

ENSIGN

United States Drilling Inc.

Company: NOBLE ENERGY INC.
Field: WATTENBERG
Cty/Bik/Par: Sec.33-T5N-R65W
Well Name: SAUER F33-77-1HN
Rig: ENSIGN 121

Job Number: 121-169
Magnetic Decl.:
Grid Corr.: 8.04
Total Survey Corr.: 8.04
Target Info: EOB: N865.9 W4.8 TVD6776 EOL: N4339.3 W25.7 TVD6776

Calculation Method
Proposed Azimuth 359.66
Depth Reference RKB
Tie Into SURFACE

Minimum Curvature

TARGET ANGLE=85
TARGET TVD =6766.7

No.	Tool Type	Survey Depth (ft)	Incl (°)	Azimuth (°)	Course Lgth (ft)	TVD (ft)	VS (ft)	Coordinates		DLS (°/100')	Bld Rate (°/100')	Wlk Rate (°/100')	Remarks	B/R NEEDED	PRJ TVD	Surveys				Planned			
								N/S (ft)	E/W (ft)							N/S	E/W	VS	TVD	VS	TVD	N/S	E/W
0	Tie In	0	0.00	0.00	0	0.00	0.00	0.00	0.00					0.84	#DIV/0!	0	0	0.00	0.00	0	0	0	0
1	MWD	176	0.40	146.85	176	176.00	-0.52	0.51	0.34	E	0.23	0.2	83.4	0.86	25116.05	-0.51	0.34	-0.52	176.00	0	2000	0	0
2	MWD	269	0.60	82.35	93	269.00	-0.73	0.72	1.00	E	0.60	0.2	-69.4	0.87	26533.09	-0.72	1.00	-0.73	269.00	14	2327.3	14	0
3	MWD	362	0.20	28.75	93	361.99	-0.52	0.51	1.56	E	0.55	-0.4	-57.6	0.89	-12863.06	-0.51	1.56	-0.52	361.99	61	2872.7	61	0
4	MWD	455	0.80	111.05	93	454.99	-0.62	0.61	2.24	E	0.86	0.6	88.5	0.89	9178.688	-0.61	2.24	-0.62	454.99	75	3200	75	0
5	MWD	548	0.30	249.25	93	547.99	-0.94	0.92	2.62	E	1.12	-0.5	148.6	0.91	-10013.45	-0.92	2.62	-0.94	547.99	75	6053.3	75	0
6	MWD	646	0.70	37.20	98	645.99	-0.55	0.54	2.74	E	0.99	0.4	-216.4	0.92	14459.56	-0.54	2.74	-0.55	645.99	75.01	6057.18	75.01	0
7	MWD	739	0.70	12.10	93	738.98	0.45	0.47	3.20	E	0.33	0.0	-27.0	0.94	#DIV/0!	0.47	3.20	0.45	738.98	75.13	6067.18	75.14	0
8	MWD	832	0.60	8.60	93	831.97	1.49	1.51	3.40	E	0.12	-0.1	-3.8	0.95	-51696.22	1.51	3.40	1.49	831.97	75.4	6077.18	75.4	0
9	MWD	925	0.50	12.80	93	924.97	2.36	2.38	3.56	E	0.12	-0.1	4.5	0.97	-51696.22	2.38	3.56	2.36	924.97	75.8	6087.17	75.8	0
10	MWD	1018	1.00	242.70	93	1017.96	2.39	2.41	2.93	E	1.48	0.5	247.2	0.98	11449.2	2.41	2.93	2.39	1017.96	76.34	6097.16	76.35	-0.01
11	MWD	1111	1.00	277.50	93	1110.95	2.13	2.14	1.40	E	0.64	0.0	37.4	0.99	#DIV/0!	2.14	1.40	2.13	1110.95	77.03	6107.13	77.03	-0.01
12	MWD	1212	0.80	269.80	101	1211.94	2.25	2.25	0.18	W	0.23	-0.2	-7.6	1.01	-27210.43	2.25	-0.18	2.25	1211.94	77.85	6117.1	77.85	-0.02
13	MWD	1306	0.60	222.70	94	1305.93	1.90	1.89	1.17	W	0.63	-0.2	-50.1	1.03	-25240.57	1.89	-1.17	1.90	1305.93	78.81	6127.05	78.81	-0.02
14	MWD	1401	0.60	206.30	95	1400.93	1.09	1.08	1.73	W	0.18	0.0	-17.3	1.05	#DIV/0!	1.08	-1.73	1.09	1400.93	79.91	6136.99	79.91	-0.03
15	MWD	1496	0.40	221.60	95	1495.92	0.40	0.38	2.17	W	0.25	-0.2	16.1	1.08	-25427.99	0.38	-2.17	0.40	1495.92	81.15	6146.91	81.15	-0.04
16	MWD	1591	0.30	171.20	95	1590.92	-0.10	0.11	2.35	W	0.33	-0.1	-53.1	1.10	-52351.92	-0.11	-2.35	-0.10	1590.92	82.52	6156.82	82.53	-0.05
17	MWD	1686	0.20	239.40	95	1685.92	-0.43	0.44	2.45	W	0.31	-0.1	71.8	1.12	-52351.92	-0.44	-2.45	-0.43	1685.92	84.04	6166.7	84.04	-0.05
18	MWD	1781	0.20	284.00	95	1780.92	-0.47	0.48	2.76	W	0.16	0.0	46.9	1.14	#DIV/0!	-0.48	-2.76	-0.47	1780.92	85.69	6176.57	85.69	-0.06
19	MWD	1876	0.30	246.80	95	1875.92	-0.52	0.54	3.15	W	0.20	0.1	-39.2	1.16	55818.76	-0.54	-3.15	-0.52	1875.92	87.48	6186.4	87.48	-0.08
20	MWD	1971	0.70	165.00	95	1970.92	-1.18	1.20	3.22	W	0.76	0.4	-86.1	1.18	15361.62	-1.20	-3.22	-1.18	1970.92	89.41	6196.22	89.41	-0.09
21	MWD	2066	1.10	332.70	95	2065.91	-0.93	0.95	3.49	W	1.88	0.4	176.5	1.19	15361.62	-0.95	-3.49	-0.93	2065.91	91.47	6206	91.48	-0.1
22	MWD	2161	1.40	6.50	95	2160.89	1.03	1.01	3.78	W	0.82	0.3	-343.4	1.21	19793.52	1.01	-3.78	1.03	2160.89	93.68	6215.76	93.68	-0.11
23	MWD	2255	2.80	10.20	94	2254.82	4.43	4.41	3.24	W	1.50	1.5	3.9	1.20	5899.531	4.41	-3.24	4.43	2254.82	96.01	6225.48	96.01	-0.13
24	MWD	2350	4.00	1.50	95	2349.66	10.03	10.01	2.74	W	1.37	1.3	-9.2	1.20	6552.212	10.01	-2.74	10.03	2349.66	98.48	6235.17	98.49	-0.14
25	MWD	2445	4.10	359.60	95	2444.42	16.73	16.72	2.68	W	0.18	0.1	376.9	1.23	52780.31	16.72	-2.68	16.73	2444.42	101.09	6244.82	101.09	-0.16
26	MWD	2539	5.40	1.70	94	2538.09	24.51	24.50	2.57	W	1.40	1.4	-380.7	1.22	6275.646	24.50	-2.57	24.51	2538.09	103.83	6254.44	103.83	-0.17
27	MWD	2634	5.30	1.20	95	2632.68	33.37	33.35	2.35	W	0.12	-0.1	-0.5	1.25	-46566.99	33.35	-2.35	33.37	2632.68	106.71	6264.02	106.71	-0.19
28	MWD	2729	5.10	358.70	95	2727.29	41.98	41.96	2.35	W	0.32	-0.2	376.3	1.29	-21967.16	41.96	-2.35	41.98	2727.29	109.72	6273.55	109.72	-0.21
29	MWD	2824	4.80	2.10	95	2821.94	50.17	50.16	2.30	W	0.44	-0.3	-375.4	1.33	-13735.68	50.16	-2.30	50.17	2821.94	112.86	6283.05	112.86	-0.23
30	MWD	2919	4.10	358.40	95	2916.65	57.54	57.52	2.25	W	0.80	-0.7	375.1	1.38	-4274.194	57.52	-2.25	57.54	2916.65	116.13	6292.5	116.14	-0.25
31	MWD	3014	3.40	10.70	95	3011.45	63.70	63.69	1.82	W	1.12	-0.7	-366.0	1.43	-4274.199	63.69	-1.82	63.70	3011.45	119.54	6301.9	119.54	-0.27
32	MWD	3108	3.30	9.10	94	3105.29	69.10	69.10	0.88	W	0.15	-0.1	-1.7	1.47	-47451.24	69.10	-0.88	69.10	3105.29	123.08	6311.25	123.08	-0.29
33	MWD	3203	2.40	356.40	95	3200.17	73.78	73.78	0.57	W	1.15	-0.9	365.6	1.53	-2571.872	73.78	-0.57	73.78	3200.17	126.74	6320.55	126.75	-0.31
34	MWD	3298	1.40	329.20	95	3295.12	76.77	76.76	1.29	W	1.39	-1.1	-28.6	1.60	-1994.673	76.76	-1.29	76.77	3295.12	130.54	6329.81	130.54	-0.33
35	MWD	3393	0.40	42.20	95	3390.11	78.01	78.01	1.66	W	1.41	-1.1	-302.1	1.68	-1994.678	78.01	-1.66	78.01	3390.11	134.47	6339	134.47	-0.36
36	MWD	3487	0.40	103.30	94	3484.10	78.18	78.17	1.12	W	0.43	0.0	65.0	1.73	#DIV/0!	78.17	-1.12	78.18	3484.10	138.52	6348.14	138.52	-0.38
37	MWD	3582	0.50	104.00	95	3579.10	78.00	78.00	0.40	W	0.11	0.1	0.7	1.78	57331.93	78.00	-0.40	78.00	3579.10	142.7	6357.23	142.7	-0.41
38	MWD	3677	0.70	126.40	95	3674.10	77.55	77.55	0.47	E	0.32	0.2	23.6	1.82	30455.51	77.55	0.47	77.55	3674.10	147.01	6366.25	147.01	-0.43
39	MWD	3772	0.90	137.10	95	3769.09	76.65	76.66	1.45	E	0.26	0.2	11.3	1.87	30455.5	76.66	1.45	76.65	3769.09	151.44	6375.22	151.44	-0.46
40	MWD	3867	1.10	128.80	95	3864.07	75.53	75.54	2.67	E	0.26	0.2	-8.7	1.93	30455.49	75.54	2.67	75.53	3864.07	156	6384.12	156	-0.49
41	MWD	3962	0.80	197.20	95	3959.06	74.32	74.34	3.18	E	1.15	-0.3	72.0	2.00	-13863.55	74.34	3.18	74.32	3959.06	160.68	6392.95	160.68	-0.52

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Rig: ENSIGN 121

Job Number: 121-169
Magnetic Decl.:
Grid Corr.: 8.04
Total Survey Corr.: 8.04
Target Info: EOB: N865.9 W4.8 TVD6776 EOL: N4339.3 W25.7 TVD6776

Calculation Method
Proposed Azimuth 359.66
Depth Reference RKB
Tie Into SURFACE

Minimum Curvature

TARGET ANGLE=85
TARGET TVD =6766.7

No.	Tool Type	Survey Depth (ft)	Incl (°)	Azimuth (°)	Course Lgth (ft)	TVD (ft)	VS (ft)	Coordinates			DLS (°/100')	Bld Rate (°/100')	Wlk Rate (°/100')	Remarks	B/R NEEDED	PRJ TVD	Surveys				Planned			
								N/S (ft)	E/W (ft)								N/S	E/W	VS	TVD	VS	TVD	N/S	E/W
42	MWD	4056	1.10	190.90	94	4053.05	72.81	72.83	N 2.81 E	0.34	0.3	-6.7		2.06	21594.06	72.83	2.81	72.81	4053.05	165.48	6401.72	165.48	-0.54	
43	MWD	4151	0.90	188.00	95	4148.03	71.18	71.19	N 2.54 E	0.22	-0.2	-3.1		2.15	-22538.38	71.19	2.54	71.18	4148.03	170.41	6410.43	170.41	-0.57	
44	MWD	4246	1.20	174.90	95	4243.02	69.45	69.46	N 2.52 E	0.40	0.3	-13.8		2.21	21938.97	69.46	2.52	69.45	4243.02	175.46	6419.06	175.46	-0.6	
45	MWD	4341	1.40	207.40	95	4337.99	67.43	67.44	N 2.08 E	0.79	0.2	34.2		2.29	30786.94	67.44	2.08	67.43	4337.99	180.63	6427.62	180.62	-0.64	
46	MWD	4436	1.80	205.80	95	4432.96	65.06	65.07	N 0.89 E	0.42	0.4	-1.7		2.37	17562.46	65.07	0.89	65.06	4432.96	185.91	6436.11	185.91	-0.67	
47	MWD	4530	1.30	237.10	94	4526.92	63.16	63.16	N 0.64 W	1.03	-0.5	33.3		2.49	-5960.087	63.16	-0.64	63.16	4526.92	191.32	6444.52	191.32	-0.7	
48	MWD	4625	1.10	177.30	95	4621.91	61.67	61.66	N 1.51 W	1.27	-0.2	-62.9		2.61	-21969.52	61.66	-1.51	61.67	4621.91	196.84	6452.86	196.84	-0.73	
49	MWD	4720	0.50	291.20	95	4716.90	60.91	60.90	N 1.85 W	1.45	-0.6	119.9		2.76	-4241.905	60.90	-1.85	60.91	4716.90	202.47	6461.12	202.47	-0.77	
50	MWD	4815	0.40	209.50	95	4811.90	60.78	60.76	N 2.40 W	0.62	-0.1	-86.0		2.90	-49035.94	60.76	-2.40	60.78	4811.90	208.23	6469.3	208.23	-0.8	
51	MWD	4910	0.40	180.00	95	4906.90	60.16	60.14	N 2.56 W	0.21	0.0	-31.1		3.05	#DIV/0!	60.14	-2.56	60.16	4906.90	214.09	6477.4	214.09	-0.84	
52	MWD	5005	0.40	124.90	95	5001.89	59.63	59.62	N 2.29 W	0.39	0.0	-58.0		3.21	#DIV/0!	59.62	-2.29	59.63	5001.89	220.07	6485.42	220.07	-0.87	
53	MWD	5100	0.20	177.30	95	5096.89	59.28	59.27	N 2.01 W	0.34	-0.2	55.2		3.41	-21922.03	59.27	-2.01	59.28	5096.89	226.16	6493.35	226.16	-0.91	
54	MWD	5194	0.10	73.40	94	5190.89	59.14	59.13	N 1.92 W	0.26	-0.1	-110.5		3.62	-48372.14	59.13	-1.92	59.14	5190.89	232.36	6501.19	232.36	-0.95	
55	MWD	5289	0.30	228.10	95	5285.89	58.99	58.98	N 2.03 W	0.41	0.2	162.8		3.83	32257.31	58.98	-2.03	58.99	5285.89	238.67	6508.95	238.67	-0.99	
56	MWD	5384	0.40	202.50	95	5380.89	58.52	58.51	N 2.34 W	0.19	0.1	-26.9		4.09	59228.72	58.51	-2.34	58.52	5380.89	245.08	6516.62	245.08	-1.02	
57	MWD	5479	0.20	309.90	95	5475.89	58.32	58.31	N 2.60 W	0.52	-0.2	113.1		4.41	-21543.03	58.31	-2.60	58.32	5475.89	251.61	6524.2	251.6	-1.06	
58	MWD	5574	0.40	290.90	95	5570.89	58.55	58.54	N 3.03 W	0.23	0.2	-20.0		4.74	32494.8	58.54	-3.03	58.55	5570.89	258.23	6531.69	258.23	-1.1	
59	MWD	5668	0.40	324.10	94	5664.89	58.94	58.92	N 3.53 W	0.24	0.0	35.3		5.14	#DIV/0!	58.92	-3.53	58.94	5664.89	264.97	6539.08	264.96	-1.14	
60	MWD	5763	0.30	315.50	95	5759.88	59.39	59.36	N 3.90 W	0.12	-0.1	-9.1		5.64	-48182.96	59.36	-3.90	59.39	5759.88	271.8	6546.38	271.8	-1.18	
61	MWD	5858	0.50	305.60	95	5854.88	59.81	59.78	N 4.41 W	0.22	0.2	-10.4		6.21	32731.3	59.78	-4.41	59.81	5854.88	278.74	6553.59	278.73	-1.23	
62	MWD	5953	0.60	312.50	95	5949.88	60.39	60.36	N 5.12 W	0.13	0.1	7.3		6.91	59607.7	60.36	-5.12	60.39	5949.88	285.77	6560.69	285.77	-1.27	
63	MWD	6048	1.20	342.20	95	6044.87	61.68	61.64	N 5.79 W	0.78	0.6	31.3		7.74	14892.84	61.64	-5.79	61.68	6044.87	292.91	6567.7	292.9	-1.31	
64	MWD	6142	9.70	2.10	94	6138.36	70.54	70.51	N 5.80 W	9.13	9.0	-361.8		7.55	6662.85	70.51	-5.80	70.54	6138.36	300.14	6574.61	300.13	-1.35	
65	MWD	6237	16.70	359.10	95	6230.79	92.22	92.18	N 5.72 W	7.40	7.4	375.8		7.58	6782.011	92.18	-5.72	92.22	6230.79	307.46	6581.41	307.46	-1.4	
66	MWD	6332	21.80	359.30	95	6320.45	123.53	123.49	N 6.15 W	5.37	5.4	0.2		8.02	6987.361	123.49	-6.15	123.53	6320.45	314.89	6588.12	314.88	-1.44	
67	MWD	6427	29.00	2.20	95	6406.21	164.23	164.20	N 5.48 W	7.69	7.6	-375.9		8.13	6792.842	164.20	-5.48	164.23	6406.21	322.4	6594.72	322.4	-1.49	
68	MWD	6522	37.50	0.10	95	6485.59	216.24	216.22	N 4.54 W	9.03	8.9	-2.2		7.90	6733.707	216.22	-4.54	216.24	6485.59	330	6601.21	330	-1.53	
69	MWD	6616	45.10	359.60	94	6556.16	278.24	278.22	N 4.73 W	8.09	8.1	382.4		7.83	6760.164	278.22	-4.73	278.24	6556.16	337.7	6607.59	337.7	-1.58	
70	MWD	6711	53.00	358.40	95	6618.37	349.93	349.90	N 6.02 W	8.37	8.3	-1.3		7.63	6754.501	349.90	-6.02	349.93	6618.37	345.48	6613.87	345.48	-1.63	
71	MWD	6806	60.10	0.10	95	6670.71	429.13	429.10	N 7.01 W	7.62	7.5	-377.2		7.72	6769.838	429.10	-7.01	429.13	6670.71	353.35	6620.04	353.35	-1.68	
72	MWD	6901	67.00	2.60	95	6713.00	514.09	514.07	N 4.95 W	7.63	7.3	2.6		8.08	6772.714	514.07	-4.95	514.09	6713.00	361.31	6626.1	361.31	-1.72	
73	MWD	6996	74.60	3.80	95	6744.22	603.57	603.58	N 0.07 E	8.09	8.0	1.3		8.18	6767.213	603.58	0.07	603.57	6744.22	369.35	6632.04	369.35	-1.77	
74	MWD	7043	79.30	1.50	47	6754.83	649.27	649.30	N 2.18 E	11.08	10.0	-4.9		6.56	6762.615	649.30	2.18	649.27	6754.83	377.47	6637.88	377.47	-1.82	
75	MWD	7081	83.40	359.40	38	6760.55	686.83	686.85	N 2.47 E	12.09	10.8	941.8		2.63	6762.046	686.85	2.47	686.83	6760.55	385.68	6643.6	385.67	-1.87	
76	PRJ	7131	85.00	359.40	50	6765.60	736.57	736.59	N 1.95 E	3.20	3.2	0.0	PRJ AT BIT	0.00	6765.6	736.59	1.95	736.57	6765.60	393.96	6649.2	393.95	-1.92	
77	MWD													#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	402.32	6654.69	402.31	-1.97	