



Apache Corporation

Eddy County, NM (NAD27 NME)
Cedar Lake Federal CA
412H

OH / Job #61263

Design: Surveys (Trinidad 436)

Standard Survey Report

05 July, 2017

OIL CONSERVATION
ARTESIA DISTRICT

JAN 23 2018

RECEIVED



Company: Apache Corporation
Project: Eddy County, NM (NAD27 NME)
Site: Cedar Lake Federal CA
Well: 412H
Wellbore: OH / Job #61263
Design: Surveys (Trinidad 436)

Local Co-ordinate Reference: Well 412H
TVD Reference: GL + KB @ 3975.50usft (Trinidad 436)
MD Reference: GL + KB @ 3975.50usft (Trinidad 436)
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	Latitude:	32° 50' 34.37962 N	
From:	Map	Easting:	633,024.10 usft	Longitude:	103° 54' 0.75173 W	
Position Uncertainty:		0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.23 °

Well	412H					
Well Position	+N/-S	0.00 usft	Northing:	679,780.79 usft	Latitude:	32° 52' 4.57380 N
	+E/-W	0.00 usft	Easting:	642,654.60 usft	Longitude:	103° 52' 7.39833 W
Position Uncertainty	0.00 usft	Wellhead Elevation:	0.00 usft	Ground Level:	3,959.00 usft	

Wellbore	OH / Job #61263				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	6/9/2015	7.60	60.83	48,625

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	82.94	

Survey Program	Date 7/5/2017				
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
38.96	623.96	VES Gyro Surveys (OH / Job #61263)	NS-GYRO-MS	North sensing gyrocompassing m/s	
623.96	11,041.00	Phoenix MWD Surveys (OH / Job #61263)	MWD+HDGM	OWSG Rev.2 MWD + HDGM	

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
38.96	0.32	28.09	38.96	0.10	0.05	0.06	0.82	0.82	0.00
103.96	0.50	30.13	103.96	0.50	0.28	0.34	0.28	0.28	3.14
168.96	0.77	31.19	168.95	1.12	0.65	0.78	0.42	0.42	1.63
233.96	1.11	32.58	233.95	2.02	1.21	1.45	0.52	0.52	2.14
298.96	1.11	59.46	298.93	2.87	2.09	2.43	0.79	0.00	41.35
363.96	1.19	69.60	363.92	3.43	3.27	3.67	0.34	0.12	15.60
428.96	1.16	87.12	428.91	3.70	4.56	4.98	0.55	-0.05	26.95
493.96	1.17	83.85	493.89	3.80	5.88	6.30	0.10	0.02	-5.03
558.96	0.87	88.52	558.88	3.89	7.03	7.45	0.48	-0.46	7.18

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623.96	0.70	73.01	623.88	4.02	7.90	8.34	0.42	-0.26	-23.86
Tie In									
711.00	0.76	50.80	710.91	4.54	8.86	9.35	0.33	0.07	-25.52
First Phoenix Survey									
835.00	0.90	39.50	834.90	5.81	10.11	10.75	0.17	0.11	-9.11
897.00	0.84	35.18	896.89	6.55	10.69	11.41	0.14	-0.10	-6.97
1,022.00	0.81	39.84	1,021.88	7.98	11.78	12.67	0.06	-0.02	3.73
1,147.00	0.99	37.21	1,146.86	9.52	13.00	14.07	0.15	0.14	-2.10
1,273.00	0.68	49.66	1,272.85	10.87	14.23	15.45	0.28	-0.25	9.88
1,397.00	0.65	33.84	1,396.84	11.93	15.18	16.53	0.15	-0.02	-12.76
1,522.00	0.09	228.94	1,521.84	12.46	15.50	16.91	0.59	-0.45	-131.92
1,647.00	0.12	147.58	1,646.84	12.28	15.50	16.89	0.11	0.02	-65.09
1,771.00	0.12	121.84	1,770.84	12.10	15.68	17.04	0.04	0.00	-20.76
1,896.00	0.42	123.63	1,895.84	11.78	16.17	17.49	0.24	0.24	1.43
2,020.00	0.67	211.56	2,019.83	10.91	16.17	17.39	0.63	0.20	70.91
2,144.00	0.76	220.67	2,143.82	9.67	15.25	16.32	0.12	0.07	7.35
2,268.00	0.94	231.44	2,267.81	8.41	13.92	14.85	0.19	0.15	8.69
2,393.00	0.21	75.04	2,392.80	7.83	13.34	14.20	0.91	-0.58	-125.12
2,518.00	0.16	338.63	2,517.80	8.05	13.50	14.39	0.22	-0.04	-77.13
2,643.00	0.39	347.62	2,642.80	8.63	13.34	14.30	0.19	0.18	7.19
2,767.00	0.30	324.72	2,766.80	9.31	13.07	14.11	0.13	-0.07	-18.47
2,892.00	0.31	301.66	2,891.80	9.75	12.59	13.69	0.10	0.01	-18.45
3,017.00	0.48	304.25	3,016.79	10.22	11.87	13.03	0.14	0.14	2.07
3,142.00	0.44	339.01	3,141.79	10.97	11.26	12.53	0.22	-0.03	27.81
3,266.00	0.33	313.37	3,265.79	11.66	10.83	12.18	0.16	-0.09	-20.68
3,391.00	0.57	310.45	3,390.78	12.31	10.10	11.53	0.19	0.19	-2.34
3,571.00	1.00	318.21	3,570.77	14.06	8.37	10.03	0.25	0.24	4.31
3,695.00	0.78	12.16	3,694.75	15.69	7.83	9.70	0.67	-0.18	43.51
3,820.00	1.04	11.71	3,819.74	17.63	8.24	10.34	0.21	0.21	-0.36
3,944.00	0.54	69.99	3,943.73	18.94	9.01	11.27	0.71	-0.40	47.00
4,069.00	0.55	44.60	4,068.72	19.56	9.99	12.32	0.19	0.01	-20.31
4,193.00	0.61	65.89	4,192.72	20.26	11.01	13.41	0.18	0.05	17.17
4,317.00	0.68	67.49	4,316.71	20.81	12.29	14.75	0.06	0.06	1.29
4,442.00	0.49	56.27	4,441.70	21.39	13.42	15.95	0.18	-0.15	-8.98
4,630.00	0.59	65.33	4,629.69	22.24	14.97	17.59	0.07	0.05	4.82
4,702.00	2.65	52.61	4,701.66	23.41	16.63	19.38	2.89	2.86	-17.67
4,764.00	11.52	49.07	4,763.13	28.34	22.46	25.77	14.32	14.31	-5.71
4,826.00	19.36	46.24	4,822.84	39.52	34.58	39.17	12.70	12.65	-4.56
4,889.00	24.08	49.34	4,881.36	55.13	51.88	58.26	7.71	7.49	4.92
4,951.00	29.30	55.91	4,936.74	71.89	74.06	82.33	9.66	8.42	10.60
5,014.00	30.78	56.22	4,991.28	89.49	100.22	110.46	2.36	2.35	0.49
5,076.00	37.66	57.22	5,042.51	108.59	129.37	141.73	11.13	11.10	1.61
5,137.00	45.09	60.03	5,088.26	129.50	163.80	178.47	12.55	12.18	4.61



Phoenix Technology Services LP

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5,200.00	52.95	60.27	5,129.54	153.15	205.02	222.28	12.48	12.48	0.38
5,262.00	58.42	56.91	5,164.49	179.86	248.67	268.89	9.89	8.82	-5.42
5,324.00	67.70	52.83	5,192.56	211.69	293.77	317.55	16.07	14.97	-6.58
5,386.00	76.99	50.70	5,211.34	248.24	340.10	368.02	15.34	14.98	-3.44
5,415.00	81.91	51.07	5,216.65	266.22	362.22	392.18	17.01	16.97	1.28
5,451.00	87.45	52.75	5,219.99	288.32	390.42	422.88	16.07	15.39	4.67
5,514.00	88.10	55.60	5,222.43	325.16	441.45	478.05	4.64	1.03	4.52
5,576.00	87.98	58.23	5,224.55	358.98	493.37	533.73	4.24	-0.19	4.24
5,639.00	88.85	59.79	5,226.30	391.41	547.35	591.29	2.83	1.38	2.48
5,701.00	89.19	61.67	5,227.36	421.71	601.42	648.67	3.08	0.55	3.03
5,763.00	89.41	63.35	5,228.12	450.33	656.42	706.77	2.73	0.35	2.71
5,825.00	89.52	64.91	5,228.69	477.38	712.20	765.45	2.52	0.18	2.52
5,887.00	89.52	66.56	5,229.21	502.86	768.72	824.67	2.66	0.00	2.66
5,950.00	90.17	66.16	5,229.38	528.12	826.43	885.05	1.21	1.03	-0.63
6,012.00	89.66	68.77	5,229.48	551.88	883.69	944.80	4.29	-0.82	4.21
6,074.00	89.52	70.47	5,229.92	573.47	941.81	1,005.12	2.75	-0.23	2.74
6,081.00	89.38	70.69	5,229.99	575.80	948.41	1,011.96	3.68	-1.98	3.10
LL Crossing 6081' MD, 89.38° Inc at 70.69° Azm									
6,136.00	88.29	72.39	5,231.11	593.21	1,000.57	1,065.86	3.68	-1.98	3.10
6,198.00	88.21	74.96	5,233.00	610.63	1,060.03	1,127.02	4.15	-0.13	4.15
6,260.00	88.35	77.44	5,234.86	625.41	1,120.21	1,188.56	4.00	0.23	4.00
6,322.00	88.51	80.43	5,236.56	637.30	1,181.03	1,250.37	4.83	0.26	4.82
6,384.00	88.49	82.45	5,238.18	646.52	1,242.31	1,312.33	3.26	-0.03	3.26
6,420.00	87.90	83.12	5,239.32	651.04	1,278.01	1,348.31	2.48	-1.63	1.87
HL Crossing 6420' MD									
6,446.00	87.48	83.61	5,240.36	654.04	1,303.82	1,374.29	2.48	-1.63	1.87
6,507.00	87.28	84.61	5,243.15	660.30	1,364.43	1,435.21	1.67	-0.33	1.64
6,569.00	88.12	86.65	5,245.64	665.02	1,426.20	1,497.09	3.56	1.35	3.29
6,631.00	88.32	88.10	5,247.57	667.85	1,488.10	1,558.87	2.36	0.32	2.34
6,692.00	90.00	88.00	5,248.46	669.93	1,549.06	1,619.62	2.76	2.75	-0.16
6,754.00	91.18	88.45	5,247.82	671.85	1,611.02	1,681.35	2.04	1.90	0.73
6,816.00	88.54	88.40	5,247.97	673.55	1,672.99	1,743.06	4.26	-4.26	-0.08
6,878.00	88.88	88.14	5,249.37	675.43	1,734.95	1,804.78	0.69	0.55	-0.42
6,940.00	89.78	87.61	5,250.09	677.72	1,796.90	1,866.55	1.68	1.45	-0.85
7,001.00	89.19	88.33	5,250.64	679.89	1,857.86	1,927.31	1.53	-0.97	1.18
7,063.00	89.81	89.47	5,251.18	681.08	1,919.84	1,988.97	2.09	1.00	1.84
7,125.00	87.56	90.05	5,252.61	681.33	1,981.82	2,050.51	3.75	-3.63	0.94
7,187.00	86.98	89.89	5,255.56	681.37	2,043.75	2,111.97	0.97	-0.94	-0.26
7,250.00	88.23	89.38	5,258.19	681.77	2,106.69	2,174.49	2.14	1.98	-0.81
7,311.00	88.23	88.82	5,260.08	682.73	2,167.66	2,235.11	0.92	0.00	-0.92
7,373.00	87.93	90.34	5,262.15	683.18	2,229.62	2,296.66	2.50	-0.48	2.45
7,434.00	88.46	89.96	5,264.07	683.02	2,290.59	2,357.14	1.07	0.87	-0.62
7,497.00	89.05	89.50	5,265.44	683.32	2,353.57	2,419.69	1.19	0.94	-0.73
7,559.00	87.96	89.91	5,267.06	683.64	2,415.55	2,481.23	1.88	-1.76	0.66

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7,621.00	88.60	89.85	5,268.92	683.77	2,477.52	2,542.75	1.04	1.03	-0.10
7,684.00	90.25	89.72	5,269.55	684.00	2,540.51	2,605.30	2.63	2.62	-0.21
7,746.00	89.11	90.11	5,269.90	684.10	2,602.51	2,666.84	1.94	-1.84	0.63
7,808.00	89.47	89.59	5,270.67	684.26	2,664.51	2,728.38	1.02	0.58	-0.84
7,871.00	87.25	89.26	5,272.47	684.89	2,727.47	2,790.95	3.56	-3.52	-0.52
7,933.00	87.45	89.31	5,275.34	685.66	2,789.40	2,852.51	0.33	0.32	0.08
7,995.00	88.15	88.88	5,277.72	686.64	2,851.35	2,914.10	1.32	1.13	-0.69
8,057.00	89.19	88.80	5,279.16	687.90	2,913.32	2,975.76	1.68	1.68	-0.13
8,121.00	90.45	88.54	5,279.36	689.38	2,977.30	3,039.44	2.01	1.97	-0.41
8,183.00	89.83	89.17	5,279.21	690.62	3,039.29	3,101.11	1.43	-1.00	1.02
8,246.00	90.61	88.84	5,278.96	691.71	3,102.28	3,163.75	1.34	1.24	-0.52
8,309.00	90.22	90.38	5,278.51	692.14	3,165.27	3,226.32	2.52	-0.62	2.44
8,371.00	91.15	90.39	5,277.77	691.73	3,227.26	3,287.80	1.50	1.50	0.02
8,434.00	90.45	90.94	5,276.89	690.99	3,290.25	3,350.22	1.41	-1.11	0.87
8,496.00	91.68	90.58	5,275.73	690.17	3,352.24	3,411.63	2.07	1.98	-0.58
8,559.00	91.40	91.21	5,274.04	689.19	3,415.21	3,474.00	1.09	-0.44	1.00
8,621.00	90.34	91.41	5,273.10	687.77	3,477.18	3,535.33	1.74	-1.71	0.32
8,683.00	91.49	91.38	5,272.11	686.26	3,539.15	3,596.65	1.86	1.85	-0.05
8,745.00	90.14	91.07	5,271.23	684.94	3,601.13	3,658.00	2.23	-2.18	-0.50
8,807.00	88.21	91.24	5,272.12	683.69	3,663.11	3,719.35	3.12	-3.11	0.27
8,869.00	87.78	91.42	5,274.29	682.25	3,725.06	3,780.65	0.75	-0.69	0.29
8,931.00	88.88	91.71	5,276.10	680.56	3,787.00	3,841.92	1.83	1.77	0.47
8,993.00	87.90	90.86	5,277.84	679.17	3,848.96	3,903.24	2.09	-1.58	-1.37
9,055.00	89.55	91.10	5,279.22	678.11	3,910.94	3,964.62	2.69	2.66	0.39
9,117.00	88.91	91.07	5,280.05	676.93	3,972.92	4,025.99	1.03	-1.03	-0.05
9,179.00	88.23	90.50	5,281.60	676.08	4,034.89	4,087.39	1.43	-1.10	-0.92
9,241.00	90.39	90.08	5,282.35	675.77	4,096.88	4,148.87	3.55	3.48	-0.68
9,303.00	91.51	89.58	5,281.32	675.95	4,158.87	4,210.41	1.98	1.81	-0.81
9,365.00	91.37	88.26	5,279.76	677.12	4,220.84	4,272.05	2.14	-0.23	-2.13
9,428.00	89.83	87.77	5,279.10	679.30	4,283.80	4,334.80	2.57	-2.44	-0.78
9,489.00	87.40	87.60	5,280.57	681.77	4,344.73	4,395.57	3.99	-3.98	-0.28
9,552.00	88.49	86.65	5,282.83	684.93	4,407.61	4,458.36	2.29	1.73	-1.51
9,616.00	87.28	87.90	5,285.19	687.97	4,471.49	4,522.13	2.72	-1.89	1.95
9,678.00	87.17	89.14	5,288.20	689.57	4,533.39	4,583.77	2.01	-0.18	2.00
9,741.00	87.62	88.94	5,291.06	690.62	4,596.32	4,646.34	0.78	0.71	-0.32
9,804.00	87.59	88.38	5,293.69	692.09	4,659.25	4,708.98	0.89	-0.05	-0.89
9,866.00	88.32	88.41	5,295.91	693.83	4,721.18	4,770.66	1.18	1.18	0.05
9,929.00	88.07	89.57	5,297.89	694.94	4,784.14	4,833.27	1.88	-0.40	1.84
9,990.00	87.96	89.65	5,300.00	695.35	4,845.10	4,893.83	0.22	-0.18	0.13
10,052.00	89.27	90.14	5,301.50	695.47	4,907.08	4,955.35	2.26	2.11	0.79
10,115.00	88.88	89.30	5,302.52	695.77	4,970.07	5,017.90	1.47	-0.62	-1.33
10,177.00	88.74	89.09	5,303.81	696.64	5,032.05	5,079.52	0.41	-0.23	-0.34
10,239.00	90.56	90.59	5,304.18	696.82	5,094.05	5,141.06	3.80	2.94	2.42



Phoenix Technology Services LP

Survey Report



Company: Apache Corporation
Project: Eddy County, NM (NAD27 NME)
Site: Cedar Lake Federal CA
Well: 412H
Wellbore: OH / Job #61263
Design: Surveys (Trinidad 436)

Local Co-ordinate Reference: Well 412H
TVD Reference: GL + KB @ 3975.50usft (Trinidad 436)
MD Reference: GL + KB @ 3975.50usft (Trinidad 436)
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)	Bulld Rate (°/100usft)	Turn Rate (°/100usft)
10,301.00	90.70	90.09	5,303.50	696.45	5,156.04	5,202.54	0.84	0.23	-0.81
10,363.00	91.20	90.16	5,302.47	696.31	5,218.03	5,264.05	0.81	0.81	0.11
10,427.00	89.33	90.89	5,302.18	695.73	5,282.03	5,327.49	3.14	-2.92	1.14
10,489.00	89.55	91.44	5,302.78	694.47	5,344.01	5,388.85	0.96	0.35	0.89
10,552.00	89.75	90.95	5,303.17	693.15	5,407.00	5,451.19	0.84	0.32	-0.78
10,614.00	89.69	90.11	5,303.47	692.58	5,468.99	5,512.65	1.36	-0.10	-1.35
10,739.00	90.19	89.91	5,303.60	692.56	5,593.99	5,636.70	0.43	0.40	-0.16
10,802.00	90.20	89.76	5,303.39	692.74	5,656.99	5,699.24	0.24	0.02	-0.24
10,865.00	90.09	88.58	5,303.23	693.65	5,719.98	5,761.87	1.88	-0.17	-1.87
10,928.00	90.59	88.03	5,302.86	695.52	5,782.95	5,824.59	1.18	0.79	-0.87
10,965.00	91.12	88.53	5,302.30	696.63	5,819.93	5,861.43	1.97	1.43	1.35
Final Phoenix MWD Survey									
11,041.00	91.12	88.53	5,300.82	698.58	5,895.89	5,937.05	0.00	0.00	0.00
Projection to TD									

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
623.96	623.88	4.02	7.90	Tie In
711.00	710.91	4.54	8.86	First Phoenix Survey
6,081.00	5,229.99	575.80	948.41	LL Crossing 6081' MD, 89.38° Inc at 70.69° Azm
6,420.00	5,239.32	651.04	1,278.01	HL Crossing 6420'MD
10,965.00	5,302.30	696.63	5,819.93	Final Phoenix MWD Survey
11,041.00	5,300.82	698.58	5,895.89	Projection to TD