



Well: Old Crow N-02 HM (slot L)
 Site: Old Crow Pad
 Project: Marshall County, West Virginia.
 Design: rev5
 Rig: Nabors X14

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	V Sect	Annotation
1	5138.00	36.62	348.50	4944.33	906.55	-184.14	0.00	0.00	888.20	Survey @ 5138.00 MD 4944.33 TVD
2	5338.00	36.62	348.50	5104.85	1023.46	-207.92	0.00	0.00	1002.76	KOP Begin 2°/100' build/turn
3	5380.77	37.07	349.72	5139.08	1048.64	-212.77	2.00	58.96	1027.30	Begin 37.07° tangent
4	6883.67	37.07	349.72	6338.29	1939.97	-374.49	0.00	0.00	1891.60	Begin 8°/100' build/turn
5	7058.11	50.00	342.03	6464.57	2055.82	-404.64	8.00	-25.14	2008.18	Begin 10°/100' build/turn
6	7483.37	91.00	329.67	6604.00	2410.71	-569.89	10.00	-18.45	2399.21	Begin 91.00° lateral
7	21005.75	91.00	329.67	6368.00	14081.11	-7396.38	0.00	0.00	15905.47	PBHL/TD 21005.75 MD 6368.00 TVD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	V Sect	Annotation
189.00	0.44	241.47	189.00	-0.35	-0.64	-0.01	MWD surveys
20954.00	90.68	330.22	6485.68	14033.24	-7393.54	15861.77	Survey @ 20954.00 MD 6485.68 TVD
21009.00	90.68	330.22	6485.03	14080.97	-7420.86	15916.73	Survey Proj. to 21009.00 MD 6485.03 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=1265+32.5 @ 1297.50usft (Nabors X14)

Northing: 14446163.99 Easting: 1706956.62 Latitude: 39.77849473 Longitude: -80.76316415

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.77°

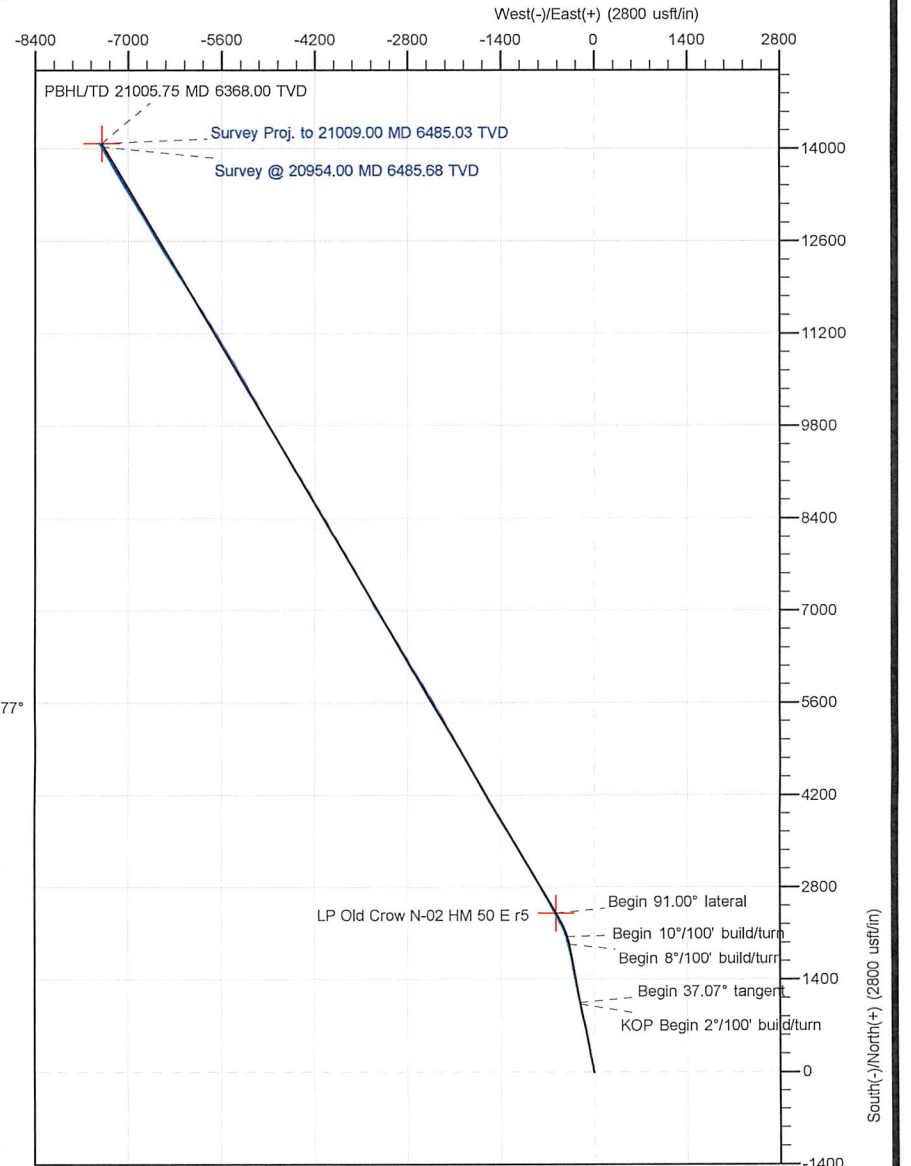
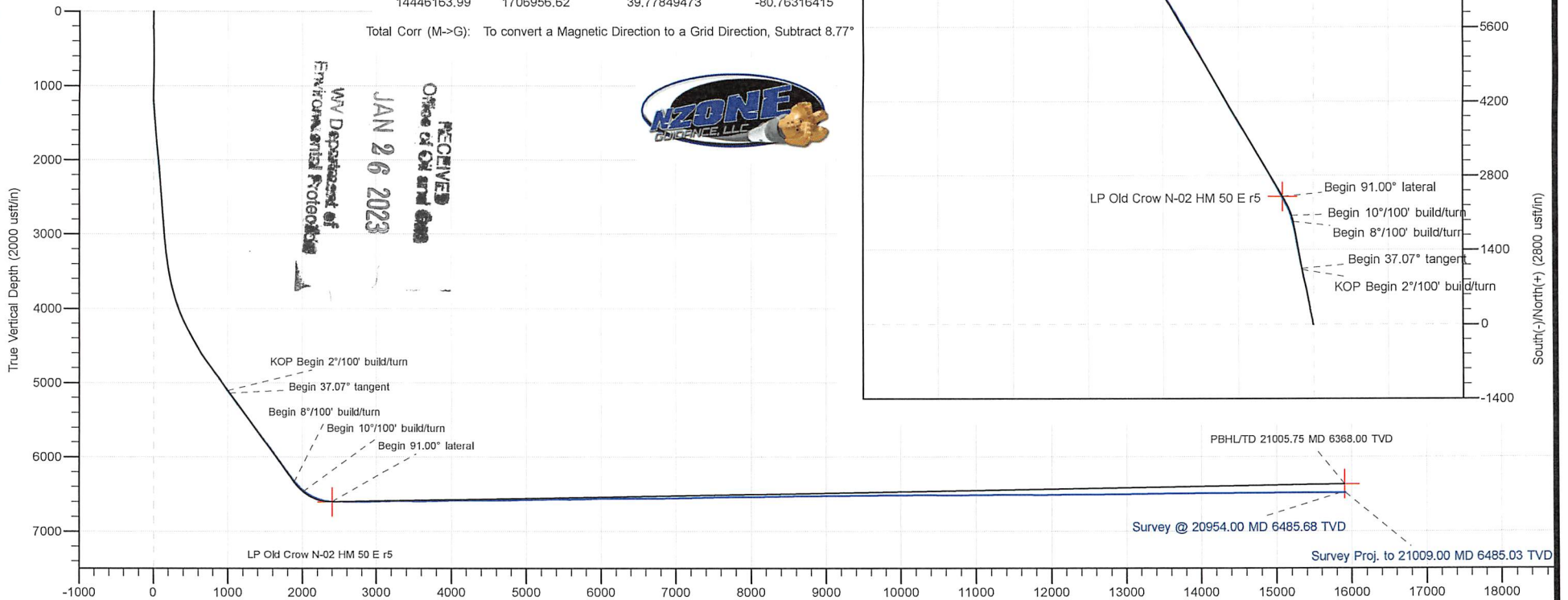


Azimuths to Grid North
 True North: -0.15°
 Magnetic North: -8.77°

Magnetic Field
 Strength: 51731.1nT
 Dip Angle: 66.52°
 Date: 8/17/2021
 Model: IGRF2020



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Vertical Section at 332.29° (2000 usft/in)



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-02 HM (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Well:	Old Crow N-02 HM (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

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	Old Crow Pad				
Site Position:		Northing:	14,446,179.89 usft	Latitude:	39.77853828
From:	Lat/Long	Easting:	1,706,970.33 usft	Longitude:	-80.76311519
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.15 °

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Environmental Protection

Well	Old Crow N-02 HM (slot L)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,163.99 usft	Latitude:	39.77849473
	+E/-W	0.00 usft	Easting:	1,706,956.62 usft	Longitude:	-80.76316415
Position Uncertainty	0.00 usft		Wellhead Elevation:	usft	Ground Level:	1,265.00 usft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	8/17/2021	-8.62	66.52	51,731.12434556

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	332.29	

Survey Program	Date	1/10/2022			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
189.00	1,012.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,072.00	2,828.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,874.00	20,954.00	MWD (Original Hole)	MWD	MWD - Standard	
21,009.00	21,009.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.00	0.00	0.00	0.00	14,446,163.99	1,706,956.62	39.77849473	-80.76316415	
189.00	0.44	241.47	189.00	-0.35	-0.64	14,446,163.65	1,706,955.98	39.77849378	-80.76316642	
MWD surveys										
236.00	0.41	244.98	236.00	-0.50	-0.95	14,446,163.49	1,706,955.67	39.77849335	-80.76316753	
279.00	0.24	252.70	279.00	-0.60	-1.17	14,446,163.40	1,706,955.44	39.77849310	-80.76316833	
326.00	0.13	250.64	326.00	-0.64	-1.32	14,446,163.35	1,706,955.30	39.77849298	-80.76316885	
369.00	0.24	217.42	369.00	-0.73	-1.42	14,446,163.26	1,706,955.20	39.77849274	-80.76316921	
416.00	0.20	238.94	416.00	-0.85	-1.55	14,446,163.14	1,706,955.07	39.77849241	-80.76316967	
459.00	0.10	251.82	459.00	-0.90	-1.65	14,446,163.09	1,706,954.97	39.77849227	-80.76317003	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-02 HM (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Well:	Old Crow N-02 HM (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
506.00	0.20	186.74	506.00	-1.00	-1.70	14,446,163.00	1,706,954.92	39.77849201	-80.76317020
549.00	0.17	189.73	548.99	-1.13	-1.72	14,446,162.86	1,706,954.90	39.77849163	-80.76317027
596.00	0.13	183.62	595.99	-1.25	-1.73	14,446,162.74	1,706,954.88	39.77849130	-80.76317033
639.00	0.10	183.05	638.99	-1.34	-1.74	14,446,162.65	1,706,954.88	39.77849106	-80.76317035
686.00	0.08	214.04	685.99	-1.41	-1.76	14,446,162.58	1,706,954.86	39.77849087	-80.76317042
730.00	0.19	219.13	729.99	-1.49	-1.82	14,446,162.50	1,706,954.80	39.77849065	-80.76317065
777.00	0.17	201.10	776.99	-1.62	-1.90	14,446,162.38	1,706,954.72	39.77849031	-80.76317091
824.00	0.07	248.47	823.99	-1.69	-1.95	14,446,162.30	1,706,954.67	39.77849010	-80.76317110
871.00	0.13	200.93	870.99	-1.75	-1.99	14,446,162.24	1,706,954.62	39.77848993	-80.76317126
919.00	0.14	151.13	918.99	-1.85	-1.98	14,446,162.14	1,706,954.63	39.77848965	-80.76317123
1,012.00	0.08	182.40	1,011.99	-2.02	-1.93	14,446,161.97	1,706,954.68	39.77848920	-80.76317105
1,072.00	0.20	289.89	1,071.99	-2.03	-2.03	14,446,161.97	1,706,954.58	39.77848918	-80.76317140
1,119.00	0.51	338.76	1,118.99	-1.80	-2.19	14,446,162.19	1,706,954.43	39.77848980	-80.76317195
1,167.00	1.10	347.09	1,166.99	-1.15	-2.37	14,446,162.84	1,706,954.25	39.77849158	-80.76317258
1,214.00	2.17	353.75	1,213.97	0.17	-2.56	14,446,164.16	1,706,954.05	39.77849522	-80.76317327
1,272.00	3.63	356.11	1,271.89	3.09	-2.81	14,446,167.09	1,706,953.81	39.77850325	-80.76317411
1,366.00	5.81	354.65	1,365.57	10.80	-3.45	14,446,174.79	1,706,953.16	39.77852442	-80.76317634
1,460.00	6.62	352.36	1,459.01	20.91	-4.62	14,446,184.90	1,706,952.00	39.77855218	-80.76318039
1,555.00	5.15	344.11	1,553.51	30.44	-6.51	14,446,194.43	1,706,950.10	39.77857837	-80.76318704
1,649.00	4.66	337.42	1,647.17	38.02	-9.13	14,446,202.01	1,706,947.48	39.77859921	-80.76319630
1,742.00	4.51	345.99	1,739.87	45.06	-11.47	14,446,209.05	1,706,945.15	39.77861855	-80.76320455
1,836.00	5.44	356.22	1,833.52	53.09	-12.66	14,446,217.08	1,706,943.96	39.77864062	-80.76320870
1,930.00	5.93	356.11	1,927.06	62.38	-13.28	14,446,226.37	1,706,943.34	39.77866614	-80.76321083
2,024.00	6.65	354.28	2,020.49	72.64	-14.15	14,446,236.63	1,706,942.46	39.77869432	-80.76321384
2,118.00	5.61	347.96	2,113.95	82.55	-15.65	14,446,246.54	1,706,940.96	39.77872155	-80.76321909
2,212.00	4.75	344.81	2,207.57	90.80	-17.63	14,446,254.79	1,706,938.98	39.77874422	-80.76322605
2,306.00	5.14	341.46	2,301.22	98.55	-19.99	14,446,262.54	1,706,936.63	39.77876551	-80.76323438
2,401.00	4.26	350.60	2,395.90	106.06	-21.92	14,446,270.06	1,706,934.70	39.77878617	-80.76324117
2,495.00	4.32	356.27	2,489.64	113.04	-22.72	14,446,277.03	1,706,933.90	39.77880534	-80.76324396
2,589.00	4.61	350.30	2,583.35	120.30	-23.59	14,446,284.29	1,706,933.03	39.77882527	-80.76324697
2,683.00	4.98	340.57	2,677.02	127.87	-25.58	14,446,291.86	1,706,931.04	39.77884608	-80.76325400
2,778.00	4.29	352.37	2,771.71	135.28	-27.42	14,446,299.27	1,706,929.19	39.77886644	-80.76326049
2,828.00	4.37	355.55	2,821.57	139.03	-27.82	14,446,303.03	1,706,928.80	39.77887675	-80.76326187
2,874.00	4.45	356.04	2,867.44	142.56	-28.08	14,446,306.55	1,706,928.54	39.77888644	-80.76326275
2,968.00	3.93	349.63	2,961.18	149.37	-28.91	14,446,313.36	1,706,927.70	39.77890514	-80.76326565
3,062.00	5.50	347.81	3,054.86	156.94	-30.44	14,446,320.93	1,706,926.17	39.77892595	-80.76327103
3,157.00	5.37	343.43	3,149.44	165.65	-32.67	14,446,329.64	1,706,923.94	39.77894989	-80.76327888
3,251.00	6.97	350.92	3,242.89	175.50	-34.83	14,446,339.49	1,706,921.79	39.77897695	-80.76328646
3,345.00	9.12	347.75	3,335.96	188.41	-37.31	14,446,352.40	1,706,919.31	39.77901243	-80.76329517
3,438.00	8.87	343.65	3,427.82	202.49	-40.89	14,446,366.49	1,706,915.73	39.77905113	-80.76330778
3,532.00	10.01	347.61	3,520.54	217.43	-44.68	14,446,381.42	1,706,911.93	39.77909217	-80.76332115
3,626.00	11.52	349.49	3,612.89	234.64	-48.15	14,446,398.63	1,706,908.47	39.77913946	-80.76333332
3,720.00	14.00	350.24	3,704.56	255.07	-51.79	14,446,419.07	1,706,904.83	39.77919561	-80.76334608
3,815.00	16.34	348.56	3,796.24	279.50	-56.39	14,446,443.50	1,706,900.23	39.77926273	-80.76336222
3,909.00	18.64	350.54	3,885.89	307.28	-61.48	14,446,471.28	1,706,895.14	39.77933906	-80.76338009
4,008.00	21.58	350.31	3,978.85	340.84	-67.15	14,446,504.84	1,706,889.47	39.77943127	-80.76339994
4,103.00	22.86	349.93	4,066.79	376.23	-73.31	14,446,540.23	1,706,883.30	39.77952851	-80.76342156
4,198.00	23.88	348.16	4,154.00	413.22	-80.49	14,446,577.22	1,706,876.13	39.77963014	-80.76344674
4,292.00	26.73	348.65	4,238.97	452.58	-88.55	14,446,616.57	1,706,868.06	39.77973829	-80.76347508
4,386.00	28.44	349.62	4,322.28	495.33	-96.75	14,446,659.32	1,706,859.87	39.77985574	-80.76350384
4,479.00	29.61	350.42	4,403.60	539.77	-104.56	14,446,703.76	1,706,852.06	39.77997784	-80.76353123
4,573.00	30.98	350.00	4,484.76	586.49	-112.63	14,446,750.49	1,706,843.99	39.78010622	-80.76355951
4,667.00	32.53	347.91	4,564.69	635.04	-122.12	14,446,799.03	1,706,834.50	39.78023960	-80.76359285
4,761.00	35.18	347.51	4,642.74	686.20	-133.27	14,446,850.19	1,706,823.34	39.78038018	-80.76363206
4,856.00	37.43	348.44	4,719.30	741.21	-144.98	14,446,905.20	1,706,811.64	39.78053134	-80.76367321



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-02 HM (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Well:	Old Crow N-02 HM (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
4,950.00	37.35	346.65	4,793.99	796.94	-157.29	14,446,960.93	1,706,799.33	39.78068449	-80.76371650
5,044.00	36.82	344.90	4,868.98	851.88	-171.21	14,447,015.87	1,706,785.41	39.78083547	-80.76376553
5,138.00	36.62	348.50	4,944.33	906.55	-184.14	14,447,070.55	1,706,772.48	39.78098571	-80.76381104
5,176.00	36.35	348.94	4,974.88	928.71	-188.56	14,447,092.71	1,706,768.06	39.78104660	-80.76382656
5,271.00	35.96	347.27	5,051.59	983.55	-200.11	14,447,147.55	1,706,756.51	39.78119729	-80.76386715
5,366.00	36.09	347.45	5,128.42	1,038.07	-212.33	14,447,202.07	1,706,744.28	39.78134710	-80.76391016
5,460.00	36.75	350.09	5,204.07	1,092.80	-223.19	14,447,256.80	1,706,733.43	39.78149748	-80.76394829
5,554.00	37.36	350.26	5,279.08	1,148.61	-232.85	14,447,312.61	1,706,723.76	39.78165083	-80.76398216
5,648.00	37.58	350.53	5,353.69	1,205.00	-242.39	14,447,368.99	1,706,714.22	39.78180574	-80.76401560
5,741.00	38.33	349.56	5,427.02	1,261.33	-252.29	14,447,425.32	1,706,704.33	39.78196052	-80.76405028
5,835.00	37.27	347.80	5,501.30	1,317.82	-263.58	14,447,481.81	1,706,693.03	39.78211574	-80.76408996
5,929.00	37.23	347.19	5,576.12	1,373.37	-275.90	14,447,537.36	1,706,680.71	39.78226837	-80.76413329
6,023.00	37.54	349.47	5,650.81	1,429.25	-287.44	14,447,593.25	1,706,669.17	39.78242194	-80.76417384
6,118.00	38.15	350.70	5,725.83	1,486.67	-297.47	14,447,650.66	1,706,659.14	39.78257968	-80.76420901
6,212.00	37.01	348.77	5,800.33	1,543.07	-307.68	14,447,707.07	1,706,648.94	39.78273466	-80.76424479
6,306.00	37.27	348.59	5,875.26	1,598.72	-318.82	14,447,762.71	1,706,637.80	39.78288757	-80.76428393
6,398.00	37.14	350.09	5,948.54	1,653.39	-329.11	14,447,817.38	1,706,627.51	39.78303777	-80.76432004
6,493.00	37.54	350.61	6,024.07	1,710.19	-338.76	14,447,874.19	1,706,617.85	39.78319384	-80.76435389
6,586.00	37.54	350.35	6,097.81	1,766.08	-348.14	14,447,930.07	1,706,608.48	39.78334739	-80.76438673
6,681.00	37.41	350.35	6,173.21	1,823.06	-357.83	14,447,987.05	1,706,598.79	39.78350395	-80.76442068
6,775.00	37.27	350.00	6,247.94	1,879.24	-367.55	14,448,043.23	1,706,589.06	39.78365830	-80.76445478
6,822.00	36.62	349.21	6,285.50	1,907.02	-372.65	14,448,071.02	1,706,583.97	39.78373464	-80.76447266
6,869.00	36.84	347.98	6,323.17	1,934.58	-378.21	14,448,098.57	1,706,578.41	39.78381035	-80.76449219
6,916.00	40.04	346.48	6,359.98	1,963.06	-384.68	14,448,127.06	1,706,571.94	39.78388863	-80.76451495
6,964.00	43.65	344.29	6,395.74	1,994.03	-392.78	14,448,158.03	1,706,563.84	39.78397374	-80.76454349
7,011.00	47.87	342.18	6,428.52	2,026.26	-402.51	14,448,190.25	1,706,554.11	39.78406231	-80.76457783
7,058.00	51.47	340.95	6,458.94	2,060.24	-413.85	14,448,224.23	1,706,542.77	39.78415571	-80.76461787
7,105.00	55.38	339.19	6,486.94	2,095.71	-426.72	14,448,259.70	1,706,529.89	39.78425321	-80.76466337
7,152.00	59.47	337.17	6,512.24	2,132.46	-441.45	14,448,296.46	1,706,515.16	39.78435425	-80.76471546
7,199.00	63.60	336.11	6,534.64	2,170.38	-457.84	14,448,334.37	1,706,498.78	39.78445850	-80.76477344
7,246.00	67.91	333.92	6,553.93	2,209.21	-475.95	14,448,373.20	1,706,480.67	39.78456526	-80.76483753
7,293.00	72.22	333.83	6,569.95	2,248.87	-495.40	14,448,412.86	1,706,461.22	39.78467432	-80.76490640
7,340.00	76.40	333.04	6,582.66	2,289.33	-515.63	14,448,453.32	1,706,440.98	39.78478558	-80.76497804
7,387.00	81.67	332.07	6,591.60	2,330.26	-536.90	14,448,494.25	1,706,419.72	39.78489815	-80.76505335
7,434.00	84.88	331.37	6,597.10	2,371.36	-559.01	14,448,535.35	1,706,397.61	39.78501118	-80.76513167
7,481.00	86.77	330.93	6,600.52	2,412.41	-581.62	14,448,576.41	1,706,374.99	39.78512409	-80.76521180
7,528.00	90.24	330.93	6,601.75	2,453.47	-604.45	14,448,617.47	1,706,352.17	39.78523701	-80.76529266
7,622.00	90.02	330.84	6,601.54	2,535.60	-650.19	14,448,699.59	1,706,306.43	39.78546287	-80.76545470
7,716.00	89.63	330.75	6,601.82	2,617.65	-696.05	14,448,781.64	1,706,260.56	39.78568853	-80.76561720
7,810.00	90.46	329.96	6,601.75	2,699.34	-742.55	14,448,863.33	1,706,214.07	39.78591322	-80.76578195
7,904.00	90.81	330.22	6,600.71	2,780.82	-789.42	14,448,944.81	1,706,167.20	39.78613731	-80.76594803
7,999.00	91.16	329.78	6,599.07	2,863.08	-836.91	14,449,027.07	1,706,119.71	39.78636356	-80.76611632
8,093.00	91.56	329.70	6,596.84	2,944.24	-884.26	14,449,108.24	1,706,072.35	39.78658681	-80.76628413
8,185.00	90.42	329.96	6,595.25	3,023.77	-930.49	14,449,187.76	1,706,026.12	39.78680554	-80.76644796
8,280.00	90.55	329.35	6,594.45	3,105.75	-978.48	14,449,269.74	1,705,978.13	39.78703103	-80.76661803
8,373.00	90.95	330.14	6,593.23	3,186.08	-1,025.34	14,449,350.07	1,705,931.28	39.78725196	-80.76678407
8,468.00	89.36	330.05	6,592.98	3,268.42	-1,072.70	14,449,432.42	1,705,883.92	39.78747845	-80.76695191
8,562.00	89.10	329.61	6,594.24	3,349.68	-1,119.94	14,449,513.68	1,705,836.68	39.78770194	-80.76711931
8,657.00	90.68	329.87	6,594.42	3,431.74	-1,167.81	14,449,595.73	1,705,788.81	39.78792762	-80.76728896
8,751.00	91.08	329.52	6,592.98	3,512.88	-1,215.23	14,449,676.87	1,705,741.38	39.78815081	-80.76745703
8,845.00	91.12	329.70	6,591.17	3,593.95	-1,262.78	14,449,757.94	1,705,693.84	39.78837379	-80.76762553
8,939.00	91.65	328.91	6,588.90	3,674.76	-1,310.75	14,449,838.75	1,705,645.87	39.78859604	-80.76779555
9,034.00	90.99	329.52	6,586.71	3,756.35	-1,359.36	14,449,920.34	1,705,597.26	39.78882046	-80.76796783
9,129.00	89.89	329.52	6,585.98	3,838.22	-1,407.54	14,450,002.21	1,705,549.07	39.78904564	-80.76813861
9,223.00	89.63	328.99	6,586.38	3,919.00	-1,455.60	14,450,083.00	1,705,501.02	39.78926784	-80.76830893

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-02 HM (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Well:	Old Crow N-02 HM (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
9,317.00	90.46	329.78	6,586.30	3,999.90	-1,503.47	14,450,163.89	1,705,453.15	39.78949034	-80.76847859	
9,412.00	90.55	329.43	6,585.47	4,081.84	-1,551.53	14,450,245.83	1,705,405.09	39.78971571	-80.76864894	
9,506.00	90.24	328.99	6,584.82	4,162.59	-1,599.65	14,450,326.58	1,705,356.97	39.78993781	-80.76881949	
9,600.00	90.24	328.99	6,584.42	4,243.15	-1,648.08	14,450,407.15	1,705,308.54	39.79015941	-80.76899114	
9,692.00	89.67	330.40	6,584.50	4,322.58	-1,694.50	14,450,486.57	1,705,262.12	39.79037786	-80.76915567	
9,787.00	90.51	330.66	6,584.35	4,405.28	-1,741.23	14,450,569.28	1,705,215.38	39.79060533	-80.76932129	
9,880.00	90.29	329.70	6,583.70	4,485.97	-1,787.48	14,450,649.96	1,705,169.14	39.79082723	-80.76948517	
9,974.00	92.18	329.35	6,581.67	4,566.96	-1,835.14	14,450,730.95	1,705,121.48	39.79105000	-80.76965410	
10,068.00	90.42	330.40	6,579.54	4,648.24	-1,882.30	14,450,812.23	1,705,074.32	39.79127354	-80.76982125	
10,163.00	91.52	331.19	6,577.93	4,731.15	-1,928.65	14,450,895.14	1,705,027.97	39.79150156	-80.76998548	
10,256.00	91.08	330.66	6,575.82	4,812.41	-1,973.83	14,450,976.40	1,704,982.79	39.79172504	-80.77014558	
10,351.00	91.12	330.14	6,574.00	4,894.99	-2,020.74	14,451,058.99	1,704,935.87	39.79195217	-80.77031184	
10,446.00	91.21	330.14	6,572.07	4,977.36	-2,068.03	14,451,141.36	1,704,888.58	39.79217872	-80.77047944	
10,540.00	89.49	330.75	6,571.49	5,059.13	-2,114.40	14,451,223.12	1,704,842.22	39.79240359	-80.77064375	
10,634.00	88.66	330.58	6,573.01	5,141.06	-2,160.44	14,451,305.06	1,704,796.17	39.79262893	-80.77080692	
10,727.00	89.98	329.96	6,574.11	5,221.81	-2,206.56	14,451,385.81	1,704,750.06	39.79285102	-80.77097036	
10,821.00	92.57	331.72	6,572.02	5,303.87	-2,252.34	14,451,467.86	1,704,704.27	39.79307669	-80.77113261	
10,915.00	92.70	331.72	6,567.70	5,386.56	-2,296.83	14,451,550.56	1,704,659.78	39.79330410	-80.77129024	
11,008.00	91.25	331.28	6,564.49	5,468.24	-2,341.18	14,451,632.24	1,704,615.44	39.79352872	-80.77144737	
11,102.00	90.24	329.43	6,563.27	5,549.93	-2,387.67	14,451,713.92	1,704,568.95	39.79375338	-80.77161213	
11,196.00	91.08	328.91	6,562.19	5,630.64	-2,435.84	14,451,794.63	1,704,520.78	39.79397537	-80.77178289	
11,290.00	90.99	328.91	6,560.49	5,711.12	-2,484.37	14,451,875.12	1,704,472.25	39.79419674	-80.77195494	
11,384.00	90.07	328.55	6,559.62	5,791.46	-2,533.16	14,451,955.46	1,704,423.46	39.79441771	-80.77212791	
11,478.00	89.58	329.08	6,559.91	5,871.88	-2,581.83	14,452,035.87	1,704,374.78	39.79463890	-80.77230046	
11,572.00	89.32	329.17	6,560.81	5,952.55	-2,630.07	14,452,116.55	1,704,326.55	39.79486079	-80.77247145	
11,666.00	89.76	329.26	6,561.57	6,033.30	-2,678.18	14,452,197.30	1,704,278.44	39.79508289	-80.77264200	
11,761.00	90.02	329.52	6,561.75	6,115.07	-2,726.55	14,452,279.06	1,704,230.06	39.79530777	-80.77281347	
11,855.00	90.64	329.96	6,561.21	6,196.26	-2,773.92	14,452,360.25	1,704,182.70	39.79553107	-80.77298138	
11,949.00	90.73	329.52	6,560.08	6,277.44	-2,821.29	14,452,441.44	1,704,135.33	39.79575436	-80.77314927	
12,043.00	90.64	329.08	6,558.96	6,358.26	-2,869.27	14,452,522.26	1,704,087.34	39.79597665	-80.77331939	
12,137.00	91.34	329.35	6,557.34	6,439.01	-2,917.18	14,452,603.00	1,704,039.24	39.79619872	-80.77348992	
12,231.00	91.52	329.43	6,554.99	6,519.88	-2,965.23	14,452,683.88	1,703,991.39	39.79642116	-80.77365954	
12,325.00	91.65	328.91	6,552.39	6,600.57	-3,013.38	14,452,764.56	1,703,943.24	39.79664308	-80.77383026	
12,419.00	91.52	328.20	6,549.79	6,680.73	-3,062.40	14,452,844.73	1,703,894.22	39.79686357	-80.77400406	
12,514.00	91.56	328.03	6,547.24	6,761.37	-3,112.56	14,452,925.36	1,703,844.05	39.79708537	-80.77418192	
12,607.00	91.03	328.64	6,545.13	6,840.50	-3,161.37	14,453,004.50	1,703,795.25	39.79730303	-80.77435498	
12,701.00	90.99	328.99	6,543.48	6,920.91	-3,210.04	14,453,084.90	1,703,746.58	39.79752418	-80.77452752	
12,796.00	91.47	328.47	6,541.44	7,002.09	-3,259.34	14,453,166.08	1,703,697.28	39.79774747	-80.77470231	
12,889.00	90.29	329.87	6,540.01	7,081.93	-3,306.99	14,453,245.93	1,703,649.63	39.79796707	-80.77487126	
12,983.00	90.81	330.40	6,539.11	7,163.45	-3,353.80	14,453,327.44	1,703,602.82	39.79819125	-80.77503717	
13,078.00	89.27	330.40	6,539.04	7,246.04	-3,400.72	14,453,410.04	1,703,555.90	39.79841842	-80.77520349	
13,172.00	90.24	330.84	6,539.44	7,327.95	-3,446.83	14,453,491.95	1,703,509.78	39.79864368	-80.77536694	
13,266.00	90.33	331.10	6,538.98	7,410.14	-3,492.45	14,453,574.14	1,703,464.17	39.79886970	-80.77552861	
13,361.00	91.43	329.70	6,537.52	7,492.73	-3,539.36	14,453,656.73	1,703,417.25	39.79909684	-80.77569491	
13,455.00	91.74	330.05	6,534.92	7,574.00	-3,586.52	14,453,738.00	1,703,370.09	39.79932036	-80.77586209	
13,549.00	90.81	329.87	6,532.82	7,655.36	-3,633.57	14,453,819.35	1,703,323.05	39.79954410	-80.77602886	
13,643.00	91.34	330.14	6,531.06	7,736.75	-3,680.55	14,453,900.75	1,703,276.06	39.79976795	-80.77619542	
13,737.00	90.11	329.87	6,529.87	7,818.15	-3,727.54	14,453,982.15	1,703,229.08	39.79999183	-80.77636199	
13,831.00	89.80	330.05	6,529.95	7,899.53	-3,774.60	14,454,063.52	1,703,182.02	39.80021563	-80.77652881	
13,926.00	90.64	330.58	6,529.58	7,982.06	-3,821.64	14,454,146.05	1,703,134.97	39.80044260	-80.77669558	
14,020.00	91.30	331.02	6,527.99	8,064.10	-3,867.50	14,454,228.09	1,703,089.12	39.80066822	-80.77686810	
14,114.00	90.64	329.26	6,526.40	8,145.61	-3,914.29	14,454,309.60	1,703,042.33	39.80089238	-80.77702398	
14,208.00	90.07	329.17	6,525.82	8,226.36	-3,962.40	14,454,390.35	1,702,994.22	39.80111448	-80.77719455	
14,303.00	90.42	329.52	6,525.41	8,308.08	-4,010.84	14,454,472.08	1,702,945.78	39.80133924	-80.77736629	
14,396.00	90.20	329.08	6,524.91	8,388.05	-4,058.31	14,454,552.04	1,702,898.30	39.80155917	-80.77753463	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-02 HM (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Well:	Old Crow N-02 HM (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
14,490.00	90.68	328.91	6,524.18	8,468.61	-4,106.73	14,454,632.61	1,702,849.88	39.80178076	-80.77770631	
14,584.00	90.07	329.61	6,523.57	8,549.40	-4,154.78	14,454,713.40	1,702,801.84	39.80200296	-80.77787666	
14,679.00	90.42	330.14	6,523.16	8,631.57	-4,202.46	14,454,795.57	1,702,754.16	39.80222894	-80.77804570	
14,773.00	90.37	329.26	6,522.52	8,712.73	-4,249.88	14,454,876.72	1,702,706.73	39.80245214	-80.77821383	
14,868.00	91.21	329.26	6,521.21	8,794.37	-4,298.44	14,454,958.37	1,702,658.18	39.80267668	-80.77838599	
14,962.00	90.95	328.38	6,519.43	8,874.78	-4,347.09	14,455,038.77	1,702,609.52	39.80289783	-80.77855853	
15,057.00	90.37	329.43	6,518.34	8,956.12	-4,396.15	14,455,120.11	1,702,560.46	39.80312155	-80.77873249	
15,151.00	89.54	329.87	6,518.41	9,037.24	-4,443.65	14,455,201.23	1,702,512.97	39.80334464	-80.77890089	
15,245.00	90.46	330.05	6,518.41	9,118.61	-4,490.70	14,455,282.60	1,702,465.91	39.80356843	-80.77906772	
15,339.00	90.24	328.91	6,517.84	9,199.58	-4,538.44	14,455,363.58	1,702,418.18	39.80379113	-80.77923697	
15,433.00	89.36	329.35	6,518.17	9,280.26	-4,586.67	14,455,444.26	1,702,369.95	39.80401303	-80.77940799	
15,527.00	89.93	329.61	6,518.75	9,361.24	-4,634.41	14,455,525.23	1,702,322.21	39.80423573	-80.77957725	
15,622.00	89.10	328.99	6,519.55	9,442.92	-4,682.90	14,455,606.92	1,702,273.71	39.80446038	-80.77974922	
15,716.00	89.89	329.17	6,520.38	9,523.56	-4,731.20	14,455,687.55	1,702,225.41	39.80468216	-80.77992049	
15,810.00	90.73	329.35	6,519.87	9,604.35	-4,779.25	14,455,768.34	1,702,177.37	39.80490435	-80.78009085	
15,904.00	89.67	329.87	6,519.55	9,685.43	-4,826.80	14,455,849.43	1,702,129.82	39.80512735	-80.78025946	
15,999.00	90.73	330.05	6,519.21	9,767.67	-4,874.36	14,455,931.66	1,702,082.26	39.80535352	-80.78042807	
16,092.00	91.25	330.31	6,517.61	9,848.34	-4,920.60	14,456,012.34	1,702,036.02	39.80557538	-80.78059201	
16,186.00	90.84	331.10	6,516.06	9,930.31	-4,966.59	14,456,094.30	1,701,990.03	39.80580079	-80.78075505	
16,281.00	90.24	330.66	6,515.33	10,013.30	-5,012.81	14,456,177.29	1,701,943.80	39.80602901	-80.78091893	
16,375.00	90.64	330.93	6,514.61	10,095.35	-5,058.68	14,456,259.34	1,701,897.94	39.80625465	-80.78108153	
16,469.00	91.38	331.19	6,512.95	10,177.60	-5,104.16	14,456,341.59	1,701,852.46	39.80648083	-80.78124275	
16,563.00	90.15	330.49	6,511.69	10,259.67	-5,149.95	14,456,423.67	1,701,806.66	39.80670654	-80.78140510	
16,658.00	88.88	330.93	6,512.50	10,342.52	-5,196.43	14,456,506.52	1,701,760.19	39.80693438	-80.78156986	
16,752.00	89.45	331.19	6,513.87	10,424.78	-5,241.91	14,456,588.77	1,701,714.71	39.80716057	-80.78173109	
16,846.00	90.20	331.72	6,514.15	10,507.35	-5,286.83	14,456,671.34	1,701,669.79	39.80738764	-80.78189032	
16,941.00	90.46	329.78	6,513.61	10,590.23	-5,333.24	14,456,754.22	1,701,623.37	39.80761556	-80.78205487	
17,033.00	91.25	329.70	6,512.23	10,669.68	-5,379.60	14,456,833.88	1,701,577.02	39.80783408	-80.78221925	
17,128.00	90.55	328.91	6,510.74	10,751.36	-5,428.09	14,456,915.36	1,701,528.53	39.80805872	-80.78239120	
17,222.00	91.43	329.35	6,509.12	10,832.03	-5,476.31	14,456,996.03	1,701,480.31	39.80828058	-80.78256221	
17,316.00	90.46	328.99	6,507.57	10,912.74	-5,524.48	14,457,076.73	1,701,432.14	39.80850254	-80.78273303	
17,409.00	89.49	328.91	6,507.61	10,992.41	-5,572.44	14,457,156.41	1,701,384.17	39.80872166	-80.78290314	
17,503.00	90.07	329.17	6,507.97	11,073.02	-5,620.80	14,457,237.01	1,701,335.82	39.80894335	-80.78307464	
17,597.00	89.76	329.26	6,508.11	11,153.77	-5,668.91	14,457,317.77	1,701,287.71	39.80916544	-80.78324526	
17,691.00	90.33	328.91	6,508.03	11,234.42	-5,717.20	14,457,398.41	1,701,239.41	39.80938724	-80.78341653	
17,786.00	90.77	328.64	6,507.12	11,315.65	-5,766.45	14,457,479.65	1,701,190.17	39.80961066	-80.78359119	
17,880.00	89.54	328.38	6,506.87	11,395.81	-5,815.55	14,457,559.80	1,701,141.07	39.80983111	-80.78376533	
17,974.00	89.98	328.55	6,507.26	11,475.93	-5,864.71	14,457,639.92	1,701,091.90	39.81005146	-80.78393971	
18,066.00	90.73	328.91	6,506.69	11,554.56	-5,912.47	14,457,718.55	1,701,044.15	39.81026772	-80.78410908	
18,160.00	91.56	329.52	6,504.81	11,635.30	-5,960.57	14,457,799.29	1,700,996.05	39.81048977	-80.78427967	
18,254.00	90.68	328.91	6,502.98	11,716.03	-6,008.67	14,457,880.03	1,700,947.95	39.81071181	-80.78445026	
18,347.00	91.34	329.17	6,501.34	11,795.77	-6,056.50	14,457,959.77	1,700,900.11	39.81093111	-80.78461992	
18,441.00	90.68	328.29	6,499.68	11,876.10	-6,105.29	14,458,040.10	1,700,851.33	39.81115204	-80.78479295	
18,535.00	89.98	327.15	6,499.14	11,955.57	-6,155.49	14,458,119.56	1,700,801.13	39.81137061	-80.78497103	
18,629.00	90.81	327.59	6,498.49	12,034.73	-6,206.17	14,458,198.73	1,700,750.45	39.81158835	-80.78515083	
18,723.00	91.34	328.03	6,496.73	12,114.27	-6,256.24	14,458,278.26	1,700,700.38	39.81180710	-80.78532844	
18,815.00	90.46	327.85	6,495.28	12,192.23	-6,305.07	14,458,356.22	1,700,651.55	39.81202152	-80.78550165	
18,909.00	89.80	328.55	6,495.07	12,272.12	-6,354.60	14,458,436.11	1,700,602.02	39.81224124	-80.78567736	
19,003.00	90.59	328.73	6,494.75	12,352.38	-6,403.52	14,458,516.38	1,700,553.10	39.81246200	-80.78585087	
19,096.00	89.76	329.08	6,494.46	12,432.02	-6,451.55	14,458,596.01	1,700,505.07	39.81268102	-80.78602123	
19,190.00	90.55	329.61	6,494.21	12,512.88	-6,499.47	14,458,676.88	1,700,457.14	39.81290340	-80.78619121	
19,284.00	89.93	329.96	6,493.82	12,594.11	-6,546.78	14,458,758.10	1,700,409.84	39.81312678	-80.78635898	
19,379.00	90.99	330.31	6,493.05	12,676.49	-6,594.08	14,458,840.48	1,700,362.53	39.81335333	-80.78652673	
19,473.00	90.20	329.96	6,492.08	12,758.00	-6,640.89	14,458,922.00	1,700,315.73	39.81357749	-80.78669271	
19,567.00	90.99	330.05	6,491.10	12,839.41	-6,687.88	14,459,003.40	1,700,268.74	39.81380136	-80.78685936	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-02 HM (slot L)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft (Nabors X14)
Well:	Old Crow N-02 HM (slot L)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
19,661.00	90.15	329.52	6,490.17	12,920.63	-6,735.18	14,459,084.63	1,700,221.44	39.81402473	-80.78702712
19,756.00	89.19	328.55	6,490.71	13,002.09	-6,784.06	14,459,166.08	1,700,172.56	39.81424876	-80.78720048
19,850.00	90.29	328.55	6,491.14	13,082.28	-6,833.10	14,459,246.27	1,700,123.52	39.81446930	-80.78737446
19,943.00	89.71	328.20	6,491.14	13,161.47	-6,881.87	14,459,325.46	1,700,074.75	39.81468709	-80.78754745
20,037.00	90.64	328.20	6,490.85	13,241.36	-6,931.40	14,459,405.35	1,700,025.22	39.81490680	-80.78772317
20,131.00	90.11	328.82	6,490.24	13,321.51	-6,980.50	14,459,485.50	1,699,976.12	39.81512725	-80.78789734
20,225.00	91.21	328.99	6,489.16	13,402.00	-7,029.04	14,459,565.99	1,699,927.58	39.81534860	-80.78806953
20,319.00	91.16	329.70	6,487.21	13,482.84	-7,076.96	14,459,646.84	1,699,879.66	39.81557094	-80.78823949
20,413.00	90.51	329.78	6,485.84	13,564.03	-7,124.32	14,459,728.02	1,699,832.30	39.81579420	-80.78840748
20,507.00	89.89	330.05	6,485.51	13,645.36	-7,171.44	14,459,809.36	1,699,785.18	39.81601787	-80.78857460
20,602.00	91.25	330.58	6,484.57	13,727.89	-7,218.49	14,459,891.88	1,699,738.13	39.81624481	-80.78874144
20,696.00	89.63	330.75	6,483.85	13,809.83	-7,264.53	14,459,973.82	1,699,692.08	39.81647015	-80.78890474
20,790.00	89.10	329.87	6,484.89	13,891.48	-7,311.09	14,460,055.48	1,699,645.53	39.81669469	-80.78906985
20,884.00	89.67	329.61	6,485.90	13,972.67	-7,358.46	14,460,136.66	1,699,598.16	39.81691796	-80.78923785
20,954.00	90.68	330.22	6,485.68	14,033.24	-7,393.54	14,460,197.23	1,699,563.07	39.81708452	-80.78936230
Survey @ 20954.00 MD 6485.68 TVD									
21,009.00	90.68	330.22	6,485.03	14,080.97	-7,420.86	14,460,244.96	1,699,535.76	39.81721578	-80.78945918
Survey Proj. to 21009.00 MD 6485.03 TVD									

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
189.00	189.00	-0.35	-0.64	MWD surveys
20,954.00	6,485.68	14,033.24	-7,393.54	Survey @ 20954.00 MD 6485.68 TVD
21,009.00	6,485.03	14,080.97	-7,420.86	Survey Proj. to 21009.00 MD 6485.03 TVD