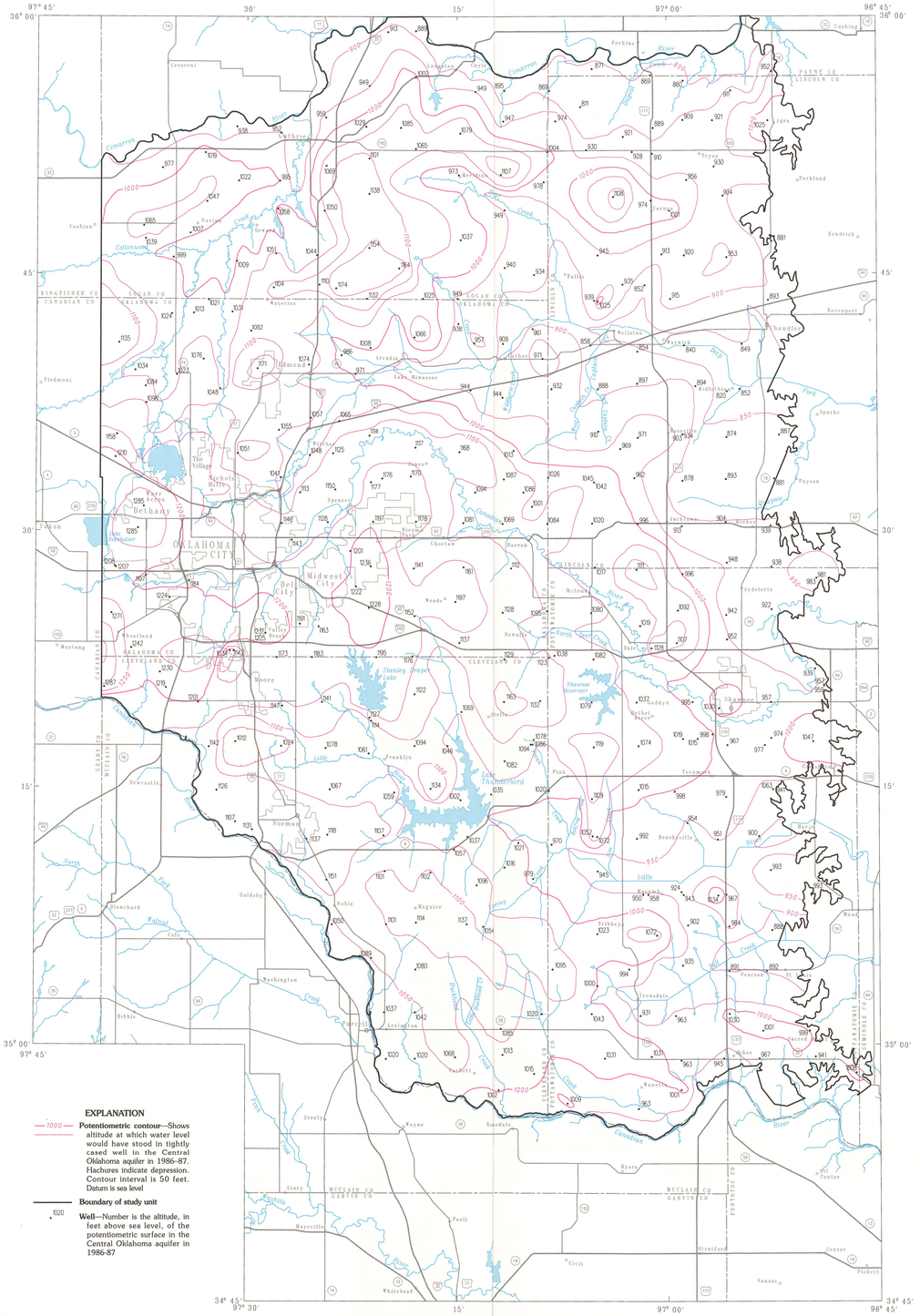


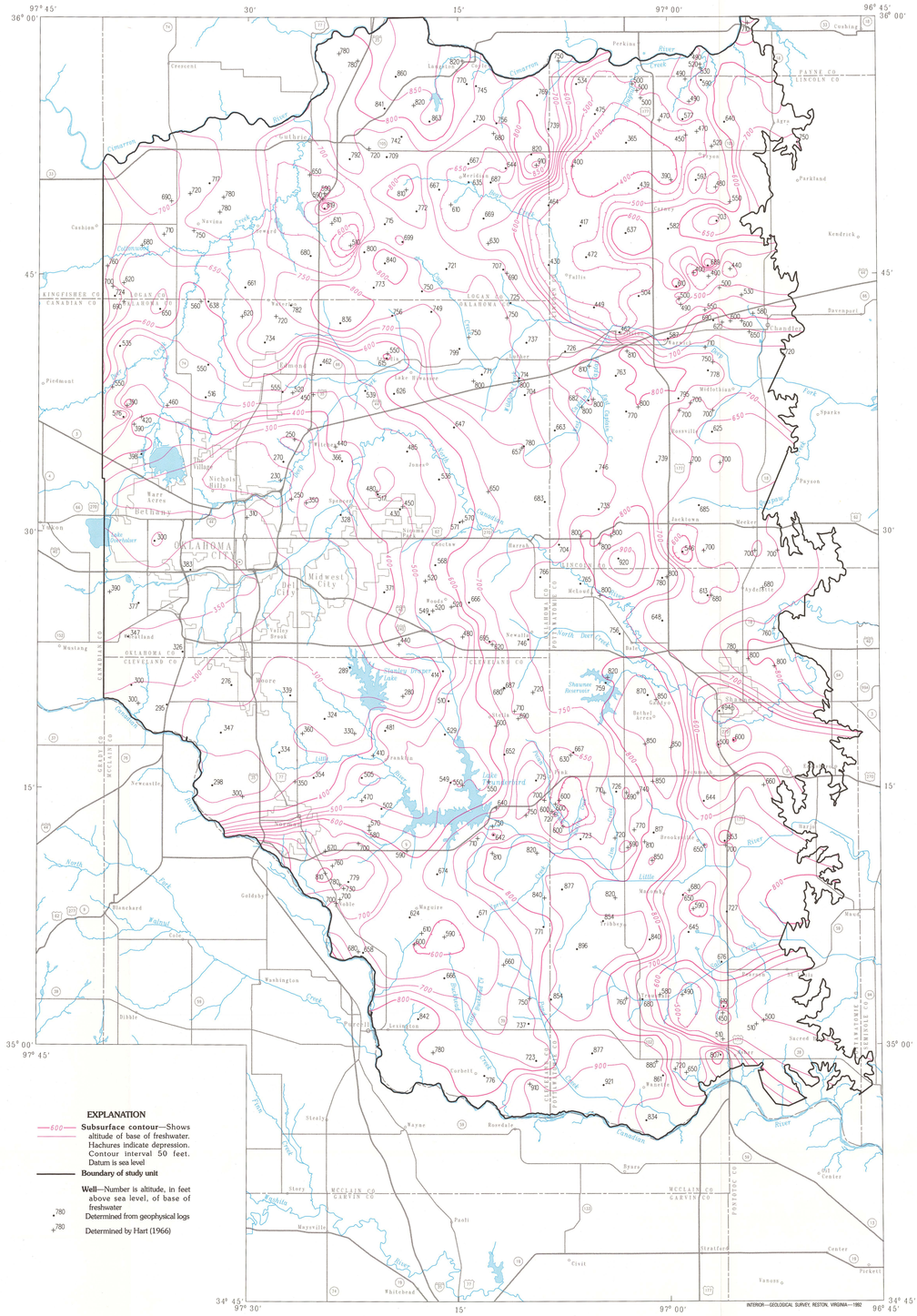
EXPLANATION

1000 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased well in the Central Oklahoma aquifer in 1986–87. Hachures indicate depression. Contour interval is 50 feet. Datum is sea level

Boundary of study unit

1020 **Well**—Number is the altitude, in feet above sea level, of the potentiometric surface in the Central Oklahoma aquifer in 1986–87

Figure 2. Water table in the Central Oklahoma aquifer study unit, 1986–87



EXPLANATION

600 — **Subsurface contour**—Shows altitude of base of freshwater. Hachures indicate depression. Contour interval 50 feet. Datum is sea level

Boundary of study unit

Well—Number is altitude, in feet above sea level, of base of freshwater
Determined from geophysical logs

780 Determined by Hart (1966)

Figure 3. Altitude of the base of fresh ground water

INTRODUCTION

This report was completed as part of one of the pilot studies of the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program. Beginning in 1986, the Congress appropriated funds for the U.S. Geological Survey to test and refine concepts for a NAWQA Program. The goals of the program are to:
(1) Provide a nationally consistent description of current water-quality conditions for a large part of the Nation's water resources,
(2) Define long-term trends (or lack of trends) in water quality, and
(3) Identify, describe, and explain, as possible, the major factors that affect the observed water-quality conditions and trends.
This information, which will be obtained on a continuing basis, would be made available to water managers, policy makers, and the public to provide an improved scientific basis for evaluating the effectiveness of water-quality management programs and for predicting the likely effects of contemplated changes in land-and water-management practices. A description of the concepts for a NAWQA Program is provided by Hirsch and others (1988).

The NAWQA Program is organized into study units based on previously defined hydrologic systems. The study units are large areas of a few thousand to several tens of thousands of square miles. Initially, seven project areas were selected as pilot studies to test and refine the assessment concept. The seven pilot study units include four that focus primarily on surface water and three that focus primarily on ground water. For surface water, the study units are major river basins; for ground water the study units are large parts of aquifers or aquifer systems.

The Central Oklahoma aquifer was selected for study in the pilot NAWQA Program because it is a major source for water supplies in central Oklahoma and because it has several known or suspected water-quality problems. These problems include: arsenic, chromium, and selenium concentrations in excess of public drinking-water standards; large gross alpha particle activity; contamination by synthetic organic compounds; and contamination by oil-field brines and drilling fluids. The aquifer also was chosen because it underlies large urban areas, and the effects of an urban environment on regional ground-water quality have not been studied extensively.

The objectives of the Central Oklahoma aquifer project are to: (1) Investigate regional ground-water quality throughout the aquifer, emphasizing the occurrence and distribution of potentially toxic substances in ground water, including trace elements, organic compounds, and radioactive constituents; (2) describe the relation of ground-water quality to hydrogeologic and other pertinent factors; and (3) provide a general description of the location, nature, and causes of selected water-quality problems within the study unit (Christenson and Parkhurst, 1987).

The Central Oklahoma aquifer project has four major components (Christenson and Parkhurst, 1987). The first component is the compilation and analysis of existing information. The second component is geohydrologic and geochemical investigations of the aquifer flow system. The third component is a regional water-quality sampling for a variety of inorganic, organic, and radioactive constituents that will produce a consistent set of data among all ground-water pilot projects. The fourth component is targeted water-quality sampling that will address, in more detail, some of the prominent water-quality problems in the aquifer.

The second component of the project, the geohydrologic and geochemical investigations of the aquifer flow system, is needed to provide background information for the water-quality assessment. The movement and fate of chemical constituents in ground water depend both on the ground-water flow system and the geochemical environment of the aquifer. The hydrogeologic maps presented in this report are an essential part of the geohydrologic and geochemical investigations.

Purpose and Scope

This report presents hydrogeologic maps of the Central Oklahoma aquifer. The maps were prepared by measuring water levels in wells during the winter of 1986 and 1987; examination of geophysical logs to determine the altitudes of the top of selected geologic units and the base of fresh ground water; and compilation of existing information on the stratigraphy of selected geologic units and the base of fresh ground water.

Acknowledgments

The authors are indebted to many people throughout the study unit for allowing access to their wells for the purpose of obtaining water-level measurements. The authors also would like to thank Engineering Enterprises, Incorporated, and especially Michael Gates, for allowing access to reports and geophysical logs that are the property of Engineering Enterprises, Incorporated, in Norman, Oklahoma.

HYDROGEOLOGY OF THE CENTRAL OKLAHOMA AQUIFER

Definition of the Central Oklahoma Aquifer

The Central Oklahoma aquifer underlies about 3,000 square miles of central Oklahoma (fig. 1), where the aquifer is used extensively for municipal, industrial, commercial, and domestic water supplies. The Central Oklahoma aquifer consists of those geologic units that yield substantial volumes of water to wells from the extensive, continuous ground-water flow system in Cleveland, Lincoln, Logan, Oklahoma, Payne, and Pottawatomie Counties. Ground water in this flow system originates as recharge from precipitation and circulates in alluvium and terrace deposits along major streams; in the Garber Sandstone and Wellington Formation; and in the Chase, Council Grove, and Admire Groups. Because most deep wells in central Oklahoma are completed in the Garber Sandstone and the Wellington Formation, the Central Oklahoma aquifer commonly has been referred to as the "Garber-Wellington aquifer," but this terminology is imprecise because: (1) The Garber Sandstone and Wellington Formation are not an aquifer outside of central Oklahoma due to a decrease in transmissivity; and (2) the water in the underlying Chase, Council Grove, and Admire Groups, and in the overlying alluvium and terrace deposits, is part of the same flow system. Therefore, the term "Central Oklahoma aquifer" is preferred. The major time-and rock-stratigraphic nomenclature of the Central Oklahoma aquifer are shown in table 1.

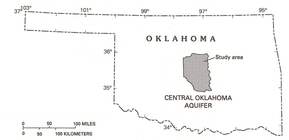


Figure 1. Location of the Central Oklahoma aquifer

Table 1. Major time-stratigraphic and geologic units in central Oklahoma

(Shaded geologic units are included in the central Oklahoma aquifer)

ERATHEM	SYSTEM	GEOLOGIC UNIT
Cenozoic	Quaternary	Alluvium
		Terrace deposits
Paleozoic	Permian	El Reno Group
		Hennessey Group
		Garber Sandstone
		Wellington Formation
		Chase Group
		Council Grove Group
		Admire Group
	Pennsylvanian	Vanoss Formation

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

Base from U.S. Geological Survey 1:100,000 quadrangles:
Ada, 1975; Bristow, 1976; Oklahoma City North, 1976;
Oklahoma City South, 1985; Pauls Valley, 1986; Shawnee, 1985.
Universal Transverse Mercator projection, Zone 14

SCALE 1:250 000

5 0 5 10 15 20 25 MILES
5 0 5 10 15 20 25 KILOMETERS

HYDROGEOLOGIC MAPS OF THE CENTRAL OKLAHOMA AQUIFER, OKLAHOMA

By
Scott C. Christenson, Robert B. Morton, and Benard A. Mesander

1992

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1992

For sale by U.S. Geological Survey, Map Distribution,
Box 25286, Federal Center, Denver, CO 80225