,686.55	1,728,473.40	39.77425573	-80.68659876
4,572.00	40.42	98.720	4,067.81	-245.64	1,587.48	14,444,677.00	1,728,535.80	39.77422891	-80.68637680
4,667.00	41.95	98.460	4,139.30	-254.98	1,649.33	14,444,667.66	1,728,597.65	39.77420266	-80.68615678
4,762.00	41.94	97.710	4,209.96	-263.91	1,712.20	14,444,658.73	1,728,660.52	39.77417753	-80.68593315



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Site:	Keith Stern	MD Reference:	RKB=748+33 @ 781.00usft (Nabors X08)
Well:	Keith Stern N-07 HM (slot T)	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	
4,856.00	41.73	98.090	4,280.00	-272.53	1,774.30	14,444,650.11	1,728,722.62	39.77415326	-80.68571223	
4,950.00	41.61	98.390	4,350.21	-281.49	1,836.15	14,444,641.15	1,728,784.47	39.77412807	-80.68549222	
5,045.00	40.21	101.500	4,422.02	-292.20	1,897.41	14,444,630.43	1,728,845.73	39.77409805	-80.68527431	
5,157.00	39.78	98.360	4,507.83	-304.62	1,968.30	14,444,618.02	1,728,916.62	39.77406326	-80.68502218	
5,251.00	40.44	98.800	4,579.72	-313.66	2,028.18	14,444,608.98	1,728,976.50	39.77403786	-80.68480918	
5,345.00	41.58	97.740	4,650.65	-322.52	2,089.22	14,444,600.11	1,729,037.54	39.77401293	-80.68459205	
5,439.00	42.11	97.570	4,720.68	-330.88	2,151.37	14,444,591.76	1,729,099.69	39.77398939	-80.68437096	
5,533.00	41.54	97.130	4,790.72	-338.90	2,213.54	14,444,583.74	1,729,161.86	39.77396676	-80.68414980	
5,628.00	40.53	98.270	4,862.38	-347.25	2,275.34	14,444,575.39	1,729,223.66	39.77394323	-80.68392994	
5,722.00	38.68	98.180	4,934.80	-355.82	2,334.65	14,444,566.82	1,729,282.97	39.77391911	-80.68371898	
5,817.00	40.13	99.590	5,008.21	-365.15	2,394.22	14,444,557.49	1,729,342.54	39.77389292	-80.68350707	
5,911.00	40.62	99.240	5,079.82	-375.11	2,454.30	14,444,547.53	1,729,402.61	39.77386498	-80.68329340	
6,005.00	40.92	99.150	5,151.01	-384.92	2,514.89	14,444,537.72	1,729,463.21	39.77383746	-80.68307786	
6,099.00	39.82	97.920	5,222.62	-393.96	2,575.10	14,444,528.68	1,729,523.42	39.77381204	-80.68286370	
6,193.00	38.59	97.740	5,295.46	-402.05	2,633.96	14,444,520.59	1,729,582.28	39.77378923	-80.68265431	
6,287.00	38.33	98.800	5,369.07	-410.46	2,691.81	14,444,512.18	1,729,640.13	39.77376558	-80.68244851	
6,382.00	39.25	98.010	5,443.12	-419.16	2,750.69	14,444,503.48	1,729,699.01	39.77374113	-80.68223909	
6,476.00	40.40	97.210	5,515.31	-427.12	2,810.36	14,444,495.52	1,729,758.68	39.77371867	-80.68202682	
6,523.00	38.90	91.500	5,551.51	-429.42	2,840.23	14,444,493.22	1,729,788.55	39.77371206	-80.68192053	
6,571.00	37.36	85.700	5,589.28	-428.72	2,869.83	14,444,493.91	1,729,818.15	39.77371369	-80.68181517	
6,618.00	36.09	81.390	5,626.95	-425.58	2,897.75	14,444,497.06	1,729,846.06	39.77372205	-80.68171579	
6,665.00	34.20	77.260	5,665.39	-420.60	2,924.32	14,444,502.04	1,729,872.64	39.77373548	-80.68162114	
6,712.00	33.54	72.430	5,704.42	-413.76	2,949.59	14,444,508.88	1,729,897.91	39.77375400	-80.68153113	
6,759.00	33.41	67.160	5,743.63	-404.82	2,973.90	14,444,517.82	1,729,922.22	39.77377833	-80.68144450	
6,806.00	34.02	61.970	5,782.73	-393.61	2,997.43	14,444,529.02	1,729,945.75	39.77380887	-80.68136059	
6,854.00	34.15	55.820	5,822.50	-379.73	3,020.44	14,444,542.91	1,729,968.76	39.77384677	-80.68127854	
6,901.00	36.18	50.810	5,860.93	-363.55	3,042.11	14,444,559.09	1,729,990.43	39.77389100	-80.68120121	
6,949.00	37.89	43.510	5,899.26	-343.90	3,063.25	14,444,578.74	1,730,011.57	39.77394476	-80.68112572	
6,996.00	39.74	36.220	5,935.90	-321.29	3,082.08	14,444,601.35	1,730,030.40	39.77400665	-80.68105843	
7,044.00	41.01	31.560	5,972.48	-295.49	3,099.39	14,444,627.15	1,730,047.71	39.77407735	-80.68099648	
7,091.00	41.89	24.880	6,007.72	-268.10	3,114.07	14,444,654.54	1,730,062.39	39.77415242	-80.68094389	
7,138.00	43.82	17.670	6,042.20	-238.34	3,125.62	14,444,684.30	1,730,073.94	39.77423403	-80.68090241	
7,185.00	46.20	12.140	6,075.44	-206.24	3,134.13	14,444,716.40	1,730,082.45	39.77432211	-80.68087172	
7,232.00	49.14	7.040	6,107.09	-172.00	3,139.88	14,444,750.64	1,730,088.20	39.77441609	-80.68085082	
7,279.00	52.44	3.260	6,136.81	-135.74	3,143.12	14,444,786.90	1,730,091.44	39.77451563	-80.68083883	
7,327.00	55.47	358.250	6,165.06	-96.96	3,143.60	14,444,825.68	1,730,091.92	39.77462213	-80.68083664	
7,374.00	58.46	354.820	6,190.68	-57.64	3,141.20	14,444,864.99	1,730,089.51	39.77473012	-80.68084468	
7,420.00	62.37	352.270	6,213.39	-17.91	3,136.68	14,444,904.73	1,730,085.00	39.77483929	-80.68086024	
7,467.00	65.63	348.670	6,234.00	23.73	3,129.67	14,444,946.37	1,730,077.99	39.77495371	-80.68088466	
7,514.00	68.84	345.150	6,252.19	65.93	3,119.85	14,444,988.57	1,730,068.16	39.77506969	-80.68091910	
7,561.00	72.18	344.010	6,267.67	108.63	3,108.06	14,445,031.27	1,730,056.38	39.77518708	-80.68096050	
7,608.00	76.88	341.990	6,280.40	151.93	3,094.82	14,445,074.57	1,730,043.13	39.77530612	-80.68100710	
7,655.00	79.16	340.850	6,290.16	195.51	3,080.17	14,445,118.15	1,730,028.48	39.77542594	-80.68105869	
7,704.00	80.97	336.010	6,298.62	240.37	3,062.42	14,445,163.01	1,730,010.74	39.77554933	-80.68112127	
7,751.00	83.38	333.900	6,305.02	282.55	3,042.71	14,445,205.19	1,729,991.03	39.77566535	-80.68119089	
7,798.00	84.88	331.440	6,309.82	324.08	3,021.25	14,445,246.72	1,729,969.57	39.77577961	-80.68126675	
7,845.00	84.75	331.180	6,314.07	365.14	2,998.78	14,445,287.78	1,729,947.09	39.77589260	-80.68134621	
7,893.00	85.27	331.000	6,318.25	407.00	2,975.66	14,445,329.64	1,729,923.98	39.77600778	-80.68142796	
7,940.00	86.95	330.830	6,321.43	447.98	2,952.87	14,445,370.62	1,729,901.18	39.77612053	-80.68150856	
7,987.00	89.01	331.090	6,323.09	489.04	2,930.07	14,445,411.68	1,729,878.38	39.77623353	-80.68158919	
8,032.00	91.34	330.920	6,322.80	572.13	2,884.02	14,445,494.77	1,729,832.34	39.77646215	-80.68175202	
8,176.00	90.59	328.280	6,321.22	653.19	2,836.46	14,445,575.83	1,729,784.78	39.77668522	-80.68192026	
8,270.00	90.81	328.720	6,320.07	733.33	2,787.35	14,445,655.97	1,729,735.67	39.77690579	-80.68209404	
8,364.00	89.19	328.810	6,320.07	813.70	2,738.61	14,445,736.34	1,729,686.93	39.77712699	-80.68226650	
8,458.00	89.67	329.250	6,321.00	894.29	2,690.24	14,445,816.93	1,729,638.56	39.77734879	-80.68243764	



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Keith Stern N-07 HM (slot T)
<b>Project:</b>	Marshall County, West Virginia.	<b>TVD Reference:</b>	RKB=748+33 @ 781.00usft (Nabors X08)
<b>Site:</b>	Keith Stern	<b>MD Reference:</b>	RKB=748+33 @ 781.00usft (Nabors X08)
<b>Well:</b>	Keith Stern N-07 HM (slot T)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Original Hole	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Original Hole	<b>Database:</b>	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	
8,552.00	90.33	328.540	6,321.00	974.78	2,641.68	14,445,897.42	1,729,590.00	39.77757029	-80.68260946	
8,546.00	91.25	328.720	6,319.71	1,055.03	2,592.75	14,445,977.67	1,729,541.07	39.77779116	-80.68278259	
8,739.00	91.38	328.100	6,317.57	1,134.23	2,544.05	14,446,056.87	1,729,492.37	39.77800913	-80.68295494	
8,834.00	90.95	327.490	6,315.64	1,214.59	2,493.43	14,446,137.23	1,729,441.75	39.77823033	-80.68313410	
8,928.00	90.20	329.510	6,314.70	1,294.73	2,444.32	14,446,217.37	1,729,392.64	39.77845089	-80.68330788	
9,022.00	89.93	328.370	6,314.59	1,375.25	2,395.82	14,446,297.89	1,729,344.14	39.77867250	-80.68347948	
9,117.00	89.49	331.180	6,315.07	1,457.33	2,348.01	14,446,379.97	1,729,296.33	39.77889836	-80.68364864	
9,212.00	90.95	332.320	6,314.71	1,541.01	2,303.04	14,446,463.65	1,729,251.36	39.77912860	-80.68380763	
9,306.00	91.69	333.550	6,312.54	1,624.69	2,260.29	14,446,547.33	1,729,208.60	39.77935883	-80.68395876	
9,400.00	93.19	331.880	6,308.54	1,708.15	2,217.24	14,446,630.79	1,729,165.56	39.77958845	-80.68411094	
9,494.00	91.78	329.510	6,304.46	1,790.04	2,171.28	14,446,712.68	1,729,119.59	39.77981377	-80.68427350	
9,587.00	91.03	329.600	6,302.18	1,870.19	2,124.17	14,446,792.83	1,729,072.48	39.78003435	-80.68444018	
9,681.00	91.03	329.950	6,300.49	1,951.40	2,076.85	14,446,874.04	1,729,025.17	39.78025782	-80.68460755	
9,775.00	91.03	329.950	6,298.80	2,032.75	2,029.79	14,446,955.39	1,728,978.11	39.78048169	-80.68477405	
9,868.00	90.29	330.560	6,297.73	2,113.49	1,983.65	14,447,036.13	1,728,931.97	39.78070387	-80.68493726	
9,962.00	90.55	330.390	6,297.04	2,195.28	1,937.33	14,447,117.92	1,728,885.65	39.78092894	-80.68510111	
10,056.00	89.36	329.950	6,297.12	2,276.83	1,890.57	14,447,199.46	1,728,838.89	39.78115333	-80.68526652	
10,150.00	89.98	330.480	6,297.66	2,358.41	1,843.88	14,447,281.04	1,728,792.20	39.78137782	-80.68543170	
10,244.00	89.36	329.860	6,298.20	2,439.95	1,797.12	14,447,362.59	1,728,745.44	39.78160221	-80.68559711	
10,339.00	89.45	330.300	6,299.19	2,522.28	1,749.74	14,447,444.92	1,728,698.06	39.78182878	-80.68576473	
10,433.00	89.67	330.390	6,299.91	2,603.97	1,703.23	14,447,526.61	1,728,651.55	39.78205355	-80.68592925	
10,527.00	89.98	330.300	6,300.20	2,685.66	1,656.73	14,447,608.29	1,728,605.04	39.78227834	-80.68609378	
10,621.00	89.63	328.720	6,300.52	2,766.65	1,609.03	14,447,689.29	1,728,557.35	39.78250124	-80.68626252	
10,715.00	89.32	327.400	6,301.38	2,846.42	1,559.31	14,447,769.06	1,728,507.63	39.78272077	-80.68643853	
10,809.00	88.92	328.010	6,302.82	2,925.87	1,509.09	14,447,848.51	1,728,457.41	39.78293944	-80.68661628	
10,903.00	89.80	330.390	6,303.87	3,006.60	1,460.97	14,447,929.24	1,728,409.28	39.78316161	-80.68678657	
10,997.00	90.64	331.000	6,303.51	3,088.57	1,414.96	14,448,011.21	1,728,363.28	39.78338716	-80.68694932	
11,092.00	90.90	331.000	6,302.23	3,171.65	1,368.91	14,448,094.29	1,728,317.22	39.78361576	-80.68711221	
11,186.00	91.30	330.830	6,300.43	3,253.78	1,323.22	14,448,176.42	1,728,271.54	39.78384175	-80.68727381	
11,280.00	89.85	330.210	6,299.49	3,335.60	1,276.96	14,448,258.24	1,728,225.28	39.78406690	-80.68743744	
11,374.00	89.89	329.950	6,299.70	3,417.07	1,230.08	14,448,339.71	1,728,178.40	39.78429109	-80.68760332	
11,468.00	90.42	330.040	6,299.45	3,498.47	1,183.07	14,448,421.11	1,728,131.39	39.78451509	-80.68776963	
11,562.00	90.55	329.950	6,298.65	3,579.87	1,136.07	14,448,502.51	1,728,084.38	39.78473909	-80.68793594	
11,656.00	90.95	328.890	6,297.42	3,660.79	1,088.25	14,448,583.43	1,728,036.57	39.78496177	-80.68810515	
11,750.00	89.49	329.070	6,297.06	3,741.35	1,039.81	14,448,663.99	1,727,988.13	39.78518345	-80.68827657	
11,844.00	89.85	329.860	6,297.60	3,822.31	992.05	14,448,744.95	1,727,940.37	39.78540625	-80.68844557	
11,939.00	89.85	330.390	6,297.85	3,904.68	944.73	14,448,827.32	1,727,893.05	39.78563292	-80.68861299	
12,034.00	90.33	330.390	6,297.70	3,987.28	897.79	14,448,909.92	1,727,846.11	39.78586020	-80.68877905	
12,129.00	90.64	331.090	6,296.89	4,070.15	851.36	14,448,992.79	1,727,799.68	39.78608824	-80.68894330	
12,223.00	91.21	331.350	6,295.38	4,152.53	806.11	14,449,075.17	1,727,754.43	39.78631490	-80.68910336	
12,316.00	90.29	330.740	6,294.16	4,233.90	761.09	14,449,156.54	1,727,709.41	39.78653878	-80.68926261	
12,411.00	90.29	330.210	6,293.68	4,316.56	714.28	14,449,239.20	1,727,662.60	39.78676624	-80.68942823	
12,505.00	90.59	330.390	6,292.96	4,398.21	667.71	14,449,320.85	1,727,616.02	39.78699091	-80.68959300	
12,599.00	89.93	330.390	6,292.53	4,479.93	621.26	14,449,402.57	1,727,569.58	39.78721578	-80.68975732	
12,693.00	89.36	330.040	6,293.11	4,561.51	574.57	14,449,484.15	1,727,522.89	39.78744027	-80.68992253	
12,787.00	89.89	330.040	6,293.73	4,642.95	527.63	14,449,565.59	1,727,475.95	39.78766436	-80.69008863	
12,881.00	89.89	330.560	6,293.91	4,724.60	481.05	14,449,647.24	1,727,429.37	39.78788904	-80.69025341	
12,975.00	89.80	330.040	6,294.16	4,806.25	434.48	14,449,728.89	1,727,382.80	39.78811371	-80.69041819	
13,068.00	90.07	330.040	6,294.27	4,886.82	388.04	14,449,809.46	1,727,336.36	39.78833543	-80.69058253	
13,163.00	89.89	330.300	6,294.30	4,969.23	340.78	14,449,891.87	1,727,289.10	39.78856220	-80.69074973	
13,257.00	88.66	330.210	6,295.49	5,050.84	294.15	14,449,973.48	1,727,242.47	39.78878676	-80.69091473	
13,351.00	88.92	330.210	6,297.48	5,132.40	247.46	14,450,055.04	1,727,195.78	39.78901118	-80.69107994	
13,445.00	89.58	330.040	6,298.71	5,213.90	200.64	14,450,136.54	1,727,148.96	39.78923545	-80.69124560	
13,539.00	90.11	329.880	6,298.96	5,295.27	153.57	14,450,217.91	1,727,101.89	39.78945935	-80.69141216	
13,634.00	90.73	329.510	6,298.26	5,377.27	105.62	14,450,299.91	1,727,053.94	39.78968501	-80.69158185	



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Keith Stern N-07 HM (slot T)
<b>Project:</b>	Marshall County, West Virginia.	<b>TVD Reference:</b>	RKB=748+33 @ 781.00usft (Nabors X08)
<b>Site:</b>	Keith Stern	<b>MD Reference:</b>	RKB=748+33 @ 781.00usft (Nabors X08)
<b>Well:</b>	Keith Stern N-07 HM (slot T)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Original Hole	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Original Hole	<b>Database:</b>	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	
13,728.00	91.25	329.070	6,296.64	5,458.08	57.62	14,450,380.72	1,727,005.94	39.78990738	-80.69175172	
13,822.00	89.98	328.720	6,295.63	5,538.56	9.07	14,450,461.20	1,726,957.38	39.79012885	-80.69192360	
13,917.00	89.58	328.100	6,296.00	5,619.48	-40.70	14,450,542.12	1,726,907.62	39.79035155	-80.69209976	
14,012.00	90.59	328.540	6,295.86	5,700.32	-90.59	14,450,622.96	1,726,857.73	39.79057404	-80.69227637	
14,106.00	90.99	327.310	6,294.56	5,779.97	-140.50	14,450,702.60	1,726,807.82	39.79079323	-80.69245307	
14,201.00	89.76	326.780	6,293.94	5,859.68	-192.18	14,450,782.32	1,726,756.14	39.79101262	-80.69263606	
14,295.00	89.54	329.330	6,294.51	5,939.43	-241.91	14,450,862.07	1,726,706.41	39.79123212	-80.69281212	
14,390.00	90.24	332.590	6,294.69	6,022.48	-288.02	14,450,945.12	1,726,660.30	39.79146062	-80.69297525	
14,452.00	89.67	331.180	6,294.74	6,077.16	-317.23	14,450,999.80	1,726,631.09	39.79161106	-80.69307859	
<b>Survey @ 14452.00 MD 6294.74 TVD</b>										
14,510.00	89.67	331.180	6,295.08	6,127.97	-345.19	14,451,050.61	1,726,603.13	39.79175088	-80.69317750	
<b>Survey Proj. to 14510.00 MD 6295.08 TVD</b>										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
197.00	197.00	-0.45	0.10	MWD surveys	
14,452.00	6,294.74	6,077.16	-317.23	Survey @ 14452.00 MD 6294.74 TVD	
14,510.00	6,295.08	6,127.97	-345.19	Survey Proj. to 14510.00 MD 6295.08 TVD	

Checked By: \_\_\_\_\_ Approved By: \_\_\_\_\_ Date: \_\_\_\_\_