RELATION BETWEEN LAND SUBSIDENCE AND GROUND-WATER-LEVEL DECLINES IN THE LANCASTER SUBBASIN

The occurrence of land subsidence caused by aquifer-system compaction resulting from ground-water-level declines has been documented in the EAFB area of Antelope Valley (Blodgett and Williams, 1992; Londquist and others, 1993). Measurements of aquifer-system vertical compaction and water-level fluctuations in the deep aquifer of the Lancaster ground-water subbasin made between May 1990 and November 1991 indicate that compaction was continuous even when water levels rose. However, sediment-compaction rates were higher during summer when ground-water levels were lowest as a result of the seasonal increase in ground-water pumping. In an earlier study, contour maps for the LAC region of Antelope Valley showed that the magnitude and rate of subsidence for 1955-67, which were highest in Lancaster, were highly correlated with contours showing average annual ground-water-level decline (Lewis and Miller, 1968, p. 3, figs. 3 and 4).

Ground-Water Data

Ground-water levels and changes since about the mid-1950's were compiled for wells in a monitoring network in Antelope Valley (tables 11 and 12). This network is cooperatively maintained by the USGS and the Antelope Valley-East Kern (AVEK) Water Agency. Ground-water levels generally were measured during the first quarter of the calendar year or during spring. Because subsidence-affected areas have been found only in the Lancaster subbasin, ground-water data from wells in this hydrologic unit were examined. The major components of the Lancaster subbasin aquifer system consist of the principal aquifer and the deep aquifer, separated by a thick, clay confining bed (Bloyd, 1967). The principal aquifer is the primary source of ground-water supply for the Lancaster subbasin, except in the northeast lobe, which includes the southern two-thirds of Rogers Lake where the deep aquifer has been developed. In this area, the principal aquifer is terminated by a confining clay layer that surfaces near Avenue B (Diane Rewis, USGS, oral commun., 1993); thus, data from wells screened only in the deep aquifer are available. South of Rosamond Lake, several wells had relatively shallow water levels, which probably represented perched water or areas of local recharge, such as near the terminus of Amargosa Creek. These wells were not retained in the data set.

Extensive differential leveling surveys were done by LAC, DPW, Road Department in 1957, 1962, 1965, 1972, 1975, and 1981, and a smaller scale leveling survey and a GPS survey were done in 1992. Therefore, regional water-level data for these years were examined. Contours of the potentiometric surface of the principal aquifer in the Lancaster ground-water subbasin of Antelope Valley were mapped for those 7 selected years (fig. 13). Beginning with the base year of 1957, generalized contours of equal water-level change for six periods also were prepared using data from wells in the principal aquifer (fig. 14). The locations of the water-level-change contours for these periods were determined by interpolating among locations of wells with calculated drawdowns relative to 1957 and generalizing the differences in hydraulic head from the potentiometric surfaces mapped for 1957 and each of the other relevant years. Potentiometric surfaces and water-level changes for wells completed in the deep aquifer were not mapped because of the paucity of data. Water levels for 13 wells completed in the deep aquifer in the vicinity of an area where there is as much as 4 ft of subsidence are presented in table 12 and the well locations are shown in figure 15.

In addition to contour maps of potentiometric surfaces and ground-water-level changes of the Lancaster ground-water subbasin, hydraulic heads for selected wells were plotted for the period of record available. In contrast to contour maps, hydrographs are of limited geographic scope but are valuable for examining the history of hydraulic-head changes at a particular location. Hydrographs of eight wells—two wells in areas where land subsidence was minimal (less than 1 ft) and six other wells—are presented to illustrate the temporal relation between subsidence and ground-water-level changes. Subsidence calculated for the period of record available for a bench mark near each well is plotted with the hydrographs.

Comparison of Ground-Water-Level Trends and Subsidence History

The contour map of the potentiometric surface of the principal aquifer of the Lancaster subbasin in 1957 (fig. 13*A*) shows ground-water depressions of about 60 and 40 ft in areas east and northwest of Lancaster, respectively. The contour map of the potentiometric surface for 1962 (fig. 13*B*) and measured water levels indicate declines of about 20 ft since 1957 throughout most of the central subbasin (fig. 14*A*), and differences in hydraulic head of 30 to 95 ft measured at a few wells contribute to ground-water depressions west of Lancaster. Note that the potentiometric-surface (fig. 13*A*) and water-level-change (fig. 14*A*) maps show no significant features near Avenue I and Sierra Highway where the average rate of subsidence was at a maximum for this period (fig. 12*A*). This high rate of subsidence is attributed to water-level declines prior to

Table 11. Ground-water levels for wells completed in the principal aquifer of the Lancaster ground-water subbasin of Antelope Valley for 7 selected years between 1957 and 1992

[Site numbers refer to locations of wells in figure 12. State well No.: See well-numbering system in text. Water-level elevations are referenced to NGVD29. ft., feet; --, no data]

Site No.	State well No.	Water-level elevation (ft)						
		1957	1962	1965	1972	1975	1981	1992
1	06N/11W-03E2	--	--	--	--	--	2,140.65	2,194.73
2	06N/11W-09P1	--	--	--	--	--	2,181.70	--
3	06N/11W-11M1	--	--	--	--	2,187.12	2,189.10	2,218.36
4	06N/11W-16J1	--	--	--	--	2,202.90	2,178.18	2,229.38
5	06N/12W-11P1	--	--	--	--	2,185.06	2,126.85	--
6	07N/10W-01P3	--	--	--	--	2,088.30	2,077.66	--
[1]7	07N/10W-05E1	--	--	--	2,188.30	2,187.20	2,211.65	2,220.31
8	07N/10W-05N1	--	--	--	--	--	2,144.81	2,186.86
9	07N/10W-09H1	--	--	--	--	--	2,151.00	--
10	07N/10W-14R3	--	--	--	--	2,084.12	2,080.93	--
11	07N/10W-15J1	--	--	--	--	2,083.00	--	--
12	07N/10W-19D1	2,222.50	--	2,177.62	2,167.26	2,163.57	2,162.80	2,179.33
13	07N/10W-22P1	--	--	--	--	2,137.44	2,138.90	2,171.07
14	07N/10W-29B1	--	--	--	--	--	2,138.30	2,183.92
15	07N/10W-29P1	--	--	--	--	--	2,147.98	2,188.80
16	07N/10W-32B1	--	--	--	--	--	2,173.50	--
17	07N/10W-33J1	2,249.74	--	--	--	2,199.40	2,197.11	2,220.37
18	07N/11W-01Q1	--	2,204.67	2,180.32	--	2,176.41	2,178.98	2,199.16
19	07N/11W-05L1	--	--	--	--	2,243.69	2,238.20	2,232.12
[2]20	07N/11W-09P2	--	--	--	--	2,170.55	2,166.77	--
21	07N/11W-10F2	--	--	--	--	2,204.60	2,212.28	--
22	07N/11W-14P2	--	--	--	--	2,131.60	2,169.66	--
23	07N/11W-27Q1	--	--	--	--	2,126.70	2,123.68	2,182.74
24	07N/11W-28Q1	--	--	--	--	--	--	2,176.18
25	07N/11W-29H1	--	--	--	--	2,143.30	2,128.98	2,172.85
26	07N/11W-31M1	--	--	--	--	2,178.20	2,165.48	2,153.31
[3]27	07N/11W-33N1	2,235.45	2,212.88	2,179.01	2,153.16	2,146.03	2,147.30	2,179.04
28	07N/12W-02E8	--	--	--	--	2,272.65	2,266.78	--
29	07N/12W-09E1	--	2,238.00	2,222.00	2,184.00	2,181.90	--	--
30	07N/12W-12R1	--	--	--	--	--	2,250.30	2,241.56
[4]31	07N/12W-15F1	2,255.40	2,237.90	2,191.06	2,192.07	2,187.10	2,175.58	--
32	07N/12W-19R1	--	2,236.00	2,222.00	2,201.48	2,190.45	2,170.05	2,157.55
33	07N/12W-21A4	--	--	--	--	2,198.51	2,183.20	2,161.10
34	07N/12W-22K1	--	--	2,221.20	2,189.71	2,178.16	2,164.31	2,150.32
35	07N/12W-24A1	--	--	--	--	--	--	2,178.72
36	07N/12W-24Q3	--	--	--	--	--	--	2,164.81
[5]37	07N/12W-27H1	--	--	--	--	2,167.22	2,154.62	2,137.98
38	07N/12W-35M1	2,273.00	--	--	--	2,180.16	2,159.73	--
[6]39	07N/13W-03E1	--	--	--	2,191.07	2,205.85	2,208.12	2,225.40
40	07N/13W-06A4	--	--	--	--	--	2,174.02	--
41	07N/13W-13N1	--	--	--	--	--	2,198.02	2,207.00
42	07N/13W-26J2	2,201.00	--	--	2,087.40	2,144.29	2,179.65	2,180.18
43	07N/13W-34B1	--	--	--	2,088.26	2,114.61	2,175.86	2,212.50
44	07N/14W-13A1	2,215.30	2,191.80	--	2,180.23	2,189.47	--	2,232.59
45	08N/10W-08R3	2,269.82	2,260.11	2,255.01	2,244.82	2,241.77	2,235.77	--
46	08N/10W-23F2	--	--	--	2,228.23	2,228.50	2,219.40	2,211.57
[7]47	08N/10W-28B1	2,265.36	2,245.63	2,233.36	2,217.23	2,213.87	--	2,206.88

Footnotes at end of table.

Table 11. Ground-water levels for wells completed in the principal aquifer of the Lancaster ground-water subbasin of Antelope Valley for 7 selected years between 1957 and 1992--*Continued*

Site No.	State well No.	Water-level elevation (ft)						
		1957	1962	1965	1972	1975	1981	1992
48	08N/10W-35Q1	--	--	2,193.34	--	--	2,084.30	--
49	08N/11W-14R1	--	--	--	2,221.37	2,226.49	--	2,230.59
50	08N/11W-15Q1	--	2,218.38	2,217.41	2,218.64	2,220.86	2,223.63	2,228.45
51	08N/11W-22P2	--	--	--	--	--	2,215.72	2,223.18
52	08N/11W-24R2	--	--	--	--	2,229.18	2,229.68	2,227.43
53	08N/11W-32P1	--	--	--	--	--	2,234.96	--
54	08N/11W-34D2	2,195.18	2,198.20	2,192.59	2,191.95	2,201.08	2,207.91	2,217.36
55	08N/11W-34R2	2,200.21	2,193.87	2,179.50	2,200.91	2,220.38	2,217.00	2,226.78
56	08N/12W-02Q1	2,273.83	2,253.79	2,253.75	2,240.04	2,234.90	2,233.25	2,234.00
57	08N/12W-05D1	--	--	--	--	2,179.11	2,195.60	2,216.94
58	08N/12W-10J1	--	--	2,262.68	--	2,252.12	2,249.84	2,248.57
59	08N/12W-14R1	--	2,251.75	2,240.91	2,226.18	2,220.80	2,221.64	--
60	08N/12W-20B2	2,278.22	2,268.23	2,255.95	--	2,238.80	2,234.76	--
61	08N/12W-21R1	--	--	--	--	--	--	2,231.95
62	08N/12W-22M1	2,283.63	2,273.11	2,261.24	--	2,246.55	2,240.92	--
63	08N/12W-26F1	--	--	--	--	2,284.21	2,283.59	2,279.50
64	08N/12W-28D1	--	--	--	--	2,253.50	--	2,248.86
65	08N/12W-30K1	2,271.24	2,254.80	2,236.89	2,224.72	2,222.65	2,223.55	2,232.72
66	08N/12W-31Q2	--	--	--	2,264.49	2,261.73	2,257.44	2,250.69
67	08N/12W-32L1	--	--	--	--	2,258.93	2,255.18	--
68	08N/12W-34K1	--	--	--	--	--	2,265.62	2,259.51
69	08N/13W-02Q1	--	--	--	--	2,168.13	2,157.48	2,210.11
70	08N/13W-03M1	--	--	--	--	2,144.03	2,159.54	2,211.48
71	08N/13W-05E1	2,236.00	2,141.80	--	2,167.57	2,133.72	2,165.41	2,205.80
72	08N/13W-06E1	--	--	--	--	2,119.92	2,142.38	--
73	08N/13W-07B1	--	--	--	--	--	--	2,202.74
74	08N/13W-08D4	--	--	--	--	2,133.85	2,151.54	--
75	08N/13W-11Q1	2,230.00	2,236.60	--	--	2,167.90	--	2,209.82
76	08N/13W-14B2	--	--	--	--	--	2,226.18	2,232.09
77	08N/13W-15M1	--	--	--	--	2,159.64	2,168.11	--
78	08N/13W-18Q2	--	--	--	--	2,162.38	2,180.75	2,217.47
79	08N/13W-20B1	2,208.00	2,190.60	--	--	2,150.78	2,173.88	2,210.52
80	08N/13W-23E1	--	--	--	--	2,176.55	2,187.68	2,212.28
81	08N/13W-23M1	--	--	--	--	--	--	2,217.77
82	08N/13W-26K1	--	--	--	--	--	2,228.40	2,232.60
83	08N/13W-31Q1	--	2,146.90	--	--	2,218.13	2,203.34	2,227.91
84	08N/13W-35M1	--	--	--	--	2,219.92	2,218.90	--
85	08N/14W-12C1	--	--	--	--	--	2,141.56	--
86	08N/14W-23G1	2,256.00	--	--	--	2,209.90	2,209.19	2,239.90
87	08N/14W-24C1	--	--	--	--	--	2,191.28	2,228.05
88	08N/14W-36E1	2,270.50	2,237.60	--	2,198.13	2,205.54	2,212.98	--
89	09N/12W-23N1	2,270.99	2,261.38	2,254.39	--	2,235.30	2,228.76	2,221.31
90	09N/12W-33P1	--	--	--	--	--	2,239.77	2,235.41
91	09N/13W-27K1	--	--	--	--	--	2,190.38	--

[1]Hydrograph is shown in figure 17.
[2]Hydrograph is shown in figure 18.
[3]Hydrograph is shown in figure 20.
[4]Hydrograph is shown in figure 16.
[5]Hydrograph is shown in figure 21.
[6]Hydrograph is shown in figure 19.
[7]Hydrograph is shown in figure 22.

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Table 12. Ground-water levels for selected wells completed in the deep aquifer of the Lancaster ground-water subbasin of Antelope Valley for 7 selected years between 1957 and 1992

[Site numbers refer to locations of wells in figure 15. State well No.: See well-numbering system in text. Elevations are referenced to NGVD29. ft., feet; --, no data]

Site No.	State well No.	Water-level elevation (ft)						
		1957	1962	1965	1972	1975	1981	1992
D1	8N/9W-06D1	--	2,261.17	2,258.12	2,253.70	2,249.71	2,247.93	2,252.27
D2	8N/10W-04E1	--	--	--	--	--	2,189.86	2,182.08
D3	8N/10W-30R1	--	--	--	--	2,206.00	2,202.80	2,217.35
D4	9N/8W-06H1	2,267.73	2,254.10	2,243.28	2,232.70	2,224.85	2,211.92	--
D5	9N/9W-02Q1	--	2,246.57	2,238.65	--	2,216.43	2,215.73	2,242.46
D6	9N/9W-06E1	2,247.11	2,245.98	2,245.05	2,241.87	2,240.88	2,238.83	--
D7	9N/9W-10R1	--	2,244.17	2,235.87	2,218.74	2,212.15	2,200.47	2,185.42
D8	9N/9W-27H2	2,257.24	2,247.67	2,239.56	2,219.72	2,214.59	2,202.19	2,186.50
D9	9N/10W-12R1	2,253.17	2,238.22	2,229.10	2,209.52	2,203.07	2,191.04	--
[1]D10	9N/10W-24C1	--	2,207.20	2,107.70	2,169.60	2,184.50	2,135.50	2,163.01
D11	9N/10W-28F2	2,245.45	2,235.00	2,230.94	2,220.45	2,216.22	2,208.72	2,199.45
D12	9N/10W-34H1	2,265.03	2,249.02	2,237.04	2,210.78	2,204.95	--	--
D13	9N/11W-36L1	2,255.17	2,239.93	2,226.92	--	2,194.41	2,188.22	2,202.81

[1]Hydrograph is shown in figure 23.

1957. Figure 16 shows the hydrograph of a well and the subsidence history of two bench marks in the area of Avenue I and Sierra Highway, which ultimately became the area of maximum cumulative subsidence in Antelope Valley. The head decline in well 7N/12W-15F1 (site no. 31, fig. 13*A*) was about 80 ft in the 15 years between 1942 and 1957 and was about 60 percent greater than the rate for the 1957-62 period (17 ft for 5 yrs). Despite the cyclical nature of seasonal pumping stresses, the rate of water-level decline was steady from the 1940's to the mid-1960's when it began to slow. The subparallel nature of the hydrograph and subsidence history curves for bench marks BM 666 and BM 474 (nos. 41 and 25, respectively, fig. 8) reflects the cause-and-effect relation between water-level decline and land subsidence with respect to both magnitude and rate (fig. 16).

Between 1957 and 1965, ground-water levels had declined between 20 and 60 ft (fig. 13*C*, 14*B*). The location of the water-level declines in and east of Lancaster are reflected in the contour map of subsidence rates between 1962 and 1965 (fig. 12*B*), some of which were the highest rates calculated for bench marks in this data set during the last 35 years. Figure 17 shows the hydrograph for well 7N/10W-05E1 (site no. 7, fig. 13*D*) near Avenue G-8 and 90th Street East and the magnitude of subsidence of a nearby bench mark. This well is representative of ground-water conditions in Area 3 where water levels declined nearly 100 ft between 1952 and 1971 and recovered about 40 ft by 1992 (fig. 17). The magnitude and average annual rates of subsidence for bench marks in this area, most notably BM 1171A (no. 69, fig. 8), were the highest for the 1962-65 period (tables 9 and 10). In fact, estimated total subsidence for BM 1171A (table 8) from about 1930 to 1992 was 6.4 ft, among the highest determined in this study. Even though water levels recovered somewhat, indications are that subsidence has not stopped. The magnitude and rate of subsidence for BM 1171A are the second-highest calculated for the most recent period, 1981-92 (table 9).

Water-levels for 1972 (fig. 13*D*) do not indicate much change in potentiometric surface since 1965 nor much difference in the magnitude of ground-water-level declines (fig. 14*C*). Of note, however, is a cone of depression greater than 100 ft illustrated by data from two wells near Quartz Hill (fig. 13*D*). Although water levels were significantly drawn down, no consequent measurable subsidence occurred here during this or later periods. The sedimentary deposits in this area are mostly coarse-grained material and there is an absence of fine-grained compressible interbeds. Therefore, minimal aquifer-system compaction and subsidence have occurred. The highest subsidence rate for 1965-72 (fig. 12*C*) was in an area centered near Avenue J and 70th Street East, between Areas 3 and 4 (fig. 1). The hydrograph for nearby well 7N/11W-09P2 (site no. 20, fig. 13*E*), indicates that water levels declined about 35 ft in the 24 years between 1964 and 1988 (fig. 18). An additional 40-ft decline in hydraulic head was estimated for the 3-year period 1961-64 using the potentiometric-surface map for 1961 prepared by Durbin (1978, pl. 3). Rapidly imposed stresses caused by this type of decline and continued regional water-level declines [for example, as much as 80 ft between 1957 and 1972

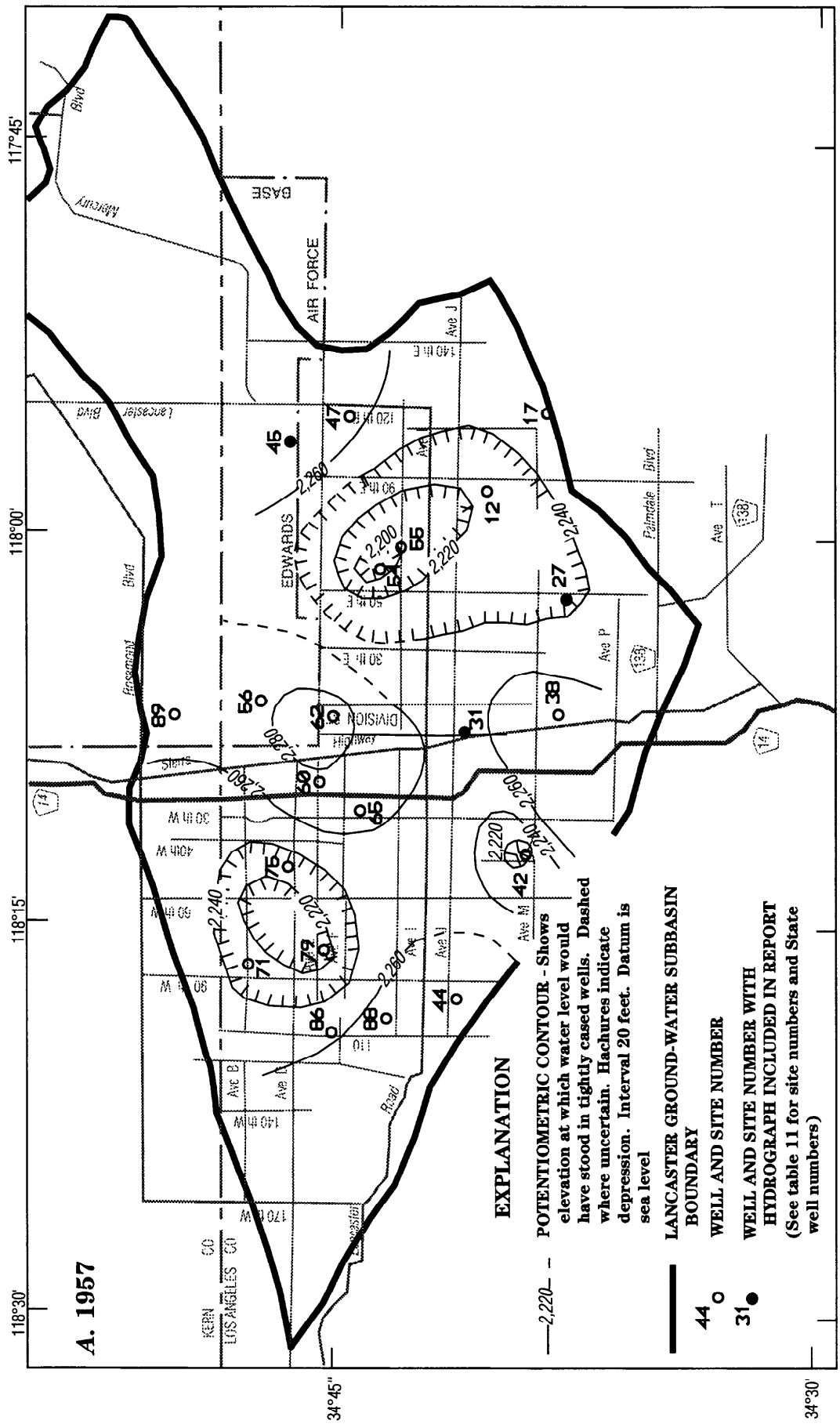

Figure 13. Potentiometric surface of principal aquifer of the Lancaster ground-water subbasin for ***A.*** 1957, ***B.*** 1962, ***C.*** 1965, ***D.*** 1972, ***E.*** 1975, ***F.*** 1981, and ***G.*** 1992.

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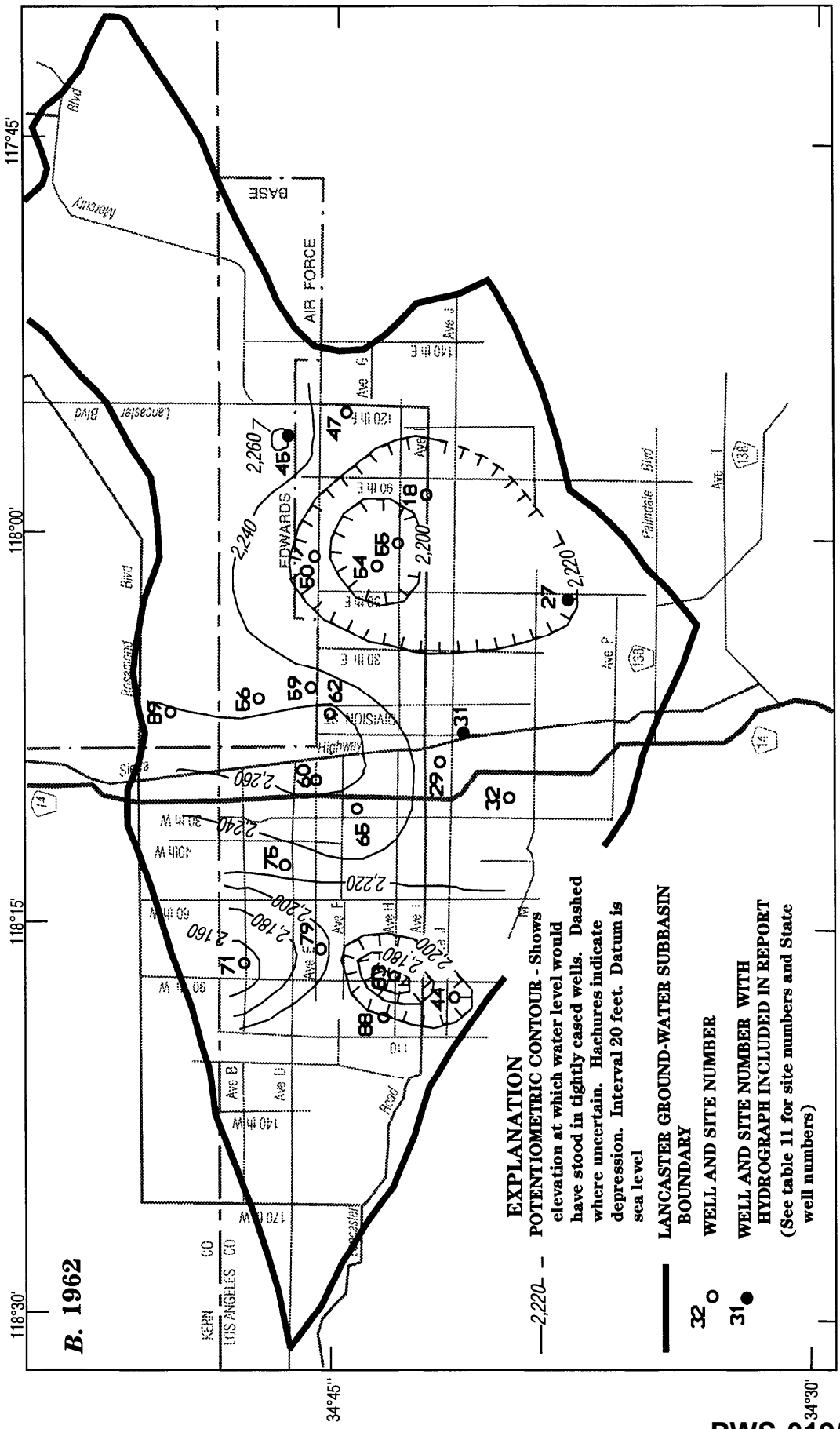

Figure 13. *Continued.*

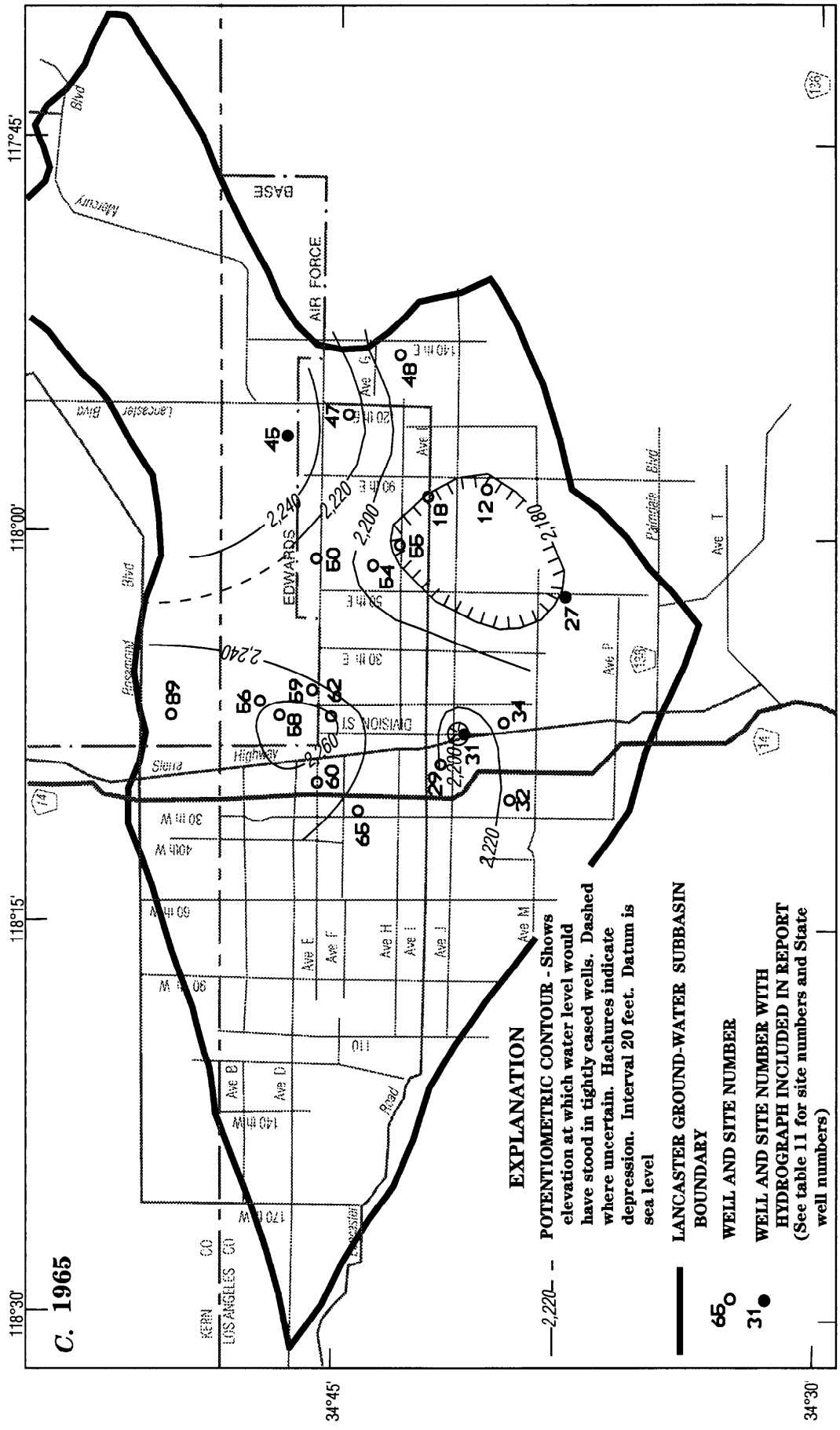

Figure 13. *Continued.*

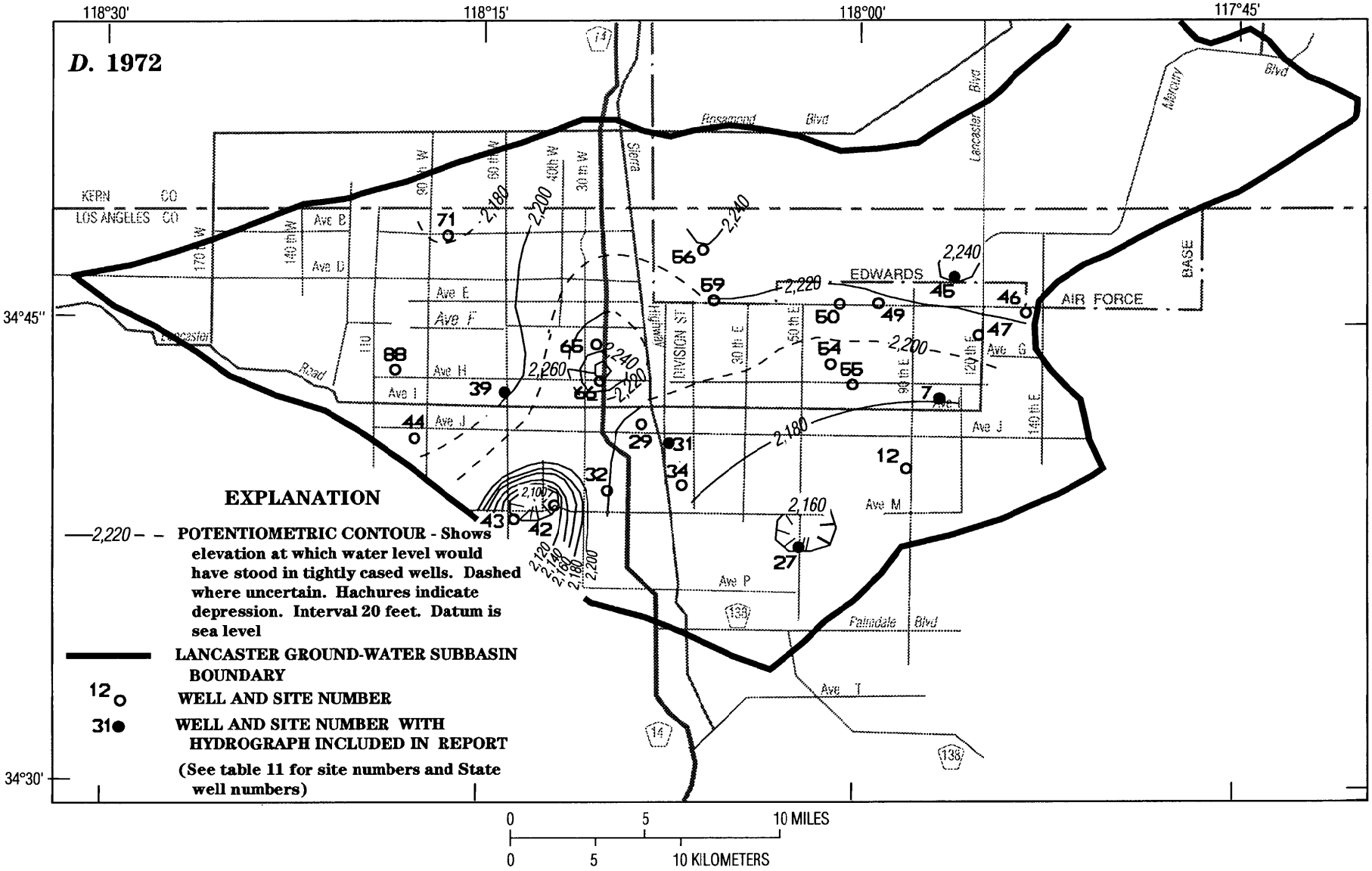

Figure 13. *Continued.*

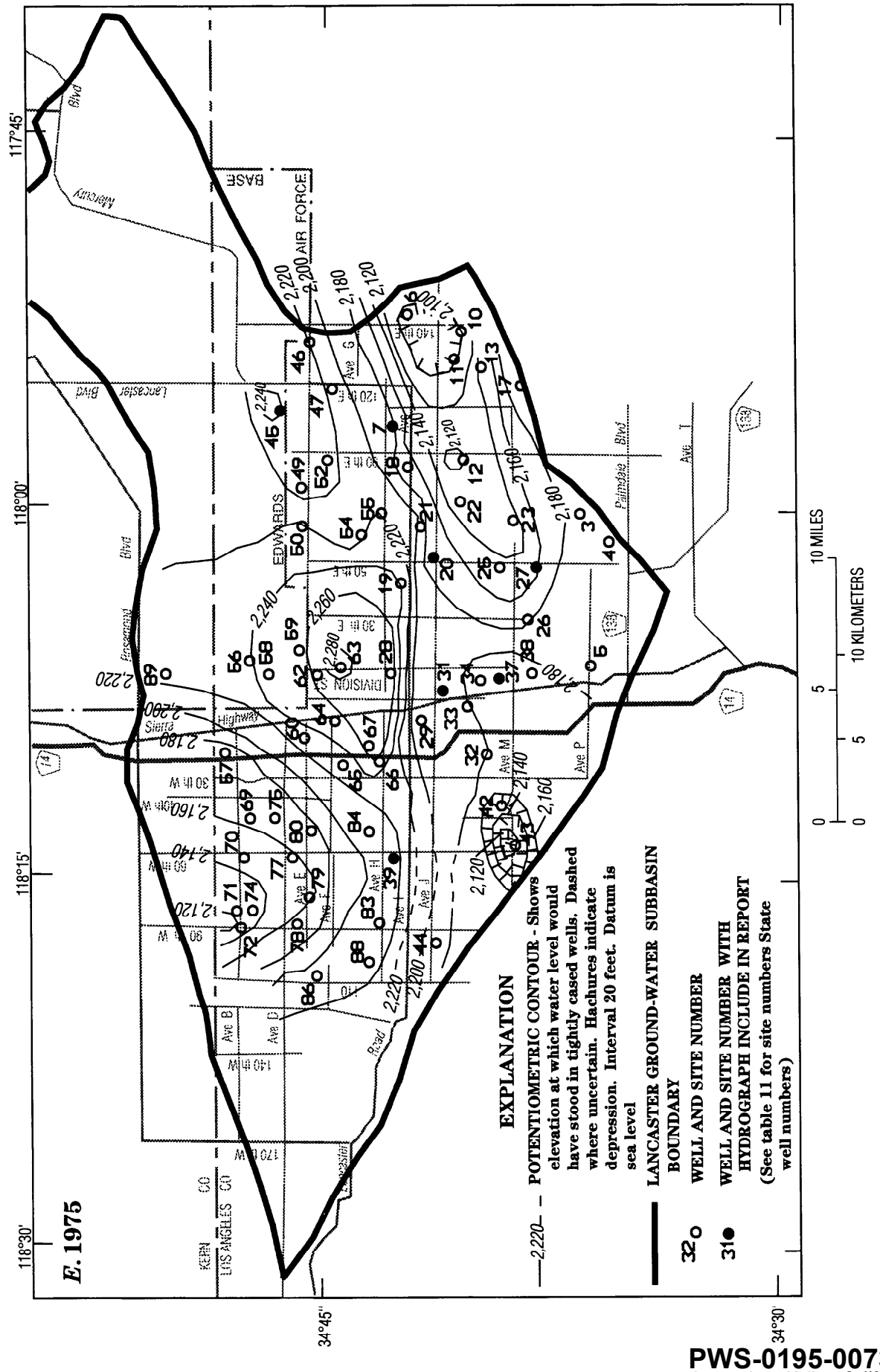

Figure 13. *Continued.*

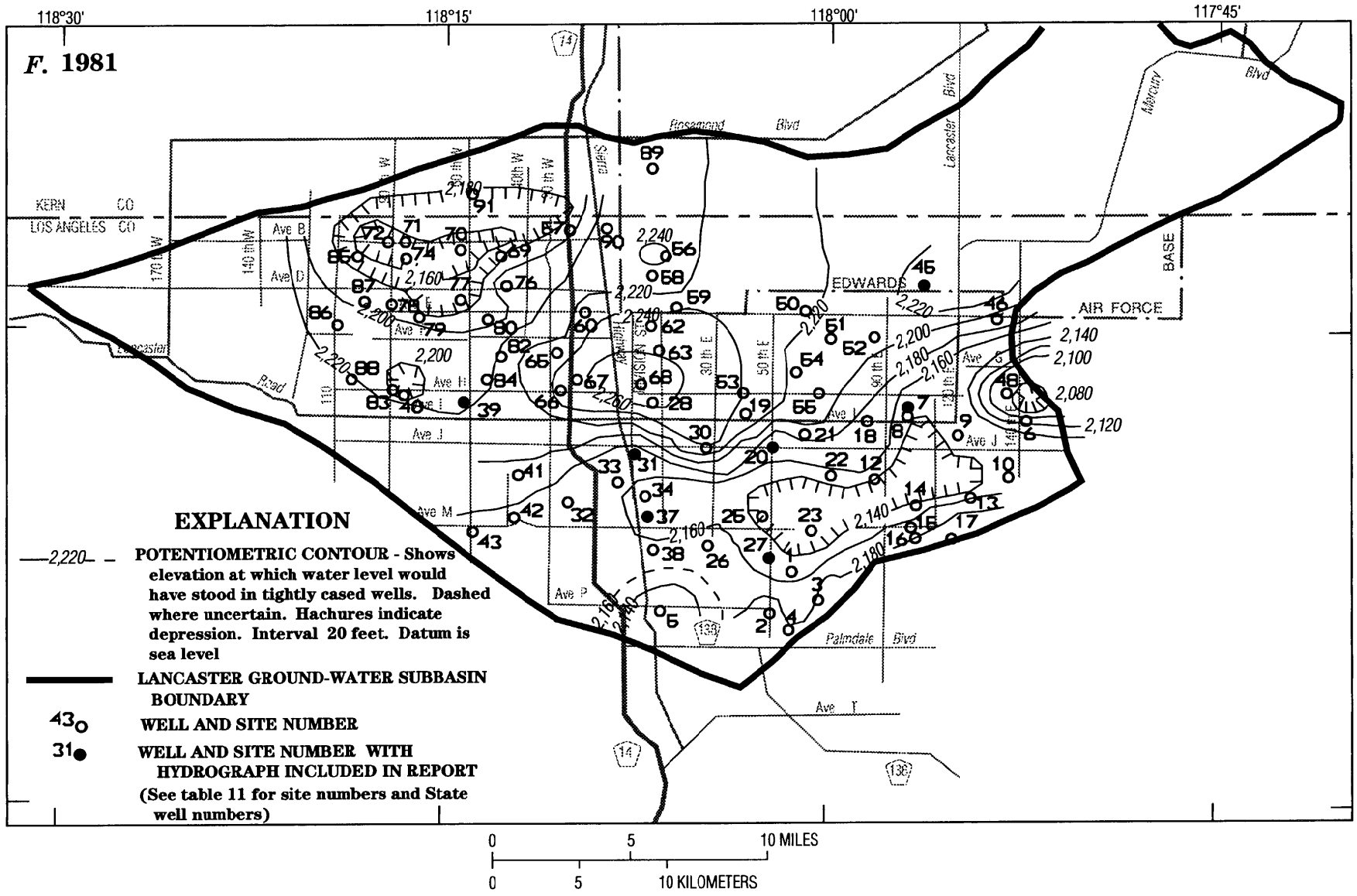

Figure 13. *Continued.*

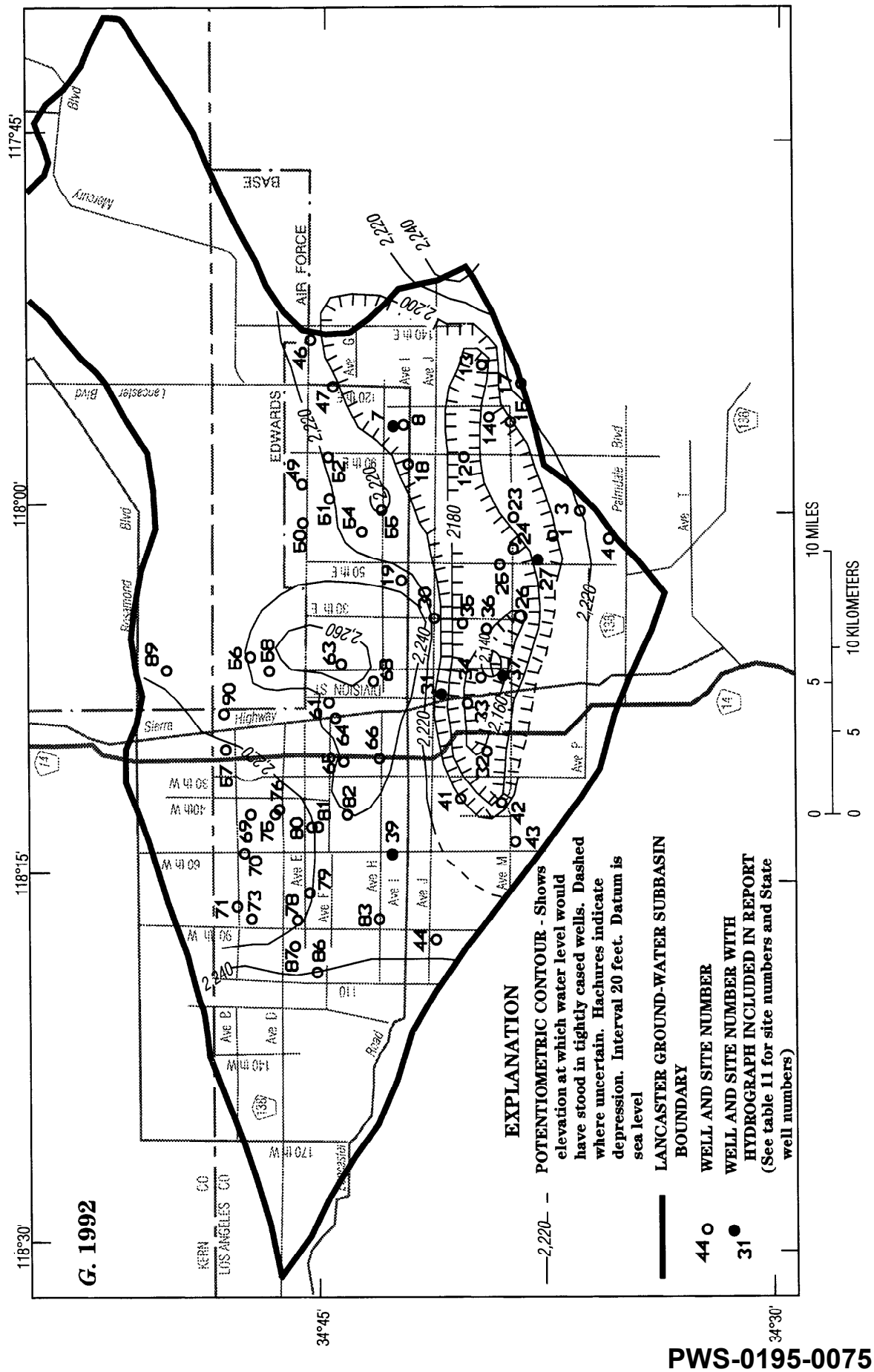

Figure 13. *Continued.*

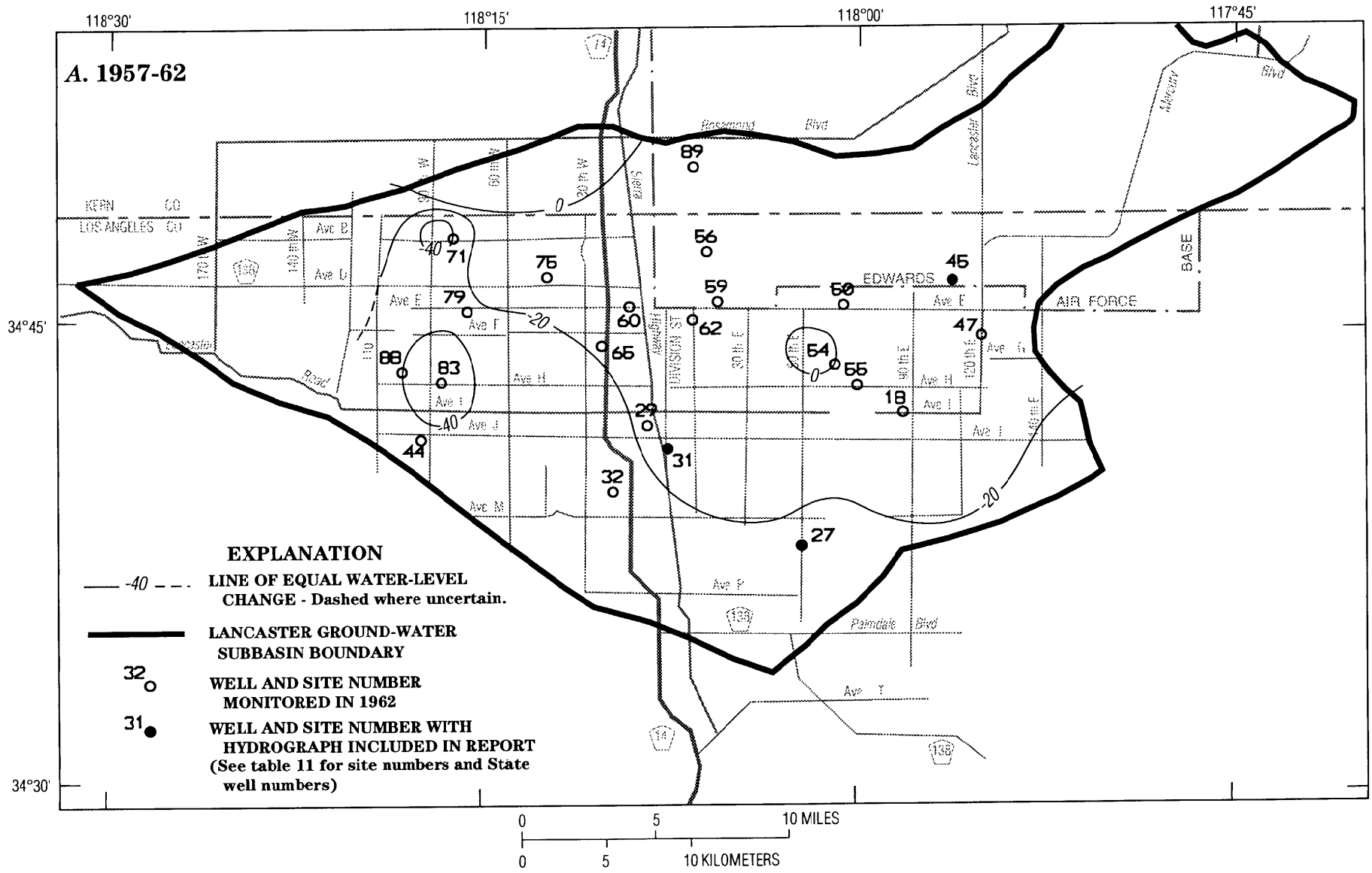

Figure 14. Generalized ground-water-level changes in the principal aquifer of the Lancaster ground-water subbasin between 1957 and ***A.*** 1962, ***B.*** 1965, ***C.*** 1972, ***D.*** 1975, ***E.*** 1981, and ***F.*** 1992.

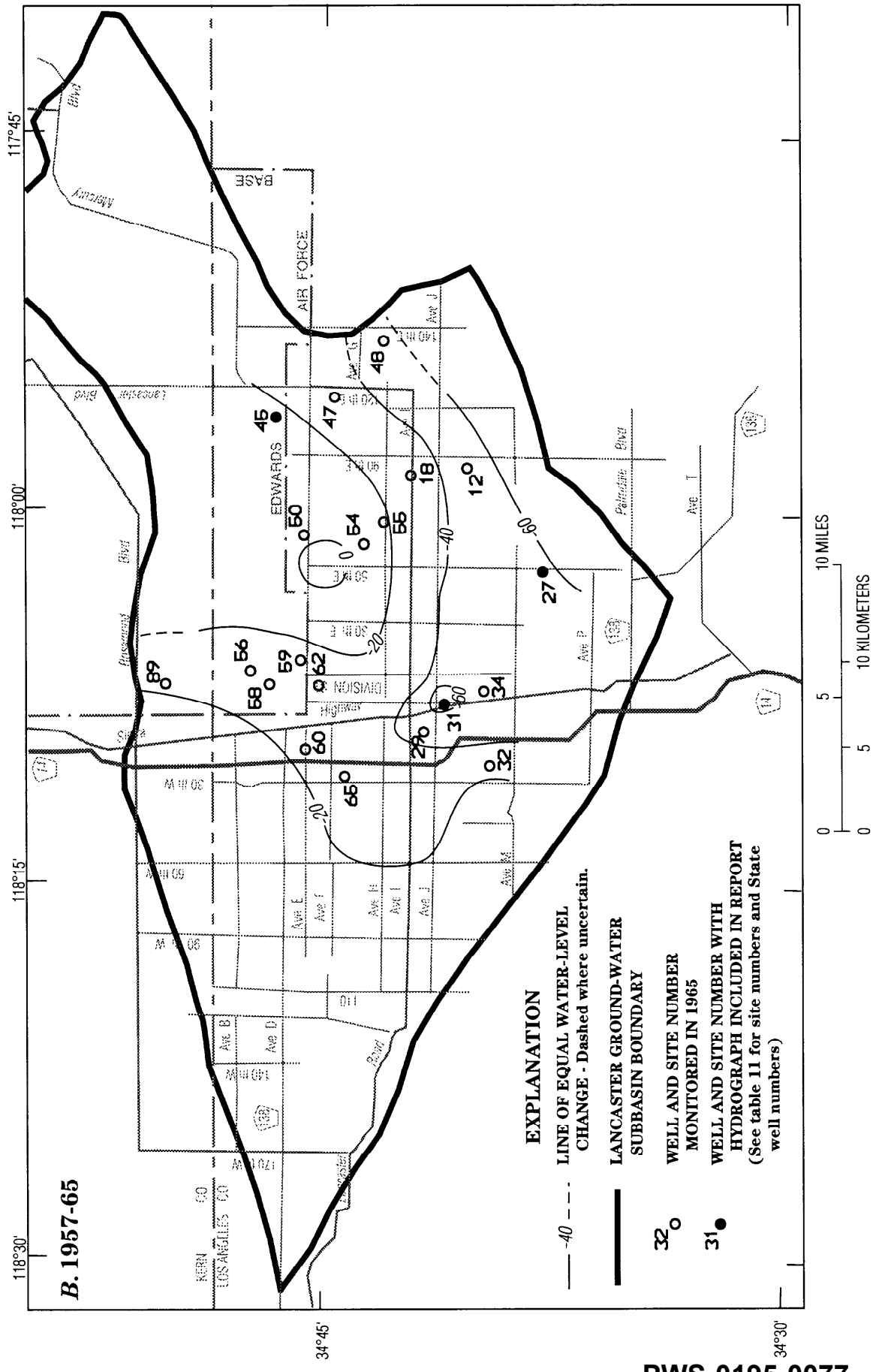

Figure 14. *Continued.*

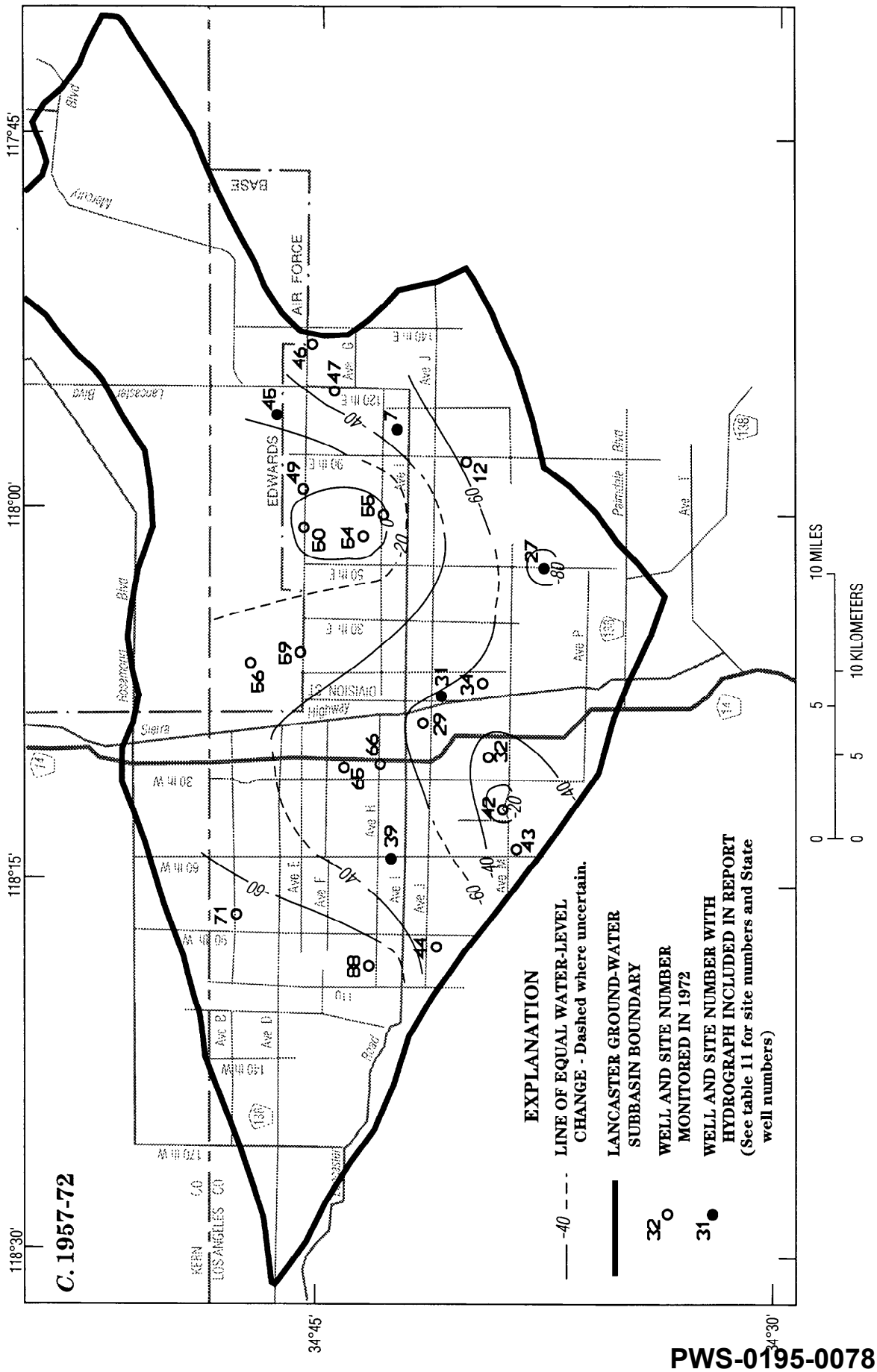

Figure 14. *Continued.*

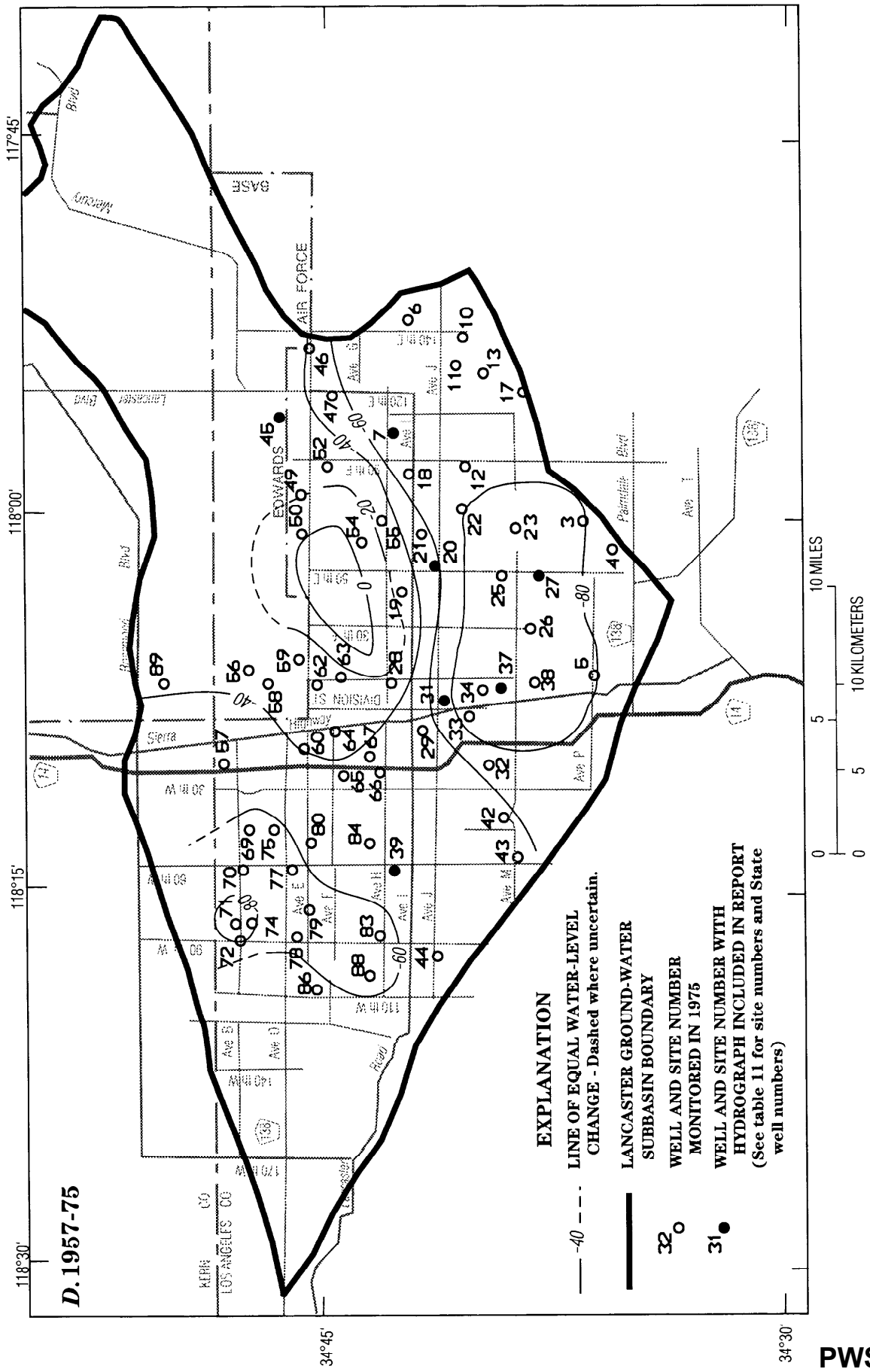

Figure 14. *Continued.*

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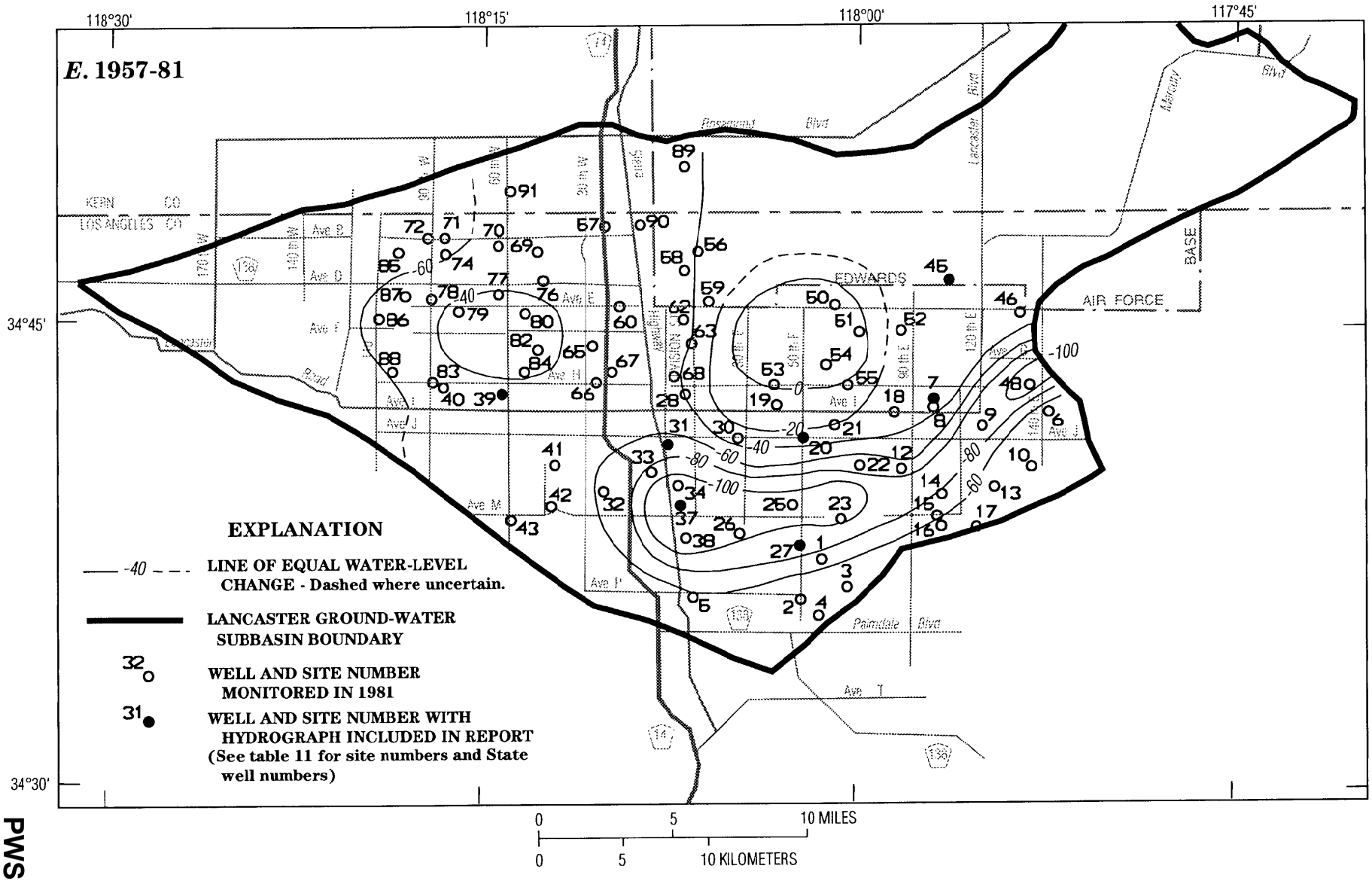

Figure 14. *Continued.*

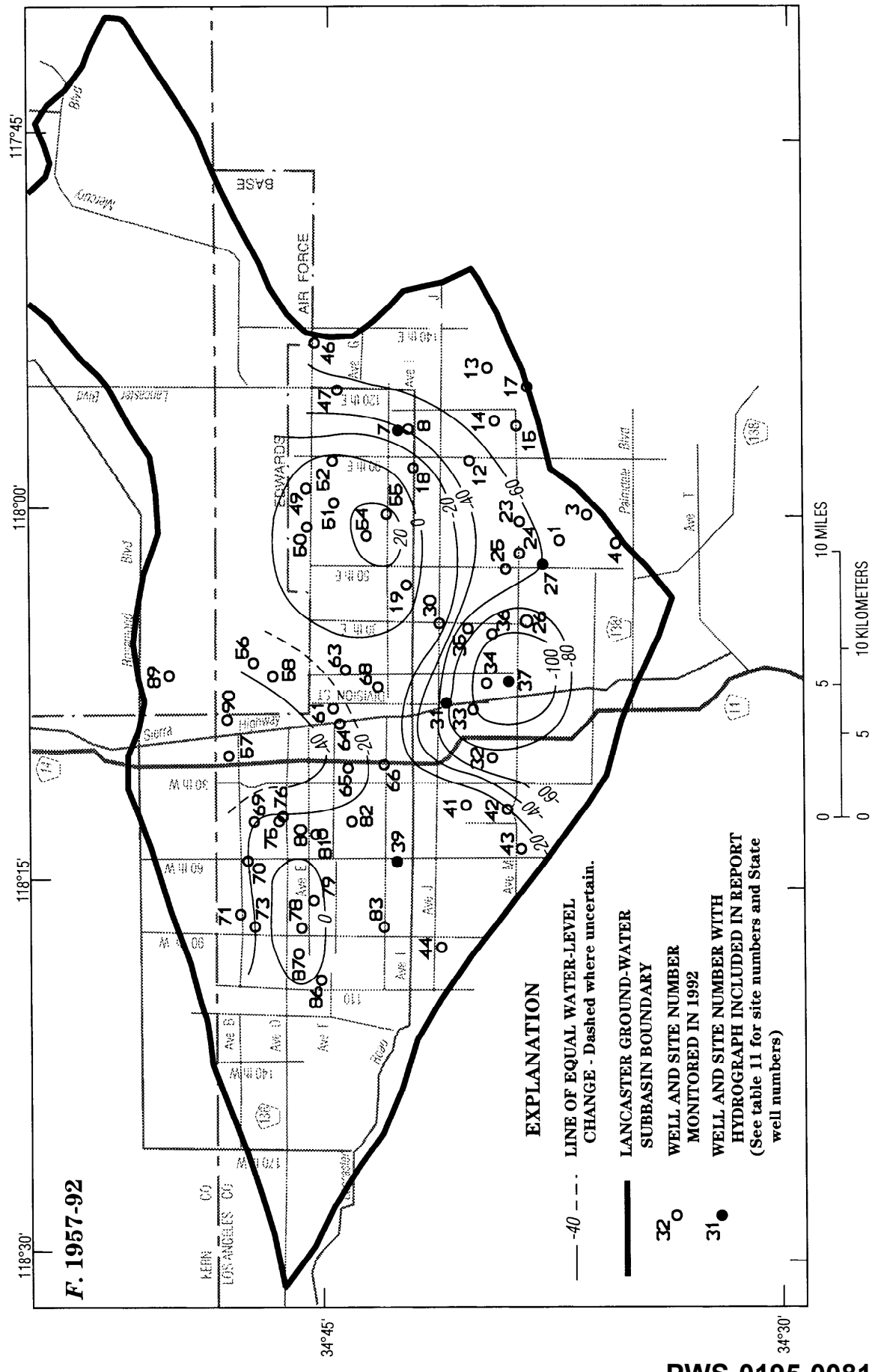

Figure 14. *Continued.*

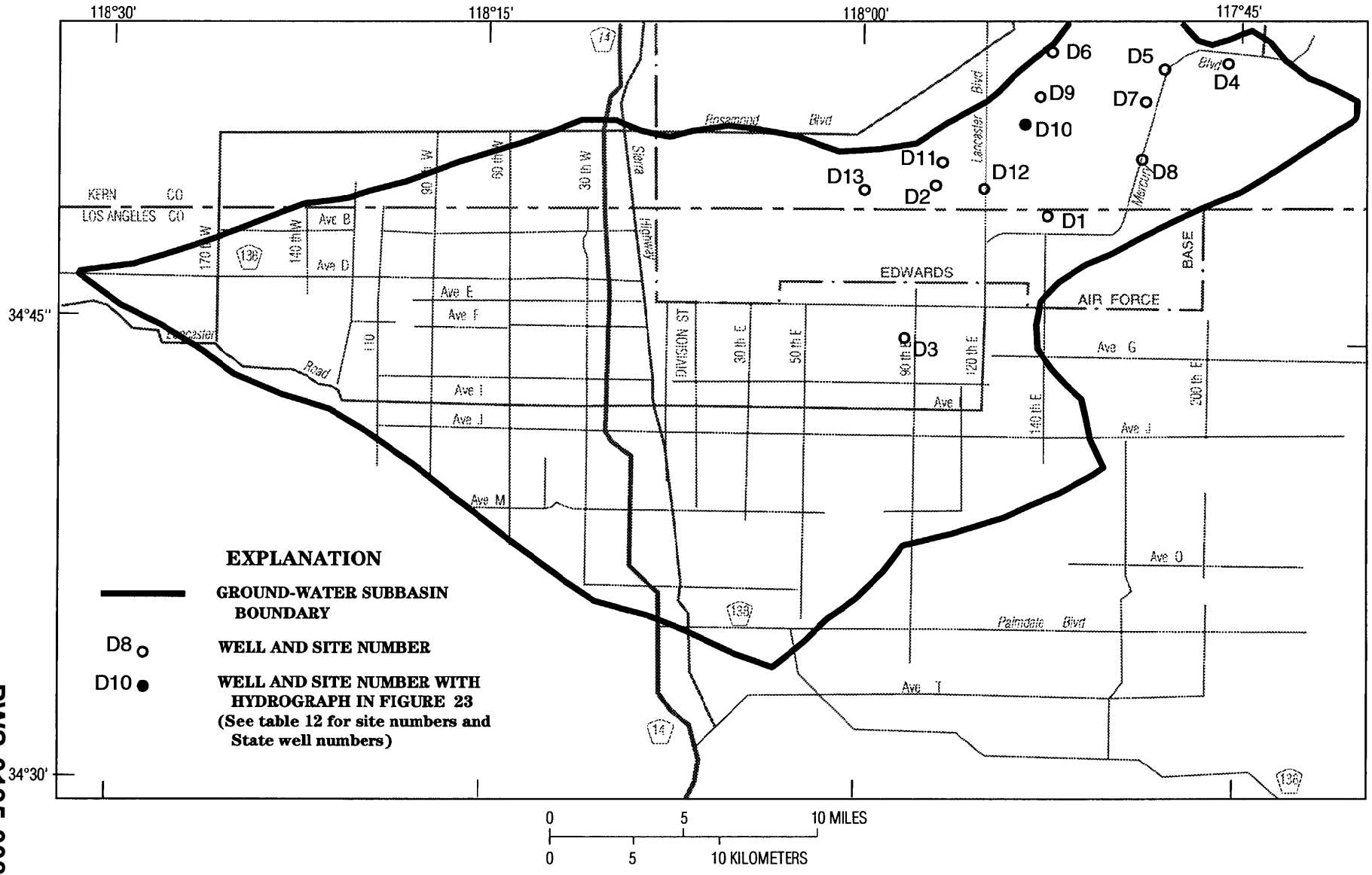

Figure 15. Location of monitoring wells completed in the deep aquifer of the Lancaster ground-water subbasin near the area of maximum subsidence on Edwards Air Force Base.

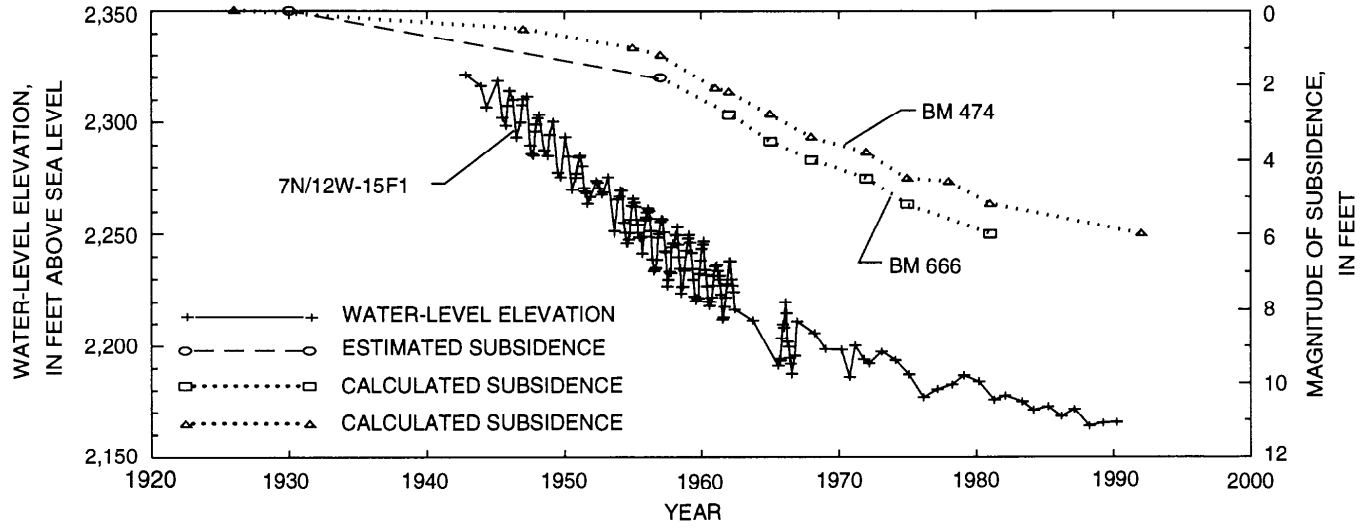

Figure 16. Water-level elevation for well 7N/12W-15F1 (site no. 31, fig. 13*A)* and historical subsidence at bench marks BM 666 and BM 474 (nos. 41 and 25, respectively, fig 8), Antelope Valley, Los Angeles County.

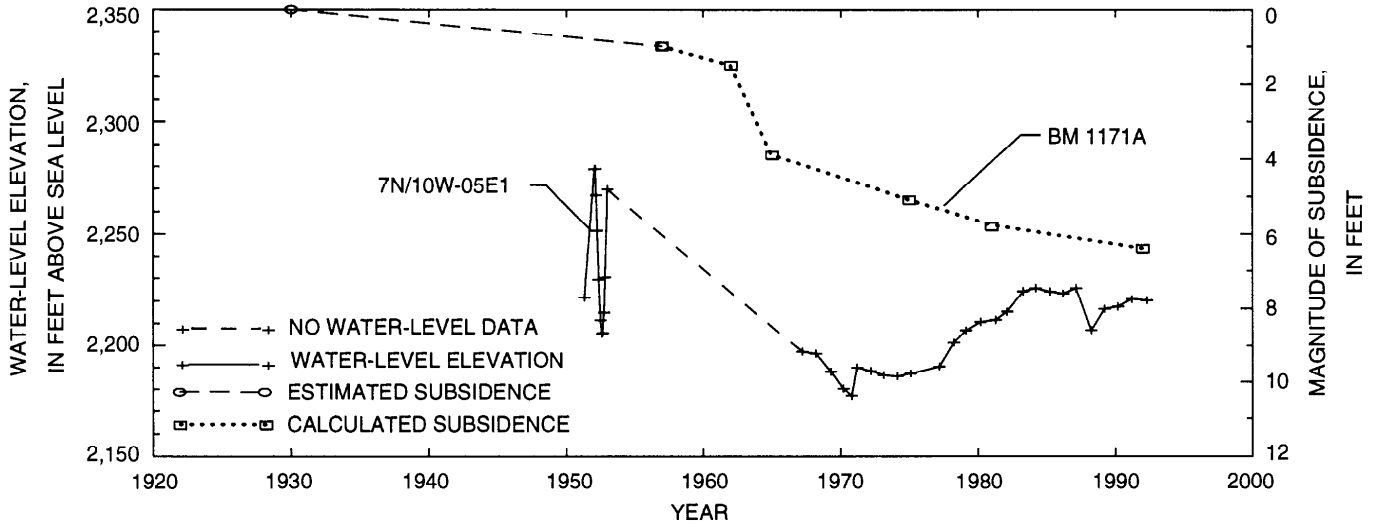

Figure 17. Water-level elevation for well 7N/10W-05E1 (site no. 7, fig. 13*D*) and historical subsidence at bench marks BM 1171A (nos. 69, fig 8), Antelope Valley, Los Angeles County.

in well 7N/11W-33N1 (site no. 27, fig. 13)] just south of this area result in subsidence where compressible sediments are present. More than 5 ft of subsidence at bench mark BM 2180 (no. 99, fig. 8) in Area 4 is shown on figure 18. Also note the correlation between the rates of water-level decline and subsidence for similar time periods.

Potentiometric-surface contour maps for 1975 and 1981 (figs. 13*E* and 13*F*) show the same general depiction of the potentiometric surface but with different hydraulic-head values. Water levels had declined more than 80 ft between 1957 and 1975 (fig. 14*D*) in a broad area around Lancaster and more than 100 ft by 1981 (fig. 14*E*) in a more extensive area between Lancaster and Redman. Correspondingly, rates of subsidence in this east-west band were highest for the 1972-75 (fig. 12*D*) and 1975-81 (fig. 12*E*) periods. The areas with the highest rates of subsidence are Areas 2, 3, and 4 (fig. 1).

Between 1981 and 1992, ground-water levels had partially recovered in some areas and continued to decline in the Lancaster area. The water-level-change map (fig. 14*F*) indicates that levels were between 60 to 100 ft lower in 1992 than in 1957 between Lancaster and Redman. However, water levels in the area west of 60th Street West had recovered to about 1957 levels. The hydrograph for

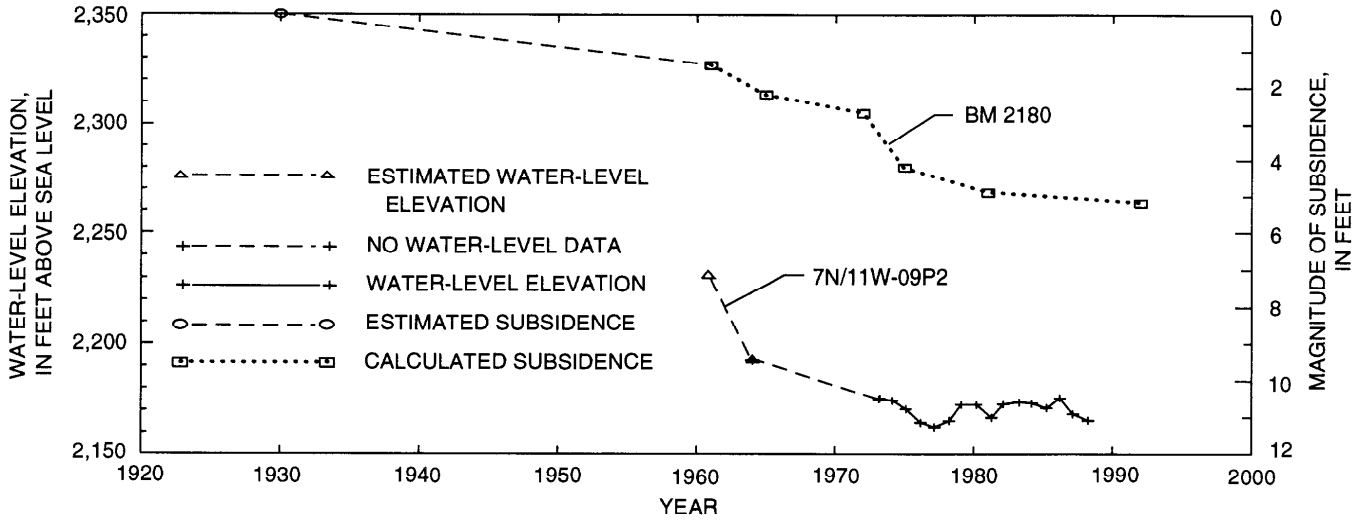

Figure 18. Water-level elevation for well 7N/11W-09P2 (site no. 20, fig. 13*E)* and historical subsidence at bench marks BM 2180 (no. 99, fig 8), Antelope Valley, Los Angeles County.

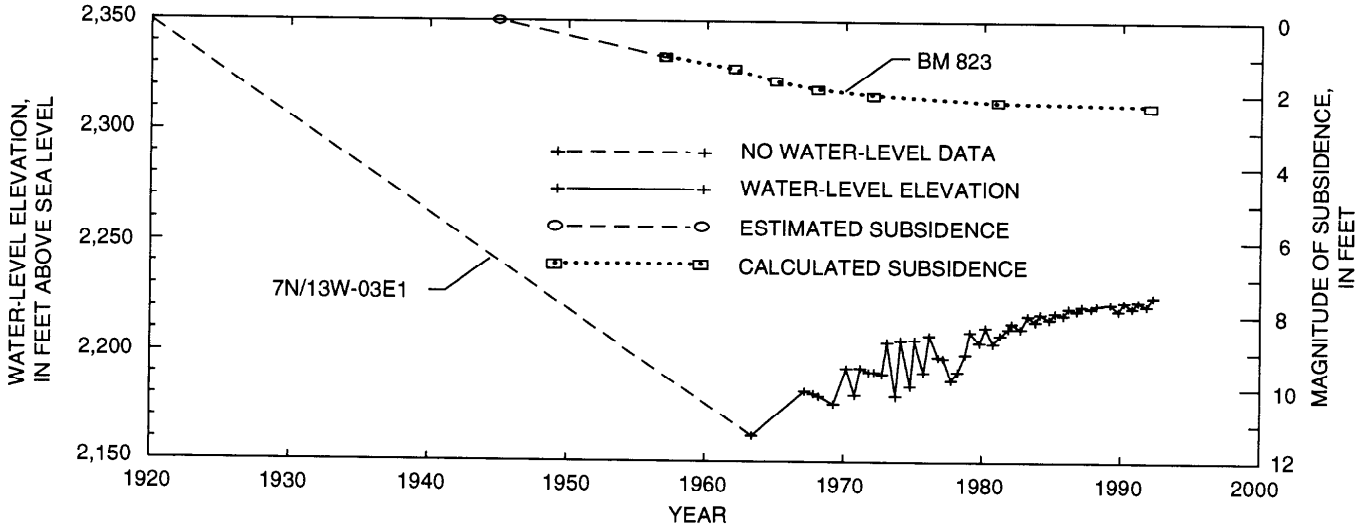

Figure 19. Water-level elevation for well 7N/13W-03E1 (site no. 39, fig. 13*D*) and historical subsidence at bench marks BM 823 (no. 46, fig 8), Antelope Valley, Los Angeles County.

well 7N/13W-03E1 (site no. 39, fig. 13*D*) substantiates why most of the subsidence measured in Area 1, between Avenues E and J and 60th to 90th Streets West, occurred prior to 1960. The water level in this well declined about 190 ft between 1920 and 1963 and subsequently recovered by about 60 ft as of 1992 (fig. 19). Rates of subsidence for bench marks BM 537 and BM 823 (nos. 34 and 46, respectively, fig. 8) for the 1981-92 period decreased to about 20 percent of the rates for the 1957-62 period (table 9). The reduction in the rate of subsidence at BM 823 lags about a decade behind the recovery in water levels. Even after 30 years of recovery, subsidence still has not ceased (fig. 19).

Two other hydrographs illustrate that declines in hydraulic head are not always correlated with aquifer-system compaction and subsidence. The hydrograph of well 7N/11W-33N1 (site no. 27, fig. 13*A*), near Avenue M and 50th Street East, shows a maximum decline in head of about 110 ft between 1952 and 1977 and a recovery of 30 ft by 1992 (fig. 20). At nearby bench mark BM 171 (no. 10, fig. 7), no subsidence occurred between 1935 and 1992 (fig. 20). In fact, between 0.1 and 0.3 ft of uplift has been calculated since 1955. Similarly, at well 7N/12W-27H1 (site no. 37, fig. 13*E*), near Avenue K-8 and Sierra Highway, a maximum of 180 ft of head decline was recorded between 1950 and 1992 (fig. 21). Cumulative subsidence of only

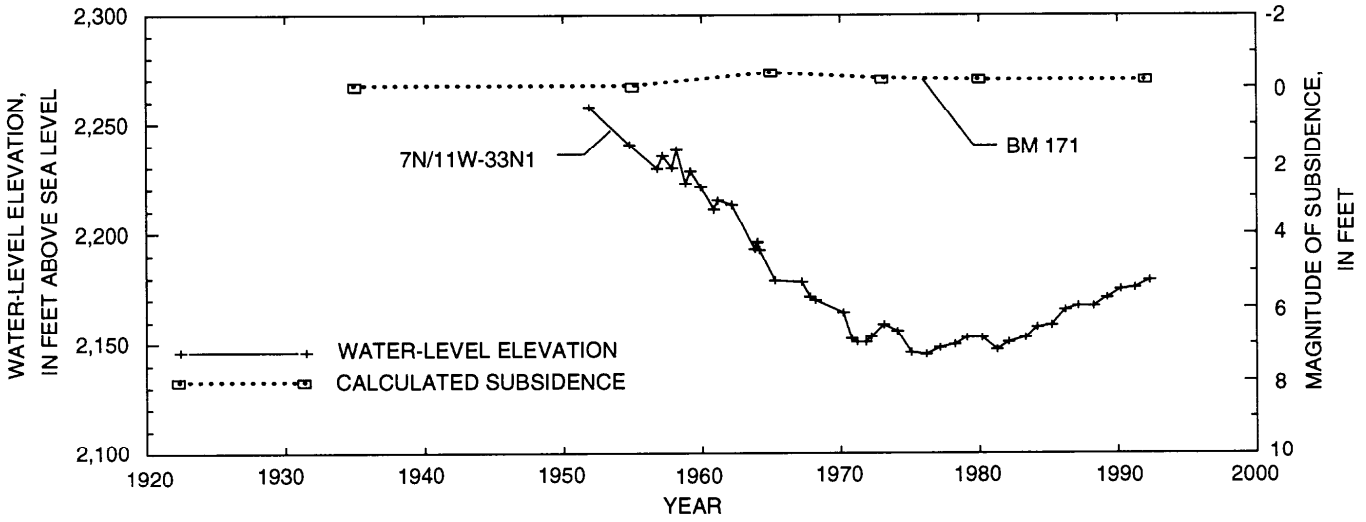

Figure 20. Water-level elevation for well 7N/11W-33N1 (site no. 27, fig. 13*A)* and historical subsidence at bench marks BM 171 (no. 10, fig 7), Antelope Valley, Los Angeles County.

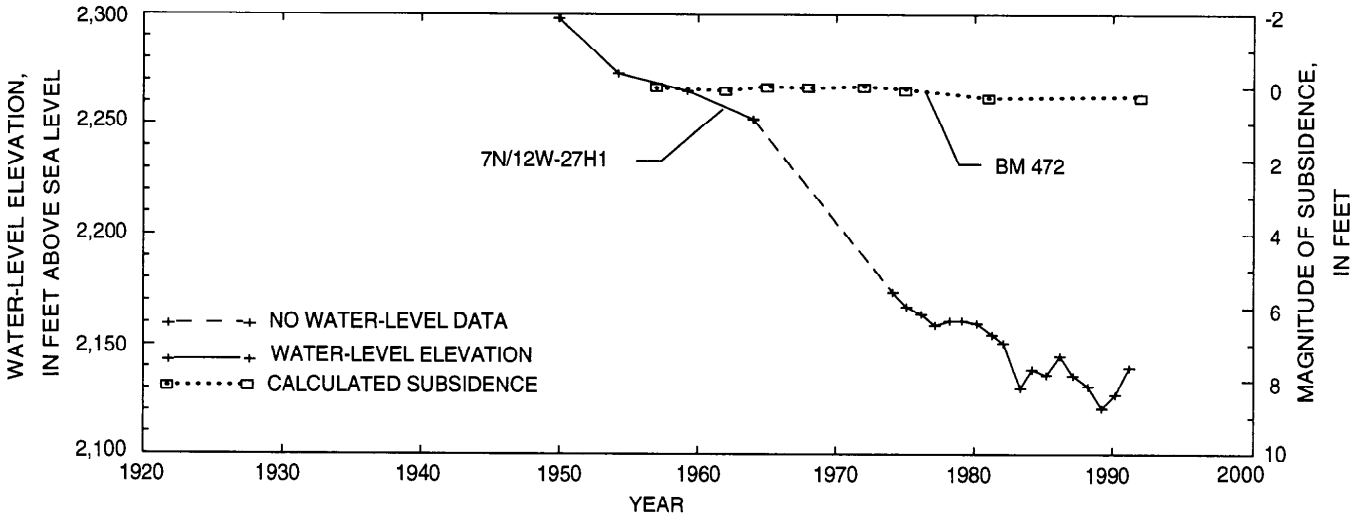

Figure 21. Water-level elevation for well 7N/12W-27H1 (site no. 37, fig. 13*E*) and historical subsidence at bench marks BM 472 (no. 24, fig 8), Antelope Valley, Los Angeles County.

0.3 ft from 1957 to 1992 (fig. 21) was calculated at nearby BM 472 (no. 24, fig. 8). These data indicate that either ground-water levels have not declined below the preconsolidation head of the fine-grained interbeds, or, more likely, the occurrence of compressible materials in these areas is insignificant. Even though large decreases in hydraulic head were measured at these and other wells, significant subsidence was not calculated for bench marks at corresponding locations.

A significant hydrologic feature evident in the three most recent potentiometric-surface contour maps (figs. 13*E-G*) is the ground-water mound north of Lancaster. This mound is near the terminus of Amargosa Creek and the wastewater treatment ponds near Rosamond Lake and has some geographic correlation with the area of smaller relative rates (and magnitudes) of subsidence mapped near Avenue E and 30th Street East (figs. 12*B*-12*E*). Further examination of the potentiometric-surface and subsidence-rate contour maps shows an apparent inverse correlation between the ground-water mound evident in 1975 and 1981 (figs. 13*E* and 13*F*, respectively) and the rates of subsidence contoured for the 1975-81 period (fig. 12*E*). For this period, the rates of subsidence near the mound southwest of Rosamond Lake are higher than in surrounding areas.

Two hypotheses for this anomaly relate to the distribution of the components of effective stress.

If wastewater effluent discharged to ponds and water from other recharge sources are perched on fine-grained sediment layers, that water is not hydraulically connected to the water table. In this case, the perched water would cause an increase in geostatic stress without a corresponding increase in pore pressure and thus would result in increased effective stress and compaction in both the principal and deep aquifers. Another possibility is that compaction is occurring primarily in the deep aquifer for similar reasons. If the ground-water-level contours represent a water-table mound in the principal aquifer and not perched water, the pore spaces would be saturated, and the higher pore pressure probably would counteract the increased geostatic stress resulting from loading by the ground-water mound. However, because the hydraulic connection between the deep aquifer and the water table (principal aquifer) is impeded by a confining bed of low permeability, compaction would occur at depth as a result of increased effective stress caused by the disparity between the increased geostatic stress and the negligible increase in pore pressure in the deep aquifer. Thus, compaction would result only, or primarily, in the deep aquifer and confining bed.

In general, the locations of the highest magnitudes and rates of land subsidence correlate with areas that have had the greatest ground-water-level declines in the principal aquifer of the Lancaster subbasin. More specifically, the areas of greatest subsidence occur somewhat northward of the areas of maximum water-level decline, most likely because of the geohydrologic setting of the aquifer system, which has a relatively coarse-grained composition nearest the base of the San Gabriel Mountains. As the topographic gradient decreases toward the playas in the closed basin, the sediments comprising the aquifer system become more fine-grained and multiple fine-grained interbeds become more prevalent. These depositional characteristics probably cause the locations of maximum subsidence and maximum water-level decline to be somewhat offset.

The correlation between the locations of subsidence and ground-water-level changes in the deep aquifer of the Lancaster subbasin is not as well illustrated. Data collected since 1989 at a monitoring station on EAFB southwest of Rogers Lake during a study done by Londquist and others (1993) illustrate the relation between land subsidence resulting from aquifer-system compaction and ground-water-level declines in the deep aquifer. In the northeast lobe of the Lancaster subbasin, the largest magnitudes of calculated or estimated subsidence between about 1930 and 1992—as much as 3.3 ft—occurred in a narrow band extending between Redman and just south of Rogers Lake. There are no long-term (pre-1950) water-level histories for wells completed in the deep aquifer in this vicinity; therefore, the hydrographs of two wells and the subsidence history of two bench marks in the general vicinity are included in this report. Figure 22 is a hydrograph for well 8N/10W-8R3 (site no. 45, fig. 13*A*), which is completed in the principal aquifer, and the magnitude of subsidence at nearby bench mark BM 1165B (no. 67, fig. 8). This figure shows a water-level decline of 55 ft between 1947 and 1991 and an estimated subsidence of 4.1 ft at BM 1165B since about 1930 to 1992.

Well 9N/10W-24C1 (site no. D10, fig. 15) is a former production well at South Base on EAFB and is completed in the deep aquifer. The hydrograph for this well shows a maximum water-level decline of about 180 ft (fig. 23) since 1953, but an average decline of about 100 ft. Subsidence of only 0.7 ft was calculated for the 1961-92 period at nearby bench mark H1155 (no. 176, fig. 7). Although this well is about 4 mi north of the area of maximum subsidence in this vicinity, the hydrogeologic setting again is important in characterizing the geographic correlation between ground-water levels and subsidence. The primary source of water for wells in this part of the subbasin is to the south because of gradational sedimentary deposition and ground-water divides to the west and north. Where both the confined (deep) and unconfined (principal) aquifers are present and utilized as significant sources of water, examination of water-level histories for wells completed in both aquifers can provide insight to the degree of compaction that could occur in each aquifer and the confining bed or interbeds.

Loss of Aquifer-System Storage

Aquifer-system compaction results in a net reduction of void space in the fine-grained, compressible interbeds and confining beds of an aquifer system and usually represents a predominantly irrecoverable loss in the storage capacity of the aquifer system. A conservative estimate of reduced storage capacity in the Lancaster ground-water subbasin was based on the volume of subsidence greater than 1 ft. This volume was computed on the basis of subsidence surfaces contoured from calculated or estimated cumulative subsidence as of 1992 (fig. 8). The area bounded by each of the contoured 1-ft intervals of subsidence was determined, and the volume of subsidence was computed by multiplying the average magnitude of subsidence in the interval by the area. About 290 mi^2 (750 km^2) has subsided more than 1 ft, and about 210 mi^2 (542 km^2) has subsided more than 2 ft. The area where subsidence exceeds 1 ft corresponds to a volume loss of more than 2.0×10^9 ft^3, which is attributable to aquifer-system com-

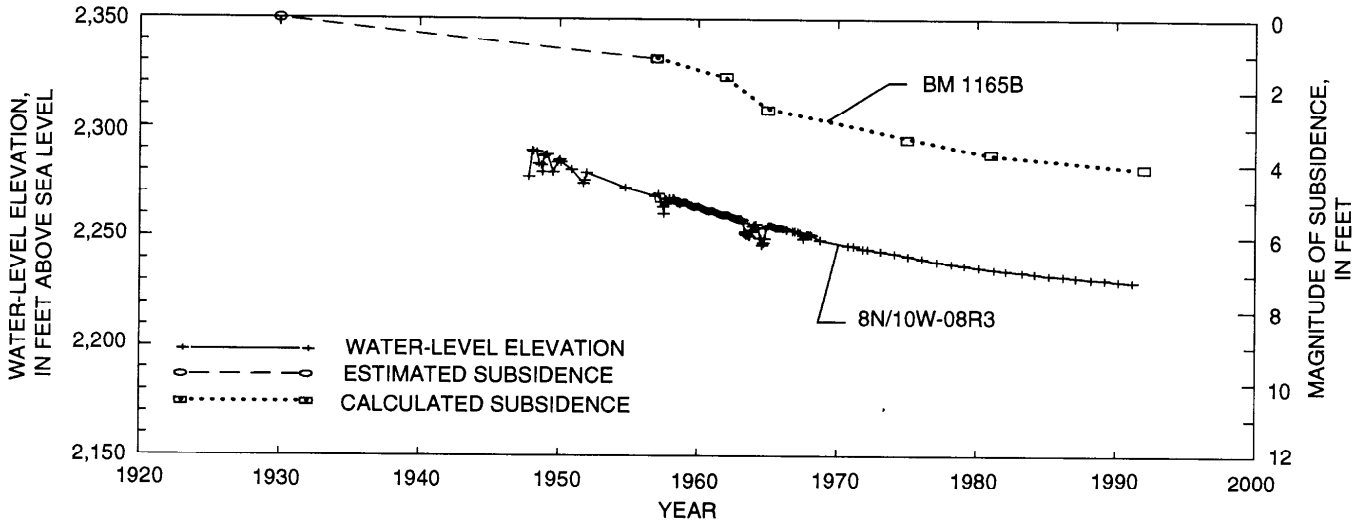

Figure 22. Water-level elevation for well 8N/10W-08R3 (site no. 45, fig. 13*A)* and historical subsidence at bench marks BM 1165B (no. 67, fig 8), Antelope Valley, Los Angeles County.

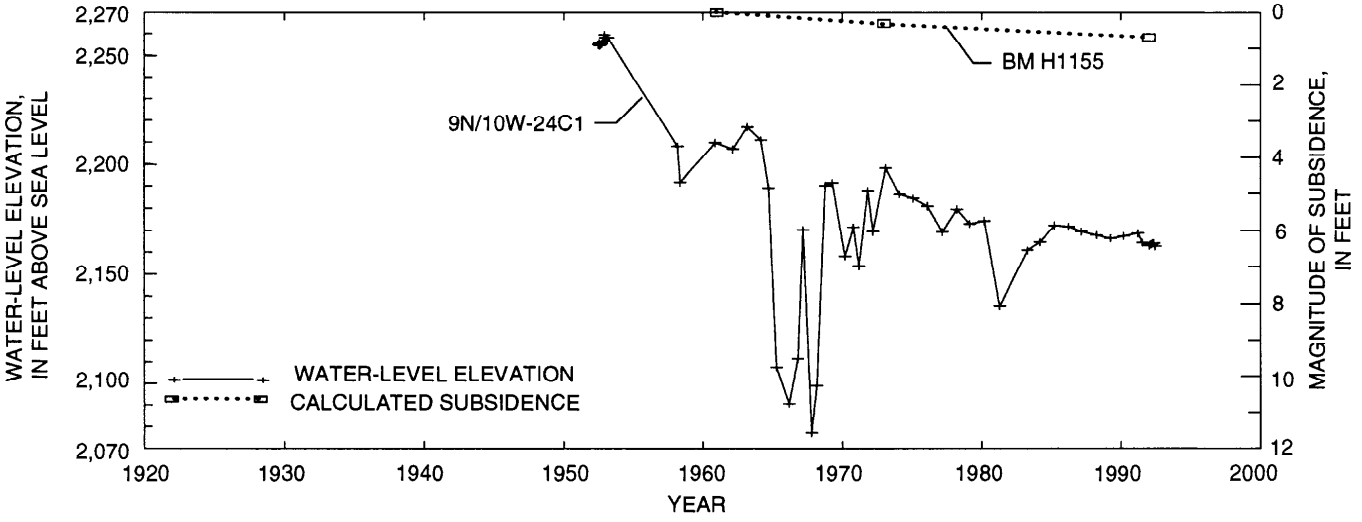

Figure 23. Water-level elevation for well 9N/10W-24C1 (site no. D10, fig. 14) and historical subsidence at bench marks H1155 (no. 176, fig 7), Antelope Valley, Kern County.

paction. This volume is equivalent to about 50,000 acre-ft of reduced storage capacity in the aquifer system in the region affected by more than 1 ft of land subsidence as of 1992. The total volume loss in the Lancaster ground-water subbasin, which would include areas affected by less than 1 ft of subsidence, would be more than 50,000 acre-ft.

The reduction in aquifer-system storage capacity of the area in the Lancaster subbasin that has subsided more than 1 ft is equivalent to the average estimated volume of water that would be recharged to all the ground-water subbasins in Antelope Valley in about 1.2 years. This calculation is based on an estimate of mean annual recharge of about 40,700 acre-ft/yr (Durbin, 1978). Because of the reduced storage capacity and reduced permeability of the aquifer system in the subsidence-affected regions, recovery of ground-water levels would be greater than if this region were unaffected by subsidence. However, in comparison with historical trends of ground-water-level declines, a post-recovery decline in ground-water levels would be more rapid and of greater magnitude for the same level of pumping stress. The increased sensitivity of the aquifer system to pumping stress increases the potential for exceeding the preconsolidation stress, which would not only yield water from storage in fine-grained materials, but also would cause renewed aquifer compaction.

LAND-SUBSIDENCE AND GROUND-WATER MONITORING IN ANTELOPE VALLEY

Long-term monitoring is essential to maintain an accurate assessment of the changes in the cumulative magnitude, rate, and geographical extent of ssubsidence. In order to monitor and attempt to con- trol the occurrence or location of subsidence resulting from aquifer-system compaction, measurements of ground-water levels and subsidence or compaction are needed to assess changing conditions. For effective management of ground-water resources in a subsidence-prone environment, one of the most important reasons for measuring ground-water levels is to determine if the previous maximum preconsolidation stress is being, or is about to be, exceeded. If water levels decline below the preconsolidation head, inelastic aquifer-system compaction results. Ground-water-level monitoring can be an early warning indicator, and the maintenance of ground-water levels above the preconsolidation head can be used as a preventive measure against the onset or renewal of subsidence. Measuring water levels as a subsidence-management tool is much less complex, less time-consuming, and thus more economical than measuring either aquifer-system compaction or land subsidence. However, because of the equilibration time-delay of aquifer-system pressures, compaction or subsidence monitoring would still be required for updated assessments.

Maintenance of Networks

The ideal situation for repeat measurement of land-surface elevations using GPS surveying is to observe an identical network configuration. It is important that the bench marks, especially the primary control stations, be protected from damage or destruction so that the integrity of the network is preserved. Detailed descriptions of the locations of the 85 stations are given in appendix A. In areas where more detailed knowledge of the localized distribution of subsidence is needed, differential leveling or GPS surveying from a network bench mark to neighboring bench marks in various directions could be done on a more frequent basis than would be done for full-scale network measurement. Examples of such locations include the three areas with the largest magnitude of subsidence (fig. 1).

Ideally, measurement of ground-water levels would continue at all wells that have numerous historical measurements. If fewer wells are available than were measured previously for reasons such as changes in use, ownership, physical condition of the well, or economic resources, a ranking system could be developed from a decision matrix to determine which of the remaining wells would merit continued measurement. Criteria on which to base such a decision could include duration and quality of historical measurements, location of the screened interval(s) of the well in relation to the aquifer system, amount of current or planned pumping activity, and duplication of representative observation points. If ground-water use were to change, measurements could be done more frequently or at different or additional wells.

Monitoring Frequency

Future changes in land-surface elevations can be detected with a high degree of confidence by repeat GPS geodetic surveying if the changes exceed the magnitude of the larger error associated with the two measurements of a bench-mark's ellipsoidal height. Reoccupation of the same network bench marks and reuse of the identical primary control stations in the network adjustment would produce results that could be readily compared with previous measurements. Comparisons of ellipsoidal heights eliminate the relatively large error associated with geoidal separations used in calculations of orthometric heights. A conservative approach would be to schedule a follow-up GPS survey no sooner than the estimated average magnitude of subsidence in the study area exceeded 2σ of the error associated with the vector for a bench-mark pair or with the ellipsoidal-height measurements of the bench marks. On the basis of the average value of ±0.006 m (0.020 ft) of 1σ error for the vertical component of vectors resulting from the minimal-constraint adjustment of the 1992 GPS surveying, resurveying would not be scheduled until more than 0.024 m [(0.006 m × 2) × 2] (0.08 ft) of subsidence was expected to have occurred in most of the subsiding area. On the basis of subsidence rates calculated for 1981-92 (0.03 ft/yr) for a large part of the Lancaster subbasin, a conservative interval for resurveying would be 3 years, assuming that no substantial increase or change in distribution of ground-water pumping had occurred during that interval and that the same or a better level of surveying accuracy would be achieved.

The frequency of ground-water-level measureements is dependent on the goals of the monitoring program. For generalized potentiometric surfaces, annual or biannual synoptic measurements of network wells may be sufficient. However, if conjunctive management of ground- and surface-water resources is a primary objective, more frequent measurements, such as monthly or weekly, of key ground-water observation wells may be more appropriate. The effect of trial water-management and subsidence-management strategies could be examined by temporary intensive monitoring of water levels. If different ground-water-management

strategies were to be tested, frequent monitoring would be prudent until the effects of the trial management strategies were determined and understood.

SUMMARY

Land-surface elevations, measured in 1992 using GPS geodetic surveying, were used to calculate magnitudes of subsidence of more than 6.5 feet since about 1930 in areas of Antelope Valley, California. Calculations of subsidence were made for more than 200 selected bench marks in the valley. If measurements were not available for the 1930-60 period, estimates were made for selected bench marks by interpolating values from contours of subsidence rates plotted from historical leveling done at neighboring bench marks. A total of 85 control stations were observed in 35 days using GPS. Three to seven receivers were operated simultaneously in the static mode with the duration of observation ranging from 4.75 to 6.75 hours. The minimal-constraint a priori errors for bias-fixed vector solutions were ±(3 millimeters + 0.4 parts per million) for x, ±(4 millimseter + 0.4 parts per million) for y, and ±(5 millimeters + 0.5 parts per million) for z, indicating that the quality of the GPS-survey measurements was high. Historical differential-leveling data published by Los Angeles County, Department of Public Works; the National Geodetic Survey; and the National Mapping Division were used in the determination of cumulative subsidence magnitudes and rates for selected periods between 1957-92.

Much of the area in the Lancaster ground-water subbasin has subsided at least 2 feet since about 1930. Subsidence of more than 5 feet occurred between about 1930 and 1992 in three areas: near Avenue I and Division Street, near Avenue G-8 and 90th Street East, and near Avenue I and 45th Street East. Subsidence at these and other locations occurred mostly after 1957, but, near Avenue I and 60th Street West, most of the subsidence (between 2 and 3 feet) occurred prior to 1960. Subsidence in the Lancaster subbasin generally coincides with large declines in ground-water levels where the subsurface lithology consists predominantly of fine-grained sedimentary deposits. Ground-water pumping since 1957 has resulted in ground-water-level declines of at least 190 feet in some wells, and declines of 60 to 100 feet have been noted in wells that are widely dispersed throughout Lancaster subbasin. Ground-water-level and subsidence monitoring programs are critical in obtaining current information to assess the effects of various ground-water and subsidence-management strategies.

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APPENDIX A. DESCRIPTIONS OF ANTELOPE VALLEY SUBSIDENCE NETWORK STATIONS

Directions to and descriptions of the Antelope Valley Subsidence Network stations are provided in this appendix to facilitate use of these geodetic stations in future measurements. The maximum possible protection from any construction activity in the vicinity of these stations is critical so that future measurements for land-subsidence determinations by Global Positioning System (GPS) surveying can be made of a network whose configuration is as similar as possible to the original.

There are 86 entries—85 are for stations measured by GPS in 1992 and 1 is for an offset station (GWM11 Reset 1971 Offset 1989) installed by the U.S. Geological Survey (USGS), Water Resources Division, in the Edwards Air Force Base subsidence network that was measured by GPS in 1989. The 7.5-minute topographic quadrangle where the station is located is given at the top of each entry. All road logs are written starting from either Lancaster or Palmdale. The mark used for centering the GPS antenna was either a centered dot within a triangle, a centered intersection of a cross consisting of a long line and a short line, or a punched dimple in the top of a knob rising about 0.5 in. above the disk. Where applicable, restricted access and other requirements are noted at the bottom of the entry. Additional comments, usually about the condition of the bench mark, are included at the end of some entries.

Abbreviations used in Appendix:

ave.	avenue
blvd.	boulevard
BM	bench mark
CDoT	California Department of Transportation
CE	County Engineer
C/L	centerline
Co.	County
diam	diameter
dr.	drive
e	east
EAFB	Edwards Air Force Base
ene	east-northeast
engr	engineer
ese	east-southeast
ft	foot, feet
HPGN	High Precision Geodetic Network
hwy.	highway
ID	identification
in.	inch
IP	iron pipe
JPL	Jet Propulsion Lab
LAA	Los Angeles Aqueduct
LAC	Los Angeles County
ls	land surface
mi	mile
mm	millimeters
n	north
NCMN	National Crustal Motion Network
ne	northeast
nne	north-northeast
nnw	north-northwest
nw	northwest
PP	power pole
PVC	polyvinyl chloride
rd.	road
RR	railroad
s	south
se	southeast
ssw	south-southwest
st.	street
sw	southwest
USC&GS	U.S. Coast and Geodetic Survey
USDI	U.S. Department of the Interior
USGS	U.S. Geological Survey
w	west
wnw	west-northwest
WRD	Water Resources Division

BM 135; H306 1935 Littlerock

From Palmdale, drive e on Hwy. 138 (also known as Pearblossom Hwy.) to 0.5 mi e of 87th St. E, or 0.35 mi w of 90th St. E. The USC&GS monument is 33 ft n of C/L of the hwy., 101 ft e of PP 1294916E, 96 ft w of PP 1294915E, and 1.0 ft n of 2-inch-diam IP witness post. It is about 1 ft higher than the hwy. and set in a square concrete post projecting 1.3 ft above ls.
Note: Corners of the post have been chipped off, but the post is still solid.
Last recovered on 4/24/92.

BM 171; E306 1935 Palmdale

From Palmdale, drive e on Ave. P to 50th St. E and thence s to the intersection of Palmdale Blvd., turning w on Palmdale Blvd. The USC&GS monument is about 230 ft w of the st., 45 ft n of C/L of the blvd., between the first and second PPs w of 50th St. E, 76 ft w of the first PP, and 31 ft se of a Joshua tree. It is set in a square concrete post projecting 0.3 ft above ls.
Last recovered on 4/28/92.

BM 336; E489 1955 Lancaster West

From Sierra Hwy., drive 3.1 mi w along Ave. M to 300 ft e of the intersection of 30th St. W, a side rd. north. The USC&GS monument is between the first and second PPs e of 30th St. W, 34 ft n of C/L of the ave., and 1.7 ft e of a witness post. It is set in a round concrete post projecting 0.3 ft above ls.
Last recovered on 5/16/94.

BM 471; B57 1926 Reset 1955 Lancaster West

From Ave. L in Lancaster, drive 1,250 ft (about 0.25 mi) s on Sierra Hwy., or 0.35 mi s of RR Milepole 408, to opposite the s fenceline of the building at 42607 Sierra Hwy. The USC&GS monument is 60 ft e of C/L of the hwy., 41.6 ft w of the w rail of the e set of tracks, and 1.5 ft e of a witness post. It is set in a round concrete post about 2.0 ft below ls.
Note: As of 7/94, this mark appears to have been buried during installation of the w set of tracks in late 1993.
Last recovered on 5/5/92.

BM 474; B2335 1902; 101-133 Lancaster West

From Sierra Hwy. in Lancaster, drive 0.05 mi n of Ave. I to a dirt track bearing ne between the third and fourth PPs, and thence about 0.1 mi ne and n to 4 3/4 PPs n of RR Milepole 405. The USGS monument is 0.05 mi w of a pipe culvert under the tracks, 49.4 ft w of the w rail of the main track, 48.8 ft e of the s wall of the building at 45354 Sierra Hwy., and 1.5 ft e of a short wooden 4 × 4-inch witness post. A bronze cap is riveted on top of a 3-inch-diam IP about 1.5 ft lower than the RR tracks and 0.2 ft below ls.
Last recovered on 5/5/92.

BM 479; OBAN 1929 LINT; 101-141 Rosamond

From Lancaster, drive n on Hwy. 14 (Antelope Freeway) and exit on Ave. F, driving e for 1.35 mi to the T-intersection at Sierra Hwy. Drive n on Sierra Hwy. for 0.45 mi until the witness post is visible to the w, 0.05 mi s of an area bounded by concrete masonry walls. Best access to the mark (especially during wet conditions when the w shoulder becomes the channel for Amargosa Creek) is a track rd. angling sw just s of the wall. The USC&GS horizontal control station is 227.1 ft w of C/L of the hwy., 81.2 ft s of OBAN RM 2, and 45.4 ft nw of OBAN RM 1. The monument is about 2 ft higher than the hwy. and is set in a round concrete post projecting about 1.3 ft above a concrete pad on top of a low knoll.
Note: The bronze tablet is in good condition and stable, but the concrete post is badly cracked vertically on the e and w sides.
Last recovered on 8/10/94.

BM 537; 102-9 1957 Lancaster West

From Hwy. 14 in Lancaster, drive 2.5 mi w on Ave. I to the intersection of 45th St. W (a dirt rd.). The CE monument is 89 ft n of C/L of the ave., 30 ft e of C/L of the st., and 3 ft s of the base of the guy wire for PP 2145, which is 29.9 ft s of the mark. It is set in a square concrete post projecting 0.4 ft above ls.
Note: The guy wire makes setup of the antenna difficult.
Last recovered on 5/6/92.

BM 823; B306 1935, 102-16; US 3170 Del Sur

From Hwy. 14 in Lancaster, drive 5.1 mi w on Ave. I to the intersection of 75th St. W (an unmarked, dirt rd. heading n). The USC&GS monument is 61 ft n of C/L of the ave., 17 ft e of C/L of the st., in line with a row of PPs leading n, and 1 ft w of a barbed-wire fence. It is set in a square concrete post about 0.7 ft below ls.
Note: It is likely that the mark will be covered with tumbleweeds and fine dirt and sand.
Last recovered on 5/6/92.

BM 1159; 106-116 1959 Redman

From Lancaster, drive n on Sierra Hwy. and thence e on Ave. E for 13 mi to the intersection of 120th St. E. The CE monument is 197 ft w of C/L of the st., 23 ft n of C/L of the ave., 2.5 ft e of PP 390066E, and 1.6 ft s of a witness post. It is about 1.5 ft lower than the ave. and set in a square concrete post about 1 ft below ls.
Last recovered on 4/5/92.

BM 1165B; 106-122 1959 Offset 1989 Redman

From Lancaster, drive n on Sierra Hwy. and thence e on Ave. E for 10 mi to the intersection of 90th St. E. The WRD monument is 330 ft w of C/L of the st., 40 ft n of C/L of the ave., 24 ft n of the fourth PP w of the intersection, and 360 ft nw of and diagonally across the intersection from LAC bench mark BM 1165A (106-122 1959). It is a USGS gaging-station disk set in the se corner of a 1.5 ft-square concrete pad flush with ls.
Last recovered on 4/23/92.

BM 1171A; 116-3 1961 Alpine Butte

From Sierra Hwy. in Lancaster, drive 9.5 mi e on Ave. I and thence 1.5 mi n on 90th St. E to the intersection of Ave. G8, a dirt rd. The CE monument is about 80 ft e of C/L of the st., 20 ft s of C/L of the ave., 23.1 ft w of PP SC13871 (with transformer), 45.1 ft e of PP on se corner of intersection, and 1.8 ft s of a yellow IP witness post. It is set in a square concrete post projecting 0.3 ft above ls.
Last recovered on 5/4/92.

BM 1276; 102-52 1957 Neenach School

From Hwy. 14 in Lancaster, drive n to the Ave. D (Hwy. 138) exit, thence 18.7 mi w to 210th St. W, thence 0.9 mi s to Lancaster Rd. (Ave. D-15), and thence 0.6 mi w. The CE monument is 32 ft n of C/L of rd. and 1 ft n of yellow IP witness post. It is set in a square concrete post projecting 0.5 ft above ls.
Last recovered on 6/30/92.

BM 1290; 102-38 1957 Lake Hughes

From Hwy. 14 in Lancaster, drive 9.5 mi w on Ave. I, or 1 mi w of 110th St. W, to where Ave. I becomes Lancaster Rd. (and turns n for 0.5 mi). Proceed 4.9 mi wnw on Lancaster Rd. to 160th St. W, and thence 0.4 mi n to where paved rd. curves w. Drive n on dirt track and then w on dirt track (extension of e-w part of Lancaster Rd.). The CE monument is 54 ft n of C/L of the rd., 33 ft w of C/L of the dirt track, 32 ft ne of a PP (not numbered), 28 ft n of a PP cut off to 5 ft, 1.5 ft s of a yellow IP witness post, 1 ft e of a steel fencepost witness post, and 7 ft nw of a corner 6 × 6-inch wooden fencepost. It is set in a square concrete post 0.4 ft below ls.
Last recovered on 5/8/92.

PWS-0195-0093

BM 1380; 110-10 1958 Ritter Ridge

From Hwy. 14 in Palmdale, drive 0.2 mi w on Ave. N to 15th St. W and thence 0.95 mi s to near the intersection of Ave. O. The CE monument is 185 ft n of C/L of the ave., 126 ft n of fire hydrant on ne corner of intersection, 24 ft e of C/L of the st., and 1 ft e of yellow IP witness post. It is set in a square concrete post projecting 0.3 ft above ls.
Last recovered on 5/6/92.

BM 1469; AVENUE 1960 Rosamond

From Hwy. 14 in Lancaster, drive n to the Ave. D (Hwy. 138) exit and thence 3.7 mi w to 50th St. W (an unmarked, dirt rd.). The USC&GS monument is 102 ft n of C/L of the ave., 92 ft w of C/L of the st., 55 ft nnw of mile-marker post 30.00 on n shoulder of the ave., 35 ft e of (Caltrans) reference mark AVENUE No. 3 1983, 47 ft s of reference mark AVENUE No. 4 1983, 2.5 ft nw of fencepost witness post, and 5 ft ssw of fiberglass-slat witness post marked "GPS 0028." It is set in a square concrete post projecting 0.3 ft above ls.
Last recovered on 5/7/92.

BM 1483; 102-63 1957 Neenach School

From Hwy. 14 in Lancaster, drive n to the Ave. D (Hwy. 138) exit and thence 22.0 mi w to where the California Aqueduct crosses from n to s of the rd. and Ave. D becomes Lancaster Rd. (about 0.5 mi w of 240th St W). Continue 1.5 mi w to where Three Points Rd. (to the s) and 160th St. W (to the n) intersect; proceed another 0.9 mi w where the hwy. bears n. The CE monument is 70 ft s of C/L of the hwy., 89 ft e of beginning of curve to n into 270th St. W, opposite e side of gravel driveway to residence 26803 W Ave C-15, 68 ft w of guy pole 1123728E, 1 ft s of steel fencepost witness post, and 1 ft n of ne corner of barbed-wire fence surrounding a corrugated metal barn bearing a Jennings Realty sign. It is set in a square concrete post projecting 0.5 ft above ls.
Last recovered on 5/8/92.

BM 1494; 102-73 1957 La Liebre Ranch

From Hwy. 14 in Lancaster, drive n to the Ave D (Hwy. 138) exit, thence w to 300th St. W, and continue w for 1.75 mi. The CE monument is 49 ft s of C/L of the hwy., 20 ft s of headwall of culvert 156+09, 1 ft s of fencepost witness post, and 1 ft n of a barbed-wire fence. It is set in a square concrete post projecting 0.1 ft above ls.
Last recovered on 6/30/92.

BM 2030; 121-11 1961 Lancaster East

From Palmdale, two alternate routes are described because Ave. M is not paved (in 1992) e of 50th St. E. From n of Plant 42, drive e on Ave. L to 60th St. E and thence 1 mi s to nw corner of intersection with dirt track (Ave. M). From s of Plant 42, drive e on Ave. P to 50th St. E, thence 2 mi n to Ave. N, thence 1 mi e to 60th St. E, and thence 1 mi n to the nw corner of intersection with dirt track (Ave. M). At red painted stake, turn w on dirt track. The CE monument is 30 ft n of the track, 42 ft w of the ave., and 1 ft w of yellow IP witness post. It is set in a square concrete post projecting 0.3 ft above ls.
Last recovered on 4/27/92.

BM 2037; 122-1 1961 Alpine Butte

From Lancaster, drive e on Ave. K to 90th St. E and thence 2 mi s to Ave. M. (Or from Palmdale, drive e on Ave. P, thence 2 mi n on 50th St. E to Ave. N, thence 4 mi e to 90th St. E, and thence 1 mi n to Ave. M). From Ave. M and 90th St. E, drive 0.5 mi e to 95th St. E. The CE monument is 89 ft e of C/L of the st., 38 ft s of C/L of the ave., and 2 ft s of yellow IP witness post. It is set in a square concrete post projecting 0.3 ft above ls.
Last recovered on 5/4/92.

BM 2076 Del Sur

From Hwy. 14 in Lancaster, drive 9.4 mi w on Ave. K to the T-intersection at 110th St. W and thence s, sw, and then w 3.5 mi on 110th St. W (which becomes Johnson Rd. when the rd. bears sw) to near the intersection with Leadhill Dr. (to n only). Continue 0.05 mi w of Leadhill Dr. to opposite the residence at 13529 Johnson Rd. (the second lot), and turn s on dirt track. The CE monument is 170 ft w of Leadhill Dr., 112 ft s of Johnson Rd., 37 ft s of PP 1938452E, 2.5 ft w of (three) corner fencepost(s) with "Game Bird Club" sign, 1.0 ft n of barbed-wire fenceline, and 2.0 ft s of yellow IP witness post. It is set in a square concrete post projecting 0.3 ft above ls.
Last recovered on 5/8/92.

BM 2169 Alpine Butte

From Sierra Hwy. in Lancaster, drive 10.6 mi e on Ave. K to 90th St. E, thence 1 mi n to Ave. J, and thence 0.5 mi e to the intersection of 95th St. E (a dirt rd.). The mark is 40 ft n of C/L of the ave., 40 ft w of C/L of the rd., and 1 ft nne of yellow IP witness post. It is a metal brad cemented (off-centered to the e) in a 2-inch-diam IP projecting 0.3 ft above ls, marked with a "LAC Engr" tag.
Note: Brad and tag are slightly depressed in the concrete.
Last recovered on 5/4/92.

BM 2174; 106-130 1959 Rosamond Lake

From Sierra Hwy. in Lancaster, drive 5.9 mi e on Ave. E to the intersection of 50th St. E. The CE monument is 26 ft n of C/L of the ave., 47 ft w of C/L of the st., 16.5 ft w of PP KY855 with two guy wires, 18 ft w of a fence corner, 1.2 ft s of a barbed-wire fence, and 1.0 ft e of a witness post. It is set in a square concrete post about level with the rd. and projects 0.8 ft above the shoulder ls.
Last recovered on 3/24/92.

BM 2180; 107-35 1961 Lancaster East

From Hwy. 14 in Lancaster, drive 6.75 mi east on Ave. I to the intersection of 45th St. E. The CE monument is 12 ft e of C/L of the st., 25 ft s of C/L of the ave., 46 ft e of PP 4089749E, and 2 ft n of yellow IP witness post. It is set in a square concrete post flush with ls.
Last recovered on 5/4/92.

BM 2186; F1154 1961 Rosamond Lake

From Sierra Hwy. in Lancaster, drive 1.9 mi e on Ave. E to the intersection of 10th St. E (renamed Challenger Way). The USC&GS monument is 43 ft s of C/L of the ave., 46 ft e of C/L of the st., 13.5 ft sw of PP 1270596E, and 1.8 ft e of a witness post. It is set in a round concrete post about 2 ft above the rd. and is flush with the shoulder ls.
Last recovered on 4/8/92.

BM 2235; 117-6 1961 Rosamond

From Hwy. 14 and Ave. K in Lancaster, drive 10.3 mi n to the Ave. A exit and thence 1.8 mi w to intersection of 40th St. W (a dirt rd.). The CE monument is 40 ft s of C/L of the ave., 8 ft s of line of power lines, 71 ft w of C/L of the st., 92 ft w of PP 649711E, 2 ft s of yellow IP witness post, and 6 ft w of another pipe post. It is set in a square concrete post projecting 0.8 ft above ls.
Note: Dirt has eroded away around base of concrete, but the mark is still stable.
Last recovered on 5/7/92.

BM 2317; 117-16 1961 Little Buttes

From Hwy. 14 and Ave. K in Lancaster, drive 10.3 mi n to the Ave. A exit and thence 6.8 mi w to intersection of 90th St. W. The CE monument is 82 ft s of the ave., 21 ft e of the st., and 2 ft n of yellow IP witness post. It is set in a square concrete post projecting 1.0 ft above ls.
Note: Dirt is eroding away under w side of concrete.
Last recovered on 5/7/92.

PWS-0195-0095

BM 2616 Palmdale

From Hwy. 14 and Ave. M, drive 7.2 mi s to the Ave. S exit and thence 4.1 mi e to 47th St. E, which is also Hwy. 138 and also Ft. Tejon Rd. Drive 0.2 mi s on Ft. Tejon Rd where the main rd. curves left and continue for about 0.2 mi farther. The LAC, Rd. Department, monument is on the northern end of a concrete culvert headwall, which is 29 ft w of the western, yellow hwy. center lines, 4.5 ft w of white edge of pavement line, and 7.5 ft n of southern end of headwall. The mark is set flush in the concrete wall about 0.5 ft above the rd. Note: Northern end of the headwall is broken, and the wall is very close to the hwy. lanes.
Last recovered on 4/24/92.

BM 2706; 115-4 1961 Lovejoy Buttes

From Palmdale, drive e on Palmdale Blvd. (Hwy. 138) to 47th St. E. Continue e on Palmdale Blvd (not Hwy. 138 after this point) for 10 mi to 150th St. E, thence 0.5 mi n to Ave. Q, thence 0.5 mi w to 145th St. E, and thence 1 mi n to where the rd. reaches the crest. The CE monument is 27 ft w of C/L of the st., 25 ft s of a yellow-green cable equipment unit, and 2 ft w of a yellow IP witness post. It is set in a square concrete post about 2 ft higher than the rd. and projects 0.2 ft above ls.
Last recovered on 4/28/92.

BM 2716; 109-4 1961 Littlerock

From Palmdale, drive east on Hwy. 138 (Palmdale Blvd.) to 47th St. E and continue e on Palmdale Blvd. for about 6 mi to the intersection of 110th St. E. The CE monument is 35 ft s of C/L of the blvd., 91 ft e of C/L of the st., and 2 ft s of yellow IP witness post. It is set in a square concrete post projecting 0.5 ft above ls.
Last recovered on 4/28/92.

BM 2746; 198-19 1961 Lovejoy Buttes

From Palmdale, drive east on Hwy. 138 (Palmdale Blvd.) to 47th St. E. Continue e on Palmdale Blvd. for about 11.5 mi to 165th St. E and thence 1.9 mi s to where the intersection of Ave. S-8 would be located. The CE monument is 42 ft e of C/L of the st., 163 ft n of the proposed ave., and 2 ft w of yellow IP witness post. It is set in a square concrete post flush with or just below ls.
Last recovered on 4/21/92.

BM 3549; 117-29 1961 Fairmont Butte

From Hwy. 14 in Lancaster, drive n to the Ave. A exit and thence 13.2 mi w to the intersection of 155th St. W (a dirt rd. heading north and privately marked), which is 0.15 mi e of where the power transmission lines cross the ave. The CE monument is 84 ft w of C/L of the st., 43 ft s of C/L of the ave., and 2 ft w of yellow IP witness post. It is set in a square concrete post that is often buried by the sand.
Last recovered on 5/8/92.

BM 3636; 119-41 1961 Little Buttes

From Hwy. 14 in Lancaster, drive n to the Ave. D exit (Hwy. 138) and thence 8.8 mi w to the intersection of 110th St. W. The CE monument is 87 ft s of C/L of the ave., 30 ft w of C/L of the st., and 2 ft w of yellow IP witness post. It is set in a square concrete post about 2.0 ft below ls.
Last recovered on 5/7/92.

BM 3738 Lancaster East

From Sierra Hwy. in Lancaster, drive 5.1 mi e on Ave. K to 50th St E and thence 3.5 mi n to Ave. G-8 (a dirt rd.). The LAC, Rd. Department, monument is 40 ft n of C/L of the rd. and 65 ft e of C/L of the st. The mark is set in the nw corner of the concrete block on which a well discharge pipe is mounted and is about 2 ft above ls.
Last recovered on 5/4/92.

BM 4116; X973 Reset 1965 Lebec

From Hwy. 14 in Lancaster, drive n to the Ave. D (Hwy. 138) exit and thence w on Hwy. 138 towards Quail Lake. From 245th St. W, where Ave. D becomes Lancaster Rd. (which is also Hwy. 138), the California Aqueduct passes under the rd., and the w driveway to the Quail Lake parking lot heads n of the rd., continue 0.2 mi w to where the hwy. divides and curves left, but exit the paved rd. by continuing straight and drive 0.2 mi farther w along the dirt shoulder. The USC&GS monument is between the third and fourth PPs w of the split, 147 ft w of PP 4053151E, 105 ft e of PP 1061891E, 77 ft n of C/L of Hwy. 138, 1.9 ft n of a barbed-wire fence, which is on an embankment about 3.5 ft above rd. grade, and 1.6 ft w of a witness post. It is set in a round concrete post projecting 0.3 ft above ls.
Last recovered on 6/30/92.

BM 4217; W811 Reset 1973 Lancaster East

From Hwy. 14 in Palmdale, drive about 1.6 mi e on Ave. N to Sierra Hwy. and thence 0.3 mi s. The USC&GS monument is 55 ft e of C/L of the hwy. and 0.2 ft s of a witness post. It is set in a round concrete post projecting 0.2 ft above ls.
Last recovered on 5/11/94.

BM 5159; B2657 1902; US 829 Palmdale

From Sierra Hwy. in Palmdale, drive to the s side of Palmdale Blvd. and bear sw into the vacant lot e of the RR tracks. The USGS monument is about 300 ft se of the intersection of Palmdale Blvd. and the RR tracks, 72.0 ft e of the e rail of the e set of tracks, 8 ft w of the PP with a guy wire that passes above the mark, and 1.6 ft s of a witness post. A bronze cap is riveted on top of a 3-inch-diam IP projecting 0.3 ft above ls.
Last recovered 4/28/92 (visible from blvd. in 1994).

BM 5190; GRINELL Reset 1929 Rogers Lake South

From Sierra Hwy. in Lancaster, drive 14.5 mi e on Ave. J to 140th St. E, thence 3.0 mi n to Ave. G, and thence 2.5 mi e to 165th St. E (a dirt side rd. to the n). Drive 1.5 mi n to the end of the track, where Ave. E8 (unmarked) ends from the e, and thence 0.6 mi e on Ave. E8 to a dirt track rd. to the n. Drive northeasterly on the track rd. for 0.65 mi to a fork, passing through several trash heaps; take the right fork and continue ne for 0.4 mi to the end of the track. The USC&GS monument is at the highest point in the vicinity, and set in the se edge of a 5 × 15-foot rock outcrop.
Last recovered 8/6/92.

BM 5204; N487 1955 Offset 1989 Rosamond

From Sierra Hwy. and Ave. I in Lancaster, drive 7 mi n to Ave. B, thence w briefly to a dirt track s, and thence s for a few hundred ft. The WRD monument is 280 ft s of C/L of the ave., 125 ft w of C/L of the hwy., and in the ne corner of a 4 × 5-foot raised concrete platform. The platform is at the e edge of and midway from the n and s edges of a series of concrete foundations (which are about 100 × 175 ft), and set flush with ls. The monument is about 370 ft sw of and across the hwy. from USC&GS bench mark N487 1955. It is a USGS gaging-station disk set flush in a concrete platform projecting 1.2 ft above ls.
Last recovered on 3/17/92.

BM 5205; M899 1955; US 4765 Palmdale

From Palmdale Blvd. in Palmdale, drive about 4.5 mi s on Sierra Hwy. to its end and thence about 0.6 mi sw (right) on Pearblossom Hwy. to near culvert 710+00 and a dirt access rd. that parallels the hwy. The USC&GS monument is about 170 ft ne of the junction of the hwy. and access rd., 63 ft nw of C/L of the hwy., 56.5 ft sw of PP 706712E, and 1.6 ft nw of a witness post. It is set in a round concrete post about 2 ft lower than the hwy. and projects 0.2 ft above ls.
Note: The access rd. is best approached from a sw/ne angle.
Last recovered on 4/25/92.

PWS-0195-0097

ALDER 1947 Rosamond Lake

From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit and thence 3.2 mi e on Rosamond Blvd. to a short paved rd. sloping down to the nw edge of Rosamond Lake. Continue about 0.1 mi southeasterly to the mark. The USC&GS horizontal-control station is 534 ft s of C/L of the blvd., due s of a "Warning--cable underground" signpost, and near a witness post that is not permanently placed. It is set in a round concrete post projecting 0.4 ft above ls.
Note: Physical access unrestricted, but notification of EAFB Security needed.
Last recovered on 8/8/92.

Aqueduct 100 Fairmont Butte

From Hwy. 14 and Ave. K in Lancaster, drive 13 mi n on Hwy. 14 and thence 14.5 mi w on Rosamond Blvd. to 170th St. W, where the paved rd. curves s. Follow curve for about 100 ft onto dirt area, thence w (not sw) on graded dirt rd. for 1.05 mi, and thence nw for 0.15 mi to a T-intersection. Turn left, driving 0.55 mi sw, thence take left leg (straight) of a Y-intersection continuing sw and thence nw for 2.1 mi, passing--in order--one dirt track intersection, two dirt tracks to the right, one to the left, and another intersection just after some loose sand. Turn right (e) before a concrete bridge over the First Los Angeles Aqueduct (LAA) and drive 0.15 mi e on the dirt rd. s of the concrete-enclosed channel to a 9 × 11-foot concrete portal projecting 2.5 ft above ls, and identified by the stenciled number "1722+34." The LAA mark is N. 25° W. and 250 ft n of the portal, just s of the crest of a sloping ridge, between two IP witness posts each about 2 ft away, of which one is yellow. It is a 3-inch-diam brass cap riveted to the top of a pipe, projecting 1.0 ft above ls.
Note: The center of the cap is concave.
Last recovered on 5/8/92.

ARP 1971 PMD Lancaster East

From Palmdale, drive e on Ave. P to 25th St. E and thence n to the guard gate at the entrance to Air Force Plant 42. After gaining entry, proceed n for about 0.9 mi, thence curve and turn right (e) following the sign to Site 5, and thence curve n to a red brick building (#552) housing Aeronautical Systems Center (ASC) Engineering. After obtaining a radio from Security in building #560 to communicate with the air traffic control tower, proceed to the nw end of the parking lot w of the ASC Engineering building and drive nw toward the runways. Turn left (sw) on the taxiway for 0.15 mi and thence right (nw) on taxiway for 0.45 mi, crossing Runway 4-22 and Taxiway E to the three-way intersection with Taxiways D(Delta) (e-w) and L(Lima) (n-s), thence bear right (n) and cross Taxiway D and drive 0.1 mi ne on minor taxiway, thence turn right (e) for 0.1 mi, thence turn left (n) on roadway ending in a circular area called a hardstand. The USC&GS Airport Reference Point monument for PMD (Palmdale Airport) is 601.6 ft nnw of the center of the circular hardstand, 798.1 ft nnw of the center of a similar circular hardstand 0.17 mi e, 707.3 ft s of the s end of the 13th painted hachure mark e of Taxiway L and near a 4 × 4-inch short wooden post painted white with blue and green paint at its top. It is set in a round concrete post flush with ls.
Note: Restricted access. Plant 42 flightline driving permit and two-way radio contact with control tower required.
Last recovered on 5/5/92.

Ask P7 Redman

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 7.5 mi n on the st., which becomes Lancaster Rd. (or 5.5 mi n of EAFB guard gate). Drive 0.1 mi e on Jones Rd., thence se and then e on poorly paved South Rd. about 0.2 mi. Turn s on a dirt rd. (leading to a dump) for a few hundred feet, thence e to the e end of a 25 × 50-foot concrete pad n of a concrete building pad projecting 2 feet above ls. The U.S. Air Forces Geodetic Survey monument is 134 ft e of C/L of the n-s dirt rd., 47 ft s of the C/L of South Rd., and 337 ft w of w fenceline of a radar installation compound. It is cemented flush in the concrete pad 8 ft s of the n edge, 13.8 ft w of the e edge, and 15.7 ft sw of ne corner.
Note: Restricted access.
Note: Ask is short for Askenia--a type of photogrammetric camera.
Last recovered on 2/1/93.

BUCKHORN 3 1967 Redman

From Sierra Hwy. in Lancaster, drive n to Rosamond Blvd. and thence 8.55 mi e to a formerly paved rd./track bearing se. Proceed around various rd. obstructions (barrels, timbers, etc.) 1.1 mi se to Buckhorn Lake edge (past T1155 1961 on left at 1.0 mi). Continue southward across lakebed for 1.05 mi to a low ridge oriented e-w, thence bear right on dirt track (past Y1155 1961 on the left) 0.05 mi to another set of tracks. Keep right for 0.1 mi to steep track to the right going up just west of the ridgeline of a circular rocky hill for 0.1 mi to the mark. The USGS horizontal-control station is cemented in a drill hole in the top of a 1.5 × 2-foot boulder projecting about 0.9 ft above ls in the center of the ridge.
Note: Restricted access. Firing Range permission suggested.
Note: There are two reference marks nearby: No. 2 1940 (36.4 ft nw of and about 1 ft above the station) and No. 3 1967. The stamping on the latter is similar to the stamping on the station, but the disk on the reference mark has an arrow and is 16.4 ft ene of and about 2 ft lower than the station.
Last recovered on 8/5/92.

BULL Neenach School

From Hwy. 14 in Lancaster, drive n to the Ave. D (Hwy. 138) exit, thence 20.4 mi w on Ave. D to 230th St. W, thence 2.0 mi n on the paved st., thence 1.0 mi n on dirt rd. to Ave. A, and thence 0.9 mi w to the mark where the rd. narrows noticeably. The USGS horizontal-control station is on a 3-foot high bank on the s shoulder, 25 ft s of C/L of the ave., and 45 ft n of the Los Angeles/Kern County line monument. It is set in a square concrete post projecting 1.0 ft above ls.
Note: The center cross is worn. The concrete post was cracked and repaired with fresh cement.
Last recovered on 6/30/92.

D1155 1961 Edwards

From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit and thence 11.5 mi e on Rosamond Blvd. to just w of and opposite Adams Rd., a side st. south to the Firing Range office. (It also is 3.55 mi sw along Rosamond Blvd. from the intersection with Lancaster Blvd.) The USC&GS monument is 73 ft w of C/L of the extension of the rd. opposite, and 38 ft nw of C/L of the blvd. It is set in the top and 0.4 ft ne of the sw end of a concrete headwall of a triple 36-inch-diam concrete pipe culvert and is about 1.5 ft lower than the blvd.
Note: Restricted access.
Last recovered on 3/31/92.

F1147 1961; 101-159 Soledad Mtn.

From Hwy. 14 in Lancaster, drive n to Rosamond Blvd. and thence 0.1 mi w to S.H. 14 Frontage Rd., a side rd. to the right. Proceed 1.2 mi n to a gravel track rd. on the w near a large rd. sign for Hwy. 14. Take the track rd., which parallels the paved frontage rd., across a small gully for 0.05 mi n to the mark w of the track. The USC&GS monument is in the se ledge of a prominent bedrock outcrop about 150 ft w of C/L of the frontage rd., 90 ft w of C/L of the track rd., about 14 ft nnw of a witness post that is next to a rectangular boulder projecting 3 ft, 125 ft w of a witness post, in a small ledge about 6 ft higher than the frontage rd., and 146.3 ft nw of CDoT (Caltrans) reference mark T-24, a 0.5-inch-diam disk nailed on top of an iron stake. It is set in an outcrop, which is about 15 ft higher than the frontage rd., and projects about 1.5 ft above ls, which is a few feet to the s.
Note: The highest point of the formation is about 17° above the antenna (set about 5 ft above the disk) at an azimuth of about 340°. Most of the rest of the outcrop is below 10°.
Last recovered on 5/7/92.

GWM2 1937 Edwards

From Hwy. 14 in Lancaster, drive n to Rosamond Blvd., thence 14.3 mi e to Lancaster Rd. and thence 1.25 mi s to a paved side rd. e to a very wide (aircraft size) double gateway in a chainlink fence. The USGS monument is 51 ft e of C/L of the blvd., 68 ft s of C/L of the rd., and 1.9 ft e of a witness post. It is set in a round concrete post projecting 1.0 ft above ls.
Note: Restricted access.
Last recovered on 3/23/92.

PWS-0195-0099

GWM4 1937 Redman

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 7.5 mi n to Jones Rd., and continue n for another 0.5 mi n on Lancaster Rd. to a dirt side rd. w. (Or, from Rosamond Blvd. to the n, drive 2.35 mi s on Lancaster Blvd. to a dirt side rd. w after the second PP.) From Lancaster Blvd., drive 1.6 mi w to the intersection with another dirt rd., thence 0.75 mi s (past a water tank at 0.25 mi), thence where the rd. continues (for 0.1 mi) to a fenced well and pump, turn right and go 0.4 mi w to a pond enclosed by a berm raised about 6 ft. Turn left west of the pond and go 0.25 mi s turning w at the curve of an intersection. The USGS monument is just e of the w end of the curved dirt rd., about 20 ft s of C/L of the rd., about 2 ft n of a barbed-wire fence, and about 3 ft w of the third wooden 4 x 6-inch fencepost from the w. It is set in a square concrete post projecting 0.6 ft above ls.
Note: Restricted access
Last recovered on 2/1/93.

GWM11 Reset 1971 Offset 1989 North Edwards

From Hwy. 14 in Lancaster, drive n to Hwy. 58 and thence e to the Clay Mine Rd. exit. From the center of the south ramps and the overpass, drive 0.2 mi e on the eastbound on-ramp for Hwy. 58. Continue to the e part of the cloverleaf to access the interior of the area n of the ramp. The WRD monument is 26 ft n of C/L of the ramp, in the e end of the n culvert headwall, and is about 3 ft above ls. It is a USGS gaging-station tablet cemented in the headwall and stamped "11GWM Offset 1989."
Last recovered in 2/92.

H1155 1961 Offset 1989 Redman

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, and thence 5.5 mi n on 120th St. (which becomes Lancaster Blvd.), or 0.35 mi n of the n intersection with Scout Rd. and just past (about 0.2 mi n of) the EAFB guard gate. (Or, from Rosamond Blvd. to the n, drive 4.7 mi s on Lancaster Blvd.) The WRD offset monument is at a small roadside cut, 72 ft e of C/L of the blvd., and 59.6 ft s of and about 4 ft lower than USC&GS monument H1155 1961. It is a USDI triangulation station disk set in a concrete post flush with ls.
Note: Restricted access
Last recovered on 4/5/92.

HPGN 0618 Lebec

From Lancaster, drive n on Hwy. 14 to the Ave D. (Hwy. 138) exit and thence about 39 mi w on Hwy. 138 to Interstate 5 northbound. Drive 7.3 mi n, passing the Gorman exit (at 3.5 mi) and Tejon Pass, indicated by the "elevation 4,014 feet" signpost (at 5 mi), to the offramp to the Lebec Rest Area. Bear right for 0.3 mi following the perimeter of the area, thence curving left (ne) to follow the right bank of Cuddy Creek for 0.1 mi to where the rd. curves left again to leave the rest stop. Instead, continue straight, jumping the curb and heading toward a hay shed in the distance and the property fence corner in the near distance. The CDoT HPGN monument is 64 ft westward of the corner of a 6-foot high chainlink fence, 7 ft w of the bank of a drainage channel, 3.6 ft se of a metal witness post, and 3.0 ft nw of a fiberglass witness post marked "0618." It is a stainless-steel rod monument with a 2.5-inch-diam aluminum disk set 0.3 ft below ls and protected by an access cover.
Last recovered on 6/30/92.

HPGN 0705 Valyermo

From Hwy. 14 in Lancaster, drive s to the Ave. S exit, thence e for about 5.5 mi, and thence southeastward on Hwy. 138 through Pearland, Littlerock, Pearblossom and Llano. About 3.4 mi e of Llano, drive s on Largo Vista Rd. (opposite 204th St. E, a dirt rd. n) for 0.45 mi to just before the California Aqueduct. The CDoT HPGN monument is 25.5 ft e of C/L of the rd., 8.1 ft e of the n end of a metal guardrail, 15.4 n of a chainlink fence at the rd. overpass headwall, and 18.8 ft w of the second post of a barbed-wire fence extending from the chainlink fence. It is a stainless-steel rod monument with a 2.5-inch-diam aluminum disk set 0.3 ft below ls and protected by an access cover.
Last recovered on 1/27/93.

HPGN 0805 Saddleback Mtn.

From Lancaster, drive n on Hwy. 14 to Mojave, thence east on Hwy. 58 to the Hwy. 395 intersection, called Kramer Junction, and alternatively, Four Corners. Drive 0.35 mi n on Hwy. 395 to a dirt rd. paralleling a transmission line opposite a transmission tower, thence 0.5 mi e to a side dirt rd. n, thence 0.25 mi n to the end of the dirt rd., thence 0.45 mi e to n of an X-intersection of dirt rds. n of a junked car, and thence nnw on the northwestern dirt rd. for 0.4 mi to the mark. The CDoT HPGN monument is 39 ft e of C/L of the rd., 68.5 ft ne of a gas pipeline signpost, and 3 ft w of a metal witness post. It is a stainless-steel rod monument with a 2.5-inch-diam aluminum disk set 0.5 ft below ls and protected by an access cover.
Last recovered on 1/29/93.

HPGN PEARBLOSSOM; NCMN 7254 Littlerock

From Hwy. 14 in Palmdale, drive s to the Ave. S exit, thence e for about 5.5 mi, and thence southeastward on Hwy. 138 through Pearland and Littlerock to 116th St. E (a side rd. n). Drive 0.35 mi n on 116th St. E and thence e for about 0.1 mi, passing through a bar gate (locked at night). Proceed n at the entrance to the State Police fenced compound (with a trailer at far nw corner) for about 100 ft into their parking lot. The USC&GS monument is in the center of a 3 × 3-foot concrete slab in the center of the parking lot and in the middle of three 4 × 8-foot concrete slabs, all flush with the pavement. It is 114.5 ft nw of the se corner of the chainlink fence, 104.0 ft due n of that fence, 52.2 ft se of a PP with meter, and 48.2 ft e of and 48.2 ft w of fences.
Note: Restricted access.
Last recovered on 4/24/92.

JUNCTION 1958 California City South

From Lancaster, drive n on Hwy. 14 to near Mojave and thence about 14 mi e on Hwy. 58 to the California City Blvd. turnoff n. (Or, from Rosamond Blvd., drive 1.75 mi w on Hwy. 58 to the mark.) The USC&GS horizontal control station is 0.28 mi e of the turnoff rd. in the median strip between the four-lane hwy., 52 ft n of C/L of the eastbound lanes, 70 ft s of C/L of the westbound lanes, 8 ft s of a witness post, and between pumping stations n and s of the hwy. It is set in a square concrete post projecting 0.5 ft above ls.
Last recovered on 4/3/92.

LC68 1952 Offset 1989 North Edwards

From Lancaster, drive n on Hwy. 14 to south of Mojave, thence about 18 mi e on Hwy. 58 to the Clay Mine Rd. exit, thence n for 1.7 mi to Highland Blvd. (no signpost), the first dirt rd. after Hillcrest St. (a paved rd.), thence 0.65 mi e to just before a housing area on the ne corner of the intersection with a paved rd. s and a dirt rd. n. Drive 0.4 mi n on the dirt rd. to intersection with e-w dirt rd., then engage four-wheel drive. Follow track to ne for about 0.1 mi, and thence bear nw up a cobbly track to e end of top of hill, keeping s of the ridgeline. The WRD monument is n of the track in a rock outcrop near a rockface that has a 1.5 ft vertical drop. An arrow is spray-painted in the face to locate the disk, which is a USGS gaging-station monument set in the flat rock surface and flush with ls.
Note: The edge of the ne quadrant of the disk has been bent over. The center punch hole is nearly obliterated by a small depression, and there are several dings, probably from buckshot.
Note: LC68 1952 is about 0.4 mi w of the offset mark and about 2.2 mi ne on Clay Mine Rd. from Hwy. 58.
Last recovered on 2/2/93.

LS38 1929 Rosamond Lake

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 2 mi e to 10th St. E, a dirt rd. n and a paved rd. s (also known as Challenger Way), thence 1 mi n to Ave. D (a dirt rd., not the wide, graded dirt rd. bearing nw), thence 1 mi e to 20th St. E (a dirt rd.), and thence 1 mi n to Ave. C (a dirt rd.). (Avenue C is flooded between 10th and 20th St. E most of the time, so the mark cannot be accessed from Ave. C w of 20th St. E.) The USGS monument is 56 ft w of C/L of the st. and 32 ft n of C/L of the ave. It is set in a square concrete post projecting 0.3 ft above ls.
Last recovered on 8/5/92.

LS46 1929 Hi Vista

From Sierra Hwy. in Lancaster, drive 17.5 mi e on Ave. J to 170th St. E (which is the access rd. to Saddleback Butte State Park to the s). Continue another 0.8 mi e to a dirt rd. left bearing ne and thence about 0.2 mi ne (or 0.1 mi ne of red automotive hulk) to just e of a small curve in track. The USGS monument is 20 ft n of C/L of track, 51 ft nne of and across track from a three-branched, large Joshua tree, and about 190 ft sw of a split in the track rd. It is set in a square concrete post projecting 0.2 ft above ls.
Last recovered on 4/22/92.

LS53 1929 Alpine Butte

From Sierra Hwy. in Lancaster, drive 14.5 mi e on Ave. J, thence 3 mi n on 140th St. E to Ave. G (paved to the e), thence 0.6 mi w on Ave. G (a dirt rd.), or 0.15 mi e of an LAC barricade and yellow IP marked "V12", and thence 415 ft s cross country to the mark. The USGS monument is on the w side of an open area (without bushes). It is set in a square concrete post projecting 0.6 ft above ls.
Last recovered on 4/23/92.

M1155 1961 Redman

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 3 mi n to Ave. B, thence 2 mi e to 140th St. E (a paved rd. s), and thence 0.1 mi farther e to a dirt track n bearing ne, just past a rd. sign for westbound traffic that indicates the T-intersection and which is w of the main entrance to the abandoned paved rd. (formerly Lancaster Blvd., now called Scout Rd.) blocked off by a cable gate. Proceed 0.25 mi n on the abandoned rd. to the mark on the w, which is also about 0.1 mi n of a group of mesquite trees. The USC&GS monument is 44 ft w of C/L of the rd. and 1.5 ft s of a witness post. It is set in a round concrete post about 3.5 ft higher than the rd. and projects 0.5 ft above ls.
Last recovered on 2/1/93.

MDC4 1973 Rogers Lake South

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 3 mi n to Ave. B, and thence 4.9 mi e to where the ave. becomes a graded dirt rd. and the main rd. curves ne and becomes Mercury Blvd. The mark is at a triangular corner of a barbed-wire fence delineating the westernmost extent of a bombing range. The USGS monument is 54 ft s of C/L of the asphalt rd. and 33 ft n of C/L of the dirt ave. It is set on a copper-coated rod encased in a white 6-inch-diam PVC drainpipe.
Last recovered on 4/7/92.

MDC6 1973 Rogers Lake South

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E., thence 3 mi n to Ave. B, and thence 4.9 mi e to where the ave. becomes a graded dirt rd. and the main rd. curves ne and becomes Mercury Blvd. Continue e on the dirt rd. (Ave. B) for 3.1 mi to the T-intersection at 200th St. E. The USGS monument is 83 ft n of C/L of the ave., 47 ft n of a barbed-wire fence corner, 35 ft w of C/L of the st., 91 ft nw of the intersection of C/Ls, and 1 ft e of a fence. It is set on a copper-coated rod encased in a yellow 6-inch-diam PVC drainpipe.
Last recovered on 4/2/92.

MDC30 1973 Rogers Lake South

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E., thence 3 mi n to Ave. B, and thence 4.9 mi e to where the ave. becomes a graded dirt rd. and the main rd. curves ne and becomes Mercury Blvd. Continue ne on Mercury Blvd. for 4.6 mi to a powerline crossing and thence about 100 yd nw on an unnamed dirt rd. (used by media for viewing space shuttle landings). The USGS monument is 6 ft e of the first PP w of the crossing, 239 ft w of C/L of the blvd., and 56 ft n of C/L of the dirt rd. It is set on a copper-coated rod encased in a white 6-inch-diam PVC drainpipe.
Last recovered on 4/2/92.

MDC33 1973 Rogers Lake North

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 3 mi n to Ave. B and thence 4.9 mi e to where the ave. becomes a graded dirt rd. and the main rd. curves ne and becomes Mercury Blvd. Continue ne on Mercury Blvd. for 7.6 mi to the s end of a small, usually dry lakebed on the e. The USGS monument is 198 ft s of a pipe culvert, about 50 ft s of the lake perimeter, 44 ft e of C/L of the blvd., and 1 ft e of a barbed-wire fence. It is set on a copper-coated rod projecting 0.3 ft above ls and is encased in a black 6-inch-diam drainpipe.
Last recovered on 4/1/92.

MONDAY RS 1929; Adobe Mtn. F-1 Adobe Mtn.

From Sierra Hwy. in Lancaster, drive e on Ave. J to 200th St. E, thence 3 mi n to Ave. G, thence 4 mi e to 240th St. E (an unmarked, dirt rd.) and mailbox 23733. Continue 0.5 mi n to a dirt side rd. west (what would be Ave. F-8), thence 0.25 mi w to the w end of a rd. cut and a dirt track n, and thence 0.1 mi n to a foot trail e. Hike up the foot trail for 400 ft to the summit of a rock outcrop and the mark. The USGS horizontal-control station is set in the rock outcrop.
Last recovered on 4/23/92.

P1155 1961 Redman

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 2.9 mi n to the triangular junction of Ave. B, bearing ne on pavement and thence s cross country to the mark on the inside of the curve. The USC&GS monument is 116 ft s of C/L at the center of the curve of the eastbound lane of Ave. B for traffic approaching from the s, 0.6 ft se of the nw corner of a concrete foundation for a small (demolished) building, and 1.5 ft s of a witness post. It is set in the top of the foundation about level with the ave.
Note: The disk has been disturbed slightly by an old crack 0.6 ft e of w edge of foundation; the disk may have shifted laterally several to 10 mms horizontally and perhaps that much vertically as well.
Last recovered on 4/7/92.

Rogers Lakebed 1; 1RLB 1989 Rogers Lake North

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 10.2 mi n on this st. (which becomes Lancaster Blvd.) to Rosamond Blvd. (Or, from Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit, thence e to Lancaster Blvd.) From this intersection, drive 0.3 mi ne on Rosamond Blvd. to Fitzgerald Blvd., thence 0.3 mi se to Wolfe Ave., and thence 0.4 mi ne to Base Operations (Ops) at Building #1200 on the right. Obtain a radio and call ID, and access the lakebed at Gate A1200 between the ne end of Building #1200 and the hanger to the ne. From the gate, turn left and drive 0.8 mi ne along Taxiway F to the fire station, thence 0.25 mi e, skirting s of the control tower, on the ends of Taxiway F and Taxiway C, to a paved crossroad, thence 0.1 mi n on the rd. to a bladed dirt rd. e, and thence 0.8 mi e. At 0.45 mi, cross the oiled fly-by line which is at an oblique angle. At 0.5 mi, bear straight on the left of a Y-intersection and continue to the edge of Rogers Lake, marked by yellow pipe gateposts. Drive 0.15 mi nne on dirt track to intersection with oiled fly-by line, thence 1.6 mi ne adjacent the line or 0.2 mi ne of the sixth oiled circle. Proceed 0.4 mi N.30°W. of--perpendicular to--the fly-by line to the mark. The WRD monument is set in a flat 0.5 × 0.5-foot lip-shaped granite outcrop virtually flush with ls. It is a USGS gaging-station disk cemented in the rock and stamped "1RLB 1989."
Note: Restricted access. Lakebed access permission, flightline driving permit, and two-way radio contact are required by Base Ops and Control Tower.
Last recovered on 8/7/92.

Rogers Lakebed 3; 3RLB 1990 Rogers Lake North

From Sierra Hwy. in Lancaster, drive n to Ave. E and thence continue 13 mi e to 120th St. E. Drive 10.2 mi n on this st. (becomes Lancaster Blvd.) to Rosamond Blvd. (Or, from Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit and thence e to Lancaster Blvd.) From this intersection, drive 0.3 mi ne on Rosamond Blvd. to Fitzgerald Blvd., continue 0.3 mi se to Wolfe Ave., and thence 0.4 mi ne to Base Ops at Building #1200 on the right. Obtain a radio and call ID, and access the lakebed at Gate A1200 between the ne end of Building #1200 and the hanger to the ne. From the gate, turn left and drive 0.8 mi ne along Taxiway F to the fire station. Continue 0.25 mi e skirting s of the control tower on the ends of Taxiway F and Taxiway C to a paved crossroad, thence 0.1 mi n on the rd. to a bladed dirt rd. e, and thence 0.8 mi e. At 0.45 mi, cross the

oiled fly-by line which is at an oblique angle. At 0.5 mi, bear straight on the left of a Y-intersection and continue to the edge of Rogers Lake (marked by yellow pipe gateposts). Drive 0.15 mi nne on dirt track to intersection with oiled fly-by line, continue 1.6 mi ne adjacent the line or 0.2 mi ne of the sixth oiled circle. Proceed 0.65 mi S.30°E. of--perpendicular to--the fly-by line to the ne corner of Runway 17L/35R (about 150 ft sw of cones marking a fissure location in 1992). Thence, drive 2.05 mi ssw along e edge of runway to the se corner of the intersection with Runway 6/24, crossing Runway 4/22 between 0.05 and 0.15 mi and Runway 6/24 between 1.95 and 2.05 mi. The WRD monument is about 10 ft s of the oiled edge of the e-w runway. The USDI triangulation station aluminum tablet is set in a concrete post flush with ls and is stamped "3RLB 1990."
Note: Restricted access. Lakebed access permission, flightline driving permit, and two-way radio contact are required by Base Ops and Control Tower.
Last recovered on 8/6/92.

Rogers Lakebed 4; 4RLB 1989 Rogers Lake South
From the south: From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, and thence 5.1 mi n to Scout Rd. (a triangular junction e). (From the north: From Rosamond Blvd., drive 5.3 mi s on Lancaster Rd. to Scout Rd.) Drive 2.25 mi e (passing a dirt rd. n at 1 mi) past the fire station/survival school in Building #510 to a rough, paved/dirt track n. Drive 0.3 mi n to Rogers Lake dry lakebed edge and thence ese along edge for about 1.5 mi. Landmarks to note on route include: at 0.1 mi--wooden posts and plywood from a small, former structure; 0.2 mi--a point of land with a wooden stake on the hilltop and some PPs only 10 ft high with resistors; 0.6 mi-- fence line; 1.0 mi--a point of land with a four-legged stand and a 10-foot long pipe on the ground; 1.3 mi--vehicle tracks s toward land; 1.4 mi--wooden survey stakes painted orange at the top about 0.1 mi inland on hill; 1.5 mi-- an airplane hulk about 0.5 mi inland. From this point, drive nnw to the se edge of Runway 17L/35R to the mark. From bench mark Rogers Lakebed 3 to the north: Rogers Lakebed 4 is 5.35 mi s along Runway 17/35 on a direct route. Because of fissuring, detours to the e are necessary, which add a couple tenths of a mi to the route. Landmarks to note include (with mileage approximate): 0.4 mi--oiled lines delineating runway disappear; 0.7--vehicle tracks cross diagonally nw-se and runway lines reappear; 0.8 mi--black oiled line perpendicular to two eastern runway lines (of four); 1.1 mi--wooden stake along runway (and several more to s); 1.3 mi--start of fissures; 1.35 mi--fissure; 1.4 mi--fissure and oiled lines disappear; 1.5 mi--fissure; 1.6 mi--fissure; 3.8 mi--vegetation; 3.9 mi--8 × 8-inch × 2-foot timber with bolts and a sail-shaped piece of metal on one end; 4.0 mi--light-colored lakebed surface to the e; 4.1 mi--n edge of Runway 7/25; 4.2 mi--s edge of Runway 7/25, bear west toward light-colored lakebed surface and thence s after rejoining the n-s runway (17/35); 5.1 mi--n edge of Runway 9/27; 5.2 mi--s edge of Runway 9/27; 5.5 mi--end of runway and location of mark. The WRD monument is 12 ft e of the s edge of the eastern-most distinct edge of the e-w oiled line marking the s end of the runway, 4 ft e of the indistinct e edge of the n-s oiled line, 3.5 ft n of an orange fiberglass witness post, and 3.5 ft se of another orange fiberglass witness post. It is a USDI triangulation station aluminum tablet set in a concrete post flush with ls (often buried by silt) and is stamped "4RLB 1989."
Note: Restricted access. Lakebed access permission, flightline driving permit, and two-way radio contact are required by Base Ops and Control Tower.
Last recovered on 8/6/92.

Rogers Lakebed 5; 5RLB 1989 Rogers Lake North
From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit and thence e to Lancaster Blvd. (Or, from Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, and thence 10.2 mi n on this st., which becomes Lancaster Blvd., to Rosamond Blvd.). Drive 3.9 mi n and thence ne on Lancaster Blvd. to a Y-intersection with Rosamond Blvd., thence 1.55 mi nne on Rosamond Blvd. to North Base Rd. Drive 0.5 mi e to northbound Lake Shore Dr. on left (southbound is just prior on the right) toward the Jet Propulsion Lab (JPL) area, thence 0.3 mi n to curve in rd., and thence 0.5 mi ne to the end of the paved rd. just past the side rd. left entrance to JPL and the start of a partially paved/dirt rd. (posted as Kern Dr.). Continue ne for 0.45 mi and bear left at a Y-intersection with a dirt track. The rd. curves left at 0.5 mi and then right heading e at 0.8 mi. At 1.6 mi bear right and se, and at 1.85 mi, turn ssw on a dirt track just before a light-blue cinder block building (about 10 × 12 ft). Drive 0.15 mi to the edge of Rogers Lake dry lakebed and thence bear w to the mark. The WRD monument is at the edge of vegetation, about 15 ft w of C/L of the track rd., and in line with the second oiled line from the e of Runway 18/36. It is a USDI aluminum tablet set in a concrete post flush with ls.
Note: Restricted access.
Last recovered on 8/7/92.

Rogers Lakebed 6; 6RLB 1989 Rogers Lake North

From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit and thence e to Lancaster Blvd. (Or, from Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, and thence 10.2 mi n on this st., which becomes Lancaster Blvd., to Rosamond Blvd.). Drive 3.9 mi n and thence ne on Lancaster Blvd. to a Y-intersection with Rosamond Blvd., thence 1.55 mi nne on Rosamond Blvd. to North Base Rd. Drive 0.5 mi e to northbound Lake Shore Dr. on left (southbound is just prior on the right) toward the JPL area, thence 0.3 mi n to curve in rd., and thence 0.5 mi ne to the end of the paved rd. just past the side rd. left entrance to JPL and the start of a partially paved/dirt rd. (posted as Kern Dr.). Continue ne for 0.45 mi and bear left at a Y-intersection with a dirt track. The rd. curves left at 0.5 mi and then right heading e at 0.8 mi. At 1.6 mi bear right and se paralleling the lakeshore. Continue for a total of 7.2 mi to the mark noting the following landmarks: at 1.85 mi--the track s to bench mark Rogers Lakebed 5 and a light-blue, cinder block building; 5.0 mi--antenna arrays are on both sides of the rd.; 6.3 mi--the old RR grade is on the left; 6.4 mi--bear right, away from the main dirt rd., to follow the lakeshore; 6.5 mi--turn right after a tall (8-foot-high?) RR tie stuck in a pile of rocks; 6.8 mi--an empty metal signpost frame; 6.9 mi--rutty ford; 7.0 mi--bear left toward an outcrop extending out from a hill; 7.2 mi--a cluster of rocks to the e with the outcrop gradually increasing in height. The WRD monument is cemented in a 3 x 2-foot flat rock at the w end of the outcrop. It is a USGS gaging-station tablet stamped "6RLB 1989."
Note: Restricted access.
Last recovered on 8/7/92.

ROSAMOND; SC 8N9N/11W12W Rosamond Lake

From Hwy. 14 in Lancaster, drive n to the Ave. A exit and thence 0.75 mi e to Sierra Hwy. Continue 0.9 mi e on an unmaintained paved rd. to the end of the pavement, passing Antelope Valley Salvage driveway at 0.6 mi, passing the southern boundary of a Superfund site to the n, and encountering severe potholes throughout and an abrupt ditch at 0.8 mi. Continue another 0.5 mi e on dirt rd. to Division St. (an unmaintained paved rd.), thence turn left (north)--DO NOT go straight--for 200 ft and then e, bearing right after 0.18 mi (unless left track has better driving conditions), and driving e for a total of 1.0 mi from Division St. to the edge of Rosamond Lake and the end of vegetation, due s of Red Hill (a mountain 3.3 mi to the n). Landmarks include: at 0.5 mi--a ¼-corner section tablet between sections 35 and 2 with yellow IP witness post; 0.8 mi--heavily eroded mound rising 5 ft and a minor boundary between lakebed and vegetation, as mapped on the 1973 topographic quadrangle. From the easternmost lakebed edge, continue due e for another 1.0 mi (passing a ¼-corner section tablet with yellow IP witness post at 0.5 mi) to ROSAMOND, the section corner for townships 8N and 9N and ranges 11W and 12W, with two orange fiberglass witness posts, 6 ft n and 6 ft w, respectively, of the mark. The LAC monument is a section corner tablet set in a cement post flush with ls.
Note: Physical access unrestricted, but notification of EAFB Security required.
Last recovered on 8/8/92.

Rosamond Lake 1; 1ROL 1989 Rosamond Lake

From Hwy. 14 in Lancaster, drive n to the Ave. A exit and thence 0.75 mi e to Sierra Hwy. Continue 0.9 mi e on an unmaintained paved rd. to the end of the pavement, passing Antelope Valley Salvage driveway at 0.6 mi, passing the southern boundary of a Superfund site to the n, and encountering severe potholes throughout and an abrupt ditch at 0.8 mi. Continue another 0.5 mi e on dirt rd. to Division St. (an unmaintained paved rd.), thence turn left (north)--DO NOT go straight--for 200 ft and then e, bearing right after 0.18 mi (unless left track has better driving conditions), and driving e for a total of 1.0 mi from Division St. to the edge of Rosamond Lake and the end of vegetation, due s of Red Hill (a mountain 3.3 mi to the n). Landmarks include: at 0.5 mi--a ¼-corner section tablet between sections 35 and 2 with yellow IP witness post; 0.8 mi--heavily eroded mound rising 5 ft and a minor boundary between lakebed and vegetation, as mapped on the 1973 topographic quadrangle. From the easternmost lakebed edge, continue due e for another 1.0 mi (passing a ¼-corner section tablet with yellow IP witness post at 0.5 mi) to ROSAMOND, the section corner for townships 8N and 9N and ranges 11W and 12W, with two orange fiberglass witness posts. Drive 0.4 mi se toward a 75 x 100 ft mound with sagebrush and an abandoned well pump marked with "50B" in grey paint. The mark is a cross chiseled in the top of a 2-inch-diam, rusted, steel-pipe elbow fitting in the hexagonal part of the pump assembly projecting about 0.8 ft above ls.
Note: Physical access unrestricted, but notification of EAFB Security required.
Last recovered on 8/8/92.

PWS-0195-0105

RS38 1932 Offset 1989 North Edwards

From Hwy. 14 in Lancaster, drive n to Hwy. 58 and thence e to the 20 Mule Team Rd. exit. At the s end of the overpass, turn w at a short paved driveway and drive 0.85 mi w on a gravel (pipeline) rd. to the mark on the n, passing a dirt rd. intersection and then, at about 0.8 mi, a single, large Joshua tree, under which is USC&GS monument 38RS 1932. The WRD monument is 132 ft N.81°W. of the original mark, 93 ft s of C/L of eastbound lanes of Hwy. 58, 1 ft s of a barbed-wire fence. It is a USDI triangulation station aluminum tablet set in a concrete post projecting 0.1 ft above ls.
Last recovered on 4/1/92.

Santa Fe Trail 1 Rogers Lake North

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 10.2 mi n on this st. (which becomes Lancaster Blvd.) to Rosamond Blvd. (Or, from Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit, thence e to Lancaster Blvd.) From this intersection, drive 0.3 mi ne on Rosamond Blvd. to Fitzgerald Blvd., thence 0.3 mi se to Wolfe Ave., and thence 0.4 mi ne to Base Ops at Building #1200 on the right. Obtain a radio and call ID, and access the lakebed at Gate A1200 between the ne end of Building #1200 and the hanger to the ne. From the gate, turn left and drive 0.8 mi ne along Taxiway F to the fire station, thence 0.25 mi e, skirting s of the control tower, on the ends of Taxiway F and Taxiway C, to a paved crossroad, thence 0.1 mi n on the rd. to a bladed dirt rd. e, and thence 0.8 mi e. At 0.45 mi, cross the oiled fly-by line which is at an oblique angle. At 0.5 mi, bear straight on the left of a Y-intersection and continue to the edge of Rogers Lake, marked by yellow pipe gateposts. Bear right around the gateposts following lake edge for 0.15 mi to the end of a peninsula. The WRD monument is at the e end of a downed PP, about 60 ft e of a debris-strewn, sandy pile rising 4 ft, in line visually with Mercury Blvd. across the lake to the e and the control tower to the w. It is a USGS gaging-station disk set in a concrete post flush with ls and stamped "TBM JPL1."
Note: Restricted access. Lakebed access permission, flightline driving permit, and two-way radio contact are required by Base Ops and Control Tower.
Note: The tablet was stable vertically, but was able to spin freely.
Last recovered on 8/7/92.

Sewage Treatment Pond 1 Redman

From Sierra Hwy. in Lancaster, drive n to Ave E, thence e to 120th St. E, and thence 7.5 mi n on the st. (which becomes Lancaster Blvd.), or 5.5 mi n of EAFB guard gate, to Jones Rd. Drive e on Jones Rd., curving ne at 0.45 mi, for a total of 1.35 mi to another guard gate. Proceed for 0.5 mi ne to a triangular junction with Ordnance St., continue straight for 0.1 mi to a stop sign, and thence drive right on an unnamed rd. (not shown on 1973 topographic quadrangle) with several reverse curves for 0.7 mi, where it curves s to join an older unnamed asphalt rd. Drive 1.0 mi s (passing a side rd. bearing sw at 0.13 mi, and a side rd. right entrance to treatment facilities farther s) to a chain gate. Drive through or around the posts to the e and drive another 0.6 mi s to the end of the rd. and Rogers Lake edge. The WRD monument is 87 ft n of a warning sign near the shoreline, about 100 ft e of C/L of the rd., near witness posts, and is just below the crest on the w side of a small knoll. It is a USDI triangulation station set in a concrete post and stamped "STP1 1992."
Note: Restricted access.
Last recovered on 4/5/92.

T1139 1961 Edwards

From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit and thence e to Lancaster Blvd. (Or, from Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, and thence 10.2 mi n on this st., which becomes Lancaster Blvd., to Rosamond Blvd.) Drive 1.75 mi n on Lancaster Blvd. to the intersection with Forbes Ave. The USC&GS monument in 55 ft e of C/L of the blvd., 19 ft n of C/L of the ave., in the top of the w end of the concrete headwall of a 36 in. concrete pipe culvert under Forbes Ave. and about level with the ave.
Note: Restricted access.
Last recovered on 3/23/92.

Transect 8 Rogers Lake South

From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 3 mi n to Ave. B, and thence 4.9 mi e to where the ave. becomes a graded dirt rd. and the main rd. curves ne and becomes Mercury Blvd. Continue ne on Mercury Blvd. for 2.6 mi to a side dirt track left, and thence 0.25 mi w to a 3-foot-high staff gage set in Rogers Lake (passing a staff indicating a high-water mark location at 0.1 mi). Bear sw, keeping the water tower (at the sw part of the lake) at the 11 o'clock position, then drive 0.45 mi until a major fissure has been crossed. Drive 0.2 mi nnw toward the wooden shelter housing the shallow extensometers and thence cross the black oiled lines delineating Runway 7/25 at 0.4 and 0.5 mi, continuing for

0.25 mi past the runway to the mark near two orange fiberglass witness posts. The WRD monument is a USDI triangulation station set in a concrete post flush with ls and stamped "TRN8 1991."
Note: Lakebed access permission, flightline driving permit, and two-way radio contact are required by Base Ops and Control Tower.
Last recovered on 8/9/92.

U56 1926; 101-156 Rosamond
From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit, thence 0.35 mi e to Sierra Hwy., and thence 0.3 mi s, or 0.2 mi s of RR milepost 394, to opposite the s shoulder of Center St., a side rd. w. The USC&GS monument is 43 ft e of C/L of the hwy., 52.9 ft se of the center of the e headwall of a 36-inch-diam corrugated pipe culvert A144+65, 8 ft w of PP 627109E, and 2.1 ft n of a witness post. It is set in a round concrete post about 0.5 ft higher than the hwy. and projects about 0.3 ft above ls.
Last recovered on 3/18/92.

U1154 1961 Rosamond Lake
From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit, thence 5.5 mi e to near the center of the n side of Rosamond Lake. The USC&GS monument is 100 ft s of C/L of the blvd., 20 ft n of a "Underground Telephone Cable" signpost, and 2.0 ft e of a witness post. It is set in the top of a round concrete post about 1 ft higher than the blvd. and projects 0.6 ft above ls.
Last recovered on 8/8/92.

V1146 1961 Rosamond
From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit, thence 2.8 mi w to 50th St. W, and thence 0.8 mi s on the westernmost dirt rd. to the second dirt rd., a side rd. e and just n of a residential compound. The USC&GS monument is 30.5 ft e of C/L of the st., 26.5 ft n of C/L of the rd., 17 ft ne of a section tablet between sections 23 and 24, 2.0 ft nne of a witness post. It is set in a round concrete post about 0.5 ft above the rd. and projects 0.5 ft above ls.
Last recovered on 5/7/92.

V1155 1961 Redman
From Sierra Hwy. in Lancaster, drive n to Ave. E, thence 9 mi e to 80th St. E (a graded dirt rd.), and thence 1.0 mi n to Ave. D (a graded dirt rd. only to the e). Bear nne to detour around trash heap, slowly crossing two narrow ruts nearly 1 ft deep. Continue 0.05 mi n and then w, carefully crossing barbed-wire fencing on the ground to the w side of the fenceline, thence 2 mi n to Ave. B, crossing a small depression or pond at 1.9 mi. The USC&GS monument is 20 ft n of C/L of the ave., 10 ft w of C/L of the st., and 1.5 ft s of a witness post. It is set in the top of a round concrete post about 1.5 ft higher than the rd. and projects 0.7 ft above ls.
Last recovered on 4/7/92.

Y1139 1961 Edwards
From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit and thence e to Lancaster Blvd. (Or, from Sierra Hwy. in Lancaster, drive n to Ave. E, thence 13 mi e to 120th St. E, thence 10.2 mi n on this st., which becomes Lancaster Blvd., to Rosamond Blvd.) Drive 3.8 mi n and thence ne on Lancaster Blvd. to a prominent quartz monzonite outcrop on the n side of the blvd., 0.1 mi w of the Y-intersection with Rosamond Blvd., and nearly opposite a new electric substation. The USC&GS monument is 109 ft nw of C/L of the blvd., 195 ft sw of a PP on the n side of the blvd. where the power lines cross the rd., and 10 ft nw of a witness post. It is set in the top of a 6 x 11-foot, nearly flat boulder which is about 1.5 ft above surrounding ls, and is 5 ft ne of the ne face of a large outcrop projecting 7 ft above ls.
Note: Restricted access.
Note: The tablet is slightly bent up at the edges such that a 5-mm gap exists between the bottom of the tablet and the cement; this occurs on the n half of the tablet, which has a shallow dish shape.
Last recovered on 2/2/93.

Y1154 1961 Rosamond Lake
From Hwy. 14 in Lancaster, drive n to the Rosamond Blvd. exit, thence 9.05 mi e on Rosamond Blvd., or 3.15 mi e of the place where the hwy. becomes divided by a median strip, to a paved cross-over between the east- and west-bound dual lanes, which is opposite and slightly nw of an oblique junction of a dirt rd. bearing se. Make a U-turn and drive 0.05 mi w to the mark where the bank rises. From the east, drive 1.35 mi w of the EAFB guard gate. The USC&GS monument is 150 ft nw of the C/L of the paved cross-over, 45 ft n of the C/L of the westbound lanes, and 2.5 ft w of a witness post. It is set in a round concrete post about 4 ft higher than the blvd. and projects 0.2 ft above ls.
Last recovered on 8/8/92.

PWS-0195-0107

Z488 1955 Lancaster East

From Sierra Hwy. in Lancaster, drive 2.45 mi e to 20th St. E, thence 0.5 mi n to Ave. H8 (an unmarked, side dirt rd. w), and thence 0.1 mi w to the ne corner of a 90°-bend in a rapidly eroding flood-drainage channel, and where the rd. bears left, bridging the ditch, and becomes the driveway to a school. The USC&GS monument is about 175 ft ene of a PP, about 125 ft wnw of a PP, about 125 ft ne of the ne corner of a chainlink fence surrounding a cinder block building (1739 E Ave. H8), 39.3 ft ne of the n end of a 30-inch pipe culvert, and 11.0 ft s of C/L of Ave. H8, in a small mound. It is set in a round concrete post about 2 ft above the rd. and projects 0.1 ft above ls.

Note: As of 9/13/94, mark appears to have been destroyed or disturbed by flood channel activity. Use bench mark A489 1955 (about 0.1 mi n) as alternate.

Last recovered on 8/4/92.