



Well: Old Crow S-15 HM (slot I)
Site: Old Crow Pad
Project: Marshall County, West Virginia.
Design: rev7

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	V Sect	Annotation
1	8866.00	89.63	151.42	6643.88	2284.56	3697.44	0.00	0.000	1917.77	Survey @ 8866.00 MD 6643.88 TVD
2	8966.00	89.63	151.42	6644.53	2196.75	3745.28	0.00	0.000	2004.96	Proj. Begin 1°/100' turn
3	9024.00	89.63	152.00	6644.90	2145.68	3772.77	1.00	90.002	2055.39	Begin 89.63° lateral
4	9254.00	89.63	152.00	6646.39	1942.60	3880.75	0.00	0.000	2254.78	Begin 1°/100' drop/turn
5	9490.86	89.00	149.72	6649.21	1735.75	3996.08	1.00	-105.329	2462.41	Begin 89.00° lateral
6	17247.41	89.00	149.72	6784.00	-4961.25	7907.08	0.00	0.000	9334.66	PBHL/TD 17247.41 MD/6784.00 TVD

ANNOTATIONS SURVEYS

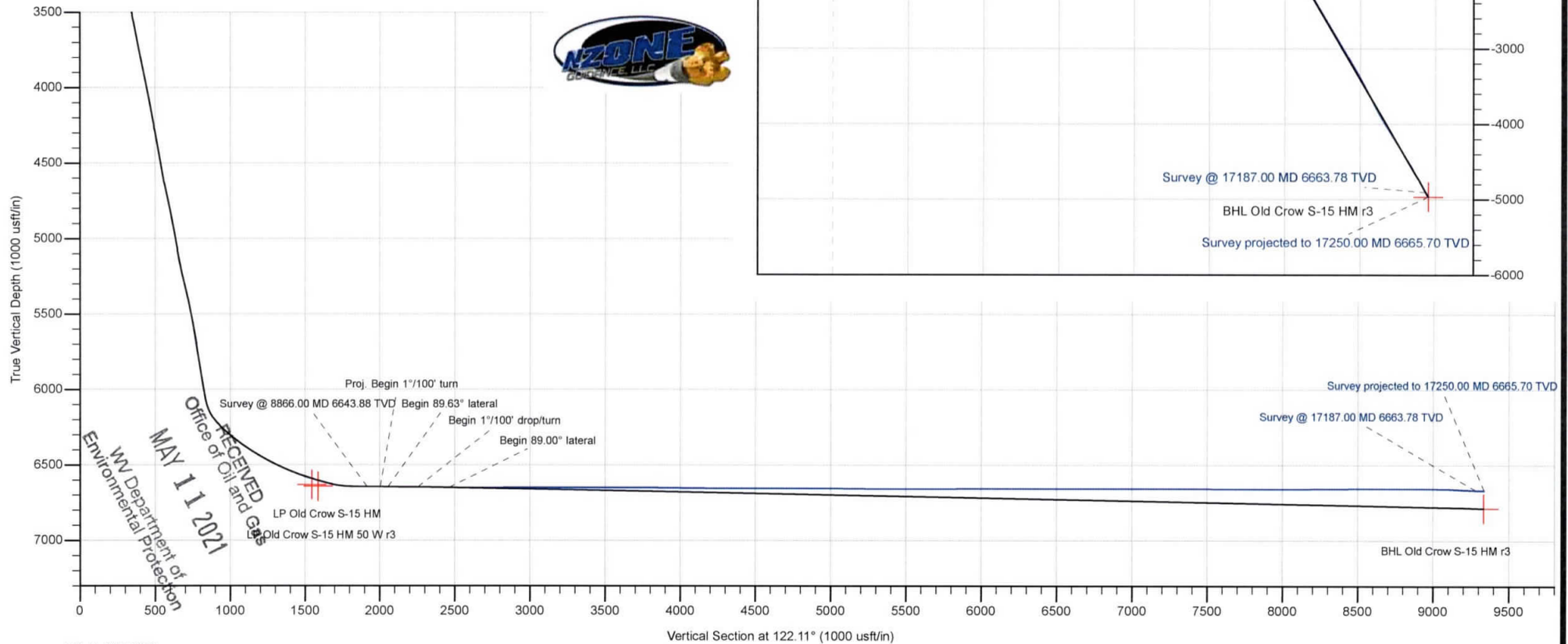
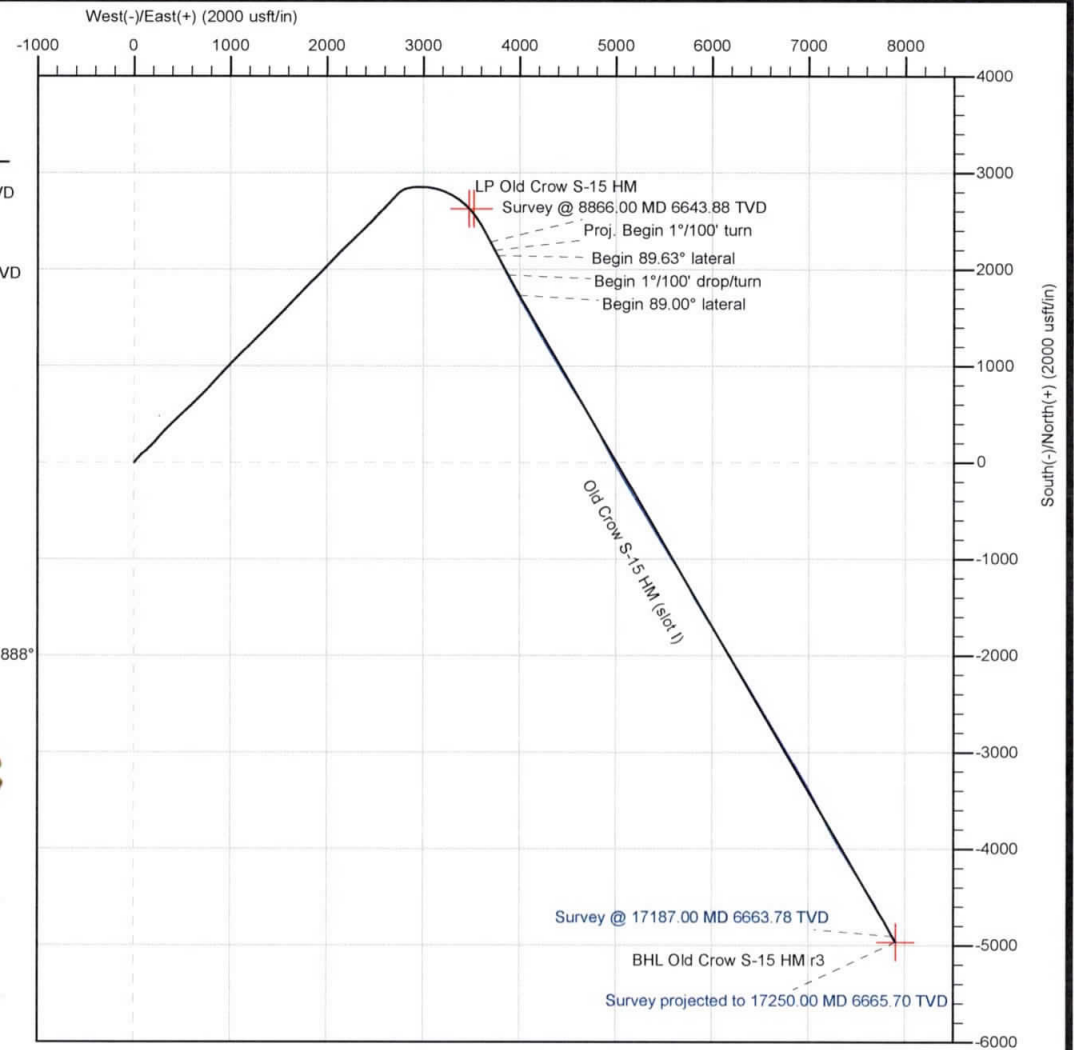
MD	Inc	Azi	TVD	+N/-S	+E/-W	V Sect	Annotation
100.00	0.22	102.73	100.00	-0.04	0.19	0.18	Gyro
7325.00	43.03	44.02	5971.10	2717.03	2671.18	818.34	MWD surveys
17187.00	88.26	150.28	6663.78	-4907.00	7879.00	9282.04	Survey @ 17187.00 MD 6663.78 TVD
17250.00	88.26	150.28	6665.70	-4961.68	7910.21	9337.55	Survey projected to 17250.00 MD 6665.70 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+26 @ 1291.00usft (Nabors B28)

Northing	Easting	Latitude	Longitude
14446117.19	1707042.99	39.77836557	-80.76285717

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.888°



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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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:	0.152 °

Well	Old Crow S-15 HM (slot I)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,117.19 usft	Latitude:	39.77836557
	+E/-W	0.00 usft	Easting:	1,707,042.99 usft	Longitude:	-80.76285717
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)
	IGRF2015	3/27/2020	-8.736	66.724	51,854.99743998

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	122.11	

Survey Program	Date	4/20/2020			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	7,018.00	Gyro 0-7018 MD (Original Hole)	NS-GYRO-MS	North sensing gyrocompassing m/s	
7,325.00	17,187.00	MWD TIP=7018 MD gyro apr1720 (Original Hole)	MWD	MWD - Standard	
17,250.00	17,250.00	Projection (Original Hole)	MWD	MWD - Standard	

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.22	102.73	100.00	-0.04	0.19	0.18	0.22	0.22	0.00
Gyro									
125.00	0.31	114.69	125.00	-0.08	0.30	0.29	0.42	0.36	47.84
150.00	0.29	117.54	150.00	-0.14	0.41	0.42	0.16	-0.08	11.40
175.00	0.22	116.60	175.00	-0.19	0.51	0.53	0.28	-0.28	3.76
200.00	0.19	124.96	200.00	-0.23	0.59	0.62	0.17	0.04	33.44
225.00	0.18	111.76	225.00	-0.27	0.66	0.70	0.17	0.04	-52.80
250.00	0.20	112.49	250.00	-0.30	0.74	0.79	0.08	0.08	2.92

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Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
275.00	0.20	108.19	275.00	-0.33	0.82	0.87	0.06	0.00	-17.20	
300.00	0.22	118.39	300.00	-0.37	0.90	0.96	0.17	0.08	40.80	
325.00	0.26	112.75	325.00	-0.42	1.00	1.06	0.19	0.16	-22.56	
350.00	0.23	119.61	350.00	-0.46	1.09	1.17	0.17	-0.12	27.44	
375.00	0.23	127.31	375.00	-0.52	1.18	1.27	0.12	0.00	30.80	
400.00	0.25	117.64	400.00	-0.57	1.26	1.38	0.18	0.08	-38.68	
425.00	0.24	126.66	425.00	-0.63	1.35	1.48	0.16	-0.04	36.08	
450.00	0.24	126.19	450.00	-0.69	1.44	1.59	0.01	0.00	-1.88	
475.00	0.21	128.51	475.00	-0.75	1.52	1.68	0.13	-0.12	9.28	
500.00	0.25	103.98	500.00	-0.79	1.61	1.78	0.42	0.16	-98.12	
525.00	0.38	68.93	525.00	-0.78	1.74	1.88	0.91	0.52	-140.20	
550.00	0.79	55.97	549.99	-0.65	1.96	2.00	1.71	1.64	-51.84	
575.00	1.49	44.37	574.99	-0.32	2.33	2.14	2.93	2.80	-46.40	
600.00	2.09	41.70	599.98	0.25	2.86	2.29	2.42	2.40	-10.68	
625.00	2.61	40.18	624.96	1.03	3.53	2.44	2.09	2.08	-6.08	
650.00	3.40	38.72	649.92	2.04	4.36	2.61	3.17	3.16	-5.84	
675.00	4.38	38.62	674.86	3.36	5.42	2.80	3.92	3.92	-0.40	
700.00	5.24	38.34	699.78	5.01	6.72	3.03	3.44	3.44	-1.12	
725.00	5.93	37.95	724.66	6.92	8.22	3.29	2.76	2.76	-1.56	
750.00	6.63	38.05	749.51	9.07	9.91	3.57	2.80	2.80	0.40	
775.00	7.14	38.15	774.33	11.43	11.76	3.88	2.04	2.04	0.40	
800.00	7.69	37.94	799.12	13.97	13.75	4.22	2.20	2.20	-0.84	
825.00	7.92	38.18	823.89	16.65	15.84	4.57	0.93	0.92	0.96	
850.00	7.96	38.32	848.65	19.36	17.98	4.94	0.18	0.16	0.56	
875.00	8.00	38.46	873.40	22.08	20.13	5.32	0.18	0.16	0.56	
900.00	8.04	37.91	898.16	24.82	22.29	5.69	0.35	0.16	-2.20	
925.00	8.06	38.46	922.91	27.57	24.45	6.06	0.32	0.08	2.20	
950.00	7.99	39.29	947.67	30.29	26.64	6.47	0.54	-0.28	3.32	
975.00	8.00	39.97	972.42	32.97	28.86	6.92	0.38	0.04	2.72	
1,000.00	7.94	40.64	997.18	35.61	31.10	7.42	0.44	-0.24	2.68	
1,025.00	7.80	42.03	1,021.95	38.18	33.36	7.96	0.95	-0.56	5.56	
1,050.00	7.75	42.81	1,046.72	40.68	35.64	8.57	0.47	-0.20	3.12	
1,075.00	7.79	43.19	1,071.49	43.15	37.95	9.21	0.26	0.16	1.52	
1,100.00	7.85	43.24	1,096.26	45.63	40.28	9.86	0.24	0.24	0.20	
1,125.00	8.04	43.23	1,121.02	48.15	42.65	10.53	0.76	0.76	-0.04	
1,150.00	8.98	41.40	1,145.74	50.88	45.13	11.18	3.91	3.76	-7.32	
1,175.00	9.49	40.51	1,170.42	53.91	47.76	11.80	2.12	2.09	-3.56	
1,200.00	9.85	40.15	1,195.06	57.12	50.48	12.40	1.46	1.44	-1.44	
1,225.00	10.44	39.97	1,219.67	60.49	53.31	13.01	2.36	2.36	-0.72	
1,250.00	11.47	40.82	1,244.21	64.10	56.39	13.69	4.17	4.12	3.40	
1,275.00	12.00	41.03	1,268.69	67.94	59.72	14.47	2.13	2.12	0.84	
1,300.00	12.25	41.25	1,293.13	71.90	63.18	15.30	1.02	1.00	0.88	
1,325.00	12.83	43.94	1,317.54	75.89	66.85	16.29	3.29	2.32	10.76	

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Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
1,350.00	13.46	46.96	1,341.88	79.88	70.91	17.60	3.73	2.52	12.08	
1,375.00	13.65	47.57	1,366.19	83.85	75.21	19.13	0.95	0.76	2.44	
1,400.00	13.89	47.94	1,390.47	87.85	79.62	20.74	1.02	0.96	1.48	
1,425.00	14.93	51.00	1,414.68	91.89	84.35	22.60	5.15	4.16	12.24	
1,450.00	15.58	52.32	1,438.80	95.97	89.51	24.80	2.95	2.60	5.28	
1,475.00	15.98	52.31	1,462.86	100.13	94.89	27.15	1.60	1.60	-0.04	
1,500.00	16.49	51.83	1,486.86	104.42	100.40	29.54	2.11	2.04	-1.92	
1,525.00	17.76	50.84	1,510.75	109.02	106.15	31.96	5.21	5.08	-3.96	
1,550.00	18.23	50.06	1,534.53	113.94	112.10	34.39	2.11	1.88	-3.12	
1,575.00	18.55	49.25	1,558.25	119.05	118.11	36.76	1.64	1.28	-3.24	
1,600.00	19.05	48.40	1,581.92	124.35	124.18	39.08	2.28	2.00	-3.40	
1,625.00	20.08	47.37	1,605.48	129.97	130.38	41.36	4.34	4.12	-4.12	
1,650.00	20.15	46.72	1,628.95	135.83	136.68	43.57	0.94	0.28	-2.60	
1,675.00	20.60	46.49	1,652.39	141.81	143.00	45.75	1.83	1.80	-0.92	
1,700.00	21.00	46.09	1,675.76	147.94	149.42	47.92	1.70	1.60	-1.60	
1,725.00	21.74	45.38	1,699.04	154.30	155.94	50.07	3.14	2.96	-2.84	
1,750.00	22.25	44.65	1,722.22	160.92	162.56	52.16	2.31	2.04	-2.92	
1,775.00	22.89	44.13	1,745.30	167.78	169.27	54.20	2.68	2.56	-2.08	
1,800.00	23.62	44.01	1,768.27	174.87	176.14	56.24	2.93	2.92	-0.48	
1,825.00	24.43	44.05	1,791.11	182.19	183.21	58.35	3.24	3.24	0.16	
1,850.00	24.86	43.91	1,813.83	189.69	190.45	60.49	1.74	1.72	-0.56	
1,875.00	25.34	43.19	1,836.47	197.37	197.76	62.59	2.28	1.92	-2.88	
1,900.00	25.67	42.66	1,859.03	205.26	205.09	64.61	1.60	1.32	-2.12	
1,925.00	25.91	41.59	1,881.54	213.32	212.38	66.50	2.09	0.96	-4.28	
1,950.00	26.19	40.56	1,904.00	221.60	219.60	68.21	2.13	1.12	-4.12	
1,975.00	26.42	39.91	1,926.41	230.06	226.75	69.78	1.47	0.92	-2.60	
2,000.00	26.71	39.92	1,948.77	238.63	233.93	71.30	1.16	1.16	0.04	
2,025.00	27.02	39.73	1,971.08	247.31	241.16	72.82	1.29	1.24	-0.76	
2,050.00	27.35	39.61	1,993.31	256.10	248.45	74.32	1.34	1.32	-0.48	
2,075.00	27.96	40.21	2,015.46	265.00	255.90	75.89	2.68	2.44	2.40	
2,100.00	29.20	42.12	2,037.41	274.00	263.77	77.78	6.16	4.96	7.64	
2,125.00	29.92	42.64	2,059.16	283.11	272.09	79.98	3.06	2.88	2.08	
2,150.00	30.29	42.87	2,080.79	292.32	280.60	82.30	1.55	1.48	0.92	
2,175.00	30.98	42.93	2,102.30	301.65	289.27	84.68	2.76	2.76	0.24	
2,200.00	31.81	43.20	2,123.64	311.16	298.16	87.16	3.37	3.32	1.08	
2,225.00	32.45	43.33	2,144.81	320.85	307.28	89.73	2.57	2.56	0.52	
2,250.00	33.10	43.72	2,165.83	330.66	316.60	92.41	2.73	2.60	1.56	
2,275.00	34.07	44.36	2,186.65	340.60	326.21	95.27	4.13	3.88	2.56	
2,300.00	34.96	44.79	2,207.25	350.69	336.15	98.32	3.69	3.56	1.72	
2,325.00	35.72	45.00	2,227.65	360.93	346.36	101.52	3.08	3.04	0.84	
2,350.00	36.55	45.45	2,247.84	371.32	356.83	104.87	3.49	3.32	1.80	
2,375.00	37.11	45.77	2,267.85	381.80	367.53	108.37	2.37	2.24	1.28	
2,400.00	37.51	45.93	2,287.73	392.35	378.41	111.97	1.65	1.60	0.64	
2,425.00	37.67	45.94	2,307.54	402.96	389.37	115.61	0.64	0.64	0.04	

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Survey									
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2,450.00	37.70	45.98	2,327.33	413.58	400.35	119.27	0.15	0.12	0.16
2,475.00	37.70	45.98	2,347.11	424.21	411.35	122.94	0.00	0.00	0.00
2,500.00	37.63	45.98	2,366.90	434.82	422.33	126.60	0.28	-0.28	0.00
2,525.00	37.73	45.96	2,386.68	445.44	433.32	130.26	0.40	0.40	-0.08
2,550.00	37.96	46.11	2,406.42	456.09	444.36	133.95	0.99	0.92	0.60
2,575.00	38.09	46.65	2,426.12	466.72	455.51	137.75	1.43	0.52	2.16
2,600.00	38.31	46.80	2,445.76	477.31	466.76	141.65	0.96	0.88	0.60
2,625.00	38.59	47.16	2,465.34	487.92	478.13	145.64	1.43	1.12	1.44
2,650.00	38.67	47.42	2,484.87	498.51	489.60	149.72	0.72	0.32	1.04
2,675.00	38.86	47.78	2,504.37	509.06	501.15	153.90	1.18	0.76	1.44
2,700.00	38.89	47.95	2,523.83	519.59	512.79	158.16	0.44	0.12	0.68
2,725.00	39.08	47.86	2,543.26	530.13	524.46	162.44	0.79	0.76	-0.36
2,750.00	39.37	47.93	2,562.63	540.73	536.19	166.75	1.17	1.16	0.28
2,775.00	39.49	47.81	2,581.94	551.38	547.97	171.06	0.57	0.48	-0.48
2,800.00	39.42	47.55	2,601.24	562.08	559.71	175.32	0.72	-0.28	-1.04
2,825.00	39.51	47.07	2,620.54	572.85	571.39	179.49	1.27	0.36	-1.92
2,850.00	39.82	46.88	2,639.79	583.74	583.06	183.58	1.33	1.24	-0.76
2,875.00	40.13	46.66	2,658.94	594.74	594.76	187.65	1.36	1.24	-0.88
2,900.00	40.33	46.35	2,678.03	605.85	606.47	191.66	1.13	0.80	-1.24
2,925.00	40.51	45.83	2,697.06	617.10	618.15	195.58	1.53	0.72	-2.08
2,950.00	41.14	45.38	2,715.98	628.53	629.83	199.39	2.78	2.52	-1.80
2,975.00	41.49	45.14	2,734.76	640.15	641.55	203.15	1.54	1.40	-0.96
3,000.00	41.65	44.75	2,753.46	651.89	653.27	206.83	1.22	0.64	-1.56
3,025.00	41.85	44.43	2,772.11	663.74	664.96	210.43	1.17	0.80	-1.28
3,050.00	42.14	44.31	2,790.69	675.70	676.65	213.98	1.20	1.16	-0.48
3,075.00	42.46	44.25	2,809.18	687.75	688.40	217.53	1.29	1.28	-0.24
3,100.00	42.39	43.81	2,827.64	699.87	700.12	221.01	1.22	-0.28	-1.76
3,125.00	42.60	43.54	2,846.07	712.09	711.79	224.40	1.11	0.84	-1.08
3,150.00	42.90	43.66	2,864.43	724.38	723.49	227.78	1.24	1.20	0.48
3,175.00	43.09	43.35	2,882.72	736.74	735.22	231.14	1.14	0.76	-1.24
3,200.00	42.97	42.23	2,900.99	749.26	746.81	234.31	3.09	-0.48	-4.48
3,225.00	43.93	42.88	2,919.14	761.92	758.44	237.42	4.24	3.84	2.60
3,250.00	44.50	43.02	2,937.06	774.69	770.32	240.70	2.31	2.28	0.56
3,275.00	44.54	42.82	2,954.88	787.52	782.26	243.99	0.58	0.16	-0.80
3,300.00	44.42	42.08	2,972.72	800.45	794.08	247.13	2.13	-0.48	-2.96
3,325.00	45.11	42.37	2,990.47	813.48	805.91	250.23	2.88	2.76	1.16
3,350.00	44.87	42.34	3,008.15	826.54	817.82	253.37	0.96	-0.96	-0.12
3,375.00	44.52	41.88	3,025.92	839.59	829.61	256.42	1.91	1.00	1.84
3,400.00	44.27	41.74	3,043.79	852.62	841.27	259.37	1.07	1.00	-0.56
3,425.00	44.03	43.19	3,061.72	865.47	853.02	262.50	4.15	-0.96	5.80
3,450.00	43.39	43.10	3,079.80	878.07	864.84	265.81	2.57	-2.56	-0.36
3,475.00	43.21	42.78	3,097.99	890.63	876.52	269.03	1.14	-0.96	-1.28
3,500.00	43.40	42.81	3,116.18	903.21	888.17	272.21	0.76	0.96	0.12

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
3,525.00	43.82	43.52	3,134.28	915.78	899.96	275.51	2.58	1.68	2.84
3,550.00	43.63	43.28	3,152.35	928.34	911.84	278.90	1.01	-0.76	-0.96
3,575.00	43.25	42.60	3,170.50	940.92	923.55	282.13	2.41	-1.52	-2.72
3,600.00	42.92	43.47	3,188.76	953.41	935.20	285.36	2.72	-1.32	3.48
3,625.00	42.44	44.27	3,207.14	965.62	946.95	288.82	2.90	-1.92	3.20
3,650.00	41.89	44.02	3,225.67	977.67	958.63	292.32	2.30	-2.20	-1.00
3,675.00	41.40	43.57	3,244.35	989.66	970.13	295.68	2.30	-1.96	-1.80
3,700.00	41.25	45.20	3,263.13	1,001.45	981.68	299.19	4.35	-0.60	6.52
3,725.00	40.79	45.68	3,281.99	1,012.97	993.37	302.97	2.23	-1.84	1.92
3,750.00	40.30	45.62	3,300.99	1,024.33	1,004.99	306.78	1.97	-1.96	-0.24
3,775.00	39.96	45.22	3,320.10	1,035.64	1,016.47	310.49	1.71	-1.36	-1.60
3,800.00	40.64	45.80	3,339.17	1,046.97	1,028.00	314.23	3.11	2.72	2.32
3,825.00	40.80	45.73	3,358.12	1,058.35	1,039.69	318.08	0.67	0.64	-0.28
3,850.00	40.39	45.08	3,377.10	1,069.77	1,051.27	321.83	2.36	-1.64	-2.60
3,875.00	40.42	44.73	3,396.14	1,081.24	1,062.71	325.41	0.92	0.12	-1.40
3,900.00	41.32	44.95	3,415.04	1,092.84	1,074.24	329.02	3.65	3.60	0.88
3,925.00	41.16	44.49	3,433.84	1,104.55	1,085.84	332.62	1.37	-0.64	-1.84
3,950.00	40.87	43.71	3,452.70	1,116.33	1,097.26	336.03	2.35	-1.16	-3.12
3,975.00	41.15	43.58	3,471.57	1,128.21	1,108.58	339.31	1.17	1.12	-0.52
4,000.00	41.90	43.82	3,490.29	1,140.19	1,120.03	342.64	3.07	3.00	0.96
4,025.00	41.73	43.76	3,508.92	1,152.22	1,131.57	346.01	0.70	-0.68	-0.24
4,050.00	40.89	43.13	3,527.70	1,164.20	1,142.91	349.26	3.75	-3.36	-2.52
4,075.00	41.38	43.98	3,546.53	1,176.12	1,154.25	352.52	2.97	1.96	3.40
4,100.00	42.01	44.81	3,565.19	1,188.00	1,165.88	356.06	3.35	2.52	3.32
4,125.00	41.88	44.85	3,583.79	1,199.85	1,177.66	359.74	0.53	-0.52	0.16
4,150.00	41.57	44.39	3,602.45	1,211.69	1,189.35	363.34	1.74	-1.24	-1.84
4,175.00	42.52	44.84	3,621.01	1,223.61	1,201.11	366.97	3.99	3.80	1.80
4,200.00	42.98	45.50	3,639.37	1,235.58	1,213.14	370.80	2.57	1.84	2.64
4,225.00	42.81	45.21	3,657.68	1,247.53	1,225.25	374.70	1.04	-0.68	-1.16
4,250.00	42.24	44.63	3,676.11	1,259.50	1,237.18	378.45	2.77	-2.28	-2.32
4,275.00	43.09	45.15	3,694.49	1,271.50	1,249.14	382.20	3.68	3.40	2.08
4,300.00	43.07	45.20	3,712.75	1,283.54	1,261.25	386.06	0.16	-0.08	0.20
4,325.00	42.61	44.76	3,731.08	1,295.56	1,273.27	389.84	2.19	-1.84	-1.76
4,350.00	42.47	44.44	3,749.50	1,307.60	1,285.14	393.50	1.03	-0.56	-1.28
4,375.00	43.34	44.55	3,767.82	1,319.74	1,297.06	397.15	3.49	3.48	0.44
4,400.00	43.17	44.22	3,786.02	1,331.98	1,309.05	400.79	1.13	-0.68	-1.32
4,425.00	42.60	43.26	3,804.34	1,344.27	1,320.81	404.22	3.47	-2.28	-3.84
4,450.00	42.69	44.27	3,822.73	1,356.50	1,332.52	407.64	2.76	1.16	4.04
4,475.00	42.98	45.93	3,841.06	1,368.50	1,344.56	411.46	4.66	1.16	6.64
4,500.00	42.47	46.09	3,859.43	1,380.28	1,356.77	415.54	2.09	-2.09	0.64
4,525.00	41.93	45.26	3,877.95	1,392.01	1,368.78	419.48	3.10	-2.76	0.64
4,550.00	42.53	45.91	3,896.46	1,403.77	1,380.78	423.39	2.97	2.40	2.60
4,575.00	42.92	46.19	3,914.83	1,415.54	1,392.99	427.48	1.74	1.56	1.12

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,600.00	42.71	45.73	3,933.17	1,427.35	1,405.21	431.55	1.51	-0.84	-1.84
4,625.00	42.39	44.83	3,951.58	1,439.25	1,417.22	435.40	2.75	-1.28	-3.60
4,650.00	43.15	45.41	3,969.94	1,451.23	1,429.25	439.22	3.42	3.04	2.32
4,675.00	43.05	45.08	3,988.19	1,463.25	1,441.38	443.10	0.99	-0.40	-1.32
4,700.00	42.49	44.15	4,006.54	1,475.34	1,453.30	446.78	3.38	-2.24	-3.72
4,725.00	42.12	43.83	4,025.03	1,487.44	1,464.99	450.25	1.71	-1.48	-1.28
4,750.00	42.31	45.09	4,043.55	1,499.43	1,476.76	453.84	3.47	0.76	5.04
4,775.00	41.66	44.75	4,062.13	1,511.27	1,488.56	457.55	2.75	-2.60	-1.36
4,800.00	41.23	44.03	4,080.87	1,523.10	1,500.14	461.07	2.57	-1.72	-2.88
4,825.00	41.31	43.85	4,099.66	1,534.97	1,511.58	464.45	0.57	0.32	-0.72
4,850.00	41.90	44.31	4,118.35	1,546.90	1,523.13	467.89	2.66	2.36	1.84
4,875.00	41.30	43.66	4,137.05	1,558.84	1,534.66	471.31	2.96	-2.40	-2.60
4,900.00	40.58	42.72	4,155.93	1,570.78	1,545.87	474.45	3.79	-2.88	-3.76
4,925.00	40.86	43.60	4,174.88	1,582.68	1,557.03	477.58	2.55	1.12	3.52
4,950.00	41.11	44.67	4,193.75	1,594.44	1,568.44	481.00	2.98	1.00	4.28
4,975.00	40.44	44.21	4,212.69	1,606.10	1,579.88	484.48	2.94	-2.68	-1.84
5,000.00	39.90	43.06	4,231.79	1,617.77	1,591.00	487.71	3.67	-2.16	-4.60
5,025.00	40.69	44.29	4,250.86	1,629.46	1,602.17	490.95	4.48	3.16	4.92
5,050.00	41.01	44.76	4,269.77	1,641.12	1,613.64	494.47	1.77	1.28	1.88
5,075.00	40.49	43.98	4,288.71	1,652.79	1,625.05	497.93	2.91	-2.08	-3.12
5,100.00	39.98	43.48	4,307.79	1,664.45	1,636.21	501.18	2.41	-2.04	-2.00
5,125.00	40.78	45.22	4,326.84	1,676.03	1,647.53	504.62	5.53	3.20	6.96
5,150.00	40.91	45.37	4,345.75	1,687.54	1,659.15	508.35	0.65	0.52	0.60
5,175.00	40.41	44.60	4,364.71	1,699.06	1,670.67	511.98	2.83	-2.00	-3.08
5,200.00	40.32	44.02	4,383.76	1,710.64	1,681.98	515.40	1.55	-0.36	-2.32
5,225.00	41.28	44.78	4,402.69	1,722.31	1,693.41	518.88	4.32	3.84	3.04
5,250.00	41.36	44.49	4,421.46	1,734.06	1,705.01	522.46	0.83	0.32	-1.16
5,275.00	40.85	43.47	4,440.30	1,745.88	1,716.42	525.84	3.37	-2.04	-4.08
5,300.00	41.20	43.53	4,459.16	1,757.79	1,727.72	529.08	1.41	1.40	0.24
5,325.00	42.13	44.13	4,477.84	1,769.78	1,739.23	532.46	4.05	3.72	2.40
5,350.00	42.31	43.87	4,496.35	1,781.86	1,750.90	535.92	1.00	0.72	-1.04
5,375.00	41.59	42.63	4,514.94	1,794.03	1,762.35	539.15	4.39	-2.88	-4.96
5,400.00	42.22	43.35	4,533.55	1,806.24	1,773.73	542.30	3.17	2.52	2.88
5,425.00	43.15	44.01	4,551.93	1,818.50	1,785.44	545.70	4.13	3.72	2.64
5,450.00	43.35	43.76	4,570.14	1,830.85	1,797.31	549.20	1.05	0.80	-1.00
5,475.00	42.79	42.87	4,588.40	1,843.27	1,809.03	552.51	3.31	-2.24	-3.56
5,500.00	43.75	44.40	4,606.60	1,855.67	1,820.85	555.94	5.69	3.84	6.12
5,525.00	44.51	45.10	4,624.55	1,868.03	1,833.11	559.75	3.61	3.04	2.80
5,550.00	44.52	44.54	4,642.37	1,880.46	1,845.46	563.61	1.57	0.04	-2.24
5,575.00	44.16	44.19	4,660.25	1,892.95	1,857.68	567.31	1.74	-1.44	-1.40
5,600.00	44.64	45.89	4,678.12	1,905.31	1,870.05	571.23	5.13	0.92	6.80
5,625.00	44.24	46.38	4,695.97	1,917.44	1,882.67	575.47	2.11	1.60	1.96
5,650.00	43.65	45.55	4,713.97	1,929.50	1,895.15	579.63	3.30	-2.36	-3.32
5,675.00	43.72	45.17	4,732.05	1,941.63	1,907.43	583.58	1.09	0.32	-1.52

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
5,700.00	44.57	45.45	4,749.99	1,953.88	1,919.81	587.56	3.49	3.40	1.12
5,725.00	44.28	45.05	4,767.84	1,966.20	1,932.24	591.54	1.61	-1.16	-1.60
5,750.00	43.47	44.10	4,785.86	1,978.54	1,944.40	595.28	4.18	-3.24	-3.80
5,775.00	43.29	44.49	4,804.03	1,990.83	1,956.39	598.90	1.29	-0.72	1.56
5,800.00	43.23	44.88	4,822.24	2,003.01	1,968.44	602.63	1.10	-0.24	1.56
5,825.00	42.55	44.21	4,840.55	2,015.14	1,980.38	606.30	3.27	-2.72	-2.68
5,850.00	42.02	43.18	4,859.05	2,027.30	1,992.00	609.68	3.49	-2.12	-4.12
5,875.00	42.51	44.18	4,877.55	2,039.46	2,003.61	613.05	3.33	1.96	4.00
5,900.00	42.48	44.71	4,895.98	2,051.51	2,015.43	616.66	1.44	-0.12	2.12
5,925.00	41.79	44.23	4,914.52	2,063.48	2,027.18	620.25	3.05	-2.76	-1.92
5,950.00	41.23	43.53	4,933.24	2,075.42	2,038.67	623.63	2.91	-2.24	-2.80
5,975.00	41.61	44.20	4,951.99	2,087.35	2,050.13	627.00	2.34	1.52	2.68
6,000.00	41.41	44.01	4,970.71	2,099.24	2,061.66	630.44	0.95	-0.80	-0.76
6,025.00	40.69	43.15	4,989.57	2,111.14	2,072.98	633.71	3.66	-2.88	-3.44
6,050.00	40.37	42.87	5,008.57	2,123.02	2,084.06	636.78	1.47	-1.28	-1.12
6,075.00	40.96	44.19	5,027.53	2,134.83	2,095.28	640.01	4.17	2.36	5.28
6,100.00	40.41	43.92	5,046.49	2,146.54	2,106.61	643.38	2.31	-2.20	-1.08
6,125.00	39.55	42.77	5,065.65	2,158.22	2,117.64	646.51	4.54	-3.44	-4.60
6,150.00	39.46	43.10	5,084.93	2,169.86	2,128.47	649.50	0.91	-0.36	1.32
6,175.00	40.04	44.88	5,104.16	2,181.36	2,139.58	652.79	5.11	2.32	7.12
6,200.00	40.26	44.96	5,123.26	2,192.78	2,150.96	656.36	0.90	0.88	0.32
6,225.00	39.58	44.13	5,142.44	2,204.21	2,162.21	659.82	3.46	-2.72	-3.32
6,250.00	40.15	44.91	5,161.63	2,215.63	2,173.45	663.26	3.03	2.28	3.12
6,275.00	41.34	46.28	5,180.57	2,227.05	2,185.11	667.07	5.95	4.76	5.48
6,300.00	41.72	46.54	5,199.28	2,238.48	2,197.11	671.16	1.67	1.52	1.04
6,325.00	41.26	45.98	5,218.01	2,249.93	2,209.08	675.21	2.36	-1.84	-2.24
6,350.00	42.16	46.87	5,236.67	2,261.39	2,221.13	679.33	4.31	3.60	3.56
6,375.00	42.92	47.61	5,255.09	2,272.87	2,233.54	683.74	3.64	3.04	2.96
6,400.00	42.97	47.38	5,273.39	2,284.38	2,246.10	688.26	0.66	0.20	-0.92
6,425.00	42.64	46.92	5,291.74	2,295.93	2,258.55	692.67	1.82	-1.32	-1.84
6,450.00	43.36	47.66	5,310.02	2,307.49	2,271.08	697.13	3.52	2.88	2.96
6,475.00	43.12	47.45	5,328.23	2,319.05	2,283.72	701.69	1.12	-0.96	-0.84
6,500.00	42.42	46.75	5,346.58	2,330.61	2,296.15	706.08	3.38	-2.80	-2.80
6,525.00	42.32	46.37	5,365.05	2,342.19	2,308.39	710.29	1.10	-0.40	-1.52
6,550.00	42.92	46.79	5,383.45	2,353.83	2,320.68	714.52	2.66	2.40	1.68
6,575.00	42.48	46.35	5,401.82	2,365.48	2,332.99	718.75	2.13	-1.76	-1.76
6,600.00	41.73	45.58	5,420.37	2,377.13	2,345.05	722.77	3.64	-3.00	-3.08
6,625.00	41.97	45.39	5,438.99	2,388.82	2,356.94	726.62	1.09	0.96	-0.76
6,650.00	42.76	45.19	5,457.46	2,400.68	2,368.91	730.47	3.21	3.16	-0.80
6,675.00	42.25	44.84	5,475.90	2,412.62	2,380.86	734.24	2.25	-2.04	-1.40
6,700.00	41.41	44.01	5,494.52	2,424.52	2,392.53	737.80	4.02	3.36	3.32
6,725.00	41.90	44.68	5,513.20	2,436.41	2,404.14	741.32	2.65	1.96	2.68
6,750.00	42.13	45.24	5,531.78	2,448.25	2,415.97	745.04	1.76	0.92	2.24

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
6,775.00	41.33	44.54	5,550.43	2,460.03	2,427.71	748.72	3.70	-3.20	-2.80	
6,800.00	40.63	44.00	5,569.31	2,471.77	2,439.16	752.17	3.14	-2.80	-2.16	
6,825.00	41.32	44.52	5,588.18	2,483.51	2,450.60	755.63	3.08	2.76	2.08	
6,850.00	41.27	44.26	5,606.97	2,495.30	2,462.14	759.13	0.71	-0.20	-1.04	
6,875.00	40.17	43.73	5,625.91	2,507.04	2,473.47	762.49	4.61	-4.40	-2.12	
6,900.00	39.44	43.24	5,645.12	2,518.65	2,484.48	765.65	3.18	-2.92	-1.96	
6,925.00	39.66	43.63	5,664.40	2,530.21	2,495.43	768.78	1.33	0.88	1.56	
6,950.00	38.89	43.24	5,683.75	2,541.70	2,506.31	771.89	3.23	-3.08	-1.56	
6,975.00	37.70	42.14	5,703.37	2,553.08	2,516.81	774.73	5.49	-4.76	-4.40	
7,000.00	37.31	42.08	5,723.20	2,564.38	2,527.02	777.37	1.57	-1.56	-0.24	
7,018.00	37.82	42.74	5,737.47	2,572.48	2,534.42	779.34	3.61	2.83	3.67	
7,325.00	43.03	44.02	5,971.10	2,717.03	2,671.18	818.34	1.72	1.70	0.42	
MWD surveys										
7,356.00	42.11	43.05	5,993.93	2,732.23	2,685.63	822.50	3.65	-2.97	-3.13	
7,450.00	42.11	42.79	6,063.66	2,778.39	2,728.55	834.32	0.19	0.00	-0.28	
7,545.00	43.56	58.35	6,133.52	2,819.06	2,778.20	854.76	11.22	1.53	16.38	
7,640.00	48.31	77.77	6,199.90	2,843.88	2,841.07	894.82	15.47	5.00	20.44	
7,734.00	53.32	84.80	6,259.32	2,854.75	2,913.01	949.97	7.87	5.33	7.48	
7,829.00	55.34	91.48	6,314.75	2,857.20	2,990.07	1,013.95	6.09	2.13	7.03	
7,923.00	55.82	98.78	6,367.94	2,850.26	3,067.22	1,082.98	6.43	0.51	7.77	
8,018.00	60.35	105.54	6,418.19	2,833.17	3,145.93	1,158.73	7.69	4.77	7.12	
8,111.00	61.93	111.96	6,463.11	2,806.98	3,222.99	1,237.92	6.28	1.70	6.90	
8,206.00	64.22	119.69	6,506.18	2,770.07	3,299.12	1,322.03	7.64	2.41	8.14	
8,301.00	68.70	125.41	6,544.14	2,723.19	3,372.43	1,409.05	7.26	4.72	6.02	
8,395.00	72.09	133.05	6,575.71	2,667.20	3,440.91	1,496.81	8.46	3.61	8.13	
8,489.00	75.21	139.65	6,602.20	2,601.95	3,503.09	1,584.16	7.51	3.32	7.02	
8,583.00	77.14	145.62	6,624.68	2,529.44	3,558.44	1,669.59	6.50	2.05	6.35	
8,677.00	85.45	150.63	6,638.90	2,450.60	3,607.41	1,752.97	10.29	8.84	5.33	
8,772.00	89.45	152.04	6,643.13	2,367.35	3,652.93	1,835.78	4.46	4.21	1.48	
8,866.00	89.63	151.42	6,643.88	2,284.56	3,697.44	1,917.49	0.69	0.19	-0.66	
8,961.00	89.36	150.81	6,644.72	2,201.38	3,743.33	2,000.57	0.70	-0.28	-0.64	
9,055.00	89.98	151.42	6,645.26	2,119.08	3,788.74	2,082.78	0.93	0.66	0.65	
9,150.00	89.89	152.57	6,645.37	2,035.20	3,833.34	2,165.15	1.21	-0.09	1.21	
9,244.00	89.45	153.00	6,645.91	1,951.61	3,876.33	2,245.99	0.65	-0.47	0.46	
9,339.00	89.36	152.30	6,646.90	1,867.24	3,919.98	2,327.81	0.74	-0.09	-0.74	
9,433.00	89.36	151.86	6,647.95	1,784.18	3,963.99	2,409.24	0.47	0.00	-0.47	
9,527.00	89.71	150.46	6,648.71	1,701.85	4,009.33	2,491.41	1.54	0.37	-1.49	
9,621.00	89.45	150.46	6,649.40	1,620.07	4,055.67	2,574.13	0.28	-0.28	0.00	
9,716.00	89.89	149.93	6,649.95	1,537.64	4,102.89	2,657.94	0.73	0.46	-0.56	
9,811.00	90.37	151.86	6,649.73	1,454.64	4,149.10	2,741.20	2.09	0.51	2.03	
9,905.00	90.29	150.63	6,649.19	1,372.23	4,194.31	2,823.30	0.51	-0.09	-1.31	
9,999.00	89.80	150.28	6,649.12	1,290.46	4,240.67	2,906.03	0.64	-0.52	-0.37	
10,094.00	90.46	149.14	6,648.90	1,208.43	4,288.58	2,990.22	1.39	0.69	-1.20	

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
10,188.00	90.07	148.79	6,648.47	1,127.88	4,337.04	3,074.08	0.56	-0.41	-0.37
10,283.00	89.67	149.05	6,648.68	1,046.52	4,386.09	3,158.87	0.50	-0.42	0.27
10,377.00	90.64	148.79	6,648.43	966.02	4,434.61	3,242.76	1.07	1.03	-0.28
10,472.00	90.33	148.79	6,647.62	884.77	4,483.84	3,327.64	0.33	-0.33	0.00
10,567.00	89.89	149.05	6,647.44	803.41	4,532.88	3,412.43	0.54	-0.46	0.27
10,662.00	89.23	148.35	6,648.17	722.24	4,582.23	3,497.38	1.01	-0.69	-0.74
10,756.00	90.24	149.05	6,648.60	641.92	4,631.06	3,581.44	1.31	1.07	0.74
10,851.00	90.11	149.14	6,648.31	560.41	4,679.86	3,666.09	0.17	-0.14	0.09
10,946.00	89.54	148.96	6,648.60	478.94	4,728.71	3,750.78	0.63	-0.60	-0.19
11,040.00	89.10	149.84	6,649.72	398.03	4,776.56	3,834.31	1.05	-0.47	0.94
11,134.00	89.71	150.72	6,650.70	316.40	4,823.16	3,917.17	1.14	0.65	0.94
11,229.00	89.85	151.86	6,651.06	233.08	4,868.79	4,000.11	1.21	0.15	1.20
11,323.00	89.14	152.21	6,651.89	150.06	4,912.87	4,081.58	0.84	-0.76	0.37
11,417.00	90.02	150.81	6,652.58	67.45	4,957.71	4,163.47	1.76	0.94	-1.49
11,511.00	89.89	150.37	6,652.65	-14.43	5,003.86	4,246.09	0.49	-0.14	-0.47
11,605.00	89.58	151.07	6,653.09	-96.42	5,049.84	4,328.61	0.81	-0.33	0.74
11,700.00	89.85	150.10	6,653.56	-179.17	5,096.49	4,412.12	1.06	0.28	-1.02
11,793.00	89.41	149.75	6,654.16	-259.65	5,143.10	4,494.37	0.60	-0.47	-0.38
11,887.00	90.51	149.49	6,654.23	-340.74	5,190.64	4,577.74	1.20	1.17	-0.28
11,980.00	90.59	149.31	6,653.33	-420.79	5,237.97	4,660.39	0.21	0.09	-0.19
12,074.00	90.11	149.05	6,652.76	-501.51	5,286.13	4,744.09	0.58	-0.51	-0.28
12,169.00	89.76	149.93	6,652.87	-583.36	5,334.36	4,828.44	1.00	-0.37	0.93
12,263.00	89.98	148.79	6,653.08	-664.23	5,382.27	4,912.01	1.24	0.23	-1.21
12,357.00	89.63	148.17	6,653.40	-744.36	5,431.41	4,996.23	0.76	-0.37	-0.66
12,451.00	88.84	147.91	6,654.65	-824.11	5,481.16	5,080.76	0.88	-0.84	-0.28
12,545.00	89.63	147.99	6,655.91	-903.77	5,531.04	5,165.35	0.84	0.84	0.09
12,640.00	89.10	147.64	6,656.96	-984.17	5,581.64	5,250.94	0.67	-0.56	-0.37
12,734.00	89.36	149.14	6,658.23	-1,064.21	5,630.90	5,335.22	1.62	0.28	1.60
12,829.00	91.43	150.63	6,657.57	-1,146.38	5,678.56	5,419.26	2.68	2.18	1.57
12,924.00	90.29	150.46	6,656.15	-1,229.09	5,725.27	5,502.79	1.21	-1.20	-0.18
13,019.00	89.93	150.46	6,655.96	-1,311.74	5,772.11	5,586.40	0.38	-0.38	0.00
13,114.00	90.11	150.28	6,655.93	-1,394.32	5,819.08	5,670.07	0.27	0.19	-0.19
13,208.00	89.49	149.14	6,656.26	-1,475.48	5,866.49	5,753.37	1.38	-0.66	-1.21
13,303.00	90.68	149.66	6,656.12	-1,557.25	5,914.84	5,837.80	1.37	1.25	0.55
13,398.00	90.68	149.23	6,654.99	-1,639.05	5,963.14	5,922.18	0.45	0.00	-0.45
13,493.00	89.76	149.05	6,654.62	-1,720.60	6,011.86	6,006.80	0.99	-0.97	-0.19
13,588.00	88.97	148.35	6,655.68	-1,801.77	6,061.21	6,091.75	1.11	-0.83	-0.74
13,682.00	89.71	148.17	6,656.76	-1,881.71	6,110.66	6,176.12	0.81	0.42	-0.19
13,777.00	90.11	149.14	6,656.91	-1,962.84	6,160.08	6,261.11	1.10	0.42	1.02
13,872.00	90.11	149.23	6,656.73	-2,044.43	6,208.74	6,345.70	0.99	0.00	0.09
13,967.00	89.67	149.23	6,656.91	-2,126.05	6,257.35	6,430.25	0.46	-0.46	0.00
14,062.00	90.68	149.14	6,656.62	-2,207.64	6,306.01	6,514.84	1.07	0.28	-0.09
14,156.00	90.42	149.84	6,655.72	-2,288.62	6,353.73	6,598.30	0.79	0.28	0.74
14,251.00	89.63	149.05	6,655.68	-2,370.43	6,402.02	6,682.69	1.18	-0.83	-0.83

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
14,346.00	90.59	149.58	6,655.49	-2,452.13	6,450.50	6,767.18	1.15	1.01	0.56
14,440.00	89.58	148.79	6,655.35	-2,532.85	6,498.66	6,850.88	1.36	-1.07	-0.84
14,535.00	90.29	149.75	6,655.46	-2,614.51	6,547.20	6,935.40	1.26	0.75	1.01
14,630.00	89.76	149.31	6,655.42	-2,696.39	6,595.37	7,019.73	0.73	-0.56	-0.46
14,725.00	90.68	149.66	6,655.06	-2,778.23	6,643.61	7,104.09	1.04	0.97	0.37
14,820.00	90.55	149.93	6,654.04	-2,860.33	6,691.40	7,188.21	0.32	-0.14	0.28
14,915.00	89.89	149.05	6,653.67	-2,942.17	6,739.63	7,272.56	1.16	-0.69	-0.93
15,010.00	89.32	148.17	6,654.33	-3,023.27	6,789.11	7,357.58	1.10	-0.60	-0.93
15,104.00	89.85	149.40	6,655.01	-3,103.65	6,837.82	7,441.57	1.42	0.56	1.31
15,199.00	89.89	151.25	6,655.22	-3,186.19	6,884.85	7,525.28	1.95	0.04	1.95
15,294.00	89.01	149.66	6,656.13	-3,268.83	6,931.69	7,608.88	1.91	-0.93	-1.67
15,389.00	89.41	150.19	6,657.44	-3,351.03	6,979.30	7,692.90	0.70	0.42	0.56
15,483.00	89.85	151.42	6,658.05	-3,433.09	7,025.15	7,775.35	1.39	0.47	1.31
15,578.00	89.23	151.77	6,658.81	-3,516.65	7,070.34	7,858.04	0.75	-0.65	0.37
15,672.00	91.03	152.30	6,658.60	-3,599.67	7,114.41	7,939.51	2.00	1.91	0.56
15,767.00	90.90	152.92	6,657.00	-3,684.01	7,158.11	8,021.35	0.67	-0.14	0.65
15,862.00	90.29	150.81	6,656.01	-3,767.77	7,202.90	8,103.81	2.31	-0.64	-2.22
15,956.00	89.76	150.19	6,655.97	-3,849.58	7,249.19	8,186.51	0.87	-0.56	-0.66
16,050.00	90.68	149.23	6,655.61	-3,930.75	7,296.60	8,269.81	1.41	0.98	-1.02
16,144.00	89.98	148.87	6,655.07	-4,011.36	7,344.94	8,353.61	0.84	-0.74	-0.38
16,238.00	90.51	148.79	6,654.67	-4,091.79	7,393.59	8,437.57	0.57	0.56	-0.09
16,332.00	90.42	149.58	6,653.91	-4,172.52	7,441.75	8,521.26	0.85	-0.10	0.84
16,427.00	89.58	147.82	6,653.91	-4,253.69	7,491.10	8,606.21	2.05	-0.88	-1.85
16,521.00	90.42	148.87	6,653.91	-4,333.70	7,540.43	8,690.53	1.43	0.89	1.12
16,615.00	90.46	148.96	6,653.18	-4,414.20	7,588.96	8,774.42	0.10	0.04	0.10
16,710.00	90.07	148.87	6,652.74	-4,495.56	7,638.01	8,859.21	0.42	-0.41	-0.09
16,804.00	89.67	149.23	6,652.96	-4,576.17	7,686.35	8,943.01	0.57	-0.43	0.38
16,897.00	88.62	149.49	6,654.35	-4,656.18	7,733.74	9,025.68	1.16	-1.13	0.28
16,991.00	88.31	150.02	6,656.86	-4,737.35	7,781.07	9,108.92	0.65	-0.33	0.56
17,086.00	87.69	149.84	6,660.18	-4,819.52	7,828.64	9,192.89	0.68	-0.65	-0.19
17,180.00	88.18	150.28	6,663.57	-4,900.92	7,875.53	9,275.87	0.70	0.52	0.47
17,187.00	88.26	150.28	6,663.78	-4,907.00	7,879.00	9,282.04	1.14	1.14	0.00
Survey @ 17187.00 MD 6663.78 TVD									
17,250.00	88.26	150.28	6,665.70	-4,961.68	7,910.22	9,337.55	0.00	0.00	0.00
Survey projected to 17250.00 MD 6665.70 TVD									

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Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
100.00	100.00	-0.04	0.19	Gyro
7,325.00	5,971.10	2,717.03	2,671.18	MWD surveys
17,187.00	6,663.78	-4,907.00	7,879.00	Survey @ 17187.00 MD 6663.78 TVD
17,250.00	6,665.70	-4,961.68	7,910.22	Survey projected to 17250.00 MD 6665.70 TVD

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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:	0.152 °

Well	Old Crow S-15 HM (slot I)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,117.19 usft	Latitude:	39.77836557
	+E/-W	0.00 usft	Easting:	1,707,042.99 usft	Longitude:	-80.76285717
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)
	IGRF2015	3/27/2020	-8.736	66.724	51,854.99743998

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	122.11	

Survey Program	Date	4/20/2020			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	7,018.00	Gyro 0-7018 MD (Original Hole)	NS-GYRO-MS	North sensing gyrocompassing m/s	
7,325.00	17,187.00	MWD TIP=7018 MD gyro apr1720 (Original Hole)	MWD	MWD - Standard	
17,250.00	17,250.00	Projection (Original Hole)	MWD	MWD - Standard	

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	14,446,117.19	1,707,042.99	39.77836557	-80.76285717
100.00	0.22	102.73	100.00	-0.04	0.19	14,446,117.15	1,707,043.18	39.77836545	-80.76285650
Gyro									
125.00	0.31	114.69	125.00	-0.08	0.30	14,446,117.11	1,707,043.28	39.77836535	-80.76285612
150.00	0.29	117.54	150.00	-0.14	0.41	14,446,117.05	1,707,043.40	39.77836519	-80.76285570
175.00	0.22	116.60	175.00	-0.19	0.51	14,446,117.00	1,707,043.50	39.77836503	-80.76285535
200.00	0.19	124.96	200.00	-0.23	0.59	14,446,116.96	1,707,043.58	39.77836492	-80.76285508
225.00	0.18	111.76	225.00	-0.27	0.66	14,446,116.92	1,707,043.65	39.77836482	-80.76285483
250.00	0.20	112.49	250.00	-0.30	0.74	14,446,116.89	1,707,043.72	39.77836473	-80.76285455
275.00	0.20	108.19	275.00	-0.33	0.82	14,446,116.86	1,707,043.81	39.77836465	-80.76285426

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 Environmental Protection

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
300.00	0.22	118.39	300.00	-0.37	0.90	14,446,116.82	1,707,043.89	39.77836455	-80.76285397	
325.00	0.26	112.75	325.00	-0.42	1.00	14,446,116.78	1,707,043.98	39.77836442	-80.76285363	
350.00	0.23	119.61	350.00	-0.46	1.09	14,446,116.73	1,707,044.08	39.77836429	-80.76285329	
375.00	0.23	127.31	375.00	-0.52	1.18	14,446,116.67	1,707,044.16	39.77836414	-80.76285299	
400.00	0.25	117.64	400.00	-0.57	1.26	14,446,116.62	1,707,044.25	39.77836399	-80.76285268	
425.00	0.24	126.66	425.00	-0.63	1.35	14,446,116.56	1,707,044.34	39.77836383	-80.76285236	
450.00	0.24	126.19	450.00	-0.69	1.44	14,446,116.50	1,707,044.43	39.77836366	-80.76285206	
475.00	0.21	128.51	475.00	-0.75	1.52	14,446,116.44	1,707,044.51	39.77836350	-80.76285178	
500.00	0.25	103.98	500.00	-0.79	1.61	14,446,116.40	1,707,044.59	39.77836338	-80.76285146	
525.00	0.38	68.93	525.00	-0.78	1.74	14,446,116.42	1,707,044.72	39.77836343	-80.76285100	
550.00	0.79	55.97	549.99	-0.65	1.96	14,446,116.54	1,707,044.94	39.77836377	-80.76285022	
575.00	1.49	44.37	574.99	-0.32	2.33	14,446,116.87	1,707,045.31	39.77836467	-80.76284890	
600.00	2.09	41.70	599.98	0.25	2.86	14,446,117.44	1,707,045.85	39.77836624	-80.76284700	
625.00	2.61	40.18	624.96	1.03	3.53	14,446,118.22	1,707,046.52	39.77836836	-80.76284461	
650.00	3.40	38.72	649.92	2.04	4.36	14,446,119.23	1,707,047.35	39.77837114	-80.76284164	
675.00	4.38	38.62	674.86	3.36	5.42	14,446,120.56	1,707,048.41	39.77837477	-80.76283786	
700.00	5.24	38.34	699.78	5.01	6.72	14,446,122.20	1,707,049.71	39.77837927	-80.76283320	
725.00	5.93	37.95	724.66	6.92	8.22	14,446,124.11	1,707,051.21	39.77838451	-80.76282783	
750.00	6.63	38.05	749.51	9.07	9.91	14,446,126.27	1,707,052.90	39.77839042	-80.76282182	
775.00	7.14	38.15	774.33	11.43	11.76	14,446,128.62	1,707,054.75	39.77839688	-80.76281522	
800.00	7.69	37.94	799.12	13.97	13.75	14,446,131.17	1,707,056.73	39.77840385	-80.76280812	
825.00	7.92	38.18	823.89	16.65	15.84	14,446,133.84	1,707,058.83	39.77841117	-80.76280064	
850.00	7.96	38.32	848.65	19.36	17.98	14,446,136.55	1,707,060.96	39.77841860	-80.76279301	
875.00	8.00	38.46	873.40	22.08	20.13	14,446,139.27	1,707,063.12	39.77842606	-80.76278531	
900.00	8.04	37.91	898.16	24.82	22.29	14,446,142.01	1,707,065.28	39.77843357	-80.76277761	
925.00	8.06	38.46	922.91	27.57	24.45	14,446,144.76	1,707,067.44	39.77844111	-80.76276988	
950.00	7.99	39.29	947.67	30.29	26.64	14,446,147.48	1,707,069.63	39.77844856	-80.76276206	
975.00	8.00	39.97	972.42	32.97	28.86	14,446,150.16	1,707,071.85	39.77845590	-80.76275414	
1,000.00	7.94	40.64	997.18	35.61	31.10	14,446,152.80	1,707,074.09	39.77846314	-80.76274613	
1,025.00	7.80	42.03	1,021.95	38.18	33.36	14,446,155.37	1,707,076.35	39.77847018	-80.76273806	
1,050.00	7.75	42.81	1,046.72	40.68	35.64	14,446,157.87	1,707,078.63	39.77847702	-80.76272992	
1,075.00	7.79	43.19	1,071.49	43.15	37.95	14,446,160.34	1,707,080.94	39.77848380	-80.76272169	
1,100.00	7.85	43.24	1,096.26	45.63	40.28	14,446,162.82	1,707,083.27	39.77849059	-80.76271338	
1,125.00	8.04	43.23	1,121.02	48.15	42.65	14,446,165.34	1,707,085.63	39.77849748	-80.76270493	
1,150.00	8.98	41.40	1,145.74	50.88	45.13	14,446,168.08	1,707,088.12	39.77850498	-80.76269605	
1,175.00	9.49	40.51	1,170.42	53.91	47.76	14,446,171.11	1,707,090.75	39.77851329	-80.76268666	
1,200.00	9.85	40.15	1,195.06	57.12	50.48	14,446,174.31	1,707,093.47	39.77852206	-80.76267696	
1,225.00	10.44	39.97	1,219.67	60.49	53.31	14,446,177.68	1,707,096.30	39.77853129	-80.76266684	
1,250.00	11.47	40.82	1,244.21	64.10	56.39	14,446,181.29	1,707,099.38	39.77854121	-80.76265585	
1,275.00	12.00	41.03	1,268.69	67.94	59.72	14,446,185.14	1,707,102.71	39.77855173	-80.76264395	
1,300.00	12.25	41.25	1,293.13	71.90	63.18	14,446,189.09	1,707,106.17	39.77856257	-80.76263162	
1,325.00	12.83	43.94	1,317.54	75.89	66.85	14,446,193.08	1,707,109.84	39.77857351	-80.76261850	
1,350.00	13.46	46.96	1,341.88	79.88	70.91	14,446,197.07	1,707,113.90	39.77858442	-80.76260404	
1,375.00	13.65	47.57	1,366.19	83.85	75.21	14,446,201.04	1,707,118.20	39.77859531	-80.76258868	
1,400.00	13.89	47.94	1,390.47	87.85	79.62	14,446,205.04	1,707,122.60	39.77860626	-80.76257297	
1,425.00	14.93	51.00	1,414.68	91.89	84.35	14,446,209.08	1,707,127.34	39.77861731	-80.76255609	
1,450.00	15.58	52.32	1,438.80	95.97	89.51	14,446,213.16	1,707,132.50	39.77862848	-80.76253769	
1,475.00	15.98	52.31	1,462.86	100.13	94.89	14,446,217.32	1,707,137.88	39.77863985	-80.76251850	
1,500.00	16.49	51.83	1,486.86	104.42	100.40	14,446,221.61	1,707,143.39	39.77865161	-80.76249884	
1,525.00	17.76	50.84	1,510.75	109.02	106.15	14,446,226.21	1,707,149.13	39.77866421	-80.76247834	
1,550.00	18.23	50.06	1,534.53	113.94	112.10	14,446,231.13	1,707,155.09	39.77867767	-80.76245710	
1,575.00	18.55	49.25	1,558.25	119.05	118.11	14,446,236.24	1,707,161.10	39.77869166	-80.76243566	
1,600.00	19.05	48.40	1,581.92	124.35	124.18	14,446,241.54	1,707,167.16	39.77870617	-80.76241402	
1,625.00	20.08	47.37	1,605.48	129.97	130.38	14,446,247.16	1,707,173.37	39.77872155	-80.76239187	
1,650.00	20.15	46.72	1,628.95	135.83	136.68	14,446,253.02	1,707,179.66	39.77873759	-80.76236942	

Office of Environmental Protection
 08/27/2021
 89-7863985

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
1,675.00	20.60	46.49	1,652.39	141.81	143.00	14,446,259.00	1,707,185.99	39.77875397	-80.76234685	
1,700.00	21.00	46.09	1,675.76	147.94	149.42	14,446,265.13	1,707,192.41	39.77877077	-80.76232396	
1,725.00	21.74	45.38	1,699.04	154.30	155.94	14,446,271.49	1,707,198.93	39.77878819	-80.76230068	
1,750.00	22.25	44.65	1,722.22	160.92	162.56	14,446,278.11	1,707,205.55	39.77880632	-80.76227705	
1,775.00	22.89	44.13	1,745.30	167.78	169.27	14,446,284.97	1,707,212.26	39.77882510	-80.76225309	
1,800.00	23.62	44.01	1,768.27	174.87	176.14	14,446,292.06	1,707,219.13	39.77884452	-80.76222859	
1,825.00	24.43	44.05	1,791.11	182.19	183.21	14,446,299.38	1,707,226.20	39.77886457	-80.76220334	
1,850.00	24.86	43.91	1,813.83	189.69	190.45	14,446,306.88	1,707,233.44	39.77888512	-80.76217751	
1,875.00	25.34	43.19	1,836.47	197.37	197.76	14,446,314.57	1,707,240.75	39.77890617	-80.76215143	
1,900.00	25.67	42.66	1,859.03	205.26	205.09	14,446,322.45	1,707,248.08	39.77892777	-80.76212526	
1,925.00	25.91	41.59	1,881.54	213.32	212.38	14,446,330.52	1,707,255.37	39.77894987	-80.76209922	
1,950.00	26.19	40.56	1,904.00	221.60	219.60	14,446,338.79	1,707,262.59	39.77897255	-80.76207347	
1,975.00	26.42	39.91	1,926.41	230.06	226.75	14,446,347.25	1,707,269.74	39.77899572	-80.76204792	
2,000.00	26.71	39.92	1,948.77	238.63	233.93	14,446,355.82	1,707,276.92	39.77901922	-80.76202230	
2,025.00	27.02	39.73	1,971.08	247.31	241.16	14,446,364.50	1,707,284.15	39.77904299	-80.76199647	
2,050.00	27.35	39.61	1,993.31	256.10	248.45	14,446,373.29	1,707,291.44	39.77906709	-80.76197044	
2,075.00	27.96	40.21	2,015.46	265.00	255.90	14,446,382.19	1,707,298.89	39.77909147	-80.76194385	
2,100.00	29.20	42.12	2,037.41	274.00	263.77	14,446,391.19	1,707,306.76	39.77911613	-80.76191574	
2,125.00	29.92	42.64	2,059.16	283.11	272.09	14,446,400.30	1,707,315.07	39.77914109	-80.76188606	
2,150.00	30.29	42.87	2,080.79	292.32	280.60	14,446,409.51	1,707,323.59	39.77916631	-80.76185568	
2,175.00	30.98	42.93	2,102.30	301.65	289.27	14,446,418.84	1,707,332.26	39.77919188	-80.76182472	
2,200.00	31.81	43.20	2,123.64	311.16	298.16	14,446,428.36	1,707,341.15	39.77921794	-80.76179298	
2,225.00	32.45	43.33	2,144.81	320.85	307.28	14,446,438.04	1,707,350.27	39.77924446	-80.76176045	
2,250.00	33.10	43.72	2,165.83	330.66	316.60	14,446,447.85	1,707,359.59	39.77927134	-80.76172719	
2,275.00	34.07	44.36	2,186.65	340.60	326.21	14,446,457.79	1,707,369.20	39.77929857	-80.76169287	
2,300.00	34.96	44.79	2,207.25	350.69	336.15	14,446,467.88	1,707,379.14	39.77932621	-80.76165739	
2,325.00	35.72	45.00	2,227.65	360.93	346.36	14,446,478.12	1,707,389.35	39.77935427	-80.76162096	
2,350.00	36.55	45.45	2,247.84	371.32	356.83	14,446,488.51	1,707,399.81	39.77938270	-80.76158362	
2,375.00	37.11	45.77	2,267.85	381.80	367.53	14,446,498.99	1,707,410.52	39.77941141	-80.76154540	
2,400.00	37.51	45.93	2,287.73	392.35	378.41	14,446,509.54	1,707,421.40	39.77944032	-80.76150660	
2,425.00	37.67	45.94	2,307.54	402.96	389.37	14,446,520.15	1,707,432.35	39.77946937	-80.76146750	
2,450.00	37.70	45.98	2,327.33	413.58	400.35	14,446,530.77	1,707,443.34	39.77949846	-80.76142829	
2,475.00	37.70	45.98	2,347.11	424.21	411.35	14,446,541.40	1,707,454.33	39.77952756	-80.76138906	
2,500.00	37.63	45.98	2,366.90	434.82	422.33	14,446,552.01	1,707,465.32	39.77955663	-80.76134986	
2,525.00	37.73	45.96	2,386.68	445.44	433.32	14,446,562.64	1,707,476.31	39.77958572	-80.76131065	
2,550.00	37.96	46.11	2,406.42	456.09	444.36	14,446,573.28	1,707,487.35	39.77961488	-80.76127126	
2,575.00	38.09	46.65	2,426.12	466.72	455.51	14,446,583.91	1,707,498.49	39.77964398	-80.76123148	
2,600.00	38.31	46.80	2,445.76	477.31	466.76	14,446,594.51	1,707,509.75	39.77967300	-80.76119131	
2,625.00	38.59	47.16	2,465.34	487.92	478.13	14,446,605.11	1,707,521.12	39.77970204	-80.76115076	
2,650.00	38.67	47.42	2,484.87	498.51	489.60	14,446,615.70	1,707,532.58	39.77973103	-80.76110984	
2,675.00	38.86	47.78	2,504.37	509.06	501.15	14,446,626.25	1,707,544.14	39.77975993	-80.76106859	
2,700.00	38.89	47.95	2,523.83	519.59	512.79	14,446,636.78	1,707,555.78	39.77978876	-80.76102708	
2,725.00	39.08	47.86	2,543.26	530.13	524.46	14,446,647.32	1,707,567.45	39.77981763	-80.76098544	
2,750.00	39.37	47.93	2,562.63	540.73	536.19	14,446,657.92	1,707,579.18	39.77984665	-80.76094359	
2,775.00	39.49	47.81	2,581.94	551.38	547.97	14,446,668.57	1,707,590.95	39.77987582	-80.76090157	
2,800.00	39.42	47.55	2,601.24	562.08	559.71	14,446,679.27	1,707,602.70	39.77990510	-80.76085966	
2,825.00	39.51	47.07	2,620.54	572.85	571.39	14,446,690.04	1,707,614.38	39.77993460	-80.76081799	
2,850.00	39.82	46.88	2,639.79	583.74	583.06	14,446,700.93	1,707,626.05	39.77996422	-80.76077636	
2,875.00	40.13	46.66	2,658.94	594.74	594.76	14,446,711.93	1,707,637.75	39.77999455	-80.76073460	
2,900.00	40.33	46.35	2,678.03	605.85	606.47	14,446,723.05	1,707,649.46	39.78002498	-80.76069281	
2,925.00	40.51	45.83	2,697.06	617.10	618.15	14,446,734.29	1,707,661.14	39.78005577	-80.76065114	
2,950.00	41.14	45.38	2,715.98	628.53	629.83	14,446,745.72	1,707,672.82	39.78008709	-80.76060946	
2,975.00	41.49	45.14	2,734.76	640.15	641.55	14,446,757.34	1,707,684.54	39.78011859	-80.76056762	
3,000.00	41.65	44.75	2,753.46	651.89	653.27	14,446,769.08	1,707,696.26	39.78015068	-80.76052580	
3,025.00	41.85	44.43	2,772.11	663.74	664.96	14,446,780.94	1,707,707.95	39.78018354	-80.76048409	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
3,050.00	42.14	44.31	2,790.69	675.70	676.65	14,446,792.89	1,707,719.64	39.78021629	-80.76044234	
3,075.00	42.46	44.25	2,809.18	687.75	688.40	14,446,804.94	1,707,731.39	39.78024928	-80.76040042	
3,100.00	42.39	43.81	2,827.64	699.87	700.12	14,446,817.06	1,707,743.11	39.78028250	-80.76035858	
3,125.00	42.60	43.54	2,846.07	712.09	711.79	14,446,829.28	1,707,754.77	39.78031596	-80.76031695	
3,150.00	42.90	43.66	2,864.43	724.38	723.49	14,446,841.57	1,707,766.48	39.78034962	-80.76027518	
3,175.00	43.09	43.35	2,882.72	736.74	735.22	14,446,853.93	1,707,778.21	39.78038349	-80.76023329	
3,200.00	42.97	42.23	2,900.99	749.26	746.81	14,446,866.45	1,707,789.80	39.78041779	-80.76019192	
3,225.00	43.93	42.88	2,919.14	761.92	758.44	14,446,879.12	1,707,801.43	39.78045248	-80.76015041	
3,250.00	44.50	43.02	2,937.06	774.69	770.32	14,446,891.88	1,707,813.31	39.78048744	-80.76010801	
3,275.00	44.54	42.82	2,954.88	787.52	782.26	14,446,904.71	1,707,825.25	39.78052260	-80.76006540	
3,300.00	44.42	42.08	2,972.72	800.45	794.08	14,446,917.64	1,707,837.07	39.78055801	-80.76002320	
3,325.00	45.11	42.37	2,990.47	813.48	805.91	14,446,930.67	1,707,848.90	39.78059372	-80.75998096	
3,350.00	44.87	42.34	3,008.15	826.54	817.82	14,446,943.74	1,707,860.81	39.78062950	-80.75993845	
3,375.00	44.52	41.88	3,025.92	839.59	829.61	14,446,956.78	1,707,872.60	39.78066524	-80.75989636	
3,400.00	44.27	41.74	3,043.79	852.62	841.27	14,446,969.82	1,707,884.26	39.78070096	-80.75985473	
3,425.00	44.03	43.19	3,061.72	865.47	853.02	14,446,982.66	1,707,896.01	39.78073615	-80.75981277	
3,450.00	43.39	43.10	3,079.80	878.07	864.84	14,446,995.27	1,707,907.83	39.78077067	-80.75977060	
3,475.00	43.21	42.78	3,097.99	890.63	876.52	14,447,007.82	1,707,919.51	39.78080506	-80.75972890	
3,500.00	43.40	42.81	3,116.18	903.21	888.17	14,447,020.40	1,707,931.16	39.78083953	-80.75968732	
3,525.00	43.82	43.52	3,134.28	915.78	899.96	14,447,032.98	1,707,942.95	39.78087398	-80.75964521	
3,550.00	43.63	43.28	3,152.35	928.34	911.84	14,447,045.53	1,707,954.83	39.78090837	-80.75960283	
3,575.00	43.25	42.60	3,170.50	940.92	923.55	14,447,058.12	1,707,966.54	39.78094284	-80.75956103	
3,600.00	42.92	43.47	3,188.76	953.41	935.20	14,447,070.60	1,707,978.19	39.78097704	-80.75951943	
3,625.00	42.44	44.27	3,207.14	965.62	946.95	14,447,082.82	1,707,989.93	39.78101050	-80.75947751	
3,650.00	41.89	44.02	3,225.67	977.67	958.63	14,447,094.86	1,708,001.62	39.78104349	-80.75943579	
3,675.00	41.40	43.57	3,244.35	989.66	970.13	14,447,106.85	1,708,013.12	39.78107633	-80.75939475	
3,700.00	41.25	45.20	3,263.13	1,001.45	981.68	14,447,118.65	1,708,024.67	39.78110865	-80.75935354	
3,725.00	40.79	45.68	3,281.99	1,012.97	993.37	14,447,130.16	1,708,036.36	39.78114018	-80.75931182	
3,750.00	40.30	45.62	3,300.99	1,024.33	1,004.99	14,447,141.52	1,708,047.98	39.78117129	-80.75927035	
3,775.00	39.96	45.22	3,320.10	1,035.64	1,016.47	14,447,152.83	1,708,059.45	39.78120227	-80.75922939	
3,800.00	40.64	45.80	3,339.17	1,046.97	1,028.00	14,447,164.16	1,708,070.99	39.78123330	-80.75918822	
3,825.00	40.80	45.73	3,358.12	1,058.35	1,039.69	14,447,175.54	1,708,082.67	39.78126446	-80.75914652	
3,850.00	40.39	45.08	3,377.10	1,069.77	1,051.27	14,447,186.96	1,708,094.26	39.78129574	-80.75910518	
3,875.00	40.42	44.73	3,396.14	1,081.24	1,062.71	14,447,198.44	1,708,105.70	39.78132717	-80.75906435	
3,900.00	41.32	44.95	3,415.04	1,092.84	1,074.24	14,447,210.03	1,708,117.23	39.78135894	-80.75902318	
3,925.00	41.16	44.49	3,433.84	1,104.55	1,085.84	14,447,221.74	1,708,128.83	39.78139101	-80.75898179	
3,950.00	40.87	43.71	3,452.70	1,116.33	1,097.26	14,447,233.53	1,708,140.25	39.78142328	-80.75894104	
3,975.00	41.15	43.58	3,471.57	1,128.21	1,108.58	14,447,245.40	1,708,151.57	39.78145580	-80.75890062	
4,000.00	41.90	43.82	3,490.29	1,140.19	1,120.03	14,447,257.38	1,708,163.02	39.78148862	-80.75885975	
4,025.00	41.73	43.76	3,508.92	1,152.22	1,131.57	14,447,269.41	1,708,174.55	39.78152158	-80.75881858	
4,050.00	40.89	43.13	3,527.70	1,164.20	1,142.91	14,447,281.39	1,708,185.90	39.78155440	-80.75877807	
4,075.00	41.38	43.98	3,546.53	1,176.12	1,154.25	14,447,293.31	1,708,197.24	39.78158705	-80.75873762	
4,100.00	42.01	44.81	3,565.19	1,188.00	1,165.88	14,447,305.19	1,708,208.87	39.78161959	-80.75869609	
4,125.00	41.88	44.85	3,583.79	1,199.85	1,177.66	14,447,317.04	1,708,220.65	39.78165205	-80.75865405	
4,150.00	41.57	44.39	3,602.45	1,211.69	1,189.35	14,447,328.89	1,708,232.34	39.78168448	-80.75861233	
4,175.00	42.52	44.84	3,621.01	1,223.61	1,201.11	14,447,340.80	1,708,244.10	39.78171713	-80.75857036	
4,200.00	42.98	45.50	3,639.37	1,235.58	1,213.14	14,447,352.77	1,708,256.13	39.78174990	-80.75852741	
4,225.00	42.81	45.21	3,657.68	1,247.53	1,225.25	14,447,364.72	1,708,268.24	39.78178264	-80.75848420	
4,250.00	42.24	44.63	3,676.11	1,259.50	1,237.18	14,447,376.69	1,708,280.17	39.78181541	-80.75844161	
4,275.00	43.09	45.15	3,694.49	1,271.50	1,249.14	14,447,388.69	1,708,292.13	39.78184829	-80.75839894	
4,300.00	43.07	45.20	3,712.75	1,283.54	1,261.25	14,447,400.73	1,708,304.24	39.78188126	-80.75835571	
4,325.00	42.61	44.76	3,731.08	1,295.56	1,273.27	14,447,412.75	1,708,316.26	39.78191419	-80.75831283	
4,350.00	42.47	44.44	3,749.50	1,307.60	1,285.14	14,447,424.79	1,708,328.12	39.78194715	-80.75827047	
4,375.00	43.34	44.55	3,767.82	1,319.74	1,297.06	14,447,436.93	1,708,340.05	39.78198040	-80.75822789	
4,400.00	43.17	44.22	3,786.02	1,331.98	1,309.05	14,447,449.17	1,708,352.03	39.78201394	-80.75818512	

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
4,425.00	42.60	43.26	3,804.34	1,344.27	1,320.81	14,447,461.46	1,708,363.80	39.78204760	-80.75814314	
4,450.00	42.69	44.27	3,822.73	1,356.50	1,332.52	14,447,473.69	1,708,375.51	39.78208111	-80.75810132	
4,475.00	42.98	45.93	3,841.06	1,368.50	1,344.56	14,447,485.69	1,708,387.55	39.78211396	-80.75805835	
4,500.00	42.47	46.09	3,859.43	1,380.28	1,356.77	14,447,497.47	1,708,399.76	39.78214622	-80.75801480	
4,525.00	41.93	45.26	3,877.95	1,392.01	1,368.78	14,447,509.20	1,708,411.77	39.78217836	-80.75797192	
4,550.00	42.53	45.91	3,896.46	1,403.77	1,380.78	14,447,520.96	1,708,423.77	39.78221056	-80.75792909	
4,575.00	42.92	46.19	3,914.83	1,415.54	1,392.99	14,447,532.73	1,708,435.98	39.78224280	-80.75788551	
4,600.00	42.71	45.73	3,933.17	1,427.35	1,405.21	14,447,544.54	1,708,448.20	39.78227515	-80.75784192	
4,625.00	42.39	44.83	3,951.58	1,439.25	1,417.22	14,447,556.44	1,708,460.21	39.78230772	-80.75779905	
4,650.00	43.15	45.41	3,969.94	1,451.23	1,429.25	14,447,568.42	1,708,472.24	39.78234053	-80.75775611	
4,675.00	43.05	45.08	3,988.19	1,463.25	1,441.38	14,447,580.45	1,708,484.37	39.78237347	-80.75771282	
4,700.00	42.49	44.15	4,006.54	1,475.34	1,453.30	14,447,592.53	1,708,496.29	39.78240657	-80.75767026	
4,725.00	42.12	43.83	4,025.03	1,487.44	1,464.99	14,447,604.63	1,708,507.98	39.78243973	-80.75762855	
4,750.00	42.31	45.09	4,043.55	1,499.43	1,476.76	14,447,616.62	1,708,519.74	39.78247256	-80.75758655	
4,775.00	41.66	44.75	4,062.13	1,511.27	1,488.56	14,447,628.46	1,708,531.55	39.78250499	-80.75754441	
4,800.00	41.23	44.03	4,080.87	1,523.10	1,500.14	14,447,640.29	1,708,543.13	39.78253738	-80.75750309	
4,825.00	41.31	43.85	4,099.66	1,534.97	1,511.58	14,447,652.16	1,708,554.57	39.78256990	-80.75746224	
4,850.00	41.90	44.31	4,118.35	1,546.90	1,523.13	14,447,664.09	1,708,566.12	39.78260257	-80.75742103	
4,875.00	41.30	43.66	4,137.05	1,558.84	1,534.66	14,447,676.03	1,708,577.65	39.78263528	-80.75737988	
4,900.00	40.58	42.72	4,155.93	1,570.78	1,545.87	14,447,687.97	1,708,588.86	39.78266799	-80.75733985	
4,925.00	40.86	43.60	4,174.88	1,582.68	1,557.03	14,447,699.87	1,708,600.02	39.78270058	-80.75730003	
4,950.00	41.11	44.67	4,193.75	1,594.44	1,568.44	14,447,711.64	1,708,611.43	39.78273281	-80.75725927	
4,975.00	40.44	44.21	4,212.69	1,606.10	1,579.88	14,447,723.29	1,708,622.87	39.78276474	-80.75721847	
5,000.00	39.90	43.06	4,231.79	1,617.77	1,591.00	14,447,734.96	1,708,633.99	39.78279670	-80.75717875	
5,025.00	40.69	44.29	4,250.86	1,629.46	1,602.17	14,447,746.66	1,708,645.16	39.78282873	-80.75713889	
5,050.00	41.01	44.76	4,269.77	1,641.12	1,613.64	14,447,758.31	1,708,656.63	39.78286066	-80.75709796	
5,075.00	40.49	43.98	4,288.71	1,652.79	1,625.05	14,447,769.98	1,708,668.04	39.78289261	-80.75705723	
5,100.00	39.98	43.48	4,307.79	1,664.45	1,636.21	14,447,781.65	1,708,679.20	39.78292457	-80.75701738	
5,125.00	40.78	45.22	4,326.84	1,676.03	1,647.53	14,447,793.23	1,708,690.52	39.78295629	-80.75697697	
5,150.00	40.91	45.37	4,345.75	1,687.54	1,659.15	14,447,804.73	1,708,702.14	39.78298779	-80.75693549	
5,175.00	40.41	44.60	4,364.71	1,699.06	1,670.67	14,447,816.25	1,708,713.66	39.78301934	-80.75689439	
5,200.00	40.32	44.02	4,383.76	1,710.64	1,681.98	14,447,827.83	1,708,724.97	39.78305107	-80.75685402	
5,225.00	41.28	44.78	4,402.69	1,722.31	1,693.41	14,447,839.50	1,708,736.40	39.78308304	-80.75681322	
5,250.00	41.36	44.49	4,421.46	1,734.06	1,705.01	14,447,851.25	1,708,748.00	39.78311521	-80.75677183	
5,275.00	40.85	43.47	4,440.30	1,745.88	1,716.42	14,447,863.08	1,708,759.41	39.78314760	-80.75673109	
5,300.00	41.20	43.53	4,459.16	1,757.79	1,727.72	14,447,874.98	1,708,770.71	39.78318021	-80.75669077	
5,325.00	42.13	44.13	4,477.84	1,769.78	1,739.23	14,447,886.97	1,708,782.21	39.78321305	-80.75664968	
5,350.00	42.31	43.87	4,496.35	1,781.86	1,750.90	14,447,899.05	1,708,793.88	39.78324615	-80.75660803	
5,375.00	41.59	42.63	4,514.94	1,794.03	1,762.35	14,447,911.22	1,708,805.34	39.78327949	-80.75656715	
5,400.00	42.22	43.35	4,533.55	1,806.24	1,773.73	14,447,923.44	1,708,816.72	39.78331294	-80.75652650	
5,425.00	43.15	44.01	4,551.93	1,818.50	1,785.44	14,447,935.69	1,708,828.43	39.78334651	-80.75648472	
5,450.00	43.35	43.76	4,570.14	1,830.85	1,797.31	14,447,948.04	1,708,840.30	39.78338033	-80.75644233	
5,475.00	42.79	42.87	4,588.40	1,843.27	1,809.03	14,447,960.46	1,708,852.01	39.78341435	-80.75640052	
5,500.00	43.75	44.40	4,606.60	1,855.67	1,820.85	14,447,972.86	1,708,863.84	39.78344832	-80.75635831	
5,525.00	44.51	45.10	4,624.55	1,868.03	1,833.11	14,447,985.22	1,708,876.09	39.78348218	-80.75631456	
5,550.00	44.52	44.54	4,642.37	1,880.46	1,845.46	14,447,997.65	1,708,888.45	39.78351623	-80.75627047	
5,575.00	44.16	44.19	4,660.25	1,892.95	1,857.68	14,448,010.15	1,708,900.67	39.78355044	-80.75622686	
5,600.00	44.64	45.89	4,678.12	1,905.31	1,870.05	14,448,022.50	1,708,913.04	39.78358429	-80.75618268	
5,625.00	44.24	46.38	4,695.97	1,917.44	1,882.67	14,448,034.63	1,708,925.66	39.78361780	-80.75613764	
5,650.00	43.65	45.55	4,713.97	1,929.50	1,895.15	14,448,046.69	1,708,938.14	39.78365053	-80.75609313	
5,675.00	43.72	45.17	4,732.05	1,941.63	1,907.43	14,448,058.82	1,708,950.42	39.78368375	-80.75604928	
5,700.00	44.57	45.45	4,749.99	1,953.88	1,919.81	14,448,071.07	1,708,962.80	39.78371729	-80.75600510	
5,725.00	44.28	45.05	4,767.84	1,966.20	1,932.24	14,448,083.39	1,708,975.23	39.78375103	-80.75596074	
5,750.00	43.47	44.10	4,785.86	1,978.54	1,944.40	14,448,095.73	1,708,987.39	39.78378425	-80.75591733	
5,775.00	43.29	44.49	4,804.03	1,990.83	1,956.39	14,448,108.02	1,708,999.38	39.78381749	-80.75587453	

Office of the State Auditor
 Department of Environmental Protection
 APR 1 2021
 08/27/2021 Build 85

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
5,800.00	43.23	44.88	4,822.24	2,003.01	1,968.44	14,448,120.20	1,709,011.43	39.78385186	-80.75583153	
5,825.00	42.55	44.21	4,840.55	2,015.14	1,980.38	14,448,132.33	1,709,023.36	39.78388507	-80.75578892	
5,850.00	42.02	43.18	4,859.05	2,027.30	1,992.00	14,448,144.49	1,709,034.98	39.78391838	-80.75574744	
5,875.00	42.51	44.18	4,877.55	2,039.46	2,003.61	14,448,156.65	1,709,046.60	39.78395168	-80.75570599	
5,900.00	42.48	44.71	4,895.98	2,051.51	2,015.43	14,448,168.70	1,709,058.42	39.78398471	-80.75566378	
5,925.00	41.79	44.23	4,914.52	2,063.48	2,027.18	14,448,180.67	1,709,070.17	39.78401749	-80.75562184	
5,950.00	41.23	43.53	4,933.24	2,075.42	2,038.67	14,448,192.61	1,709,081.66	39.78405020	-80.75558084	
5,975.00	41.61	44.20	4,951.99	2,087.35	2,050.13	14,448,204.54	1,709,093.12	39.78408286	-80.75553993	
6,000.00	41.41	44.01	4,970.71	2,099.24	2,061.66	14,448,216.44	1,709,104.65	39.78411544	-80.75549877	
6,025.00	40.69	43.15	4,989.57	2,111.14	2,072.98	14,448,228.33	1,709,115.97	39.78414802	-80.75545836	
6,050.00	40.37	42.87	5,008.57	2,123.02	2,084.06	14,448,240.21	1,709,127.05	39.78418056	-80.75541880	
6,075.00	40.96	44.19	5,027.53	2,134.83	2,095.28	14,448,252.02	1,709,138.27	39.78421291	-80.75537875	
6,100.00	40.41	43.92	5,046.49	2,146.54	2,106.61	14,448,263.73	1,709,149.60	39.78424499	-80.75533829	
6,125.00	39.55	42.77	5,065.65	2,158.22	2,117.64	14,448,275.41	1,709,160.63	39.78427698	-80.75529893	
6,150.00	39.46	43.10	5,084.93	2,169.86	2,128.47	14,448,287.05	1,709,171.46	39.78430888	-80.75526026	
6,175.00	40.04	44.88	5,104.16	2,181.36	2,139.58	14,448,298.55	1,709,182.56	39.78434037	-80.75522063	
6,200.00	40.26	44.96	5,123.26	2,192.78	2,150.96	14,448,309.97	1,709,193.95	39.78437163	-80.75518000	
6,225.00	39.58	44.13	5,142.44	2,204.21	2,162.21	14,448,321.40	1,709,205.20	39.78440295	-80.75513983	
6,250.00	40.15	44.91	5,161.63	2,215.63	2,173.45	14,448,332.83	1,709,216.44	39.78443424	-80.75509972	
6,275.00	41.34	46.28	5,180.57	2,227.05	2,185.11	14,448,344.24	1,709,228.10	39.78446550	-80.75505811	
6,300.00	41.72	46.54	5,199.28	2,238.48	2,197.11	14,448,355.67	1,709,240.10	39.78449680	-80.75501527	
6,325.00	41.26	45.98	5,218.01	2,249.93	2,209.08	14,448,367.12	1,709,252.07	39.78452815	-80.75497256	
6,350.00	42.16	46.87	5,236.67	2,261.39	2,221.13	14,448,378.58	1,709,264.12	39.78455955	-80.75492955	
6,375.00	42.92	47.61	5,255.09	2,272.87	2,233.54	14,448,390.06	1,709,276.53	39.78459097	-80.75488526	
6,400.00	42.97	47.38	5,273.39	2,284.38	2,246.10	14,448,401.57	1,709,289.08	39.78462248	-80.75484046	
6,425.00	42.64	46.92	5,291.74	2,295.93	2,258.55	14,448,413.12	1,709,301.54	39.78465411	-80.75479601	
6,450.00	43.36	47.66	5,310.02	2,307.49	2,271.08	14,448,424.68	1,709,314.07	39.78468577	-80.75475130	
6,475.00	43.12	47.45	5,328.23	2,319.05	2,283.72	14,448,436.24	1,709,326.71	39.78471742	-80.75470620	
6,500.00	42.42	46.75	5,346.58	2,330.61	2,296.15	14,448,447.80	1,709,339.14	39.78474906	-80.75466182	
6,525.00	42.32	46.37	5,365.05	2,342.19	2,308.39	14,448,459.38	1,709,351.37	39.78478078	-80.75461816	
6,550.00	42.92	46.79	5,383.45	2,353.83	2,320.68	14,448,471.02	1,709,363.67	39.78481264	-80.75457428	
6,575.00	42.48	46.35	5,401.82	2,365.48	2,332.99	14,448,482.67	1,709,375.98	39.78484456	-80.75453034	
6,600.00	41.73	45.58	5,420.37	2,377.13	2,345.05	14,448,494.32	1,709,388.03	39.78487646	-80.75448733	
6,625.00	41.97	45.39	5,438.99	2,388.82	2,356.94	14,448,506.02	1,709,399.93	39.78490849	-80.75444488	
6,650.00	42.76	45.19	5,457.46	2,400.68	2,368.91	14,448,517.87	1,709,411.90	39.78494095	-80.75440215	
6,675.00	42.25	44.84	5,475.90	2,412.62	2,380.86	14,448,529.81	1,709,423.85	39.78497365	-80.75435951	
6,700.00	41.41	44.01	5,494.52	2,424.52	2,392.53	14,448,541.72	1,709,435.52	39.78500626	-80.75431785	
6,725.00	41.90	44.68	5,513.20	2,436.41	2,404.14	14,448,553.60	1,709,447.13	39.78503880	-80.75427639	
6,750.00	42.13	45.24	5,531.78	2,448.25	2,415.97	14,448,565.44	1,709,458.96	39.78507123	-80.75423418	
6,775.00	41.33	44.54	5,550.43	2,460.03	2,427.71	14,448,577.23	1,709,470.70	39.78510352	-80.75419226	
6,800.00	40.63	44.00	5,569.31	2,471.77	2,439.16	14,448,588.97	1,709,482.15	39.78513567	-80.75415141	
6,825.00	41.32	44.52	5,588.18	2,483.51	2,450.60	14,448,600.71	1,709,493.59	39.78516782	-80.75411057	
6,850.00	41.27	44.26	5,606.97	2,495.30	2,462.14	14,448,612.49	1,709,505.13	39.78520012	-80.75406937	
6,875.00	40.17	43.73	5,625.91	2,507.04	2,473.47	14,448,624.23	1,709,516.46	39.78523225	-80.75402893	
6,900.00	39.44	43.24	5,645.12	2,518.65	2,484.48	14,448,635.84	1,709,527.47	39.78526405	-80.75398961	
6,925.00	39.66	43.63	5,664.40	2,530.21	2,495.43	14,448,647.40	1,709,538.41	39.78529572	-80.75395054	
6,950.00	38.89	43.24	5,683.75	2,541.70	2,506.31	14,448,658.89	1,709,549.30	39.78532719	-80.75391169	
6,975.00	37.70	42.14	5,703.37	2,553.08	2,516.81	14,448,670.28	1,709,559.80	39.78535808	-80.75387419	
7,000.00	37.31	42.08	5,723.20	2,564.38	2,527.02	14,448,681.57	1,709,570.01	39.78538932	-80.75383775	
7,018.00	37.82	42.74	5,737.47	2,572.48	2,534.42	14,448,689.67	1,709,577.41	39.78541151	-80.75381132	
7,235.00	43.03	44.02	5,971.10	2,717.03	2,671.18	14,448,834.22	1,709,714.17	39.78580746	-80.75332307	
MWD surveys										
7,356.00	42.11	43.05	5,993.93	2,732.23	2,685.63	14,448,849.42	1,709,728.62	39.78584998	-80.75327150	
7,450.00	42.11	42.79	6,063.66	2,778.39	2,728.55	14,448,895.58	1,709,771.54	39.78597853	-80.75311826	
7,545.00	43.56	58.35	6,133.52	2,819.06	2,778.20	14,448,936.25	1,709,821.19	39.78608684	-80.75294114	

Office of Environmental Protection
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 MAY 11 2021
 Department of Environmental Protection

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
7,640.00	48.31	77.77	6,199.90	2,843.88	2,841.07	14,448,961.08	1,709,884.06	39.78615454	-80.75271708	
7,734.00	53.32	84.80	6,259.32	2,854.75	2,913.01	14,448,971.94	1,709,956.00	39.78618384	-80.75246089	
7,829.00	55.34	91.48	6,314.75	2,857.20	2,990.07	14,448,974.39	1,710,033.06	39.78618997	-80.75218656	
7,923.00	55.82	98.78	6,367.94	2,850.26	3,067.22	14,448,967.45	1,710,110.21	39.78617033	-80.75191202	
8,018.00	60.35	105.54	6,418.19	2,833.17	3,145.93	14,448,950.37	1,710,188.92	39.78612282	-80.75163199	
8,111.00	61.93	111.96	6,463.11	2,806.98	3,222.99	14,448,924.17	1,710,265.97	39.78605030	-80.75135797	
8,206.00	64.22	119.69	6,506.18	2,770.07	3,299.12	14,448,887.26	1,710,342.11	39.78594836	-80.75108733	
8,301.00	68.70	125.41	6,544.14	2,723.19	3,372.43	14,448,840.38	1,710,415.42	39.78581904	-80.75082682	
8,395.00	72.09	133.05	6,575.71	2,667.20	3,440.91	14,448,784.39	1,710,483.90	39.78566475	-80.75058361	
8,489.00	75.21	139.65	6,602.20	2,601.95	3,503.09	14,448,719.14	1,710,546.08	39.78548509	-80.75036291	
8,583.00	77.14	145.62	6,624.68	2,529.44	3,558.44	14,448,646.63	1,710,601.43	39.78528552	-80.75016661	
8,677.00	85.45	150.63	6,638.90	2,450.60	3,607.41	14,448,567.79	1,710,650.40	39.78506864	-80.74999308	
8,772.00	89.45	152.04	6,643.13	2,367.35	3,652.93	14,448,484.54	1,710,695.91	39.78483965	-80.74983190	
8,866.00	89.63	151.42	6,643.88	2,284.56	3,697.44	14,448,401.75	1,710,740.43	39.78461196	-80.74967425	
8,961.00	89.36	150.81	6,644.72	2,201.38	3,743.33	14,448,318.57	1,710,786.32	39.78438318	-80.74951174	
9,055.00	89.98	151.42	6,645.26	2,119.08	3,788.74	14,448,236.27	1,710,831.73	39.78415680	-80.74935093	
9,150.00	89.89	152.57	6,645.37	2,035.20	3,833.34	14,448,152.40	1,710,876.33	39.78392612	-80.74919299	
9,244.00	89.45	153.00	6,645.91	1,951.61	3,876.33	14,448,068.80	1,710,919.32	39.78369622	-80.74904081	
9,339.00	89.36	152.30	6,646.90	1,867.24	3,919.98	14,447,984.43	1,710,962.96	39.78346416	-80.74888630	
9,433.00	89.36	151.86	6,647.95	1,784.18	3,963.99	14,447,901.38	1,711,006.98	39.78323574	-80.74873047	
9,527.00	89.71	150.46	6,648.71	1,701.85	4,009.33	14,447,819.04	1,711,052.32	39.78300927	-80.74856991	
9,621.00	89.45	150.46	6,649.40	1,620.07	4,055.67	14,447,737.26	1,711,098.66	39.78278433	-80.74840576	
9,716.00	89.89	149.93	6,649.95	1,537.64	4,102.89	14,447,654.83	1,711,145.88	39.78255758	-80.74823851	
9,811.00	90.37	151.86	6,649.73	1,454.64	4,149.10	14,447,571.83	1,711,192.08	39.78232929	-80.74807487	
9,905.00	90.29	150.63	6,649.19	1,372.23	4,194.31	14,447,489.42	1,711,237.30	39.78210263	-80.74791475	
9,999.00	89.80	150.28	6,649.12	1,290.46	4,240.67	14,447,407.65	1,711,283.65	39.78187769	-80.74775058	
10,094.00	90.46	149.14	6,648.90	1,208.43	4,288.58	14,447,325.62	1,711,331.57	39.78165205	-80.74758085	
10,188.00	90.07	148.79	6,648.47	1,127.88	4,337.04	14,447,245.08	1,711,380.03	39.78143048	-80.74740916	
10,283.00	89.67	149.05	6,648.68	1,046.52	4,386.09	14,447,163.71	1,711,429.07	39.78120665	-80.74723542	
10,377.00	90.64	148.79	6,648.43	966.02	4,434.61	14,447,083.21	1,711,477.60	39.78098519	-80.74706351	
10,472.00	90.33	148.79	6,647.62	884.77	4,483.84	14,447,001.96	1,711,526.82	39.78076168	-80.74688911	
10,567.00	89.89	149.05	6,647.44	803.41	4,532.88	14,446,920.60	1,711,575.87	39.78053786	-80.74671537	
10,662.00	89.23	148.35	6,648.17	722.24	4,582.23	14,446,839.43	1,711,625.22	39.78031456	-80.74654053	
10,756.00	90.24	149.05	6,648.60	641.92	4,631.06	14,446,759.11	1,711,674.05	39.78009361	-80.74636752	
10,851.00	90.11	149.14	6,648.31	560.41	4,679.86	14,446,677.60	1,711,722.84	39.77986937	-80.74619467	
10,946.00	89.54	148.96	6,648.60	478.94	4,728.71	14,446,596.13	1,711,771.70	39.77964525	-80.74602160	
11,040.00	89.10	149.84	6,649.72	398.03	4,776.56	14,446,515.22	1,711,819.55	39.77942269	-80.74585211	
11,134.00	89.71	150.72	6,650.70	316.40	4,823.16	14,446,433.59	1,711,866.15	39.77919815	-80.74568708	
11,229.00	89.85	151.86	6,651.06	233.08	4,868.79	14,446,350.28	1,711,911.78	39.77896898	-80.74552549	
11,323.00	89.14	152.21	6,651.89	150.06	4,912.87	14,446,267.26	1,711,955.86	39.77874064	-80.74536945	
11,417.00	90.02	150.81	6,652.58	67.45	4,957.71	14,446,184.64	1,712,000.69	39.77851342	-80.74521070	
11,511.00	89.89	150.37	6,652.65	-14.43	5,003.86	14,446,102.76	1,712,046.85	39.77828817	-80.74504724	
11,605.00	89.58	151.07	6,653.09	-96.42	5,049.84	14,446,020.77	1,712,092.83	39.77806265	-80.74488444	
11,700.00	89.85	150.10	6,653.56	-179.17	5,096.49	14,445,938.02	1,712,139.48	39.77783503	-80.74471922	
11,793.00	89.41	149.75	6,654.16	-259.65	5,143.10	14,445,857.54	1,712,186.09	39.77761365	-80.74455416	
11,887.00	90.51	149.49	6,654.23	-340.74	5,190.64	14,445,776.45	1,712,233.62	39.77739058	-80.74438579	
11,980.00	90.59	149.31	6,653.33	-420.79	5,237.97	14,445,696.40	1,712,280.96	39.77717098	-80.74421811	
12,074.00	90.11	149.05	6,652.76	-501.51	5,286.13	14,445,615.68	1,712,329.12	39.77695432	-80.74404753	
12,169.00	89.76	149.93	6,652.87	-583.36	5,334.36	14,445,533.83	1,712,377.35	39.77673217	-80.74387670	
12,263.00	89.98	148.79	6,653.08	-664.23	5,382.27	14,445,452.96	1,712,425.26	39.77650069	-80.74370702	
12,357.00	89.63	148.17	6,653.40	-744.36	5,431.41	14,445,372.83	1,712,474.40	39.77628024	-80.74353293	
12,451.00	88.84	147.91	6,654.65	-824.11	5,481.16	14,445,293.09	1,712,524.15	39.77606085	-80.74335667	
12,545.00	89.63	147.99	6,655.91	-903.77	5,531.04	14,445,213.42	1,712,574.03	39.77584168	-80.74317996	
12,640.00	89.10	147.64	6,656.96	-984.17	5,581.64	14,445,133.02	1,712,624.63	39.77562449	-80.74300070	
12,734.00	89.36	149.14	6,658.23	-1,064.21	5,630.90	14,445,052.98	1,712,673.89	39.77540028	-80.74282618	

Office of Oil and Gas
 West Virginia Department of Environmental Protection
 08/27/2021

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
12,829.00	91.43	150.63	6,657.57	-1,146.38	5,678.56	14,444,970.81	1,712,721.55	39.77517425	-80.74265740
12,924.00	90.29	150.46	6,656.15	-1,229.09	5,725.27	14,444,888.10	1,712,768.26	39.77494673	-80.74249200
13,019.00	89.93	150.46	6,655.96	-1,311.74	5,772.11	14,444,805.45	1,712,815.10	39.77471938	-80.74232615
13,114.00	90.11	150.28	6,655.93	-1,394.32	5,819.08	14,444,722.87	1,712,862.07	39.77449223	-80.74215983
13,208.00	89.49	149.14	6,656.26	-1,475.48	5,866.49	14,444,641.71	1,712,909.48	39.77426895	-80.74199193
13,303.00	90.68	149.66	6,656.12	-1,557.25	5,914.84	14,444,559.94	1,712,957.83	39.77404401	-80.74182066
13,398.00	90.68	149.23	6,654.99	-1,639.05	5,963.14	14,444,478.14	1,713,006.12	39.77381898	-80.74164963
13,493.00	89.76	149.05	6,654.62	-1,720.60	6,011.86	14,444,396.59	1,713,054.85	39.77359464	-80.74147704
13,588.00	88.97	148.35	6,655.68	-1,801.77	6,061.21	14,444,315.42	1,713,104.20	39.77337134	-80.74130224
13,682.00	89.71	148.17	6,656.76	-1,881.71	6,110.66	14,444,235.49	1,713,153.65	39.77315142	-80.74112708
13,777.00	90.11	149.14	6,656.91	-1,962.84	6,160.08	14,444,154.35	1,713,203.07	39.77292821	-80.74095204
13,872.00	90.11	149.23	6,656.73	-2,044.43	6,208.74	14,444,072.76	1,713,251.73	39.77270376	-80.74077968
13,967.00	89.67	149.23	6,656.91	-2,126.05	6,257.35	14,443,991.14	1,713,300.33	39.77247921	-80.74060755
14,062.00	90.68	149.14	6,656.62	-2,207.64	6,306.01	14,443,909.55	1,713,349.00	39.77225476	-80.74043520
14,156.00	90.42	149.84	6,655.72	-2,288.62	6,353.73	14,443,828.57	1,713,396.72	39.77203198	-80.74026620
14,251.00	89.63	149.05	6,655.68	-2,370.43	6,402.02	14,443,746.76	1,713,445.01	39.77180693	-80.74009517
14,346.00	90.59	149.58	6,655.49	-2,452.13	6,450.50	14,443,665.07	1,713,493.49	39.77158218	-80.73992348
14,440.00	89.58	148.79	6,655.35	-2,532.85	6,498.66	14,443,584.34	1,713,541.64	39.77136010	-80.73975294
14,535.00	90.29	149.75	6,655.46	-2,614.51	6,547.20	14,443,502.68	1,713,590.19	39.77113545	-80.73958103
14,630.00	89.76	149.31	6,655.42	-2,696.39	6,595.37	14,443,420.80	1,713,638.36	39.77091021	-80.73941043
14,725.00	90.68	149.66	6,655.06	-2,778.23	6,643.61	14,443,338.96	1,713,686.60	39.77068506	-80.73923961
14,820.00	90.55	149.93	6,654.04	-2,860.33	6,691.40	14,443,256.86	1,713,734.39	39.77045922	-80.73907038
14,915.00	89.89	149.05	6,653.67	-2,942.17	6,739.63	14,443,175.02	1,713,782.62	39.77023407	-80.73889959
15,010.00	89.32	148.17	6,654.33	-3,023.27	6,789.11	14,443,093.92	1,713,832.10	39.77001097	-80.73872434
15,104.00	89.85	149.40	6,655.01	-3,103.65	6,837.82	14,443,013.54	1,713,880.81	39.76978981	-80.73855181
15,199.00	89.89	151.25	6,655.22	-3,186.19	6,884.85	14,442,931.00	1,713,927.84	39.76956277	-80.73838530
15,294.00	89.01	149.66	6,656.13	-3,268.83	6,931.69	14,442,848.36	1,713,974.68	39.76933544	-80.73821946
15,389.00	89.41	150.19	6,657.44	-3,351.03	6,979.30	14,442,766.16	1,714,022.28	39.76910931	-80.73805091
15,483.00	89.85	151.42	6,658.05	-3,433.09	7,025.15	14,442,684.10	1,714,068.13	39.76888359	-80.73788859
15,578.00	89.23	151.77	6,658.81	-3,516.65	7,070.34	14,442,600.54	1,714,113.32	39.76865375	-80.73772864
15,672.00	91.03	152.30	6,658.60	-3,599.67	7,114.41	14,442,517.52	1,714,157.40	39.76842540	-80.73757265
15,767.00	90.90	152.92	6,657.00	-3,684.01	7,158.11	14,442,433.19	1,714,201.10	39.76819344	-80.73741802
15,862.00	90.29	150.81	6,656.01	-3,767.77	7,202.90	14,442,349.42	1,714,245.89	39.76796303	-80.73725949
15,956.00	89.76	150.19	6,655.97	-3,849.58	7,249.19	14,442,267.61	1,714,292.18	39.76773798	-80.73709562
16,050.00	90.68	149.23	6,655.61	-3,930.75	7,296.60	14,442,186.44	1,714,339.59	39.76751470	-80.73692775
16,144.00	89.98	148.87	6,655.07	-4,011.36	7,344.94	14,442,105.83	1,714,387.93	39.76729292	-80.73675656
16,238.00	90.51	148.79	6,654.67	-4,091.79	7,393.59	14,442,025.40	1,714,436.58	39.76707165	-80.73658426
16,332.00	90.42	149.58	6,653.91	-4,172.52	7,441.75	14,441,944.67	1,714,484.73	39.76684956	-80.73641375
16,427.00	89.58	147.82	6,653.91	-4,253.69	7,491.10	14,441,863.50	1,714,534.09	39.76662625	-80.73623898
16,521.00	90.42	148.87	6,653.91	-4,333.70	7,540.43	14,441,783.49	1,714,583.42	39.76640611	-80.73606426
16,615.00	90.46	148.96	6,653.18	-4,414.20	7,588.96	14,441,702.99	1,714,631.95	39.76618464	-80.73589240
16,710.00	90.07	148.87	6,652.74	-4,495.56	7,638.01	14,441,621.63	1,714,681.00	39.76596082	-80.73571871
16,804.00	89.67	149.23	6,652.96	-4,576.17	7,686.35	14,441,541.02	1,714,729.34	39.76573903	-80.73554752
16,897.00	88.62	149.49	6,654.35	-4,656.18	7,733.74	14,441,461.01	1,714,776.73	39.76551893	-80.73537972
16,991.00	88.31	150.02	6,656.86	-4,737.35	7,781.07	14,441,379.84	1,714,824.06	39.76529562	-80.73521214
17,086.00	87.69	149.84	6,660.18	-4,819.52	7,828.64	14,441,297.67	1,714,871.63	39.76506959	-80.73504372
17,180.00	88.18	150.28	6,663.57	-4,900.92	7,875.53	14,441,216.27	1,714,918.52	39.76484565	-80.73487774
17,187.00	88.26	150.28	6,663.78	-4,907.00	7,879.00	14,441,210.20	1,714,921.99	39.76482894	-80.73486546
Survey @ 17187.00 MD 6663.78 TVD									
17,250.00	88.26	150.28	6,665.70	-4,961.68	7,910.22	14,441,155.51	1,714,953.20	39.76467849	-80.73475494
Survey projected to 17250.00 MD 6665.70 TVD									

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-15 HM (slot I)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-15 HM (slot I)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
100.00	100.00	-0.04	0.19	Gyro
7,325.00	5,971.10	2,717.03	2,671.18	MWD surveys
17,187.00	6,663.78	-4,907.00	7,879.00	Survey @ 17187.00 MD 6663.78 TVD
17,250.00	6,665.70	-4,961.68	7,910.22	Survey projected to 17250.00 MD 6665.70 TVD

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