

Apache Corporation

Eddy County, NM (NAD27 NME)

Crow Federal

#18H

15-40992

WB1/Job #1311163

Plan: Plan #4 09-25-13

Standard Planning Report

25 September, 2013



PHOENIX
TECHNOLOGY SERVICES



Phoenix Technology Services
Planning Report



Database:	GCR DB	Local Co-ordinate/Reference:	Well #18H
Company:	Apache Corporation	TVD/Reference:	KB @ 3849.00usft (Capstar 114)
Project:	Eddy County, NM (NAD27 NME)	MD/Reference:	KB @ 3849.00usft (Capstar 114)
Site:	Crow Federal	North Reference:	Grid
Well:	#18H	Survey Calculation Method:	Minimum Curvature
Wellbore:	WB1/Job #1311163		
Design:	Plan #4_09-25-13		

Project:	Eddy County, NM (NAD27 NME)		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site:		Crow Federal			
Site Position:		Northing:	671,130.90 usft	Latitude:	32° 50' 38.92786 N
From:	Map	Easting:	643,906.80 usft	Longitude:	103° 51' 53.16689 W
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.25 °

Well:	#18H					
Well Position	+N/-S	886.70 usft	Northing:	672,017.60 usft	Latitude:	32° 50' 47.93560 N
	+E/-W	-5,426.40 usft	Easting:	638,480.40 usft	Longitude:	103° 52' 56.72745 W
Position Uncertainty	0.00 usft		Wellhead Elevation:	Ground Level:		3,838.00 usft

Wellbore		WB1/Job #1311163			
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010_14	09/04/13	7.50	60.65	48,731

Design:	Plan #4 09-25-13			
Audit Notes:				
Version:	Phase:	PLAN	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction
	(usft)	(usft)	(usft)	(°)
	0.00	0.00	0.00	86.13

Plan Sections										
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Dogleg	Build	Turn	TFO	Target
Depth	(°)	(°)	Depth	(usft)	(usft)	Rate	Rate	Rate	(°)	
(usft)			(usft)			(%/100usft)	(%/100usft)	(%/100usft)		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
600.00	0.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00	
800.00	4.00	0.00	799.84	6.98	0.00	2.00	2.00	0.00	0.00	
4,820.00	4.00	0.00	4,810.05	287.40	0.00	0.00	0.00	0.00	0.00	
5,086.67	0.00	0.00	5,076.50	296.70	0.00	1.50	-1.50	0.00	180.00	
5,683.75	0.00	0.00	5,673.58	296.70	0.00	0.00	0.00	0.00	0.00	
6,422.12	88.59	89.63	6,151.00	299.68	465.77	12.00	12.00	0.00	89.63	
10,798.67	88.59	89.63	6,259.00	327.60	4,841.10	0.00	0.00	0.00	0.00	PBHL-Crow Fed #18H



Phoenix Technology Services
Planning Report



Database:	GCR DB	Local Co-ordinate Reference:	Well #18H
Company:	Apache Corporation	TVD Reference:	KB @ 3849.00usft (Capstar 114)
Project:	Eddy County, NM (NAD27 NME)	MD Reference:	KB @ 3849.00usft (Capstar 114)
Site:	Crow Federal	North Reference:	Grid
Well:	#18H	Survey Calculation Method:	Minimum Curvature
Wellbore:	WB1/Job #1311163		
Design:	Plan #4-09-25-13		

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	
470.00	0.00	0.00	470.00	0.00	0.00	0.00	0.00	0.00	0.00	
4 1/2" Production										
529.00	0.00	0.00	529.00	0.00	0.00	0.00	0.00	0.00	0.00	
Rustler										
600.00	0.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00	
Start Build 2.00										
700.00	2.00	0.00	699.98	1.75	0.00	0.12	2.00	2.00	0.00	
722.04	2.44	0.00	722.00	2.60	0.00	0.18	2.00	2.00	0.00	
B/Salt										
800.00	4.00	0.00	799.84	6.98	0.00	0.47	2.00	2.00	0.00	
Start 4020.00 hold at 800.00 MD										
900.00	4.00	0.00	899.59	13.95	0.00	0.94	0.00	0.00	0.00	
1,000.00	4.00	0.00	999.35	20.93	0.00	1.41	0.00	0.00	0.00	
1,100.00	4.00	0.00	1,099.11	27.91	0.00	1.88	0.00	0.00	0.00	
1,200.00	4.00	0.00	1,198.86	34.88	0.00	2.36	0.00	0.00	0.00	
1,300.00	4.00	0.00	1,298.62	41.86	0.00	2.83	0.00	0.00	0.00	
1,400.00	4.00	0.00	1,398.38	48.83	0.00	3.30	0.00	0.00	0.00	
1,500.00	4.00	0.00	1,498.13	55.81	0.00	3.77	0.00	0.00	0.00	
1,600.00	4.00	0.00	1,597.89	62.78	0.00	4.24	0.00	0.00	0.00	
1,685.33	4.00	0.00	1,683.01	68.74	0.00	4.64	0.00	0.00	0.00	
B/Salt										
1,700.00	4.00	0.00	1,697.65	69.76	0.00	4.71	0.00	0.00	0.00	
1,800.00	4.00	0.00	1,797.40	76.73	0.00	5.18	0.00	0.00	0.00	
1,847.73	4.00	0.00	1,845.01	80.06	0.00	5.41	0.00	0.00	0.00	
Yates										
1,900.00	4.00	0.00	1,897.16	83.71	0.00	5.65	0.00	0.00	0.00	
2,000.00	4.00	0.00	1,996.91	90.69	0.00	6.12	0.00	0.00	0.00	
2,100.00	4.00	0.00	2,096.67	97.68	0.00	6.59	0.00	0.00	0.00	
2,130.42	4.00	0.00	2,127.01	99.78	0.00	6.74	0.00	0.00	0.00	
Seven Rivers										
2,200.00	4.00	0.00	2,196.43	104.64	0.00	7.06	0.00	0.00	0.00	
2,300.00	4.00	0.00	2,296.18	111.61	0.00	7.54	0.00	0.00	0.00	
2,400.00	4.00	0.00	2,395.94	118.59	0.00	8.01	0.00	0.00	0.00	
2,500.00	4.00	0.00	2,495.70	125.56	0.00	8.48	0.00	0.00	0.00	
2,600.00	4.00	0.00	2,595.45	132.54	0.00	8.95	0.00	0.00	0.00	
2,700.00	4.00	0.00	2,695.21	139.52	0.00	9.42	0.00	0.00	0.00	
2,744.92	4.00	0.00	2,740.02	142.65	0.00	9.63	0.00	0.00	0.00	
Queen										
2,800.00	4.00	0.00	2,794.97	146.49	0.00	9.89	0.00	0.00	0.00	
2,900.00	4.00	0.00	2,894.72	153.47	0.00	10.36	0.00	0.00	0.00	
3,000.00	4.00	0.00	2,994.48	160.44	0.00	10.83	0.00	0.00	0.00	
3,100.00	4.00	0.00	3,094.23	167.42	0.00	11.30	0.00	0.00	0.00	
3,160.94	4.00	0.00	3,155.02	171.67	0.00	11.59	0.00	0.00	0.00	
Grayburg										
3,200.00	4.00	0.00	3,193.99	174.39	0.00	11.77	0.00	0.00	0.00	
3,300.00	4.00	0.00	3,293.75	181.37	0.00	12.25	0.00	0.00	0.00	
3,400.00	4.00	0.00	3,393.50	188.35	0.00	12.72	0.00	0.00	0.00	
3,496.76	4.00	0.00	3,490.03	195.09	0.00	13.17	0.00	0.00	0.00	
San Andres										
3,500.00	4.00	0.00	3,493.26	195.32	0.00	13.19	0.00	0.00	0.00	
3,600.00	4.00	0.00	3,593.02	202.30	0.00	13.66	0.00	0.00	0.00	
3,700.00	4.00	0.00	3,692.77	209.27	0.00	14.13	0.00	0.00	0.00	



Phoenix Technology Services
Planning Report



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Company:	Apache Corporation	TVD Reference:	KB @ 3849.00usft (Capstar 114)
Project:	Eddy County NM (NAD27 NME)	MD Reference:	KB @ 3849.00usft (Capstar 114)
Site:	Crow Federal	North Reference:	Grid
Well:	#18H	Survey Calculation Method:	Minimum Curvature
Wellbore:	WB1/Job #1311163		
Design:	Plan #4_09-25-13		

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)	
3,800.00	4.00	0.00	3,792.53	216.25	0.00	14.60	0.00	0.00	0.00	
3,900.00	4.00	0.00	3,892.29	223.22	0.00	15.07	0.00	0.00	0.00	
4,000.00	4.00	0.00	3,992.04	230.20	0.00	15.54	0.00	0.00	0.00	
4,100.00	4.00	0.00	4,091.80	237.17	0.00	16.01	0.00	0.00	0.00	
4,200.00	4.00	0.00	4,191.56	244.15	0.00	16.48	0.00	0.00	0.00	
4,300.00	4.00	0.00	4,291.31	251.13	0.00	16.96	0.00	0.00	0.00	
4,400.00	4.00	0.00	4,391.07	258.10	0.00	17.43	0.00	0.00	0.00	
4,500.00	4.00	0.00	4,490.82	265.08	0.00	17.90	0.00	0.00	0.00	
4,600.00	4.00	0.00	4,590.58	272.05	0.00	18.37	0.00	0.00	0.00	
4,700.00	4.00	0.00	4,690.34	279.03	0.00	18.84	0.00	0.00	0.00	
4,800.00	4.00	0.00	4,790.09	286.00	0.00	19.31	0.00	0.00	0.00	
4,820.00	4.00	0.00	4,810.05	287.40	0.00	19.40	0.00	0.00	0.00	
Start Drop -1.50										
4,900.00	2.80	0.00	4,889.90	292.14	0.00	19.72	1.50	-1.50	0.00	
4,964.19	1.84	0.00	4,954.04	294.74	0.00	19.90	1.50	-1.50	0.00	
Glorieta										
5,000.00	1.30	0.00	4,989.84	295.72	0.00	19.97	1.50	-1.50	0.00	
5,046.21	0.61	0.00	5,036.04	296.49	0.00	20.02	1.50	-1.50	0.00	
(Yeso) Paddock										
5,086.67	0.00	0.00	5,076.50	296.70	0.00	20.03	1.50	-1.50	0.00	
Start 597.08 hold at 5086.67 MD										
5,100.00	0.00	0.00	5,089.83	296.70	0.00	20.03	0.00	0.00	0.00	
5,200.00	0.00	0.00	5,189.83	296.70	0.00	20.03	0.00	0.00	0.00	
5,300.00	0.00	0.00	5,289.83	296.70	0.00	20.03	0.00	0.00	0.00	
5,400.00	0.00	0.00	5,389.83	296.70	0.00	20.03	0.00	0.00	0.00	
5,500.00	0.00	0.00	5,489.83	296.70	0.00	20.03	0.00	0.00	0.00	
5,600.00	0.00	0.00	5,589.83	296.70	0.00	20.03	0.00	0.00	0.00	
5,611.21	0.00	0.00	5,601.04	296.70	0.00	20.03	0.00	0.00	0.00	
Blindbry										
5,683.75	0.00	0.00	5,673.58	296.70	0.00	20.03	0.00	0.00	0.00	
KOP Start Build 12.00										
5,700.00	1.95	89.63	5,689.83	296.71	0.28	20.31	12.00	12.00	0.00	
5,800.00	13.95	89.63	5,788.68	296.79	14.08	34.09	12.00	12.00	0.00	
5,900.00	25.94	89.63	5,882.51	297.01	48.13	68.07	12.00	12.00	0.00	
6,000.00	37.94	89.63	5,967.22	297.35	100.94	120.78	12.00	12.00	0.00	
6,100.00	49.94	89.63	6,039.09	297.79	170.20	189.92	12.00	12.00	0.00	
6,200.00	61.94	89.63	6,095.00	298.32	252.89	272.46	12.00	12.00	0.00	
6,300.00	73.93	89.63	6,132.49	298.91	345.40	364.79	12.00	12.00	0.00	
6,400.00	85.93	89.63	6,149.94	299.54	443.68	462.89	12.00	12.00	0.00	
6,422.12	88.59	89.63	6,151.00	299.68	465.77	484.94	12.00	12.00	0.00	
LP Start 4376.75 hold at 6422.12 MD										
6,500.00	88.59	89.63	6,152.92	300.17	543.62	562.65	0.00	0.00	0.00	
6,600.00	88.59	89.63	6,155.39	300.81	643.59	662.43	0.00	0.00	0.00	
6,700.00	88.59	89.63	6,157.85	301.45	743.56	762.22	0.00	0.00	0.00	
6,800.00	88.59	89.63	6,160.32	302.09	843.53	862.00	0.00	0.00	0.00	
6,900.00	88.59	89.63	6,162.79	302.73	943.49	961.78	0.00	0.00	0.00	
7,000.00	88.59	89.63	6,165.26	303.36	1,043.46	1,061.56	0.00	0.00	0.00	
7,100.00	88.59	89.63	6,167.73	304.00	1,143.43	1,161.35	0.00	0.00	0.00	
7,200.00	88.59	89.63	6,170.19	304.64	1,243.40	1,261.13	0.00	0.00	0.00	
7,300.00	88.59	89.63	6,172.66	305.28	1,343.36	1,360.91	0.00	0.00	0.00	
7,400.00	88.59	89.63	6,175.13	305.92	1,443.33	1,460.69	0.00	0.00	0.00	
7,500.00	88.59	89.63	6,177.60	306.55	1,543.30	1,560.48	0.00	0.00	0.00	
7,600.00	88.59	89.63	6,180.06	307.19	1,643.27	1,660.26	0.00	0.00	0.00	



Phoenix Technology Services Planning Report



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Company:	Apache Corporation	TVD Reference:	KB @ 3849.00usft (Capstar 114)
Project:	Eddy County, NM (NAD27-NME)	MD Reference:	KB @ 3849.00usft (Capstar 114)
Site:	Crow Federal	North Reference:	Grid
Well:	#18H	Survey Calculation Method:	Minimum Curvature
Wellbore:	WB1/Job #1311183		
Design:	Plan #4_09-25-13		

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)
7,700.00	88.59	89.63	6,182.53	307.83	1,743.23	1,760.04	0.00	0.00	0.00
7,800.00	88.59	89.63	6,185.00	308.47	1,843.20	1,859.82	0.00	0.00	0.00
7,900.00	88.59	89.63	6,187.47	309.11	1,943.17	1,959.60	0.00	0.00	0.00
8,000.00	88.59	89.63	6,189.93	309.74	2,043.14	2,059.39	0.00	0.00	0.00
8,100.00	88.59	89.63	6,192.40	310.38	2,143.10	2,159.17	0.00	0.00	0.00
8,200.00	88.59	89.63	6,194.87	311.02	2,243.07	2,258.95	0.00	0.00	0.00
8,252.38	88.59	89.63	6,196.16	311.35	2,295.44	2,311.22	0.00	0.00	0.00
MP-Crow Fed #18H									
8,300.00	88.59	89.63	6,197.34	311.66	2,343.04	2,358.73	0.00	0.00	0.00
8,400.00	88.59	89.63	6,199.80	312.30	2,443.01	2,458.52	0.00	0.00	0.00
8,500.00	88.59	89.63	6,202.27	312.93	2,542.97	2,558.30	0.00	0.00	0.00
8,600.00	88.59	89.63	6,204.74	313.57	2,642.94	2,658.08	0.00	0.00	0.00
8,700.00	88.59	89.63	6,207.21	314.21	2,742.91	2,757.86	0.00	0.00	0.00
8,800.00	88.59	89.63	6,209.68	314.85	2,842.88	2,857.65	0.00	0.00	0.00
8,900.00	88.59	89.63	6,212.14	315.49	2,942.84	2,957.43	0.00	0.00	0.00
9,000.00	88.59	89.63	6,214.61	316.12	3,042.81	3,057.21	0.00	0.00	0.00
9,100.00	88.59	89.63	6,217.08	316.76	3,142.78	3,158.99	0.00	0.00	0.00
9,200.00	88.59	89.63	6,219.55	317.40	3,242.75	3,256.78	0.00	0.00	0.00
9,300.00	88.59	89.63	6,222.01	318.04	3,342.71	3,356.56	0.00	0.00	0.00
9,400.00	88.59	89.63	6,224.48	318.68	3,442.68	3,456.34	0.00	0.00	0.00
9,500.00	88.59	89.63	6,226.95	319.31	3,542.65	3,556.12	0.00	0.00	0.00
9,600.00	88.59	89.63	6,229.42	319.95	3,642.62	3,655.91	0.00	0.00	0.00
9,700.00	88.59	89.63	6,231.88	320.59	3,742.58	3,755.69	0.00	0.00	0.00
9,800.00	88.59	89.63	6,234.35	321.23	3,842.55	3,855.47	0.00	0.00	0.00
9,900.00	88.59	89.63	6,236.82	321.87	3,942.52	3,955.25	0.00	0.00	0.00
10,000.00	88.59	89.63	6,239.29	322.50	4,042.49	4,055.04	0.00	0.00	0.00
10,100.00	88.59	89.63	6,241.75	323.14	4,142.45	4,154.82	0.00	0.00	0.00
10,200.00	88.59	89.63	6,244.22	323.78	4,242.42	4,254.60	0.00	0.00	0.00
10,300.00	88.59	89.63	6,246.69	324.42	4,342.39	4,354.38	0.00	0.00	0.00
10,400.00	88.59	89.63	6,249.16	325.06	4,442.36	4,454.17	0.00	0.00	0.00
10,500.00	88.59	89.63	6,251.63	325.69	4,542.32	4,553.95	0.00	0.00	0.00
10,600.00	88.59	89.63	6,254.09	326.33	4,642.29	4,653.73	0.00	0.00	0.00
10,700.00	88.59	89.63	6,256.56	326.97	4,742.26	4,753.51	0.00	0.00	0.00
10,794.29	88.59	89.63	6,258.89	327.57	4,836.52	4,847.60	0.00	0.00	0.00
PBHL-Crow Fed #18H									
10,798.87	88.59	89.63	6,259.00	327.60	4,841.10	4,852.17	0.00	0.00	0.00
TD at 10798.87 - PBHL-Crow Fed #18H.v3									

Design Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
miss target									
Shape									
PBHL-Crow Fed #18H v	0.00	0.00	6,259.00	327.60	4,841.10	672,345.20	643,321.50	32° 50' 50.96917" N	103° 51' 59.96453" W
- plan hits target center									
- Point									



Phoenix Technology Services Planning Report

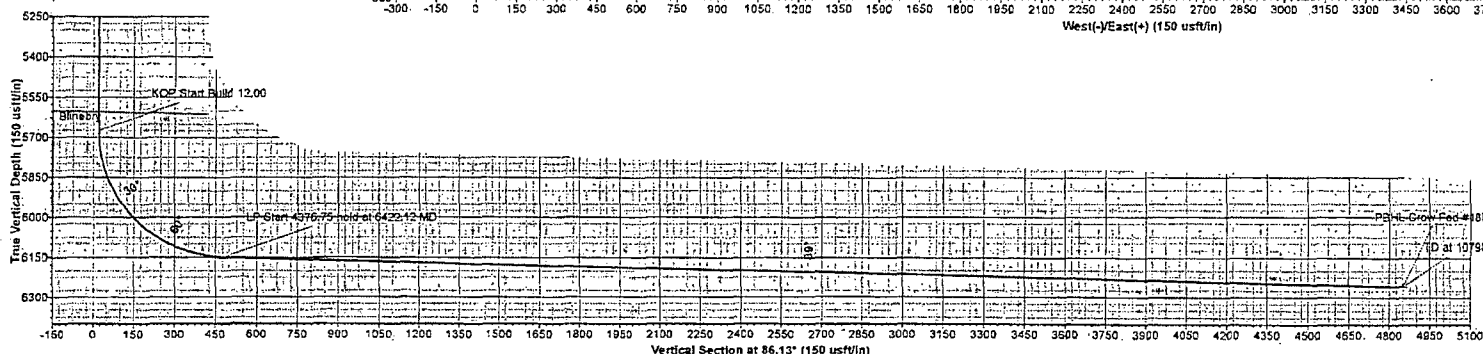
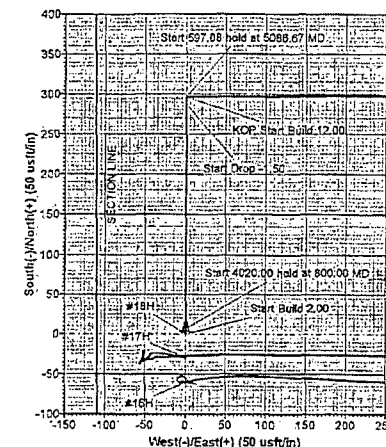
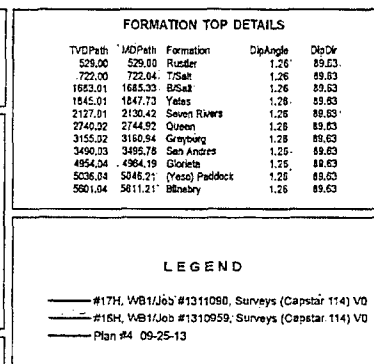
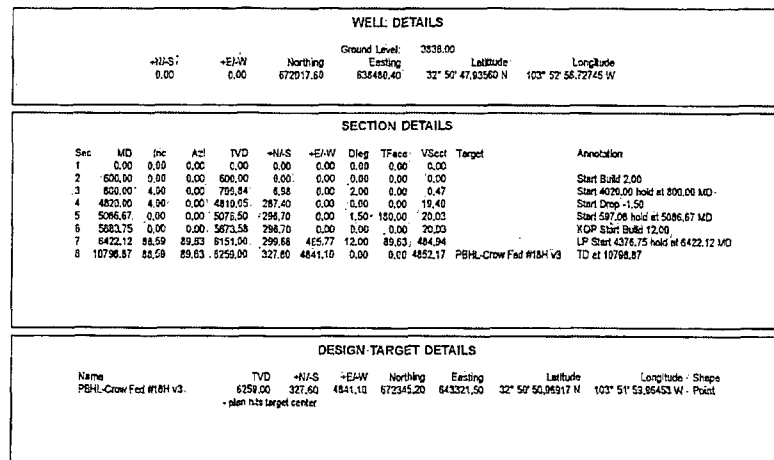
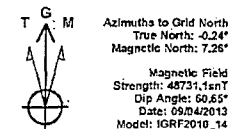
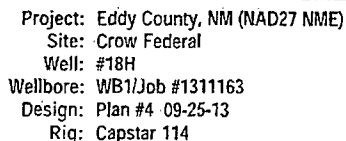


Database:	GCR DB	Local Co-ordinate Reference:	Well #18H
Company:	Apache Corporation	TVD Reference:	KB @ 3849.00usft (Capstar 114)
Project:	Eddy County, NM (NAD27-NME)	MD Reference:	KB @ 3849.00usft (Capstar 114)
Site:	Crow Federal	North Reference:	Grid
Well:	#18H	Survey Calculation Method:	Minimum Curvature
Wellbore:	WB1/Job #1311163		
Design:	Plan #4 09-25-13		

Casing Points				
Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
470.00	470.00	4 1/2" Production	4-1/2	6-1/8

Formations						
Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)	
529.00	529.00	Rustler		1.26	89.63	
722.04	722.00	T/Salt		1.26	89.63	
1,685.33	1,683.01	B/Salt		1.26	89.63	
1,847.73	1,845.01	Yales		1.26	89.63	
2,130.42	2,127.01	Seven Rivers		1.26	89.63	
2,744.92	2,740.02	Queen		1.26	89.63	
3,160.94	3,155.02	Grayburg		1.26	89.63	
3,496.76	3,490.03	San Andres		1.26	89.63	
4,964.19	4,954.04	Glorieta		1.26	89.63	
5,046.21	5,036.04	(Yeso) Paddock		1.26	89.63	
5,611.21	5,601.04	Blaineby		1.26	89.63	

Plan Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N-S (usft)	+E-W (usft)	Comment	
600.00	600.00	0.00	0.00	Start Build 2.00	
800.00	799.84	6.98	0.00	Start 4020.00 hold at 800.00 MD	
4,820.00	4,810.05	287.40	0.00	Start Drop -1.50	
5,086.67	5,076.50	296.70	0.00	Start 597.08 hold at 5086.67 MD	
5,683.75	5,673.58	296.70	0.00	KOP Start Build 12.00	
6,422.12	6,151.00	299.68	465.77	LP Start 4376.75 hold at 6422.12 MD	
10,798.87	6,259.00	327.60	4,841.10	TD at 10798.87	



Map System: US State Plane 1927 (Exact solution)
Datum: NAD 1927 (NADCON CONUS)
Ellipsoid: Clarke 1868
Zone Name: New Mexico East 3001
Local Origin: Well #18H, Grid North
Latitude: 32° 50' 47.03560 N
Longitude: 103° 52' 56.7245 W
Grid East: 638480.40
Grid North: 872017.60
Scale Factor: 1.000
Geomagnetic Model: IGRF2010_14
Sample Date: 04-Sep-13
Magnetic Declination: 7.50°
Dip Angle from Horizontal: 60.65°
Magnetic Field Strength: 48731
To convert a Magnetic Direction to a Grid Direction, Add 7.26°
To convert a Magnetic Direction to a True Direction, Add 7.50° East
To convert a True Direction to a Grid Direction, Subtract 0.24°