



Well: Van Winkle S-23 HU (slot D)
 Site: Van Winkle
 Project: Marshall County, West Virginia NAD83 UTM 17N
 Design: rev9
 Rig: Nabors B28

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Annotation
1	21066.00	89.04	151.09	11205.16	-7842.71	5662.81	0.00	0.00	9668.00	Survey @ 21066.00 MD 11205.16 TVD
2	21100.00	89.03	150.51	11205.74	-7872.39	5679.39	1.71	-90.99	9701.88	S/T Begin 2°/100' drop/turn (120R)
3	21220.00	87.83	152.59	11209.02	-7977.85	5736.53	2.00	120.00	9821.28	Begin 87.83° lateral
4	21570.00	87.83	152.59	11222.27	-8288.33	5897.54	0.00	0.00	10168.79	Begin 2°/100' build/turn
5	21635.47	89.00	152.00	11224.08	-8346.27	5927.97	2.00	-26.77	10233.84	Begin 89.00° lateral
6	22035.47	89.00	152.00	11231.06	-8699.39	6115.73	0.00	0.00	10631.66	Begin 2°/100' turn
7	22156.04	89.00	149.59	11233.17	-8804.61	6174.55	2.00	-90.03	10751.79	Begin 89.00° lateral
8	25640.06	89.00	149.59	11294.00	-11808.81	7937.93	0.00	0.00	14228.80	PBHL/TD @ 25640.06 MD 11294.00 TVD

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
Van Winkle S-23HU PBHL r7 - plan hits target center	11294.00	-11808.81	7937.93	14435505.826	1725079.397	39.749075000	-80.698788000

ANNOTATIONS SURVEYS ORIGINAL HOLE

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
179.00	0.38	154.84	179.00	-0.50	0.23	0.54	MWD surveys
22563.00	89.25	150.28	11230.41	-9139.79	6409.74	11161.18	Top of Fish @ 22563.00 MD 11230.41 TVD
22835.00	88.60	150.56	11236.02	-9376.03	6544.42	11432.38	Survey @ 22835.00 MD 11236.02 TVD
22900.00	88.60	150.56	11237.60	-9432.62	6576.36	11497.16	Survey Proj. to 22900.00 MD 11237.60 TVD OH

ANNOTATIONS SURVEYS SIDETRACK 01

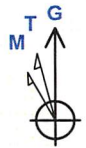
MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
21066.00	89.04	151.09	11205.16	-7842.71	5662.81	9668.00	Tie into original hole @ 21066 MD
25590.00	88.97	148.14	11318.88	-11754.73	7928.46	14178.63	Survey @ 25590.00 MD 11318.88 TVD
25657.00	88.97	148.14	11320.09	-11811.63	7963.82	14245.58	Survey Proj. to 25657 MD 11320.09 TVD ST1

Geodetic System: Universal Transverse Mercator (US Survey Feet)
 Datum: NAD83 West Virginia - HARN
 Ellipsoid: GRS 1980
 Zone: Zone 17N (84 W to 78 W)

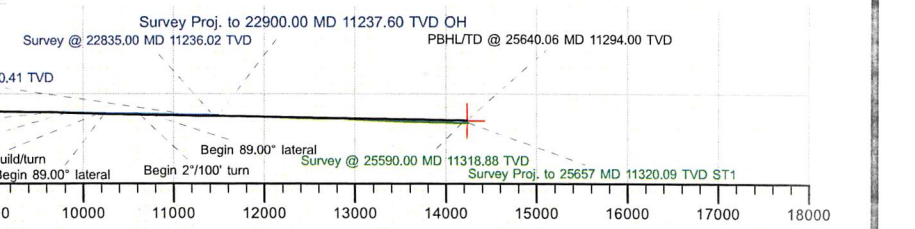
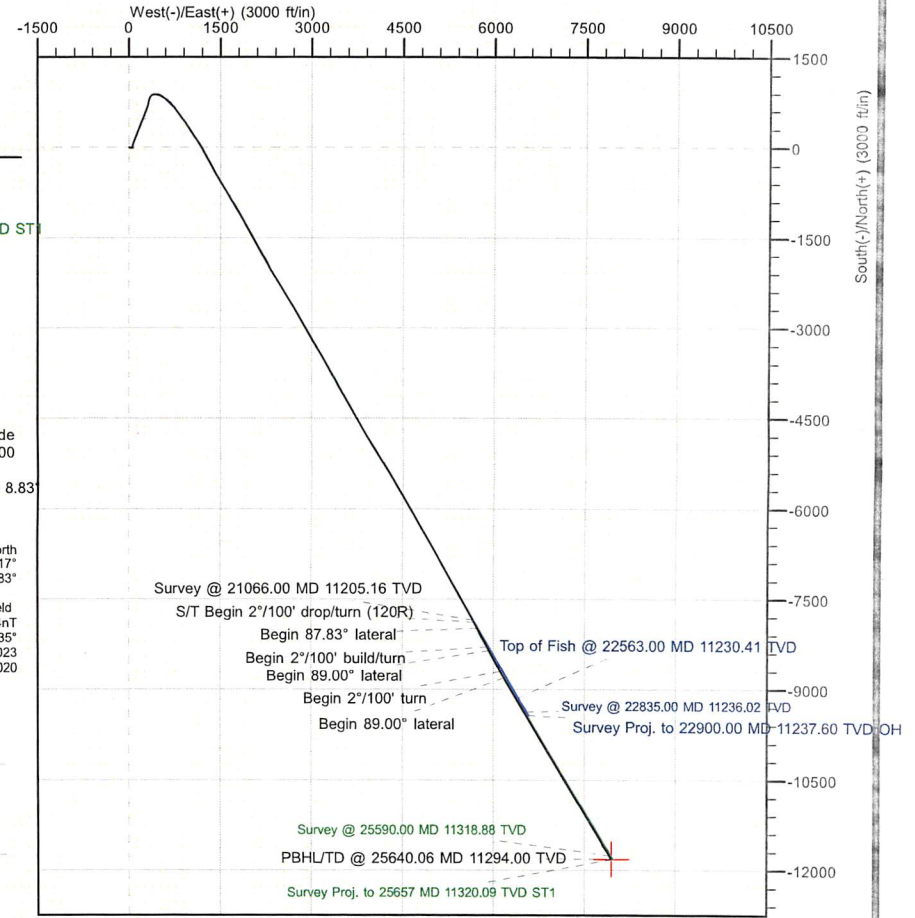
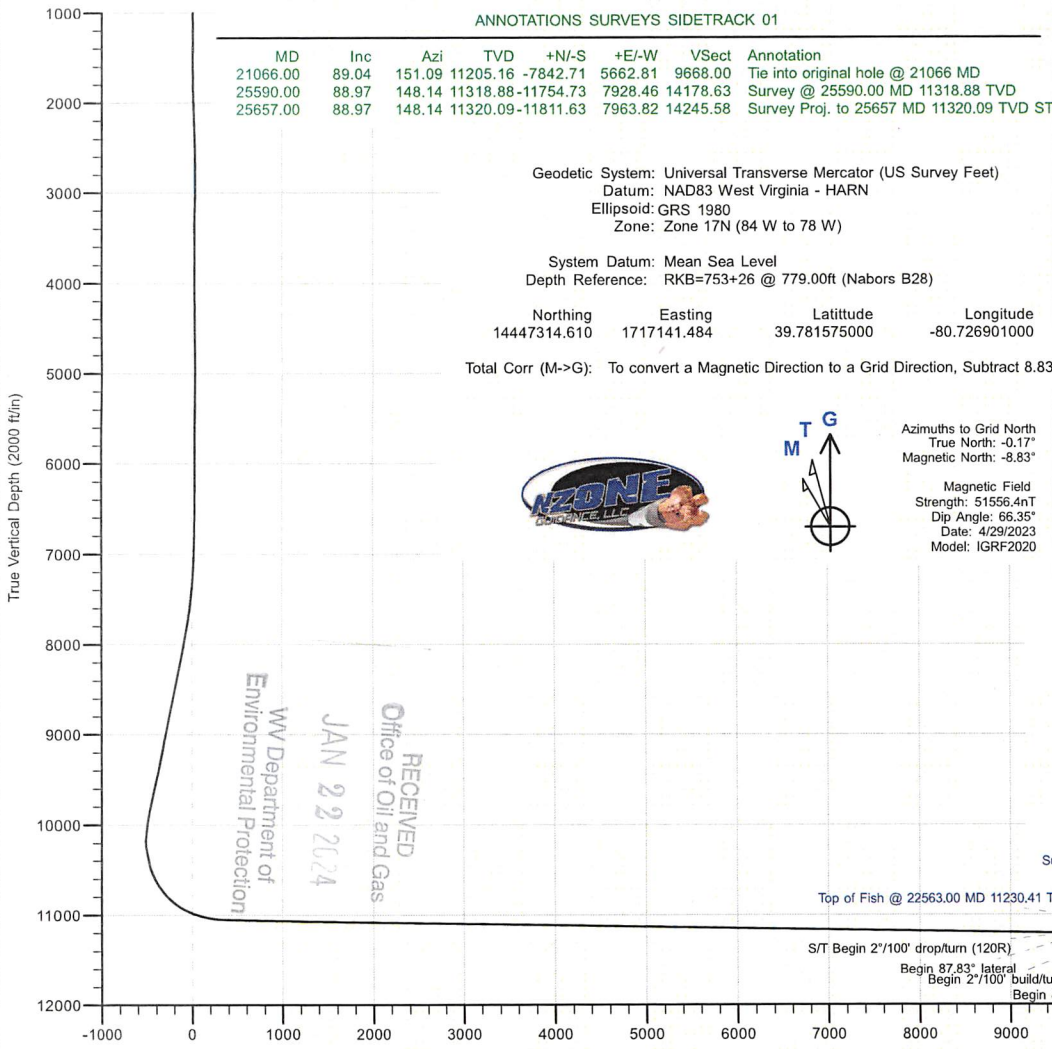
System Datum: Mean Sea Level
 Depth Reference: RKB=753+26 @ 779.00ft (Nabors B28)

Northing	Easting	Latitude	Longitude
14447314.610	1717141.484	39.781575000	-80.726901000

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.83



Azimuths to Grid North
 True North: -0.17°
 Magnetic North: -8.83°
 Magnetic Field Strength: 51556.4nT
 Dip Angle: 66.35°
 Date: 4/29/2023
 Model: IGRF2020





Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Project	Marshall County, West Virginia NAD83 UTM 17N		
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	Van Winkle				
Site Position:		Northing:	14,447,369.493 usft	Latitude:	39.781725330
From:	Lat/Long	Easting:	1,717,188.440 usft	Longitude:	-80.726733270
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "		

Well	Van Winkle S-23 HU (slot D)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,314.610 usft	Latitude:	39.781575000
	+E/-W	0.00 ft	Easting:	1,717,141.484 usft	Longitude:	-80.726901000
Position Uncertainty	0.00 ft		Wellhead Elevation:	ft	Ground Level:	753.00 ft
Grid Convergence:	0.17 °					

Wellbore	Sidetrack 01				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	4/29/2023	-8.65	66.35	51,556.39025259

Design	Surveys Sidetrack 01				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	21,066.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	146.09	

Survey Program	Date	5/22/2023			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	1,467.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,499.00	4,408.00	MWD 1499-4408 MD (Original Hole)	MWD	MWD - Standard	
4,419.00	21,066.00	MWD (Original Hole)	MWD	MWD - Standard	
21,094.00	25,590.00	MWD ST1 (Sidetrack 01)	MWD	MWD - Standard	
25,657.00	25,657.00	Projection (Sidetrack 01)	MWD	MWD - Standard	

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14.00	0.00	0.00	14.00	0.00	0.00	0.00	0.00	0.00	0.00
179.00	0.38	154.84	179.00	-0.50	0.23	0.54	0.23	0.23	0.00
208.00	0.26	125.82	208.00	-0.62	0.33	0.70	0.68	-0.41	-100.07
238.00	0.38	166.10	238.00	-0.76	0.41	0.85	0.82	0.40	134.27
267.00	0.21	225.61	267.00	-0.89	0.39	0.95	1.13	-0.59	205.21

02/23/2024

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Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
298.00	0.32	143.92	298.00	-1.00	0.40	1.05	1.15	0.35	-263.52	
328.00	0.40	164.87	328.00	-1.17	0.48	1.23	0.51	0.27	69.83	
359.00	0.49	196.35	359.00	-1.40	0.47	1.42	0.83	0.29	101.55	
391.00	0.15	225.31	391.00	-1.56	0.40	1.52	1.14	-1.06	90.50	
422.00	0.46	178.58	421.99	-1.71	0.37	1.63	1.20	1.00	-150.74	
454.00	0.42	210.70	453.99	-1.94	0.32	1.79	0.77	-0.13	100.38	
486.00	0.36	190.29	485.99	-2.14	0.24	1.91	0.47	-0.19	-63.78	
517.00	0.64	181.29	516.99	-2.41	0.22	2.12	0.94	0.90	-29.03	
549.00	0.27	57.48	548.99	-2.55	0.28	2.27	2.57	-1.16	-386.91	
580.00	0.26	135.81	579.99	-2.56	0.39	2.34	1.08	-0.03	252.68	
612.00	0.53	97.99	611.99	-2.63	0.59	2.51	1.13	0.84	-118.19	
643.00	0.73	79.88	642.99	-2.62	0.92	2.69	0.90	0.65	-58.42	
675.00	0.60	103.29	674.99	-2.62	1.29	2.89	0.93	-0.41	73.16	
707.00	0.97	92.56	706.98	-2.67	1.72	3.18	1.24	1.16	-33.53	
739.00	0.77	89.20	738.98	-2.68	2.21	3.45	0.64	-0.63	-10.50	
770.00	0.98	101.07	769.98	-2.73	2.67	3.76	0.89	0.68	38.29	
802.00	1.48	111.94	801.97	-2.93	3.33	4.29	1.72	1.56	33.97	
833.00	1.58	106.80	832.96	-3.21	4.11	4.95	0.55	0.32	-16.58	
865.00	1.85	102.21	864.94	-3.44	5.03	5.67	0.95	0.84	-14.34	
897.00	2.28	93.92	896.92	-3.60	6.17	6.43	1.63	1.34	-25.91	
928.00	2.30	101.62	927.90	-3.76	7.40	7.25	0.99	0.06	24.84	
960.00	2.35	91.88	959.87	-3.91	8.68	8.09	1.24	0.16	-30.44	
992.00	2.01	85.56	991.85	-3.89	9.90	8.75	1.30	-1.06	-19.75	
1,024.00	1.58	79.66	1,023.83	-3.77	10.89	9.21	1.46	-1.34	-18.44	
1,056.00	1.33	84.17	1,055.82	-3.65	11.70	9.56	0.86	-0.78	14.09	
1,087.00	0.91	82.17	1,086.82	-3.58	12.30	9.83	1.36	-1.35	-6.45	
1,119.00	1.17	70.76	1,118.81	-3.44	12.86	10.03	1.03	0.81	-35.66	
1,151.00	0.64	65.19	1,150.81	-3.26	13.33	10.14	1.68	-1.66	-17.41	
1,182.00	0.79	56.48	1,181.80	-3.07	13.66	10.17	0.60	0.48	-28.10	
1,214.00	0.34	359.63	1,213.80	-2.85	13.85	10.09	2.09	-1.41	-177.66	
1,246.00	0.64	10.05	1,245.80	-2.58	13.88	9.88	0.97	0.94	32.56	
1,278.00	0.58	316.08	1,277.80	-2.29	13.80	9.59	1.74	-0.19	-168.66	
1,310.00	0.54	281.29	1,309.80	-2.14	13.54	9.33	1.05	-0.13	-108.72	
1,341.00	0.79	263.71	1,340.80	-2.14	13.18	9.13	1.03	0.81	-56.71	
1,373.00	0.89	258.23	1,372.79	-2.21	12.72	8.93	0.40	0.31	-17.13	
1,404.00	1.48	279.46	1,403.79	-2.19	12.09	8.56	2.34	1.90	68.48	
1,436.00	1.42	277.84	1,435.78	-2.07	11.29	8.02	0.23	-0.19	-5.06	
1,467.00	1.07	293.08	1,466.77	-1.91	10.64	7.52	1.54	-1.13	49.16	
1,499.00	0.75	309.47	1,498.77	-1.66	10.20	7.07	1.28	-1.00	51.22	
1,531.00	0.40	314.81	1,530.76	-1.44	9.96	6.76	1.11	-1.09	16.69	
1,562.00	0.59	18.33	1,561.76	-1.22	9.94	6.55	1.76	0.61	204.90	
1,594.00	0.54	41.76	1,593.76	-0.95	10.09	6.41	0.73	-0.16	73.22	
1,626.00	1.24	64.43	1,625.76	-0.69	10.50	6.43	2.41	2.19	70.84	
1,657.00	1.84	89.43	1,656.75	-0.54	11.30	6.75	2.86	1.94	80.65	



Survey Report



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Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
1,689.00	2.63	92.41	1,688.72	-0.56	12.55	7.47	2.49	2.47	9.31
1,720.00	2.85	90.45	1,719.69	-0.60	14.03	8.32	0.77	0.71	-6.32
1,752.00	3.34	87.83	1,751.64	-0.57	15.76	9.26	1.59	1.53	-8.19
1,784.00	3.99	89.69	1,783.57	-0.53	17.80	10.37	2.06	2.03	5.81
1,815.00	3.75	94.64	1,814.50	-0.60	19.89	11.60	1.33	-0.77	15.97
1,847.00	3.42	93.09	1,846.44	-0.74	21.89	12.82	1.07	-1.03	-4.84
1,877.00	2.63	91.56	1,876.40	-0.81	23.47	13.76	2.65	-2.63	-5.10
1,909.00	2.42	87.38	1,908.37	-0.80	24.88	14.54	0.87	-0.66	-13.06
1,940.00	2.11	95.51	1,939.34	-0.82	26.10	15.24	1.44	-1.00	26.23
1,971.00	2.31	83.76	1,970.32	-0.81	27.29	15.89	1.59	0.65	-37.90
2,003.00	2.15	81.36	2,002.30	-0.65	28.52	16.45	0.58	-0.50	-7.50
2,034.00	2.05	83.86	2,033.28	-0.50	29.65	16.96	0.44	-0.32	8.06
2,066.00	2.10	87.68	2,065.25	-0.42	30.80	17.53	0.46	0.16	11.94
2,097.00	2.69	86.60	2,096.23	-0.35	32.10	18.20	1.91	1.90	-3.48
2,129.00	2.12	83.96	2,128.20	-0.24	33.43	18.85	1.81	-1.78	-8.25
2,161.00	2.09	88.09	2,160.18	-0.16	34.61	19.44	0.48	-0.09	12.91
2,192.00	2.08	94.55	2,191.16	-0.19	35.73	20.09	0.76	-0.03	20.84
2,220.00	2.26	94.59	2,219.14	-0.27	36.79	20.75	0.64	0.64	0.14
2,252.00	2.50	96.23	2,251.11	-0.40	38.11	21.59	0.78	0.75	5.13
2,284.00	2.70	96.04	2,283.08	-0.55	39.56	22.53	0.63	0.63	-0.59
2,315.00	2.83	95.77	2,314.04	-0.71	41.04	23.48	0.42	0.42	-0.87
2,347.00	2.95	96.95	2,346.00	-0.89	42.65	24.53	0.42	0.38	3.69
2,378.00	3.05	96.24	2,376.96	-1.07	44.26	25.58	0.34	0.32	-2.29
2,410.00	3.18	97.22	2,408.91	-1.28	45.98	26.71	0.44	0.41	3.06
2,442.00	3.33	98.03	2,440.86	-1.52	47.79	27.92	0.49	0.47	2.53
2,474.00	3.50	98.00	2,472.80	-1.78	49.67	29.19	0.53	0.53	-0.09
2,505.00	3.29	98.69	2,503.75	-2.05	51.49	30.43	0.69	-0.68	2.23
2,537.00	2.51	100.06	2,535.71	-2.31	53.09	31.53	2.45	-2.44	4.28
2,567.00	2.12	98.04	2,565.68	-2.50	54.28	32.36	1.33	-1.30	-6.73
2,599.00	1.64	97.29	2,597.66	-2.64	55.32	33.06	1.50	-1.50	-2.34
2,631.00	1.58	94.42	2,629.65	-2.74	56.22	33.63	0.31	-0.19	-8.97
2,662.00	1.26	101.89	2,660.64	-2.84	56.98	34.14	1.19	-1.03	24.10
2,694.00	0.79	107.44	2,692.64	-2.98	57.53	34.57	1.50	-1.47	17.34
2,726.00	0.67	126.12	2,724.63	-3.15	57.89	34.91	0.83	-0.38	58.38
2,756.00	0.60	140.93	2,754.63	-3.38	58.13	35.24	0.59	-0.23	49.37
2,788.00	0.57	154.45	2,786.63	-3.65	58.31	35.56	0.44	-0.09	42.25
2,820.00	0.60	188.40	2,818.63	-3.96	58.35	35.84	1.07	0.09	106.09
2,851.00	0.83	226.43	2,849.63	-4.28	58.17	36.00	1.66	0.74	122.68
2,883.00	1.07	237.10	2,881.62	-4.60	57.75	36.03	0.93	0.75	33.34
2,914.00	1.34	241.74	2,912.62	-4.93	57.19	35.99	0.93	0.87	14.97
2,946.00	1.44	249.59	2,944.61	-5.25	56.48	35.86	0.67	0.31	24.53
2,977.00	1.40	256.85	2,975.60	-5.47	55.75	35.64	0.59	-0.13	23.42
3,009.00	1.15	274.03	3,007.59	-5.53	55.04	35.30	1.42	-0.78	53.69



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3,040.00	1.07	287.64	3,038.58	-5.42	54.46	34.88	0.89	-0.26	43.90	
3,071.00	1.09	304.94	3,069.58	-5.17	53.94	34.38	1.05	0.06	55.81	
3,102.00	1.11	323.29	3,100.57	-4.76	53.52	33.81	1.13	0.06	59.19	
3,134.00	1.26	332.20	3,132.56	-4.20	53.17	33.15	0.74	0.47	27.84	
3,165.00	1.40	340.93	3,163.56	-3.54	52.89	32.44	0.79	0.45	28.16	
3,197.00	1.40	341.12	3,195.55	-2.80	52.63	31.69	0.01	0.00	0.59	
3,228.00	1.28	344.56	3,226.54	-2.11	52.42	30.99	0.47	-0.39	11.10	
3,260.00	0.97	356.73	3,258.53	-1.49	52.31	30.42	1.22	-0.97	38.03	
3,292.00	0.86	4.62	3,290.53	-0.98	52.31	30.00	0.52	-0.34	24.66	
3,324.00	0.79	3.23	3,322.52	-0.52	52.34	29.64	0.23	-0.22	-4.34	
3,356.00	0.73	7.84	3,354.52	-0.10	52.38	29.31	0.27	-0.19	14.41	
3,388.00	0.75	13.30	3,386.52	0.30	52.46	29.01	0.23	0.06	17.06	
3,419.00	0.75	15.73	3,417.52	0.70	52.56	28.74	0.10	0.00	7.84	
3,451.00	0.82	22.99	3,449.51	1.11	52.71	28.48	0.38	0.22	22.69	
3,483.00	0.77	25.00	3,481.51	1.52	52.89	28.25	0.18	-0.16	6.28	
3,515.00	0.90	29.43	3,513.51	1.93	53.10	28.02	0.45	0.41	13.84	
3,546.00	0.85	35.90	3,544.50	2.33	53.36	27.83	0.36	-0.16	20.87	
3,578.00	0.91	37.42	3,576.50	2.72	53.65	27.67	0.20	0.19	4.75	
3,610.00	0.99	42.50	3,608.50	3.13	53.99	27.53	0.36	0.25	15.88	
3,642.00	1.09	53.77	3,640.49	3.51	54.42	27.45	0.71	0.31	35.22	
3,673.00	1.21	69.48	3,671.48	3.80	54.97	27.51	1.08	0.39	50.68	
3,705.00	1.42	81.51	3,703.48	3.98	55.68	27.76	1.08	0.66	37.59	
3,737.00	1.55	88.48	3,735.46	4.05	56.50	28.16	0.69	0.41	21.78	
3,769.00	1.60	92.99	3,767.45	4.04	57.38	28.66	0.42	0.16	14.09	
3,801.00	1.38	93.26	3,799.44	3.99	58.21	29.16	0.69	-0.69	0.84	
3,832.00	1.11	91.68	3,830.43	3.96	58.88	29.56	0.88	-0.87	-5.10	
3,864.00	1.03	89.80	3,862.43	3.95	59.48	29.90	0.27	-0.25	-5.88	
3,896.00	0.83	77.52	3,894.42	4.00	60.00	30.15	0.88	-0.63	-38.38	
3,928.00	0.90	72.38	3,926.42	4.13	60.46	30.30	0.33	0.22	-16.06	
3,959.00	0.91	65.70	3,957.42	4.30	60.92	30.41	0.34	0.03	-21.55	
3,991.00	0.90	71.41	3,989.41	4.49	61.39	30.52	0.28	-0.03	17.84	
4,023.00	0.80	77.41	4,021.41	4.62	61.84	30.67	0.42	-0.31	18.75	
4,055.00	0.77	74.27	4,053.41	4.72	62.27	30.82	0.16	-0.09	-9.81	
4,086.00	0.48	100.61	4,084.40	4.76	62.60	30.97	1.29	-0.94	84.97	
4,118.00	0.23	102.49	4,116.40	4.72	62.79	31.11	0.78	-0.78	5.88	
4,150.00	0.30	161.19	4,148.40	4.63	62.88	31.24	0.83	0.22	183.44	
4,181.00	0.58	182.87	4,179.40	4.39	62.90	31.44	1.04	0.90	69.94	
4,213.00	0.68	185.01	4,211.40	4.04	62.87	31.72	0.32	0.31	6.69	
4,245.00	0.80	186.21	4,243.40	3.63	62.83	32.04	0.38	0.38	3.75	
4,277.00	0.94	192.44	4,275.39	3.15	62.75	32.39	0.53	0.44	19.47	
4,308.00	0.99	204.14	4,306.39	2.66	62.59	32.71	0.65	0.16	37.74	
4,340.00	0.85	217.48	4,338.39	2.22	62.33	32.93	0.80	-0.44	41.69	
4,372.00	0.85	228.06	4,370.38	1.87	62.01	33.04	0.49	0.00	33.06	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
4,408.00	0.87	232.99	4,406.38	1.53	61.59	33.09	0.21	0.06	13.69
4,419.00	0.85	230.75	4,417.38	1.43	61.46	33.11	0.36	-0.18	-20.36
4,512.00	0.84	249.64	4,510.37	0.75	60.29	33.01	0.30	-0.01	20.31
4,605.00	0.75	257.82	4,603.36	0.39	59.06	32.62	0.16	-0.10	8.80
4,698.00	0.68	269.45	4,696.35	0.25	57.91	32.10	0.17	-0.08	12.51
4,791.00	0.50	281.25	4,789.35	0.33	56.96	31.50	0.23	-0.19	12.69
4,883.00	0.27	300.06	4,881.34	0.51	56.38	31.03	0.28	-0.25	20.45
4,977.00	0.10	46.05	4,975.34	0.68	56.25	30.81	0.33	-0.18	112.76
5,069.00	0.34	66.70	5,067.34	0.85	56.55	30.85	0.27	0.26	22.45
5,162.00	0.47	69.19	5,160.34	1.09	57.16	30.99	0.14	0.14	2.68
5,256.00	0.46	103.31	5,254.34	1.14	57.89	31.35	0.29	-0.01	36.30
5,349.00	0.64	132.58	5,347.33	0.70	58.64	32.13	0.35	0.19	31.47
5,442.00	0.90	145.71	5,440.33	-0.25	59.43	33.36	0.34	0.28	14.12
5,535.00	0.97	153.34	5,533.31	-1.56	60.20	34.88	0.15	0.08	8.20
5,628.00	1.22	160.75	5,626.30	-3.20	60.88	36.61	0.31	0.27	7.97
5,721.00	0.66	89.39	5,719.29	-4.13	61.74	37.87	1.28	-0.60	-76.73
5,814.00	1.15	72.02	5,812.27	-3.83	63.16	38.42	0.60	0.53	-18.68
5,908.00	1.02	22.06	5,906.26	-2.77	64.37	38.21	0.98	-0.14	-53.15
6,001.00	0.94	2.80	5,999.25	-1.24	64.72	37.13	0.36	-0.09	-20.71
6,094.00	0.77	340.83	6,092.24	0.12	64.55	35.92	0.39	-0.18	-23.62
6,187.00	0.44	310.43	6,185.23	0.94	64.08	34.97	0.48	-0.35	-32.69
6,280.00	0.52	311.42	6,278.23	1.45	63.49	34.22	0.09	0.09	1.06
6,373.00	0.50	322.41	6,371.22	2.05	62.92	33.40	0.11	-0.02	11.82
6,469.00	0.50	328.26	6,467.22	2.74	62.45	32.57	0.05	0.00	6.09
6,562.00	0.66	330.62	6,560.22	3.55	61.97	31.63	0.17	0.17	2.54
6,655.00	0.70	330.03	6,653.21	4.51	61.42	30.53	0.04	0.04	-0.63
6,746.00	0.92	337.12	6,744.20	5.66	60.86	29.25	0.27	0.24	7.79
6,841.00	1.88	284.05	6,839.17	6.74	59.05	27.35	1.60	1.01	-55.86
6,938.00	1.03	311.77	6,936.14	7.71	56.86	25.32	1.11	-0.88	28.58
7,030.00	2.39	327.41	7,028.10	9.88	55.21	22.60	1.55	1.48	17.00
7,134.00	2.69	353.00	7,132.00	14.13	53.75	18.26	1.12	0.29	24.61
7,217.00	4.63	357.71	7,214.83	19.41	53.37	13.67	2.36	2.34	5.67
7,309.00	6.02	13.37	7,306.43	27.81	54.34	7.23	2.17	1.51	17.02
7,402.00	7.92	17.81	7,398.74	38.66	57.43	-0.05	2.12	2.04	4.77
7,495.00	10.84	19.20	7,490.49	53.02	62.27	-9.27	3.15	3.14	1.49
7,590.00	13.37	19.45	7,583.37	71.82	68.86	-21.19	2.66	2.66	0.26
7,683.00	14.46	21.86	7,673.64	92.73	76.77	-34.14	1.33	1.17	2.59
7,776.00	15.62	23.36	7,763.45	115.00	86.05	-47.44	1.32	1.25	1.61
7,870.00	17.86	22.00	7,853.46	139.99	96.47	-62.36	2.42	2.38	-1.45
7,963.00	18.09	20.75	7,941.92	166.72	106.93	-78.71	0.48	0.25	-1.34
8,056.00	18.29	20.54	8,030.28	193.88	117.17	-95.54	0.23	0.22	-0.23
8,149.00	20.19	23.01	8,118.08	222.32	128.56	-112.79	2.22	2.04	2.66
8,242.00	20.14	23.17	8,205.38	251.81	141.13	-130.25	0.08	-0.05	0.17
8,335.00	19.95	19.70	8,292.75	281.47	152.78	-148.37	1.29	-0.20	-3.73



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
8,428.00	20.06	18.19	8,380.14	311.56	163.11	-167.58	0.57	0.12	-1.62
8,521.00	20.29	20.01	8,467.43	341.87	173.61	-186.87	0.72	0.25	1.96
8,613.00	18.71	21.09	8,554.15	370.62	184.38	-204.73	1.76	-1.72	1.17
8,707.00	18.48	21.16	8,643.25	398.58	195.18	-221.91	0.25	-0.24	0.07
8,800.00	18.99	20.80	8,731.32	426.47	205.87	-239.09	0.56	0.55	-0.39
8,894.00	19.77	23.04	8,819.99	455.40	217.53	-256.60	1.15	0.83	2.38
8,977.00	20.18	20.96	8,898.00	481.69	228.14	-272.49	0.99	0.49	-2.51
9,070.00	20.13	20.61	8,985.31	511.65	239.51	-291.01	0.14	-0.05	-0.38
9,163.00	17.63	19.65	9,073.30	539.89	249.88	-308.67	2.71	-2.69	-1.03
9,257.00	17.45	19.38	9,162.92	566.60	259.35	-325.55	0.21	-0.19	-0.29
9,350.00	18.51	20.00	9,251.38	593.62	269.02	-342.58	1.16	1.14	0.67
9,444.00	20.09	20.53	9,340.10	622.76	279.79	-360.76	1.69	1.68	0.56
9,537.00	20.22	19.65	9,427.40	652.86	290.79	-379.59	0.35	0.14	-0.95
9,631.00	20.22	17.80	9,515.61	683.62	301.22	-399.31	0.68	0.00	-1.97
9,724.00	20.26	17.01	9,602.87	714.32	310.85	-419.42	0.30	0.04	-0.85
9,818.00	18.37	15.43	9,691.57	744.17	319.55	-439.33	2.09	-2.01	-1.68
9,912.00	16.84	13.23	9,781.17	771.70	326.61	-458.25	1.77	-1.63	-2.34
10,006.00	16.18	12.18	9,871.29	797.76	332.49	-476.59	0.77	-0.70	-1.12
10,050.00	16.22	22.21	9,913.55	809.44	336.10	-484.27	6.35	0.09	22.80
10,063.00	14.89	11.75	9,926.08	812.76	337.13	-486.45	23.84	-10.23	-80.46
10,110.00	14.36	19.90	9,971.56	824.15	340.34	-494.11	4.52	-1.13	17.34
10,156.00	14.45	28.58	10,016.12	834.56	345.03	-500.13	4.69	0.20	18.87
10,203.00	15.42	35.46	10,061.54	844.80	351.46	-505.05	4.30	2.06	14.64
10,249.00	16.70	42.55	10,105.74	854.65	359.48	-508.75	5.09	2.78	15.41
10,296.00	19.13	46.47	10,150.46	864.93	369.63	-511.62	5.77	5.17	8.34
10,343.00	20.24	58.81	10,194.74	874.45	382.18	-512.52	9.14	2.36	26.26
10,390.00	19.84	71.50	10,238.91	881.19	396.70	-510.01	9.27	-0.85	27.00
10,436.00	19.31	83.05	10,282.27	884.59	411.66	-504.49	8.48	-1.15	25.11
10,483.00	19.44	91.73	10,326.62	885.30	427.20	-496.41	6.13	0.28	18.47
10,529.00	18.52	91.95	10,370.12	884.82	442.15	-487.67	2.01	-2.00	0.48
10,576.00	17.94	93.10	10,414.76	884.17	456.84	-478.94	1.45	-1.23	2.45
10,622.00	20.19	100.24	10,458.24	882.38	471.73	-469.14	7.04	4.89	15.52
10,669.00	23.11	106.98	10,501.92	878.24	488.54	-456.33	8.15	6.21	14.34
10,715.00	26.03	112.75	10,543.76	871.70	506.48	-440.89	8.21	6.35	12.54
10,762.00	29.08	119.23	10,585.43	862.13	525.97	-422.07	9.09	6.49	13.79
10,808.00	31.68	122.89	10,625.12	850.11	545.87	-400.99	6.94	5.65	7.96
10,855.00	34.03	124.17	10,664.60	836.02	567.12	-377.45	5.21	5.00	2.72
10,901.00	36.28	125.36	10,702.20	820.91	588.87	-352.77	5.11	4.89	2.59
10,948.00	39.24	128.31	10,739.36	803.64	611.89	-325.60	7.38	6.30	6.28
10,995.00	41.98	131.57	10,775.04	783.99	635.32	-296.22	7.37	5.83	6.94
11,042.00	45.03	134.30	10,809.13	761.94	658.98	-264.72	7.62	6.49	5.81
11,088.00	48.30	136.94	10,840.70	738.02	682.36	-231.83	8.24	7.11	5.74
11,135.00	52.01	138.62	10,870.81	711.29	706.59	-196.13	8.36	7.89	3.57

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
11,181.00	55.68	140.91	10,897.94	682.94	730.57	-159.22	8.93	7.98	4.98
11,228.00	59.43	141.92	10,923.15	651.94	755.29	-119.70	8.18	7.98	2.15
11,273.00	63.15	143.25	10,944.77	620.59	779.26	-80.31	8.66	8.27	2.96
11,320.00	66.59	144.44	10,964.72	586.23	804.36	-37.80	7.67	7.32	2.53
11,366.00	69.33	144.70	10,981.98	551.49	829.07	4.82	5.98	5.96	0.57
11,413.00	71.81	144.66	10,997.62	515.33	854.69	49.13	5.28	5.28	-0.09
11,459.00	74.24	144.88	11,011.05	479.40	880.07	93.11	5.30	5.28	0.48
11,506.00	76.67	145.49	11,022.85	442.05	906.04	138.59	5.32	5.17	1.30
11,552.00	78.92	146.38	11,032.57	404.81	931.22	183.55	5.24	4.89	1.93
11,599.00	81.22	146.90	11,040.68	366.14	956.68	229.84	5.01	4.89	1.11
11,645.00	83.65	148.31	11,046.73	327.64	981.10	275.42	6.09	5.28	3.07
11,692.00	86.43	149.02	11,050.80	287.65	1,005.45	322.19	6.10	5.91	1.51
11,738.00	88.64	147.43	11,052.78	248.58	1,029.65	368.11	5.92	4.80	-3.46
11,831.00	88.82	147.08	11,054.84	170.38	1,079.94	461.07	0.42	0.19	-0.38
11,924.00	88.07	146.38	11,057.36	92.66	1,130.94	554.03	1.10	-0.81	-0.75
12,017.00	88.38	151.09	11,060.24	13.22	1,179.17	646.86	5.07	0.33	5.06
12,109.00	88.95	153.07	11,062.39	-68.04	1,222.23	738.33	2.24	0.62	2.15
12,202.00	88.78	152.50	11,064.23	-150.73	1,264.76	830.67	0.64	-0.18	-0.61
12,295.00	88.82	151.93	11,066.18	-232.99	1,308.10	923.12	0.61	0.04	-0.61
12,388.00	88.86	153.16	11,068.06	-315.50	1,350.97	1,015.51	1.32	0.04	1.32
12,481.00	89.09	149.20	11,069.72	-396.95	1,395.78	1,108.11	4.26	0.25	-4.26
12,574.00	89.26	149.33	11,071.06	-476.88	1,443.31	1,200.96	0.23	0.18	0.14
12,667.00	89.09	148.98	11,072.40	-556.72	1,490.98	1,293.82	0.42	-0.18	-0.38
12,760.00	89.17	149.55	11,073.81	-636.64	1,538.51	1,386.66	0.62	0.09	0.61
12,853.00	89.22	148.98	11,075.12	-716.57	1,586.03	1,479.51	0.62	0.05	-0.61
12,947.00	89.04	148.98	11,076.55	-797.12	1,634.47	1,573.38	0.19	-0.19	0.00
13,040.00	88.95	148.84	11,078.18	-876.75	1,682.49	1,666.25	0.18	-0.10	-0.15
13,133.00	89.17	148.71	11,079.71	-956.27	1,730.69	1,759.14	0.27	0.24	-0.14
13,225.00	89.17	149.06	11,081.04	-1,035.02	1,778.23	1,851.02	0.38	0.00	0.38
13,318.00	89.04	151.62	11,082.49	-1,115.82	1,824.24	1,943.75	2.76	-0.14	2.75
13,411.00	89.17	151.53	11,083.94	-1,197.60	1,868.50	2,036.31	0.17	0.14	-0.10
13,505.00	89.22	151.22	11,085.26	-1,280.10	1,913.53	2,129.90	0.33	0.05	-0.33
13,598.00	89.22	152.02	11,086.53	-1,361.91	1,957.73	2,222.46	0.86	0.00	0.86
13,692.00	89.17	151.27	11,087.85	-1,444.63	2,002.37	2,316.01	0.80	-0.05	-0.80
13,785.00	89.22	151.27	11,089.16	-1,526.17	2,047.07	2,408.62	0.05	0.05	0.00
13,878.00	88.91	151.62	11,090.67	-1,607.85	2,091.52	2,501.20	0.50	-0.33	0.38
13,971.00	88.78	151.22	11,092.55	-1,689.50	2,136.00	2,593.78	0.45	-0.14	-0.43
14,064.00	89.00	151.09	11,094.35	-1,770.94	2,180.86	2,686.40	0.27	0.24	-0.14
14,157.00	88.91	151.00	11,096.05	-1,852.31	2,225.87	2,779.04	0.14	-0.10	-0.10
14,251.00	89.35	151.62	11,097.47	-1,934.76	2,270.99	2,872.63	0.81	0.47	0.66
14,344.00	89.31	151.88	11,098.56	-2,016.67	2,315.01	2,965.17	0.28	-0.04	0.28
14,438.00	89.48	147.57	11,099.56	-2,097.83	2,362.38	3,058.96	4.59	0.18	-4.59
14,531.00	89.44	150.43	11,100.43	-2,177.53	2,410.28	3,151.82	3.08	-0.04	3.08



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
14,624.00	89.31	147.74	11,101.45	-2,257.31	2,458.05	3,244.68	2.90	-0.14	-2.89
14,717.00	89.40	147.79	11,102.49	-2,335.97	2,507.65	3,337.64	0.11	0.10	0.05
14,810.00	89.35	152.15	11,103.51	-2,416.46	2,554.18	3,430.40	4.69	-0.05	4.69
14,903.00	89.22	148.93	11,104.67	-2,497.42	2,599.91	3,523.10	3.46	-0.14	-3.46
14,997.00	89.04	148.89	11,106.10	-2,577.91	2,648.44	3,616.97	0.20	-0.19	-0.04
15,090.00	88.95	149.72	11,107.73	-2,657.87	2,695.91	3,709.81	0.90	-0.10	0.89
15,183.00	88.95	149.42	11,109.43	-2,738.04	2,743.00	3,802.62	0.32	0.00	-0.32
15,276.00	89.00	149.28	11,111.10	-2,818.04	2,790.41	3,895.46	0.16	0.05	-0.15
15,369.00	88.95	149.28	11,112.76	-2,897.97	2,837.91	3,988.30	0.05	-0.05	0.00
15,461.00	88.91	149.15	11,114.48	-2,977.00	2,884.99	4,080.15	0.15	-0.04	-0.14
15,554.00	89.13	148.98	11,116.07	-3,056.75	2,932.79	4,173.01	0.30	0.24	-0.18
15,647.00	89.00	151.93	11,117.59	-3,137.64	2,978.64	4,265.72	3.17	-0.14	3.17
15,740.00	88.86	148.98	11,119.32	-3,218.53	3,024.48	4,358.42	3.18	-0.15	-3.17
15,833.00	88.95	151.71	11,121.10	-3,299.32	3,070.48	4,451.14	2.94	0.10	2.94
15,926.00	88.82	149.20	11,122.91	-3,380.21	3,116.33	4,543.84	2.70	-0.14	-2.70
16,019.00	88.95	149.42	11,124.72	-3,460.17	3,163.79	4,636.68	0.27	0.14	0.24
16,112.00	89.09	149.02	11,126.31	-3,540.05	3,211.37	4,729.53	0.46	0.15	-0.43
16,204.00	89.09	149.72	11,127.77	-3,619.21	3,258.24	4,821.36	0.76	0.00	0.76
16,298.00	88.95	153.43	11,129.38	-3,701.85	3,302.97	4,914.90	3.95	-0.15	3.95
16,391.00	88.78	149.81	11,131.22	-3,783.64	3,347.16	5,007.44	3.90	-0.18	-3.89
16,484.00	88.86	153.03	11,133.14	-3,865.28	3,391.63	5,100.00	3.46	0.09	3.46
16,578.00	89.09	152.46	11,134.82	-3,948.83	3,434.67	5,193.35	0.65	0.24	-0.61
16,670.00	89.09	152.50	11,136.28	-4,030.41	3,477.18	5,284.77	0.04	0.00	0.04
16,763.00	88.86	149.11	11,137.95	-4,111.57	3,522.53	5,377.43	3.65	-0.25	-3.65
16,857.00	89.17	149.42	11,139.56	-4,192.36	3,570.56	5,471.27	0.47	0.33	0.33
16,951.00	88.95	149.86	11,141.10	-4,273.46	3,618.06	5,565.08	0.52	-0.23	0.47
17,045.00	89.22	153.29	11,142.60	-4,356.10	3,662.80	5,658.62	3.66	0.29	3.65
17,138.00	89.17	148.93	11,143.91	-4,437.50	3,707.71	5,751.23	4.69	-0.05	-4.69
17,231.00	89.35	151.93	11,145.11	-4,518.37	3,753.60	5,843.95	3.23	0.19	3.23
17,324.00	89.00	152.63	11,146.45	-4,600.69	3,796.85	5,936.40	0.84	-0.38	0.75
17,418.00	88.82	148.31	11,148.24	-4,682.44	3,843.16	6,030.08	4.60	-0.19	-4.60
17,512.00	89.17	152.77	11,149.89	-4,764.25	3,889.37	6,123.76	4.76	0.37	4.74
17,606.00	88.91	149.72	11,151.47	-4,846.64	3,934.58	6,217.36	3.26	-0.28	-3.24
17,700.00	89.00	150.43	11,153.18	-4,928.10	3,981.47	6,311.11	0.76	0.10	0.76
17,792.00	88.82	146.77	11,154.93	-5,006.59	4,029.38	6,402.99	3.98	-0.20	-3.98
17,885.00	89.22	147.34	11,156.52	-5,084.63	4,079.95	6,495.96	0.75	0.43	0.61
17,979.00	89.22	151.27	11,157.80	-5,165.43	4,127.92	6,589.79	4.18	0.00	4.18
18,073.00	88.82	146.90	11,159.41	-5,246.05	4,176.20	6,683.62	4.67	-0.43	-4.65
18,166.00	89.13	147.83	11,161.07	-5,324.35	4,226.34	6,776.59	1.05	0.33	1.00
18,260.00	89.22	151.49	11,162.43	-5,405.46	4,273.81	6,870.38	3.89	0.10	3.89
18,353.00	89.00	146.55	11,163.87	-5,485.16	4,321.66	6,963.22	5.32	-0.24	-5.31
18,447.00	89.26	148.36	11,165.30	-5,564.38	4,372.22	7,057.17	1.95	0.28	1.93
18,541.00	89.09	148.80	11,166.65	-5,644.59	4,421.22	7,151.08	0.50	-0.18	0.47
18,636.00	89.09	149.99	11,168.16	-5,726.34	4,469.58	7,245.90	1.25	0.00	1.25



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
18,732.00	89.13	150.03	11,169.65	-5,809.48	4,517.56	7,341.67	0.06	0.04	0.04
18,826.00	88.95	150.25	11,171.23	-5,890.99	4,564.35	7,435.42	0.30	-0.19	0.23
18,921.00	89.04	149.86	11,172.90	-5,973.30	4,611.77	7,530.18	0.42	0.09	-0.41
19,017.00	88.95	150.08	11,174.58	-6,056.40	4,659.80	7,625.94	0.25	-0.09	0.23
19,112.00	89.09	149.81	11,176.20	-6,138.61	4,707.37	7,720.72	0.32	0.15	-0.28
19,204.00	89.04	149.33	11,177.71	-6,217.93	4,753.97	7,812.53	0.52	-0.05	-0.52
19,298.00	89.40	150.69	11,178.99	-6,299.33	4,800.95	7,906.30	1.50	0.38	1.45
19,392.00	88.95	149.20	11,180.34	-6,380.68	4,848.02	8,000.08	1.66	-0.48	-1.59
19,484.00	89.09	150.61	11,181.91	-6,460.27	4,894.14	8,091.86	1.54	0.15	1.53
19,577.00	89.04	150.25	11,183.43	-6,541.14	4,940.03	8,184.58	0.39	-0.05	-0.39
19,671.00	89.22	150.65	11,184.86	-6,622.91	4,986.38	8,278.30	0.47	0.19	0.43
19,764.00	89.09	151.66	11,186.23	-6,704.36	5,031.24	8,370.92	1.09	-0.14	1.09
19,857.00	89.22	151.18	11,187.60	-6,786.02	5,075.73	8,463.51	0.53	0.14	-0.52
19,950.00	89.09	150.25	11,188.97	-6,867.12	5,121.22	8,556.19	1.01	-0.14	-1.00
20,043.00	89.22	151.80	11,190.34	-6,948.47	5,166.26	8,648.84	1.67	0.14	1.67
20,136.00	89.04	150.34	11,191.76	-7,029.85	5,211.24	8,741.47	1.58	-0.19	-1.57
20,229.00	89.35	150.69	11,193.06	-7,110.80	5,257.01	8,834.19	0.50	0.33	0.38
20,322.00	89.04	152.37	11,194.37	-7,192.54	5,301.34	8,926.76	1.84	-0.33	1.81
20,415.00	89.26	151.53	11,195.75	-7,274.61	5,345.07	9,019.26	0.93	0.24	-0.90
20,508.00	89.17	150.96	11,197.02	-7,356.13	5,389.80	9,111.87	0.62	-0.10	-0.61
20,601.00	89.09	150.47	11,198.43	-7,437.24	5,435.29	9,204.56	0.53	-0.09	-0.53
20,694.00	89.22	150.34	11,199.81	-7,518.09	5,481.21	9,297.29	0.20	0.14	-0.14
20,787.00	89.13	150.52	11,201.15	-7,598.97	5,527.10	9,390.01	0.22	-0.10	0.19
20,879.00	89.22	151.09	11,202.47	-7,679.28	5,571.97	9,481.69	0.63	0.10	0.62
20,972.00	89.22	150.78	11,203.74	-7,760.56	5,617.15	9,574.35	0.33	0.00	-0.33
21,066.00	89.04	151.09	11,205.16	-7,842.71	5,662.81	9,668.00	0.38	-0.19	0.33
Tie into original hole @ 21066 MD									
21,094.00	87.87	152.19	11,205.92	-7,867.34	5,676.10	9,695.86	5.73	-4.18	3.93
21,125.00	88.44	154.73	11,206.92	-7,895.06	5,689.95	9,726.58	8.39	1.84	8.19
21,156.00	88.97	155.53	11,207.62	-7,923.17	5,702.98	9,757.19	3.10	1.71	2.58
21,218.00	90.51	155.26	11,207.90	-7,979.54	5,728.79	9,818.37	2.52	2.48	-0.44
21,265.00	88.97	152.54	11,208.11	-8,021.74	5,749.47	9,864.93	6.65	-3.28	-5.79
21,311.00	89.01	152.27	11,208.92	-8,062.50	5,770.77	9,910.64	0.59	0.09	-0.59
21,404.00	87.74	152.19	11,211.56	-8,144.76	5,814.08	10,003.07	1.37	-1.37	-0.09
21,497.00	87.43	151.92	11,215.48	-8,226.84	5,857.63	10,095.49	0.44	-0.33	-0.29
21,590.00	89.14	152.19	11,218.26	-8,308.96	5,901.19	10,187.94	1.86	1.84	0.29
21,683.00	90.02	152.10	11,218.94	-8,391.18	5,944.64	10,280.42	0.95	0.95	-0.10
21,776.00	90.46	152.10	11,218.55	-8,473.37	5,988.16	10,372.90	0.47	0.47	0.00
21,869.00	89.89	150.87	11,218.27	-8,555.08	6,032.55	10,465.49	1.46	-0.61	-1.32
21,962.00	88.62	149.46	11,219.48	-8,635.75	6,078.81	10,558.24	2.04	-1.37	-1.52
22,055.00	88.44	149.55	11,221.87	-8,715.86	6,125.99	10,651.05	0.22	-0.19	0.10
22,149.00	88.66	149.55	11,224.24	-8,796.87	6,173.62	10,744.85	0.23	0.23	0.00
22,242.00	88.13	150.25	11,226.85	-8,877.29	6,220.24	10,837.60	0.94	-0.57	0.75



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
22,335.00	88.40	149.81	11,229.66	-8,957.82	6,266.67	10,930.34	0.55	0.29	-0.47	
22,429.00	88.35	149.20	11,232.33	-9,038.78	6,314.36	11,024.13	0.65	-0.05	-0.65	
22,521.00	88.88	148.58	11,234.55	-9,117.53	6,361.88	11,116.00	0.89	0.58	-0.67	
22,614.00	88.70	147.88	11,236.52	-9,196.58	6,410.83	11,208.91	0.78	-0.19	-0.75	
22,707.00	88.84	147.53	11,238.51	-9,275.17	6,460.51	11,301.85	0.41	0.15	-0.38	
22,800.00	88.22	149.02	11,240.90	-9,354.25	6,509.39	11,394.75	1.73	-0.67	1.60	
22,893.00	88.53	148.93	11,243.54	-9,433.91	6,557.31	11,487.60	0.35	0.33	-0.10	
22,986.00	88.18	149.81	11,246.21	-9,513.90	6,604.67	11,580.40	1.02	-0.38	0.95	
23,079.00	88.53	149.64	11,248.88	-9,594.18	6,651.54	11,673.18	0.42	0.38	-0.18	
23,172.00	89.10	149.64	11,250.80	-9,674.41	6,698.53	11,765.98	0.61	0.61	0.00	
23,265.00	89.10	149.55	11,252.26	-9,754.61	6,745.59	11,858.80	0.10	0.00	-0.10	
23,358.00	89.49	149.81	11,253.40	-9,834.89	6,792.54	11,951.61	0.50	0.42	0.28	
23,451.00	87.38	150.60	11,255.94	-9,915.56	6,838.73	12,044.33	2.42	-2.27	0.85	
23,544.00	87.34	149.81	11,260.23	-9,996.18	6,884.89	12,136.99	0.85	-0.04	-0.85	
23,637.00	88.18	150.34	11,263.86	-10,076.72	6,931.25	12,229.69	1.07	0.90	0.57	
23,730.00	88.62	150.25	11,266.46	-10,157.46	6,977.32	12,322.40	0.48	0.47	-0.10	
23,823.00	88.75	150.16	11,268.59	-10,238.15	7,023.52	12,415.14	0.17	0.14	-0.10	
23,916.00	88.97	149.46	11,270.44	-10,318.52	7,070.27	12,507.92	0.79	0.24	-0.75	
24,008.00	88.92	149.20	11,272.14	-10,397.63	7,117.19	12,599.76	0.29	-0.05	-0.28	
24,101.00	88.97	148.76	11,273.85	-10,477.32	7,165.11	12,692.63	0.48	0.05	-0.47	
24,195.00	89.32	148.41	11,275.25	-10,557.53	7,214.10	12,786.53	0.53	0.37	-0.37	
24,288.00	88.48	149.64	11,277.04	-10,637.25	7,261.96	12,879.39	1.60	-0.90	1.32	
24,381.00	87.03	150.25	11,280.68	-10,717.68	7,308.50	12,972.10	1.69	-1.56	0.66	
24,473.00	86.99	149.81	11,285.48	-10,797.27	7,354.39	13,063.76	0.48	-0.04	-0.48	
24,567.00	87.91	149.55	11,289.66	-10,878.33	7,401.80	13,157.48	1.02	0.98	-0.28	
24,660.00	87.91	149.02	11,293.05	-10,958.24	7,449.27	13,250.27	0.57	0.00	-0.57	
24,753.00	87.78	149.02	11,296.55	-11,037.91	7,497.11	13,343.09	0.14	-0.14	0.00	
24,846.00	87.69	148.58	11,300.23	-11,117.40	7,545.24	13,435.91	0.48	-0.10	-0.47	
24,939.00	87.78	147.35	11,303.90	-11,196.17	7,594.54	13,528.79	1.33	0.10	-1.32	
25,031.00	88.18	148.67	11,307.15	-11,274.15	7,643.24	13,620.67	1.50	0.43	1.43	
25,125.00	88.57	150.16	11,309.81	-11,355.04	7,691.05	13,714.48	1.64	0.41	1.59	
25,218.00	88.92	150.08	11,311.85	-11,435.66	7,737.37	13,807.22	0.39	0.38	-0.09	
25,310.00	88.79	149.46	11,313.69	-11,515.13	7,783.68	13,899.02	0.69	-0.14	-0.67	
25,403.00	88.88	149.20	11,315.58	-11,595.11	7,831.11	13,991.85	0.30	0.10	-0.28	
25,496.00	89.05	148.58	11,317.26	-11,674.72	7,879.15	14,084.72	0.69	0.18	-0.67	
25,590.00	88.97	148.14	11,318.88	-11,754.73	7,928.46	14,178.63	0.48	-0.09	-0.47	
Survey @ 25590.00 MD 11318.88 TVD										
25,657.00	88.97	148.14	11,320.09	-11,811.63	7,963.82	14,245.58	0.00	0.00	0.00	
Survey Proj. to 25657 MD 11320.09 TVD ST1										



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Design Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
21,066.00	11,205.16	-7,842.71	5,662.81	Tie into original hole @ 21066 MD
25,590.00	11,318.88	-11,754.73	7,928.46	Survey @ 25590.00 MD 11318.88 TVD



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Project	Marshall County, West Virginia NAD83 UTM 17N		
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	Van Winkle				
Site Position:		Northing:	14,447,369.493 usft	Latitude:	39.781725330
From:	Lat/Long	Easting:	1,717,188.440 usft	Longitude:	-80.726733270
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "	Grid Convergence:	0.17 °

Well	Van Winkle S-23 HU (slot D)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,314.610 usft	Latitude:	39.781575000
	+E/-W	0.00 ft	Easting:	1,717,141.484 usft	Longitude:	-80.726901000
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level:	753.00 ft

Wellbore	Sidetrack 01				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	4/29/2023	-8.65	66.35	51,556.39025259

Design	Surveys Sidetrack 01				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	21,066.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	146.09	

Survey Program	Date 5/22/2023				
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	1,467.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,499.00	4,408.00	MWD 1499-4408 MD (Original Hole)	MWD	MWD - Standard	
4,419.00	21,066.00	MWD (Original Hole)	MWD	MWD - Standard	
21,094.00	25,590.00	MWD ST1 (Sidetrack 01)	MWD	MWD - Standard	
25,657.00	25,657.00	Projection (Sidetrack 01)	MWD	MWD - Standard	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.00	0.00	0.00	0.00	14,447,314.610	1,717,141.484	39.781575000	-80.726901000	
14.00	0.00	0.00	14.00	0.00	0.00	14,447,314.610	1,717,141.484	39.781575000	-80.726901000	
179.00	0.38	154.84	179.00	-0.50	0.23	14,447,314.115	1,717,141.717	39.781573638	-80.726900177	
208.00	0.26	125.82	208.00	-0.62	0.33	14,447,313.989	1,717,141.811	39.781573292	-80.726899843	
238.00	0.38	166.10	238.00	-0.76	0.41	14,447,313.853	1,717,141.890	39.781572917	-80.726899563	
267.00	0.21	225.61	267.00	-0.89	0.39	14,447,313.722	1,717,141.875	39.781572559	-80.726899618	
298.00	0.32	143.92	298.00	-1.00	0.40	14,447,313.613	1,717,141.886	39.781572258	-80.726899582	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
328.00	0.40	164.87	328.00	-1.17	0.48	14,447,313.444	1,717,141.963	39.781571793	-80.726899311
359.00	0.49	196.35	359.00	-1.40	0.47	14,447,313.212	1,717,141.953	39.781571157	-80.726899346
391.00	0.15	225.31	391.00	-1.56	0.40	14,447,313.051	1,717,141.885	39.781570716	-80.726899591
422.00	0.46	178.58	421.99	-1.71	0.37	14,447,312.898	1,717,141.859	39.781570296	-80.726899684
454.00	0.42	210.70	453.99	-1.94	0.32	14,447,312.669	1,717,141.803	39.781569667	-80.726899888
486.00	0.36	190.29	485.99	-2.14	0.24	14,447,312.469	1,717,141.725	39.781569119	-80.726900167
517.00	0.64	181.29	516.99	-2.41	0.22	14,447,312.200	1,717,141.704	39.781568381	-80.726900246
549.00	0.27	57.48	548.99	-2.55	0.28	14,447,312.062	1,717,141.763	39.781568001	-80.726900036
580.00	0.26	135.81	579.99	-2.56	0.39	14,447,312.051	1,717,141.874	39.781567970	-80.726899642
612.00	0.53	97.99	611.99	-2.63	0.59	14,447,311.979	1,717,142.071	39.781567769	-80.726898941
643.00	0.73	79.88	642.99	-2.62	0.92	14,447,311.993	1,717,142.407	39.781567806	-80.726897744
675.00	0.60	103.29	674.99	-2.62	1.29	14,447,311.991	1,717,142.771	39.781567796	-80.726896449
707.00	0.97	92.56	706.98	-2.67	1.72	14,447,311.940	1,717,143.205	39.781567653	-80.726894906
739.00	0.77	89.20	738.98	-2.68	2.21	14,447,311.931	1,717,143.690	39.781567624	-80.726893178
770.00	0.98	101.07	769.98	-2.73	2.67	14,447,311.883	1,717,144.159	39.781567488	-80.726891511
802.00	1.48	111.94	801.97	-2.93	3.33	14,447,311.676	1,717,144.811	39.781566915	-80.726889193
833.00	1.58	106.80	832.96	-3.21	4.11	14,447,311.403	1,717,145.591	39.781566158	-80.726886417
865.00	1.85	102.21	864.94	-3.44	5.03	14,447,311.166	1,717,146.518	39.781565500	-80.726883120
897.00	2.28	93.92	896.92	-3.60	6.17	14,447,311.013	1,717,147.658	39.781565071	-80.726879064
928.00	2.30	101.62	927.90	-3.76	7.40	14,447,310.846	1,717,148.883	39.781564601	-80.726874707
960.00	2.35	91.88	959.87	-3.91	8.68	14,447,310.695	1,717,150.167	39.781564176	-80.726870136
992.00	2.01	85.56	991.85	-3.89	9.90	14,447,310.717	1,717,151.382	39.781564226	-80.726865811
1,024.00	1.58	79.66	1,023.83	-3.77	10.89	14,447,310.840	1,717,152.376	39.781564554	-80.726862273
1,056.00	1.33	84.17	1,055.82	-3.65	11.70	14,447,310.956	1,717,153.179	39.781564869	-80.726859412
1,087.00	0.91	82.17	1,086.82	-3.58	12.30	14,447,311.027	1,717,153.781	39.781565056	-80.726857269
1,119.00	1.17	70.76	1,118.81	-3.44	12.86	14,447,311.169	1,717,154.341	39.781565442	-80.726855274
1,151.00	0.64	65.19	1,150.81	-3.26	13.33	14,447,311.351	1,717,154.812	39.781565940	-80.726853596
1,182.00	0.79	56.48	1,181.80	-3.07	13.66	14,447,311.542	1,717,155.147	39.781566461	-80.726852401
1,214.00	0.34	359.63	1,213.80	-2.85	13.85	14,447,311.759	1,717,155.331	39.781567054	-80.726851746
1,246.00	0.64	10.05	1,245.80	-2.58	13.88	14,447,312.030	1,717,155.361	39.781567798	-80.726851634
1,278.00	0.58	316.08	1,277.80	-2.29	13.80	14,447,312.322	1,717,155.280	39.781568602	-80.726851920
1,310.00	0.54	281.29	1,309.80	-2.14	13.54	14,447,312.469	1,717,155.020	39.781569006	-80.726852845
1,341.00	0.79	263.71	1,340.80	-2.14	13.18	14,447,312.474	1,717,154.664	39.781569023	-80.726854111
1,373.00	0.89	258.23	1,372.79	-2.21	12.72	14,447,312.399	1,717,154.202	39.781568822	-80.726855758
1,404.00	1.48	279.46	1,403.79	-2.19	12.09	14,447,312.416	1,717,153.571	39.781568873	-80.726858002
1,436.00	1.42	277.84	1,435.78	-2.07	11.29	14,447,312.538	1,717,152.771	39.781569214	-80.726860850
1,467.00	1.07	293.08	1,466.77	-1.91	10.64	14,447,312.704	1,717,152.124	39.781569675	-80.726863150
1,499.00	0.75	309.47	1,498.77	-1.66	10.20	14,447,312.954	1,717,151.687	39.781570366	-80.726864702
1,531.00	0.40	314.81	1,530.76	-1.44	9.96	14,447,313.166	1,717,151.446	39.781570950	-80.726865557
1,562.00	0.59	18.33	1,561.76	-1.22	9.94	14,447,313.393	1,717,151.420	39.781571576	-80.726865649
1,594.00	0.54	41.76	1,593.76	-0.95	10.09	14,447,313.662	1,717,151.572	39.781572313	-80.726865104
1,626.00	1.24	64.43	1,625.76	-0.69	10.50	14,447,313.924	1,717,151.985	39.781573029	-80.726863632
1,657.00	1.84	89.43	1,656.75	-0.54	11.30	14,447,314.074	1,717,152.785	39.781573433	-80.726860782
1,689.00	2.63	92.41	1,688.72	-0.56	12.55	14,447,314.048	1,717,154.032	39.781573352	-80.726856343
1,720.00	2.85	90.45	1,719.69	-0.60	14.03	14,447,314.012	1,717,155.514	39.781573241	-80.726851071
1,752.00	3.34	87.83	1,751.64	-0.57	15.76	14,447,314.041	1,717,157.241	39.781573306	-80.726844923
1,784.00	3.99	89.69	1,783.57	-0.53	17.80	14,447,314.083	1,717,159.285	39.781573403	-80.726837644
1,815.00	3.75	94.64	1,814.50	-0.60	19.89	14,447,314.006	1,717,161.374	39.781573176	-80.726830210
1,847.00	3.42	93.09	1,846.44	-0.74	21.89	14,447,313.870	1,717,163.371	39.781572785	-80.726823106
1,877.00	2.63	91.56	1,876.40	-0.81	23.47	14,447,313.803	1,717,164.952	39.781572588	-80.726817477
1,909.00	2.42	87.38	1,908.37	-0.80	24.88	14,447,313.814	1,717,166.361	39.781572606	-80.726812463
1,940.00	2.11	95.51	1,939.34	-0.82	26.10	14,447,313.789	1,717,167.583	39.781572528	-80.726808114
1,971.00	2.31	83.76	1,970.32	-0.81	27.29	14,447,313.802	1,717,168.772	39.781572554	-80.726803881
2,003.00	2.15	81.36	2,002.30	-0.65	28.52	14,447,313.963	1,717,170.006	39.781572984	-80.726799485



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-23 HU (slot D)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-23 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
25,310.00	88.79	149.46	11,313.69	-11,515.13	7,783.68	14,435,799.503	1,724,925.149	39.749882941	-80.699333271
25,403.00	88.88	149.20	11,315.58	-11,595.11	7,831.11	14,435,719.529	1,724,972.577	39.749662873	-80.699165486
25,496.00	89.05	148.58	11,317.26	-11,674.72	7,879.15	14,435,639.918	1,725,020.621	39.749443796	-80.698995510
25,590.00	88.97	148.14	11,318.88	-11,754.73	7,928.46	14,435,559.902	1,725,069.924	39.749223596	-80.698821059
Survey @ 25590.00 MD 11318.88 TVD									
25,657.00	88.97	148.14	11,320.09	-11,811.63	7,963.82	14,435,503.006	1,725,105.284	39.749067016	-80.698695938
Survey Proj. to 25657 MD 11320.09 TVD ST1									

Design Annotations					
Measured Depth (ft)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Comment	
21,066.00	11,205.16	-7,842.71	5,662.81	Tie into original hole @ 21066 MD	
25,590.00	11,318.88	-11,754.73	7,928.46	Survey @ 25590.00 MD 11318.88 TVD	
25,657.00	11,320.09	-11,811.63	7,963.82	Survey Proj. to 25657 MD 11320.09 TVD ST1	