

# **PDC ENERGY**

**WELD COUNTY, COLORADO  
SE SE SEC. 18 T4N R64W 6th P.M.  
COLLINS 18Q-221  
JOB # 2015-117-123**

**11 October, 2015**

**Survey: FINAL SURVEYS**





Project: WELD COUNTY, COLORADO  
Site: SE SE SEC. 18 T4N R64W 6th P.M.  
Well: COLLINS 18Q-221  
Wellbore: JOB # 2015-117-123  
Design: FINAL SURVEYS

#### ANNOTATIONS

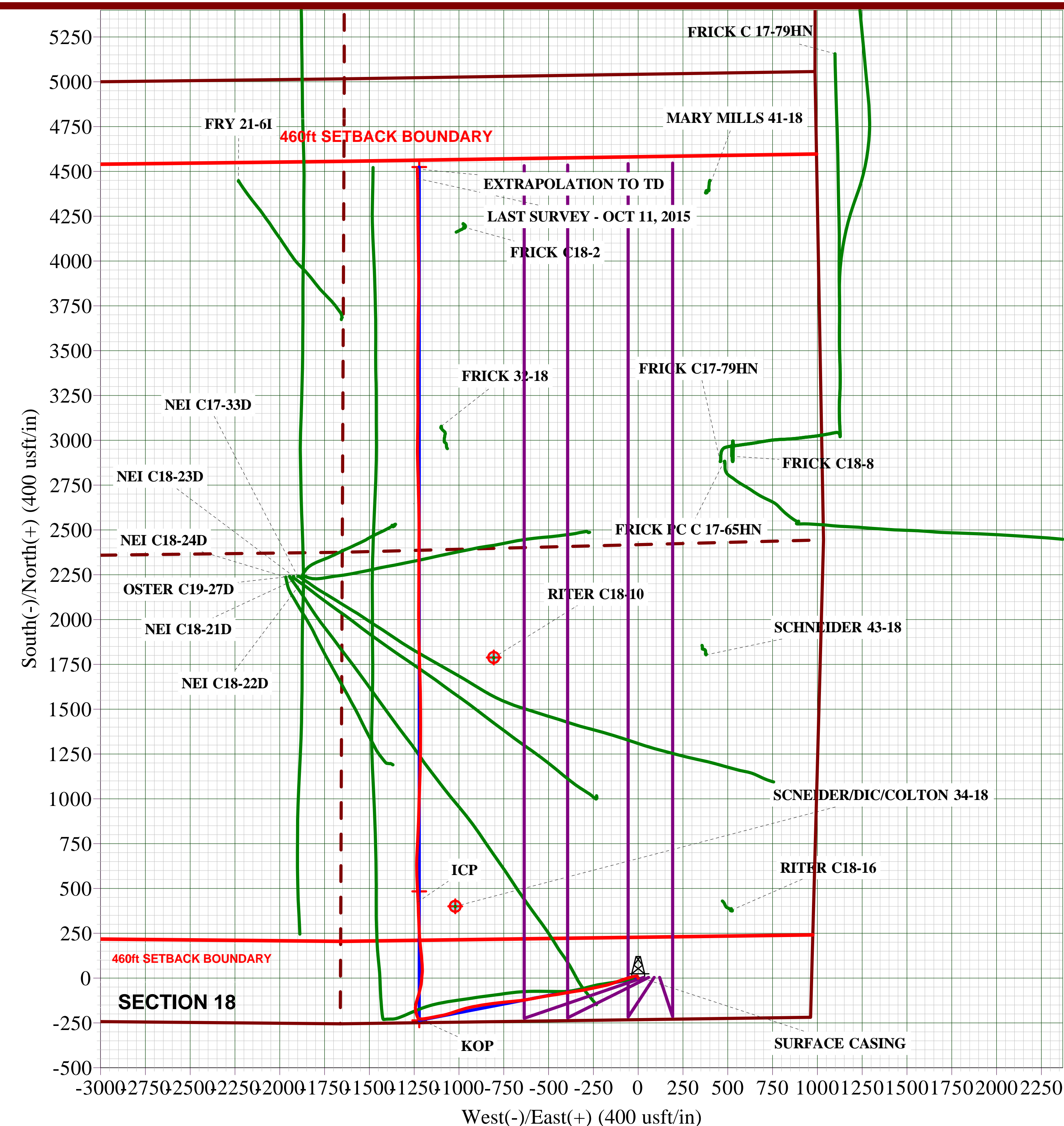
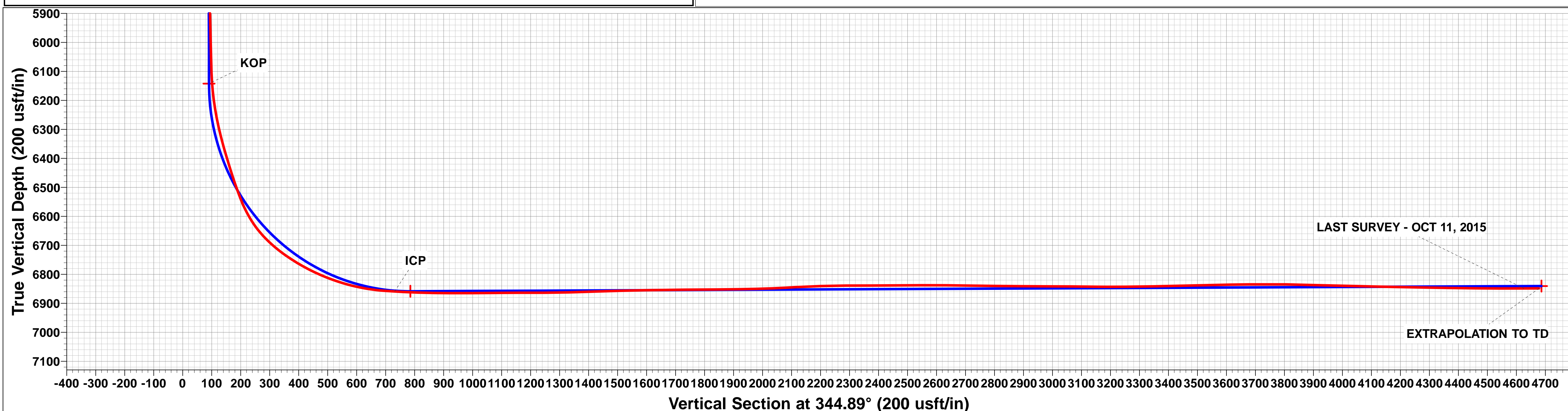
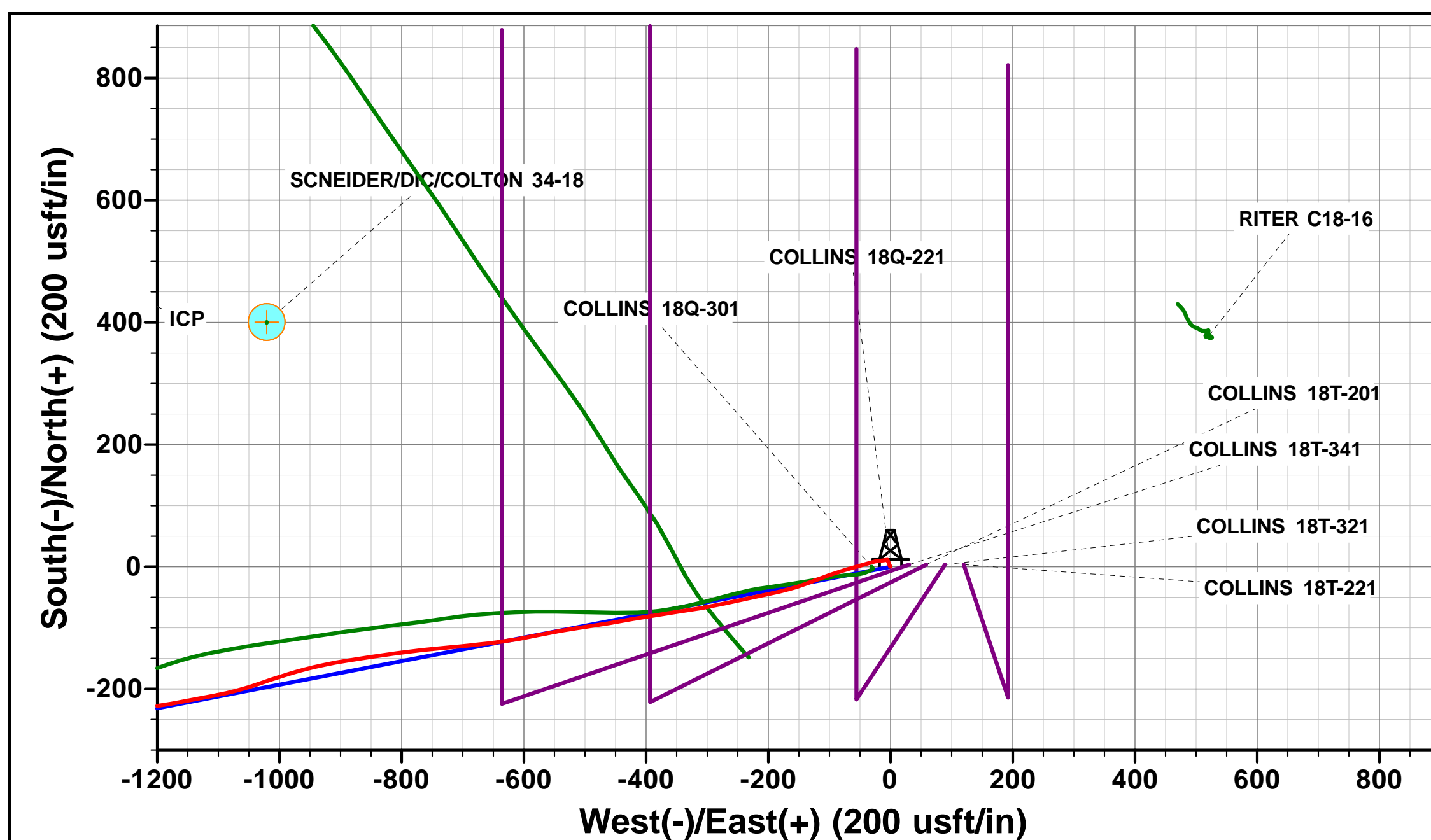
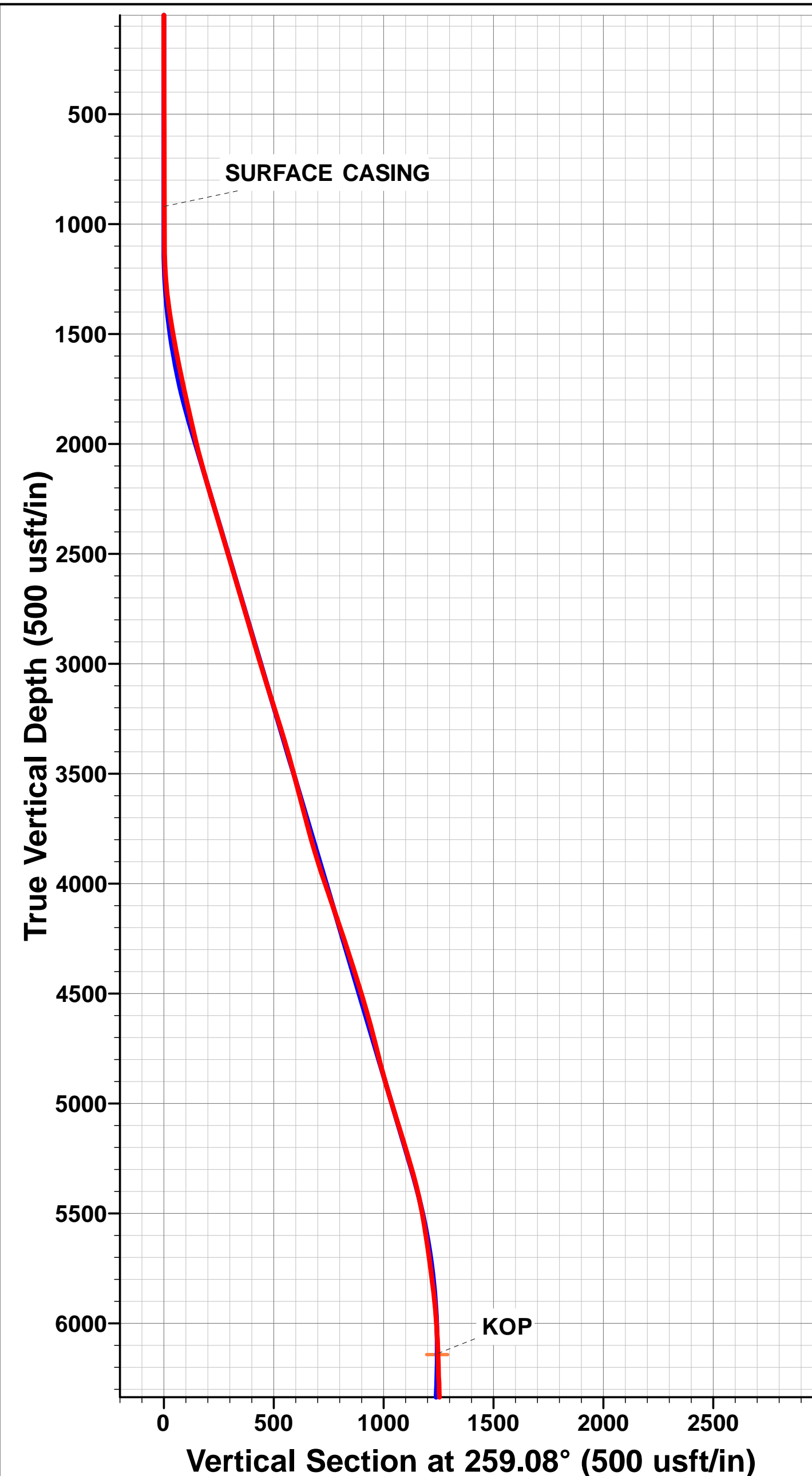
TVD	MD	Inc	Azi	+N/-S	+E/-W	Vsect	Departure	Annotation
919.9	920.0	0.93	338.51	8.3	-3.6	8.9	9.4	SURFACE CASING
6136.9	6305.0	4.38	321.74	-226.3	-1226.5	101.2	1265.7	KOP
6859.2	7396.0	86.63	357.61	425.7	-1228.1	731.0	1926.0	ICP
6848.7	11432.0	90.30	358.70	4460.0	-1230.4	4626.6	5961.2	LAST SURVEY - OCT 11, 2015
6848.5	11485.0	90.30	358.70	4513.0	-1231.6	4678.0	6014.2	EXTRAPOLATION TO TD

#### AS DRILLED LOCAL COORDINATES:

SHL: 234ft FSL & 970t FEL Sec 18  
7" ICP: 659.7ft FSL & 2198.1ft FEL Sec 18  
BHL: 511.7ft FNL & 2228.2ft FEL Sec 18

#### WELLBORE TARGET DETAILS (LAT/LONG)

Name	TVD	+N/-S	+E/-W	Latitude	Longitude
7" ICP *NEW* - COLLINS 18Q-221	6858.5	483.6	-1221.4	40.307067	-104.591929
BHL - COLLINS 18Q-221	6840.5	4524.7	-1221.4	40.318160	-104.591930
KOP - COLLINS 18Q-221	6142.3	-235.7	-1221.4	40.305093	-104.591929



## Survey Report



<b>Company:</b>	PDC ENERGY	<b>Local Co-ordinate Reference:</b>	Well COLLINS 18Q-221
<b>Project:</b>	WELD COUNTY, COLORADO	<b>TVD Reference:</b>	KB @ 4796.5usft (ENS 123)
<b>Site:</b>	SE SE SEC. 18 T4N R64W 6th P.M.	<b>MD Reference:</b>	KB @ 4796.5usft (ENS 123)
<b>Well:</b>	COLLINS 18Q-221	<b>North Reference:</b>	True
<b>Wellbore:</b>	JOB # 2015-117-123	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL SURVEYS	<b>Database:</b>	EDM 5000.1 Single User Db

<b>Project</b>	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		
<b>Map Zone:</b>	Colorado Northern Zone		Using geodetic scale factor

Site	SE SE SEC. 18 T4N R64W 6th P.M.				
Site Position:		Northing:	1,355,536.25 usft	Latitude:	40.305750
From:	Lat/Long	Easting:	3,254,595.50 usft	Longitude:	-104.587120
Position Uncertainty:	0.0 usft	Slot Radius:	1.10000 ft	Grid Convergence:	0.59 °

Well	COLLINS 18Q-221					
Well Position	+N-S	0.0 usft	Northing:	1,355,531.36 usft	Latitude:	40.305740
	+E-W	0.0 usft	Easting:	3,254,475.62 usft	Longitude:	-104.587550
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	4,783.0 usft

<b>Wellbore</b>	JOB # 2015-117-123				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2015	02/07/2015	8.32	66.86	52,586

<b>Design</b>	FINAL SURVEYS				
<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) (usft)</b>	<b>+N-S (usft)</b>	<b>+E-W (usft)</b>	<b>Direction (°)</b>	
	0.0	0.0	0.0	344.89	

<b>Survey Program</b>	<b>Date</b>	11/10/2015			
<b>From (usft)</b>	<b>To (usft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
268.0	11,485.0	FINAL SURVEYS (JOB # 2015-117-123)	MWD	MWD - Standard	

<b>Survey</b>										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Subsea Depth (usft)	+N-S (usft)	+E-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.0	0.00	0.00	0.0	4,796.5	0.0	0.0	0.0	0.00	0.00	0.00
268.0	0.30	311.20	268.0	4,528.5	0.5	-0.5	0.6	0.11	0.11	0.00
547.0	0.90	342.00	547.0	4,249.5	3.0	-1.8	3.4	0.24	0.22	11.04
827.0	0.80	341.10	827.0	3,969.5	7.0	-3.1	7.5	0.04	-0.04	-0.32
<b>SURFACE CASING</b>										
920.0	0.93	338.51	919.9	3,876.6	8.3	-3.6	8.9	0.15	0.14	-2.78
1,104.0	1.20	335.10	1,103.9	3,692.6	11.4	-4.9	12.3	0.15	0.15	-1.85
1,384.0	8.20	254.70	1,382.9	3,413.6	8.8	-25.4	15.1	2.89	2.50	-28.71
1,663.0	11.90	253.60	1,657.6	3,138.9	-4.6	-72.2	14.4	1.33	1.33	-0.39
1,943.0	13.20	248.40	1,930.9	2,865.6	-24.5	-129.7	10.2	0.61	0.46	-1.86
2,213.0	16.50	258.20	2,191.9	2,604.6	-43.7	-195.9	8.9	1.53	1.22	3.63
2,483.0	16.40	257.40	2,450.8	2,345.7	-59.8	-270.6	12.8	0.09	-0.04	-0.30
2,753.0	16.60	262.50	2,709.7	2,086.8	-73.2	-346.1	19.5	0.54	0.07	1.89

# Survey Report



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<b>Project:</b>	WELD COUNTY, COLORADO	<b>TVD Reference:</b>	KB @ 4796.5usft (ENS 123)
<b>Site:</b>	SE SE SEC. 18 T4N R64W 6th P.M.	<b>MD Reference:</b>	KB @ 4796.5usft (ENS 123)
<b>Well:</b>	COLLINS 18Q-221	<b>North Reference:</b>	True
<b>Wellbore:</b>	JOB # 2015-117-123	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL SURVEYS	<b>Database:</b>	EDM 5000.1 Single User Db

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Subsea Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
3,022.0	16.40	259.20	2,967.7	1,828.8	-85.3	-421.5	27.5	0.36	-0.07	-1.23
3,292.0	18.20	261.70	3,225.4	1,571.1	-98.5	-500.6	35.3	0.72	0.67	0.93
3,562.0	14.80	258.10	3,484.3	1,312.2	-111.7	-576.1	42.3	1.31	-1.26	-1.33
3,831.0	14.90	262.40	3,744.3	1,052.2	-123.4	-644.0	48.7	0.41	0.04	1.60
4,100.0	19.10	265.00	4,001.5	795.0	-131.8	-722.2	60.9	1.59	1.56	0.97
4,370.0	18.60	262.20	4,257.0	539.5	-141.5	-808.9	74.2	0.38	-0.19	-1.04
4,639.0	16.80	260.70	4,513.3	283.2	-153.6	-889.7	83.6	0.69	-0.67	-0.56
4,909.0	13.80	255.20	4,773.7	22.8	-168.2	-959.4	87.7	1.23	-1.11	-2.04
5,179.0	17.90	250.60	5,033.4	-236.9	-190.2	-1,029.7	84.7	1.59	1.52	-1.70
5,448.0	16.30	259.50	5,290.5	-494.0	-210.8	-1,105.8	84.7	1.14	-0.59	3.31
5,718.0	9.10	259.40	5,553.7	-757.2	-221.6	-1,164.1	89.4	2.67	-2.67	-0.04
5,987.0	7.10	261.90	5,820.1	-1,023.6	-227.9	-1,201.5	93.1	0.75	-0.74	0.93
6,257.0	2.80	288.70	6,089.0	-1,292.5	-228.1	-1,224.3	98.8	1.77	-1.59	9.93
<b>KOP</b>										
6,305.0	4.38	321.74	6,136.9	-1,340.4	-226.3	-1,226.5	101.2	5.29	3.29	68.83
6,347.0	6.30	334.00	6,178.7	-1,382.2	-223.0	-1,228.5	104.9	5.29	4.57	29.19
6,437.0	11.60	338.40	6,267.6	-1,471.1	-210.1	-1,234.0	118.7	5.93	5.89	4.89
6,526.0	15.50	346.00	6,354.1	-1,557.6	-190.3	-1,240.2	139.5	4.81	4.38	8.54
6,616.0	18.30	0.80	6,440.3	-1,643.8	-164.4	-1,242.9	165.2	5.68	3.11	16.44
6,706.0	23.30	17.70	6,524.5	-1,728.0	-133.3	-1,237.3	193.8	8.63	5.56	18.78
6,796.0	34.20	16.70	6,603.2	-1,806.7	-92.0	-1,224.6	230.3	12.12	12.11	-1.11
6,885.0	46.50	11.00	6,671.0	-1,874.5	-36.1	-1,211.2	280.8	14.42	13.82	-6.40
6,975.0	55.00	0.80	6,727.9	-1,931.4	33.0	-1,204.4	345.8	12.87	9.44	-11.33
7,065.0	61.60	353.80	6,775.2	-1,978.7	109.4	-1,208.2	420.5	9.87	7.33	-7.78
7,155.0	69.10	354.40	6,812.8	-2,016.3	190.7	-1,216.6	501.1	8.36	8.33	0.67
7,244.0	76.30	357.70	6,839.2	-2,042.7	275.4	-1,222.4	584.4	8.83	8.09	3.71
7,334.0	84.00	358.00	6,854.6	-2,058.1	363.9	-1,225.7	670.8	8.56	8.56	0.33
7,355.0	85.80	357.90	6,856.5	-2,060.0	384.8	-1,226.5	691.2	8.58	8.57	-0.48
<b>ICP</b>										
7,396.0	86.63	357.61	6,859.2	-2,062.7	425.7	-1,228.1	731.0	2.15	2.03	-0.70
7,483.0	88.40	357.00	6,862.9	-2,066.4	512.5	-1,232.1	815.9	2.15	2.03	-0.70
7,573.0	89.20	358.50	6,864.8	-2,068.3	602.4	-1,235.7	903.7	1.89	0.89	1.67
7,662.0	90.60	3.20	6,865.0	-2,068.5	691.4	-1,234.4	989.2	5.51	1.57	5.28
7,752.0	90.60	3.00	6,864.0	-2,067.5	781.3	-1,229.5	1,074.7	0.22	0.00	-0.22
7,842.0	90.10	2.00	6,863.5	-2,067.0	871.2	-1,225.6	1,160.5	1.24	-0.56	-1.11
7,932.0	89.80	1.40	6,863.6	-2,067.1	961.1	-1,222.9	1,246.6	0.75	-0.33	-0.67
8,022.0	91.80	2.20	6,862.3	-2,065.8	1,051.1	-1,220.1	1,332.7	2.39	2.22	0.89
8,112.0	91.80	1.50	6,859.5	-2,063.0	1,141.0	-1,217.2	1,418.8	0.78	0.00	-0.78
8,202.0	91.50	0.90	6,856.9	-2,060.4	1,230.9	-1,215.3	1,505.1	0.75	-0.33	-0.67
8,292.0	91.00	0.20	6,854.9	-2,058.4	1,320.9	-1,214.4	1,591.7	0.96	-0.56	-0.78
8,382.0	90.60	359.90	6,853.7	-2,057.2	1,410.9	-1,214.3	1,678.6	0.56	-0.44	-0.33
8,472.0	90.50	359.80	6,852.8	-2,056.3	1,500.9	-1,214.6	1,765.6	0.16	-0.11	-0.11
8,562.0	90.50	359.00	6,852.0	-2,055.5	1,590.9	-1,215.5	1,852.7	0.89	0.00	-0.89
8,651.0	90.80	358.00	6,851.0	-2,054.5	1,679.8	-1,217.8	1,939.2	1.17	0.34	-1.12
8,741.0	92.20	358.80	6,848.7	-2,052.2	1,769.8	-1,220.4	2,026.7	1.79	1.56	0.89
8,831.0	93.30	358.40	6,844.3	-2,047.8	1,859.6	-1,222.6	2,114.0	1.30	1.22	-0.44
8,921.0	91.70	359.40	6,840.4	-2,043.9	1,949.5	-1,224.3	2,201.2	2.10	-1.78	1.11
9,010.0	90.30	0.40	6,838.9	-2,042.4	2,038.5	-1,224.4	2,287.2	1.93	-1.57	1.12
9,100.0	90.00	0.20	6,838.6	-2,042.1	2,128.5	-1,224.0	2,373.9	0.40	-0.33	-0.22
9,190.0	90.30	0.20	6,838.4	-2,041.9	2,218.5	-1,223.6	2,460.7	0.33	0.33	0.00
9,279.0	90.60	0.10	6,837.7	-2,041.2	2,307.5	-1,223.4	2,546.6	0.36	0.34	-0.11
9,369.0	89.20	0.40	6,837.8	-2,041.3	2,397.5	-1,223.0	2,633.4	1.59	-1.56	0.33
9,459.0	89.30	0.20	6,839.0	-2,042.5	2,487.5	-1,222.5	2,720.2	0.25	0.11	-0.22

# Survey Report



<b>Company:</b>	PDC ENERGY	<b>Local Co-ordinate Reference:</b>	Well COLLINS 18Q-221
<b>Project:</b>	WELD COUNTY, COLORADO	<b>TVD Reference:</b>	KB @ 4796.5usft (ENS 123)
<b>Site:</b>	SE SE SEC. 18 T4N R64W 6th P.M.	<b>MD Reference:</b>	KB @ 4796.5usft (ENS 123)
<b>Well:</b>	COLLINS 18Q-221	<b>North Reference:</b>	True
<b>Wellbore:</b>	JOB # 2015-117-123	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL SURVEYS	<b>Database:</b>	EDM 5000.1 Single User Db

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Subsea Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
9,549.0	89.20	359.30	6,840.2	-2,043.7	2,577.5	-1,222.9	2,807.1	1.01	-0.11	-1.00
9,639.0	89.70	358.60	6,841.1	-2,044.6	2,667.5	-1,224.6	2,894.4	0.96	0.56	-0.78
9,729.0	89.80	358.60	6,841.5	-2,045.0	2,757.4	-1,226.8	2,981.9	0.11	0.11	0.00
9,819.0	89.60	358.00	6,841.9	-2,045.4	2,847.4	-1,229.5	3,069.4	0.70	-0.22	-0.67
9,908.0	89.20	359.70	6,842.9	-2,046.4	2,936.4	-1,231.2	3,155.8	1.96	-0.45	1.91
9,998.0	90.80	1.30	6,842.9	-2,046.4	3,026.4	-1,230.5	3,242.5	2.51	1.78	1.78
10,088.0	90.60	0.40	6,841.8	-2,045.3	3,116.3	-1,229.1	3,329.0	1.02	-0.22	-1.00
10,178.0	91.20	0.30	6,840.3	-2,043.8	3,206.3	-1,228.6	3,415.7	0.68	0.67	-0.11
10,268.0	91.50	358.70	6,838.2	-2,041.7	3,296.3	-1,229.4	3,502.8	1.81	0.33	-1.78
10,358.0	91.50	0.80	6,835.9	-2,039.4	3,386.3	-1,229.8	3,589.7	2.33	0.00	2.33
10,448.0	89.90	0.90	6,834.8	-2,038.3	3,476.2	-1,228.4	3,676.3	1.78	-1.78	0.11
10,537.0	90.20	359.80	6,834.7	-2,038.2	3,565.2	-1,227.9	3,762.0	1.28	0.34	-1.24
10,627.0	88.90	0.60	6,835.4	-2,038.9	3,655.2	-1,227.6	3,848.8	1.70	-1.44	0.89
10,717.0	88.00	1.60	6,837.8	-2,041.3	3,745.2	-1,225.8	3,935.2	1.49	-1.00	1.11
10,806.0	88.80	0.20	6,840.3	-2,043.8	3,834.1	-1,224.4	4,020.7	1.81	0.90	-1.57
10,896.0	89.00	359.40	6,842.1	-2,045.6	3,924.1	-1,224.8	4,107.7	0.92	0.22	-0.89
10,986.0	88.90	359.40	6,843.7	-2,047.2	4,014.1	-1,225.7	4,194.8	0.11	-0.11	0.00
11,076.0	88.90	359.40	6,845.4	-2,048.9	4,104.1	-1,226.6	4,281.9	0.00	0.00	0.00
11,166.0	89.00	359.20	6,847.1	-2,050.6	4,194.1	-1,227.7	4,369.1	0.25	0.11	-0.22
11,256.0	89.40	359.90	6,848.3	-2,051.8	4,284.0	-1,228.4	4,456.2	0.90	0.44	0.78
11,346.0	89.90	359.40	6,848.9	-2,052.4	4,374.0	-1,229.0	4,543.2	0.79	0.56	-0.56
<b>LAST SURVEY - OCT 11, 2015</b>										
11,432.0	90.30	358.70	6,848.7	-2,052.2	4,460.0	-1,230.4	4,626.6	0.94	0.47	-0.81
<b>EXTRAPOLATION TO TD</b>										
11,485.0	90.30	358.70	6,848.5	-2,052.0	4,513.0	-1,231.6	4,678.0	0.00	0.00	0.00



# Survey Report



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<b>Project:</b>	WELD COUNTY, COLORADO	<b>TVD Reference:</b>	KB @ 4796.5usft (ENS 123)
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<b>Well:</b>	COLLINS 18Q-221	<b>North Reference:</b>	True
<b>Wellbore:</b>	JOB # 2015-117-123	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL SURVEYS	<b>Database:</b>	EDM 5000.1 Single User Db

Targets									
Target Name	Dip Angle	Dip Dir.	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
- hit/miss target	(°)	(°)	(usft)	(usft)	(usft)	(usft)	(usft)		
- Shape									
BHL - COLLINS 18Q- - survey misses target center by 17.5usft at 11485.0usft MD (6848.5 TVD, 4513.0 N, -1231.6 E) - Point	0.00	0.00	6,840.5	4,524.7	-1,221.4	1,360,043.08	3,253,207.78	40.318160	-104.591930
RITER C18-10 - survey misses target center by 533.7usft at 8739.6usft MD (6848.7 TVD, 1768.4 N, -1220.3 E) - Circle (radius 30.0)	0.00	0.00	7,184.5	1,788.8	-806.0	1,357,311.66	3,253,651.30	40.310650	-104.590440
7" ICP *NEW* - COLL - survey misses target center by 9.9usft at 7453.4usft MD (6862.0 TVD, 483.0 N, -1230.6 E) - Point	0.00	0.00	6,858.5	483.6	-1,221.4	1,356,002.35	3,253,249.36	40.307067	-104.591929
KOP - COLLINS 18Q- - survey misses target center by 11.1usft at 6309.4usft MD (6141.3 TVD, -226.0 N, -1226.7 E) - Point	0.00	0.00	6,142.3	-235.7	-1,221.4	1,355,283.12	3,253,256.76	40.305093	-104.591929
SCHNEIDER/DIC/CO - survey misses target center by 790.4usft at 7396.0usft MD (6859.2 TVD, 425.7 N, -1228.1 E) - Circle (radius 30.0)	0.00	0.00	7,621.5	400.8	-1,020.8	1,355,921.58	3,253,450.80	40.306840	-104.591210

Survey Annotations				
Measured Depth	Vertical Depth	Local Coordinates		Comment
(usft)	(usft)	+N/-S (usft)	+E/-W (usft)	
920.0	919.9	8.3	-3.6	SURFACE CASING
6,305.0	6,136.9	-226.3	-1,226.5	KOP
7,396.0	6,859.2	425.7	-1,228.1	ICP
11,432.0	6,848.7	4,460.0	-1,230.4	LAST SURVEY - OCT 11, 2015
11,485.0	6,848.5	4,513.0	-1,231.6	EXTRAPOLATION TO TD

Checked By: _____	Approved By: _____	Date: _____
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