



Apache Corporation

Eddy County, NM (NAD27 NME)

Cedar Lake Federal CA

410H

30-015-43521

OH / Job #60428

NM OIL CONSERVATION
ARTESIA DISTRICT

FEB 15 2018

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Design: Surveys (Trinidad 436)

Standard Survey Report

04 June, 2017



Company: Apache Corporation
Project: Eddy County, NM (NAD27 NME)
Site: Cedar Lake Federal CA
Well: 410H
Wellbore: OH / Job #60428
Design: Surveys (Trinidad 436)

Local Co-ordinate Reference: Well 410H
TVD Reference: KB @ 3968.00usft (Capstar 114)
MD Reference: KB @ 3968.00usft (Capstar 114)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: Compass 5000 GCR

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	Cedar Lake Federal CA		
Site Position:		Northing:	670,624.80 usft
From:	Map	Easting:	633,024.10 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 50' 34.37962 N
		Longitude:	103° 54' 0.75173 W
		Grid Convergence:	0.23 °

Well	410H		
Well Position	+N/-S	0.00 usft	Northing: 679,716.19 usft
	+E/-W	0.00 usft	Easting: 642,647.50 usft
Position Uncertainty	0.00 usft	Wellhead Elevation:	0.00 usft
		Latitude:	32° 52' 3.93489 N
		Longitude:	103° 52' 7.48491 W
		Ground Level:	3,957.00 usft

Wellbore	OH / Job #60428				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	6/9/2017	7.42	60.82	48,408

Design	Surveys (Trinidad 436)				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.00	0.00	0.00	82.96	

Survey Program	Date 6/4/2017				
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
51.83	636.00	Phoenix Gyro Surveys (OH / Job #60428)	PHX_SPT_GTD	PHX Continuous north-seeking gyro	
712.00	11,483.00	Phoenix MWD Surveys (OH / Job #60428)	MWD+HDGM	OWSG Rev.2 MWD + HDGM	

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
51.83	0.29	29.25	51.83	0.11	0.06	0.08	0.56	0.56	0.00
113.33	0.50	33.36	113.33	0.47	0.29	0.34	0.34	0.34	6.68
174.83	0.91	149.17	174.83	0.28	0.69	0.71	1.97	0.67	188.31
236.33	1.51	106.78	236.31	-0.37	1.71	1.65	1.69	0.98	-68.93
297.83	1.62	9.66	297.80	0.25	2.63	2.64	3.82	0.18	-157.92
359.33	1.73	24.24	359.27	1.95	3.16	3.38	0.71	0.18	23.71
420.83	1.74	359.66	420.74	3.73	3.54	3.97	1.20	0.02	-39.97
482.33	1.80	20.26	482.22	5.57	3.87	4.52	1.03	0.10	33.50
543.83	1.55	12.10	543.69	7.29	4.37	5.24	0.56	-0.41	-13.27



Phoenix Technology Services LP

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605.33	1.42	14.55	605.17	8.84	4.74	5.79	0.24	-0.21	3.98
636.00	1.36	18.35	635.83	9.56	4.95	6.08	0.36	-0.20	12.39
Tie In									
712.00	0.98	13.92	711.81	11.04	5.39	6.70	0.51	-0.50	-5.83
First Phoenix MWD Survey									
837.00	0.91	17.98	836.80	13.02	5.95	7.51	0.08	-0.06	3.25
962.00	1.10	18.00	961.78	15.11	6.63	8.43	0.15	0.15	0.02
1,087.00	0.98	14.78	1,086.76	17.28	7.27	9.34	0.11	-0.10	-2.58
1,213.00	1.09	4.15	1,212.74	19.52	7.64	9.97	0.18	0.09	-8.44
1,338.00	2.13	57.07	1,337.69	21.97	9.67	12.29	1.37	0.83	42.34
1,463.00	2.58	59.05	1,462.59	24.68	14.03	16.95	0.37	0.36	1.58
1,589.00	2.64	60.98	1,588.46	27.55	19.00	22.24	0.08	0.05	1.53
1,714.00	3.00	62.60	1,713.30	30.45	24.43	27.97	0.29	0.29	1.30
1,838.00	1.37	74.90	1,837.21	32.33	28.74	32.48	1.36	-1.31	9.92
1,963.00	1.29	86.84	1,962.18	32.79	31.59	35.37	0.23	-0.06	9.55
2,088.00	1.35	79.96	2,087.14	33.13	34.44	38.24	0.14	0.05	-5.50
2,213.00	1.22	80.26	2,212.11	33.61	37.20	41.04	0.10	-0.10	0.24
2,337.00	1.27	62.33	2,336.08	34.47	39.72	43.65	0.32	0.04	-14.46
2,461.00	0.48	59.64	2,460.07	35.37	41.38	45.41	0.64	-0.64	-2.17
2,586.00	0.55	31.18	2,585.06	36.15	42.15	46.26	0.21	0.06	-22.77
2,712.00	0.57	31.22	2,711.06	37.20	42.79	47.02	0.02	0.02	0.03
2,838.00	0.34	246.96	2,837.06	37.59	42.77	47.05	0.69	-0.18	-114.49
2,960.00	0.47	238.04	2,959.05	37.19	42.01	46.25	0.12	0.11	-7.31
3,085.00	0.58	260.07	3,084.05	36.81	40.95	45.15	0.18	0.09	17.62
3,211.00	0.87	208.63	3,210.04	35.86	39.86	43.96	0.54	0.23	-40.83
3,336.00	0.91	202.79	3,335.02	34.11	39.02	42.91	0.08	0.03	-4.67
3,462.00	1.09	190.84	3,461.00	32.01	38.41	42.05	0.22	0.14	-9.48
3,584.00	1.13	191.29	3,582.98	29.69	37.96	41.31	0.03	0.03	0.37
3,709.00	1.07	181.78	3,707.96	27.31	37.68	40.75	0.15	-0.05	-7.61
3,834.00	1.02	179.25	3,832.94	25.04	37.66	40.44	0.05	-0.04	-2.02
3,958.00	0.26	100.30	3,956.93	23.88	37.95	40.59	0.81	-0.61	-63.67
4,083.00	0.26	115.73	4,081.93	23.71	38.48	41.10	0.06	0.00	12.34
4,207.00	0.30	113.20	4,205.93	23.46	39.04	41.62	0.03	0.03	-2.04
4,332.00	0.21	149.66	4,330.93	23.13	39.45	41.99	0.14	-0.07	29.17
4,457.00	0.20	132.40	4,455.93	22.79	39.73	42.22	0.05	-0.01	-13.81
4,583.00	0.25	89.04	4,581.92	22.64	40.17	42.64	0.14	0.04	-34.41
4,708.00	0.27	89.70	4,706.92	22.65	40.73	43.20	0.02	0.02	0.53
4,833.00	0.14	51.38	4,831.92	22.75	41.15	43.63	0.15	-0.10	-30.66
4,957.00	0.17	94.83	4,955.92	22.83	41.45	43.94	0.10	0.02	35.04
5,078.00	0.12	91.69	5,076.92	22.81	41.75	44.24	0.04	-0.04	-2.60
5,093.00	0.17	130.15	5,091.92	22.79	41.79	44.27	0.71	0.33	256.40
5,155.00	2.00	53.16	5,153.91	23.38	42.72	45.27	3.18	2.95	-124.18
5,217.00	8.25	48.31	5,215.63	26.99	46.92	49.87	10.10	10.08	-7.82

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5,280.00	15.09	43.37	5,277.29	35.97	55.93	59.92	10.96	10.86	-7.84
5,342.00	21.00	43.59	5,336.22	49.90	69.15	74.74	9.53	9.53	0.35
5,405.00	27.84	45.87	5,393.55	68.34	87.51	95.23	10.96	10.86	3.62
5,467.00	35.03	46.83	5,446.41	90.62	110.91	121.19	11.62	11.60	1.55
5,528.00	43.35	47.08	5,493.65	116.90	139.06	152.35	13.64	13.64	0.41
5,591.00	51.77	47.24	5,536.13	148.48	173.12	190.03	13.37	13.37	0.25
5,653.00	58.55	47.28	5,571.53	183.00	210.48	231.33	10.94	10.94	0.06
5,715.00	64.02	50.93	5,601.31	218.54	251.58	276.48	10.22	8.82	5.89
5,777.00	71.86	51.41	5,624.58	254.54	296.31	325.29	12.67	12.65	0.77
5,838.00	79.01	52.11	5,639.91	291.05	342.66	375.76	11.77	11.72	1.15
5,907.00	86.16	55.29	5,648.81	331.51	397.77	435.42	11.32	10.36	4.61
5,969.00	87.87	57.38	5,652.04	365.83	449.30	490.77	4.35	2.76	3.37
6,032.00	89.05	59.23	5,653.73	398.92	502.88	548.00	3.48	1.87	2.94
6,096.00	89.69	60.70	5,654.44	430.95	558.28	606.91	2.50	1.00	2.30
6,159.00	89.72	62.37	5,654.76	460.97	613.66	665.56	2.65	0.05	2.65
6,221.00	89.41	64.84	5,655.23	488.53	669.19	724.05	4.02	-0.50	3.98
6,284.00	89.30	67.18	5,655.94	514.14	726.74	784.30	3.72	-0.17	3.71
6,346.00	89.08	69.64	5,656.82	536.95	784.38	844.31	3.98	-0.35	3.97
6,409.00	88.43	72.69	5,658.19	557.29	843.99	905.95	4.95	-1.03	4.84
6,470.00	88.18	74.82	5,659.99	574.34	902.52	966.14	3.51	-0.41	3.49
6,532.00	88.21	76.07	5,661.94	589.91	962.50	1,027.58	2.02	0.05	2.02
6,594.00	89.11	76.46	5,663.39	604.63	1,022.71	1,089.14	1.58	1.45	0.63
6,656.00	89.72	77.48	5,664.03	618.61	1,083.11	1,150.79	1.92	0.98	1.65
6,718.00	89.11	79.16	5,664.66	631.16	1,143.82	1,212.58	2.88	-0.98	2.71
6,780.00	89.75	79.31	5,665.28	642.74	1,204.73	1,274.45	1.06	1.03	0.24
6,842.00	90.28	79.95	5,665.26	653.90	1,265.71	1,336.35	1.34	0.85	1.03
6,904.00	89.41	81.70	5,665.43	663.78	1,326.92	1,398.30	3.15	-1.40	2.82
6,966.00	88.71	82.65	5,666.44	672.22	1,388.33	1,460.28	1.90	-1.13	1.53
7,028.00	87.80	84.00	5,668.33	679.43	1,449.88	1,522.25	2.63	-1.47	2.18
7,090.00	87.62	86.29	5,670.81	684.67	1,511.60	1,584.15	3.70	-0.29	3.69
7,152.00	87.96	87.31	5,673.20	688.13	1,573.46	1,645.97	1.73	0.55	1.65
7,214.00	88.80	87.61	5,674.95	690.88	1,635.37	1,707.75	1.44	1.35	0.48
7,276.00	89.33	88.26	5,675.97	693.11	1,697.32	1,769.51	1.35	0.85	1.05
7,339.00	87.93	88.81	5,677.47	694.72	1,760.28	1,832.19	2.39	-2.22	0.87
7,401.00	88.74	89.08	5,679.27	695.86	1,822.25	1,893.82	1.38	1.31	0.44
7,463.00	89.30	89.36	5,680.33	696.70	1,884.23	1,955.45	1.01	0.90	0.45
7,525.00	88.49	90.12	5,681.53	696.99	1,946.22	2,017.00	1.79	-1.31	1.23
7,587.00	89.47	90.88	5,682.63	696.44	2,008.21	2,078.45	2.00	1.58	1.23
7,649.00	89.24	90.68	5,683.33	695.60	2,070.20	2,139.87	0.49	-0.37	-0.32
7,711.00	89.27	90.38	5,684.14	695.03	2,132.19	2,201.32	0.49	0.05	-0.48
7,773.00	88.04	90.33	5,685.59	694.64	2,194.17	2,262.79	1.99	-1.98	-0.08
7,836.00	88.90	90.30	5,687.27	694.30	2,257.14	2,325.25	1.37	1.37	-0.05
7,898.00	89.27	90.39	5,688.26	693.92	2,319.13	2,386.73	0.61	0.60	0.15
7,960.00	89.21	89.20	5,689.09	694.15	2,381.13	2,448.28	1.92	-0.10	-1.92



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8,023.00	89.89	88.78	5,689.58	695.26	2,444.12	2,510.93	1.27	1.08	-0.67
8,085.00	90.79	88.86	5,689.21	696.53	2,506.10	2,572.60	1.46	1.45	0.13
8,147.00	89.83	88.86	5,688.88	697.77	2,568.09	2,634.27	1.55	-1.55	0.00
8,210.00	88.54	89.53	5,689.77	698.65	2,631.07	2,696.89	2.31	-2.05	1.06
8,273.00	89.91	90.32	5,690.63	698.73	2,694.06	2,759.42	2.51	2.17	1.25
8,335.00	89.27	89.90	5,691.07	698.61	2,756.06	2,820.93	1.23	-1.03	-0.68
8,397.00	89.70	89.50	5,691.63	698.94	2,818.06	2,882.50	0.95	0.69	-0.65
8,459.00	88.71	88.51	5,692.49	700.02	2,880.04	2,944.15	2.26	-1.60	-1.60
8,521.00	89.39	88.10	5,693.52	701.85	2,942.01	3,005.87	1.28	1.10	-0.66
8,583.00	88.12	88.51	5,694.86	703.68	3,003.96	3,067.58	2.15	-2.05	0.66
8,644.00	89.02	88.60	5,696.39	705.22	3,064.92	3,128.27	1.48	1.48	0.15
8,707.00	87.65	88.91	5,698.22	706.59	3,127.88	3,190.92	2.23	-2.17	0.49
8,769.00	88.18	88.98	5,700.47	707.73	3,189.83	3,252.54	0.86	0.85	0.11
8,832.00	88.99	89.25	5,702.03	708.70	3,252.80	3,315.16	1.36	1.29	0.43
8,893.00	89.27	89.33	5,702.95	709.46	3,313.79	3,375.78	0.48	0.46	0.13
8,956.00	89.75	89.18	5,703.49	710.28	3,376.78	3,438.40	0.80	0.76	-0.24
9,019.00	90.03	88.77	5,703.61	711.40	3,439.77	3,501.05	0.79	0.44	-0.65
9,081.00	90.53	88.53	5,703.31	712.87	3,501.75	3,562.74	0.89	0.81	-0.39
9,143.00	88.96	88.30	5,703.59	714.58	3,563.73	3,624.46	2.56	-2.53	-0.37
9,205.00	89.41	88.10	5,704.47	716.53	3,625.69	3,686.19	0.79	0.73	-0.32
9,267.00	89.97	87.90	5,704.80	718.69	3,687.65	3,747.95	0.96	0.90	-0.32
9,330.00	90.79	87.63	5,704.39	721.15	3,750.60	3,810.73	1.37	1.30	-0.43
9,393.00	90.31	88.50	5,703.78	723.28	3,813.56	3,873.47	1.58	-0.76	1.38
9,456.00	91.12	88.61	5,702.99	724.86	3,876.54	3,936.17	1.30	1.29	0.17
9,519.00	90.28	89.10	5,702.22	726.12	3,939.52	3,998.83	1.54	-1.33	0.78
9,581.00	88.85	89.83	5,702.70	726.70	4,001.51	4,060.42	2.59	-2.31	1.18
9,643.00	89.75	89.90	5,703.45	726.85	4,063.51	4,121.97	1.46	1.45	0.11
9,706.00	90.34	89.66	5,703.40	727.09	4,126.51	4,184.52	1.01	0.94	-0.38
9,768.00	89.52	89.81	5,703.48	727.38	4,188.50	4,246.09	1.34	-1.32	0.24
9,830.00	89.30	90.36	5,704.12	727.28	4,250.50	4,307.61	0.96	-0.35	0.89
9,893.00	87.73	90.64	5,705.75	726.73	4,313.47	4,370.04	2.53	-2.49	0.44
9,955.00	87.84	90.46	5,708.15	726.14	4,375.43	4,431.45	0.34	0.18	-0.29
10,017.00	88.46	90.06	5,710.15	725.86	4,437.39	4,492.91	1.19	1.00	-0.65
10,080.00	89.13	90.05	5,711.47	725.80	4,500.38	4,555.42	1.06	1.06	-0.02
10,142.00	89.36	90.10	5,712.29	725.72	4,562.37	4,616.93	0.38	0.37	0.08
10,203.00	89.89	89.29	5,712.69	726.04	4,623.37	4,677.51	1.59	0.87	-1.33
10,266.00	90.50	88.65	5,712.47	727.17	4,686.36	4,740.16	1.40	0.97	-1.02
10,329.00	91.79	88.37	5,711.22	728.81	4,749.32	4,802.85	2.10	2.05	-0.44
10,391.00	91.26	89.32	5,709.57	730.06	4,811.29	4,864.50	1.75	-0.85	1.53
10,453.00	90.20	90.08	5,708.78	730.39	4,873.28	4,926.07	2.10	-1.71	1.23
10,515.00	91.54	90.00	5,707.83	730.34	4,935.27	4,987.58	2.17	2.16	-0.13
10,577.00	90.36	90.71	5,706.81	729.96	4,997.26	5,049.06	2.22	-1.90	1.15
10,640.00	89.50	91.33	5,706.88	728.84	5,060.25	5,111.43	1.68	-1.37	0.98

Company: Apache Corporation
Project: Eddy County, NM (NAD27 NME)
Site: Cedar Lake Federal CA
Well: 410H
Wellbore: OH / Job #60428
Design: Surveys (Trinidad 436)

Local Co-ordinate Reference: Well 410H
TVD Reference: KB @ 3968.00usft (Capstar 114)
MD Reference: KB @ 3968.00usft (Capstar 114)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: Compass 5000 GCR

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)
10,702.00	88.52	91.63	5,707.95	727.24	5,122.22	5,172.74	1.65	-1.58	0.48
10,765.00	89.41	91.35	5,709.09	725.60	5,185.19	5,235.03	1.48	1.41	-0.44
10,827.00	88.69	91.46	5,710.12	724.08	5,247.16	5,296.35	1.17	-1.16	0.18
10,888.00	87.37	91.65	5,712.22	722.42	5,308.10	5,356.63	2.19	-2.16	0.31
10,951.00	88.21	91.12	5,714.65	720.90	5,371.03	5,418.90	1.58	1.33	-0.84
11,014.00	88.77	91.08	5,716.31	719.69	5,434.00	5,481.24	0.89	0.89	-0.06
11,076.00	87.68	90.88	5,718.23	718.63	5,495.96	5,542.60	1.79	-1.76	-0.32
11,138.00	88.29	90.52	5,720.41	717.88	5,557.92	5,604.00	1.14	0.98	-0.58
11,200.00	89.30	90.38	5,721.71	717.39	5,619.90	5,665.46	1.64	1.63	-0.23
11,263.00	90.39	90.07	5,721.88	717.14	5,682.90	5,727.95	1.80	1.73	-0.49
11,325.00	88.82	90.21	5,722.31	716.99	5,744.89	5,789.46	2.54	-2.53	0.23
11,387.00	89.86	90.18	5,723.02	716.78	5,806.89	5,850.96	1.68	1.68	-0.05
11,418.00	90.39	90.06	5,722.96	716.71	5,837.89	5,881.72	1.75	1.71	-0.39
Final Phoenix MWD Survey									
11,483.00	91.50	89.81	5,721.88	716.79	5,902.88	5,946.23	1.75	1.71	-0.38
Projection to TD									

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
636.00	635.83	9.56	4.95	Tie In
712.00	711.81	11.04	5.39	First Phoenix MWD Survey
11,418.00	5,722.96	716.71	5,837.89	Final Phoenix MWD Survey
11,483.00	5,721.88	716.79	5,902.88	Projection to TD