

51-01634



Noble Energy SHL17FHS Gyro+MWD 0ft to 17425ft MD Survey Report

(Dof Survey)

Report Date: September 18, 2013 - 09:15 AM
Client: Noble Energy
Field: WV Marshall County (MAD 32)
Structure / Slot: Noble Energy SHL17 Pad / R/B 171FHS
Well: SHL 17FHS
Borehole: Original Borehole
MWD / Unknown: Unknown / Unknown
Survey Name: Noble Energy SHL 17FHS Gyro+MWD 0ft to 17425ft MD
Survey Data: September 07, 2013
Tool J/HD / DDI / ERD Ratio: 245.000 / 111.000 / 988.0 / 6.874 / 1.752
Coordinate Reference System: NAD27 West Virginia State Plane, National Zone, US Foot
Location Lat / Long: N 30° 58' 38.5070" S, E 171° 52' 05.5052" W
Location Grid NE YX: N 309140 6272 HUS, E 1711520 055 HUS
CRS Grid Convergence Angle: -0.6595°
CRS Grid Scale Factor: 0.99985651
Version / Patch: 2.7.998.0
Survey / DLS Computation: Minimum Curvature / Lubinski
Vertical Section Azimuth: 318.445 ° (Grid North)
Vertical Section Origin: 0.000 ft, 0.000 ft
TVD Reference Datum: well
TVD Reference Elevation: 1250.500 ft above MSL
Sealed / Ground Elevation: 1272.000 ft above MSL
Magnetic Declination: -8.473 °
Total Gravity Field Strength: 960.4485mg (0.0005 Gauss)
Gravity Model: DGM
Total Magnetic Field Strength: 32156.858 nT
Magnetic Dip Angle: 67.251 °
Declination Date: September 07, 2013
Magnetic Declination Model: IHDGM 2013
Grid Convergence Used: Grid North
North Reference: 0.6595 °
Total Cor Mag North-Grid North: -78.199 °
Local Coord Referenced To: Well/Hous

Table with columns: Comments, MD (ft), Incl (°), Azim Grid (°), TVD (ft), TVDSS (ft), VSECC (ft), NS (ft), EW (ft), BR (ft), TR (ft), Horning (ft), Easting (ft), Latitude (N/S), Longitude (E/W), Directional Difficulty Index. The table contains a dense grid of numerical data points for each depth interval.

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Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	TVDSS (ft)	VSEC (ft)	NS (ft)	EW (ft)	DL8 (ft)	BR (ft)	TR (ft)	Northing (ft)	Easting (ft)	Latitude (°)	Longitude (°)	Directional	Difficulty Index
	7050.00	07.14	309.83	6001.70	6310.70	471.59	-400.23	-1162.30	0.10	8.14	7.50	539394.41	1710266.77	N 30 55 34.47 W	80 32 0.54	5.70	
	7144.00	69.58	300.34	6017.70	5327.29	512.70	-374.43	-1105.30	7.50	5.42	5.58	639776.21	1710233.81	N 30 56 24.07 W	80 32 0.50	5.48	
	7188.00	72.17	312.26	6032.21	5341.71	553.60	-347.27	-1226.78	8.58	5.80	6.81	539402.37	1710202.30	N 30 58 34.94 W	80 32 1.37	5.31	
	7253.00	74.58	314.57	6045.00	6264.69	690.63	-317.64	-1258.08	7.25	5.31	5.16	539432.00	1710217.04	N 30 58 35.23 W	80 32 1.78	5.43	
	7278.00	75.24	318.67	6050.82	6300.37	840.25	-286.09	-1287.03	8.71	1.51	6.89	539483.64	1710241.10	N 30 58 35.53 W	80 32 2.16	5.45	
	7323.00	76.69	320.48	6050.97	6379.47	694.07	-252.75	-1310.38	8.71	7.67	4.24	539496.68	1710212.74	N 30 58 35.58 W	80 32 2.54	5.48	
	7368.00	83.07	321.44	6074.10	5383.60	776.44	-218.17	-1343.87	6.12	8.73	2.80	539511.00	1710184.85	N 30 58 36.70 W	80 32 3.90	5.50	
	7412.00	85.87	322.42	6078.34	6387.84	772.14	-183.63	-1371.16	8.65	6.36	1.55	539560.00	1710157.84	N 30 58 38.54 W	80 32 3.25	5.82	
	7457.00	88.90	324.38	6080.02	6389.62	818.03	-147.33	-1397.98	9.88	6.87	4.36	539602.00	1710131.14	N 30 58 38.89 W	80 32 3.60	5.55	
	7502.00	91.10	326.18	6079.94	6399.14	861.61	-110.55	-1423.81	4.86	2.78	4.00	539636.00	1710105.61	N 30 58 37.26 W	80 32 3.93	5.67	
	7546.00	93.03	327.54	6077.66	6397.18	902.92	-75.04	-1449.10	0.36	0.00	0.36	539723.99	1710093.03	N 30 58 36.60 W	80 32 4.67	5.60	
	7602.00	91.85	326.86	6076.95	6395.05	1050.07	-48.73	-1528.04	1.71	0.62	3.05	539788.35	1710000.19	N 30 58 38.81 W	80 32 5.31	5.62	
	7782.00	91.81	327.81	6072.02	6382.62	1138.69	123.54	-1577.06	0.84	-0.04	6.84	620873.16	1700852.04	N 30 58 39.55 W	80 32 5.04	5.86	
	7872.00	91.51	325.79	6070.57	6380.67	1277.69	188.73	-1620.48	2.02	-0.11	-2.02	539848.34	1709802.63	N 30 58 40.70 W	80 32 5.66	5.68	
	7961.00	91.65	325.20	6068.11	6377.61	1316.00	272.66	-1670.82	0.66	0.10	-0.60	540021.69	1709852.32	N 30 58 41.01 W	80 32 7.24	5.70	
	8050.00	91.81	325.70	6065.86	6375.08	1404.10	348.40	-1727.21	0.40	-0.04	0.40	540095.00	1709801.92	N 30 58 41.72 W	80 32 7.50	5.72	
	8140.00	91.44	325.81	6063.18	6372.68	1493.45	419.68	-1777.97	0.21	-0.18	-0.10	540169.28	1709751.11	N 30 58 42.45 W	80 32 8.50	5.75	
	8220.00	91.58	325.79	6060.84	6370.24	1561.71	493.17	-1828.11	0.20	0.10	0.20	540242.78	1709701.03	N 30 58 43.17 W	80 32 9.22	5.77	
	8318.00	91.58	325.70	6058.36	6367.88	1670.94	567.54	-1878.75	1.10	0.00	-0.10	540311.73	1709650.80	N 30 58 43.00 W	80 32 9.88	5.79	
	8408.00	91.83	325.20	6057.18	6365.63	1750.26	640.67	-1929.10	0.01	-0.85	-0.46	540390.40	1709599.98	N 30 58 44.92 W	80 32 10.54	5.81	
	8497.00	91.14	325.20	6057.13	6363.83	1847.63	714.03	-1979.61	0.54	0.24	-0.01	540403.02	1709549.31	N 30 58 45.34 W	80 32 11.20	5.83	
	8587.00	91.58	325.20	6056.60	6362.60	1928.97	788.70	-2029.84	0.72	-0.12	0.72	540533.88	1709498.47	N 30 58 46.07 W	80 32 11.88	5.85	
	8676.00	91.17	325.51	6056.84	6360.24	2025.21	861.83	-2080.64	0.20	0.16	-0.47	540611.42	1709448.34	N 30 58 46.76 W	80 32 12.52	5.87	
	8785.00	90.07	325.12	6056.80	6358.19	2112.67	935.01	-2131.46	0.45	-0.11	-0.44	540684.90	1709397.70	N 30 58 47.30 W	80 32 13.18	5.89	
	8855.00	90.38	325.14	6056.50	6356.30	2202.36	1008.65	-2182.91	0.35	0.34	0.02	540758.43	1709347.29	N 30 58 48.23 W	80 32 13.85	5.90	
	8925.00	90.56	324.14	6055.57	6354.67	2293.43	1082.26	-2234.90	1.13	0.19	-1.11	540831.82	1709294.17	N 30 58 48.56 W	80 32 14.53	5.92	
	9004.00	90.58	323.81	6054.40	6353.10	2384.10	1156.12	-2286.67	1.89	0.03	1.88	540904.70	1709243.00	N 30 58 49.60 W	80 32 15.20	5.94	
	9124.00	90.62	325.10	6053.75	6351.25	2470.15	1229.26	-2337.10	0.78	0.04	-0.79	540978.22	1709192.06	N 30 58 50.30 W	80 32 15.87	5.96	
	9213.00	90.10	325.12	6053.10	6349.60	2558.58	1302.25	-2388.01	0.59	-0.58	0.62	541051.82	1709141.10	N 30 58 51.10 W	80 32 16.53	5.98	
	9303.00	90.34	324.88	6052.66	6348.25	2647.97	1375.08	-2439.03	0.38	0.27	-0.27	541125.64	1709090.54	N 30 58 51.83 W	80 32 17.20	5.99	
	9393.00	90.02	325.07	6052.09	6347.39	2737.39	1449.07	-2490.28	0.38	0.31	0.21	541199.23	1709039.59	N 30 58 52.56 W	80 32 17.88	6.01	
	9482.00	90.00	324.20	6051.81	6346.11	2826.05	1522.00	-2542.74	1.12	-0.70	-0.58	541273.85	1708989.44	N 30 58 53.20 W	80 32 18.55	6.03	
	9572.00	90.48	324.87	6051.23	6345.73	2915.35	1595.94	-2595.02	0.08	0.53	0.42	541348.10	1708939.16	N 30 58 53.98 W	80 32 19.23	6.04	
	9662.00	91.07	327.07	6050.62	6344.62	3004.69	1670.01	-2646.64	2.89	0.88	-2.81	541421.88	1708889.03	N 30 58 54.71 W	80 32 19.89	6.06	
	9751.00	90.85	325.69	6049.76	6343.70	3093.79	1744.22	-2698.65	1.30	-0.68	-1.65	541495.77	1708838.82	N 30 58 55.44 W	80 32 20.53	6.08	
	9841.00	90.84	324.81	6049.77	6343.07	3182.03	1818.29	-2750.78	1.31	0.03	-1.31	541569.84	1708788.42	N 30 58 56.16 W	80 32 21.20	6.09	
	9931.00	90.84	323.11	6049.59	6342.59	3270.59	1892.54	-2802.93	1.13	0.19	-1.11	541643.98	1708738.23	N 30 58 56.87 W	80 32 21.88	6.11	
	10021.00	90.07	323.16	6049.52	6342.02	3359.22	1967.84	-2855.74	0.34	0.10	-0.28	541718.26	1708687.45	N 30 58 57.58 W	80 32 22.56	6.12	
	10110.00	89.87	323.51	6049.49	6341.69	3448.05	2043.73	-2908.49	0.40	-0.11	0.39	541792.77	1708637.11	N 30 58 58.29 W	80 32 23.23	6.14	
	10200.00	90.18	323.58	6049.41	6341.36	3537.01	2120.60	-2961.41	0.60	-0.00	0.60	541867.40	1708586.90	N 30 58 59.00 W	80 32 23.97	6.15	
	10290.00	90.00	323.78	6049.51	6341.01	3626.19	2197.02	-3014.11	0.40	0.00	0.40	541942.18	1708536.90	N 30 58 59.70 W	80 32 24.67	6.16	
	10380.00	90.07	323.43	6049.48	6340.56	3715.22	2273.45	-3066.42	0.40	0.08	-0.20	542000.99	1708484.38	N 30 58 60.41 W	80 32 25.30	6.18	
	10468.00	90.07	323.20	6049.35	6340.56	3806.90	2352.83	-3117.89	0.25	0.00	-0.26	542072.30	1708431.21	N 30 58 61.11 W	80 32 26.00	6.19	
	10558.00	90.10	323.17	6049.22	6340.72	3896.10	2434.89	-3171.82	0.05	0.03	-0.03	542144.41	1708378.28	N 30 58 61.81 W	80 32 26.78	6.20	
	10648.00	90.07	323.74	6049.08	6340.88	3985.89	2497.19	-3226.61	0.83	-0.03	0.83	542216.71	1708325.69	N 30 58 62.52 W	80 32 27.40	6.21	
	10737.00	90.14	323.21	6049.02	6340.51	4074.51	2578.13	-3278.48	0.50	0.08	-0.50	542288.21	1708273.05	N 30 58 63.22 W	80 32 28.15	6.23	
	10827.00	90.10	323.28	6049.73	6340.23	4164.10	2661.82	-3332.33	0.39	-0.04	0.68	542360.33	1708219.87	N 30 58 63.90 W	80 32 28.85	6.24	
	10917.00	90.00	323.57	6049.65	6340.15	4253.85	2743.10	-3385.96	0.04	-0.11	0.32	542432.60	1708166.25	N 30 58 64.64 W	80 32 29.55	6.25	
	11006.00	90.00	323.43	6049.65	6340.15	4342.81	2824.64	-3438.80	0.18	0.00	-0.18	542504.14	1708113.01	N 30 58 65.34 W	80 32 30.24	6.26	
	11096.00	90.14	323.30	6049.54	6340.04	4432.17	2906.29	-3492.87	0.17	0.18	-0.06	542576.20	1708059.65	N 30 58 66.04 W	80 32 30.94	6.27	
	11186.00	90.00	323.49	6049.63	6340.03	4521.72	2989.92	-3547.30	1.72	-0.16	-1.71	542648.27	1708006.01	N 30 58 66.76 W	80 32 31.63	6.28	
	11276.00	90.00	323.56	6049.43	6340.03	4610.10	3072.02	-3602.04	0.78	0.00	0.78	542720.33	1707952.17	N 30 58 67.46 W	80 32 32.30	6.30	
	11366.00	90.10	323.57	6049.35	6340.65	4699.40	3047.17	-3646.02	0.11	0.11	-0.01	542792.60	1707898.20	N 30 58 68.20 W	80 32 32.98	6.31	
	11455.00	89.87	323.83	6049.30	6340.60	4788.68	3121.52	-3697.84	0.32	-0.14	0.20	542864.91	1707844.56	N 30 58 68.90 W	80 32 33.62	6.32	
	11545.00	90.10	323.23	6049.24	6340.74	4877.90	3194.80	-3749.81	0.60	0.16	-0.67	542937.28	1707791.21	N 30 58 69.65 W	80 32 34.26	6.34	
	11634.00	90.07	323.40	6049.11	6340.91	4966.36	3268.90	-3801.23	0.19	-0.03	0.10	543009.38	1707737.00	N 30 58 70.38 W	80 32 34.95	6.33	
	11724.00	90.03	323.71	6049.03	6340.63	5054.67	3342.30	-3852.67	0.35	-0.04	0.35	543081.78	1707683.01	N 30 58 71.10 W	80 32 35.61	6.35	
	11813.00	90.03	324.81	6048.96	6340.49	5144.05	3416.16	-3904.08	1.22	0.00	-1.22	543154.04	1707628.25	N 30 58 71.82 W	80 32 36.28	6.36	
	11902.00	90.07	325.82	6048.91	6340.41	5232.42	3489.30	-3955.60	1.47	0.04	1.47	543226.77	1707573.54	N 30 58 72.54 W	80 32 36.94	6.38	
	11992.00	90.07	325.02	6048.60	6340.30	5321.06	3563.44	-4007.12	0.00	0.00	0.00	543301.31	1707518.11	N 30 58 73.27 W	80 32 37.60	6.39	
	12082.00	90.14	325.10	6048.03	6340.13	5410.97	3638.05	-4058.05									

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Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	TVDS3 (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (ft/100ft)	BR (ft/100ft)	TR (ft/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S °'")	Longitude (E/W °'")	Directional Difficulty Index
	17187.00	80.03	320.37	8627.82	5337.32	10480.76	7822.31	-6075.87	0.28	-0.27	-0.10	647671.60	1704553.70	N 30 50 55.01 W	80 33 18.44	0.86
	17276.00	80.14	325.04	8627.68	5337.18	10569.95	7890.23	-7025.14	0.50	0.12	-0.48	647645.52	1704504.22	N 30 50 55.73 W	80 33 17.00	0.86
	17365.00	80.03	320.32	8627.65	5337.05	10559.12	7871.04	-7076.17	0.56	-0.12	0.64	647720.33	1704454.20	N 30 50 56.46 W	80 33 17.74	0.87
Final Survey 17-Sub-13	17389.00	80.21	328.00	8627.50	5337.00	10680.80	7880.17	-7087.04	2.38	0.78	-2.20	647739.45	1704441.43	N 30 50 56.65 W	80 33 17.81	0.87
Projection to Bit	17425.00	80.21	328.00	8627.37	5336.87	10710.59	8020.02	-7108.07	0.00	0.00	0.00	647760.30	1704421.30	N 30 50 56.04 W	80 33 18.17	0.87

Survey Type: Def Survey

Survey Error Model: ISCWSA Rev 0 \*\*\* 3-D 95.000% Confidence 2.7835 sigma

Survey Program:

Description	Part	MD From (ft)	MD To (ft)	ECU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	18.500	Act Strs	30.000	30.000	SLB_NSG+MSHOT-Depth Only	Original Borehole / Noble Energy SHL17FHS Gyro+MWD Off to 17425ft MD
	1	18.500	3070.000	Act Strs	30.000	30.000	SLB_NSG+MSHOT	Original Borehole / Noble Energy SHL17FHS Gyro+MWD Off to 17425ft MD
	1	3070.000	3210.000	Act Strs	30.000	30.000	SLB_NSG+SSHOT	Original Borehole / Noble Energy SHL17FHS Gyro+MWD Off to 17425ft MD
	1	3210.000	3304.000	Act Strs	30.000	30.000	SLB_MVD-INC_CHKLY	Original Borehole / Noble Energy SHL17FHS Gyro+MWD Off to 17425ft MD
	1	3304.000	17360.000	Act Strs	30.000	30.000	SLB_MWD-STD	Original Borehole / Noble Energy SHL17FHS Gyro+MWD Off to 17425ft MD
	1	17360.000	17425.000	Act Strs	30.000	30.000	SLB_BLKIND-TREND	Original Borehole / Noble Energy SHL17FHS Gyro+MWD Off to 17425ft MD



