

51-01585



Noble Energy SHL17BHS Gyro+MWD 0' to 17566' MD Survey Report



(Dot Survey)

Report Date: August 06, 2013 - 11:00 AM
Client: Noble Energy
Field: WV Marshall County (NAD 27)
Structure / Blot: Noble Energy SHL17 Pad / SHL17BHS
Well: SHL17BHS
Original Borehole: Original Borehole
UWI / APB: Unknown / Untested
Survey Name: Noble Energy SHL17BHS Gyro-MWD 0' to 17566' MD
Survey Date: July 26, 2013
Tert / AMD / DOI / ERD Ratio: 3:10.516 / 1:11.001 / 2:4.6 / 0.91 / 1.744
Coordinate Reference System: NAD27 West Virginia State Plane, Northern Zone, US Feet
Location Lat / Long: N 39° 58' 38.62429" W 81° 31' 43.20222"
Location Grid N/E Y/X: N 539735 4081 815.5 E 171480373 0125
GRS Grid Convergence Angle: -0.65961°
Grid Scale Factor: 0.99995851

Survey / DLS Competition: Minimum Curvature / Lukinski
Vertical Section Admits: 330 / 62 * (GRD North)
Vertical Section Origin: 0.000 ft, 0.000 ft
TVD Reference Datum: RSI
TVD Reference Elevation: 1250.500 ft above NGS
Sealed / Ground Elevation: 1272.000 ft above NGS
Magnetic Declination: -8.470 °
Total Gravity Field Strength: 985.306mgals (9.80326 Gauss)
Total Magnetic Field Strength: 53184.358 nT
Magnetic Dip Angle: 67.542 °
Declination Date: July 26, 2013
Magnetic Declination Model: IGRM13_2013
North Reference: 539764.70
Grid Convergence Used: -0.65961 °
Total Corr Mag North-Guid North: -7.8132 °
Local Grid Referenced To: Well / Head

Table with columns: Comments, MD (ft), Inci (in), Azim Grid (°), TVD (ft), TVDSS (ft), VSEC (ft), NS (ft), EW (ft), DLS (ft/1000), BR (ft/1000), IR (ft/1000), Northing (ftUS), Easting (ftUS), Latitude (N/S °'"), Longitude (E/W °'"), Directional Difficulty Index. The table contains multiple rows of survey data points.

51-01585

Comments	MD (ft)	Incl (°)	Adm Grid (E)	TVD (ft)	TVD030 (ft)	V80C (ft)	NS (ft)	EW (ft)	DLS (ft/100ft)	BR (ft/100ft)	TR (ft/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N 89° 58' 33" W)	Longitude (E 101° 31' 45.17" W)	Directional Index
	5490.00	22.25	00 07	5435.77	4145.27	18.83	70.77	87.87	5.70	5.82	-7.08	53036.26	1711506.33	N 38 58 33.37 W	80 31 45.17	3.95
	5490.00	24.09	08 20	5478.08	4185.08	18.42	77.20	104.38	6.28	0.23	-1.08	530842.88	1711584.75	N 38 58 30.43 W	80 31 44.04	4.02
	5538.00	28.31	07 50	5518.20	4275.80	13.94	84.50	123.07	7.41	7.38	-1.42	530850.28	1711803.44	N 38 58 35.51 W	80 31 44.72	4.09
	5583.00	31.20	07 50	5555.54	4295.04	11.45	93.31	143.38	4.40	4.30	-1.24	530958.79	1711821.74	N 38 58 36.60 W	80 31 44.40	4.15
	5627.00	32.84	07 46	5592.07	4302.27	8.87	102.18	164.26	5.41	1.30	1.05	530967.07	1711844.01	N 38 58 39.89 W	80 31 44.10	4.21
	5717.00	37.55	07 94	5668.89	4370.10	2.62	121.81	212.41	5.48	5.48	0.53	530987.20	1711882.70	N 38 58 39.89 W	80 31 43.56	4.42
	5807.00	34.58	03 42	5729.46	4448.05	-1.07	143.54	260.88	4.45	-3.32	-5.02	530999.02	1711711.04	N 38 58 40.11 W	80 31 42.07	4.42
	5894.00	38.05	08 08	5810.90	4520.40	-6.60	163.23	308.56	5.55	4.80	5.21	530970.71	1711780.42	N 38 58 40.30 W	80 31 42.25	4.51
	5988.00	40.60	08 75	5880.17	4580.07	-14.28	190.37	352.48	5.32	2.27	0.77	530951.85	1711802.84	N 38 58 40.54 W	80 31 41.68	4.58
	6075.00	40.29	07 03	5947.66	4607.36	-21.74	207.53	418.13	0.03	-4.86	-1.26	530973.31	1711894.40	N 38 58 40.75 W	80 31 40.98	4.64
	6165.00	40.82	06 07	6016.34	4725.84	-28.21	230.51	490.05	0.70	0.37	-1.07	530959.98	1711950.30	N 38 58 40.02 W	80 31 40.20	4.69
	6255.00	38.60	06 45	6085.17	4794.87	-34.05	253.58	573.14	1.14	-1.13	-0.24	540019.06	1712003.40	N 38 58 41.22 W	80 31 39.01	4.74
	6341.00	38.56	07 08	6151.04	4861.44	-39.70	274.80	572.95	1.31	-1.22	0.73	540040.44	1712075.30	N 38 58 41.44 W	80 31 38.08	4.78
	6386.00	39.49	08 18	6221.92	4932.92	-41.23	297.21	508.41	8.40	2.02	-12.95	540052.76	1712078.70	N 38 58 41.87 W	80 31 36.85	4.82
	6431.00	41.46	04 18	6291.17	5004.01	-39.76	322.82	623.06	11.14	4.40	-15.71	540089.39	1712103.40	N 38 58 41.72 W	80 31 35.33	4.85
	6478.00	42.38	07 36	6354.88	5064.10	-34.52	341.92	640.31	10.32	7.00	-15.16	540087.40	1712126.05	N 38 58 41.91 W	80 31 34.04	4.90
	6520.00	42.80	07 36	6413.23	5123.05	-20.00	363.21	607.11	0.34	1.00	-13.70	540109.80	1712147.45	N 38 58 42.13 W	80 31 32.77	4.93
	6565.00	42.87	07 36	6472.05	5181.90	-14.21	391.34	685.89	10.24	0.02	-15.20	540132.81	1712168.23	N 38 58 42.37 W	80 31 31.54	4.97
	6610.00	42.90	07 36	6530.87	5240.75	-8.42	419.47	764.67	9.01	-0.47	-14.22	540158.09	1712187.09	N 38 58 42.63 W	80 31 30.34	5.00
	6655.00	43.08	07 36	6589.69	5300.60	-18.65	447.60	843.45	8.26	-0.27	-12.07	540186.40	1712203.28	N 38 58 42.90 W	80 31 29.17	5.03
	6699.00	43.08	07 36	6648.51	5360.45	-13.86	475.73	922.23	8.30	0.91	-11.81	540215.32	1712219.70	N 38 58 43.19 W	80 31 28.04	5.08
	6744.00	45.07	11 06	6707.39	5420.30	01.29	503.86	1001.00	8.79	2.20	-12.13	540245.85	1712236.69	N 38 58 43.49 W	80 31 26.94	5.09
	6789.00	45.83	8 01	6766.28	5480.15	88.16	531.99	1079.87	11.21	-0.21	-8.76	540277.45	1712253.69	N 38 58 43.80 W	80 31 25.88	5.12
	6834.00	47.05	3 70	6825.09	5540.00	112.00	560.12	1158.74	7.83	3.82	-0.76	540309.05	1712270.69	N 38 58 44.11 W	80 31 24.83	5.17
	6878.00	49.74	0 20	6883.90	5599.85	141.47	588.25	1237.59	9.35	7.02	-1.88	540340.61	1712287.69	N 38 58 44.42 W	80 31 23.83	5.19
	6923.00	54.48	36 31	6942.71	5659.70	173.10	616.38	1316.42	10.78	8.31	-0.84	540372.04	1712304.69	N 38 58 44.73 W	80 31 22.83	5.20
	6968.00	58.21	35 28	7001.52	5719.55	204.85	644.51	1395.25	10.48	8.29	-7.87	540403.48	1712321.69	N 38 58 45.04 W	80 31 21.83	5.20
	7013.00	61.30	35 10	7060.36	5779.40	236.60	672.64	1474.08	8.82	6.80	-0.00	540434.92	1712338.69	N 38 58 45.35 W	80 31 20.83	5.23
	7058.00	63.00	34 70	7119.20	5839.25	268.45	700.77	1552.91	7.73	6.03	-3.36	540466.36	1712355.69	N 38 58 45.66 W	80 31 19.83	5.20
	7103.00	64.60	34 30	7178.04	5899.10	300.30	728.90	1631.74	12.42	10.24	-7.87	540497.80	1712372.69	N 38 58 45.97 W	80 31 18.83	5.32
	7148.00	71.70	34 18	7236.88	5958.95	332.15	757.03	1710.57	8.63	6.09	-5.53	540529.24	1712389.69	N 38 58 46.28 W	80 31 17.83	5.34
	7193.00	75.80	33 28	7295.72	6018.80	364.00	785.16	1789.40	10.84	9.11	-5.73	540560.68	1712406.69	N 38 58 46.59 W	80 31 16.83	5.37
	7238.00	78.37	32 70	7354.56	6078.65	395.85	813.29	1868.23	9.88	5.04	-1.14	540592.12	1712423.69	N 38 58 46.90 W	80 31 15.83	5.40
	7283.00	81.24	31 33	7413.40	6138.50	427.70	841.42	1947.06	9.36	-9.58	-0.68	540623.56	1712440.69	N 38 58 47.21 W	80 31 14.83	5.43
	7328.00	84.09	30 36	7472.24	6198.35	459.55	869.55	2025.89	10.14	1.47	-0.60	540655.00	1712457.69	N 38 58 47.52 W	80 31 13.83	5.46
	7373.00	87.32	29 39	7531.08	6258.20	491.70	897.68	2104.72	6.07	5.80	-3.64	540686.44	1712474.69	N 38 58 47.83 W	80 31 12.83	5.48
	7418.00	89.48	28 42	7590.00	6318.05	523.85	925.81	2183.55	4.49	4.08	-5.08	540717.88	1712491.69	N 38 58 48.14 W	80 31 11.83	5.51
	7463.00	90.00	28 00	7648.84	6377.90	555.90	953.94	2262.38	0.22	0.58	0.33	540749.32	1712508.69	N 38 58 48.45 W	80 31 10.83	5.54
	7508.00	90.85	27 36	7707.68	6437.75	588.05	982.07	2341.21	0.67	0.82	-0.27	540780.76	1712525.69	N 38 58 48.76 W	80 31 9.83	5.54
	7553.00	90.87	26 54	7766.52	6497.60	620.15	1010.20	2420.04	3.74	-0.85	-3.36	540812.20	1712542.69	N 38 58 49.07 W	80 31 8.83	5.60
	7598.00	90.48	26 13	7825.36	6557.45	652.20	1038.29	2500.87	1.81	0.57	-1.72	540843.64	1712559.69	N 38 58 49.38 W	80 31 7.83	5.63
	7643.00	90.41	25 31	7884.20	6617.30	684.30	1066.38	2581.70	3.28	0.08	-2.26	540875.08	1712576.69	N 38 58 49.69 W	80 31 6.83	5.66
	7688.00	89 79	24 49	7943.04	6677.15	716.40	1094.47	2662.51	0.72	-0.72	0.04	540906.52	1712593.69	N 38 58 50.00 W	80 31 5.83	5.68
	7733.00	88 52	24 07	8001.88	6737.00	748.45	1122.56	2743.32	0.98	-0.27	0.94	540937.96	1712610.69	N 38 58 50.31 W	80 31 4.83	5.71
	7778.00	88 86	23 25	8060.72	6796.85	780.50	1150.65	2824.13	0.38	0.38	1.10	540969.40	1712627.69	N 38 58 50.62 W	80 31 3.83	5.74
	7823.00	88 10	22 43	8119.56	6856.70	812.55	1178.74	2904.94	2.68	0.27	2.67	540999.84	1712644.69	N 38 58 50.93 W	80 31 2.83	5.78
	7868.00	88 00	22 01	8178.40	6916.55	844.60	1206.83	2985.75	2.30	-0.10	2.20	541031.28	1712661.69	N 38 58 51.24 W	80 31 1.83	5.80
	7913.00	87 50	21 19	8237.24	6976.40	876.65	1234.92	3066.56	2.48	-0.81	2.20	541062.72	1712678.69	N 38 58 51.55 W	80 31 0.83	5.81
	7958.00	88 49	20 37	8296.08	7036.25	908.70	1263.01	3147.37	1.96	1.84	-0.80	541094.16	1712695.69	N 38 58 51.86 W	80 31 0.83	5.84
	8003.00	88 86	20 00	8354.92	7096.10	940.75	1291.10	3227.72	3.43	1.65	2.89	541125.60	1712712.69	N 38 58 52.17 W	80 31 0.83	5.86
	8048.00	90 28	19 18	8413.76	7155.95	972.80	1319.19	3308.17	2.71	0.27	2.70	541157.04	1712729.69	N 38 58 52.48 W	80 31 0.83	5.88
	8093.00	89 07	18 36	8472.60	7215.80	1004.85	1347.28	3388.62	0.91	-0.48	-4.79	541188.48	1712746.69	N 38 58 52.79 W	80 31 0.83	5.90
	8138.00	89 10	18 00	8531.44	7275.65	1036.90	1375.37	3469.07	4.80	0.14	-0.80	541219.92	1712763.69	N 38 58 53.10 W	80 31 0.83	5.90
	8183.00	89 40	17 18	8590.28	7335.50	1068.95	1403.46	3549.46	6.26	-0.03	-0.26	541251.36	1712780.69	N 38 58 53.41 W	80 31 0.83	5.94
	8228.00	90 00	16 36	8649.12	7395.35	1101.00	1431.55	3629.84	1.97	-0.08	1.97	541282.80	1712797.69	N 38 58 53.72 W	80 31 0.83	5.98
	8273.00	90 20	15 54	8707.96	7455.20	1133.05	1459.64	3710.23	1.58	-0.85	1.33	541314.24	1712814.69	N 38 58 54.03 W	80 31 0.83	6.00
	8318.00	89 52	15 12	8766.80	7515.05	1165.10	1487.73	3790.62	1.22	0.20	2.02	541345.68	1712831.69	N 38 58 54.34 W	80 31 0.83	6.02
	8363.00	89 00	14 30	8825.64	7574.90	1197.15	1515.82	3871.01	2.57	-0.89	2.42	541377.12	1712848.69	N 38 58 54.65 W	80 31 0.83	6.04
	8408.00	88 00	13 48	8884.48	7634.75	1229.20	1543.91	3951.40	3.10	1.12	0.63	541408.56	1712865.69	N 38 58 54.96 W	80 31 0.83	6.04
	8453.00	87 50	13 06	8943.32	7694.60	1261.25	1572.00	4031.79	3.12	0.22	-0.87	541440.00	1712882.69	N 38 58 55.27 W	80 31 0.83	6.08
	8498.00	87 30	12 24	9002.16	7754.45	1293.30	1600.09	4112.18	1.22	0.84	1.22	541471.44	1712899.69	N 38 58 55.58 W	80 31 0.83	6.10
	8543.00	86 50	11 42													

51-01581

Comments	MD (ft)	Incl (°)	Adm Grid (°)	TVD (ft)	TVDSS (ft)	VSEC (ft)	MS (ft)	EW (ft)	DLG (ft/100ft)	BR (ft/100ft)	TR (ft/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ° ' '')	Longitude (E/W ° ° ' '')	Directional Difficulty Index
14502.00	88.88	324.35	8994.17	5403.67	7748.13	8928.10	-3521.68	0.81	-0.31	0.88	549973.35	1707050.04	N 39 59 45.52 W	80 32 32.55	6.74	
14682.00	89.07	324.54	6695.01	5404.51	7837.98	6981.37	-3873.81	0.90	-0.88	0.21	549146.51	1707096.71	N 39 59 47.24 W	80 32 25.24	6.75	
14771.00	89.21	324.11	6888.34	5405.84	7926.00	7953.61	-3025.71	0.51	0.18	-0.48	546518.80	1707854.62	N 39 59 47.85 W	80 32 23.91	6.76	
14861.00	89.00	323.87	8997.75	5407.25	8015.34	7126.31	-3678.74	0.64	-0.23	-0.40	546801.49	1707801.70	N 39 59 48.68 W	80 32 34.81	6.77	
14954.00	89.07	323.72	6699.29	5408.75	8103.05	7158.07	-3731.43	0.10	0.68	0.00	548903.20	1707749.10	N 39 59 49.35 W	80 32 35.20	6.77	
15040.00	89.35	323.02	8700.40	5409.90	8192.89	7270.24	-3785.12	0.84	0.21	-0.78	547035.42	1707995.41	N 39 59 50.07 W	80 32 25.99	6.78	
15129.00	89.83	323.21	8701.12	5410.83	8281.10	7341.47	-3836.48	0.63	0.54	0.33	547106.65	1707842.08	N 39 59 50.77 W	80 32 26.69	6.79	
15219.00	90.34	323.61	8700.00	5410.48	8370.47	7414.27	-3891.39	1.01	0.67	1.51	547179.44	1707589.15	N 39 59 51.48 W	80 32 37.38	6.80	
15308.00	90.17	326.38	8700.60	5410.10	8459.01	7487.20	-3942.41	0.82	-0.19	0.80	547252.37	1707538.13	N 39 59 52.20 W	80 32 38.05	6.80	
15398.00	89.93	326.81	8700.52	5410.02	8548.05	7561.50	-3893.10	0.65	-0.27	0.50	547326.68	1707467.35	N 39 59 52.92 W	80 32 38.71	6.81	
15487.00	89.83	328.28	8700.70	5410.20	8637.35	7635.30	-4042.84	0.43	-0.11	0.42	547400.53	1707427.70	N 39 59 53.63 W	80 32 39.38	6.82	
15577.00	89.83	328.81	8700.07	5410.47	8727.11	7710.45	-4092.40	0.59	0.00	0.20	547475.81	1707368.00	N 39 59 54.38 W	80 32 40.01	6.83	
15667.00	89.90	327.30	8701.18	5410.68	8816.82	7785.98	-4141.40	0.58	0.08	0.54	547551.13	1707339.15	N 39 59 55.13 W	80 32 40.65	6.83	
15758.00	90.17	327.77	8701.13	5410.83	8905.77	7861.07	-4190.17	0.61	0.30	0.53	547626.22	1707291.38	N 39 59 55.86 W	80 32 41.27	6.84	
15848.00	90.07	325.00	8700.94	5410.44	8995.30	7936.01	-4238.89	3.08	-0.11	-0.08	547701.16	1707241.56	N 39 59 56.60 W	80 32 41.92	6.85	
15935.00	89.93	326.60	8700.94	5410.44	9084.16	8009.03	-4289.00	1.84	-0.10	1.63	547774.78	1707191.56	N 39 59 57.32 W	80 32 42.58	6.86	
16025.00	90.10	326.40	8700.02	5410.42	9173.02	8084.72	-4338.01	0.27	0.10	-0.19	547848.88	1707141.94	N 39 59 58.00 W	80 32 43.23	6.87	
16114.00	90.14	325.84	8700.73	5410.23	9262.83	8159.84	-4386.19	0.70	0.04	-0.70	547923.78	1707092.37	N 39 59 58.78 W	80 32 43.87	6.87	
16204.00	89.90	324.80	8700.70	5410.20	9352.22	8232.88	-4434.40	1.10	-0.27	-1.10	547997.78	1707041.17	N 39 59 59.51 W	80 32 44.54	6.88	
16293.00	89.86	323.74	8700.88	5410.36	9440.64	8304.88	-4481.37	1.10	-0.04	-1.10	548070.03	1706989.20	N 40 0 0 21 W	80 32 45.22	6.89	
16382.00	89.90	322.55	8701.05	5410.86	9528.88	8378.15	-4544.69	1.23	0.08	-1.22	548141.28	1706935.88	N 40 0 0 21 W	80 32 45.82	6.90	
16472.00	89.90	322.26	8701.15	5410.68	9617.81	8447.52	-4599.57	0.41	-0.03	-0.41	548212.85	1706881.05	N 40 0 1 01 W	80 32 46.42	6.90	
16562.00	89.79	321.20	8701.45	5410.86	9706.82	8518.26	-4655.13	1.00	-0.10	-0.99	548283.40	1706825.44	N 40 0 2 30 W	80 32 47.36	6.91	
16651.00	89.93	321.52	8701.42	5410.02	9794.65	8587.83	-4710.64	0.52	0.46	0.28	548353.05	1706770.03	N 40 0 3 58 W	80 32 48.03	6.92	
16741.00	89.93	321.52	8701.42	5410.02	9883.49	8658.42	-4766.49	0.28	-0.27	-0.09	548423.54	1706714.08	N 40 0 3 58 W	80 32 48.81	6.92	
16830.00	89.84	321.28	8701.59	5411.09	9971.30	8727.98	-4822.92	0.28	-0.08	-0.27	548493.09	1706658.56	N 40 0 4 26 W	80 32 49.63	6.93	
16920.00	89.97	320.94	8701.72	5411.22	10060.02	8798.03	-4878.42	0.40	0.12	-0.38	548563.14	1706602.06	N 40 0 5 04 W	80 32 50.27	6.94	
17009.00	90.17	321.77	8701.01	5411.11	10147.81	8867.84	-4934.10	0.96	0.22	0.93	548633.85	1706546.48	N 40 0 5 72 W	80 32 50.99	6.94	
17099.00	90.83	321.41	8700.83	5410.33	10237.25	8940.88	-4988.23	0.31	0.73	6.27	548705.06	1706494.36	N 40 0 6 44 W	80 32 51.68	6.95	
17188.00	90.17	328.97	8700.95	5409.55	10326.14	9016.30	-5033.23	1.60	-0.74	1.42	548781.46	1706447.25	N 40 0 7 18 W	80 32 52.29	6.96	
17278.00	89.93	328.52	8699.97	5409.47	10414.10	9093.68	-5079.50	0.58	-0.27	0.04	548858.68	1706401.03	N 40 0 7 54 W	80 32 53.00	6.97	
17367.00	90.10	328.72	8699.95	5409.46	10503.08	9170.35	-5124.87	0.20	0.19	0.22	548935.46	1706350.02	N 40 0 8 59 W	80 32 53.49	6.98	
17457.00	89.93	330.13	8699.92	5409.42	10592.07	9248.26	-5169.07	0.40	-0.19	0.48	549013.34	1706310.02	N 40 0 9 48 W	80 32 54.08	6.98	
17547.00	90.10	330.33	8699.90	5409.40	10680.07	9312.48	-5209.41	0.35	0.23	0.27	549077.57	1706274.18	N 40 0 10 09 W	80 32 54.66	6.99	
17636.00	90.10	330.23	8699.84	5409.34	10768.07	9342.80	-5273.74	0.00	0.00	0.00	549107.08	1706259.68	N 40 0 10 30 W	80 32 54.70	6.99	

Survey Type: Def Survey

Survey Error Model: ISCWSA Row 0 *** 3-D 95.000% Confidence 2.7956 sigma

Survey Program:

Description	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	0.000	18.000		Act 8In	30.000	SLB_NSQ+MSHOT-Depth Only	Original Borehole / Noble Energy SHL17BHS Gyro+MWD 0' to 17568' MD
	18.500	3067.000		Act 8In	30.000	SLB_NSQ+MSHOT	Original Borehole / Noble Energy SHL17BHS Gyro+MWD 0' to
	3067.000	17531.000		Act 8In	30.000	SLB_MWD-BTD	Original Borehole / Noble Energy SHL17BHS Gyro+MWD 0' to
	17531.000	17568.000		Act 8In	30.000	SLB_BLMF+TEND	Original Borehole / Noble Energy SHL17BHS Gyro+MWD 0' to