Water-Level Declines in the Amargosa Valley Area, Nye County, Nevada, 1962-84

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CONVERSION FACTORS AND ABBREVIATIONS

"Inch-pound" units of measure used in this report may be converted to International System (metric) units by using the following factors:

Multiply	*by*	*To obtain*
Acres	0.4047	Square hectometers (hm^2)
Feet (ft)	0.3048	Meters (m)
Miles (mi)	1.609	Kilometers (km)
Square miles (mi^2)	2.590	Square kilometers (km^2)

ALTITUDE DATUM

The term "National Geodetic Vertical Datum of 1929" replaces the formerly used term "mean sea level" to describe the datum for altitude measurements. The geodetic datum is derived from a general adjustment of the first-order leveling networks of both the United States and Canada. For convenience in this report, the datum also is referred to as "sea level."

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ABSTRACT

Ground-water levels were measured in selected wells in the heavily pumped Amargosa Valley area in January 1984. These measurements indicate that the water levels have declined as much as 27 feet since the wells were measured in 1962. A study by the U.S. Bureau of Reclamation in 1975 included data for two inadvertently misplotted wells. These data led the Bureau to believe that water levels in part of the pumped area had risen and formed a localized mound, whereas water levels actually had declined in that area.

INTRODUCTION

Purpose and Scope of the Study

Ground-water levels as of 1962 in the Amargosa Valley area of southern Nye County, Nev., were reported by Walker and Eakin (1963, table 3, plate 3). A U.S. Bureau of Reclamation report (1975) on their Amargosa Project contains water-level information (map 1167-300-4) that locally is at considerable variance with the data shown by Walker and Eakin (1963). A field study was therefore undertaken by the U.S. Geological Survey, in cooperation with the National Park Service, to determine the cause of the apparent discrepancy. The study consisted of evaluating existing data and measuring water levels in selected wells throughout the area of interest.

Numbering System for Hydrologic Sites

The numbering system for hydrologic sites used in this report indicates location on the basis of the rectangular subdivision of public lands, referenced to the Mount Diablo base line and meridian. Each number consists of four units: The first is the township south of the base line; the second unit is the range east of the meridian; the third unit designates the location within a square-mile section. The section number is followed by a letter or letters that indicate the quarter section and quarter-quarter section; the letters A, B, C, and D designate the northeast, northwest, southwest, and southeast quarters, respectively. The last unit is a sequence number that follows the letters. As an example, well S16 E48 1AB1 is located in NW¼NE¼ sec. 1, T. 16 S., R. 48 E., and it is the first well recorded in that tract.

GEOGRAPHIC AND HYDROGEOLOGIC SETTING

The Amargosa Valley area is in the southern part of Amargosa Desert, a northwest-trending valley along the Nevada-California border. The study area lies between Lathrop Wells, Nev., and Death Valley Junction, Calif., and is about 70 miles west-northwest of Las Vegas, Nev. (figure 1).

The study area is underlain at depth by carbonate rocks, which transmit water freely (Winograd and Thordarson, 1975). These rocks probably are overlain by nearly continuous beds of volcanic rocks, dominantly tuff, which are much less permeable and which tend to confine water in the underlying carbonate rocks. Some ground water probably moves upward from the carbonate rocks through the volcanic rocks into the valley-fill deposits of gravel, sand, silt, and clay, which constitute the main pumped aquifer in the Amargosa Valley area. The study area is bounded on the east by an inferred northwest- to north-trending fault (plate 1) that may be a barrier to ground-water flow from the east. The fault trace is parallel to, and just west of, a line of springs in the eastern part of Ash Meadows (plate 1). The effectiveness of the barrier in impeding east-to-west ground-water flow at depth through the carbonate-rock aquifer is not known, but the presence of the springs strongly suggests that the fault affects the ground-water hydrology of the area.

GROUND-WATER OCCURRENCE

Ground-water flow in the valley-fill aquifer enters the study area primarily from the direction of Big Dune and Fortymile Wash to the north and the Spring Mountains to the east (plate 1, figure 1). This flow may originate from recharge to the valley fill upgradient from the study area, as well as from upward subsurface flow through the underlying volcanic rocks from the carbonate-rock aquifer. Flow from the Spring Mountains may be dominantly through the deeper carbonate rocks. The overall region contributing ground-water inflow to the area by way of the carbonate-rock aquifer is probably much larger than the Amargosa Desert - Spring Mountains area, and may comprise all or parts of Oasis Valley, Crater Flat, Fortymile Wash, Jackass Flats, Rock Valley, the northern and western flanks of the Spring Mountains, and other valleys to the north and northeast (Walker and Eakin, 1963; Rush, 1971; and Winograd and Thordarson, 1975). Ground water in these valleys enters the deep underlying carbonate-rock aquifer, within which flow is toward the Amargosa Desert.

Ground-water movement in the area is complex because of the existence of two aquifer systems--the valley-fill deposits and the underlying carbonate rocks. Ground water in the carbonate rocks generally has a higher head than water in the valley-fill aquifer. Consequently, some of the ground water in the carbonate-rock aquifer discharges from springs and then percolates into the valley fill, and some moves directly upward into the valley fill where the vertical permeability of volcanic rocks and valley-fill deposits overlying the carbonate rocks permits. These relations are particularly complex in the eastern Ash Meadows area beneath the line of springs, as described by Dudley and Larson (1976).

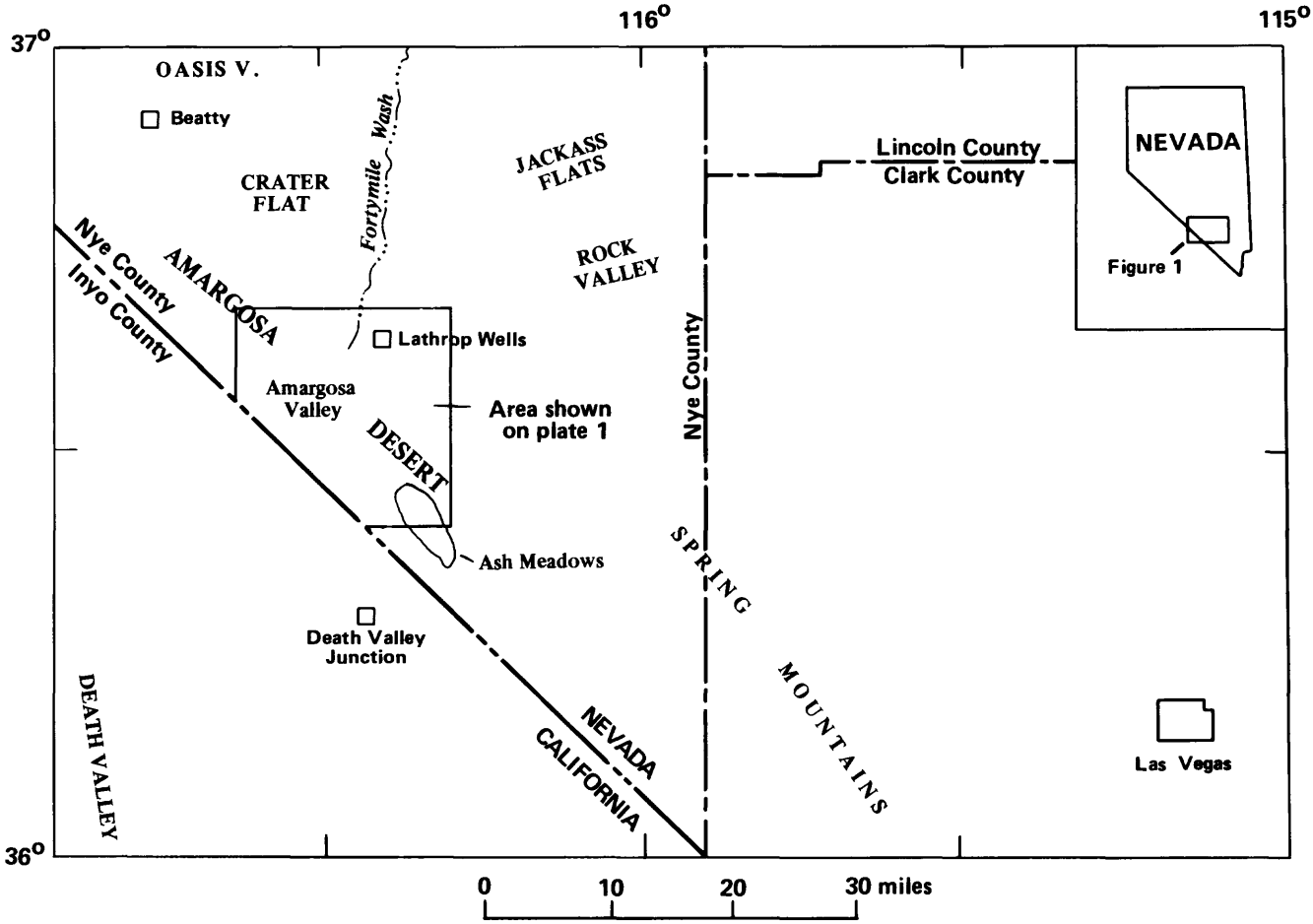

FIGURE 1.--Location of study area.

NET WATER-LEVEL FLUCTUATIONS, 1962-84

Water levels were measured in 1962 as part of a reconnaissance study of ground-water resources of the Amargosa Desert (Walker and Eakin, 1963, table 3). Water levels in selected wells were measured again in January 1984 for this study. These data are given in table 1 and water-level contours for 1962 and 1984 are shown on plate 1. Table 1 also lists the net declines between 1962 and 1984, which ranged from 1.4 to as much as 27.4 feet. The declines presumably are related to major ground-water development in the agricultural area about 10 miles southwest of Lathrop Wells. Plate 1 shows that net declines exceeded 10 feet in a combined area of at least 25 square miles.

Reference has been made by James A. Goodrich (Camp Dresser and McKee, Inc., written communication, 1983) to water-level data contained in a report by the U.S. Bureau of Reclamation (1975) that in part are substantially different from the data given by Walker and Eakin (1963, table 3, plate 3). During the course of the present investigation, the data presented by the Bureau were reviewed. Of particular concern was a ground-water mound shown in T. 16 S., R. 48 E. (U.S. Bureau of Reclamation, 1975, map 1167-300-4). The mound is also reflected in the contours of water-level altitude shown by the Bureau (1975, map 1167-300-5). No wells are shown on either map in the vicinity of the mound, and no data are given in the report to substantiate the interpretations shown on either map. The original field map used to prepare map 1167-300-5 was inspected by J. P. Akers, U.S. Geological Survey, at the Bureau of Reclamation office in Boulder City, Nev. This map showed two wells in sec. 1, T. 16 S., R. 48 E., labeled AD and CD, with depths to water of 52 and 44 feet below land surface, respectively. Records for these wells could not be found in the files of the U.S. Bureau of Reclamation, the U.S. Geological Survey, or the Nevada State Engineer. Additionally, an intensive search in the field at these locations by J. P. Akers and R. L. Carson, U.S. Geological Survey, on November 14, 1983, failed to find the two wells. The Bureau believes that these two sites, shown only on a work copy of one of their maps, are inadvertently misplotted, and that the wells are actually located in sec. 1, T. 17 S., R. 48 E. (D. L. Brandstetter, U.S. Bureau of Reclamation, oral communication, 1983). If so, they may be two wells listed by Walker and Eakin (1963, table 3, wells 1a1 and 1c1). Those wells had depths to water of 51.6 and 45.2 feet below land surface, respectively, in 1962 (table 1).

TABLE 1.--Water levels and water-level changes, 1962-84

[Water levels for 1962 are from Walker and Eakin (1963, table 3); water levels for 1984 were measured by U.S. Geological Survey.]

Map number (pl. 1)	Well number	Land-surface altitude (feet above sea level)[a]	Well depth (feet)[a]	Water level (feet below land surface)		Decline in water level, 1962-84 (feet)
				1962[b]	Jan. 18-20, 1984	
1	S16 E48 1AB1	2,430	[c]523	—	150.8	—
2	2B1	2,423	332	135.9	142.6	6.7
3	2D1	2,409.7	410	124.3	131.4	7.1
4	3A1	2,412.3	235	127.4	143.7	16.3
5	5B1	2,405.5	250	127.6	142.5	14.9
6	9B1	2,390	242	105.2	116.0	10.8
7	10B1	2,397.8	300	116.6	131.2	14.6
8	13A1	2,386.1	250	116.8	121.9	5.1
9	14B1	2,381	315	102.7	109.5	6.8
10	17A1	2,370.3	280	100.6	109.0	8.4
11	18B1	2,363	361	90.0	117.4	27.4
12	26A1	2,336	138	75.7	100.3	24.6
13	27D1	2,324.6	188	58.8	64.0	5.2
14	36A1	2,323.7	165	67.5	82.7	15.2
15	S16 E49 19B1	2,370.8	725	106.0	113.7	7.7
16	20A1	2,384	204	118.4	129.8	11.4
17	22B1	2,395	347	131.1	138.8	7.7
18	22D1	2,380	341	112.1	132.3	20.2
19	23A1	2,403	382	105.9	107.3	1.4
20	26D2	2,352	300	106.8	133.5	26.7
21	28C1	2,349	185	92.0	110.9	18.9
22	S17 E48 1A1	2,303	135	51.6	—	—
23	1C1	2,295.7	214	45.2	—	—
24	S17 E49 4A1	2,300	630	80.7	86.8	6.1
25	6B1	2,305	120	50.1	66.6	16.5
26	11B2	2,274	274	59.4	65.0	5.6
27	15B1	2,264.8	200	52.0	61.2	9.2

[a] Altitudes listed to nearest tenth of a foot were determined by plane table (Walker and Eakin, 1963, table 3); those listed to nearest foot were estimated from topographic maps. Well depths are from Walker and Eakin (1963, table 3), except as indicated.

[b] Water levels measured in June or July, with two exceptions: S16 E48 17A1, August 1962; and S17 E49 4A1, October 1962.

[c] From driller's log on file with Nevada State Engineer.

The field investigations on November 14, 1983, led to the discovery of a well in sec. 1, T. 16 S., R. 48 E. (1ABl, table 1, plate 1). The depth to water below land surface was 150.6 feet. The records for this well, in the files of the Nevada State Engineer, indicate that it was drilled in June 1963, and that the depth to water reported at that time was 167 feet below land surface (the accuracy of this reported value is not known). The depths to water in two wells in adjacent section 2 of the same township (2Bl and 2Dl, table 1) were 142.6 and 131.4 feet below land surface in 1984. These depths are 60 to 100 feet greater than the depths implied for that immediate area by the U.S. Bureau of Reclamation map. The net water-level declines in these two wells between 1962 and 1984 were 6.7 and 7.1 feet (table 1), which is further evidence that the implied ground-water mound does not exist and that that interpretation apparently resulted from the inadvertent misplotting of two wells.

CONCLUSIONS

Ground-water flow in the Amargosa Valley area is complex and involves a valley-fill aquifer and an underlying carbonate-rock aquifer. Ground-water development in the area is in the valley-fill aquifer about 10 miles southwest of Lathrop Wells. Water levels measured in selected wells in the area in 1984 are lower than those measured in 1962 (table 1), demonstrating that water levels have undergone a net decline since 1962. An implied water-level rise and resulting ground-water mound suggested on a map from a U.S. Bureau of Reclamation report (1975, map 1167-300-4) appear to be based on the inadvertent misplotting of two wells. Data presented herein indicate that the implied mound does not exist.

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