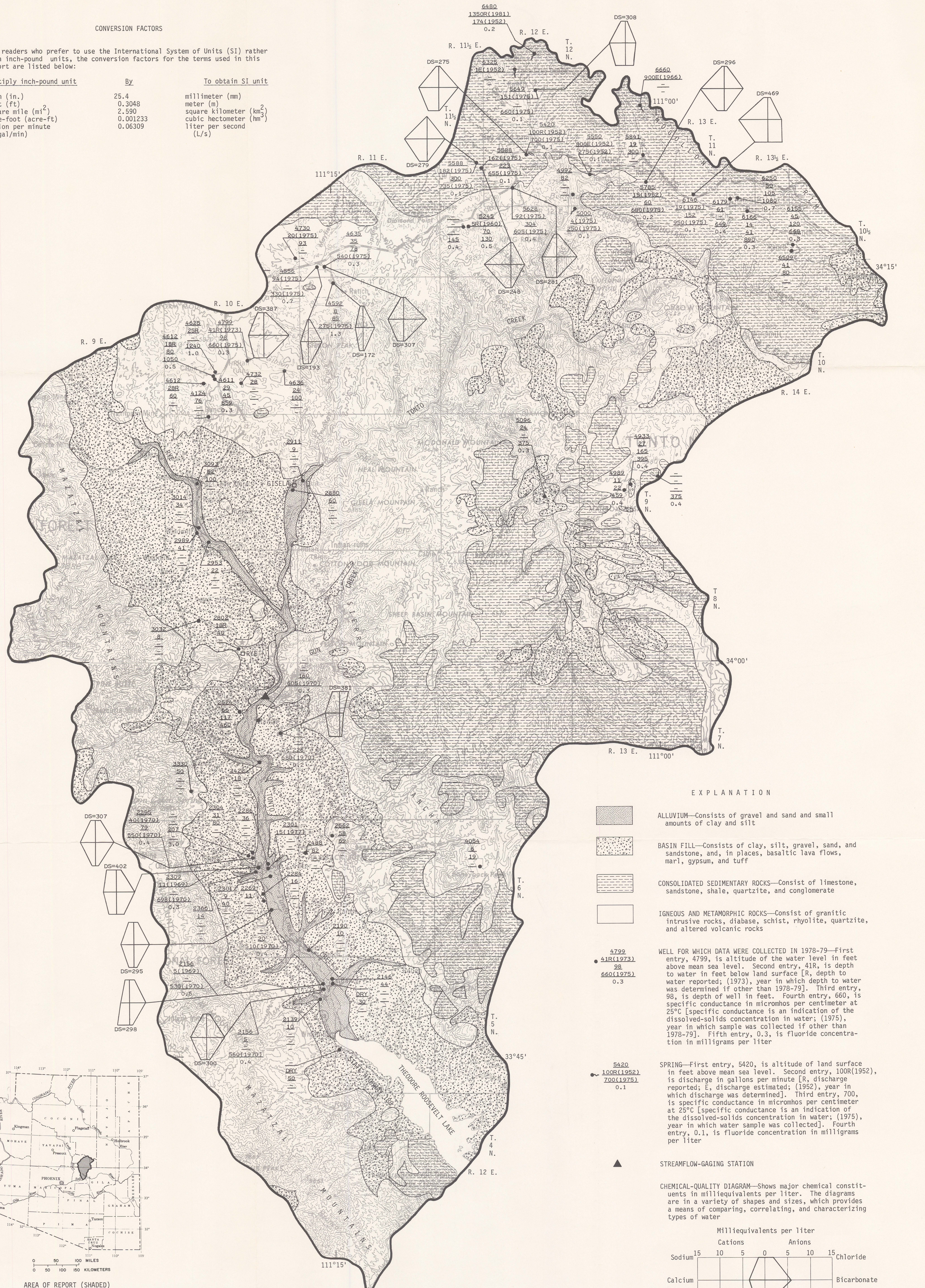
PREPARED IN COOPERATION WITH THE
ARIZONA DEPARTMENT OF WATER RESOURCES

CONVERSION FACTORS

For readers who prefer to use the International System of Units (SI) rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound unit	By	To obtain SI unit
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
square mile (mi^2)	2.590	square kilometer (km^2)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
gallon per minute (gal/min)	0.06309	liter per second (L/s)



AREA OF REPORT (SHADED)

5 0 5 MILES
5 0 5 KILOMETERS

TOPOGRAPHIC CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
DATUM IS MEAN SEA LEVEL

EXPLANATION

ALLUVIUM—Consists of gravel and sand and small amounts of clay and silt

BASIN FILL—Consists of clay, silt, gravel, sand, and sandstone, and, in places, basaltic lava flows, marl, gypsum, and tuff

CONSOLIDATED SEDIMENTARY ROCKS—Consist of limestone, sandstone, shale, quartzite, and conglomerate

IGNEOUS AND METAMORPHIC ROCKS—Consist of granitic intrusive rocks, diabase, schist, rhyolite, quartzite, and altered volcanic rocks

4799
41R(1973)
98
660(1975)
0.3

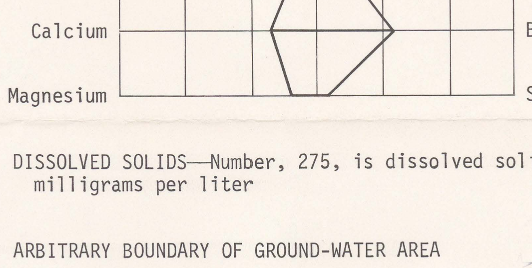
WELL FOR WHICH DATA WERE COLLECTED IN 1978-79—First entry, 4799, is altitude of the water level in feet above mean sea level. Second entry, 41R, is depth to water in feet below land surface [R, depth to water reported; (1973), year in which depth to water was determined if other than 1978-79]. Third entry, 98, is depth of well in feet. Fourth entry, 660, is specific conductance in micromhos per centimeter at 25°C [specific conductance is an indication of the dissolved-solids concentration in water; (1975), year in which sample was collected if other than 1978-79]. Fifth entry, 0.3, is fluoride concentration in milligrams per liter

5420
100R(1952)
700(1975)
0.1

SPRING—First entry, 5420, is altitude of land surface in feet above mean sea level. Second entry, 100R(1952), is discharge in gallons per minute [R, discharge reported; E, discharge estimated; (1952), year in which discharge was determined]. Third entry, 700, is specific conductance in micromhos per centimeter at 25°C [specific conductance is an indication of the dissolved-solids concentration in water; (1975), year in which water sample was collected]. Fourth entry, 0.1, is fluoride concentration in milligrams per liter

STREAMFLOW-GAGING STATION

CHEMICAL-QUALITY DIAGRAM—Shows major chemical constituents in milliequivalents per liter. The diagrams are in a variety of shapes and sizes, which provides a means of comparing, correlating, and characterizing types of water



DS=275

DISSOLVED SOLIDS—Number, 275, is dissolved solids in milligrams per liter

ARBITRARY BOUNDARY OF GROUND-WATER AREA

The Tonto basin area includes about 955 mi^2 in central Arizona. The area is bounded on the north by the Mogollon Rim, on the east by the Sierra Ancha Mountains, on the west by the Mazatzal Mountains, and on the south by Theodore Roosevelt Lake. The area is drained by Tonto Creek, which flows north to south and discharges into Theodore Roosevelt Lake.

Because the Tonto basin area is entirely within the Tonto National Forest, only about 3 percent of the land is privately owned and, for the most part, wells inventoried were on private land. Only selected wells are shown on the map because of the high well density on the private land.

The rocks in the Tonto basin area are divided into four water-bearing units as shown on the map: alluvium, basin fill, consolidated sedimentary rocks, and igneous and metamorphic rocks. The water-bearing characteristics of the rocks may vary greatly within the boundaries of a unit and between units because of complex faulting or fracturing, and because of the relative topographic positions of the units.

The alluvium consists chiefly of gravel and sand and small amounts of clay and silt. The unit occurs mainly in a narrow strip along Tonto Creek downstream from Gisela and along Rye Creek where it overlies the basin fill and locally may be as much as 65 ft thick (Schumann and Thomsen, 1972, p. 12). Alluvium also is present along other stream channels that are cut into other rock units throughout the Tonto basin area. The alluvium is highly permeable, and wells in the lower Tonto drainage may yield as much as 2,500 gal/min of water (Schumann and Thomsen, 1972, p. 13). Where the alluvium is thinner and less widespread, well yields probably are less.

The basin fill may be divided into upper and lower parts (Schumann and Thomsen, 1972, p. 11). The upper part is composed mainly of clay and silt and contains some gravel and sand near the mountains. The lower part is made up of interbedded gravel, sand, and sandstone; the beds are weakly cemented and contain a large amount of silt. In places the lower part contains interbedded basaltic lava flows, marl, gypsum, and tuff. In general, the permeability of both parts is low, and wells that tap the unit yield less than 10 gal/min. In T. 10½ N., R. 14 E., wells are reported to yield a few hundred gallons per minute, which indicates that the basin fill contains more gravel and sand and (or) is less cemented and thus more permeable than that along the lower Tonto Creek drainage as described by Schumann and Thomsen (1972).

The consolidated sedimentary rocks consist of limestone, sandstone, and shale near the north boundary of the area and limestone, quartzite, and conglomerate in the higher elevations of the Sierra Ancha Mountains in the east-central part. Availability and movement of water in this unit is controlled largely by faults, fractures, and solution channels. Water also may be present in connected pore spaces in the sandstone beds. Springs yield from 1 to 900 gal/min from the unit (Feth and Hem, 1963, p. 49). Domestic wells are reported to yield less than 10 gal/min, but the reported discharge may represent only the maximum capacity of the pump.

The igneous and metamorphic rocks consist of granitic intrusive rocks, diabase, schist, rhyolite, quartzite, and altered volcanic rocks in the mountain areas along the sides of Tonto and Rye Creeks. Younger deposits of gravel, sand, conglomerate, and basalt may be present in places. Almost no quantitative data are available on spring discharge from the igneous and metamorphic rocks. The estimated discharge of a spring in sec. 26, T. 11 N., R. 12 E., was 800 gal/min on May 4, 1952, and the measured discharge of another spring in sec. 24, T. 10½ N., R. 12 E., was 4 gal/min on July 16, 1975. Domestic wells that are drilled in the granitic rocks in the northern part of the area generally yield less than 10 gal/min but may yield more when drilled into a highly fractured or weathered zone.

The Tonto basin area may be divided roughly into an upper and a lower part at the streamflow-gaging station on Tonto Creek above Gun Creek, near Roosevelt, Arizona, in the SW¼NE¼ sec. 2, T. 7 N., R. 10 E. In the upper part of the area the average annual precipitation is about 20 in. (Sellers and Hill, 1974, fig. 3). This amount falling on the 675 mi^2 drainage area would produce about 720,000 acre-ft/yr of runoff less the loss to evapotranspiration and infiltration. The amount of streamflow that passes the gaging station and enters the lower part of the basin averages about 97,000 acre-ft/yr (U.S. Geological Survey, 1980, p. 370). Thus, about 87 percent of the precipitation that falls in the basin is lost to evapotranspiration and infiltration.

Development of ground-water resources is slight and water is used mainly for domestic and a few public supplies. No irrigation wells are known to have been drilled in the Tonto basin area above the narrows near Gisela in the NE¼ sec. 18, T. 9 N., R. 11 E. A few irrigation wells were drilled in the alluvium below this point, and a few small parcels of land are being irrigated near Gisela and Rye and below the streamflow-gaging station that divides the area. The amount of ground water withdrawn by irrigation wells is unknown but probably does not exceed several hundreds of acre-feet per year because the small amount of private land under cultivation precludes large-scale irrigation.

In the Tonto basin area the water generally is of good chemical quality. In 18 water samples for which complete chemical analyses were made, the dissolved-solids concentrations ranged from 172 to 469 mg/L (milligrams per liter), and most water samples contained less than 400 mg/L. The specific-conductance values shown on the map, however, indicate that the dissolved-solids concentration in water from a few wells was more than 600 mg/L. Specific conductance varies with the concentration of ions in solution; the dissolved-solids values may be estimated by multiplying the specific conductance by 0.6. The maximum concentration for dissolved solids in public water supplies is 500 mg/L, as proposed in the secondary drinking-water regulations of the U.S. Environmental Protection Agency (1977b, p. 17146). The U.S. Environmental Protection Agency (1977a, b) has established national regulations and guidelines for the quality of water provided by public water systems. The regulations are either primary or secondary. Primary drinking-water regulations govern constituents in drinking water that have been shown to affect human health. Secondary drinking-water regulations apply to constituents that affect esthetic quality. The primary regulations are enforceable either by the Environmental Protection Agency or by the States; in contrast, the secondary regulations are not Federally enforceable. The secondary regulations are intended as guidelines for the States. The regulations express limits as "maximum contaminant levels," where contaminant means physical, chemical, biological, or radiological substance or matter in water.

The maximum concentration for fluoride in public water supplies differs according to the annual average maximum daily air temperature (Bureau of Water Quality Control, 1978, p. 6). The amount of water consumed by humans, and therefore the amount of fluoride ingested, increases as air temperatures increase; as a result, the maximum concentration for fluoride decreases as air temperatures increase. In the Tonto basin area the annual average maximum daily air temperature is about 76°F, and the maximum concentration for fluoride is 1.6 mg/L. Fluoride concentrations in ground water were 0.1 to 1.3 mg/L, but most samples contained less than 0.7 mg/L.

An exception to the above range in chemical-quality values must be noted. A well in sec. 10, T. 6 N., R. 10 E., was drilled to a depth of 207 ft in the upper part of the basin fill, and the water contained unacceptable amounts of dissolved solids, fluoride, and arsenic. The water sample contained 3,940 mg/L of dissolved solids and 3.0 mg/L of fluoride. The arsenic concentration was 0.21 mg/L, which is more than four times the maximum concentration of 0.05 mg/L for arsenic in public water supplies (Bureau of Water Quality Control, 1978, p. 5). The well was abandoned. (See Schumann and Thomsen, 1972, p. 34.)

The hydrologic data on which this map is based are available, for the most part, in computer-printout form and may be consulted at the Arizona Department of Water Resources, 99 East Virginia, Phoenix, and at U.S. Geological Survey offices in: Federal Building, 301 West Congress Street, Tucson, and Valley Center, Suite 1880, Phoenix. Material from which copies can be made at private expense is available at the Tucson and Phoenix offices of the U.S. Geological Survey.

SELECTED REFERENCES

Bureau of Water Quality Control, 1978, Drinking water regulations for the State of Arizona: Arizona Department of Health Services duplicated report, 39 p.

Feth, J. H., and Hem, J. D., 1963, Reconnaissance of headwater springs in the Gila River drainage basin, Arizona: U.S. Geological Survey Water-Supply Paper 1619-H, 54 p.

National Academy of Sciences and National Academy of Engineering, 1973 [1974], Water quality criteria, 1972: U.S. Environmental Protection Agency Report, EPA-R3-73-033, 594 p.

Schumann, H. H., and Thomsen, B. W., 1972, Hydrologic regimen of lower Tonto Creek basin, Gila County, Arizona—a reconnaissance study: Arizona Water Commission Bulletin 3, 39 p.

Sellers, W. D., and Hill, R. H., eds., 1974, Arizona climate 1931-1972: Tucson, University of Arizona Press, 616 p.

U.S. Environmental Protection Agency, 1976 [1978], Quality criteria for water: U.S. Environmental Protection Agency publication, 256 p.

__________1977a, National interim primary drinking water regulations: U.S. Environmental Protection Agency Report, EPA-570/9-76-003, 159 p.

__________1977b, National secondary drinking water regulations: Federal Register, v. 42, no. 62, March 31, 1977, p. 17143-17147.

U.S. Geological Survey, 1980, Water resources data for Arizona, water year 1979: U.S. Geological Survey Water-Data Report AZ-79-1, 614 p.

Wilson, E. D., Moore, R. T., and Peirce, H. W., 1959, Geologic map of Gila County, Arizona: Arizona Bureau of Mines map, scale 1:375,000.

BASE FROM U.S. GEOLOGICAL SURVEY
MESA 1:250,000, 1954-69 AND
HOLBROOK 1:250,000, 1954-70

GEOLOGY GENERALIZED FROM WILSON, MOORE, AND PEIRCE (1959)
AND SCHUMANN AND THOMSEN (1972)

MAP SHOWING GROUND-WATER CONDITIONS IN THE TONTO BASIN AREA, GILA COUNTY, ARIZONA–1979

BY
E. E. DENIS