Hydrologic Data from the Study of Acidic Contamination in the Miami Wash–Pinal Creek Area, Arizona, Water Years 1992–93

By D.J. GELLENBECK and YVONNE R. HUNTER

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FIGURES

CONVERSION FACTORS

Multiply	By	To obtain
centimeter (cm)	0.3937	inch
millimeter (mm)	0.03937	inch
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
square centimeter (cm^2)	0.155	square inch
square kilometer (km^2)	0.3861	square mile
cubic meter (m^3)	35.31	cubic foot
cubic meter (m^3)	0.0008107	acre-foot
liter per minute (L/min)	0.2642	gallon per minute
cubic meter per second (m^3/s)	35.31	cubic foot per second

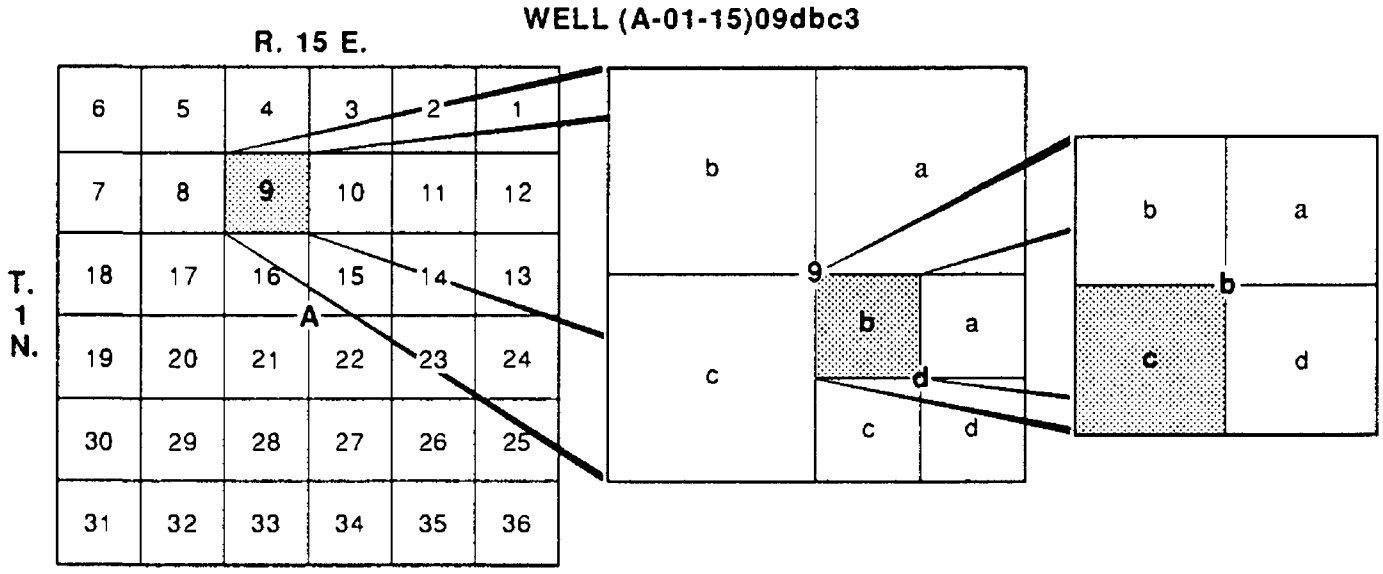
In this report, temperature is reported in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) by the following equation:

$$°F = 1.8(°C) + 32$$

ABBREVIATED WATER-QUALITY UNITS

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 concentration (milligrams) 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 degrees Celsius.

WELL-NUMBERING AND NAMING SYSTEM



Quadrant A, Township 1 North, Range 15 East, section 9, quarter section d, quarter section b, quarter section c, third 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 (A–01–15)09dbc3 designates the well as being in the SW1/4, NW1/4, SE1/4, section 9, Township 1 North, and Range 15 East.

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."

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By D.J. Gellenbeck *and* Yvonne R. Hunter

Abstract

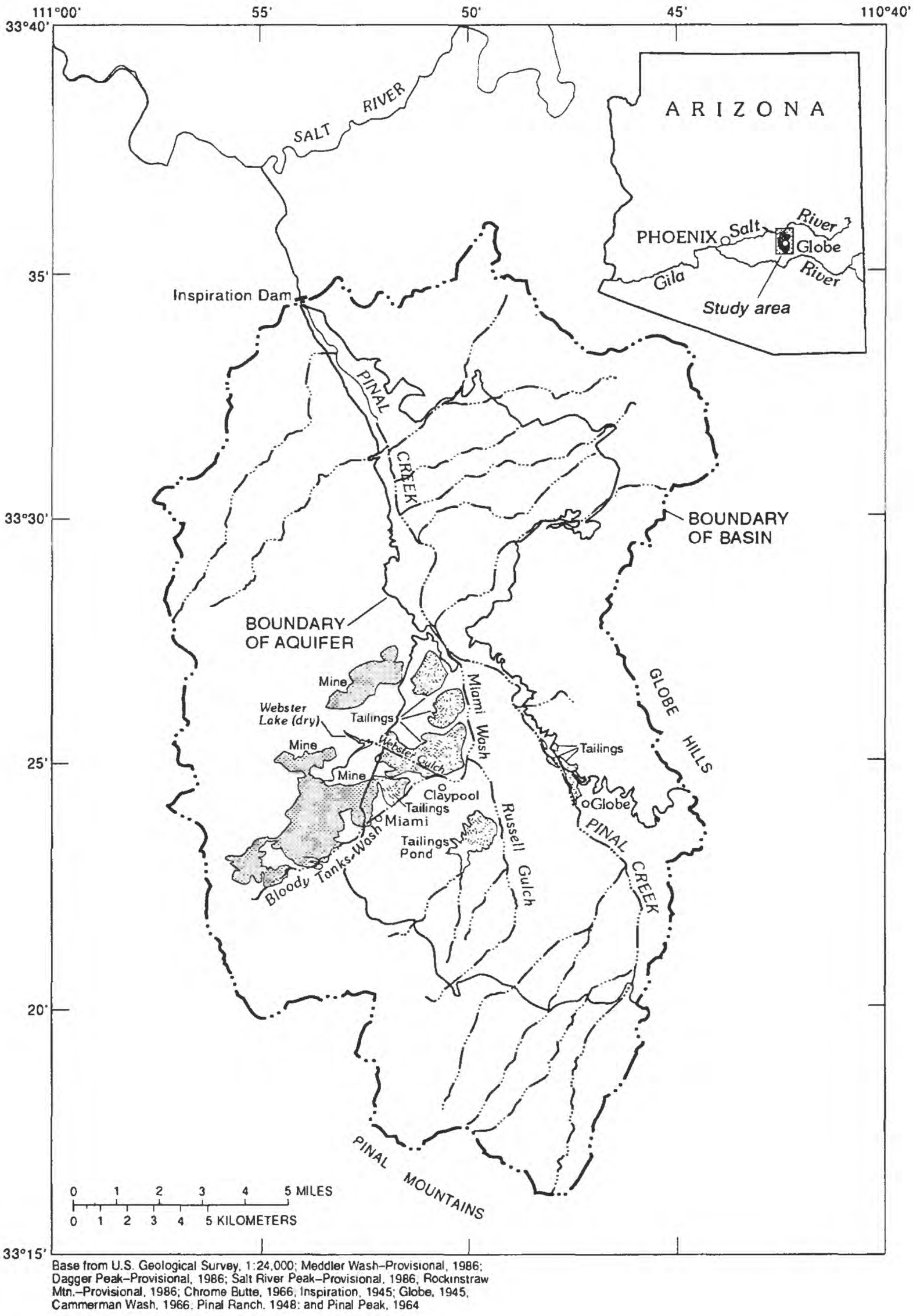
Since 1984, hydrologic data have been collected as part of a U.S. Geological Survey study of the occurrence and movement of acidic contamination in the aquifer and streams of the Pinal Creek drainage basin near Globe, Arizona. Ground-water data from that study are presented for water years 1992 and 1993 and include location, construction information, site plans, water levels, chemical and physical field measurements, and selected chemical analyses of water samples for 10 monitoring well groups. During January 1993, a flood occurred in Pinal Creek that resulted in a record peak discharge of 5,700 cubic feet per second. During this flood, well group 450 was destroyed. Surface-water data are presented for 13 sites and include discharge measurements, chemical and physical field measurements, and chemical analyses of water. Data from a solute-transport study that was conducted in November 1992 are presented for shallow ground-water and surface-water sites along Pinal Creek. During this study, variations in metal chemistry with distance along Pinal Creek and depth below the streambed were determined and two filter sizes were used to quantify the partitioning of metals between dissolved and particulate phases. Monthly precipitation data and long-term precipitation statistics are presented for two sites.

INTRODUCTION

Copper has been mined since 1903 from granite porphyry adjacent to an aquifer in the Pinal Creek drainage basin (fig. 1). Mining is the principal industry in the area, but has caused some contamination of ground-water resources. These effects have long been recognized in the area and were first quantified in 1983 (Rouse, 1983; Envirologic Systems, Inc., 1983). After that evaluation of ground-water contamination, dissolved-metal concentrations have been monitored in the ground water and surface water of the Pinal Creek basin. In June 1993, dissolved Cu, Fe, and Mn concentrations were 26,000, 380,000, and 13,000 µg/L, respectively, in acidic ground water from well 101. In the perennial reach of Pinal Creek at Setka Ranch, dissolved Cu, Fe, and Mn were 40, <130, and 55,000 µg/L, respectively.

The study area is in Gila County, Arizona, and includes the communities of Globe, Miami, and Claypool (fig. 1). The Pinal Creek drainage basin is in the Upper Salt River (USR) ground-water basin (Smith and others, 1994, p. 301) and in Hydrologic Unit 15060103 (Upper Salt River; U.S. Geological Survey, 1975). Miami Wash, a tributary to Pinal Creek, drains the area that contains the most intensive mining activity. Pinal Creek flows into the Salt River about 5 km upstream from the high-water line of Roosevelt Lake.

In the spring of 1984, the U.S. Geological Survey (USGS) began a study of contaminant movement in the Pinal Creek drainage basin in cooperation with the Arizona Department of Health Services and Salt River Project (SRP). Initial sets of observation wells were drilled at five sites in October 1984, and initial samples for chemical analysis were collected in November 1984. The



Base from U.S. Geological Survey, 1:24,000; Meddler Wash–Provisional, 1986; Dagger Peak–Provisional, 1986; Salt River Peak–Provisional, 1986, Rockinstraw Mtn.–Provisional, 1986; Chrome Butte, 1966, Inspiration, 1945; Globe, 1945, Cammerman Wash, 1966. Pinal Ranch, 1948; and Pinal Peak, 1964

Figure 1. Location of Pinal Creek basin and study area.

objectives of the study are to identify and describe the processes that control the movement and reactions of inorganic ground-water contaminants, monitor the movement of the contaminants, and model the movement of water and inorganic contaminants in ground water and surface water in the basin. A major concern is how solutes and solids in the system are transformed by each other in a complex environment. The study focuses on the destination or fate of contaminants rather than on sources of ground-water contamination. Since 1985, principal project funding has been provided by the USGS Toxics Substances Hydrology Program.

During water year 1993, the Pinal Creek basin was affected by a series of storms that resulted in a record peak discharge of 5,700 cubic feet per second at Inspiration Dam on January 11, 1993. The storms occurred from the beginning of January to the beginning of February and caused heavy and prolonged precipitation across the State of Arizona (MacNish and others, 1993). Water levels rose and some changes in water chemistry were observed after this large flow event. Pinal Creek and Miami Wash, normally intermittent streams in most of the basin, flowed continuously for several weeks after the storms. Well group 450 was destroyed during floods in January 1993 (fig. 2).

Purpose and Scope

The purpose of this report is to present hydrologic data for ground water and surface water of Pinal Creek basin near Globe, Arizona. Included in this report are chemical analyses of ground water and streamflow, records of stream discharge, and ground-water levels. The data have been and are to be used in several interpretive reports in which an exhaustive data summary would be inappropriate. In the interest of completeness, some data that have been published elsewhere are included. This report includes data for water years 1992 and 1993, which correspond to the period October 1, 1991, through September 30, 1993.

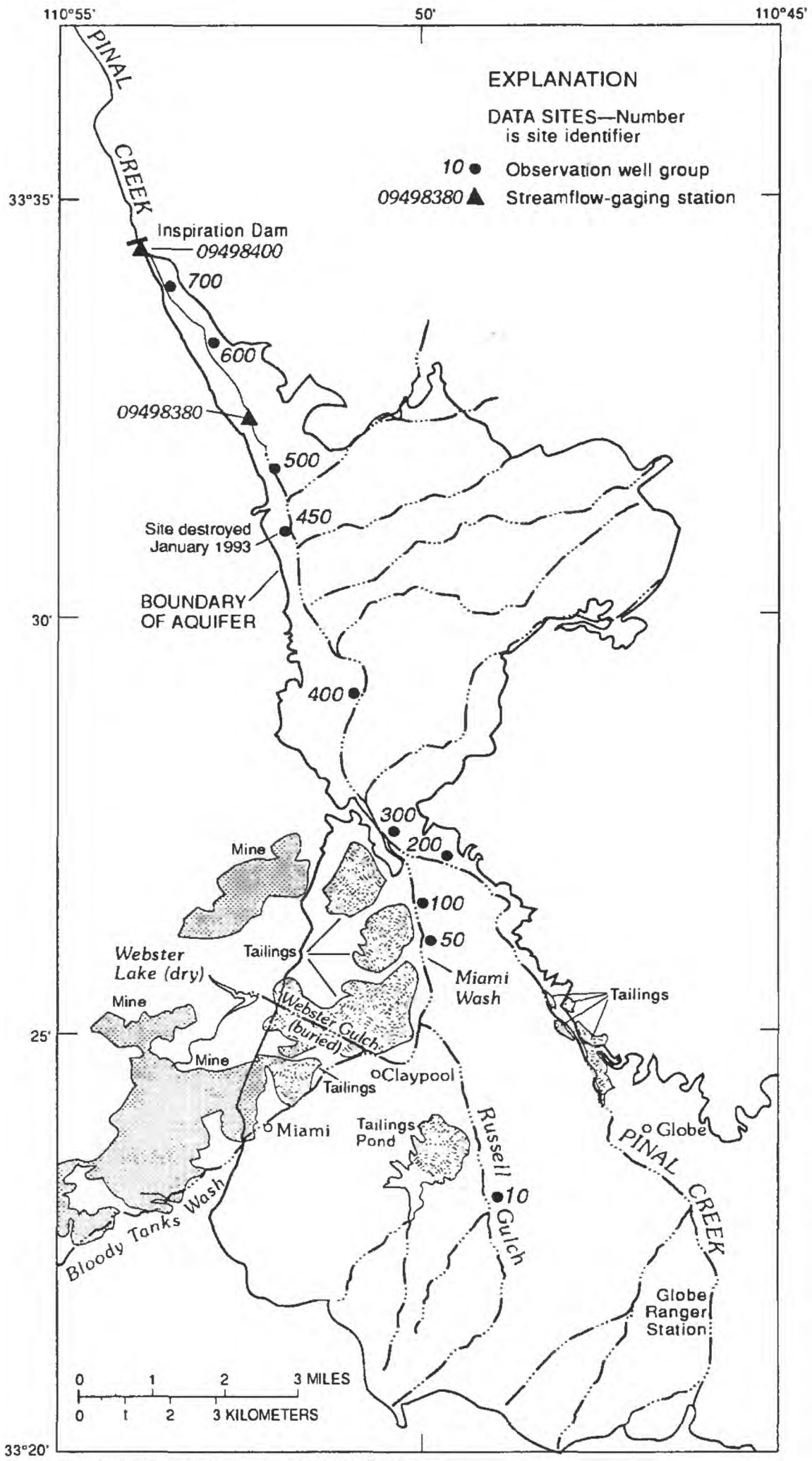
Other Publications Pertinent to the Study Site

A complete list of papers, which include investigations completed at Pinal Creek, are included in the "Selected References" section of this report. The following summary focuses on some of the publications related to studies completed at the site.

Geology of the Globe–Miami mining district has been described by Ransome (1903) and Peterson (1962). In 1979, the Central Arizona Association of Governments, which is responsible for water-quality management planning in Gila County, established a Mineral Extraction Task Force (METF) to study water-quality problems in the Globe–Miami area. The METF study identified areas where contaminated water was present and probable sources for the contamination (Rouse, 1981, 1983; Envirologic Systems, Inc., 1983). Studies to construct a coupled flow and solute transport model of the alluvial aquifer at the site have been completed by Hydro Geo Chem, Inc. (1989). Ongoing studies by Hydro Geo Chem, Inc., include an evaluation of remediation alternatives.

Lithologic, water-chemistry, and water-level data collected as part of the present USGS study for water years 1984–91 were presented by Eychaner and others (1989), Brown (1990), and Longsworth and Taylor (1992). Neaville and Brown (1994) described the hydrogeology and the hydrologic system of the Pinal Creek basin.

Eychaner and Stollenwerk (1985) described the distribution of contaminants in the aquifer and the principal geochemical reactions on the basis of the initial data collection. Results of four specialized studies completed at the site have been published in scientific journals. Lind and Hem (1993) determined the composition of manganese minerals that precipitated from both ground water and surface water at the site. Hem and Lind (1994) conducted laboratory experiments to better understand the processes involved with the Mn-bearing precipitates that form in Pinal Creek and to explain the mineralogy of the precipitates. Stollenwerk (1994) described column experiments that involved alluvium and uncontaminated and acidic ground water from the site. Modeling was used to understand the geochemical reactions occurring at the site. Pool and Eychaner (in press) presented results



Base from U.S. Geological Survey, 1:24,000; Rockinstraw Mtn.–Provisional, 1986; Salt River Peak–Provisional, 1986; Inspiration, 1945; Globe, 1945; Pinal Ranch, 1948; and Pinal Peak, 1964

Figure 2. Locations of ground-water and surface-water data-collection sites, Pinal Creek basin.

from temporal-gravity surveys that were used to measure aquifer-storage change and estimate values of specific yield.

Thirty-one papers that discuss work and findings at the site were presented at technical meetings of the Toxics Substances Hydrology Program in 1985 (Massachusetts), 1987 (Florida), 1988 (Phoenix), 1991 (California), and 1993 (Colorado).

Acknowledgments

These data were collected with the cooperation and assistance of landowners and local residents who granted permission to cross over, collect data, and install wells on their properties. Landowners and local residents that cooperated with the study include: Barbara Caretto, Hollis Crim, Pat Kelley, Eva Setka, Martin Setka, Nellie Setka, Arizona Department of Transportation, Cyprus Miami Mining Corporation, Magma Copper Corporation, and the U.S. Forest Service.

DATA COLLECTION

During water year 1992, the USGS drilled one borehole at site 600, a new well group (fig. 2). Specific construction details for this well are included in the "Hydrologic Data" section of this report. The well was developed by jetting high-pressure air horizontally through the well screen to agitate the natural material, airlift water and fine sediments from the well, and increase the porosity and permeability of natural material adjacent to and near the well screen. Development was attempted twice for approximately 2 hours each time.

Ground-water samples from the project wells were collected by installing either a 240-volt electric-submersible pump and rigid polyvinyl-chloride (PVC) discharge pipe or a 12-volt submersible pump used with or without an inflatable packer in the well and pumping until a representative sample could be collected. Discharge rate, water level, pH, specific conductance, temperature, and dissolved-oxygen concentration generally were monitored during pumping. Water samples were collected only after at least three casing volumes of water had been pumped from the well and the value of each field measurement had stabilized.

Pump-discharge rate, duration, and water-level drawdown are included in the data tables when the data are available. Samples for dissolved constituents were passed through a 0.45-µm polycarbonate filter and collected in polypropylene bottles. Unfiltered samples for total constituent analyses were collected in polypropylene bottles. Nitric acid (HNO_3) was used as a preservative in samples for metal analyses. Unfiltered water was used for total inorganic carbon (TIC) analyses; the water was collected in baked glass bottles for samples collected in November 1991 and May 1992 and in septum vials for samples collected in November 1992 and June 1993. TIC data for samples collected in septum vials appear to be more reliable than data for samples collected in glass bottles. During analysis, the sample is extracted directly through the vial's septum and is not exposed to the atmosphere.

Most ground- and surface-water samples and field parameters were collected using methods described by Smith and others (1994, p. 6–28), including the methods of collecting, examining, and computing records of discharge and water chemistry; definition of terms related to streamflow, water quality, and other hydrologic data; and the description of the downstream order, latitude-longitude, and land-net methods of identifying data-collection sites. Explanations of modified or nonstandard methods used to collect data or samples are included in this report. Well-construction data and water-level measurements were made in inch-pound units and converted to metric units.

Data are presented for 33 project wells that include location, construction details, site plan, water-level measurements, and chemical analyses of water samples. Hydrographs showing water-level data available for selected wells are included in the "Hydrologic Data" section of this report. Two wells that have the largest difference in water levels in each well group are shown on hydrographs. Information for six project exploration boreholes and one well group, which was destroyed, is also included. Water levels were measured with a chalked steel tape or a calibrated

electric tape. Wells 54, 104, 201, 202, 303, and 403 were dry during part of water years 1992–93.

Chemical analyses of surface water from 13 sites along Pinal Creek and Miami Wash (fig. 3) are presented. Monthly discharge data and chemical analyses are presented for Pinal Creek at Inspiration Dam (09498400). Discharge, field, and chemical data usually collected bimonthly are included for Pinal Creek at Setka Ranch (09498380). Discharge, field, and chemical data are presented for 11 additional surface-water sites along Pinal Creek. In June and July 1993, samples for chemical analyses were collected at the beginning of perennial flow in Pinal Creek. In this report, this site is identified as the "head of flow." The location of the head of flow changes over time (fig. 4). Additional observations of no flow and observations, estimates, and measurements of discharge at various points in the basin during water years 1992–93 are on file in the USGS Arizona District Office.

During May 1993, surface-water samples were collected at 11 of the 13 sites along Pinal Creek and Miami Wash, which had been flowing continuously since the storms in January and February 1993. Unfiltered and filtered (0.45–μm filter) samples were collected for analyses; samples for metal analyses were preserved with HNO_3. Data for surface-water measurements and chemical analyses are included in the "Hydrologic Data" section of this report.

Data collected during a study conducted in November 1992 to quantify solute-transport processes are presented. Samples of shallow ground water and surface water were analyzed for Ca, Mg, Na, K, Al, Co, Cu, Fe, Mn, Ni, Si, and Zn concentrations at various locations along Pinal Creek (fig. 4). Unfiltered and filtered (using 0.45- and 0.001–μm filters) samples were analyzed to evaluate the contribution of suspended particulate (>0.45 μm), colloidal (0.001–0.45 μm), and dissolved (<0.001 μm) species in the transport of these metals. Water samples were acidified with trace-metal grade HNO_3 for metal analyses. Shallow ground water, surface water, bank seeps, and tributaries along the perennial reach of Pinal Creek were sampled (fig. 4). Before collecting water samples, temperature, specific conductance, dissolved oxygen, pH, and oxidation-reduction potential were monitored in a flow-through chamber while being pumped at approximately 200 mL/min. Shallow ground-water samples were collected through multilevel samplers at sites 0, 1, 3, and 5 (fig. 4) at 3, 6, 12, 25, 50, and 100 cm below the streambed. Metal concentrations for these samples were determined using inductively coupled plasma atomic emission spectroscopy (ICP).

Monthly precipitation data and long-term precipitation statistics are presented for the two active precipitation-measurement sites closest to Pinal Creek (fig. 3). The data were assembled from published climatological data reports and annual summaries (National Climatic Data Center, issued monthly and annually, respectively). Because precipitation data customarily are reported on a calendar-year basis, data for calendar years 1991 through 1993 are included to cover water years 1992–93.

Most chemical analyses presented in this report were done by the USGS National Water-Quality Laboratory (NWQL), Arvada, Colorado; by the USGS Project Laboratory, Ocala, Florida; and by K.G. Stollenwerk, a geochemist in the USGS National Research Program (NRP), Lakewood, Colorado. Chemical analyses for the solute-transport study and some surface-water samples were done by C.C. Fuller, hydrologist, NRP, Menlo Park, California, and J.W. Harvey, hydrologist, USGS, Palo Alto, California. Where analyses from multiple sources appear in the same table, they are identified by a designated number in the laboratory column. If the laboratory is not indicated, the analysis is from the NWQL.

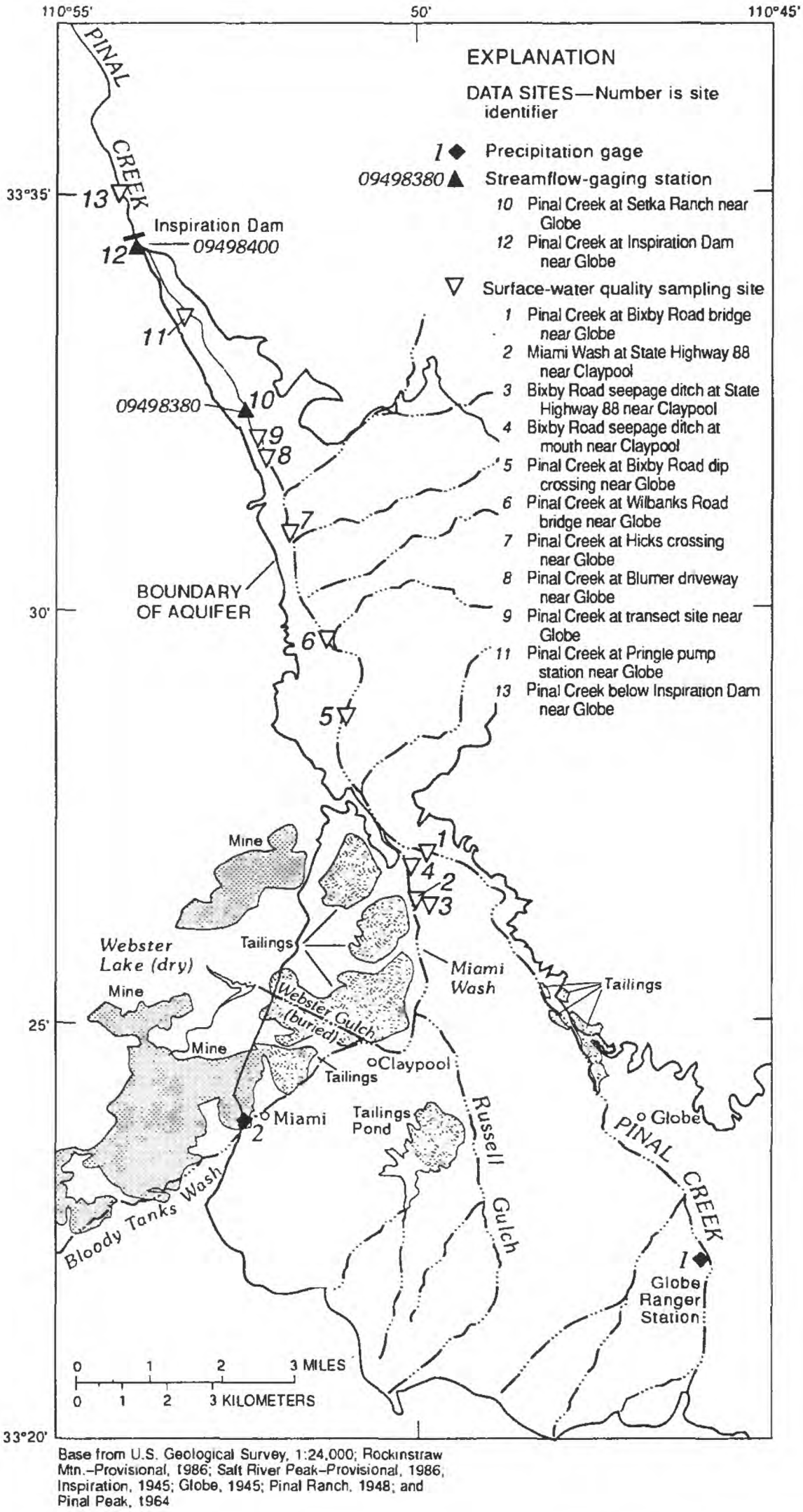
The ionic balance and ionic strength (Hem, 1985, p. 16 and 164) are reported in data tables in the "Hydrologic Data" section in this report if enough constituents were available in the analysis to accurately represent the water sample.

The balance was computed as:

$$\frac{\Sigma cations - \Sigma anions}{\Sigma cations + \Sigma anions} x100 = \text{percent ionic balance}$$

where

$\Sigma cations$ = the sum of the concentrations of all positively charged ions, in milliequivalents per liter, and



Base from U.S. Geological Survey, 1:24,000; Rockinstraw Mtn.–Provisional, 1986; Salt River Peak–Provisional, 1986, Inspiration, 1945; Globe, 1945; Pinal Ranch, 1948; and Pinal Peak, 1964

Figure 3. Locations of surface-water and precipitation data-collection sites, Pinal Creek basin.

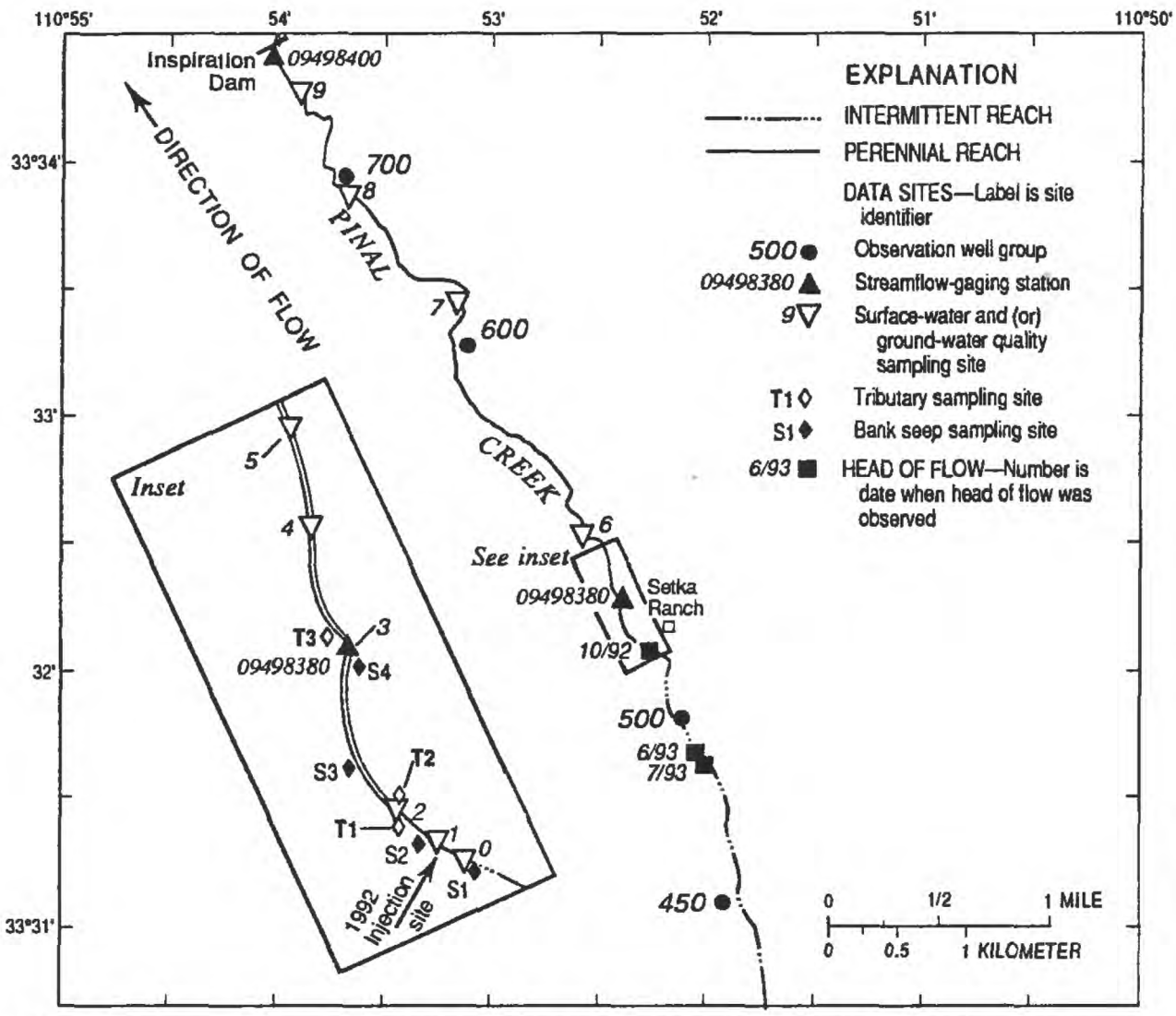


Figure 4. Locations of head of flow (October 1992 through July 1993) and sites sampled during the solute-transport study (November 1992).

$\Sigma anions$ = the sum of the concentrations of all negatively charged ions, in milliequivalents per liter.

The following species were used in the computation of the ionic balance and ionic strength: Ca, Mg, Na, K, SO_4, Cl, F, Ba, Be, Co, Cu, Fe, Mn, Zn, HCO_3, Al, Li, Cd, Ag, Pb, and Sr. Iron was assumed to be Fe^{+2} because field measurements and geochemical modeling showed negligible Fe^{+3} in waters that have dissolved-iron concentrations greater than 200 µg/L (Eychaner and Stollenwerk, 1985). In water samples that have iron concentrations smaller than 200 µg/L, iron was assumed to be Fe^{+3}.

Stollenwerk, Fuller, and the NWQL, analyzed water samples for most metals by ICP, which simultaneously determines the concentration of as many as 20 elements. An elevated concentration of one element, particularly iron, can interfere with the analytical accuracy and detection limits of other elements that are present in much lower concentrations. Under criteria described by Eychaner and others (1989, p. 5), two cobalt analyses from NWQL were deleted because of interference.

Dissolved concentrations of Cd, Mn, Ni, or Zn were in some cases greater than total-recoverable concentrations of these elements in laboratory analyses of samples from Pinal Creek at Setka Ranch and Pinal Creek at Inspiration Dam. The differences in concentrations from these analyses probably resulted from differences in precision between the analytical techniques used. The dissolved fraction was analyzed using ICP; the total-recoverable concentration was analyzed using graphite furnace-atomic absorption, which is less precise. Discrepancies also can result from rounding of values. The concentrations therefore are considered to be equal.

SELECTED REFERENCES

Brown, J.G., 1990, Chemical, geologic, and hydrologic data from the study of acidic contamination in the

Miami Wash–Pinal Creek area, Arizona, water years 1988–89: U.S. Geological Survey Open-File Report 90–395, 75 p.

_____ 1991, Particle tracking analysis of flow in the stream-aquifer system in Pinal Creek basin, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 448–453.

Brown, J.G., and Harvey, J.W., in press, Hydrologic and geochemical factors affecting metal contaminant transport in Pinal Creek basin near Globe, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Envirologic Systems, Inc., 1983, Mining activities and water-quality report: Florence, Arizona, Central Arizona Association of Governments, Mineral Extraction Task Force Report METF–7, 142 p.

Eychaner, J.H., 1988a, Geohydrologic setting of the Miami Wash–Pinal Creek acidic ground-water study near Globe, Arizona, *in* Ragone, S.E., ed., U.S. Geological Survey's Program on Toxic Waste—Ground-Water Contamination—Fiscal Year 1986 Program Overview and Selected Abstracts from the Second Technical Meeting, Cape Cod, Massachusetts, October 21–25, 1985: U.S. Geological Survey Open-File Report 86–481, p. E-3 to E-5.

_____ 1988b, Evolution of acidic ground-water contamination in a copper-mining area in Arizona, *in* Ouazar, D., Brebbia, C.A., and Stout, G.E., eds., Computer Methods and Water Resources, First International Conference, Morocco, 1988, Proceedings, v. 6 (Water Quality, Planning and Management): Southampton, U.K., Computational Mechanics Publications, p. 291-302.

_____ 1989a, Movement of inorganic contaminants in acidic water near Globe, Arizona, *in* Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Phoenix, Arizona, September 26–30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88–4220, p. 567–575.

_____ 1989b, Research activities related to acidic water near Globe, Arizona, *in* Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Phoenix, Arizona, September 26–30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88–4220, p. 599–601.

_____ 1991a, Inorganic contaminants in acidic water near Globe, Arizona, *in* Rasmussen, T.C., ed., Survival in the Desert: Water Quality and Quantity Issues into the 21st Century: Arizona Hydrological Society, Proceedings of the Third Annual Symposium, Casa Grande, Arizona, September 20–22, 1990, p. 242–252.

_____ 1991b, The Globe, Arizona, research site—Contaminants related to copper mining in a hydrologically integrated environment, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 439–447.

_____ 1991c, Solute transport in perennial streamflow at Pinal Creek, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 481–485.

Eychaner, J.H., Rehmann, M.R., and Brown, J.G., 1989, Chemical, geologic, and hydrologic data from the study of acidic contamination in the Miami Wash–Pinal Creek area, Arizona, water years 1984–87: U.S. Geological Survey Open-File Report 89–410, 105 p.

Eychaner, J.H., and Stollenwerk, K.G., 1985, Neutralization of acidic ground water near Globe, Arizona, *in* Schmidt, K.D., ed., Groundwater Contamination and Reclamation, Proceedings of a Symposium, Tucson, Arizona, August 14–15, 1985: Bethesda, Maryland, American Water Resources Association, p. 141–148.

_____ 1987, Acidic ground-water contamination from copper mining near Globe, Arizona, I. Overview, *in* Franks, B.J., ed., U.S. Geological Survey Program on Toxic Waste—Ground-Water Contamination—Proceedings of the Third Technical Meeting, Pensacola, Florida, March 23–27, 1987: U.S. Geological Survey Open-File Report 87–109, p. D-13 to D-18.

Faires, L.M., and Eychaner, J.H., 1991, Trace-element trends at Pinal Creek, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey

Water-Resources Investigations Report 91–4034, p. 461–465.

Ficklin, W.H., Love, A.H., and Briggs, P.K., 1991, Analytical results for total and partial metal extractions in aquifer material, Pinal Creek, Globe, Arizona: U.S. Geological Survey Open-File Report 91–111, 33 p.

Ficklin, W.H., Love, A.H., and Papp, C.S.E., 1991, Solid-phase variations in an aquifer as the aqueous solution changes, Globe, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 475–480.

Glynn, P.D., 1991, Effect of impurities in gypsum on contaminant transport at Pinal Creek, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 466–474.

Glynn, P.D., and Busenberg, E., in press a, Dissolved gas and chlorofluorocarbon content of ground waters in the Pinal Creek Basin, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Glynn, P.D., and Busenberg, E., in press b, Unsaturated zone diffusion of carbon dioxide and oxygen in the Pinal Creek basin, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Glynn, P.D., Engesgaard, P., and Kipp, K.L., 1991, Use and limitations of two computer codes for simulating geochemical mass transport at the Pinal Creek Toxic-Waste Site, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 454–460.

Harvey, J.W., and Fuller, C.C., in press, Association of metal contaminants with colloidal and suspended particulate material in shallow ground water and surface water at Pinal Creek, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Harvey, J.W., Fuller, C.C., and Wagner, B.J., in press, Interactions between shallow ground water and surface water that affect metal transport in Pinal Creek, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Haschenburger, J.K., 1989a, Manganese in channel sediments of Pinal Creek, Arizona, *in* Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Phoenix, Arizona, September 26–30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88–4220, p. 593–597.

_____1989b, Variation of copper in stream sediment: Tempe, Arizona State University, master's thesis, 67 p.

Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water, 3d edition: U.S. Geological Survey Water-Supply Paper 2254, 263 p.

Hem, J.D., and Lind, C.J., 1994, Chemistry of manganese precipitation in Pinal Creek, Arizona, USA: A laboratory study: Geochimica et Cosmochimica Acta, v. 58, no. 6, p. 1601–1614.

Hem, J.D., and Lind, C.J., in press, Chemical processes in manganese oxide and carbonate precipitation in Pinal Creek, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Hydro Geo Chem, Inc., 1989, Investigation of acid water contamination along Miami Wash and Pinal Creek, Gila County, Arizona: Claypool, Arizona, Cyprus Miami Mining Corporation report, 140 p.

Lind, C.J., 1991, Manganese minerals and associated fine particulates in the Pinal Creek streambed, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology

Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 486–491.

Lind, C.J., and Anderson, L.D., 1992, Trace metal scavenging by precipitating Mn and Fe oxides, *in* Kharaka, Y.K., and Maest, A.S., eds., Proceedings of the Seventh International Symposium on Water-Rock Interaction—WRI 7, Park City, Utah, USA, July 13–18, 1992: Brookfield, Vermont, A.A. Balkema Publishers, p. 397–402.

Lind, C.J., and Hem, J.D., 1993, Manganese minerals and associated fine particulates in the streambed of Pinal Creek, Arizona, U.S.A.: a mining-related acid drainage problem: Applied Geochemistry, v. 8, no. 1, p. 67–80.

Lind, C.J., and Stollenwerk, K.G., in press, Alteration of alluvium by acidic ground water resulting from copper mining at Pinal Creek, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Longsworth, S.A., 1991, Measurement of stream reaeration at Pinal Creek, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 492–497.

Longsworth, S.A., and Taylor, A.M., 1992, Hydrologic data from the study of acidic contamination in the Miami Wash–Pinal Creek area, Arizona, water years 1990–91: U.S. Geological Survey Open-File Report 92–468, 59 p.

Love, A.H., and Ficklin, W.H., 1990, Sequential-partial extraction of Pinal Creek aquifer material near Globe, Arizona, for SO_4^{-2} and PO_4^{-3}, *in* Rocky Mountain Conference on Analytical Chemistry, 32nd, July 29–August 3, 1990, Proceedings: Society for Applied Spectroscopy, 6 p.

MacNish, R.D., Smith, C.F., and Goddard, K.E., 1993, Floods in Arizona, January 1993: U.S. Geological Survey Open-File Report 93–54, 2 p.

National Climatic Data Center, issued monthly, Climatological data, Arizona: U.S. Department of Commerce, National Climatic Data Center, v. 91–93, no. 1–12.

_____ issued annually, Climatological data annual summaries, Arizona: U.S. Department of Commerce, National Climatic Data Center, v. 91–93, no. 13.

Neaville, C.C., 1989, Simulation of ground- and surface-water flow in the Globe area, Arizona, *in* Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Phoenix, Arizona, September 26–30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88–4220, p. 577–579.

_____1991, Hydrogeology and simulation of ground-water and surface-water flow in the Pinal Creek basin, Gila County, Arizona: Tucson, University of Arizona, master's thesis, 149 p.

Neaville, C.C., and Brown, J.G., 1994, Hydrogeology and hydrologic system of Pinal Creek basin, Gila County, Arizona: U.S. Geological Survey Water-Resources Investigations Report 93–4212, 32 p.

Novo-Gradac, K.J., and Smith, C.N., 1991, Application of MINTEQA2 to the speciation of contaminants at Globe, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 498–501.

Peterson, N.P., 1962, Geology and ore deposits of the Globe–Miami district, Arizona: U.S. Geological Survey Professional Paper 342, 151 p.

Pool, D.R., and Eychaner, J.H., in press, Measurement of aquifer-storage change and specific yield using gravity surveys: Ground Water.

Puls, R.W., and Eychaner, J.H., 1990, Sampling of ground water for inorganics—pumping rate, filtration, and oxidation effects, *in* Proceedings of the Fourth National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring, and Geophysical Methods, Las Vegas, Nevada, May 14–17, 1990: Dublin, Ohio, Water Well Journal Publishing Company, p. 313–327.

Puls, R.W., Eychaner, J.H., and Powell, R.M., 1990, Colloidal-facilitated transport of inorganic contaminants in ground water, Part I, Sampling considerations: U.S. Environmental Protection Agency Environmental Research Brief, EPA 600/M–90/023, 11 p.

Puls, R.W., and Powell, R.M., 1990, Transport of Fe^{59}-labeled iron oxide colloids in laboratory columns using natural aquifer material: Eos Transactions, American Geophysical Union, v. 71, p. 504.

Puls, R.W., Powell, R.M., and Rees, T.F., 1991, Stability and transport of inorganic colloids through contaminated aquifer material, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 507–510.

Ransome, F.L., 1903, Geology of the Globe copper district, Arizona: U.S. Geological Survey Professional Paper 12, 168 p.

Reese, R.S., 1989, Characterization of organic contamination of ground water in a mining area, Globe, Arizona: Tucson, University of Arizona, master's thesis, 138 p.

Reese, R.S., and Bassett, R.L., 1990, Characterization of organic contamination of ground water in a mining area, Globe, Arizona, *in* Lehr, J.H., ed., Ground water management, Proceedings of the ground-water geochemistry conference, Kansas City, Missouri, February 20–22, 1990: National Water Well Association, p. 221–236.

Rouse, J.V., 1981, Geohydrology of the Globe–Miami, Arizona, area: Florence, Arizona, Central Arizona Association of Governments, Mineral Extraction Task Force Report METF–5, 103 p.

_____ 1983, Water-quality report for the Globe–Miami area: Florence, Arizona, Central Arizona Association of Governments, Mineral Extraction Task Force Report METF–6, 2 volumes, 448 p.

Smith, C.F., Rigas, P.D., Ham, L.K., Duet, N.R., Anning, D.W., 1994, Water Resources Data, Arizona, water year 1993: U.S. Geological Survey Water-Data Report AZ–93–1, 360 p.

Spindler, P.H., 1993, Algal distribution and chemical gradients in Pinal Creek, Gila County, Arizona: Tempe, Arizona State University, master's thesis, 73 p.

Spindler, P.H., and Sommerfeld, M.R., in press, Relations among algal species and chemical gradients in Pinal Creek, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Stollenwerk, K.G., 1988, Neutralization of acidic ground water in eastern Arizona, *in* Ragone, S.E., ed., U.S. Geological Survey's Program on Toxic Waste—Ground-Water Contamination—Fiscal Year 1986 Program Overview and Selected Abstracts from the Second Technical Meeting, Cape Cod, Massachusetts, October 21–25, 1985: U.S. Geological Survey Open-File Report 86–481, p. E-7 to E-8.

_____1990, Simulation of the sorption of Co, Cu, Ni, and Zn with a two-site, diffuse layer sorption model: Eos Transactions, American Geophysical Union, v. 71, p. 519.

_____1991, Simulation of copper, cobalt, and nickel sorption in an alluvial aquifer near Globe, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 502–506.

_____1994, Geochemical interactions between constituents in acidic groundwater and alluvium in an aquifer near Globe, Arizona: Applied Geochemistry, v. 9, no. 4, p. 353–369.

Stollenwerk, K.G., and Eychaner, J.H., 1987, Acidic ground-water contamination from copper mining near Globe, Arizona, *in* II. Neutralization capacity of alluvium, *in* Franks, B.J., ed., U.S. Geological Survey Program on Toxic Waste—Ground-Water Contamination—Proceedings of the Third Technical Meeting, Pensacola, Florida, March 23–27, 1987: U.S. Geological Survey Open-File Report 87–109, p. D-19 to D-24.

_____1989, Solubility of aluminum and iron in ground water near Globe, Arizona, *in* Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Phoenix, Arizona, September 26–30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88–4220, p. 581–591.

Tolle, Shirin, and Arthur, G.V., 1991, Aquifer restoration under the Clean Water Act, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 520–523.

U.S. Geological Survey, 1975, Hydrologic unit map—1974, State of Arizona: U.S. Geological Survey Hydrologic Unit Map series, 1 sheet.

Wagner, B.J., and Harvey, J.W., in press, Solute transport parameter estimation for an injection experiment at Pinal Creek, Arizona, *in* Morganwalp, D.W., and Aronson, D.A., eds., 1994, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20–24,

1993: U.S. Geological Survey Water-Resources Investigations Report 94–4014.

Wallin, R.W., 1991, Ground-water transport of polycyclic aromatic hydrocarbons in association with humic substances in the Pinal Creek basin, Globe, Arizona: Tucson, University of Arizona, master's thesis, 80 p.

Wallin, R.W., Bassett, R.L., and Eychaner, J.H., 1991, Ground-water transport of polycyclic aromatic hydrocarbons in association with humic substances in the Pinal Creek basin, Globe, Arizona, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 511–515.

Walter, G.R., and Norris, J.R., 1991, Hydrochemical zoning in the Pinal Creek alluvium, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Monterey, California, March 11–15, 1991: U.S. Geological Survey Water-Resources Investigations Report 91–4034, p. 516–519.

(page 15 follows)

HYDROLOGIC DATA

(page 17 follows)

GROUND WATER

Well 10

LOCATION.—Lat 33°23'10", long 110°49'05", in SE 1/4 SE 1/4 NW 1/4 sec. 34, T. 1 N., R. 15 E. (A-01-15) 34bdd1, 90 m east of Russell Gulch, and 3 km southwest of Globe.

Landowner: Pinto Valley Division, Magma Copper Corporation

LAND SURFACE DATUM.—1,056 m above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.—In December 1988, three attempts to drill this well using a hollow stem auger were abandoned at depths of less than 3 m because of large rocks in hole.

DRILLING AND WELL CONSTRUCTION

The well was cased and screened with nominal 10-centimeter diameter, schedule 40, polyvinyl chloride (PVC) pipe. The screened interval is a single 9.1-meter length of PVC pipe that has 5,472 factory-cut slots 4.4 cm long by 0.51 mm wide for a total open area of 1,228 cm^2. The borehole annulus around the slotted pipe is filled to approximately 17.0 m below land surface with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 16.4 to 17.0 m below land surface. Natural material fills the borehole annulus from approximately 16.4 to 2.4 m below land surface. A concrete seal extends from the land surface to a depth of 2.4 m

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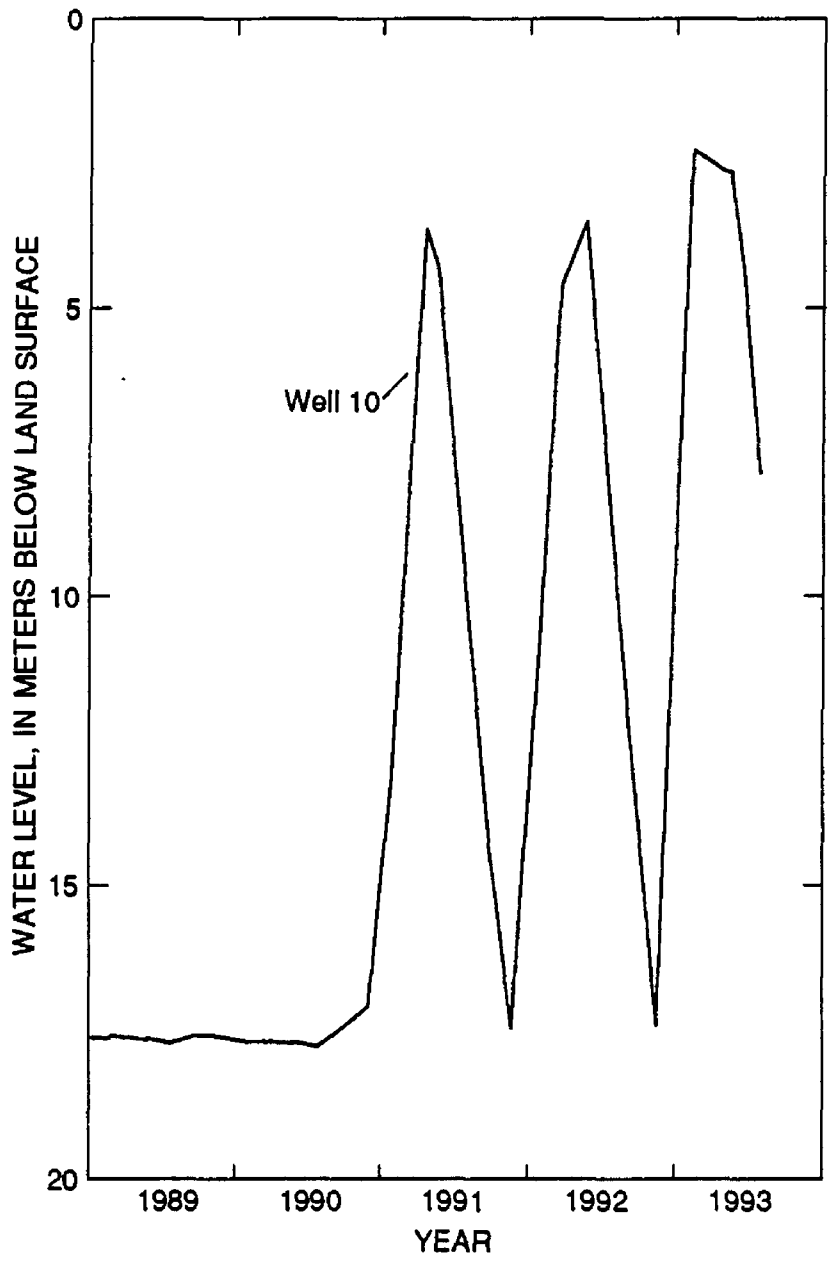
Logs: D, drillers; G, geologist; P, particle size

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (meters)	Geologic Unit	Bottom of seal (meters)	Logs available
10	bdd1	01-06-89	Air Hammer	27.9	27.1	18.0-27.1	Basin Fill	2.4	DGP

GROUND WATER—Continued

Well 10—Continued

Date	Water level, in meters below land surface
11-20-91	17.38
01-30-92	10.51
03-19-92	4.55
05-21-92	3.45
08-21-92	10.92
09-25-92	13.71
11-15-92	17.33
02-10-93	2.23
04-21-93	2.56
05-16-93	2.63
06-14-93	4.25
07-28-93	7.83



GROUND WATER—Continued

Well 10—Continued

Field Measurements

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; m, meters; dashes indicate no data]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature air (°C)	Temperature water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dis IT field (mg/L as HCO_3)	Average discharge (L/min)	Pumping period (hours)	Drawdown (m)
010	11-20-91	532	6.4	340	--	15.5	6.5	196	3.03	0.78	--
	06-14-93	471	7.0	322	21.5	16.5	7.2	186	19.3	0.65	0.44

Laboratory Measurements

[Laboratory—110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; mol/L, moles per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Ionic balance (percent)	Ionic strength (mol/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Silica, dissolved (mg/L as SiO_2)
010	11-20-91	110	-0.39	0.009	55	18	29	90	16	24
	06-14-93	110	-2.5	0.007	48	16	23	78	10	20

Well	Date	Laboratory	Aluminum, dissolved (µg/L as Al)	Cadmium, dissolved (µg/L as Cd)	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Nickel, dissolved (µg/L as Ni)	Strontium, dissolved (µg/L as Sr)	Zinc, dissolved (µg/L as Zn)
010	11-20-91	110	<500	<50	<20	<10	<20	<30	<50	350	<15
	06-14-93	110	<2,500	<250	<100	<50	<100	<150	<250	<950	<75

GROUND WATER—Continued

Well Group 50

LOCATION.—Lat 33°26'11", long 110°49'51", in SE 1/4 SW 1/4 SE 1/4 sec. 9, T. 1 N., R. 15 E. (A-01-15)09dcd, 170 m east of Miami Wash, and 6 km northwest of Globe.

Landowner: Pinto Valley Division, Magma Copper Corporation

LAND SURFACE DATUM.—987.6 m above National Geodetic Vertical Datum of 1929 (levels by Water Resources Division, U.S. Geological Survey).

REMARKS.—Wells 51, 52, 53, and 54 were originally identified as MP1W1, MP1W2, MP1W3, and MP1W4, respectively.

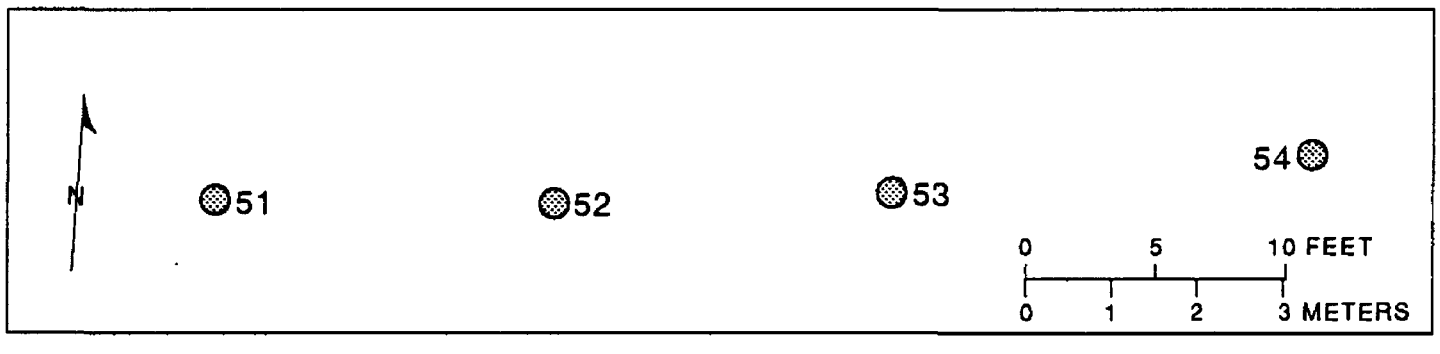
DRILLING AND WELL CONSTRUCTION

All holes listed below were drilled by normal-circulation rotary drilling with bentonite mud. The wells were cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. Each well has a single 0.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. Each screen has 1470 factory-cut slots 3.6 cm long by 0.64 mm wide for a total open area of 339 cm^2. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 0.5 to 1.5 m above the screen. A concrete seal extends from the land surface to a depth of 3 m for each well.

Logs: C, caliper; E, electric; G, geologist; P, particle size. Dashes indicate no data.

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (meters)	Geologic Unit	Bottom of aeal (meters)	Logs available
51	dcd1	10-11-84	Rotary, Bentonite	33.5	33.4	32.4-33.3	Basin Fill	3	CEGP
52	dcd2	10-12-84	Rotary, Bentonite	20.1	19.8	18.8-19.7	Alluvium	3	--
53	dcd3	10-12-84	Rotary, Bentonite	28.0	27.8	26.8-27.7	Basin Fill	3	--
54	dcd3	10-12-84	Rotary, Bentonite	11.3	11.0	10.0-10.9	Alluvium	3	--

WELL GROUP 50 SITE PLAN

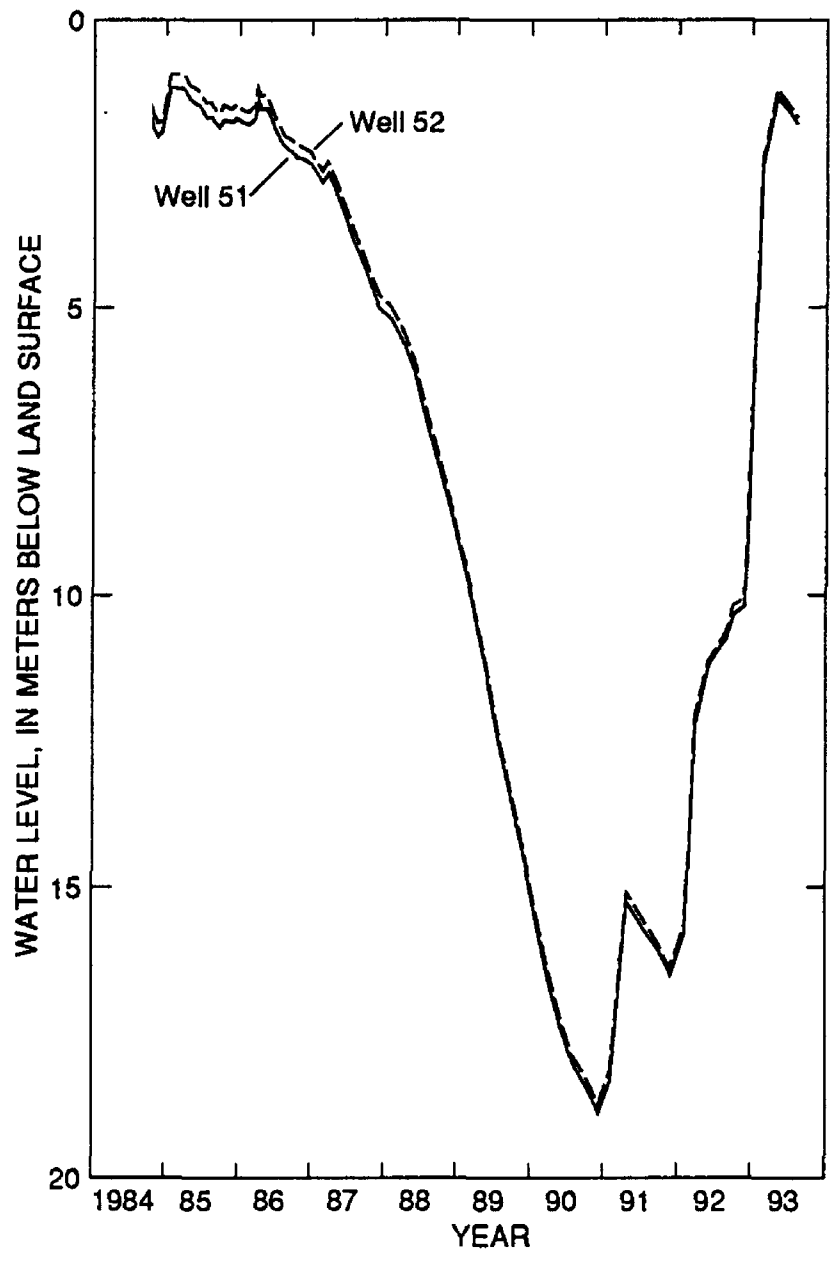


GROUND WATER—Continued

Well Group 50—Continued

Water level, in metera below land surface		
	Well Number	
Date	51	52
11-19-91	16.51	16.45
01-30-92	15.79	15.72
03-19-92	12.22	12.14
05-21-92	11.30	11.21
05-27-92	11.22	11.19
08-21-92	10.77	10.69
09-25-92	10.34	10.25
11-16-92	10.21	10.12
02-10-93	2.60	2.51
04-21-93	1.39	1.26
05-16-93	1.50	1.38
06-16-93	1.63	1.53
07-28-93	1.86	1.77

Weter level, in meters below land surface		
	Well Number	
Date	53	54
11-19-91	16.44	DRY
01-30-92	15.72	DRY
03-19-92	12.14	DRY
05-21-92	11.22	DRY
05-27-92	11.20	DRY
08-21-92	10.69	10.69
09-25-92	10.26	10.27
11-16-92	10.13	10.13
02-10-93	2.52	2.52
04-21-93	1.27	1.28
05-16-93	1.39	1.34
06-16-93	1.55	1.55
07-28-93	1.78	1.80



GROUND WATER—Continued

Well Group 50—Continued

Field Measurements

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Average discharge (L/min)	Pumping period (hours)
51	11-19-91	4,430	3.6	450	--	18.5	<0.1	45.4	0.46
	05-27-92	3,740	3.7	450	--	19.0	<0.1	53.4	0.50
	11-16-92	3,510	3.8	434	--	18.0	<0.1	3.79	0.63
	06-16-93	2,660	4.0	--	25.0	18.5	0.4	39.4	0.50
52	11-19-91	1,940	3.6	470	--	18.5	<0.1	24.2	0.37
	05-27-92	1,140	3.6	466	--	18.5	<0.1	34.8	0.40
	06-16-93	1,410	4.0	--	31.0	17.5	0.4	41.3	0.43
53	11-19-91	3,680	3.6	470	--	18.0	<0.1	34.8	0.33
	11-16-92	2,460	3.9	436	--	18.5	<0.1	3.79	0.35
	06-16-93	2,010	4.0	--	33.0	18.0	0.4	33.3	0.40
54	11-16-92	2,060	3.9	507	--	19.0	2.7	1.89	0.42
	06-16-93	1,460	4.0	--	34.0	19.0	1.2	33.7	0.48

Laboratory Measurements

[Laboratory—10, USGS National Water-Quality Laboratory, Arvada, Colorado; 110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; 20, USGS research laboratory, Ocala, Florida; mg/L milligrams per liter; µg/L, micrograms per liter; mol/L, moles per liter; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Ionic balance (percent)	Ionic strength (mol/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)
51	11-19-91	10	3.3	0.145	500	120	95	8.7	3,200
	11-19-91	110	4.0	0.146	460	130	100	--	3,200
	05-27-92	110	-3.7	0.114	400	87	72	--	2,700
	11-16-92	20	--	--	--	--	--	--	--
	11-16-92	110	-2.9	0.106	450	71	90	--	2,500
	06-16-93	110	4.8	0.070	260	60	82	--	1,500
52	11-19-91	110	2.4	0.048	100	61	54	--	1,100
	05-27-92	110	-0.53	0.023	57	30	33	--	550
	06-16-93	110	0.96	0.030	95	34	52	--	690
53	11-19-91	110	-0.87	0.114	370	97	75	--	2,700
	11-16-92	20	--	--	--	--	--	--	--
	11-16-92	110	-2.6	0.060	190	50	70	--	1,400
	06-16-93	110	3.5	0.049	130	47	76	--	1,100
54	11-16-92	20	--	--	--	--	--	--	--
	11-16-92	110	-5.6	0.042	220	52	85	--	1,000
	06-16-93	10	-1.1	0.030	150	45	56	6.4	690
	06-16-93	110	3.4	0.030	170	42	64	--	660

GROUND WATER—Continued

Well Group 50—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Aluminum, dissolved (µg/L as Al)	Barium, dissolved (µg/L as Ba)	Beryllium, dissolved (µg/L as Be)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)
51	11-19-91	10	100	14	89	64,000	12	77	240	190	<50
	11-19-91	110	120	--	96	73,000	--	--	--	200	--
	05-27-92	110	92	--	90	45,000	--	--	--	<100	--
	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	110	100	--	94	30,000	--	--	--	<500	--
	06-16-93	110	80	--	87	20,000	--	--	--	<250	--
52	11-19-91	110	57	--	94	20,000	--	--	--	74	--
	05-27-92	110	21	--	83	7,800	--	--	--	<50	--
	06-16-93	110	37	--	90	11,000	--	--	--	<250	--
53	11-19-91	110	77	--	90	48,000	--	--	--	150	--
	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	110	100	--	85	17,000	--	--	--	<250	--
	06-16-93	110	50	--	84	15,000	--	--	--	<250	--
54	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	110	95	--	96	8,000	--	--	--	<250	--
	06-16-93	10	43	5.1	99	7,800	20	22	30	10	8
	06-16-93	110	52	--	110	7,200	--	--	--	<250	--

Well	Date	Laboratory	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L as Ag)
51	11-19-91	10	--	47,000	730,000	<100	340	21,000	<100	860	<10
	11-19-91	110	4,900	48,000	740,000	--	--	23,000	--	920	--
	05-27-92	110	3,500	32,000	500,000	--	--	16,000	--	660	--
	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	110	<200	26,000	430,000	--	--	13,000	--	<500	--
	06-16-93	110	<100	21,000	350,000	--	--	11,000	--	<250	--
52	11-19-91	110	1,800	18,000	260,000	--	--	10,000	--	480	--
	05-27-92	110	800	8,700	100,000	--	--	5,400	--	190	--
	06-16-93	110	<100	10,000	110,000	--	--	6,200	--	<250	--
53	11-19-91	110	3,600	33,000	540,000	--	--	17,000	--	640	--
	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	110	<100	17,000	300,000	--	--	9,200	--	<250	--
	06-16-93	110	<100	17,000	270,000	--	--	8,800	--	<250	--
54	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	110	<100	7,800	<100	--	--	21,000	--	<250	--
	06-16-93	10	220	7,700	58	<10	220	14,000	<10	290	2.0
	06-16-93	110	<100	7,400	<100	--	--	13,000	--	<250	--

GROUND WATER—Continued

Well Group 50—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Strontium, dissolved (µg/L as Sr)	Vanadium, dissolved (µg/L aa V)	Zinc, dissolved (µg/L as Zn)	Carbon, inorganic, total (mg/L as C)
51	11-19-91	10	890	240	6,700	--
	11-19-91	110	900	--	7,100	--
	05-27-92	110	880	--	4,400	--
	11-16-92	20	--	--	--	41
	11-16-92	110	<1,900	--	3,800	--
	06-16-93	110	<950	--	3,200	--
52	11-19-91	110	400	--	2,600	--
	05-27-92	110	230	--	1,100	--
	06-16-93	110	<950	--	1,400	--
53	11-19-91	110	680	--	500	--
	11-16-92	20	--	--	--	30
	11-16-92	110	<950	--	2,400	--
	06-16-93	110	<950	--	2,500	--
54	11-16-92	20	--	--	--	21
	11-16-92	110	<950	--	1,000	--
	06-16-93	10	660	<6	1,100	--
	06-16-93	110	<950	--	1,100	--

GROUND WATER—Continued

Well Group 100

LOCATION.—Lat 33°26'29", long 110°49'58", in SW 1/4 NW 1/4 SE 1/4 sec. 9, T. 1 N., R. 15 E. (A-01-15)09dbc, in the right-of-way of State Highway 88, 150 m east of Miami Wash, and 7 km northwest of Globe.

Landowner: Arizona Department of Transportation

LAND SURFACE DATUM.—985.40 m above National Geodetic Vertical Datum of 1929 (levels by Water Resources Division, U.S. Geological Survey)

REMARKS.—Wells 101, 102, 103, 104, 105, and 106 were originally identified as X1W1, X1W2, X1W3, X1W4, X1W5, and X1W6, respectively.

DRILLING AND WELL CONSTRUCTION

Wells 101-105 were cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. Each well has a single 0.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. Each screen has 1,470 factory-cut slots 3.6 cm long by 0.64 mm wide for a total open area of 339 cm^2. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 0.5 to 1.5 m above the screen. A concrete seal extends from the land surface to the depth listed.

Well 1EX was drilled for exploration purposes. After water samples and cuttings were collected, the hole was sealed with concrete to its total depth.

The casing of well 106 was accidentally crushed at about 46 m depth during pressure grouting. The borehole annulus probably is grouted from 0 to 15 m and from 46 to 55 m. Air jetting during attempted development removed most water from the upper casing. The water level rose from 37 to 29 m below land surface during the next 54 days, which represents an average inflow of 1.2 L/d. The casing then was filled with concrete.

Well 107 was cased with nominal 10-centimeter diameter, schedule 80 PVC pipe. The well has a single 4.4-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. The screen has 3,168 factory cut slots 3.4 cm long by 0.64 mm wide for a total open area of 689 cm^2. The borehole around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 1 to 2 m above the screen. A concrete seal extends from the land surface to a depth of 1.5 m.

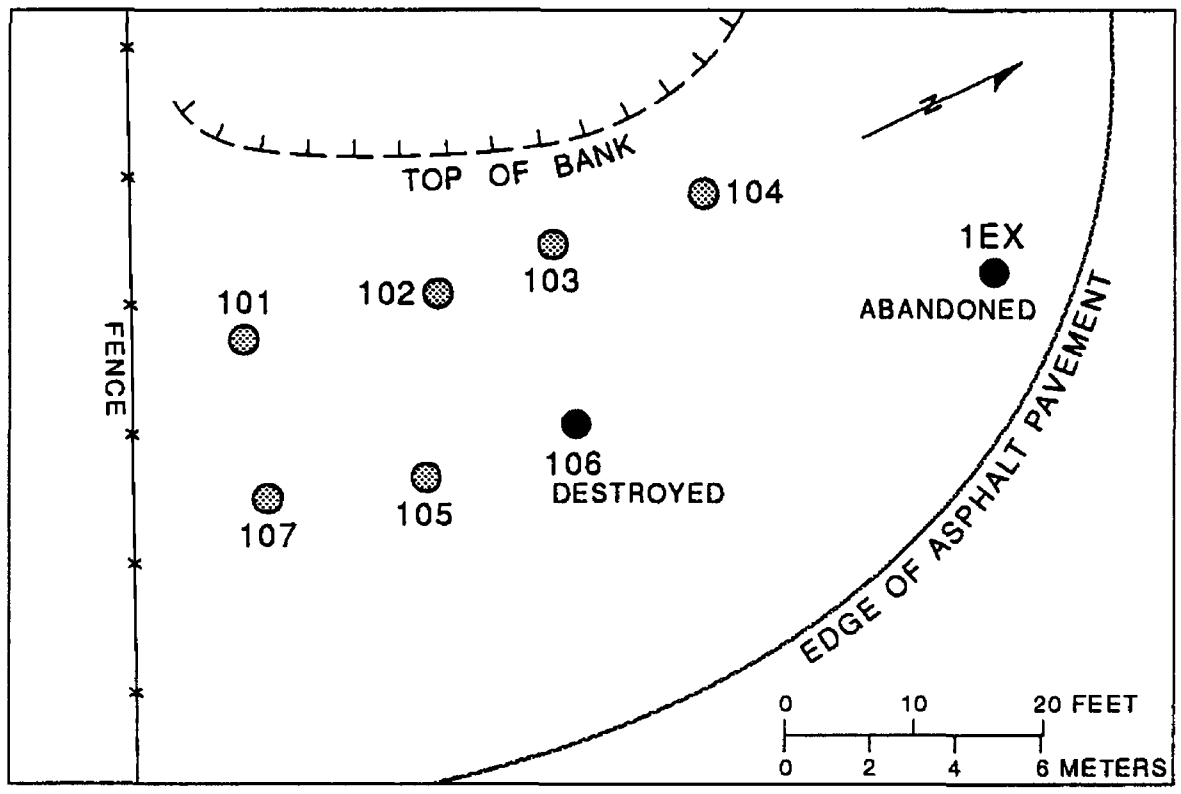
GROUND WATER—Continued

Well Group 100—Continued

Logs: C, caliper; D, driller's; E, electric; G, geologist; P, particle size; U, gamma-gamma. Dashes indicate no data.

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (meters)	Geologic Unit	Bottom of seal (meters)	Logs available
101	dbc1	10-10-84	Rotary, Bentonite	36.3	36.1	35.1-36.0	Basin Fill	3	CEGPU
102	dbc2	10-11-84	Rotary, Bentonite	25.3	25.2	24.2-25.1	Alluvium	3	--
103	dbc3	10-11-84	Rotary, Bentonite	19.2	19.1	18.1-19.0	Alluvium	3	--
104	dbc4	10-11-84	Rotary, Bentonite	11.3	11.2	10.1-11.1	Alluvium	3	--
1EX	--	12-11-85	Dual-wall air rotary	77.7	--	--	--	--	DGP
105	dbc5	05-22-86	Rotary, Bentonite	49.1	48.8	47.2-48.1	Basin Fill	38.1	D
106	dbc6	05-20-86	Rotary, Bentonite	62.5	--	--	--	--	--
107	dbc7	12-14-88	Hollow stem auger	22.6	19.3	14.9-19.2	Alluvium	1.5	DGP

WELL GROUP 100 SITE PLAN

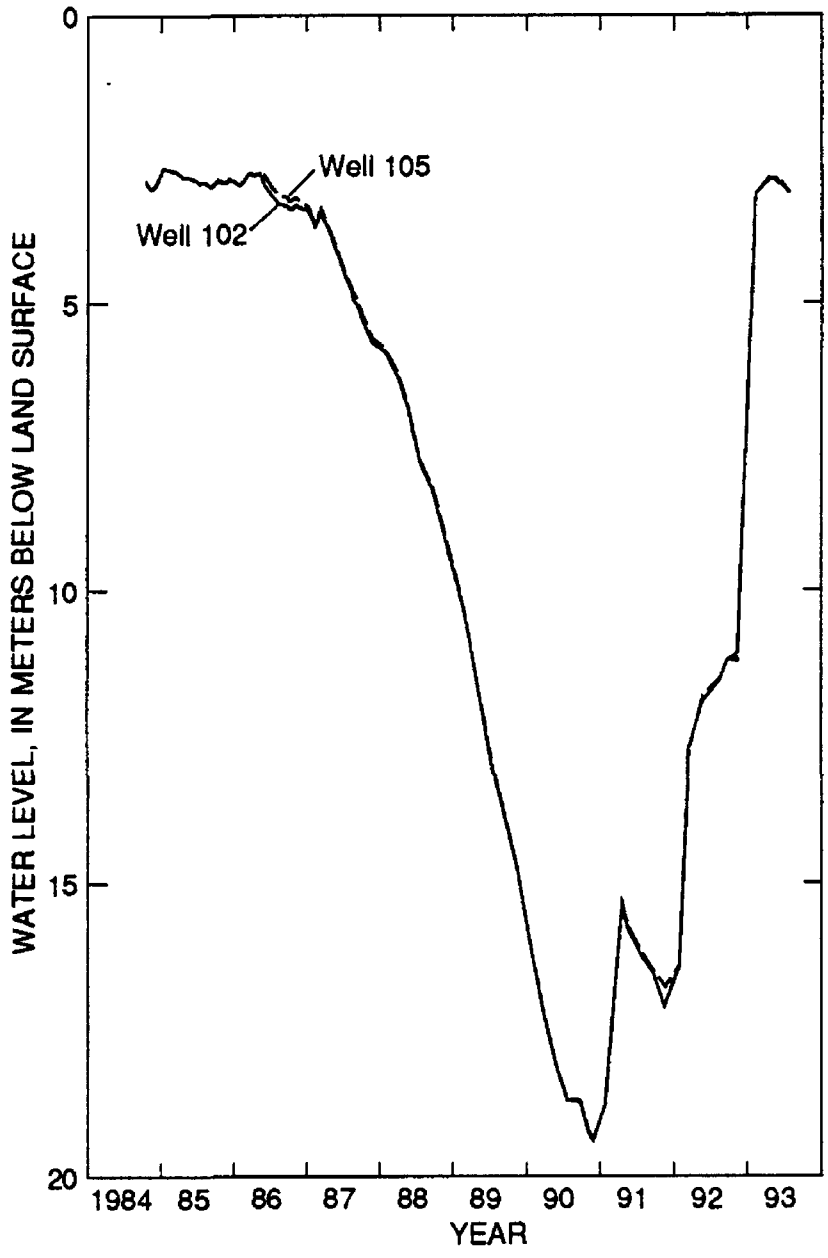


GROUND WATER—Continued

Well Group 100—Continued

Water level, in meters below land surface			
	Well Number		
Date	101	102	103
11-20-91	16.57	17.15	17.15
01-30-92	16.49	16.45	16.45
03-19-92	12.77	12.73	12.72
05-21-92	11.97	11.94	11.91
05-27-92	11.92	11.92	11.82
08-21-92	11.56	11.53	11.51
09-25-92	11.24	11.20	11.18
11-15-92	11.21	11.08	11.16
02-10-93	3.16	3.13	3.10
04-21-93	2.90	2.87	2.86
05-16-93	2.90	2.87	2.84
06-09-93	2.99	2.96	2.94
06-17-93	2.99	2.96	2.94
07-28-93	3.13	3.12	3.10

Water level, in meters below land surface			
	Well Number		
Date	104	105	107
11-20-91	DRY	16.80	17.00
01-30-92	DRY	16.43	16.38
03-19-92	DRY	12.73	12.66
05-21-92	DRY	11.89	11.86
05-27-92	DRY	11.78	11.77
08-21-92	DRY	11.49	11.45
09-25-92	DRY	11.18	11.13
11-15-92	DRY	11.19	11.10
02-10-93	3.13	3.12	3.06
04-21-93	2.86	2.82	2.76
05-16-93	2.87	2.86	2.78
06-09-93	2.97	2.94	2.87
06-17-93	2.97	2.93	2.87
07-28-93	3.12	3.11	3.02



GROUND WATER—Continued

Well Group 100—Continued

Field Measurements

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; m, meters; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dia IT field (mg/L as HCO_3)	Average discharge (L/min)	Pumping period (houra)	Drawdown (m)
101	11-20-91	5,330	3.5	450	--	17.5	<0.1	--	46.6	0.33	--
	05-27-92	4,570	3.6	430	--	18.0	<0.1	--	60.9	0.53	--
	11-16-92	4,290	3.8	465	--	17.5	0.1	--	37.9	0.50	--
	06-17-93	3,590	3.5	417	35.0	18.0	<0.1	--	46.2	0.78	--
102	11-20-91	4,590	3.7	360	--	18.5	<0.1	--	3.41	0.88	--
	11-16-92	3,920	3.8	436	--	18.0	<0.1	--	3.79	0.40	--
	06-17-93	3,540	3.5	380	29.0	19.0	<0.1	--	4.16	3.2	--
103	11-20-91	3,480	3.5	310	15.0	18.5	0.1	--	3.41	0.42	--
	05-27-92	2,760	3.5	474	--	19.0	<0.1	--	48.8	0.42	--
	06-17-93	2,520	3.4	469	30.0	18.0	<0.1	--	28.4	0.73	--
104	06-17-93	1,420	3.7	648	30.0	19.0	<0.1	--	3.56	1.6	--
105	11-20-91	3,670	6.4	320	--	18.5	0.3	--	10.6	0.30	11.0
	11-15-92	3,260	6.8	313	--	18.5	1.0	619	--	1.2	--
	06-17-93	3,120	6.2	339	29.0	18.5	<0.1	194	14.4	1.5	--

GROUND WATER—Continued

Well Group 100—Continued

Laboratory Measurements

[Laboratory—10, USGS National Water-Quality Laboratory, Arvada, Colorado; 110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; 20, USGS research laboratory, Ocala, Florida; mol/L, moles per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Ionic balance (percent)	Ionic strength (mol/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)
101	11-20-91	110	1.9	0.186	440	190	130	—	4,100
	05-27-92	110	-1.6	0.145	350	150	84	—	3,300
	11-16-92	20	—	—	—	—	—	—	—
	11-16-92	10	-0.03	0.143	430	110	93	9.0	3,000
	11-16-92	110	-7.2	0.131	430	80	86	--	3,200
	06-17-93	110	-1.8	0.104	460	72	90	--	2,400
102	11-20-91	10	3.3	0.146	510	150	110	6.4	3,200
	11-20-91	110	-1.0	0.152	450	150	97	—	3,500
	11-16-92	20	—	--	—	—	--	—	—
	11-16-92	110	-1.9	0.121	500	57	75	—	2,800
	06-17-93	110	-4.2	0.107	560	43	73	—	2,500
103	11-20-91	110	0.73	0.105	400	110	85	—	2,400
	05-27-92	110	-3.7	0.074	340	75	41	—	1,800
	06-17-93	110	4.7	0.069	400	43	73	—	1,500
104	06-17-93	10	-2.1	0.030	170	40	52	5.2	710
	06-17-93	110	-3.2	0.028	140	38	61	—	660
105	11-20-91	110	1.9	0.080	420	140	280	—	1,800
	11-15-92	110	-2.1	0.067	380	120	230	—	1,200
	06-17-93	110	-0.77	0.055	290	—	260	—	1,200

GROUND WATER—Continued

Well Group 100—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Aluminum, dissolved (µg/L as Al)	Barium, dissolved (µg/L as Ba)	Beryllium, dissolved (µg/L as Be)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)
101	11-20-91	110	180	--	97	110,000	--	--	--	280	--
	05-27-92	110	130	--	88	74,000	--	--	--	<100	--
	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	10	110	13	80	--	11	59	270	220	20
	11-16-92	110	130	--	69	59,000	--	--	--	<250	--
	06-17-93	110	110	--	84	36,000	--	--	--	<250	--
102	11-20-91	10	140	14	100	63,000	12	76	220	200	<50
	11-20-91	110	130	--	110	81,000	--	--	--	220	--
	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	110	130	--	73	46,000	--	--	--	<250	--
	06-17-93	110	120	--	97	36,000	--	--	--	<250	--
103	11-20-91	110	86	--	120	43,000	--	--	--	110	--
	05-27-92	110	63	--	98	24,000	--	--	--	<100	--
	06-17-93	110	65	--	97	21,000	--	--	--	<250	--
104	06-17-93	10	48	3.6	90	5,900	19	22	40	9.0	9
	06-17-93	110	45	--	97	5,800	--	--	--	<250	--
105	11-20-91	110	180	--	55	2,500	--	--	--	<250	--
	11-15-92	110	170	--	40	<2,500	--	--	--	<250	--
	06-17-93	110	120	--	43	<2,500	--	--	--	<250	--

GROUND WATER—Continued

Well Group 100—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L as Ag)
101	11-20-91	110	6,600	68,000	960,000	--	--	35,000	--	1,200	--
	05-27-92	110	5,100	47,000	740,000	--	--	25,000	--	960	--
	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	10	--	39,000	540,000	50	280	20,000	<30	790	<3.0
	11-16-92	110	5,480	38,000	580,000	--	--	15,000	--	800	--
	06-17-93	110	3,940	26,000	380,000	--	--	13,000	--	530	--
102	11-20-91	10	--	51,000	660,000	<100	410	26,000	<100	970	12
	11-20-91	110	4,600	50,000	660,000	--	--	28,000	--	1,100	--
	11-16-92	20	--	--	--	--	--	--	--	--	--
	11-16-92	110	5,620	32,000	560,000	--	--	10,000	--	800	--
	06-17-93	110	3,240	21,000	330,000	--	--	7,600	--	380	--
103	11-20-91	110	2,700	30,000	380,000	--	--	22,000	--	720	--
	05-27-92	110	1,700	20,000	210,000	--	--	14,000	--	440	--
	06-17-93	110	2,040	15,000	200,000	--	--	7,600	--	310	--
104	06-17-93	10	220	6,900	42	<10	200	14,000	<10	260	3.0
	06-17-93	110	<100	6,700	<100	--	--	13,000	--	<250	--
105	11-20-91	110	<100	<50	<100	--	--	6,800	--	<250	--
	11-15-92	110	<100	<50	<100	--	--	3,800	--	<250	--
	06-17-93	110	<100	<50	<100	--	--	2,600	--	<250	--

GROUND WATER—Continued

Well Group 100—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Strontium, dissolved (µg/L as Sr)	Vanadium, dissolved (µg/L as V)	Zinc, dissolved (µg/L as Zn)	Carbon, inorganic, total (mg/L as C)
101	11-20-91	110	1,500	--	9,800	--
	05-27-92	110	1,100	--	7,100	--
	11-16-92	20	--	--	--	50
	11-16-92	10	1,100	160	5,300	--
	11-16-92	110	<950	--	3,800	--
	06-17-93	110	<950	--	3,600	--
102	11-20-91	10	1,300	230	6,900	--
	11-20-91	110	1,200	--	7,500	--
	11-16-92	20	--	--	--	46
	11-16-92	110	<950	--	3,000	--
	06-17-93	110	<950	--	2,200	--
103	11-20-91	110	1,100	--	4,800	--
	05-27-92	110	700	--	3,300	--
	06-17-93	110	<950	--	2,200	--
104	06-17-93	10	730	<6	870	--
	06-17-93	110	<950	--	900	--
105	11-20-91	110	1,300	--	240	--
	11-15-92	110	<950	--	<75	--
	06-17-93	110	<950	--	<75	--

GROUND WATER—Continued

Well Group 200

LOCATION.—Lat 33°27'07", long 110°49'55", in SW 1/4 SW 1/4 SE 1/4 sec. 4, T. 1 N., R. 15 E. (A-01-15) 04dcc, 7 m northeast of Bixby Road, 50 m north of Pinal Creek, and 8 km northwest of Globe.

Landowner: F.R. Kelly, Claypool, Arizona.

LAND SURFACE DATUM.—979.9 m above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.—Wells 201 and 202 were originally identified as X2W1 and X2W2, respectively.

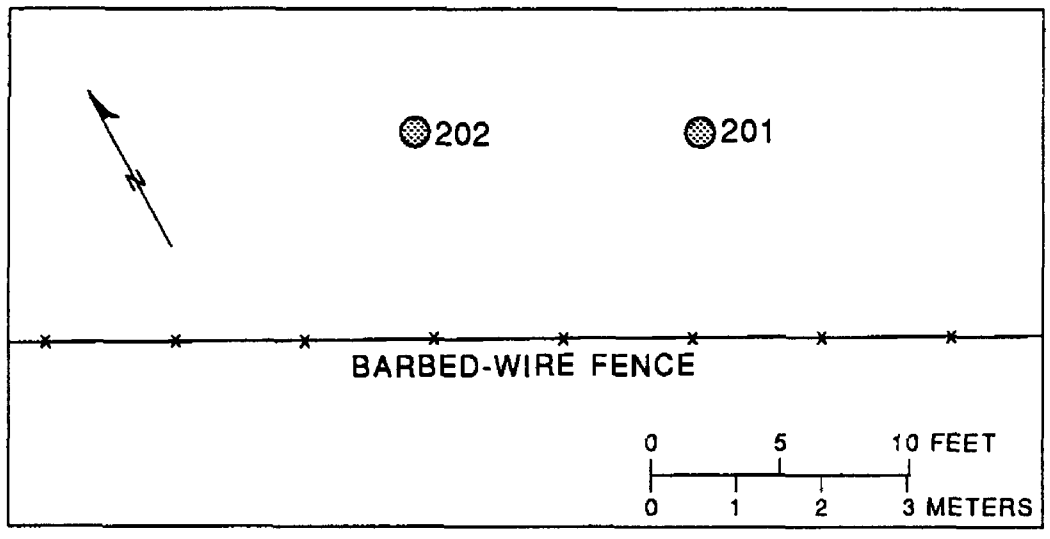
DRILLING AND WELL CONSTRUCTION

Both holes listed below were drilled by normal-circulation rotary drilling with bentonite mud. The wells were cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. Each well has a single 0.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. Each screen has 1,470 factory-cut slots 3.6 cm long by 0.64 mm wide for a total open area of 339 cm^2. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 0.5 to 1.5 m above the screen. A concrete seal extends from the land surface to the depth listed.

Logs: C, caliper; E, electric; G, geologist; J, gamma; P, particle size; U, gamma-gamma. Dashes indicate no data.

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (metera)	Geologic Unit	Bottom of seal (metera)	Logs available
201	dcc1	10-05-84	Rotary, Bentonite	18.6	18.6	17.6-18.5	Basin Fill	3	CEGJPU
202	dcc2	10-06-84	Rotary, Bentonite	12.5	12.3	11.3-12.2	Alluvium	3	--

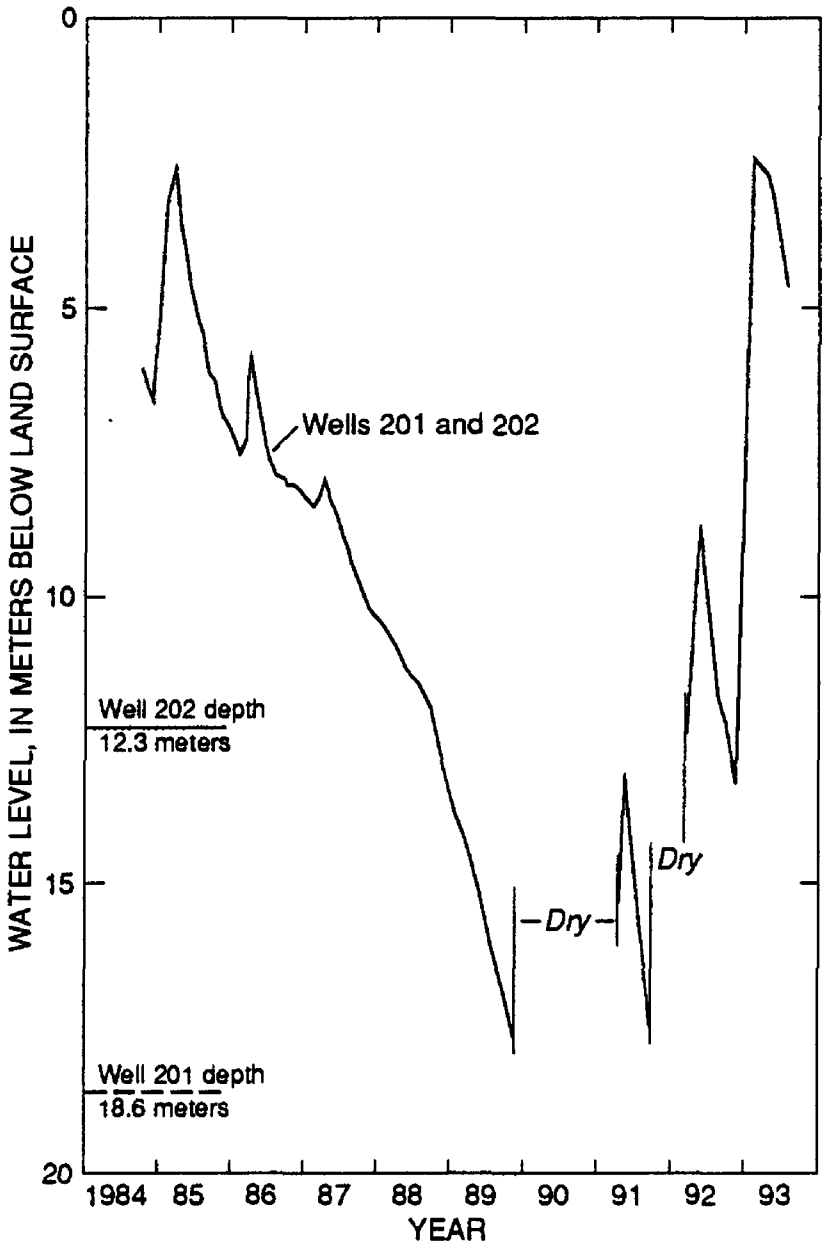
WELL GROUP 200 SITE PLAN



GROUND WATER—Continued

Well Group 200—Continued

Water level, in metera below land surface		
	Well Number	
Date	201	202
01-30-92	DRY	DRY
03-19-92	12.40	DRY
05-21-92	8.76	8.86
05-27-92	8.88	8.97
08-21-92	11.79	11.84
09-25-92	12.20	DRY
11-15-92	13.27	DRY
02-10-93	2.44	2.51
04-21-93	2.72	2.77
05-16-93	3.04	3.09
06-14-93	3.69	3.73
07-28-93	4.63	4.65



GROUND WATER—Continued

Well Group 200—Continued

Field Measurements

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; m, meters; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature air (°C)	Temperature water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dis iT field (mg/L as HCO_3)	Average discharge (L/min)	Pumping period (hours)	Drawdown (m)
201	05-27-92	636	6.5	427	--	18.0	10.3	153	4.92	1.2	0.625
	06-14-93	590	7.0	383	40.0	15.0	8.3	144	17.4	2.0	3.54
202	05-27-92	603	6.6	415	--	18.0	8.4	150	4.92	0.48	0.061
	06-14-93	500	6.8	385	35.0	13.5	--	132	18.9	0.85	--

Laboratory Measurements

[Laboratory—110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; mol/L, moles per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Ionic baiance (percent)	Ionic strength (mol/L)	Calcium, dissolved (mg/L aa Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sulfate, dissolved (mg/L sa SO_4)	Chioride, dissolved (mg/L aa Cl)	Silica, dissolved (mg/L as SiO_2)
201	05-27-92	110	-2.0	0.010	68	15	26	150	14	27
	06-14-93	110	-1.8	0.009	69	12	28	150	12	22
202	05-27-92	110	-1.1	0.010	67	15	26	150	14	26
	06-14-93	110	3.8	0.008	68	11	20	120	8.0	22

Well	Date	Laboratory	Aluminum, dissolved (µg/L as Al)	Cadmium, dissolved (µg/L as Cd)	Cobsit, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L ss Mn)	Nickel, dissolved (µg/L as Ni)	Strontium, dissolved (µg/L as Sr)	Zinc, dissolved (µg/L as Zn)
201	05-27-92	110	<500	<50	<20	<10	120	<30	<50	230	<15
	06-14-93	110	<2,500	<250	<100	<50	<100	<150	<250	<950	<75
202	05-27-92	110	<500	<50	<20	<10	<20	<30	<50	230	<15
	06-14-93	110	<500	<50	<20	<10	<20	<30	<50	<190	<15

GROUND WATER—Continued

Well Group 300

LOCATION.—Lat 33°27'17", long 110°50'19", in SE 1/4 NW 1/4 SW 1/4 sec. 4, T. 1 N., R. 15 E. (A-01-15)04cbd, 100 m northeast of Pinal Creek, and 8 km northwest of Globe.

Landowner: H and E Ranch, Inc., Globe, Arizona.

LAND SURFACE DATUM.—972.3 m above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.—Wells 301, 302, 303, and 304 were originally identified as X3W1, X3W2, X3W3,and X3W4, respectively.

DRILLING AND WELL CONSTRUCTION

All holes for which well depth is listed below were cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. Each well has a single 0.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. Each screen has 1,470 factory-cut slots 3.6 cm long by 0.64 mm wide for a total open area of 339 cm^2. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 0.5 to 1.5 m above the screen. A concrete seal extends from the land surface to the depth listed. Caving of subsurface and surface materials interfered with completing several holes to their planned depths.

Wells 3EX, 3EX2, and 3EX3 were drilled for exploration purposes. After water samples and cuttings were collected, the total depth of each hole was sealed with concrete.

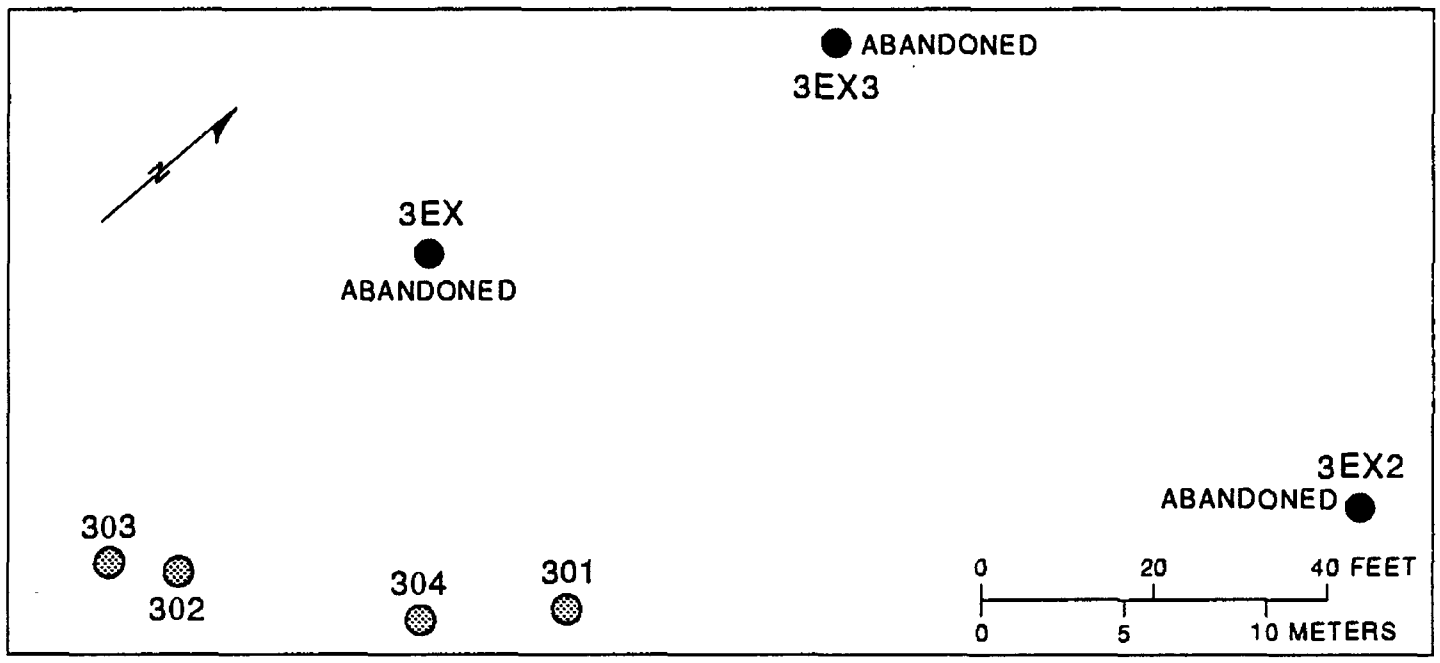
GROUND WATER—Continued

Well Group 300—Continued

Logs: C, caliper; D, driller's; E, electric; G, geologist; J, gamma; P, particle size; U, gamma-gamma. Dashes indicate no data.

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (meters)	Geologic Unit	Bottom of seal (meters)	Logs available
301	cbd1	10-07-84	Rotary, Bentonite	59.4	59.1	58.1-59.0	Basin Fill	3	CEJGPU
302	cbd2	10-08-84	Rotary, Bentonite	36.0	35.8	34.8-35.7	Alluvium	3	--
303	cbd3	10-08-84	Rotary, Bentonite	14.6	14.4	13.4-14.3	Alluvium	3	D
3EX	--	12-17-85	Dual-wall Air Rotary	54.9	--	--	--	--	DGP
3EX2	--	12-19-85	Dual-wall Air Rotary	36.6	--	--	--	--	--
3EX3	--	1-09-86	Dual-wall Air Rotary	102.1	--	--	--	--	GP
304	cbd4	5-24-86	Rotary, Bentonite	48.8	30.3	28.7-29.6	Alluvium	27	D

WELL GROUP 300 SITE PLAN



GROUND WATER—Continued

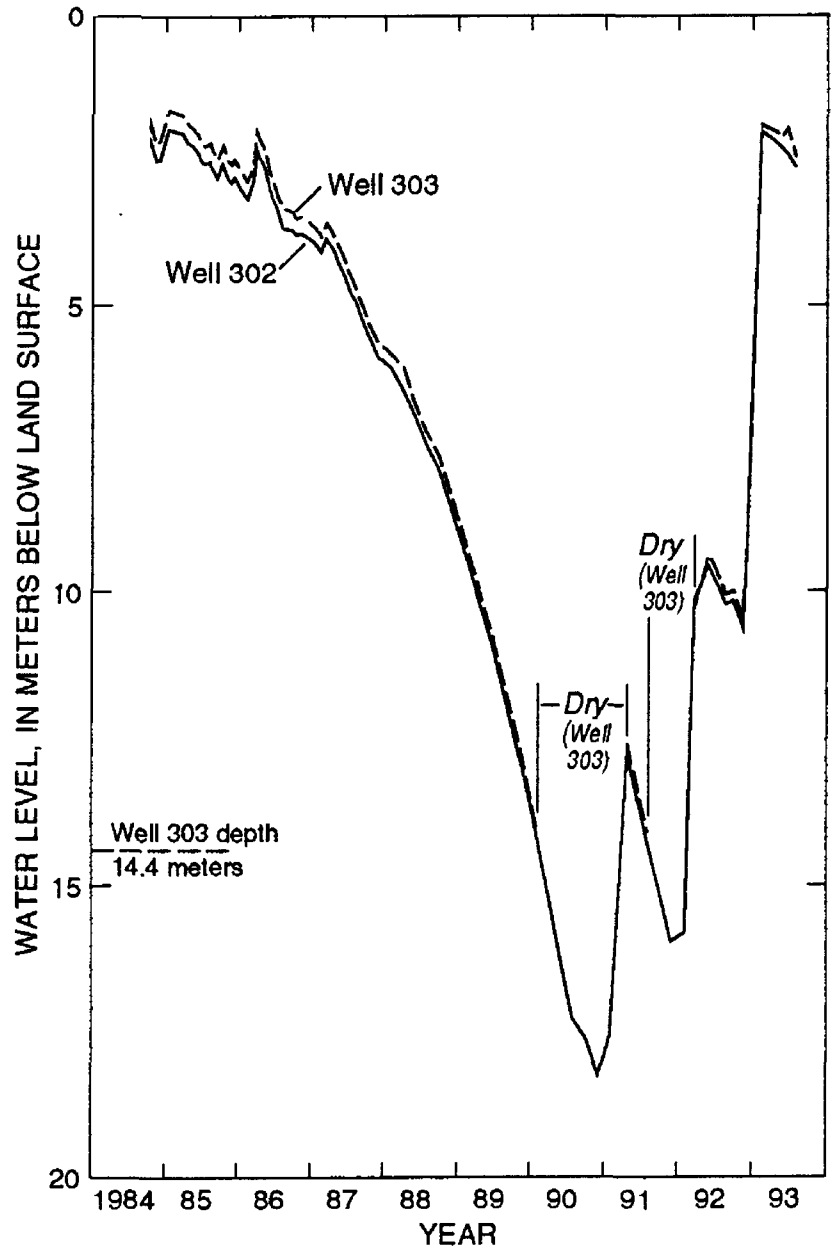
Well Group 300—Continued

Water level, in meters below land surface

Date	Well Number 301	302
11-21-91	15.59	15.99
01-30-92	15.65	15.82
03-19-92	10.32	10.17
05-21-92	9.40	9.57
05-28-92	9.16	9.57
08-21-92	10.21	10.23
09-25-92	10.08	10.18
11-15-92	10.71	10.66
02-10-93	2.09	2.03
04-21-93	2.00	2.22
05-16-93	2.09	2.31
06-19-93	2.26	2.44
07-28-93	2.90	2.65

Water level, in meters below land surface

Date	Well Number 303	304
11-21-91	DRY	15.96
01-30-92	DRY	15.80
03-19-92	10.24	10.13
05-21-92	9.38	9.51
05-28-92	9.38	9.51
08-21-92	10.05	10.21
09-25-92	9.99	10.15
11-15-92	10.48	10.63
02-10-93	1.89	1.97
04-21-93	2.01	2.15
05-16-93	2.12	2.25
06-19-93	1.96	2.37
07-28-93	2.46	2.62



GROUND WATER—Continued

Well Group 300—Continued

Field Measurements

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; m, meters; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dis IT field (mg/L as HCO_3)	Average discharge (L/min)	Pumping period (hours)	Drawdown (m)
301	11-15-92	1,920	6.8	191	--	18.5	3.2	188	3.03	3.7	--
	06-19-93	1,750	6.5	215	--	19.0	3.0	185	9.84	1.7	24.4
302	11-21-91	4,780	3.6	440	--	18.0	<0.1	--	36.3	0.42	--
	11-15-92	3,940	4.2	436	--	18.5	<0.1	--	31.0	0.48	--
	06-19-93	3,190	3.7	450	31.5	18.5	<0.1	--	37.9	0.65	--
303	05-28-92	2,560	3.9	525	--	19.0	<0.1	--	24.6	0.50	0.792
	06-19-93	1,640	4.1	585	25.0	17.0	<0.1	--	4.54	2.0	--
304	11-21-91	4,010	3.7	440	--	17.5	<0.1	--	32.6	0.35	--
	05-28-92	3,430	3.9	419	--	17.0	<0.1	--	34.8	0.48	--
	06-19-93	3,050	3.7	441	21.0	17.0	<0.1	--	36.3	0.66	--

Laboratory Measurements

[Laboratory—10, USGS National Water-Quality Laboratory, Arvada, Colorado; 110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; 20, USGS research laboratory, Ocala, Florida; mg/L, milligrams per liter; mol/L, moles per liter; µg/L, micrograms per liter; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Total dissolved solids, sum (mg/L)	Ionic balance (percent)	Ionic strength (mol/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)
301	11-15-92	10	1,550	0.40	0.044	330	47	54	10	930
	11-15-92	110	--	-6.1	0.039	280	42	41	--	870
	06-19-93	110	--	5.0	0.038	290	44	64	--	740
302	11-21-91	110	--	-0.14	0.162	410	170	96	--	3,700
	11-15-92	20	--	--	--	--	--	--	--	--
	11-15-92	110	--	2.0	0.132	410	100	89	--	2,900
	06-19-93	110	--	-1.2	0.104	420	83	87	--	2,400
303	05-28-92	110	--	-0.49	0.062	260	94	56	--	1,500
	06-19-93	10	--	0.66	0.036	210	54	51	6.2	850
	06-19-93	110	--	3.7	0.038	240	51	63	--	860
304	11-21-91	110	--	0.78	0.128	410	140	82	--	2,900
	05-28-92	110	--	-3.6	0.096	320	100	55	--	2,300
	06-19-93	110	--	-0.80	0.085	400	76	77	--	2,000

GROUND WATER—Continued

Well Group 300—Continued

Laboratory Measurements—Continued

Well	Dste	Laboratory	Chloride, dissolved (mg/L ss Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L ss SiO_2)	Aluminum, dissolved (µg/L ss Al)	Bsrium, dissolved (µg/L ss Ba)	Beryllium, dissolved (µg/L as Be)	Boron, dissolved (µg/L ss B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L ss Cr)
301	11-15-92	10	38	2.1	27	140	31	27	60	16	20
	11-15-92	110	45	--	18	<2,500	--	--	--	<250	--
	06-19-93	110	53	--	29	<2,500	--	--	--	<250	--
302	11-21-91	110	140	--	95	80,000	--	--	--	250	--
	11-15-92	20	--	--	--	--	--	--	--	--	--
	11-15-92	110	120	--	86	63,000	--	--	--	<250	--
	06-19-93	110	98	--	89	36,000	--	--	--	<250	--
303	05-28-92	110	65	--	95	11,000	--	--	--	<100	--
	06-19-93	10	29	5.0	86	6,800	14	30	50	11	7
	06-19-93	110	33	--	90	7,000	--	--	--	<250	--
304	11-21-91	110	120	--	93	59,000	--	--	--	150	--
	05-28-92	110	70	--	84	41,000	--	--	--	<100	--
	06-19-93	110	82	--	88	29,000	--	--	--	<250	--

Well	Dste	Laboratory	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L ss Li)	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L ss Ag)
301	11-15-92	10	90	<30	3,600	<30	86	19,000	<30	130	6.0
	11-15-92	110	<100	<50	3,200	--	--	12,000	--	<250	--
	06-19-93	110	<100	<50	5,600	--	--	19,000	--	<250	--
302	11-21-91	110	5,800	51,000	840,000	--	--	32,000	--	1,100	--
	11-15-92	20	--	--	--	--	--	--	--	--	--
	11-15-92	110	5,990	46,000	700,000	--	--	20,000	--	870	--
	06-19-93	110	4,290	30,000	410,000	--	--	16,000	--	680	--
303	05-28-92	110	400	17,000	160,000	--	--	25,000	--	670	--
	06-19-93	10	240	10,000	46	<10	220	15,000	<10	410	2.0
	06-19-93	110	220	10,000	<100	--	--	14,000	--	380	--
304	11-21-91	110	3,900	36,000	550,000	--	--	37,000	--	1,000	--
	05-28-92	110	2,800	27,000	360,000	--	--	23,000	--	660	--
	06-19-93	110	2,630	22,000	240,000	--	--	19,000	--	590	--

GROUND WATER—Continued

Well Group 300—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Strontium, dissolved (µg/L as Sr)	Vanadium, dissolved (µg/L as V)	Zinc, dissolved (µg/L as Zn)	Carbon, inorganic, total (mg/L as C)
301	11-15-92	10	530	<18	180	--
	11-15-92	110	<950	--	150	--
	06-19-93	110	<950	--	<75	--
302	11-21-91	110	1,100	--	8,200	--
	11-15-92	20	--	--	--	37
	11-15-92	110	<950	--	4,500	--
	06-19-93	110	1,100	--	4,000	--
303	05-28-92	110	1,000	--	2,800	--
	06-19-93	10	740	<6	1,500	--
	06-19-93	110	900	--	1,500	--
304	11-21-91	110	1,300	--	5,600	--
	05-28-92	110	1,200	--	4,200	--
	06-19-93	110	1,200	--	3,000	--

GROUND WATER—Continued

Well Group 400

LOCATION.—Lat 33°29'04", long 110°50'48", in SE 1/4 NW 1/4 SE 1/4 sec. 29 T. 2 N., R. 15 E. (A-02-15)29dbd, 10 m west of Pinal Creek, and 11 km northwest of Globe.

Landowner: Tonto National Forest

LAND SURFACE DATUM.—943 m above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.—Wells 401, 402, 403, and 404 were originally identified as X4W1, X4W2, X4W3, and X4W4, respectively.

DRILLING AND WELL CONSTRUCTION

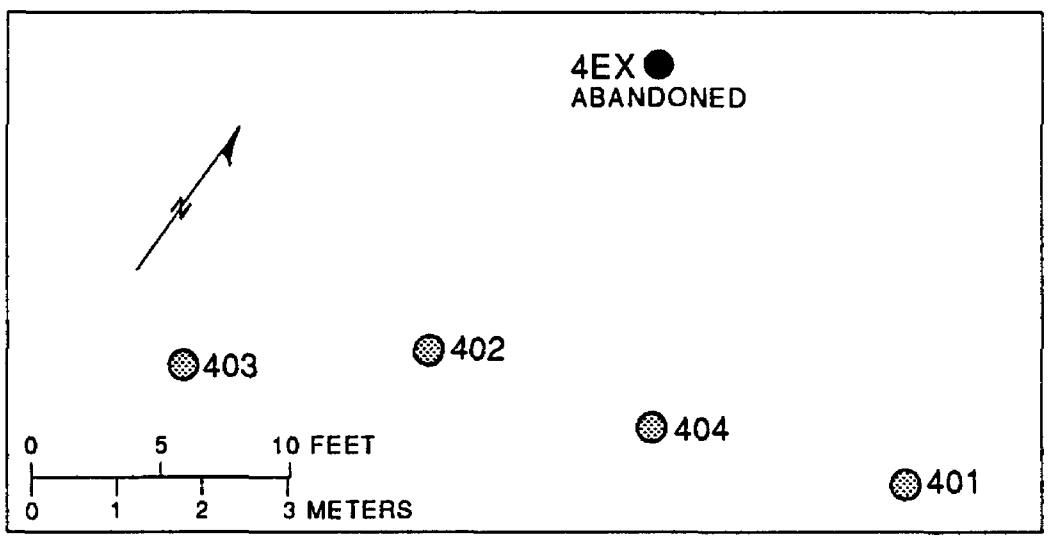
All holes for which well depth is listed below were cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. Each well has a single 0.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. Each screen has 1,470 factory-cut slots 3.6 cm long by 0.64 mm wide for a total open area of 339 cm^2. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 0.5 to 1.5 m above the screen. A concrete seal extends from the land surface to the depth listed.

Well 4EX was drilled for exploration purposes. After water samples and cuttings were collected, the hole was sealed with concrete to its total depth.

Logs: C, caliper; D, driller's; E, electric; G, geologist; P, particle size. Dashes indicate no data.

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (metera)	Geologic Unit	Bottom of seal (meters)	Logs available
401	dbd1	10-09-84	Rotary, Bentonite	34.4	34.2	33.2-34.1	Basin Fill	3	CEGP
402	dbd2	10-10-84	Rotary, Bentonite	21.0	20.8	19.8-20.7	Alluvium	3	--
403	dbd3	10-10-84	Rotary, Bentonite	13.1	13.0	12.0-12.9	Alluvium	3	--
4EX	--	01-07-86	Dual-wall Air Rotary	73.2	--	--	--	--	DGP
404	dbd4	09-04-86	Cable Tool	55.5	55.3	53.7-54.6	Basin Fill	48.5	D

WELL GROUP 400 SITE PLAN



GROUND WATER—Continued

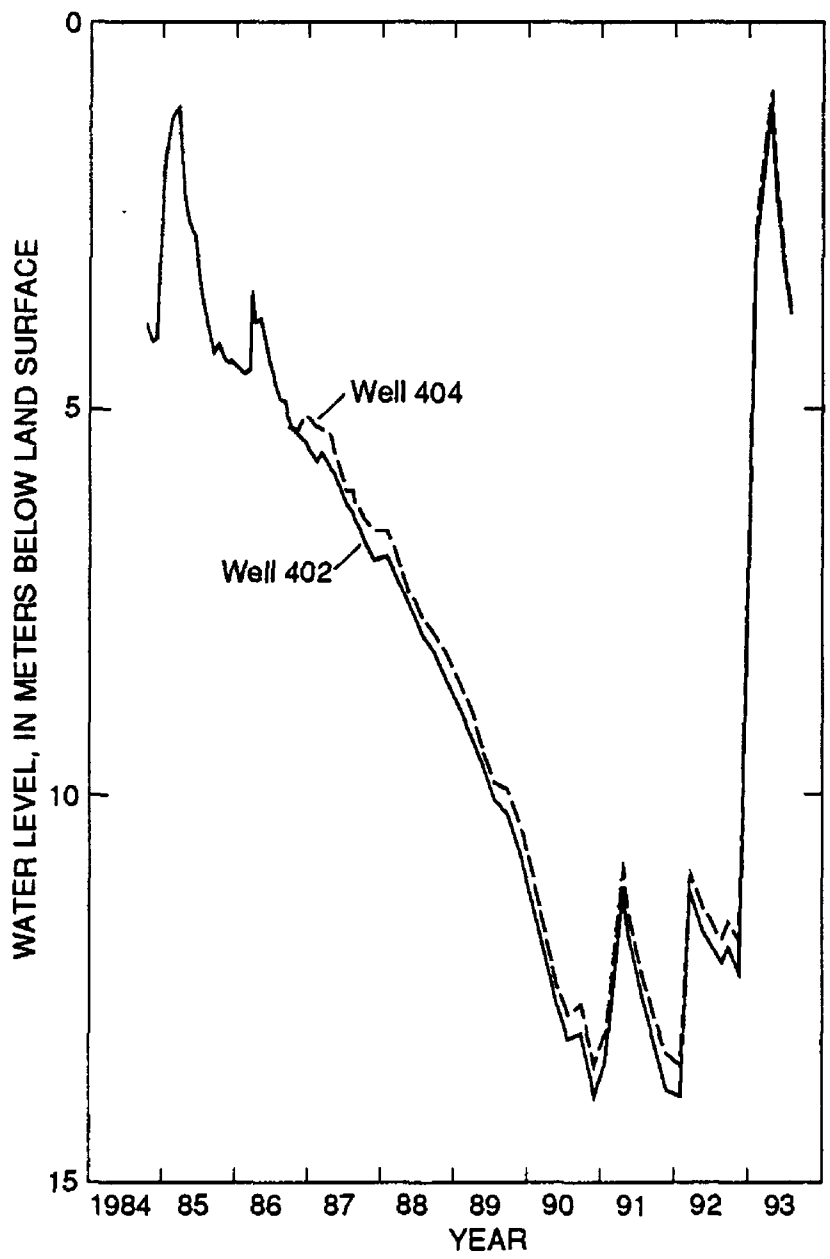
Well Group 400—Continued

Water level, in meters below land aurface

Date	Well Number 401	402
11-21-91	13.71	13.81
01-30-92	13.85	13.89
03-19-92	11.21	11.24
05-21-92	11.75	11.78
08-21-92	12.15	12.18
09-25-92	11.94	11.98
11-15-92	12.30	12.33
02-05-93	2.86	2.83
04-21-93	1.18	1.12
05-16-93	2.31	2.28
06-09-93	2.97	2.93
06-18-93	3.14	3.12
07-28-93	3.83	3.78

Water level, in meters below land aurface

Date	Well Number 403	404
11-21-91	DRY	13.35
01-30-92	DRY	13.50
03-19-92	11.21	11.02
05-21-92	11.78	11.45
08-21-92	12.18	11.88
09-25-92	11.98	11.65
11-15-92	12.33	11.95
02-05-93	2.80	2.54
04-21-93	1.06	0.90
05-16-93	2.26	2.01
06-09-93	2.60	2.72
06-18-93	3.10	2.99
07-28-93	3.76	3.68



GROUND WATER—Continued

Well Group 400—Continued

Field Measurements

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dis IT field (mg/L as HCO_3)	Average discharge (L/min)	Pumping period (hours)
401	11-21-91	3,450	4.6	400	7.0	18.0	0.9	--	41.6	0.90
	06-18-93	3,320	4.7	353	32.5	17.5	<0.1	--	34.8	0.65
402	11-21-91	3,900	4.0	430	--	17.5	<0.1	--	22.7	0.55
	11-15-92	3,200	4.1	417	--	17.5	0.1	--	20.1	0.58
	06-18-93	1,540	3.9	477	--	15.0	<0.1	--	4.81	1.8
403	11-15-92	1,490	4.6	456	--	16.0	4.4	--	1.89	0.46
	06-18-93	866	5.2	518	35.0	15.5	4.5	12	4.92	3.0
404	11-21-91	404	7.4	360	--	18.5	7.9	228	20.8	1.2
	06-18-93	510	7.4	312	27.0	19.0	6.5	212	16.3	2.0

Laboratory Measurements

[Laboratory—10, USGS National Water-Quality Laboratory, Arvada, Colorado; 110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; 20, USGS research laboratory, Ocala, Florida; mg/L, milligrams per liter; mol/L, moles per liter; µg/L, micrograms per liter; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Total dissolved solids, sum (mg/L)	Ionic balance (percent)	Ionic strength (mol/L)	Calcium, dissolved (mg/L as Cs)	Magnesium, dissolved (mg/L ss Mg)	Sodium, dissolved (mg/L ss Na)	Potassium, dissolved (mg/L ss K)	Sulfate, dissolved (mg/L ss SO_4)
401	11-21-91	110	--	3.3	0.107	390	150	76	--	2,400
	06-18-93	110	--	-0.17	0.096	490	96	79	--	2,300
402	11-21-91	110	--	1.8	0.122	390	180	91	--	2,800
	11-15-92	20	--	--	--	--	--	--	--	--
	11-15-92	110	--	1.0	0.093	320	120	100	--	2,100
	06-18-93	110	--	3.3	0.034	170	41	44	--	780
403	11-15-92	20	--	--	--	--	--	--	--	--
	11-15-92	10	--	-4.0	0.032	190	49	33	5.3	780
	11-15-92	110	--	4.3	0.031	220	47	37	--	700
	06-18-93	10	579	-1.2	0.016	98	22	34	3.2	370
	06-18-93	110	--	1.6	0.020	140	26	47	--	480
404	11-21-91	110	--	-2.7	0.006	39	14	22	--	12
	06-18-93	110	--	5.6	0.006	47	13	26	--	12

GROUND WATER—Continued

Well Group 400—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Aluminum, dissolved (µg/L as Al)	Barium, dissolved (µg/L as Ba)	Beryllium, dissolved (µg/L as Be)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L aa Cd)	Chromium, dissolved (µg/L as Cr)
401	11-21-91	110	98	--	71	22,000	--	--	--	130	--
	06-18-93	110	67	--	64	12,000	--	--	--	<250	--
402	11-21-91	110	130	--	92	27,000	--	--	--	150	--
	11-15-92	20	--	--	--	--	--	--	--	--	--
	11-15-92	110	93	--	120	23,000	--	--	--	<250	--
	06-18-93	110	17	--	59	6,800	--	--	--	<250	--
403	11-15-92	20	--	--	--	--	--	--	--	--	--
	11-15-92	10	29	2.6	43	310	15	5	50	8.0	10
	11-15-92	110	40	--	50	<2,500	--	--	--	<250	--
	06-18-93	10	26	0.40	14	230	22	<0.5	30	2.0	<5
	06-18-93	110	24	--	19	<500	--	--	--	<50	--
404	11-21-91	110	10	--	24	<500	--	--	--	<50	--
	06-18-93	110	12	--	27	<500	--	--	--	<50	--

Well	Date	Laboratory	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L as Ag)
401	11-21-91	110	3,400	23,000	450,000	--	--	51,000	--	910	--
	06-18-93	110	3,600	15,000	270,000	--	--	35,000	--	670	--
402	11-21-91	110	4,000	28,000	510,000	--	--	66,000	--	1100	--
	11-15-92	20	--	--	--	--	--	--	--	--	--
	11-15-92	110	3,240	22,000	360,000	--	--	51,000	--	<250	--
	06-18-93	110	909	7,500	68,000	--	--	15,000	--	320	--
403	11-15-92	20	--	--	--	--	--	--	--	--	--
	11-15-92	10	190	2,500	41	<10	79	17,000	<10	290	5.0
	11-15-92	110	220	2,300	<100	--	--	17,000	--	<250	--
	06-18-93	10	40	220	<3	<10	11	4,000	<10	80	<1.0
	06-18-93	110	40	<10	<20	--	--	4,600	--	<50	--
404	11-21-91	110	<20	<10	<20	--	--	<30	--	<50	--
	06-18-93	110	<20	<10	<20	--	--	<30	--	<50	--

GROUND WATER—Continued

Well Group 400—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Strontium, dissolved (µg/L as Sr)	Vanadium, dissolved (µg/L as V)	Zinc, dissolved (µg/L as Zn)	Carbon, inorganic, total (mg/L as C)
401	11-21-91	110	1,600	--	4,300	--
	06-18-93	110	1,600	--	2,700	--
402	11-21-91	110	1,800	--	5,100	--
	11-15-92	20	--	--	--	36
	11-15-92	110	2,000	--	4,800	--
	06-18-93	110	<950	--	1,400	--
403	11-15-92	20	--	--	--	18
	11-15-92	10	850	<6	700	--
	11-15-92	110	<950	--	900	--
	06-18-93	10	430	<6	120	--
	06-18-93	110	600	--	200	--
404	11-21-91	110	250	--	<15	--
	06-18-93	110	<190	--	<15	--

GROUND WATER—Continued

Well Group 450

LOCATION.—Lat 33°31'08", long 110°51'56", in NE 1/4 SW 1/4 NE 1/4 sec. 18, T. 2 N., R. 15 E. (A-02-15)18aca, 10 m west of Pinal Creek, and 15 km northwest of Globe.

Landowner: Cyprus Miami Mining Corporation

LAND SURFACE DATUM.—908.36 m above National Geodetic Vertical Datum of 1929 (Levels by Cyprus Miami Mining Corporation).

REMARKS.—Wells 451, 452, and 453 were destroyed by floods in January 1993.

DRILLING AND WELL CONSTRUCTION

Each well is cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. The borehole annulus around each screen is filled with washed pea gravel from uncontaminated local alluvium.

Well 451 had a 2.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. The screen has 2,112 factory-cut slots 3.4 cm long by 0.64 mm wide for a total open area of 460 cm^2. During drilling, formation material collapsed around the casing from approximately 1.3 to 16.8 m above the screen, or to within about 4.6 m of land surface. A layer of bentonite pellets 0.3 m thick was placed in the annulus on the collapsed material. A concrete seal extends from the land surface to a depth of 3 m.

Well 452 had a 3.0-meter length of slotted, 10-centimeter diameter, schedule 40, PVC pipe as the well screen. The screen has 1,824 factory-cut slots 4.44 cm long by 0.51 mm wide for a total open area of 413 cm^2. Sand was back-filled on top of the gravel from approximately 1.5 to 3.5 m above the screen. A layer of bentonite pellets 0.3 m thick was placed in the annulus on the back-filled sand. A concrete seal extends from the land surface to a depth of 1.8 m.

Well 453 had a 3.0-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. The screen has 2,320 factory-cut slots 2.01 cm long by 0.64 mm wide for a total open area of 298 cm^2. The hole caved in during installation of casing. Sand was back-filled on top of the gravel from approximately 0.3 m below to 0.6 m above the screen. A layer of bentonite pellets 0.5 m thick was placed in the annulus on the back-filled sand. A concrete seal extends from the land surface to a depth of 2.3 m.

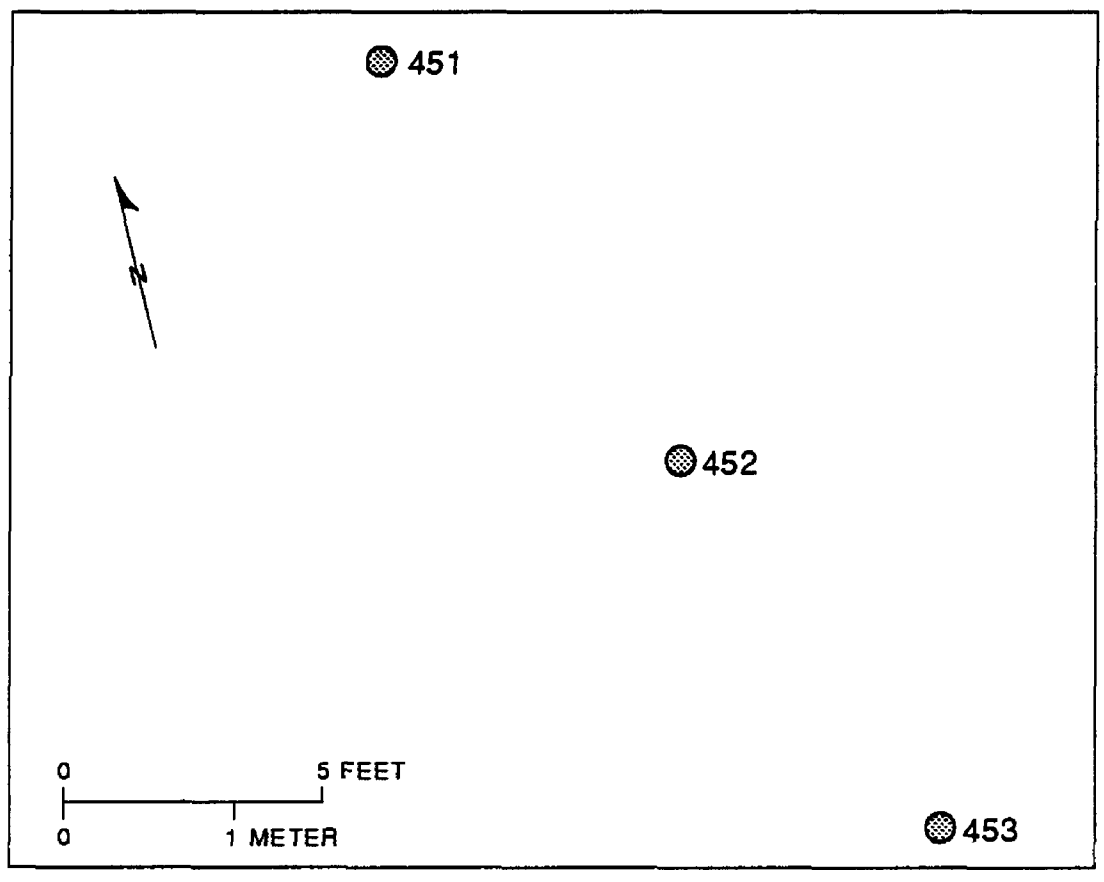
GROUND WATER—Continued

Well Group 450—Continued

Logs: D, driller's; G, geologist; P, particle size

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (meters)	Geologic Unit	Bottom of aeal (meters)	Logs available
451	aca1	12-21-88	Hollow-stem Auger	24.7	24.4	21.5-24.4	Alluvium	3.0	DGP
452	aca2	12-17-88	Hollow-stem Auger	8.5	8.2	5.2-8.2	Alluvium	1.8	DGP
453	aca3	05-08-90	Hollow-stem Auger	24.4	6.3	3.2-6.2	Alluvium	2.7	DGP

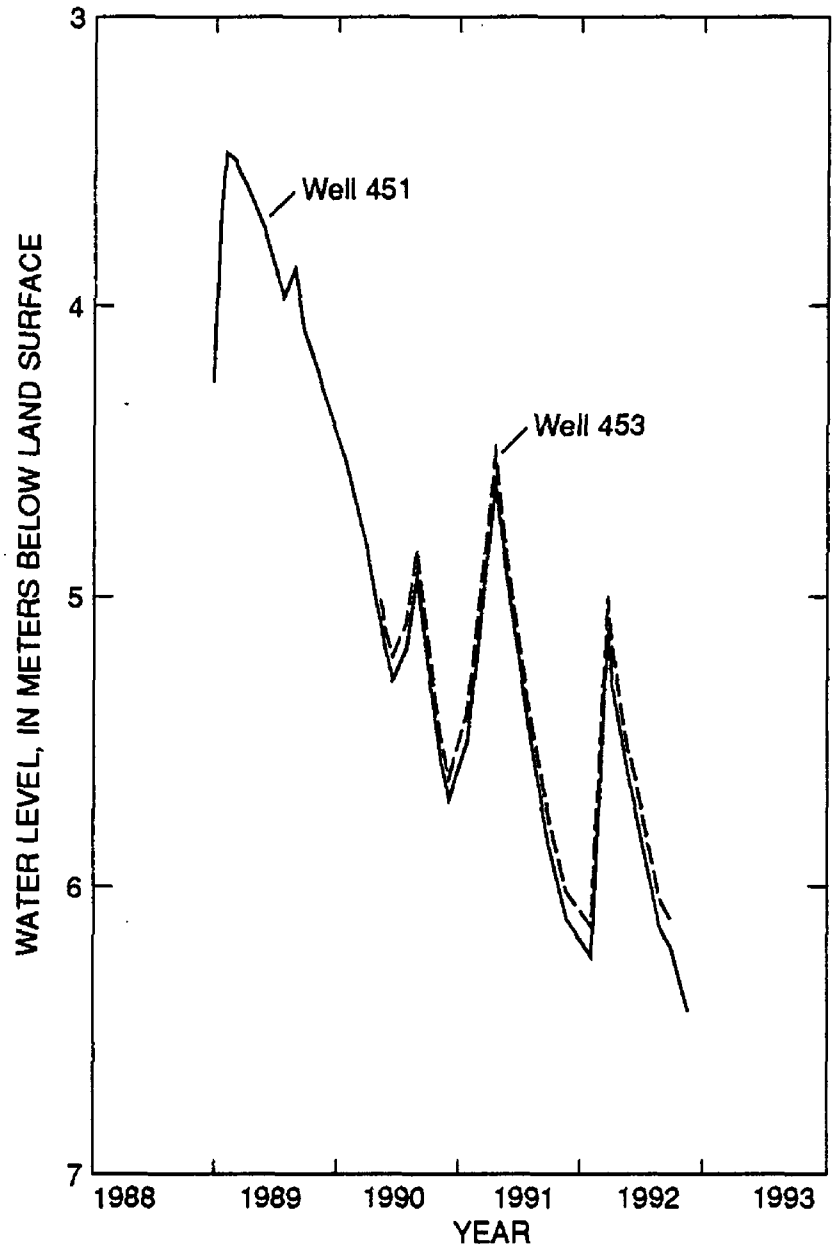
WELL GROUP 450 SITE PLAN



Well Group 450—Continued

Water level, in meters below lsnd surfsce
[NM, not measured]

Date	Well Number		
	451	452	453
11-18-91	6.11	6.06	6.02
01-30-92	6.24	6.18	6.14
03-19-92	5.12	5.04	5.00
03-31-92	5.30	5.22	5.18
05-21-92	5.64	5.57	5.54
05-27-92	5.66	5.61	5.56
08-21-92	6.14	6.07	6.04
09-25-92	6.21	6.15	6.12
11-14-92	6.43	6.36	NM



GROUND WATER—Continued

Well Group 450—Continued

Field Measurement

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; m, meters; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dis IT field (mg/L as HCO_3)	Average discharge (L/min)	Pumping period (hours)	Drawdown (m)
451	11-18-91	3,770	4.1	370	4.0	18.0	<0.1	--	4.54	0.35	0.488
	05-28-92	3,890	4.1	348	--	19.0	<0.1	--	4.54	0.68	--
	11-14-92	3,720	4.4	411	--	18.5	<0.1	--	4.16	0.46	--
452	11-19-91	2,790	4.9	440	4.0	19.5	0.2	--	14.4	0.73	0.488
	05-28-92	2,210	4.9	436	--	15.0	<0.1	11	4.54	0.61	--
	11-14-92	2,760	5.0	440	--	20.0	0.7	7	--	0.45	--

Laboratory Measurements

[10, USGS National Water-Quality Laboratory, Arvada, Colorado; 110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; 20, USGS research laboratory, Ocala, Florida; mol/L, moles per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; dashes indicate no data; <, actual valne is known to be less than value shown]

Well	Date	Laboratory	Ionic balance (percent)	Ionic atrength (mol/L)	Calcium, diasolved (mg/L as Ca)	Magnealum, dissolved (mg/L as Mg)	Sodium, diasolved (mg/L as Na)	Potaasium, dissolved (mg/L as K)	Sulfate, diasolved (mg/L aa SO_4)
451	11-18-91	110	3.4	0.117	530	190	87	--	2,600
	05-28-92	110	-2.0	0.106	400	180	80	--	2,500
	11-14-92	20	--	--	--	--	--	--	--
	11-14-92	10	-1.8	0.111	460	130	85	8.6	2,500
	11-14-92	110	-0.20	0.115	580	140	110	--	2,700
452	11-19-91	110	-1.4	0.071	410	110	79	--	1,700
	05-28-92	110	6.5	0.055	320	100	49	--	1,200
	11-14-92	20	--	--	--	--	--	--	--
	11-14-92	110	2.8	0.069	450	94	74	--	1,600

GROUND WATER—Continued

Well Group 450—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Aluminum, dissolved (µg/L as Al)	Barium, dissolved (µg/L as Ba)	Beryllium, dissolved (µg/L as Be)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)
451	11-18-91	110	150	--	89	14,000	--	--	--	100	--
	05-28-92	110	95	--	79	13000	--	--	--	<100	--
	11-14-92	20	--	--	--	--	--	--	--	--	--
	11-14-92	10	90	8.0	68	--	15	23	160	95	30
	11-14-92	110	120	--	83	11,000	--	--	--	<250	--
452	11-19-91	110	69	--	68	4,600	--	--	--	30	--
	05-28-92	110	55	--	67	4,900	--	--	--	<100	--
	11-14-92	20	--	--	--	--	--	--	--	--	--
	11-14-92	110	63	--	70	3,900	--	--	--	<250	--

Well	Date	Laboratory	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L as Ag)
451	11-18-91	110	3,100	16,000	310,000	--	--	87,000	--	1,300	--
	05-28-92	110	2,800	15,000	280,000	--	--	72,000	--	1,200	--
	11-14-92	20	--	--	--	--	--	--	--	--	--
	11-14-92	10	—	14,000	240,000	40	260	58,000	<30	1,000	9.0
	11-14-92	110	2,950	14,000	270,000	--	--	65,000	--	910	--
452	11-19-91	110	920	900	200	--	--	70,000	--	990	--
	05-28-92	110	900	1,600	160	--	--	65,000	--	880	--
	11-14-92	20	--	--	--	--	--	--	--	--	--
	11-14-92	110	875	2,700	<100	--	--	63,000	--	815	--

GROUND WATER—Continued

Well Group 450—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Strontium, dissolved (µg/L as Sr)	Vanadium, dissolved (µg/L as V)	Zinc, dissolved (µg/L as Zn)	Carbon, inorganic, total (mg/L as C)
451	11-18-91	110	2,200	--	5,100	--
	05-28-92	110	1,900	--	4,200	--
	11-14-92	20	--	--	--	48
	11-14-92	10	1,800	56	3,200	--
	11-14-92	110	2,300	--	3,600	--
452	11-19-91	110	1,700	--	3,000	--
	05-28-92	110	1,400	--	3,100	--
	11-14-92	20	--	--	--	32
	11-14-92	110	<950	--	3,100	--

GROUND WATER—Continued

Well Group 500

LOCATION.—Lat 33°31'51", long 110°52'05", in SE 1/4 SE 1/4 NW 1/4 sec. 7, T. 2 N., R. 15 E. (A-02-15)07bdd, 60 m east of Pinal Creek, and 16 km northwest of Globe.

Landowner: Tonto National Forest

LAND SURFACE DATUM.—896.57 m above National Geodetic Vertical Datum of 1929 (levels by Cyprus Miami Mining Corporation).

REMARKS.—Wells 501, 502, 503, and 504 were originally identified as X5W1, X5W2, X5W3, and X5W4, respectively. In Brown (1990) and Longsworth and Taylor (1992) the location of wells 505 and 506 in the site plan were incorrect, the locations of these wells have been corrected in this report.

DRILLING AND WELL CONSTRUCTION

Well 5EX was drilled for exploration purposes. After water samples and cuttings were collected, the entire depth of the hole was sealed with concrete.

Wells 501–504 were cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. Each well has a single 0.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. Each screen has 1,470 factory-cut slots 3.6 cm long by 0.64 mm wide for a total open area of 339 cm^2. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 0.5 to 1.5 m above the screen. A concrete seal extends from the land surface to the depth listed. Hole 503 caved during installation of casing.

Well 505 was cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. The well has a a single 1.5-meter length of slotted, 10-centimeter diameter, schedule 40, PVC pipe as well screen. The screen has 3,648 factory-cut slots 4.4 cm long by 0.51 mm wide for a total open area of 819 cm^2. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated alluvium. A layer of bentonite pellets was placed in the annulus from approximately 0.9 to 1.2 m above the screen. A concrete seal extends from the land surface to the depth listed.

Well 506 was cased with nominal 10-centimeter diameter, schedule 80, PVC pipe. The well has a a single 1.5-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as well screen. The screen in well 506 has 1,056 factory-cut slots 3.4 cm long by 0.64 mm wide for a total open area of 230 cm^2. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated alluvium. Formation material collapsed around the casing from 0.8 to 3.4 m above the screen, or to within about 1.8 m of land surface. A layer of bentonite pellets 0.3 m thick was placed in the annulus on the collapsed material. A concrete seal extends from the land surface to a depth of 1.5 m.

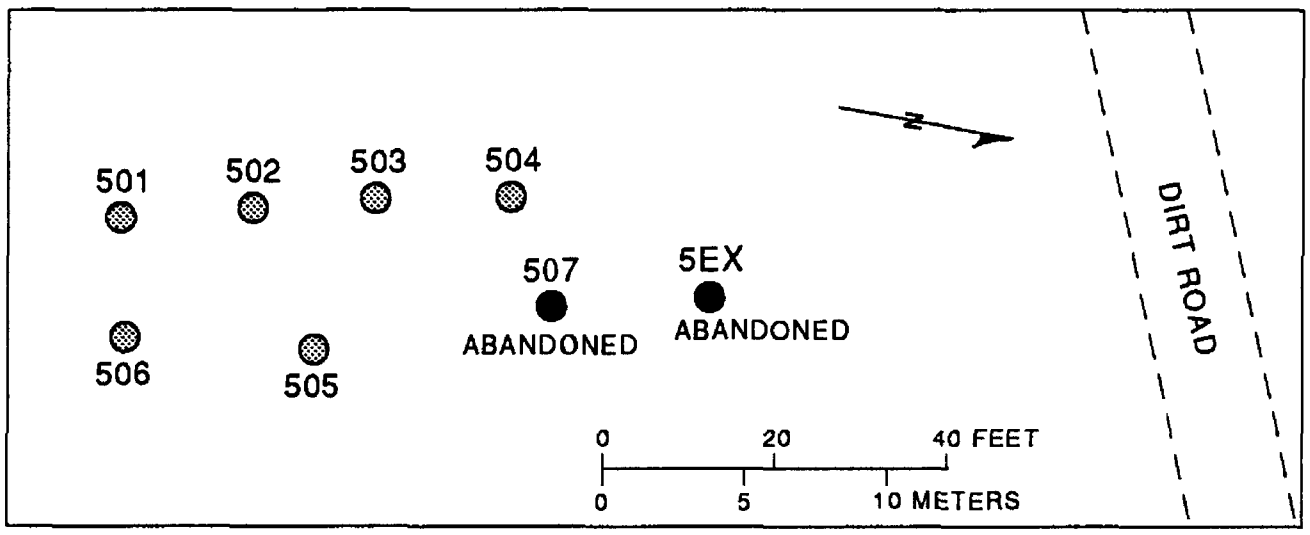
GROUND WATER—Continued

Well Group 500—Continued.

Logs: D, driller's; G, geologist; P, particle size. Dashes indicate no data.

Well	Section location	Date completed	Drilling method	Hole depth (metera)	Well depth (meters)	Screened interval (meters)	Geologic Unit	Bottom of seal (meters)	Logs available
5EX	--	12-13-85	Dual-wall Air Rotary	89.9	--	--	--	--	DGP
501	bdd1	05-22-86	Rotary, Bentonite	17.1	17.0	15.4-16.3	Alluvium	15.2	D
502	bdd2	05-22-86	Rotary, Bentonite	38.1	38.0	36.5-37.4	Basin Fill	35.1	D
503	bdd3	05-22-86	Rotary, Bentonite	73.2	25.0	23.4-24.3	Alluvium	19.8	D
504	bdd4	07-24-86	Cable Tool	69.5	69.2	67.6-68.6	Basin Fill	64.0	D
505	bdd5	12-17-88	Hollow-stem Auger	22.2	21.6	15.5-21.6	Alluvium	1.5	DGP
506	bdd6	12-15-88	Hollow-stem Auger	7.3	6.7	5.2-6.7	Alluvium	1.5	DGP

WELL GROUP 500 SITE PLAN



GROUND WATER—Continued

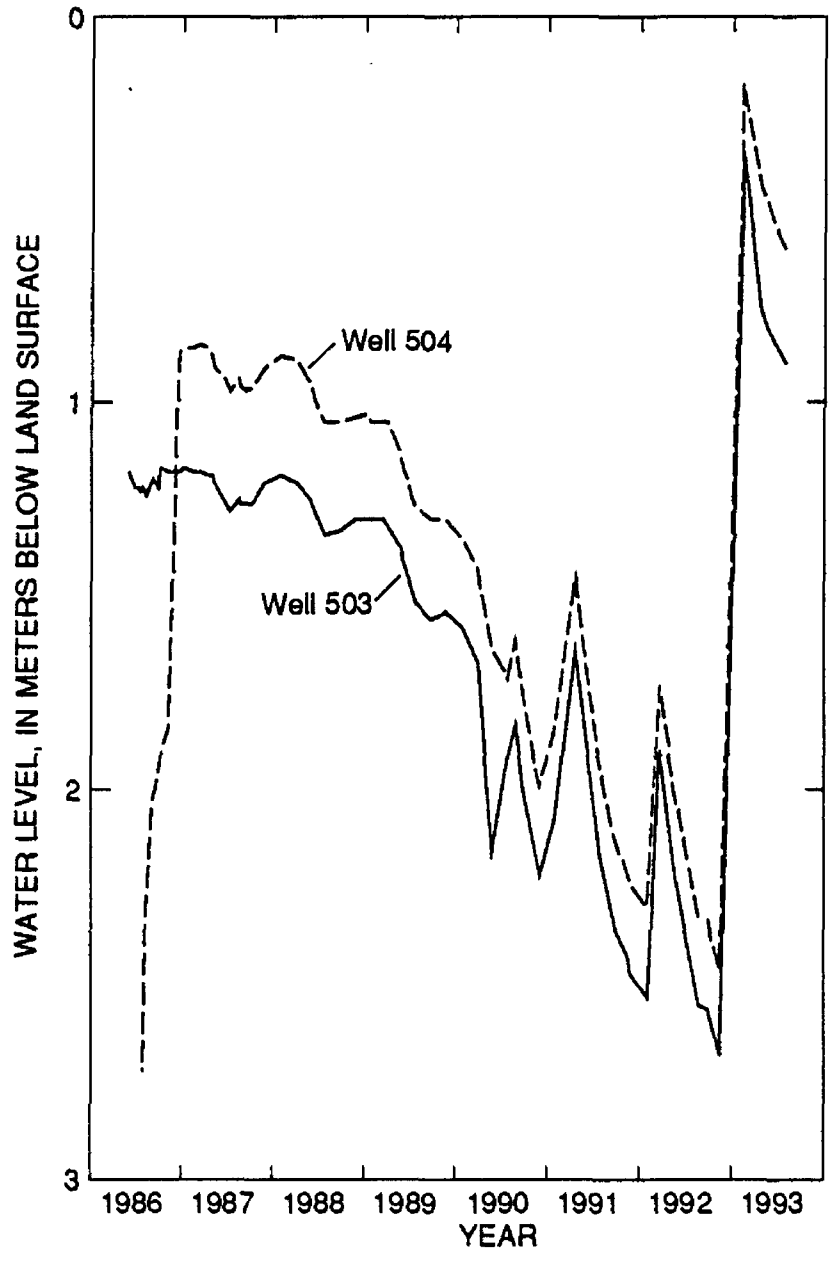
Well Group 500—Continued

Water level, in meters below land aurface

Date	Well Number 501	502	503
11-18-91	2.37	2.35	2.43
11-22-91	2.40	2.39	2.47
01-30-92	2.46	2.45	2.53
03-19-92	1.83	1.83	1.91
05-21-92	2.16	2.15	2.23
05-29-92	2.16	2.16	2.25
08-21-92	2.47	2.47	2.55
09-25-92	2.49	2.48	2.56
11-14-92	2.62	2.60	2.68
02-05-93	0.57	0.57	0.66
02-10-93	0.26	0.27	0.35
04-21-93	0.68	0.67	0.76
05-16-93	0.71	0.70	0.81
06-15-93	0.76	0.75	0.85
07-28-93	0.80	0.80	0.90

Water level, in meters below land surface

Date	Well Number 504	505	506
11-18-91	2.22	2.45	2.37
11-22-91	2.24	2.43	2.50
01-30-92	2.30	2.49	2.46
03-19-92	1.73	1.87	1.83
05-21-92	2.03	2.18	2.17
05-29-92	2.04	2.21	2.18
08-21-92	2.32	2.51	2.49
09-25-92	2.33	2.53	2.51
11-14-92	2.46	2.66	2.62
02-05-93	0.41	0.62	0.61
02-10-93	0.17	0.32	0.27
04-21-93	0.44	0.72	0.72
05-16-93	0.48	0.77	0.77
06-15-93	0.54	0.81	0.79
07-28-93	0.60	0.86	0.83



GROUND WATER—Continued

Well Group 500—Continued

Field Measurements

[µS/cm, microsiemens per centimeter; °C, degrees Celsius; mV, millivolts; mg/L, milligrams per liter; L/min, liters per minute; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dis IT field (mg/L as HCO_3)	Average discharge (L/min)	Pumping period (hours)
501	11-22-91	3,590	5.7	240	--	18.0	<0.1	98	18.5	0.51
	11-14-92	3,590	5.7	438	--	18.5	<0.1	78	4.54	0.40
	06-15-93	2,780	5.6	--	35.0	19.5	0.3	50	18.5	0.46
502	11-22-91	1,890	7.0	370	--	19.0	3.7	189	36.3	0.60
	06-15-93	--	7.2	--	38.0	20.5	3.7	178	41.3	0.61
503	11-22-91	3,580	5.6	410	--	18.0	<0.1	66	30.3	0.45
	05-29-92	3,620	5.4	371	--	18.5	<0.1	65	35.6	0.37
	11-14-92	3,560	5.6	445	--	18.5	0.2	56	31.8	0.50
	06-15-93	2,950	5.6	--	37.0	19.5	0.2	39	4.16	2.6
504	11-22-91	413	7.1	350	--	20.5	6.6	227	57.9	0.81
	11-14-92	416	7.6	407	--	20.5	5.7	232	41.6	0.73
	06-15-93	403	7.4	--	22.0	22.0	6.1	213	53.0	0.96
505	11-14-92	3,570	5.9	422	--	18.5	<0.1	117	30.3	--
	06-15-93	2,980	5.9	--	37.0	19.0	0.4	80	34.1	0.63
506	11-18-91	3,500	5.9	420	--	18.5	<0.1	122	4.92	0.70
	05-29-92	3,510	5.8	369	--	18.5	<0.1	--	4.77	0.63
	11-14-92	3,500	5.9	433	--	19.0	<0.1	111	4.16	0.60
	06-15-93	2,620	6.2	--	30.0	19.5	0.3	150	4.54	0.76

Laboratory Measurements

[Laboratory—10, USGS National Water-Quality Laboratory, Arvada, Colorado; 110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; mol/L, moles per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Total dissolved solids, sum (mg/L)	Ionic balance (percent)	Ionic strength (mol/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)
501	11-22-91	110	--	4.0	0.110	680	210	86	--	2,400
	11-14-92	110	--	0.65	0.109	730	150	110	--	2,500
	06-15-93	110	--	2.3	0.082	560	110	86	--	1,900
502	11-22-91	110	--	0.21	0.044	330	66	43	--	950
	06-15-93	110	--	4.9	0.051	410	66	49	--	1,100
503	11-22-91	110	--	2.7	0.105	630	200	86	--	2,400
	05-29-92	110	--	2.4	0.098	520	220	82	--	2,200
	11-14-92	110	--	2.4	0.103	690	150	110	--	2,300
	06-15-93	10	3,090	-0.50	0.088	540	130	76	6.9	2,100
	06-15-93	110	--	6.3	0.063	450	86	62	--	1,400
504	11-22-91	10	247	-0.34	0.006	45	15	19	2.1	17
	11-22-91	110	--	2.9	0.006	44	16	21	--	12
	11-14-92	110	--	2.6	0.006	50	14	23	--	14
	06-15-93	10	238	3.4	0.006	45	15	19	2.2	16
	06-15-93	110	--	-2.7	0.005	--	12	17	--	14
505	11-14-92	10	3,300	-3.7	0.093	580	140	91	5.0	2,200
	11-14-92	110	--	-0.22	0.105	700	140	130	--	2,400
	06-15-93	110	--	3.1	0.084	590	120	85	--	1,900
506	11-18-91	110	--	0.35	0.098	600	190	74	--	2,200
	05-29-92	110	--	3.8	0.094	530	220	77	--	2,100
	11-14-92	110	--	-2.6	0.100	660	140	100	--	2,300
	06-15-93	110	--	-3.3	0.070	450	100	82	--	1,700

GROUND WATER—Continued

Well Group 500—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Aluminum, dissolved (µg/L as Al)	Barium, dissolved (µg/L as Ba)	Beryllium, dissolved (µg/L as Be)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)
501	11-22-91	110	110	--	92	<2,500	--	--	--	<250	--
	11-14-92	110	120	--	81	<2,500	--	--	--	<250	--
	06-15-93	110	45	--	71	<2,500	--	--	--	<250	--
502	11-22-91	110	23	--	31	<1,000	--	--	--	<100	--
	06-15-93	110	20	--	35	<500	--	--	--	<50	--
503	11-22-91	110	110	--	92	<2,500	--	--	--	<250	--
	05-29-92	110	100	--	86	2,300	--	--	--	<100	--
	11-14-92	110	120	--	78	<2,500	--	--	--	<250	--
	06-15-93	10	69	5.6	74	3,000	30	15	60	30	40
	06-15-93	110	54	--	55	<2,500	--	--	--	<250	--
504	11-22-91	10	11	0.30	26	<10	12	<0.5	20	<1.0	<5
	11-22-91	110	8.4	--	28	<500	--	--	--	<50	--
	11-14-92	110	12	--	29	<500	--	--	--	<50	--
	06-15-93	10	8.9	0.20	27	<10	12	1	20	<1.0	<5
	06-15-93	110	--	--	24	<500	--	--	--	<50	--
505	11-14-92	10	100	0.70	60	20	28	<2	70	7.0	40
	11-14-92	110	120	--	70	<2,500	--	--	--	<250	--
	06-15-93	110	46	--	71	<5,000	--	--	--	<500	--
506	11-18-91	110	110	--	77	<2,500	--	--	--	<250	--
	05-29-92	110	100	--	81	1,300	--	--	--	<100	--
	11-14-92	110	120	--	68	<2,500	--	--	--	<250	--
	06-15-93	110	46	--	53	<5,000	--	--	--	<500	--

GROUND WATER—Continued

Well Group 500—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Cobalt, dissolved (µg/L ss Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L ss Pb)	Lithium, dissolved (µg/L as Li)	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L as Ag)
501	11-22-91	110	<20	<50	<100	--	--	110,000	--	750	--
	11-14-92	110	120	<50	<100	--	--	89,000	--	790	--
	06-15-93	110	430	<50	<100	--	--	74,000	--	1,450	--
502	11-22-91	110	<40	<20	<40	--	--	<60	--	<100	--
	06-15-93	110	<20	<10	<20	--	--	<30	--	<50	--
503	11-22-91	110	350	<50	<100	--	--	120000	--	1,000	--
	05-29-92	110	500	<20	220	--	--	110,000	--	1,100	--
	11-14-92	110	580	<50	<100	--	--	94,000	--	1,080	--
	06-15-93	10	1,100	40	10	<30	230	97,000	<30	1,100	15
	06-15-93	110	1,040	<50	<100	--	--	62,000	--	1,020	--
504	11-22-91	10	<3	<10	4	<10	18	<1	<10	<10	1.0
	11-22-91	110	<20	<10	<20	--	--	<30	--	<50	--
	11-14-92	110	<20	<10	<20	--	--	<30	--	<50	--
	06-15-93	10	<3	<10	6	<10	15	2	<10	<10	<1.0
	06-15-93	110	<20	<10	<20	--	--	<30	--	<50	--
505	11-14-92	10	30	<30	43	<30	200	63,000	<30	460	19
	11-14-92	110	<100	<50	<100	--	--	68,000	--	<250	--
	06-15-93	110	<200	<100	<200	--	--	62,000	--	<500	--
506	11-18-91	110	<100	<50	<100	--	--	62,000	--	290	--
	05-29-92	110	<40	<20	<40	--	--	70,000	--	<100	--
	11-14-92	110	<100	<50	<100	--	--	53,000	--	<250	--
	06-15-93	110	<200	<100	<200	--	--	33,000	--	<500	--

GROUND WATER—Continued

Well Group 500—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Strontium, dissolved (µg/L as Sr)	Vanadium, dissolved (µg/L as V)	Zinc, dissolved (µg/L aa Zn)
501	11-22-91	110	2,700	--	480
	11-14-92	110	2,800	--	<75
	06-15-93	110	2,100	--	<75
502	11-22-91	110	1,600	--	29
	06-15-93	110	2,100	--	<15
503	11-22-91	110	2,700	--	480
	05-29-92	110	2,300	--	740
	11-14-92	110	2,600	--	800
	06-15-93	10	1,900	<18	2,100
	06-15-93	110	1,500	--	1,400
504	11-22-91	10	330	6	5
	11-22-91	110	340	--	20
	11-14-92	110	400	--	<15
	06-15-93	10	330	<6	<3
	06-15-93	110	<190	--	<15
505	11-14-92	10	2,200	<18	42
	11-14-92	110	2,700	--	<75
	06-15-93	110	2,200	--	<150
506	11-18-91	110	2,600	--	100
	05-29-92	110	2,400	--	<30
	11-14-92	110	2,500	--	<75
	06-15-93	110	1,700	--	<150

GROUND WATER—Continued

Well 601

LOCATION.—Lat 33°33'07", long 110°53'06", in NE 1/4 NW 1/4 NW 1/4 sec. 1, T. 2 N., R. 14 E. (A-02-14)01abb, 43 m east of Pinal Creek, and 20 km northwest of Globe.

Landowner: Cyprus Miami Mining Corporation.

LAND SURFACE DATUM.—869 m above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.—Caving occurred after the casing was placed in the borehole. Natural material fills the borehole annulus around the well screen. Pumping water from this well is difficult.

DRILLING AND WELL CONSTRUCTION

Well 601 was cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. The well has a single 0.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as well screen. The screen has 1,470 factory-cut slots 3.8 cm long by 0.64 mm wide for a total open area of 358 cm^2.

The borehole annulus is filled with natural material to between 3.4 and 5.2 m below land surface. Bentonite was placed on top of this uneven surface, but a good seal was not achieved. Sand and natural material was placed on top of the bentonite up to approximately 1.2 m below land surface. Cement grout seals the well from the land surface to 1.2 m below land surface and was used to set a 1.5-meter-long steel security casing.

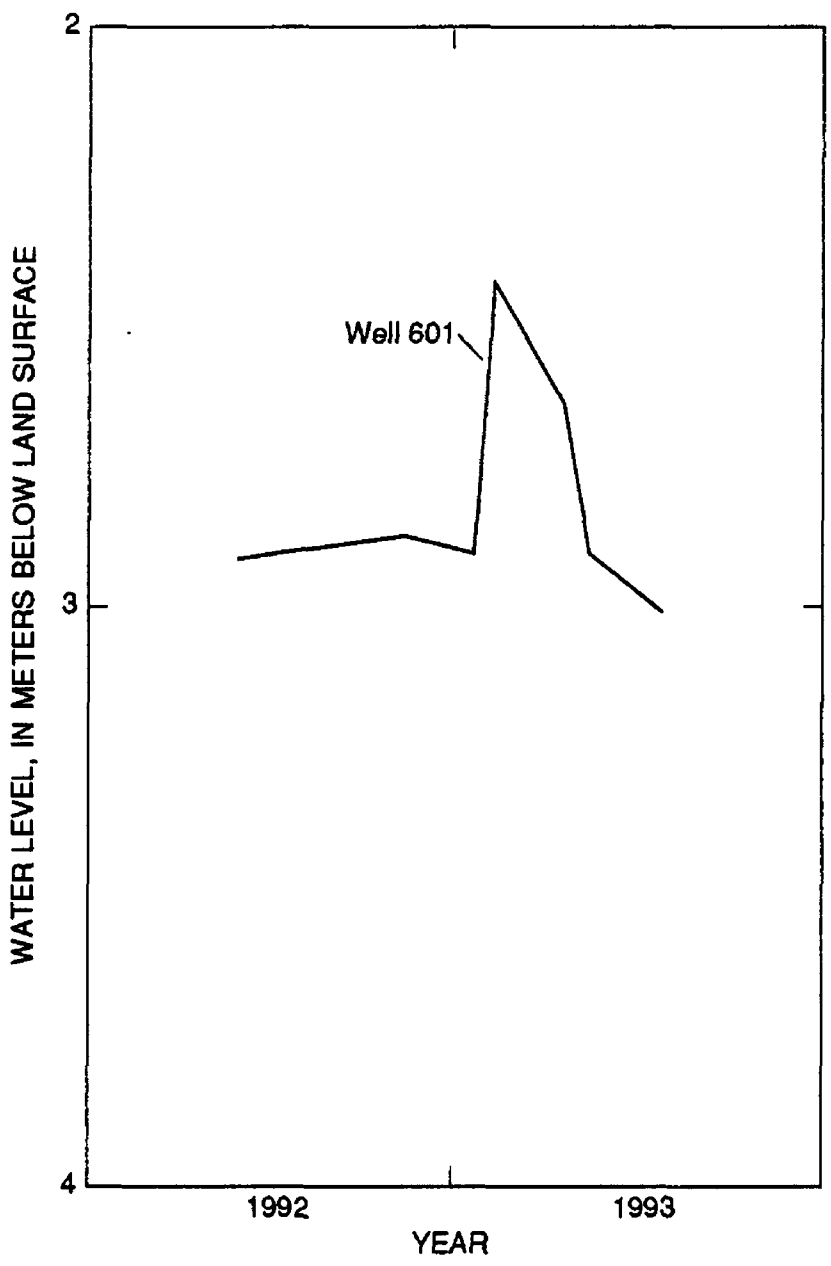
Logs: D, driller's

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (meters)	Geologic Unit	Bottom of seal (meters)	Logs available
601	abb1	03-31-92	Hollow-stem Auger	12.0	8.6	8.0-8.9	Alluvium	1.2	D

GROUND WATER—Continued

Well 601—Continued

Date	Water level, in metera below land aurface
05-29-92	2.91
11-13-92	2.87
01-21-93	2.90
02-05-93	2.58
02-10-93	2.43
04-21-93	2.64
05-16-93	2.90
07-28-93	3.00



GROUND WATER—Continued

Well 601—Continued

Field Measurements

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; m, meters; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dia IT field (mg/L as HCO_3)	Average discharge (L/min)	Pumping period (hours)	Drawdown (m)
601	11-13-92	3,080	6.4	358	--	19.5	0.6	176	1.59	1.0	--

Laboratory Measurements

[Laboratory—10, USGS National Water-Quality Laboratory, Arvada, Colorado; 110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; mg/L, milligrams per liter; mol/L, moles per liter; µg/L, micrograms per liter; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Total dissolved solids, sum (mg/L)	Ionic balance (percent)	Ionic strength (mci/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)
601	11-13-92	10	2,640	-2.1	0.075	530	110	76	4.4	1,700
	11-13-92	110	----	-7.9	0.071	450	110	69	--	1,700

Well	Date	Laboratory	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Aluminum, dissolved (µg/L as Al)	Barium, dissolved (µg/L as Ba)	Beryllium, dissolved (µg/L as Be)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)
601	11-13-92	10	86	0.20	43	<10	31	<2	70	<3.0	20
	11-13-92	110	95	--	53	<2,500	--	--	--	<250	--

GROUND WATER—Continued

Well 601—Continued

Laboratory Measurements—Continued

Well	Date	Laboratory	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)
601	11-13-92	10	<9	<30	40	<30	88	1,700	<30
	11-13-92	110	<100	<50	<100	--	--	1,900	--

Well	Date	Laboratory	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L as Ag)	Strontium, dissolved (µg/L as Sr)	Vanadium, dissolved (µg/L as V)	Zinc, dissolved (µg/L as Zn)
601	11-13-92	10	<30	<3.0	2,100	<18	25
	11-13-92	110	<250	--	2,800	--	<75

GROUND WATER—Continued

Well Group 700

LOCATION.—Lat 33°34'03", long 110°53'45", in SE 1/4 SE 1/4 SE 1/4 sec. 26, T. 3 N., R. 14 E. (A-03-14)26ddd, 52 m east of Pinal Creek, and 21 km northwest of Globe.

Landowner: Cyprus Miami Mining Corporation

LAND SURFACE DATUM.—845.8 m above National Geodetic Vertical Datum of 1929, from topographic map.

DRILLING AND WELL CONSTRUCTION

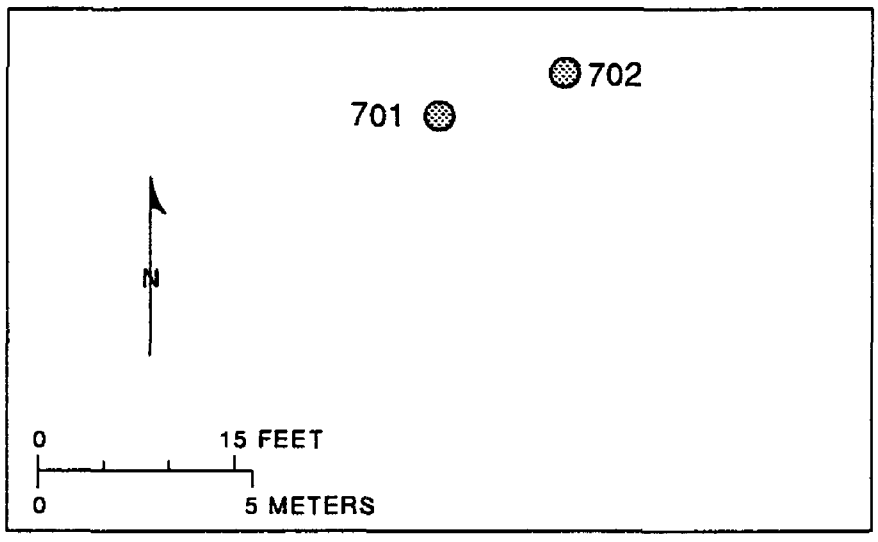
Well 701 was cased with nominal 10-centimeter diameter, schedule 40, PVC pipe. The well has a 0.9-meter length of slotted, 10-centimeter diameter, schedule 80, PVC pipe as the well screen. The screen has 1,470 factory-cut slots 3.6 cm long by 0.64 mm wide for a total open area of 339 cm^2. The hole caved during installation of casing. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 0.3 to 1.0 m above the screen. A concrete seal extends from the land surface to a depth of 3.6 m.

Well 702 was cased with nominal 5-centimeter diameter, class 160, PVC pipe. The well has a 0.9-meter length of slotted, 5-centimeter diameter, class 160, PVC pipe as the well screen. The screen has 216 field-cut slots that average 4.6 cm long and are 0.51 mm wide for a total open area of 51 cm^2. The hole caved during installation of casing. The borehole annulus around the screen is filled with washed pea gravel from uncontaminated local alluvium. A layer of bentonite pellets was placed in the annulus from approximately 1.2 to 2.1 m above the screen. A concrete seal extends from the land surface to a depth of 5.2 m.

Logs: D, driller's; G, geologist; P, particle size.

Well	Section location	Date completed	Drilling method	Hole depth (meters)	Well depth (meters)	Screened interval (meters)	Geologic Unit	Bottom of seal (meters)	Logs available
701	ddd1	05-11-90	Hollow Stem Auger	8.7	5.0	4.1-5.0	Alluvium	3.6	D
702	ddd2	05-11-90	Hollow Stem Auger	8.1	7.3	6.4-7.3	Alluvium	5.2	DGP

WELL GROUP 700 SITE PLAN

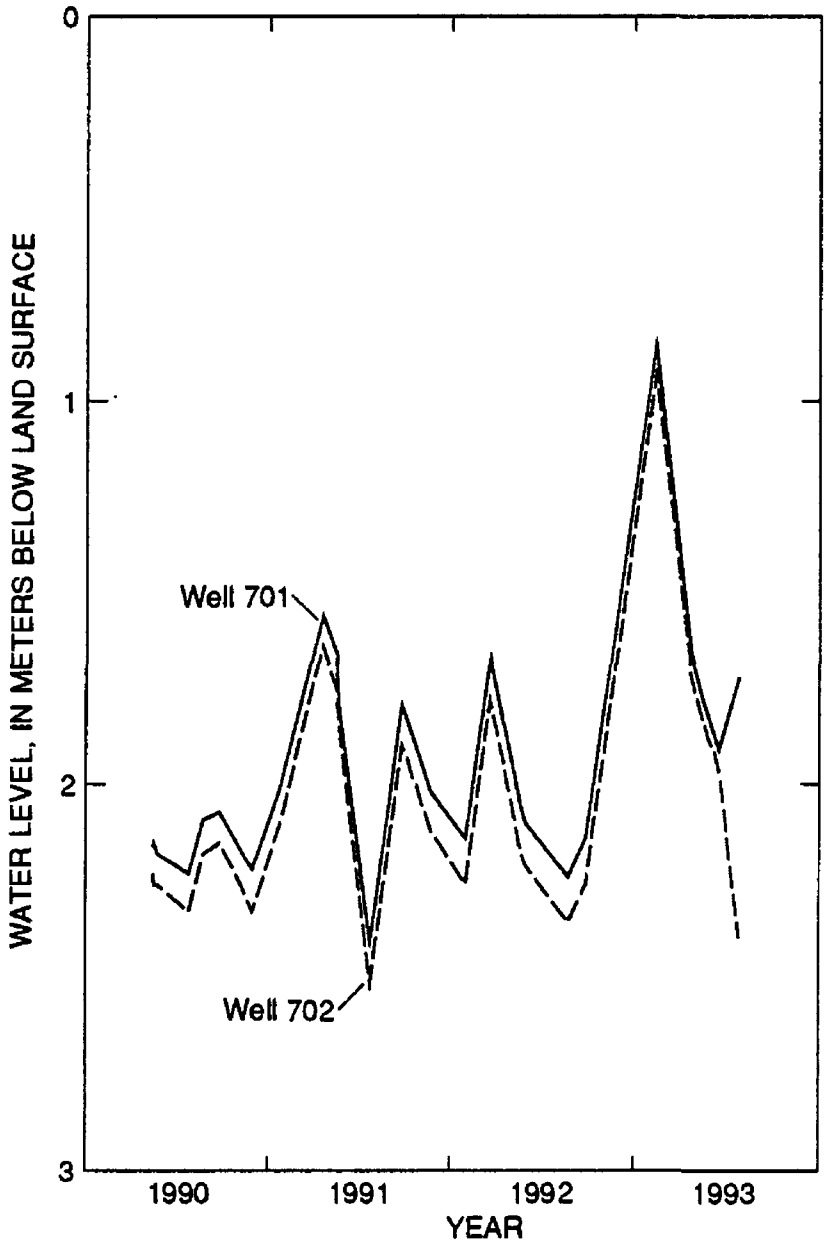


GROUND WATER—Continued

Well Group 700—Continued

Water level, in meters below land surface

Date	Well Number	
	701	702
11-22-91	2.02	2.12
01-30-92	2.14	2.26
03-19-92	1.67	1.78
05-21-92	2.06	2.18
05-29-92	2.10	2.21
08-21-92	2.24	2.36
09-25-92	2.14	2.26
02-10-93	0.85	0.93
04-22-93	1.66	1.72
05-16-93	1.78	1.84
06-16-93	1.91	1.96
07-27-93	1.72	2.40



Field Measurements

[µS/cm, microsiemens per centimeter; mV, millivolts; °C, degrees Celsius; mg/L, milligrams per liter; L/min, liters per minute; dashes indicate no data; <, actual value is known to be less than value shown]

Well	Date	Specific conductance (µS/cm)	pH (standard units)	Oxidation reduction potential (mV)	Temperature, air (°C)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dis IT field (mg/L aa HCO_3)	Average discharge (L/min)	Pumping period (hours)
701	11-22-91	3,350	6.8	240	--	19.0	<0.1	190	4.92	0.32
	05-29-92	3,140	6.8	271	--	18.0	<0.1	199	4.54	0.83
	06-16-93	3,340	6.9	--	--	19.0	0.4	227	3.79	0.68
702	11-22-91	3,310	6.7	280	--	18.5	<0.1	214	2.65	0.66
	05-29-92	3,290	7.0	242	--	19.0	<0.1	207	2.65	0.58
	06-16-93	3,200	7.0	--	36.0	19.5	0.2	195	1.89	0.48

Laboratory Measurements

[Laboratory—110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; mol/L, moles per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Well	Date	Laboratory	Ionic balance (percent)	Ionic strength (mol/L)	Calcium, dissolved (mg/L aa Ca)	Magnesium, dissolved (mg/L aa Mg)	Sodium, dissolved (mg/L as Na)	Sulfate, dissolved (mg/L aa SO_4)
701	11-22-91	110	-1.9	0.084	550	160	68	1,900
	05-29-92	110	-1.3	0.078	470	170	65	1,700
	06-16-93	110	-2.4	0.075	520	100	99	1,700
702	11-22-91	110	-0.64	0.091	640	160	61	2,000
	05-29-92	110	-4.6	0.084	520	170	52	1,900
	06-16-93	110	-3.7	0.078	580	92	70	1,800

GROUND WATER—Continued

Well Group 700—Continued

Laboratory Measurements—Continued

Well	Dste	Lab-ora-tory	Chloride, dis-solved (mg/L ss Cl)	Silica, dis-solved (mg/L as SiO_2)	Alumi-num, dis-solved (µg/L ss Al)	Cad-mium, dis-solved (µg/L ss Cd)	Cobalt, dis-solved (µg/L ss Co)
701	11-22-91	110	100	44	<2,500	<250	<100
	05-29-92	110	93	46	<1,000	<100	<40
	06-16-93	110	64	35	<2,500	<250	<100
702	11-22-91	110	110	40	<2,500	<250	<100
	05-29-92	110	96	37	<1,000	<100	<40
	06-16-93	110	68	27	<2,500	<250	<100

Well	Dste	Lab-ors-tory	Copper, dis-solved (µg/L as Cu)	Iron, dis-solved (µg/L ss Fe)	Msngs-nese, dis-solved (µg/L as Mn)	Nickel, dis-solved (µg/L ss Ni)	Stron-tium, dis-solved (µg/L ss Sr)	Zinc, dis-solved (µg/L as Zn)
701	11-22-91	110	<50	<100	400	<250	2,400	<75
	05-29-92	110	<20	<40	500	<100	2,000	<30
	06-16-93	110	<50	<100	640	<250	2,000	<75
702	11-22-91	110	<50	<100	2,200	<250	3,100	<75
	05-29-92	110	<20	<40	2,000	<100	2,500	<30
	06-16-93	110	<50	<100	1,300	<250	2,400	<75

GROUND WATER—Continued

Quality Assurance and Quality Control Data

Laboratory Measurements

[Laboratory—10, USGS National Water-Quality Laboratory, Arvada, Colorado; 110, USGS research laboratory (K.G. Stollenwerk), Lakewood, Colorado; mg/L, milligrams per liter; µg/L, micrograms per liter; dashes indicate no data; <, actual value is known to be less than value shown]

Ssmple type	Dste	Time	Lab-ors-tory	Calcium, dissolved (mg/L ss Ca)	Magne-sium, dis-solved (mg/L ss Mg)	Sodium, dis-solved (mg/L ss Ns)	Sulfate, dis-solved (mg/L as SO_4)	Chloride, dis-solved (mg/L ss Cl)	Fluoride, dis-solved (mg/L as F)	Silica, dis-solved (mg/L as SiO_2)
Deionized water blank	11-17-92	0830	10	--	0.02	<0.01	<0.20	<0.10	<0.10	0.02
Pump blank	11-17-92	1040	10	--	0.04	<0.01	<0.20	--	--	0.02
Filter blank	11-17-92	0930	10	--	<0.02	<0.01	<0.20	<0.10	<0.10	0.03
Filter blank	06-18-93	1630	110	<0.135	<0.055	<0.100	--	--	--	<0.290

Sample type	Date	Lab-ora-tory	Alumi-num, dis-solved (µg/L as Al)	Barium, dis-solved (µg/L ss Bs)	Beryi-ilium, dis-solved (µg/L as Be)	Boron, dis-solved (µg/L ss B)	Cad-mium, dis-solved (µg/L as Cd)	Chro-mium, dis-solved (µg/L ss Cr)	Cobsit, dis-solved (µg/L ss Co)	Copper, dis-solved (µg/L as Cu)	Iron, dis-solved (µg/L as Fe)
Deionized water blank	11-17-92	10	<10	<2	<0.5	<10	<1.0	<5	<3	<10	12
Pump blank	11-17-92	10	<10	<2	<0.5	--	1.0	<5	<3	<10	<3
Filter blank	11-17-92	10	<10	<2	<0.5	<10	<1.0	<5	<3	<10	<3
Filter blank	06-18-93	110	<500	--	--	--	<50	--	<20	<10	<20

Ssmple type	Date	Lab-ora-tory	Lesd, dis-solved (µg/L as Pb)	Lithium, dis-solved (µg/L as Li)	Mangs-nese, dis-solved (µg/L ss Mn)	Molyb-denum, dis-solved (µg/L as Mo)	Nickei, dis-solved (µg/L ss Ni)	Siiver, dis-solved (µg/L ss Ag)	Stron-tium, dis-solved (µg/L ss Sr)	Vana-dium, dis-soived (µg/L ss V)	Zinc, dis-soived (µg/L ss Mo)
Deionized water blank	11-17-92	10	<10	<4	1	<10	<10	<1.0	<1	<6	8
Pump blank	11-17-92	10	<10	<4	<1	<10	<10	1.0	1	<6	8
Filter blank	11-17-92	10	<10	<4	<1	<10	<10	1.0	<1	<6	6
Filter blank	06-18-93	110	--	--	<30	--	<50	--	<190	--	<15

SURFACE WATER

332704110495400 Pinal Creek at Bixby Road Bridge near Globe, Arizona

LOCATION.—Lat. 33°27'04", long 110°49'54", in SW1/4 SW1/4 SE1/4 sec. 4, T. 1 N., R. 15 E., at bridge on Bixby Road 0.6 km upstream from Miami Wash, 17.0 km upstream from Inspiration Dam, 23.2 km upstream from mouth, and 7 km northwest of Globe.

DRAINAGE AREA.—115.1 km^2

CHANNEL ELEVATION.—977 m above National Geodetic Vertical Datum of 1929, from topographic map.

PREVIOUS DATA COLLECTION AT SITE.—Two discharge measurements and water-quality analyses in February 1982 were reported by the Central Arizona Association of Governments, Mineral Extraction Task Force, at site GM24. A discharge measurement and water-quality analysis completed in March 1985 and an analysis of stream-bottom material collected in August 1985 were presented in Eychaner and others (1989).

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter]

Date	Time	Discharge instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Barometric pressure (mm of mercury)	Oxygen, dissolved (mg/L)	Bicarbonate water dis IT field (mg/L as HCO_3)
5-16-93	1545	1.89	500	7.9	30.5	31.0	684	6.7	84

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratory	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Aluminum, dissolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)
5-16-93	140	40	11	47	3.9	190	33	<110	<20

Date	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Nickel, dissolved (mg/L as Ni)	Silica, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
5-16-93	120	<130	<60	<90	24	<20

SURFACE WATER—Continued

09498350 Miami Wash at State Highway 88 near Claypool, Arizona

LOCATION.—Lat 33°26'32", long 110°50'02", in SW1/4 NW1/4 SE1/4 sec. 9, T. 1 N., R. 15 E., at bridge on State Highway 88, 0.9 km upstream from Bixby Road Seepage Ditch, 1.1 km upstream from mouth, 1.7 km downstream from confluence of Bloody Tanks Wash and Russell Gulch, 17.5 km upstream from Inspiration Dam, and 3.7 km northeast of Claypool.

DRAINAGE AREA.—158.9 km², including approximately 80 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—982 m above National Geodetic Vertical Datum of 1929 (levels by Water Resources Division, U.S. Geological Survey).

PREVIOUS DATA COLLECTION AT SITE.—Eight discharge measurements and water-quality analyses from February to June 1983 are presented in Eychaner and others (1989). Eight discharge measurements and water-quality analyses from January through August 1985 are presented in Eychaner and others (1989).

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter]

Date	Time	Discharge instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature air (°C)	Temperature water (°C)	Bsrometric pressure (mm of mercury)	Oxygen, dissolved (mg/L)	Bicarbonste water dis IT fleid (mg/L ss HCO_3)
5-17-93	1120	0.31	660	7.0	28	21	683	9.5	58

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Dste	Laboratory	Calclum, dissolved (mg/L ss Ca)	Magne-slum, dissolved (mg/L ss Mg)	Sodlum, dissolved (mg/L as Ns)	Potas-sium, dissolved (mg/L as K)	Sulfste, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Aluml-num, dissolved (µg/L ss Al)	Cobalt, dissolved (µg/L as Co)
5-17-93	140	80	17	23	4.5	240	12	<110	30

Date	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manga-nese, dissolved (µg/L as Mn)	Nickel, dissolved (mg/L as Nl)	Silica, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
5-17-93	70	<130	73,700	<90	30	30

SURFACE WATER—Continued

332628110495100 Bixby Road Seepage Ditch at State Highway 88 near Claypool, Arizona

LOCATION.—Lat 33°26'28", long 110°49'51", in SE1/4 NW1/4 SE1/4 sec. 9, T. 1 N., R. 15 E., at a double concrete-box culvert on State Highway 88, 1.1 km upstream from mouth, 17.7 km upstream from Inspiration Dam, and 3.7 km northeast of Claypool.

DRAINAGE AREA.—0.26 km^2.

CHANNEL ELEVATION.—982.8 m above National Geodetic Vertical Datum of 1929 (levels by Water Resources Division, U.S. Geological Survey).

PREVIOUS DATA COLLECTION AT SITE.—Two discharge measurements and water-quality analyses in March and August 1985 are presented in Eychaner and others (1989). One analysis of streambottom material collected in August 1985 also is presented in Eychaner and others (1989).

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter]

Date	Time	Discharge instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Bsrometric preasure (mm of mercury)	Oxygen, disaolved (mg/L)	Bicarbonate water diasolved (mg/L as HCO_3)
5-17-93	1450	0.4	3,200	6.2	26	22	683	8.3	539

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratory	Caicium, disaolved (mg/L as Ca)	Magnesium, diaaolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potaasium, dissolved (mg/L as K)	Sulfata, dissolved (mg/L as SO_4)	Chioride, disaolved (mg/L as Cl)	Aluminum, diaaolved (µg/L aa Al)	Cobalt, dissolved (µg/L aa Co)
5-17-93	140	560	100	99	4.6	1,860	110	1,300	170

Date	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Nickel, dissolved (mg/L as Ni)	Siiica, dissolved (mg/L aa SiO_2)	Zino, disaolved (µg/L as Zn)
5-17-93	4,600	<130	13,700	420	53	900

09498360 Bixby Road Seepage Ditch at mouth near Claypool, Arizona

LOCATION.—Lat 33°26'57", long 110°50'06", in NE1/4 NE1/4 NW1/4 sec. 9, T. 1 N., R. 15 E., at mouth, 0.2 km upstream from mouth of Miami Wash, 1.1 km downstream from State Highway 88, 16.6 km upstream from Inspiration Dam, and 4.5 km northeast of Claypool.

DRAINAGE AREA.—0.7 km^2.

CHANNEL ELEVATION.—975 m above National Geodetic Vertical Datum of 1929, from topographic map.

PREVIOUS DATA COLLECTION AT SITE.—Six discharge measurements and water-quality analyses from April to July 1983 were published as Miami Wash Tributary No. 2 (East Side) near Claypool, Arizona. Two discharge measurements and water-quality analyses in March and August 1985 are presented in Eychaner and others (1989). One analysis of stream-bottom material collected in August 1985 also is presented in Eychaner and others (1989).

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter]

Date	Laboratory	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Aluminum, dissolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)
5-17-93	140	560	110	98	6.6	1,930	100	7,500	340

Date	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Nickel, dissolved (mg/L as Ni)	Silica, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
5-17-93	11,000	2,160	23,300	560	73	1,800

SURFACE WATER—Continued

332843110510100 Pinal Creek at Bixby Road dip crossing near Globe, Arizona

LOCATION.—Lat 33°28'43", long 110°51'01", in NW1/4 NW1/4 NE1/4 sec. 32, T. 2 N., R. 15 E., at an unpaved ford 2.3 km upstream from Wilbanks Road, 3.4 km downstream from Miami Wash, 13.0 km upstream from Inspiration Dam, 19.2 km upstream from mouth, and 11 km northwest of Globe.

DRAINAGE AREA.—332 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—947 m above National Geodetic Vertical Datum of 1929, from topographic map.

PREVIOUS DATA COLLECTION AT SITE.—One discharge measurement, one water-quality analysis, and one analysis of stream-bottom material in March 1985 are presented in Eychaner and others (1989).

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter]

Date	Time	Dis-charge instan-taneous (ft^3/s)	Spe-cific con-duct-ance (µS/cm)	pH (stan-dard units)	Tem-pers-ture, air (°C)	Tem-pera-ture, water (°C)	Bsro-metric pressure (mm of mercury)	Oxygen, dis-solved (mg/L)	Bicarbo-nate wa-ter dia IT field (mg/L ss HCO_3)
5-17-93	1600	1.98	1,900	7.8	30.5	31.0	685	6.6	56

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Dste	Laboratory	Calcium, dissolved (mg/L ss Cs)	Msgne-sium, dissolved (mg/L ss Mg)	Sodium, dissolved (mg/L as Na)	Potss-sium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Alumi-num, dissolved (µg/L as Al)	Cobalt, dissolved (µg/L ss Co)
5-17-93	140	300	56	59	6.0	960	60	<110	140

Date	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Msnga-nese, dissolved (µg/L ss Mn)	Nickel, dissolved (mg/L as Ni)	Silica, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
5-17-93	220	<130	7,300	180	41	200

SURFACE WATER—Continued

332939110511700 Pinal Creek at Wilbanks Road Bridge near Globe, Arizona

LOCATION.—Lat 33°29'39", long 110°51'17", in NW1/4 NE1/4 NW1/4 sec. 29, T. 2 N., R. 15 E., at bridge on Wilbanks Road, 10.7 km upstream from Inspiration Dam, 16.9 km upstream from mouth, and 13 km northwest of Globe.

DRAINAGE AREA.—371 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—931 m above National Geodetic Vertical Datum of 1929, from topographic map.

PREVIOUS DATA COLLECTION AT SITE.—Two discharge measurements and water-quality analyses in March and August 1985 are presented in Eychaner and others (1989). One analysis of streambottom material in March 1985 are presented in Eychaner and others (1989).

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter]

Date	Time	Dis-charge inatan-taneoua (ft^3/s)	Spe-cific con-duct-ance (µS/cm)	pH (stan-dard unita)	Tem-pera-ture, air (°C)	Tem-pera-ture, water (°C)	Baro-metric preasure (mm of mercury)	Bicarbo-nate wa-ter dis IT field (mg/L as HCO_3)
5-18-93	1345	2.21	2,070	7.3	29.0	26.0	687	124

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratory	Calcium, dissolved (mg/L as Ca)	Magne-sium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L aa Na)	Potas-sium, dlaaolved (mg/L aa K)	Sulfate, dissolved (mg/L ss SO_4)	Chloride, dissolved (mg/L as Cl)	Alumi-num, diasolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)
5-18-93	140	340	64	51	6.5	1,080	38	160	60

Date	Copper, disaolved (µg/L aa Cu)	Iron, disaolved (µg/L as Fe)	Manga-nese, dissolved (µg/L aa Mn)	Nickel, dissolved (mg/L as Ni)	Silica, dissolved (mg/L as SiO_2)	Zinc, disaolved (µg/L as Zn)
5-18-93	120	<130	4,500	100	43	200

SURFACE WATER—Continued

333056110514800 Pinal Creek at Hicks Crossing near Globe, Arizona

LOCATION.—Lat 33°30'56", long 110°51'48", in NE1/4 NW1/4 SE1/4 sec. 18, T. 2 N., R. 15 E., at a concrete-paved ford 8.0 km upstream from Inspiration Dam, 14.2 km upstream from mouth, and 15 km northwest of Globe.

DRAINAGE AREA.—403 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—911 m above National Geodetic Vertical Datum of 1929, from topographic map.

PREVIOUS DATA COLLECTION AT SITE.—One discharge measurement, water-quality analysis, and analysis of stream-bottom material in March 1985 are presented in Eychaner and others (1989).

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter; dashes indicate no data]

Date	Time	Discharge instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Barometric pressure (mm of mercury)	Oxygen, dissolved (mg/L)	Bicarbonate water dis IT field (mg/L as HCO_3)
5-18-93	1130	0.31	1,925	8.0	28.0	32.5	689	6.4	106

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratory	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Aluminum, dissolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)
5-18-93	140	320	61	62	6.8	990	37	<110	60

Date	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Nickel, dissolved (mg/L as Ni)	Silica, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
5-18-93	30	<130	4,700	<90	42	40

SURFACE WATER—Continued

Pinal Creek at Head of Flow near Globe, Arizona

LOCATION.—See fig. 4 for locations of head of flow.

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter]

Date	Time	Discharge instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dissolved iT field (mg/L as HCO_3)
6-17-93	1810	0.01	840	6.44	19.0	4.8	84
7-27-93	0910	0.01	1,570	6.38	21.0	1.6	78

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratory	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L aa Na)	Potassium, dissolved (mg/L aa K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L aa Cl)
6-17-93	140	200	46	33	5.7	580	33
7-27-93	140	260	65	39	5.3	770	57

Date	Aluminum, dissolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L aa Cu)	Iron, dissolved (µg/L aa Fe)	Manganese, dissolved (µg/L aa Mn)	Nickel, dissolved (mg/L aa Ni)	Silica, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
6-17-93	670	40	50	250	12,600	260	47	100
7-27-93	200	<20	<30	1,570	14,800	<90	34	40

SURFACE WATER—Continued

333147110520500 Pinal Creek at Blumer Driveway near Globe, Arizona

LOCATION.—Lat 33°31'51", long 110°52'08", in SE1/4 SE1/4 NW1/4 sec. 7, T. 2 N., R. 15 E., at an unpaved ford 1.7 km downstream from Hicks Crossing, 6.3 km upstream from Inspiration Dam, 12.5 km upstream from mouth, and 17 km northwest of Globe.

DRAINAGE AREA.—455 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—895 m above National Geodetic Vertical Datum of 1929, from topographic map.

PREVIOUS DATA COLLECTION AT SITE.—Four discharge measurements and water-quality analyses from March through September 1985 and one analysis of stream-bottom material in August 1985 are presented in Eychaner and others (1989).

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter; dashes indicate no data]

Date	Time	Discharge Inatantaneous (ft^3/a)	Specific conductance (µS/cm)	pH (atandard unita)	Temperature air, (°C)	Temperature water, (°C)	Barometric preaaure (mm of mercury)	Oxygen, dissolved (mg/L)	Bicarbonate water dia IT fieid (mg/L aa HCO_3)
5-18-93	1005	2.39	1,975	6.7	24.0	22.0	690	7.4	67
6-18-93	1716	1.04	1,620	6.6	----	22.1	---	11.8	68

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratory	Calcium, diasolved (mg/L as Ca)	Magnesium, dissolved (mg/L aa Mg)	Sodium, dissolved (mg/L as Na)	Potaasium, diasolved (mg/L as K)	Sulfate, dissolved (mg/L aa SO_4)	Chloride, dissolved (mg/L as Cl)	Aiuminum, disaolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)
5-18-93	140	300	73	54	4.0	1,070	47	290	30
6-18-93	140	370	94	58	5.0	1,230	54	510	60

Date	Copper, disaolved (µg/L as Cu)	Iron, diasolved (µg/L as Fe)	Manganeae, disaolved (µg/L as Mn)	Nickel, diaaolved (mg/L as Ni)	Silica, diaaolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
5-18-93	80	<130	29,200	330	56	100
6-18-93	80	<130	39,600	410	62	100

SURFACE WATER—Continued

333205110521600 Pinal Creek at transect site near Globe, Arizona

LOCATION.—Lat 33°32'05", long 110°52'16", in SE1/4 NW1/4 NW1/4 sec. 7, T. 2 N., R. 15 E., 0.5 km downstream from Blumer driveway, 5.8 km upstream from Inspiration Dam, 12.0 km upstream from mouth, and 17.5 km northwest of Globe.

DRAINAGE AREA.—457 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—899 m above National Geodetic Vertical Datum of 1929, from topographic map.

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter]

Date	Time	Discharge instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature, water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dissolved (mg/L as HCO_3)
6-17-93	1213	3.3	1,890	6.3	24.5	9.0	79

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratory	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Aluminum, dissolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)
6-17-93	140	440	110	70	5.0	1,470	58	310	84

Date	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Nickel, dissolved (mg/L as Ni)	Silica, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
6-17-93	50	<130	41,300	340	66	90

SURFACE WATER—Continued

09498380 Pinal Creek at Setka Ranch near Globe, Arizona

LOCATION.—Lat 33°32'23", long 110°52'26", in SE 1/4 SW 1/4 SW 1/4 sec. 6, T. 2 N., R. 15 E., at an unpaved ford 2.9 km downstream from Hicks Crossing, 5.1 km upstream from Inspiration Dam, 11.3 km upstream from mouth, and 18 km northwest of Globe.

DRAINAGE AREA.—458 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—884 m above National Geodetic Vertical Datum of 1929, from topographic map.

PERIOD OF RECORD.—July 1987 to current year.

REMARKS.—Station was formerly identified by number 333223110522600.

Field Measurements

[ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter; dashes indicate no data]

Date	Time	Discharge inatantaneous (ft³/s)	Specific conductsnce (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)
11-20-91	1000	2.1	3,220	6.4	8.0	17.0
01-29-92	1030	3.4	3,310	6.3	9.0	18.0
03-18-92	1000	3.3	3,310	6.2	14.5	18.0
05-20-92	1000	3.6	3,350	6.2	23.0	20.0
07-29-92	0930	3.1	3,240	6.3	29.0	21.0
09-22-92	1005	3.3	3,500	6.1	26.5	19.0
11-17-92	1040	3.2	3,380	6.0	14.5	17.0
04-21-93	1245	13.2	2,225	7.1	----	26.0
05-19-93	0800	4.2	2,900	6.8	25.5	18.0
06-17-93	1500	5.9	2,100	6.4	----	21.5
07-27-93	1245	5.6	2,900	6.6	36.5	25.0

09498380 Pinal Creek at Setka Ranch near Globe, Arizona—Continued

Field Measurements—Continued

Date	Barometric pressure (mm of mercury)	Oxygen, dissolved (mg/L)	Oxygen dissolved (percent saturation)	Alkalinity wat dis tot IT field (mg/L as $CaCO_3$)	Bicarbonate water dis IT field (mg/L as HCO_3)	Carbonate water dis IT field (mg/L as CO_3)
11-20-91	698	5.7	66	48	59	0
01-29-92	692	6.0	71	46	56	0
03-18-92	687	5.3	63	46	56	0
05-20-92	684	6.0	75	43	53	0
07-29-92	687	5.6	71	40	49	0
09-22-92	689	5.2	63	40	49	0
11-17-92	686	5.7	66	39	47	0
04-21-93	---	7.3	--	85	104	0
05-19-93	689	7.2	--	69	84	0
06-17-93	---	8.1	--	72	88	0
07-27-93	686	8.6	115	63	77	0

Laboratory Measurements

[Laboratory—10, National Water-Quality Laboratory, Arvada, Colorado; 140, USGS research laboratory, Menlo Park, California; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; sediment analyses were completed at the Iowa District Sediment Laboratory; T/D, tons per day; dashes indicate no data; <, actual value is known to be less than value shown]

Date	Laboratory	Solids, residue at 180 °C dissolved (mg/L)	Solids, sum of constituents, dissolved (mg/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
11-20-91	10	3,370	3,280	560	130	90	7.0	2,200	100
01-29-92	10	3,460	3,340	590	140	94	5.3	2,200	110
03-18-92	10	3,850	3,150	540	130	83	4.8	2,100	110
05-20-92	10	3,480	3,280	640	140	93	5.5	2,100	94
07-29-92	10	3,420	3,230	590	140	89	5.7	2,100	110
09-22-92	10	3,450	3,170	560	130	84	5.7	2,100	92
11-17-92	10	3,470	3,050	530	130	90	5.7	2,000	93
04-21-93	140	---	---	350	78	59	5.4	1,110	54
05-19-93	140	---	---	490	120	74	4.5	1,680	74
06-17-93	140	---	---	510	130	84	5.8	1,690	70
07-27-93	10	2,860	2,730	500	120	77	2.6	1,800	68
07-27-93	140	---	---	530	130	85	7.4	1,760	68

SURFACE WATER—Continued

09498380 Pinal Creek at Setka Ranch near Globe, Arizona—Continued

Laboratory Measurements—Continued

Date	Laboratory	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Nitrogen, total (mg/L as N)	Nitrogen, NO_2 and NO_3, total (mg/L as N)	Nitrogen, NO_2, total (mg/L as N)	Nitrogen, ammonia, total (mg/L as N)	Nitrogen, ammonia and organic, total (mg/L as N)	Nitrogen, organic, total (mg/L as N)	Phosphorus, total (mg/L as P)
11-20-91	10	1.9	70	--	<0.050	0.020	0.080	<0.20	--	0.100
01-29-92	10	1.8	73	--	<0.050	<0.010	0.080	<0.20	--	0.120
03-18-92	10	2.3	66	--	<0.050	<0.010	0.090	<0.20	--	0.130
05-20-92	10	2.5	74	--	<0.050	<0.010	0.080	<0.20	--	0.110
07-29-92	10	2.8	72	--	<0.050	<0.010	0.140	<0.20	--	0.080
09-22-92	10	3.1	72	--	<0.050	<0.010	0.180	<0.20	--	0.150
11-17-92	10	3.1	73	--	<0.050	0.010	0.130	<0.20	--	0.120
04-21-93	140	---	47	--	--	--	--	--	--	--
05-19-93	140	---	64	--	--	--	--	--	--	--
06-17-93	140	---	71	--	--	--	--	--	--	--
07-27-93	10	1.7	64	0.30	--	--	--	0.30	0.30	0.080
07-27-93	140	---	66	--	--	--	--	--	--	--

Date	Laboratory	Phosphorus, organic total (mg/L as P)	Phoaphorus, ortho, total (mg/L as P)	Phosphate, total (mg/L as P)	Aluminum, diasolved (µg/L as Al)	Barium, diasolved (µg/L aa Ba)	Beryllium, diasolved (µg/L as Be)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)	Cobsit, diasolved (µg/L as Co)
11-20-91	10	0.04	0.060	0.18	--	30	2	9.0	30	80
01-29-92	10	--	0.120	0.37	--	19	<2	11	20	70
03-18-92	10	0.04	0.090	0.28	--	31	2	12	<20	120
05-20-92	10	0.01	0.100	0.31	--	24	<5	<10	<50	110
07-29-92	10	--	0.090	0.28	--	28	4	14	30	140
09-22-92	10	0.05	0.100	0.31	--	25	2	6.0	20	150
11-17-92	10	0.02	0.100	0.31	--	25	3	12	20	180
04-21-93	140	--	--	--	170	--	--	--	--	70
05-19-93	140	--	--	--	210	--	--	--	--	120
06-17-93	140	--	--	--	430	--	--	--	--	110
07-27-93	10	--	--	--	--	29	<2	5.0	<20	90
07-27-93	140	--	--	--	330	--	--	--	--	99

09498380 Pinal Creek at Setka Ranch near Globe, Arizona—Continued

Laboratory Measurements—Continued

Date	Laboratory	Copper, total recoverable (µg/L aa Cu)	Copper, dissolved (µg/L aa Cu)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Lead, total recoverable (µg/L aa Pb)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)	Manganese, total recoverable (µg/L as Mn)	Manganese, dissolved (µg/L as Mn)
11-20-91	10	93	80	490	87	1	<1	280	86,000	85,000
01-29-92	10	27	24	150	55	<1	<1	300	86,000	91,000
03-18-92	10	89	74	840	78	<1	<1	290	89,000	85,000
05-20-92	10	29	24	170	100	<1	<1	260	91,000	100,000
07-29-92	10	39	21	920	100	<1	<1	280	90,000	96,000
09-22-92	10	45	39	250	41	<1	<1	280	99,000	91,000
11-17-92	10	28	3	70	35	<1	<1	290	94,000	94,000
04-21-93	140	--	60	--	<130	--	--	--	--	22,500
05-19-93	140	--	60	--	<130	--	--	--	--	52,600
06-17-93	140	--	50	--	<130	--	--	--	--	55,200
07-27-93	10	41	31	90	<9	<1	<1	210	60,000	58,000
07-27-93	140	--	30	--	<130	--	--	--	--	60,000

Date	Laboratory	Molybdenum, dissolved (µg/L as Mo)	Nickel, total recoverable (µg/L aa Ni)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L aa Ag)	Strontium, dissolved (µg/L as Sr)	Vanadium, dissolved (µg/L as V)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)	Sediment, suspended (mg/L)	Sediment discharge, suspended (T/D)
11-20-91	10	<30	900	880	16	1,900	<18	50	50	19	0.11
01-29-92	10	<30	950	930	8.0	2,100	<18	50	40	7	0.06
03-18-92	10	<30	950	880	6.0	1,900	<18	60	51	44	0.40
05-20-92	10	<100	1,100	990	<10	2,200	<60	60	70	9	0.09
07-29-92	10	<30	1,000	980	19	2,000	<18	60	76	27	0.23
09-22-92	10	<30	1,000	960	8.0	2,000	<18	70	47	10	0.09
11-17-92	10	<30	1,100	1,000	15	2,000	<18	70	63	5	0.04
04-21-93	140	--	--	200	--	--	--	--	100	--	--
05-19-93	140	--	--	480	--	--	--	--	100	--	--
06-17-93	140	--	--	520	--	--	--	--	100	--	--
07-27-93	10	<30	480	490	<3.0	1,800	<18	100	98	42	0.64
07-27-93	140	--	--	480	--	--	--	--	100	--	--

SURFACE WATER—Continued

333332110531701 Pinal Creek at Pringle Pumping Station near Globe, Arizona

LOCATION.—Lat 33°33'32", long 110°53'17", in NW1/4 NE1/4 SW1/4 sec. 36, T. 3 N., R. 14 E., 200 m southeast of pump house at Pringle Pump Station, 2.1 km upstream from Inspiration Dam, 8.2 km upstream from mouth, and 21 km northwest of Globe.

DRAINAGE AREA.—500 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—861 m above National Geodetic Vertical Datum of 1929, from topographic map.

PREVIOUS DATA COLLECTION AT SITE.—One discharge and four water-quality analyses between April and July 1990 and one discharge measurement and water-quality analysis in February 1982 reported by the Central Arizona Association of Governments, Mineral Extraction Task Force at site GM28. One isotopic analysis in May 1989 is presented in Brown (1990).

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter; dashes indicate no data]

Date	Time	Discharge inatan-taneoua (ft^3/a)	Specific conduct-ance (µS/cm)	pH (standard unita)	Temperature, air (°C)	Temperature, water (°C)	Barometric preaaure (mm of mercury)	Oxygen, dissolved (mg/L)	Bicarbonate water dissolved IT field (mg/L aa HCO_3)
05-19-93	1045	13.6	3,000	7.5	28.0	12.0	694	7.5	112
06-18-93	1338	10.4	2,280	7.5	——	27.0	—	8.7	137

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratory	Calcium, diasolved (mg/L aa Ca)	Magnesium, disaolved (mg/L aa Mg)	Sodium, diasolved (mg/L) aa Na)	Potaasium, dissolved (mg/L as K)	Sulfate, diasolved (mg/L as $SO_{4)}$	Chloride, dissolved (mg/L aa Cl)	Aluminum, diasolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)
05-19-93	140	530	120	75	4.9	1,770	84	<110	80
06-18-93	140	570	140	85	6.2	1,810	82	190	83

Date	Copper, diaaolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, diasolved (µg/L as Mn)	Nickel, dissolved (mg/L as Nl)	Silica, disaolved (mg/L as SiO_2)	Zinc, diasolved (µg/L as Zn)
05-19-93	<30	<130	39,100	310	58	50
06-18-93	<30	<130	45,500	360	64	60

SURFACE WATER—Continued

09498400 Pinal Creek at Inspiration Dam near Globe, Arizona

LOCATION.—Lat 33°34'23", long 110°54'02", in NE 1/4 NW 1/4 SE 1/4 sec. 26, T. 3 N., R. 14 E., in Tonto National Forest, on right bank 2.1 m upstream from Inspiration Dam, 6.2 km upstream from mouth, and 22 km northwest of Globe.

DRAINAGE AREA.—504 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

Water Discharge Records

PERIOD OF RECORD.—July 1980 to current year.

GAGE.—Water-stage recorder in stilling well. Elevation of gage is 835 m above National Geodetic Vertical Datum of 1929, from topographic map. In February 1991 a steel-plate weir with "V" notch was added to the concrete dam lip, located 2.1 m below the stilling well. The "V" notch is located 2.1 m from the right bank.

AVERAGE DISCHARGE.—13 years (water years 1981–93), 16.4 ft³/s (520,000,000 ft³/yr).

REMARKS.—Records rated as good for water year 1992. Records rated as fair for water year 1993.

Monthly and yearly mean discharge, in cubic feet per second

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1992	4.33	6.60	6.17	6.70	13.5	12.3	7.23	8.04	5.85	5.36	7.98	6.63	7.54
1993	6.08	5.91	10.7	440	406	67.3	30.1	19.6	16.2	10.0	10.5	10.2	84.2

Monthly and yearly discharge, in thousands of cubic feet

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1992	134.2	197.9	191.4	207.6	392.5	381.7	216.8	249.3	175.5	166.3	247.5	198.9	2,759.6
1993	188.4	177.2	331.5	13,652.1	11,363	2,085	904	607	486	311.3	326.7	306.4	30,738.6

09498400 Pinal Creek at Inspiration Dam near Globe, Arizona—Continued

PERIOD OF RECORD.—November 1989 to current year.

Field Measurements

[ft^3/sec, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; NTU, nephelometric turbidity units; mm, millimeters; mg/L, milligrams per liter; cols./100 mL, colonies per 100 milliliters; K, based on non-ideal colony count; dashes indicate no data]

Date	Time	Discharge instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Turbidity (NTU)	Barometric pressure (mm of mercury)
11-20-91	1700	6.6	3,250	7.5	8.0	16.0	30	697
01-29-92	1520	6.1	3,250	8.0	17.5	18.0	1.4	693
03-18-92	1530	7.2	3,210	7.8	19.0	22.0	19	691
05-20-92	1545	8.0	3,240	7.8	20.0	19.0	1.5	688
07-29-92	1605	5.0	3,150	7.9	35.5	32.5	13	687
09-22-92	1455	6.1	3,450	7.8	33.0	29.0	120	689
11-17-92	1610	5.6	3,360	7.8	16.0	16.0	0.80	687
01-07-93	1500	1,120	410	7.7	14.0	10.0	3,000	685
03-04-93	1300	78	1,110	8.0	27.0	18.0	140	693
04-22-93	1009	24.2	2,500	7.9	---	22.0	---	---
05-19-93	1410	18.0	2,900	7.8	30.5	28.0	---	695
05-26-93	1300	16	2,880	7.8	33.0	29.0	1.6	688
06-18-93	1159	12.6	2,170	7.7	---	25.0	---	---
07-27-93	1715	9.4	3,000	7.8	35.0	27.0	0.50	686
09-22-93	1100	10	2,930	8.0	27.0	24.0	0.50	687

Date	Oxygen, dissolved (mg/L)	Oxygen dissolved (percent saturation)	Bicarbonate water dis IT field (mg/L as HCO_3)	Carbonate water dis IT field (mg/L as CO_3)	Alkalinity wat dis tot IT field (mg/L as $CaCO_3$)	Coliform, fecal um-mf (cols./100 mL)	Streptococci, fecal kf agar (cols./ 100 mL)
11-20-91	8.3	93	133	0	109	100	660
01-29-92	8.2	97	122	0	100	<1	K8
03-18-92	7.1	91	118	0	97	42	48
05-20-92	8.2	100	132	0	108	100	260
07-29-92	6.3	97	125	0	102	K71	100
09-22-92	6.4	94	127	0	104	280	110
11-17-92	8.4	96	128	0	105	K5	K16
01-07-93	10.2	101	57	0	47	K7,300	44,000
03-04-93	8.3	97	116	0	95	47	660
04-22-93	8.3	---	131	0	107	---	---
05-19-93	6.9	---	129	0	106	K4,100	56
05-26-93	6.5	95	142	0	116	---	---
06-18-93	7.8	---	159	0	130	---	---
07-27-93	7.0	98	124	0	102	K14	92
09-22-93	8.5	113	120	0	98	K4	71

SURFACE WATER—Continued

09498400 Pinal Creek at Inspiration Dam near Globe, Arizona—Continued

Laboratory Measurements

[Laboratory—10, National Water-Quality Laboratory, Arvada, Colorado; 140, USGS research laboratory, Menlo Park, California; °C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; sediment analyses are completed at the Iowa District Sediment Laboratory; T/D, tons per day; dashes indicate no data; <, actual value is known to be less than value shown]

Date	Laboratory	Solids, residue at 180 °C diaaolved (mg/L)	Solids, sum of constituenta, dissolved (mg/L)	Residue, total at 105°C, auapended (mg/L)	Calcium, diasolved (mg/L aa Ca)	Magne-sium, dissolved (mg/L aa Mg)	Sodium, diasolved (mg/L aa Na)	Potas-aium, diasolved (mg/L as K)	Sulfate, diaaolved (mg/L aa SO_4)
11-20-91	10	3,290	3,110	85	570	140	91	5.0	2,100
01-29-92	10	3,310	2,950	9	520	130	92	4.6	2,000
03-18-92	10	3,340	3,040	45	600	140	84	3.4	2,000
05-20-92	10	3,190	2,790	6	560	140	87	5.1	1,800
07-29-92	10	3,280	2,900	52	600	140	86	5.2	1,900
09-22-92	10	3,320	2,980	115	530	140	86	5.2	2,000
11-17-92	10	3,320	2,900	3	550	140	88	4.9	1,900
01-07-93	10	275	247	19,100	56	7.5	7.7	3.4	140
03-04-93	10	841	759	378	160	34	33	3.9	440
04-22-93	140	----	----	----	420	96	88	6.4	1,350
05-19-93	140	----	----	----	510	120	92	5.6	1,620
05-26-93	10	2,780	2,550	20	470	120	78	5.2	1,700
06-18-93	140	----	----	----	530	130	84	6.4	1,660
07-27-93	10	2,880	2,670	4	490	120	89	4.3	1,800
07-27-93	140	----	----	----	570	140	90	6.3	1,740
09-22-93	10	2,860	2,710	1	530	120	80	4.7	1,800
09-22-93	140	----	----	----	570	140	91	5.5	1,770

SURFACE WATER—Continued

09498400 Pinal Creek at Inspiration Dam near Globe, Arizona—Continued

Laboratory Measurements—Continued

Dste	Laboratory	Chloride, dissolved (mg/L ss Cl)	Fluoride, dissolved (mg/L as F)	Nitrogen, NO_2 and NO_3, total (mg/L as N)	Nitrogen smmonia, total (mg/L as N)	Nitrogen, ammonia and organ-ic, totsi (mg/L as N)	Phos-phorus, total (mg/L as P)	Alumi-num, dis-solved (µg/L as Al)	Arsenic, total (µg/L as As)	Arsenic, dis-solved (µg/L ss As)
11-20-91	10	96	0.70	0.071	0.080	<0.20	0.130	--	<1	2
01-29-92	10	93	0.80	<0.050	0.060	<0.20	0.050	--	<1	<1
03-18-92	10	110	0.90	0.054	0.120	<0.20	0.170	--	2	1
05-20-92	10	93	1.1	<0.050	0.080	<0.20	0.060	--	1	<1
07-29-92	10	66	1.4	<0.050	0.180	0.30	0.590	--	1	<1
09-22-92	10	110	1.3	0.059	0.130	<0.20	0.210	--	3	1
11-17-92	10	100	1.3	<0.050	0.130	<0.20	0.040	--	<1	<1
01-07-93	10	3.8	0.40	--	--	8.6	10.0	--	15	2
03-04-93	10	25	0.40	--	--	0.30	0.290	--	4	<1
04-22-93	140	67	---	--	--	--	--	<110	--	--
05-19-93	140	80	---	--	--	--	--	<110	--	--
05-26-93	10	80	0.90	--	--	<0.20	0.050	--	1	<1
06-18-93	140	79	---	--	--	--	--	140	--	--
07-27-93	10	68	1.0	--	--	0.20	0.050	--	<1	<1
07-27-93	140	77	---	--	--	--	--	200	--	--
09-22-93	10	72	1.4	--	--	0.20	0.060	--	<1	<1
09-22-93	140	73	---	--	--	--	--	170	--	--

SURFACE WATER—Continued

09498400 Pinal Creek at Inspiration Dam near Globe, Arizona—Continued

Laboratory Measurements—Continued

Date	Laboratory	Barium, dissolved (µg/L aa Ba)	Boron, dissolved (µg/L as B)	Cadmium, total recoverable (µg/L aa Cd)	Cadmium, dissolved (µg/L as Cd)	Chromium, total recoverable (µg/L aa Cr)	Chromium, dissolved (µg/L aa Cr)	Cobalt, dissolved (µg/L as Co)	Copper, total recoverable (µg/L as Cu)	Copper, dissolved (µg/L aa Cu)
11-20-91	010	100	70	4	4.0	4	1	--	--	6
01-29-92	010	<100	70	4	4.0	4	1	--	14	6
03-18-92	010	<100	70	4	4.0	6	2	--	140	7
05-20-92	010	<100	80	4	4.0	<1	1	--	27	6
07-29-92	010	<100	80	3	3.0	<1	<1	--	37	2
09-22-92	010	<100	80	5	3.0	<1	<1	--	160	2
11-17-92	010	<100	70	5	5.0	1	<1	--	11	7
01-07-93	010	20	10	15	<1.0	190	<1	--	16,000	30
03-04-93	010	100	40	1	<1.0	9	<1	--	400	17
04-22-93	140	--	--	--	--	--	--	40	--	<30
05-19-93	140	--	--	--	--	--	--	40	--	<30
05-26-93	010	<100	80	3	3.0	1	<1	--	63	5
06-18-93	140	--	--	--	--	--	--	70	--	<30
07-27-93	010	<100	70	4	4.0	2	<1	--	22	12
07-27-93	140	--	--	--	--	--	--	30	--	<30
09-22-93	010	100	70	4	4.0	<1	<1	--	14	9
09-22-93	140	--	--	--	--	--	--	30	--	<30

SURFACE WATER—Continued

09498400 Pinal Creek at Inspiration Dam near Globe, Arizona—Continued

Laboratory Measurements—Continued

Date	Laboratory	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)	Manganese, total recoverable (µg/L as Mn)	Manganese, dissolved (µg/L as Mn)	Mercury, total recoverable (µg/L as Hg)
11-20-91	010	3,800	<10	2	<1	170	44,000	43,000	<0.10
01-29-92	010	200	20	<1	<1	180	42,000	44,000	<0.20
03-18-92	010	3,500	<10	<1	<1	170	44,000	43,000	<0.10
05-20-92	010	560	<10	<1	<1	170	39,000	40,000	<0.10
07-29-92	010	1,500	<10	<1	<1	170	43,000	42,000	<0.10
09-22-92	010	4,300	10	5	<1	170	43,000	41,000	<0.10
11-17-92	010	110	20	<1	<1	--	51,000	51,000	<0.10
01-07-93	010	260,000	7	950	<1	7	52,000	54	0.50
03-04-93	010	19,000	<10	23	<1	40	6,200	5,100	<0.10
04-22-93	140	--	<130	--	--	--	--	17,400	--
05-19-93	140	--	<130	--	--	--	--	25,800	--
05-26-93	010	1,500	<10	<1	<1	150	29,000	27,000	<0.10
06-18-93	140	--	<130	--	--	--	--	32,000	--
07-27-93	010	100	<10	<1	<1	170	43,000	39,000	<0.10
07-27-93	140	--	<130	--	--	--	--	42,900	
09-22-93	010	80	<10	<1	<1	170	38,000	40,000	<0.10
09-22-93	140	--	<130	--	--	--	--	46,900	--

SURFACE WATER—Continued

09498400 Pinal Creek at Inspiration Dam near Globe, Arizona—Continued

Laboratory Measurements—Continued

Date	Laboratory	Nickel, dissolved (µg/L aa Ni)	Selenium, total (µg/L as Se)	Selenium, dissolved (µg/L as Se)	Silver, dissolved (µg/L aa Ag)	Silica, dissolved (mg/L as SiO_2)	Zinc, total recoverable (µg/L aa Zn)	Zinc, dissolved (µg/L as Zn)	Sediment, auspended (mg/L)	Sediment discharge, suspended (T/D)
11-20-91	10	--	<1	<1	<1.0	--	40	10	168	3.0
01-29-92	10	--	<1	<1	<1.0	--	30	20	4	0.07
03-18-92	10	--	<1	<1	<1.0	--	30	10	222	4.3
05-20-92	10	--	<1	<1	<1.0	--	40	30	90	1.9
07-29-92	10	--	<1	<1	<1.0	--	20	<10	91	1.2
09-22-92	10	--	<1	<1	<1.0	--	50	<10	178	2.9
11-17-92	10	--	<1	<1	<1.0	--	30	30	2	0.03
01-07-93	10	--	<1	<1	<1.0	--	2,300	<3	25,600	77,300
03-04-93	10	--	<1	<1	<1.0	--	130	<10	1,550	327
04-22-93	140	210	--	--	--	49	--	20	--	--
05-19-93	140	210	--	--	--	56	--	20	--	--
05-26-93	10	--	<1	<1	<1.0	--	50	30	431	19
06-18-93	140	240	--	--	--	60	--	40	--	--
07-27-93	10	--	<1	<1	<1.0	--	50	40	16	0.39
07-27-93	140	290	--	--	--	60	--	60	--	--
09-22-93	10	--	<1	<1	<1.0	--	60	40	2	0.06
09-22-93	140	330	--	--	--	62	--	50	--	--

SURFACE WATER—Continued

333501110541300 Pinal Creek below Inspiration Dam near Globe, Arizona

LOCATION.—Lat 33°35'01", long 110°54'13", in NE1/4 SE1/4 SW1/4 sec. 23, T. 3 N., R. 14 E., in Tonto National Forest, 1.6 km downstream from Inspiration Dam, 4.6 km upstream from mouth, and 23 km northwest of Globe.

DRAINAGE AREA.—507 km², including approximately 85 km² that is partly or entirely noncontributing due to mine pits and dumps.

CHANNEL ELEVATION.—750 m above National Geodetic Vertical Datum of 1929, from topographic map.

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter]

Date	Time	Discharge inatantaneoua (ft^3/a)	Specific conductance (µS/cm)	pH (atandard unita)	Temperature water (°C)	Oxygen, dissolved (mg/L)	Bicarbonate water dia iT field (mg/L as HCO_3)
06-18-93	1120	13.4	2,130	8.0	22.5	9.4	175

Laboratory Measurements

[Laboratory—140, USGS research laboratory, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown]

Date	Laboratcry	Calcium, disacived (mg/L as Ca)	Magnesium, dissolved (mg/L aa Mg)	Sodium, diaacived (mg/L aa Na)	Pctassium, dissoived (mg/L aa K)	Sulfate, dissoived (mg/L aa SO_4)	Chicride, dissoived (mg/L aa Ci)	Aiumi-num, dissoived (µg/L as Ai)	Cobait, dissoived (µg/L aa Co)
06-18-93	140	530	120	83	5.8	1,640	78	140	70

Date	Copper, dissoived (µg/L as Cu)	Ircn, dissoived (µg/L as Fe)	Manganese, dissoived (µg/L as Mn)	Nickei, dissoived (mg/L as Ni)	Siiica, dissoived (mg/L as SiO_2)	Zinc, disscived (µg/L as Zn)
06-18-93	<30	<130	30,400	250	58	30

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992
GROUND WATER

Field Measurements

[cm, centimeters; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; dashes indicate no data; see fig. 4 for location of sampling sites]

Site nsme	Date	Time	Depth below surface (cm)	Specific conduct-snca (µS/cm)	pH (stan-dsrd units)	Tem-pera-ture water (°C)	Oxygen, dis-solved (mg/L)	Bicarbo-nate wa-ter dis-solved (mg/L as HCO_3)
0	11/19	1429	3	3,190	5.84	14.1	2.3	51
	11/19	1325	6	3,170	5.80	13.9	0.8	49
	11/19	1252	12	3,150	5.73	13.7	0.9	67
	11/19	1204	25	3,160	5.66	15.2	0.7	57
	11/19	1030	50	3,180	5.64	15.9	0.8	48
1	11/20	908	3	3,260	5.57	16.7	2.3	35
	11/20	840	6	3,250	5.53	16.2	1.1	32
	11/20	756	12	3,250	5.50	16.6	1.1	32
	11/19	1632	25	3,200	5.46	17.1	0.8	25
	11/19	1544	50	3,190	5.53	17.8	0.8	32
	11/20	1059	100	3,260	5.46	17.8	0.8	32
3	11/20	1532	3	3,400	5.73	16.8	2.0	49
	11/20	1503	6	3,410	5.61	17.2	0.9	--
	11/20	1431	12	3,410	5.63	17.5	0.8	79
	11/20	1351	25	3,390	5.63	17.4	0.7	--
	11/20	1302	50	3,400	5.61	18.0	1.8	5
	11/20	1715	100	3,400	5.70	15.0	1.1	--
5	11/21	1412	50	3,410	5.07	15.4	--	--

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992—Continued

GROUND WATER—Continued

Laboratory Measurements—Continued

Concentrations for Unfiltered Samples

[Laboratory—140, Menlo Park, California; cm, centimeters; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown; see fig. 4 for location of sampling sites]

Site name	Depth below surface (cm)	Date	Time	Laboratory	Calcium, total (mg/L as Ca)	Magnesium, total (mg/L as Mg)	Sodium, total (mg/L as Na)	Potassium, total (mg/L aa K)
0	3	11/19	1429	140	550	140	80	4.7
	6	11/19	1325	140	520	130	90	5.5
	12	11/19	1252	140	520	130	80	5.9
	25	11/19	1204	140	570	140	80	5.0
	50	11/19	1030	140	530	130	80	4.8
1	3	11/20	0908	140	550	130	80	5.8
	6	11/20	0840	140	540	140	100	6.5
	12	11/20	0756	140	540	140	100	6.7
	25	11/19	1632	140	530	130	80	4.9
	50	11/19	1544	140	540	130	80	4.7
	100	11/20	1059	140	540	130	80	5.0
3	3	11/20	1532	140	590	150	90	6.7
	6	11/20	1503	140	580	150	90	7.0
	12	11/20	1431	140	550	140	100	6.8
	25	11/20	1351	140	540	140	100	6.7
	50	11/20	1302	140	540	140	110	6.3
	100	11/20	1715	140	560	140	120	7.3
5	50	11/21	1412	140	600	150	90	6.0

Site name	Depth below surface (cm)	Aluminum, total (µg/L as Al)	Cobalt, total (µg/L aa Co)	Copper, total (µg/L as Cu)	Iron, total (µg/L as Fe)	Manganese, total (µg/L aa Mn)	Nickel, total (mg/L as Ni)	Silica, total (mg/L as SiO_2)	Zinc, total (µg/L as Zn)
0	3	<110	60	210	<130	71,300	720	77	70
	6	120	50	150	<130	68,200	670	73	70
	12	<110	70	70	<130	65,700	660	73	60
	25	310	70	60	350	71,000	700	79	80
	50	180	94	30	<130	71,400	670	75	100
1	3	620	230	30	<130	84,100	960	79	50
	6	830	210	<30	<130	89,300	990	79	50
	12	960	230	<30	<130	90,800	1,030	81	50
	25	760	280	<30	<130	88,100	990	77	50
	50	880	280	<30	<130	91,300	1,070	79	50
	100	1,000	340	<30	<130	92,700	1,040	77	70
3	3	540	140	<30	<130	101,000	990	81	60
	6	300	60	<30	<130	102,000	950	79	50
	12	290	110	<30	<130	97,000	930	73	30
	25	450	94	<30	<130	96,500	940	73	40
	50	370	80	<30	<130	95,500	900	73	30
	100	1,200	94	<30	770	98,100	950	79	30
5	50	1,200	<20	80	<130	82,900	1,050	81	160

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992—Continued
GROUND WATER—Continued

Laboratory Measurements—Continued

Concentrations for Filtered Samples

[Laboratory—140, Menlo Park, California; cm, centimeters; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown; dashes indicate no data; see fig. 4 for location of sampling sites]

Site name	Depth below surface (cm)	Laboratory	Filter size (micro-meter)	Calcium, dis-solved (mg/L as Cs)	Magne-sium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potas-sium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
0	3	140	0.45	530	130	80	4.8	1,950	84
	3	140	0.001	520	130	90	5.2	—	—
	6	140	0.45	570	140	80	5.8	1,960	84
	6	140	0.001	560	140	80	4.6	—	—
	12	140	0.45	520	130	80	5.4	1,980	83
	12	140	0.001	520	130	80	6.1	—	—
	25	140	0.45	550	130	80	3.9	1,980	83
	25	140	0.001	530	130	80	3.9	—	—
	50	140	0.45	530	130	90	5.5	1,980	83
	50	140	0.45	520	130	80	5.8	—	—
	50	140	0.001	510	130	80	4.8	—	—
1	3	140	0.45	550	130	80	4.9	2,010	83
	3	140	0.001	530	130	90	5.6	—	—
	6	140	0.45	540	130	90	7.2	2,010	83
	6	140	0.001	530	130	90	4.6	—	—
	12	140	0.45	540	130	90	5.5	2,010	83
	12	140	0.001	510	120	70	4.8	—	—
	25	140	0.45	540	130	80	5.5	2,020	83
	25	140	0.001	540	130	80	4.6	—	—
	50	140	0.45	520	130	80	4.8	1,960	83
	50	140	0.001	510	120	80	5.5	2,020	83
	100	140	0.45	520	130	80	5.7	—	—
	100	140	0.001	510	120	80	5.1	—	—
3	3	140	0.45	570	140	80	5.8	2,100	90
	3	140	0.001	570	140	90	6.8	—	—
	6	140	0.45	570	140	90	6.5	2,130	91
	6	140	0.1	570	140	80	6.1	—	—
	12	140	0.001	540	130	110	6.4	—	—
	12	140	0.45	550	140	100	7.1	2,120	91
	25	140	0.45	570	140	80	6.5	2,120	90
	25	140	0.1	540	140	100	5.9	—	—
	50	140	0.001	550	140	90	5.3	—	—
	50	140	0.45	550	140	100	5.6	2,120	91
	100	140	0.45	560	140	80	4.7	2,130	92
5	50	140	0.45	600	150	80	6.9	2,130	91
	50	140	0.001	580	140	90	6.4	—	—

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992—Continued

GROUND WATER—Continued

Laboratory Measurements—Continued

Concentrations for Filtered Samples—Continued

Site name	Depth below surface (cm)	Aluminum, dissolved (µg/L ss Al)	Cobalt, dissolved (µg/L ss Co)	Copper, dissolved (µg/L ss Cu)	Iron, dissolved (µg/L ss Fe)	Manganeae, dissolved (µg/L as Mn)	Nickel, dissolved (mg/L ss Ni)	Silios, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L aa Zn)
0	3	<110	40	210	<130	69,500	680	75	60
	3	<110	30	190	<130	68,800	650	73	90
	6	<110	60	150	<130	72,200	700	79	40
	6	<110	70	140	<130	70,900	700	77	80
	12	120	70	90	<130	66,600	650	73	70
	12	<110	80	70	<130	65,400	640	73	60
	25	<110	91	30	<130	69,200	670	77	80
	25	<110	92	30	<130	68,200	670	75	100
	50	190	82	30	<130	72,000	710	77	160
	50	<110	50	<30	<130	71,000	690	75	120
	50	130	50	<30	<130	68,800	670	73	170
1	3	690	220	30	<130	86,400	980	79	50
	3	710	190	30	<130	83,400	930	77	80
	6	830	230	<30	<130	88,800	1,020	79	50
	6	750	230	<30	<130	88,600	1,000	79	70
	12	870	250	<30	<130	90,100	1,030	79	50
	12	760	270	<30	<130	84,300	960	73	70
	25	790	310	<30	<130	90,700	1,030	77	50
	25	790	280	<30	<130	91,000	1,020	77	60
	50	800	250	<30	<130	88,400	1,010	77	50
	50	770	250	<30	<130	86,100	990	75	70
	100	960	340	<30	<130	89,500	1,010	75	60
	100	1,000	340	<30	<130	88,200	1,000	73	60
3	3	450	130	<30	<130	98,500	960	77	90
	3	480	100	<30	<130	99,000	930	79	60
	6	250	70	<30	<130	99,600	920	77	60
	6	240	83	<30	<130	98,100	920	77	50
	12	370	100	<30	<130	95,800	900	71	40
	12	300	130	<30	<130	97,300	900	73	40
	25	250	110	<30	<130	97,300	930	75	60
	25	310	82	<30	<130	96,500	920	71	40
	50	240	100	<30	<130	94,700	880	71	50
	50	260	99	<30	<130	95,700	920	71	30
	100	150	110	<30	<130	97,100	910	71	30
5	50	990	50	70	<130	82,700	1,030	79	80
	50	1,100	40	70	<130	81,000	1,050	77	300

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992—Continued

SURFACE WATER

Field Measurements

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; dashes indicate no data; site S4-20 is a sample collected at site S4 from a drive point 20 centimeters below the streambed; see fig. 4 for location of sampling sites]

Site	Dste	Time	Dis-chsrge instsn-tsneous (ft^3/s)	Spe-cific con-duct-snce (µS/cm)	pH (stsn-dsrd units)	Tem-pers-ture, water (°C)	Oxygen, dis-solved (mg/L)	Bicarbo-nste ws-ter dis-solved (mg/L as HCO_3)
Surface-water sampling locations								
1	11/20	1004	0.06	3250	5.68	16.8	4.8	32
2	11/21	0954	---	----	---	---	---	---
3	11/20	1630	2.05	3380	5.95	15.4	4.7	46
4	11/21	1540	3.10	----	5.97	16	6.4	54
5	11/21	1455	3.04	3360	6.17	16.2	8.0	49
6	11/22	1555	---	----	6.68	16.3	8.5	84
7	11/23	1608	---	----	7.40	16.9	9.2	109
8	11/23	1650	---	----	7.97	13.8	9.4	123
9	11/23	1551	---	----	7.79	13.8	9.3	123
Tributary sampling locations								
T1	11/22	1030	---	----	---	---	---	---
T2	11/22	0835	---	----	---	---	---	---
T3	11/22	0900	---	----	---	---	---	---
Seep sampling locations								
S1	11/22	1718	---	----	---	---	---	---
S2	11/22	----	---	----	---	---	---	---
S3	11/22	----	---	----	---	---	---	---
S4	11/23	1557	---	----	---	---	---	---
S4-20	11/23	----	---	----	5.8	17.2	---	88

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992—Continued

SURFACE WATER—Continued

Laboratory Measurements

Concentrations for Unfiltered Samples

[Laboratory—140, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; <, actual value is known to be less than value shown; dashes indicate no data; site S4-20 is a sample collected at site S4 from a drive point 20 centimeters below the streambed; see fig. 4 for locations of sampling sites]

Site name	Date	Time	Laboratory	Calcium, total (mg/L aa Ca)	Magnesium, total (mg/L aa Mg)	Sodium, total (mg/L aa Na)	Potassium, total (mg/L aa K)	Sulfate, total (mg/L aa SO_4)	Chloride, total (mg/L aa Cl)
Surface-water sampling locations									
1	11/20	1004	140	560	130	80	6.8	----	--
2	11/21	0954	140	530	130	78	5.1	2,000	82
3	11/20	1630	140	590	140	83	8.4	----	--
4	11/21	1540	140	530	130	80	5.7	----	--
5	11/21	1455	140	600	150	93	5.0	----	--
6	11/22	1555	140	620	150	94	5.5	----	--
7	11/23	1608	140	640	160	105	4.6	----	--
8	11/23	1650	140	620	150	106	5.4	----	--
9	11/23	1551	140	640	160	116	6.5	----	--
Tributary sampling locations									
T1	11/22	1030	140	540	130	84	4.4	----	--
T2	11/22	0835	140	590	160	119	8.7	2,090	87
T3	11/22	0900	140	550	140	83	7.2	2,150	92
Seep sampling locations									
S1	11/22	1718	140	600	160	119	8.5	----	--
S2	11/22	----	140	510	130	80	6.6	----	--
S3	11/22	----	140	580	140	86	6.3	----	--
S4	11/23	----	140	560	130	81	5.9	----	--
S4-20	11/23	----	140	620	160	108	6.6	----	--

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992—Continued

SURFACE WATER—Continued

Laboratory Measurements—Continued

Concentrations for Unfiltered Samples—Continued

Site name	Aluminum, total (µg/L aa Al)	Cobalt, total (µg/L as Co)	Copper, total (µg/L as Cu)	Iron, total (µg/L aa Fe)	Manganese, total (µg/L as Mn)	Nickel, total (mg/L as Ni)	Silica, total (mg/L aa SiO_2)	Zinc, total (µg/L as Zn)
Surface-water sampling locations								
1	420	150	60	<130	77,700	870	81	50
2	280	240	<30	<130	86,600	1,040	77	60
3	1,200	260	40	<130	97,300	1,060	81	90
4	990	210	<30	<130	86,700	910	71	100
5	1,300	190	30	<130	102,000	1,070	81	80
6	840	110	30	190	82,400	750	77	90
7	1,300	60	50	870	64,600	560	74	<20
8	440	40	<30	<130	62,000	520	68	<20
9	410	50	<30	<130	53,700	480	66	<20
Tributary sampling locations								
T1	1,300	150	70	<130	84,100	1,060	83	60
T2	2,300	240	60	290	101,000	1,250	90	60
T3	1,900	200	30	<130	107,000	1,170	75	100
Seep sampling locations								
S1	230	<20	170	530	72,300	640	86	50
S2	700	50	60	680	72,400	890	83	20
S3	500	40	30	1,130	71,400	720	79	100
S4	<110	70	30	2,090	63,700	540	71	60
S4-20	1,600	<20	170	2,410	75,800	640	88	70

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992—Continued

SURFACE WATER—Continued

Laboratory Measurements—Continued

Concentrations for Filtered Samples

[Laboratory—140, Menlo Park, California; mg/L, milligrams per liter; µg/L, micrograms per liter; dashes indicate no data; <, actual value is known to be less than value shown; site S4-20 is a sample collected at site S4 from a drive point 20 centimeters below the streambed; see fig. 4 for location of sampling sites]

Site name	Date	Laboratory	Filter size (micrometer)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (µg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Surface-water sampling locations									
1	11/20	140	0.45	560	140	95	6.7	—	—
	11/20	140	0.001	540	140	95	5.3	—	—
3	11/20	140	0.45	590	140	83	6.8	—	—
	11/20	140	0.001	580	150	91	7.3	—	—
4	11/21	140	0.45	550	140	86	8.2	2,080	90
	11/21	140	0.001	520	130	81	5.3	—	—
5	11/21	140	0.45	580	140	86	7.9	2,090	90
	11/21	140	0.001	580	150	100	7.9	—	—
6	11/22	140	0.45	640	160	99	6.3	—	—
	11/22	140	0.001	620	150	95	7.2	—	—
7	11/23	140	0.45	610	140	84	6.3	—	—
	11/23	140	0.001	590	140	90	7.1	—	—
8	11/23	140	0.45	620	150	100	5.8	—	—
	11/23	140	0.001	630	160	112	5.7	—	—
9	11/23	140	0.45	620	150	92	6.6	—	—
	11/23	140	0.001	580	140	94	6.2	—	—
Seep sampling locations									
S4	11/23	140	0.45	540	130	76	6.0	—	—
S4-20	11/23	140	0.45	540	130	83	6.9	—	—
	11/23	140	0.001	560	140	85	6.2	—	—

SOLUTE-TRANSPORT STUDY DATA, NOVEMBER 1992—Continued

SURFACE WATER—Continued

Laboratory Measurements—Continued

Concentrations for Filtered Samples—Continued

Site name	Filter size (micrometer)	Aluminum, dissolved (µg/L as Al)	Cobalt, dissolved (µg/L as Co)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Nickel, dissolved (mg/L as Ni)	Silica, dissolved (mg/L as SiO_2)	Zinc, dissolved (µg/L as Zn)
Surface-water sampling locations									
1	0.45	440	120	60	<130	79,700	890	83	70
	0.001	410	120	50	<130	77,900	870	81	90
3	0.45	1,100	260	<30	<130	96,900	1,040	81	80
	0.001	1,200	250	<30	<130	96,700	1,050	81	100
4	0.45	1,000	210	30	<130	91,600	970	75	70
	0.001	1,000	220	<30	<130	89,400	960	68	60
5	0.45	1,200	200	30	<130	98,900	1,040	79	90
	0.001	1,200	160	<30	<130	101,000	1,060	79	130
6	0.45	700	110	30	<130	84,800	780	78	40
	0.001	670	130	<30	160	80,500	780	75	100
7	0.45	390	100	<30	<130	60,700	550	66	50
	0.001	290	100	<30	<130	59,500	510	64	80
8	0.45	310	60	<30	<130	60,600	510	66	<20
	0.001	370	50	<30	<130	62,100	550	68	40
9	0.45	300	90	<30	<130	51,800	450	64	60
	0.001	170	90	<30	<130	47,700	420	58	<20
Seep sampling locations									
S4	0.45	<110	80	30	2,160	61,400	500	68	90
S4-20	0.45	<110	80	<30	660	66,500	550	68	60
	0.001	140	30	<30	620	69,100	560	71	60

PRECIPITATION DATA

Globe Ranger Station

LOCATION.—Lat 33°22'40", long 110°46'11", in NE 1/4 NW 1/4 NW 1/4 sec. 1, T. 1 S., R. 15 E., at U.S. Forest Service ranger station 2.4 km southeast of Globe post office.

ELEVATION.—1,097 m above National Geodetic Vertical Datum of 1929, from topographic map.

PERIOD OF RECORD.—March 1981 to current year. Between January 1907 and February 1981, precipitation near Globe was recorded at 10 locations ranging from 0.8 km north to 3.9 km northwest of the present site at elevations between 1,049 and 1,131 m. The longest periods at a single site were from January 1907 to September 1925 at elevation 1,090 m and from May 1953 to June 1975 at elevation 1,080 m.

Precipitation, in millimeters

[M, insufficient or partial data (1–9 daily values missing)]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly total
1991	29	13	129	0	0	9	26	99	14	37	63	49	468
1992	37	54	96	11	70	3	65	119	49	15	0	157	676
1993	19	153	35	0	14	0	11	50	9	46	86	9	M632

Monthly precipitation statistics for 1907–93 (all gage sites), in millimeters

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mean	43	38	38	14	10	9	65	71	34	30	27	47
Maximum	219	155	121	72	70	49	172	206	136	156	121	218
Minimum	0	0	0	0	0	0	7	8	0	0	0	0
Number of observations	87	87	87	87	87	86	86	87	86	86	86	85

Annual precipitation statistics for 1907–93 (all gage sites), in millimeters

Mean	426
Maximum	712
Minimum	203
Number of observations	84

PRECIPITATION DATA—Continued

Miami

LOCATION.—Lat 33°24'15", long 110°52'09", in SE 1/4 NE 1/4 NW 1/4 sec. 30, T. 1 N., R. 15 E., at Miami East plant site of Magma Copper Corporation, 0.5 km northwest of Miami post office.

ELEVATION.—1,084 m above National Geodetic Vertical Datum of 1929, from topographic map.

PERIOD OF RECORD.—February 1914 to current year.

Precipitation, in millimeters

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly total
1991	55	24	170	0	0	9	8	75	39	53	72	74	577
1992	52	61	127	10	64	17	47	150	16	6	2	163	715
1993	261	152	42	0	6	0	21	73	3	40	77	11	686

Monthly precipitation statistics for 1914–93, in millimeters

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mean	56	46	48	19	11	9	64	79	39	33	35	61
Maximum	261	206	173	100	64	91	219	213	179	193	181	293
Minimum	0	0	0	0	0	0	9	8	0	0	0	0
Number of observations	79	80	80	80	80	80	80	80	80	80	80	80

Annual precipitation statistics for 1914–93, in millimeters

Mean	498
Maximum	715
Minimum	167
Number of observations	79