

PETROLEUM DEVELOPMENT CORP Weld County CO

Well Name: Thornton 15Y-414

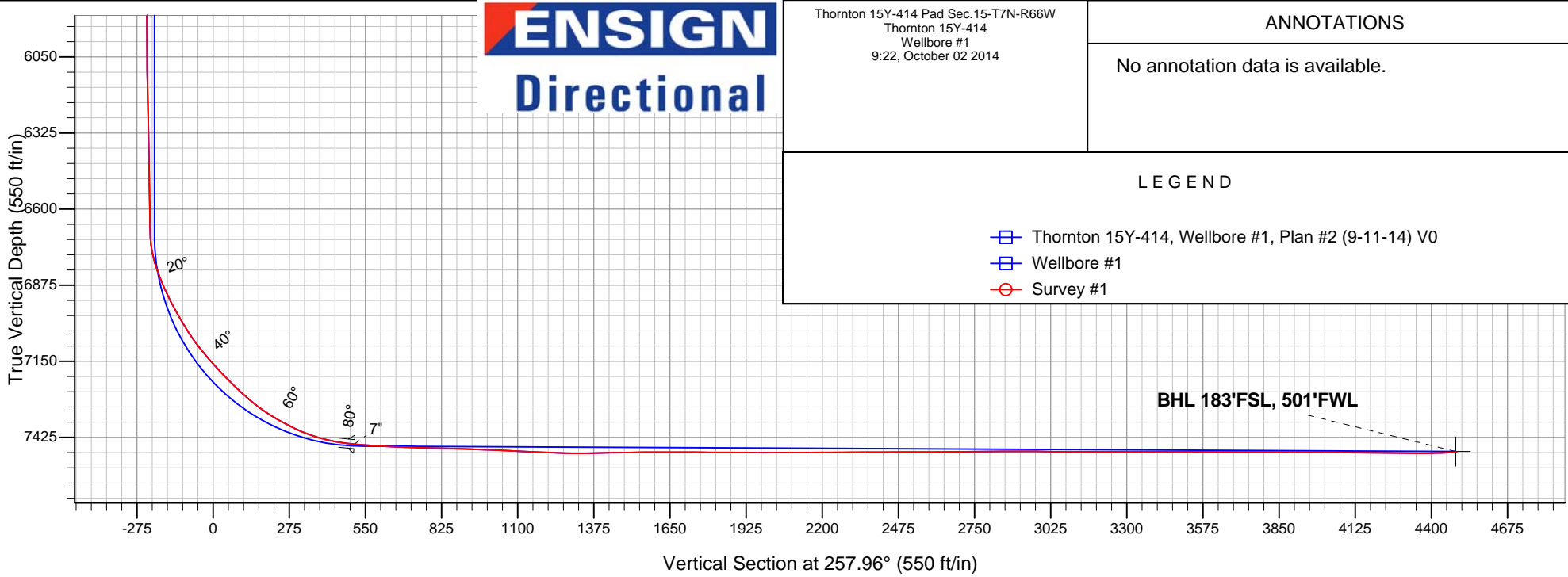
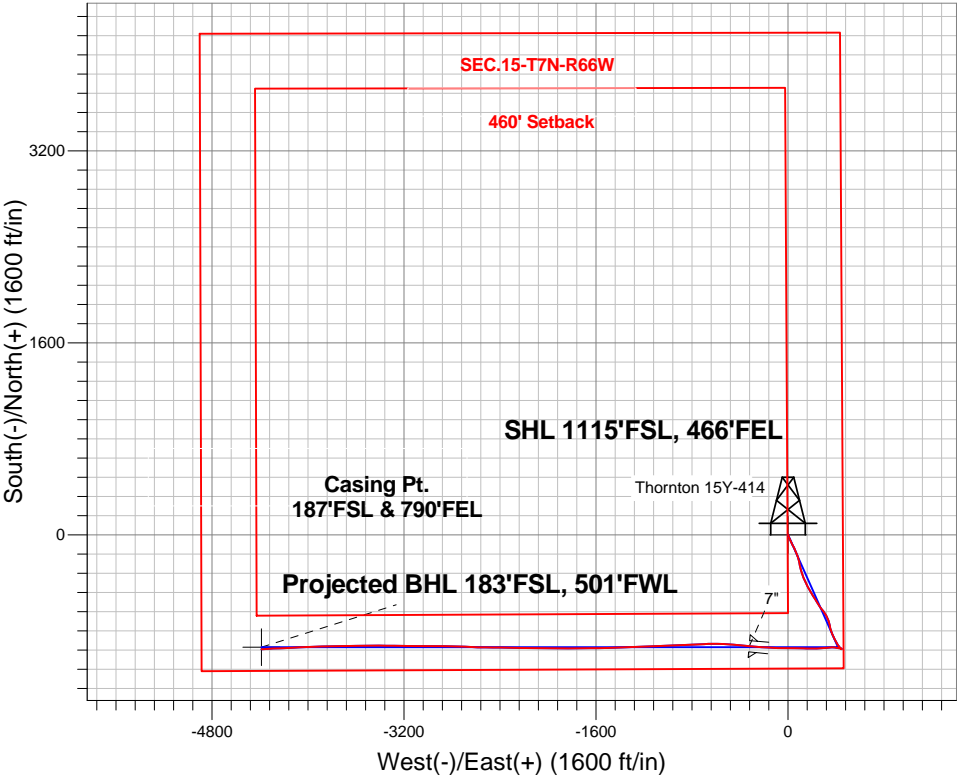
Surface Location: Thornton 15Y-414 Pad Sec.15-T7N-R66W
North American Datum 1983 , US State Plane 1983 , Colorado Northern Zone

Ground Elevation: 4921.0

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	1451734.68	3206719.85	40.571030	-104.755880	
Ensign Rig #14 - RKB - 15' WELL @ 4936.0ft (Ensign Rig #14 - RKB - 15')						

FINAL SURVEY

Projected Bottom Hole Location
12015'MD 7479'TVD 953'S & 4389'W of SHL
92.2 degree Incl @ 267.0 degree AZM





PETROLEUM DEVELOPMENT CORP Weld County CO

SEC.15-T7N-R66W

Thornton 15Y-414 Pad Sec.15-T7N-R66W

Thornton 15Y-414

Wellbore #1

Survey: Survey #1

Standard Survey Report

02 October, 2014

Company:	PETROLEUM DEVELOPMENT CORP Weld County CO	Local Co-ordinate Reference:	Well Thornton 15Y-414
Project:	SEC.15-T7N-R66W	TVD Reference:	WELL @ 4936.0ft (Ensign Rig #14 - RKB - 15')
Site:	Thornton 15Y-414 Pad Sec.15-T7N-R66W	MD Reference:	WELL @ 4936.0ft (Ensign Rig #14 - RKB - 15')
Well:	Thornton 15Y-414	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Landmark

Project	SEC.15-T7N-R66W, Weld County, Colorado		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		Using Well Reference Point
Map Zone:	Colorado Northern Zone		Using geodetic scale factor

Site		Thornton 15Y-414 Pad Sec.15-T7N-R66W			
Site Position:		Northing:	1,451,734.70ft	Latitude:	40.571030
From:	Lat/Long	Easting:	3,206,719.85ft	Longitude:	-104.755880
Position Uncertainty:	0.0 ft	Slot Radius:	"	Grid Convergence:	0.48 °

Well	Thornton 15Y-414					
Well Position	+N-S	0.0 ft	Northing:	1,451,734.68 ft	Latitude:	40.571030
	+E-W	0.0 ft	Easting:	3,206,719.85 ft	Longitude:	-104.755880
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,921.0 ft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	9/11/2014	8.44	67.08	52,879

Design	Wellbore #1				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.0	0.0	0.0	257.96	

Survey Program	Date	10/2/2014			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
124.0	12,015.0	Survey #1 (Wellbore #1)	MWD	MWD - Standard	

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)	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00	
1.0	0.00	71.40	1.0	0.0	0.0	0.0	0.32	0.32	0.00	
SHL 1115'FSL, 466'FEL										
124.0	0.40	71.40	124.0	0.1	0.4	-0.4	0.32	0.32	0.00	
188.0	1.10	134.30	188.0	-0.2	1.1	-1.0	1.54	1.09	98.28	
251.0	2.10	158.90	251.0	-1.7	1.9	-1.5	1.89	1.59	39.05	
314.0	3.80	168.20	313.9	-4.8	2.8	-1.7	2.79	2.70	14.76	
377.0	5.50	169.20	376.7	-9.8	3.7	-1.6	2.70	2.70	1.59	
473.0	7.10	160.10	472.1	-19.9	6.6	-2.3	1.96	1.67	-9.48	
566.0	8.60	154.70	564.2	-31.6	11.6	-4.7	1.80	1.61	-5.81	
661.0	10.60	155.00	657.9	-46.0	18.3	-8.3	2.11	2.11	0.32	
758.0	12.20	154.30	753.0	-63.3	26.5	-12.7	1.66	1.65	-0.72	

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Well:	Thornton 15Y-414	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	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)
878.0	12.80	154.20	870.1	-86.7	37.8	-18.9	0.50	0.50	-0.08
1,012.0	13.50	152.90	1,000.6	-114.0	51.4	-26.5	0.57	0.52	-0.97
1,106.0	12.80	156.10	1,092.1	-133.3	60.6	-31.5	1.07	-0.74	3.40
1,232.0	12.50	158.60	1,215.1	-158.7	71.2	-36.6	0.50	-0.24	1.98
1,386.0	12.90	163.70	1,365.3	-190.7	82.1	-40.5	0.77	0.26	3.31
1,533.0	12.00	164.70	1,508.9	-221.2	90.8	-42.6	0.63	-0.61	0.68
1,716.0	14.90	166.80	1,686.8	-262.5	101.2	-44.2	1.61	1.58	1.15
1,897.0	14.60	166.60	1,861.9	-307.3	111.8	-45.2	0.17	-0.17	-0.11
2,080.0	13.00	158.60	2,039.6	-349.0	124.6	-49.1	1.36	-0.87	-4.37
2,262.0	12.50	155.60	2,217.1	-386.0	140.2	-56.7	0.46	-0.27	-1.65
2,444.0	12.90	152.10	2,394.7	-421.8	157.9	-66.4	0.48	0.22	-1.92
2,633.0	11.40	148.90	2,579.4	-456.5	177.4	-78.3	0.87	-0.79	-1.69
2,822.0	13.00	149.20	2,764.1	-490.7	197.9	-91.2	0.85	0.85	0.16
3,012.0	12.00	147.70	2,949.6	-525.8	219.4	-105.0	0.55	-0.53	-0.79
3,201.0	11.00	149.10	3,134.8	-557.9	239.2	-117.6	0.55	-0.53	0.74
3,391.0	11.80	148.00	3,321.1	-589.9	258.8	-130.1	0.44	0.42	-0.58
3,581.0	10.90	141.90	3,507.4	-620.5	280.2	-144.6	0.79	-0.47	-3.21
3,738.0	10.60	143.10	3,661.6	-643.7	298.0	-157.2	0.24	-0.19	0.76
3,864.0	10.30	146.40	3,785.5	-662.4	311.2	-166.2	0.53	-0.24	2.62
3,990.0	9.20	155.20	3,909.7	-680.9	321.6	-172.6	1.47	-0.87	6.98
4,117.0	8.40	152.40	4,035.2	-698.4	330.2	-177.3	0.71	-0.63	-2.20
4,212.0	10.20	164.00	4,129.0	-712.6	335.7	-179.8	2.73	1.89	12.21
4,306.0	9.50	166.30	4,221.6	-728.1	339.9	-180.6	0.85	-0.74	2.45
4,401.0	11.10	163.70	4,315.1	-744.5	344.3	-181.5	1.75	1.68	-2.74
4,528.0	11.50	170.70	4,439.6	-768.8	349.8	-181.8	1.12	0.31	5.51
4,686.0	11.30	160.50	4,594.5	-798.9	357.5	-183.0	1.28	-0.13	-6.46
4,844.0	12.00	158.20	4,749.3	-828.7	368.7	-187.8	0.53	0.44	-1.46
5,001.0	10.70	154.70	4,903.2	-857.1	381.0	-193.9	0.94	-0.83	-2.23
5,160.0	10.70	149.80	5,059.4	-883.2	394.8	-201.9	0.57	0.00	-3.08
5,317.0	9.70	148.50	5,213.9	-907.0	409.0	-210.9	0.65	-0.64	-0.83
5,475.0	8.60	143.40	5,369.9	-927.9	423.0	-220.2	0.86	-0.70	-3.23
5,602.0	6.00	142.60	5,495.9	-940.8	432.7	-227.0	2.05	-2.05	-0.63
5,728.0	3.60	137.80	5,621.4	-948.9	439.4	-231.8	1.93	-1.90	-3.81
5,854.0	1.60	97.70	5,747.3	-952.1	443.8	-235.5	2.06	-1.59	-31.83
6,012.0	1.20	35.90	5,905.3	-951.1	446.9	-238.8	0.94	-0.25	-39.11
6,202.0	1.50	290.60	6,095.2	-948.6	445.8	-238.2	1.13	0.16	-55.42
6,391.0	1.30	287.80	6,284.2	-947.1	441.4	-234.2	0.11	-0.11	-1.48
6,581.0	1.10	279.00	6,474.1	-946.1	437.5	-230.6	0.14	-0.11	-4.63
6,739.0	0.80	264.40	6,632.1	-946.0	435.0	-228.1	0.24	-0.19	-9.24
6,770.0	1.00	285.30	6,663.1	-945.9	434.5	-227.7	1.23	0.65	67.42
6,802.0	2.70	282.50	6,695.1	-945.7	433.5	-226.7	5.32	5.31	-8.75
6,833.0	7.20	278.30	6,726.0	-945.3	430.8	-224.3	14.55	14.52	-13.55
6,865.0	12.20	277.70	6,757.5	-944.5	425.5	-219.2	15.63	15.63	-1.88
6,896.0	16.80	278.30	6,787.5	-943.4	417.8	-211.9	14.85	14.84	1.94
6,927.0	20.00	278.80	6,816.9	-942.0	408.1	-202.7	10.34	10.32	1.61
6,959.0	22.20	279.10	6,846.8	-940.2	396.8	-192.0	6.88	6.88	0.94
6,991.0	24.10	276.00	6,876.2	-938.5	384.3	-180.1	7.05	5.94	-9.69
7,023.0	25.70	269.80	6,905.2	-937.9	370.9	-167.1	9.56	5.00	-19.38
7,054.0	27.50	266.00	6,932.9	-938.4	357.0	-153.5	7.99	5.81	-12.26
7,085.0	29.00	264.60	6,960.3	-939.6	342.4	-138.9	5.29	4.84	-4.52
7,117.0	30.00	264.60	6,988.1	-941.1	326.7	-123.3	3.13	3.13	0.00
7,148.0	31.20	265.60	7,014.8	-942.4	311.0	-107.6	4.20	3.87	3.23
7,181.0	32.80	266.30	7,042.8	-943.7	293.5	-90.3	4.98	4.85	2.12
7,212.0	35.00	266.50	7,068.5	-944.8	276.3	-73.2	7.11	7.10	0.65

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Well:	Thornton 15Y-414	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	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)
7,244.0	37.80	267.20	7,094.3	-945.8	257.3	-54.4	8.85	8.75	2.19
7,275.0	39.90	267.20	7,118.4	-946.7	237.9	-35.2	6.77	6.77	0.00
7,307.0	42.10	268.60	7,142.5	-947.5	216.9	-14.6	7.45	6.88	4.38
7,338.0	43.30	270.40	7,165.3	-947.7	195.9	6.0	5.52	3.87	5.81
7,370.0	43.70	272.50	7,188.5	-947.1	173.9	27.5	4.69	1.25	6.56
7,402.0	44.70	271.90	7,211.5	-946.3	151.6	49.1	3.39	3.13	-1.88
7,433.0	46.20	271.10	7,233.2	-945.7	129.5	70.6	5.18	4.84	-2.58
7,464.0	47.70	271.10	7,254.4	-945.3	106.8	92.6	4.84	4.84	0.00
7,496.0	49.60	271.10	7,275.5	-944.8	82.8	116.0	5.94	5.94	0.00
7,527.0	51.40	270.70	7,295.2	-944.4	58.9	139.3	5.89	5.81	-1.29
7,559.0	53.50	270.90	7,314.7	-944.1	33.5	164.1	6.58	6.56	0.63
7,591.0	56.10	270.50	7,333.2	-943.7	7.4	189.6	8.19	8.13	-1.25
7,622.0	59.30	270.00	7,349.8	-943.6	-18.8	215.2	10.41	10.32	-1.61
7,654.0	61.80	270.40	7,365.5	-943.5	-46.7	242.4	7.89	7.81	1.25
7,685.0	63.30	271.60	7,379.8	-943.1	-74.2	269.2	5.93	4.84	3.87
7,717.0	65.40	272.80	7,393.6	-941.9	-103.0	297.1	7.38	6.56	3.75
7,749.0	68.30	273.30	7,406.2	-940.4	-132.4	325.5	9.18	9.06	1.56
7,780.0	71.50	273.00	7,416.9	-938.8	-161.4	353.6	10.36	10.32	-0.97
7,812.0	74.60	273.20	7,426.2	-937.1	-192.0	383.2	9.71	9.69	0.63
7,844.0	76.80	273.50	7,434.1	-935.3	-223.0	413.1	6.93	6.88	0.94
7,875.0	79.40	273.90	7,440.5	-933.4	-253.2	442.3	8.48	8.39	1.29
7,908.0	82.70	274.40	7,445.6	-931.0	-285.7	473.6	10.11	10.00	1.52
7,944.0	85.40	275.20	7,449.3	-928.0	-321.4	507.8	7.82	7.50	2.22
7,946.3	85.44	275.26	7,449.5	-927.8	-323.6	510.0	3.12	1.87	2.50
7"									
7,976.0	86.00	276.00	7,451.7	-924.9	-353.2	538.3	3.12	1.88	2.50
8,007.0	86.50	276.20	7,453.8	-921.6	-383.9	567.6	1.74	1.61	0.65
8,039.0	86.70	275.60	7,455.7	-918.3	-415.7	598.0	1.97	0.63	-1.88
8,070.0	87.20	275.10	7,457.3	-915.4	-446.5	627.6	2.28	1.61	-1.61
8,101.0	87.40	273.70	7,458.8	-913.1	-477.4	657.3	4.56	0.65	-4.52
8,133.0	87.70	272.50	7,460.2	-911.3	-509.3	688.1	3.86	0.94	-3.75
8,164.0	88.00	272.50	7,461.3	-910.0	-540.3	718.1	0.97	0.97	0.00
8,195.0	88.00	271.60	7,462.4	-908.9	-571.2	748.2	2.90	0.00	-2.90
8,227.0	88.10	270.20	7,463.5	-908.4	-603.2	779.3	4.38	0.31	-4.38
8,258.0	88.30	269.50	7,464.5	-908.4	-634.2	809.7	2.35	0.65	-2.26
8,290.0	88.90	267.90	7,465.2	-909.2	-666.2	841.1	5.34	1.88	-5.00
8,321.0	88.90	267.50	7,465.8	-910.4	-697.1	871.6	1.29	0.00	-1.29
8,353.0	88.50	267.50	7,466.6	-911.8	-729.1	903.2	1.25	-1.25	0.00
8,384.0	88.00	267.50	7,467.5	-913.2	-760.0	933.8	1.61	-1.61	0.00
8,416.0	87.40	267.40	7,468.8	-914.6	-792.0	965.3	1.90	-1.88	-0.31
8,447.0	87.80	267.50	7,470.1	-916.0	-822.9	995.8	1.33	1.29	0.32
8,510.0	87.10	268.20	7,472.9	-918.3	-885.8	1,057.8	1.57	-1.11	1.11
8,573.0	87.20	267.90	7,476.0	-920.5	-948.7	1,119.8	0.50	0.16	-0.48
8,636.0	87.60	267.50	7,478.9	-923.0	-1,011.6	1,181.8	0.90	0.63	-0.63
8,699.0	88.10	267.70	7,481.2	-925.6	-1,074.5	1,243.9	0.85	0.79	0.32
8,762.0	89.60	267.40	7,482.5	-928.3	-1,137.4	1,306.0	2.43	2.38	-0.48
8,825.0	91.40	267.50	7,482.0	-931.1	-1,200.4	1,368.1	2.86	2.86	0.16
8,888.0	90.90	267.70	7,480.7	-933.8	-1,263.3	1,430.2	0.85	-0.79	0.32
8,952.0	90.80	267.40	7,479.7	-936.5	-1,327.2	1,493.3	0.49	-0.16	-0.47
9,014.0	90.50	268.10	7,479.0	-938.9	-1,389.2	1,554.4	1.23	-0.48	1.13
9,077.0	89.80	268.60	7,478.9	-940.7	-1,452.1	1,616.4	1.37	-1.11	0.79
9,140.0	90.10	268.60	7,478.9	-942.3	-1,515.1	1,678.3	0.48	0.48	0.00
9,203.0	89.80	269.50	7,479.0	-943.3	-1,578.1	1,740.1	1.51	-0.48	1.43

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9,266.0	90.00	269.50	7,479.1	-943.9	-1,641.1	1,801.9	0.32	0.32	0.00
9,328.0	89.90	269.30	7,479.2	-944.5	-1,703.1	1,862.6	0.36	-0.16	-0.32
9,392.0	89.30	270.00	7,479.6	-944.9	-1,767.1	1,925.3	1.44	-0.94	1.09
9,454.0	90.00	270.00	7,480.0	-944.9	-1,829.1	1,985.9	1.13	1.13	0.00
9,518.0	90.00	269.30	7,480.0	-945.3	-1,893.1	2,048.6	1.09	0.00	-1.09
9,581.0	90.00	269.70	7,480.0	-945.9	-1,956.1	2,110.3	0.63	0.00	0.63
9,644.0	90.10	270.70	7,479.9	-945.6	-2,019.1	2,171.9	1.60	0.16	1.59
9,708.0	90.70	271.20	7,479.5	-944.6	-2,083.1	2,234.3	1.22	0.94	0.78
9,771.0	90.10	270.70	7,479.0	-943.5	-2,146.1	2,295.6	1.24	-0.95	-0.79
9,834.0	90.40	271.60	7,478.8	-942.3	-2,209.1	2,357.0	1.51	0.48	1.43
9,897.0	89.90	270.90	7,478.6	-940.9	-2,272.0	2,418.3	1.37	-0.79	-1.11
9,960.0	90.40	271.10	7,478.4	-939.8	-2,335.0	2,479.7	0.85	0.79	0.32
10,024.0	90.00	270.00	7,478.2	-939.2	-2,399.0	2,542.1	1.83	-0.63	-1.72
10,087.0	90.30	270.40	7,478.0	-939.0	-2,462.0	2,603.7	0.79	0.48	0.63
10,149.0	90.90	271.20	7,477.4	-938.1	-2,524.0	2,664.1	1.61	0.97	1.29
10,213.0	90.10	271.20	7,476.8	-936.8	-2,588.0	2,726.4	1.25	-1.25	0.00
10,276.0	90.70	273.20	7,476.4	-934.3	-2,651.0	2,787.5	3.31	0.95	3.17
10,338.0	90.70	272.60	7,475.6	-931.2	-2,712.9	2,847.4	0.97	0.00	-0.97
10,401.0	90.00	271.60	7,475.3	-928.9	-2,775.8	2,908.5	1.94	-1.11	-1.59
10,465.0	89.30	270.50	7,475.6	-927.7	-2,839.8	2,970.8	2.04	-1.09	-1.72
10,529.0	89.40	270.70	7,476.4	-927.0	-2,903.8	3,033.3	0.35	0.16	0.31
10,591.0	89.80	270.90	7,476.8	-926.2	-2,965.8	3,093.7	0.72	0.65	0.32
10,655.0	89.70	270.00	7,477.1	-925.7	-3,029.8	3,156.2	1.41	-0.16	-1.41
10,718.0	90.20	270.20	7,477.1	-925.6	-3,092.8	3,217.8	0.85	0.79	0.32
10,781.0	90.10	270.20	7,477.0	-925.3	-3,155.8	3,279.4	0.16	-0.16	0.00
10,845.0	89.40	270.00	7,477.3	-925.2	-3,219.8	3,341.9	1.14	-1.09	-0.31
10,908.0	89.50	270.20	7,477.9	-925.1	-3,282.8	3,403.5	0.35	0.16	0.32
10,971.0	90.00	271.20	7,478.1	-924.4	-3,345.8	3,465.0	1.77	0.79	1.59
11,034.0	90.50	270.90	7,477.9	-923.2	-3,408.8	3,526.3	0.93	0.79	-0.48
11,097.0	90.30	269.50	7,477.4	-923.0	-3,471.8	3,587.9	2.24	-0.32	-2.22
11,161.0	89.80	269.10	7,477.4	-923.8	-3,535.8	3,650.7	1.00	-0.78	-0.63
11,224.0	89.60	268.90	7,477.7	-924.9	-3,598.8	3,712.5	0.45	-0.32	-0.32
11,287.0	90.00	269.70	7,477.9	-925.6	-3,661.7	3,774.3	1.42	0.63	1.27
11,350.0	89.90	268.90	7,478.0	-926.4	-3,724.7	3,836.0	1.28	-0.16	-1.27
11,413.0	89.80	268.80	7,478.1	-927.7	-3,787.7	3,897.9	0.22	-0.16	-0.16
11,477.0	89.40	268.20	7,478.6	-929.3	-3,851.7	3,960.8	1.13	-0.63	-0.94
11,540.0	89.30	268.20	7,479.3	-931.3	-3,914.7	4,022.8	0.16	-0.16	0.00
11,603.0	89.70	268.40	7,479.8	-933.2	-3,977.6	4,084.8	0.71	0.63	0.32
11,666.0	89.70	267.20	7,480.2	-935.6	-4,040.6	4,146.9	1.90	0.00	-1.90
11,730.0	89.00	266.70	7,480.9	-939.0	-4,104.5	4,210.1	1.34	-1.09	-0.78
11,793.0	88.90	267.70	7,482.1	-942.1	-4,167.4	4,272.2	1.59	-0.16	1.59
11,857.0	90.00	267.50	7,482.7	-944.8	-4,231.3	4,335.3	1.75	1.72	-0.31
11,920.0	91.10	267.20	7,482.1	-947.7	-4,294.3	4,397.5	1.81	1.75	-0.48
11,965.0	92.20	267.00	7,480.8	-950.0	-4,339.2	4,441.9	2.48	2.44	-0.44
12,014.8	92.20	267.00	7,478.9	-952.6	-4,388.9	4,491.0	0.00	0.00	0.00
BHL 200'FSL, 500'FWL									
12,015.0	92.20	267.00	7,478.8	-952.6	-4,389.1	4,491.2	0.00	0.00	0.00

Company:	PETROLEUM DEVELOPMENT CORP Weld County CO	Local Co-ordinate Reference:	Well Thornton 15Y-414
Project:	SEC.15-T7N-R66W	TVD Reference:	WELL @ 4936.0ft (Ensign Rig #14 - RKB - 15')
Site:	Thornton 15Y-414 Pad Sec.15-T7N-R66W	MD Reference:	WELL @ 4936.0ft (Ensign Rig #14 - RKB - 15')
Well:	Thornton 15Y-414	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Landmark

Casing Points					
	Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
	7,946.3	7,449.5	7"	7	7-1/2

Checked By: _____	Approved By: _____	Date: _____
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