



Noble Energy Inc.

**Weld County, CO
Sec 28, T9N, R59W, 6th PM
Cutthroat LC28-78HNB**

Wellbore #1

Design: Wellbore #1 FINAL

DDC Survey Report

22 September, 2014



Company:	Noble Energy Inc.	Local Co-ordinate Reference:	Well Cutthroat LC28-78HNB
Project:	Weld County, CO	TVD Reference:	WELL @ 4884.0usft (H&P #326)
Site:	Sec 28, T9N, R59W, 6th PM	MD Reference:	WELL @ 4884.0usft (H&P #326)
Well:	Cutthroat LC28-78HNB	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	Cutthroat LC28-78HNB					
Well Position	+N/-S	0.0 usft	Northing:	1,506,890.51 usft	Latitude:	40° 42' 53.964 N
	+E/-W	0.0 usft	Easting:	3,419,266.48 usft	Longitude:	103° 59' 15.036 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	8/12/2014	8.04	67.32	53,041

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	349.56	

Survey Program	Date	9/22/2014			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
370.0	620.0	SURFACE (Wellbore #1)	Flexi-Shot	VES Flexi-Shot Tool	
648.0	6,547.0	MWD SURVEY - VERT / BUILD (Wellbore)	MWD default	MWD - Standard	
6,624.0	10,424.0	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	
370.0	0.30	324.86	370.0	0.8	-0.6	0.9	0.08	0.08	0.00	
TIE IN @ 620' MD / 620' TVD										
620.0	0.30	290.66	620.0	1.6	-1.5	1.8	0.07	0.00	-13.68	
648.0	0.53	320.65	648.0	1.7	-1.7	2.0	1.10	0.82	107.11	
741.0	0.44	325.40	741.0	2.3	-2.2	2.7	0.11	-0.10	5.11	
834.0	0.26	356.16	834.0	2.8	-2.4	3.2	0.27	-0.19	33.08	
927.0	0.26	359.85	927.0	3.2	-2.4	3.6	0.02	0.00	3.97	
1,019.0	0.35	347.90	1,019.0	3.7	-2.5	4.1	0.12	0.10	-12.99	

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Well:	Cutthroat LC28-78HNB	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	0.26	337.53	1,111.0	4.2	-2.6	4.6	0.11	-0.10	-11.27
1,203.0	0.35	350.01	1,203.0	4.7	-2.7	5.1	0.12	0.10	13.57
1,296.0	0.44	356.16	1,296.0	5.3	-2.8	5.7	0.11	0.10	6.61
1,388.0	0.62	350.71	1,388.0	6.1	-2.9	6.6	0.20	0.20	-5.92
1,481.0	0.70	315.73	1,481.0	7.0	-3.4	7.5	0.43	0.09	-37.61
1,574.0	0.79	307.12	1,574.0	7.8	-4.3	8.5	0.15	0.10	-9.26
1,666.0	0.79	294.29	1,666.0	8.5	-5.4	9.3	0.19	0.00	-13.95
1,757.0	0.97	299.03	1,756.9	9.1	-6.6	10.2	0.21	0.20	5.21
1,851.0	3.52	277.59	1,850.9	9.9	-10.2	11.6	2.81	2.71	-22.81
1,944.0	4.92	271.43	1,943.6	10.4	-17.0	13.3	1.58	1.51	-6.62
2,036.0	6.86	254.91	2,035.1	9.0	-26.2	13.6	2.78	2.11	-17.96
2,128.0	7.74	243.84	2,126.4	4.9	-37.1	11.5	1.80	0.96	-12.03
2,223.0	10.02	247.00	2,220.2	-1.2	-50.5	8.0	2.45	2.40	3.33
2,317.0	12.31	245.07	2,312.5	-8.6	-67.1	3.7	2.47	2.44	-2.05
2,411.0	14.95	246.83	2,403.8	-17.6	-87.3	-1.5	2.84	2.81	1.87
2,506.0	14.86	242.08	2,495.6	-28.1	-109.3	-7.9	1.29	-0.09	-5.00
2,600.0	16.09	238.04	2,586.2	-40.7	-131.1	-16.3	1.74	1.31	-4.30
2,695.0	16.27	237.51	2,677.4	-54.8	-153.4	-26.1	0.25	0.19	-0.56
2,790.0	16.18	237.68	2,768.7	-69.0	-175.9	-36.0	0.11	-0.09	0.18
2,884.0	15.83	236.81	2,859.0	-83.0	-197.7	-45.8	0.45	-0.37	-0.93
2,978.0	15.30	241.73	2,949.6	-95.9	-219.3	-54.6	1.51	-0.56	5.23
3,073.0	14.25	247.70	3,041.4	-106.3	-241.2	-60.8	1.95	-1.11	6.28
3,167.0	13.45	249.46	3,132.7	-114.5	-262.1	-65.1	0.96	-0.85	1.87
3,261.0	13.98	250.52	3,224.0	-122.1	-283.0	-68.8	0.62	0.56	1.13
3,356.0	15.83	252.98	3,315.8	-129.8	-306.3	-72.1	2.06	1.95	2.59
3,451.0	16.44	252.10	3,407.1	-137.7	-331.4	-75.4	0.69	0.64	-0.93
3,545.0	17.50	251.04	3,497.0	-146.4	-357.5	-79.2	1.17	1.13	-1.13
3,640.0	18.55	250.34	3,587.3	-156.1	-385.2	-83.7	1.13	1.11	-0.74
3,734.0	19.43	249.99	3,676.2	-166.5	-414.0	-88.7	0.94	0.94	-0.37
3,828.0	17.85	246.30	3,765.3	-177.6	-441.9	-94.6	2.10	-1.68	-3.93
3,923.0	14.25	248.06	3,856.6	-187.8	-466.0	-100.3	3.82	-3.79	1.85
4,017.0	13.19	246.83	3,947.9	-196.4	-486.6	-105.0	1.17	-1.13	-1.31
4,111.0	10.82	246.30	4,039.8	-204.2	-504.6	-109.3	2.52	-2.52	-0.56
4,206.0	9.50	245.42	4,133.3	-211.0	-519.9	-113.3	1.40	-1.39	-0.93
4,300.0	9.06	252.80	4,226.1	-216.4	-534.0	-116.1	1.35	-0.47	7.85
4,395.0	9.41	252.45	4,319.9	-221.0	-548.6	-117.9	0.37	0.37	-0.37
4,489.0	9.50	251.40	4,412.6	-225.8	-563.2	-120.0	0.21	0.10	-1.12
4,584.0	9.58	253.86	4,506.3	-230.5	-578.3	-121.9	0.44	0.08	2.59
4,679.0	9.94	248.76	4,599.9	-235.6	-593.5	-124.2	0.99	0.38	-5.37
4,773.0	9.32	249.11	4,692.6	-241.3	-608.2	-127.1	0.66	-0.66	0.37
4,867.0	8.71	253.15	4,785.4	-246.1	-622.1	-129.3	0.93	-0.65	4.30
4,962.0	7.30	253.86	4,879.5	-249.8	-634.8	-130.7	1.49	-1.48	0.75
5,057.0	8.79	253.33	4,973.5	-253.6	-647.5	-132.0	1.57	1.57	-0.56

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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)
5,152.0	6.86	254.91	5,067.7	-257.1	-660.0	-133.3	2.04	-2.03	1.66
5,246.0	6.07	257.55	5,161.1	-259.7	-670.2	-133.9	0.90	-0.84	2.81
5,341.0	1.76	238.56	5,255.8	-261.5	-676.4	-134.6	4.68	-4.54	-19.99
5,407.0	1.67	226.61	5,321.8	-262.7	-677.9	-135.5	0.56	-0.14	-18.11
5,434.0	1.49	222.22	5,348.8	-263.2	-678.5	-135.9	0.80	-0.67	-16.26
5,529.0	4.13	335.95	5,443.7	-261.0	-680.7	-133.4	5.18	2.78	119.72
5,623.0	13.37	7.24	5,536.5	-247.1	-680.7	-119.7	10.71	9.83	33.29
5,717.0	24.71	358.97	5,625.3	-216.6	-679.7	-89.8	12.37	12.06	-8.80
5,812.0	32.01	352.65	5,708.8	-171.7	-683.3	-45.0	8.30	7.68	-6.65
5,907.0	35.96	351.24	5,787.6	-119.1	-690.7	8.0	4.24	4.16	-1.48
6,002.0	48.36	349.13	5,857.9	-56.5	-701.7	71.6	13.14	13.05	-2.22
6,096.0	52.76	353.35	5,917.6	15.3	-712.7	144.1	5.82	4.68	4.49
6,191.0	56.81	3.90	5,972.5	92.7	-714.4	220.6	10.02	4.26	11.11
6,285.0	60.59	1.43	6,021.3	172.9	-710.7	298.8	4.61	4.02	-2.63
CROSSED SECTION LINE @ 6366' MD / 6057' TVD									
6,365.6	66.41	359.93	6,057.2	245.0	-709.8	369.5	7.41	7.22	-1.86
6,380.0	67.45	359.68	6,062.9	258.2	-709.9	382.6	7.41	7.23	-1.76
6,474.0	77.65	359.85	6,091.0	347.8	-710.2	470.7	10.85	10.85	0.18
6,547.0	83.10	0.38	6,103.2	419.7	-710.1	541.4	7.50	7.47	0.73
7" CASING POINT @ 6594' MD / 6109' TVD									
6,594.0	83.80	0.59	6,108.6	466.4	-709.7	587.3	1.55	1.48	0.45
6,624.0	84.24	0.73	6,111.7	496.2	-709.4	616.6	1.55	1.48	0.45
6,719.0	89.43	0.91	6,117.0	591.0	-708.0	709.6	5.47	5.46	0.19
6,814.0	90.22	0.20	6,117.3	686.0	-707.1	802.8	1.12	0.83	-0.75
6,908.0	90.04	359.33	6,117.0	780.0	-707.5	895.3	0.95	-0.19	-0.93
7,003.0	90.57	359.15	6,116.5	875.0	-708.7	989.0	0.59	0.56	-0.19
7,097.0	90.22	358.45	6,115.9	969.0	-710.7	1,081.7	0.83	-0.37	-0.74
7,192.0	90.40	358.62	6,115.4	1,064.0	-713.1	1,175.6	0.26	0.19	0.18
7,286.0	90.13	358.62	6,114.9	1,157.9	-715.4	1,268.4	0.29	-0.29	0.00
7,381.0	89.96	359.15	6,114.9	1,252.9	-717.2	1,362.1	0.59	-0.18	0.56
7,476.0	89.43	358.27	6,115.4	1,347.9	-719.4	1,455.9	1.08	-0.56	-0.93
7,570.0	88.81	358.10	6,116.8	1,441.8	-722.3	1,548.9	0.68	-0.66	-0.18
7,665.0	88.29	357.74	6,119.2	1,536.7	-725.8	1,642.8	0.67	-0.55	-0.38
7,759.0	90.13	359.85	6,120.5	1,630.7	-727.8	1,735.6	2.98	1.96	2.24
7,854.0	89.60	359.50	6,120.7	1,725.7	-728.3	1,829.1	0.67	-0.56	-0.37
7,948.0	90.13	0.91	6,121.0	1,819.7	-728.0	1,921.5	1.60	0.56	1.50
8,043.0	90.04	0.38	6,120.8	1,914.7	-726.9	2,014.7	0.57	-0.09	-0.56
8,137.0	90.75	0.73	6,120.2	2,008.7	-726.0	2,107.0	0.84	0.76	0.37
8,232.0	90.66	0.38	6,119.0	2,103.7	-725.1	2,200.2	0.38	-0.09	-0.37
8,327.0	90.13	0.38	6,118.4	2,198.7	-724.4	2,293.5	0.56	-0.56	0.00
8,421.0	89.87	359.85	6,118.4	2,292.7	-724.3	2,386.0	0.63	-0.28	-0.56
8,516.0	90.13	359.68	6,118.4	2,387.7	-724.6	2,479.4	0.33	0.27	-0.18
8,611.0	90.84	358.97	6,117.5	2,482.7	-725.8	2,573.1	1.06	0.75	-0.75
8,705.0	92.15	359.33	6,115.1	2,576.6	-727.2	2,665.7	1.45	1.39	0.38

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Well:	Cutthroat LC28-78HNB	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)	
8,800.0	90.57	358.80	6,112.8	2,671.6	-728.7	2,759.4	1.75	-1.66	-0.56	
8,894.0	89.16	357.22	6,113.1	2,765.5	-732.0	2,852.4	2.25	-1.50	-1.68	
8,989.0	89.16	357.04	6,114.5	2,860.4	-736.7	2,946.5	0.19	0.00	-0.19	
9,084.0	88.90	356.34	6,116.1	2,955.2	-742.2	3,040.8	0.79	-0.27	-0.74	
9,178.0	88.64	355.81	6,118.1	3,049.0	-748.6	3,134.1	0.63	-0.28	-0.56	
9,273.0	89.78	357.39	6,119.4	3,143.8	-754.3	3,228.4	2.05	1.20	1.66	
9,368.0	89.34	357.22	6,120.1	3,238.7	-758.7	3,322.5	0.50	-0.46	-0.18	
9,462.0	89.16	356.69	6,121.4	3,332.5	-763.7	3,415.8	0.60	-0.19	-0.56	
9,557.0	89.34	357.39	6,122.6	3,427.4	-768.6	3,509.9	0.76	0.19	0.74	
9,651.0	89.69	357.74	6,123.4	3,521.3	-772.6	3,603.0	0.53	0.37	0.37	
9,746.0	90.92	358.97	6,122.9	3,616.3	-775.4	3,696.9	1.83	1.29	1.29	
9,840.0	90.57	358.27	6,121.7	3,710.2	-777.6	3,789.7	0.83	-0.37	-0.74	
9,935.0	90.48	357.92	6,120.8	3,805.2	-780.8	3,883.7	0.38	-0.09	-0.37	
10,029.0	90.31	357.74	6,120.1	3,899.1	-784.3	3,976.7	0.26	-0.18	-0.19	
10,124.0	89.69	355.81	6,120.1	3,993.9	-789.7	4,070.9	2.13	-0.65	-2.03	
10,219.0	90.22	356.51	6,120.2	4,088.7	-796.0	4,165.3	0.92	0.56	0.74	
10,314.0	89.87	355.99	6,120.1	4,183.5	-802.3	4,259.6	0.66	-0.37	-0.55	
10,373.0	89.16	355.28	6,120.6	4,242.4	-806.8	4,318.3	1.70	-1.20	-1.20	
TD @ 10424' MD / 6121' TVD										
10,424.0	89.16	355.28	6,121.4	4,293.2	-810.9	4,369.1	0.00	0.00	0.00	

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
620.0	620.0	1.6	-1.5	TIE IN @ 620' MD / 620' TVD
6,365.6	6,057.2	245.0	-709.8	CROSSED SECTION LINE @ 6366' MD / 6057' TVD
6,594.0	6,108.6	466.4	-709.7	7" CASING POINT @ 6594' MD / 6109' TVD
10,424.0	6,121.4	4,293.2	-810.9	TD @ 10424' MD / 6121' TVD

Checked By: _____ Approved By: _____ Date: _____



Survey Certification Sheet

Noble Energy Inc
Company

RM-140796
Job Number

8/28/14
Date

Sec28,T9N,R59W 6th PM
Lease

Cutthroat LC28-78HNB
Well Name

Weld, CO
County & State

API: 05-123-38846

Surveyed from a depth of: 620 feet to 10424 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.

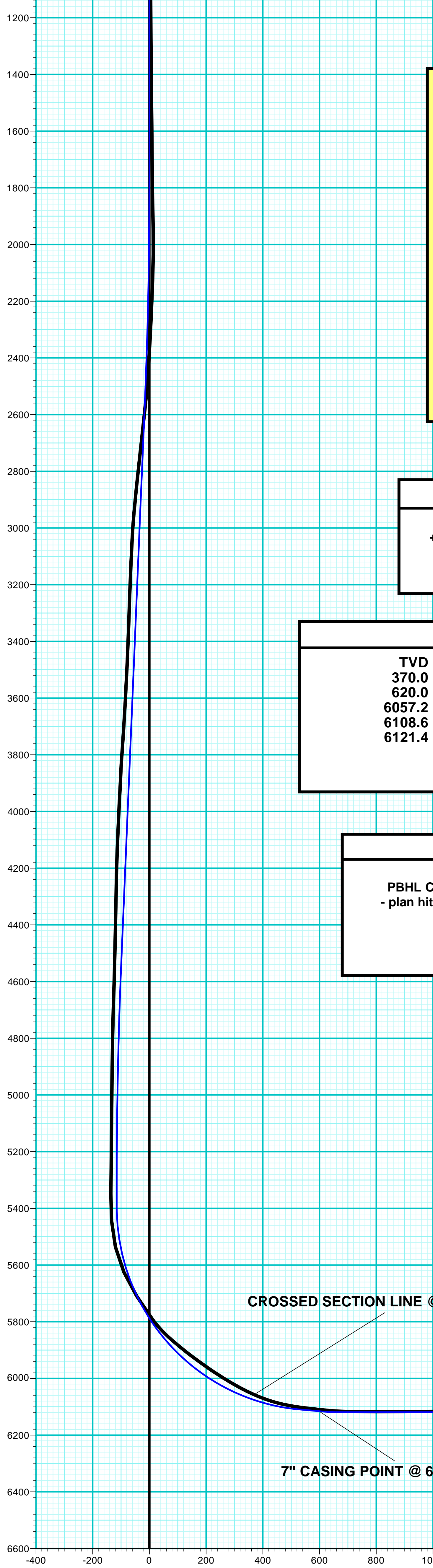
Digitally signed by Larry Wright
DN: cn=Larry Wright, o=The Directional
Drilling Company, ou=GM of Guidance
Services,
email=larryw@directionaldrillers.com,
c=US
Date: 2014.08.28 15:04:32 -05'00'

Larry Wright
MWD General Manager

Company Name: Noble Energy Inc.
Cutthroat LC28-78HNB
Weld County, CO
Rig: H&P #326
Created By: Kris Ray
Date: 8/20/2014

Cutthroat LC28-78HNB
Weld County, CO
Q140643 & RM-140796
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



T

G

M

Azimuths to Grid North

Correction: 7.06°

Magnetic Field

Strength: 53040.5snT

Dip Angle: 67.32°

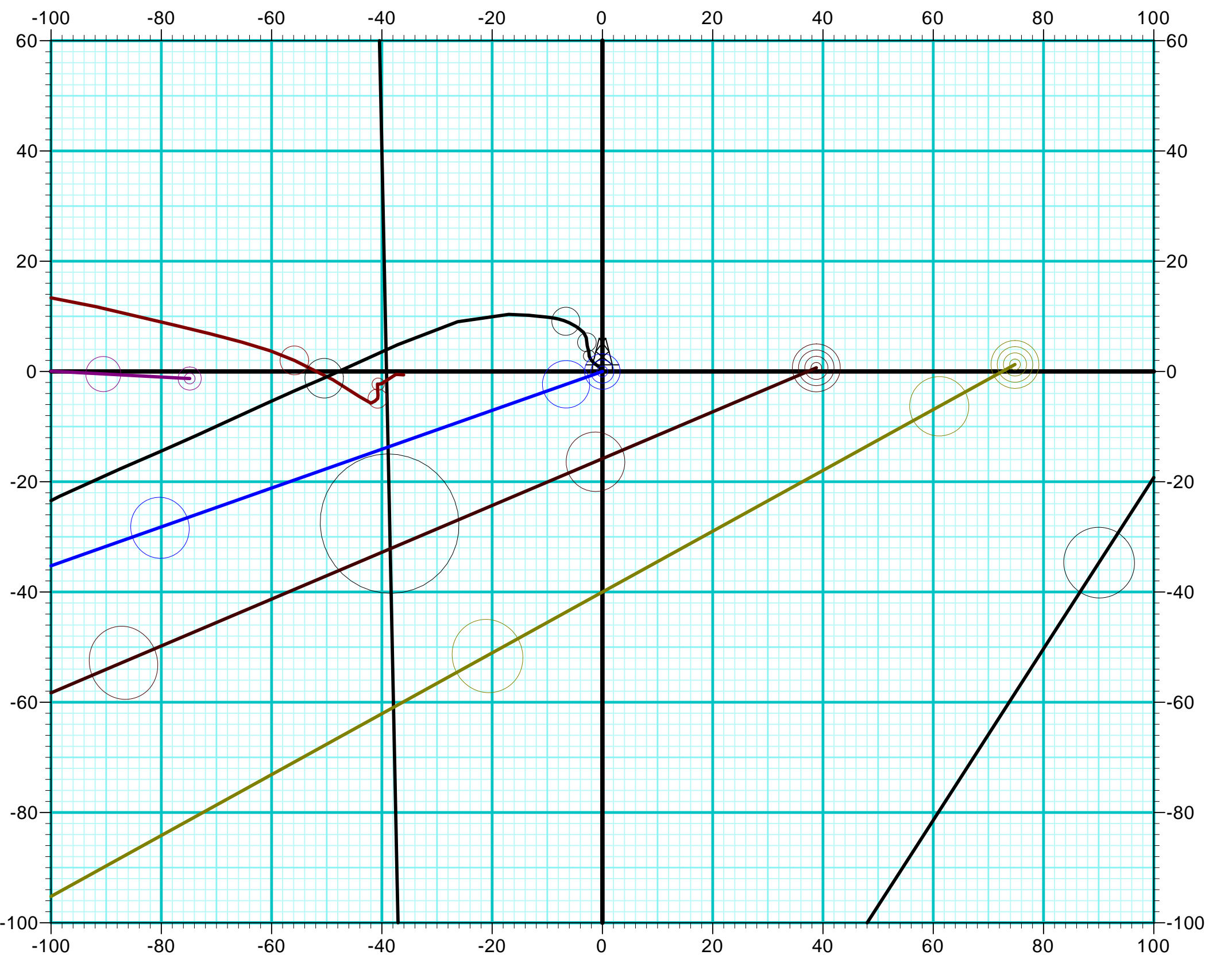
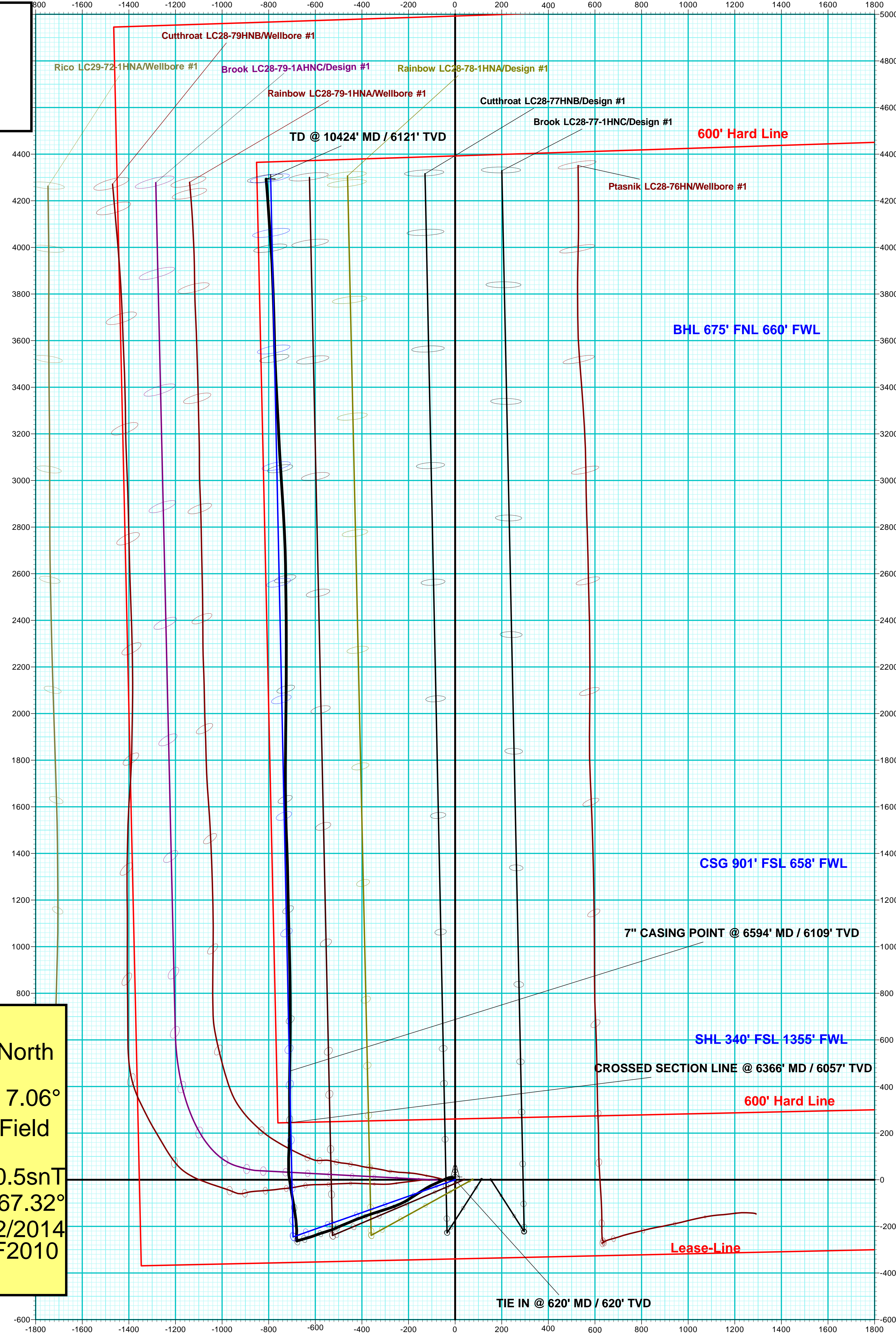
Date: 8/12/2014

Model: IGRF2010

WELL DETAILS: Cutthroat LC28-78HNB						
Ground Level: 4862.0						
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	1506890.51	3419266.48	40° 42' 53.964 N	103° 59' 15.036 W	

ANNOTATIONS							
TVD	MD	Inc	Azi	+N/-S	+E/-W	VSectDeparture	Annotation
370.0	370.0	0.30	324.86	0.8	-0.6	0.9	1.0 First Survey @ 370' MD / 370' TVD
620.0	620.0	0.30	290.66	1.6	-1.5	1.8	2.3 TIE IN @ 620' MD / 620' TVD
6057.2	6365.6	66.41	359.93	245.0	-709.8	369.5	1256.4 CROSSED SECTION LINE @ 6366' MD / 6057' TVD
6108.6	6594.0	83.80	0.59	466.4	-709.7	587.3	1477.5 7" CASING POINT @ 6594' MD / 6109' TVD
6121.4	10424.0	89.16	355.28	4293.2	-810.9	4369.1	5306.9 TD @ 10424' MD / 6121' TVD

DESIGN TARGET DETAILS						
Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude
PBHL Cutthroat LC28-78HNB - plan hits target center	6119.0	4293.6	-791.2	1511184.11	3418475.28	40° 43' 36.517 N
						103° 59' 24.360 W



Vertical Section at 349.56° (200 usft/in)