

INTRODUCTION

The northern part of the Chinle area includes about 3,000 mi<sup>2</sup> in northeastern Arizona and is entirely in the Navajo Indian Reservation. The main source of water is from the several aquifers that are made up of one or more formations. The aquifers are stacked one on the other and generally are not hydraulically connected; the composite stratigraphic column indicates the relative position of the formations. The main water-bearing units are the C, N, and D aquifers and the alluvium. The geologic structure and topographic relief preclude a uniform depth to water in the area; therefore, recommended drilling depths should be determined on an individual site basis. Ground-water development has been slight and has been mainly for public, domestic, and livestock supplies. In 1975 about 1,000 acre-ft of ground water was withdrawn from the aquifers, and the water levels measured in 1976 probably are similar to those in 1951-76—the period for which data were used to compile these maps.

The hydrologic data on which these maps are based are available, for the most part, in computer-printout form for consultation at the Arizona Water Commission, 222 North Central Avenue, Suite 800, Phoenix, and at U.S. Geological Survey offices in: Federal Building, 301 West Congress Street, Tucson; Valley Center, Suite 1880, Phoenix; and 2255 North Gemini Drive, Building 3, Flagstaff. Material from which copies can be made at private expense is available at the Tucson, Phoenix, and Flagstaff offices of the U.S. Geological Survey.

C AQUIFER

The C aquifer underlies the entire northern part of the Chinle area and consists of the Shinarump Member of the Chinle Formation, the De Chelly Sandstone, and the uppermost beds of the Chinle Formation. The aquifer, which is composed of a series of conglomerate, sandstone, and siltstone beds, crops out in the south-eastern part of the area. The depth to the top of the aquifer generally increases from south to north; near Red Mesa, it is about 1,500 ft below land surface. The aquifer is about 1,500 ft thick in the Black Mountain area and thins to less than 500 ft in Canyon de Chelly, where erosion has removed the units that overlie the Supai Formation.

Ground water is under confined conditions along the west and east edges and probably in the northern part of the area; no water wells penetrate the aquifer in the northern part of the area. In the Many Farms and Round Rock areas wells flow at the land surface. The aquifer is partly saturated and ground water is under unconfined or water-table conditions in the south-eastern part of the area, where the aquifer receives its recharge and the overlying Chinle Formation has been removed by erosion. Ground water moves to the west and northwest from the recharge area.

The C aquifer yields small to moderate quantities of water to wells. Well yields range from less than 10 to more than 125 gal/min and depend on the saturated thickness of the aquifer. The water is of suitable chemical quality for most uses. In general, the water contains less than 500 mg/L (milligrams per liter) of dissolved solids and has a calcium bicarbonate composition. The fluoride concentration ranges from 0.2 to 5.9 mg/L; however, fluoride concentrations generally are equal to or less than the recommended average optimum concentration in drinking water (U.S. Public Health Service, 1962). The recommended average optimum fluoride concentration for a water supply differs according to the annual average maximum daily air temperatures. In the northern part of the Chinle area the annual average maximum daily air temperature is about 68°F, and the optimum concentration of fluoride in drinking water is 0.5 mg/L. The presence of concentrations greater than 1.8 mg/L is grounds for rejection of the water for public supply.

N AQUIFER

The N aquifer underlies the north half and the west edge of the area and consists of the Navajo Sandstone, the Kayenta Formation, and the Lukachukai Member of the Wingate Sandstone. The aquifer is composed of fine-grained sandstone and siltstone and is about 700 ft thick near Red Mesa, 500 ft thick near Red Rock, 1,100 ft thick near Rock Point, and 800 ft thick near Lohali Point.

In most of the area the aquifer is only partly saturated, and ground water occurs under unconfined conditions. Near Lohali Point, the aquifer is completely saturated, and ground water occurs under confined conditions. The N aquifer yields small quantities of water to wells. Well yields range from less than 5 to as much as 50 gal/min and depend on the saturated thickness of the sandstone bed penetrated by the well. In general, the water contains less than 500 mg/L of dissolved solids and has a sodium or calcium bicarbonate composition. The fluoride concentration ranges from 0.0 to 2.2 mg/L, but generally is equal to or less than the recommended average optimum concentration in drinking water.

SELECTED REFERENCES

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Irwin, J. H., Stevens, P. R., and Cooley, M. E., 1971, Geology of the Paleozoic rocks, Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah: U.S. Geol. Survey Prof. Paper 521-C, 32 p.

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O'Sullivan, R. B., Repenning, C. A., Beaumont, E. C., and Page, H. G., 1972, Stratigraphy of the Cretaceous rocks and the Tertiary Ojo Alamo Sandstone, Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah: U.S. Geol. Survey Prof. Paper 521-E, 65 p.

Repenning, C. A., Cooley, M. E., and Akers, J. P., 1969, Stratigraphy of the Chinle and Moenkopi Formations, Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah: U.S. Geol. Survey Prof. Paper 521-B, 34 p.

U.S. Public Health Service, 1962, Drinking water standards, 1962: U.S. Public Health Service Pub. 956, 61 p.

EXPLANATION

5800 ————— POTENTIOMETRIC CONTOUR, C AQUIFER—Shows altitude at which water level would have stood in tightly cased well. Dashed where approximately located. Contour interval 200 feet. Datum is mean sea level.

5000 ————— POTENTIOMETRIC CONTOUR, N AQUIFER—Shows altitude at which water level would have stood in tightly cased well. Contour interval 200 feet. Datum is mean sea level.

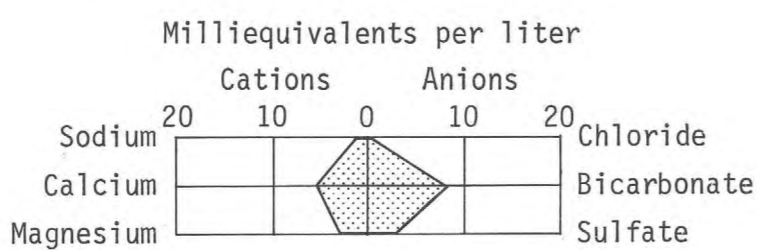
11Y-109  
166M  
5592  
822  
0.7

WELL THAT PENETRATES THE C AQUIFER—First entry, 11Y-109, is well number or name. Second entry, 166M, is depth to water in feet below land surface (R, depth to water reported; N, depth to water measured; F, flowing well). Third entry, 5599, is altitude of the water level in feet above mean sea level. Fourth entry, 822, is specific conductance in microhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in water). Fifth entry, 0.7, is fluoride concentration in milligrams per liter.

2K-218  
216M  
5084  
212  
0.2

WELL THAT PENETRATES THE N AQUIFER—First entry, 2K-218, is well number. Second entry, 216M, is depth to water in feet below land surface (R, depth to water reported; N, depth to water measured). Third entry, 5084, is altitude of the water level in feet above mean sea level. Fourth entry, 212, is specific conductance in microhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in water). Fifth entry, 0.2, is fluoride concentration in milligrams per liter.

CHEMICAL-QUALITY PATTERN DIAGRAM—Shows major chemical constituents in milliequivalents per liter. The pattern is in a variety of shapes and sizes, which provides a means of comparing, correlating, and characterizing similar or dissimilar types of water. The pattern tends to maintain its characteristic shape as the sample becomes dilute or concentrated, and the pattern size varies in proportion to the variation in dissolved solids.



APPROXIMATE AREAL EXTENT OF THE N AQUIFER

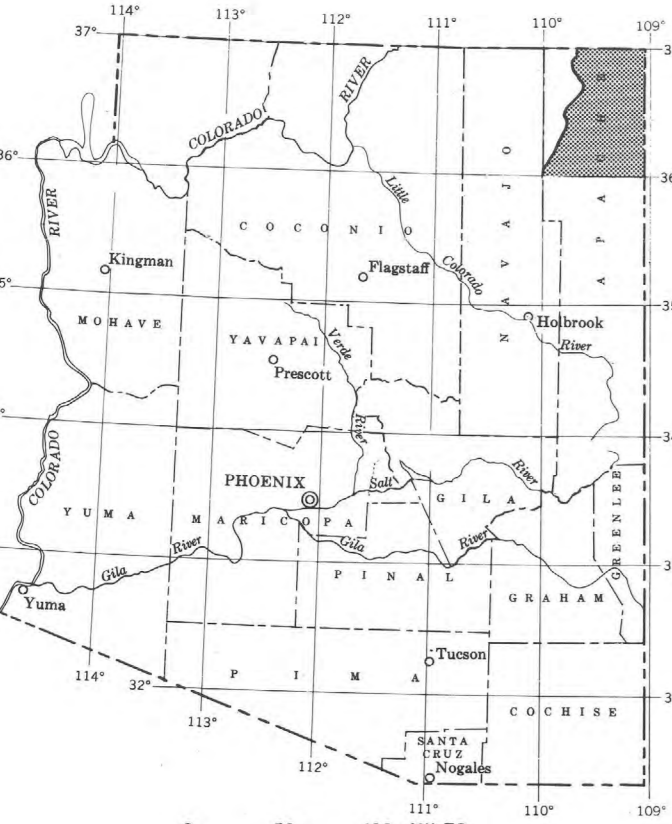
APPROXIMATE BOUNDARY BETWEEN CONFINED AND UNCONFINED CONDITIONS IN THE C AQUIFER

APPROXIMATE BOUNDARY BETWEEN CONFINED AND UNCONFINED CONDITIONS IN THE N AQUIFER—Queried where uncertain

GENERALIZED DIRECTION OF GROUND-WATER FLOW

ARBITRARY BOUNDARY OF GROUND-WATER AREA

Composite stratigraphic column for the northern part of the Chinle area	
System	Formation or member
Tertiary	Chinle Sandstone
	Shinarump Member
	De Chelly Sandstone
Cretaceous	Navajo Sandstone
	Kayenta Formation
	Lukachukai Member
Jurassic	Navajo Sandstone
	Kayenta Formation
	Lukachukai Member
Jurassic and Triassic	Navajo Sandstone
	Kayenta Formation
	Lukachukai Member
Permian	Navajo Sandstone
	Kayenta Formation
	Lukachukai Member



INDEX MAP SHOWING AREA OF REPORT (SHADED)

