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Dissolved-Solids Concentrations and Loads in Return Flows to the Colorado River from Agricultural Land in Southern California

(U.S.) Geological Survey
Menlo Park, CA

Jul 80

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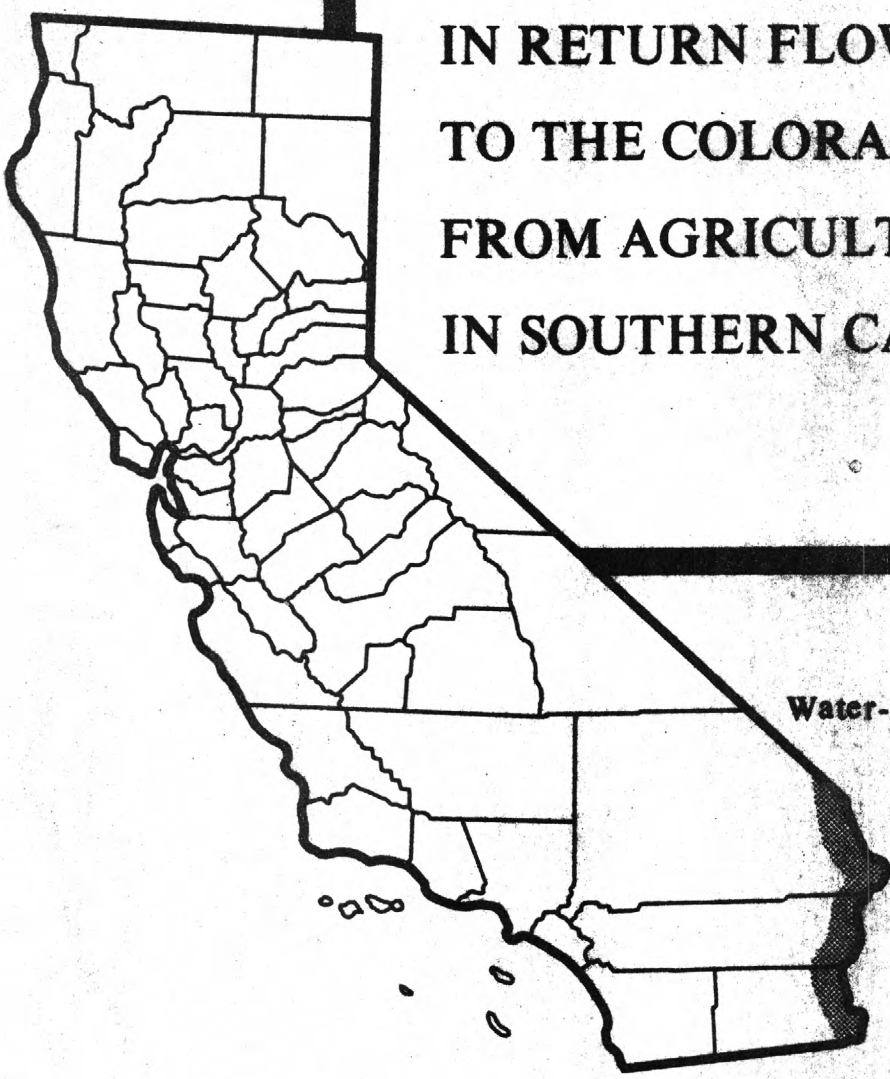
DISSOLVED-SOLIDS CONCENTRATIONS AND LOADS IN RETURN FLOWS TO THE COLORADO RIVER FROM AGRICULTURAL LAND IN SOUTHERN CALIFORNIA



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Prepared in cooperation with the
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

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DISSOLVED-SOLIDS CONCENTRATIONS AND LOADS IN RETURN FLOWS

TO THE COLORADO RIVER FROM AGRICULTURAL LAND

IN SOUTHERN CALIFORNIA

By John M. Klein and Wesley L. Bradford

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations 80-52

Prepared in cooperation with the

California Regional Water Quality Control Board

Colorado River Basin Region

July 1980

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UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, SECRETARY

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CONVERSION FACTORS

The inch-pound system is used in this report. For readers who prefer metric units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound unit	By	To obtain metric unit
acre	0.4047	hm^2 (square hectometer)
acre-ft (acre-foot)	1,233	m^3 (cubic meter)
ft (foot)	0.3048	m (meter)
ft/mi (foot per mile)	0.189	m/km (meter per kilometer)
ft^3/s (cubic foot per second)	0.02832	m^3/s (cubic meter per second)
inch	25.4	mm (millimeter)
mi (mile)	1.609	km (kilometer)
ton (short)	0.9072	Mg (megagram)
ton/acre	2.2417	Mg/hm^2 (megagram per square hectometer)
ton/acre-ft (ton per acre-foot)	0.0007	Mg/m^3 (megagram per cubic meter)
ton/d (ton per day)	0.9072	Mg/d (megagram per day)
ton/yr (ton per year)	0.9072	Mg/yr (megagram per year)
(ton/yr)/acre (ton per year per acre)	2.2417	$(Mg/yr)/hm^2$ (megagram per year per square hectometer)

Abbreviations used:
mg/L (milligrams per liter)
µmho (micromhos per centimeter)

DISSOLVED-SOLIDS CONCENTRATIONS AND LOADS IN RETURN FLOWS TO THE COLORADO RIVER FROM AGRICULTURAL LAND IN SOUTHERN CALIFORNIA

By John M. Klein and Wesley L. Bradford

ABSTRACT

The dissolved-solids concentration in Colorado River water increases from less than 50 mg/L (milligrams per liter) at the river's origin to about 700 mg/L at the California border and to about 900 mg/L at the United States-Mexico boundary. Much of the latter increase is due to depletion by agricultural use and irrigation return water with salts leached from soils under cultivation.

Forty sites in three agricultural areas--Fort Mojave, Bard Valley, and Palo Verde Valley--were sampled to describe the dissolved-solids concentrations in return flows. Emphasis was on Palo Verde Valley.

In the Fort Mojave area, the dissolved-solids concentration of Colorado River water was about 700 mg/L, while the concentration in water at the tile-drain convergence averaged about 2,500 mg/L. In the closed sump that presently receives all irrigation return, concentrations ranged from 812 to 1,760 mg/L.

In Bard Valley, water diverted from the river had an annual mean dissolved-solids concentration of about 835 mg/L. During the study, concentrations in the two main drains carrying irrigation return water ranged from 953 to 1,290 mg/L.

Selected drains in Palo Verde Valley were sampled several times to determine dissolved-solids loads from subareas within the valley. Loads determined in this study were compared with those of an earlier study. In agreement with the earlier study, loads were found to be largest from three subareas in the southern half of the valley and comparatively small from the four subareas in the northern half. Smaller loads were found in this study from all subareas, however. The differences are thought to be due to generally lower water discharge observed in drains during this study.

INTRODUCTION

Statement of the Problem

The concentration of dissolved solids in Colorado River water increases from less than 50 mg/L at the river's origin in Colorado (fig. 1) to an average of 900 mg/L at the United States-Mexico boundary. Every use or depletion of water by man's activities contributes to the increase in dissolved solids. The main depletion of Colorado River water is by agricultural use (U.S. Bureau of Reclamation, 1977b, p. 21).

Two procedures used in southern California to develop agricultural lands adjacent to the Colorado River add to the amount of dissolved solids in the river. First, the land adjacent to the river is leached to reduce salt concentration. Second, after crops are planted and irrigated, drain systems carry excess irrigation water back to the river to prevent waterlogging and salt accumulation on the land. Both practices, while essential to agriculture, contribute dissolved solids to the river.

The increasing amount of dissolved solids (also called salinity) in the river adversely affects about 10 million people and 1 million acres of fertile, irrigated farmland. In late 1973, the Colorado River Basin States created the Colorado River Basin Salinity Control Forum to establish numeric salinity criteria and a plan of implementation for salinity control in the Colorado River. The Forum's recommended standards were adopted by the States and approved by the U.S. Environmental Protection Agency in 1976.

In California the local regulatory agency responsible for implementing the plan is the California Regional Water Quality Control Board, Colorado River Basin Region. In addition, the Colorado River Board, a State agency established to exercise continuous comprehensive jurisdiction over the Colorado River in California, has been pursuing responsible planning in the management of the Colorado River.

The California Regional Water Quality Control Board, Colorado River Basin Region (hereafter referred to as the Regional Board), pursuant to the objectives of Public Law 92-500, requested the U.S. Geological Survey to participate in a cooperatively funded study to monitor water quality of return flows to the Colorado River from agricultural areas in California.

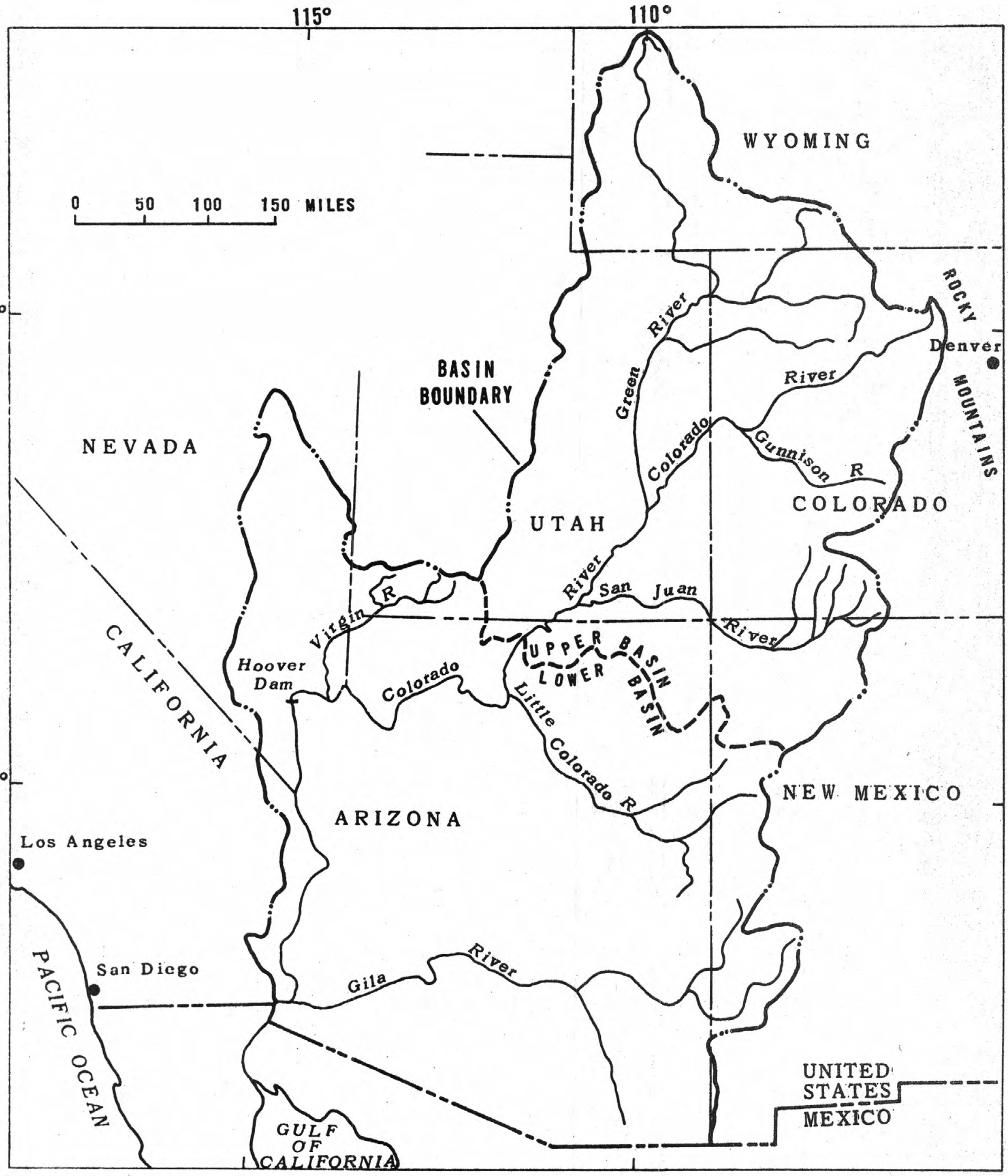

FIGURE 1.--Location of Colorado River drainage.

Objectives of the Study

The overall purpose of the study was to provide the Regional Board with data on the salinity of return flows to the Colorado River. The more specific objectives were:

1. To describe concentrations of the major dissolved inorganic chemical constituents in surface-water discharges for three agricultural areas of California: the Fort Mojave area, the Palo Verde Valley, and the Bard Valley north of Yuma, Ariz. (fig. 2). In this study, because of limited funds, data were collected predominantly in the Palo Verde Valley where agriculture is most developed. If there are subsequent studies, data collection will be concentrated in the Fort Mojave and Bard Valley areas.

2. To describe the areal distribution of dissolved-solids concentrations in the surface-water irrigation drains of the three study areas. For this objective also, emphasis was on Palo Verde Valley.

Previous Investigations

Previous investigations of most importance to this study are the detailed geologic and hydrologic descriptions of the area by Metzger, Loeltz, and Irelan (1973); Olmsted, Loeltz, and Irelan (1973); and Metzger and Loeltz (1973). Adequate references to other investigations are presented in those publications. The U.S. Bureau of Reclamation has collected hydrologic data in recent years and has appraised irrigation practices. Water-quality and streamflow data are published annually by the U.S. Geological Survey. Bookman-Edmonston Engineering, Inc. (1976) analyzed dissolved-solids discharges from the Palo Verde Irrigation District, outlined specific areas of dissolved-solids loads in irrigation return drains, and discussed alternative salinity management procedures. Other reports dealing specifically with salt and salinity management are listed in the "Selected References" section of this report.

Acknowledgments

The Fort Mojave Tribal Council allowed access to sampling sites on Indian Reservation land. Russel Bros. Ranches, Inc., contractors farming the Fort Mojave area, were helpful in the collection of water samples in their area. Palo Verde Irrigation District personnel also supplied data collected as part of their irrigation management practices.

DESCRIPTION OF THE STUDY AREAS

The study areas (fig. 2) are adjacent to the lower reaches of the Colorado River in California in San Bernardino, Riverside, and Imperial Counties. They extend from the California-Nevada State line on the north to the United States-Mexico boundary on the south. The eastern boundary of the study areas is the Colorado River, and the western perimeter is defined by the western extent of the Colorado River flood-plain valley fill deposits and an escarpment of older terrace deposits and resistant rock types of significant relief.

Rainfall in this area of the California-Arizona desert averages about 4 inches per year and is highly variable. Agriculture is supported by extensive irrigation with Colorado River water.

Geohydrology

The rugged mountains forming the western perimeters of the study areas are composed of consolidated igneous and metamorphic rocks that form the basement complex beneath the partly unconsolidated and unconsolidated alluvial deposits of the separate basins. Fractures may be present in these basement deposits allowing transmission of minor quantities of ground water.

Both younger and older alluvium of varying degrees of consolidation were deposited throughout the study areas by the meandering of the Colorado River and by flooding prior to control of the river by upstream dams. These deposits, well-suited for agricultural development, are highly permeable and, where saturated, will yield water readily to wells.

In the irrigated valleys, depth to ground water ranges from about 7 ft in Palo Verde Valley to about 100 ft in Bard Valley. The slope of the shallow ground-water surface, where it exists, is away from the river in some areas and toward the river in others, suggesting that the river may recharge the shallow aquifer in some areas and receive seepage from it in others. Dissolved-solids concentrations in ground water are generally high, ranging from 600 to 6,000 mg/L in Palo Verde Valley and up to 1,500 mg/L in Bard Valley. The predominant constituents generally are sodium and chloride.

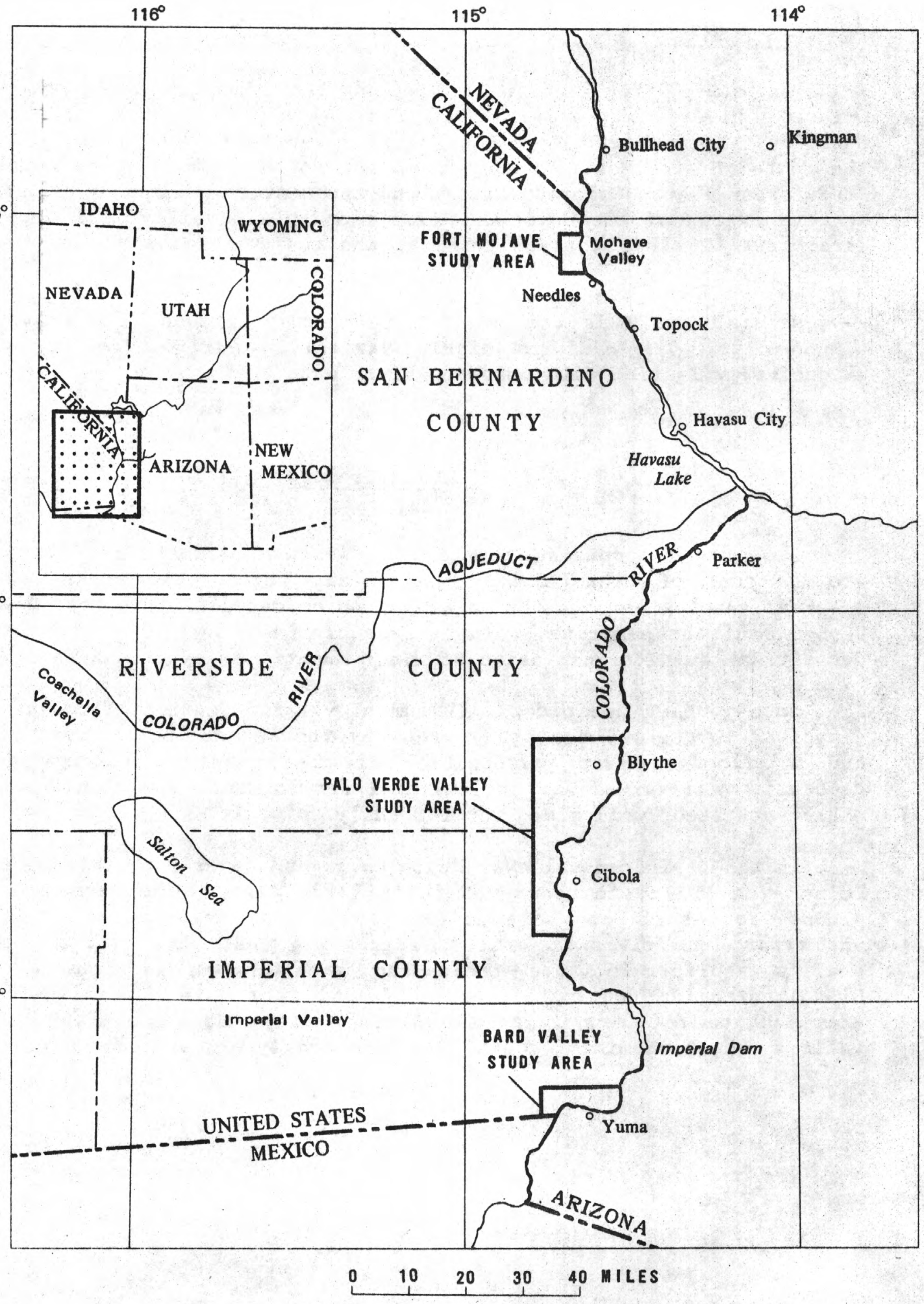

FIGURE 2.--Location of study areas.

Soils

Of the three study areas, soils of only the Palo Verde Valley have been studied in detail (U.S. Soil Conservation Service, 1974). Coarse-textured soils predominate adjacent to the river, grading to fine-textured soils adjacent to the mesas and escarpments on the perimeter. Prior to agricultural development and regulated flow in the river, evaporation, in conjunction with transpiration by phreatophytes in marshes and bogs, increased salt concentration in soils. With time, high concentrations developed in the soil horizons. M. P. Einert (written commun., 1978) found that soluble salts ranged from 0.02 percent in sandy, well-drained soils to over 2 percent in tight, clayey soils.

Development of the flood-plain soils for economic crop production requires leaching and flushing most of the soluble salts from the soil with large volumes of Colorado River water. Generally, repeated flushings for 1 year will leach well-drained soils sufficiently to plant salt-tolerant crops, and irrigation will continue the leaching process. Fine-textured soils must first be broken up at depth to facilitate leaching and drainage.

Fort Mojave Area and Bard Valley

In the northern part of the Fort Mojave area (figs. 2 and 3), irrigation is with ground water. Acreage in the southern part of the area is irrigated with Colorado River water. The few tile drains available empty into a closed sump along the west perimeter of the area. By directing the used irrigation water away from the Colorado River, direct degradation of the river is avoided.

The flat part of the Colorado River flood plain, downstream from Laguna Dam, north and west of the Colorado River, and south of the All American Canal is informally designated as Bard Valley (fig. 4). The Colorado River is diverted above Imperial Dam to supply the All American Canal, the source of irrigation water in Bard Valley. Several major canals divert the water to laterals and to the point of crop application. A series of drains has been constructed to prevent waterlogging in the irrigated area by intercepting percolating irrigation return. The drain water is then returned to the Colorado River.

Palo Verde Valley

Palo Verde Valley (figs. 2 and 5) includes about 92,000 acres of irrigated land within the boundaries of the Palo Verde Irrigation District. Irrigation water is supplied from the Colorado River through a complex distribution system consisting of 295 mi of laterals and canals. Excess water in the canals can be returned to the river at several spill locations throughout the eastern part of the valley.

To prevent the buildup of a high ground-water table, about 150 mi of open ditches drain the surface runoff and ground-water seepage to the Palo Verde Outfall Drain (fig. 5), which trends southward through the central part of the valley. This major drain enters the Colorado River about 10 mi south of Palo Verde Valley.

METHODS OF DATA COLLECTION

Forty sampling sites (figs. 3, 4, and 5) were selected to provide water-quality data for initial interpretation and assessment of dissolved solids in discharge. At 19 sites in Palo Verde Valley, 4 sites in the Fort Mojave area, and 2 sites in Bard Valley, samples were collected for analysis of the major inorganic chemical constituents listed in the supplemental data. At the remaining sites (14 in Palo Verde Valley and 1 in Bard Valley) only field measurements of temperature, specific conductance, and pH were made. Water samples were collected in November 1977 and January, March, and September 1978 and analyzed by the National Water Quality Laboratory in Arvada, Colo.

A relation between specific conductance and dissolved-solids concentration (residue on evaporation at 180°C) was determined from available data to calculate concentrations of dissolved solids at sites where only field measurements of specific conductance were taken. The data fit the linear regression equation:

$$\text{Dissolved solids (mg/L)} = 0.544 \times \text{specific conductance } (\mu\text{mho}) + 267.$$

The fit was excellent with $r^2 = 0.96$. The fit is poor when specific-conductance values are below 1,400. The equation is not used below that value.

RESULTS AND DISCUSSION

Each of the study areas is discussed separately. However, only limited discussion is presented for the Fort Mojave area and Bard Valley because of limited information available. The approach used is to describe dissolved-solids concentration changes in water as it moves through the irrigation cycle from its diversion into the area to its termination point.

Fort Mojave Area

Water is diverted from the Colorado River with a series of lift pumps at sample site 1 (fig. 3) and transmitted via the Fort Mojave Main Canal to the points of application. Samples were collected at the diversion point (site 1) to determine the quality of the river water before it was used for irrigation (see supplemental data). The concentration of dissolved solids (sum of constituents) was about 700 mg/L. The major dissolved constituents were sodium, calcium, and sulfate. The concentrations of individual constituents relative to the sums of constituents were consistent among the samples and are considered to be representative of surface water applied to the crops in the area.

Substantial chemical changes occur in the water from its point of diversion at the Colorado River to the tile-drain convergence point (site 2) where it was sampled. In the November sample, the dissolved-solids concentration was 2,590 mg/L. The predominant ions were sodium and sulfate with a noticeable increase in the chloride percentage over that of the diversion water. The passage of the water through the irrigation cycle apparently results in concentration and composition changes due to leaching of soluble minerals and evaporation.

The sump along the south and west perimeters of the flood-plain deposits (fig. 3) receives irrigation tailwater, return flow from the tile-drain collection system, and natural runoff from the hills to the west. Samples from different parts of the sump taken at different times attest to this variability of sources.

At sample site 3 (fig. 3), water is pumped from the sump back into the irrigation cycle for reuse on some fields. A sample of this water obtained November 15, 1977, contained 875 mg/L of dissolved solids, mainly calcium, sodium, and sulfate. The sump pump was not operating during the January 1978 visit; thus, a sample was collected from the sump itself (site 4, fig. 3). The water contained 812 mg/L of dissolved solids, mainly sodium, sulfate, and chloride. During the March 1978 visit, the sump was again sampled at site 4 (fig. 3). The water contained 1,760 mg/L dissolved solids, predominantly sodium and sulfate. Water-quality fluctuations of this magnitude in the sump may be caused either by variations in the pattern of water usage or by natural processes, such as increases in concentration by evaporation, precipitation of minerals from solution, or by the flushing of surface evaporite salts during runoff from the hills to the west.

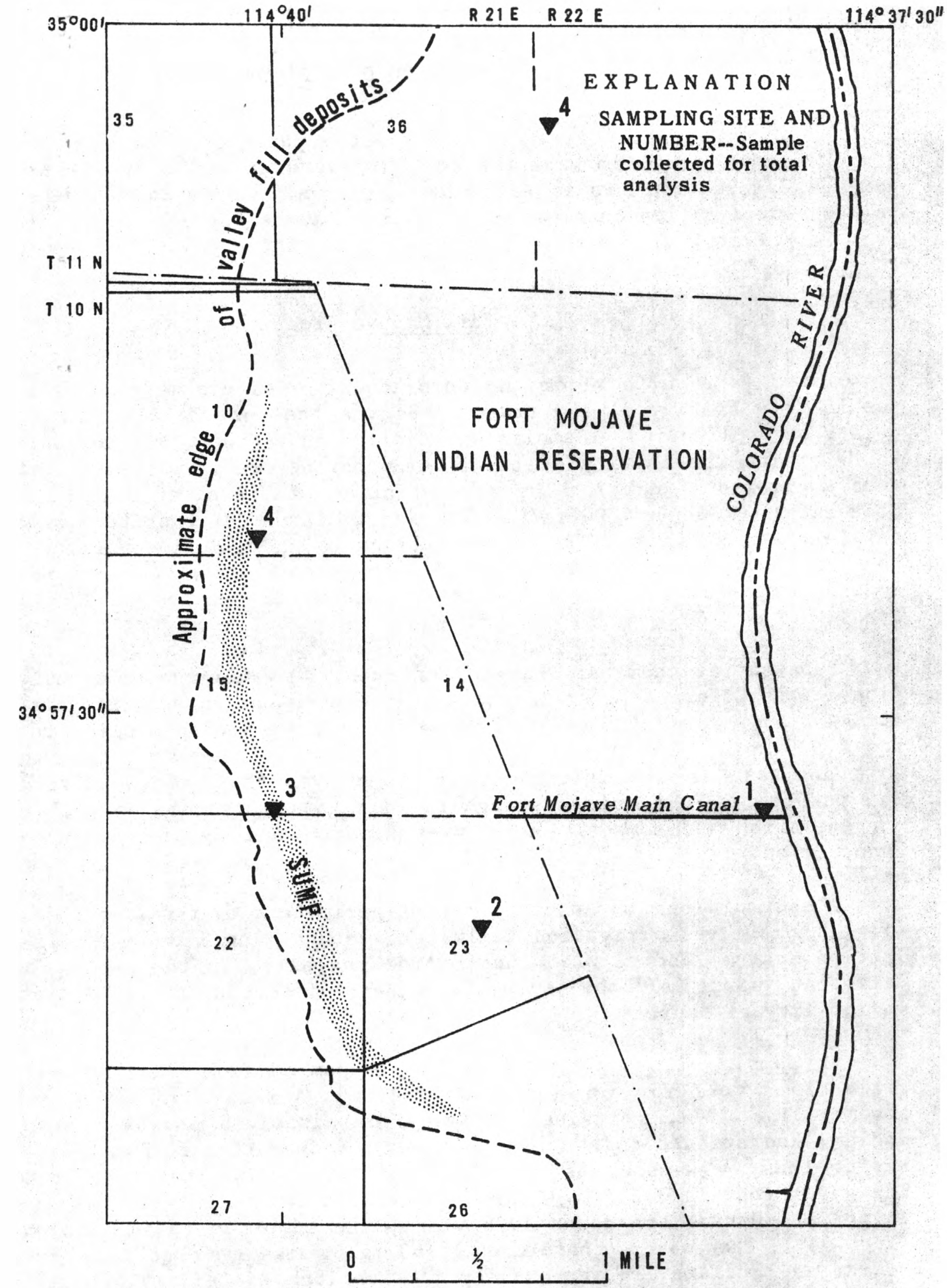

FIGURE 3.--Location of sampling sites, Fort Mojave Main Canal, and sump in the Fort Mojave area.

Bard Valley

According to U.S. Geological Survey records at station 09429490 (fig. 4), the dissolved-solids concentration of the Colorado River above Imperial Dam fluctuates considerably and so must, therefore, the dissolved solids of the water diverted into Bard Valley. The annual mean concentrations of dissolved solids have, however, remained nearly constant, ranging only from 832 to 837 mg/L for the last 3 years.

Two primary drains direct irrigation return flow away from Bard Valley to the Colorado River. The Araz Drain drains the western half of the valley, and the Reservation Main Drain drains the eastern half.

Water samples from Araz Drain (site 1, fig. 4) contained dissolved solids (sum of constituents) in amounts ranging from 953 to 1,040 mg/L, mainly sodium and sulfate. The various samples taken were consistent in composition and concentration. Because discharges in the drain were small (1 to 2.3 ft^3/s) at the time of sampling, loads of dissolved solids were also small compared to the load already present in the river. However, larger discharges probably occur at other times of the year depending upon irrigation practices, particularly during the summer when irrigation water use is normally highest.

Water samples taken from the Reservation Main Drain (site 2, fig. 4) contained dissolved solids in amounts ranging from 1,250 to 1,290 mg/L. The samples maintained a consistent composition, predominated by sodium, calcium, and sulfate. Discharges during sampling were generally about 25 ft^3/s.

One specific-conductance measurement at the Reservation Main Drain (site 3) in September indicated a dissolved-solids concentration (residue on evaporation at 180°C) of about 1,060 mg/L.

Palo Verde Valley

Mean monthly surface-water discharge and chemical-quality data were used to estimate monthly dissolved-solids loads (residue on evaporation at 180°C) entering and leaving Palo Verde Valley in irrigation water during 1973-77 (fig. 6). Inflow data were for the diversions at the Palo Verde diversion dam (fig. 5). Outflow data were for the Palo Verde Outflow Drain (fig. 5).

A large amount of dissolved solids is diverted to the valley from the Colorado River during the peak summer irrigation season when more dissolved solids enter the valley than leave it (fig. 6). In contrast, during the autumn and winter when irrigation is at a minimum, more dissolved solids leave the valley than enter it (fig. 6). Salt-budget conditions were unfavorable during the spring and summer of 1977 when, after an exceptionally dry winter, higher dissolved-solids loads were diverted into the valley than in previous years.

Data collected during this study were used to describe the chemical quality of water draining the valley and to determine specific areas contributing proportionally larger dissolved-solids loads. Seasonal variations of dissolved-solids concentrations were determined for seven subareas (figs. 7-11) as defined by Bookman-Edmonston Engineering, Inc. (1976). In most of the valley these variations are small. However, at site 1 in the East Side subarea (fig. 7) and at sites 25, 26, and 27 (fig. 11) seasonal variations in dissolved-solids concentrations were large. Variations of up to a factor of 2.5 were seen at site 25.

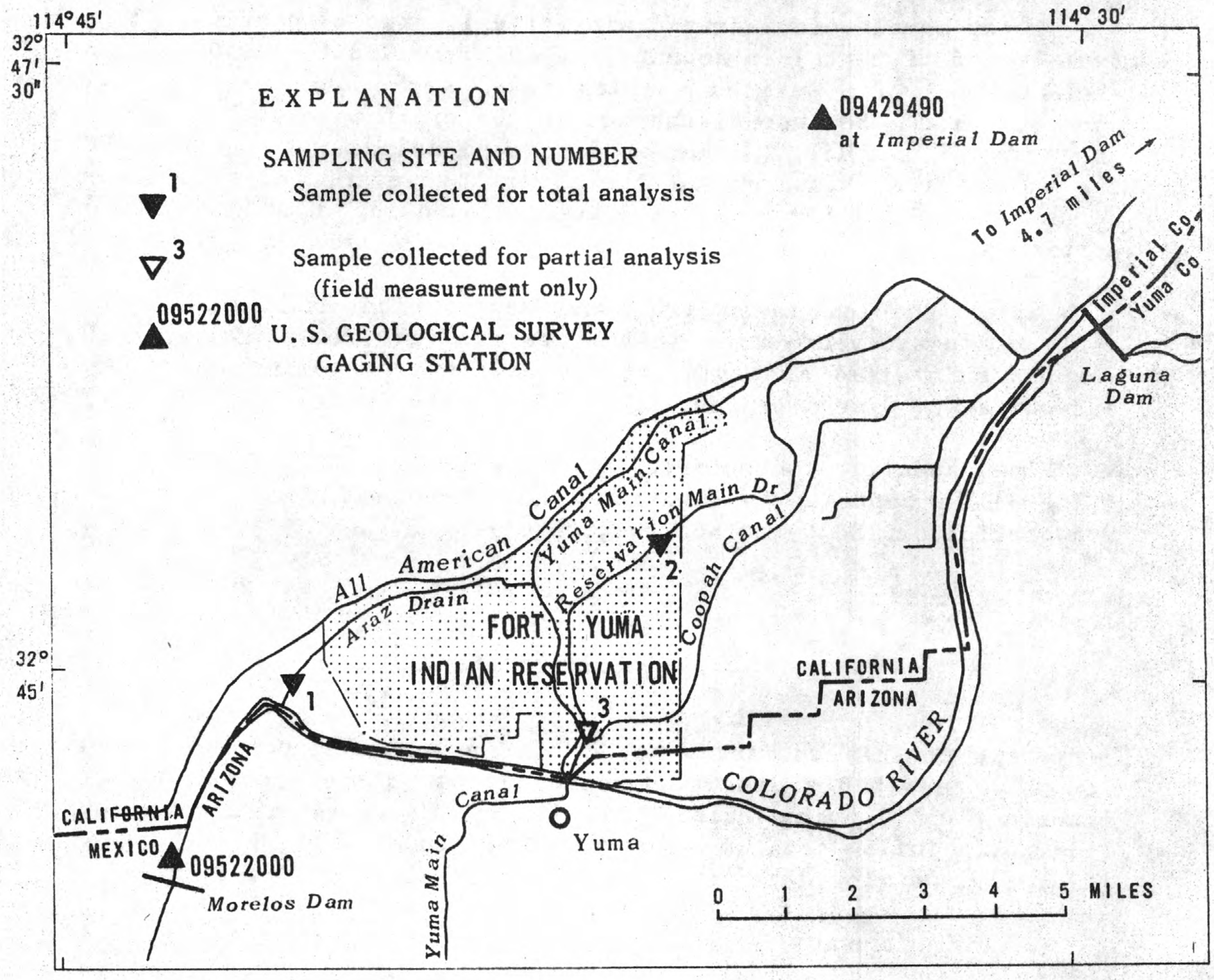

FIGURE 4.-- Location of drain-sampling sites and Morelos Dam, Bard Valley.

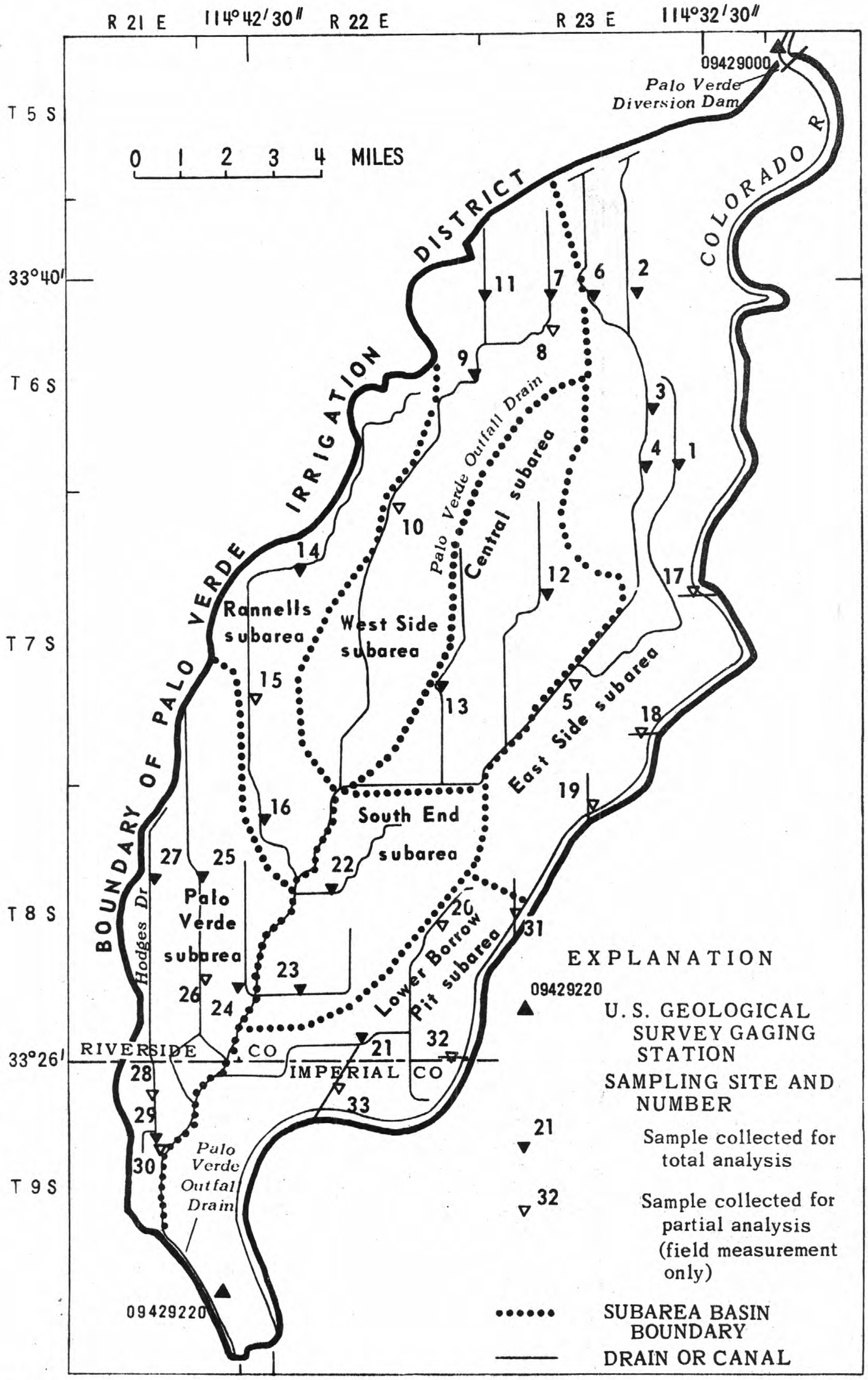

FIGURE 5.—Location of sampling sites and hydrologic subareas in Palo Verde Valley. Subareas defined by Bookman-Edmonston Engineering, Inc. (1976).

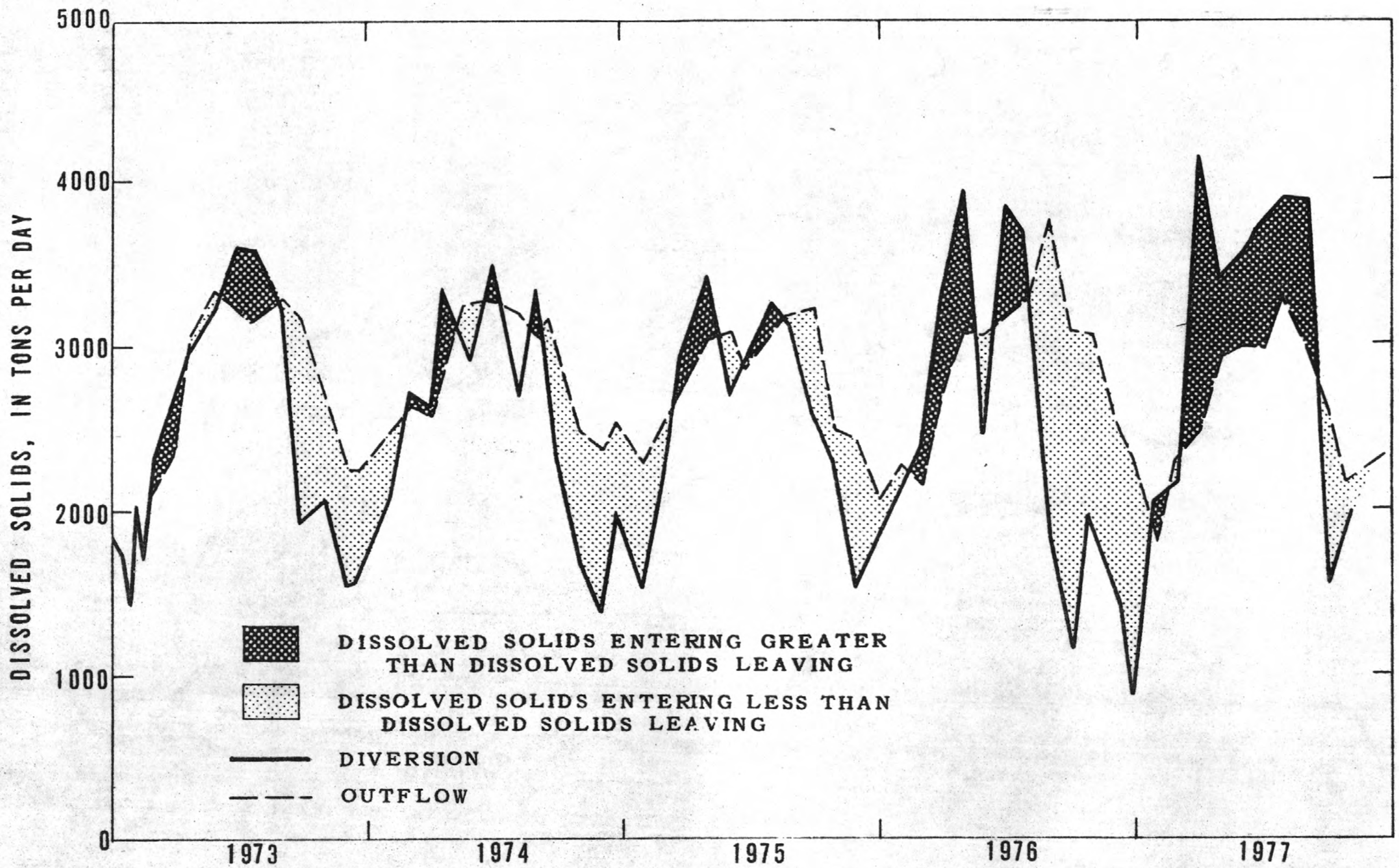

FIGURE 6.--Comparison of dissolved solids in tons per day diverted from the Colorado River at the Palo Verde Diversion Dam and returned to the Colorado River at the Palo Verde Outfall Drain for 1973–77.

The highest concentrations of dissolved solids and the greatest variation in concentrations occur in the southern half of the valley. For example, site 28 (fig. 11) samples ranged from about 2,220 to 3,530 mg/L in dissolved-solids concentration while at site 12 (fig. 8) in the northern half, by contrast, samples ranged from 1,300 to 1,330 mg/L.

The following discussions compare the drainage from the various subareas. Numbers used in the comparisons are from field and laboratory data.

The East Side subarea (fig. 7) is drained by the Upper Borrow Pit Drain (site 1), the East Side Drain (sites 2, 3, 4, and 5), and the North End Drain (site 6). The most variable dissolved-solids concentrations were observed at site 1. A substantial increase in discharge from 0.14 to 11 ft^3/s between January and March did not dilute the drain water but seems rather to have contributed water of higher dissolved solids. Concentrations increased from 2.71 ton/acre-ft in January to 2.83 ton/acre-ft in March. Concentrations at sites 2, 4, 5, and 6 were all nearly constant with time.

The West Side subarea (fig. 8) is drained by the West Side Drain (sites 7, 8, 9, and 10) and the Upper West Side Drain (site 11). Sites 7 and 11 represent drainage water from areas of similar size and agricultural use, but the water at site 11 is more consistent in composition and higher in concentration than the water at site 7. This may indicate more soluble material in the soil or new land being put into production upstream of site 11. Substantial drainage enters the West Side Drain between site 9 and sites 7 and 11, as evidenced by discharges of 18 to 31 ft^3/s at site 9 and concurrent discharges of 4 to 9 ft^3/s at sites 7 and 11. The higher dissolved-solids concentration in water coming from the Upper West Side Drain causes the increase in dissolved solids between sites 8 and 10.

Dissolved-solids concentrations at both monitoring sites in the Central subarea drainage (sites 12 and 13, fig. 8) were similar. However, the discharges at site 12 were higher (10, 9.1, 11, and 11 ft^3/s) than those at site 13 (4.4, --, 6.5, and 12 ft^3/s) and hence, the loads at site 12 were higher.

The dissolved-solids concentrations varied greatly at sites 14, 15, and 16 in the Rannells subarea drainage (fig. 9). Discharges at site 16 were 3 to 3.8 times greater than at site 14, indicating substantial drainage inflow between the two stations. Maximum dissolved-solids concentrations at sites 15 (1,900 mg/L) and 16 (1,920 mg/L) compared to site 14 (1,620 mg/L) indicate that concentrations increase southward in the subarea.

Variability and lack of seasonal trend characterize the data collected at sites 20 and 21 (fig. 10), respectively, in the Lower Borrow Pit subarea. The November, March, and September samples indicate higher dissolved-solids concentrations at site 20 than downstream at site 21; however, the reverse was true in January. Inflow from an unsampled drain to the south may affect the observations at site 21. The dissolved-solids concentrations in the Lower Borrow Pit subarea are lower than in the Rannells subarea and are comparable to subareas to the north.

The dissolved-solids concentrations are similar as are the discharges at the two sites (22 and 23, fig. 10) monitored in the South End subarea.

The Palo Verde subarea is drained by three major drains and several minor ones (fig. 11). The major drains and their monitoring stations are the Estes Drain, site 24; the Palo Verde Drain, sites 25 and 26; and the Hodges Drain, sites 27, 28, and 29. Considerable variation in the dissolved-solids concentrations was observed. The data from sites 25 and 26 indicate that dissolved-solids concentrations decreased from January to March, with higher concentrations at site 26. Although discharge data were not collected at site 26, increases in dissolved-solids concentration suggest that there was inflow between the sites. Data at sites 27 and 28 also indicate decreases in dissolved-solids concentration from January to March. The highest dissolved-solids concentrations in Palo Verde Valley were seen at sites 27, 28, and 29; the highest dissolved-solids concentration observed in the entire study, 3,530 mg/L, occurred at site 28 in January. The January high concentration at site 27 indicates that the factors affecting the drainage at sites 27 and 28 are similar. The tendency for concentrations to decrease from site 28 to 29, the site farthest south on Hodges Drain, may be due to dilution by inflow from South Hodges Drain.

Excess water in the canal system returns to the Colorado River at sites 17, 18, 19, 31, 32, and 33 (fig. 5). The specific conductance of water at those sites ranged from 1,050 to 1,250 μmho, much like that of diverted Colorado River water which ranged from 1,080 to 1,210 μmho during 1978 (U.S. Geological Survey records at 09429000, Palo Verde Canal near Blythe, Calif.). These data indicate that there is little change in the dissolved-solids concentration from the point of diversion to the point of application to crops in any subarea, substantiating the assumption of Bookman-Edmonston Engineering, Inc. (1976) that this was the case.

Tables 1, 2, and 3 compare the results of this investigation with those of Bookman-Edmonston Engineering, Inc. (1976). The dissolved-solids loads in tons per year and tons per year per acre were calculated in this study from instantaneous measurements of discharge and dissolved solids (or dissolved solids calculated from specific conductance). Bookman-Edmonston averaged available discharge data. The variation in calculation methods may be the major source of differences in computed dissolved-solids loads between the two studies, but cropping patterns, changes in irrigation practices, or changes in soil salinity since that study could also be important.

Results of both investigations show that the Palo Verde, Rannells, and West Side subareas are the top three contributors of dissolved solids to the Palo Verde Outfall Drain (table 2). The dissolved-solids loads obtained from this study are all lower than those from the earlier investigation.

Table 3 compares the four values of dissolved-solids concentrations obtained in this study with the single value obtained in the earlier study. Concentrations observed in this study were generally lower in the Central, Lower Barrow Pit, Palo Verde, South End, and West Side subareas, and higher in the East Side and Rannells subareas than found in the Bookman-Edmonston (1976) study. Lower dissolved-solids concentrations can account for some of the differences in annual load figures between the two studies shown in table 2, but most of the differences are probably due to lower discharge occurring during the 1977-78 study period than occurred during the Bookman-Edmonston (1976) study.

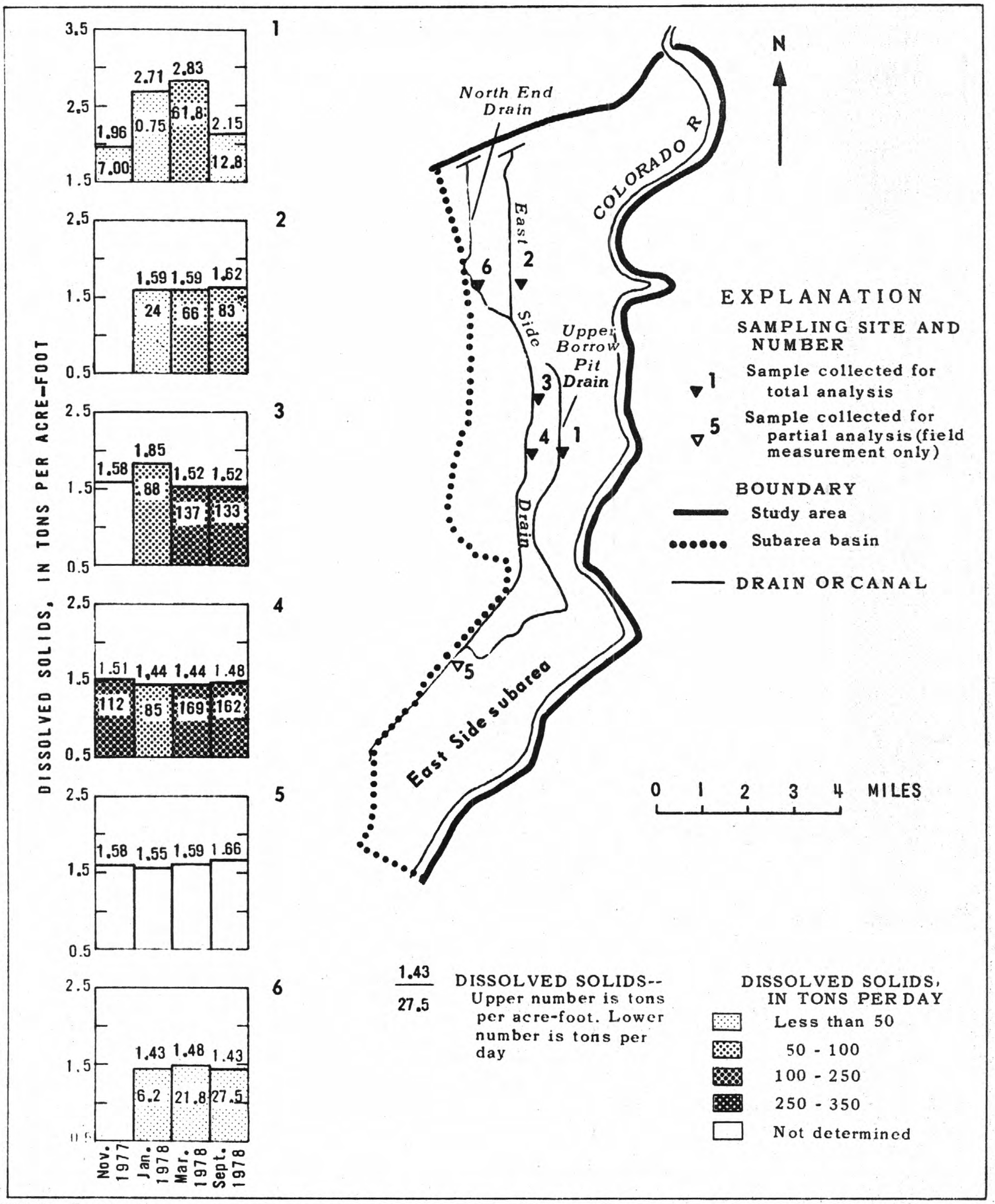

FIGURE 7.--Variations in dissolved-solids concentration and load with time at the indicated sampling sites on drains or canals in the East Side subarea, Palo Verde Valley.

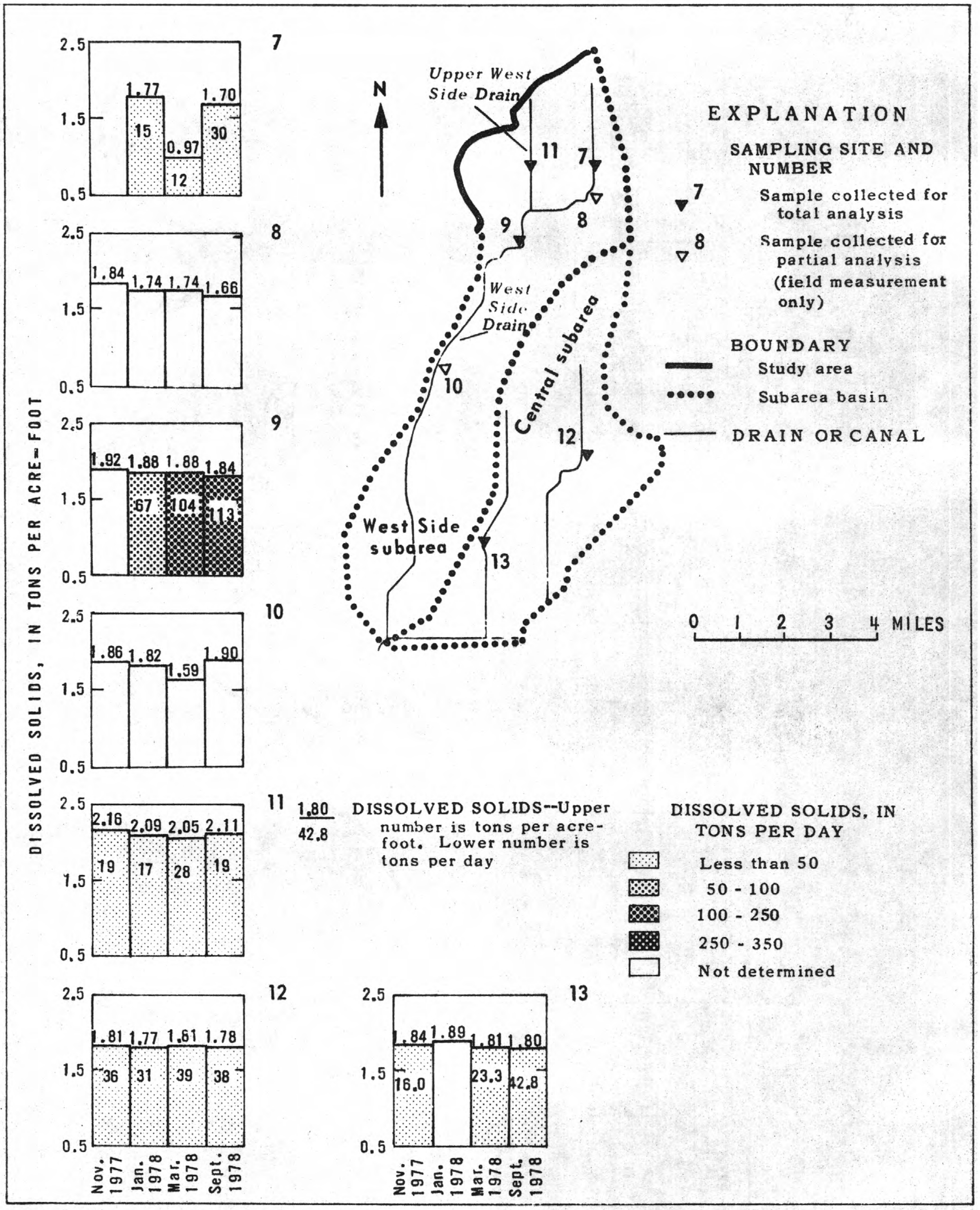

FIGURE 8.--Variations in dissolved-solids concentration and load with time at the indicated sampling sites on drains or canals in the West Side and Central subareas, Palo Verde Valley.

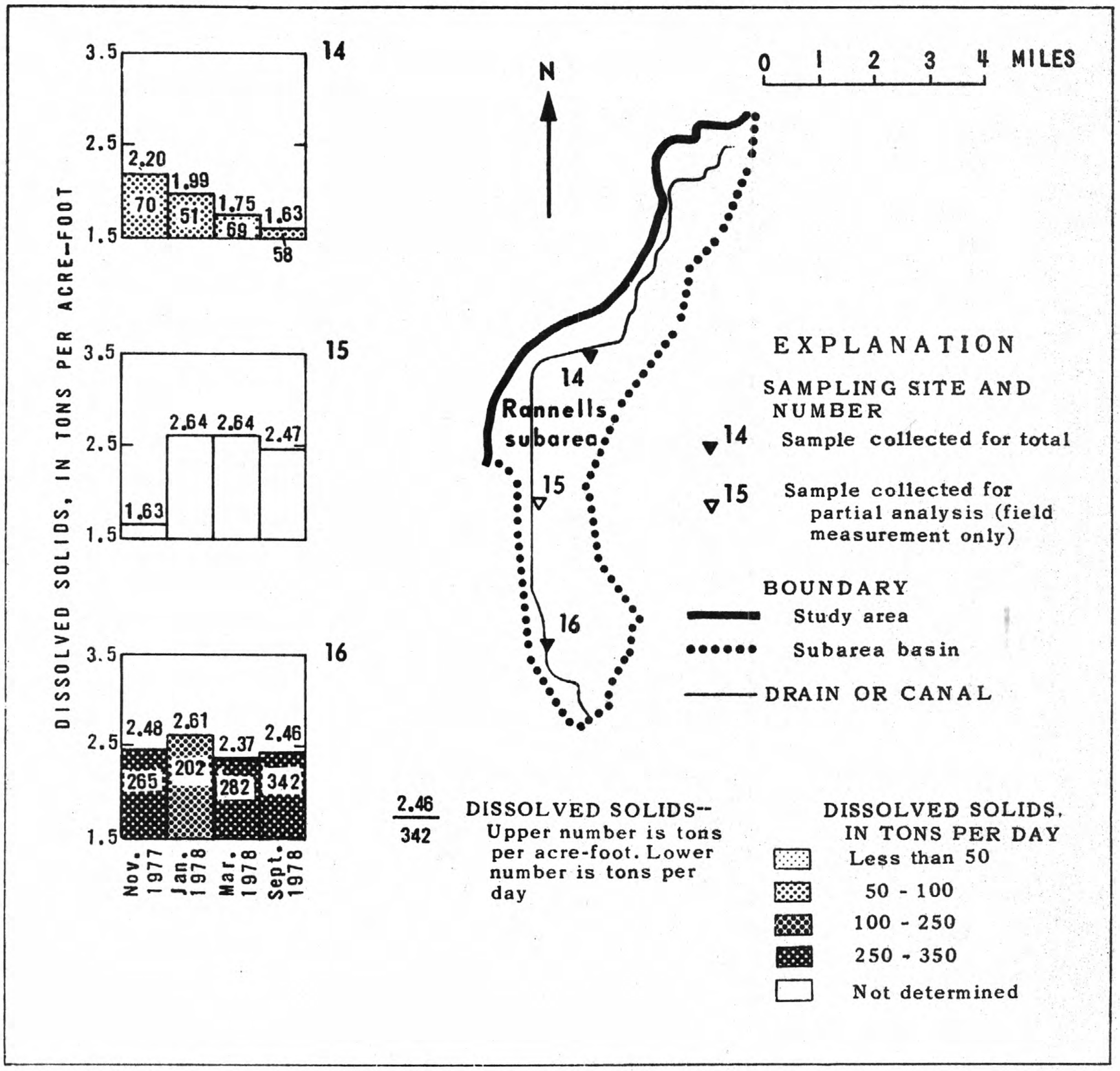

FIGURE 9.--Variations in dissolved-solids concentration and load with time at the indicated sampling sites on drains or canals in the Rannells subarea, Palo Verde Valley.

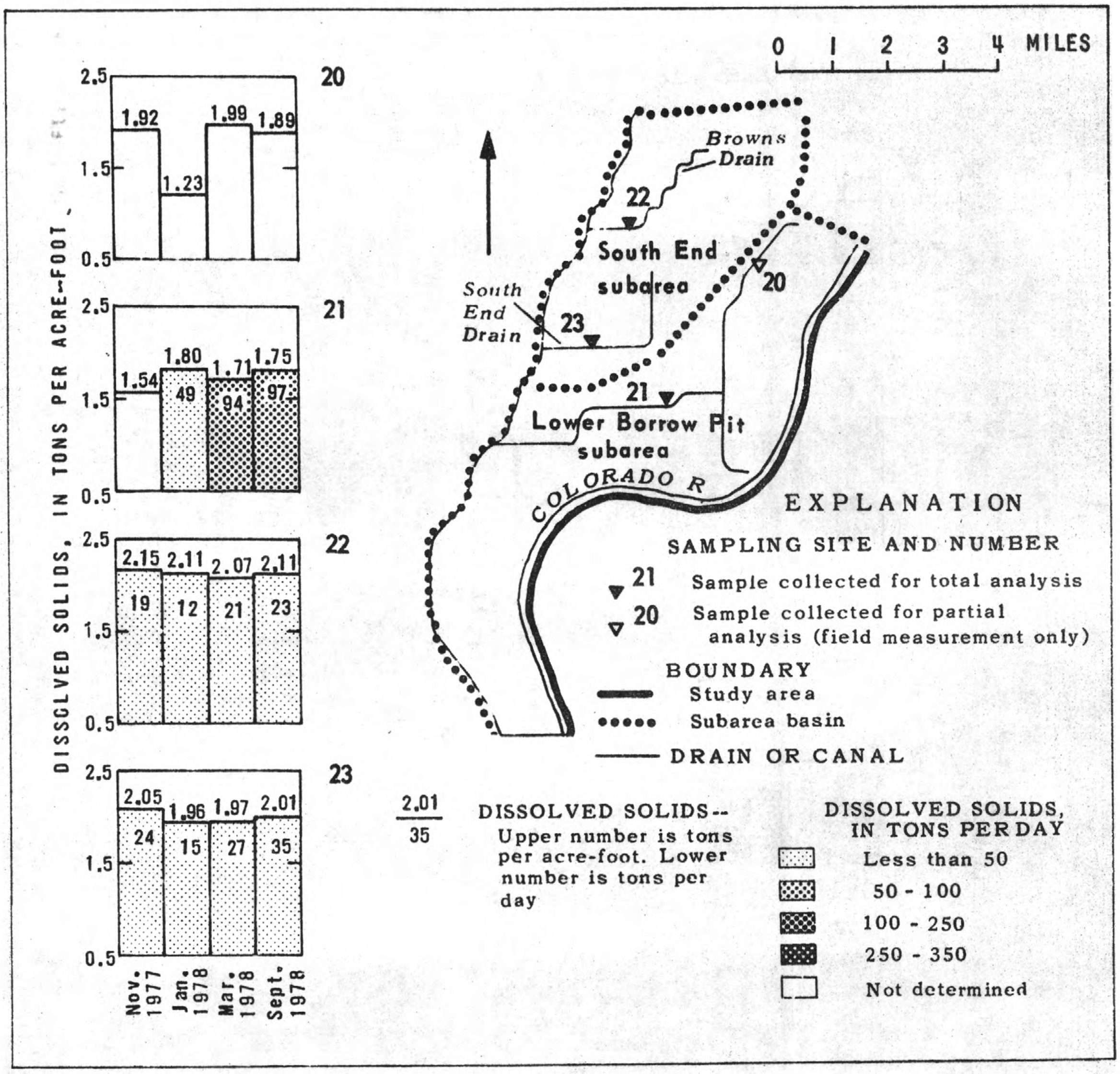

FIGURE 10.--Variations in dissolved-solids concentration and load with time at the indicated sampling sites on drains or canals in the Lower Borrow Pit and South End subareas, Palo Verde Valley.

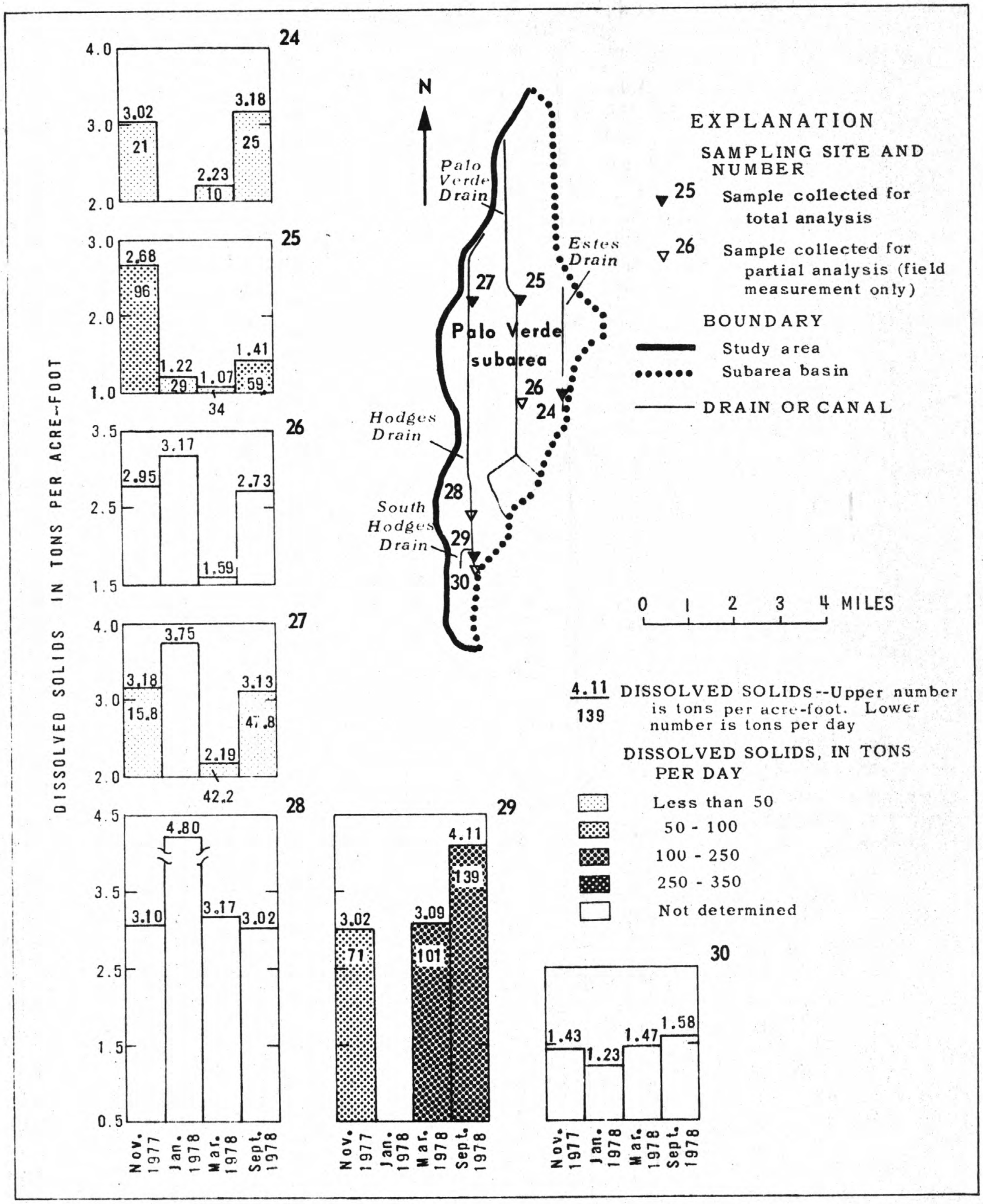

FIGURE 11.--Variations in dissolved-solids concentration and load with time at the indicated sampling sites on drains or canals in the Palo Verde subarea, Palo Verde Valley.

TABLE 1. - Ranking of subareas by decreasing quantities of dissolved solids discharged per acre

Bookman-Edmonston Engineering, Inc.	U.S. Geological Survey
Palo Verde	Rannells
Rannells	West Side
West Side	Palo Verde
Lower Borrow Pit	East Side
South End	Lower Borrow Pit
Central	South End
East Side	Central

TABLE 2. - Average annual discharge, dissolved-solids load, and dissolved-solids load per acre from each subarea--comparison of results of two studies

[Dissolved solids, residue on evaporation at 180°C]

Subarea	Site	Average annual drainage discharge (thousands of acre-ft)		Dissolved-solids load (thousands of ton/yr)		Dissolved-solids load [(ton/yr)/acre[1]]	
		B-E[1]	USGS[2]	B-E[3]	USGS[4]	B-E[5]	USGS[5]
East Side	5	77	62	115	98	3.5	2.9
Central	12,13	30	10	54	22	4.2	1.7
Lower Borrow Pit	21	32	17	65	28	4.2	1.8
Palo Verde	24,26,29	43	31	158	94	12.6	7.5
Rannells	16	51	37	125	100	12.4	9.9
South End	22,23	15	7.4	47	16	5.2	1.8
West Side	10	71	71	145	128	8.4	7.3

[1]B-E (Bookman-Edmonston Engineering, Inc.), 1976 data compilation and summary. Figures are derived from hydrosalinity balance sheets, figures 7-13, and accompanying data appendix A; hydrologic data and discharge data obtained from an average of Palo Verde Irrigation District measurements January 1970-74.

[2]Calculated from field measurements and estimates, and discharge data from Palo Verde Irrigation District. No original data at site 10 (West Side), so B-E value used.

[3]Values calculated from hydrosalinity balance sheets, figures 7-13 in B-E study.

[4]Averages of all estimates of instantaneous loads made at sites listed expressed as thousands of ton/year.

[5]Acreage for each subarea obtained from Palo Verde Irrigation District, and are actual irrigated acres, not the entire acreage of the subunit.

TABLE 3. - Comparison of concentrations of dissolved solids (residue on evaporation at 180°C) calculated by two studies

Subarea	Canal and site No.	Dissolved solids in return flow (ton/acre-ft)	
		B-E[1]	USGS[2]
East Side	East Side (5)	1.49	1.58, 1.55, 1.59, 1.66
Central	Central (13)	1.89	1.84, 1.89, 1.81, 1.80
	Lovekin (12)	1.76	1.81, 1.77, 1.81, 1.78
Lower Borrow Pit	Lower Borrow Pit (21)	2.03	1.54, 1.80, 1.71, 1.75
Palo Verde	Estes (24)	4.80	3.02, -- 2.23, 3.18
	Palo Verde (26)	3.27	2.95, 3.17, 1.59, 2.73
	Hodges (29)	4.08	3.02, -- 3.09, 4.11
Rannells	Rannells (16)	2.45	2.48, 2.61, 2.37, 2.46
South End	South End (23)	3.00	2.05, 1.96, 1.97, 2.01
	Browns (22)	2.22	2.15, 2.11, 2.07, 2.11
West Side	West Side (10)	2.04	1.86, 1.82, 1.59, 1.90

[1]B-E (Bookman-Edmonston Engineering, Inc., 1976).
[2]USGS (U.S. Geological Survey). The four values are for November 1977, January, March, and September 1978.

SUMMARY AND CONCLUSIONS

Forty sampling sites on irrigation-water drains in agricultural lands of southern California adjacent to the Colorado River were selected to describe dissolved-solids concentrations in return flows to the river. Three areas--the Fort Mojave area, Palo Verde Valley, and Bard Valley--were investigated, and changes in the quality of Colorado River water were evaluated. The greatest emphasis was on Palo Verde Valley.

The Fort Mojave area is in various stages of land and water management. Surface water is applied to crops only in the southern part of the area. Drainage water intercepted from tile-drain systems and field tailwater are diverted to a closed sump along the western perimeter of the valley.

Substantial chemical changes occur in the irrigation water in the Fort Mojave area from its point of diversion at the Colorado River to the point sampled at the tile-drain convergence points. The dissolved-solids concentration (sum of constituents) in the water diverted from the Colorado River averaged about 700 mg/L during the study period. The dissolved-solids concentration averaged about 2,500 mg/L at the tile-drain convergence point.

Two primary drains direct irrigation return flows away from Bard Valley to the Colorado River. During the study period dissolved-solids concentrations in the water in the two drains ranged from 953 to 1,290 mg/L. The annual mean concentrations in Colorado River water diverted into the valley ranged from 832 to 837 mg/L for the previous 3 years.

Palo Verde Valley contains about 92,000 acres of land used year round for crop production. A complex system of 295 mi of laterals and canals transmits the river water to its point of crop application, and 150 mi of drains intercept and return the spent irrigation water to the Colorado River. In general, leaching of soluble minerals from the soils occurs throughout the valley as shown by greater dissolved-solids (residue on evaporation at 180°C) loads being carried out of the valley in irrigation return than are diverted in from the river. Dissolved-solids returns to the Colorado River are usually greatest in the autumn and winter months.

Selected drains in Palo Verde Valley were sampled several times during the study period to determine dissolved-solids loads from specific areas. Variations were greatest, dissolved-solids concentrations were highest, and loads were largest in drainage water in the southern half of Palo Verde Valley. Water from many of the northern sampling sites was of relatively constant concentration and composition. Load variations were mostly attributable to discharge variations. The sampling sites on the Hodges Drain discharged the largest tonnage of dissolved solids from Palo Verde subarea. Larger volumes of return flows from the Rannells subarea, however, resulted in larger dissolved-solids loads (9.1 ton/acre) than from the more saline drainage in the Palo Verde subarea (6.5 ton/acre).

Data from both this study and a previous study by Bookman-Edmonston Engineering, Inc. (1976) indicate that the Palo Verde, Rannells, and West Side subareas are the top three contributors of dissolved solids, although the ranking differs between the two studies. Dissolved-solids loads from the subareas calculated in this study are generally lower than those calculated by the previous study. Differences may be due largely to differences in discharge of the sampled drains and differences in the method of computation between the two studies.

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SUPPLEMENTAL DATA

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SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

FORT MOJAVE AREA SITE 1, STATION IDENTIFICATION 345712114381001, FORT MOJAVE MAIN CANAL

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
14...	1500	12	1080	7.6	17.0	330	200	83
JAN , 1978								
26...	1030	--	1100	8.2	10.0	--	--	--
MAR								
23...	0715	12	1050	7.6	15.0	340	210	84
SEP								
11...	1630	35	1090	7.8	19.5	310	180	75

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
14...	30	100	39	2.4	7.2	130	300	92	.3
JAN , 1978									
26...	--	--	--	--	--	--	--	--	--
MAR									
23...	31	100	39	2.4	5.4	130	290	90	.3
SEP									
11...	29	110	43	2.7	5.2	130	290	90	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
14...	2.9	738	695	1.00	24.5	.14	160	40
JAN , 1978								
26...	--	--	--	--	--	--	--	--
MAR								
23...	7.9	692	711	.94	22.0	5.3	140	70
SEP								
11...	8.7	715	690	.94	69.1	.26	170	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

FORT MOJAVE AREA SITE 2, STATION IDENTIFICATION 345645114391101, FORT MOJAVE TILE DRAIN

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
14...	1600	.80	3800	7.1	21.2	1200	800	290
MAR , 1978								
23...	0830	--	3500	7.2	20.0	1200	810	290

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
14...	110	450	45	5.7	7.2	380	1000	500	.2
MAR , 1978									
23...	110	370	40	4.7	6.9	370	950	390	.4

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
14...	4.8	2790	2590	3.79	6.03	.01	180	4100
MAR , 1978								
23...	17	--	2360	3.21	--	.04	230	1700

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

FORT MOJAVE AREA SITE 3, STATION IDENTIFICATION 345813114401801, FORT MOJAVE SUMP PUMP

1978 WATER YEAR

DATE	TIME	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)
NOV , 1977							
15...	0800	1750	7.6	13.0	430	280	110
MAR , 1978							
23...	0740	1800	7.2	18.0	490	300	130

DATE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)
NOV , 1977									
15...	38	120	37	2.5	12	160	370	130	.2
MAR , 1978									
23...	39	210	48	4.2	13	180	380	270	.3

DATE	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)
NOV , 1977							
15...	.8	891	875	1.21	.01	190	70
MAR , 1978							
23...	1.9	1150	1160	1.56	.66	200	410

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

FORT MOJAVE AREA SITE 4, STATION IDENTIFICATION 345712114400801,
FORT MOJAVE SUMP, 1 MILE SOUTH OF PUMP

1978 WATER YEAR

DATE	TIME	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
JAN , 1978							
26...	1200	1250	7.4	8.0	350	200	100
MAR							
23...	0810	2890	7.2	17.0	820	570	200

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
JAN , 1978									
26...	25	130	43	3.0	15	160	280	16	.3
MAR									
23...	77	300	44	4.6	11	250	660	350	.4

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
JAN , 1978							
26...	2.1	813	812	1.11	1.3	210	20
MAR							
23...	6.8	1730	1760	2.35	.36	190	320

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

BARD VALLEY SITE 1, STATION IDENTIFICATION 324444114414001,
ARAZ DRAIN NEAR ARAZ, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
09...	1100	1.0	1400	8.1	16.0	390	220	100
JAN , 1978								
30...	1510	2.3	1550	7.7	18.5	410	230	100
MAR								
14...	1420	1.0	1620	8.5	28.0	440	260	110
SEP								
15...	1620	--	1400	7.8	35.5	360	200	87

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
09...	34	170	48	3.7	4.7	170	380	150	.2
JAN , 1978									
30...	38	190	50	4.1	4.9	170	410	170	.3
MAR									
14...	40	190	48	3.9	5.5	180	410	160	.4
SEP									
15...	34	210	56	4.8	4.8	160	390	160	.4

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
09...	9.8	1010	953	1.37	2.73	.01	180	40
JAN , 1978								
30...	22	1060	1040	1.44	6.58	.19	200	30
MAR								
14...	20	1040	1040	1.41	2.81	.16	220	20
SEP								
15...	23	1040	1010	1.37	--	.16	260	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

BARD VALLEY SITE 2, STATION IDENTIFICATION 324656114360401,
RESERVATION MAIN DRAIN AT ROSS AVE. NEAR WINTERHAVEN, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
09...	1300	25	2000	8.1	19.5	600	370	160
JAN , 1978								
30...	1405	28	1900	7.4	20.5	540	320	140
MAR								
14...	1340	25	1900	7.4	26.0	580	350	150
SEP								
15...	1545	30	1800	7.5	33.0	530	380	140

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
09...	48	200	42	3.6	5.9	230	470	220	.2
JAN , 1978									
30...	46	210	46	3.9	6.0	220	470	220	.4
MAR									
14...	49	220	45	4.0	6.6	220	490	220	.5
SEP									
15...	44	200	45	3.8	5.5	150	480	220	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
09...	8.8	1320	1250	1.80	89.1	.04	250	90
JAN , 1978								
30...	21	1560	1250	2.12	119	.25	250	10
MAR								
14...	20	1310	1290	1.78	88.4	.24	260	20
SEP								
15...	16	--	1200	--	--	.34	270	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 1, STATION IDENTIFICATION 333625114330301,
BORROW PIT DRAIN AT HIGHWAY 10 NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
16...	1200	1.8	2200	7.3	17.0	650	370	170
JAN , 1978								
24...	1110	.14	3000	7.4	12.0	840	550	220
MAR								
21...	1440	11	3400	7.2	22.0	850	590	230
SEP								
13...	0852	3.0	2300	7.2	21.5	700	410	190

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
16...	55	230	43	3.9	6.3	280	430	290	.1
JAN , 1978									
24...	71	350	47	5.3	7.6	290	580	500	.4
MAR									
21...	68	380	49	5.7	8.7	260	580	660	.4
SEP									
13...	55	240	42	3.9	5.6	290	510	310	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
16...	5.0	1440	1350	1.96	7.00	.02	230	50
JAN , 1978								
24...	18	1990	1920	2.71	.75	.18	310	10
MAR								
21...	19	2080	2100	2.83	61.8	.08	370	50
SEP								
13...	21	1580	1486	2.15	12.8	.86	250	--

SUPPLEMENTAL DATA

HEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 2, STATION IDENTIFICATION 333942114334401,
EAST SIDE DRAIN AT 6TH AVE. NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
JAN , 1978								
24...	0745	7.6	1575	7.3	14.5	560	310	150
MAR								
22...	0955	21	1725	7.7	19.5	590	340	150
SEP								
12...	1440	26	1700	7.6	25.0	500	250	130

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
JAN , 1978									
24...	46	170	39	3.1	5.7	250	450	170	.3
MAR									
22...	52	180	40	3.2	6.5	250	440	150	.4
SEP									
12...	43	190	45	3.7	5.5	250	450	160	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
JAN , 1978								
24...	18	1170	1170	1.59	24.2	.43	190	20
MAR								
22...	15	1170	1230	1.59	66.3	19	200	1000
SEP								
12...	19	1190	1129	1.62	83.5	.54	220	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 3, STATION IDENTIFICATION 333754114332701,
EAST SIDE DRAIN AT 10TH AVE. NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
16...	0900	--	1700	7.3	16.5	560	310	150
JAN , 1978								
24...	0925	24	1500	7.6	7.0	650	340	170
MAR								
21...	1515	45	1650	7.5	23.0	530	290	140
SEP								
13...	0815	44	1600	7.1	23.0	490	260	130

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
16...	44	160	38	3.0	5.9	250	420	150	.3
JAN , 1978									
24...	55	210	41	3.6	13	310	470	200	.4
MAR									
21...	43	170	41	3.2	6.0	240	420	150	.4
SEP									
13...	40	180	44	3.5	5.3	230	440	150	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
16...	9.1	1160	1090	1.58	--	.16	210	50
JAN , 1978								
24...	15	1360	1320	1.85	88.1	.07	270	120
MAR								
21...	15	1120	1090	1.52	137	.66	200	30
SEP								
13...	19	1120	1084	1.52	133	.63	200	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 4, STATION IDENTIFICATION 333625114334501,
EAST SIDE DRAIN AT HIGHWAY 10 NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
16...	1115	37	1600	7.4	19.0	520	280	140
JAN , 1978								
24...	1120	30	1625	7.5	15.0	510	280	140
MAR								
21...	1450	59	1590	7.4	24.5	520	280	130
SEP								
13...	0835	55	1600	7.3	23.0	460	290	120

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
16...	41	160	40	3.1	6.0	240	390	150	.2
JAN , 1978									
24...	39	150	39	2.9	5.2	230	390	160	.4
MAR									
21...	47	160	40	3.1	5.6	240	390	150	.3
SEP									
13...	39	170	44	3.4	5.2	170	400	150	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
16...	6.7	1110	1040	1.51	112	.06	200	30
JAN , 1978								
24...	19	1060	1040	1.44	85.9	.53	190	0
MAR								
21...	16	1060	1040	1.44	169	.16	190	0
SEP								
13...	19	1090	1023	1.48	162	.50	210	--

ɪEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 6, STATION IDENTIFICATION 333942114344701,
NORTH END DRAIN AT 6TH AVE. NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
JAN , 1978								
24...	0912	2.2	1180	7.5	13.0	500	280	130
MAR								
22...	0940	7.4	1600	7.3	21.0	550	320	140
SEP								
12...	1500	9.7	1530	7.5	26.0	490	280	130

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
JAN , 1978									
24...	42	150	39	2.9	5.7	210	410	140	.3
MAR									
22...	49	160	38	3.0	6.3	230	410	140	.5
SEP									
12...	40	150	40	3.0	6.0	210	520	130	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
JAN , 1978								
24...	13	1050	1020	1.43	6.24	.13	190	20
MAR								
22...	15	1090	1110	1.48	21.8	12	190	530
SEP								
12...	16	1050	1103	1.43	27.5	.32	210	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 7, STATION IDENTIFICATION 333942114353601,
WEST SIDE DRAIN AT 6TH AVE. NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
JAN , 1978								
24...	0930	4.3	1850	7.6	16.0	570	310	140
MAR								
22...	0920	6.4	1200	7.8	18.5	350	220	88
SEP								
12...	1530	9.0	1800	7.6	28.0	500	260	120

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
JAN , 1978									
24...	53	210	44	3.8	4.8	260	500	180	.3
MAR									
22...	32	110	40	2.6	5.5	130	290	89	.4
SEP									
12...	49	220	49	4.3	4.8	240	480	170	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
JAN , 1978								
24...	18	1300	1260	1.77	15.1	.08	250	10
MAR								
22...	8.0	714	808	.97	12.3	24	140	240
SEP								
12...	23	1250	1188	1.70	30.4	.26	260	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 9, STATION IDENTIFICATION 333755114372301,
WEST SIDE DRAIN AT 10TH AND DEFRAIN AVE., BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
16...	0945	--	2000	7.3	18.0	630	360	160
JAN , 1978								
24...	1040	18	1975	7.6	15.0	640	370	160
MAR								
22...	0720	28	2000	7.3	20.3	640	360	150
SEP								
13...	0715	31	1950	7.1	23.0	580	320	150

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
16...	56	220	43	3.8	5.9	270	530	190	.1
JAN , 1978									
24...	58	210	41	3.6	5.1	270	540	200	.4
MAR									
22...	65	210	41	3.6	5.8	280	530	190	.3
SEP									
13...	51	210	44	3.8	5.2	260	530	180	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
16...	8.8	1410	1330	1.92	--	.03	260	30
JAN , 1978								
24...	21	1380	1360	1.88	67.1	.29	250	0
MAR								
22...	18	1380	1340	1.88	104	.39	260	30
SEP								
13...	20	1350	1163	1.84	113	.30	290	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 11, STATION IDENTIFICATION 333940114370801,
UPPER WEST SIDE DRAIN AT 6TH AVE. NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
16...	0800	4.5	2150	7.1	17.5	730	410	180
JAN , 1978								
24...	0945	4.3	2100	7.6	15.0	700	380	170
MAR								
22...	0905	7.0	2050	7.3	21.0	730	410	170
SEP								
12...	1600	4.7	2200	7.4	28.0	680	380	170

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
16...	68	230	40	3.7	6.9	320	590	190	.2
JAN , 1978									
24...	67	230	41	3.8	5.9	320	590	210	.5
MAR									
22...	73	230	41	3.7	6.4	310	610	200	.5
SEP									
12...	62	230	42	3.8	6.0	300	590	200	.4

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
16...	11	1590	1470	2.16	19.5	.17	290	100
JAN , 1978								
24...	23	1540	1490	2.09	17.9	.43	290	20
MAR								
22...	19	1510	1550	2.05	28.5	13	290	800
SEP								
12...	23	1550	1439	2.11	19.7	.29	320	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 12, STATION IDENTIFICATION 333426114355801,
LOVEKIN DRAIN AT 18TH NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
16...	1445	10	2000	7.2	25.5	540	240	140
JAN , 1978								
24...	1250	9.1	2000	7.5	22.0	510	200	140
MAR								
21...	1405	11	2100	7.5	28.0	560	240	140
SEP								
13...	0945	11	2000	7.3	24.0	520	270	140

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
16...	45	250	50	4.7	7.0	300	410	240	.2
JAN , 1978									
24...	40	240	50	4.6	7.0	310	360	270	.5
MAR									
21...	51	250	49	4.6	6.8	320	440	240	.4
SEP									
13...	41	230	49	4.4	5.6	250	410	240	.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
16...	11	1330	1280	1.81	36.6	.03	320	70
JAN , 1978								
24...	26	1300	1270	1.77	31.9	.23	350	10
MAR								
21...	20	1330	1340	1.81	39.5	.29	330	30
SEP								
13...	22	1310	1242	1.78	38.9	1.5	310	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 13, STATION IDENTIFICATION 333241114381901, CENTRAL DRAIN AT 22ND AVE. NEAR RIPLEY, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (MICRO-MHOS)	PH (UNITS)	TEMPERATURE (DEG C)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)
NOV , 1977								
16...	1550	4.4	1900	7.4	20.0	610	340	160
JAN , 1978								
24...	1415	--	1980	7.9	11.0	610	360	160
MAR								
21...	1210	6.5	2000	8.1	23.0	610	340	160
SEP								
13...	1015	12	1900	7.1	23.0	600	330	160

DATE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)
NOV , 1977									
16...	51	200	41	3.5	6.2	270	480	180	.2
JAN , 1978									
24...	52	220	43	3.9	7.9	250	530	210	.5
MAR									
21...	52	210	42	3.7	8.5	270	500	180	.4
SEP									
13...	48	190	41	3.4	5.9	270	500	180	.3

DATE	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)
NOV , 1977								
16...	5.7	1350	1250	1.84	16.0	.18	260	60
JAN , 1978								
24...	15	1390	1350	1.89	--	.17	270	10
MAR								
21...	18	1330	1290	1.81	23.3	.22	250	50
SEP								
13...	20	1320	1248	1.80	42.8	1.6	260	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 14, STATION IDENTIFICATION 333443114412601, RANNELLS DRAIN AT KEIM NEAR BLYTHE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
16...	1340	16	2350	7.4	23.0	570	340	150
JAN , 1978								
24...	1225	13	2100	7.9	18.5	420	170	100
MAR								
21...	1245	20	2000	7.6	26.0	440	210	100
SEP								
13...	1115	18	1800	7.2	25.0	390	180	93

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
16...	48	320	54	5.8	10	230	640	240	.4
JAN , 1978									
24...	42	340	63	7.2	6.0	250	540	280	1.4
MAR									
21...	46	270	57	5.6	6.9	230	470	210	1.1
SEP									
13...	39	260	59	5.7	5.8	210	450	190	.8

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
16...	4.6	1620	1550	2.20	70.4	.12	490	40
JAN , 1978								
24...	21	1460	1490	1.99	51.2	.49	450	10
MAR								
21...	16	1290	1260	1.75	69.7	.19	380	60
SEP								
13...	16	1200	1165	1.63	58.3	.17	340	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 16, STATION IDENTIFICATION 333025114421401, RANNELLS DRAIN AT 28TH AVE. NEAR RIPLEY, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (MICRO-MHOS)	PH (UNITS)	TEMPERATURE (DEG C)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)
NOV , 1977								
17...	0840	54	2800	7.3	19.0	440	200	120
JAN , 1978								
24...	1445	39	3000	7.7	20.0	360	130	95
MAR								
21...	1035	60	2700	8.1	24.0	410	180	110
SEP								
13...	1050	70	2800	7.4	24.5	410	170	110

DATE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)
NOV , 1977									
17...	34	470	69	9.8	8.5	240	620	370	1.0
JAN , 1978									
24...	31	510	75	12	8.5	240	660	410	2.3
MAR									
21...	32	450	70	9.7	8.5	230	600	370	2.1
SEP									
13...	33	460	70	9.9	7.6	240	650	380	2.1

DATE	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)
NOV , 1977								
17...	11	1820	1780	2.48	265	.15	800	50
JAN , 1978								
24...	26	1920	1890	2.61	202	.66	920	0
MAR								
21...	19	1740	1730	2.37	282	.55	780	40
SEP								
13...	22	1810	1787	2.46	342	.65	830	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 21, STATION IDENTIFICATION 332620114395001,
LOWER BORROW PIT DRAIN AT C CANAL, PALO VERDE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
18...	1030	--	1650	7.2	18.0	540	310	140
JAN , 1978								
25...	0830	14	1925	7.5	15.0	630	350	170
MAR								
21...	0750	27	1880	7.5	20.5	600	330	160
SEP								
14...	1045	28	1900	7.3	24.0	550	320	140

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
18...	46	180	42	3.4	6.6	230	400	160	.2
JAN , 1978									
25...	51	190	39	3.3	5.2	290	450	230	.2
MAR									
21...	48	190	41	3.4	5.8	270	440	190	.3
SEP									
14...	48	210	45	3.9	5.0	230	450	200	.2

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
18...	5.4	1130	1080	1.54	--	.08	190	100
JAN , 1978								
25...	21	1320	1290	1.80	49.9	.41	200	10
MAR								
21...	17	1260	1210	1.71	94.9	.15	200	50
SEP								
14...	21	1290	1192	1.75	97.5	.42	220	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 22, STATION IDENTIFICATION 332906114402101,
BROWNS DRAIN AT STEPHENSON AVE., PALO VERDE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
17...	1130	4.6	2250	7.2	19.5	610	320	150
JAN , 1978								
24...	1540	3.0	2140	7.6	18.5	610	320	150
MAR								
21...	1100	5.2	2390	7.8	23.0	640	350	150
SEP								
13...	1345	5.7	2250	7.3	26.0	610	330	150

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
17...	58	300	51	5.3	5.9	300	550	260	.1
JAN , 1978									
24...	58	290	50	5.1	5.6	300	540	270	.4
MAR									
21...	65	300	50	5.2	5.9	300	600	250	.4
SEP									
13...	56	290	51	5.1	4.8	280	570	260	.4

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
17...	4.7	1580	1510	2.15	19.6	.03	320	40
JAN , 1978								
24...	23	1550	1520	2.11	12.6	.28	310	20
MAR								
21...	19	1520	1570	2.07	21.3	.19	310	30
SEP								
13...	22	1550	1499	2.11	23.9	.30	300	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 23, STATION IDENTIFICATION 332701144115O1,
SOUTH END DRAIN AT KEIM BLVD. NEAR PALO VERDE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
17...	1500	5.9	2200	7.3	20.0	560	260	140
JAN , 1978								
25...	0935	4.0	2650	7.2	16.5	560	260	140
MAR								
21...	0810	7.0	2225	8.0	21.0	590	290	140
SEP								
14...	1015	8.9	2200	7.3	24.0	560	270	140

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
17...	50	280	52	5.2	5.2	300	510	240	.2
JAN , 1978									
25...	50	290	53	5.4	4.8	300	500	250	.4
MAR									
21...	58	290	51	5.2	5.3	300	530	240	.4
SEP									
14...	50	300	54	5.5	4.2	290	540	260	.4

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
17...	9.5	1510	1410	2.05	24.1	.11	320	50
JAN , 1978								
25...	22	1440	1440	1.96	15.6	.47	310	10
MAR								
21...	18	1450	1460	1.97	27.4	.10	310	40
SEP								
14...	21	1480	1469	2.01	35.6	.62	310	--

SUPPLEMENTAL DATA

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 24, STATION IDENTIFICATION 332734114422801,
ESTES DRAIN AT C 03 10 4 CANAL NEAR PALO VERDE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
17...	1530	3.5	3400	7.9	18.5	330	0	83
MAR , 1978								
21...	0840	2.3	2550	7.9	18.0	390	120	100
SEP								
13...	1445	4.0	3600	7.8	26.0	320	0	82

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
17...	29	630	80	15	6.9	340	820	380	2.0
MAR , 1978									
21...	35	410	69	9.0	9.4	270	660	220	3.6
SEP									
13...	28	680	82	17	6.7	340	860	430	6.0

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
17...	8.3	2220	2170	3.02	21.0	.20	1100	120
MAR , 1978								
21...	14	1640	1620	2.23	10.2	2.0	760	90
SEP								
13...	21	2340	2297	3.18	25.3	.53	1300	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 25, STATION IDENTIFICATION 332935114433701,
PALO VERDE DRAIN AT 30TH AVE., PALO VERDE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
17...	1055	18	3100	7.4	20.0	400	160	120
JAN , 1978								
24...	1515	12	1340	7.9	13.5	360	210	91
MAR								
21...	1020	16	1225	8.1	20.0	330	190	80
SEP								
13...	1300	21	1600	7.8	26.0	350	200	92

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
17...	25	530	74	12	8.9	240	660	450	1.6
JAN , 1978									
24...	32	150	47	3.4	5.5	150	350	140	.7
MAR									
21...	31	130	46	3.1	5.6	140	320	110	.7
SEP									
13...	29	220	57	5.1	5.3	150	400	190	1.3

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
17...	12	1970	1950	2.68	96.8	.13	930	90
JAN , 1978								
24...	9.7	894	869	1.22	29.0	.20	220	0
MAR								
21...	8.8	790	771	1.07	34.1	.16	190	30
SEP								
13...	13	1040	1028	1.41	59.0	.27	340	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 27, STATION IDENTIFICATION 332928114443101,
HODGES DRAIN AT 30TH AVE. NEAR PALO VERDE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
17...	0940	2.5	3700	7.2	21.0	450	260	130
JAN , 1978								
24...	1500	--	5000	7.4	18.5	470	290	140
MAR								
21...	0905	9.7	2600	7.7	23.0	390	220	110
SEP								
13...	1315	7.7	4000	7.5	27.0	440	280	130

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
17...	30	650	75	13	11	190	590	720	1.4
JAN , 1978									
24...	29	810	79	16	11	180	650	990	4.1
MAR									
21...	29	420	69	9.2	8.4	170	510	440	2.3
SEP									
13...	28	660	76	14	10	160	590	810	4.7

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
17...	8.8	2340	2260	3.18	15.8	.30	1200	100
JAN , 1978								
24...	30	2760	2780	3.75	--	.53	1500	0
MAR								
21...	17	1610	1640	2.19	42.2	.82	720	40
SEP								
13...	26	2300	2329	3.13	47.8	.63	1300	--

CHEMICAL ANALYSES OF WATER SAMPLES FROM THE FORT MOJAVE, PALO VERDE VALLEY, AND BARD VALLEY AREAS

PALO VERDE VALLEY SITE 29, STATION IDENTIFICATION 332436114481801,
HODGES DRAIN BELOW SOUTH HODGES DRAIN, PALO VERDE, CALIF.

1978 WATER YEAR

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
NOV , 1977								
17...	1345	12	3500	7.4	19.0	470	280	130
MAR , 1978								
20...	1620	16	3800	8.0	23.0	440	240	120
SEP								
14...	0855	17	4900	7.4	24.0	490	260	140

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
NOV , 1977									
17...	36	560	72	11	10	200	660	610	2.0
MAR , 1978									
20...	35	660	76	14	10	210	730	700	3.0
SEP									
14...	35	850	78	17	12	230	790	980	5.0

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)
NOV , 1977								
17...	15	2220	2150	3.02	71.9	.63	1200	30
MAR , 1978								
20...	18	2270	2400	3.09	101	.51	1300	30
SEP								
14...	26	3020	2951	4.11	139	.75	1900	--

SUPPLEMENTAL DATA

FIELD MEASUREMENTS OF SPECIFIC CONDUCTANCE

Site	Date	Specific conductance (micromhos)
Palo Verde Valley site 5 East Side at 22nd St.	11-16-77	1,680
	1-24-78	1,650
	3-21-78	1,700
	9-13-78	1,800
Palo Verde Valley site 8 West Side at 8th St.	11-16-77	2,000
	1-24-78	1,880
	3-22-78	1,880
	9-12-78	1,800
Palo Verde Valley site 10 West Side at 14th St.	11-16-77	2,050
	1-24-78	2,000
	3-21-78	1,700
	9-13-78	2,100
Palo Verde Valley site 15 Rannells at 22nd St.	11-17-77	1,750
	1-24-78	3,000
	3-21-78	3,000
	9-13-78	2,800
Palo Verde Valley site 17 F Spill	11-18-77	1,100
	1-24-78	1,100
	3-21-78	1,050
	9-14-78	1,100
Palo Verde Valley site 18 D-10-11-2 Spill	11-18-77	1,100
	1-25-78	1,150
	3-21-78	1,150
	9-14-78	1,100
Palo Verde Valley site 19 D-10-11-5 Spill	11-18-77	1,120
	1-25-78	1,200
	3-21-78	1,180
	9-14-78	1,100
Palo Verde Valley site 20 Lower Borrow Pit at Arrowhead	11-17-77	2,100
	1-25-78	1,250
	3-21-78	2,190
	9-13-78	2,080
Palo Verde Valley site 26 Palo Verde at 35th St.	11-17-77	3,500
	1-25-78	3,800
	3-21-78	1,700
	9-14-78	3,200

SUPPLEMENTAL DATA

FIELD MEASUREMENTS OF SPECIFIC CONDUCTANCE

Site	Date	Specific conductance (micromhos)
Palo Verde Valley site 28	11-17-77	3,700
	1-25-78	6,000
	3-20-78	3,800
	9-14-78	3,600
Palo Verde Valley site 30	11-17-77	1,500
CO-3 at Palo Verde	1-25-78	1,250
Irrigation District gage	3-20-78	1,550
	9-14-78	1,700
Palo Verde Valley site 31	11-18-77	1,150
D-23-1 Spill	1-25-78	1,250
	3-21-78	1,200
	9-14-78	1,100
Palo Verde Valley site 32	11-18-77	1,100
D-23-1 at Taylor's ferry	1-25-78	1,125
	3-21-78	1,080
	9-14-78	1,100
Palo Verde Valley site 33	11-18-77	1,100
C Spill near county line	1-25-78	1,125
	3-21-78	1,090
	9-14-78	1,100
Bard Valley site 3	--	--
Reservation Main Drain	--	--
at Avenue A	--	--
	9-15-78	1,450