

51-01641



Noble Energy SHL13EHS Gyro+MWD 0ft to 13390ft MD Survey Report



(Daf Survey)

Report Date: December 01, 2013 - 09:54 AM
Client: Noble Energy
Field: WV Marshall County (NAD 27)
Structure / Slot: Noble Energy SHL13 Pad/SHL13EHS
Well: SHL13EHS
Borehole: Original Borehole
UWI / API#: Unknown / Unknown
Survey Name: Noble Energy SHL13EHS Gyro+MWD 0ft to 13390ft MD
Survey Date: November 22, 2013
Tort / AMD / DOI / ERO Ratio: 202/509 / 1/152/491 ft / 6/330 / 1/211
Coordinate Reference System: NAD27 West Virginia State Plane, Northern Zone, US Feet
Location Lat / Long: N 40° 07' 14.63105", W 80° 32' 8.97345"
Location Grid NE YX: N 549496, 109 8105, E 1709826 781 8105
CRS Grid Convergence Angle: -0.6006°
Grid Scale Factor: 0.99996247
Version / Patch: 2.7.998.0
Survey / DLS Computation: Minimum Curvature / Lubinski
Vertical Section Azimuth: 300.839° (Grid North)
Vertical Section Origin: 0.000 ft, 0.000 ft
TVD Reference Datum: KB
TVD Reference Elevation: 1300.450 ft above MSL
Seabed / Ground Elevation: 1281.910 ft above MSL
Magnetic Declination: -8.433°
Total Gravity Field Strength: 990.340mgals (9.80665 Based)
Gravity Model: GAIM
Total Magnetic Field Strength: 53164.777 nT
Magnetic Dip Angle: 87.574°
Declination Date: November 22, 2013
Magnetic Declination Model: HDGM 2013
North Reference: Grid North
Grid Convergence Used: -0.6006°
Total Corr Mag North-Grid: -7.7719°
Local Coord Reference To: Well Head

Table with columns: Comments, MD (ft), Incl (°), Azim Grid (°), TVD (ft), TVDSS (ft), VSEC (ft), NS (ft), EW (ft), DLS (ft/100ft), BR (ft/100ft), TR (ft/100ft), Northing (ft), Easting (ft), Latitude (N/S °), Longitude (E/W °), Directional Difficulty Index. The table contains multiple rows of data representing survey points and measurements.

10/31/2014

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Comments	MD (ft)	Incl (°)	Azin Grd (°)	TVD (ft)	TVDBS (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLB (ft/100ft)	BR (ft/100ft)	TR (ft/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S +°)	Longitude (E/W +°)	Directional Difficulty Index
7373.00	61.72	298.62	3382.23	6282.03	1113.25	-734.59	-1841.32	9.92	2.88	7.13	548761.55	1707885.04	N 40 0 7.15 W	80 32 33.61	5.52	
7418.00	63.80	300.85	3603.08	6302.63	1192.84	-715.41	-1878.42	9.21	4.52	8.96	548760.72	1707880.44	N 40 0 7.24 W	80 32 34.26	5.55	
7462.00	65.86	304.42	3821.80	6321.35	1192.23	-693.99	-2009.98	9.06	4.68	8.57	548802.14	1707816.68	N 40 0 7.54 W	80 32 34.70	5.67	
7507.00	68.45	307.65	4039.27	6338.82	1233.99	-669.59	-2043.50	8.77	5.76	7.18	548826.54	1707783.37	N 40 0 7.78 W	80 32 35.13	5.60	
7552.00	70.16	310.32	4255.17	6356.72	1278.05	-643.11	-2079.21	8.73	3.80	5.93	548853.02	1707750.63	N 40 0 8.04 W	80 32 35.56	5.61	
7597.00	71.24	312.90	4470.55	6374.60	1318.37	-618.91	-2107.98	8.92	2.40	5.73	548881.22	1707718.91	N 40 0 8.31 W	80 32 35.97	5.62	
7641.00	73.65	315.56	4683.32	6382.87	1359.96	-595.48	-2138.01	7.95	5.48	6.05	548910.40	1707687.65	N 40 0 8.60 W	80 32 36.38	5.64	
7686.00	77.29	317.28	4894.61	6394.16	1402.91	-564.09	-2168.03	8.89	8.09	3.82	548942.04	1707656.84	N 40 0 8.91 W	80 32 36.75	5.66	
7731.00	79.95	319.37	5103.49	6403.04	1448.13	-521.15	-2197.35	7.48	5.91	4.64	548974.98	1707629.52	N 40 0 9.22 W	80 32 37.13	5.68	
7776.00	82.39	321.21	5310.40	6409.95	1489.37	-489.94	-2226.78	6.76	5.42	4.09	549008.19	1707601.11	N 40 0 9.52 W	80 32 37.50	5.70	
7820.00	84.71	322.95	5514.89	6414.69	1531.55	-452.45	-2252.62	6.50	5.27	3.95	549043.67	1707574.25	N 40 0 9.80 W	80 32 37.85	5.71	
7865.00	88.04	323.93	5718.19	6417.74	1574.56	-418.38	-2279.37	7.71	7.40	2.18	549079.74	1707547.50	N 40 0 10.28 W	80 32 38.20	5.73	
7910.00	88.11	324.56	5919.70	6419.25	1617.50	-379.89	-2305.65	1.41	1.60	1.40	549116.24	1707521.22	N 40 0 10.61 W	80 32 38.54	5.74	
7961.00	88.05	324.44	6121.41	6420.96	1666.07	-338.29	-2333.25	0.28	-0.12	-0.24	549157.73	1707491.63	N 40 0 11.02 W	80 32 38.89	5.76	
8050.00	88.25	325.38	6324.28	6423.83	1750.63	-285.81	-2366.40	1.06	0.22	1.03	549200.51	1707460.48	N 40 0 11.73 W	80 32 39.00	5.78	
8140.00	88.48	324.80	6528.85	6426.40	1836.05	-191.80	-2437.83	0.57	0.28	-0.51	549004.31	1707389.05	N 40 0 12.48 W	80 32 40.27	5.80	
8229.00	88.74	324.88	6728.23	6427.78	1920.66	-119.01	-2489.01	1.42	-0.02	-0.02	549077.11	1707337.87	N 40 0 13.17 W	80 32 40.94	5.82	
8319.00	90.17	324.08	6929.30	6427.85	2008.43	-65.77	-2541.31	1.03	0.48	-0.91	549050.35	1707283.57	N 40 0 13.89 W	80 32 41.62	5.84	
8408.00	89.54	324.13	7129.53	6428.08	2091.42	26.32	-2592.50	0.71	-0.71	0.08	549022.43	1707233.38	N 40 0 14.59 W	80 32 42.30	5.86	
8498.00	88.91	323.68	7329.74	6429.29	2177.45	99.04	-2648.52	0.86	-0.70	-0.50	549095.15	1707180.37	N 40 0 15.31 W	80 32 42.99	5.87	
8588.00	89.68	324.48	7530.85	6430.40	2263.40	171.92	-2699.31	1.23	0.88	0.89	549068.02	1707127.57	N 40 0 16.02 W	80 32 43.68	5.89	
8677.00	90.74	323.85	7730.52	6430.07	2349.35	244.08	-2751.40	1.37	1.19	-0.67	549040.18	1707075.49	N 40 0 16.73 W	80 32 44.36	5.91	
8767.00	91.00	323.61	7929.16	6428.71	2434.45	316.65	-2804.82	0.42	0.29	-0.30	549012.75	1707022.27	N 40 0 17.44 W	80 32 45.08	5.93	
8856.00	90.80	324.68	8127.76	6427.31	2519.37	388.66	-2858.83	1.42	-0.22	1.40	548984.95	1706970.27	N 40 0 18.15 W	80 32 45.74	5.95	
8946.00	90.52	324.90	8326.72	6426.27	2600.92	462.51	-2908.34	0.34	-0.31	0.14	548956.56	1706920.15	N 40 0 18.87 W	80 32 46.41	5.96	
9035.00	90.11	323.76	8526.23	6425.78	2689.78	534.85	-2958.18	1.40	-0.46	-1.38	550030.94	1706868.72	N 40 0 19.58 W	80 32 47.09	5.98	
9125.00	90.23	329.08	8725.97	6425.52	2778.33	608.49	-3011.90	2.58	0.13	2.56	550164.58	1706818.00	N 40 0 20.33 W	80 32 47.77	6.00	
9215.00	89.91	325.48	8925.86	6425.41	2860.46	682.91	-3062.51	0.78	-0.36	-0.87	550179.00	1706764.39	N 40 0 21.03 W	80 32 48.43	6.02	
9304.00	90.14	329.54	9125.82	6425.37	2944.32	758.71	-3112.27	1.22	0.26	1.19	550252.78	1706714.63	N 40 0 21.78 W	80 32 49.08	6.03	
9393.00	90.99	327.57	9325.20	6424.75	3028.03	831.33	-3160.87	1.30	0.56	1.16	550327.47	1706666.24	N 40 0 22.48 W	80 32 49.71	6.05	
9483.00	90.11	329.05	9524.59	6424.14	3111.78	907.27	-3207.94	1.75	-0.91	1.84	550404.94	1706618.96	N 40 0 23.24 W	80 32 50.33	6.06	
9572.00	90.34	331.33	9724.24	6423.70	3193.49	985.19	-3255.19	2.57	0.28	2.56	550481.26	1706574.72	N 40 0 24.00 W	80 32 50.91	6.08	
9662.00	89.83	331.63	9924.11	6423.66	3275.29	1064.26	-3295.16	0.66	-0.57	0.33	550560.33	1706531.75	N 40 0 24.77 W	80 32 51.47	6.10	
9751.00	89.77	330.78	10124.42	6423.37	3359.36	1142.26	-3338.03	0.96	-0.97	-0.96	550638.32	1706488.89	N 40 0 25.54 W	80 32 52.04	6.11	
9841.00	91.39	331.23	10324.59	6423.14	3438.24	1221.23	-3381.17	2.12	1.89	1.26	550717.30	1706445.75	N 40 0 26.31 W	80 32 52.60	6.13	
9930.00	88.68	328.26	10524.59	6423.16	3519.90	1300.38	-3425.53	1.75	-0.93	-1.12	550794.42	1706402.48	N 40 0 27.07 W	80 32 53.16	6.15	
10020.00	87.42	324.53	10726.67	6422.22	3604.73	1373.27	-3475.30	4.37	-1.40	-1.44	550869.32	1706351.82	N 40 0 27.80 W	80 32 53.83	6.17	
10109.00	88.20	321.31	10930.06	6422.63	3690.17	1444.21	-3528.91	3.72	0.88	-3.62	550940.26	1706298.01	N 40 0 28.50 W	80 32 54.53	6.19	
10198.00	90.86	321.98	11130.97	6420.52	3777.17	1514.77	-3584.76	2.63	2.73	0.74	551010.82	1706242.17	N 40 0 29.19 W	80 32 55.28	6.21	
10288.00	90.72	322.32	11332.89	6420.44	3863.97	1585.63	-3633.87	0.38	0.07	0.37	551081.89	1706189.55	N 40 0 29.85 W	80 32 56.06	6.22	
10378.00	90.63	321.88	11534.84	6420.39	3949.83	1656.06	-3684.64	0.50	-0.10	-0.40	551152.10	1706137.83	N 40 0 30.57 W	80 32 56.70	6.23	
10468.00	90.26	322.04	11736.14	6420.79	4036.71	1726.94	-3730.10	0.45	-0.10	0.18	551222.88	1706087.83	N 40 0 31.27 W	80 32 57.42	6.24	
10557.00	90.17	321.22	11937.81	6420.76	4122.76	1796.71	-3780.34	0.93	-0.10	-0.92	551292.75	1706032.59	N 40 0 31.95 W	80 32 58.14	6.26	
10647.00	90.29	321.08	12139.44	6420.59	4209.97	1868.00	-3831.81	0.22	0.13	-0.16	551362.83	1705985.12	N 40 0 32.64 W	80 32 58.87	6.27	
10737.00	90.20	320.96	12341.08	6420.23	4297.23	1936.75	-3884.44	0.15	-0.10	-0.11	551432.78	1705938.50	N 40 0 33.32 W	80 32 59.61	6.28	
10826.00	90.37	323.51	12542.62	6420.03	4383.03	2007.10	-3937.94	2.87	0.19	2.87	551503.13	1705894.00	N 40 0 34.01 W	80 33 0.32	6.29	
10916.00	90.11	325.07	12744.24	6420.79	4468.88	2080.17	-4025.47	1.78	-0.29	1.73	551576.20	1705850.47	N 40 0 34.73 W	80 33 1.01	6.31	
11005.00	89.11	323.90	12945.85	6420.57	4553.76	2152.48	-4077.35	2.00	-1.12	-1.65	551648.50	1705804.59	N 40 0 35.43 W	80 33 1.69	6.32	
11095.00	89.34	320.46	13147.06	6420.66	4640.60	2223.41	-4132.72	3.50	0.26	-3.49	551719.43	1705804.23	N 40 0 36.13 W	80 33 2.41	6.34	
11185.00	90.23	321.94	13348.26	6420.95	4727.78	2293.55	-4189.11	1.92	0.99	1.64	551789.57	1705803.84	N 40 0 36.81 W	80 33 3.14	6.35	
11274.00	89.74	321.24	13549.42	6420.77	4813.85	2363.29	-4244.40	0.98	-0.55	-0.79	551859.30	1705802.55	N 40 0 37.50 W	80 33 3.87	6.36	
11364.00	90.23	319.83	13750.45	6420.60	4898.28	2432.77	-4301.60	1.80	-0.54	-1.57	551928.76	1705802.35	N 40 0 38.18 W	80 33 4.61	6.38	
11453.00	90.32	323.01	13951.26	6420.57	4987.41	2502.33	-4357.10	3.57	0.10	3.57	551999.34	1705809.96	N 40 0 38.86 W	80 33 5.33	6.39	
11543.00	90.08	325.31	14152.27	6420.53	5073.32	2575.26	-4409.79	2.57	0.26	2.56	552071.29	1705817.17	N 40 0 39.57 W	80 33 6.02	6.41	
11632.00	90.88	326.83	14353.09	6420.51	5157.60	2648.69	-4460.11	1.04	0.67	0.56	552144.69	1705808.85	N 40 0 40.29 W	80 33 6.68	6.42	
11722.00	90.49	326.89	14553.90	6420.45	5242.42	2723.81	-4509.96	1.25	-0.41	1.18	552219.91	1705817.00	N 40 0 41.00 W	80 33 7.33	6.43	
11811.00	90.72	327.53	14754.51	6420.41	5326.85	2799.43	-4558.16	0.76	0.26	0.72	552294.42	1705808.80	N 40 0 41.70 W	80 33 7.96	6.44	
11901.00	90.37	328.83	14954.10	6420.65	5409.73	2874.81	-4605.74	1.28	-0.39	1.22	552370.81	1705821.22	N 40 0 42.51 W	80 33 8.59	6.45	
11990.00	90.03	325.70	15154.79	6420.34	5493.16	2948.58	-4653.99	3.31	-0.38	-3.29	552448.58	1705829.67	N 40 0 43.24 W	80 33 9.22	6.46	
12080.00	90.69	325.58	15355.50	6420.25	5576.36	3023.86	-4704.79	0.15	0.07	-0.13	552526.87	1705832.18	N 40 0 43.97 W	80 33 9.88	6.47	
12170.00	90.46	327.22	15556.21	6420.22	5659.18	3098.94	-4754.59	1.87	0.41	1.82	552604.83	1705822.38	N 40 0 44.71 W	80 33 1		

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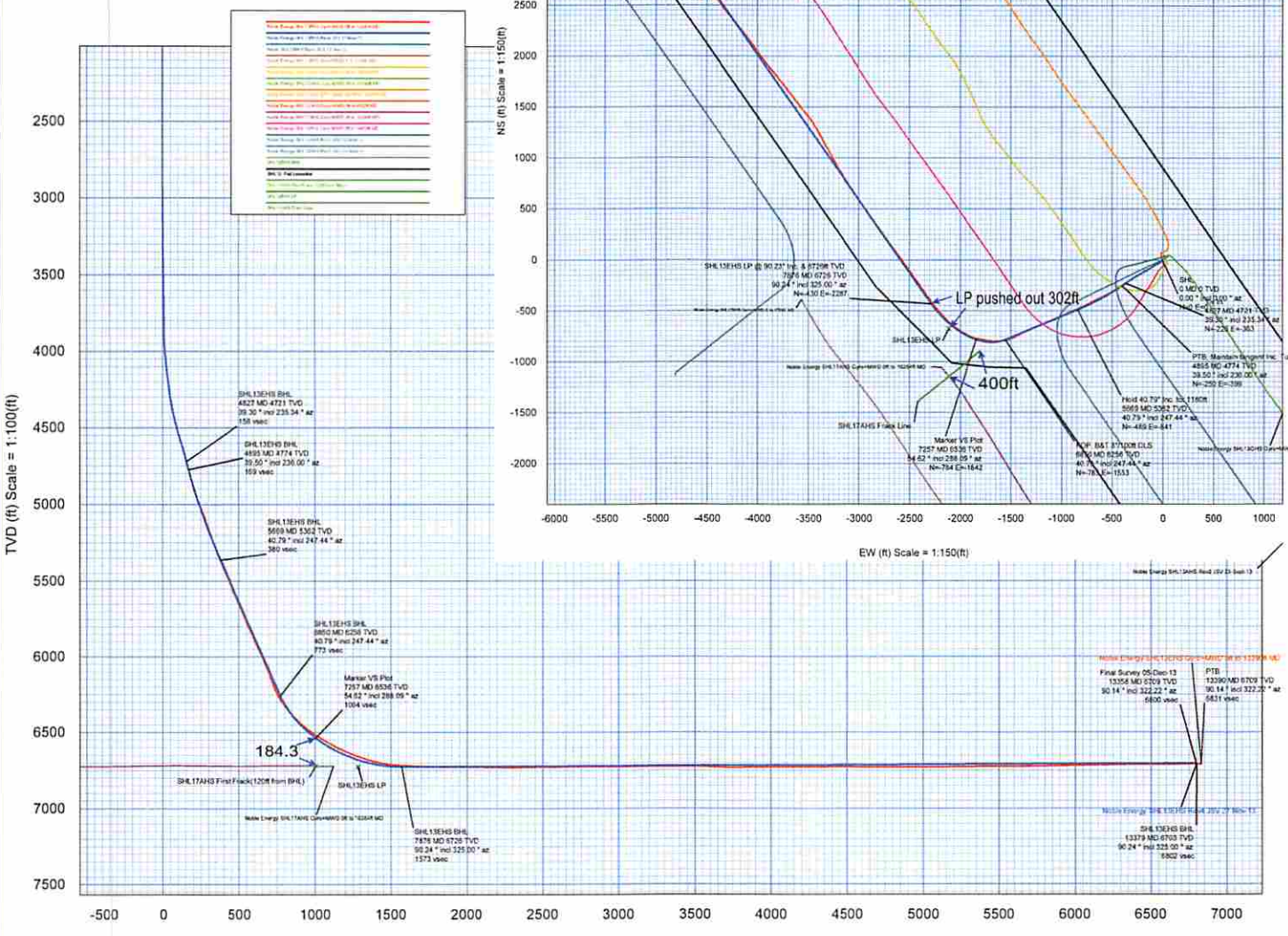
Borehole: Original Borehole	Well: SHL13EHS	Field: WV Marshall County (NAD 27)	Structure: Precision 543
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Gravity & Magnetic Parameters		Surface Location		Miscellaneous	
Model: HDGM 2013	Dip: 67.574°	Date: 11/22/2013	NAD27 West Virginia State Plane, Northern Zone, US Feet	Slot: SHL13EHS	TVD Ref: KB(1300.43ft above MSL)
MagDec: -8.433°	FS: 53164.777ft	Gravity FS: 989.35mgals (9.80665 Based)	Lat: N 40 9 14.63 Lon: W 80 32 8.97	Northing: 549456.109MUS Easting: 1709826.781MUS	Scale Fact: 1 Plan: Noble Energy SHL13EHS Gyro-MWD Off to 13390R MD

Target Location	Shape	Latitude	Longitude	Grid Coordinate	UIC	UIC Code
SHL13 Pad Lease	Point	N 42 0 14.38	W 80 32 8.88	549517.04	1709826.77	1300.43
SHL13EHS BHL	Point	N 42 0 54.30	W 80 29 19.53	549391.72	1709833.38	5807.79
SHL17AH3 Prod Frack	Point	N 42 0 51.00	W 80 28 26.94	549371.27	1709774.62	6750.25
SHL17AH3 Frack Line	Point	N 42 0 51.00	W 80 28 18.84	549371.27	1709714.62	6750.25
SHL13EHS LP	Point	N 42 0 51.72	W 80 28 26.24	549376.13	1709773.87	6750.25

PAWT	Seq	Survey Task	Vendor/Tool	Start Date	End Date	MD (ft)	Survey Frequency (Start/Stop)	EOA Size	EOZ Size	Contingency
1	1	SLB_MWD/MWD/Chm	CHM	30	30	8	15.54	Adj Stop	1.25	1.25
1	2	SLB_MWD/MWD/Chm	CHM	30	30	15.54	1207.8	Adj Stop	1.25	1.25
1	3	SLB_MWD/Chm/TD	CHM	30	30	2207.8	344	Adj Stop	18.18	18.18
1	4	SLB_MWD/Chm	CHM	30	30	3444	13358	Adj Stop	181.18	25.76
1	5	SLB_MWD/Chm	CHM	30	30	7338	13390	Adj Stop	180.62	28.22

Critical Point	MD	BCL	AZW	TVD	VSEC	N-VB	EW-VB	CLS
Start	8.88	0.00	0.00	3.00	3.00	0.00	0.00	0.00
Final Survey (B-Case 13)	13390.00	80.14	322.22	6750.79	1706.73	409.58	6414.02	0.03
PTB	13390.00	80.14	322.22	6750.79	1706.73	409.58	6414.02	0.00



Vertical Section (ft) Azim = 306.839° Scale = 1:100(ft) Origin = 0N/-S, 0E/-W