

Survey Report

Company:	Petroleum Development Corp.	Local Co-ordinate Reference:	Well BERNHARDT 6K-323
Project:	Weld County	TVD Reference:	13' KB @ 4726.0usft (ENSIGN 124)
Site:	S6-T4N-R66W	MD Reference:	13' KB @ 4726.0usft (ENSIGN 124)
Well:	BERNHARDT 6K-323	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Project	Weld County		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Northern Zone		

Site		S6-T4N-R66W			
Site Position:		Northing:	1,367,096.68 usft	Latitude:	40.339120
From:	Lat/Long	Easting:	3,187,949.64 usft	Longitude:	-104.825760
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.44 °

Well	BERNHARDT 6K-323					
Well Position	+N/-S	0.0 usft	Northing:	1,367,104.19 usft	Latitude:	40.339140
	+E/-W	0.0 usft	Easting:	3,187,980.25 usft	Longitude:	-104.825650
Position Uncertainty		0.0 usft	Wellhead Elevation:	0.0 usft	Ground Level:	4,713.0 usft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	4/20/2015	8.65	66.88	52,613

Design	FINAL				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.0	0.0	0.0	180.00	

Survey Program	Date	5/4/2015			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
161.0	11,787.0	Survey #1 (HZ)	MWD	Geolink MWD	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00		
161.0	0.40	235.20	161.0	-0.3	-0.5	0.3	0.25	0.25		
254.0	0.40	253.40	254.0	-0.6	-1.0	0.6	0.14	0.00		
346.0	0.40	319.20	346.0	-0.4	-1.6	0.4	0.47	0.00		
438.0	0.40	328.00	438.0	0.1	-1.9	-0.1	0.07	0.00		
531.0	0.60	342.00	531.0	0.8	-2.3	-0.8	0.25	0.22		
624.0	1.20	45.70	624.0	1.9	-1.7	-1.9	1.16	0.65		
716.0	2.40	42.00	715.9	4.1	0.3	-4.1	1.31	1.30		
809.0	3.60	36.70	808.8	7.8	3.3	-7.8	1.32	1.29		
855.0	4.00	35.30	854.7	10.3	5.1	-10.3	0.89	0.87		
956.0	4.60	34.50	955.4	16.5	9.4	-16.5	0.60	0.59		
1,048.0	6.60	42.50	1,047.0	23.5	15.1	-23.5	2.33	2.17		
1,141.0	8.80	47.00	1,139.1	32.3	23.9	-32.3	2.45	2.37		

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Well:	BERNHARDT 6K-323	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
1,234.0	11.00	46.50	1,230.7	43.2	35.6	-43.2	2.37	2.37	
1,326.0	11.40	36.70	1,321.0	56.5	47.4	-56.5	2.11	0.43	
1,419.0	11.90	29.80	1,412.1	72.2	57.6	-72.2	1.59	0.54	
1,512.0	11.80	29.00	1,503.1	88.9	67.0	-88.9	0.21	-0.11	
1,604.0	12.10	33.30	1,593.1	105.2	76.8	-105.2	1.02	0.33	
1,697.0	11.00	28.90	1,684.2	121.1	86.5	-121.1	1.51	-1.18	
1,789.0	11.30	34.00	1,774.5	136.2	95.8	-136.2	1.12	0.33	
1,881.0	9.90	40.10	1,864.9	149.8	105.9	-149.8	1.95	-1.52	
1,972.0	11.70	39.60	1,954.3	162.9	116.8	-162.9	1.98	1.98	
2,064.0	13.20	40.90	2,044.1	178.0	129.6	-178.0	1.66	1.63	
2,157.0	11.50	37.90	2,135.0	193.3	142.3	-193.3	1.95	-1.83	
2,249.0	13.60	40.70	2,224.8	208.8	155.0	-208.8	2.38	2.28	
2,341.0	14.90	41.50	2,314.0	225.8	169.9	-225.8	1.43	1.41	
2,433.0	13.40	41.00	2,403.2	242.7	184.7	-242.7	1.64	-1.63	
2,529.0	13.40	39.60	2,496.5	259.7	199.1	-259.7	0.34	0.00	
2,624.0	13.50	38.40	2,588.9	276.9	213.0	-276.9	0.31	0.11	
2,720.0	13.40	37.80	2,682.3	294.4	226.8	-294.4	0.18	-0.10	
2,815.0	11.30	36.40	2,775.1	310.6	239.0	-310.6	2.23	-2.21	
2,911.0	9.90	34.30	2,869.5	325.0	249.3	-325.0	1.51	-1.46	
3,006.0	10.90	37.20	2,962.9	338.9	259.3	-338.9	1.19	1.05	
3,101.0	9.40	35.40	3,056.4	352.4	269.2	-352.4	1.61	-1.58	
3,197.0	9.60	32.60	3,151.1	365.5	278.1	-365.5	0.52	0.21	
3,292.0	10.00	39.00	3,244.7	378.6	287.6	-378.6	1.22	0.42	
3,387.0	12.30	36.10	3,337.9	393.2	298.7	-393.2	2.49	2.42	
3,483.0	13.30	36.80	3,431.5	410.3	311.3	-410.3	1.05	1.04	
3,578.0	12.10	34.50	3,524.2	427.3	323.5	-427.3	1.37	-1.26	
3,673.0	11.40	32.60	3,617.2	443.4	334.2	-443.4	0.84	-0.74	
3,769.0	14.00	37.80	3,710.9	460.6	346.5	-460.6	2.96	2.71	
3,864.0	14.20	36.70	3,803.0	479.0	360.5	-479.0	0.35	0.21	
3,960.0	13.90	36.50	3,896.1	497.7	374.4	-497.7	0.32	-0.31	
4,055.0	12.30	35.20	3,988.6	515.1	387.0	-515.1	1.71	-1.68	
4,150.0	10.80	32.50	4,081.7	530.9	397.6	-530.9	1.68	-1.58	
4,246.0	10.50	31.10	4,176.1	546.0	407.0	-546.0	0.41	-0.31	
4,341.0	10.00	29.90	4,269.6	560.5	415.5	-560.5	0.57	-0.53	
4,437.0	11.80	35.20	4,363.8	575.8	425.3	-575.8	2.14	1.87	
4,532.0	12.00	40.40	4,456.8	591.2	437.3	-591.2	1.15	0.21	
4,628.0	11.20	41.80	4,550.8	605.8	450.0	-605.8	0.88	-0.83	
4,723.0	10.40	39.60	4,644.1	619.3	461.6	-619.3	0.95	-0.84	
4,818.0	10.00	38.70	4,737.6	632.3	472.3	-632.3	0.45	-0.42	
4,914.0	9.30	37.10	4,832.3	645.0	482.2	-645.0	0.78	-0.73	
5,010.0	8.70	34.00	4,927.1	657.2	490.9	-657.2	0.80	-0.62	
5,105.0	7.70	28.80	5,021.1	668.8	498.0	-668.8	1.31	-1.05	
5,201.0	7.80	32.80	5,116.2	679.9	504.6	-679.9	0.57	0.10	
5,296.0	6.90	26.80	5,210.5	690.4	510.7	-690.4	1.24	-0.95	
5,391.0	7.30	29.90	5,304.7	700.7	516.3	-700.7	0.58	0.42	
5,487.0	7.40	37.40	5,400.0	710.9	523.1	-710.9	1.00	0.10	
5,582.0	6.10	37.00	5,494.3	719.8	529.8	-719.8	1.37	-1.37	
5,677.0	6.60	44.20	5,588.7	727.7	536.7	-727.7	0.99	0.53	
5,773.0	5.50	43.70	5,684.2	735.0	543.7	-735.0	1.15	-1.15	
5,868.0	5.00	32.70	5,778.8	741.8	549.1	-741.8	1.18	-0.53	
5,963.0	4.50	22.40	5,873.5	748.7	552.7	-748.7	1.04	-0.53	
6,059.0	4.80	30.60	5,969.1	755.7	556.2	-755.7	0.76	0.31	
6,154.0	4.00	37.40	6,063.9	761.7	560.2	-761.7	1.00	-0.84	

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Well:	BERNHARDT 6K-323	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
6,249.0	3.10	25.20	6,158.7	766.7	563.3	-766.7	1.23	-0.95	
6,345.0	2.50	20.80	6,254.6	771.0	565.2	-771.0	0.66	-0.62	
6,440.0	2.10	23.90	6,349.5	774.5	566.6	-774.5	0.44	-0.42	
6,536.0	1.30	84.70	6,445.4	776.2	568.4	-776.2	1.93	-0.83	
6,631.0	3.30	174.10	6,540.4	773.6	569.8	-773.6	3.72	2.11	
6,679.0	5.80	174.90	6,588.2	769.8	570.1	-769.8	5.21	5.21	
6,726.0	9.70	180.50	6,634.8	763.5	570.3	-763.5	8.44	8.30	
6,774.0	12.60	182.70	6,681.9	754.2	570.0	-754.2	6.11	6.04	
6,822.0	15.70	179.00	6,728.4	742.5	569.9	-742.5	6.72	6.46	
6,861.0	18.00	176.30	6,765.7	731.2	570.4	-731.2	6.23	5.90	
6,908.0	22.60	171.70	6,809.8	715.0	572.2	-715.0	10.35	9.79	
6,956.0	26.90	175.40	6,853.4	695.0	574.4	-695.0	9.52	8.96	
7,003.0	32.40	175.60	6,894.2	671.9	576.2	-671.9	11.70	11.70	
7,051.0	38.60	178.40	6,933.3	644.1	577.6	-644.1	13.35	12.92	
7,099.0	44.80	178.50	6,969.1	612.1	578.4	-612.1	12.92	12.92	
7,147.0	51.60	177.80	7,001.1	576.4	579.6	-576.4	14.21	14.17	
7,194.0	58.10	179.60	7,028.1	538.0	580.5	-538.0	14.18	13.83	
7,242.0	65.30	180.90	7,050.9	495.8	580.3	-495.8	15.19	15.00	
7,290.0	71.10	180.40	7,068.7	451.2	579.8	-451.2	12.12	12.08	
7,338.0	74.70	181.40	7,082.8	405.4	579.0	-405.4	7.76	7.50	
7,385.0	80.20	181.70	7,093.0	359.5	577.8	-359.5	11.72	11.70	
7,434.0	87.40	180.00	7,098.3	310.8	577.1	-310.8	15.09	14.69	
7,481.0	90.40	179.40	7,099.2	263.9	577.3	-263.9	6.51	6.38	
7,519.0	90.06	179.17	7,099.1	225.9	577.8	-225.9	1.08	-0.90	7" (1728' FWL, 2122' FSL)
7,581.0	89.50	178.80	7,099.3	163.9	578.9	-163.9	1.08	-0.90	
7,677.0	90.10	178.90	7,099.6	67.9	580.8	-67.9	0.63	0.62	
7,772.0	89.80	178.20	7,099.7	-27.1	583.2	27.1	0.80	-0.32	
7,867.0	90.10	180.70	7,099.8	-122.1	584.1	122.1	2.65	0.32	
7,963.0	90.00	180.50	7,099.7	-218.1	583.1	218.1	0.23	-0.10	
8,058.0	89.80	179.80	7,099.9	-313.1	582.9	313.1	0.77	-0.21	
8,153.0	89.40	181.40	7,100.5	-408.0	581.9	408.0	1.74	-0.42	
8,249.0	89.20	179.90	7,101.7	-504.0	580.8	504.0	1.58	-0.21	
8,344.0	90.90	180.90	7,101.6	-599.0	580.1	599.0	2.08	1.79	
8,440.0	91.20	181.80	7,099.9	-695.0	577.9	695.0	0.99	0.31	
8,535.0	90.60	181.40	7,098.4	-789.9	575.2	789.9	0.76	-0.63	
8,630.0	90.00	180.70	7,097.9	-884.9	573.5	884.9	0.97	-0.63	
8,725.0	89.40	179.50	7,098.4	-979.9	573.3	979.9	1.41	-0.63	
8,821.0	89.30	179.20	7,099.5	-1,075.9	574.4	1,075.9	0.33	-0.10	
8,916.0	89.30	179.20	7,100.6	-1,170.9	575.7	1,170.9	0.00	0.00	
9,012.0	89.90	180.10	7,101.3	-1,266.9	576.3	1,266.9	1.13	0.62	
9,107.0	89.70	180.60	7,101.6	-1,361.9	575.7	1,361.9	0.57	-0.21	
9,203.0	89.40	181.30	7,102.4	-1,457.8	574.1	1,457.8	0.79	-0.31	
9,298.0	90.40	179.20	7,102.6	-1,552.8	573.7	1,552.8	2.45	1.05	
9,393.0	90.20	179.20	7,102.1	-1,647.8	575.1	1,647.8	0.21	-0.21	
9,489.0	90.70	178.60	7,101.3	-1,743.8	576.9	1,743.8	0.81	0.52	
9,584.0	90.50	176.90	7,100.3	-1,838.7	580.6	1,838.7	1.80	-0.21	
9,680.0	90.30	177.50	7,099.6	-1,934.6	585.3	1,934.6	0.66	-0.21	
9,775.0	90.70	178.30	7,098.8	-2,029.5	588.8	2,029.5	0.94	0.42	
9,870.0	90.40	178.50	7,097.9	-2,124.5	591.4	2,124.5	0.38	-0.32	
9,966.0	88.90	181.70	7,098.5	-2,220.5	591.3	2,220.5	3.68	-1.56	
10,061.0	87.80	181.10	7,101.2	-2,315.4	589.0	2,315.4	1.32	-1.16	
10,156.0	89.00	180.40	7,103.9	-2,410.4	587.7	2,410.4	1.46	1.26	
10,252.0	89.30	181.40	7,105.3	-2,506.3	586.2	2,506.3	1.09	0.31	

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Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
10,347.0	90.80	182.10	7,105.2	-2,601.3	583.3	2,601.3	1.74	1.58	
10,443.0	90.70	180.60	7,104.0	-2,697.3	581.0	2,697.3	1.57	-0.10	
10,538.0	90.70	179.70	7,102.8	-2,792.2	580.8	2,792.2	0.95	0.00	
10,634.0	90.20	179.40	7,102.0	-2,888.2	581.6	2,888.2	0.61	-0.52	
10,729.0	91.20	181.20	7,100.9	-2,983.2	581.1	2,983.2	2.17	1.05	
10,825.0	90.90	180.60	7,099.1	-3,079.2	579.5	3,079.2	0.70	-0.31	
10,920.0	90.70	180.60	7,097.8	-3,174.2	578.6	3,174.2	0.21	-0.21	
11,015.0	90.90	181.50	7,096.5	-3,269.2	576.8	3,269.2	0.97	0.21	
11,108.0	90.00	180.70	7,095.7	-3,362.1	575.0	3,362.1	1.29	-0.97	
11,201.0	89.60	180.80	7,096.1	-3,455.1	573.8	3,455.1	0.44	-0.43	
11,293.0	91.10	180.00	7,095.5	-3,547.1	573.2	3,547.1	1.85	1.63	
11,385.0	90.70	179.80	7,094.1	-3,639.1	573.3	3,639.1	0.49	-0.43	
11,478.0	90.60	179.30	7,093.0	-3,732.1	574.1	3,732.1	0.55	-0.11	
11,571.0	90.80	179.20	7,091.9	-3,825.1	575.3	3,825.1	0.24	0.22	
11,663.0	90.90	179.50	7,090.5	-3,917.1	576.3	3,917.1	0.34	0.11	
11,735.0	90.50	178.90	7,089.6	-3,989.1	577.3	3,989.1	1.00	-0.56	LAST CES SURVEY @ 11,735' MD
11,787.0	90.50	178.90	7,089.2	-4,041.0	578.3	4,041.0	0.00	0.00	PTB @ 11,787' MD (1720' FWL, 2149' FNL)

Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
BERNHARDT 6K-323 PI	0.00	0.00	7,097.0	-4,050.9	579.9	1,363,057.81	3,188,590.96	40.328020	-104.823570
- hit/miss target									
- Shape									
- actual wellpath misses target center by 12.7usft at 11787.0usft MD (7089.2 TVD, -4041.0 N, 578.3 E)									
- Point									

Casing Points					
Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")	
7,519.0	7,099.1	7" (1728' FWL, 2122' FSL)	0	0	

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
11,735.0	7,089.6	-3,989.1	577.3	LAST CES SURVEY @ 11,735' MD	
11,787.0	7,089.2	-4,041.0	578.3	PTB @ 11,787' MD (1720' FWL, 2149' FNL)	

Checked By: _____ Approved By: _____ Date: _____