



## **Noble Energy Inc.**

**Weld County, CO  
Sec 10, T8N, R59W, 6th PM  
Castor LG10-72HN**

**Wellbore #1**

**Survey: MWD FINAL**

## **DDC Survey Report**

**09 January, 2013**



<b>Company:</b>	Noble Energy Inc.	<b>Local Co-ordinate Reference:</b>	Well Castor LG10-72HN
<b>Project:</b>	Weld County, CO	<b>TVD Reference:</b>	WELL @ 4796.0usft (H&P #326)
<b>Site:</b>	Sec 10, T8N, R59W, 6th PM	<b>MD Reference:</b>	WELL @ 4796.0usft (H&P #326)
<b>Well:</b>	Castor LG10-72HN	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<b>Database:</b>	EDM 5000.1 Single User Db

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 10, T8N, R59W, 6th PM			
Site Position:		Northing:	1,490,984.99 usft	Latitude:	40° 40' 15.220 N
From:	Map	Easting:	3,428,659.80 usft	Longitude:	103° 57' 16.670 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	1.00 °

Well	Castor LG10-72HN					
Well Position	+N-S	0.0 usft	Northing:	1,490,984.99 usft	Latitude:	40° 40' 15.220 N
	+E-W	0.0 usft	Easting:	3,428,659.80 usft	Longitude:	103° 57' 16.670 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	4,766.0 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	9/25/2012	8.27	67.36	53,222

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	357.38	

Survey Program		Date	1/9/2013		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
1,502.0	10,235.0	MWD (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)
TIE IN @ 1460' MD / 1460' TVD									
1,460.0	0.00	0.00	1,460.0	0.0	0.0	0.0	0.00	0.00	0.00
1,502.0	0.20	118.90	1,502.0	0.0	0.1	0.0	0.48	0.48	0.00
1,782.0	0.90	231.00	1,782.0	-1.7	-1.2	-1.6	0.35	0.25	40.04
1,876.0	2.80	215.00	1,875.9	-4.0	-3.1	-3.9	2.08	2.02	-17.02
1,970.0	5.40	199.00	1,969.7	-10.1	-5.9	-9.8	3.00	2.77	-17.02
2,062.0	8.10	195.30	2,061.0	-20.4	-9.0	-20.0	2.97	2.93	-4.02
2,155.0	10.20	197.80	2,152.9	-34.6	-13.2	-33.9	2.30	2.26	2.69
2,249.0	12.40	197.60	2,245.0	-52.1	-18.8	-51.2	2.34	2.34	-0.21
2,341.0	14.70	200.60	2,334.5	-72.5	-25.9	-71.2	2.61	2.50	3.26
2,434.0	15.80	202.30	2,424.2	-95.2	-34.9	-93.5	1.28	1.18	1.83

<b>Company:</b>	Noble Energy Inc.	<b>Local Co-ordinate Reference:</b>	Well Castor LG10-72HN
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<b>Site:</b>	Sec 10, T8N, R59W, 6th PM	<b>MD Reference:</b>	WELL @ 4796.0usft (H&P #326)
<b>Well:</b>	Castor LG10-72HN	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<b>Database:</b>	EDM 5000.1 Single User Db

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)
2,526.0	15.50	201.70	2,512.8	-118.2	-44.2	-116.1	0.37	-0.33	-0.65
2,619.0	15.30	201.60	2,602.4	-141.2	-53.3	-138.6	0.22	-0.22	-0.11
2,713.0	15.10	200.50	2,693.1	-164.2	-62.1	-161.2	0.37	-0.21	-1.17
2,807.0	13.90	200.00	2,784.2	-186.3	-70.3	-182.9	1.28	-1.28	-0.53
2,902.0	13.60	198.70	2,876.4	-207.6	-77.8	-203.8	0.45	-0.32	-1.37
2,997.0	13.70	198.20	2,968.7	-228.8	-84.9	-224.7	0.16	0.11	-0.53
3,092.0	15.30	197.00	3,060.7	-251.5	-92.0	-247.0	1.71	1.68	-1.26
3,187.0	15.80	198.30	3,152.2	-275.8	-99.8	-270.9	0.64	0.53	1.37
3,282.0	16.40	196.10	3,243.5	-300.9	-107.6	-295.7	0.90	0.63	-2.32
3,377.0	16.90	189.40	3,334.5	-327.5	-113.5	-321.9	2.09	0.53	-7.05
3,472.0	14.90	195.10	3,425.9	-352.9	-119.0	-347.1	2.67	-2.11	6.00
3,567.0	12.00	200.30	3,518.3	-373.9	-125.6	-367.8	3.30	-3.05	5.47
3,662.0	9.40	202.10	3,611.6	-390.4	-131.9	-383.9	2.76	-2.74	1.89
3,757.0	6.30	201.90	3,705.7	-402.4	-136.8	-395.7	3.26	-3.26	-0.21
3,852.0	5.70	197.30	3,800.2	-411.8	-140.1	-404.9	0.81	-0.63	-4.84
3,947.0	5.20	188.10	3,894.8	-420.5	-142.1	-413.6	1.06	-0.53	-9.68
4,042.0	5.50	198.10	3,989.4	-429.1	-144.2	-422.1	1.03	0.32	10.53
4,136.0	4.70	199.10	4,083.0	-437.0	-146.8	-429.9	0.86	-0.85	1.06
4,231.0	4.00	200.70	4,177.7	-443.8	-149.3	-436.5	0.75	-0.74	1.68
4,326.0	3.30	197.70	4,272.5	-449.5	-151.3	-442.1	0.76	-0.74	-3.16
4,421.0	2.40	157.60	4,367.4	-454.0	-151.3	-446.6	2.24	-0.95	-42.21
4,516.0	0.20	347.40	4,462.4	-455.6	-150.6	-448.3	2.73	-2.32	-179.16
4,611.0	1.30	340.00	4,557.4	-454.5	-151.0	-447.1	1.16	1.16	-7.79
4,706.0	1.70	307.50	4,652.4	-452.6	-152.5	-445.1	0.97	0.42	-34.21
4,801.0	0.70	263.80	4,747.3	-451.8	-154.2	-444.3	1.36	-1.05	-46.00
4,896.0	0.40	237.70	4,842.3	-452.0	-155.1	-444.5	0.40	-0.32	-27.47
4,991.0	0.40	146.90	4,937.3	-452.5	-155.2	-444.9	0.60	0.00	-95.58
5,086.0	0.20	105.90	5,032.3	-452.8	-154.8	-445.3	0.30	-0.21	-43.16
5,181.0	0.10	96.20	5,127.3	-452.9	-154.6	-445.3	0.11	-0.11	-10.21
5,276.0	0.10	50.00	5,222.3	-452.8	-154.4	-445.3	0.08	0.00	-48.63
5,371.0	8.40	351.20	5,317.0	-445.9	-155.4	-438.3	8.79	8.74	-61.89
5,466.0	12.70	356.60	5,410.4	-428.6	-157.1	-421.0	4.64	4.53	5.68
5,561.0	17.60	6.20	5,502.0	-403.9	-156.2	-396.3	5.78	5.16	10.11
5,656.0	25.00	359.20	5,590.5	-369.5	-154.9	-362.0	8.22	7.79	-7.37
5,751.0	32.20	356.90	5,673.9	-324.1	-156.6	-316.6	7.67	7.58	-2.42
5,846.0	38.10	355.20	5,751.5	-269.5	-160.4	-261.9	6.29	6.21	-1.79
5,941.0	45.30	2.00	5,822.4	-206.5	-161.7	-198.9	8.94	7.58	7.16
5,986.0	49.40	3.30	5,852.9	-173.4	-160.1	-165.9	9.36	9.11	2.89
6,036.0	54.60	2.60	5,883.7	-134.1	-158.1	-126.7	10.46	10.40	-1.40
6,131.0	65.00	2.60	5,931.4	-52.2	-154.4	-45.1	10.95	10.95	0.00
6,226.0	76.50	2.50	5,962.7	37.3	-150.4	44.1	12.11	12.11	-0.11
6,266.0	81.10	2.80	5,970.4	76.5	-148.6	83.2	11.52	11.50	0.75

CROSSED HARD LINE @ 6290' MD / 5973' TVD

<b>Company:</b>	Noble Energy Inc.	<b>Local Co-ordinate Reference:</b>	Well Castor LG10-72HN
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<b>Well:</b>	Castor LG10-72HN	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<b>Database:</b>	EDM 5000.1 Single User Db

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)
6,290.0	84.50	2.23	5,973.4	100.2	-147.5	106.9	14.38	14.18	-2.38
6,321.0	88.90	1.50	5,975.2	131.2	-146.5	137.7	14.38	14.18	-2.35
6,455.0	89.30	0.50	5,977.3	265.1	-144.2	271.4	0.80	0.30	-0.75
6,550.0	90.90	2.30	5,977.2	360.1	-141.9	366.2	2.54	1.68	1.89
6,645.0	90.10	0.90	5,976.3	455.0	-139.2	460.9	1.70	-0.84	-1.47
6,740.0	90.90	1.90	5,975.5	550.0	-136.9	555.7	1.35	0.84	1.05
6,835.0	90.40	359.30	5,974.4	645.0	-135.9	650.5	2.79	-0.53	-2.74
6,930.0	90.20	357.40	5,973.9	739.9	-138.7	745.5	2.01	-0.21	-2.00
7,025.0	90.50	357.60	5,973.4	834.9	-142.8	840.5	0.38	0.32	0.21
7,120.0	91.00	356.50	5,972.1	929.7	-147.7	935.5	1.27	0.53	-1.16
7,215.0	90.80	356.40	5,970.6	1,024.5	-153.6	1,030.5	0.24	-0.21	-0.11
7,310.0	91.20	355.80	5,969.0	1,119.3	-160.0	1,125.4	0.76	0.42	-0.63
7,405.0	89.20	358.70	5,968.6	1,214.2	-164.6	1,220.4	3.71	-2.11	3.05
7,500.0	91.20	358.70	5,968.3	1,309.1	-166.7	1,315.4	2.11	2.11	0.00
7,595.0	90.20	359.70	5,967.1	1,404.1	-168.1	1,410.3	1.49	-1.05	1.05
7,690.0	89.90	359.60	5,967.1	1,499.1	-168.6	1,505.3	0.33	-0.32	-0.11
7,785.0	90.10	359.10	5,967.1	1,594.1	-169.7	1,600.2	0.57	0.21	-0.53
7,880.0	89.80	359.50	5,967.1	1,689.1	-170.9	1,695.1	0.53	-0.32	0.42
7,975.0	90.90	359.40	5,966.6	1,784.1	-171.8	1,790.1	1.16	1.16	-0.11
8,070.0	88.90	357.90	5,966.7	1,879.1	-174.0	1,885.0	2.63	-2.11	-1.58
8,165.0	90.60	358.30	5,967.1	1,974.0	-177.2	1,980.0	1.84	1.79	0.42
8,260.0	89.00	357.70	5,967.5	2,068.9	-180.5	2,075.0	1.80	-1.68	-0.63
8,354.0	93.10	359.50	5,965.7	2,162.9	-182.8	2,169.0	4.76	4.36	1.91
8,450.0	93.10	358.60	5,960.6	2,258.7	-184.4	2,264.8	0.94	0.00	-0.94
8,544.0	92.90	0.40	5,955.6	2,352.6	-185.2	2,358.6	1.92	-0.21	1.91
8,639.0	93.90	1.60	5,950.0	2,447.4	-183.5	2,453.2	1.64	1.05	1.26
8,734.0	90.90	359.10	5,946.0	2,542.3	-183.0	2,548.0	4.11	-3.16	-2.63
8,829.0	88.40	357.80	5,946.6	2,637.2	-185.5	2,643.0	2.97	-2.63	-1.37
8,924.0	89.00	358.10	5,948.8	2,732.2	-188.9	2,737.9	0.71	0.63	0.32
9,019.0	89.60	357.60	5,949.9	2,827.1	-192.5	2,832.9	0.82	0.63	-0.53
9,114.0	90.10	357.40	5,950.2	2,922.0	-196.6	2,927.9	0.57	0.53	-0.21
9,209.0	90.40	357.10	5,949.8	3,016.9	-201.2	3,022.9	0.45	0.32	-0.32
9,304.0	88.70	359.80	5,950.5	3,111.8	-203.8	3,117.9	3.36	-1.79	2.84
9,399.0	89.50	358.90	5,952.0	3,206.8	-204.8	3,212.8	1.27	0.84	-0.95
9,494.0	90.60	359.50	5,951.9	3,301.8	-206.2	3,307.8	1.32	1.16	0.63
9,589.0	89.40	2.20	5,951.9	3,396.8	-204.8	3,402.6	3.11	-1.26	2.84
9,684.0	90.70	2.20	5,951.8	3,491.7	-201.1	3,497.3	1.37	1.37	0.00
9,779.0	88.50	1.40	5,952.5	3,586.7	-198.1	3,592.0	2.46	-2.32	-0.84
9,874.0	89.10	1.80	5,954.5	3,681.6	-195.5	3,686.7	0.76	0.63	0.42
9,969.0	90.00	2.00	5,955.2	3,776.5	-192.3	3,781.4	0.97	0.95	0.21
10,064.0	90.30	2.00	5,955.0	3,871.5	-189.0	3,876.1	0.32	0.32	0.00
10,159.0	91.00	0.80	5,953.9	3,966.4	-186.7	3,970.8	1.46	0.74	-1.26
10,190.0	91.10	1.40	5,953.3	3,997.4	-186.1	4,001.8	1.96	0.32	1.94

<b>Company:</b>	Noble Energy Inc.	<b>Local Co-ordinate Reference:</b>	Well Castor LG10-72HN
<b>Project:</b>	Weld County, CO	<b>TVD Reference:</b>	WELL @ 4796.0usft (H&P #326)
<b>Site:</b>	Sec 10, T8N, R59W, 6th PM	<b>MD Reference:</b>	WELL @ 4796.0usft (H&P #326)
<b>Well:</b>	Castor LG10-72HN	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Wellbore #1	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Wellbore #1	<b>Database:</b>	EDM 5000.1 Single User Db

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)	
TD @ 10235' MD / 5953' TVD										
10,235.0	91.10	1.40	5,952.5	4,042.4	-185.0	4,046.6	0.00	0.00	0.00	

Survey Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
1,460.0	1,460.0	0.0	0.0	TIE IN @ 1460' MD / 1460' TVD	
6,290.0	5,973.4	100.2	-147.5	CROSSED HARD LINE @ 6290' MD / 5973' TVD	
10,235.0	5,952.5	4,042.4	-185.0	TD @ 10235' MD / 5953' TVD	

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

Noble Energy  
Company

RM-12757  
Job Number

10/23/2012  
Date

Sec10,T8N,R59W,6thM  
Lease

Castor LG10-72HN  
Well Name

Weld,CO  
County & State

Surveyed from a depth of: 1460 feet to 10235 feet MD

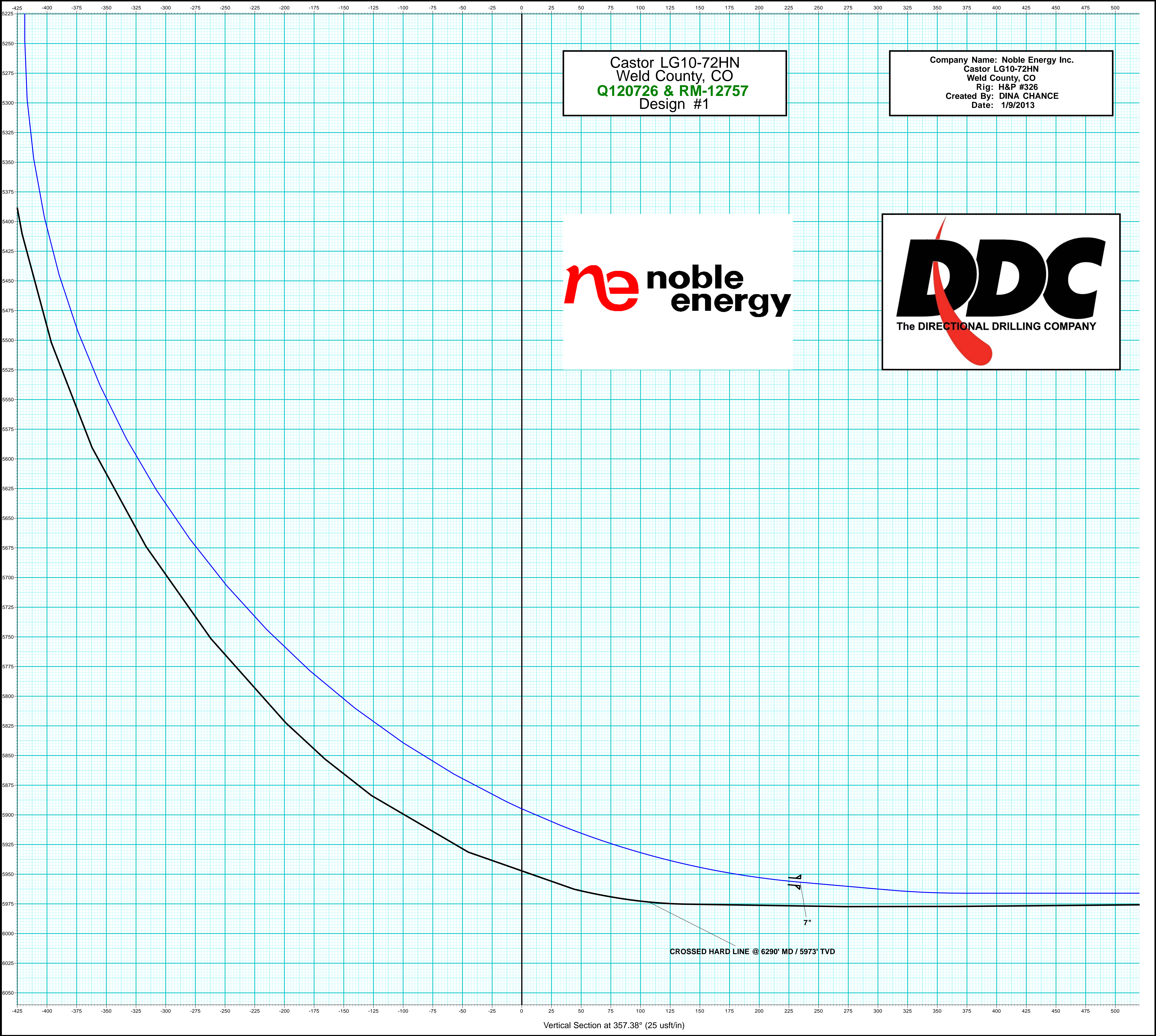
Type of Survey: MWD

Directional Supervisor/Surveyor: Worth Barham

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.

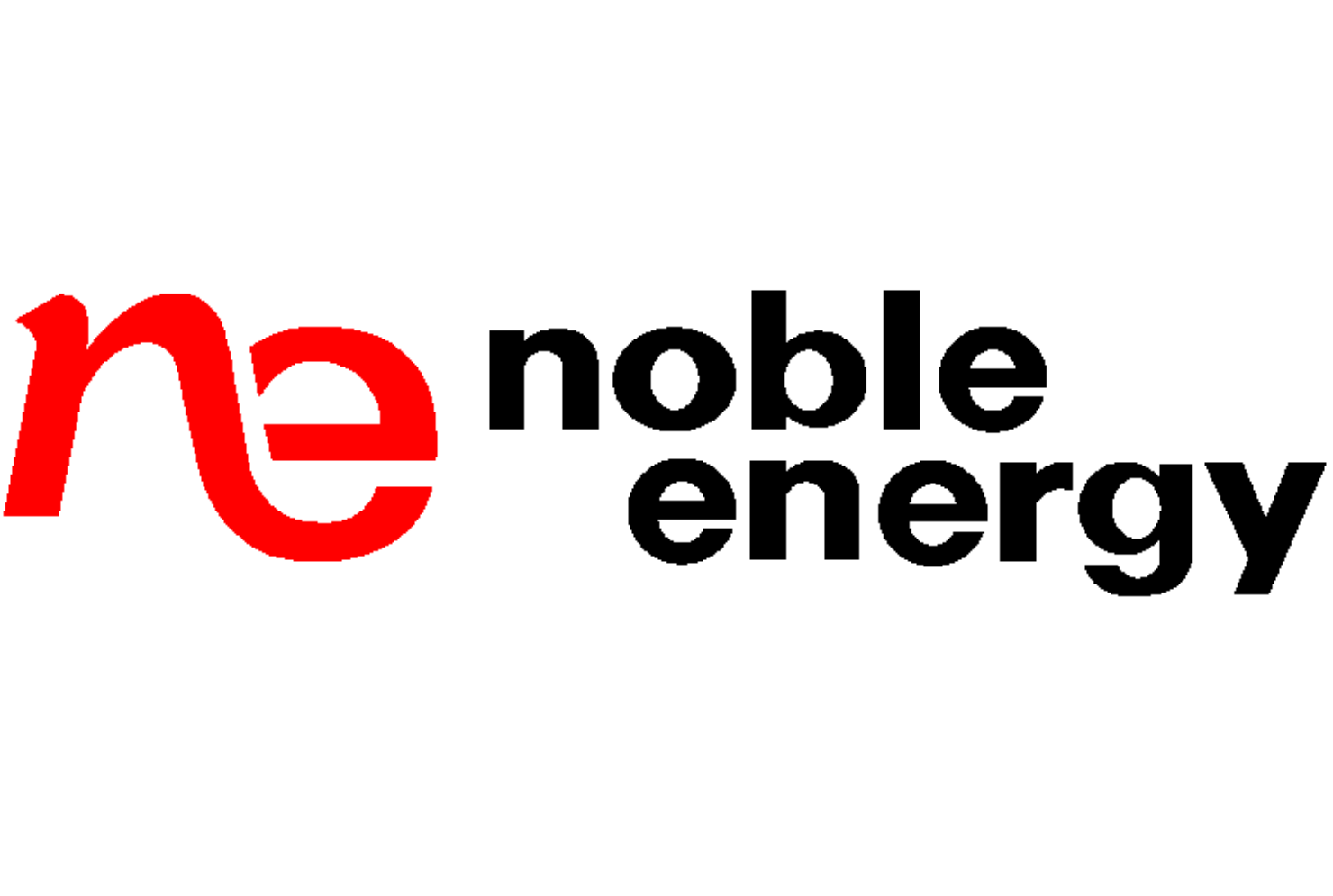
Digitally signed by Larry Wright  
DN: cn=Larry Wright, o=The Directional  
Drilling Company, ou=GM of Guidance  
Services,  
email=larryw@directionaldrillers.com,  
c=US  
Date: 2012.10.25 15:51:35 -05'00'

Larry Wright  
MWD General Manager



Castor LG10-72HN  
Weld County, CO  
**Q120726 & RM-12757**  
Design #1

Company Name: Noble Energy Inc.  
Castor LG10-72HN  
Weld County, CO  
Rig: H&P #326  
Created By: DINA CHANCE  
Date: 1/9/2013



CROSSED HARD LINE @ 6290' MD / 5973' TVD

Vertical Section at 357.38° (25 usft/in)



Company Name: Noble Energy Inc.  
Castor LG10-72HN  
Weld County, CO  
Rig: H&P #326  
Created By: Dina Chance  
Date: 1/9/2013

Castor LG10-72HN  
Weld County, CO  
Q120726 & RM-12757  
Design #1

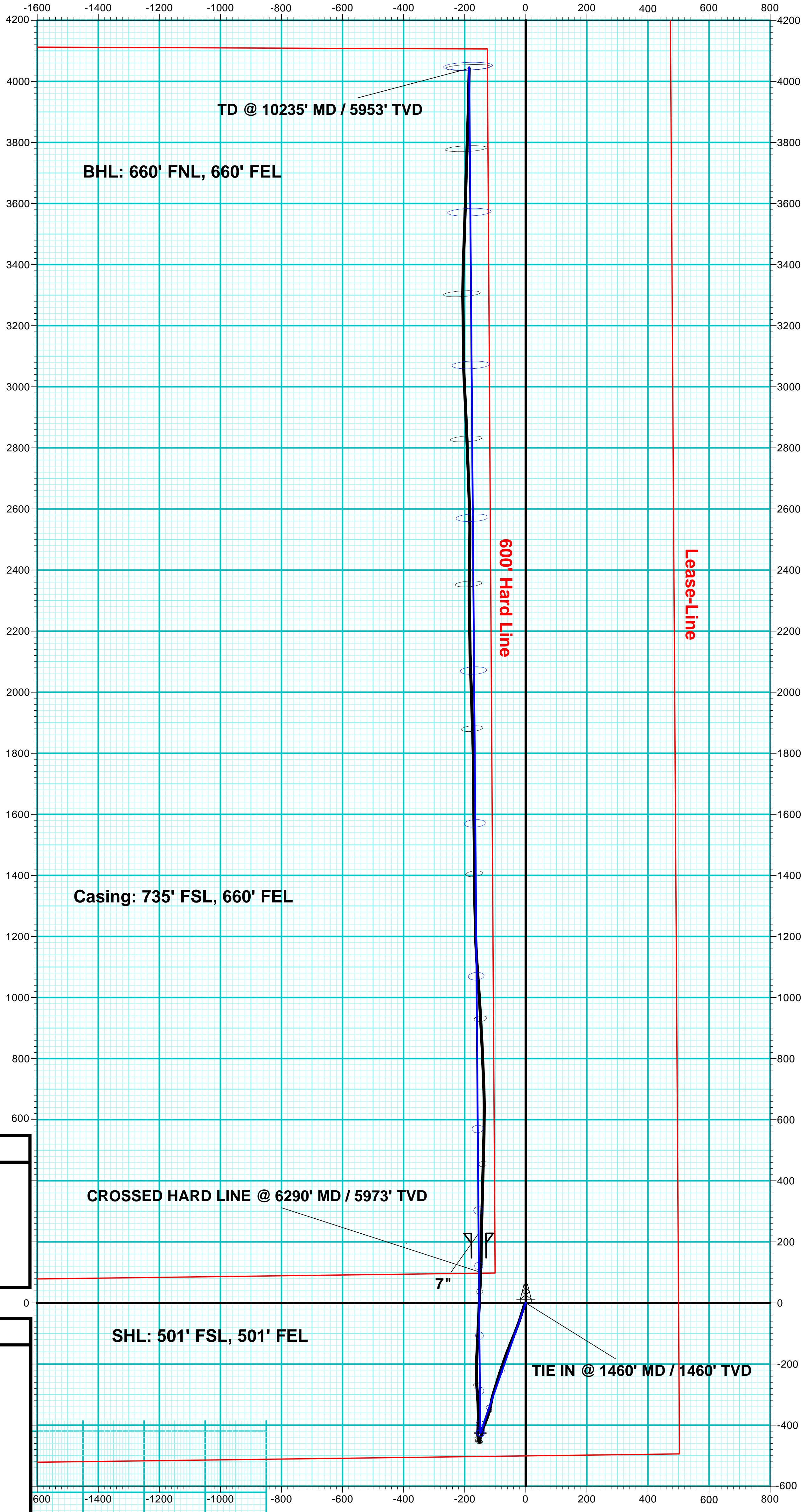
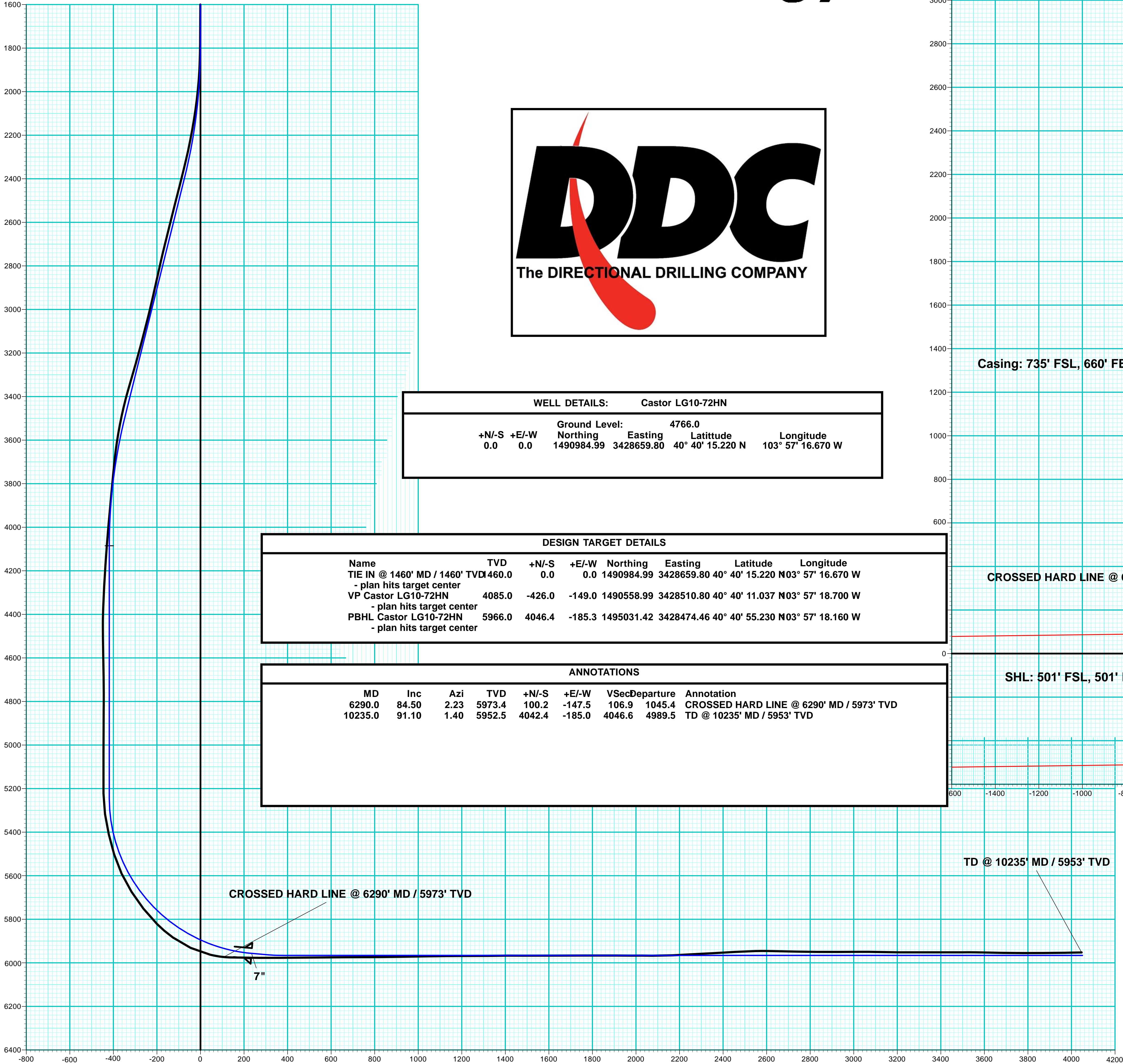
PROJECT DETAILS:	Weld County, CO
Geodetic System:	US State Plane 1983
Datum:	North American Datum 1983
Ellipsoid:	GRS 1980
Zone:	Colorado Northern Zone
System Datum:	Mean Sea Level



WELL DETAILS:		Castor LG10-72HN				
		Ground Level:		4766.0		
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	
0.0	0.0	1490984.99	3428659.80	40° 40' 15.220 N	103° 57' 16.670 W	

DESIGN TARGET DETAILS							
Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
TIE IN @ 1460' MD / 1460' TVD	1460.0	0.0	0.0	1490984.99	3428659.80	40° 40' 15.220 N	103° 57' 16.670 W
- plan hits target center							
VP Castor LG10-72HN	4085.0	-426.0	-149.0	1490558.99	3428510.80	40° 40' 11.037 N	103° 57' 18.700 W
- plan hits target center							
PBHL Castor LG10-72HN	5966.0	4046.4	-185.3	1495031.42	3428474.46	40° 40' 55.230 N	103° 57' 18.160 W
- plan hits target center							

ANNOTATIONS									
MD	Inc	Azi	TVD	+N/-S	+E/-W	VSec	Departure	Annotation	
6290.0	84.50	2.23	5973.4	100.2	-147.5	106.9	1045.4	CROSSED HARD LINE @ 6290' MD / 5973' TVD	
10235.0	91.10	1.40	5952.5	4042.4	-185.0	4046.6	4989.5	TD @ 10235' MD / 5953' TVD	



T

G

M

Azimuths to Grid North

Magnetic North: 7.27°

Magnetic Field

Strength: 53221.7snT

Dip Angle: 67.36°

Date: 9/25/2012

Model: IGRF2010

Vertical Section at 357.38° (200 usft/in)