Quality of Water and Chemistry of Bottom Sediment in the Rillito Creek Basin, Tucson, Arizona, 1986–92

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CONVERSION FACTORS

Multiply inch-pound unit	By	To obtain metric unit
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
cubic feet per second (ft^3/s)	0.0283	cubic meter per second
gallon per minute (gal/min)	0.06309	liter per second
foot per year (ft/yr)	0.3048	meter per year
acre-foot (acre-ft)	0.001233	cubic hectometer

In this report, degrees are reported in Celsius (°C), which can be converted to degrees Fahrenheit (°F) by the following equation:

$$°F = 1.8(°C)+32$$

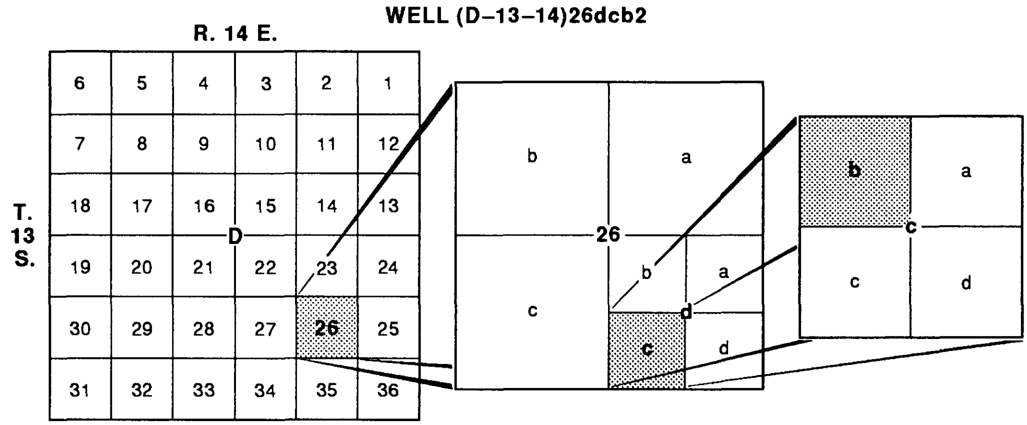
ABBREVIATED UNITS FOR WATER QUALITY AND BOTTOM-SEDIMENT CHEMISTRY

Chemical concentration and water temperature are given only in metric units. Chemical concentration in water is given in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is a unit expressing the solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to 1 milligram per liter. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million. Specific conductance is given in microsiemens per centimeter (µS/cm) at 25°C. Radioactivity is expressed in picocuries per liter (pCi/L) or picocuries per gram (pCi/g), which is the amount of radioactive decay producing 2.2 disintegrations per minute in a unit volume (liter) of water or volume (gram) of sediment. Chemical concentration in bottom sediment is given in grams per kilogram (g/kg), micrograms per gram (µg/g), milligrams per kilogram (mg/kg), or micrograms per kilogram (µg/kg). Grams per kilogram is equal to parts per thousand (ppt). Milligrams per kilogram and micrograms per gram are equal to parts per million (ppm). Micrograms per kilogram is equal to parts per billion (ppb).

VERTICAL DATUM

Sea Level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called *Sea Level Datum of 1929*.

WELL-NUMBERING AND NAMING SYSTEM



Quadrant D, Township 13 South, Range 14 East, section 26, quarter section d, quarter section c, quarter section b, second well inventoried in 10-acre tract

The well numbers used by the U.S. Geological Survey in Arizona are in accordance with the Bureau of Land Management's system of land subdivision. The land survey in Arizona is based on the Gila and Salt River meridian and base line, which divide the state into four quadrants and are designated by capital letters A, B, C, and D in a counterclockwise direction, beginning in the northeast quarter. The first digit of a well number indicates the township, the second the range, and the third the section in which the well is situated. The lowercase letters a, b, c, and d after the section number indicate the well location within the section. The first letter denotes a particular 160-acre tract, the second the 40-acre tract and the third the 10-acre tract. These letters also are assigned in a counterclockwise direction, beginning in the northeast quarter. If the location is known within the 10-acre tract, three lowercase letters are shown in the well number. Where more than one well is within a 10-acre tract, consecutive numbers beginning with 1 are added as suffixes. In the example shown, well number (D–13–14)26dcb2 designates the well as being in the NW1/4, SW1/4, SE1/4, section 26, Township 13 South, and Range 14 East.

Quality of Water and Chemistry of Bottom Sediment in the Rillito Creek Basin, Tucson, Arizona, 1986–92

By Saeid Tadayon *and* Christopher F. Smith

Abstract

Controlled artificial recharge of surface runoff is being considered as a water-management technique to address the problem of ground-water overdraft in Rillito Creek basin, Arizona. Surface-water, ground-water, and bottom-sediment data were collected from August 25, 1986, through March 13, 1992, to provide information that would be needed to plan and manage artificial recharge operations.

Suspended-sediment concentrations in streams generally increased with increases in streamflow and were highest during the summer. The surface water is a calcium and bicarbonate type, and the ground water is a calcium, sodium, and bicarbonate type. Total recoverable trace elements in surface water that exceeded the State of Arizona maximum contaminant levels for drinking water were barium, cadmium, chromium, lead, and mercury. None of the dissolved trace elements in surface water exceeded the drinking-water standards. The median values for dissolved activities of gross beta as strontium-90/yttrium-90 and dissolved gross beta as cesium-137 were lower in ground water than in surface water. Comparisons of trace-element concentrations in bottom sediment with those reported for soils of the western conterminous United States generally indicate similar concentrations for most of the trace elements, with the exceptions of scandium and tin. The maximum concentrations of total nitrite plus nitrate as nitrogen in three ground-water samples exceeded U.S. Environmental Protection Agency maximum contaminant levels for drinking water. Seven organochlorine pesticides were detected in surface-water samples and ten were detected in bottom-sediment samples. Three priority pollutants were detected in surface water, two were detected in ground water, and eleven were detected in bottom sediment. Low concentrations of oil and grease were detected in 7 of 25 surface-water samples.

INTRODUCTION

Controlled artificial recharge of surface runoff is being considered as a water-management technique to address the problem of ground-water overdraft. The U.S. Bureau of Reclamation High Plains States Groundwater Demonstration Program suggested the Rillito Creek in Tucson, Arizona, as a site to study the feasibility of using stormwater runoff for artificial recharge. The Pima County Department of Transportation and Flood Control District (PCFCD) in cooperation with the U.S. Bureau of Reclamation is developing plans for the implementation of a proposed ground-water recharge project in a 1-mile reach of the Rillito Creek between Craycroft Road and Swan Road in the north-central part of Tucson (fig. 1). The proposed ground-water recharge project in Rillito Creek will utilize runoff for infiltration and recharge purposes within the channel and excavated overbank areas. This proposed recharge would be accomplished by water spreading and detention using an inflatable dam.

In urban areas, the use of recharge facilities has caused concern about the quality of urban runoff and the potential for ground-water contamination. Runoff from developed areas is exposed to a broad range of contaminant sources, and the presence of particular contaminants may depend on the type of land use. Little is known of the chemical quality of runoff from a southwestern

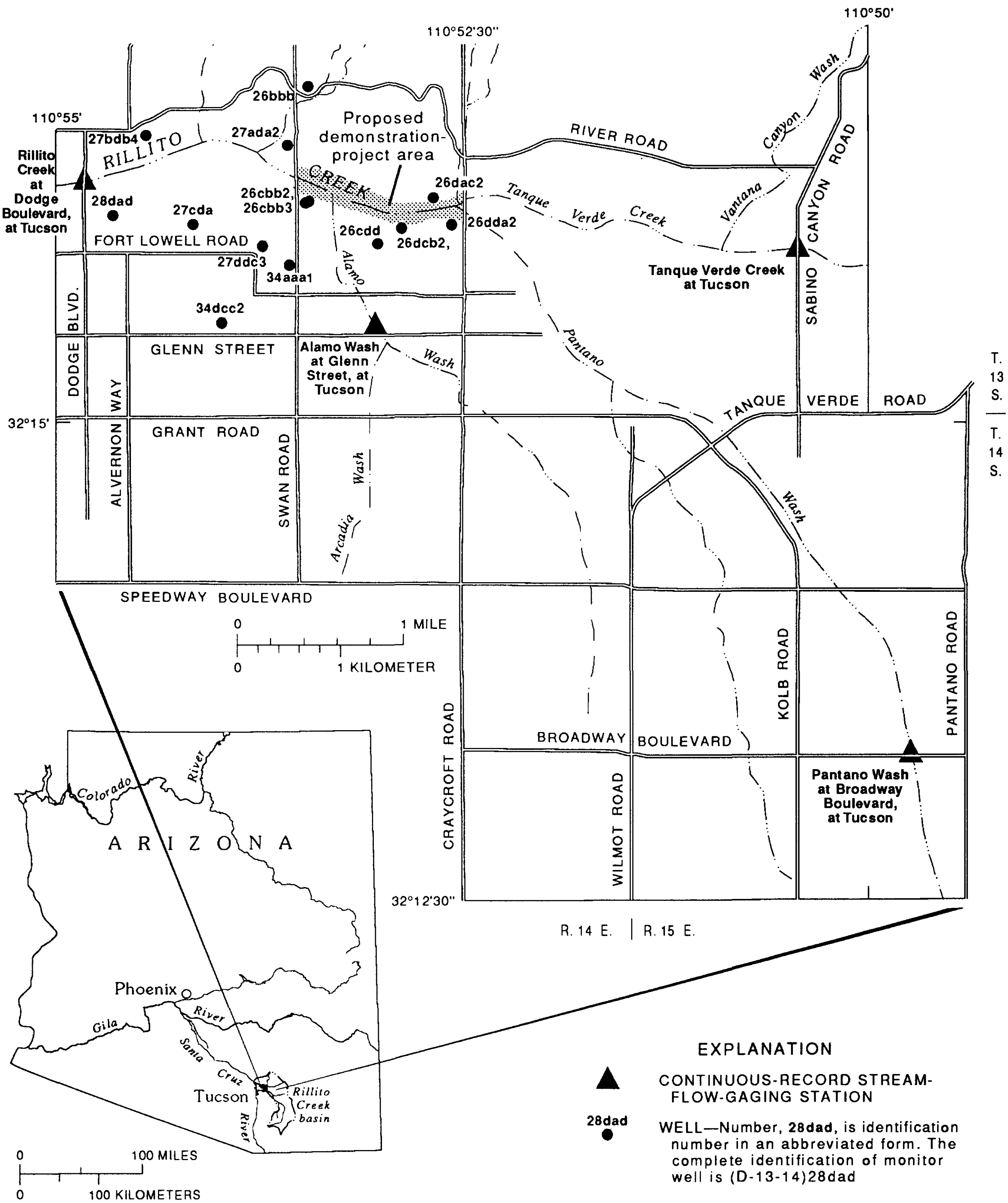


Figure 1. Location of study area and surface-water and ground-water data-collection sites, Rillito Creek basin.

urbanized environment and even less about the potential for contamination of ground water by recharge of urban runoff in the Tucson area. In 1986, the U.S. Geological Survey (USGS) in cooperation with the Arizona Department of Water Resources (ADWR), and PCFCD began collecting baseline physical and chemical data from surface water, ground water, and bottom sediment in the Rillito Creek basin.

Purpose and Scope

The purpose of this report is to (1) present physical and chemical data of surface water, ground water, and bottom sediment and (2) compare the quality of surface water with that of ground water in the study area. This study includes the collection and analysis of physical and chemical data from 4 surface-water, 14 ground-water, and 4 bottom-sediment sites. Data for this study were collected from August 25, 1986, through March 13, 1992.

Description of the Study Area

The Tucson basin is a broad 1,000-square-mile area in the upper Santa Cruz drainage basin in southern Arizona (Laney, 1972). The basin is about 50 mi long and is 15 to 20 mi wide in the southern and central parts and 4 mi wide at the northwest outlet (Davidson, 1973). The basin is bounded on the north by the Tortolita and Santa Catalina Mountains; on the east by the Rincon Mountains; on the south by the Santa Rita Mountains; and on the west by the Sierrita, Black, and Tucson Mountains (fig. 2). These mountains consist of igneous, metamorphic, and sedimentary rocks from Precambrian to late Tertiary age (Davidson, 1973). The basin is underlain by several thousand feet of unconsolidated and semiconsolidated alluvial material (Burkham, 1970). The primary stratigraphic units of the Tucson basin are the Pantano Formation of Oligocene age, the Tinaja beds of Miocene and Pliocene age, and the Fort Lowell Formation of Pleistocene age (Davidson, 1973). The Pantano Formation consists of silty sandstone to gravel that is cemented by calcium carbonate (Davidson, 1973). The Pantano Formation contains a few interbedded volcanic flows and tuffs and are as much as thousands of feet thick (Davidson, 1973; Anderson, 1987). The Tinaja beds unconformably overlie the Pantano Formation and are unconformably overlain by the Fort Lowell Formation. The Tinaja beds consist of clayey silt, mudstone, and gravel and are as much as 5,000 ft thick (Davidson, 1973). The Fort Lowell Formation overlies the Tinaja beds and is overlain by surficial deposits. The Fort Lowell Formation, which consists of silty gravel near the margin of the basin to a silty sand and clayey silt in the central part of the basin, is 300 to 400 ft thick in most of the basin and thins toward the mountains (Davidson, 1973). In some areas of the Tucson basin, the surficial deposits include alluvial-fan, sheetflow, and stream-channel deposits overlying the older sedimentary units and range from a thin veneer to tens of feet thick (Davidson, 1973).

The climate of the Tucson basin is semiarid and is characterized by hot summers and mild winters. The mean annual precipitation is about 12 in. at the lower altitudes and increases to 30 in. or more in the surrounding mountains. The Tucson basin has two distinct rainfall seasons, and about 50 percent of the annual precipitation occurs during the summer season. The summer rainfall is characterized by localized high-intensity and short-duration storms. The winter rainfall generally is less intense and of longer duration.

Hydrology

Surface Water

The Santa Cruz River and Rillito Creek are the major surface-water channels in the Tucson basin. The main tributaries to Rillito Creek include Tanque Verde Creek, Pantano Wash, and Alamo Wash. Rillito Creek flows about 12 mi west-northwestward from the confluence of Pantano Wash and Tanque Verde Creek to the Santa Cruz River (fig. 2). Rillito Creek at Dodge Boulevard drains 871 mi^2 of mountains, desert, and approximately 34 mi^2 of urban area and is, for the most part, unregulated. Tanque Verde Creek at Sabino Canyon Road drains 219 mi^2 of mainly rural area, including mountainous areas in the northeastern part of the basin, and is dominated by winter flows. Pantano Wash at Broadway

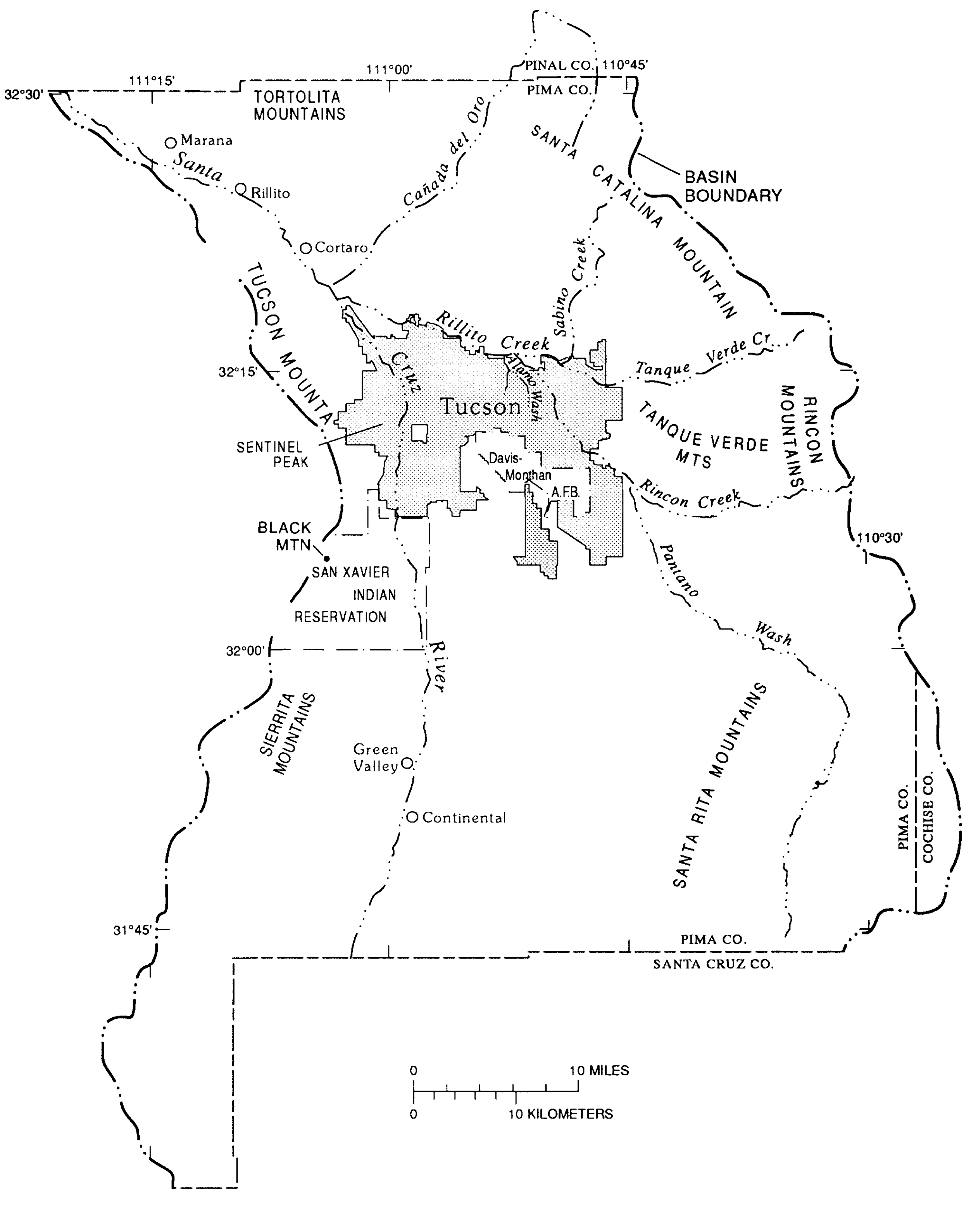


Figure 2. Location of Rillito Creek in the upper Santa Cruz drainage basin.

Boulevard drains 599 mi^2 of the valley area in the southern and southeastern parts of the basin and is dominated by summer flows. Alamo Wash at Glenn Street drains 9.6 mi^2 of urban area. Rillito Creek and its tributaries are ephemeral, meaning that flow in the stream generally is in response to precipitation (Condes de la Torre, 1970).

Streamflow in the Rillito Creek and its tributaries are affected by the type of storm. Summer flows, which generally result from localized, high-intensity thunderstorms, are sudden and have high peak discharges, short durations, and high suspended-sediment concentrations. Winter flows, which generally result from more widespread frontal storms, generally have lower peak discharges, longer durations, and lower suspended-sediment concentrations (Matlock, 1965).

Streamflow is produced from rainfall and snowmelt originating in the Tanque Verde Creek and Rillito Creek watersheds. Flow in the Pantano and Alamo Washes generally consists of rainfall runoff. Runoff from local rainfall may last for several hours; however, streamflow from snowmelt may last for several weeks or more. Davidson (1973) calculated mean annual streamflow within the Tucson basin as 68,000 acre-ft for 1936–63. The average annual discharge passing the streamflow-gaging station, Rillito Creek near Tucson, was 11,660 acre-ft for 67 years of record for 1908–75 (U.S. Geological Survey, 1976).

Ground Water

According to Davidson (1973), recharge of the aquifer underlying the Tucson basin occurs primarily through streamflow infiltration and averages 51,000 acre-ft/yr; mountain-front recharge averages 31,000 acre-ft/yr; and subsurface inflow averages 17,000 acre-ft/yr. Other sources of recharge include return flows of water pumped for irrigation, public supply, and industrial use.

Ground-water levels in the basin fluctuate in response to high recharge in the stream channels and the pumping activity in the area (Camp Dresser and McKee, Inc., 1990). Streamflow data from the gaging station, Tanque Verde Creek at Tucson, and a hydrograph from well (D-13-14)26cbb2 about 3 mi downstream indicate that water levels in the well respond to flow in the channel (fig. 3). Hydrographs for nine other wells in the study area (figs. 7–15) and tables 7–11 are presented in the "Basic Data" section at the back of the report. Water levels rise quickly when recharge occurs in Rillito Creek because of the high permeability of the sediments in the channel and the shallow depth to ground water (Camp Dresser and McKee, Inc., 1990). The depth to ground water ranged from about 10 to 120 ft along Tanque Verde Creek, 225 to 350 ft along Pantano Wash, 15 to 150 ft along Rillito Creek, 60 to 150 ft along the Santa Cruz River, and 125 to more than 350 ft in the central part of the basin (City of Tucson, 1987–93).

Artificial Recharge

Artificial recharge is the planned recharge of an aquifer. Sources of water for artificial recharge can include storm runoff, imported river water, sewage effluent, irrigation water, and industrial wastewater (Wilson, 1985). Selection of a particular method for artificial recharge depends on land and water availability; physical, chemical, and biological composition of the recharge water; and hydrogeologic conditions of the area (Oaksford, 1985; Wilson, 1985).

Artificial recharge has been used in different parts of the world and in many locations in the United States to meet a number of water-resources management purposes (DeCook and Waterstone, 1987). Some purposes of artificial-recharge operations are (1) water conservation, (2) subsurface storage of water for the conjunctive management of surface-water and ground-water supplies, (3) control of floodwater and storm runoff, (4) control of water level and land subsidence, (5) creation of barriers to salt-water intrusion in coastal aquifers, (6) water-quality management, (7) purification of water through natural filtration, and (8) improvement of ground water by dilution (Richter and Chun, 1961; Wilson, 1985).

According to Wilson (1985), artificial recharge can be accomplished by water spreading, pits, and wells. Water spreading involves the release of water onto the surface of a basin where it percolates through the ground into the aquifer; the systems are either in-channel or off-channel. Recharge pits operate under the same principle as water-spreading basins but generally are excavated

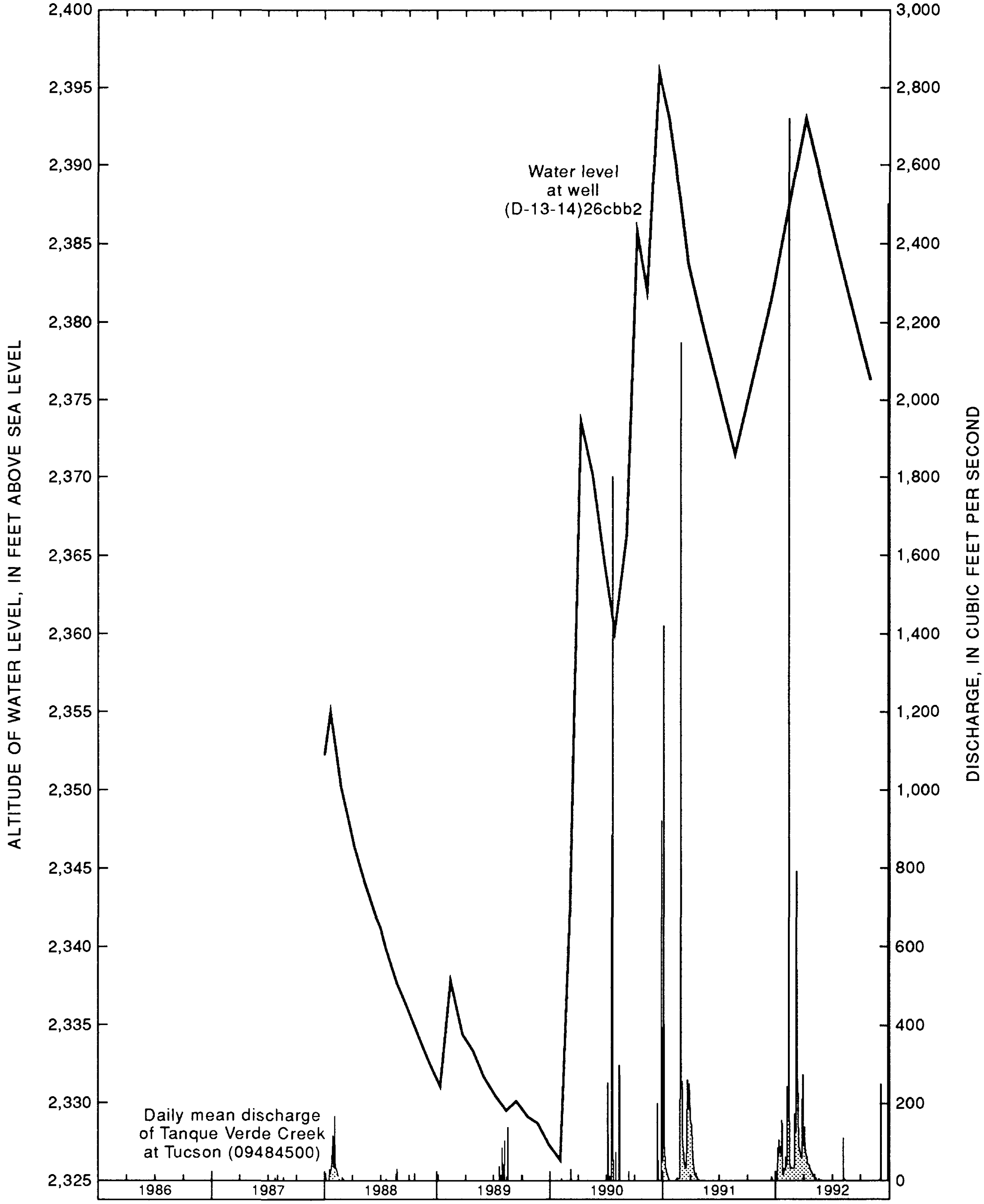


Figure 3. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)26cbb2, 1986–92.

to greater depth. Artificial recharge by well can be done by recharge wells, injection wells, and shafts or dry wells. The use of recharge wells involves the release of water into a well where it is carried directly into an unconfined aquifer by gravity. The use of an injection well involves the injection of water by extra pressure into the aquifer (generally confined). Recharge shafts or dry wells are bore holes constructed into permeable layers within the unsaturated zone. Water recharged through wells needs to be of good chemical and biological quality and generally low in suspended sediment (Brown and Signor, 1974).

The proposed Rillito Creek ground-water recharge project will utilize runoff entering a 1-mile reach of the Rillito Creek between Craycroft Road and Swan Road for infiltration and recharge purposes within the channel and excavated overbank areas. This proposed recharge can be done by water spreading and detention using an inflatable dam.

Previous Studies

Pashley (1966) described the structure and stratigraphy of the central, northern, and eastern parts of the Tucson basin. Davidson (1973) defined the geohydrology of the Tucson basin, and Anderson (1987) detailed the Cenozoic stratigraphy and geologic history of the Tucson basin. Anderson (1988) also reported on aquifer compaction, land subsidence, and earth fissures that are caused by a decline in ground-water levels. A regional study of the southwestern alluvial basins was done by Freethey and Anderson (1986), Robertson (1991), and Anderson and others (1992). The quality of water from Tucson's urban watersheds was studied by Dharmadhikari (1970). The quality of surface water and ground water in the Tucson area was reported by Laney (1972). The quality of sewage effluent recharged to the aquifer underlying the Santa Cruz River was investigated by Wilson and others (1975). The effect of urban runoff and its potential for ground-water pollution was studied by Mooradian (1980). Olson (1987) studied the potential of using dry wells for injection of urban stormwater in Tucson and its effect on ground-water quality. The effect of recharged effluent from the Nogales International Wastewater Treatment Plant, Roger Road Wastewater Treatment Facility, and Ina Road Water Pollution Control Facility on the quality of ground water underlying the Santa Cruz River channel was studied by Schmidt and others (1989). The effect of silt-laden water on infiltration in alluvial channels of the Rillito Creek was studied by Matlock (1965). Infiltration in the main channels of the Tucson basin were investigated by Burkham (1970). Condes de la Torre (1970) studied the streamflow in the upper Santa Cruz River basin, Santa Cruz and Pima Counties. Studies related to stream-channel recharge in the Tucson basin were done by Keith (1981), Olson (1982), Kaddour (1983), and Katz (1987).

APPROACH

The quality and discharge of surface water were determined at three inflow sites and one outflow site for the recharge project area. Surface-water samples were collected to determine possible occurrence and concentrations of contaminants. Ground-water samples were collected from 14 wells to determine general quality in the study area. Bottom-sediment samples also were collected at the four surface-water sites and analyzed to determine the presence and concentration of contaminants.

METHODS OF DATA COLLECTION

Discharge was determined from stage readings using rating curves developed from current-meter measurements. Surface-water samples were collected automatically and manually. Ground-water samples were collected by using submersible pumps. Bottom-sediment samples were collected by scooping.

Surface-Water Discharge

Runoff data are based on discharge measurements and stage records from four streamflow-gaging stations. The streamflow-gaging stations—Tanque Verde Creek at Tucson; Pantano Wash at Broadway Boulevard, at Tucson; Alamo Wash at Tucson; and Rillito Creek at Dodge Boulevard, at Tucson—were run as stage-hydrograph stations (fig. 1). Discharge was either measured during sample collection, using current-meter measurements, or was determined by using recorded gage heights and previously drawn rating curves from stage-discharge relations.

The gaging stations on Tanque Verde and Rillito Creeks were equipped with a mercury manometer, a data-collection platform (DCP), and an analog recorder in a 4- by 4-foot walk-in shelter. The manometer measures stage by sensing pressure over an orifice near the streambed. Stage data are transferred to the DCP by an encoder. The DCP reads and stores data at 5-minute intervals and transmits the accumulated data to the Geostationary Operational Earth Satellite (GOES) every 4 hours. The data are retrieved from the satellite through the downlink station in Colorado and are transmitted to the computer system in Arizona.

A float-operated digital water-stage recorder was installed on the streamflow-gaging stations on Pantano and Alamo Washes. Stage data were recorded at 5-minute intervals. The gaging station on Pantano Wash has a gage house and a 24-inch-diameter stilling well, and the station on Alamo Wash has an in-bank stilling well and a 4- by 4-foot walk-in shelter that houses a float-operated digital water-stage recorder.

The streamflow-gaging station on Tanque Verde Creek is on the left bank, as viewed from upstream, at the downstream side of the Sabino Canyon Road bridge. The channel is 320 ft wide at the gaging station. The channel bed is natural and the banks are soil cement for a long distance upstream and downstream. The rating curve for Tanque Verde Creek was developed from 25 current-meter measurements between 1990 and 1991 and is considered good for flows greater than 300 ft^3/s. Discharge computed for flows of less than 300 ft^3/s are significantly less accurate because small channels change constantly in the bed of the main channel. A stable relation between stage and discharge is not possible under such conditions.

The streamflow-gaging station on Pantano Wash is attached to a steel piling at the downstream side of the east-bound Broadway Boulevard bridge. The channel banks upstream from the gaging station are soil cement, and the bed is natural. The channel is 240 ft wide at the gaging station. Because the rating curve for Pantano Wash was developed from only six current-meter measurements made since 1987, the rating curve is considered poor. The highest measured discharge was 4,470 ft^3/s. More measurements are needed to establish a good rating curve.

The streamflow-gaging station on Alamo Wash is 270 ft downstream from Glenn Street on the right bank. In 1986, the trapezoidal channel of Alamo Wash was lined with concrete from Glenn Street bridge to 330 ft downstream. The channel is 60 ft wide at the gaging station. The rating curve is fair and was developed from 10 current-meter measurements of less than 330 ft^3/s and one slope-area measurement of 4,000 ft^3/s. More measurements of higher flows are needed to establish a good rating curve.

The streamflow-gaging station at Rillito Creek is on the right-hand side of the downstream bridge abutment at Dodge Boulevard. The channel upstream from the bridge has a natural sand bed and soil-cement banks. Downstream from the bridge, the bed and right bank are natural and the left bank is soil cement. The channel is 260 ft wide at the gaging station. The north abutment was damaged twice in a 7-month period by large flows on July 24, 1990, and on January 6, 1991. Repairs to the abutment have made data collection more difficult. Large earthen berms were erected to protect the damaged abutment as it was being repaired. The earthen berms redirected flow away from the gaging station and isolated the station during periods of low flow. The gaging station, however, was not isolated during periods of medium flows. More measurements are needed to improve the rating at this site.

Surface-Water Sampling

From February 25, 1987, through March 13, 1992, samples of surface water were collected at four streamflow-gaging stations—Tanque Verde Creek at Tucson; Pantano Wash at Broadway Boulevard, at Tucson; Alamo Wash at Tucson; and Rillito Creek at Dodge Boulevard, at Tucson (fig. 1). Samples were collected by automatic and manual-sampling procedures. Automatic samples usually were collected at discharges greater than 1,000 ft^3/s that occurred late at night or early in the morning. Manual samples were collected at discharges of less than 300 ft^3/s that occurred during the day.

A Manning S–4501 automatic sampler was installed at each of the four stations. All wetted parts in the sampler are made of Teflon or glass to ensure that the samples were not contaminated by the sampling apparatus.

Automatic samplers at the Tanque Verde Creek and Rillito Creek stations were programmed to be activated when the stage exceeded a threshold value of 0.2 ft in 2 minutes. A sample was collected every 5 minutes during a rising stage and every 10 minutes during a falling stage. The samplers at Pantano and Alamo Washes were activated at 2-minute intervals when the stage reached the threshold level of the 2-wire actuators. The sampler intake at each site was installed at least 1 ft above the channel bed, and the threshold was set at least 0.2 ft above the intake.

Samples were collected in twenty-four 350-milliliter (mL) glass bottles and were composited. A complete set of analyses for all constituent groups required a total of about 10 liters (L) of sample water. The maximum quantity of water that can be collected by the automatic samplers used for this investigation is about 7.7 L; the average quantity of water collected was about 4.4 L. The average was less than the maximum possible because the bottles did not always fill completely and the durations of the flows were not always sufficient to allow for all 24 bottles to fill. Also, sample volume is lost when sediment is filtered out; therefore, when samples were collected with the automatic sampler, only selected analyses could be performed.

Large-volume samples were collected manually when possible to allow for a more complete set of analyses and to ensure a more representative sample. Samples were collected according to procedures described by the U.S Geological Survey (1977). Manual samples were collected using equal-width-increment methods and composited. The equal-width method requires equal spacing of several verticals across the cross section and an equal transit rate, both up and down, in all verticals. The width of increments to be sampled is determined by dividing the stream width by the number of vertical samples necessary to provide sufficient sample volume.

Manual sampling equipment consists of hand-held and cable-reel samplers. To prevent trace-metal contamination of the sample, the samplers are coated with epoxy paint and equipped with nylon nozzles and silicon gaskets. Where streams could be waded, a DH–48 sampler was used to obtain samples. The DH–48 sampler consists of a streamlined aluminum casting 13 in. long that partly encloses the sample container. The container, typically a round pint glass bottle, is sealed against a rubber gasket recessed in the head cavity of the sampler by a hand-operated spring-tensioned pull-rod assembly at the tail of the sampler. As the sampling device is immersed, the sample enters the container and is collected through the intake nozzle. The sampler, including container, weighs 4.5 pounds and can sample to within 3.5 in. of the streambed (Guy and Norman, 1970).

When streams could not be waded, D–74 samplers were used to obtain samples. The D–74 sampler weighs 62 pounds and is designed for sampling with a cable-and-reel suspension. The D–74 sampler has a streamlined cast bronze body 24 in. long that completely encloses the sample container and is completely coated with epoxy paint to prevent trace-metal contamination of the sample. This sampler accommodates a quart glass bottle or, with the addition of an adaptor sleeve, a pint glass bottle can be used.

Surface-water samples were analyzed for properties and for concentrations of major ions, nutrients, trace elements, radionuclides, organochlorine pesticides, priority pollutants, volatile organic compounds, organic carbon, and oil and grease. Suspended-sediment samples were analyzed for sediment concentrations and for particle-size distribution.

All samples to be analyzed for dissolved constituents were passed through a 0.45-micrometer pore size filter to remove suspended material. Samples for total constituents were discharged into sample bottles without being filtered. Water samples were collected by personnel of the U.S. Geological Survey in Tucson and processed in the field using methods described by the U.S. Geological Survey (1977).

Sample treatment and preservation were performed according to recommended methods of the U.S. Geological Survey (1985). Preservatives such as acids, bases, and metallic salts were added to water samples to retain dissolved constituents in solution, and to minimize changes due to chemical and biological activities (Ward and Harr, 1990). Some examples of preservation are refrigeration and additions of nitric acid, sulfuric acid, hydrochloric acid, mercuric chloride, and nitric acid-potassium dichromate.

Samples were analyzed for sediment concentration and particle-size distribution at USGS sediment laboratories in Iowa City, Iowa, and Vancouver, Washington. Radionuclide analysis of water samples was performed by a private laboratory under contract by the U.S. Geological Survey. All other analyses of water samples were performed by the U.S. Geological Survey National Water Quality Laboratory in Arvada, Colorado.

Ground-Water Sampling

Samples of water were collected from 14 wells from August 25, 1986, through March 28, 1989. The wells are within a 2-mile reach of Rillito Creek from the confluence of Tanque Verde Creek and Pantano Wash downstream to Dodge Boulevard (fig. 1). Production and monitoring wells were sampled in this study. Well-construction information for selected wells in the study area are presented in table 1. Dedicated pumps were used to collect samples from seven wells, and a portable submersible pump was used to collect samples from the remaining seven wells. Samples were collected by personnel of the Arizona Department of Water Resources. Before sampling, the wells were pumped until a minimum of three casing volumes of water were removed; specific conductance, pH, dissolved-oxygen concentration, and temperature were continually monitored until stable. Ground-water samples were analyzed for properties and for the concentrations of major ions, nutrients, trace elements, radionuclides, organochlorine pesticides, priority pollutants, volatile organic compounds, organic carbon, and oil and grease. Ground-water samples were sent to the U.S. Geological Survey National Water Quality Laboratory in Arvada, Colorado. Ground-water samples were analyzed using the same procedures as those of surface-water samples.

Bottom-Sediment Sampling

From July 28, 1987, through February 20, 1992, samples of bottom sediment were collected from Tanque Verde Creek at Sabino Canyon Road, Pantano Wash at Broadway Boulevard, Alamo Wash at Glenn Street, and Rillito Creek at Dodge Boulevard. Samples were collected shortly after recession of runoff by personnel of the U.S. Geological Survey in Tucson. Samples were collected from the upper 2 in. of sediment using materials that would not be sources of additional contaminants. Plastic spoons and containers were used to collect samples for inorganic analyses and stainless-steel spoons and containers were used to collect samples for organic analyses. Samples were collected in equal-width increments across the channel, composited and mixed into a single sample, passed through a 500-micrometer-size sieve, and split into several sample containers in the field.

Samples were analyzed for nutrients, trace elements, radionuclides, organochlorine pesticides, priority pollutants, inorganic and organic carbon, and oil and grease. Particle-size distributions were determined on unsieved sediment from each site. Samples for particle-size distribution were analyzed using a wet-sieve method by U.S. Geological Survey sediment laboratories in Iowa City, Iowa, and Vancouver, Washington. Plastic containers were used for storage and shipment of bottom-sediment samples for analysis of inorganic constituents. Samples collected for the determination of organic compounds were stored and shipped in glass bottles. Samples for analysis of nutrients and organics were preserved by immediately chilling to 4°C to retard any chemical and (or) biological changes that may occur before analysis. Samples for analysis of trace elements and radionuclides required no preservation.

At the laboratory, samples for trace-elements analyses were air dried and then crushed and sieved through a 230-mesh (63 micrometer) screen. The fine materials that passed through the screen were retained and analyzed. Analysis of bottom-sediment samples for radionuclides was performed by a private laboratory under contract by the U.S. Geological Survey. Trace elements were analyzed by the U.S. Geological Survey, Geologic Division, Lakewood, Colorado. All other analyses of

Table 1. Well-construction information for selected wells, Rillito Creek basin

Well identification (D-13-14)	Depth of well, in feet	Perforated zone, in feet	Diameter, in inches	Casing type	Date installed	Pump
26bbb	200	90–195	8	Steel	1960	No
26cbb2	130	90–130	6	Steel	1988	No
26cbb3	80	45–80	6	Steel	1988	No
26cdd	155	30–155	12	Steel	1969	Yes
26dac2	100	50–100	10	Steel	1971	No
26dcb2	120	80–120	6	Steel	1988	No
26dda2	100	20–80	12	Steel	1974	Yes
27ada2	300	30–70	12.75	Steel	([1])	Yes
27bdb4	135	([1])	12	Steel	1954	No
27cda	320	[2]160–225	8–10	Steel	1977	Yes
27ddc3	240	200–240	10	Steel	1936	Yes
28dad	150	50–130	8	Steel	[2]1935	Yes
34aaa1	135	40–130	12	Steel	1948	Yes
34dcc2	260	([1])	12	Steel	1951	No

[1]Unknown. [2]Data are questionable.

bed-material samples were performed by the U.S. Geological Survey, Geochemistry Laboratory, Arvada, Colorado.

QUALITY OF WATER AND CHEMISTRY OF BOTTOM SEDIMENT

This section contains a summary of physical and chemical data and interpretations of the data. Results of the analyses of all surface-water, ground-water, and bottom-sediment samples are given in tables 7–11 at the end of the report.

Surface Water

A summary was compiled from the several types of surface-water-quality data collected during the study—suspended sediment, properties, major ions, nutrients, trace elements, radionuclides, organochlorine pesticides, priority pollutants, organic carbon, and oil and grease (table 2). A summary of the results of analyses of constituent groups, such as organochlorine pesticides and priority pollutants, was determined only for those constituents detected. A summary of the results of analyses of volatile organic compounds was not compiled because none of the constituents were detected. Analytical results for all surface-water samples are presented in tables 7 and 8 at the end of the report. Although Rillito Creek is an ephemeral stream and is not used as a drinking-water supply, the water chemistry was compared with the U.S. Environmental Protection Agency (USEPA) primary and secondary drinking-water regulations and the State of Arizona drinking-water standards (State of Arizona, 1991).

Suspended sediment.—Concentrations of suspended sediment ranged from 22 to 36,700 mg/L. Flow during the summer months generally contained higher concentrations of sediment than the flow during the rest of the year (table 7). Sediment concentrations generally tend to increase with an increase in streamflow. Suspended-sediment transport is of concern for several reasons. Suspended sediment can clog the channel bed during recharge, which reduces infiltration rates, and can serve as a transport mechanism for many inorganic, organic, and biological pollutants.

Table 2. Summary of selected physical and chemical data for surface-water sites, Rillito Creek basin, February 25, 1987, through March 13, 1992

[mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25°C; ft^3/s, cubic feet per second; °C, degrees Celsius; NTU, nephelometric-turbidity units; µg/L, micrograms per liter; pCi/L, picocuries per liter; <, less than. DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenylethylene; DDT, dichlorodiphenyltrichloroethane]

Constituent	Number of observations	Minimum	Maximum	Median
Suspended sediment:				
Suspended sediment (mg/L)	40	22	36,700	4,730
Properties:				
Specific conductance (µS/cm)	25	47	475	79
pH (units)	28	6.5	9.2	8.3
Discharge (ft^3/s)	35	6	5,900	325
Water temperature (°C)	19	9	30.5	14
Turbidity (NTU)	35	2.3	29,000	380
Dissolved oxygen (mg/L)	7	6.2	11	6.6
Hardness as $CaCO_3$ (mg/L)	35	15	150	35
Alkalinity as $CaCO_3$ (mg/L)	26	12	97	31
Dissolved solids at 180°C (mg/L)	35	19	243	85
Major ions:				
Calcium, dissolved (mg/L)	35	4.3	53	11
Magnesium, dissolved (mg/L)	35	.6	5.9	1.3
Sodium, dissolved (mg/L)	35	1.5	14	4.5
Sodium adsorption ratio	35	.1	.7	.4
Potassium, dissolved (mg/L)	35	.7	6.5	2.1
Bicarbonate as HCO_3 (mg/L)	26	14	121	37
Sulfate, dissolved (mg/L)	35	1.2	52	7.2
Chloride, dissolved (mg/L)	35	.8	7.2	3.0
Fluoride, dissolved (mg/L)	35	<.1	.6	.1
Silica, dissolved (mg/L)	35	1.7	36	8.2
Nutrients (mg/L):				
Nitrogen, total as N	18	.31	11	1.4
Nitrogen, organic, total as N	22	.17	9.7	.8
Nitrogen, ammonia, dissolved, as N	22	<.01	.56	.06
Nitrogen, ammonia, total, as N	22	.01	.97	.08
Nitrogen, ammonia plus organic, total as N	22	.20	10	1.0
Nitrogen, nitrate, dissolved as N	9	.06	.71	.22
Nitrogen, nitrate, total as N	15	.08	1.13	.37
Nitrogen, nitrite, dissolved as N	13	<.01	.03	.02
Nitrogen, nitrite, total as N	22	<.01	.27	.02
Nitrogen, nitrite plus nitrate, dissolved, as N	22	<.01	.98	.27

Table 2. Summary of selected physical and chemical data for surface-water sites, Rillito Creek basin, February 25, 1987, through March 13,1992—Continued

Constituent	Number of observations	Minimum	Maximum	Median
Nutrients (mg/L)—Continued				
Nitrogen, nitrite plus nitrate, total as N	22	<.01	1.40	.32
Phosphate, total as PO_4	22	.03	2.36	.34
Orthophosphate, dissolved as PO_4	21	.03	1.20	.42
Phosphorus, dissolved as P	22	.01	.46	.09
Phosphorus, total as P	22	.02	4.90	.42
Orthophosphorus, dissolved as P	22	<.01	.38	.08
Trace elements (μg/L):				
Aluminum, total recoverable	42	470	550,000	89,500
Arsenic, dissolved	23	<1	13	3
Arsenic, total	41	<1	38	8
Barium, dissolved	23	<100	190	29
Barium, total recoverable	42	<100	10,000	1,000
Beryllium, total recoverable	42	<10	60	<10
Boron, dissolved	23	<10	40	20
Cadmium, dissolved	23	<1	2	<1
Cadmium, total recoverable	42	<1	12	2
Chromium, dissolved	23	<1	20	<1
Chromium, total recoverable	41	<1	350	68
Cobalt, total recoverable	42	<1	180	30
Copper, dissolved	23	<10	340	10
Copper, total recoverable	39	2	2,500	260
Iron, total recoverable	42	330	510,000	85,000
Lead, dissolved	23	<1	<5	1
Lead, total recoverable	40	<5	1,900	155
Lithium, total recoverable	42	<10	1,600	110
Manganese, total recoverable	42	20	49,000	4,900
Mercury, dissolved	21	<.1	.2	<.1
Mercury, total recoverable	39	<.1	2.8	.3
Molybdenum, dissolved	23	<1	3	1
Molybdenum, total recoverable	42	<1	5	1
Nickel, dissolved	23	<1	4	1
Nickel, total recoverable	42	<1	700	97
Selenium, dissolved	22	<1	5	<1
Selenium, total	42	<1	6	<1

Table 2. Summary of selected physical and chemical data for surface-water sites, Rillito Creek basin, February 25, 1987, through March 13,1992—Continued

Constituent	Number of observations	Minimum	Maximum	Median
Trace elements (mg/L)—Continued:				
Silver, dissolved	23	<1	1	<1
Silver, total recoverable	42	<1	4	<1
Vandium, dissolved	22	2	18	8
Zinc, dissolved	23	<3	170	<10
Zinc, total recoverable	42	<10	4,300	790
Radionuclides:				
Gross alpha, dissolved as U (µg/L)	17	<.4	4.4	.8
Gross alpha, suspended as U (µg/L)	17	<.6	1,500	93
Gross beta, dissolved as Sr-90/Y-90 (pCi/L)	17	.9	13	3.1
Gross beta, total as Sr-90/Y-90 (pCi/L)	17	<.4	910	97
Gross beta, dissolved as Cs-137 (pCi/L)	17	1	17	4.1
Gross beta, suspended as Cs-137 (pCi/L)	17	<.4	1,000	110
Organochlorine pesticides, total recoverable (µg/L):				
Aldrin	19	<.01	.02	<.01
Chlordane	19	<.10	1.50	.01
DDD	19	<.01	<.1	<.01
DDE	19	<.01	<.1	<.01
DDT	19	<.01	.1	<.01
Dieldrin	19	<.01	.19	<.01
Endrin	19	<.01	.01	<.01
Priority pollutants, total recoverable (µg/L)				
Bis(2-ethyl hexyl)phthalate	23	<5	<13	<5
Fluoranthene	25	<5	6	<5
Pyrene	25	<5	6	<5
Organic carbon and oil and grease (mg/L):				
Organic carbon, dissolved	12	5.7	19	11.5
Organic carbon, total	28	8.8	240	50.5
Oil and grease, total	25	<1	3	<1

Properties.—Specific conductance is the ability of water to conduct electrical current. Specific conductance generally was higher during the high flows that occurred in the summer months and lower during low flows that occurred during the winter and spring months from snowmelt runoff. Specific conductance ranged from 47 µS/cm in February 1992 at Tanque Verde Creek to 475 µS/cm in July 1990 at Rillito Creek.

The pH is defined as the negative log of the hydrogen-ion activity in water. When the pH is 7, the water is said to be neutral; a pH of greater than 7 is basic (alkaline), and a pH of less than 7 is acidic. The data indicate that the water generally is alkaline. The pH of water for all sites ranged from 6.5 to 9.2, and the median value was 8.3 for 28 samples. The median pH of 8.3 was within the USEPA secondary maximum contaminant level (SMCL) of 6.5 to 8.5 for drinking water (U.S. Environmental Protection Agency, 1993b).

Turbidity is an important indicator of water quality that relates to the penetration of light. Turbidity ranged from 2.3 at Tanque Verde Creek to 29,000 nephelometric-turbidity units (NTU) at Rillito Creek. Turbidity generally fluctuated seasonally and with discharge and was higher during the summer months and lower during the low-flow periods in the winter months. Increased turbidity in the summer probably was caused by suspended silts, clays, and organic particles in water.

Dissolved oxygen in surface water is derived from the atmosphere through aeration and is given off by aquatic plants in the process of photosynthesis. The solubility of oxygen in water is dependent on the partial pressure of oxygen in the air, water temperature, concentration of dissolved solids, and biological activity. As temperature and dissolved-solids concentration of the water increases, the saturation concentration of dissolved oxygen decreases. Dissolved-oxygen concentrations ranged from 6.2 at Alamo Wash to 11 mg/L at Tanque Verde Creek.

Hardness is a measure of the relative amount of certain ions in water, mainly calcium and magnesium, that form insoluble precipitates with soap. According to Hem (1989), water with a hardness of less than 60 mg/L as calcium carbonate ($CaCO_3$) is soft, 61 to 120 mg/L is moderately hard, 121 to 180 mg/L is hard, and more than 180 mg/L is very hard. Data indicate that the surface water in this study was soft to hard. Hardness values generally ranged from 15 to 81 mg/L as $CaCO_3$ except in two samples from Alamo Wash and Rillito Creek, which were 140 and 150 mg/L, respectively.

Alkalinity is a measure of the capacity of water to neutralize acid. Alkalinity of water is due primarily to the presence of bicarbonate, carbonate, and hydroxide ions. Alkalinity in filtered samples ranged from 12 mg/L (as $CaCO_3$) at Tanque Verde Creek to 97 mg/L at Rillito Creek and is expressed in terms of an equivalent amount of $CaCO_3$.

Dissolved solids is a general term used to describe the mineral content of water. Dissolved solids consist primarily of calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, and nitrate. At Rillito Creek, dissolved-solids concentrations ranged from 19 to 243 mg/L. Surface water typically had low concentrations of dissolved solids, which were below the SMCL of 500 mg/L for drinking water.

Major ions.—Calcium, magnesium, and sodium are common constituents in most natural waters and result from the dissolution of many rock minerals. Concentrations of dissolved calcium, magnesium, and sodium in water at all sites in this study generally were low. The highest concentrations of calcium were detected at Rillito Creek (46 mg/L) and Alamo Wash (53 mg/L). Maximum concentrations of magnesium and sodium were detected in samples from Rillito Creek and ranged from 0.8 to 5.9 mg/L and 3.9 to 14 mg/L, respectively. Potassium concentrations ranged from 0.7 to 6.5 mg/L in the study area.

The sodium-adsorption ratios, which generally indicate the proportion of sodium over calcium and magnesium, were small at all sites and ranged from 0.1 to 0.7. According to Ayers and Westcot (1986), infiltration rates have been reduced on agricultural land by application of water that had a sodium-adsorption ratio greater than 3. Sodium tends to cause swelling and dispersion of clays, which clog and reduce permeability in the soil (Hillel, 1980).

Dissolved bicarbonate concentrations (HCO_3) ranged from 14 at Tanque Verde Creek to 121 mg/L at Rillito Creek. The highest dissolved sulfate concentration of 52 mg/L was detected in July 1988 at Rillito Creek. Low concentrations of dissolved chloride and fluoride were detected in the study area and ranged from 0.8 to 7.2 mg/L and less than 0.1 to 0.6 mg/L, respectively. Concentrations of sulfate and chloride were below the USEPA SMCL's of 250 mg/L. Concentrations of fluoride were below the maximum contaminant level (MCL) of 4 mg/L (U.S. Environmental Protection Agency, 1993a). Sulfate occurs naturally in water from the leaching of gypsum, chloride occurs in igneous rock, and fluoride occurs in igneous and sedimentary rocks (Hem, 1989). The concentration of dissolved silica generally was low at all four sites. The maximum silica concentration was 36 mg/L in one sample from Alamo Wash. The trilinear diagram illustrates the relative proportions of major ions in surface-water samples (fig. 4). The water is primarily a calcium and bicarbonate type.

Nutrients.—Nitrogen occurs in several forms including molecular nitrogen, ammonia, organic nitrogen, nitrate, and nitrite (Moore, 1991). Nitrogen compounds in surface water originate from both natural and anthropogenic sources (Marron and others, 1989; Moore, 1991). Natural sources of nitrogen are found in soil or biological material, and anthropogenic sources include fertilizers, sewage, and animal wastes (Hem, 1989; Marron and others, 1989; Moore, 1991). Concentrations of nitrogen, organic nitrogen, ammonia, nitrate, and nitrite generally were low for all four sampling sites.

Total nitrogen is a measure of organic and inorganic forms of dissolved and suspended nitrogen. The maximum concentrations of total nitrogen (as N) were 11 mg/L at Tanque Verde Creek, 3.3 mg/L at Pantano Wash, 3.2 mg/L at Alamo Wash, and 4.4 mg/L at Rillito Creek. The total organic nitrogen (as N) in water was detected in the greatest concentration of any nitrogen species and ranged from 0.17 to 9.7 mg/L at Tanque Verde Creek, from 0.63 to 2.6 mg/L at Pantano Wash, from 0.26 to 1.9 mg/L at Alamo Wash, and 0.52 to 3.0 mg/L at Rillito Creek. The concentrations of total ammonia (as N) ranged from 0.09 to 0.59 mg/L at Alamo Wash and 0.07 to 0.97 mg/L at Rillito Creek. The maximum concentrations of total nitrate (1.13 mg/L) and total nitrite as N (0.27 mg/L) were detected at Rillito Creek. Low concentrations of dissolved ammonia, nitrate, and nitrite were detected in the study area and ranged from less than 0.01 to 0.56 mg/L, from 0.06 to 0.71 mg/L and less than 0.01 to 0.03 mg/L, respectively. Concentrations of nitrate plus nitrite (as N) and nitrite (as N) were below the USEPA MCL for drinking water of 10 mg/L and 1 mg/L, respectively

Sources of phosphate in water include fertilizers, animal metabolic waste, and weathering of igneous rocks (Hem, 1989). According to Hem (1989), concentrations of phosphate ions in most natural waters rarely exceed a few tenths or hundredths of a milligram per liter owing to the adsorption of phosphate ions by metal oxides. Concentrations of phosphorous and phosphate were low at all four sampling sites.

The maximum concentration of total phosphate (as PO_4) was 2.36 mg/L at Tanque Verde Creek. The highest concentration of total phosphorus (as P) was 4.90 mg/L at Alamo Wash. Concentrations of dissolved orthophosphorus (as P) generally were small in the study area and ranged from less than 0.01 to 0.38 mg/L at Tanque Verde Creek.

Trace elements.—The concentrations of elements in natural water are the result of natural weathering and erosion of rocks and soils. According to Hem (1989), chemical properties can be more important in controlling concentrations of an element in water than is the average abundance of the elements in the rock materials. Concentrations of dissolved and total trace elements generally were highest during the high flows caused by summer rainstorms and lowest during low flows that generally occurred during the winter and spring months as a result of snowmelt runoff.

The highest measured concentrations of total recoverable aluminum (550,000 µg/L), barium (10,000 µg/L), beryllium (60 µg/L), cadmium (12 µg/L), chromium (350 µg/L), copper (2,500 µg/L), mercury (2.8 µg/L), iron (510,000 µg/L), lead (1,900 µg/L), manganese (49,000 µg/L), and nickel (700 µg/L) were detected in surface-water samples. The State of Arizona MCL's for total recoverable barium (1,000 µg/L), chromium (50 µg/L), and lead (50 µg/L) were exceeded in most of the samples at all four sampling sites (State of Arizona, 1991). The State of Arizona MCL's for cadmium (10 µg/L) and mercury (2 µg/L) were exceeded in one sample from Tanque Verde Creek. None of the dissolved constituent values exceeded the State of Arizona

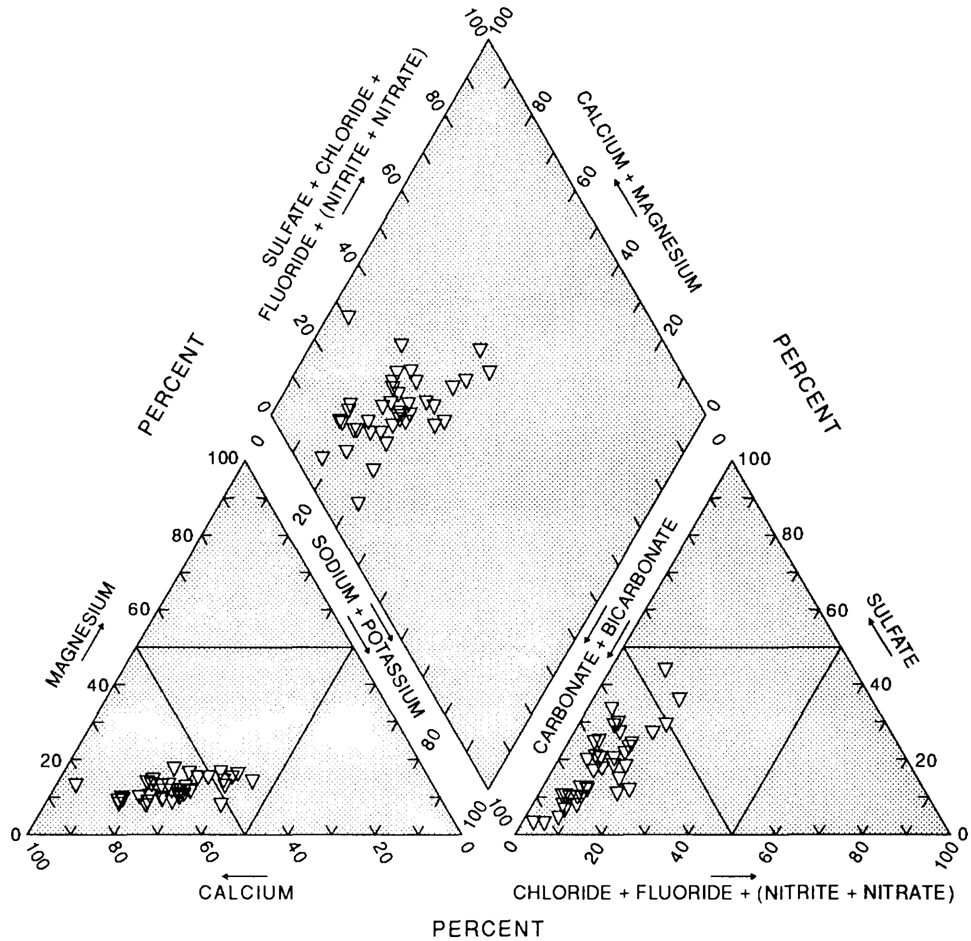


Figure 4. Relative compositions of surface water, in percent, Rillito Creek basin, 1987–92.

MCL's. The USEPA SMCL's for total recoverable aluminum (50 µg/L), manganese (50 µg/L), and iron (300 µg/L) were exceeded in most of the samples at the four sites.

Samples to be analyzed for dissolved trace elements were passed through a 0.45-micrometer pore-size filter that removed most of the suspended material and resulted in significantly lower trace-element concentrations. A sample that is to be analyzed for total recoverable constituents is not filtered, and therefore contains the same amount of sediment by volume as the suspended-sediment sample. Concentrations of total recoverable chromium, nickel, and zinc correlated with suspended-sediment concentrations (fig. 5).

Trace metals tend to adhere to the surface of sediment particles, and a strong positive correlation exists between decreasing grain size and increasing trace-element concentration (Horowitz, 1985). According to Horowitz (1985), the metal ions are attracted to the surface of colloidal material; therefore, sediments with large surface-area to mass ratios such as clay particles, are the best adsorbers. Surfaces of the clay particles are negatively charged and tend to adsorb to the positively charged cations in the water (Dunn and others, 1980). Clay-sized particles have proportionally large surface areas and are measured in square meters per gram as opposed to sand-sized particles with surface area commonly measured in square centimeters per gram (Horowitz, 1985).

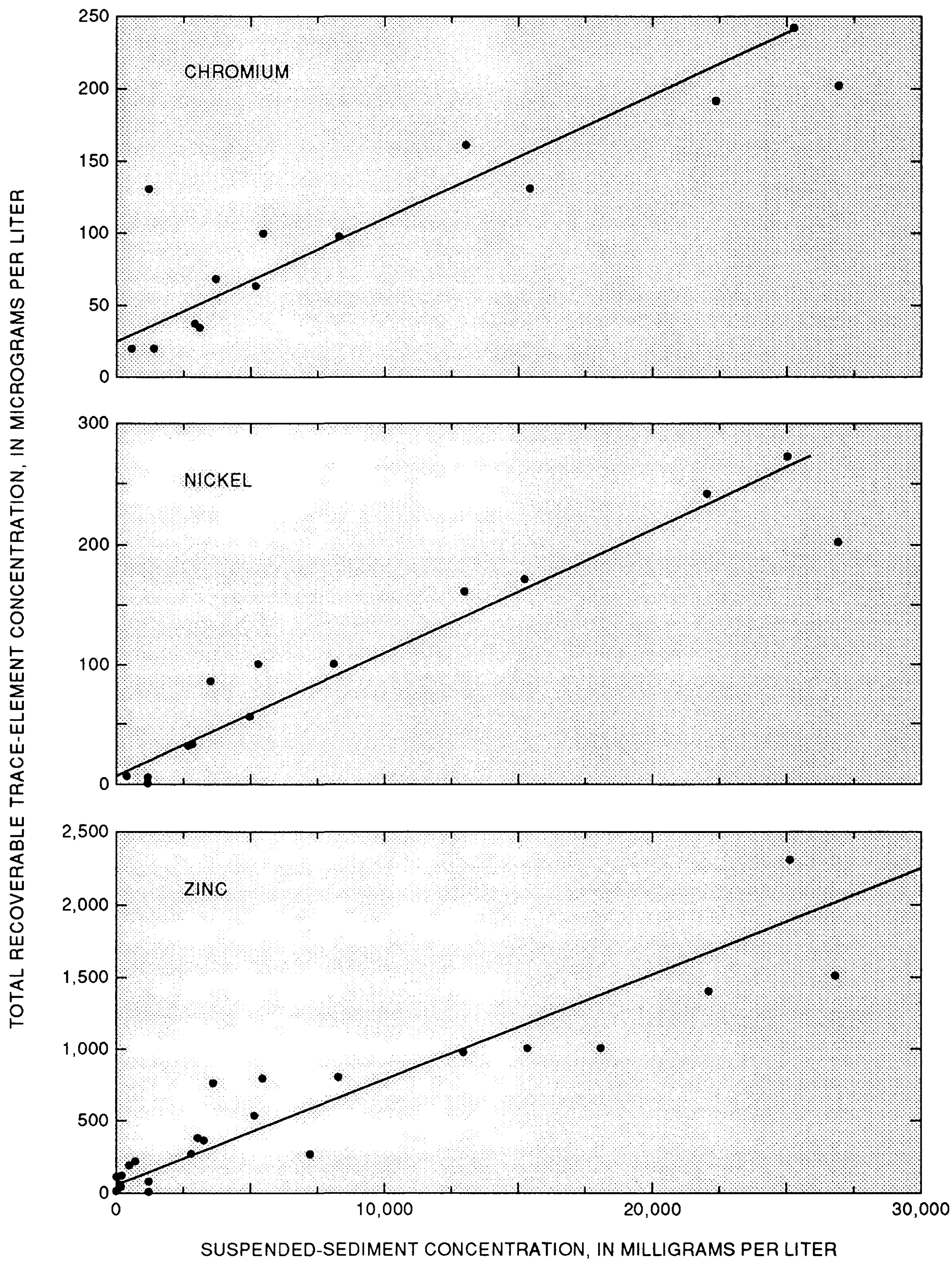


Figure 5. Relation between selected total recoverable trace-element concentration and suspended-sediment concentration in surface-water samples, Rillito Creek basin.

Radionuclides.—Radionuclides in natural water are the result of disintegration of high-atomic-weight isotopic elements. Seventeen surface-water samples were analyzed for gross alpha and gross beta activities. Dissolved and suspended gross alpha and gross beta activities were higher in samples from high flows that occurred in the summer months and lower in samples from low flows that generally occurred during the winter and spring months from snowmelt runoff. As a result of sorptive processes, radionuclides in surface waters are bound predominantly to stream sediments (Sayre and others, 1963). Gross alpha and gross beta activities in samples of suspended sediment were extremely variable throughout the study area.

Dissolved gross alpha activity (as natural uranium U) and suspended gross alpha activity (as U) were highest at Pantano Wash—4.4 and 1,500 µg/L, respectively. The highest activity of dissolved gross beta was detected at Tanque Verde Creek (13 pCi/L). Activity of suspended gross beta (as Sr-90/Y-90) ranged from less than 0.4 to 320 pCi/L at Tanque Verde Creek, 23 to 910 pCi/L at Pantano Wash, 6.8 to 110 pCi/L at Alamo Wash, and 5.2 to 360 pCi/L at Rillito Creek. The highest activity of gross beta as cesium-137 (Cs-137) was detected in Tanque Verde Creek (17 pCi/L). Activity of suspended gross beta (as Cs-137) ranged from less than 0.4 to 340 pCi/L at Tanque Verde Creek, 25 to 1,000 pCi/L at Pantano Wash, 7.5 to 120 pCi/L at Alamo Wash, and 5.7 to 390 pCi/L at Rillito Creek.

The unadjusted median value of 93 µg/L for suspended gross alpha activity (as U) that converts to 63.2 pCi/L (assuming a 0.68 conversion factor) could exceed the State of Arizona MCL for drinking water of 15 pCi/L for adjusted gross alpha (minus uranium and radon). Uranium and radon need to be measured separately to determine compliance. Dissolved gross alpha activities (as U) did not exceed the USEPA MCL for drinking water. USEPA or State of Arizona MCL's do not exist for gross beta. Activities of dissolved gross alpha and dissolved gross beta were significantly lower than the activities of suspended gross alpha and suspended gross beta because suspended material was removed by filtration.

Organochlorine pesticides.—Multiple organochlorine pesticides were detected in samples collected at Alamo Wash and Rillito Creek. Chlordane was the only constituent detected at all four sampling sites. Pesticides that were detected at Alamo Wash were aldrin, chlordane, dichlorodiphenyldichloroethane (DDD), dichlorodiphenylethylene (DDE), dichlorodiphenyltrichloroethane (DDT), dieldrin, and endrin. Chlordane and dieldrin were detected at Rillito Creek; chlordane was detected at Tanque Verde Creek and Pantano Wash.

The maximum aldrin concentration of 0.02 µg/L was detected in a sample from Alamo Wash. Chlordane was detected at all four sampling sites; concentrations ranged from less than 0.1 to 0.2 µg/L at Tanque Verde Creek, less than 0.01 to 0.2 µg/L at Pantano Wash, less than 0.1 to 1.5 µg/L at Alamo Wash, and less than 0.1 to 0.1 µg/L at Rillito Creek. Concentrations of DDD, DDE, DDT, and endrin were detected only in samples from Alamo Wash; the maximum concentrations detected were 0.03, 0.05, 0.01, and 0.01 µg/L, respectively. Dieldrin was detected only in samples from Alamo Wash and Rillito Creek, and the maximum levels were 0.19 and 0.02 µg/L, respectively. Concentrations of chlordane and endrin were below the USEPA MCL of 2 µg/L. Some of the pesticides in the water probably are the result of frequent use of chemicals to control weeds and insects in nearby urban and agricultural areas.

Priority pollutants.—The chemicals bis(2-ethylhexyl)phthalate and fluoranthene were detected in three of nine samples from Alamo Wash and in two of six samples from Rillito Creek. The maximum concentrations of bis(2-ethylhexyl)-phthalate were 10 µg/L at Alamo Wash and 11 µg/L at Rillito Creek. Fluoranthene was detected in only 5 of 10 samples from Alamo Wash and the maximum concentration was 6 µg/L. Pyrene also was detected in 4 of 10 samples from Alamo Wash, and concentrations ranged from less than 5 to 6 µg/L. Distribution of the priority pollutants probably is the result of a higher intensity of urbanization and type of land use within the Alamo Wash and Rillito Creek watersheds.

Volatile organic compounds.—Volatile-organic compounds (VOC's) were not detected in samples from the four sampling sites. The detection limits for the VOC's were 1, 3, or 5 µg/L.

Organic carbon.—Organic carbon in natural water is derived from soil and plants (Thurman, 1985). Dissolved and total organic carbon were detected at all four sites. Concentrations of dissolved organic carbon ranged from 5.7 at Pantano Wash to 19 mg/L at Tanque Verde Creek. Concentrations of total organic carbon were higher during the high flows that occurred in the summer months and lower during low flows that generally occurred during the winter and spring months from snowmelt runoff. Total organic carbon ranged from 8.8 to 240 mg/L at Tanque Verde Creek, 30 to 150 mg/L at Pantano Wash, 14 to 93 mg/L at Alamo Wash, and 19 to 210 mg/L at Rillito Creek.

Oil and grease.—Oil and grease were detected at all sampling sites except Pantano Wash and ranged from less than 1 to 2 mg/L at Tanque Verde Creek, less than 1 to 3 mg/L at Alamo Wash, and less than 1 to 2 mg/L at Rillito Creek. Oil and grease in surface water probably was the result of rainfall runoff from roads and parking lots.

Ground Water

A summary was compiled from the following types of ground-water data that were collected during the study—properties, major ions, nutrients, trace elements, radionuclides, organic carbon, and oil and grease (table 3). Organochlorine pesticides, priority pollutants, and volatile organics were not detected in the samples. Results of the analyses of all ground-water samples are presented in table 9 at the end of the report.

Properties.—Specific conductance in ground water ranged from 215 µS/cm at well (D-13-14)27bdb4 to 720 µS/cm at well (D-13-14)26bbb. pH ranged from 6.7 to 7.9 and was within the SMCL range of 6.5 to 8.5. Turbidity generally ranged from 0.1 to 3.8 NTU; however, samples from well (D-13-14) 26dcb2 and (D-13-14)26bbb were 25 and 90 NTU, respectively. Turbidity in ground water probably is due to well construction. Dissolved-oxygen concentrations ranged from 2.6 mg/L at well (D-13-14)26dac2 to 10.4 mg/L at well (D-13-14)28dad. The data indicate that the ground water is soft to very hard. Hardness concentrations ranged from 59 mg/L (as $CaCO_3$) at well (D-13-14)34aaa1 to 390 mg/L at well (D-13-14)26bbb. Laboratory-measured alkalinities for unfiltered samples ranged from 83 mg/L at well (D-13-14)27bdb4 to 219 mg/L at well (D-13-14)34dcc2. Dissolved-solids concentrations ranged from 132 mg/L at well (D-13-14)27bdb4 to 689 mg/L at well (D-13-14)26bbb. The maximum concentration of 689 mg/L in one sample from well (D-13-14)26bbb exceeded the SMCL of 500 mg/L.

Major ions.—Concentrations of dissolved calcium (120 mg/L) and magnesium (21 mg/L) were highest in samples from well (D-13-14)26bbb. Dissolved sodium concentrations ranged from 7.2 mg/L at well (D-13-14)27bdb4 to 55 mg/L at well (D-13-14)34dcc2. Sodium-adsorption ratios ranged from 0.3 to 2. Concentrations of dissolved potassium generally were low and ranged from 0.9 mg/L at well (D-13-14)34aaa1 to 3.1 mg/L at well (D-13-14)26bbb.

Dissolved bicarbonate concentrations ranged from 101 mg/L (as $CaCO_3$) at well (D-13-14)27bdb4 to 267 mg/L at well (D-13-14)34dcc2. Dissolved sulfate concentrations ranged from 10 mg/L at well (D-13-14)28dad to 42 mg/L at well (D-13-14)34dcc2. Dissolved chloride concentrations generally ranged from 2 to 43 mg/L; however, samples from well (D-13-14)26bbb had concentrations of 97 and 180 mg/L. Dissolved fluoride concentrations ranged from 0.1 to 0.6 mg/L. Maximum concentrations of dissolved sulfate, chloride, and fluoride did not exceed the SMCL's of 250 mg/L for sulfate and chloride and the MCL of 4 mg/L for fluoride. Dissolved silica concentrations ranged from 17 mg/L at well (D-13-14)27bdb4 to 43 mg/L at well (D-13-14)26bbb. The water is primarily a calcium sodium and bicarbonate type (fig. 6).

Nutrients.—Concentrations of total nitrogen (as N) ranged from 0.7 mg/L at well (D-13-14)26dda2 to 25 mg/L at well (D-13-14)26bbb. Total nitrate (as N) in ground water was detected in the highest concentration of any nitrogen species. Organic nitrogen is converted to ammonia by bacteria and then under aerobic conditions the ammonia is oxidized to nitrate and nitrite (Miller and Blair, 1971). The highest concentration of total nitrate (as N) was 18 mg/L at well (D-13-14)26bbb. The maximum total nitrite plus nitrate (as N) also was detected at this well and ranged from 15 to 25 mg/L. The USEPA MCL of 10 mg/L for total nitrite plus nitrate (as N) was exceeded for all three samples collected from well (D-13-14)26bbb. The most probable source of

Table 3. Summary of selected physical and chemical data for ground-water sites, Rillito Creek basin, August 25, 1986, through March 28, 1989

[mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25°C, °C; degrees Celsius; NTU, nephelometetric-turbidity, µg/L, micrograms per liter; pCi/L, picocuries per liter]

Constituent	Number of observations	Minimum	Maximum	Median
Properties:				
Specific conductance (µS/cm)	25	215	720	317
pH (units)	25	6.7	7.9	7.3
Water temperature (°C)	25	17	25	20
Turbidity (NTU)	25	.1	90	.4
Dissolved oxygen (mg/L)	25	2.6	10.4	5.7
Hardness as $CaCO_3$ (mg/L)	25	59	390	110
Alkalinity as $CaCO_3$ (mg/L)	25	83	219	125
Dissolved solids at 180°C (mg/L)	25	132	689	202
Major ions:				
Calcium, dissolved (mg/L)	25	22	120	43
Magnesium, dissolved (mg/L)	25	1	21	3.4
Sodium, dissolved (mg/L)	25	7.2	55	25
Sodium adsorption ratio	25	.3	2	.9
Potassium, dissolved (mg/L)	25	.9	3.1	1.9
Bicarbonate as HCO_3 (mg/L)	25	101	267	152
Sulfate, dissolved (mg/L)	25	10	42	20
Chloride, dissolved (mg/L)	25	2	180	8.8
Fluoride, dissolved (mg/L)	25	.1	.6	.2
Silica, dissolved (mg/L)	25	17	43	27
Nutrients (mg/L):				
Nitrogen, total as N	15	.70	25	3.40
Nitrogen, organic, total as N	12	.16	2.1	.47
Nitrogen, ammonia, dissolved as N	20	<.01	.05	<.01
Nitrogen, ammonia, total as N	20	<.01	.05	.03
Nitrogen, ammonia plus organic, total as N	20	<.20	2.2	.40
Nitrogen, nitrate, dissolved as N	4	.48	18	.54
Nitrogen, nitrite, total as N	20	<.01	.02	.01
Nitrogen, nitrite plus nitrate, dissolved, as N	20	.43	23	1.60
Nitrogen, nitrite plus nitrate, total as N	20	.45	25	1.75
Phosphate, total as PO_4	12	.03	.18	.08
Orthophosphate, dissolved as PO_4	7	.03	.15	.06
Phosphorus, dissolved as P	20	<.01	.06	.01
Phosphorus, total as P	20	<.01	.12	.02
Orthophosphorus, dissolved as P	20	<.01	.05	<.01

Table 3. Summary of selected physical and chemical data for ground-water sites, Rillito Creek basin, August 25, 1986, through March 28, 1989—Continued

[mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25°C, °C; degrees Celsius; NTU, nephelometetric-turbidity, µg/L, micrograms per liter; pCi/L, picocuries per liter]

Constituent	Number of observations	Minimum	Maximum	Median
Trace elements (µg/L):				
Aluminum, total recoverable	17	<10	2,200	10
Arsenic, total	17	<1	4	2
Barium, total recoverable	17	<100	400	<100
Beryllium, total recoverable	17	<10	<10	<10
Cadmium, total recoverable	17	<1	1	<1
Chromium, total recoverable	17	<10	10	<10
Cobalt, total recoverable	17	<1	3	<1
Copper, total recoverable	17	1	33	4
Iron, total recoverable	17	<10	3,400	160
Lead, total recoverable	17	<5	38	<5
Lithium, total recoverable	17	<10	60	10
Manganese, total recoverable	17	<10	180	10
Mercury, total recoverable	17	<.1	.1	<.1
Molybdenum, total recoverable	17	<1	5	2
Nickel, total recoverable	17	<1	9	2
Selenium, total	17	<1	2	<1
Silver, total recoverable	17	<1	1	<1
Zinc, total recoverable	17	<10	100	30
Radionuclides:				
Gross alpha, dissolved as U (µg/L)	13	<.6	9.2	3.3
Gross beta, dissolved as Sr-90/Y-90 (pCi/L)	13	.6	4.6	2.2
Gross beta, dissolved as Cs-137 (pCi/L)	13	.7	6.7	2.9
Radon 222, total (pCi/L)	13	120	690	400
Priority pollutants, total recoverable (µg/L)				
Di-n-octyl phthlate	20	<10	17	<10
Phenol (C6h-50h)	20	<5	39	<5
Volatile organic compounds (µg/L)				
Methylbromide	26	<3	5.3	<3
Methylchloride	26	.3	4.0	<3
Toluene	26	<3	3.2	<3
Organic carbon and oil and grease (mg/L):				
Organic carbon, dissolved	11	.9	3.9	1.3
Organic carbon, total	24	.3	4.0	1.1
Oil and grease, total	14	<1	<1	<1

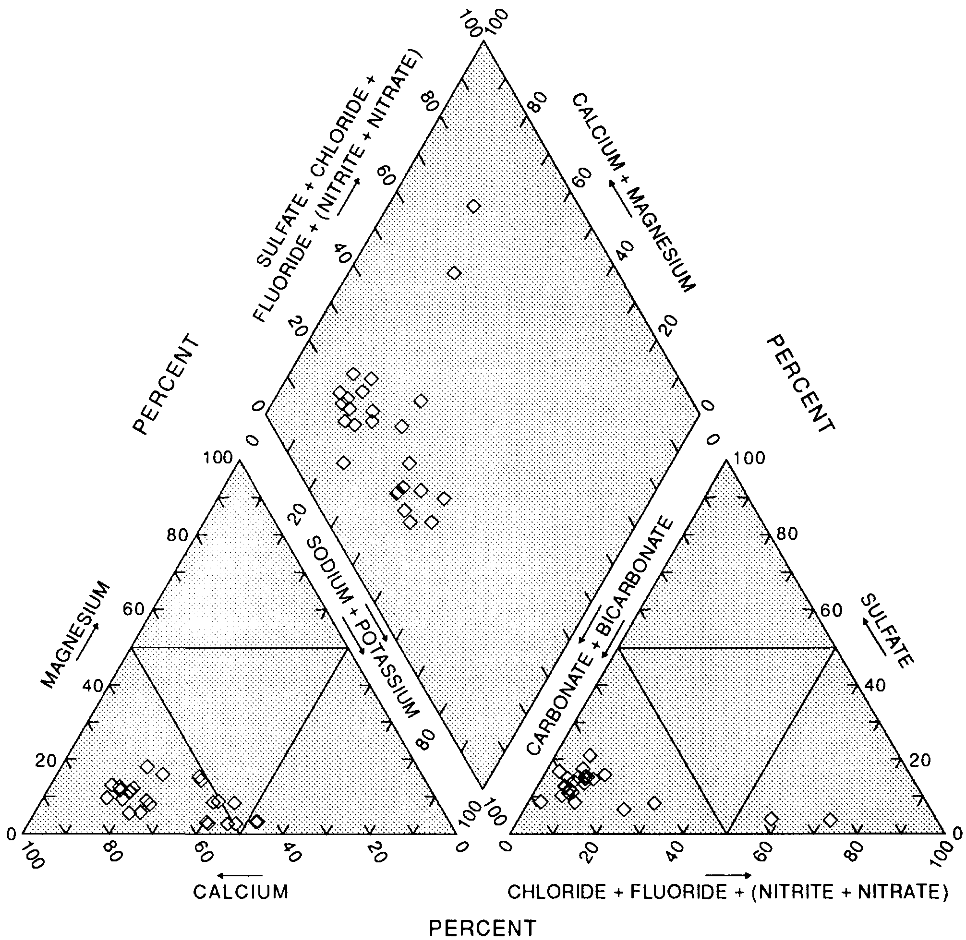


Figure 6. Relative compositions of ground water, in percent, Rillito Creek basin, 1986–89.

nitrate at this well is leachate from residential septic tanks in the area. Low concentrations of dissolved and total ammonia and total nitrite (as N) were detected at all wells in the study area.

Concentrations of total phosphate (0.18 mg/L) and dissolved orthophosphate (0.15 mg/L) (as P) were highest at well (D-13-14)27bdb4. The highest concentration of total phosphorus (as P) of 0.12 mg/L was detected at well (D-13-14)26dcb2. Low concentrations of dissolved phosphorus and orthophosphorus (as P) were detected in ground water.

Trace elements.—The highest measured concentrations of total recoverable aluminum (2,200 μg/L), barium (400 μg/L), copper (33 μg/L), iron (3,400 μg/L), lead (38 μg/L), lithium (60 μg/L), manganese (180 μg/L), and zinc (100 μg/L) were detected in ground-water samples. The highest lead concentrations, 11 and 38 μg/L, were detected at wells (D-13-14)26dda2 and (D-13-14)34aaa1, respectively. Maximum concentrations of total recoverable aluminum (2,200 μg/L) in one sample at well (D-13-14)26dcb2 and iron (380 to 3,400 μg/L) in seven wells exceeded the USEPA MCL's of 50 μg/L and 300 μg/L, respectively. The wells were not constructed for water-quality monitoring and construction materials could have contributed to increased concentrations of some metals such as copper, iron, lead, and zinc.

Radionuclides.—Radionuclides in ground water are derived naturally from contact with

Table 4. Summary of selected particle-size distribution and selected chemical constituents for bottom-sediment sites, Rillito Creek basin, July 28, 1987, through February 20, 1992

[%, percent; mm, millimeter; mg/kg, milligrams per kilogram; µg/g, micrograms per gram; pCi/g, picocuries per gram; µg/kg, micrograms per kilogram; g/kg, gram per kilogram; <, less than. DDD, dichlorodiphenyl-dichloroethane; DDE, dichlorodiphenylethylene; DDT, dichlorodiphenyltrichloroethane; PCB, polychlorinated biphenyl]

Constituent	Number of observations	Minimum	Maximum	Median
Particle-size distribution (%):				
Silt and clay (< 0.063 mm)	5	0.5	4.1	1
Sand (0.062–2 mm)	5	86.8	99.5	99
Nutrients, total (mg/kg):				
Nitrogen, ammonium as N	9	<10	15	1.7
Nitrogen, ammonium plus organic as N	8	40	450	70
Nitrogen, nitrite plus nitrate as N	9	<2	26	<2
Phosphorus as P	9	160	240	190
Trace elements (µg/g):				
Aluminum, total recoverable	9	54,000	76,300	65,000
Arsenic, total	9	<10	8	<10
Barium, total recoverable	9	660	1,000	750
Beryllium, total recoverable	9	1	2	2
Cadmium, total recoverable	9	<2	<2	<2
Calcium, total recoverable	9	8,400	56,000	22,000
Chromium, total recoverable	9	3	51	30
Cobalt, total recoverable	9	2	11	8
Copper, total recoverable	9	4	83	30
Iron, total recoverable	9	4,200	27,600	24,000
Lead, total recoverable	9	20	58	30
Lithium, total recoverable	9	9	36	30
Magnesium, total recoverable	9	800	9,500	7,000
Manganese, total recoverable	9	180	1,180	520
Molybdenum, total recoverable	9	<2	2	<2
Nickel, total recoverable	9	<2	20	10
Potassium, total recoverable	9	21,000	32,000	26,000
Scandium, total recoverable	9	<2	80	8
Silver, total recoverable	9	<2	<2	<2
Sodium, total recoverable	9	12,000	24,000	17,000
Strontium, total recoverable	9	200	299	250
Tantalum, total recoverable	9	<40	<40	<40
Thorium, total recoverable	9	<4	16	10
Tin, total recoverable	9	<5	180	<5
Titanium, total recoverable	9	500	3,300	2,800
Uranium, total recoverable	9	<100	<100	<100

Table 4. Summary of selected particle-size distribution and selected chemical constituents for bottom-sediment sites, Rillito Creek basin, July 28, 1987, through February 20, 1992—Continued

Constituent	Number of observations	Minimum	Maximum	Median
Trace elements (μg/g)—Continued:				
Vanadium, total recoverable	9	7	64	49
Ytterbium, total recoverable	9	<1	30	2
Zinc, total recoverable	9	11	200	60
Radionuclides:				
Gross alpha, as U (μg/g)	9	1	20.3	14
Gross alpha, as Th-230 (μg/g)	8	.7	17.1	10.5
Gross beta, as Sr-90/Y-90 (pCi/g)	8	5.1	35	31.5
Gross beta, as Cs-137 (pCi/g)	8	9.4	59	32
Organochlorine pesticides, total recoverable (μg/kg)				
Chlordane	8	<10	140	<10
DDD	8	<.1	.1	<.1
DDE	8	<.1	3.4	<.1
DDT	8	<.1	2.8	<.1
Dieldrin	8	<.1	10	<.1
Heptachlor	8	<.1	.9	<.1
Heptachlor epoxide	8	<.1	.12	<.1
Lindane	8	<.1	.2	<.1
PCB	8	<1.0	13	<1.0
Methoxychlor	8	<.1	.5	<.1
Priority pollutants, total recoverable (μg/kg)				
Benzo A anthracene1,2-benzanthranene	8	<400	710	<400
Benzo B fluoranthene	8	<400	1,100	<400
Benzo K fluoranthene	8	<400	930	<400
Benzo A pyrene	8	<400	850	<400
Benzogh I perylene, 1, 2-benzoperylene	8	<400	760	<400
Chrysene	8	<400	1,200	<400
Biz(2-ethylhexyl)phthalate	8	<200	1,800	<200
Fluoranthene	8	<200	2,300	<200
Indeno(1,2,3-cd)pyrene	8	<400	830	<400
Phenanthrene	8	<200	620	<200
Pyrene	8	<200	2,000	<200
Inorganic carbon and organic carbon:				
Inorganic carbon, total (g/kg)	9	.1	7.3	3.3
Organic carbon plus inorganic carbon, total (g/kg)	9	1	13	1.7

Wash, 170 to 190 mg/kg at Alamo Wash, and 160 to 220 mg/kg at Rillito Creek.

Trace elements.—Total recoverable aluminum, barium, calcium, iron, magnesium, manganese, potassium, sodium, and titanium concentrations in bottom sediment were higher than concentrations of the other trace elements. Concentrations of trace elements in bottom sediment from all four sampling sites were not greatly different from each other (table 11). Cadmium, gold, silver, tantalum, and uranium concentrations were less than the detection limit, and molybdenum (2 µg/g) was detected in only one sample at Tanque Verde Creek.

Because of the absence of trace-element criteria for bottom sediment, analytical results from the sampling sites are compared with geochemical baseline information from soils of the western United States compiled by the U.S. Geological Survey (Shacklette and Boerngen, 1984). Table 5 has been modified from Shacklette and Boerngan to include only the constituent concentrations that were part of the chemical analyses. Soil-sample data in table 5 consists of selected natural soils west of the 97th meridian within the conterminous United States. Samples were collected at a depth of approximately 8 inches below land surface and at 50-mile intervals. The soil samples were oven dried and then sifted through a 2-millimeter sieve before analysis.

Comparison of bottom-sediment and soil data in table 5 indicates generally similar concentrations for most of the trace elements. With the exceptions of scandium and tin, the ranges of concentrations in bottom sediment were within the ranges found in soil and do not indicate a significant accumulation of trace elements.

Radionuclides.—The highest activity of gross alpha (as U) was detected in bottom sediment from Tanque Verde Creek (14 µg/g), Pantano Wash (16.6 µg/g), Alamo Wash (14 µg/g), and Rillito Creek (20.3 µg/g). Activities of gross alpha (as Th-230) were detected at Alamo Wash and Rillito Creek and ranged from 10 to 17.1 pCi/g and 11 to 14.4 pCi/g, respectively. Gross beta activity (as Sr-90/Y-90) was highest at Tanque Verde Creek (35 pCi/g), and gross beta activity (as Cs-137) was highest at Alamo Wash (59 pCi/g).

Organochlorine pesticides.—Several organochlorine pesticides were detected in bottom-sediment samples collected at the four sites. Concentrations of these compounds, with the exception of chlordane, dieldrin, and PCB were slightly higher than the detection limit. The highest concentrations of organochlorine pesticides were found in bottom sediment from Alamo Wash. Concentrations of chlordane ranged from 1.0 to 31 µg/kg at Tanque Verde Creek, 1.0 to 140 µg/kg at Alamo Wash, and less than 0.1 to 1.0 µg/kg at Rillito Creek. Concentrations of DDE, heptachlor, heptachlor epoxide, and lindane were detected only in samples from Alamo Wash. Concentrations of DDT were detected in samples from Tanque Verde Creek and Alamo Wash and ranged from less than 0.1 to 1.3 µg/kg and 0.2 to 2.8 µg/kg, respectively. Dieldrin concentrations ranged from less than 0.1 to 2.5 µg/kg at Tanque Verde Creek, 0.7 to 10 µg/kg at Alamo Wash, and less than 0.1 to 0.2 µg/kg at Rillito Creek. The highest concentrations of PCB were detected at Tanque Verde Creek (5 µg/kg) and at Alamo Wash (13 µg/kg). Methoxychlor was detected in one sample (0.5 µg/kg) from Pantano Wash.

Priority pollutants.—Eleven priority pollutants were detected in bottom-sediment samples collected at Alamo Wash. Fluoranthene and pyrene were the only priority pollutants detected at Tanque Verde Creek. The maximum concentrations of fluoranthene (2,300 µg/kg) and pyrene (2,000 µg/kg) were detected at Alamo Wash. Priority pollutants were detected in concentrations of approximately 2 to 12 times the detection limits.

Inorganic and organic carbon.— Inorganic and organic carbon were detected at all four sampling sites. Concentrations of inorganic carbon ranged from 0.1 to 2.1 g/kg at Tanque Verde Creek, from 1.7 to 2.2 g/kg at Pantano Wash, from 1.7 to 7.3 g/kg at Alamo Wash, and 0.8 to 2.0 g/kg at Rillito Creek. Inorganic carbon plus organic carbon ranged from 1 to 13 g/kg at Tanque Verde Creek, 3.3 to 3.6 g/kg at Pantano Wash, 2.2 to 9.0 g/kg at Alamo Wash, and 1.4 to 3.1 g/kg at Rillito Creek.

Oil and grease.—Oil and grease were not detected in any of the bottom-sediment samples. The detection limit for oil and grease in bottom sediment is 1,000 mg/kg.

Table 5. Trace-element concentrations in bottom sediment of the Rillito Creek basin and in soils of the western conterminous United States

[Minimum, maximum, median, and mean are reported in micrograms per gram (μg/g); mean is geometric; >, greater than; <, less than. Modified from Shacklette and Borengan (1984)]

Constituent	Bottom sediment			Soil		
	Minimum	Maximum	Median	Minimum	Maximum	Mean
Aluminum	54,000	76,300	65,000	5,000	>100,000	58,000
Arsenic	<10	8	<10	<.10	97	5.5
Barium	660	1,000	750	70	5,000	580
Beryllium	1	2	2	<1	15	.68
Chromium	3	51	30	3	2,000	41
Cobalt	2	11	8	<3	50	7.1
Copper	4	83	30	2	300	21
Iron	4,200	27,600	24,000	1,000	100,000	21,000
Lead	20	58	30	<10	700	17
Lithium	9	36	30	5	130	22
Magnesium	800	9,500	7,000	300	>100,000	7,400
Manganese	180	1,180	520	30	5,000	380
Molybdenum	<2	2	<2	<3	7	.85
Nickel	<2	20	10	<5	700	15
Potassium	21,000	32,000	26,000	1,900	630,000	18,000
Scandium	<2	80	8	<5	50	8.2
Sodium	12,000	24,000	17,000	500	100,000	9,700
Strontium	200	299	250	10	3,000	200
Thorium	<4	16	10	2.4	31	9.1
Tin	<5	180	<5	<0.1	7.4	.9
Titanium	500	3,300	2,800	500	20,000	2,200
Uranium	<100	<100	<100	.68	7.9	2.5
Vanadium	7	64	49	7	500	70
Ytterbium	<1	30	2	<10	150	22
Zinc	11	200	60	10	2,100	55

Comparison of Surface-Water and Ground-Water Quality

According to Hem (1989), the chemical composition of natural water is derived from many different sources of solutes, including gases and aerosols from the atmosphere, weathering and erosion of rocks and soil, solution or precipitation reactions occurring below the land surface, and human activities. The chemical composition of ground water in the study area is affected by streamflow recharge, underflow, geology, mineralogy, internal and external drainage patterns, and historical development (Anderson and others, 1992). Recharge water infiltrating the unsaturated zone may undergo many physical, chemical, and biological processes (Crites and Nolte, 1985; Knorr and Client, 1985; Mackay and others, 1985; Oaksford, 1985). Such processes may include dissolution;, ion exchange; adsorption; filtration; precipitation; volatilization; and physical, chemical, and microbial degradation (Miller and Blair, 1971; DeCook and Wilson, 1980; Mooradian, 1983; Olson, 1987). Filtration and adsorption are the most important purification processes, playing a vital part in quality improvement and in the attenuation of constituents in the unsaturated zone during infiltration (Miller and Blair, 1971; Crites, 1985; Huisman and Olsthhoorn, 1983; Miller, 1990). Median values for selected physical and chemical data in surface water and ground water are presented in table 6.

Properties.—pH ranged from 6.5 to 9.2 with a median value of 8.3 in surface water and ranged from 6.7 to 7.9 with a median value of 7.3 in ground water. Specific conductance, hardness, and dissolved-solids concentrations were greater in ground water than in surface water. Median values for hardness indicate that surface water is soft and ground water is moderately hard. Concentrations of dissolved solids ranged from 39 to 243 mg/L in surface water and 132 to 689 mg/L in ground water.

Major ions.—Concentrations of all major ions, with the exception of potassium, were greater in ground water than in surface water. The largest differences were in concentrations of bicarbonate, calcium, sodium, sulfate, and silica. According to Hem (1989), concentrations of dissolved silica commonly are considerably higher in ground water than in surface water because silica is a constituent of most igneous rocks and are found in some form in most other rocks and soils. Concentrations of major ions generally were lower in ground water along the Rillito Creek than in ground water in the surrounding areas. The surface water is a calcium and bicarbonate type and the ground water is a calcium sodium and bicarbonate type.

Nutrients.—Concentrations of total organic nitrogen (as N) and ammonia (as N) were higher in surface water than in ground water. Concentrations of dissolved and total nitrite plus nitrate (as N) were higher in ground water than in surface water.

Concentrations of total phosphate (as PO_4), dissolved orthophosphate (as PO_4), dissolved and total phosphorus (as P), and dissolved orthophosphorus (as P) were higher in surface water than in ground water. According to Bouwer (1989), most of the phosphates in ground water probably are removed by precipitation of calcium phosphate.

Trace elements.—Median values for selected trace elements in surface water and ground water are presented in table 6. The median values for total recoverable trace elements, with the exception of molybdenum, in surface water are higher than in ground water.

Radionuclides.—The median values for dissolved activities of gross beta (as Sr-90/Y-90) and dissolved gross beta (as Cs-137) were lower in ground water than in surface water. Dissolved gross alpha activity (as U) was higher in ground water.

Organochlorine pesticides.—Several organochlorine pesticides were detected in surface-water and bottom-sediment samples. Chlordane was found at higher concentrations than other pesticides. Some of the pesticides in surface water and bottom sediment probably were caused by use of chemicals to control weeds and insects in urban and agricultural areas. None of the organochlorine pesticides were detected in the ground-water samples.

Priority pollutants.—Several priority pollutants were detected in surface-water, ground-water, and bottom-sediment samples. None of the priority pollutants that were detected in ground-water samples were detected in surface-water or bottom-sediment samples.

Volatile organic compounds.—Volatile organic compounds were not detected in surface-water samples. Low concentrations of three VOC's

Table 6. Median values of physical and chemical data for surface-water and ground-water samples, Rillito Creek basin, August 25, 1986, through February 13, 1992

[µS/cm, microsiemens per centimeter at 25°C, °C, degrees Celsius; NTU, nephelometric-turbidity units; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter]

Constituent	Surface water	Ground water
Properties:		
Specific conductance (µS/cm)	79	317
pH (units)	8.3	7.3
Dissolved oxygen (mg/L)	6.6	5.7
Hardness as $CaCO_3$ (mg/L)	35	110
Alkalinity as $CaCO_3$ (mg/L)	31	125
Dissolved solids at 180°C (mg/L)	85	202
Major ions:		
Calcium, dissolved (mg/L)	11	43
Magnesium, dissolved (mg/L)	1.3	3.4
Sodium, dissolved (mg/L)	4.5	25
Sodium adsorption ratio	.4	.9
Potasium, dissolved (mg/L)	2.1	1.9
Bicarbonate as HCO_3 (mg/L)	37	152
Sulfate, dissolved (mg/L)	7.2	20
Chloride, dissolved (mg/L)	3.0	8.8
Fluoride, dissolved (mg/L)	.1	.2
Silica, dissolved (mg/L)	8.2	27
Nutrients (mg/L):		
Nitrogen, total as N	1.40	3.40
Nitrogen, organic, total as N	.80	.47
Nitrogen, ammonia, dissolved as N	.06	<.01
Nitrogen, ammonia, total as N	.08	.03
Nitrogen, ammonia plus organic, total as N	1.00	.40
Nitrogen, nitrate, dissolved as N	.22	.54
Nitrogen, nitrite, total as N	.02	.01
Nitrogen, nitrite plus nitrate, dissolved, as N	.27	1.60
Nitrogen, nitrite plus nitrate, total as N	.32	1.75
Orthophosphate, dissolved as PO_4	.42	.06
Phosphorus, dissolved as P	.09	.01
Nutrients (mg/L)—Continued:		
Phosphorus, total as P	0.42	0.02
Orthophosphorus, dissolved as P	.08	<.01
Trace elements (µg/L):		
Aluminum, total recoverable	89,500	10
Arsenic, total	8	2
Barium, total recoverable	1,000	<100
Beryllium, total recoverable	<10	<10
Cadmium, total recoverable	2	<1
Chromium, total recoverable	84	<10
Cobalt, total recoverable	30	<1
Copper, total recoverable	260	4
Iron, total recoverable	85,000	160
Lead, total recoverable	155	<5
Lithium, total recoverable	110	10
Manganese, total recoverable	4,900	10
Mercury, total recoverable	.3	<.1
Molybdenum, total recoverable	1	2
Nickel, total recoverable	97	2
Selenium, total	<1	<1
Silver, total recoverable	<1	<1
Zinc, total recoverable	790	30
Radionuclides:		
Gross alpha, dissolved as U (µg/L)	.8	3.3
Gross beta, dissolved as Sr-90/Y-90 (pCi/L)	3.1	2.2
Gross beta, dissolved as Cs-137 (pCi/L)	4.1	2.9
Organic carbon, (mg/L):		
Organic carbon, dissolved	11.5	1.3
Organic carbon, total	50.5	1.1

were detected in five ground-water samples but were not detected in subsequent resampling.

Organic carbon.—Concentrations of dissolved and total organic carbon were higher in surface water than in ground water. Lower concentrations of organic carbon in ground water could have resulted from adsorption.

Oil and grease.—Low concentrations of oil and grease were detected in 7 of 25 surface-water samples. Oil and grease were not detected in any of the ground-water and bottom-sediment samples.

SUMMARY

Controlled artificial recharge of surface runoff is being considered as a water-management technique to address the problem of ground-water overdraft. The use of recharge facilities in urban areas has caused concern about the quality of urban runoff to be recharged and the potential for ground-water contamination. The proposed ground-water recharge in Rillito Creek will utilize runoff entering a 1-mile reach of the creek between Craycroft and Swan Roads for infiltration and recharge purposes within the channel and excavated overbank areas.

Physical and chemical data were collected from 4 surface-water, 14 ground-water, and 4 bottom-sediment sites during 1986–92. Surface-water and bottom-sediment samples were collected in order to determine the occurrence and concentrations of contaminants. Ground water from nearby wells was sampled and analyzed to determine general water-quality conditions in the recharge area.

The response of ground-water levels to streamflow in Tanque Verde Creek is shown by hydrographs from wells and the gaging-station data. Discharge was determined at the four sites from stage readings using rating curves developed from previous current-meter measurements.

Sediment concentrations tended to increase in relation to an increase in streamflow and were higher during the summer. Suspended-sediment concentrations ranged from 22 to 36,700 mg/L in surface water.

The median value of pH was higher in surface water than in ground water. Specific conductance, hardness, and dissolved-solids concentrations generally were greater in ground water than in surface water. Dissolved-solids concentrations ranged from 39 to 243 mg/L in surface water and 132 to 689 mg/L in ground water. The dissolved-solids concentration of 689 mg/L in one sample at well (D-13-14)26bbb exceeded the SMCL of 500 mg/L.

The concentrations of all major ions analyzed, with the exception of potassium, were greater in ground water than in surface water. The largest differences were in bicarbonate, calcium, sodium, sulfate, and silica concentrations. The surface water is a calcium and bicarbonate type and the ground water is a calcium sodium and bicarbonate type.

Total organic nitrogen (as N) was highest in surface water and ranged from 0.17 to 9.7 mg/L. The maximum concentration of total nitrite plus nitrate (as N) in ground water ranged from 15 to 25 mg/L and exceeded the MCL of 10 mg/L. The most probable source of nitrate in ground water is leachate from residential septic tanks in the area.

Concentrations of total and dissolved phosphate and orthophosphates (as P) were higher in surface water than in ground water. Most of the phosphate in ground water probably is removed by precipitation of calcium phosphate.

The highest concentrations of total recoverable barium (10,000 µg/L), cadmium (12 µg/L), chromium (350 µg/L), lead (1,900 µg/L) and mercury (2.8 µg/L) were detected in surface water and exceeded the State of Arizona MCL's for drinking water.

The highest concentrations of total recoverable lead (11 and 38 µg/L) were detected at wells (D-13-14)26dda2 and (D-13-14)34aaa1, respectively. Maximum concentrations of total recoverable aluminum (60 to 2,200 µg/L) in five wells and iron (380 to 3,400 µg/L) in seven wells exceeded the USEPA SMCL's of 50 and 300 µg/L, respectively.

Analyses of bottom sediments for trace elements were compared with baseline geochemical information for soils of the western conterminous United States compiled by the U.S. Geological Survey. Concentrations of trace elements in bottom sediment generally were similar to reported concentrations in soils of the western conterminous United States and do not suggest a significant accumulation of these elements.

The unadjusted median value of 93 µg/L for suspended gross alpha activity (as U) that converts to 63.2 pCi/L (assuming a 0.68 conversion factor) could exceed the State of Arizona MCL for drinking water of 15 pCi/L for adjusted gross alpha (minus uranium and radon). None of the dissolved gross alpha activities (as U) exceeded the USEPA MCL for drinking water. Dissolved gross alpha and dissolved gross beta were significantly lower than suspended gross alpha and suspended gross beta because the suspended material larger than 0.45-micrometer was removed by filtration. In ground-water samples, the median value of 400 pCi/L for radon exceeded the USEPA proposed MCL of 300 pCi/L.

Seven organochlorine pesticides were detected in surface-water samples and ten were detected in bottom-sediment samples. Chlordane ranged from less than 0.1 to 150 µg/L and less than 10 to 140 mg/kg, in surface water and bottom sediment, respectively. The presence of some of the pesticides in surface water and bottom sediment is most likely the result of frequent use of the chemicals to control weeds and insects in urban and agricultural areas. None of the organochlorine pesticides were detected in ground water.

Three priority pollutants were detected in surface-water samples, two were detected in ground-water samples, and eleven were detected in bottom-sediment samples. Laboratory or field contamination most likely were responsible for detection of di-n-octyl phthalate in ground-water samples. The presence of the other priority pollutants in surface water and bottom sediment is attributed to a higher intensity of urbanization and the type of land use within the Alamo Wash and Rillito Creek watersheds.

Volatile organic compounds were not detected in samples from surface water. Low concentrations of methylbromide, methylchloride, and toluene were detected in five samples of ground water but were not detected in subsequent sampling. None of the constituents were detected in the resampling of these wells.

Concentrations of dissolved and total organic carbon were higher in surface water than in ground water. Adsorption can reduce the amount of organics in ground water.

Low concentrations of oil and grease were detected in 7 of 25 surface-water samples. Oil and grease were not detected in any of the ground-water and bottom-sediment samples. The presence of oil and grease in surface water was most likely the result of rainfall runoff from roads and parking lots.

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BASIC DATA

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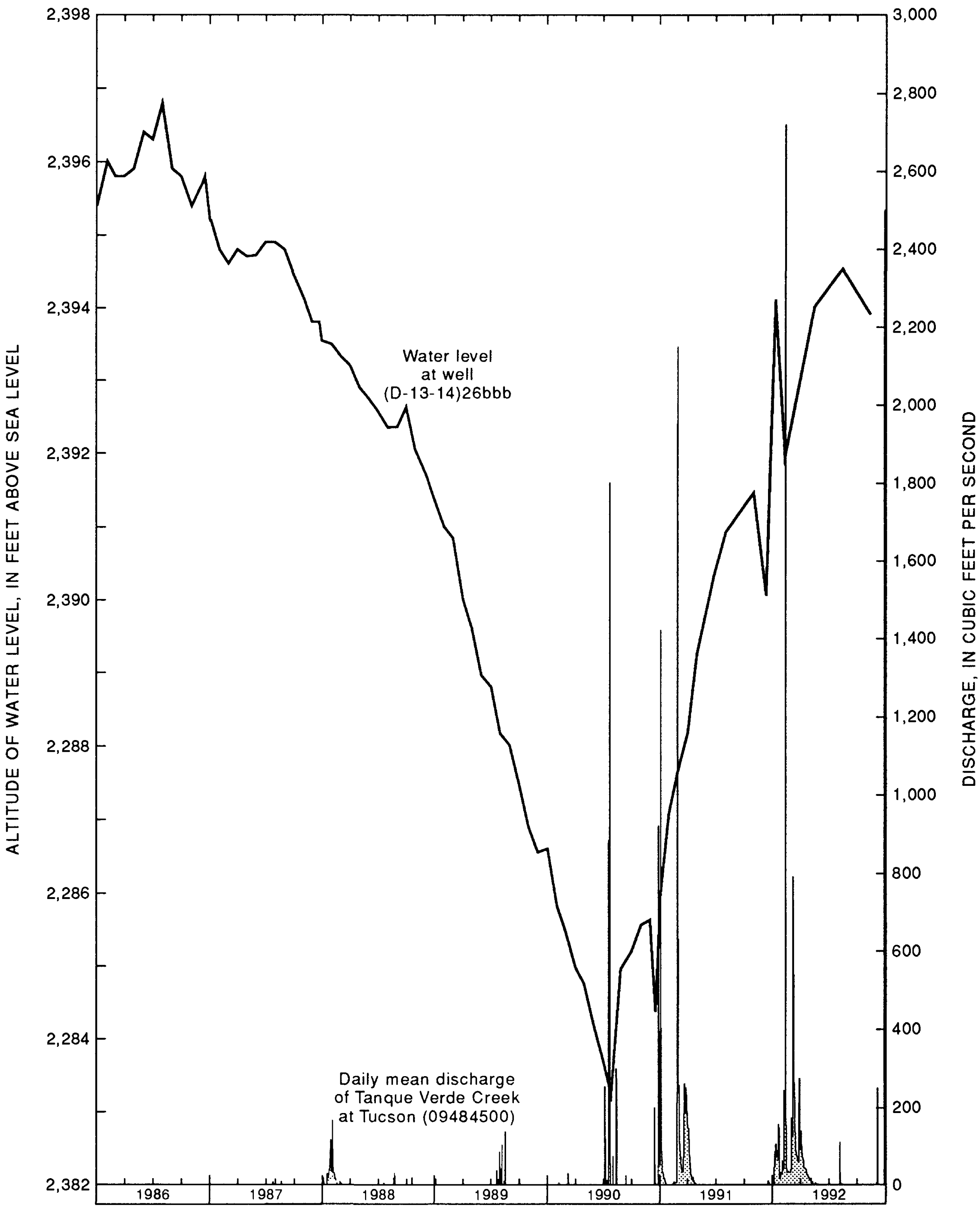

Figure 7. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)26bbb, 1986–92.

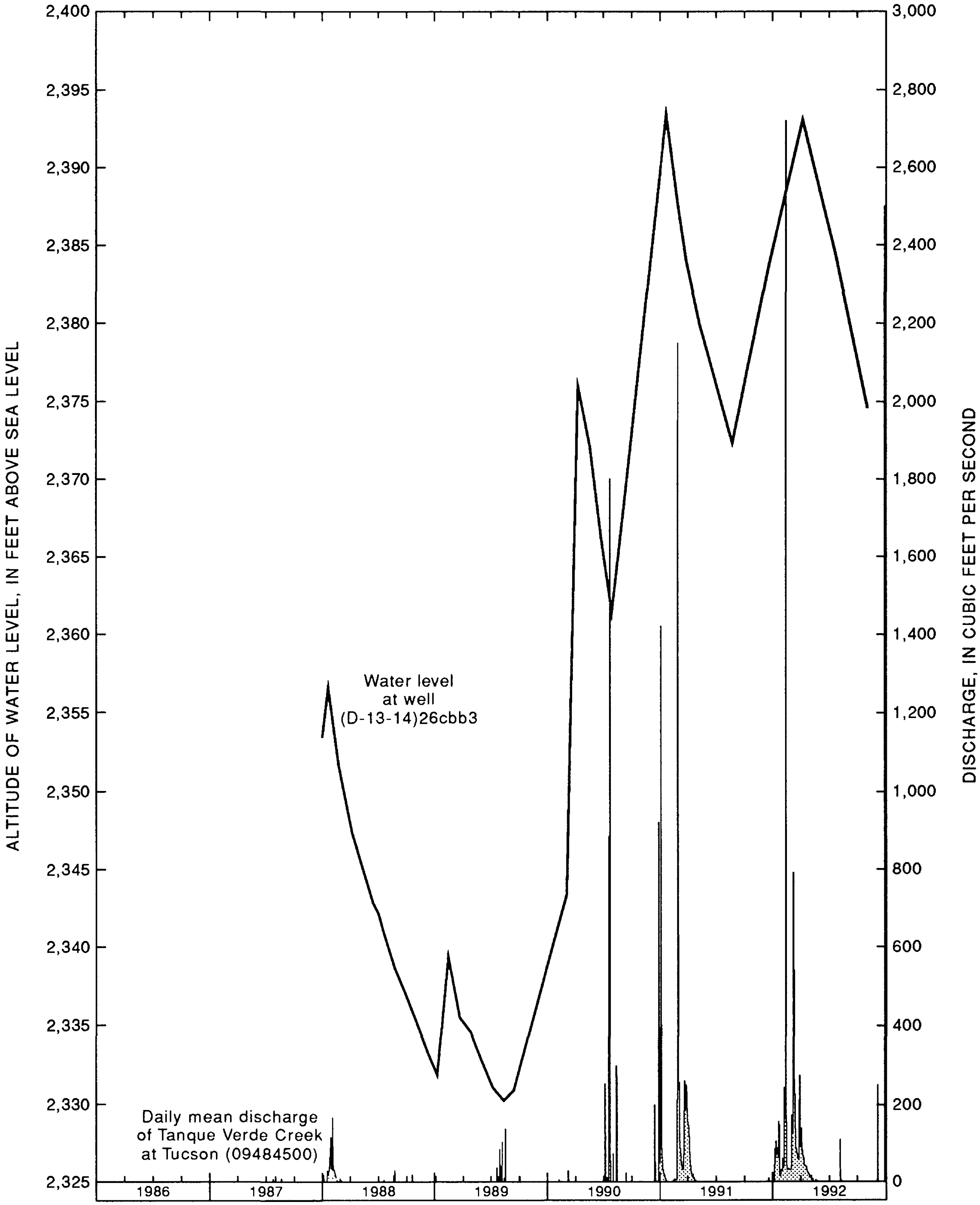

Figure 8. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)26cbb3, 1986–92.

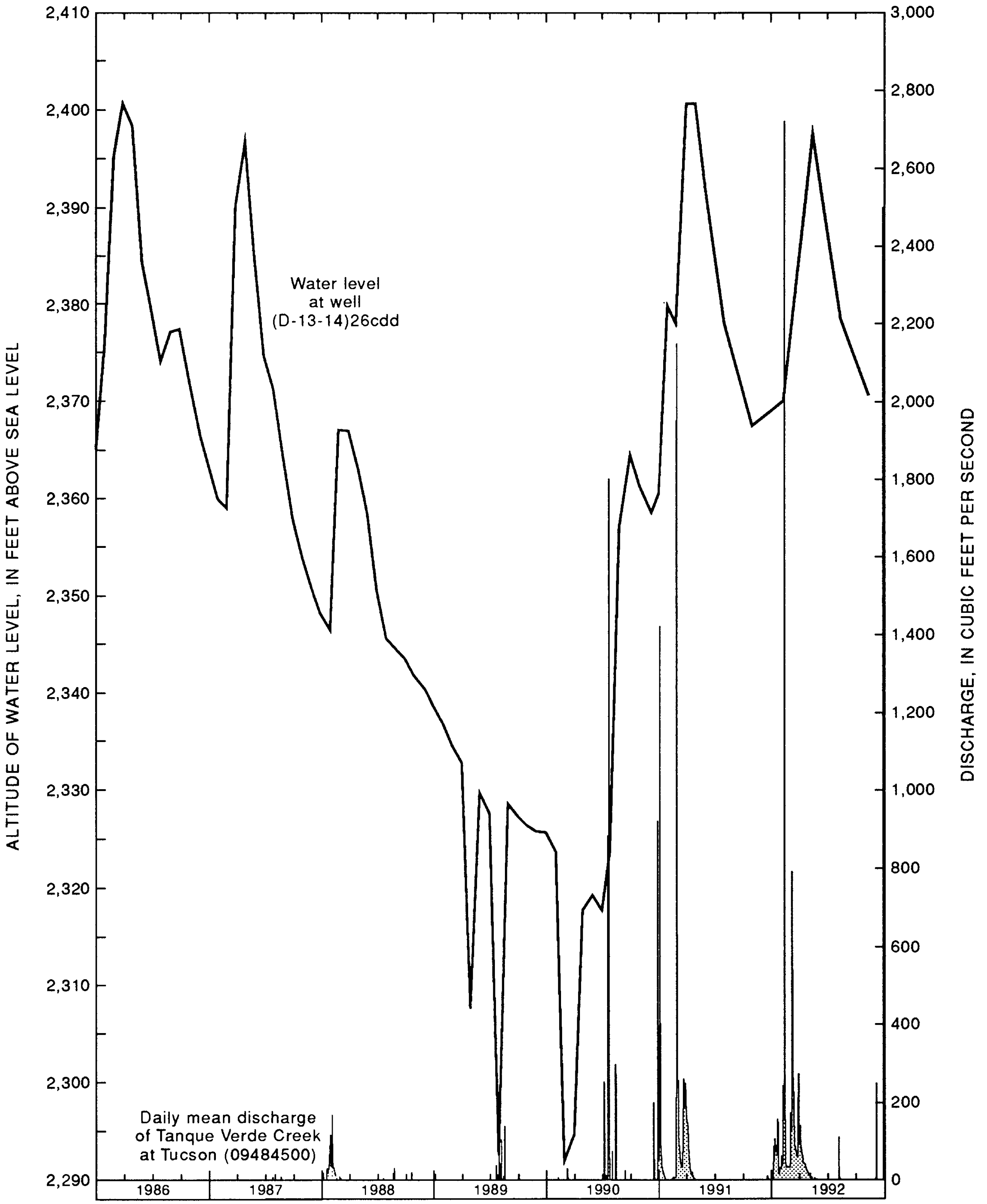

Figure 9. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)26cdd, 1986–92.

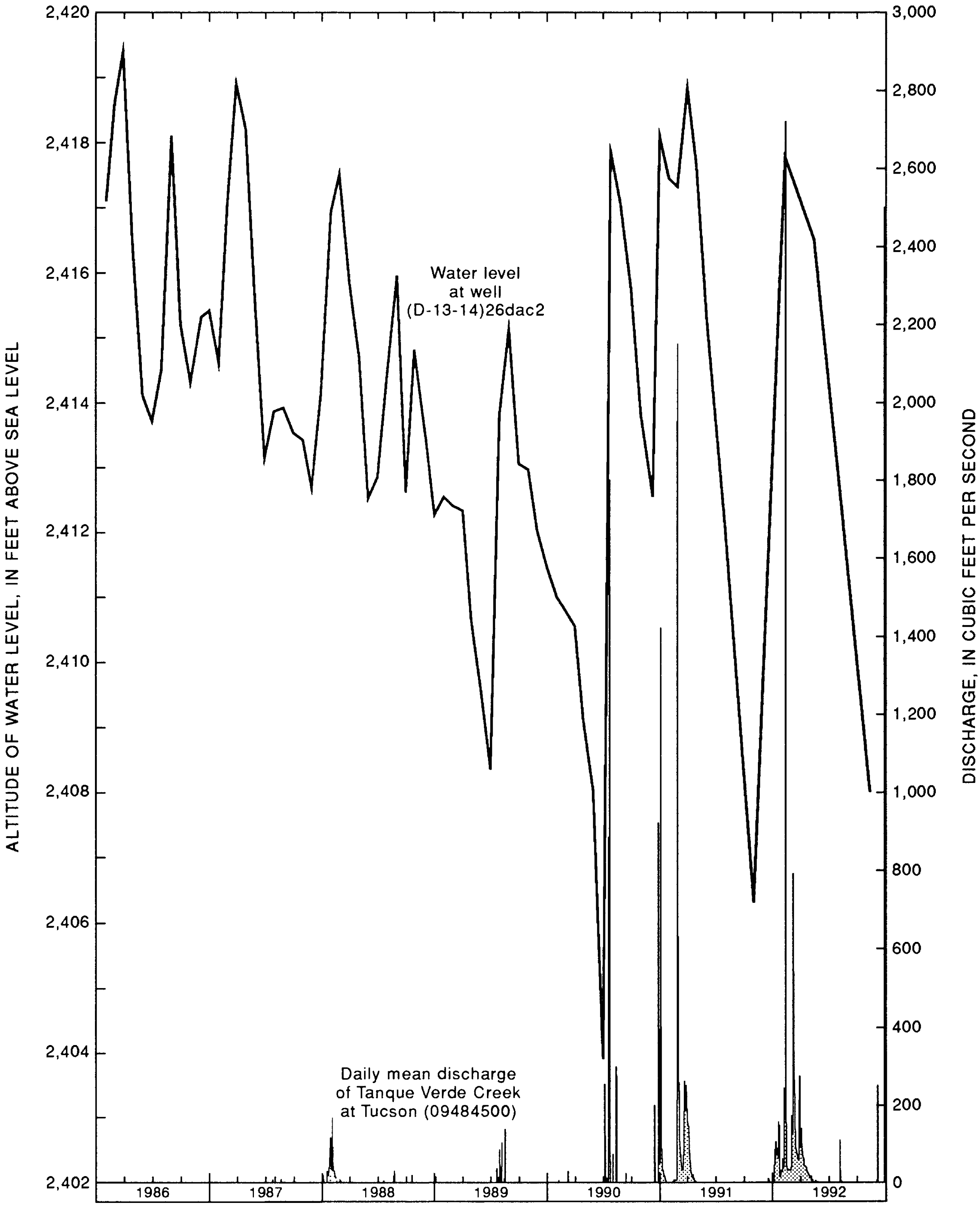

Figure 10. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)26dac2, 1986–92.

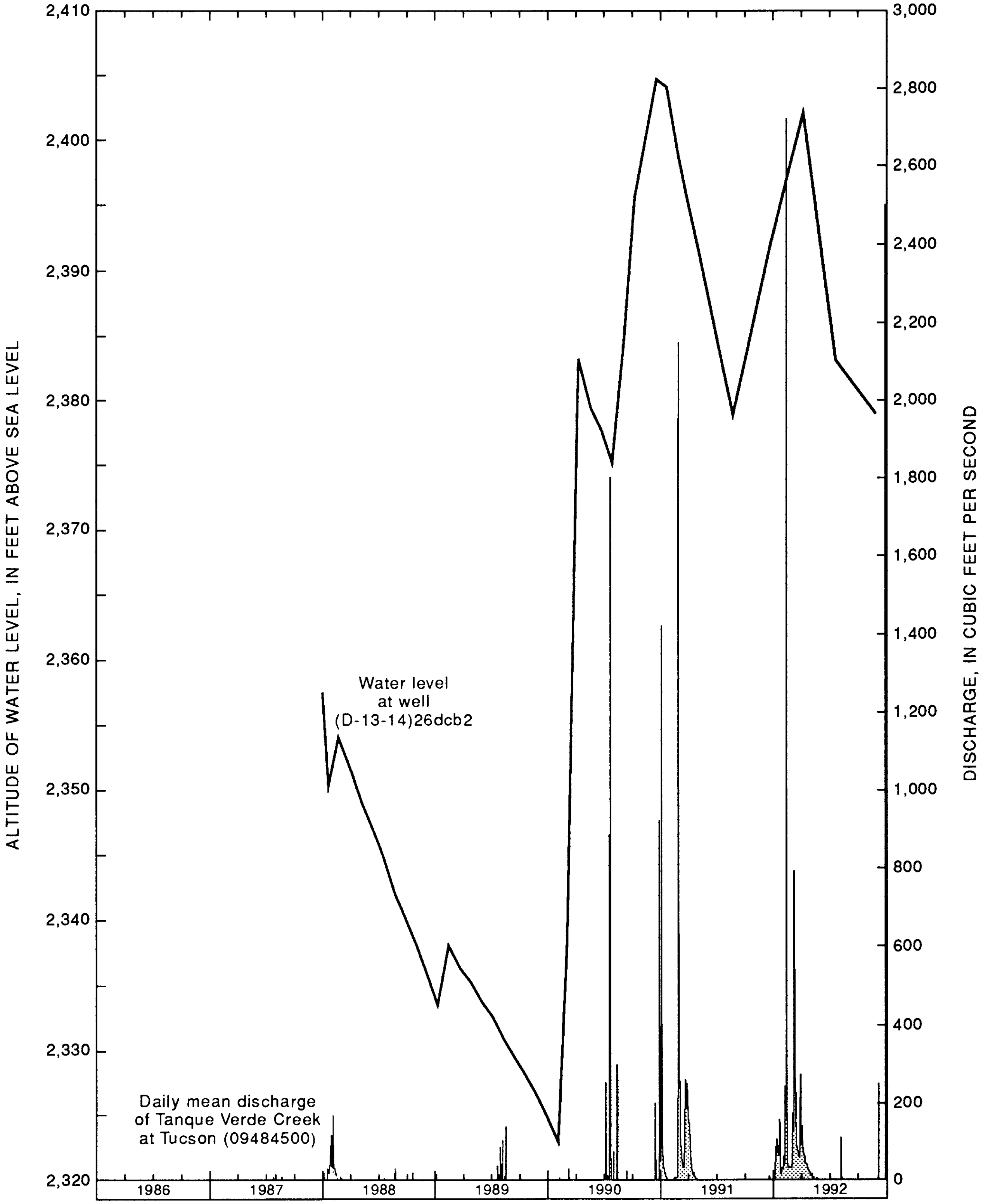

Figure 11. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)26dcb2, 1986–92.

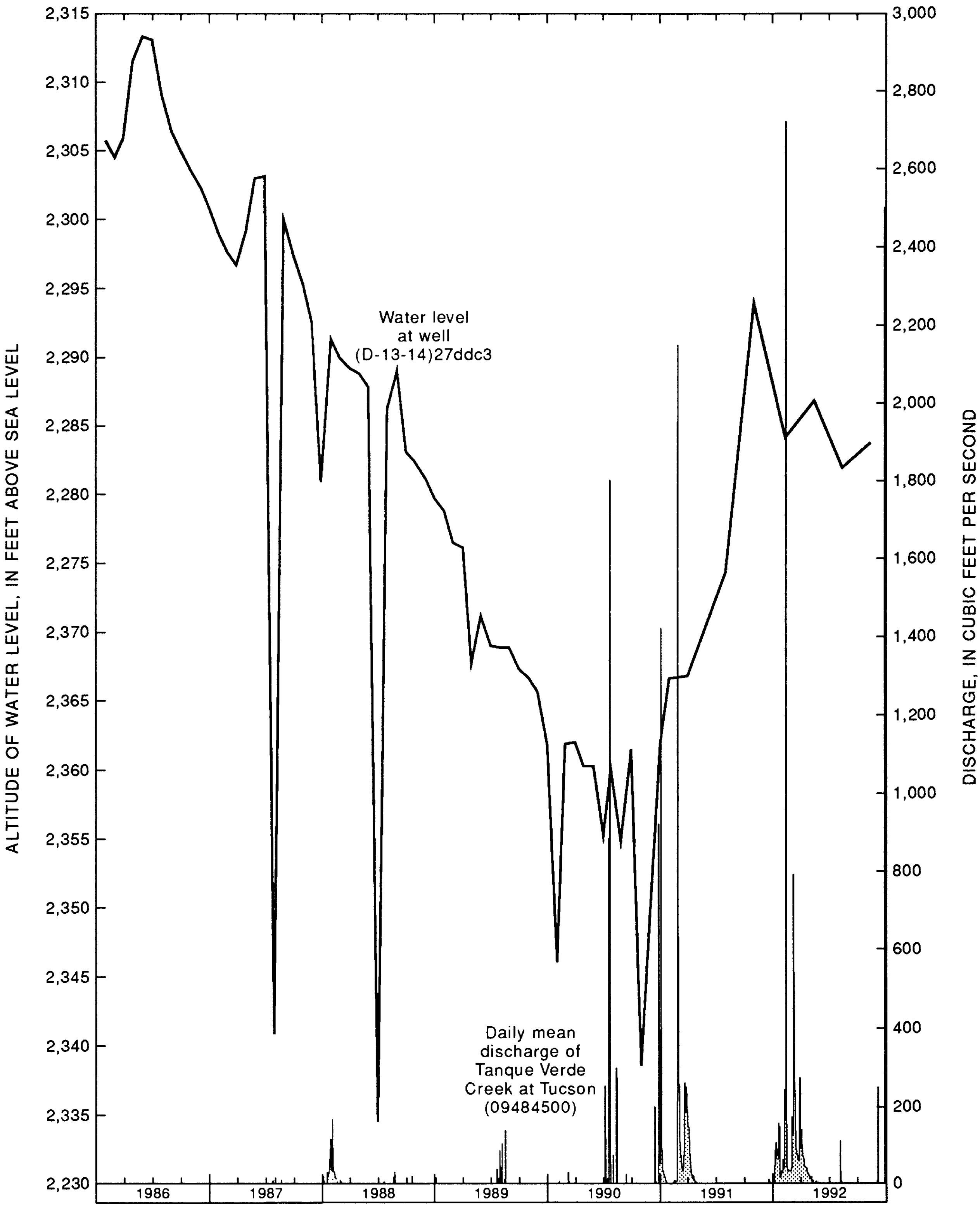

Figure 12. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)27ddc3, 1986–92.

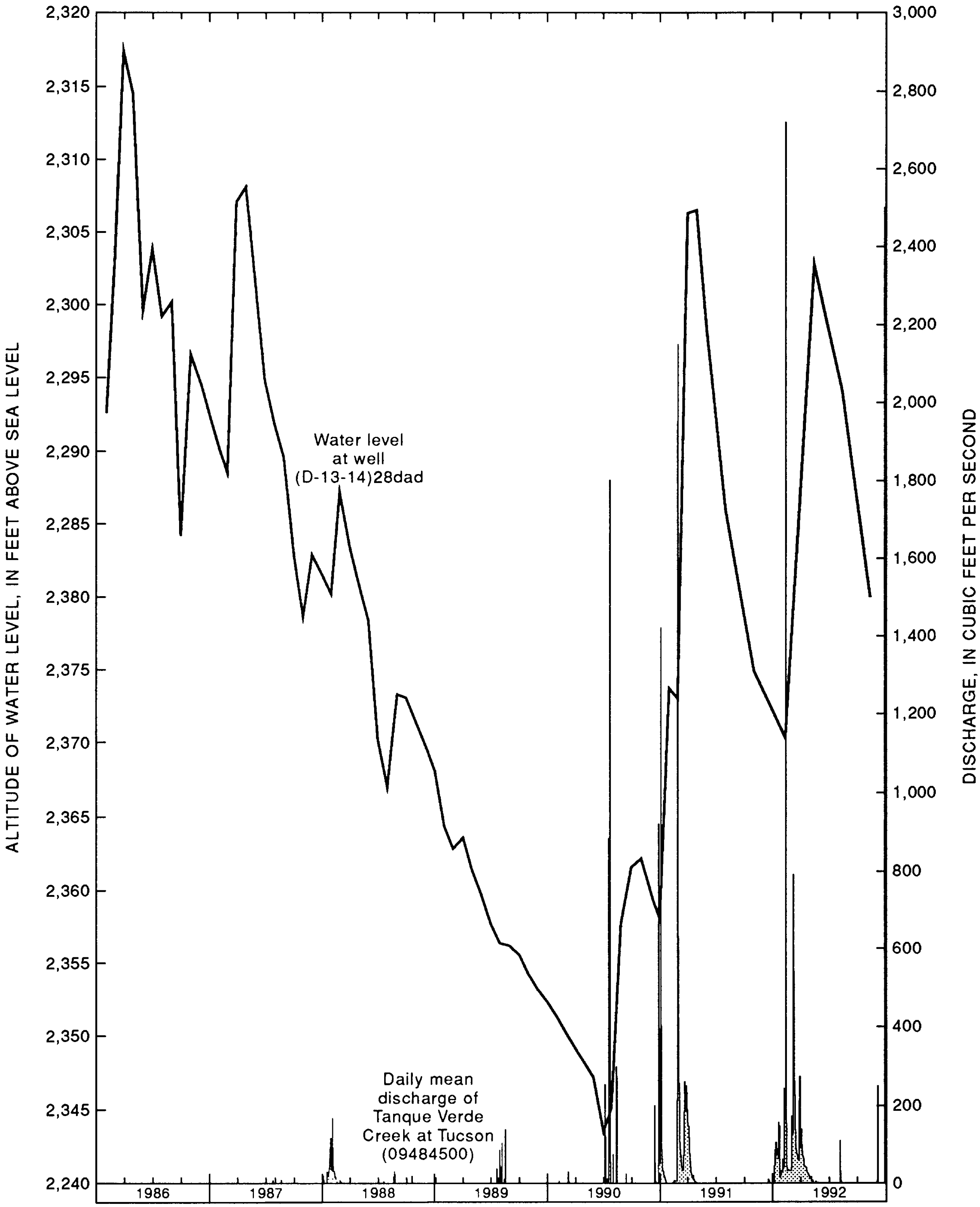

Figure 13. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)28dad, 1986–92.

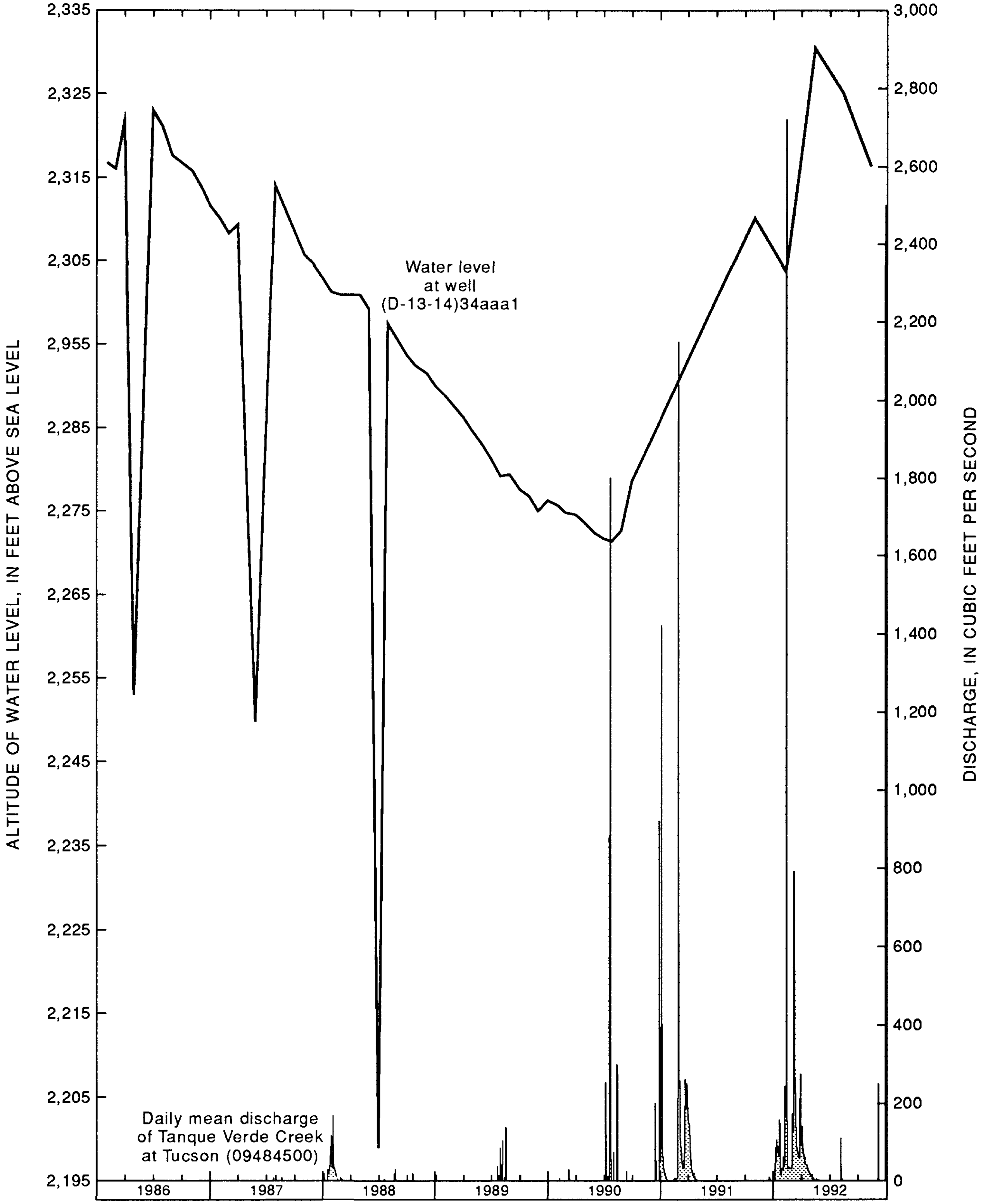

Figure 14. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)34aaa1, 1986–92.

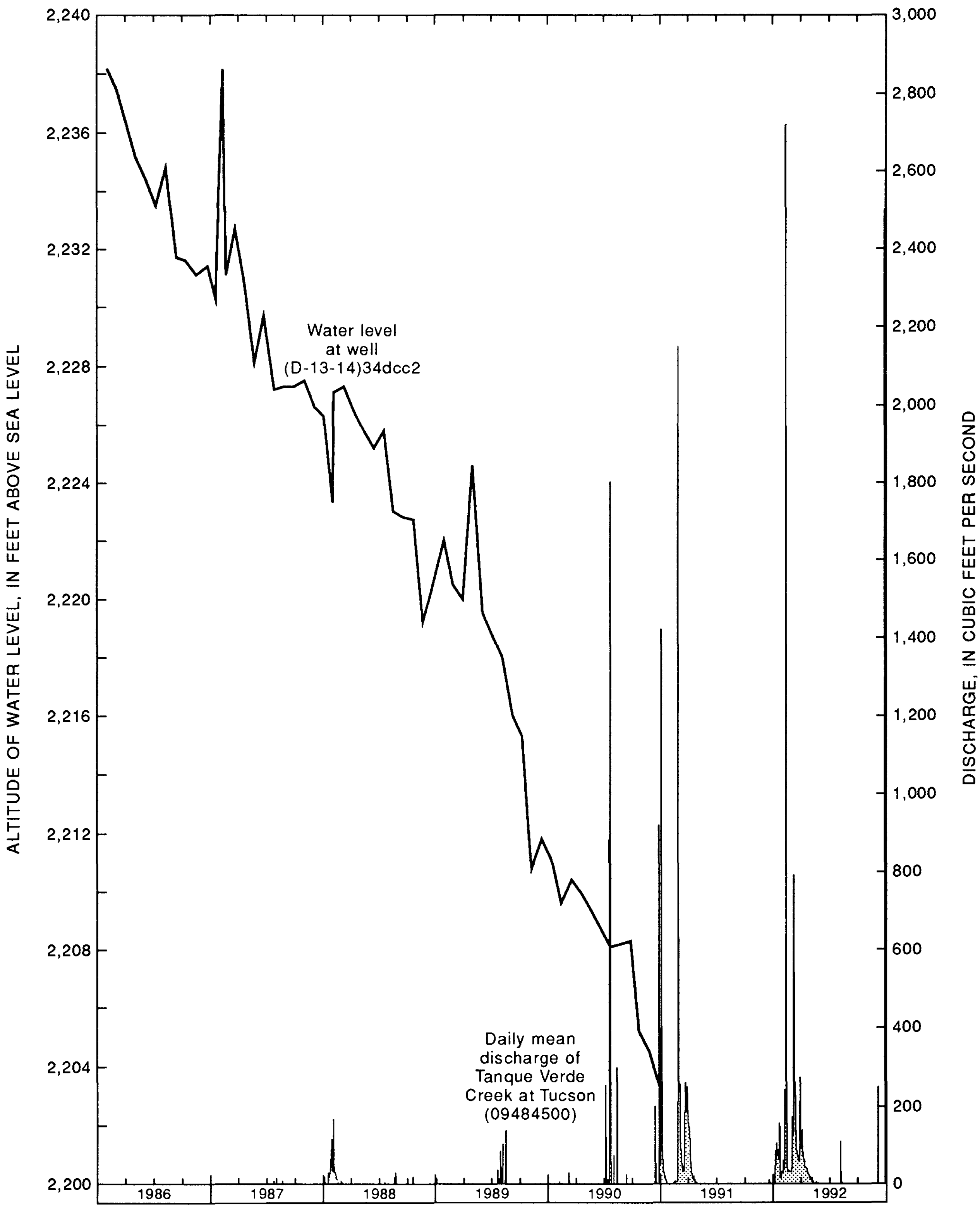

Figure 15. Flow in Tanque Verde Creek and water levels in observation well (D-13-14)34dcc2, 1986–92.

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Table 7. Suspended-sediment concentration and particle-size distribution of surface-water samples, Rillito Creek basin

[ft^3/s, cubic feet per second; mg/L, milligrams per liter; mm, millimeter; <, less than; ≥, equal to or greater than; dashes indicate no data]

Date	Time	Sample-collection method	Discharge (ft^3/s)	Suspended-sediment concentration (mg/L)	Particle-size distribution, in percent: Silt and clay <0.062 mm	Particle-size distribution, in percent: Sand and coarser material ≥0.062-2 mm
Tanque Verde Creek at Tucson						
08-25-87	1535	Automatic	23	1,290	3	97
01-28-88	1600	Manual	71	47	71	29
08-19-88	1820	Automatic	1,690	10,300	92	8
08-19-88	1935	Manual	275	5,420	97	3
08-03-89	1735	Manual	69	3,740	---	---
07-07-90	1430	Automatic	2,400	9,020	---	---
07-20-90	0250	Automatic	1,600	5,520	---	---
07-24-90	0940	Automatic	4,400	8,380	---	---
01-06-92	1430	Manual	105	182	66	34
01-13-92	1230	Manual	62	22	78	22
02-09-92	1115	Manual	120	133	10	90
02-21-92	1100	Manual	35	39	24	76
03-13-92	1030	Manual	164	220	7	93
Pantano Wash at Broadway Boulevard						
07-20-88	1520	Manual	20	4,860	100	0
07-24-90	1130	Manual	4,470	27,000	---	---
02-13-92	0930	Manual	97	3,340	8	92
12-29-92	1045	Manual	35	1,790	99	1
Alamo Wash at Glenn Street						
02-25-87	1220	Manual	59	1,350	84	16
07-26-87	1515	Manual	168	2,930	83	17
09-04-87	1530	Manual	58	558	91	9
11-01-87	1000	Automatic	747	4,600	92	8
08-20-88	2200	Automatic	4,000	9,050	82	18
07-20-90	0330	Automatic	800	5,230	---	---
07-24-90	0700	Automatic	870	2,930	---	---
09-14-90	1900	Automatic	955	6,260	---	---
10-27-91	1040	Manual	62	589	88	12
11-15-91	1320	Manual	33	147	90	10
12-11-91	1100	Manual	49	313	55	45
01-06-92	1310	Manual	325	789	64	36
Rillito Creek at Dodge Boulevard						
07-30-88	0950	Manual	224	36,700	98	2
08-20-88	2340	Automatic	5,900	18,600	86	14
10-20-88	1000	Manual	265	5,410	84	16
07-26-89	2030	Manual	3,940	26,300	---	---
07-07-90	1550	Automatic	2,300	25,200	---	---
07-20-90	0325	Automatic	4,800	15,400	---	---
07-24-90	1830	Manual	5,260	22,300	---	---
02-09-92	0950	Manual	95	251	47	53
02-13-92	1400	Manual	4,500	18,200	67	33
02-13-92	1433	Automatic	4,300	7,320	30	70
03-13-92	1430	Manual	149	67	35	65

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Properties and major ions

[ft³/s, cubic feet per second; °C, degrees Celsius; mm, millimeter; μS/cm, microsiemens per centimeter; mg/L, miligrams per liter; NTU nephelometric-turbidity units; μg/L, micrograms per liter; pCi/L, picocuries per liter; dashes indicate no data; <, less than]

Date	Discharge, instantaneous, (ft³/s)	Temperature, water (°C)	Temperature, air (°C)	Barometric pressure (mm of Hg)	Specific conductance (μS/cm)	Specific conductance lab (μS/cm)	Oxygen, dissolved (mg/L)	pH (standard units)	Turbidity (NTU)
Tanque Verde Creek at Tucson									
08-25-87	23	28.0	---	711	99	78	11.0	8.0	26
01-28-88	71	13.0	25.0	---	70	63	---	8.0	6.5
02-02-88	44	9.0	12.0	711	59	62	10.2	9.2	4.4
08-19-88	1,800	26.0	---	---	135	108	---	8.6	260
08-19-88	633	26.0	---	692	109	107	6.5	8.7	380
08-01-89	6	30.5	346.0	693	110	105	6.6	8.4	2.3
07-07-90	2,400	---	---	---	---	257	---	---	330
07-07-90	450	23.5	---	681	290	192	6.4	8.2	1,200
07-08-90	1,600	---	---	---	---	362	---	---	880
01-05-91	1,080	---	---	---	98	215	---	8.1	730
01-06-92	105	11.0	10.0	---	67	79	---	7.0	46
01-13-92	62	9.0	9.5	---	58	60	---	6.9	5.2
02-09-92	120	10.5	14.0	---	47	51	---	6.5	7.0
02-21-92	35	---	---	---	---	74	---	---	5.2
Pantano Wash at Broadway Boulevard									
11-01-87	50	20.0	22.0	628	95	98	8.5	8.6	870
07-24-90	9,600	---	---	---	118	106	---	8.6	3,400
07-24-90	4,470	22.0	30.0	---	130	169	---	8.4	3,800
02-13-92	97	---	---	---	87	---	---	---	850
12-29-92	35	13.0	17.0	---	104	118	---	7.3	730
Alamo Wash at Glenn Street									
08-11-87	230	---	---	---	116	150	---	7.9	87
09-04-87	58	27.0	28.0	712	95	172	6.2	8.5	140
08-20-88	4,000	---	---	---	110	127	---	8.6	160
07-24-90	870	---	---	---	---	188	---	---	450
10-27-91	62	18.0	16.5	---	97	108	---	7.5	140
11-15-91	33	14.0	11.0	---	79	112	---	6.9	52
12-11-91	49	13.0	14.0	---	65	93	---	7.2	75
01-06-92	325	10.0	9.0	---	56	87	---	8.2	170
Rillito Creek at Dodge Boulevard									
07-30-88	5,300	---	---	---	380	461	---	8.0	29,000
08-20-88	5,900	---	---	---	150	104	---	8.7	500
07-24-90	1,360	---	---	---	475	293	---	---	1,300
07-24-90	5,260	---	35.0	---	---	189	---	8.5	3,200
01-05-91	1,050	---	---	---	---	103	---	8.5	850
02-09-92	95	9.0	9.5	---	64	75	---	6.9	39
02-13-92	4,500	---	---	---	---	104	---	---	510
02-13-92	4,300	17.0	---	---	66	87	---	6.8	450

Table 8. Analytical results of surface-water samples, Rillito Creek basin—Continued
Properties and major ions—Continued

Date	Alkalinity, lab (mg/L as $CaCO_3$)	Alkalinity, water dissolved in field (mg/L as $CaCO_3$)	Carbonate, water dissolved in field (mg/L as CO_3)	Bicarbonate, water dissolved in field (mg/L as HCO_3)	Hardness, total (mg/L as $CaCO_3$)	Hardness, noncarbonate dissolved in field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Potassium, dissolved (mg/L as K)
Tanque Verde Creek at Tucson									
08-25-87	26	30	0	36	25	0	7.7	1.4	1.5
01-28-88	14	15	0	19	18	2	5.4	1.1	.8
02-02-88	14	34	11	20	21	0	6.1	1.3	.9
08-19-88	32	---	---	---	35	---	12	1.1	3.7
08-19-88	33	31	0	38	37	6	13	1.1	4.6
08-02-89	31	50	0	61	35	0	11	1.9	2.1
07-07-90	80	---	---	---	81	---	25	4.6	6.5
07-07-90	80	56	0	68	49	0	16	2.2	3.8
07-08-90	94	---	---	---	51	---	17	2.1	4.0
01-05-92	90	40	0	49	39	0	13	1.7	1.9
01-06-92	27	21	0	26	25	3	8.2	1.0	.9
01-13-92	15	12	0	15	16	3	4.7	1.0	.7
02-19-92	15	12	---	14	15	3	4.3	1.0	.7
02-21-92	20	---	---	---	21	---	6.6	1.2	.7
Pantano Wash at Broadway Boulevard									
11-01-87	91	39	0	47	32	0	11	1.2	3.4
07-24-88	---	40	---	49	36	0	12	1.5	2.9
07-24-90	134	50	---	61	46	0	15	2.0	3.5
02-13-92	33	---	---	---	28	---	10	.8	1.6
12-29-92	68	45	0	55	43	0	15	1.3	2.2
Alamo Wash at Glenn Street									
08-11-87	39	48	0	56	43	0	15	1.3	2.8
09-04-87	73	39	0	47	150	110	53	5.1	2.1
08-20-88	28	---	---	---	32	---	11	1.0	3.0
07-24-90	87	---	---	---	31	---	11	.9	1.6
10-27-91	71	27	0	33	37	10	13	1.0	2.9
11-15-91	43	25	0	31	31	5	11	.8	2.0
12-11-91	52	28	0	34	26	0	9.4	.7	1.4
01-06-92	43	25	0	31	24	0	8.5	.6	1.3
Rillito Creek at Dodge Boulevard									
07-30-88	109	97	0	121	140	40	46	5.9	5.1
08-20-88	39	---	---	---	38	---	13	1.4	4.2
07-24-90	35	30	---	36	36	7	12	1.5	2.6
07-24-90	37	61	---	74	52	0	16	2.9	4.1
01-05-92	46	47	0	57	42	0	14	1.6	1.9
02-09-92	29	23	---	28	24	1	8.2	.8	.8
02-13-92	57	---	---	---	30	---	10	1.1	1.5
02-13-92	40	24	0	29	27	---	9.1	1.1	1.3

Table 8. Analytical results of surface-water samples, Rillito Creek basin—Continued
Properties and major ions—Continued

Date	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Sodium, percent	Chloride, dissolved (mg/L as CL)	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, residue at 180°C dissolved (mg/L)
				Tanque Verde Creek at Tucson				
08-25-87	5.1	0.4	29	2.2	13	0.20	12	44
01-28-88	5.0	.5	36	2.9	15	.20	13	62
02-02-88	4.9	.5	33	3.0	16	.20	12	61
08-19-88	8.8	.7	33	5.2	12	.20	5.4	108
08-19-88	4.3	.3	18	3.4	13	.20	6.5	107
08-01-89	6.4	.5	27	4.4	14	.10	13	85
07-07-90	8.9	.4	18	7.2	9.7	<.10	8.5	205
07-07-90	4.1	.3	14	3.6	6.4	.10	6.8	137
07-08-90	4.4	.3	15	5.7	4.5	.20	6.3	155
01-05-91	5.3	.4	22	6.6	5.9	<.10	8.1	148
01-06-92	4.8	.4	29	2.6	5.5	<.10	9.4	62
01-13-92	5.5	.6	42	3.4	9.5	.20	15	59
02-09-92	4.2	.5	37	2.4	6.3	.20	11	41
02-21-92	5.7	.5	36	4.0	8.9	.10	14	60
				Pantano Wash at Broadway Boulevard				
11-01-87	2.9	.2	15	2.6	8.5	.10	5.1	54
07-24-90	6.1	.4	25	1.3	1.2	.20	6.6	80
07-24-90	7.1	.5	24	3.5	7.3	<.10	7.9	126
02-13-92	1.8	.1	11	0.9	2.6	<.10	2.8	39
12-29-92	4.0	.3	16	2.0	5.4	.10	8.8	95
				Alamo Wash at Glenn Street				
08-11-87	5.5	.4	21	3.2	16	.10	4.6	85
09-04-87	2.5	.1	3	1.3	13	.10	36	68
08-20-88	3.5	.3	18	4.5	10	.10	4.9	127
07-24-90	2.1	.2	12	1.7	2.6	.10	3.0	89
10-27-91	3.5	.3	16	2.8	7.1	.10	2.4	94
11-15-91	3.2	.3	17	3.9	4.2	.20	2.2	56
12-11-91	1.6	.1	11	.8	2.0	<.10	1.9	53
01-06-92	1.5	.1	11	1.3	2.3	.10	1.7	46
				Rillito Creek at Dodge Boulevard				
07-30-88	14	.5	17	5.3	52	.60	14	243
08-20-88	4.9	.3	20	2.4	10	.10	8.2	104
07-24-90	3.9	.3	18	4.9	6.1	<.10	4.7	84
07-24-90	7.5	.5	22	4.6	17	.20	18	163
01-05-91	6.2	.4	23	3.8	7.2	<.10	12	19
02-09-92	4.3	.4	27	2.6	6.6	.20	11	48
02-13-92	5.2	.4	26	1.7	6.7	.20	11	90
02-13-92	4.5	.4	25	1.5	6.6	.20	10	75

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Nutrients

Date	Discharge, instantaneous, (ft^3/s)	Phosphate, total (mg/L as PO_4)	Phosphate, ortho, dissolved (mg/L as PO_4)	Phosphorus, total (mg/L as P)	Phosphorus, dissolved (mg/L as P)	Phosphate, ortho, dissolved (mg/L as P)	Nitrogen, total (mg/L as N)	Nitrogen, organic total (mg/L as N)
				Tanque Verde Creek at Tucson				
08-25-87	23	0.06	0.06	0.10	0.03	0.02	---	0.67
02-02-88	44	.03	---	.02	.01	<.01	---	.57
08-01-89	6	.15	.15	.09	.07	.05	---	.58
08-03-89	69	2.36	1.2	2.40	.46	.38	11	9.7
01-05-91	1,080	.34	.28	.59	.29	.09	1.3	1.1
01-06-92	105	.18	.06	.18	.03	.02	.71	.54
01-13-92	62	.03	.03	.02	.02	.01	.46	.37
02-21-92	35	.06	.06	.02	.02	.02	.31	.17
				Pantano Wash at Broadway Boulevard				
11-01-87	50	.67	.43	1.20	.18	.14	1.1	.63
07-24-90	4,470	.43	.43	4.90	.26	.14	3.3	2.6
02-13-92	97	.34	.28	.49	.09	.09	1.2	.89
12-29-92	35	---	.28	---	---	.09	---	---
				Alamo Wash at Glenn Street				
09-04-87	58	.40	.25	.16	.12	.08	2.2	1.5
10-27-91	62	.80	.71	.65	.33	.23	3.2	1.9
11-15-91	33	.46	.34	.29	.14	.11	1.5	.75
12-11-91	49	.37	.28	.20	.09	.09	.95	.51
01-06-92	325	.71	.25	.59	.09	.08	.73	.26
				Rillito Creek at Dodge Boulevard				
07-30-88	5,300	.40	.15	1.20	.07	.05	4.0	1.6
07-26-89	3,940	1.38	.98	.52	.36	.32	4.4	3.0
01-05-91	1,050	.34	.31	.42	.33	.10	1.3	.95
02-09-92	95	.18	.06	.14	.01	.02	---	.52
02-13-92	4,500	.61	.25	1.00	.09	.08	2.3	1.9
02-13-92	4,300	.21	.15	.42	.07	.05	1.7	1.4

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Nutrients—Continued

Date	Nitrogen, ammonia dis-solved (mg/L as N)	Nitrogen, ammonia total (mg/L as N)	Nitro-gen, nitrite, dis-solved (mg/L as N)	Nitro-gen, nitrite, total (mg/L as N)	Nitro-gen, nitrate, dis-solved (mg/L as N)	Nitro-gen, nitrate, total (mg/L as N)	Nitrogen, ammonia plus organic total (mg/L as N)	Nitrogen, NO_2+NO_3 total (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
Tanque Verde Creek at Tucson									
08-25-87	<0.01	0.03	---	<0.01	---	---	0.70	<0.10	<0.10
02-02-88	.02	.03	---	<.01	---	---	.60	<.10	<.10
08-01-89	.03	.02	---	<.01	---	---	.60	<.10	<.10
08-03-89	.32	.25	---	.09	---	0.71	10	.80	.91
01-05-91	.50	.04	.02	.02	0.18	.18	1.1	.20	.20
01-06-92	.04	.06	.01	.03	.08	.0	.60	.11	.09
01-13-92	.05	.03	.02	<.01	.07	---	.40	.06	.08
02-21-92	.05	.03	<.01	.01	---	10	.20	.11	.11
Pantano Wash at Broadway Boulevard									
11-01-87	.09	.07	---	.02	---	.38	.70	.40	.34
07-24-90	.15	.08	---	.05	----	.55	2.70	.60	.50
02-13-92	.04	.01	.02	.02	.26	.26	.90	.28	.28
12-29-92	.05	---	.02	---	.12	---	---	---	.14
Alamo Wash at Glenn Street									
09-04-87	.14	.33	---	.03	---	.37	1.80	.40	.36
10-27-91	.56	.59	.03	.04	.71	.67	2.50	.71	.74
11-15-91	.25	.25	.03	.05	.45	.43	1.00	.48	.48
12-11-91	<.16	.09	.02	.04	.36	.31	.60	.35	.38
01-06-92	.09	.14	.02	.12	.31	.21	.40	.33	.33
Rillito Creek at Dodge Boulevard									
07-30-88	.05	.97	---	.27	---	1.13	2.60	1.40	<.10
07-26-89	.56	.48	---	.12	---	.78	3.50	.90	.98
01-05-91	.37	.05	.02	.02	.18	.28	1.00	.30	.20
02-09-92	.04	.08	<.01	.02	---	---	.60	<.05	<.05
02-13-92	.06	.06	<.01	<.01	---	---	2.00	.26	.28
02-13-92	.04	.07	<.01	<.01	---	---	1.50	.20	.19

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Trace elements

Date	Discharge, instan-taneous, (ft³/s)	Barium, dissolved (µg/L as Ba)	Barium, total recov-erable (µg/L as Ba)	Zinc, dis-solved (µg/L as Zn)	Zinc, total recov-erable (µg/L as Zn)	Sele-nium, dis-solved (µg/L as Se)	Sele-nium, total (µg/L as Se)	Molyb-denum, dis-solved (µg/L as Mo)	Molyb-denum total (µg/L as Mo)
Tanque Verde Creek at Tucson									
08-25-87	23	---	<100	---	<10	---	<1	---	<1
02-02-88	44	100	100	20	20	<1	<1	2	2
08-20-88	3,800	---	1,800	---	1,000	---	<1	---	<1
08-03-89	69	---	1,200	---	760	---	<1	---	2
08-18-89	2,100	---	4,000	---	3,300	---	<4	---	<4
07-07-90	450	---	2,000	---	920	---	<3	---	<1
07-08-90	1,600	---	2,000	---	1,300	---	<3	---	3
07-20-90	2,200	11	1,200	12	790	<1	<2	1	2
07-24-90	4,400	---	1,500	---	800	---	<1	---	<1
08-03-90	1,400	---	1,700	---	1,000	---	<3	---	1
08-14-90	980	---	2,200	---	1,500	---	<2	---	<1
12-28-90	1,000	---	1,200	---	920	---	<1	---	<1
01-05-91	1,080	---	500	---	450	---	<1	---	3
01-06-92	105	29	100	11	60	<1	<1	<1	<1
02-09-92	120	6	<100	7	20	<1	<1	<1	<1
02-21-92	35	<100	<100	<10	20	<1	<1	<1	<1
Pantano Wash at Broadway Boulevard									
11-01-87	50	14	1,000	12	380	<1	<1	<1	1
07-30-88	26	---	3,000	---	1,200	---	<1	---	2
07-24-90	3,710	33	3,600	6	1,300	<1	<2	2	2
07-24-90	4,470	29	4,500	26	1,500	<1	<3	1	1
08-03-90	5,300	---	4,900	---	1,800	---	<3	---	2
02-13-92	97	16	800	5	360	<1	<1	1	1
12-29-92	35	30	---	5	---	<1	---	<1	---
Alamo Wash at Glenn Street									
02-25-87	55	---	100	---	80	---	<1	---	3
08-11-87	230	29	---	11	----	<1	---	<1	---
09-04-87	58	190	200	170	190	5	5	1	1
08-20-88	4,000	<100	<100	110	1,300	<1	<1	1	2
07-20-90	629	24	1,000	5	530	<1	<2	<1	1
07-24-90	870	---	500	---	270	---	<1	---	1
09-14-90	695	---	600	---	380	---	<1	---	1
10-27-91	62	<100	200	38	190	<1	<1	3	3
11-15-91	33	17	<100	13	110	<1	<1	2	1
12-11-91	49	14	<100	8	120	<1	<1	1	<1
01-06-92	325	27	200	7	220	<1	<1	1	2
Rillito Creek at Dodge Boulevard									
07-30-88	5,300	---	10,000	---	4,300	---	<1	---	1
08-20-88	5,900	---	4,200	---	1,600	---	<1	---	2
07-07-90	2,300	---	5,200	---	2,300	---	<1	---	4
07-20-90	4,800	21	2,300	5	1,000	<1	<2	1	2
07-24-90	1,360	---	2,400	---	970	---	6	---	2
07-24-90	5,260	36	4,600	49	1,400	<1	<3	<1	<1
01-05-91	1,050	---	800	---	450	---	<1	---	5
02-09-92	95	8	<100	<3	40	<1	<1	<1	<1
02-13-92	4,500	14	900	8	1,000	<1	<1	<1	2
02-13-92	4,300	11	500	5	270	<1	<1	<1	1

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Trace elements—Continued

Date	Arsenic, dissolved (µg/L as As)	Arsenic, total (µg/L as As)	Copper, dissolved (µg/L as Cu)	Copper, total (µg/L as Cu)	Mercury, dissolved (µg/L as Hg)	Mercury, total (µg/L as Hg)	Chromium, dissolved (µg/L as Cr)	Chromium, total (µg/L as Cr)
Tanque Verde Creek at Tucson								
08-25-87	---	<1	---	7	----	<0.10	---	130
02-02-88	<1	<1	6	<0.1	<0.10	<1	1	---
08-20-88	---	8	---	340	---	<.10	---	120
08-03-89	---	---	---	310	---	---	---	68
08-18-89	---	17	---	1,200	----	1.0	---	350
07-07-90	---	6	---	390	----	.50	---	110
07-08-90	---	10	---	450	----	.50	---	170
07-20-90	5	7	20	260	<.1	.30	2	99
07-24-90	---	4	---	320	----	.30	---	97
08-03-90	---	13	---	390	----	.50	---	140
08-14-90	---	27	---	660	----	2.8	---	210
12-28-90	---	15	---	400	----	.30	---	120
01-05-91	---	5	---	180	----	.30	---	55
01-06-92	<1	<1	10	---	<.1	<.10	3	3
02-09-92	<1	<1	<10	6	<.1	<.10	<1	2
02-21-92	<1	<1	<10	2	<.1	<.10	<1	<1
Pantano Wash at Broadway Boulevard								
11-01-87	3	5	<10	140	----	1.1	<10	48
07-30-88	---	10	---	520	----	----	---	160
07-24-90	6	14	20	510	----	.50	<1	160
07-24-90	4	17	30	600	<.1	.70	<1	200
08-03-90	---	21	---	630	----	.90	---	230
02-13-92	2	3	<10	130	<.1	<.10	<1	39
12-29-92	2	---	<10	---	<.1	----	<1	---
Alamo Wash at Glenn Street								
02-25-87	---	3	---	21	----	<.10	---	20
08-11-87	13	---	10	---	.2	----	<10	---
09-04-87	4	5	30	42	<.1	.10	20	20
08-20-88	11	12	340	340	<.1	<.10	1	120
07-20-90	9	12	10	140	<.1	.90	3	63
07-24-90	---	9	---	84	----	.20	---	37
09-14-90	---	38	---	200	----	.20	---	34
10-27-91	3	3	20	40	<.1	.20	2	23
11-15-91	2	2	20	94	<.1	<.10	<1	5
12-11-91	2	5	<10	---	<.1	<.10	<1	5
01-06-92	<1	3	10	---	<.1	<.10	2	14
Rillito Creek at Dodge Boulevard								
07-30-88	---	8	---	2,500	---	----	---	300
08-20-88	---	10	---	630	---	.20	---	200
07-07-90	---	15	---	960	---	1.0	---	240
07-20-90	10	15	20	260	<.1	1.2	<1	130
07-24-90	---	10	---	430	---	.50	---	160
07-24-90	5	18	30	580	<.1	.70	4	190
01-05-91	---	24	---	160	---	.30	---	57
02-09-92	<1	<1	<10	14	.1	.10	<1	3
02-13-92	4	4	<10	170	<.1	<.10	<1	57
02-13-92	1	3	<10	120	<.1	.10	<1	33

Table 8. Analytical results of surface-water samples, Rillito Creek basin—Continued
Trace elements—Continued

Date	Boron, dissolved (µg/L as B)	Vandium, dissolved (µg/L as V)	Silver, dissolved (µg/L as Ag)	Silver, total recoverable (µg/L as Ag)	Cadmium, dissolved (µg/L as Cd)	Cadmium, total recoverable (µg/L as Cd)	Lead, dissolved (µg/L as Pb)	Lead, total recoverable (µg/L as Pb)
Tanque Verde Creek at Tucson								
08-25-87	---	---	---	<1	---	<1	---	<5
02-02-88	<10	2	<1.0	<1	1.0	<1	<5	<5
08-20-88	---	---	---	<1	---	1	---	300
08-03-89	---	---	---	1	---	4	---	400
08-18-89	---	---	---	2	---	12	---	1,100
07-07-90	---	---	---	1	---	3	---	210
07-08-90	---	---	---	1	---	4	---	240
07-20-90	30	12	<1.0	<1	<1.0	2	1	200
07-24-90	---	---	---	1	---	2	---	260
08-03-90	---	---	---	1	---	4	---	310
08-14-90	---	---	---	1	---	4	---	520
12-28-90	---	---	---	1	---	3	---	300
01-05-91	---	---	---	<1	---	3	---	150
01-06-92	<10	4	<1.0	<1	<1.0	<1	1	11
02-09-92	<10	4	<1.0	<1	<1.0	<1	<1	2
02-21-92	<10	---	<1.0	<1	<1.0	<1	<1	<1
Pantano Wash at Broadway Boulevard								
11-01-87	20	11	1.0	1	<1.0	1	<5	100
07-30-88	---	---	---	<1	---	<1	---	500
07-24-90	30	10	1.0	1	<1.0	<1	<1	400
07-24-90	30	12	1.0	2	<1.0	<1	3	21
08-03-90	---	---	---	2	---	1	---	450
02-13-92	20	3	<1.0	<1	<1.0	2	1	130
12-29-92	10	6	<1.0	---	<1.0	---	1	---
Alamo Wash at Glenn Street								
02-25-87	---	---	---	<1	---	<1	---	60
08-11-87	40	11	<1.0	---	<1.0	---	<5	---
09-04-87	30	9	<1.0	1	1.0	1	<5	77
08-20-88	20	13	<1.0	2	2.0	2	<5	---
07-20-90	30	10	<1.0	<1	<1.0	4	1	210
07-24-90	---	---	---	<1	---	2	---	110
09-14-90	---	---	---	<1	---	4	---	200
10-27-91	20	12	<1.0	<1	<1.0	1	1	13
11-15-91	20	5	<1.0	<1	<1.0	<1	2	28
12-11-91	20	4	<1.0	<1	<1.0	<1	<1	30
01-06-92	10	4	<1.0	<1	<1.0	2	2	110
Rillito Creek at Dodge Boulevard								
07-30-88	---	---	---	4	---	1	---	1,900
08-20-88	---	---	---	1	---	6	---	----
07-07-90	---	---	---	2	---	3	---	600
07-20-90	40	13	<1.0	1	<1.0	4	1	370
07-24-90	---	---	---	1	---	2	---	320
07-24-90	40	18	<1.0	2	<1.0	<1	2	17
01-05-91	---	---	---	<1	---	3	---	160
02-09-92	<10	5	<1.0	<1	<1.0	<1	<1	7
02-13-92	20	7	<1.0	<1	<1.0	2	<1	120
02-13-92	10	6	<1.0	<1	<1.0	1	2	100

Table 8. Analytical results of surface-water samples, Rillito Creek basin—Continued
Trace elements—Continued

Date	Nickel, dissolved (µg/L as Ni)	Nickel, total recoverable (µg/L as Ni)	Manganese, total recoverable (µg/L as Mn)	Iron, total recoverable (µg/L as Fe)	Beryllium, total recoverable (µg/L as Be)	Lithium, total recoverable (µg/L as Li)	Aluminum, total recoverable (µg/L as Al)	Cobalt, total recoverable (µg/L as Co)
Tanque Verde Creek at Tucson								
08-25-87	---	<1	40	960	<10	<10	1,100	<1
02-02-88	2	2	20	330	<10	<10	470	3
08-20-88	---	97	6,900	100,000	10	220	150,000	30
08-03-89	---	86	6,400	85,000	10	120	95,000	40
08-18-89	---	400	21,000	510,000	20	380	410,000	50
07-07-90	---	110	8,700	160,000	<10	190	150,000	70
07-08-90	---	130	9,000	200,000	<10	280	210,000	90
07-20-90	4	100	5,100	130,000	10	170	130,000	40
07-24-90	---	100	6,000	130,000	<10	160	120,000	50
08-03-90	---	160	6,600	170,000	10	270	200,000	90
08-14-90	---	240	12,000	270,000	10	340	270,000	30
12-28-90	---	130	7,600	170,000	<10	200	71,000	80
01-05-91	---	260	3,000	72,000	<10	110	58,000	30
01-06-92	<1	2	120	3,500	<10	<10	4,700	3
02-09-92	<1	1	30	720	<10	<10	1,100	2
02-21-92	<1	3	20	360	<10	<10	830	<1
Pantano Wash at Broadway Boulevard								
11-01-87	<1	33	2,400	51,000	<10	110	56,000	20
07-30-88	---	200	15,000	170,000	20	610	280,000	20
07-24-90	1	190	11,000	200,000	10	350	220,000	100
07-24-90	3	200	13,000	250,000	20	450	300,000	130
08-03-90	---	300	17,000	290,000	20	520	320,000	170
02-13-92	<1	37	2,000	42,000	<10	70	49,000	20
12-29-92	<1	---	---	---	---	---	---	---
Alamo Wash at Glenn Street								
02-25-87	---	6	150	4,500	<10	<10	7,300	2
08-11-87	4	---	---	---	---	---	---	---
09-04-87	3	7	420	9,700	<10	20	17,000	5
08-20-88	1	100	4,900	93,000	10	180	140,000	30
07-20-90	4	56	1,900	59,000	<10	90	84,000	20
07-24-90	---	32	1,000	32,000	<10	40	43,000	10
09-14-90	---	33	1,100	28,000	<10	40	40,000	10
10-27-91	3	20	320	8,500	<10	20	10,000	5
11-15-91	1	5	110	2,600	<10	<10	3,500	2
12-11-91	<1	5	140	4,300	<10	10	6,600	3
01-06-92	<1	14	340	11,000	<10	10	18,000	6
Rillito Creek at Dodge Boulevard								
07-30-88	---	700	49,000	340,000	60	1,600	550,000	100
08-20-88	---	300	13,000	160,000	20	390	260,000	50
07-07-90	---	270	23,000	310,000	<10	360	290,000	180
07-20-90	1	170	7,300	160,000	10	260	180,000	50
07-24-90	---	160	7,000	150,000	<10	240	170,000	80
07-24-90	2	240	14,000	280,000	20	480	280,000	150
01-05-91	---	64	3,300	71,000	<10	110	56,000	30
02-09-92	<1	4	120	3,600	<10	<10	4,400	2
02-13-92	1	55	3,000	73,000	<10	110	71,000	40
02-13-92	1	32	1,800	44,000	<10	70	44,000	20

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Radionuclides

Date	Discharge, instantaneous, (ft^3/s)	Gross alpha, dissolved (µg/L as U-Nat)	Gross alpha, suspended (µg/L as U-Nat)	Gross beta, dissolved (pCi/L as Sr-90/Y-90)	Gross beta, suspended total (pCi/L as Sr-90/Y-90)	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, suspended total (pCi/L as Cs-137)
Tanque Verde Creek at Tucson							
02-02-88	44	0.6	0.4	0.9	<0.4	1.0	<0.4
08-01-89	6	.8	<.6	4.8	<.6	6.1	.6
08-03-89	69	.7	120	11	180	12	220
07-07-90	450	3.4	460	13	320	17	340
07-08-90	1,600	.7	150	9.9	160	13	190
01-06-92	105	<.6	2.2	1.4	4	1.5	4.4
Pantano Wash at Broadway Boulevard							
11-01-87	50	.7	180	2.8	97	3.5	110
07-20-88	20	1.5	400	5.6	220	7.7	250
07-24-90	4,470	4.4	93	5.2	23	7.0	25
08-03-90	5,300	1.4	1,500	4.6	910	6.2	1,000
02-13-92	97	.8	340	2.0	120	2.4	130
Alamo Wash at Glenn Street							
09-04-87	58	<.4	7.0	1.9	7.7	2.3	9.0
10-14-88	50	.6	1.2	3.1	110	4.1	120
11-15-91	33	<.6	10	1.7	6.8	1.9	7.5
Rillito Creek at Dodge Boulevard							
10-20-88	265	1.2	27	2.7	60	3.5	69
07-24-90	5,260	4.0	710	6.1	360	8.2	390
02-09-92	95	.8	7.5	.9	5.2	1.0	5.7

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Organochlorine pesticides
[DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenylethylene; DDT, dichlorodiphenyltrichloroethane; PCB, polychlorinated biphenyl]

Date	Dis-charge, instan-taneous, (ft^3/s)	Per-thane, total (µg/L)	Endo-sulfate, total (µg/L)	Aldrin, total (µg/L)	Chlor-dane, total (µg/L)	DDD, total (µg/L)	DDE, total (µg/L)	DDT, total (µg/L)	Diel-drin, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	44	<0.1	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01
07-24-90	4,400	<.1	<.01	<.01	.2	<.01	<.01	<.01	<.01
01-06-92	105	<.1	<.01	<.01	<.1	<.01	<.01	<.01	<.01
02-09-92	120	<.1	<.01	<.01	<.1	<.01	<.01	<.01	<.01
Pantano Wash at Broadway Boulevard									
11-01-87	50	<.1	<.01	<.01	.2	<.01	<.01	<.01	<.01
07-24-90		<.1	<.01	<.01	.1	<.01	<.01	<.01	<.01
02-13-92	97	<.1	<.01	<.01	<.1	<.01	<.01	<.01	<.01
Alamo Wash at Glenn Street									
07-26-87	415	<.1	<.01	.02	1.5	.03	.05	<.01	.19
09-04-87	58	<.1	<.01	<.01	.2	<.01	<.01	<.01	.01
07-24-90	870	<.1	<.01	<.01	.6	<.01	<.01	<.01	<.01
09-14-90	695	<.1	<.01	<.01	1.1	<.10	<.10	<.10	<.15
10-27-91	62	<.1	<.01	<.01	.1	<.01	<.01	<.01	.01
11-15-91	33	<.1	<.01	<.01	.1	<.01	<.01	<.01	.01
12-11-91	49	<.1	<.01	<.01	.1	<.01	.01	.01	.01
01-06-92	325	<.1	<.01	<.01	<.1	<.01	.01	<.01	.02
Rillito Creek at Dodge Boulevard									
07-30-88	5,300	<.1	<.01	<.01	.1	<.01	<.01	<.01	<.01
07-24-90	1,360	<.1	<.01	<.01	.1	<.01	<.01	<.01	.02
02-09-92	95	<.1	<.01	<.01	<.1	<.01	<.01	<.01	<.01
02-13-92	4,500	<.1	<.01	<.01	<.1	<.01	<.01	<.01	<.01

Table 8. Analytical results of surface-water samples, Rillito Creek basin—Continued
Organochlorine pesticides—Continued

Date	Endrin, total (µg/L)	Hepta-chlor, total (µg/L)	Hepta-chlor epoxide, total (µg/L)	Lindane, total (µg/L)	Toxa-phene, total (µg/L)	PCB, total (µg/L)	Naph-thalene, poly-chlor total (µg/L)	Meth-oxy-chlor, total (µg/L)	Mirex, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	<0.01	<0.01	<0.01	<0.01	<1	<0.1	<0.10	<0.01	<0.01
07-24-90	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
01-06-92	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
02-09-92	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
Pantano Wash at Broadway Boulevard									
11-01-87	<.01	<.01	<.01	<0.01	<1	<.1	<.10	<.01	<.01
07-24-90	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
02-13-92	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
Alamo Wash at Glenn Street									
07-26-87	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
09-04-87	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
07-24-90	.01	<.01	<.02	<.01	<1	<.1	<.10	<.01	<.01
09-14-90	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
10-27-91	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
11-15-91	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
12-11-91	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
01-06-92	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
Rillito Creek at Dodge Boulevard									
07-30-88	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
07-24-90	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
02-09-92	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01
02-13-92	<.01	<.01	<.01	<.01	<1	<.1	<.10	<.01	<.01

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Priority pollutants

Date	Discharge, instantaneous, (ft³/s)	Para-chloro-meta cresol, total (µg/L)	2-Chloro-phenol, total (µg/L)	2,4-Dichloro-phenol, total (µg/L)	2,4,6-Trichloro-phenol, total (µg/L)	2,4-Dimethyl-phenol, total (µg/L)	4,6-Dinitro-ortho-cresol, total (µg/L)	2,4-Dinitro-phenol, total (µg/L)	2-Nitro-phenol, total (µg/L)	4-Nitro-phenol, total (µg/L)
Tanque Verde Creek at Tucson										
02-02-88	44	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
08-20-88	3,800	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
07-20-90	2,200	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
07-24-90	4,400	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
01-05-91	1,080	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
01-06-92	105	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
02-09-92	120	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
Pantano Wash at Broadway Boulevard										
11-01-87	50	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
02-13-92	97	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
Alamo Wash at Glenn Street										
07-26-87	415	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
08-11-87	230	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
08-20-88	4,000	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
07-20-90	629	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
07-24-90	870	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
09-14-90	695	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
10-27-91	62	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
11-15-91	33	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
12-11-91	49	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
01-06-92	325	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
Rillito Creek at Dodge Boulevard										
07-30-88	5,300	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
08-20-88	5,900	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
07-20-90	4,800	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
01-05-91	1,050	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
02-09-92	95	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
02-13-92	4,500	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Priority pollutants—Continued

Date	Penta-chloro-phenol, total (μg/L)	Phenol, (C6h-50h) total (μg/L)	Ace-naph-thene, total (μg/L)	Ace-naph-thylene, total (μg/L)	Anthra-cene, total (μg/L)	Benzo A anthra-cene 1,2-benzan-thracene, total (μg/L)	Benzo B fluor-anthene, total (μg/L)	Benzo K fluor-anthene, total (μg/L)	Benzo A pyrene, total (μg/L)
Tanque Verde Creek at Tucson									
02-02-88	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
08-20-88	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
07-20-90	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
07-24-90	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
01-05-91	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
01-06-92	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
02-09-92	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
Pantano Wash at Broadway Boulevard									
11-01-87	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
02-13-92	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
Alamo Wash at Glenn Street									
07-26-87	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
08-11-87	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
08-20-88	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
07-20-90	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
07-24-90	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
09-14-90	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
10-27-91	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
11-15-91	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
12-11-91	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
01-06-92	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
Rillito Creek at Dodge Boulevard									
07-30-88	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
08-20-88	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
07-20-90	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
01-05-91	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
02-09-92	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
02-13-92	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Priority pollutants—Continued

Date	Benzogh I perylene,1, 12-benzo-perylene, total (µg/L)	N-butyl-benzly-phthalate, total (µg/L)	Bis (2-chloro-ethoxy) methane, total (µg/L)	Bis (2-chloro-ethyl) ether, total (µg/L)	Bis(2-chloro-isopropyl) ether, total (µg/L)	4-Bromo-phenyl phenyl ether, total (µg/L)	2-Chloro-naph-thalene, total (µg/L)	4-Chloro-phenyl phenyl ether, total (µg/L)	Chrysene, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
08-20-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-20-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-24-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
01-05-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
01-06-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
02-09-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
Pantano Wash at Broadway Boulevard									
11-01-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
02-13-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
Alamo Wash at Glenn Street									
07-26-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
08-11-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
08-20-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-20-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-24-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
09-14-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
10-27-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
11-15-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
12-11-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
01-06-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
Rillito Creek at Dodge Boulevard									
07-30-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
08-20-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-20-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
01-05-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
02-09-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
02-13-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Priority pollutants—Continued

Date	1,2,5,6 Dibenz-anthra-cene, total (µg/L)	Di-n-butyl phthal-ate, total (µg/L)	1,2-Di-chloro-benzene, total (µg/L)	1,3-Di-chloro-benzene, total (µg/L)	1,4-Di-chloro-benzene, total (µg/L)	Di-ethyl-phthal-ate, total (µg/L)	Di-methyl-phthal-ate, total (µg/L)	2,4-Di-nitro-toluene, total (µg/L)	2,6-Di-nitro-toluene, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
08-20-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-20-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-24-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-05-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-06-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
02-09-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Pantano Wash at Broadway Boulevard									
11-01-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
02-13-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Alamo Wash at Glenn Street									
07-26-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
08-11-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
08-20-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-20-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-24-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
09-14-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
10-27-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11-15-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
12-11-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-06-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Rillito Creek at Dodge Boulevard									
07-30-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
08-20-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-20-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-05-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
02-09-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
02-13-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Priority pollutants—Continued

Date	Di-n-octyl phthalate, total (µg/L)	Bis (2-ethylhexyl) phthalate, total (µg/L)	Fluorene, total (µg/L)	Fluoranthene, total (µg/L)	Hexachlorobenzene, total (µg/L)	Hexachlorobutadiene, total (µg/L)	Hexachlorocyclopentadiene, total (µg/L)	Hexachloroethane, total (µg/L)	Indeno (1,2,3-cd) pyrene, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
08-20-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-20-90	<10.0	----	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
04-24-90	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
01-05-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
01-06-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
02-09-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
Pantano Wash at Broadway Boulevard									
11-01-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
02-13-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
Alamo Wash at Glenn Street									
07-26-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
08-11-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
08-20-88	<10.0	<7.0	<5.0	5.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-20-90	<10.0	----	<5.0	6.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-24-90	<10.0	10.0	<5.0	6.0	<5.0	<5.0	<5.0	<5.0	<10.0
09-14-90	<10.0	6.0	<5.0	5.0	<5.0	<5.0	<5.0	<5.0	<10.0
10-27-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
11-15-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
12-11-91	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
01-06-92	<10.0	6.0	<5.0	5.1	<5.0	<5.0	<5.0	<5.0	<10.0
Rillito Creek at Dodge Boulevard									
07-30-88	<10.0	<13.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
08-20-88	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
07-20-90	<10.0	7.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
01-05-91	<10.0	11.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
02-09-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
02-13-92	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0

Table 8. Analytical results of surface-water samples, Rillito Creek basin
Priority pollutants—Continued

Date	Iso-phorone, total (µg/L)	Naph-thalene, total (µg/L)	Nitro-benzene, total (µg/L)	N-nitro-sodi-methyl-amine, total (µg/L)	N-nitro-sodi-phenyl-amine, total (µg/L)	N-nitro-sodi-n-propyl-amine, total (µg/L)	Phenan-threne, total (µg/L)	Pyrene, total (µg/L)	1,2,4-Trichloro-benzene, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
02-20-88	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-20-90	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-24-90	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-05-91	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-06-92	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
02-09-92	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Pantano Wash at Broadway Boulevard									
11-01-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
02-13-92	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Alamo Wash at Glenn Street									
07-26-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
08-11-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
09-20-88	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.0	<5.0
07-24-90	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	<5.0
07-14-90	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
09-27-90	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
10-27-91	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.0	<5.0
11-15-91	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	<5.0
12-11-91	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-06-92	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Rillito Creek at Dodge Boulevard									
07-30-88	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
08-20-88	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
07-20-90	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-05-91	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
01-09-92	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
02-13-92	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table 8. Analytical results of surface-water samples, Rillito Creek basin—Continued
Volatile organic compounds

Date	Discharge, instantaneous, (ft^3/s)	Benzene, total (µg/L)	Bromoform, total (µg/L)	Carbontetrachloride, total (µg/L)	Chlorobenzene, total (µg/L)	Chlorodibromomethane, total (µg/L)	Chloroethane, total (µg/L)	2-Chloroethylvinylether, total (µg/L)	Chloroform, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	44	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
01-06-92	105	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Pantano Wash at Broadway Boulevard									
11-01-87	50	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
07-24-90	4,470	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
02-13-92	97	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Alamo Wash at Glenn Street									
09-04-87	58	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
11-15-91	33	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
01-06-92	325	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Rillito Creek at Dodge Boulevard									
07-30-88	5,300	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
02-09-92	95	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Date	Dichlorobromomethane, total (µg/L)	Dichlorodifluoromethane, total (µg/L)	1,1-Dichloroethane, total (µg/L)	1,2-Dichloroethane, total (µg/L)	1,1-Dichloroethylene, total (µg/L)	1,2-Transdichloroethane, total (µg/L)	1,2-Dichloropropane, total (µg/L)	1,3-Dichloropropene, total (µg/L)	Ethylbenzene, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
01-06-92	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	---	<3.0
Pantano Wash at Broadway Boulevard									
11-01-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
07-24-90	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
02-13-92	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	---	<3.0
Alamo Wash at Glenn Street									
09-04-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
11-15-91	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	---	<3.0
01-06-92	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	---	<3.0
Rillito Creek at Dodge Boulevard									
07-30-88	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
02-09-92	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	---	<3.0

Table 8. Analytical results of surface-water samples, Rillito Creek basin—Continued
Volatile organic compounds—Continued

Date	Methyl-bromide, total (µg/L)	Methyl-ene, chloride, total (µg/L)	1,1,2,2-Tetra-chloro-ethane, total (µg/L)	Tetra-chloro-ethylene, total (µg/L)	Toluene, total (µg/L)	1,1,1-Tri-chloro-ethane, total (µg/L)	1,1,2-Tri-chloro-ethane, total (µg/L)	Tri-chloro-ethylene, total (µg/L)	Tri-chloro-fluoro-methane, total (µg/L)
Tanque Verde Creek at Tucson									
02-02-88	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
01-06-92	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Pantano Wash at Broadway Boulevard									
11-01-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
07-24-90	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
02-13-92	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Alamo Wash at Glenn Street									
09-04-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
11-15-91	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
01-06-92	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Rillito Creek at Dodge Boulevard									
07-30-88	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
02-09-92	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Date	Vinyl chlo-ride, total (µg/L)	Methyl-chloride, total (µg/L)	1,2-Di-bromo-ethane, total (µg/L)	1,2-Di-chloro-benzene, total (µg/L)	1,3-Di-chloro-benzene, total (µg/L)	1,4-Di-chloro-benzene, total (µg/L)	Cis 1,3-Di-chloro-propene, total (µg/L)	Trans-1,3-Di-chloro-propene, total (µg/L)	Styrene, total (µg/L)	Xylene, total, (µg/L)
Tanque Verde Creek at Tucson										
02-02-88	<3.0	<3.0	---	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0	<3.0
01-06-92	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Pantano Wash at Broadway Boulevard										
11-01-87	<3.0	<3.0	---	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0	<3.0
07-24-90	<1.0	<3.0	<3.0	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0	<3.0
02-13-92	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Alamo Wash at Glenn Street										
09-04-87	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
11-15-91	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
01-06-92	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Rillito Creek at Dodge Boulevard										
07-30-88	<3.0	<3.0	---	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0	<3.0
02-09-92	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Table 8. Analytical results of surface-water samples, Rillito Creek basin—Continued
Organic carbon and oil and grease

Date	Discharge, instantaneous, (ft^3/s)	Carbon organic, dissolved (mg/L as C)	Carbon, organic total (mg/L as C)	Oil and grease, total recoverable, gravimetric (mg/L)
Tanque Verde Creek at Tucson				
08-25-87	23	10	9.3	--
02-02-88	44	9.3	8.8	<1
08-20-88	3,800	6.0	110	2
08-01-89	6	15	15	<1
08-03-89	69	13	87	<1
07-07-90	450	19	210	--
07-20-90	2,200	---	53	1
07-24-90	4,400	---	180	<1
12-28-90	1,000	---	240	--
01-05-91	1,080	---	74	--
01-06-92	105	---	13	<1
02-09-92	120	---	12	<1
Pantano Wash at Broadway Boulevard				
11-01-87	50	---	64	<1
07-24-90	3,710	---	99	<1
07-24-90	4,470	5.7	150	<1
02-13-92	97	---	30	--
12-29-92	35	15	---	--
Alamo Wash at Glenn Street				
08-11-87	230	18	69	--
09-04-87	458	---	29	2
08-20-88	4,000	7.2	93	3
07-20-90	629	---	38	<1
07-24-90	870	---	---	<1
10-27-91	69	---	41	1
11-15-91	33	---	20	1
12-11-91	49	---	14	<1
01-06-92	325	---	15	<1
Rillito Creek at Dodge Boulevard				
07-30-88	5,300	---	---	<1
08-20-88	5,900	7.3	210	2
07-26-89	3,940	14	190	<1
07-20-90	4,800	---	---	<1
02-09-92	95	---	19	<1
02-13-92	4,500	---	48	<1

Table 9. Analytical results of ground-water samples, Rillito Creek basin
Properties and major ions

[°C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, miligrams per liter; NTU nephelometric-turbidity units; µg/L, micrograms per liter; pCi/L, picocuries per liter; dashes indicate no data; <, less than]

Well number (D-13-14)	Date	Temperature, water (°C)	Specific conductance (µS/cm)	Bicarbonate, lab (mg/L as HCO_3)	Oxygen, dissolved (mg/L)	Turbidity (NTU)	Solids, residue at 180°C, dissolved (mg/L)	pH (standard units)	Alkalinity, lab (mg/L as $CaCO_3$)	Hardness, total (mg/L as $CaCO_3$)	Silica, dissolved (mg/L as SiO_2)
34dcc2	09-08-86	24.0	605	267	6.5	0.5	370	7.2	219	190	38
	06-16-87	24.0	660	---	6.1	---	---	7.2	---	---	--
	03-27-89	---	---	252	---	.4	317	---	207	150	36
34aaa1	09-09-86	19.0	267	113	8.0	.2	183	7.4	93	59	24
	06-16-87	19.0	240	---	9.3	---	---	7.4	---	---	---
	03-29-89	---	---	121	---	.1	166	---	99	62	25
27ddc3	08-27-86	21.0	275	138	7.2	.6	187	7.7	113	82	27
	06-15-87	19.0	295	---	5.9	---	---	7.5	---	---	---
	03-28-89	---	---	154	---	.1	202	---	126	92	27
26cdd	09-09-86	17.5	225	105	5.1	.8	136	7.0	86	81	24
	06-16-87	17.0	220	---	5.7	---	---	7.1	---	---	---
27cda	08-25-86	20.5	360	170	4.1	.2	241	7.8	139	95	28
	03-30-89	---	---	176	---	.1	218	---	144	95	29
	11-03-89	20.0	375	---	4.8	---	---	7.6	---	---	---
26dda2	08-26-86	20.5	405	205	3.7	.4	245	7.3	168	170	20
	03-29-89	---	---	141	---	.5	190	---	116	130	20
	11-03-89	21.5	430	---	6.0	---	---	6.7	---	---	---
26dac2	08-26-86	21.0	255	124	2.6	1.9	137	6.9	102	99	19
	06-16-87	19.0	320	---	4.4	---	---	7.3	---	---	---
	03-29-89	---	---	165	---	.2	216	---	135	150	19
28dad	08-25-86	18.0	235	143	10.4	.3	187	7.9	117	110	28
	03-29-89	---	---	129	---	.1	152	---	106	92	28
27ada2	08-27-86	24.0	603	233	6.2	.2	363	7.6	191	190	39
	06-15-87	25.0	685	---	6.7	---	---	7.3	---	---	---
	03-29-89	---	---	216	---	.1	308	---	177	170	40
27bdb4	08-28-86	16.5	317	152	3.1	.3	197	6.9	125	140	17
	09-08-86	17.5	215	101	3.9	1.8	132	7.0	83	90	18
	06-15-87	16.0	245	---	3.6	---	---	7.0	---	---	---
	03-27-89	---	---	243	---	90	315	---	199	140	30
26bbb	09-08-86	25.0	720	152	7.2	.6	480	7.6	125	250	43
	06-15-87	25.0	690	---	4.7	---	---	7.7	---	---	---
	03-27-89	---	---	139	---	3.8	689	---	114	390	43
26dcb2	03-28-89	17.5	230	111	4.6	25	146	6.9	91	90	23
26cbb3	03-28-89	21.5	305	136	2.7	3.5	187	6.7	111	120	26
26cbb2	03-28-89	20.0	470	180	5.8	.6	248	7.4	148	150	33

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Properties and major ions—Continued

Well number (D-13-14)	Date	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Potassium, dissolved (mg/L as K)	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Chloride, dissolved (mg/L as Cl)	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L as F)
34dcc2	09-08-86	64	6.4	2.1	55	2	16	42	0.2
	03-27-89	51	5.4	2.0	46	2	10	28	.1
34aaa1	09-09-86	22	1.0	1.0	29	2	10	20	.3
	03-29-89	23	1.1	.9	31	2	9.0	17	.3
27ddc3	08-27-86	31	1.1	1.3	25	1	4.2	16	.2
	03-28-89	35	1.1	1.4	29	1	4.9	22	.2
26cdd	09-09-86	29	2.1	1.2	12	.6	3.5	16	.3
27cda	08-25-86	36	1.2	1.5	36	2	8.7	27	.5
	03-30-89	36	1.3	1.2	39	2	6.8	22	.5
26dda2	08-26-86	59	6.3	2.3	14	.5	10	22	.3
	03-29-89	43	4.7	1.9	13	.5	8.8	33	.2
26dac2	08-26-86	34	3.4	1.9	9.6	.4	4.2	12	.2
	03-29-89	51	5.0	2.0	15	.5	12	27	.2
28dad	08-26-86	40	1.9	1.4	13	.5	3.2	17	.2
	03-29-89	34	1.7	1.0	13	.6	2.0	10	.2
27ada2	08-27-86	59	10	2.5	43	1	43	23	.4
	03-29-89	51	9.3	2.3	36	1	29	16	.4
27bdb4	08-28-86	46	5.0	2.1	9.0	.3	3.0	25	.2
	09-08-86	31	3.1	1.9	7.2	.3	2.2	15	.3
	03-27-89	48	5.2	2.2	51	2	18	20	.5
26bbb	09-08-86	80	13	2.5	36	1	97	13	.6
	03-27-89	120	21	3.1	42	.9	180	17	.3
26dcb2	03-28-89	32	2.5	1.0	8.8	.4	3.6	13	.2
26cbb3	03-28-89	44	3.4	1.1	9.2	.4	3.4	25	.2
26cbb2	03-28-89	53	4.3	1.5	21	.7	9.5	28	.2

Table 9. Analytical results of ground-water samples, Rillito Creek basin
Nutrients

Well number (D-13-14)	Date	Phosphate, total (mg/L as PO_4)	Phosphate, ortho, dissolved (mg/L as PO_4)	Phosphorus, total (mg/L as P)	Phosphorus, dissolved (mg/L as P)	Phos-phorus, ortho dissolved (mg/L as P)	Nitrogen, total (mg/L as N)	Nitrogen, organic total (mg/L as N)
34dcc2	09-08-86	0.06	---	0.02	0.02	<0.01	3.9	0.37
	03-27-89	.03	0.03	.02	.02	.01	2.6	---
34aaa1	09-09-86	.06	.06	.02	.02	.02	1.3	---
27ddc3	08-27-86	.03	---	.03	.03	<.01	3.4	2.1
	03-28-89	.09	---	<.01	<.01	<.01	---	---
26cdd	09-09-86	.09	.09	.04	.04	.03	.80	---
27cda	08-25-86	---	---	.02	.01	<.01	---	---
26dda2	08-26-86	.12	.06	.04	.03	.02	.70	.16
26dac2	08-26-86	.12	.06	.07	.03	.02	---	---
28dad	08-25-86	---	---	.02	.01	<.01	---	---
27ada2	08-27-86	---	---	.02	.01	<.01	9.7	.46
	06-15-87	---	---	.03	.02	<.01	8.6	.69
	03-29-89	.06	---	<.01	<.01	<.01	4.8	.36
27bdb4	08-28-86	---	---	---	---	---	---	---
	09-08-86	.18	.15	.07	.06	.05	1.1	.48
26bbb	09-08-86	---	---	.01	<.01	<.01	19	1.1
	06-15-87	---	---	.03	.02	<.01	17	1.8
	03-27-89	---	---	<.01	<.01	<.01	25	.27
26dcb2	03-28-89	.12	.06	.12	.04	.02	---	---
26cbb3	03-28-89	.06	---	.03	.01	<.01	2.3	.45
26cbb2	03-28-89	---	---	.01	.01	<.01	2.1	.39

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Nutrients—Continued

Well number (D-13-14)	Date	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, ammonia total (mg/L as N)	Nitrogen, nitrite, total (mg/L as N)	Nitrogen, nitrate total (mg/L as N)	Nitrogen, ammonia plus organic, total (mg/L as N)	Nitrogen, NO_2+NO_3, total (mg/L as N)	Nitrogen, NO_2+NO_3, dissolved (mg/L as N)
34dcc2	09-08-86	0.02	0.03	0.01	3.49	0.40	3.50	3.40
	03-27-89	<.01	<.01	<.01	---	.20	2.40	2.40
34aaa1	09-09-86	<.01	<.01	<.01	---	.40	.90	.95
27ddc3	08-27-86	<.01	.05	<.01	---	2.2	1.20	1.20
	03-28-89	<.01	.05	<.01	---	< .20	1.40	1.40
26cdd	09-09-86	<.01	<.01	<.01	---	.20	.60	.92
27cda	08-25-86	.02	<.01	<.01	---	<.20	1.60	1.50
26dda2	08-26-86	<.01	.04	<.01	---	.20	.50	.43
26dac2	08-26-86	<.01	.04	.02	.48	<.20	.50	.52
28dad	08-25-86	.01	<.01	<.01	---	<.20	1.10	1.10
27ada2	08-27-86	<.01	.04	<.01	---	.50	9.20	6.20
	06-15-87	.01	.01	<.01	---	.70	7.90	7.30
	03-29-89	<.01	.04	<.01	---	.40	4.40	4.50
27bdb4	08-28-86	---	---	---	---	---	---	---
	09-08-86	.01	.02	.01	.59	.50	.60	.61
26bbb	09-08-86	.05	.04	.01	18.0	1.1	18.0	16.0
	06-15-87	.02	.01	<.01	---	1.8	15.0	15.0
	03-27-89	.04	.03	<.01	---	.3	25.0	23.0
26dcb2	03-28-89	<.01	.04	<.01	---	<.20	1.00	1.00
26cbb3	03-28-89	<.01	.05	<.01	---	.50	1.80	1.90
26cbb2	03-28-89	.01	.01	<.01	---	.40	1.70	1.70

Table 9. Analytical results of ground-water samples, Rillito Creek basin
Trace elements

Well number (D-13-14)	Date	Barium, total recov-erable (µg/L as Ba)	Zinc, total recov-erable (µg/L as Zn)	Selenium, total (µg/L as Se)	Molyb-denum, total recov-erable (µg/L as Mo)	Arsenic, total (µg/L as As)	Copper, total recov-erable (µg/L as Cu)	Mercury, total recov-erable (µg/L as Hg)	Chro-mium, total recov-erable (µg/L as Cr)	Silver, total recov-erable (µg/L as Ag)
34dcc2	09-08-86	100	40	<1	1	<1	3	<0.10	<10	<1
34aaa1	09-09-86	<100	100	<1	2	4	33	<.10	10	<1
	06-16-87	<100	<10	<1	<1	3	2	<.10	10	<1
	03-29-89	100	<10	<1	2	4	1	<.10	2	<1
27ddc3	08-27-86	<100	30	<1	2	<1	3	<.10	<10	<1
26cdd	09-09-86	<100	10	<1	1	<1	3	.10	10	<1
27cda	08-25-86	<100	30	<1	5	3	3	<.10	<10	<1
26dda2	08-26-86	100	90	<1	<1	<1	6	<.10	10	<1
26dac2	08-26-86	100	60	<1	3	<1	7	<.10	<10	<1
28dad	08-25-86	<100	60	<1	4	<1	4	.10	<10	<1
27ada2	08-27-86	100	20	<1	2	3	6	<.10	<10	<1
27bdb4	08-28-86	---	---	---	---	---	---	---	---	---
	09-08-86	<100	<10	<1	2	1	6	<.10	<10	<1
26bbb	09-08-86	200	50	<1	1	2	5	<.10	<10	<1
	03-27-89	400	40	2	3	2	5	<.10	3	<1
26dcb2	03-28-89	100	20	<1	2	2	6	<.10	4	<1
26cbb3	03-28-89	200	<10	<1	2	2	1	<.10	2	1
26cbb2	03-28-89	<100	40	<1	2	1	1	<.10	3	<1

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Trace elements—Continued

Well number (D-13-14)	Date	Nickel, total recov-erable (µg/L as Ni)	Manga-nese, total recov-erable (µg/L as Mn)	Iron, total (µg/L as Fe)	Beryl-lium, total recov-erable (µg/L as Be)	Lithium, total recov-erable (µg/L as Li)	Alum-inum, total recov-erable (µg/L as Al)	Cobalt, total recov-erable (µg/L as Co)	Cadmium, total recov-erable (µg/L as Cd)	Lead, total recov-erable (µg/L as Pb)
34dcc2	09-08-86	3	20	380	<10	<10	---	<1	<1	<5
34aaa1	09-09-86	9	20	160	<10	30	80	<1	<1	38
	06-16-87	<1	<10	<10	<10	20	<10	<1	<1	<5
	03-29-89	<1	<10	50	<10	30	<10	<1	<1	<5
27ddc3	08-27-86	4	<10	10	<10	30	<10	<1	<1	<5
26cdd	09-09-86	5	<10	110	<10	<10	80	<1	<1	<5
27cda	08-25-86	1	<10	20	<10	60	<10	<1	<1	<5
26dda2	08-26-86	6	<10	70	<10	<10	<10	<1	<1	11
26dac2	08-26-86	2	40	960	<10	<10	10	<1	<1	<5
28dad	08-25-86	2	<10	80	<10	10	<10	<1	<1	<5
27ada2	08-27-86	4	10	40	<10	30	<10	<1	<1	<5
27bdb4	09-08-86	2	10	730	<10	<10	---	1	---	---
26bbb	09-08-86	4	180	1,200	<10	30	---	3	<1	<5
	03-27-89	4	180	2,300	<10	30	60	<1	<1	<5
26dcb2	03-28-89	2	160	3,400	<10	<10	2,200	9	<1	<5
26cbb3	03-28-89	<1	20	840	<10	10	<10	<1	<1	<5
26cbb2	03-28-89	<1	30	2,600	<10	<10	120	2	<1	<5

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued

Radionuclides

Well number (D-13-14)	Date	Gross alpha, dissolved (µg/L as U-Nat)	Gross beta, dissolved (pCi/L as Sr-90/Y-90)	Gross beta, dissolved (pCi/L as Cs-137)	Radon-222, total (pCi/L)
34dcc2	03-27-89	3.5	3.5	4.6	140
34aaa1	03-29-89	3.3	2.2	2.9	400
27ddc3	03-28-89	9.2	.8	1.0	470
27cda	03-30-89	9.0	3.8	5.3	690
26dda2	03-29-89	1.0	2.0	2.3	210
26dac2	03-29-89	1.3	3.2	4.2	170
28dad	03-29-89	3.5	1.8	2.4	270
27ada2	03-29-89	4.5	3.5	4.6	450
27bdb4	03-27-89	6.8	4.3	5.7	150
26bbb	03-27-89	1.9	4.6	6.7	120
26dcb2	03-28-89	<.6	.6	.7	500
26cbb2	03-28-89	2.3	2.0	2.7	440
26cbb3	03-28-89	.6	1.2	1.6	480

Organochlorine pesticides

[DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenylethylene; DDT, dichlorodiphenyltrichloroethane; PCB, polychlorinated biphenyl]

Well number (D-13-14)	Date	Perthane, total (µg/L)	Endosulfate, total (µg/L)	Aldrin, total (µg/L)	Chlordane, total (µg/L)	DDD, total (µg/L)	DDE, total (µg/L)	DDT, total (µg/L)	Dieldrin, total (µg/L)
34dcc2	09-08-86	<0.1	<0.010	<0.010	<0.1	<0.010	<0.010	<0.010	<0.010
34aaa1	09-09-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
27ddc3	08-27-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
26cdd	09-09-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
27cda	08-25-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
26dda2	08-26-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
26dac2	08-26-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
28dad	08-25-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
27ada2	08-27-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
27bdb4	09-08-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010
26bbb	09-08-86	<.1	<.010	<.010	<.1	<.010	<.010	<.010	<.010

Well number (D-13-14)	Date	Endrin, total (µg/L)	Hepta-chlor, total (µg/L)	Hepta-chlor epoxide, total (µg/L)	Lindane, total (µg/L)	Toxa-phene, total (µg/L)	PCB, total (µg/L)	Naph-thalene, polychlor total (µg/L)	Meth-oxychlor, total (µg/L)	Mirex, total (µg/L)
34dcc2	09-08-86	<0.010	<0.010	<0.010	<0.010	<1.0	<0.1	<0.10	<0.01	<0.01
34aaa1	09-09-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
27ddc3	08-27-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
26cdd	09-09-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
27cda	08-25-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
26dda2	08-26-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
26dac2	08-26-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
28dad	08-25-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
27ada2	08-27-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
27bdb4	09-08-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01
26bbb	09-08-86	<.010	<.010	<.010	<.010	<1.0	<.1	<.10	<.01	<.01

Table 9. Analytical results of ground-water samples, Rillito Creek basin
Priority pollutants

Well number (D-13-14)	Date	Para-chloro-meta cresol, total (µg/L)	2-Chloro-phenol, total (µg/L)	2,4-Di-chloro-phenol, total (µg/L)	2,4,6-Tri-chloro-phenol, total (µg/L)	2,4-Dimethyl-phenol, total (µg/L)	4,6-Dinitro-ortho-cresol, total (µg/L)	2,4-Dinitro-phenol, total (µg/L)	2-Nitro-phenol, total (µg/L)	4-Nitro-phenol, total (µg/L)
34dcc2	09-08-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
	06-16-87	<30.0	<6.0	<6.0	<20.0	<6.0	<30.0	<20.0	<6.0	<30.0
	03-27-89	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
34aaa1	09-09-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
27ddc3	08-27-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
	06-15-87	<30.0	<6.0	<6.0	<20.0	<6.0	<30.0	<20.0	<6.0	<30.0
26cdd	09-09-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
	06-16-87	<30.0	<6.0	<6.0	<20.0	<6.0	<30.0	<20.0	<6.0	<30.0
27cda	08-25-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
26dda2	08-26-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
26dac2	08-26-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
	06-16-87	<30.0	<6.0	<6.0	<20.0	<6.0	<30.0	<20.0	<6.0	<30.0
	03-29-89	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
28dad	08-25-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
27ada2	08-27-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
	06-15-87	<30.0	<6.0	<6.0	<20.0	<6.0	<30.0	<20.0	<6.0	<30.0
27bdb4	09-08-86	<5.0	<6.0	<6.0	<5.0	<6.0	<30.0	<20.0	<6.0	<30.0
	06-15-87	<30.0	<6.0	<6.0	<20.0	<6.0	<30.0	<20.0	<6.0	<30.0
	03-27-89	<30.0	<5.0	<5.0	<20.0	<5.0	<30.0	<20.0	<5.0	<30.0
26bbb	09-08-86	<10.0	<12.0	<12.0	<10.0	<12.0	<60.0	<40.0	<12.0	<60.0

Well number (D-13-14)	Date	Penta-chloro-phenol, total (µg/L)	Phenol, (C6h-50h) total (µg/L)	Ace-naph-thene, total (µg/L)	Ace-naph-thylene, total (µg/L)	Anthra-cene, total (µg/L)	Benzo A anthra-cene, 1,2-benzan-thracene, total (µg/L)	Benzo B fluor-anthene, total (µg/L)	Benzo K fluor-anthene, total (µg/L)	Benzo A pyrene, total (µg/L)
34dcc2	09-08-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	06-16-87	<30.0	39.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	03-27-89	<30.0	16.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
34aaa1	09-09-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
27ddc3	08-27-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	06-15-87	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
26cdd	09-09-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	06-16-87	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
27cda	08-25-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
26dda2	08-26-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
26dac2	08-26-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	06-16-87	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	03-29-89	<30.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
28dad	08-25-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
27ada2	08-27-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	06-15-87	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
27bdb4	09-08-86	<30.0	<6.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	06-15-87	<30.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
	03-27-89	<30.0	5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
26bbb	09-08-86	<60.0	<12.0	<10.0	<10.0	<10.0	<20.0	<20.0	<20.0	<20.0

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Priority pollutants—Continued

Well number (D-13-14)	Date	Benzogh I perylene, 1, 12-benzo-perylene, total (µg/L)	N-Butyl-benzly-phthalate, total (µg/L)	Bis (2-chloro-ethoxy) methane, total (µg/L)	Bis (2-chloro-ethyl) ether, total (µg/L)	Bis (2 chloro-isopropyl) ether, total (µg/L)	4-Bromo-phenyl phenyl ether, total (µg/L)	2-Chloro-naphtha-lene, total (µg/L)	4-Chloro-phenyl phenyl ether, total (µg/L)	Chrysene, total (µg/L)
34dcc2	09-08-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-16-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	03-27-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
34aaa1	09-09-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
27ddc3	08-27-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
26cdd	09-09-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-16-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
27cda	08-25-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
26dda2	08-26-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
26dac2	08-26-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-16-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	03-29-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
28dad	08-25-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
27ada2	08-27-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
27bdb4	09-08-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	03-27-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
26bbb	09-08-86	<20.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<20.0

Well number (D-13-14)	Date	1,2,5,6 Dibenz-anthra-cene, total (µg/L)	Di-n-butyl-phthalate, total (µg/L)	1,2-Dichloro-benzene, total (µg/L)	1,3-Dichloro-benzene, total (µg/L)	1,4-Dichloro-benzene, total (µg/L)	Diethyl-phthal-ate, total (µg/L)	Di-methyl-phthal-ate, total (µg/L)	2,4-Dinitro-toluene, total (µg/L)	2,6-Dinitro-toluene, total (µg/L)
34dcc2	09-08-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
	06-16-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	03-27-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
34aaa1	09-09-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
27ddc3	08-27-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
26cdd	09-09-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
	06-16-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
27cda	08-25-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
26dda2	08-26-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
26dac2	08-26-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
	06-16-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	03-29-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
28dad	08-25-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
27ada2	08-27-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
27bdb4	09-08-86	<10.0	<5.0	<3.0	<3.0	<3.0	<5.0	<5.0	<5.0	<5.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	03-27-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
26bbb	09-08-86	<20.0	<10.0	<3.0	<3.0	<3.0	<10.0	<10.0	<10.0	<10.0

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Priority pollutants—Continued

Well number (D-13-14)	Date	Di-n-octyl-phthal-ate, total (µg/L)	Bis (2-ethyl-hexyl) phthal-ate, total (µg/L)	Fluorene, total (µg/L)	Fluor-anthene, total (µg/L)	Hexa-chloro-benzene, total (µg/L)	Hexa-chloro-butadiene, total (µg/L)	Hexa-chloro-cyclopent-adiene, total (µg/L)	Hexa-chloro-ethane, total (µg/L)	Indeno (1,2,3-cd) pyrene, total (µg/L)
34dcc2	09-08-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-16-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	03-27-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
34aaa1	09-09-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
27ddc3	08-27-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
26cdd	09-09-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-16-87	17.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
27cda	08-25-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
26dda2	08-26-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
26dac2	08-26-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-16-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	03-29-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
28dad	08-25-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
27ada2	08-27-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
27bdb4	09-08-86	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	06-15-87	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
	03-27-89	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
26bbb	09-08-86	<20.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<20.0

Well number (D-13-14)	Date	Isopho-rone, total (µg/L)	Naphtha-lene, total (µg/L)	Nitro-benzene, total (µg/L)	N-nitro-sodi-methyl-amine, total (µg/L)	N-nitro-sodi-phenyl-amine, total (µg/L)	N-nitro-sodi-n-propyl-amine, total (µg/L)	Phenan-threne, total (µg/L)	Pyrene, total (µg/L)	1,2,4-Trichloro-benzene, total (µg/L)
34dcc2	09-08-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	06-16-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	03-27-89	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
34aaa1	09-09-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
27ddc3	08-27-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	06-15-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
26cdd	09-09-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	06-16-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
27cda	08-25-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
26dda2	08-26-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
26dac2	08-26-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	06-16-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	03-29-89	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
28dad	08-25-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
27ada2	08-27-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	06-15-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
27bdb4	09-08-86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	06-15-87	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	03-27-89	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
26bbb	09-08-86	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Volatile organic compounds

Well number (D-13-14)	Date	Benzene, total (µg/L)	Bromoform, total (µg/L)	Carbontetrachloride, total (µg/L)	Chlorobenzene, total (µg/L)	Chlorodibromomethane, total (µg/L)	Chloroethane, total (µg/L)	2-Chloroethylvinylether, total (µg/L)	Chloroform, total (µg/L)
34dcc2	09-08-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-16-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
34aaa1	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27ddc3	08-27-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cdd	09-09-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27cda	08-25-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-30-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dda2	08-26-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dac2	08-26-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
28dad	08-25-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27ada2	08-27-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27bdb4	09-08-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-15-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26bbb	09-08-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-15-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dcb2	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cbb2	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cbb3	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Volatile organic compounds—Continued

Well number (D-13-14)	Date	Dichlorobromomethane, total (μg/L)	Dichlorodifluoromethane, total (μg/L)	1,1-Dichloroethane, total (μg/L)	1,2-Dichloroethane, total (μg/L)	1,1-Dichloroethylene, total (μg/L)	1,2-Transdichloroethane, total (μg/L)	1,2-Dichloropropane, total (μg/L)	1,3-Dichloropropene, total (μg/L)	Ethylbenzene, total (μg/L)
34dcc2	09-08-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-16-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
34aaa1	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27ddc3	08-27-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cdd	09-09-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27cda	08-25-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-30-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dda2	08-26-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dac2	08-26-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
28dad	08-25-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27ada2	08-27-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27bdb4	09-08-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-15-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26bbb	09-08-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-15-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dcb2	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cbb2	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cbb3	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Volatile organic compounds—Continued

Well number (D-13-14)	Date	Methyl-bromide, total (µg/L)	Methyl-ene, chloride, total (µg/L)	1,1,2,2-Tetra-chloro-ethane, total (µg/L)	Tetra-chloro-ethyl-ene, total (µg/L)	Toluene, total (µg/L)	1,1,1-Tri-chloro-ethane, total (µg/L)	1,1,2-Trichloro-ethane, total (µg/L)	Tri-chloro-ethylene, total (µg/L)	Tri-chloro-fluoro-methane, total (µg/L)
34dcc2	09-08-86	5.3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-16-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
34aaa1	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27ddc3	08-27-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cdd	09-09-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27cda	08-25-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-30-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dda2	08-26-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dac2	08-26-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
28dad	08-25-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27ada2	08-27-86	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27bdb4	09-08-86	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-15-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26bbb	09-08-86	<3.0	<3.0	<3.0	<3.0	3.2	<3.0	<3.0	<3.0	<3.0
	06-15-87	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dcb2	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cbb2	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cbb3	03-28-89	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Volatile organic compounds—Continued

Well number (D-13-14)	Date	Vinyl chloride, total (µg/L)	Methyl-chloride, total (µg/L)	1,2-Di-bromo-ethane, total (µg/L)	1,2-Di-chloro-benzene, total (µg/L)	1,3-Di-chloro-benzene, total (µg/L)	1,4-Di-chloro-benzene, total (µg/L)	Cis-1,3-Di-chloro-propene, total (µg/L)	Trans-1,3-Di-chloro-propene, total (µg/L)	Xylene, total (µg/L)
34dcc2	09-08-86	<3.0	7.7	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-16-87	<3.0	<3.0	---	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0
	03-27-89	<1.0	<3.0	<3.0	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0
34aaa1	03-29-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27ddc3	08-27-86	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-28-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cdd	09-09-86	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	---
27cda	08-25-86	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-30-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dda2	08-26-86	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dac2	08-26-86	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<1.0	<3.0	<3.0	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0
28dad	08-25-86	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27ada2	08-27-86	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-29-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
27bdb4	09-08-86	<3.0	8.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	---
	06-15-87	<3.0	<3.0	---	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0
	03-27-89	<1.0	<3.0	<3.0	<5.0	<5.0	<5.0	<3.0	<3.0	<3.0
26bbb	09-08-86	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	06-15-87	<3.0	<3.0	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	03-27-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26dcb2	03-28-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cbb2	03-28-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
26cbb3	03-28-89	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Table 9. Analytical results of ground-water samples, Rillito Creek basin—Continued
Organic carbon and oil and grease

Well number (D-13-14)	Date	Carbon organic, dissolved (mg/L as C)	Carbon, organic total (mg/L as C)	Oil and grease, total recoverable, gravimetric (mg/L)
34dcc2	09-08-86	3.9	3.9	0.3
	03-27-89	---	1.0	---
34aaa1	09-09-86	1.1	2.3	.2
	03-29-89	---	.4	---
27ddc3	08-27-86	.9	.7	.2
	03-28-89	---	.3	---
26cdd	09-09-86	1.8	2.1	.3
27cda	08-25-86	1.3	.3	.2
	03-30-89	---	1.0	---
26dda2	08-26-86	2.6	2.3	.1
	03-29-89	---	1.0	---
26dac2	08-26-86	2.5	2.8	.2
	03-29-89	---	1.1	---
28dad	08-25-86	1.3	1.1	.2
	03-29-89	---	.7	---
27ada2	09-08-86	1.0	.9	.2
	03-27-89	---	.1	---
27bdb4	09-08-86	3.5	3.6	.3
	03-27-89	---	1.5	---
26bbb	09-08-86	3.5	4.0	.2
26dcb2	03-28-89	---	1.5	---
26cbb2	03-28-89	---	.7	---
26cbb3	03-28-89	---	3.2	---

Table 10. Particle-size distribution of bottom-sediment samples, Rillito Creek basin
[<, less than; mm, millimeters; dashes indicate no data]

Date	Particle-size distribution, in percent		
	Gravel (< 2 mm)	Sand (0.062 to 2 mm)	Silt and clay (<0.062 mm)
Tanque Verde Creek at Tucson			
07-24-89	9.1	86.8	4.1
07-21-92	---	99	1
Pantano Wash at Broadway Boulevard			
02-21-92	---	96.4	3.6
Alamo Wash at Glenn Street			
02-21-92	---	99.5	.5
Rillito Creek at Dodge Boulevard			
02-21-92	---	99.3	.7

Table 11. Analytical results of bottom-sediment samples, Rillito Creek basin
Nutrients
[mg/kg, milligrams per kilogram; µg/g, micrograms per gram; pCi/g, picocuries per gram; µg/kg, micrograms per kilogram; g/kg, grams per kilogram; <, less than; dashes indicate no data]

Date	Moisture content, dry weight (percentage of total)	Phosphorus, total (mg/kg as P)	Nitrogen, NO_2+NO_3, total (mg/kg as N)	Nitrogen, NH_4, total (mg/kg as N)	Nitrogen, NH_4 plus organic, total (mg/kg as N)
Tanque Verde Creek at Tucson					
08-22-88	3.0	210	3.0	15	240
07-25-89	26	160	26	<10	450
02-21-92	<2.0	240	<2.0	2.3	50
Pantano Wash at Broadway Boulevard					
11-02-87	2.0	160	2.0	1.4	---
02-20-92	<2.0	210	<2.0	.7	60
Alamo Wash at Glenn Street					
07-28-87	12	190	12	11	230
02-10-92	<2.0	170	<2.0	1.7	80
Rillito Creek at Dodge Boulevard					
08-03-88	<2.0	160	<2.0	5.3	200
02-20-92	<2.0	220	<2.0	1.1	40

Table 11. Analytical results of bottom-sediment samples, Rillito Creek basin
Trace elements

Date	Aluminum, recoverable (µg/g as Al)	Calcium, recoverable (µg/g as Ca)	Iron, recoverable (µg/g as Fe)	Potassium, recoverable (µg/g as K)	Magnesium, recoverable (µg/g as Mg)	Sodium, recoverable (µg/g as Na)	Titanium, total (µg/g as Ti)	Manganese, recoverable (µg/g as Mn)
Tanque Verde Creek at Tucson								
08-22-88	74,000	30,000	25,000	26,000	7,000	19,000	3,100	580
07-25-89	76,300	34,600	27,600	24,600	8,600	15,000	3,300	1,180
02-21-92	65,000	8,400	4,200	32,000	800	24,000	500	180
Pantano Wash at Broadway Boulevard								
11-02-87	63,000	39,000	24,000	21,000	7,400	17,000	2,800	520
02-20-92	54,000	14,000	8,500	29,000	2,900	17,000	1,100	200
Alamo Wash at Glenn Street								
07-28-87	65,000	47,000	26,000	24,000	9,500	12,000	3,200	540
02-10-92	54,000	12,000	6,900	31,000	1,400	17,000	900	260
Rillito Creek at Dodge Boulevard								
08-03-88	66,000	56,000	27,000	24,000	9,300	13,000	2,800	630
02-20-92	64,000	12,000	6,900	29,000	1,400	23,000	800	240

Date	Silver, recoverable (µg/g as Ag)	Arsenic, total (µg/g as As)	Gold, sediment suspended (µg/g as Au)	Barium, recoverable (µg/g as Ba)	Beryllium, recoverable (µg/g as Be)	Cadmium, recoverable (µg/g as Cd)	Cobalt, recoverable (µg/g as Co)	Chromium, recoverable (µg/g as Cr)
Tanque Verde Creek at Tucson								
08-22-88	<2	<10	<8	750	2	<2	8	33
07-25-89	<2	<10	<8	676	2	<2	11	34
02-21-92	<2	<10	<8	1,000	2	<2	2	3
Pantano Wash at Broadway Boulevard								
11-02-87	<2	<10	<8	650	2	<2	8	51
02-20-92	<2	<10	<8	750	1	<2	3	5
Alamo Wash at Glenn Street								
07-28-87	<2	8	<8	700	2	<2	9	44
02-10-92	<2	<10	<8	830	1	<2	3	6
Rillito Creek at Dodge Boulevard								
08-03-88	<2	<10	<8	700	2	<2	9	30
02-20-92	<2	<10	<8	860	1	<2	2	5

Table 11. Analytical results of bottom-sediment samples, Rillito Creek basin—Continued
Trace elements—Continued

Date	Copper, recoverable (μg/g as Cu)	Lithium, recoverable (μg/g as Li)	Molybdenum, recoverable (μg/g as Mo)	Nickel, recoverable (μg/g as Ni)	Lead, recoverable (μg/g as Pb)	Scandium, total (μg/g as Sc)	Tin, recoverable (μg/g as Sn)
			Tanque Verde Creek at Tucson				
08-22-88	30	30	<2	10	40	80	<10
07-25-89	80	36	2	19	58	11	<10
02-21-92	4	9	<1	<2	25	<2	<5
			Pantano Wash at Broadway Boulevard				
11-02-87	30	30	<2	20	30	70	180
02-20-92	9	16	<2	3	20	2	<5
			Alamo Wash at Glenn Street				
07-28-87	40	30	<2	20	50	8	<10
02-10-92	7	11	<2	2	26	<2	<5
			Rillito Creek at Dodge Boulevard				
08-03-88	30	40	<2	10	30	8	<10
02-20-92	7	12	<2	3	23	2	<5

Date	Tantalum, (μg/g as Ta)	Thorium, (μg/g as Th)	Uranium, natural, total (μg/g as U)	Vanadium, total (μg/g as V)	Ytterbium, (μg/g as Yb)	Zinc, recoverable (μg/g as Zn)	Strontium, recoverable (μg/g as Sr)
			Tanque Verde Creek at Tucson				
08-22-88	<40	14	<100	49	30	90	250
07-25-89	<40	10	<100	51	2	200	299
02-21-92	<40	<4	<100	7	<1	11	260
			Pantano Wash at Broadway Boulevard				
110-02-87	<40	14	<100	52	30	60	240
02-20-92	<40	5	<100	17	1	19	210
			Alamo Wash at Glenn Street				
07-28-87	<40	16	<100	64	30	100	260
02-10-92	<40	5	<100	14	1	23	200
			Rillito Creek at Dodge Boulevard				
08-03-88	<40	14	<100	59	30	100	250
02-20-92	<40	4	<100	12	1	16	250

Table 11. Analytical results of bottom-sediment samples, Rillito Creek basin—Continued
Radionuclides

Date	Gross alpha, (µg/g as U-Nat)	Gross beta (pCi/g as Sr-90/Y-90)	Gross alpha, (pCi/g as Th-230)	Gross beta, (pCi/g as Cs-137)	Uranium-235, (pCi/g)	Uranium-238, (pCi/g)
Tanque Verde Creek at Tucson						
08-22-88	14	34	8.9	54	---	---
02-21-92	9.4	5.1	6.7	9.8	---	---
Pantano Wash at Broadway Boulevard						
11-02-87	1.0	32	.7	50	.02	.8
02-20-92	16.6	5.0	10.7	10.2	---	---
Alamo Wash at Glenn Street						
07-28-87	14	35	10	59	.06	1.10
02-10-92	11.6	33.8	17.1	9.4	---	---
Rillito Creek at Dodge Boulevard						
08-03-88	17	29	11	45	---	---
02-20-92	20.3	8.4	14.4	18	---	---

Table 11. Analytical results of bottom-sediment samples, Rillito Creek basin—Continued
Organochlorine pesticides
[DDD, dichlorodiphenyldichloroethane; DDE, dichlorodiphenylethylene; DDT, dichlorodiphenyltrichloroethane; PCB, polychlorinated biphenyl; PCN, polychlorinated naphthalene]

Date	Perthane, (µg/kg)	Endo-sulfan, total (µg/kg)	Aldrin, total (µg/kg)	Chlordane, total (µg/kg)	DDD, total (µg/kg)	DDE, total (µg/kg)	DDT, total (µg/kg)	Dieldrin, total (µg/kg)	Endrin, total (µg/kg)
Tanque Verde Creek at Tucson									
08-22-88	<1.0	<0.1	<0.1	31	<0.1	<0.1	1.3	2.5	<0.1
02-21-92	<1.0	<.1	<.1	<1.0	<.1	<.1	<.1	<.1	<.1
Pantano Wash at Broadway Boulevard									
11-02-87	<1.0	<.1	<.1	<1.0	<.1	<.1	<.1	<.1	<.1
02-20-92	<1.0	<.1	<.1	<1.0	<.1	<.1	<.1	<.1	<.1
Alamo Wash at Glenn Street									
07-28-87	<1.0	<.1	<.1	140	<.1	3.4	2.8	10	<.1
02-10-92	<1.0	<.1	<.1	1.0	.1	.2	.2	.7	<.1
Rillito Creek at Dodge Boulevard									
08-03-88	<1.0	<.1	<.1	1.0	<.1	<1.0	<.1	.2	<.1
02-20-92	<1.0	<.1	<.1	<1.0	<.1	<1.0	<.1	<.1	<.1

Date	Heptachlor, total (µg/kg)	Hepta-chlor epoxide, total (µg/kg)	Lindane, total (µg/kg)	Toxaphene, total (µg/kg)	PCB, total (µg/kg)	PCN, total (µg/kg)	Methoxy-chlor, total (µg/kg)	Mirex, total (µg/kg
Tanque Verde Creek at Tucson								
08-22-88	<.1	<.1	<.1	<10	5	<1.0	<.1	<.1
02-21-92	<.1	<.1	<.1	<10	<1.0	<1.0	<.1	<.1
Pantano Wash at Broadway Boulevard								
11-02-87	<.1	<.1	<.1	<10	<1.0	<1.0	<.1	<.1
02-20-92	<.1	<.1	<.1	<10	<1.0	<1.0	.5	<.1
Alamo Wash at Glenn Street								
07-28-87	.9	.12	.2	<10	13	<1.0	<.1	<.1
02-10-92	.1	<.1	<.1	<10	<1.0	<1.0	<.1	<.1
Rillito Creek at Dodge Boulevard								
08-03-88	<.1	<.1	<.1	<10	<1.0	<1.0	<.1	<.1
02-20-92	<.1	<.1	<.1	<10	<1.0	<1.0	<.1	<.1

Table 11. Analytical results of bottom-sediment samples, Rillito Creek basin—Continued
Priority pollutants

Date	Para-chloro-meta cresol (µg/kg)	2-Chloro-phenol (µg/kg)	2,4-Di-chloro-phenol (µg/kg)	2,4-Dichloro-phenol, (µg/kg)	4, 6-Di-nitro-ortho cresol (µg/kg)	2, 4-Dinitro-phenol (µg/kg)	2-Nitro-phenol (µg/kg)	4-Nitro-phenol (µg/kg)	Penta-chloro-phenol (µg/kg)
Tanque Verde Creek at Tucson									
08-22-88	<600	<200	<200	<200	<600	<600	<200	<600	<600
02-21-92	<600	<200	<200	<200	<600	<600	<200	<600	<600
Pantano Wash at Broadway Boulevard									
11-02-87	<600	<200	<200	<200	<600	<600	<200	<600	<600
02-20-92	<600	<200	<200	<200	<600	<600	<200	<600	<600
Alamo Wash at Glenn Street									
07-28-87	<600	<200	<200	<200	<600	<600	<200	<600	<600
02-10-92	<600	<200	<200	<200	<600	<600	<200	<600	<600
Rillito Creek at Dodge Boulevard									
08-03-88	<600	<200	<200	<200	<600	<600	<200	<600	<600
02-20-92	<600	<200	<200	<200	<600	<600	<200	<600	<600

Date	Phenol (C6h-50h) (µg/kg)	2,4,6-Tri-chloro-phenol (µg/kg)	Ace-naph-thene (µg/kg)	Ace-naph-thylene (µg/kg)	Anthra-cene (µg/kg)	Benzo A anthra-cene 1,2-benzan-thranene (µg/kg)	Benzo B fluor-anthene (µg/kg)	Benzo K fluor-anthene (µg/kg)	Benzo A pyrene (µg/kg)
Tanque Verde Creek at Tucson									
08-22-88	<200	<600	<200	<200	<200	<400	<400	<400	<400
02-21-92	<200	<600	<200	<200	<200	<400	<400	<400	<400
Pantano Wash at Broadway Boulevard									
11-02-87	<200	<600	<200	<200	<200	<400	<400	<400	<400
02-20-92	<200	<600	<200	<200	<200	<400	<400	<400	<400
Alamo Wash at Glenn Street									
07-28-87	<200	<600	<200	<200	<200	710	1,100	930	850
02-10-92	<200	<600	<200	<200	<200	<400	<400	<400	<400
Rillito Creek at Dodge Boulevard									
08-03-88	<200	<600	<200	<200	<200	<400	<400	<400	<400
02-20-92	<200	<600	<200	<200	<200	<400	<400	<400	<400

Date	Benzogh I perylene 1, 12-benzo-perylene (µg/kg)	Di-N-butyl phthan-ate (µg/kg)	Bis (2-chloro-ethoxy) methane (µg/kg)	Bis (2-chloro-ethyl) ether (µg/kg)	4-Bromo-phenyl phenyl ether (µg/kg)	2-Chloro-naphtha-lene (µg/kg)	4-Chloro-phenyl phenyl ether (µg/kg)	Chrysene (µg/kg)	1,2,4-Tri-chloro-benzene (µg/kg
Tanque Verde Creek at Tucson									
08-22-88	<400	<200	<200	<200	<200	<200	---	<400	<200
02-21-92	<400	<200	<200	<200	<200	<200	---	<400	<200
Pantano Wash at Broadway Boulevard									
11-02-87	<400	<200	<200	<200	<200	<200	---	<400	<200
02-20-92	<400	<200	<200	<200	<200	<200	---	<400	<200
Alamo Wash at Glenn Street									
07-28-87	760	<200	<200	<200	<200	<200	<200	1,200	<200
02-10-92	<400	<200	<200	<200	<200	<200	<200	<400	<200
Rillito Creek at Dodge Boulevard									
08-03-88	<400	<200	<200	<200	<200	<200	---	<400	<200
02-20-92	<400	<200	<200	<200	<200	<200	---	<400	<200

Table 11. Analytical results of bottom-sediment samples, Rillito Creek basin—Continued
Priority pollutants—Continued

Date	1,2,5,6-Dibenzanthracene (µg/kg)	Di-N-butylphthalate (µg/kg)	1,2-Dichlorobenzene (µg/kg)	1,3-Dichlorobenzene (µg/kg)	1,4-Dichlorobenzene (µg/kg)	Diethylphthalate (µg/kg)	Dimethylphthalate (µg/kg)	2,4-Dinitrotoluene (µg/kg)	2,6-Dinitrotoluene (µg/kg)
Tanque Verde Creek at Tucson									
08-22-88	<400	<200	<200	<200	<200	<200	<200	<200	<200
02-21-92	<400	<200	<200	<200	<200	<200	<200	<200	<200
Pantano Wash at Broadway Boulevard									
11-02-87	<400	<200	<200	<200	<200	<200	<200	<200	<200
02-20-92	<400	<200	<200	<200	<200	<200	<200	<200	<200
Alamo Wash at Glenn Street									
07-28-87	<400	<200	<200	<200	<200	<200	<200	<200	<200
02-10-92	<400	<200	<200	<200	<200	<200	<200	<200	<200
Rillito Creek at Dodge Boulevard									
08-03-88	<400	<200	<200	<200	<200	<200	<200	<200	<200
02-20-92	<400	<200	<200	<200	<200	<200	<200	<200	<200

Date	Di-n-octyl phthalate (µg/kg)	Bis (2-ethylhexly) phthalate (µg/kg)	Fluorene (µg/kg)	Fluoranthene (µg/kg)	Hexachlorobenzene (µg/kg)	Hexachlorobutadience (µg/kg)	Hexacholorcyclopentadiene (µg/kg)	Hexachloroethane (µg/kg)	Indeno-(1,2,3-cd) pyrene (µg/kg)
Tanque Verde Creek at Tucson									
08-22-88	<400	<200	<200	390	<200	<200	<200	<200	<200
02-21-92	<400	<200	<200	<200	<200	<200	<200	<200	<200
Pantano Wash at Broadway Boulevard									
11-02-87	<400	<200	<200	<200	<200	<200	<200	<200	<200
02-20-92	<400	<200	<200	<200	<200	<200	<200	<200	<200
Alamo Wash at Glenn Street									
07-28-87	<400	1,800	<200	2,300	<200	<200	<200	<200	830
02-10-92	<400	<200	<200	220	<200	<200	<200	<200	430
Rillito Creek at Dodge Boulevard									
08-03-88	<400	<200	<200	<200	<200	<200	<200	<200	<200
02-20-92	<400	<200	<200	<200	<200	<200	<200	<200	<400

Date	Isophorone (µg/kg)	Naphthalene (µg/kg)	Nitrobenzene (µg/kg)	N-nitrosodimethylamine (µg/kg)	N-nitrosodiphenylamine (µg/kg)	Nitrosodi-n-propylamine (µg/kg)	Phenanthrene (µg/kg)	Pyrene (µg/kg)
Tanque Verde Creek at Tucson								
08-22-88	<200	<200	<200	<200	<200	<200	<200	480
02-21-92	<200	<200	<200	<200	<200	<200	<200	480
Pantano Wash at Broadway Boulevard								
11-02-87	<200	<200	<200	<200	<200	<200	<200	<200
02-20-92	<200	<200	<200	<200	<200	<200	<200	<200
Alamo Wash at Glenn Street								
07-28-87	<200	<200	<200	<200	<200	<200	620	2,000
02-10-92	<200	<200	<200	<200	<200	<200	620	2,000
Rillito Creek at Dodge Boulevard								
08-03-88	<200	<200	<200	<200	<200	<200	<200	<200
02-20-92	<200	<200	<200	<200	<200	<200	<200	<200

Table 11. Analytical results of bottom-sediment samples, Rillito Creek basin—Continued
Inorganic carbon plus organic carbon, inorganic carbon, and oil and grease

Date	Carbon organic plus organic, total (g/kg as C)	Carbon, inorganic total (g/kg as C)	Oil and grease, total gravimetric (mg/kg)
Tanque Verde Creek at Tucson			
08-22-88	8.2	2.1	<1,000
07-25-89	13	1.3	---
02-21-92	1	.1	<1,000
Pantano Wash at Broadway Boulevard			
11-02-87	3.6	1.7	<1,000
02-20-92	3.3	2.2	<1,000
Alamo Wash at Glenn Street			
07-28-87	9.0	7.3	<1,000
02-10-92	2.2	1.7	<1,000
Rillito Creek at Dodge Boulevard			
08-03-88	3.1	2.0	<1,000
02-20-92	1.4	.8	<1,000