

51-01628



Noble Energy MND9EHS Gyro+MWD 0ft to 15720ft MD Survey Report

(Def Survey)

Report Date: November 11, 2013 - 08:02 AM
Client: Noble Energy
Field: WV Marshall County (NAD 27)
Structure / Slot: Noble Energy MND9 Pad / MND9EHS
Well: MND9EHS
Borehole: Original Borehole
UWI / AP# : Unknown / Unknown
Survey Name: Noble Energy MND9EHS Gyro+MWD 0ft to 15720ft MD
Survey Date: October 29, 2013
Tort / AHD / DDI / ERD Ratio: 269.180 * / 10208.863 ft / 6.832 / 1.606
Coordinate Reference System: NAD27 West Virginia State Plane, Northern Zone, US Feet
Location Lat / Long: N 39° 49' 53.49712" W 80° 47' 14.11514"
Location Grid N/E Y/X: N 487565.229 ftUS, E 1638496.030 ftUS
Grid Grid Convergence Angle: -0.8210 *
Grid Scale Factor: 0.99994716
Version / Patch: 2.7.998.0
Survey / DLS Computation: Vertical Section Azimuth: 331.357 * (Grid North)
Vertical Section Origin: 0.000 ft, 0.000 ft
TVD Reference Datum: KB
TVD Reference Elevation: 1245.500 ft above MSL
Seabed / Ground Elevation: 1219.620 ft above MSL
Magnetic Declination: -7.590 *
Total Gravity Field Strength: 999.3452mgm (9.80665 Based)
Gravity Model: GARM
Total Magnetic Field Strength: 52848.565 nT
Magnetic Dip Angle: 67.353 *
Declination Date: October 29, 2013
Magnetic Declination Model: HDGM 2013
Grid North: 13.74 *
Grid Convergence Used: -0.8210 *
Total Corr Mag North-Grid North: -0.7695 *
Local Coord Referenced 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 (ftUS), Easting (ftUS), Latitude (N/S ° ' ''), Longitude (E/W ° ' ''), Directional Difficulty Index. The table contains multiple rows of survey data points.

12/12/2014

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Comments	MD (ft)	Incl (°)	Azim Grid (°)	TYD (ft)	TYDSS (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLB (ft/100ft)	BR (ft/100ft)	TR (ft/100ft)	Northing (ft)	Easting (ft)	Latitude (deg)	Longitude (deg)	Directional Drift/Diffculty Index
	5702.00	37.70	60.27	5615.78	4370.26	97.17	234.10	225.69	1.78	1.38	-1.85	487790.31	1630721.90	N 39 48 55.64 W	80 47 11.27	4.55
	5749.00	40.75	65.94	5652.14	4406.64	94.71	248.15	253.08	6.51	6.30	-0.70	487811.36	1630749.10	N 39 48 57.17 W	80 47 10.82	4.00
	5706.00	43.73	67.35	5686.93	4441.43	91.79	258.68	292.00	6.85	6.34	3.00	487823.68	1630776.10	N 39 49 56.09 W	80 47 10.55	4.64
	5843.00	43.51	68.81	5720.96	4475.46	88.05	270.82	312.15	1.91	-0.47	2.68	487836.03	1630808.16	N 39 49 56.22 W	80 47 10.17	4.68
	5890.00	44.50	68.78	5754.78	4509.28	83.88	282.69	342.58	2.12	2.11	0.32	487847.90	1630838.56	N 39 49 56.34 W	80 47 9.78	4.71
	5938.00	44.24	68.63	5789.06	4543.58	80.18	295.42	373.62	3.15	-1.46	-1.46	487860.64	1630869.63	N 39 49 56.34 W	80 47 9.38	4.74
	5986.00	44.02	68.43	5823.53	4578.03	77.45	309.00	404.15	1.80	-0.86	-2.50	487874.21	1630900.18	N 39 49 56.81 W	80 47 8.99	4.77
	6033.00	43.17	62.81	5857.37	4612.07	75.94	323.19	433.26	4.51	-1.48	-0.00	487888.40	1630930.29	N 39 49 56.75 W	80 47 8.62	4.80
	6080.00	43.18	54.62	5891.87	4646.37	77.48	339.91	460.60	11.83	0.02	-17.00	487905.12	1630965.70	N 39 49 56.92 W	80 47 8.28	4.85
	6128.00	43.81	47.89	5926.71	4681.21	83.25	360.55	486.44	9.50	1.31	-13.01	487925.78	1631002.44	N 39 49 57.13 W	80 47 7.95	4.89
	6175.00	44.48	34.63	5962.44	4714.94	91.94	383.30	509.96	6.18	4.38	8.64	487948.51	1631035.95	N 39 49 57.36 W	80 47 7.63	4.92
	6222.00	45.87	30.05	6003.50	4748.09	103.28	408.27	532.02	7.93	2.90	-10.38	487973.47	1631070.92	N 39 49 57.61 W	80 47 7.35	4.95
	6270.00	47.90	36.80	6026.37	4780.87	117.23	435.83	553.55	5.56	4.42	-4.89	488001.13	1631094.55	N 39 49 57.88 W	80 47 7.10	4.98
	6317.00	49.55	32.72	6057.35	4811.85	133.07	464.98	573.60	7.32	3.32	-6.88	488030.17	1631099.68	N 39 49 58.17 W	80 47 6.85	5.02
	6365.00	51.19	27.15	6087.98	4842.48	152.34	496.90	602.10	9.57	3.42	-11.80	488062.19	1631088.10	N 39 49 58.40 W	80 47 6.62	5.05
	6412.00	52.38	20.36	6117.07	4871.57	174.87	530.76	606.04	11.83	2.53	-14.45	488095.96	1631022.94	N 39 49 58.63 W	80 47 6.44	5.09
	6459.00	53.94	14.00	6145.27	4899.77	201.05	566.66	618.05	11.18	3.32	-13.34	488131.86	1631014.05	N 39 49 58.18 W	80 47 6.30	5.13
	6507.00	55.50	8.88	6173.01	4927.51	231.00	605.04	625.83	9.44	3.25	-10.85	488170.23	1631012.83	N 39 49 58.56 W	80 47 6.21	5.16
	6553.00	58.15	3.85	6198.86	4953.36	262.20	642.85	629.08	9.51	1.41	-11.37	488208.04	1631025.97	N 39 49 59.94 W	80 47 6.16	5.19
	6601.00	58.81	35.70	6224.67	4979.17	297.43	683.29	630.52	11.41	5.54	-11.83	488248.48	1631026.52	N 39 50 0.34 W	80 47 6.18	5.22
	6648.00	61.06	35.74	6248.23	5002.73	334.56	723.81	627.21	10.75	4.79	-11.13	488288.90	1631023.20	N 39 50 0.74 W	80 47 6.21	5.26
	6696.00	63.51	34.92	6270.56	5025.06	374.51	765.80	620.79	7.29	5.10	-5.88	488330.99	1631018.79	N 39 50 1.15 W	80 47 6.30	5.29
	6743.00	66.80	34.72	6290.36	5044.88	415.21	807.56	612.34	8.39	6.57	-0.74	488372.74	1631008.33	N 39 50 1.58 W	80 47 6.42	5.31
	6790.00	70.87	34.38	6307.43	5061.83	457.87	849.94	601.36	11.34	9.00	-7.28	488415.13	1631007.36	N 39 50 1.98 W	80 47 6.52	5.34
	6837.00	74.38	33.95	6321.48	5075.96	501.78	892.50	587.25	11.41	7.47	-9.04	488457.48	1631003.25	N 39 50 2.40 W	80 47 6.78	5.38
	6885.00	78.89	33.10	6333.37	5087.87	547.93	935.70	570.07	7.20	5.23	-6.10	488500.88	1631006.07	N 39 50 2.82 W	80 47 6.98	5.40
	6932.00	79.87	33.82	6342.92	5097.42	593.82	977.55	558.96	9.24	5.91	-6.08	488542.73	1631004.96	N 39 50 3.17 W	80 47 6.94	5.43
	6980.00	82.35	33.18	6350.42	5104.92	641.22	1019.52	529.91	8.42	5.58	-3.39	488584.69	1631004.92	N 39 50 3.65 W	80 47 7.53	5.48
	7027.00	85.73	32.26	6355.31	5109.81	687.91	1059.57	504.85	10.32	7.19	-7.45	488624.74	1631000.85	N 39 50 4.04 W	80 47 7.84	5.51
	7074.00	89.79	32.03	6357.14	5111.64	734.62	1098.33	478.35	11.03	8.64	-8.87	488663.50	1631001.08	N 39 50 4.42 W	80 47 8.19	5.58
	7120.00	89.93	32.82	6357.38	5111.88	789.71	1175.48	421.22	11.17	10.15	-11.85	488704.64	1631001.23	N 39 50 4.17 W	80 47 8.94	5.65
	7265.00	92.66	32.46	6357.58	5113.58	837.86	1252.12	349.10	13.83	10.00	-12.77	488747.28	1631001.11	N 39 50 4.50 W	80 47 9.67	5.59
	7360.00	89.86	32.64	6357.83	5112.33	1018.42	1330.64	311.64	2.20	0.03	2.20	488800.80	1631001.65	N 39 50 6.82 W	80 47 10.37	5.61
	7457.00	89.97	32.80	6357.98	5112.48	1115.27	1413.18	280.70	3.05	0.11	3.05	488978.33	1631001.72	N 39 50 7.50 W	80 47 11.04	5.65
	7502.00	90.58	33.17	6357.52	5112.02	1210.26	1495.83	214.05	1.77	0.64	1.65	489051.06	1631001.08	N 39 50 8.31 W	80 47 11.85	5.69
	7548.00	91.14	32.69	6356.59	5111.09	1304.24	1577.74	183.77	1.84	0.24	-0.54	489142.86	1631001.73	N 39 50 9.17 W	80 47 12.26	5.71
	7741.00	93.17	32.69	6355.17	5109.67	1399.08	1658.52	117.61	2.97	0.65	-2.89	489223.66	1631013.83	N 39 50 9.90 W	80 47 12.91	5.74
	7835.00	91.38	32.52	6355.16	5107.56	1492.81	1737.52	66.91	0.71	0.22	0.87	489302.85	1631062.94	N 39 50 10.68 W	80 47 13.58	5.78
	7928.00	91.44	32.67	6350.79	5105.29	1585.52	1815.53	18.34	1.02	0.08	-1.02	489380.88	1631052.36	N 39 50 11.44 W	80 47 14.24	5.79
	8022.00	91.24	32.62	6349.05	5103.34	1672.11	1892.56	-36.04	1.06	0.64	-0.64	489460.59	1631042.99	N 39 50 12.25 W	80 47 14.83	5.81
	8116.00	91.44	32.62	6347.05	5101.55	1758.64	1972.08	-80.40	0.35	0.33	0.14	489537.20	1631040.55	N 39 50 12.97 W	80 47 15.63	5.83
	8212.00	90.82	32.62	6345.50	5100.00	1868.19	2050.66	-142.85	0.65	0.00	0.00	489615.77	1631033.18	N 39 50 13.74 W	80 47 16.33	5.85
	8306.00	90.69	32.91	6344.43	5098.03	1961.74	2128.46	-195.80	0.12	0.07	0.10	489693.57	1631030.44	N 39 50 14.50 W	80 47 17.02	5.87
	8401.00	91.10	32.78	6342.94	5097.44	2056.20	2207.05	-348.83	0.45	0.43	-0.14	489772.17	1631027.12	N 39 50 15.27 W	80 47 17.71	5.89
	8496.00	92.48	32.41	6341.24	5095.74	2150.71	2284.98	-303.28	1.45	-0.15	-1.44	489850.06	1631027.77	N 39 50 16.03 W	80 47 18.43	5.92
	8590.00	91.03	32.04	6339.60	5094.10	2243.86	2360.73	-358.88	1.46	0.07	-1.46	489928.35	1631037.17	N 39 50 16.77 W	80 47 19.15	5.94
	8685.00	90.93	32.14	6337.98	5092.48	2337.71	2436.07	-410.72	1.18	-0.11	-1.16	490001.17	1631030.33	N 39 50 17.51 W	80 47 19.91	5.98
	8780.00	91.24	32.40	6336.18	5090.68	2431.19	2510.06	-478.27	1.65	0.33	-1.62	490075.15	1631019.78	N 39 50 18.23 W	80 47 20.68	5.98
	8874.00	91.27	32.17	6334.12	5088.82	2523.68	2593.23	-535.24	1.58	0.03	1.58	490148.32	1631009.82	N 39 50 18.95 W	80 47 21.45	6.00
	8969.00	91.24	32.25	6332.04	5086.54	2617.65	2659.14	-602.32	2.50	-0.00	2.51	490224.22	1631003.75	N 39 50 19.68 W	80 47 22.20	6.02
	9064.00	91.24	32.52	6329.98	5084.48	2712.04	2736.93	-646.81	1.56	0.00	1.55	490300.00	1631004.25	N 39 50 20.45 W	80 47 22.91	6.04
	9158.00	91.44	32.47	6327.70	5082.29	2805.69	2815.37	-698.55	1.87	0.21	1.86	490380.45	1631001.52	N 39 50 21.22 W	80 47 23.56	6.06
	9253.00	90.96	32.93	6325.60	5080.30	2900.52	2896.08	-748.62	1.50	-0.51	1.51	490461.15	1631001.75	N 39 50 22.01 W	80 47 24.25	6.08
	9347.00	91.34	33.06	6323.91	5078.41	2994.48	2977.26	-795.92	1.92	0.40	1.87	490542.35	1631001.15	N 39 50 22.81 W	80 47 24.87	6.10
	9442.00	91.24	33.87	6321.77	5076.27	3089.41	3061.34	-840.11	3.38	-0.11	3.38	490626.40	1631000.96	N 39 50 23.63 W	80 47 25.45	6.12
	9537.00	90.93	33.00	6319.95	5074.45	3184.37	3145.14	-884.79	4.08	-0.29	-4.07	490710.19	1631001.29	N 39 50 24.45 W	80 47 26.04	6.14
	9632.00	90.06	32.48	6318.13	5072.63	3279.15	3225.45	-925.48	4.66	-0.86	-0.86	490790.82	1631001.00	N 39 50 25.17 W	80 47 26.70	6.16
	9726.00	90.41	32.69	6316.78	5070.26	3372.69	3303.06	-968.47	0.50	0.40	0.44	490868.13	1631001.61	N 39 50 25.00 W	80 47 27.40	6.18
	9821.00	90.07	32.96	6316.37	5072.87	3467.21	3381.49	-1042.11	0.68	-0.36	-0.58	490946.54	1631001.98	N 39 50 26.78 W	80 47 28.10	6.19
	9916.00	90.34	32.53	6318.03	5072.53	3561.67	3450.54	-1096.27	0.37	0.28	-0.24	491024.56	1631001.82	N 39 50 27.63 W	80 47 28.81	6.21
	10010.00	90.07	32.49	6317.89	5072.19	3655.05	3538.31	-1150.51	0.85	-0.20	-0.80	491101.35	1631001.58	N 39 50 28.28 W	80 47 29.52	6.22
	10105.00	90.15	32.61	6317.61	5072.11	37										

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Comments	MD (ft)	Incl (°)	Asm Grid (°)	TVD (ft)	TVDSS (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLs (°/100ft)	BR (°/100ft)	TR (°/100ft)	Northing (ftUS)	Eastng (ftUS)	Latitude (N/S ° ° °)	Longitude (E/W ° ° °)	Directional Drift/Def Index
	15419.00	90.48	323.40	6252.78	5007.28	5024.36	7945.11	-4279.85	1.07	-0.11	-1.08	495009.90	1834218.42	N 39 51 11.40	W 80 48 10.45	6.81
	15513.00	91.13	324.11	6251.48	5005.98	0117.52	8020.91	-4335.42	1.02	0.60	0.76	495585.70	1834160.85	N 39 51 12.14	W 80 48 11.17	6.82
	15608.00	90.82	323.89	6250.01	5004.51	0211.71	8097.68	-4391.38	0.70	-0.54	-0.44	495682.44	1834104.89	N 39 51 12.89	W 80 48 11.91	6.82
Final Survey 10-Nov-13	15675.00	91.10	324.23	6249.01	5003.51	0278.14	8151.83	-4430.80	1.08	0.72	0.81	495716.61	1834065.48	N 39 51 13.42	W 80 48 12.42	6.83
Projection to BH	15720.00	91.10	324.23	6248.14	5002.64	0322.78	8188.33	-4457.10	0.00	0.00	0.00	495753.11	1834039.18	N 39 51 13.78	W 80 48 12.77	6.83

Survey Type: Def Survey

Survey Error Model: ISOWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma

Survey Program:

Description	Part	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	25.880	Act Strs	30.000	30.000	SLB_NSG+MSHOT-Depth Only	Original Borehole / Noble Energy MND9EHS Gyro+MWD 0ft to 15720ft MD
	1	25.880	2464.000	Act Strs	30.000	30.000	SLB_NSG+MSHOT	Original Borehole / Noble Energy MND9EHS Gyro+MWD 0ft to
	1	2464.000	15675.000	Act Strs	30.000	30.000	SLB_MWD-STD	Original Borehole / Noble Energy MND9EHS Gyro+MWD 0ft to
	1	15675.000	15720.000	Act Strs	30.000	30.000	SLB_BLIND+TREND	Original Borehole / Noble Energy MND9EHS Gyro+MWD 0ft to

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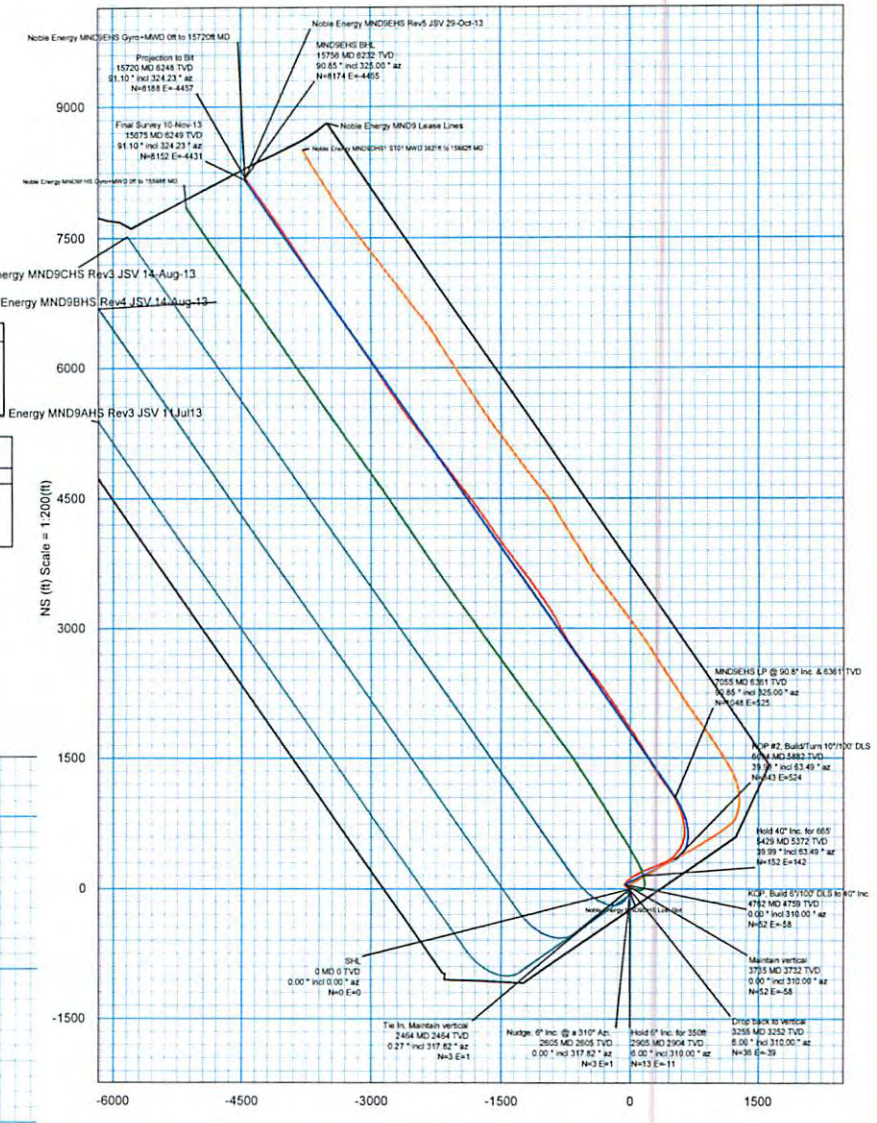


Noble Energy



Borehole: Original Borehole	Well: MND9EHS	Field: WV Marshall County (NAD 27)	Structure: Nomac 79
Gravity & Magnetic Parameters		Surface Location	Miscellaneous
Model: HDGM 2013	Dip: 67.333°	Date: 10/29/2013	Lat: N 39 49 53.50
MagDec: -7.59°	FS: 52848.965mT	Gravity FS: 999.345mgal	Northing: 487565.229RUS
			Grid Conv: -0.821"
			Slot: MND9EHS
			TVD Ref: KB(1245.5R above MSL)
			Plan: Noble Energy MND9EHS Gyro-MWD DR to 15720R MD

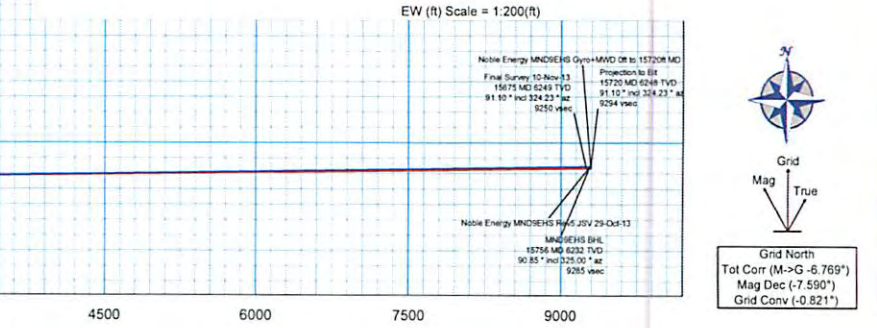
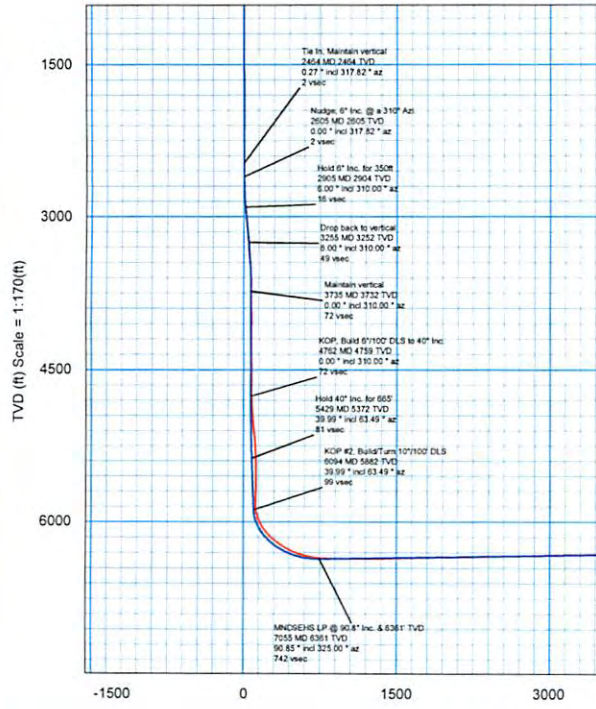
- Noble Energy MND9EHS Gyro-MWD DR to 15720R MD
- Noble Energy MND9EHS Rev5 J2V 29-Oct-13
- Noble Energy MND9EHS Rev3 J2V 14-Aug-13
- Noble Energy MND9EHS Rev4 J2V 14-Aug-13
- Noble Energy MND9EHS Rev3 J2V 14-Aug-13
- Noble Energy MND9EHS Rev4 J2V 14-Aug-13
- Noble Energy MND9EHS Rev3 J2V 14-Aug-13
- Noble Energy MND9EHS Rev4 J2V 14-Aug-13
- Noble Energy MND9EHS MWD DR to 6240R
- MND9EHS BHL
- MND9EHS LP
- Noble Energy MND9 Lease Lines



Part	Seq	Survey Tool	Vendor Tool	Probe Size (in)	Probe Size (mm)	MD From (ft)	MD To (ft)	Survey Frequency (Start/Stop)	EW Size (Start/Stop)	ZWV Size (Start/Stop)	Comments
1	1	SLB MWD/MSHCT	SLB MWD/MSHCT	30	30	0	23.88	Act Drw	1.25	1.25	
1	2	SLB MWD/MSHCT	SLB MWD/MSHCT	30	30	25.88	2464	Act Drw	2.00	1.73	
1	3	SLB MWD/MSHCT	SLB MWD/MSHCT	30	30	2464	15675	Act Drw	253.77	24.11	
1	4	SLB MWD/TREND	SLB MWD/TREND	30	30	15675	15720	Act Drw	239.23	25.23	

Northings		Eastings		Surface Location		Grid Coordinates		Local Coordinates	
487565.229	1039496.63	Latitude	N 39 49 53.50	Longitude	W 80 47 14.12	VSite Azimuth	331.887		
Target Name	Shape	Dimension	Latitude	Longitude	Northing	Easting	TVD	VSite	N-True (1)
Noble Energy MND9 Lease Lines	Point	NA	N 39 49 53.50	W 80 47 14.12	487565.229	1039496.63	15720	331.887	(1)
MND9EHS BHL	Point	NA	N 39 49 53.50	W 80 47 14.12	487565.229	1039496.63	15720	331.887	(1)
MND9EHS LP	Point	NA	N 39 49 53.50	W 80 47 14.12	487565.229	1039496.63	15720	331.887	(1)

Critical Points									
Critical Point	MD	INCL	AZIM	TVD	VSite	N-True (1)	E-True (1)	CLS	
Drill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Final Survey 10-Nov-13	15675.00	91.10	324.23	6248.14	8718.14	8718.14	4487.10	1.08	
Projection to Ellipsoid	15720.00	91.10	324.23	6248.14	8718.14	8718.14	4487.10	0.00	



Vertical Section (ft) Azim = 335.911° Scale = 1:170(ft) Origin = 0N/-S, 0E/+W