



Apache Corporation

Eddy County, NM (NAD27 NME)

Crow Federal

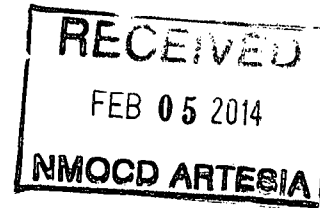
#10H API#30-015-40574

OH / Job #1310298

Survey: Phoenix MWD Surveys

Standard Survey Report

07 May, 2013





Phoenix Technology Services
Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #10H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3925.00usft (Capstar 114)
Site:	Crow Federal	MD Reference:	KB @ 3925.00usft (Capstar 114)
Well:	#10H	North Reference:	Grid
Wellbore:	OH / Job #1310298	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	GCR DB

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
From:	Map	Easting:	643,906.80 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 50' 38.927956 N
		Longitude:	103° 51' 53.166888 W
		Grid Convergence:	0.25 °

Well	#10H		
Well Position	+N/-S	0.00 usft	Northing:
	+E/-W	0.00 usft	Easting:
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft
		Latitude:	32° 50' 38.927956 N
		Longitude:	103° 51' 53.166888 W
		Ground Level:	3,915.00 usft

Wellbore	OH / Job #1310298		
Magnetics	Model Name	Sample Date	Declination
			(°)
	IGRF2010_14	03/08/13	7.56
			Dip Angle:
			(°)
			Field Strength
			(nT)
			60.67
			48,780

Design	Surveys (Capstar 114)		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(usft)	(usft)	(usft)
	0.00	0.00	0.00
			Direction
			(°)
			89.57

Survey Program	Date 05/07/13		
From	To	Survey (Wellbore)	Tool Name
(usft)	(usft)		
629.00	9,765.00	Phoenix MWD Surveys (OH / Job #131029	MWD
			Description :
			MWD - Standard

Survey			
Measured Depth	Inclination	Azimuth	Vertical
(usft)	(°)	(°)	Depth
			(usft)
		+N/-S	+E/-W
		(usft)	(usft)
		Vertical	Dogleg
		Section	Rate
		(usft)	(°/100usft)
			Build
			Rate
			(°/100usft)
			Turn
			Rate
			(°/100usft)
0.00	0.00	0.00	0.00
629.00	0.40	233.40	628.99
			-1.31
			-1.76
			-1.77
			0.06
			0.06
			0.00
Phoenix First MWD Survey			
715.00	0.40	228.90	714.99
			-1.69
			-2.23
			-2.24
			0.04
			0.00
			-5.23
800.00	0.40	242.70	799.99
			-2.02
			-2.72
			-2.73
			0.11
			0.00
			16.24
886.00	0.50	228.80	885.99
			-2.40
			-3.27
			-3.28
			0.17
			0.12
			-16.16
972.00	0.70	218.30	971.98
			-3.06
			-3.87
			-3.90
			0.26
			0.23
			-12.21
1,057.00	0.60	208.20	1,056.98
			-3.86
			-4.41
			-4.44
			0.18
			-0.12
			-11.88
1,143.00	0.70	223.30	1,142.97
			-4.64
			-4.98
			-5.01
			0.23
			0.12
			17.56
1,228.00	1.10	238.00	1,227.96
			-5.45
			-6.03
			-6.07
			0.54
			0.47
			17.29
1,314.00	1.00	236.20	1,313.95
			-6.30
			-7.35
			-7.40
			0.12
			-0.12
			-2.09



Phoenix Technology Services

Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #10H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3925.00usft (Capstar 114)
Site:	Crow Federal	MD Reference:	KB @ 3925.00usft (Capstar 114)
Well:	#10H	North Reference:	Grid
Wellbore:	OH / Job #1310298	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	GCR 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)
1,399.00	1.20	266.90	1,398.93	-6.77	-8.86	-8.91	0.72	0.24	36.12
1,485.00	1.10	286.20	1,484.92	-6.58	-10.55	-10.60	0.46	-0.12	22.44
1,570.00	1.10	289.20	1,569.90	-6.09	-12.10	-12.15	0.07	0.00	3.53
1,656.00	1.10	303.70	1,655.88	-5.36	-13.57	-13.61	0.32	0.00	16.86
1,742.00	1.20	294.40	1,741.87	-4.53	-15.08	-15.11	0.25	0.12	-10.81
1,827.00	1.50	293.10	1,826.84	-3.72	-16.91	-16.94	0.35	0.35	-1.53
1,913.00	1.50	300.80	1,912.81	-2.71	-18.91	-18.93	0.23	0.00	8.95
1,998.00	1.00	277.20	1,997.79	-2.04	-20.60	-20.62	0.83	-0.59	-27.76
2,084.00	0.50	263.50	2,083.79	-1.99	-21.72	-21.73	0.61	-0.58	-15.93
2,169.00	0.80	263.00	2,168.78	-2.11	-22.68	-22.69	0.35	0.35	-0.59
2,255.00	0.70	293.20	2,254.77	-1.97	-23.76	-23.77	0.47	-0.12	35.12
2,341.00	0.40	312.60	2,340.77	-1.56	-24.46	-24.47	0.41	-0.35	22.56
2,426.00	0.60	16.30	2,425.77	-0.93	-24.55	-24.56	0.65	0.24	74.94
2,512.00	0.70	33.80	2,511.76	-0.07	-24.14	-24.13	0.26	0.12	20.35
2,597.00	1.10	29.40	2,596.75	1.08	-23.45	-23.44	0.48	0.47	-5.18
2,683.00	1.40	8.30	2,682.73	2.84	-22.89	-22.87	0.63	0.35	-24.53
2,768.00	1.20	27.20	2,767.71	4.65	-22.33	-22.30	0.55	-0.24	22.24
2,854.00	1.00	32.00	2,853.69	6.09	-21.52	-21.48	0.26	-0.23	5.58
2,940.00	1.30	14.70	2,939.68	7.67	-20.88	-20.82	0.53	0.35	-20.12
3,025.00	1.60	13.20	3,024.65	9.76	-20.36	-20.29	0.36	0.35	-1.76
3,111.00	1.80	10.50	3,110.61	12.26	-19.84	-19.75	0.25	0.23	-3.14
3,197.00	1.50	347.40	3,196.58	14.68	-19.84	-19.73	0.84	-0.35	-26.86
3,281.00	1.20	329.90	3,280.55	16.52	-20.52	-20.40	0.60	-0.36	-20.83
3,367.00	1.20	315.10	3,366.53	17.93	-21.61	-21.47	0.36	0.00	-17.21
3,418.00	1.10	301.70	3,417.52	18.57	-22.40	-22.26	0.56	-0.20	-26.27
3,551.00	1.20	314.90	3,550.50	20.22	-24.48	-24.32	0.21	0.08	9.92
3,637.00	0.70	93.20	3,636.49	20.83	-24.59	-24.43	2.07	-0.58	160.81
3,723.00	0.70	93.20	3,722.49	20.77	-23.54	-23.38	0.00	0.00	0.00
3,808.00	1.90	117.50	3,807.46	20.09	-21.77	-21.62	1.52	1.41	28.59
3,893.00	2.20	125.10	3,892.41	18.50	-19.19	-19.05	0.48	0.35	8.94
3,979.00	0.60	154.80	3,978.38	17.15	-17.64	-17.52	1.98	-1.86	34.53
4,065.00	0.30	185.40	4,064.38	16.51	-17.47	-17.35	0.44	-0.35	35.58
4,150.00	1.00	135.30	4,149.37	15.77	-16.97	-16.85	0.99	0.82	-58.94
4,236.00	1.50	129.50	4,235.35	14.52	-15.58	-15.47	0.60	0.58	-6.74
4,321.00	1.90	129.30	4,320.31	12.92	-13.63	-13.53	0.47	0.47	-0.24
4,407.00	2.50	132.50	4,406.25	10.75	-11.14	-11.06	0.71	0.70	3.72
4,493.00	1.40	149.20	4,492.20	8.58	-9.22	-9.16	1.43	-1.28	19.42
4,578.00	1.20	174.00	4,577.18	6.80	-8.60	-8.54	0.70	-0.24	29.18
4,664.00	0.40	84.90	4,663.17	5.93	-8.20	-8.16	1.46	-0.93	-103.60
4,729.00	1.00	44.80	4,728.17	6.35	-7.58	-7.53	1.14	0.92	-61.69
4,797.00	1.20	51.10	4,796.15	7.22	-6.60	-6.55	0.34	0.29	9.26
4,829.00	1.40	61.40	4,828.15	7.62	-6.00	-5.94	0.96	0.63	32.19
4,861.00	3.10	84.40	4,860.12	7.89	-4.80	-4.74	5.91	5.31	71.88



Phoenix Technology Services
Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #10H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3925.00usft (Capstar 114)
Site:	Crow Federal	MD Reference:	KB @ 3925.00usft (Capstar 114)
Well:	#10H	North Reference:	Grid
Wellbore:	OH / Job #1310298	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	GCR 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)
4,893.00	9.00	91.70	4,891.93	7.90	-1.43	-1.37	18.56	18.44	22.81
4,925.00	14.10	93.00	4,923.27	7.62	4.97	5.03	15.96	15.94	4.06
4,957.00	20.40	91.00	4,953.82	7.32	14.45	14.50	19.77	19.69	-6.25
4,989.00	24.20	91.60	4,983.42	7.04	26.58	26.64	11.90	11.88	1.88
5,021.00	28.80	92.30	5,012.05	6.55	40.85	40.90	14.41	14.38	2.19
5,053.00	32.90	92.80	5,039.51	5.81	57.24	57.28	12.84	12.81	1.56
5,085.00	36.20	92.80	5,065.87	4.93	75.36	75.40	10.31	10.31	0.00
5,117.00	41.50	92.40	5,090.78	4.02	95.41	95.44	16.58	16.56	-1.25
5,149.00	46.30	90.70	5,113.83	3.43	117.58	117.60	15.44	15.00	-5.31
5,181.00	51.30	90.40	5,134.90	3.21	141.65	141.67	15.64	15.63	-0.94
5,213.00	56.30	89.40	5,153.80	3.26	167.46	167.48	15.83	15.63	-3.13
5,245.00	60.60	90.10	5,170.54	3.37	194.73	194.75	13.57	13.44	2.19
5,277.00	64.50	91.20	5,185.28	3.05	223.12	223.13	12.56	12.19	3.44
5,309.00	68.80	91.00	5,197.97	2.48	252.48	252.49	13.45	13.44	-0.63
5,341.00	72.20	90.50	5,208.65	2.09	282.64	282.65	10.73	10.63	-1.56
5,373.00	74.20	90.20	5,217.89	1.90	313.27	313.28	6.31	6.25	-0.94
5,405.00	74.90	89.70	5,226.42	1.93	344.12	344.12	2.66	2.19	-1.56
5,437.00	74.90	89.50	5,234.75	2.15	375.01	375.01	0.60	0.00	-0.63
5,469.00	77.50	88.60	5,242.39	2.66	406.08	406.09	8.57	8.13	-2.81
5,495.00	80.80	89.00	5,247.28	3.20	431.60	431.62	12.78	12.69	1.54
5,518.00	83.40	88.10	5,250.44	3.77	454.38	454.39	11.95	11.30	-3.91
5,550.00	85.30	88.50	5,253.59	4.72	486.21	486.23	6.07	5.94	1.25
5,646.00	90.20	88.10	5,257.36	7.56	582.06	582.10	5.12	5.10	-0.42
5,742.00	89.80	88.10	5,257.36	10.75	678.01	678.07	0.42	-0.42	0.00
5,838.00	89.30	89.00	5,258.11	13.18	773.97	774.05	1.07	-0.52	0.94
5,934.00	89.30	89.30	5,259.29	14.60	869.95	870.04	0.31	0.00	0.31
6,030.00	89.60	89.10	5,260.21	15.94	965.94	966.03	0.38	0.31	-0.21
6,126.00	89.50	90.70	5,260.96	16.11	1,061.93	1,062.03	1.67	-0.10	1.67
6,222.00	89.70	92.20	5,261.63	13.68	1,157.90	1,157.97	1.58	0.21	1.56
6,318.00	88.40	90.20	5,263.22	11.67	1,253.86	1,253.91	2.48	-1.35	-2.08
6,413.00	86.90	88.70	5,267.12	12.58	1,348.77	1,348.82	2.23	-1.58	-1.58
6,508.00	88.80	87.10	5,270.68	16.06	1,443.63	1,443.71	2.61	2.00	-1.68
6,603.00	89.10	89.60	5,272.43	18.79	1,538.57	1,538.66	2.65	0.32	2.63
6,699.00	88.70	90.00	5,274.27	19.13	1,634.55	1,634.65	0.59	-0.42	0.42
6,794.00	88.20	90.00	5,276.84	19.13	1,729.51	1,729.61	0.53	-0.53	0.00
6,890.00	87.40	89.60	5,280.52	19.46	1,825.44	1,825.53	0.93	-0.83	-0.42
6,986.00	89.00	89.20	5,283.54	20.47	1,921.38	1,921.48	1.72	1.67	-0.42
7,082.00	88.30	88.20	5,285.80	22.64	2,017.33	2,017.44	1.27	-0.73	-1.04
7,178.00	89.20	88.80	5,287.89	25.16	2,113.27	2,113.40	1.13	0.94	0.63
7,274.00	89.90	89.30	5,288.65	26.75	2,209.26	2,209.40	0.90	0.73	0.52
7,370.00	89.60	89.40	5,289.07	27.84	2,305.25	2,305.39	0.33	-0.31	0.10
7,464.00	89.50	89.10	5,289.81	29.07	2,399.24	2,399.39	0.34	-0.11	-0.32
7,560.00	90.20	91.00	5,290.06	28.98	2,495.23	2,495.38	2.11	0.73	1.98



Phoenix Technology Services
Survey Report



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Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3925.00usft (Capstar 114)
Site:	Crow Federal	MD Reference:	KB @ 3925.00usft (Capstar 114)
Well:	#10H	North Reference:	Grid
Wellbore:	OH / Job #1310298	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	GCR 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)	
7,656.00	89.80	90.80	5,290.06	27.48	2,591.22	2,591.35	0.47	-0.42	-0.21	
7,752.00	89.80	90.30	5,290.39	26.55	2,687.22	2,687.34	0.52	0.00	-0.52	
7,849.00	89.60	90.50	5,290.90	25.88	2,784.21	2,784.33	0.29	-0.21	0.21	
7,945.00	89.00	88.60	5,292.07	26.63	2,880.20	2,880.32	2.08	-0.63	-1.98	
8,041.00	89.20	89.30	5,293.58	28.39	2,976.17	2,976.30	0.76	0.21	0.73	
8,137.00	89.50	89.40	5,294.67	29.48	3,072.16	3,072.29	0.33	0.31	0.10	
8,232.00	90.50	90.20	5,294.67	29.81	3,167.15	3,167.29	1.35	1.05	0.84	
8,328.00	90.90	90.90	5,293.50	28.89	3,263.14	3,263.27	0.84	0.42	0.73	
8,424.00	89.60	90.60	5,293.08	27.63	3,359.13	3,359.24	1.39	-1.35	-0.31	
8,521.00	88.50	91.00	5,294.69	26.28	3,456.11	3,456.21	1.21	-1.13	0.41	
8,617.00	87.80	91.40	5,297.79	24.27	3,552.03	3,552.12	0.84	-0.73	0.42	
8,713.00	88.00	90.50	5,301.30	22.68	3,647.95	3,648.02	0.96	0.21	-0.94	
8,809.00	88.40	89.60	5,304.32	22.60	3,743.91	3,743.97	1.03	0.42	-0.94	
8,905.00	88.90	89.80	5,306.58	23.10	3,839.88	3,839.94	0.56	0.52	0.21	
9,001.00	88.30	89.30	5,308.93	23.85	3,935.85	3,935.91	0.81	-0.63	-0.52	
9,098.00	89.20	88.80	5,311.04	25.46	4,032.81	4,032.89	1.06	0.93	-0.52	
9,194.00	88.70	87.80	5,312.80	28.31	4,128.75	4,128.84	1.16	-0.52	-1.04	
9,290.00	89.20	88.80	5,314.56	31.15	4,224.69	4,224.80	1.16	0.52	1.04	
9,386.00	89.70	88.80	5,315.48	33.16	4,320.66	4,320.79	0.52	0.52	0.00	
9,482.00	88.70	88.50	5,316.82	35.43	4,416.62	4,416.77	1.09	-1.04	-0.31	
9,578.00	87.80	88.90	5,319.75	37.60	4,512.55	4,512.71	1.03	-0.94	0.42	
9,674.00	86.80	89.10	5,324.28	39.28	4,608.43	4,608.60	1.06	-1.04	0.21	
9,710.00	86.50	88.90	5,326.38	39.90	4,644.36	4,644.53	1.00	-0.83	-0.56	
Phoenix Last MWD Survey										
9,765.00	86.50	88.90	5,329.74	40.96	4,699.25	4,699.43	0.00	0.00	0.00	
Projection to TD										

Survey Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
629.00	628.99	-1.31	-1.76	Phoenix First MWD Survey	
9,710.00	5,326.38	39.90	4,644.36	Phoenix Last MWD Survey	
9,765.00	5,329.74	40.96	4,699.25	Projection to TD	

Checked By: _____ Approved By: _____ Date: _____

Phoenix Technology Services SURVEY DATA CERTIFICATION



PHOENIX JOB NUMBER 1310298

OPERATOR Apache Corp

WELL NAME Crow Federal #10H

COUNTY & STATE

Eddy, NM

API WELL NUMBER 30-015-40574

PROPOSED DIRECTION 89.57

TIE-IN DATA						
MEASURED	VERTICAL			N-S	E-W	DATA
DEPTH	DEPTH	INCLIN	AZIMUTH	COORD	COORD	SOURCE
ft	.00 ft	.0 ft	.0 ft	.00 ft	.00 ft	Surface

FIRST	FIRST		
SURVEY	SURVEY		
DATE	DEPTH	INCLIN	AZIMUTH
19-Apr-13	629 ft	0.4	233.4

SURVEY INSTRUMENT
TYPE
Phoenix MWD

LAST	LAST		
SURVEY	SURVEY		
DATE	DEPTH	INCLIN	AZIMUTH
6-May-13	9,710 ft	86.5	88.9

TO THE BEST OF MY KNOWLEDGE I
CERTIFY THIS SURVEY DATA TO BE
TRUE AND CORRECT.

PROJECTED	PROJECTED		
TD SURVEY	TD SURVEY		
DATE	DEPTH	INCLIN	AZIMUTH
6-May-13	9,765 ft	86.5	88.9

Brad Hill

PRINT YOUR NAME ABOVE

Brad Hill

SIGN YOUR NAME ABOVE

MAGNETIC DECLINATION OR TOTAL GRID

TOTAL CORRECTION USED	7.55
DECLINATION OR GRID	GRID

5/6/2013

TODAY'S DATE

MWD SUPERVISOR 1

Brad Hill

DIRECTIONAL DRILLER 1

Tim Owens

MWD SUPERVISOR 2

Matt Dice

DIRECTIONAL DRILLER 2

Ken Smith

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