



Noble Energy Inc.

Weld County, CO
Sec 28, T9N, R59W, 6th PM
Rainbow LC28-79-1HNA

Wellbore #1

Design: Wellbore #1 **FINAL**

DDC Survey Report

22 September, 2014



Company:	Noble Energy Inc.	Local Co-ordinate Reference:	Well Rainbow LC28-79-1HNA
Project:	Weld County, CO	TVD Reference:	WELL @ 4884.0usft
Site:	Sec 28, T9N, R59W, 6th PM	MD Reference:	WELL @ 4884.0usft
Well:	Rainbow LC28-79-1HNA	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 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	Rainbow LC28-79-1HNA					
Well Position	+N/-S	0.0 usft	Northing:	1,506,889.89 usft	Latitude:	40° 42' 53.964 N
	+E/-W	0.0 usft	Easting:	3,419,230.44 usft	Longitude:	103° 59' 15.504 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	0.0 usft	Ground Level:	4,854.0 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	7/23/2014	8.04	67.32	53,046

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	345.78	

Survey Program	Date	9/22/2014			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
267.0	610.0	Surface Surveys (Wellbore #1)	Flexi-Shot	VES Flexi-Shot Tool	
647.0	6,534.0	MWD Surveys - Vert/Build (Wellbore #1)	MWD default	MWD - Standard	
6,629.0	10,108.0	MWD Surveys - 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	
267.0	0.60	273.87	267.0	0.1	-1.4	0.4	0.22	0.22	0.00	
TIE IN @ 610' MD / 610' TVD END OF SUR HOLE / BEGIN INT HOLE										
610.0	0.60	200.87	610.0	-1.5	-3.8	-0.5	0.21	0.00	-21.28	
647.0	0.09	331.91	647.0	-1.6	-3.9	-0.6	1.79	-1.38	354.25	
740.0	0.35	251.20	740.0	-1.6	-4.2	-0.6	0.37	0.28	-86.78	
833.0	0.18	287.97	833.0	-1.7	-4.6	-0.5	0.25	-0.18	39.54	
927.0	0.00	41.70	927.0	-1.6	-4.8	-0.4	0.19	-0.19	0.00	
1,018.0	0.44	176.00	1,018.0	-2.0	-4.7	-0.8	0.48	0.48	0.00	

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Well:	Rainbow LC28-79-1HNA	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 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)
1,111.0	0.62	180.04	1,111.0	-2.9	-4.7	-1.6	0.20	0.19	4.34
1,202.0	0.44	170.55	1,202.0	-3.7	-4.7	-2.4	0.22	-0.20	-10.43
1,295.0	0.35	207.28	1,295.0	-4.3	-4.7	-3.0	0.28	-0.10	39.49
1,387.0	0.53	241.91	1,387.0	-4.7	-5.2	-3.3	0.34	0.20	37.64
1,481.0	0.44	240.33	1,481.0	-5.1	-5.9	-3.5	0.10	-0.10	-1.68
1,573.0	2.81	307.13	1,572.9	-3.9	-8.0	-1.8	2.90	2.58	72.61
1,665.0	4.31	299.57	1,664.7	-0.9	-12.8	2.3	1.70	1.63	-8.22
1,757.0	5.45	294.30	1,756.4	2.6	-19.8	7.4	1.33	1.24	-5.73
1,850.0	6.95	285.33	1,848.9	5.9	-29.3	12.9	1.92	1.61	-9.65
1,943.0	8.53	283.05	1,941.0	9.0	-41.4	18.9	1.73	1.70	-2.45
2,035.0	9.94	283.40	2,031.8	12.4	-55.8	25.7	1.53	1.53	0.38
2,128.0	9.85	278.65	2,123.4	15.4	-71.5	32.5	0.88	-0.10	-5.11
2,222.0	9.32	281.64	2,216.1	18.2	-86.9	38.9	0.77	-0.56	3.18
2,316.0	8.44	282.69	2,309.0	21.2	-101.1	45.4	0.95	-0.94	1.12
2,411.0	9.41	279.00	2,402.8	24.0	-115.5	51.6	1.19	1.02	-3.88
2,505.0	8.62	280.41	2,495.7	26.4	-130.1	57.6	0.87	-0.84	1.50
2,600.0	10.20	275.31	2,589.4	28.5	-145.4	63.4	1.88	1.66	-5.37
2,694.0	10.11	274.61	2,681.9	29.9	-161.9	68.8	0.16	-0.10	-0.74
2,789.0	10.11	274.08	2,775.5	31.2	-178.6	74.1	0.10	0.00	-0.56
2,883.0	9.94	271.97	2,868.0	32.1	-194.9	79.0	0.43	-0.18	-2.24
2,978.0	10.99	277.95	2,961.4	33.6	-212.1	84.7	1.59	1.11	6.29
3,072.0	9.67	276.89	3,053.9	35.8	-228.8	90.9	1.42	-1.40	-1.13
3,167.0	6.77	267.93	3,147.9	36.5	-242.3	94.9	3.33	-3.05	-9.43
3,261.0	7.74	287.09	3,241.2	38.2	-253.9	99.4	2.76	1.03	20.38
3,355.0	9.94	281.64	3,334.1	41.7	-267.9	106.2	2.50	2.34	-5.80
3,450.0	11.70	280.06	3,427.4	45.0	-285.4	113.8	1.88	1.85	-1.66
3,544.0	12.84	279.71	3,519.2	48.5	-305.1	121.9	1.22	1.21	-0.37
3,639.0	13.72	278.12	3,611.7	51.8	-326.6	130.5	1.00	0.93	-1.67
3,733.0	12.93	278.30	3,703.2	54.9	-348.1	138.7	0.84	-0.84	0.19
3,828.0	11.34	283.40	3,796.0	58.6	-367.7	147.1	2.02	-1.67	5.37
3,922.0	9.85	282.69	3,888.4	62.5	-384.5	155.1	1.59	-1.59	-0.76
4,017.0	8.53	276.54	3,982.2	65.1	-399.5	161.2	1.73	-1.39	-6.47
4,111.0	8.09	281.82	4,075.2	67.3	-412.9	166.6	0.94	-0.47	5.62
4,205.0	7.30	280.23	4,168.4	69.7	-425.2	172.0	0.87	-0.84	-1.69
4,299.0	6.16	275.14	4,261.7	71.2	-436.1	176.1	1.37	-1.21	-5.41
4,394.0	6.95	274.96	4,356.1	72.1	-446.9	179.7	0.83	0.83	-0.19
4,489.0	8.27	281.64	4,450.3	74.0	-459.3	184.6	1.67	1.39	7.03
4,583.0	8.27	280.06	4,543.3	76.6	-472.6	190.3	0.24	0.00	-1.68
4,678.0	9.23	281.64	4,637.2	79.3	-486.8	196.5	1.04	1.01	1.66
4,772.0	9.94	283.05	4,729.9	82.7	-502.1	203.5	0.80	0.76	1.50
4,867.0	9.85	270.04	4,823.5	84.5	-518.2	209.2	2.35	-0.09	-13.69
4,961.0	7.47	264.59	4,916.4	83.9	-532.3	212.1	2.68	-2.53	-5.80
5,056.0	7.65	267.75	5,010.6	83.1	-544.8	214.4	0.48	0.19	3.33

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Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 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)
5,151.0	6.86	273.55	5,104.8	83.2	-556.8	217.4	1.13	-0.83	6.11
5,245.0	7.74	286.74	5,198.1	85.4	-568.4	222.4	2.01	0.94	14.03
5,313.0	7.91	292.89	5,265.4	88.5	-577.1	227.6	1.26	0.25	9.04
5,339.0	8.35	293.42	5,291.2	90.0	-580.5	229.8	1.72	1.69	2.04
5,434.0	12.93	290.25	5,384.5	96.4	-596.8	240.0	4.86	4.82	-3.34
5,529.0	19.79	295.00	5,475.6	106.9	-621.4	256.3	7.35	7.22	5.00
5,623.0	25.68	296.41	5,562.3	122.7	-654.1	279.6	6.29	6.27	1.50
5,718.0	33.59	298.87	5,644.8	144.6	-695.6	311.0	8.42	8.33	2.59
5,812.0	41.06	302.03	5,719.5	173.5	-744.6	351.1	8.20	7.95	3.36
5,907.0	42.12	310.64	5,790.6	210.9	-795.3	399.8	6.12	1.12	9.06
6,002.0	47.04	315.74	5,858.3	256.5	-843.8	456.0	6.40	5.18	5.37
6,096.0	59.00	325.23	5,914.8	314.6	-891.0	523.8	15.04	12.72	10.10
6,191.0	63.49	340.00	5,960.7	388.3	-928.9	604.6	14.41	4.73	15.55
6,285.0	69.82	344.39	5,997.9	470.4	-955.2	690.7	7.98	6.73	4.67
6,380.0	76.41	346.50	6,025.5	558.4	-978.0	781.5	7.25	6.94	2.22
6,464.0	85.38	349.67	6,038.8	639.4	-995.1	864.3	11.31	10.68	3.77
7" CASING POINT @ 6511' MD / 6042' TVD END INT HOLE / BEGIN LATERAL									
6,511.0	86.91	355.46	6,041.9	685.9	-1,001.2	910.8	12.70	3.25	12.31
6,534.0	87.67	358.28	6,043.0	708.9	-1,002.4	933.4	12.70	3.31	12.28
6,629.0	87.05	359.86	6,047.4	803.7	-1,004.0	1,025.7	1.78	-0.65	1.66
6,723.0	91.01	0.74	6,049.0	897.7	-1,003.5	1,116.7	4.32	4.21	0.94
6,817.0	91.80	0.74	6,046.7	991.7	-1,002.3	1,207.5	0.84	0.84	0.00
6,912.0	89.69	359.69	6,045.5	1,086.7	-1,001.9	1,299.5	2.48	-2.22	-1.11
7,006.0	89.69	358.81	6,046.0	1,180.6	-1,003.1	1,390.9	0.94	0.00	-0.94
7,101.0	89.78	358.11	6,046.4	1,275.6	-1,005.7	1,483.6	0.74	0.09	-0.74
7,195.0	90.31	357.93	6,046.3	1,369.6	-1,008.9	1,575.4	0.60	0.56	-0.19
7,290.0	90.13	357.40	6,046.0	1,464.5	-1,012.8	1,668.4	0.59	-0.19	-0.56
7,384.0	90.48	356.35	6,045.5	1,558.3	-1,017.9	1,760.6	1.18	0.37	-1.12
7,479.0	91.01	355.64	6,044.2	1,653.1	-1,024.6	1,854.1	0.93	0.56	-0.75
7,573.0	90.22	357.58	6,043.2	1,746.9	-1,030.1	1,946.4	2.23	-0.84	2.06
7,668.0	89.87	358.81	6,043.1	1,841.9	-1,033.1	2,039.2	1.35	-0.37	1.29
7,762.0	89.96	357.58	6,043.3	1,935.8	-1,036.1	2,131.0	1.31	0.10	-1.31
7,857.0	89.16	358.98	6,044.0	2,030.8	-1,038.9	2,223.8	1.70	-0.84	1.47
7,951.0	88.72	358.63	6,045.8	2,124.7	-1,040.9	2,315.3	0.60	-0.47	-0.37
8,046.0	88.37	357.58	6,048.2	2,219.6	-1,044.0	2,408.1	1.16	-0.37	-1.11
8,140.0	89.08	359.86	6,050.3	2,313.6	-1,046.1	2,499.7	2.54	0.76	2.43
8,234.0	89.16	359.51	6,051.7	2,407.6	-1,046.6	2,590.9	0.38	0.09	-0.37
8,329.0	89.60	359.34	6,052.7	2,502.6	-1,047.6	2,683.2	0.50	0.46	-0.18
8,423.0	89.52	358.46	6,053.4	2,596.5	-1,049.4	2,774.8	0.94	-0.09	-0.94
8,517.0	90.92	358.98	6,053.1	2,690.5	-1,051.5	2,866.4	1.59	1.49	0.55
8,612.0	91.36	358.98	6,051.2	2,785.5	-1,053.2	2,958.9	0.46	0.46	0.00
8,706.0	90.92	358.28	6,049.3	2,879.4	-1,055.4	3,050.5	0.88	-0.47	-0.74
8,801.0	90.66	357.40	6,048.0	2,974.4	-1,059.0	3,143.4	0.97	-0.27	-0.93
8,895.0	91.45	0.21	6,046.3	3,068.3	-1,061.0	3,234.9	3.10	0.84	2.99

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Well:	Rainbow LC28-79-1HNA	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 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	90.31	358.81	6,044.8	3,163.3	-1,061.8	3,327.2	1.90	-1.20	-1.47	
9,085.0	91.28	358.46	6,043.5	3,258.3	-1,064.1	3,419.8	1.09	1.02	-0.37	
9,179.0	90.13	358.98	6,042.4	3,352.2	-1,066.2	3,511.4	1.34	-1.22	0.55	
9,274.0	90.13	358.11	6,042.1	3,447.2	-1,068.6	3,604.1	0.92	0.00	-0.92	
9,368.0	87.76	358.63	6,043.9	3,541.1	-1,071.2	3,695.8	2.58	-2.52	0.55	
9,463.0	87.58	357.75	6,047.7	3,636.0	-1,074.2	3,788.5	0.94	-0.19	-0.93	
9,558.0	87.05	357.23	6,052.2	3,730.8	-1,078.4	3,881.4	0.78	-0.56	-0.55	
9,652.0	90.31	359.34	6,054.3	3,824.7	-1,081.2	3,973.1	4.13	3.47	2.24	
9,747.0	90.48	358.81	6,053.7	3,919.7	-1,082.7	4,065.6	0.59	0.18	-0.56	
9,841.0	90.48	357.58	6,052.9	4,013.7	-1,085.7	4,157.4	1.31	0.00	-1.31	
9,936.0	90.92	356.87	6,051.7	4,108.5	-1,090.3	4,250.5	0.88	0.46	-0.75	
10,031.0	90.48	355.29	6,050.6	4,203.3	-1,096.8	4,343.9	1.73	-0.46	-1.66	
10,057.0	90.48	355.29	6,050.4	4,229.2	-1,098.9	4,369.6	0.00	0.00	0.00	
TD @ 10108' MD/ 6050' TVD										
10,108.0	90.48	355.29	6,049.9	4,280.0	-1,103.1	4,419.9	0.00	0.00	0.00	

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
610.0	610.0	-1.5	-3.8	TIE IN @ 610' MD / 610' TVD END OF SUR HOLE / BEGIN INT HOLE	
6,511.0	6,041.9	685.9	-1,001.2	7" CASING POINT @ 6511' MD / 6042' TVD END INT HOLE / BEGIN LATERAL	
10,108.0	6,049.9	4,280.0	-1,103.1	TD @ 10108' MD/ 6050' TVD	

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

Noble Energy Inc.
Company

RM-140716
Job Number

8/06/14
Date

Sec 28,T9N,R59W,6th PM
Lease

Rainbow LC28-79-1HNA
Well Name

Weld, CO
County & State

API: 05-123-38853

Surveyed from a depth of: 610 feet to 10108 feet MD

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: 2014.08.08 12:43:58 -05'00'

Larry Wright
MWD General Manager

Company Name: Noble Energy Inc.
Rainbow LC28-79-1HNA
Weld County, CO
Rig: H&P #326
Created By: Kris Ray
Date: 8/04/2014

Rainbow LC28-79-1HNA
Weld County, CO
Q140646 & RM-140716
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: Rainbow LC28-79-1HNA						
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	1506889.89	3419230.45	40° 42' 53.964 N	103° 59' 15.504 W	

T

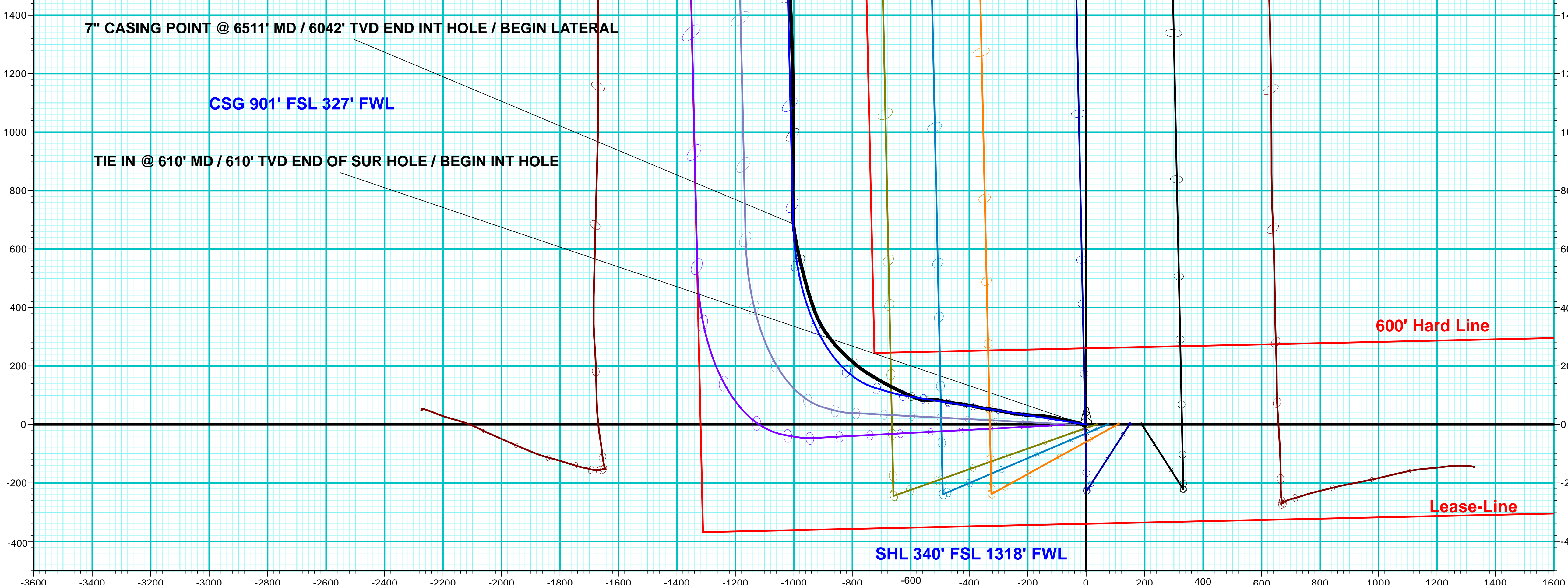
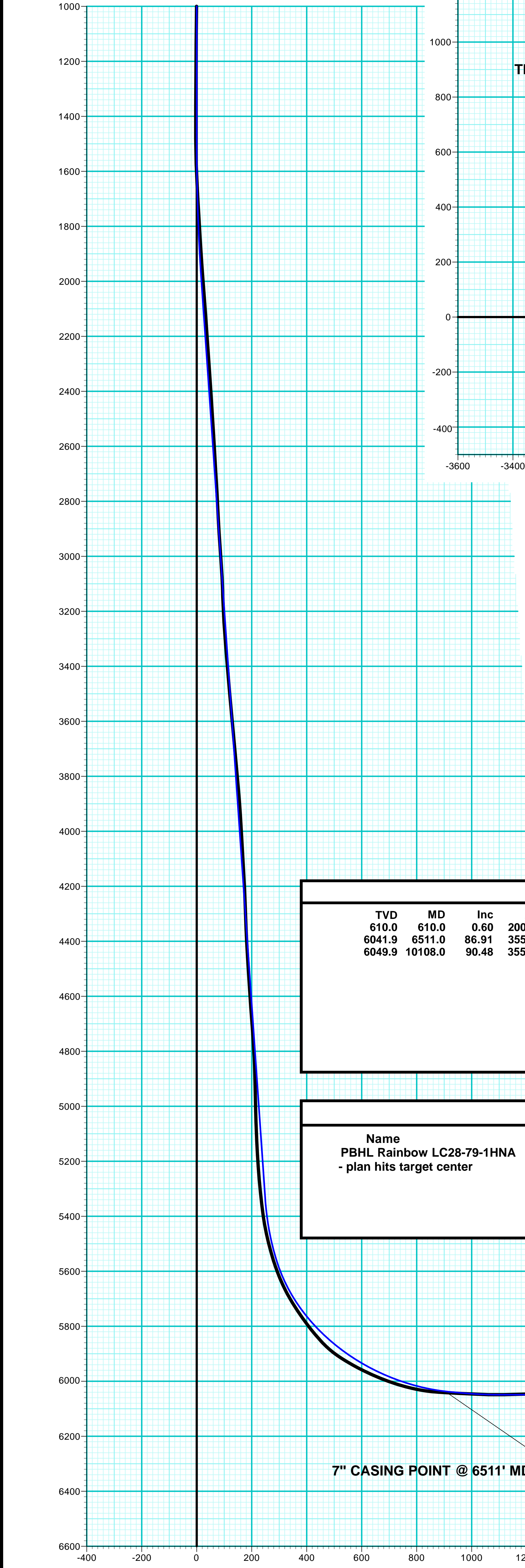
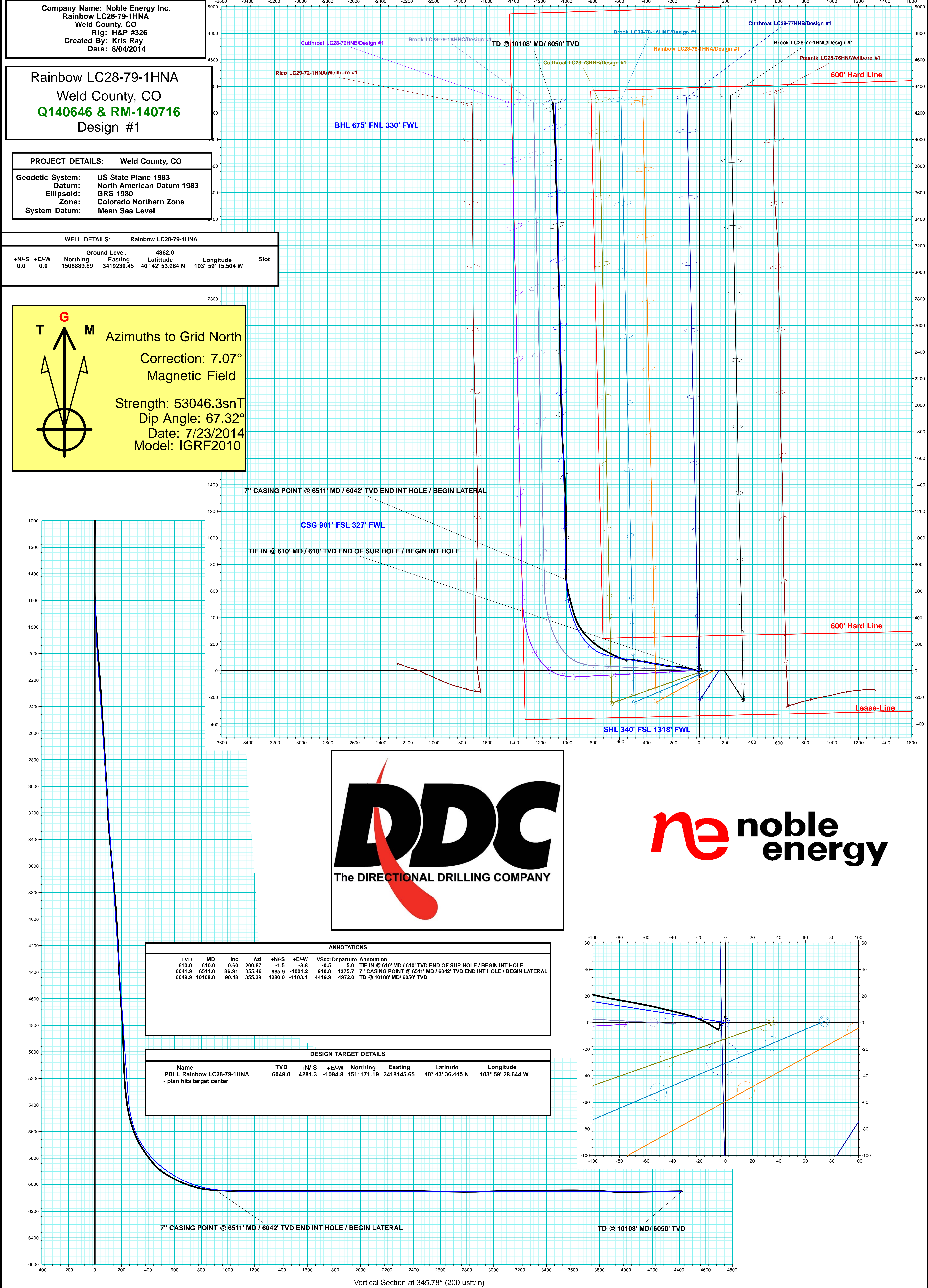
G

M

Azimuths to Grid North

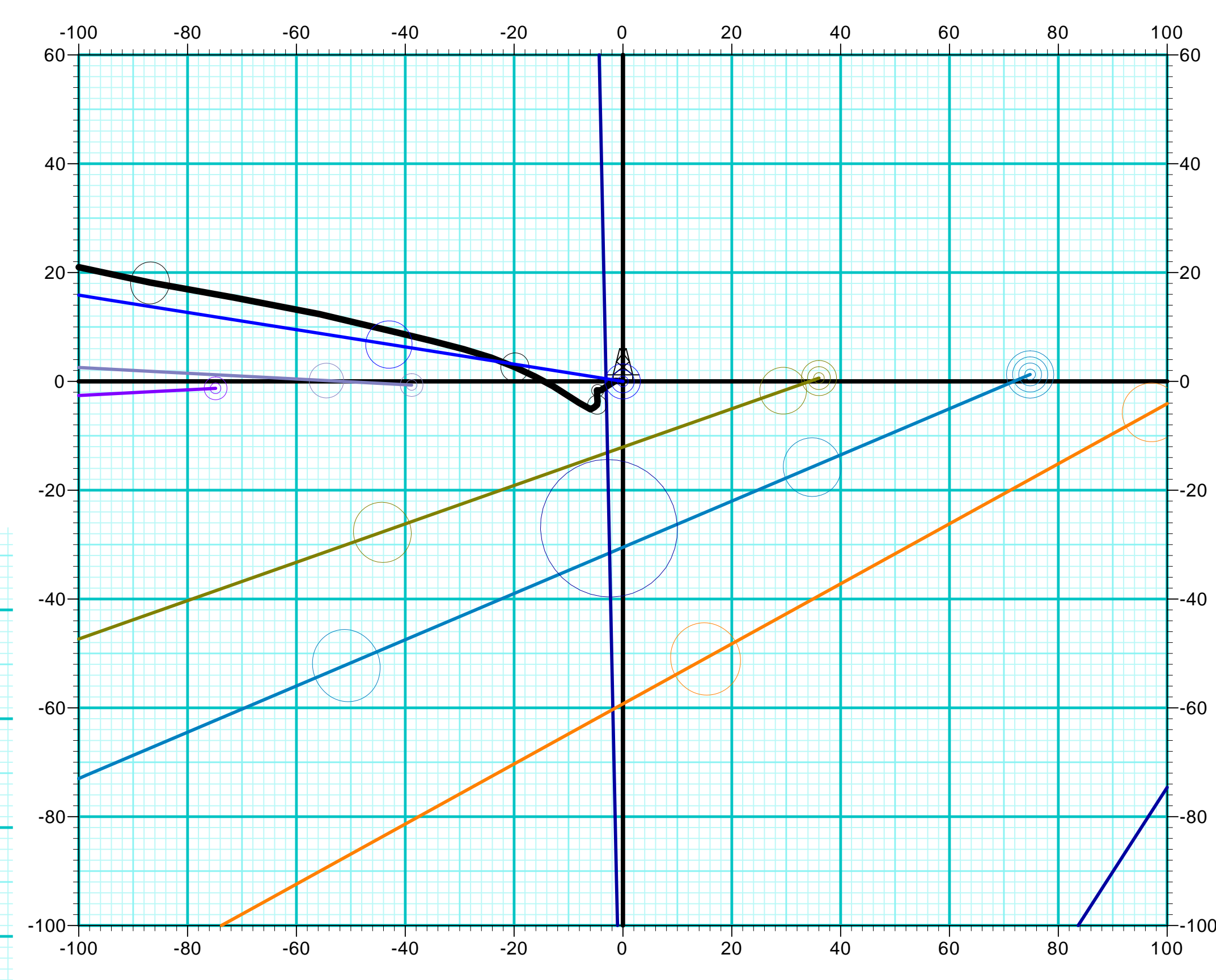
Correction: 7.07°
Magnetic Field

Strength: 53046.3snT
Dip Angle: 67.32°
Date: 7/23/2014
Model: IGRF2010



ANNOTATIONS									
TVD	MD	Inc	Azi	+N/-S	+E/-W	VSect	Departure	Annotation	
610.0	610.0	0.60	200.87	-1.5	-3.8	-0.5	5.0	TIE IN @ 610' MD / 610' TVD END OF SUR HOLE / BEGIN INT HOLE	
6041.9	6511.0	86.91	355.46	685.9	-1001.2	910.8	1375.7	7\"/>	
6049.9	10108.0	90.48	355.29	4280.0	-1103.1	4419.9	4972.0	TD @ 10108' MD/ 6050' TVD	

DESIGN TARGET DETAILS							
Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
PBHL Rainbow LC28-79-1HNA - plan hits target center	6049.0	4281.3	-1084.8	1511171.19	3418145.65	40° 43' 36.445 N	103° 59' 28.644 W



Vertical Section at 345.78° (200 usft/in)