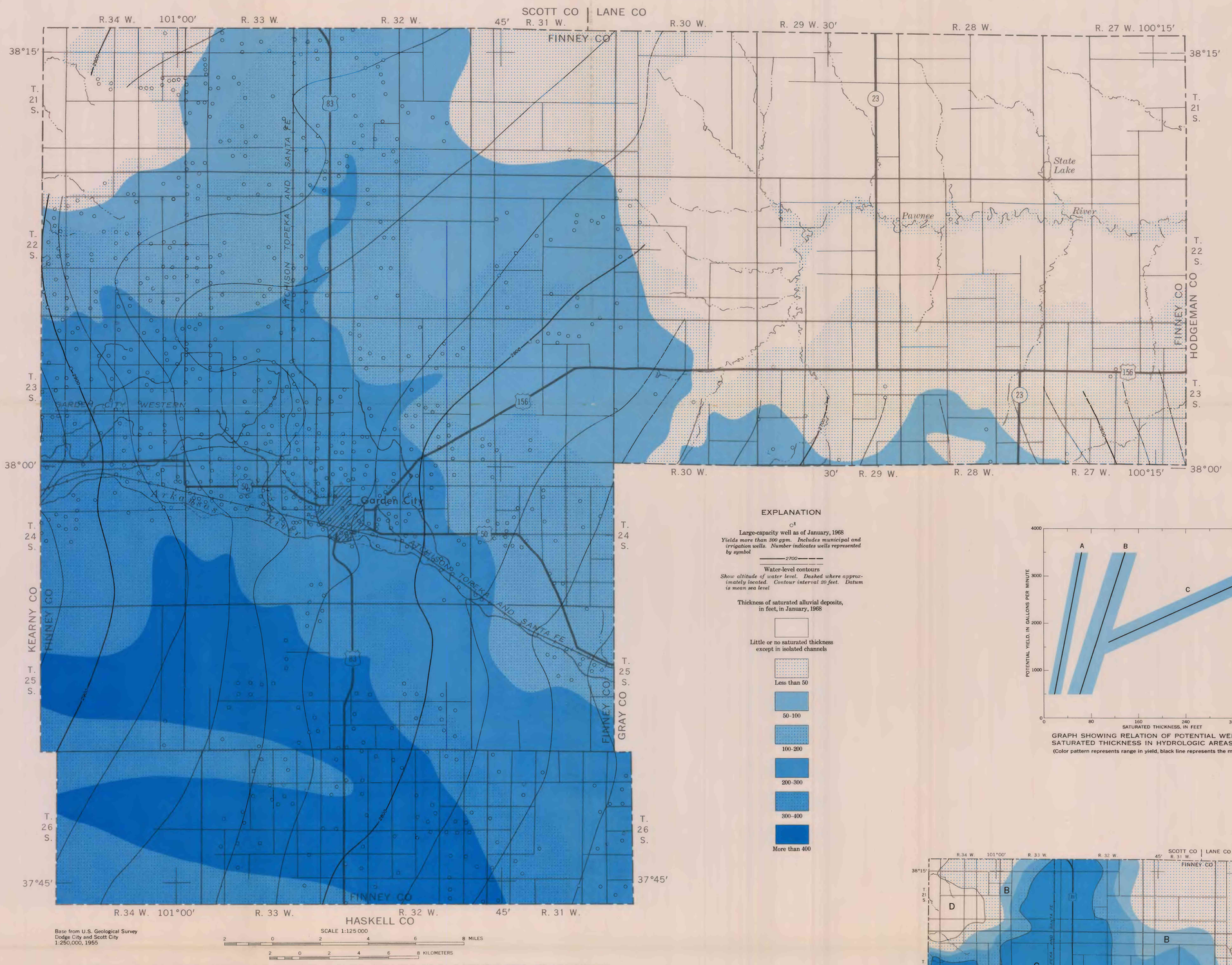
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
STATE GEOLOGICAL SURVEY OF KANSAS
KANSAS STATE DEPARTMENT OF HEALTH
KANSAS STATE BOARD OF AGRICULTURE

HYDROLOGIC INVESTIGATIONS
ATLAS HA-442 (SHEET 2 OF 3)

HYDROLOGY OF TERTIARY AND QUATERNARY DEPOSITS



EXPLANATION

c¹ Large-capacity well as of January, 1968
Yields more than 300 gpm. Includes municipal and irrigation wells. Number indicates wells represented by symbol

2700 Water-level contours
Show altitude of water level. Dashed where approximately located. Contour interval 20 feet. Datum is mean sea level

Thickness of saturated alluvial deposits, in feet, in January, 1968

- Little or no saturated thickness except in isolated channels
- Less than 50
- 50–100
- 100–200
- 200–300
- 300–400
- More than 400

Base from U.S. Geological Survey
Dodge City and Scott City
1:250,000, 1955

SCALE 1:125 000
2 0 2 4 6 8 MILES
2 0 2 4 6 8 KILOMETERS

HYDROLOGIC MAP SHOWING WATER-LEVEL CONTOURS, SATURATED THICKNESS, AND LOCATION OF LARGE-CAPACITY WELLS

GRAPH SHOWING RELATION OF POTENTIAL WELL YIELD TO SATURATED THICKNESS IN HYDROLOGIC AREAS A, B, AND C
(Color pattern represents range in yield, black line represents the mean-curve value)

HYDROLOGY OF TERTIARY AND QUATERNARY DEPOSITS

GENERAL FEATURES

Alluvial deposits of Tertiary and Quaternary age form the principal aquifer in Finney County. Because these deposits consist of lenticular beds of clay, silt, sand, and gravel, the ground water may be unconfined or semiconfined. The water-yielding capacity of the aquifer differs from one place to another owing to changes in lithology.

Ground-water movement is generally to the southeast as depicted by the water-level contours on the hydrologic map. Water enters the aquifer by underflow from the west and north, by precipitation within the county, by percolation of water applied for irrigation, and by infiltration from the rivers in times of above-normal runoff. Water is discharged by underflow on the east and south, by evapotranspiration where the water table is shallow, by seepage to the Arkansas and Pawnee Rivers, and by pumpage from wells. A large depression has developed in the water-level surface in the area surrounding the northwest corner of T. 23 S., R. 33 W., as a result of heavy pumping. Ground-water movement in this area is toward the center of the depression.

The saturated thickness, shown on the hydrologic map, represents the depth from the water level to the bedrock surface. The saturated thickness ranges from a few feet in the northeastern and northwestern parts of the county to over 400 feet in the southern part. The depth to water (minimum pumping lift) at a selected site can be approximated by subtracting saturated thickness from depth to bedrock.

A general relationship exists between well yield and saturated thickness. An analysis of sample logs, drillers' logs, well yields, and drillers' well-performance tests indicates that the aquifer may be subdivided into four general areas of similar well-yield characteristics. The relationship between potential well yield and saturated thickness for areas A, B, and C is illustrated in the graph and discussed in the following section. In area D (not shown on the graph) the saturated thickness and potential yield are negligible. The range of probable yield in gallons per minute, based on numerous well-performance tests, shows the magnitude of potential yield that may be obtained from a specific saturated thickness in each area. However, the actual yield of an individual well depends on the well construction, method of completion, and density of well development in the surrounding area (mutual well interference), as well as the lithology of the sediments at the well site. The map showing the potential ground-water yield to wells was drawn by comparing values shown on the map of saturated thickness with the mean-curve value for each hydrologic area, and was adjusted by available field data. Because wells are normally designed for irrigation requirements and pump efficiency rather than aquifer efficiency, the estimated values are useful chiefly as a general guide in planning. Test drilling is recommended for locating a large-capacity well to ensure the greatest yield for the least pumping lift.

Summary of well-performance tests

Hydrologic area	Description	Saturated thickness (feet)	Effective thickness (feet)	Effective thickness (percent of saturated thickness)	Aquifer potential: Yield (gpm)	Aquifer potential: Specific capacity (gpm per ft)
A	Shallow unconfined aquifer	11–53 38 avg.	11–53 37 avg.	98	650–2,660 1,900 avg.	71–85 75 avg.
B	Deep unconfined aquifer	42–110 77 avg.	42–110 70 avg.	92	510–2,450 1,260 avg.	13–46 25 avg.
C	Deep semiconfined aquifer	110–400 227 avg.	92–220 115 avg.	51	1,400–3,080 2,310 avg.	16–35 27 avg.

AQUIFER CHARACTERISTICS AND RELATION TO YIELD

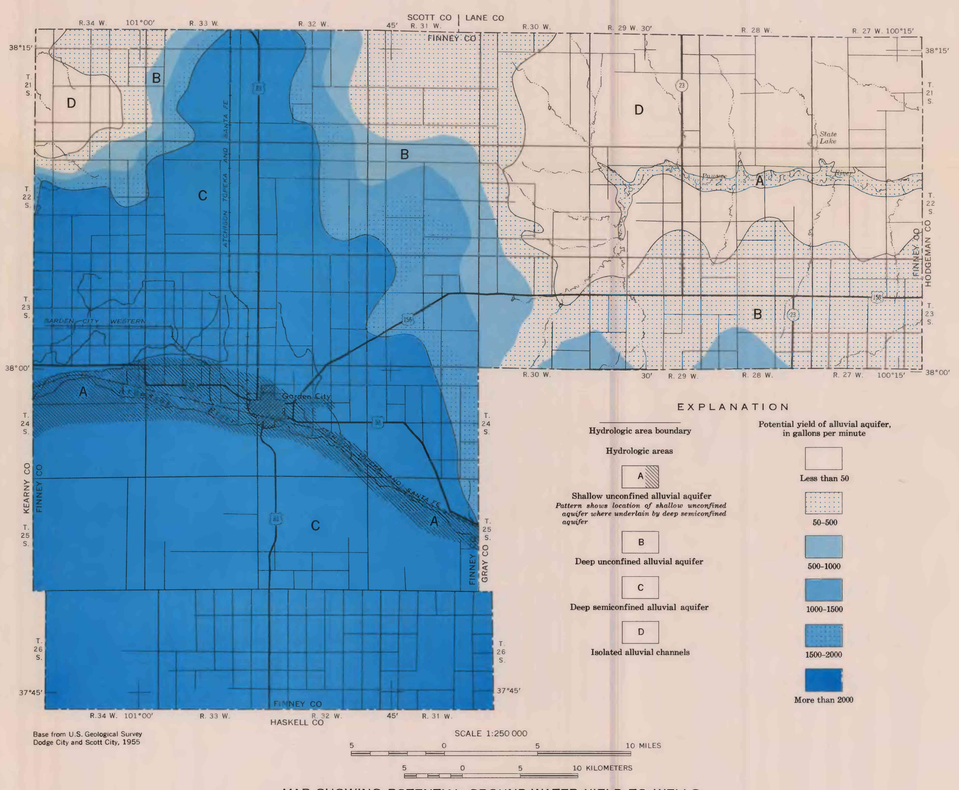
The characteristics and comparative yields of the major hydrologic areas in the alluvial aquifer are shown in the summary table and described below. The effective thickness (based on drillers' logs and general yield data from adjacent wells) is considered to be the part of the saturated material that yields most of the water. Data from well-performance tests were made comparable by calculating potential yield and specific capacity (gallons per minute per foot of drawdown) for an assumed drawdown in the pumped well equal to 70 percent of the effective thickness. The four general areas of similar hydrologic characteristics are described as follows:

AREA A—The shallow unconfined aquifer in the Arkansas River valley (patterned area) consists of coarse to very coarse-grained sediments, has an effective thickness of 98 percent, and yields large quantities of water (75 gpm) per foot of drawdown. In the Pawnee River valley, the aquifer consists of fine- to coarse-grained sediments, resulting in a reduced potential yield.

AREA B—The deep unconfined aquifer in the northern part of the county consists of stratified fine- to coarse-grained sediments, has an effective thickness of 92 percent, and yields an average of 25 gpm per foot of drawdown.

AREA C—The deep semiconfined aquifer in most of the western part of the county consists of stratified fine- to coarse-grained sediments interbedded with thick layers of fine-grained sediments, has an effective thickness of 51 percent, and yields an average of 27 gpm per foot of drawdown.

AREA D—The saturated part of the alluvial deposits is thin and yields little or no water to wells, except in isolated channels.



MAP SHOWING POTENTIAL GROUND-WATER YIELD TO WELLS

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1972—W71135

GROUND WATER IN FINNEY COUNTY, SOUTHWESTERN KANSAS

By
E. D. Gutentag, D. H. Lobmeyer, H. E. McGovern, and W. A. Long

1972