

# Great Western

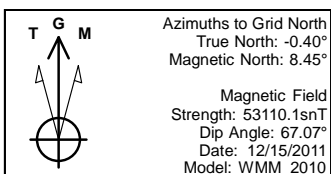
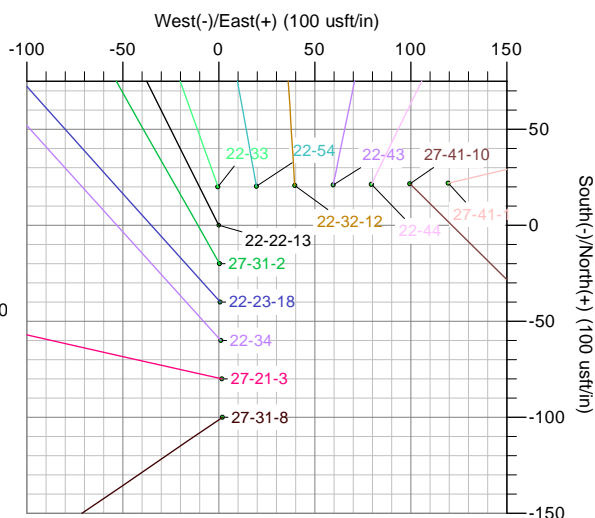
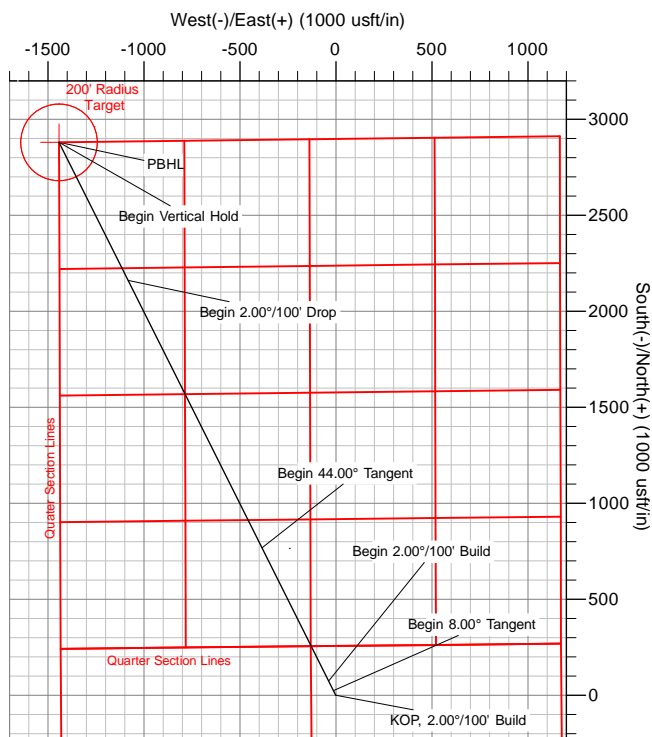
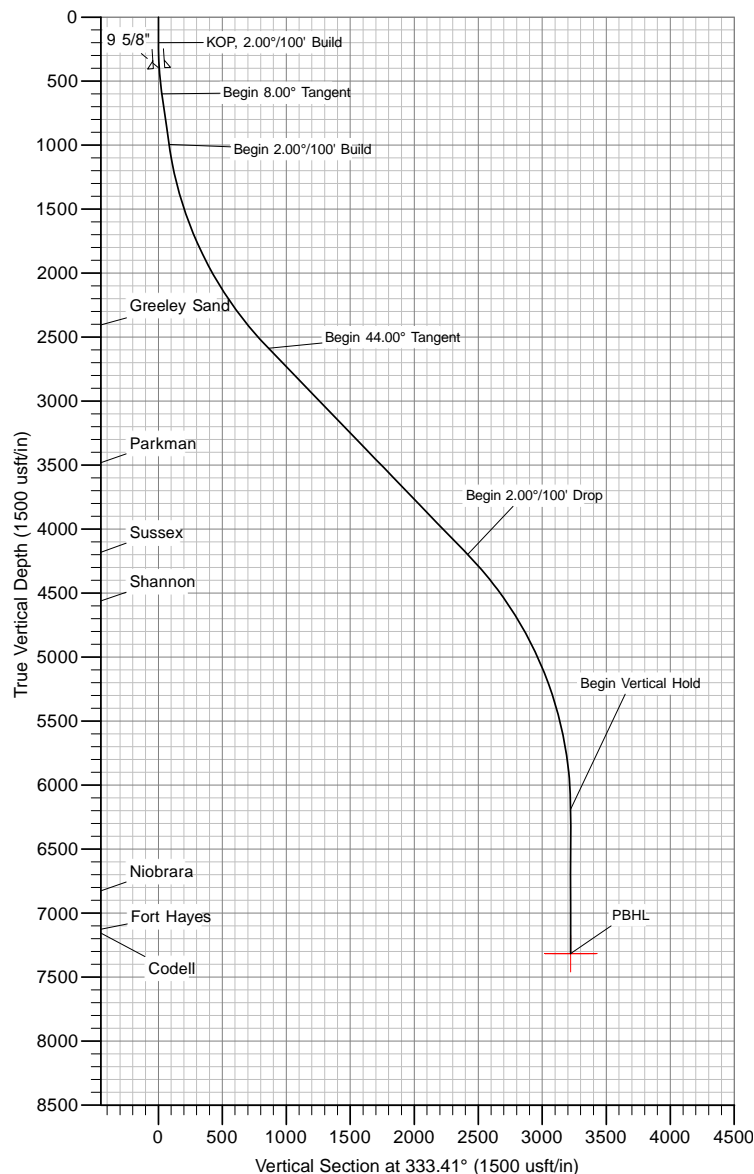
Company: Great Western  
Site: Diamond Valley  
Well: 22-22-13  
Project: Weld County, Colorado (NAD 83)  
Rig Name: Cade 22

**MS Energy Services**  
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## ANNOTATIONS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Departure	Annotation
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	KOP, 2.00°/100' Build
600.00	8.00	333.41	598.70	24.93	-12.48	27.88	27.88	Begin 8.00° Tangent
1000.00	8.00	333.41	994.81	74.71	-37.40	83.55	83.55	Begin 2.00°/100' Build
2800.17	44.00	333.41	2586.28	768.87	-384.88	859.82	859.82	Begin 44.00° Tangent
5041.31	44.00	333.41	4198.33	2161.10	-1081.79	2416.74	2416.74	Begin 2.00°/100' Drop
7241.48	0.00	0.00	6188.50	2880.19	-1441.75	3220.89	3220.89	Begin Vertical Hold
8368.98	0.00	0.00	7316.00	2880.19	-1441.75	3220.89	3220.89	PBHL



Created By: Marcus Mitcham  
Date: 12:25, December 22 2011  
Plan: Design #1

US State Plane 1983  
Colorado Northern Zone

The customer should only rely on this document after independently verifying all paths, targets, coordinates, lease and hard lines represented. Any decisions made or wells drilled utilizing this or any other information supplied by MS Energy are at the sole risk and responsibility of the customer. MS Energy is not responsible for the accuracy of this schematic or the information contained herein.

# **Great Western**

**Weld County, Colorado (NAD 83)**

**Diamond Valley**

**22-22-13**

**Wellbore #1**

**Plan: Design #1**

## **Standard Planning Report**

**22 December, 2011**

<b>Database:</b>	Local DB	<b>Local Co-ordinate Reference:</b>	Well 22-22-13
<b>Company:</b>	Great Western	<b>TVD Reference:</b>	WELL @ 4781.00usft (Cade 22)
<b>Project:</b>	Weld County, Colorado (NAD 83)	<b>MD Reference:</b>	WELL @ 4781.00usft (Cade 22)
<b>Site:</b>	Diamond Valley	<b>North Reference:</b>	Grid
<b>Well:</b>	22-22-13	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Wellbore #1		
<b>Design:</b>	Design #1		

<b>Project</b>	Weld County, Colorado (NAD 83)		
<b>Map System:</b>	US State Plane 1983	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b>	North American Datum 1983		
<b>Map Zone:</b>	Colorado Northern Zone		

<b>Well</b>	22-22-13			
<b>Well Position</b>	<b>+N/-S</b>	1,412,666.98 usft	<b>Northing:</b>	1,412,666.98 usft
	<b>+E/-W</b>	3,174,013.66 usft	<b>Easting:</b>	3,174,013.66 usft
<b>Position Uncertainty</b>		0.00 usft	<b>Wellhead Elevation:</b>	<b>Latitude:</b> 40° 27' 52.157 N
				<b>Longitude:</b> 104° 52' 28.555 W
				<b>Ground Level:</b> 4,767.00 usft

<b>Wellbore</b>	Wellbore #1				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	WMM_2010	12/15/2011	8.86	67.07	53,110

<b>Design</b>	Design #1			
<b>Audit Notes:</b>				
<b>Version:</b>	<b>Phase:</b>	PROTOTYPE	<b>Tie On Depth:</b>	0.00
<b>Vertical Section:</b>	<b>Depth From (TVD) (usft)</b>	<b>+N/-S (usft)</b>	<b>+E/-W (usft)</b>	<b>Direction (°)</b>
	0.00	0.00	0.00	333.41

<b>Plan Sections</b>										
<b>Measured Depth (usft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (usft)</b>	<b>+N/-S (usft)</b>	<b>+E/-W (usft)</b>	<b>Dogleg Rate (°/100usft)</b>	<b>Build Rate (°/100usft)</b>	<b>Turn Rate (°/100usft)</b>	<b>TFO (°)</b>	<b>Target</b>
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	0.00	
600.00	8.00	333.41	598.70	24.93	-12.48	2.00	2.00	0.00	333.41	PBHL v1 - Diamond -
1,000.00	8.00	333.41	994.81	74.71	-37.40	0.00	0.00	0.00	0.00	
2,800.17	44.00	333.41	2,586.28	768.87	-384.88	2.00	2.00	0.00	0.00	
5,041.31	44.00	333.41	4,198.33	2,161.10	-1,081.79	0.00	0.00	0.00	0.00	
7,241.48	0.00	0.00	6,188.50	2,880.19	-1,441.75	2.00	-2.00	0.00	180.00	
8,368.98	0.00	0.00	7,316.00	2,880.19	-1,441.75	0.00	0.00	0.00	0.00	PBHL v1 - Diamond -

<b>Database:</b>	Local DB	<b>Local Co-ordinate Reference:</b>	Well 22-22-13
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<b>Project:</b>	Weld County, Colorado (NAD 83)	<b>MD Reference:</b>	WELL @ 4781.00usft (Cade 22)
<b>Site:</b>	Diamond Valley	<b>North Reference:</b>	Grid
<b>Well:</b>	22-22-13	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Wellbore #1		
<b>Design:</b>	Design #1		

Planned 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)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>KOP, 2.00°/100' Build</b>									
300.00	2.00	333.41	299.98	1.56	-0.78	1.75	2.00	2.00	0.00
400.00	4.00	333.41	399.84	6.24	-3.12	6.98	2.00	2.00	0.00
400.16	4.00	333.41	400.00	6.25	-3.13	6.99	0.00	0.00	0.00
<b>9 5/8"</b>									
500.00	6.00	333.41	499.45	14.03	-7.02	15.69	2.00	2.00	0.00
600.00	8.00	333.41	598.70	24.93	-12.48	27.88	2.00	2.00	0.00
<b>Begin 8.00° Tangent</b>									
700.00	8.00	333.41	697.73	37.38	-18.71	41.80	0.00	0.00	0.00
800.00	8.00	333.41	796.76	49.82	-24.94	55.71	0.00	0.00	0.00
900.00	8.00	333.41	895.78	62.27	-31.17	69.63	0.00	0.00	0.00
1,000.00	8.00	333.41	994.81	74.71	-37.40	83.55	0.00	0.00	0.00
<b>Begin 2.00°/100' Build</b>									
1,100.00	10.00	333.41	1,093.57	88.70	-44.40	99.19	2.00	2.00	0.00
1,200.00	12.00	333.41	1,191.73	105.76	-52.94	118.27	2.00	2.00	0.00
1,300.00	14.00	333.41	1,289.16	125.88	-63.01	140.77	2.00	2.00	0.00
1,400.00	16.00	333.41	1,385.75	149.02	-74.60	166.65	2.00	2.00	0.00
1,500.00	18.00	333.41	1,481.38	175.16	-87.68	195.88	2.00	2.00	0.00
1,600.00	20.00	333.41	1,575.92	204.27	-102.25	228.44	2.00	2.00	0.00
1,700.00	22.00	333.41	1,669.28	236.32	-118.29	264.27	2.00	2.00	0.00
1,800.00	24.00	333.41	1,761.32	271.26	-135.78	303.34	2.00	2.00	0.00
1,900.00	26.00	333.41	1,851.95	309.05	-154.70	345.60	2.00	2.00	0.00
2,000.00	28.00	333.41	1,941.04	349.64	-175.02	391.00	2.00	2.00	0.00
2,100.00	30.00	333.41	2,028.50	392.99	-196.72	439.48	2.00	2.00	0.00
2,200.00	32.00	333.41	2,114.21	439.04	-219.77	490.98	2.00	2.00	0.00
2,300.00	34.00	333.41	2,198.08	487.74	-244.15	545.44	2.00	2.00	0.00
2,400.00	36.00	333.41	2,279.99	539.03	-269.83	602.80	2.00	2.00	0.00
2,500.00	38.00	333.41	2,359.85	592.85	-296.76	662.97	2.00	2.00	0.00
2,559.04	39.18	333.41	2,406.00	625.78	-313.25	699.80	2.00	2.00	0.00
<b>Greeley Sand</b>									
2,600.00	40.00	333.41	2,437.56	649.12	-324.93	725.90	2.00	2.00	0.00
2,700.00	42.00	333.41	2,513.03	707.78	-354.30	791.51	2.00	2.00	0.00
2,800.17	44.00	333.41	2,586.28	768.87	-384.88	859.82	2.00	2.00	0.00
<b>Begin 44.00° Tangent</b>									
2,900.00	44.00	333.41	2,658.09	830.88	-415.92	929.17	0.00	0.00	0.00
3,000.00	44.00	333.41	2,730.02	893.01	-447.02	998.64	0.00	0.00	0.00
3,100.00	44.00	333.41	2,801.95	955.13	-478.11	1,068.11	0.00	0.00	0.00
3,200.00	44.00	333.41	2,873.88	1,017.25	-509.21	1,137.58	0.00	0.00	0.00
3,300.00	44.00	333.41	2,945.81	1,079.37	-540.31	1,207.05	0.00	0.00	0.00
3,400.00	44.00	333.41	3,017.74	1,141.49	-571.40	1,276.52	0.00	0.00	0.00
3,500.00	44.00	333.41	3,089.67	1,203.61	-602.50	1,345.99	0.00	0.00	0.00
3,600.00	44.00	333.41	3,161.60	1,265.74	-633.60	1,415.46	0.00	0.00	0.00
3,700.00	44.00	333.41	3,233.53	1,327.86	-664.69	1,484.93	0.00	0.00	0.00
3,800.00	44.00	333.41	3,305.46	1,389.98	-695.79	1,554.40	0.00	0.00	0.00
3,900.00	44.00	333.41	3,377.39	1,452.10	-726.89	1,623.87	0.00	0.00	0.00
4,000.00	44.00	333.41	3,449.32	1,514.22	-757.98	1,693.34	0.00	0.00	0.00
4,044.04	44.00	333.41	3,480.99	1,541.58	-771.68	1,723.94	0.00	0.00	0.00
<b>Parkman</b>									
4,100.00	44.00	333.41	3,521.25	1,576.34	-789.08	1,762.81	0.00	0.00	0.00
4,200.00	44.00	333.41	3,593.18	1,638.47	-820.18	1,832.28	0.00	0.00	0.00

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<b>Project:</b>	Weld County, Colorado (NAD 83)	<b>MD Reference:</b>	WELL @ 4781.00usft (Cade 22)
<b>Site:</b>	Diamond Valley	<b>North Reference:</b>	Grid
<b>Well:</b>	22-22-13	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Wellbore #1		
<b>Design:</b>	Design #1		

**Planned 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)
4,300.00	44.00	333.41	3,665.11	1,700.59	-851.27	1,901.75	0.00	0.00	0.00
4,400.00	44.00	333.41	3,737.04	1,762.71	-882.37	1,971.22	0.00	0.00	0.00
4,500.00	44.00	333.41	3,808.97	1,824.83	-913.47	2,040.69	0.00	0.00	0.00
4,600.00	44.00	333.41	3,880.90	1,886.95	-944.56	2,110.16	0.00	0.00	0.00
4,700.00	44.00	333.41	3,952.83	1,949.07	-975.66	2,179.63	0.00	0.00	0.00
4,800.00	44.00	333.41	4,024.76	2,011.19	-1,006.75	2,249.10	0.00	0.00	0.00
4,900.00	44.00	333.41	4,096.69	2,073.32	-1,037.85	2,318.57	0.00	0.00	0.00
5,000.00	44.00	333.41	4,168.62	2,135.44	-1,068.95	2,388.04	0.00	0.00	0.00
5,017.21	44.00	333.41	4,180.99	2,146.13	-1,074.30	2,399.99	0.00	0.00	0.00
<b>Sussex</b>									
5,041.31	44.00	333.41	4,198.33	2,161.10	-1,081.79	2,416.74	0.00	0.00	0.00
<b>Begin 2.00°/100' Drop</b>									
5,100.00	42.83	333.41	4,240.96	2,197.17	-1,099.85	2,457.08	2.00	-2.00	0.00
5,200.00	40.83	333.41	4,315.47	2,256.80	-1,129.70	2,523.76	2.00	-2.00	0.00
5,300.00	38.83	333.41	4,392.26	2,314.08	-1,158.37	2,587.81	2.00	-2.00	0.00
5,400.00	36.83	333.41	4,471.24	2,368.92	-1,185.82	2,649.14	2.00	-2.00	0.00
5,500.00	34.83	333.41	4,552.31	2,421.26	-1,212.02	2,707.68	2.00	-2.00	0.00
5,510.56	34.62	333.41	4,560.99	2,426.64	-1,214.72	2,713.69	2.00	-2.00	0.00
<b>Shannon</b>									
5,600.00	32.83	333.41	4,635.38	2,471.04	-1,236.94	2,763.34	2.00	-2.00	0.00
5,700.00	30.83	333.41	4,720.34	2,518.20	-1,260.55	2,816.08	2.00	-2.00	0.00
5,800.00	28.83	333.41	4,807.08	2,562.68	-1,282.81	2,865.82	2.00	-2.00	0.00
5,900.00	26.83	333.41	4,895.51	2,604.42	-1,303.71	2,912.50	2.00	-2.00	0.00
6,000.00	24.83	333.41	4,985.52	2,643.38	-1,323.21	2,956.07	2.00	-2.00	0.00
6,100.00	22.83	333.41	5,076.99	2,679.51	-1,341.30	2,996.47	2.00	-2.00	0.00
6,200.00	20.83	333.41	5,169.81	2,712.76	-1,357.94	3,033.65	2.00	-2.00	0.00
6,300.00	18.83	333.41	5,263.88	2,743.09	-1,373.12	3,067.57	2.00	-2.00	0.00
6,400.00	16.83	333.41	5,359.07	2,770.47	-1,386.83	3,098.19	2.00	-2.00	0.00
6,500.00	14.83	333.41	5,455.27	2,794.86	-1,399.04	3,125.47	2.00	-2.00	0.00
6,600.00	12.83	333.41	5,552.37	2,816.23	-1,409.74	3,149.37	2.00	-2.00	0.00
6,700.00	10.83	333.41	5,650.24	2,834.56	-1,418.91	3,169.87	2.00	-2.00	0.00
6,800.00	8.83	333.41	5,748.77	2,849.83	-1,426.55	3,186.94	2.00	-2.00	0.00
6,900.00	6.83	333.41	5,847.83	2,862.01	-1,432.65	3,200.56	2.00	-2.00	0.00
7,000.00	4.83	333.41	5,947.31	2,871.09	-1,437.20	3,210.72	2.00	-2.00	0.00
7,100.00	2.83	333.41	6,047.08	2,877.06	-1,440.19	3,217.40	2.00	-2.00	0.00
7,200.00	0.83	333.41	6,147.02	2,879.92	-1,441.62	3,220.59	2.00	-2.00	0.00
7,241.48	0.00	0.00	6,188.50	2,880.19	-1,441.75	3,220.89	2.00	-2.00	64.11
<b>Begin Vertical Hold</b>									
7,300.00	0.00	0.00	6,247.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
7,400.00	0.00	0.00	6,347.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
7,500.00	0.00	0.00	6,447.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
7,600.00	0.00	0.00	6,547.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
7,700.00	0.00	0.00	6,647.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
7,800.00	0.00	0.00	6,747.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
7,878.96	0.00	0.00	6,825.99	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
<b>Niobrara</b>									
7,900.00	0.00	0.00	6,847.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
8,000.00	0.00	0.00	6,947.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
8,100.00	0.00	0.00	7,047.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
8,178.96	0.00	0.00	7,125.99	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
<b>Fort Hayes</b>									
8,200.00	0.00	0.00	7,147.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
8,208.96	0.00	0.00	7,155.99	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00

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<b>Site:</b>	Diamond Valley	<b>North Reference:</b>	Grid
<b>Well:</b>	22-22-13	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Wellbore #1		
<b>Design:</b>	Design #1		

Planned 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)
<b>Codell</b>									
8,300.00	0.00	0.00	7,247.02	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
8,368.98	0.00	0.00	7,316.00	2,880.19	-1,441.75	3,220.89	0.00	0.00	0.00
<b>PBHL</b>									

Design Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
PBHL v1 - Diamond - 22	0.00	0.00	7,316.00	2,880.19	-1,441.75	1,415,547.17	3,172,571.91	40° 28' 20.718 N	104° 52' 46.947 W
- plan hits target center									
- Circle (radius 200.00)									

Casing Points					
Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")	
400.16	400.00	9 5/8"	9-5/8	12-1/4	

Formations					
Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)
2,559.04	2,406.00	Greeley Sand		0.00	
4,044.04	3,480.99	Parkman		0.00	
5,017.21	4,180.99	Sussex		0.00	
5,510.56	4,560.99	Shannon		0.00	
7,878.96	6,825.99	Niobrara		0.00	
8,178.96	7,125.99	Fort Hayes		0.00	
8,208.96	7,155.99	Codell		0.00	

Plan Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
200.00	200.00	0.00	0.00	KOP, 2.00°/100' Build
600.00	598.70	24.93	-12.48	Begin 8.00° Tangent
1,000.00	994.81	74.71	-37.40	Begin 2.00°/100' Build
2,800.17	2,586.28	768.87	-384.88	Begin 44.00° Tangent
5,041.31	4,198.33	2,161.10	-1,081.79	Begin 2.00°/100' Drop
7,241.48	6,188.50	2,880.19	-1,441.75	Begin Vertical Hold
8,368.98	7,316.00	2,880.19	-1,441.75	PBHL