



## **Noble Energy Inc.**

Weld County, CO

Sec 22, T9N, R59W, 6th PM

Castor Federal LC22-78HN

Wellbore #1

Design: Wellbore #1 **FINAL**

## **DDC Survey Report**

18 January, 2013



Company:	Noble Energy Inc.	Local Co-ordinate Reference:	Well Castor Federal LC22-78HN
Project:	Weld County, CO	TVD Reference:	WELL @ 4946.0usft (H&P #326)
Site:	Sec 22, T9N, R59W, 6th PM	MD Reference:	WELL @ 4946.0usft (H&P #326)
Well:	Castor Federal LC22-78HN	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	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 22, T9N, R59W, 6th PM		
Site Position:		Northing:	1,516,819.31 usft
From:	Map	Easting:	3,423,444.14 usft
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "
		Latitude:	40° 44' 31.350 N
		Longitude:	103° 58' 18.570 W
		Grid Convergence:	0.99 °

Well	Castor Federal LC22-78HN		
Well Position	+N/-S	0.0 usft	Northing: 1,516,819.31 usft
	+E/-W	0.0 usft	Easting: 3,423,444.14 usft
Position Uncertainty	0.0 usft	Wellhead Elevation:	usft
		Latitude:	40° 44' 31.350 N
		Longitude:	103° 58' 18.570 W
		Ground Level:	4,916.0 usft

Wellbore	Wellbore #1		
Magnetics	Model Name	Sample Date	Declination (°)
	IGRF2010	1/8/2013	8.25
			Dip Angle (°)
			67.40
			Field Strength (nT)
			53,225

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)
	0.0	0.0	0.0
			Direction (°)
			176.20

Survey Program	Date 1/18/2013		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name
748.0	10,391.0	MWD (Wellbore #1)	MWD default
			Description
			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)	
665.0	0.00	0.00	665.0	0.0	0.0	0.0	0.00	0.00	0.00	
748.0	0.20	56.10	748.0	0.1	0.1	-0.1	0.24	0.24	0.00	
1,026.0	0.30	121.70	1,026.0	0.0	1.1	0.1	0.10	0.04	23.60	
1,304.0	0.10	134.40	1,304.0	-0.6	1.9	0.7	0.07	-0.07	4.57	
1,585.0	0.30	110.60	1,585.0	-1.0	2.8	1.2	0.08	0.07	-8.47	
1,863.0	0.40	49.50	1,863.0	-0.6	4.2	0.9	0.13	0.04	-21.98	
1,957.0	0.50	57.50	1,957.0	-0.2	4.8	0.5	0.13	0.11	8.51	
2,050.0	2.70	30.60	2,049.9	1.9	6.3	-1.5	2.44	2.37	-28.92	
2,142.0	4.40	23.60	2,141.8	7.0	8.8	-6.4	1.90	1.85	-7.61	
2,237.0	6.20	23.80	2,236.4	15.0	12.3	-14.2	1.89	1.89	0.21	



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Well:	Castor Federal LC22-78HN	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	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)
2,332.0	8.00	13.90	2,330.6	26.1	16.0	-25.0	2.28	1.89	-10.42
2,427.0	9.50	11.50	2,424.5	40.2	19.1	-38.9	1.62	1.58	-2.53
2,521.0	11.70	15.20	2,516.9	57.0	23.2	-55.4	2.45	2.34	3.94
2,616.0	13.60	19.20	2,609.6	76.9	29.4	-74.8	2.20	2.00	4.21
2,711.0	15.30	17.60	2,701.6	99.4	36.8	-96.7	1.84	1.79	-1.68
2,805.0	15.30	17.50	2,792.3	123.0	44.3	-119.8	0.03	0.00	-0.11
2,900.0	14.90	15.90	2,884.0	146.7	51.4	-143.0	0.61	-0.42	-1.68
2,995.0	13.80	16.40	2,976.0	169.4	58.0	-165.1	1.17	-1.16	0.53
3,090.0	14.00	19.00	3,068.2	191.1	64.9	-186.4	0.69	0.21	2.74
3,184.0	13.90	19.90	3,159.5	212.5	72.5	-207.2	0.25	-0.11	0.96
3,279.0	15.90	16.20	3,251.3	235.7	80.0	-229.9	2.33	2.11	-3.89
3,374.0	15.10	14.10	3,342.8	260.2	86.6	-253.9	1.03	-0.84	-2.21
3,469.0	16.40	20.40	3,434.2	284.8	94.3	-277.9	2.26	1.37	6.63
3,563.0	17.40	18.90	3,524.2	310.5	103.5	-303.0	1.16	1.06	-1.60
3,658.0	16.20	22.70	3,615.1	336.2	113.2	-327.9	1.71	-1.26	4.00
3,752.0	14.20	24.30	3,705.8	358.8	123.0	-349.8	2.17	-2.13	1.70
3,847.0	13.80	25.00	3,798.0	379.7	132.6	-370.0	0.46	-0.42	0.74
3,942.0	10.60	18.00	3,890.9	398.2	140.1	-388.1	3.70	-3.37	-7.37
4,037.0	7.00	18.00	3,984.7	412.1	144.6	-401.6	3.79	-3.79	0.00
4,132.0	5.60	20.80	4,079.2	421.9	148.0	-411.2	1.51	-1.47	2.95
4,227.0	4.40	27.30	4,173.8	429.5	151.3	-418.5	1.39	-1.26	6.84
4,321.0	3.40	30.80	4,267.6	435.1	154.4	-423.9	1.09	-1.06	3.72
4,416.0	3.80	25.90	4,362.4	440.3	157.2	-428.9	0.53	0.42	-5.16
4,511.0	2.60	35.40	4,457.2	444.9	159.9	-433.3	1.38	-1.26	10.00
4,606.0	2.30	51.90	4,552.2	447.8	162.6	-436.1	0.80	-0.32	17.37
4,700.0	1.70	33.60	4,646.1	450.2	164.9	-438.3	0.92	-0.64	-19.47
4,795.0	1.40	16.90	4,741.1	452.5	166.0	-440.5	0.57	-0.32	-17.58
4,890.0	1.00	34.20	4,836.0	454.2	166.8	-442.2	0.56	-0.42	18.21
4,985.0	0.90	22.40	4,931.0	455.6	167.5	-443.5	0.23	-0.11	-12.42
5,270.0	0.70	337.70	5,216.0	459.3	167.7	-447.2	0.22	-0.07	-15.68
5,365.0	0.60	339.80	5,311.0	460.3	167.3	-448.2	0.11	-0.11	2.21
5,457.0	0.30	139.80	5,403.0	460.6	167.3	-448.5	0.97	-0.33	173.91
5,552.0	10.00	177.40	5,497.5	452.1	167.9	-440.0	10.28	10.21	39.58
5,647.0	20.00	192.70	5,589.2	428.0	164.6	-416.1	11.23	10.53	16.11
5,741.0	30.10	191.50	5,674.2	389.1	156.4	-377.9	10.76	10.74	-1.28
5,836.0	39.80	186.00	5,752.0	335.4	148.4	-324.8	10.73	10.21	-5.79
5,881.0	41.20	184.30	5,786.2	306.3	145.8	-295.9	3.96	3.11	-3.78
5,930.0	42.40	179.20	5,822.8	273.6	144.8	-263.4	7.36	2.45	-10.41
5,975.0	44.20	176.90	5,855.5	242.8	145.9	-232.6	5.32	4.00	-5.11
6,025.0	47.00	175.30	5,890.5	207.2	148.3	-196.9	6.05	5.60	-3.20
6,070.0	48.40	175.00	5,920.8	174.0	151.2	-163.6	3.15	3.11	-0.67
6,120.0	51.00	175.00	5,953.1	136.0	154.5	-125.5	5.20	5.20	0.00
6,165.0	52.80	175.30	5,980.9	100.7	157.5	-90.1	4.03	4.00	0.67
6,214.0	55.80	176.00	6,009.5	61.1	160.5	-50.3	6.23	6.12	1.43

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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)
6,259.0	58.00	175.50	6,034.1	23.5	163.3	-12.6	4.98	4.89	-1.11
6,309.0	64.30	174.80	6,058.2	-20.1	167.0	31.2	12.66	12.60	-1.40
6,354.0	69.60	175.10	6,075.8	-61.4	170.6	72.6	11.79	11.78	0.67
CROSSED HARD LINE @ 6389' MD / 6087' TVD									
6,389.4	72.29	175.03	6,087.3	-94.7	173.5	106.0	7.60	7.60	-0.20
6,404.0	73.40	175.00	6,091.7	-108.6	174.7	120.0	7.60	7.60	-0.20
6,449.0	77.70	175.50	6,102.9	-152.0	178.3	163.5	9.62	9.56	1.11
6,499.0	79.20	175.10	6,112.9	-200.8	182.3	212.5	3.10	3.00	-0.80
6,528.0	82.80	175.80	6,117.4	-229.4	184.6	241.1	12.64	12.41	2.41
6,558.0	85.70	176.40	6,120.4	-259.2	186.6	271.0	9.87	9.67	2.00
6,653.0	88.20	176.50	6,125.5	-353.8	192.5	365.8	2.63	2.63	0.11
6,748.0	88.50	176.70	6,128.2	-448.6	198.2	460.8	0.38	0.32	0.21
6,843.0	88.20	175.70	6,131.0	-543.4	204.4	555.7	1.10	-0.32	-1.05
6,938.0	88.10	175.70	6,134.0	-638.1	211.6	650.7	0.11	-0.11	0.00
7,033.0	89.80	178.50	6,135.8	-732.9	216.4	745.7	3.45	1.79	2.95
7,128.0	89.30	178.30	6,136.5	-827.9	219.0	840.6	0.57	-0.53	-0.21
7,223.0	92.50	180.10	6,135.0	-922.8	220.3	935.4	3.86	3.37	1.89
7,317.0	92.30	179.70	6,131.1	-1,016.8	220.5	1,029.1	0.48	-0.21	-0.43
7,413.0	92.50	179.40	6,127.1	-1,112.7	221.3	1,124.9	0.38	0.21	-0.31
7,508.0	90.20	181.60	6,124.8	-1,207.6	220.4	1,219.6	3.35	-2.42	2.32
7,602.0	89.60	180.20	6,125.0	-1,301.6	219.0	1,313.3	1.62	-0.64	-1.49
7,697.0	89.30	180.20	6,125.9	-1,396.6	218.6	1,408.0	0.32	-0.32	0.00
7,792.0	88.60	178.80	6,127.6	-1,491.6	219.5	1,502.9	1.65	-0.74	-1.47
7,887.0	88.50	178.50	6,130.0	-1,586.5	221.7	1,597.7	0.33	-0.11	-0.32
7,981.0	90.40	179.50	6,130.9	-1,680.5	223.3	1,691.6	2.28	2.02	1.06
8,077.0	90.20	179.00	6,130.4	-1,776.5	224.6	1,787.5	0.56	-0.21	-0.52
8,171.0	89.70	178.80	6,130.5	-1,870.5	226.4	1,881.4	0.57	-0.53	-0.21
8,266.0	90.20	179.70	6,130.6	-1,965.5	227.6	1,976.2	1.08	0.53	0.95
8,361.0	89.40	177.20	6,130.9	-2,060.4	230.2	2,071.2	2.76	-0.84	-2.63
8,456.0	89.90	175.30	6,131.5	-2,155.2	236.4	2,166.2	2.07	0.53	-2.00
8,551.0	89.80	174.30	6,131.8	-2,249.8	245.0	2,261.1	1.06	-0.11	-1.05
8,646.0	92.20	174.10	6,130.1	-2,344.3	254.6	2,356.0	2.54	2.53	-0.21
8,741.0	87.00	176.20	6,130.8	-2,438.9	262.7	2,451.0	5.90	-5.47	2.21
8,835.0	89.30	176.70	6,133.8	-2,532.7	268.5	2,544.9	2.50	2.45	0.53
8,930.0	89.90	179.40	6,134.5	-2,627.6	271.7	2,639.9	2.91	0.63	2.84
9,025.0	90.10	179.70	6,134.5	-2,722.6	272.5	2,734.7	0.38	0.21	0.32
9,120.0	89.30	179.70	6,135.0	-2,817.6	273.0	2,829.5	0.84	-0.84	0.00
9,215.0	90.80	181.30	6,134.9	-2,912.6	272.1	2,924.3	2.31	1.58	1.68
9,310.0	91.00	182.30	6,133.4	-3,007.6	269.1	3,018.8	1.07	0.21	1.05
9,405.0	90.80	182.90	6,131.9	-3,102.5	264.8	3,113.2	0.67	-0.21	0.63
9,500.0	90.00	180.80	6,131.2	-3,197.4	261.8	3,207.7	2.37	-0.84	-2.21
9,594.0	89.30	181.30	6,131.8	-3,291.4	260.0	3,301.4	0.92	-0.74	0.53
9,689.0	89.10	181.50	6,133.1	-3,386.3	257.7	3,396.0	0.30	-0.21	0.21



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Site:	Sec 22, T9N, R59W, 6th PM	MD Reference:	WELL @ 4946.0usft (H&P #326)
Well:	Castor Federal LC22-78HN	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 5000.1 Single User Db

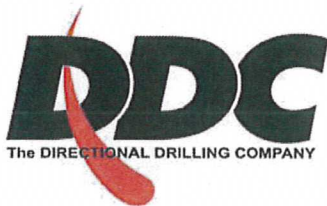
#### Survey

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)
9,784.0	90.30	179.00	6,133.6	-3,481.3	257.3	3,490.7	2.92	1.26	-2.63
9,879.0	89.20	177.80	6,134.1	-3,576.3	260.0	3,585.7	1.71	-1.16	-1.26
9,974.0	90.00	177.20	6,134.7	-3,671.2	264.1	3,680.6	1.05	0.84	-0.63
10,068.0	89.40	177.60	6,135.2	-3,765.1	268.4	3,774.6	0.77	-0.64	0.43
10,163.0	90.60	177.10	6,135.2	-3,860.0	272.8	3,869.6	1.37	1.26	-0.53
10,258.0	90.70	176.70	6,134.1	-3,954.8	277.9	3,964.6	0.43	0.11	-0.42
10,353.0	89.90	176.50	6,133.6	-4,049.7	283.5	4,059.6	0.87	-0.84	-0.21
TD @ 10391' MD / 6134' TVD									
10,391.0	89.30	175.80	6,133.9	-4,087.6	286.1	4,097.6	2.43	-1.58	-1.84

#### Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
6,389.4	6,087.3	-94.7	173.5	CROSSED HARD LINE @ 6389' MD / 6087' TVD
10,391.0	6,133.9	-4,087.6	286.1	TD @ 10391' MD / 6134' TVD

Checked By: \_\_\_\_\_ Approved By: \_\_\_\_\_ Date: \_\_\_\_\_



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## Survey Certification Sheet

Noble Energy  
Company

RM-12030  
Job Number

1/18/13  
Date

Sec22, T9N, R59W, 6<sup>TH</sup> PM  
Lease

Castor Federal LC22-78HN  
Well Name

Weld, CO  
County & State

Surveyed from a depth of: 665 feet to 10391 feet MD

Type of Survey: MWD

Directional Supervisor/Surveyor: Chris Abbott

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.

Larry Wright  
MWD General Manager

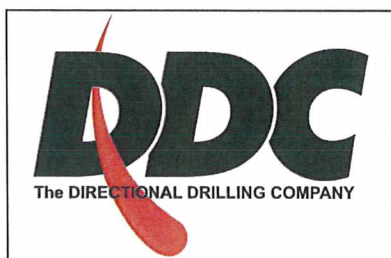


Company Name: Noble Energy Inc.  
 Castor Federal LC22-78HN  
 Weld County, CO  
 Rig: H&P #326  
 Created By: Dina Chance  
 Date: 1/18/2013

Castor Federal LC22-78HN  
 Weld County, CO  
**Q120889 & RM-13030**  
 Design #1

PROJECT DETAILS: Weld County, CO

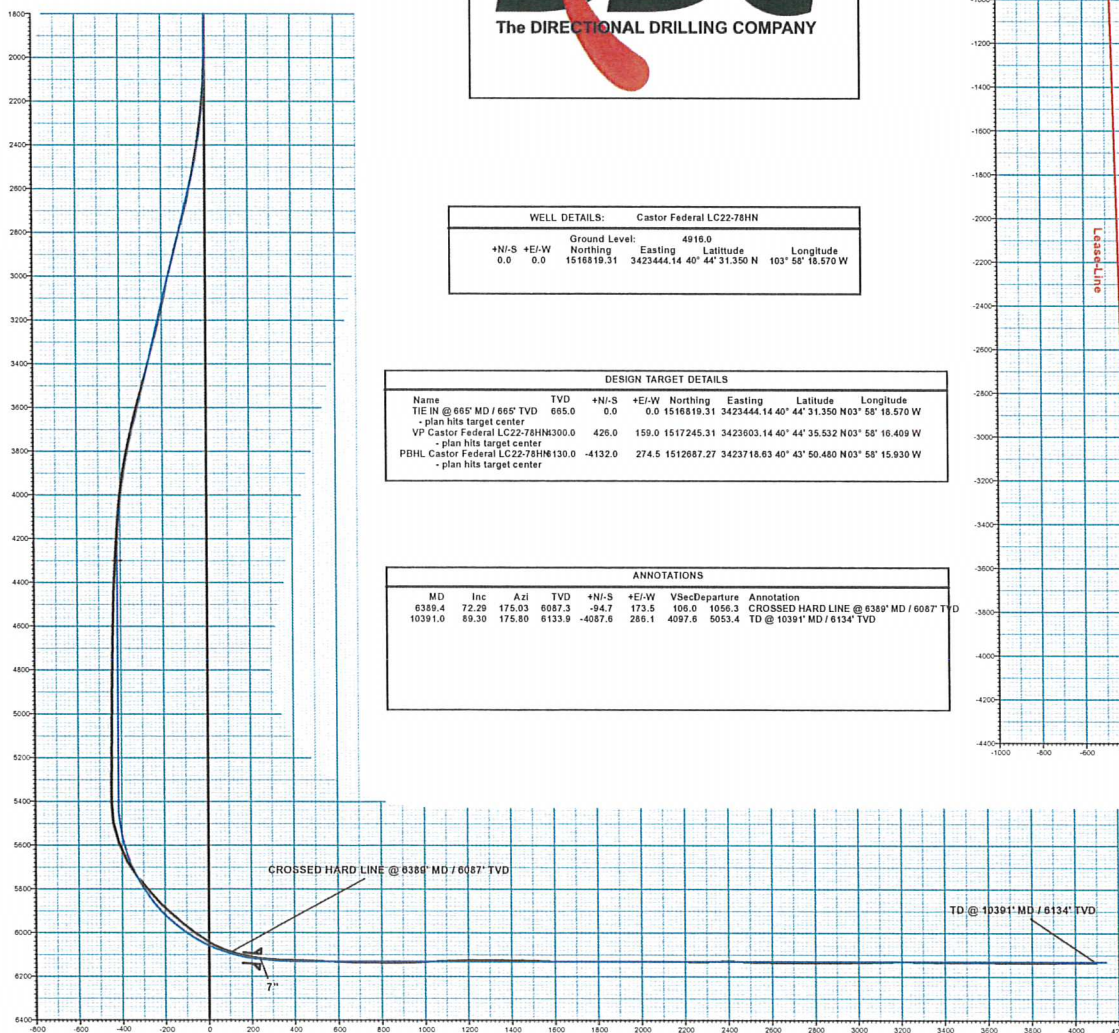
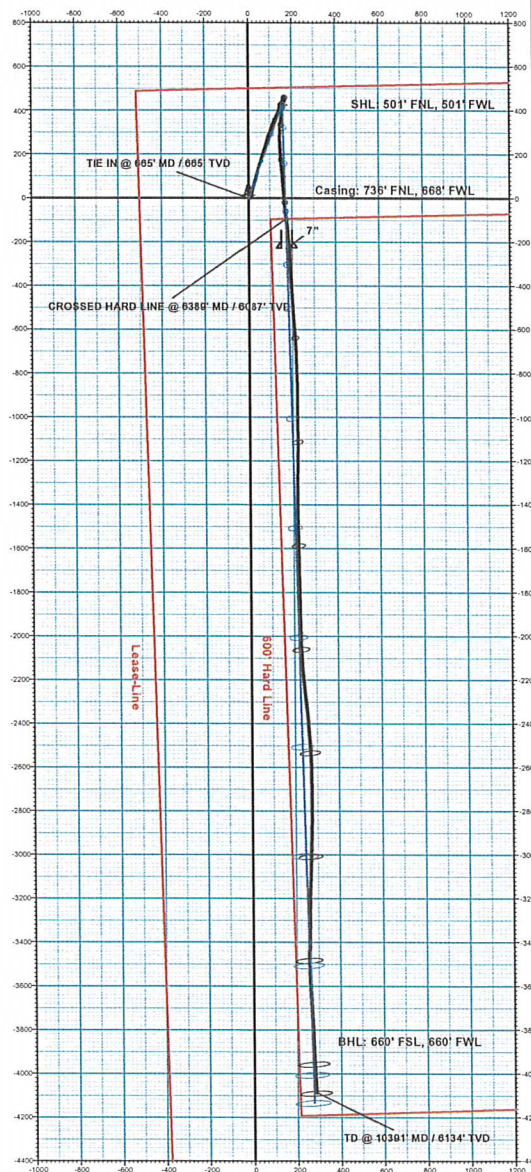
Geodetic System: US State Plane 1983  
 Datum: North American Datum 1983  
 Ellipsoid: GRS 1980  
 Zone: Colorado Northern Zone  
 System Datum: Mean Sea Level



WELL DETAILS: Castor Federal LC22-78HN					
Ground Level:			4916.0		
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
0.0	0.0	15168.19.31	3423444.14 40° 44' 31.350 N	103° 58' 18.570 W	

DESIGN TARGET DETAILS						
Name	MD	TVD	+N/-S	+E/-W	Northing	Easting
TIE IN @ 665' MD / 665' TVD	665.0	665.0	0.0	0.0	15168.19.31	3423444.14 40° 44' 31.350 N
- plan hits target center						
VP Castor Federal LC22-78HN300.0	426.0	159.0	1517245.31	3423603.14 40° 44' 35.532 N	103° 58' 16.409 W	
- plan hits target center						
PBIHL Castor Federal LC22-78HN130.0	-4132.0	274.5	1512687.27	3423718.63 40° 43' 50.480 N	103° 58' 15.930 W	
- plan hits target center						

ANNOTATIONS									
MD	Inc	Azi	TVD	+N/-S	+E/-W	VSec	Departure	Annotation	
6389.4	72.29	175.03	6057.3	-94.7	173.5	106.0	1056.3	CROSSED HARD LINE @ 6389' MD / 6087' TVD	
10391.0	89.30	175.80	6133.9	-4087.6	286.1	4097.6	5053.4	TD @ 10391' MD / 6134' TVD	



**T** **G** **M**  
 Azimuths to Grid North  
 Magnetic North: 7.26°  
 Magnetic Field  
 Strength: 53225.0snT  
 Dip Angle: 67.40°  
 Date: 1/8/2013  
 Model: IGRF2010

Vertical Section at 176.20° (200 usf/in)



Castor Federal LC22-78HN  
Weld County, CO  
Q120889 & RM-13030  
Design #1

Company Name: Noble Energy Inc.  
Castor Federal LC22-78HN  
Weld County, CO  
Rig: H&P #326  
Created By: Dina Chance  
Date: 1/18/2013

