

PETROLEUM DEVELOPMENT CORP Weld County CO

Well Name: **Sorin Natural Resources 2M-423**

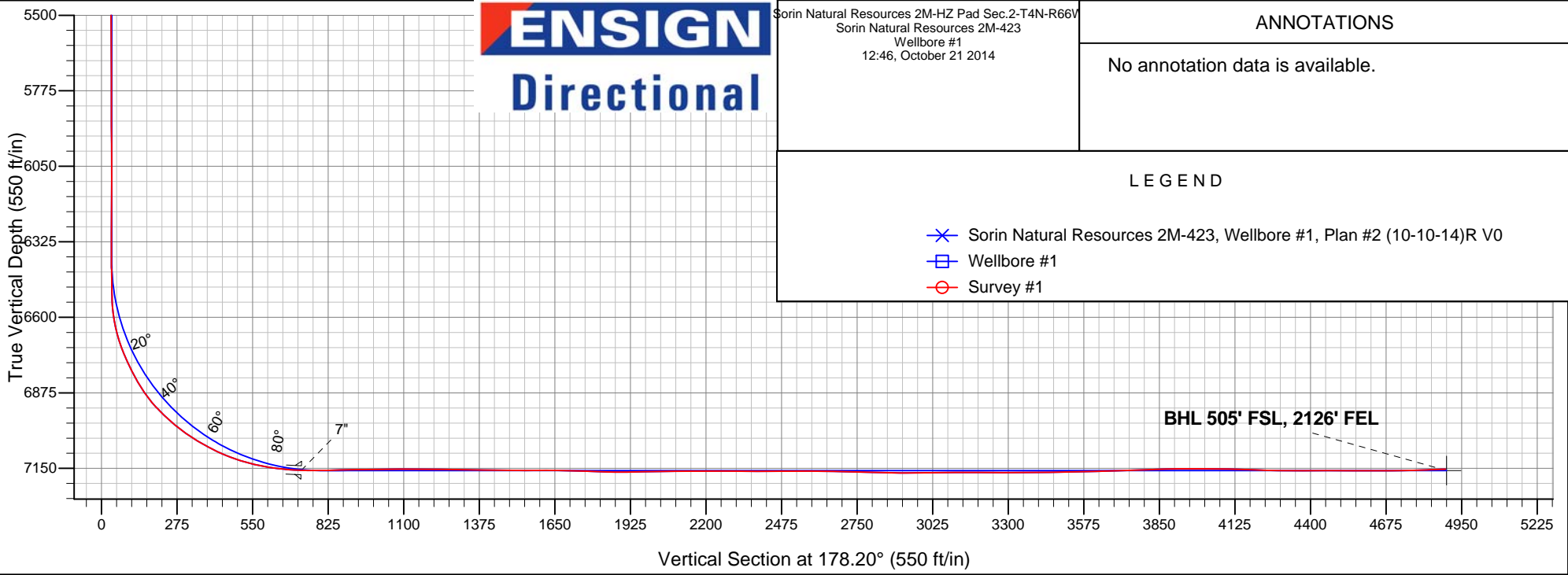
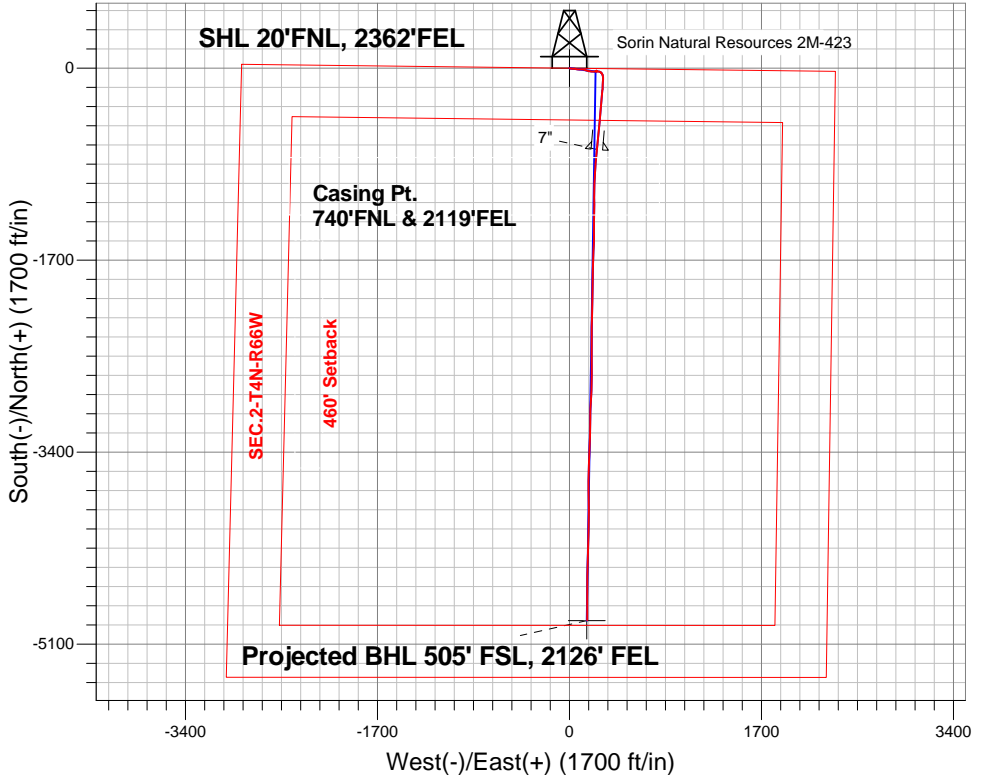
Surface Location: Sorin Natural Resources 2M-HZ Pad Sec.2-T4N-R66W  
North American Datum 1983 , US State Plane 1983 , Colorado Northern Zone

Ground Elevation: 4673.0

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	1370695.63	3210931.44	40.348490	-104.743210	
Ensign Rig #136 - RKB - 12.5' WELL @ 4686 ft (Ensign Rig #136 - RKB - 13')						

FINAL SURVEY

Projected Bottom Hole Location  
11748'MD 7153'TVD 4888'S & 157'E of SHL  
92.3 degree Incl @ 179.4 degree AZM





# **PETROLEUM DEVELOPMENT CORP Weld County CO**

**SEC.2-T4N-R66W**

**Sorin Natural Resources 2M-HZ Pad Sec.2-T4N-R66W**

**Sorin Natural Resources 2M-423**

**Wellbore #1**

**Survey: Survey #1**

## **Standard Survey Report**

**21 October, 2014**

<b>Company:</b>	PETROLEUM DEVELOPMENT CORP Weld County CO	<b>Local Co-ordinate Reference:</b>	Well Sorin Natural Resources 2M-423
<b>Project:</b>	SEC.2-T4N-R66W	<b>TVD Reference:</b>	WELL @ 4685.5ft (Ensign Rig #136 - RKB - 12.5')
<b>Site:</b>	Sorin Natural Resources 2M-HZ Pad Sec.2-T4N-R66W	<b>MD Reference:</b>	WELL @ 4685.5ft (Ensign Rig #136 - RKB - 12.5')
<b>Well:</b>	Sorin Natural Resources 2M-423	<b>North Reference:</b>	True
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<b>Database:</b>	Landmark

<b>Project</b>	SEC.2-T4N-R66W, Weld County, Colorado		
<b>Map System:</b>	US State Plane 1983	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b>	North American Datum 1983		Using Well Reference Point
<b>Map Zone:</b>	Colorado Northern Zone		Using geodetic scale factor

Site		Sorin Natural Resources 2M-HZ Pad Sec.2-T4N-R66W			
Site Position:		Northing:	1,370,695.40 ft	Latitude:	40.348490
From:	Lat/Long	Easting:	3,210,900.78 ft	Longitude:	-104.743320
Position Uncertainty:	0.0 ft	Slot Radius:	"	Grid Convergence:	0.49 °

Well	Sorin Natural Resources 2M-423					
Well Position	+N-S	0.0 ft	Northing:	1,370,695.63 ft	Latitude:	40.348490
	+E-W	0.0 ft	Easting:	3,210,931.44 ft	Longitude:	-104.743210
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,673.0 ft

<b>Wellbore</b>	Wellbore #1				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2010	10/10/2014	8.40	66.90	52,758

<b>Design</b>	Wellbore #1				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.0
<b>Vertical Section:</b>	<b>Depth From (TVD) (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Direction (°)</b>	
	0.0	0.0	0.0	178.20	

<b>Survey Program</b>	<b>Date</b>	10/21/2014			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
69.0	11,748.0	Survey #1 (Wellbore #1)	MWD	MWD - Standard	

<b>Survey</b>										
<b>Measured Depth (ft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Vertical Section (ft)</b>	<b>Dogleg Rate (°/100ft)</b>	<b>Build Rate (°/100ft)</b>	<b>Turn Rate (°/100ft)</b>	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00	
1.0	0.00	33.00	1.0	0.0	0.0	0.0	0.29	0.29	0.00	
<b>SHL 20'FNL, 2362'FEL</b>										
69.0	0.20	33.00	69.0	0.1	0.1	-0.1	0.29	0.29	0.00	
155.0	0.40	119.10	155.0	0.1	0.4	-0.1	0.51	0.23	100.12	
251.0	0.40	38.80	251.0	0.2	0.9	-0.2	0.54	0.00	-83.65	
345.0	0.30	159.40	345.0	0.2	1.2	-0.2	0.65	-0.11	128.30	
438.0	0.10	335.00	438.0	0.1	1.3	0.0	0.43	-0.22	188.82	
532.0	0.20	35.10	532.0	0.3	1.3	-0.2	0.18	0.11	63.94	
625.0	0.70	107.50	625.0	0.2	2.0	-0.2	0.72	0.54	77.85	

<b>Company:</b>	PETROLEUM DEVELOPMENT CORP Weld County CO	<b>Local Co-ordinate Reference:</b>	Well Sorin Natural Resources 2M-423
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<b>Site:</b>	Sorin Natural Resources 2M-HZ Pad Sec.2-T4N-R66W	<b>MD Reference:</b>	WELL @ 4685.5ft (Ensign Rig #136 - RKB - 12.5')
<b>Well:</b>	Sorin Natural Resources 2M-423	<b>North Reference:</b>	True
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<b>Database:</b>	Landmark

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
719.0	0.40	94.40	719.0	0.0	2.8	0.1	0.34	-0.32	-13.94
813.0	0.60	163.10	813.0	-0.5	3.3	0.6	0.63	0.21	73.09
896.0	0.60	124.60	896.0	-1.1	3.8	1.3	0.48	0.00	-46.39
938.0	0.30	176.60	938.0	-1.4	4.0	1.5	1.14	-0.71	123.81
1,033.0	2.70	117.00	1,032.9	-2.6	6.0	2.8	2.70	2.53	-62.74
1,128.0	2.90	94.70	1,127.8	-3.8	10.4	4.2	1.16	0.21	-23.47
1,223.0	5.40	95.80	1,222.6	-4.5	17.2	5.0	2.63	2.63	1.16
1,316.0	4.80	99.30	1,315.2	-5.6	25.4	6.4	0.73	-0.65	3.76
1,414.0	4.30	93.70	1,412.9	-6.5	33.1	7.5	0.68	-0.51	-5.71
1,507.0	3.70	88.20	1,505.7	-6.6	39.6	7.8	0.77	-0.65	-5.91
1,601.0	4.00	91.90	1,599.5	-6.6	45.9	8.0	0.41	0.32	3.94
1,694.0	3.10	94.90	1,692.3	-6.9	51.6	8.5	0.99	-0.97	3.23
1,788.0	3.90	103.00	1,786.1	-7.9	57.3	9.7	1.00	0.85	8.62
1,882.0	4.70	102.30	1,879.8	-9.4	64.2	11.4	0.85	0.85	-0.74
1,975.0	4.20	91.20	1,972.6	-10.3	71.3	12.5	1.07	-0.54	-11.94
2,069.0	5.60	98.80	2,066.2	-11.1	79.3	13.5	1.64	1.49	8.09
2,163.0	5.10	88.70	2,159.8	-11.7	88.0	14.4	1.13	-0.53	-10.74
2,256.0	4.80	78.50	2,252.5	-10.8	95.9	13.8	1.00	-0.32	-10.97
2,350.0	5.50	91.00	2,346.1	-10.1	104.3	13.4	1.40	0.74	13.30
2,444.0	5.40	98.90	2,439.7	-10.9	113.2	14.4	0.80	-0.11	8.40
2,537.0	5.50	95.20	2,532.2	-11.9	121.9	15.8	0.39	0.11	-3.98
2,659.0	6.10	114.20	2,653.6	-15.1	133.7	19.3	1.64	0.49	15.57
2,749.0	6.20	111.80	2,743.1	-18.9	142.5	23.3	0.31	0.11	-2.67
2,840.0	4.80	107.40	2,833.7	-21.9	150.7	26.6	1.61	-1.54	-4.84
2,930.0	4.90	104.20	2,923.4	-23.9	158.1	28.9	0.32	0.11	-3.56
3,020.0	4.70	99.80	3,013.1	-25.5	165.4	30.7	0.47	-0.22	-4.89
3,111.0	4.20	96.50	3,103.8	-26.5	172.4	31.9	0.62	-0.55	-3.63
3,201.0	3.90	90.70	3,193.6	-26.9	178.7	32.5	0.56	-0.33	-6.44
3,292.0	4.50	103.70	3,284.3	-27.8	185.3	33.6	1.23	0.66	14.29
3,382.0	4.00	99.10	3,374.1	-29.1	191.8	35.1	0.67	-0.56	-5.11
3,472.0	3.80	94.90	3,463.9	-29.9	197.9	36.1	0.39	-0.22	-4.67
3,562.0	3.30	89.10	3,553.7	-30.1	203.5	36.5	0.68	-0.56	-6.44
3,653.0	2.90	87.70	3,644.5	-30.0	208.4	36.5	0.45	-0.44	-1.54
3,743.0	3.00	89.10	3,734.4	-29.8	213.0	36.5	0.14	0.11	1.56
3,833.0	2.90	87.50	3,824.3	-29.7	217.6	36.5	0.14	-0.11	-1.78
3,924.0	2.80	87.30	3,915.2	-29.5	222.2	36.4	0.11	-0.11	-0.22
4,014.0	2.70	87.00	4,005.1	-29.3	226.5	36.4	0.11	-0.11	-0.33
4,104.0	2.80	77.70	4,095.0	-28.7	230.7	35.9	0.51	0.11	-10.33
4,195.0	0.50	57.10	4,185.9	-28.0	233.2	35.3	2.57	-2.53	-22.64
4,286.0	0.40	83.50	4,276.9	-27.8	233.9	35.1	0.25	-0.11	29.01
4,376.0	0.50	105.30	4,366.9	-27.8	234.6	35.2	0.22	0.11	24.22
4,466.0	0.40	78.00	4,456.9	-27.9	235.3	35.2	0.26	-0.11	-30.33
4,557.0	0.90	40.40	4,547.9	-27.3	236.0	34.6	0.69	0.55	-41.32
4,647.0	1.10	24.40	4,637.9	-25.9	236.9	33.3	0.38	0.22	-17.78
4,737.0	1.30	27.40	4,727.9	-24.2	237.7	31.7	0.23	0.22	3.33
4,828.0	0.50	173.60	4,818.9	-23.7	238.2	31.2	1.91	-0.88	160.66
4,918.0	0.30	172.40	4,908.9	-24.3	238.3	31.8	0.22	-0.22	-1.33
5,057.0	0.50	126.70	5,047.9	-25.1	238.8	32.5	0.26	0.14	-32.88
5,099.0	0.60	107.50	5,089.9	-25.2	239.2	32.7	0.50	0.24	-45.71
5,189.0	0.40	85.90	5,179.9	-25.4	239.9	32.9	0.30	-0.22	-24.00
5,280.0	0.90	229.20	5,270.9	-25.8	239.7	33.3	1.37	0.55	157.47

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<b>Well:</b>	Sorin Natural Resources 2M-423	<b>North Reference:</b>	True
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<b>Database:</b>	Landmark

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
5,370.0	0.60	230.60	5,360.9	-26.6	238.8	34.0	0.33	-0.33	1.56	
5,461.0	0.40	171.20	5,451.9	-27.2	238.5	34.6	0.58	-0.22	-65.27	
5,552.0	0.20	191.40	5,542.9	-27.7	238.5	35.1	0.25	-0.22	22.20	
5,642.0	0.40	223.00	5,632.9	-28.0	238.3	35.5	0.28	0.22	35.11	
5,732.0	0.40	222.90	5,722.9	-28.5	237.8	35.9	0.00	0.00	-0.11	
5,822.0	0.30	253.80	5,812.9	-28.8	237.4	36.2	0.23	-0.11	34.33	
5,913.0	0.60	264.20	5,903.9	-28.9	236.7	36.3	0.34	0.33	11.43	
6,003.0	0.50	250.10	5,993.9	-29.1	235.8	36.5	0.19	-0.11	-15.67	
6,094.0	0.90	85.90	6,084.9	-29.2	236.2	36.6	1.53	0.44	-180.44	
6,184.0	0.90	82.40	6,174.8	-29.0	237.6	36.5	0.06	0.00	-3.89	
6,275.0	0.70	87.00	6,265.8	-28.9	238.9	36.4	0.23	-0.22	5.05	
6,365.0	0.70	86.60	6,355.8	-28.8	240.0	36.3	0.01	0.00	-0.44	
6,410.0	1.30	87.20	6,400.8	-28.8	240.7	36.3	1.33	1.33	1.33	
6,455.0	5.40	98.40	6,445.7	-29.1	243.3	36.7	9.18	9.11	24.89	
6,501.0	10.10	92.60	6,491.3	-29.6	249.5	37.4	10.35	10.22	-12.61	
6,546.0	13.90	96.80	6,535.3	-30.4	258.8	38.5	8.66	8.44	9.33	
6,591.0	15.40	109.60	6,578.9	-33.0	269.8	41.5	7.91	3.33	28.44	
6,636.0	16.10	132.20	6,622.2	-39.3	280.1	48.0	13.64	1.56	50.22	
6,682.0	17.80	150.40	6,666.2	-49.7	288.3	58.7	12.06	3.70	39.57	
6,727.0	20.10	163.60	6,708.8	-63.1	293.9	72.2	10.78	5.11	29.33	
6,772.0	24.20	174.00	6,750.5	-79.7	297.0	88.9	12.58	9.11	23.11	
6,817.0	26.70	182.80	6,791.1	-98.9	297.5	108.2	10.06	5.56	19.56	
6,862.0	29.50	184.90	6,830.8	-120.1	296.1	129.3	6.60	6.22	4.67	
6,907.0	33.80	182.60	6,869.1	-143.6	294.5	152.8	9.92	9.56	-5.11	
6,953.0	40.10	183.10	6,905.9	-171.2	293.2	180.3	13.71	13.70	1.09	
6,998.0	44.00	184.50	6,939.3	-201.3	291.1	210.3	8.91	8.67	3.11	
7,043.0	48.40	184.90	6,970.4	-233.7	288.5	242.6	9.80	9.78	0.89	
7,089.0	51.70	184.20	7,000.0	-268.8	285.7	277.6	7.27	7.17	-1.52	
7,134.0	54.90	183.80	7,026.9	-304.8	283.2	313.5	7.15	7.11	-0.89	
7,179.0	59.50	184.70	7,051.2	-342.5	280.4	351.1	10.36	10.22	2.00	
7,224.0	62.30	186.50	7,073.1	-381.6	276.5	390.1	7.14	6.22	4.00	
7,270.0	65.80	187.00	7,093.2	-422.7	271.7	431.0	7.67	7.61	1.09	
7,320.0	70.20	186.30	7,112.0	-468.7	266.3	476.9	8.90	8.80	-1.40	
7,360.0	73.50	185.90	7,124.4	-506.5	262.3	514.5	8.30	8.25	-1.00	
7,405.0	77.20	185.60	7,135.8	-549.8	257.9	557.7	8.25	8.22	-0.67	
7,450.0	80.30	185.20	7,144.6	-593.8	253.7	601.4	6.94	6.89	-0.89	
7,496.0	83.50	184.90	7,151.1	-639.1	249.7	646.7	6.99	6.96	-0.65	
7,541.0	86.30	184.70	7,155.1	-683.8	246.0	691.2	6.24	6.22	-0.44	
7,577.0	87.93	184.70	7,156.9	-719.6	243.0	726.9	4.52	4.52	0.00	
7"										
7,583.0	88.20	184.70	7,157.1	-725.6	242.6	732.9	4.52	4.52	0.00	
7,676.0	92.00	185.40	7,156.9	-818.2	234.4	825.2	4.15	4.09	0.75	
7,770.0	90.60	184.40	7,154.8	-911.9	226.3	918.5	1.83	-1.49	-1.06	
7,863.0	90.60	182.10	7,153.8	-1,004.7	221.1	1,011.1	2.47	0.00	-2.47	
7,963.0	90.00	179.80	7,153.3	-1,104.7	219.4	1,111.0	2.38	-0.60	-2.30	
8,064.0	89.90	180.70	7,153.4	-1,205.7	219.0	1,211.9	0.90	-0.10	0.89	
8,155.0	89.10	180.80	7,154.2	-1,296.7	217.8	1,302.8	0.89	-0.88	0.11	
8,245.0	88.50	180.10	7,156.0	-1,386.6	217.1	1,392.8	1.02	-0.67	-0.78	
8,336.0	89.80	180.00	7,157.4	-1,477.6	217.0	1,483.7	1.43	1.43	-0.11	
8,426.0	90.50	182.80	7,157.2	-1,567.6	214.8	1,573.5	3.21	0.78	3.11	
8,516.0	89.10	182.60	7,157.5	-1,657.5	210.6	1,663.3	1.57	-1.56	-0.22	

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Survey										
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8,607.0	88.20	181.40	7,159.6	-1,748.4	207.4	1,754.0	1.65	-0.99	-1.32	
8,697.0	87.90	180.70	7,162.7	-1,838.3	205.7	1,843.9	0.85	-0.33	-0.78	
8,788.0	91.50	181.00	7,163.2	-1,929.3	204.4	1,934.8	3.97	3.96	0.33	
8,878.0	91.10	180.30	7,161.1	-2,019.3	203.4	2,024.7	0.90	-0.44	-0.78	
8,968.0	90.00	181.50	7,160.3	-2,109.3	201.9	2,114.6	1.81	-1.22	1.33	
9,058.0	90.50	181.30	7,159.9	-2,199.2	199.7	2,204.4	0.60	0.56	-0.22	
9,149.0	89.30	181.00	7,160.0	-2,290.2	197.9	2,295.3	1.36	-1.32	-0.33	
9,239.0	89.90	180.10	7,160.6	-2,380.2	197.1	2,385.2	1.20	0.67	-1.00	
9,329.0	90.60	179.80	7,160.3	-2,470.2	197.1	2,475.2	0.85	0.78	-0.33	
9,419.0	89.20	180.30	7,160.4	-2,560.2	197.1	2,565.1	1.65	-1.56	0.56	
9,510.0	90.00	179.80	7,161.0	-2,651.2	197.0	2,656.1	1.04	0.88	-0.55	
9,600.0	88.40	180.30	7,162.3	-2,741.2	196.9	2,746.0	1.86	-1.78	0.56	
9,691.0	87.80	181.40	7,165.3	-2,832.1	195.6	2,836.9	1.38	-0.66	1.21	
9,781.0	90.60	183.80	7,166.6	-2,922.0	191.5	2,926.6	4.10	3.11	2.67	
9,872.0	90.50	182.60	7,165.7	-3,012.9	186.4	3,017.2	1.32	-0.11	-1.32	
9,962.0	90.70	181.00	7,164.8	-3,102.8	183.6	3,107.0	1.79	0.22	-1.78	
10,053.0	89.30	180.30	7,164.8	-3,193.8	182.5	3,197.9	1.72	-1.54	-0.77	
10,143.0	90.00	181.90	7,165.3	-3,283.8	180.8	3,287.8	1.94	0.78	1.78	
10,233.0	90.70	182.20	7,164.8	-3,373.7	177.6	3,377.6	0.85	0.78	0.33	
10,323.0	90.50	182.20	7,163.8	-3,463.6	174.1	3,467.4	0.22	-0.22	0.00	
10,414.0	91.30	181.90	7,162.4	-3,554.6	170.9	3,558.2	0.94	0.88	-0.33	
10,505.0	91.80	180.50	7,159.9	-3,645.5	169.0	3,649.0	1.63	0.55	-1.54	
10,595.0	92.20	178.90	7,156.8	-3,735.5	169.4	3,738.9	1.83	0.44	-1.78	
10,685.0	91.90	178.90	7,153.6	-3,825.4	171.2	3,828.9	0.33	-0.33	0.00	
10,776.0	90.70	179.60	7,151.5	-3,916.4	172.4	3,919.8	1.53	-1.32	0.77	
10,866.0	89.30	181.70	7,151.5	-4,006.3	171.3	4,009.7	2.80	-1.56	2.33	
10,957.0	89.20	182.20	7,152.7	-4,097.3	168.2	4,100.5	0.56	-0.11	0.55	
11,047.0	87.50	181.40	7,155.3	-4,187.2	165.4	4,190.3	2.09	-1.89	-0.89	
11,138.0	89.30	181.20	7,157.8	-4,278.1	163.4	4,281.1	1.99	1.98	-0.22	
11,228.0	90.00	180.50	7,158.4	-4,368.1	162.0	4,371.0	1.10	0.78	-0.78	
11,318.0	90.20	181.00	7,158.2	-4,458.1	160.8	4,461.0	0.60	0.22	0.56	
11,409.0	89.60	181.40	7,158.4	-4,549.1	158.9	4,551.8	0.79	-0.66	0.44	
11,552.0	90.40	180.50	7,158.4	-4,692.1	156.6	4,694.7	0.84	0.56	-0.63	
11,590.0	90.90	180.10	7,157.9	-4,730.1	156.4	4,732.6	1.68	1.32	-1.05	
11,680.0	92.20	179.60	7,155.5	-4,820.0	156.6	4,822.6	1.55	1.44	-0.56	
11,695.0	92.30	179.40	7,154.9	-4,835.0	156.7	4,837.6	1.49	0.67	-1.33	
11,748.0	92.30	179.40	7,152.8	-4,888.0	157.3	4,890.5	0.00	0.00	0.00	
BHL 500' FSL, 2130' FEL										

Casing Points					
Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")	
7,577.0	7,156.9	7"	7	7-1/2	

Checked By: \_\_\_\_\_ Approved By: \_\_\_\_\_ Date: \_\_\_\_\_