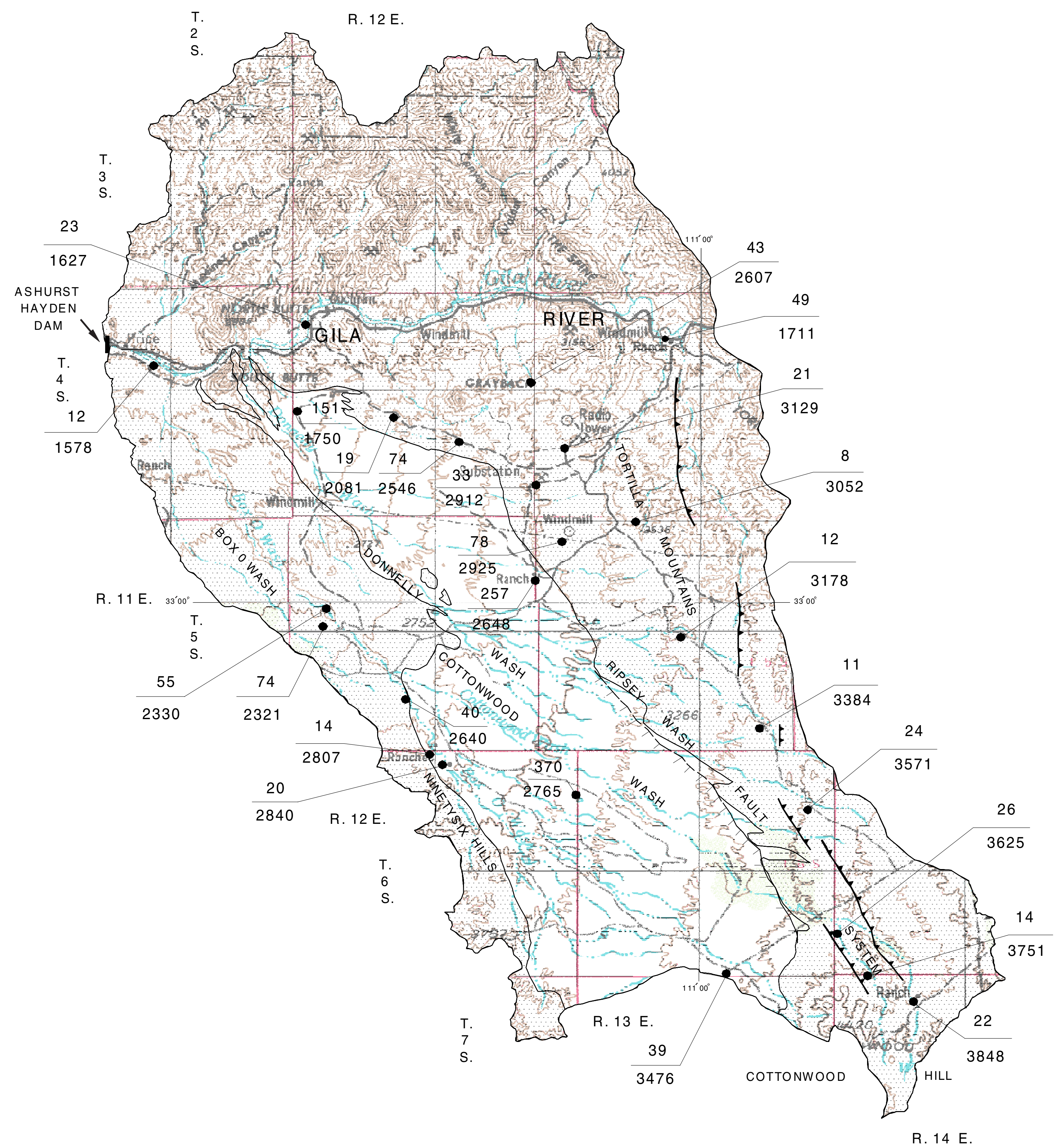


SCALE

5 0 1 5 MILES

EXPLANATION

43
2607

WELL IN WHICH DEPTH TO WATER WAS MEASURED IN 1996 -1997. Upper number, 43, is depth to water in feet below land surface. Lower number, 2607, is the altitude of the water level in feet. Datum is the National Vertical Geodetic Datum of 1927

ALLUVIAL BASIN FILL - Consists of semi-consolidated to poorly consolidated sand, silt, clay, gravel and conglomerate

HARDROCK (GRANITIC, METAMORPHIC, VOLCANIC OR CONSOLIDATED SEDIMENTARY ROCK)- Water may occur in weathered or fractured zones, joint systems, or fluvial deposits in overlying bedrock

FAULTLINE SCARP

THRUST FAULT

BOUNDARY OF THE DONNELLY WASH BASIN

INTRODUCTION

Location and Boundaries Donnelly Wash basin is a small rectangular shaped basin with an area of about 293 square miles. It is located approximately 12 miles east of Florence, Arizona in the central portion of the southeastern quarter of the state and is part of the Mexican Highland section of the Basin and Range province. The basin is bounded by the Tortilla Mountains on the east, Cottonwood Hill on the south and Ninetysix Hills on the southwest. The western boundary is an unnamed ridge on the west side of Box O Wash. The north side of the basin is bounded by about 35 miles of ridgeline.

Drainage and Land Form A 16-mile reach of the Gila River flows from east to west and is the major drainage feature of the basin. Prior to the completion of Coolidge Dam in 1928, located approximately 45 miles upstream of the basin, the river was naturally perennial. Flows in the river are now regulated at the Dam, by the San Carlos Project, under the Gila River Decree of 1935.

On the north side of the Gila River an area of about 80 square miles of rugged but unnamed mountains drain into the river. On the south side of the Gila River, Donnelly Wash and Box O Wash, with its major tributary Cottonwood Wash, are the two major drainage systems of the basin. Both are ephemeral and run roughly parallel to each other from southeast to northwest before draining into the river approximately 4 miles upstream of Ashurst-Hayden Dam.

Land surface altitudes range from 1,580 feet above mean sea level at Ashurst-Hayden Dam where the Gila River exits the basin, to 4,420 feet at Cottonwood Hill at the southern end of the basin. The average surface gradient of the alluvium drained by Donnelly Wash and Cottonwood Wash is about 2 percent (a drop of about 105 feet per mile) and 1.5 percent (80 feet per mile), respectively.

Climate The climate of Donnelly Wash basin is semi-arid, typified by mild winters and hot summers. There are no temperature or precipitation stations within the basin. The nearest stations are at Florence, approximately 12 miles to the west and Winkleman, approximately 6 miles east of the Tortilla Mountains. Average daily maximum temperatures during July, the hottest month of the year, range from 106°F at Florence to 103°F at Winkleman. Average daily minimum temperatures during January, the coldest month, range from 36°F to 29°F, respectfully. Average annual precipitation ranges from about 10 inches at Florence to about 14 inches at Winkleman (Sellers, et al. 1985, pg.88, 90-91, 93, 113 and 115).

Land Use There are no towns or communities in the basin. The only active enterprise is cattle ranching. The basin is also used for recreational activities such as prospecting, camping, hunting and fishing. Only about 12 percent of the basin is privately owned, while state trust lands make up about 50 percent and the remaining 38 percent is under federal management.

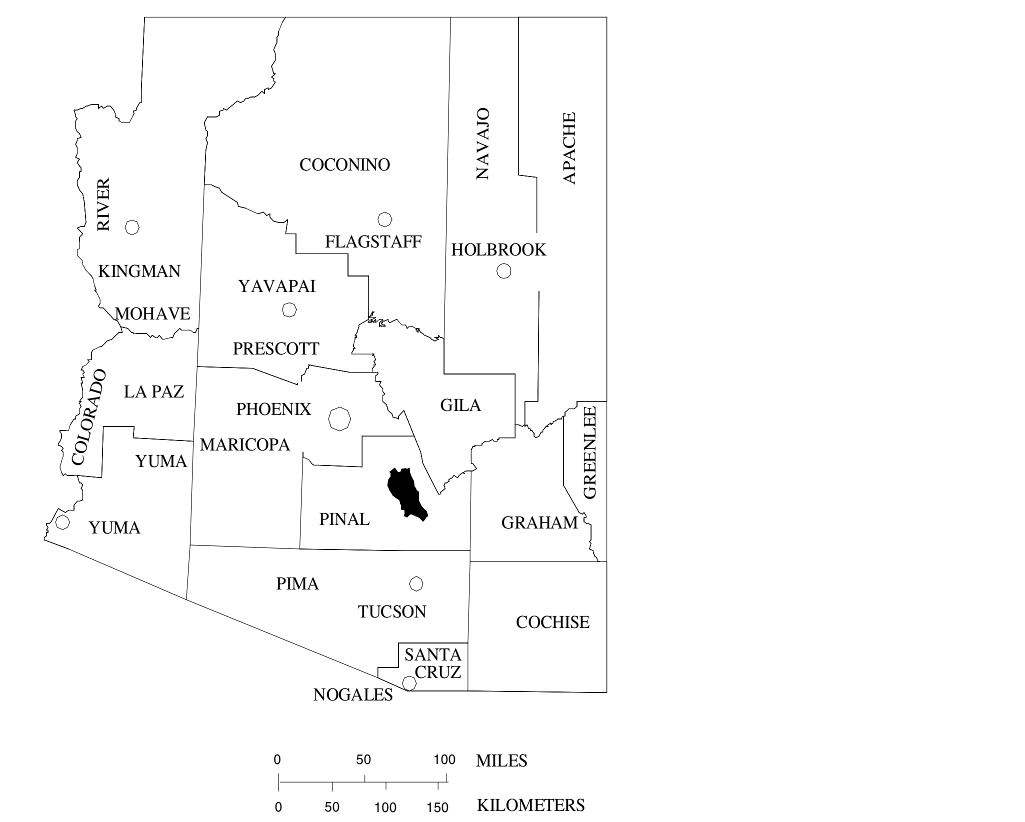
GEOLOGY

Hardrock Formations The oldest rock formations in the basin are the Pinal Schist of older Precambrian age and the intrusive Ruin Granite of younger Precambrian age (Krieger, 1974a, p. 1.). The Pinal Schist crops out primarily in the Ninetysix Hills area along the southwestern rim of the basin. The Ruin Granite crops out extensively along the western face of the Tortilla Mountains and Cottonwood Hill.

Further to the west of the Tortilla Mountains a large Paleocene pluton, the Tea Cup Granodiorite, intruded the Ruin Granite. Grayback Mountain is the primary outcrop feature of this pluton (Krieger, 1974c, p. 1). Intrusive rocks of Precambrian to mid-Tertiary age are abundant near the northwestern edge of the alluvial basin fill, where the Box O and Donnelly Washes enter the Gila River (Richard and Spencer, 1997, p. 12). Numerous dikes and sills intrude the hardrock formations throughout the basin.

Alluvial Basin Fill Along the axis of the basin the alluvial basin fill overlies the Ruin Granite and the Tea Cup Granodiorite and is primarily made up of decomposed bedrock and materials washed down from the surrounding highlands. This process is ongoing as can be seen on the eastern edge of the alluvial basin fill at the base of the Tortilla Mountains. There, the hardrock is covered with a relatively thin layer of soils and gravels which make up a shallow veneer overlying pediments and terraces (Cornwall and Krieger, 1975a, p.1). Hackberry (1993, p.4) has identified this surficial geology (Holocene) as the Grayback-Fan Complex.

The alluvial basin fill, formerly called Gila Conglomerate (Gilbert, 1875), consists of two layers: a thin upper unit unconformably overlaying a thicker lower unit. The upper layer, the Big Dome Formation (Krieger, 1974a, p.3), is not more than a few hundred feet thick and is of Quaternary and late Tertiary age (mid-Pliocene). The materials of this layer consist of poorly consolidated clays, silts, sands and gravels. The lower unit, known as the San Manuel Formation, may reach a maximum thickness of 2,000 feet and is of mid-Tertiary age (Miocene). The materials of this layer consist of coarse grained alluvial and lacustrine sandstones and conglomerates. The contact between the 2 units is not well defined but where they are exposed, the upper unit is yellower in color and more fine grained (Krieger, 1974a, p.3, Naruk and others, 1986, p.1,013).



INDEX MAP SHOWING AREA OF REPORT (SHADED)

Structural Formation Unlike most of the basins of the Basin and Range province which were formed by thrust block faulting, some of Donnelly Wash basin is thought to be originally formed by extentional faulting of tilted crustal blocks between 16 and 25 million years ago (Howard and Frost, 1996, pg. 512). Evidence of this extentional faulting can be seen on the east face of the Tortilla Mountains where strata of Precambrian sedimentary rocks of the Apache group lie vertically rather than horizontally. Subsequent normal faulting on the west side of the Tortilla Mountains, the Ripsey Wash Fault system, created a basin depression which, when filled in by erosion, formed the present alluvial deposition. The fill is very thin on the western edge of the basin and gradually increases to as much as 2,000 feet thick as it approaches the Ripsey Wash fault system on the eastern side of the alluvium (Krieger, 1974a, p. 3, 1974b, p. 2., Naru and others 1986 p. 1013).

GROUNDWATER OCCURRENCE

Alluvial Basin Fill The alluvial basin fill forms the primary water-bearing unit of the basin but covers only about 30 percent of the overall basin. The remaining 70 percent of the basin consist of hardrock which surrounds and underlies the basin fill.

Hardrock Groundwater occurrence in the hardrock areas of the basin constitutes a secondary water-bearing source. Most of the wells in the hardrock are located along stream channels which cut through the hardrock. Groundwater also occurs in fissures, fractures, weathered zones and mine shafts.

Groundwater Movement and Storage In general, groundwater movement in the Donnelly Wash basin follows the surface-water drainage. Groundwater moves from the mountain fronts and higher elevations toward the center of the basin and moves in a northwesterly direction along the axis of the basin. Freethey and Anderson(1986, map 3) estimate that the total volume of recoverable groundwater from the basin to a depth of 1,200 feet below the land surface is less than one 1,000,000 acre feet.

Recharge Groundwater in the Donnelly Wash basin alluvium is recharged by mountain front runoff from the surrounding hardrock and by streambed infiltration. Direct recharge from precipitation seepage is minimal. Desert flora absorbs most of the precipitation before it can percolate down to the aquifer. Subsequent evapotransporation from the flora returns this moisture to the atmosphere.

Discharge Groundwater is naturally discharged from the alluvium into the Gila River as underflow from the Box O Wash and Donnelly Wash. Freethey and Anderson(1986, map 3) estimate an average of 4 thousand acre feet of inflow and outflow through the aquifer of the basin. Discharge from pumpage is minimal as there are no large capacity wells in the basin. Domestic and stock well are the primary sources of pumpage discharge.

Static Water-Level Conditions Static water-level measurements were collected from the Donnelly Wash basin by the Arizona Department of Water Resources in 1996 and 1997. Depth to groundwater varies from approximately 150 feet in the northern end of the alluvium to 256 feet in the center and to about 370 feet in the southern portion of the alluvium. Water levels are shallower in wells located in the hardrock areas, with depths to groundwater ranging from 12 to 75 feet, where small amounts of groundwater are present as described earlier.

MESA, AZ, 1954, REV. 1978, 1:250,000.
TUCSON, AZ., 1956, REV. 1977, 1:250,000

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**MAPS SHOWING GROUNDWATER CONDITIONS IN THE DONNELLY WASH BASIN
PINAL COUNTY, ARIZONA—1996 - 1997**

**BY
ANDREW OVERBY**

These hydrologic maps are available upon request from the ADWR BOOKSTORE of Water Resources 500 North Third Street Phoenix, Arizona 85004-3921. The hydrologic data on which these maps are based are available, for the most part, in computer-printout and may be consulted at the Department of Water Resources and at the U.S. Geological Survey offices located at 520 N. Park Ave., Suite 221,Tucson, Arizona 85719, and 1545 West University, Tempe, Arizona 85281

PREPARED IN COOPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY

ARIZONA DEPARTMENT OF WATER RESOURCES

SCALE

5 0 1 5 MILES

EXPLANATION

1420 / 1.2 — WELL IN WHICH WATER WAS SAMPLED IN 1996 – 1997 Upper number, 1420, is specific conductance in microsiemens per centimeter at 25º C. Lower number, 1.2 is the fluoride concentration in milligrams per liter

1830 — SPRING—Number, 1830, is the altitude of the spring in feet, Datum is the National Vertical Geodetic Datum of 1927

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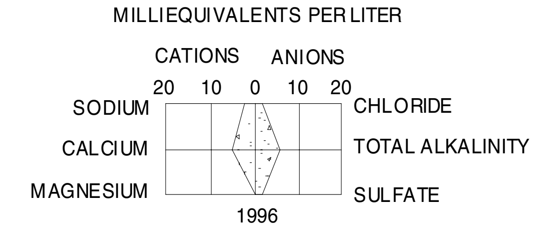
FAULTLINE SCARP

THRUST FAULT

BOUNDARY OF THE DONNELLY WASH BASIN

STIFF DIAGRAM—Shows major chemical constituents in milliequivalents per liter. The diagrams are in a variety of shapes and sizes, providing a means of comparing, correlating, and characterizing similar or dissimilar types of water. 1996, below diagram, indicates year in which sample was collected.

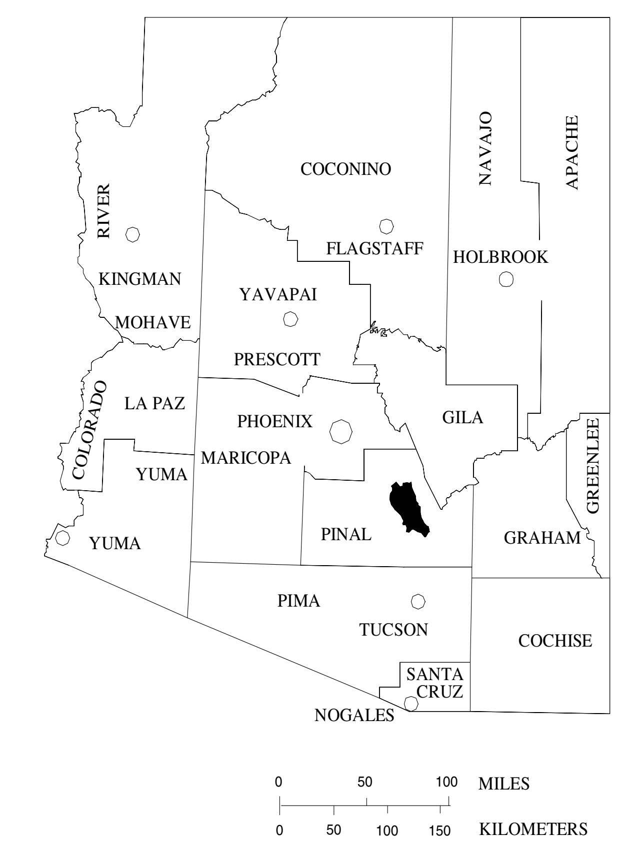


WATER QUALITY

Water Quality The Arizona Department of Water Resources collected 11 water samples from the Donnelly Wash basin during the summer of 1996 and 1997. The samples were analyzed for specific-conductance, pH, fluoride, temperature, ion concentration and metal content. Specific-conductance values ranged from 425 to 830 microsiemens per centimeter(mS/cm) in the alluvium and from 515 to 1430 mS/cm in the hardrock, except for a spring in Section 8, Township 4 South, Range 12 East, which had a conductance value of 4250 mS/cm. Dissolved-solid concentration may be approximated by multiplying specific-conductance values by 0.6, which is the approximate ratio of dissolved solids in milligrams per liter(mg/L) to specific-conductance concentrations in mS/cm at 25°C. The U.S. Environmental Protection Agency(1988, p.14) has established the secondary maximum concentration levels(SMCL) for total dissolved solids at 500 mg/L (approximately equivalent to 833 mS/cm). SMCL's are guidelines only and are not enforceable standards. SMCL's are based on aesthetic quality of water such as taste, odor and color. Water with levels above the SMCL's are not necessarily a health risk.

Fluoride levels ranged form 0.3 to 0.7 mg/L in the alluvium and from 0.2 to 1.2 mg/L in the hardrock, except for the spring in Section 9, Township 4 South, Range 13 East, which had a fluoride level of 13 mg/L. Arizona has established a maximum contaminant level of 4.0 mg/L for fluoride (Arizona Department of Environmental Quality, 1991, p.26).

The detailed water analyses are shown on the map in the form of Stiff diagrams. These diagrams represent the ionic content of the samples and are used to compare and contrast water quality analyses. They indicate the principle ions of sodium, chloride, calcium, bicarbonate (expressed as total alkalinity), magnesium and sulfate.



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