



HOBBS OCD

MAY 15 2015

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Apache Corporation (873)

Lea County, NM (NAD27 NME)

WBDU

#178W

30-025-41547

UL B 16-215-37E

S20' FNL + 2095' FEL

WB1 / Job #1411971

Survey: Phoenix MWD Survey

Standard Survey Report

11 December, 2014

MAY 18 2015



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Company: Apache Corporation
Project: Lea County, NM (NAD27 NME)
Site: WBDU
Well: #178W
Wellbore: WB1 / Job #1411971
Design: Surveys (Capstar 118)

Local Co-ordinate Reference: Well #178W
TVD Reference: KB @ 3499.00usft (Capstar 118)
MD Reference: KB @ 3499.00usft (Capstar 118)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: Compass 5000 GCR

Project	Lea 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	WBDU		
Site Position:		Northing:	538,109.00 usft
From:	Map	Easting:	858,688.20 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 28' 26.39792 N
		Longitude:	103° 10' 12.95694 W
		Grid Convergence:	0.62 °

Well	#178W		
Well Position	+N/-S	0.00 usft	Northing: 541,988.20 usft
	+E/-W	0.00 usft	Easting: 860,034.00 usft
Position Uncertainty	0.00 usft	Wellhead Elevation:	0.00 usft
		Latitude:	32° 29' 4.63298 N
		Longitude:	103° 9' 56.75444 W
		Ground Level:	3,488.00 usft

Wellbore	WB1 / Job #1411971		
Magnetics	Model Name	Sample Date	Declination (°)
	BGGM2014	11/21/2014	7.15
			Dip Angle (°)
			60.41
			Field Strength (nT)
			48,434

Design	Surveys (Capstar 118)		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)
	0.00	0.00	0.00
			Direction (°)
			175.42

Survey Program	Date 12/11/2014		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name
100.00	1,286.00	SDI Gyro Survey (WB1 / Job #1411971)	Scientific Gyro
1,349.00	6,955.00	Phoenix MWD Survey (WB1 / Job #14119)	PHX+MWD+BGGM
			Description
			Scientific Drilling Intl. Standard Wireline Keeper
			PHX+MWD+BGGM v3:standard declination

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)
1,286.00	0.32	269.30	1,285.95	-1.61	-8.28	0.94	0.00	0.00	0.00
Tie-on to SDI Gyro Survey									
1,349.00	0.30	289.00	1,348.95	-1.56	-8.61	0.87	0.17	-0.03	31.27
First Phoenix MWD Survey									
1,434.00	0.08	259.90	1,433.95	-1.50	-8.88	0.78	0.27	-0.26	-34.24
1,477.00	1.00	229.50	1,476.94	-1.75	-9.20	1.01	2.17	2.14	-70.70
1,648.00	1.10	208.00	1,647.92	-4.16	-11.10	3.26	0.24	0.06	-12.57
1,690.00	1.30	209.00	1,689.91	-4.94	-11.52	4.00	0.48	0.48	2.38
1,733.00	2.00	211.00	1,732.89	-6.01	-12.14	5.02	1.63	1.63	4.65

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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)
1,819.00	1.50	177.00	1,818.85	-8.42	-12.86	7.36	1.31	-0.58	-39.53
1,861.00	1.50	181.00	1,860.84	-9.52	-12.84	8.46	0.25	0.00	9.52
2,074.00	1.70	166.00	2,073.75	-15.37	-12.12	14.35	0.22	0.09	-7.04
2,330.00	2.60	170.40	2,329.57	-24.78	-10.24	23.88	0.36	0.35	1.72
2,458.00	2.10	163.50	2,457.46	-29.89	-9.09	29.07	0.45	-0.39	-5.39
2,503.00	2.10	169.80	2,502.43	-31.49	-8.71	30.70	0.51	0.00	14.00
2,543.00	1.80	177.00	2,542.41	-32.84	-8.54	32.05	0.97	-0.75	18.00
2,714.00	1.60	177.00	2,713.39	-33.14	-8.33	32.37	1.99	-0.12	-102.47
2,841.00	0.30	201.60	2,840.37	-31.67	-8.40	30.90	1.48	-1.02	-126.12
2,969.00	1.10	318.20	2,968.36	-31.07	-9.34	30.22	0.99	0.63	91.09
3,055.00	0.70	141.30	3,054.36	-30.86	-9.56	30.00	2.09	-0.47	-205.70
3,097.00	1.10	144.10	3,096.35	-31.39	-9.16	30.56	0.96	0.95	6.67
3,182.00	0.70	109.00	3,181.34	-32.22	-8.19	31.46	0.78	-0.47	-41.29
3,268.00	1.10	73.10	3,267.33	-32.15	-6.91	31.50	0.78	0.47	-41.74
3,395.00	1.70	89.80	3,394.30	-31.79	-3.86	31.38	0.57	0.47	13.15
3,586.00	3.30	86.80	3,585.11	-31.47	4.46	31.73	0.84	0.84	-1.57
3,736.00	4.80	117.00	3,734.75	-34.08	14.37	35.12	1.71	1.00	20.13
3,907.00	4.80	141.40	3,905.16	-42.92	25.21	44.80	1.19	0.00	14.27
3,950.00	4.30	146.60	3,948.03	-45.67	27.22	47.70	1.51	-1.16	12.09
4,035.00	4.40	146.00	4,032.78	-51.04	30.80	53.33	0.13	0.12	-0.71
4,120.00	6.10	147.00	4,117.42	-57.53	35.08	60.15	2.00	2.00	1.18
4,162.00	6.70	152.00	4,159.16	-61.56	37.44	64.36	1.95	1.43	11.90
4,291.00	4.10	151.50	4,287.58	-72.26	43.18	75.48	2.02	-2.02	-0.39
4,333.00	4.20	149.10	4,329.47	-74.90	44.69	78.23	0.48	0.24	-5.71
4,375.00	4.00	150.00	4,371.36	-77.49	46.21	80.93	0.50	-0.48	2.14
4,418.00	4.30	153.10	4,414.25	-80.23	47.69	83.78	0.87	0.70	7.21
4,461.00	4.20	155.10	4,457.13	-83.09	49.08	86.75	0.42	-0.23	4.65
4,504.00	3.90	160.90	4,500.02	-85.90	50.22	89.64	1.18	-0.70	13.49
4,546.00	3.60	161.60	4,541.93	-88.50	51.10	92.30	0.72	-0.71	1.67
4,589.00	3.40	158.50	4,584.85	-90.97	52.00	94.83	0.64	-0.47	-7.21
4,632.00	3.40	160.00	4,627.78	-93.36	52.90	97.28	0.21	0.00	3.49
4,674.00	3.30	160.30	4,669.71	-95.66	53.73	99.65	0.24	-0.24	0.71
4,717.00	3.40	160.30	4,712.63	-98.03	54.58	102.07	0.23	0.23	0.00
4,760.00	3.30	163.80	4,755.56	-100.42	55.36	104.52	0.53	-0.23	8.14
4,803.00	3.30	163.20	4,798.49	-102.79	56.06	106.94	0.08	0.00	-1.40
4,845.00	3.30	163.80	4,840.42	-105.11	56.75	109.31	0.08	0.00	1.43
4,888.00	3.20	164.50	4,883.35	-107.45	57.41	111.70	0.25	-0.23	1.63
4,931.00	3.20	163.10	4,926.28	-109.76	58.08	114.05	0.18	0.00	-3.26
4,973.00	3.30	162.70	4,968.21	-112.04	58.78	116.37	0.24	0.24	-0.95
5,016.00	3.20	164.30	5,011.14	-114.37	59.47	118.76	0.31	-0.23	3.72
5,058.00	3.30	164.40	5,053.08	-116.66	60.12	121.09	0.24	0.24	0.24
5,101.00	3.30	165.40	5,096.01	-119.05	60.76	123.53	0.13	0.00	2.33
5,144.00	3.20	164.70	5,138.94	-121.41	61.39	125.92	0.25	-0.23	-1.63

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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)
5,186.00	3.10	164.40	5,180.87	-123.63	62.01	128.19	0.24	-0.24	-0.71
5,229.00	3.00	167.10	5,223.81	-125.85	62.57	130.45	0.41	-0.23	6.28
5,272.00	3.20	166.70	5,266.75	-128.12	63.10	132.75	0.47	0.47	-0.93
5,314.00	3.00	168.20	5,308.69	-130.33	63.59	134.99	0.51	-0.48	3.57
5,357.00	2.90	164.10	5,351.63	-132.48	64.12	137.18	0.54	-0.23	-9.53
5,400.00	3.00	167.00	5,394.57	-134.62	64.67	139.36	0.42	0.23	6.74
5,442.00	2.70	168.90	5,436.52	-136.66	65.11	141.43	0.75	-0.71	4.52
5,485.00	2.70	169.90	5,479.47	-138.66	65.48	143.44	0.11	0.00	2.33
5,528.00	2.80	169.60	5,522.42	-140.69	65.85	145.49	0.23	0.23	-0.70
5,571.00	2.70	173.10	5,565.38	-142.72	66.16	147.55	0.45	-0.23	8.14
5,613.00	2.50	173.90	5,607.33	-144.62	66.38	149.46	0.48	-0.48	1.90
5,656.00	2.60	174.90	5,650.29	-146.52	66.56	151.37	0.25	0.23	2.33
5,699.00	2.50	172.80	5,693.25	-148.42	66.77	153.28	0.32	-0.23	-4.88
5,741.00	2.40	176.50	5,735.21	-150.21	66.93	155.07	0.45	-0.24	8.81
5,788.00	2.60	175.80	5,782.16	-152.25	67.07	157.12	0.43	0.43	-1.49
5,827.00	2.50	178.00	5,821.13	-153.99	67.17	158.86	0.36	-0.26	5.64
5,869.00	2.40	175.00	5,863.09	-155.78	67.28	160.65	0.39	-0.24	-7.14
5,912.00	2.40	175.10	5,906.05	-157.57	67.43	162.45	0.01	0.00	0.23
5,955.00	2.20	174.20	5,949.01	-159.29	67.59	164.18	0.47	-0.47	-2.09
5,997.00	2.10	176.10	5,990.98	-160.86	67.72	165.75	0.29	-0.24	4.52
6,040.00	2.10	175.80	6,033.96	-162.43	67.84	167.33	0.03	0.00	-0.70
6,083.00	2.20	177.80	6,076.93	-164.04	67.93	168.94	0.29	0.23	4.65
6,126.00	2.30	177.30	6,119.89	-165.73	68.00	170.63	0.24	0.23	-1.16
6,168.00	2.20	175.50	6,161.86	-167.37	68.10	172.28	0.29	-0.24	-4.29
6,211.00	2.10	178.10	6,204.83	-168.98	68.19	173.89	0.32	-0.23	6.05
6,254.00	2.20	180.10	6,247.80	-170.60	68.22	175.50	0.29	0.23	4.65
6,296.00	2.20	179.80	6,289.77	-172.21	68.22	177.11	0.03	0.00	-0.71
6,339.00	2.20	181.50	6,332.74	-173.86	68.20	178.75	0.15	0.00	3.95
6,381.00	2.40	186.10	6,374.70	-175.54	68.08	180.42	0.65	0.48	10.95
6,424.00	2.20	186.60	6,417.67	-177.26	67.89	182.11	0.47	-0.47	1.16
6,467.00	2.20	185.90	6,460.64	-178.90	67.71	183.73	0.06	0.00	-1.63
6,553.00	3.10	180.70	6,546.54	-182.86	67.52	187.67	1.08	1.05	-6.05
6,595.00	3.00	184.10	6,588.48	-185.10	67.42	189.89	0.49	-0.24	8.10
6,638.00	3.20	181.30	6,631.42	-187.42	67.32	192.19	0.58	0.47	-6.51
6,681.00	2.90	183.10	6,674.36	-189.70	67.23	194.47	0.73	-0.70	4.19
6,723.00	3.00	180.40	6,716.31	-191.86	67.16	196.61	0.41	0.24	-6.43
6,766.00	2.80	182.50	6,759.25	-194.04	67.11	198.78	0.53	-0.47	4.88
6,809.00	2.60	185.00	6,802.20	-196.06	66.98	200.78	0.54	-0.47	5.81
6,851.00	2.70	180.90	6,844.16	-198.00	66.88	202.71	0.51	0.24	-9.76
6,904.00	2.80	184.50	6,897.10	-200.54	66.76	205.23	0.38	0.19	6.79
Last Phoenix MWD Survey									
6,955.00	2.80	184.50	6,948.04	-203.02	66.57	207.69	0.00	0.00	0.00
Projection to TD									

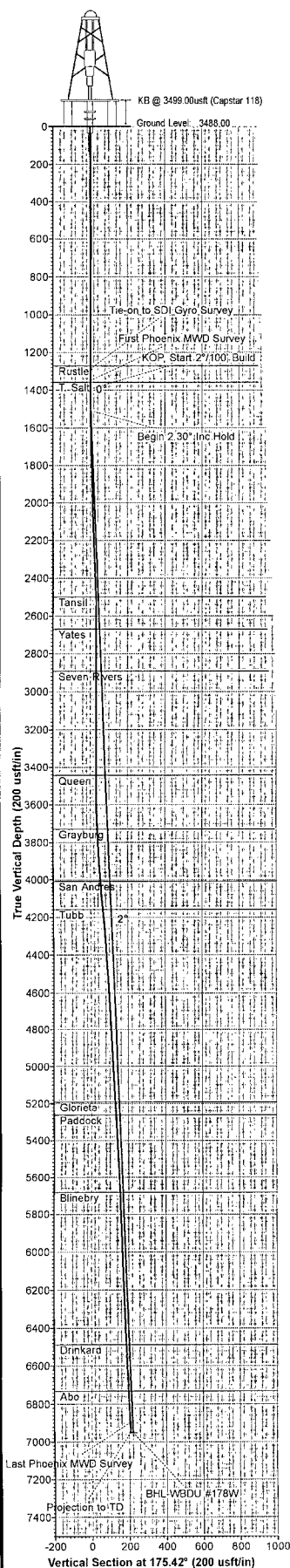
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Survey Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,286.00	1,285.95	-1.61	-8.28	Tie-on to SDI Gyro Survey
1,349.00	1,348.95	-1.56	-8.61	First Phoenix MWD Survey
6,904.00	6,897.10	-200.54	66.76	Last Phoenix MWD Survey
6,955.00	6,948.04	-203.02	66.57	Projection to TD

Checked By: _____ Approved By: _____ Date: _____



WELL DETAILS									
+N-S	+E-W	Northing	Ground Level	Easting	Latitude	Longitude			
0.00	0.00	541988.20	3488.00	860034.00	32° 29' 4.63298 N	103° 9' 56.75444 W			

SECTION DETAILS									
Sec	MD	Inc	Azi	TVD	+N-S	+E-W	Dleg	TFace	VSecl
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1394.00	0.00	0.00	1394.00	0.00	0.00	0.00	0.00	0.00
3	1508.82	2.30	175.42	1508.79	-2.29	0.18	2.00	175.42	2.30
4	6954.40	2.30	175.42	6950.00	-219.80	17.60	0.00	0.00	220.50

Annotation: KOP, Start 2°/100' Build
Begin 2.30° Inc Hold
TD at 6954.40' MD

DESIGN TARGET DETAILS									
Name	TVD	+N-S	+E-W	Northing	Easting	Latitude	Longitude	Shape	
BHL-WBDU #178W	6950.00	-219.80	17.60	541768.40	860051.60	32° 29' 2.45640 N	103° 9' 56.57708 W	Circle (Radius: 20.00)	

- plan hits target center

FORMATION TOP DETAILS				
TVDPath	MDPath	Formation	DipAngle	DipDir
1270.00	1270.00	Rustler		
1357.00	1357.00	T. Salt		
2499.00	2499.83	Tansil		
2670.00	2670.96	Yates		
2892.00	2893.14	Seven Rivers		
3443.00	3444.59	Queen		
3729.00	3730.82	Grayburg		
4008.00	4010.04	San Andres		
4158.00	4160.16	Tubb		
5191.00	5193.99	Glorieta		
5261.00	5264.05	Paddock		
5981.00	5984.38	Blinberry		
6486.00	6490.03	Drinkard		
6730.00	6734.23	Abo		

Map System: US State Plane 1927 (Exact solution)
Datum: NAD 1927 (NADCON CONUS)
Ellipsoid: Clarke 1856
Zone Name: New Mexico East 3001
Local Origin: Well #178W, Grid North
Latitude: 32° 29' 4.63298 N
Longitude: 103° 9' 56.75444 W
Grid East: 860034.00
Grid North: 541988.20
Scale Factor: 1.000
Geomagnetic Model: BGM2014
Sample Date: 21-Nov-14
Magnetic Declination: 7.15°
Dip Angle from Horizontal: 60.41°
Magnetic Field Strength: 48434
To convert a Magnetic Direction to a Grid Direction, Add 6.52°
To convert a Magnetic Direction to a True Direction, Add 7.15° East
To convert a True Direction to a Grid Direction, Subtract 0.63°

LEGEND

— #178W, WB1 / Job #1411971, Surveys (Capstar 118) V0
— Plan #1 10-07-14

