



Noble Energy Inc.

**Weld County, CO
Sec 28, T9N, R59W, 6th PM
Cutthroat LC28-77HNB**

Wellbore #1

Design: Wellbore #1 FINAL

DDC Survey Report

03 September, 2014



Company:	Noble Energy Inc.	Local Co-ordinate Reference:	Well Cutthroat LC28-77HNB
Project:	Weld County, CO	TVD Reference:	WELL @ 4883.0usft (H&P #326)
Site:	Sec 28, T9N, R59W, 6th PM	MD Reference:	WELL @ 4883.0usft (H&P #326)
Well:	Cutthroat LC28-77HNB	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass

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

Site		Sec 28, T9N, R59W, 6th PM			
Site Position:		Northing:	1,506,743.69 usft	Latitude:	40° 42' 52.295 N
From:	Map	Easting:	3,420,557.77 usft	Longitude:	103° 58' 58.302 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.98 °

Well		Cutthroat LC28-77HNB				
Well Position	+N/-S	0.0 usft	Northing:	1,506,892.46 usft	Latitude:	40° 42' 53.964 N
	+E/-W	0.0 usft	Easting:	3,419,380.12 usft	Longitude:	103° 59' 13.560 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	0.0 usft	Ground Level:	4,853.0 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	8/26/2014	8.03	67.31	53,037

Design	Wellbore #1				
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	356.78	

Survey Program	Date	9/2/2014			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
270.0	620.0	GYRO (Wellbore #1)	Good_gyro	Good Gyro	
740.0	6,442.0	MWD Surveys - Vert/Build (Wellbore #1)	MWD default	MWD - Standard	
6,533.0	10,368.0	MWD Survey - Lateral (Wellbore #1)	MWD default	MWD - Standard	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical 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	0.0	0.0	0.0	0.00	0.00	0.00	
270.0	0.30	231.35	270.0	-0.4	-0.6	-0.4	0.11	0.11	0.00	
TIE IN @ 620' MD / 620' TVD END OF SURFACE HOLE / BEGIN INT HOLE										
620.0	0.10	207.35	620.0	-1.3	-1.4	-1.2	0.06	-0.06	-6.86	
740.0	0.35	196.37	740.0	-1.7	-1.6	-1.6	0.21	0.21	-9.15	
833.0	0.26	181.95	833.0	-2.2	-1.6	-2.1	0.13	-0.10	-15.51	
926.0	0.44	187.23	926.0	-2.8	-1.7	-2.7	0.20	0.19	5.68	
1,018.0	0.35	200.06	1,018.0	-3.4	-1.8	-3.3	0.14	-0.10	13.95	
1,110.0	0.53	202.52	1,110.0	-4.0	-2.1	-3.9	0.20	0.20	2.67	

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Well:	Cutthroat LC28-77HNB	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
1,202.0	0.70	217.28	1,202.0	-4.9	-2.6	-4.7	0.25	0.18	16.04
1,310.0	0.70	229.06	1,310.0	-5.8	-3.5	-5.6	0.13	0.00	10.91
1,403.0	0.70	239.96	1,403.0	-6.5	-4.4	-6.2	0.14	0.00	11.72
1,496.0	0.70	236.27	1,496.0	-7.1	-5.4	-6.8	0.05	0.00	-3.97
1,589.0	0.53	255.25	1,589.0	-7.5	-6.3	-7.2	0.28	-0.18	20.41
1,682.0	0.70	267.56	1,681.9	-7.7	-7.3	-7.2	0.23	0.18	13.24
1,774.0	0.62	267.73	1,773.9	-7.7	-8.3	-7.2	0.09	-0.09	0.18
1,866.0	0.44	273.53	1,865.9	-7.7	-9.2	-7.2	0.20	-0.20	6.30
1,958.0	0.44	255.60	1,957.9	-7.8	-9.9	-7.2	0.15	0.00	-19.49
2,051.0	0.53	249.45	2,050.9	-8.0	-10.6	-7.4	0.11	0.10	-6.61
2,143.0	0.62	237.85	2,142.9	-8.4	-11.4	-7.8	0.16	0.10	-12.61
2,236.0	0.70	257.54	2,235.9	-8.8	-12.4	-8.1	0.26	0.09	21.17
2,329.0	0.62	281.44	2,328.9	-8.8	-13.5	-8.1	0.31	-0.09	25.70
2,421.0	0.44	274.41	2,420.9	-8.7	-14.3	-7.9	0.21	-0.20	-7.64
2,512.0	2.81	251.03	2,511.9	-9.4	-16.8	-8.5	2.65	2.60	-25.69
2,606.0	4.92	236.80	2,605.7	-12.4	-22.3	-11.1	2.45	2.24	-15.14
2,699.0	7.39	225.55	2,698.1	-18.7	-29.9	-17.0	2.94	2.66	-12.10
2,791.0	9.32	219.75	2,789.1	-28.6	-38.9	-26.4	2.29	2.10	-6.30
2,884.0	11.26	213.42	2,880.6	-42.0	-48.7	-39.2	2.41	2.09	-6.81
2,978.0	13.10	208.14	2,972.5	-59.0	-58.8	-55.6	2.29	1.96	-5.62
3,072.0	12.75	206.56	3,064.1	-77.7	-68.5	-73.7	0.53	-0.37	-1.68
3,166.0	11.08	200.59	3,156.1	-95.4	-76.3	-91.0	2.21	-1.78	-6.35
3,261.0	11.17	204.10	3,249.3	-112.4	-83.2	-107.5	0.72	0.09	3.69
3,355.0	11.17	204.98	3,341.5	-129.0	-90.8	-123.6	0.18	0.00	0.94
3,450.0	11.87	204.63	3,434.6	-146.2	-98.8	-140.4	0.74	0.74	-0.37
3,545.0	12.49	204.28	3,527.5	-164.4	-107.1	-158.1	0.66	0.65	-0.37
3,639.0	10.55	196.54	3,619.6	-181.9	-113.7	-175.3	2.63	-2.06	-8.23
3,734.0	7.91	191.44	3,713.4	-196.7	-117.5	-189.8	2.91	-2.78	-5.37
3,828.0	6.33	220.98	3,806.7	-206.9	-122.2	-199.8	4.18	-1.68	31.43
3,922.0	5.54	199.35	3,900.2	-215.1	-127.1	-207.7	2.51	-0.84	-23.01
4,016.0	5.19	195.84	3,993.8	-223.5	-129.7	-215.9	0.51	-0.37	-3.73
4,111.0	4.92	194.26	4,088.4	-231.6	-131.9	-223.8	0.32	-0.28	-1.66
4,206.0	4.75	186.35	4,183.1	-239.4	-133.3	-231.6	0.72	-0.18	-8.33
4,300.0	3.96	164.20	4,276.8	-246.4	-132.9	-238.6	1.96	-0.84	-23.56
4,395.0	0.26	214.82	4,371.7	-249.8	-132.1	-242.0	4.00	-3.89	53.28
4,489.0	0.70	338.57	4,465.7	-249.4	-132.4	-241.6	0.93	0.47	131.65
4,583.0	1.14	359.49	4,559.7	-247.9	-132.7	-240.1	0.58	0.47	22.26
4,678.0	1.58	15.84	4,654.7	-245.7	-132.3	-237.9	0.61	0.46	17.21
4,772.0	2.02	37.64	4,748.6	-243.2	-130.9	-235.4	0.86	0.47	23.19
4,866.0	0.70	16.37	4,842.6	-241.3	-129.8	-233.6	1.48	-1.40	-22.63
4,961.0	0.62	33.94	4,937.6	-240.3	-129.3	-232.7	0.23	-0.08	18.49
5,055.0	2.64	223.44	5,031.6	-241.5	-130.5	-233.8	3.46	2.15	-181.38
5,150.0	2.55	226.60	5,126.5	-244.5	-133.6	-236.6	0.18	-0.09	3.33

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Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
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Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
5,244.0	2.29	235.92	5,220.4	-247.0	-136.6	-239.0	0.50	-0.28	9.91
5,339.0	1.93	235.74	5,315.3	-249.0	-139.5	-240.7	0.38	-0.38	-0.19
5,434.0	2.20	284.96	5,410.3	-249.4	-142.6	-241.0	1.83	0.28	51.81
5,528.0	8.44	359.84	5,503.9	-242.0	-144.4	-233.5	8.67	6.64	79.66
5,622.0	17.50	4.94	5,595.4	-221.0	-143.2	-212.6	9.71	9.64	5.43
5,717.0	26.03	8.81	5,683.5	-186.1	-138.8	-178.0	9.10	8.98	4.07
5,812.0	36.58	7.23	5,764.6	-137.3	-132.0	-129.7	11.14	11.11	-1.66
5,907.0	48.54	359.14	5,834.5	-73.3	-128.9	-66.0	13.82	12.59	-8.52
6,001.0	51.62	353.51	5,894.8	-1.5	-133.6	6.0	5.64	3.28	-5.99
6,096.0	56.19	356.15	5,950.8	75.0	-140.5	82.7	5.31	4.81	2.78
6,190.0	56.63	355.27	6,002.8	153.0	-146.4	161.0	0.91	0.47	-0.94
6,285.0	61.11	354.57	6,051.9	234.0	-153.6	242.3	4.76	4.72	-0.74
CROSSED 600' HARD LINE @ 6311.9' MD / 6064.1 TVD									
6,311.9	65.17	355.32	6,064.1	257.9	-155.7	266.3	15.28	15.08	2.79
6,380.0	75.45	357.03	6,087.0	321.8	-159.9	330.3	15.28	15.10	2.51
6,442.0	87.41	358.79	6,096.2	383.0	-162.1	391.5	19.49	19.29	2.84
7" CASING POINT @ 6485' MD / 6097.6' TVD / END OF INT HOLE / BEGIN LATERAL									
6,485.0	88.86	0.37	6,097.6	425.9	-162.4	434.4	4.98	3.37	3.67
6,533.0	90.48	2.13	6,097.9	473.9	-161.4	482.2	4.98	3.37	3.67
6,625.0	91.45	1.78	6,096.3	565.9	-158.3	573.9	1.12	1.05	-0.38
6,720.0	89.34	1.25	6,095.7	660.8	-155.8	668.5	2.29	-2.22	-0.56
6,815.0	89.52	0.72	6,096.6	755.8	-154.1	763.3	0.59	0.19	-0.56
6,909.0	89.69	0.72	6,097.3	849.8	-152.9	857.0	0.18	0.18	0.00
7,004.0	89.08	0.19	6,098.3	944.8	-152.2	951.8	0.85	-0.64	-0.56
7,098.0	88.99	0.19	6,099.9	1,038.8	-151.9	1,045.7	0.10	-0.10	0.00
7,193.0	88.90	0.02	6,101.6	1,133.7	-151.7	1,140.5	0.20	-0.09	-0.18
7,287.0	91.36	0.90	6,101.4	1,227.7	-150.9	1,234.3	2.78	2.62	0.94
7,382.0	91.71	0.55	6,098.9	1,322.7	-149.7	1,329.0	0.52	0.37	-0.37
7,477.0	90.92	359.84	6,096.7	1,417.7	-149.4	1,423.8	1.12	-0.83	-0.75
7,571.0	89.96	358.79	6,096.0	1,511.7	-150.5	1,517.7	1.51	-1.02	-1.12
7,666.0	89.96	358.26	6,096.0	1,606.6	-153.0	1,612.7	0.56	0.00	-0.56
7,760.0	90.22	358.44	6,095.9	1,700.6	-155.7	1,706.6	0.34	0.28	0.19
7,855.0	90.40	357.91	6,095.4	1,795.5	-158.7	1,801.6	0.59	0.19	-0.56
7,949.0	89.16	357.38	6,095.7	1,889.5	-162.6	1,895.6	1.43	-1.32	-0.56
8,044.0	89.34	357.21	6,097.0	1,984.3	-167.1	1,990.6	0.26	0.19	-0.18
8,139.0	89.78	356.85	6,097.7	2,079.2	-172.0	2,085.6	0.60	0.46	-0.38
8,233.0	90.13	357.21	6,097.8	2,173.1	-176.9	2,179.6	0.53	0.37	0.38
8,327.0	89.96	358.79	6,097.7	2,267.0	-180.1	2,273.6	1.69	-0.18	1.68
8,422.0	89.34	358.26	6,098.3	2,362.0	-182.6	2,368.5	0.86	-0.65	-0.56
8,517.0	89.08	358.26	6,099.6	2,456.9	-185.5	2,463.5	0.27	-0.27	0.00
8,611.0	89.08	358.26	6,101.1	2,550.9	-188.3	2,557.4	0.00	0.00	0.00
8,706.0	89.60	358.61	6,102.2	2,645.8	-190.9	2,652.4	0.66	0.55	0.37
8,800.0	89.87	359.14	6,102.6	2,739.8	-192.8	2,746.3	0.63	0.29	0.56
8,895.0	90.04	359.14	6,102.7	2,834.8	-194.2	2,841.2	0.18	0.18	0.00

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Well:	Cutthroat LC28-77HNB	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	Compass

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
8,990.0	90.13	358.79	6,102.6	2,929.8	-195.9	2,936.2	0.38	0.09	-0.37	
9,084.0	90.57	358.79	6,102.0	3,023.8	-197.9	3,030.1	0.47	0.47	0.00	
9,179.0	90.66	358.44	6,101.0	3,118.7	-200.2	3,125.1	0.38	0.09	-0.37	
9,274.0	90.84	358.44	6,099.7	3,213.7	-202.8	3,220.0	0.19	0.19	0.00	
9,368.0	91.28	358.61	6,098.0	3,307.6	-205.2	3,313.9	0.50	0.47	0.18	
9,463.0	91.45	358.26	6,095.7	3,402.6	-207.8	3,408.9	0.41	0.18	-0.37	
9,557.0	91.28	358.09	6,093.5	3,496.5	-210.8	3,502.8	0.26	-0.18	-0.18	
9,652.0	89.43	358.44	6,092.9	3,591.5	-213.7	3,597.8	1.98	-1.95	0.37	
9,747.0	89.96	358.44	6,093.4	3,686.4	-216.2	3,692.7	0.56	0.56	0.00	
9,841.0	88.72	357.91	6,094.5	3,780.4	-219.2	3,786.7	1.43	-1.32	-0.56	
9,936.0	89.08	357.91	6,096.3	3,875.3	-222.7	3,881.7	0.38	0.38	0.00	
10,030.0	89.08	357.21	6,097.8	3,969.2	-226.7	3,975.7	0.74	0.00	-0.74	
10,125.0	88.99	357.03	6,099.4	4,064.0	-231.5	4,070.6	0.21	-0.09	-0.19	
10,219.0	89.60	356.85	6,100.6	4,157.9	-236.5	4,164.6	0.68	0.65	-0.19	
10,306.0	89.43	356.68	6,101.3	4,244.8	-241.4	4,251.6	0.28	-0.20	-0.20	
TD @ 10368' MD / 6101.9' TVD - PBHL Cutthroat LC28-77HNB										
10,368.0	89.43	356.68	6,101.9	4,306.7	-245.0	4,313.6	0.00	0.00	0.00	

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
620.0	620.0	-1.3	-1.4	TIE IN @ 620' MD / 620' TVD END OF SURFACE HOLE / BEGIN INT HOLE	
6,311.9	6,064.1	257.9	-155.7	CROSSED 600' HARD LINE @ 6311.9' MD / 6064.1 TVD	
6,485.0	6,097.6	425.9	-162.4	7" CASING POINT @ 6485' MD / 6097.6' TVD / END OF INT HOLE / BEGIN L/	
10,368.0	6,101.9	4,306.7	-245.0	TD @ 10368' MD / 6101.9' TVD	

Checked By: _____	Approved By: _____	Date: _____
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Survey Certification Sheet

Noble Energy Inc
Company

RM-140865
Job Number

9/12/14
Date

Sec28,T9N,R59W,6TH PM
Lease

Cutthroat LC28-77HNB
Well Name

Weld, CO
County & State

API: 05-123-38851

Surveyed from a depth of: 620' to 10368' MD (DDC Certified Survey Data)

Type of Survey: MWD

Directional Supervisor/Surveyor: Bob Kubistek

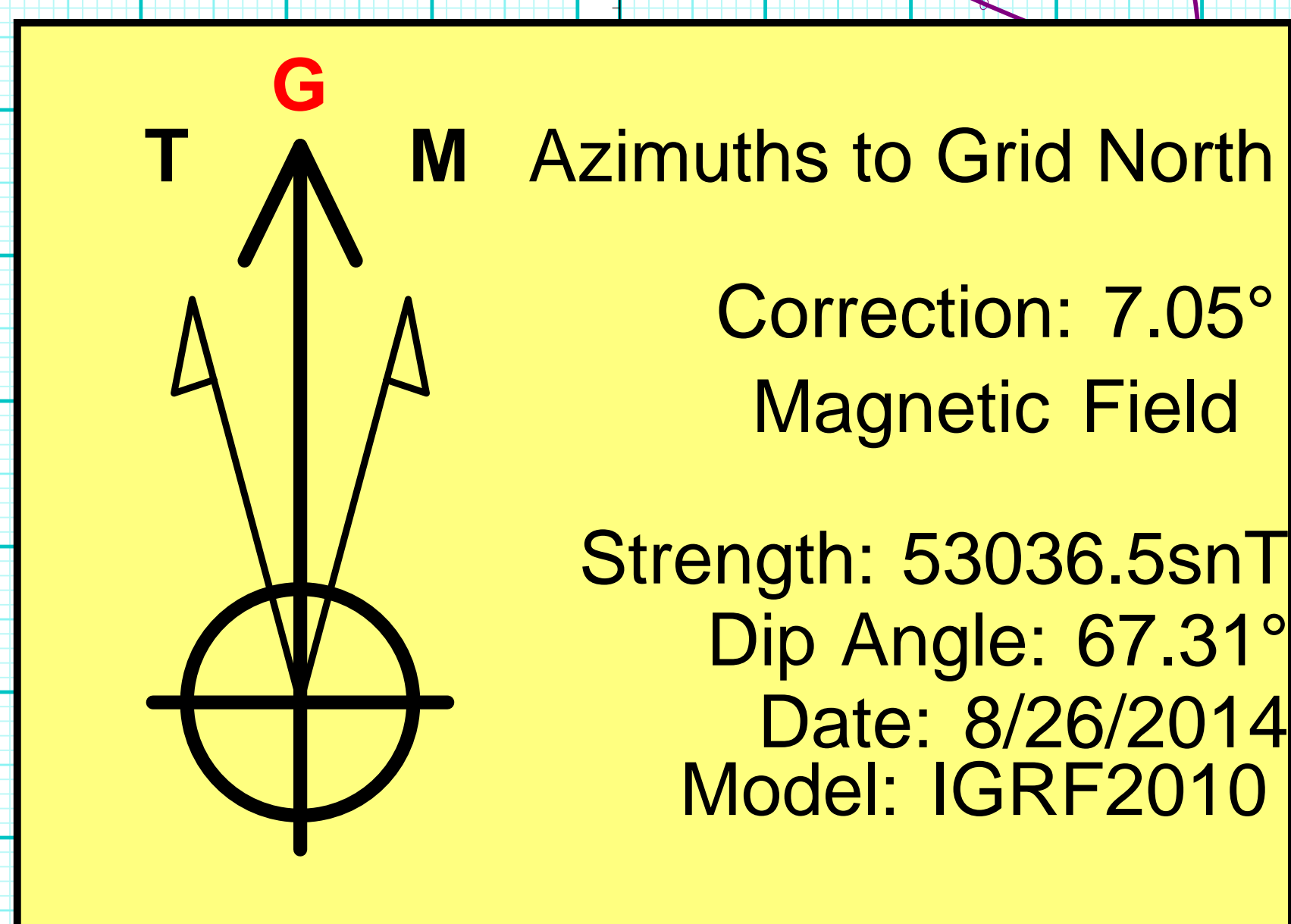
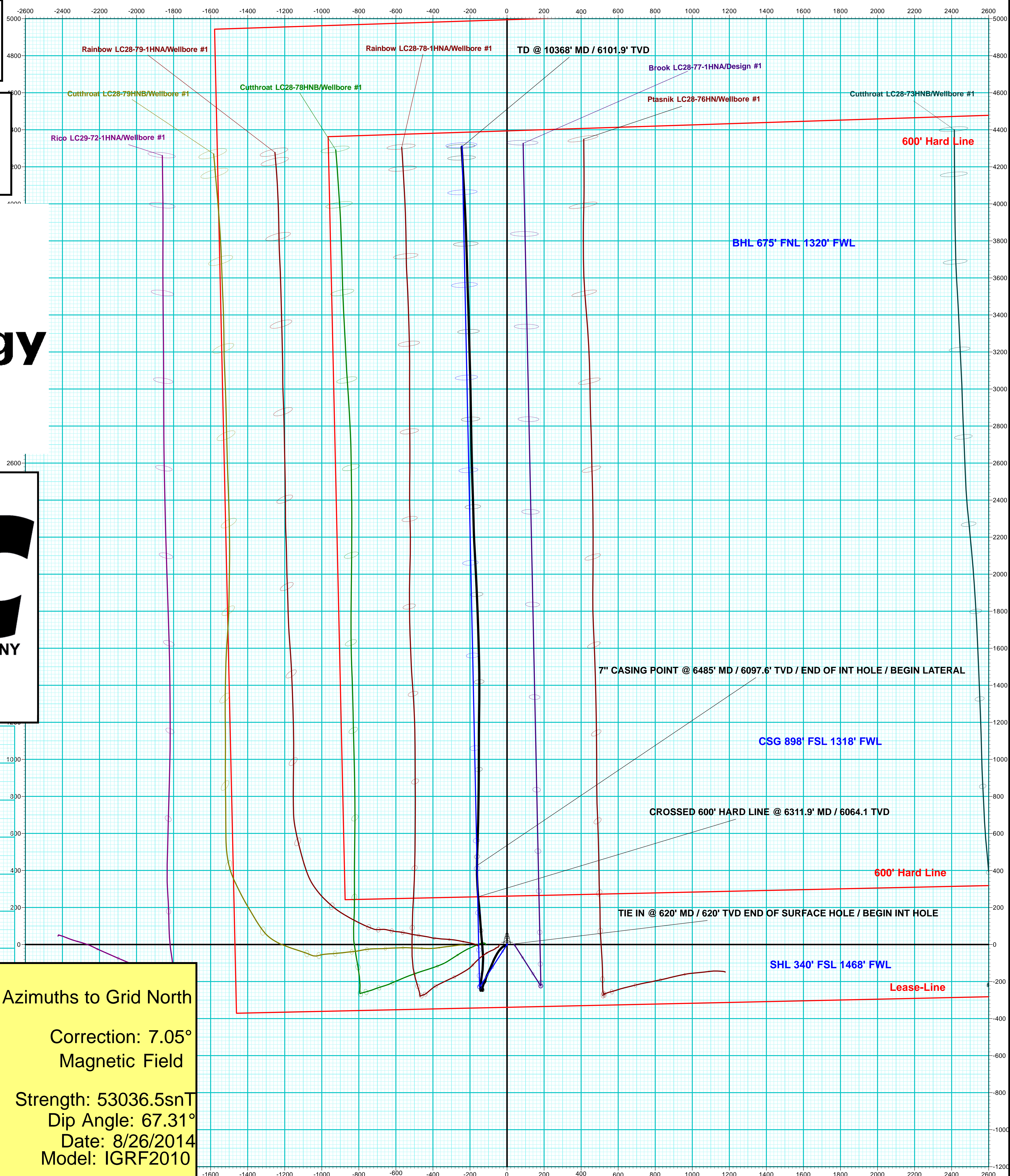
The data and calculations for this survey have been checked by me and conform to the standards and procedures set forth by **The Directional Drilling Company (DDC)**. This report represents a true and correct Directional survey of this well based on the original data obtained at the well site. Wellbore Coordinates are calculated using minimum curvature.

Digitally signed by Larry Wright
DN: cn=Larry Wright, o=The
Directional Drilling Company,
ou=GM of Guidance Services,
email=larryw@directionaldrillers
.com, c=US
Date: 2014.09.12 12:07:45 -05'00'

Larry Wright
MWD General Manager

Company Name: Noble Energy Inc.
Cutthroat LC28-77HNB
Weld County, CO
Rig: H&P #326
Created By: Kris Ray
Date: 9/2/2014

Cutthroat LC28-77HNB
Weld County, CO
Q140642 & RM-140865
Design #1

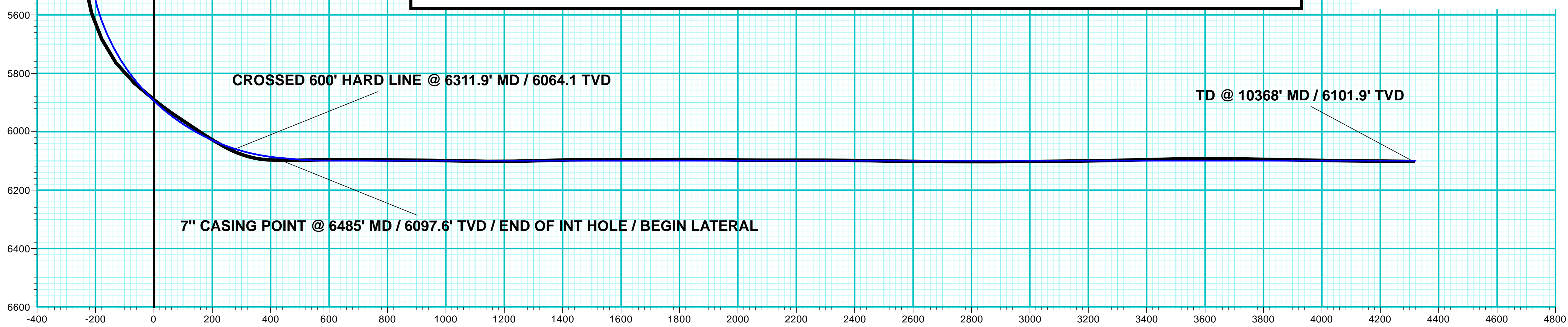
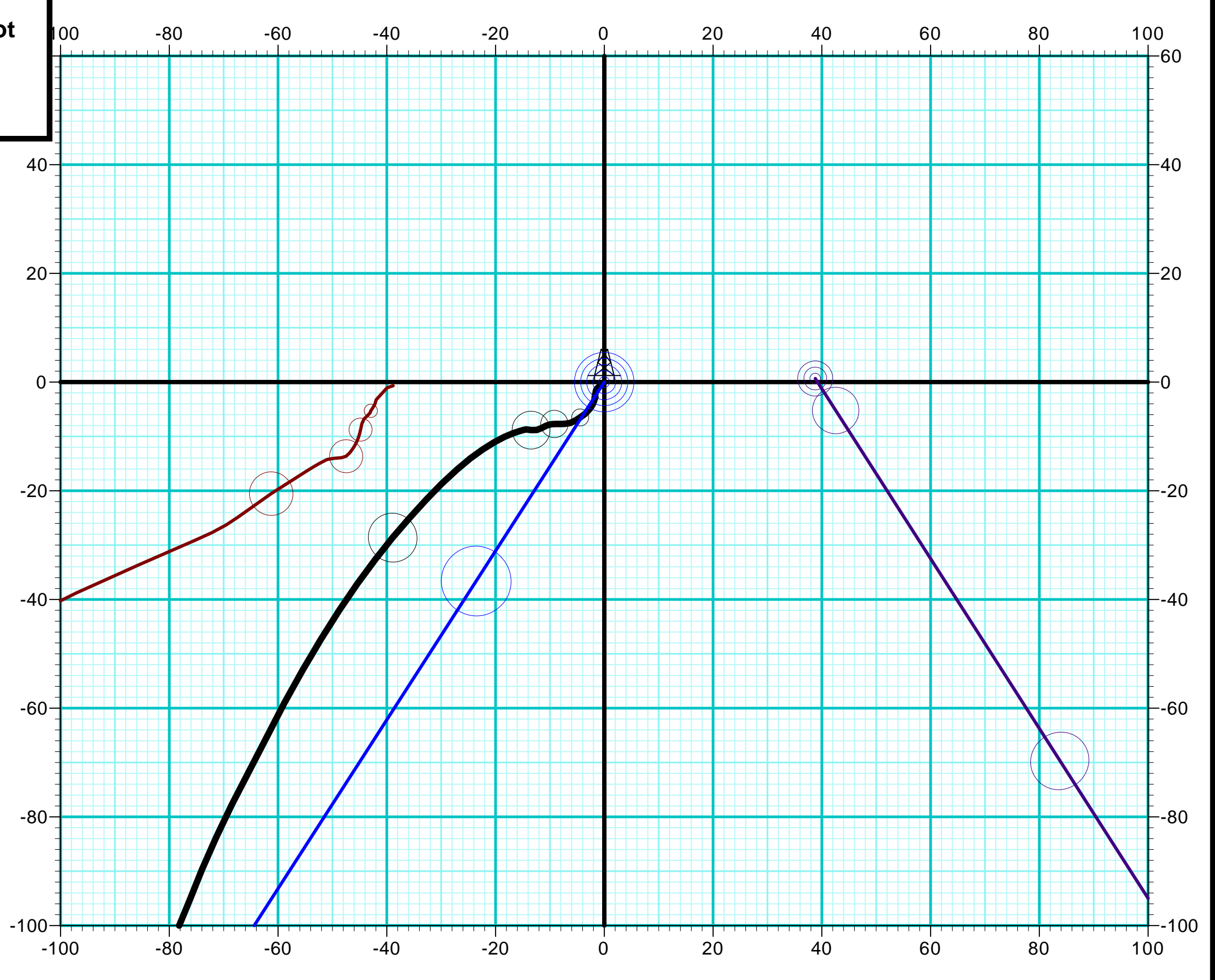


PROJECT DETAILS:		Weld County, CO
Geodetic System:	US State Plane 1983	
Datum:	North American Datum 1983	
Ellipsoid:	GRS 1980	
Zone:	Colorado Northern Zone	
System Datum:	Mean Sea Level	

WELL DETAILS:		Cutthroat LC28-77HNB				
		Ground Level:		4853.0		
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	1506892.45	3419380.12	40° 42' 53.964 N	103° 59' 13.560 W	

ANNOTATIONS									
	TVD	MD	Inc	Azi	+N/-S	+E/-W	V'Sect	Departure	Annotation
	620.0		0.10	207.35	-1.3	-1.4	-1.2	620' MD / 620' TVD	END OF SURFACE HOLE / BEGIN INT HOLE
6064.1	6311.9	65.07	355.32	257.9	-155.7	266.3	835.0	CROSSED 600' HARD LINE @ 6311.9' MD / 6064.1' TVD	
6097.6	6485.0	88.86	0.37	425.9	-162.4	434.4	1002.3	7" CASING POINT @ 6485' MD / 6097.6' TVD / END OF INT HOLE / BEGIN LATERAL	
6101.9	10368.0	89.43	356.68	4306.7	-245.0	4313.6	4885.0	TD @ 10368' MD / 6101.9' TVD	

DESIGN TARGET DETAILS							
Name	TVD	+N-S	+E-W	Northing	Easting	Latitude	Longitude
PBHL Cutthroat LC28-77HNB - plan hits target center	6099.0	4313.8	-242.7	1511206.25	3419137.42	40° 43' 36.624 N	103° 59' 15.756 W



Vertical Section at 356.78° (200 usft/in)