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DEPARTMENT OF NATURAL RESOURCES
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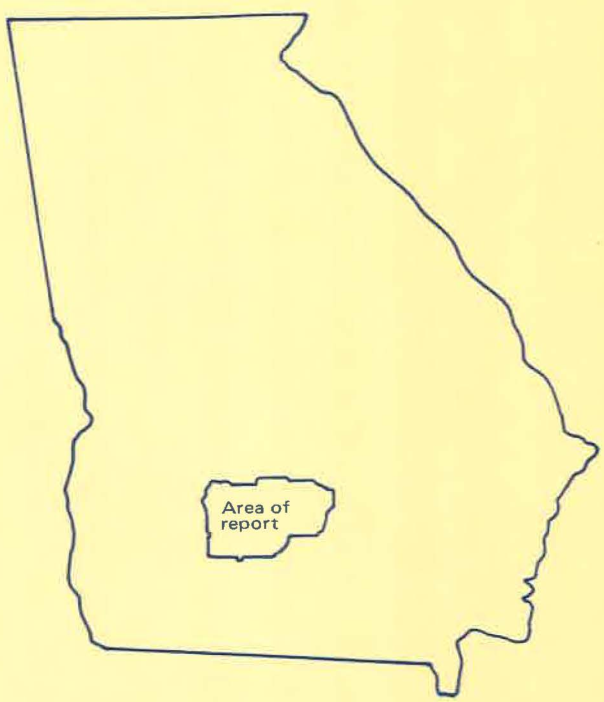
THE GEOHYDROLOGY OF BEN HILL, IRWIN, TIFT, TURNER, AND WORTH COUNTIES, GEORGIA

by

THOMAS W. WATSON



HYDROLOGIC ATLAS 2

THE GEOHYDROLOGY OF BEN HILL, IRWIN, TIFT, TURNER, AND WORTH COUNTIES, GEORGIA

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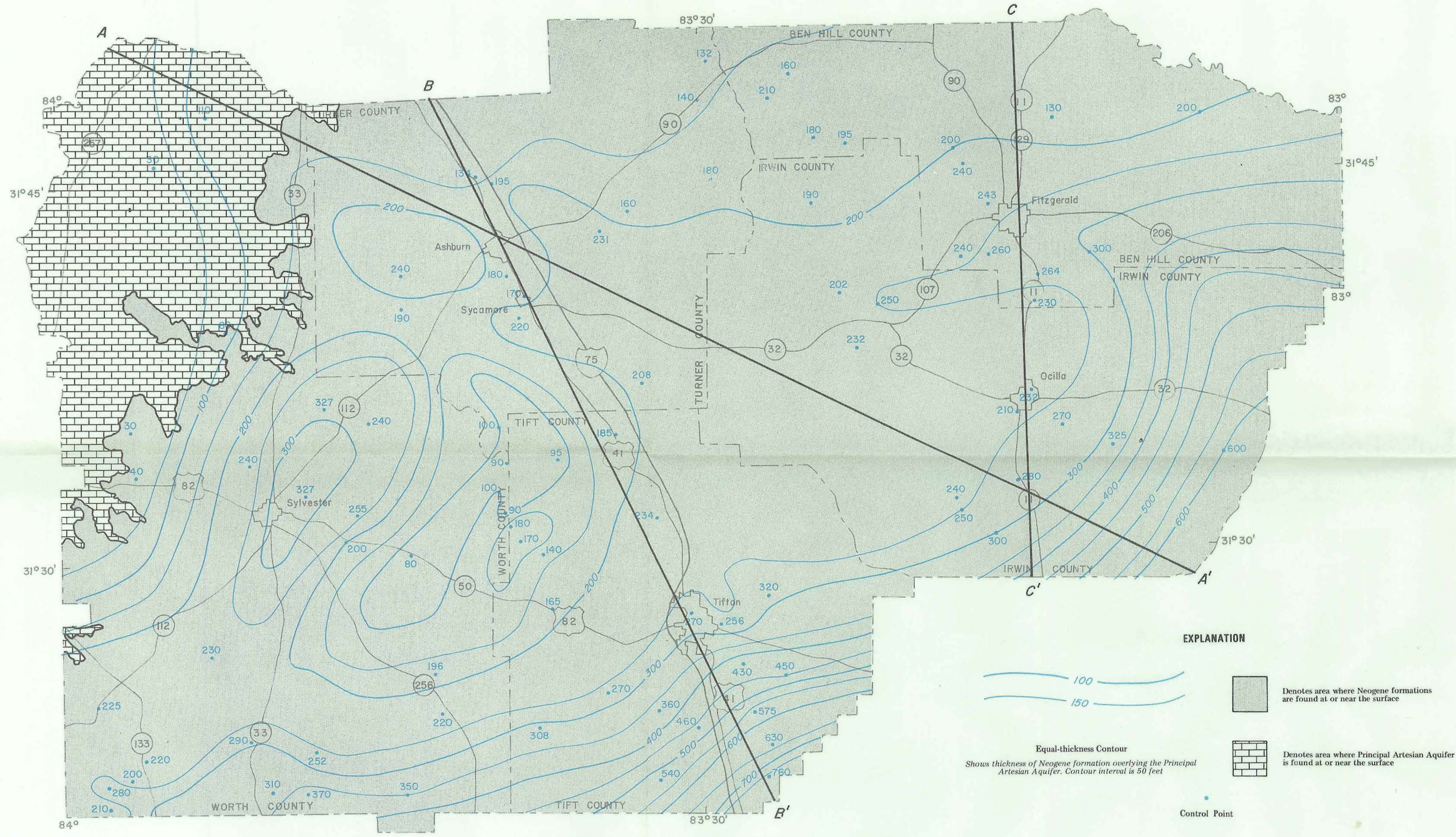
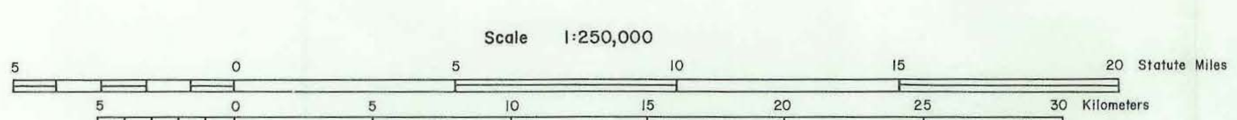
Figure 1. THICKNESS OF THE NEOGENE FORMATION





INTRODUCTION

Ben Hill, Irwin, Tift, Turner, and Worth Counties are located in southwest Georgia on the Coastal Plain. These five counties were selected for study because of their steady population growth in the past 10 years. New developments in agriculture, an abundance of good quality water, and an expanding transportation system promise to make this area of south Georgia one of continuing growth. Since ground water has been a significant aspect in the development of these counties, it is important to know how much water the aquifer is capable of producing, the quality of the water, and how to insure the availability of this resource for continued use.

GEOLOGY

The surface sediment of the study area is primarily a sand-clay mixture that varies in thickness from less than 50 feet to several hundred feet. This series of shallow, unconsolidated sediments was deposited in the last 25 million years, a period of time known as the Neogene. Examinations of these sediments indicate that most were deposited in ancient seas that once covered the area. On the land surface, it is generally difficult to distinguish the contact between different geologic formations, since physical weathering and erosion commonly cause the contacts between adjacent rock units to appear gradational. In the southeastern portions of Tift and Irwin Counties, these Neogene age sediments become quite thick, as indicated by the contour lines on Fig. 1 and the type of sediment changes at depth from a mixture of poorly sorted sand and clay to very fine-grained, fissile clays and silts.

The principal artesian aquifer, which supplies water to all municipal and industrial wells and most deep domestic wells in this area, underlies the unconsolidated sediments. This aquifer consists primarily of the Suwannee and Ocala Limestone and many lens-shaped bodies of Neogene limestone overlying the Suwannee.

The principal artesian aquifer can be thought of as a wedge, roughly 250 feet thick in the northwestern portion of the study area, thickening to more than 400 feet in the southeast. If it were possible to remove the Neogene sands and clays, exposing the top of the principal artesian aquifer, one would see a rather rugged landscape. The surface of the principal artesian aquifer has been extensively eroded and marked with sinkholes, giving this buried surface considerable relief. When drilling, therefore, it is helpful to recognize that the depth to limestone can vary by tens of feet within a short lateral distance. Another important feature of interest to the well driller is found in southern Tift and Irwin Counties. Figures 1 and 3 both indicate a depression in the surface of the principal artesian aquifer along with a thickening of the overlying sediments. Within this depression the limestone is either missing entirely, or it exists at depths greatly exceeding those in other portions of the study area. High yield wells in this area are commonly difficult to complete because of the tight, impermeable clays filling the depression.

Most drilled wells in the study area draw at least part of their water from the principal artesian aquifer. Most domestic wells are drilled through the sand and clay layers of the Neogene and are finished in the top few feet of the limestone. Water users who require more water than the average domestic well can provide, have drilled a larger diameter well or have drilled deeper into the aquifer. Pump and aquifer tests at the Tifton, Sycamore, and Fitzgerald city wells indicate that sustained yields of 1000 gallons per minute and more are possible for large wells tapping the principal artesian aquifer (Sever, 1969).

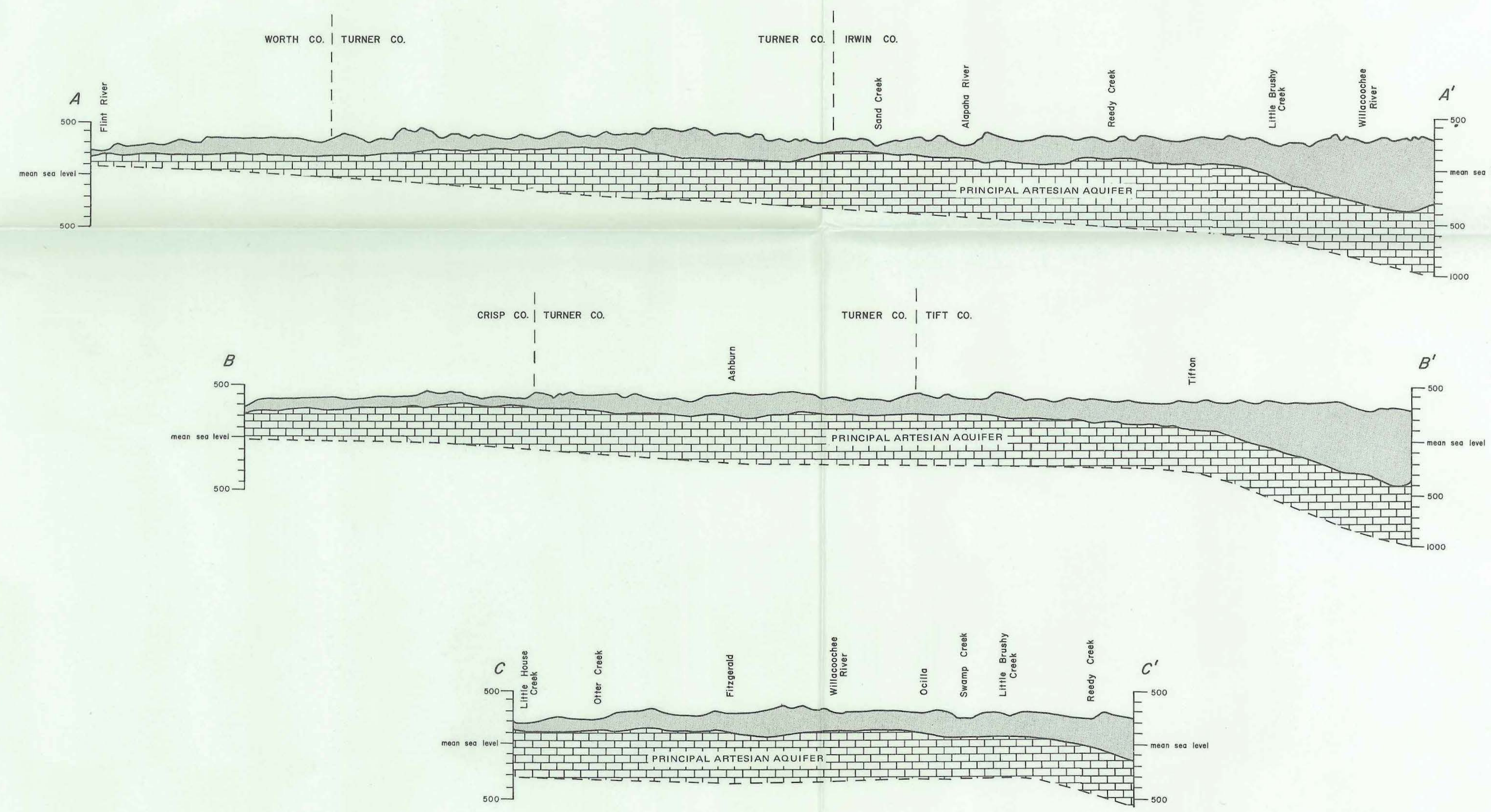


Figure 2. GEOLOGIC SECTIONS

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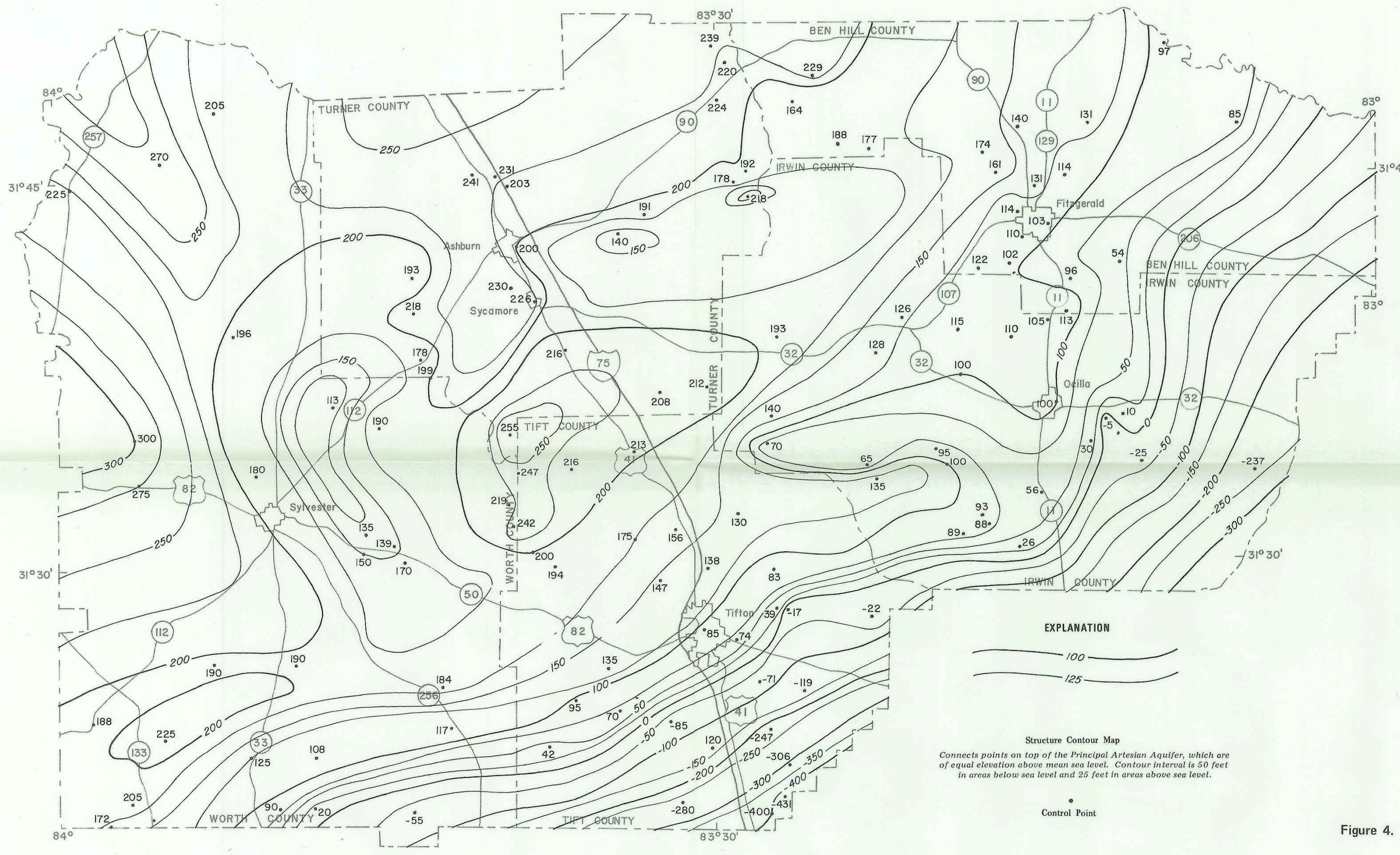
Figure 3. CONFIGURATION OF THE TOP OF THE PRINCIPAL ARTESIAN AQUIFER



EXPLANATION

100

125

Structure Contour Map

Connects points on top of the Principal Artesian Aquifer, which are of equal elevation above mean sea level. Contour interval is 50 feet in areas below sea level and 25 feet in areas above sea level.

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Control Point

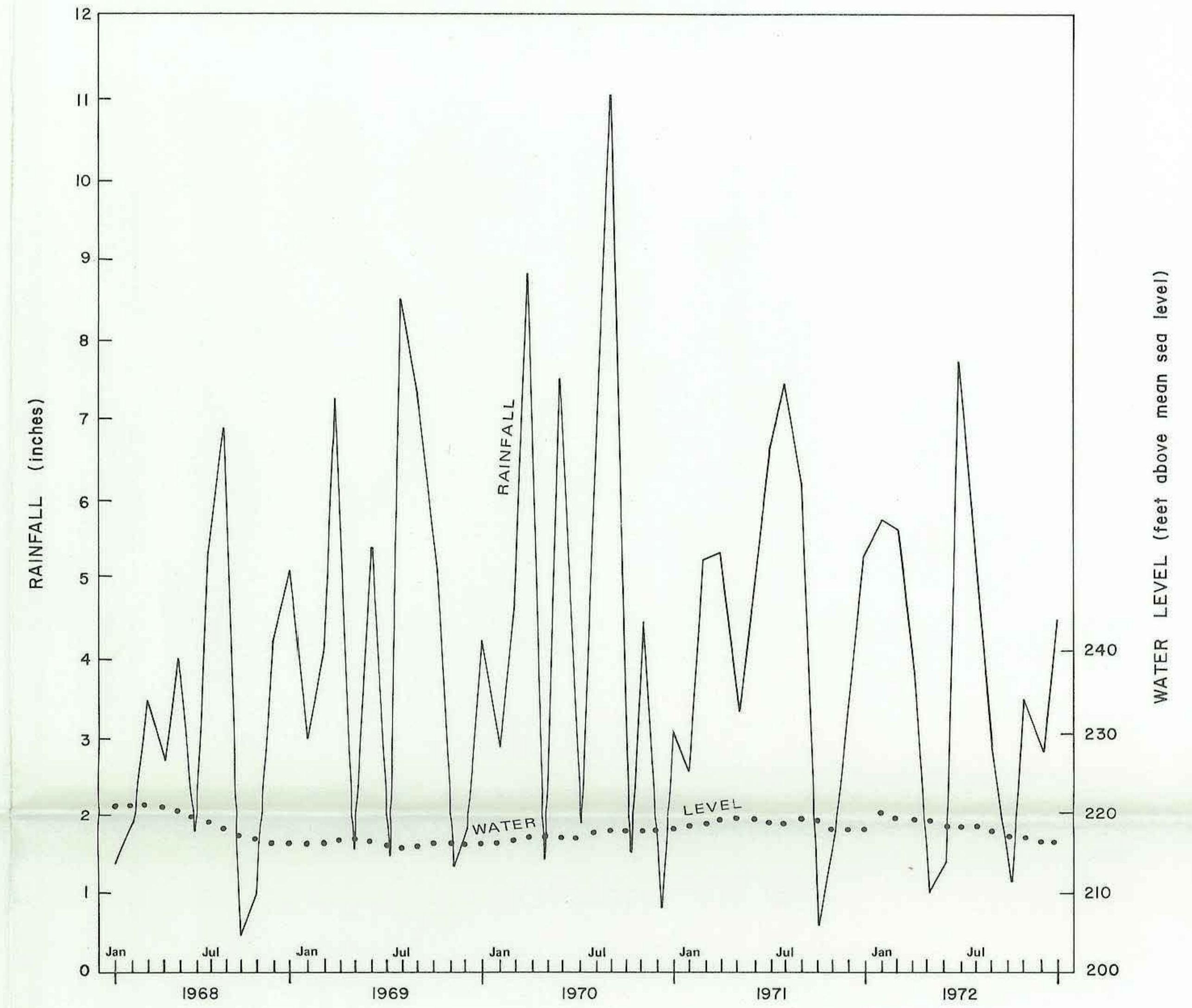


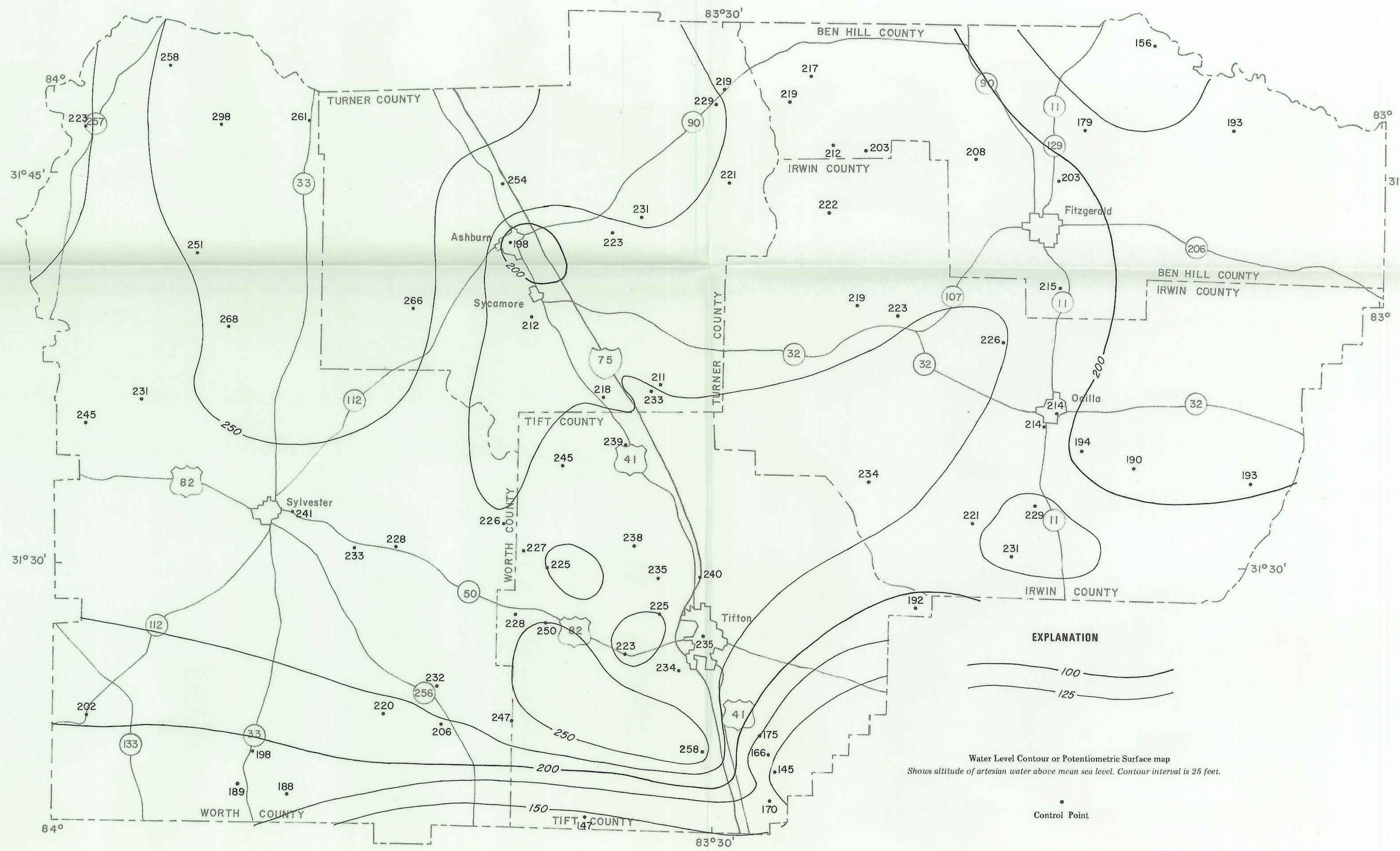
Figure 5. Chart comparing monthly fluctuation in rainfall with water level fluctuation in an observation well in Tifton, Georgia.

SCALE 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

Figure 4. WATER LEVEL IN THE PRINCIPAL ARTESIAN AQUIFER



EXPLANATION

100

125

Water Level Contour or Potentiometric Surface map

Shows altitude of artesian water above mean sea level. Contour interval is 25 feet.

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Control Point

RAINFALL

Rainfall in southwest Georgia averages approximately 46 inches per year. An examination of rainfall data, however, shows that rainfall is not evenly distributed throughout the year (U. S. Dept. of Comm., 1962). Wet months can be followed by extremely dry months during which water sources at or near the surface are depleted by evaporation. A fraction of the rainfall is not returned directly to the atmosphere but is absorbed by the earth and percolates downward into the layers of rock and sediment. This water is stored underground in a natural water supply system that is the principal artesian aquifer. Since evaporation has only a small effect on ground water levels in the report area, deep wells generally maintain adequate water levels during periods of drought.

Figure 5 shows the water level record of a U. S. Geological Survey observation well in Tifton, along with rainfall records for the same time period. It can be seen that the monthly rainfall variation is rather high, whereas the water level in the well fluctuates much less.

WATER LEVEL

The water level map of the principal artesian aquifer is constructed from measurements of water levels in wells known to tap this aquifer. Geologic conditions in the report area are such that the ground water is under pressure, causing it to rise in a cased well, above the level at which it is first encountered in drilling. The aquifer in the study area is thus an artesian aquifer. The water level map can be used to predict the unpumped water level in a proposed well by subtracting the elevation of the ground water level from the elevation of the land surface at the well site. The remainder will be the approximate distance from the land surface to the static water level in the completed well. It should be emphasized that this is strictly an estimate of static water level. Actual levels may vary somewhat. Generally, the contours are more reliable where data points are closely spaced.

To date, pumping has not caused any obvious changes in water levels of the principal artesian aquifer in the study area. Heavy dependence upon ground water from deep wells is comparatively recent. This office, in cooperation with the U. S. Geological Survey will continue to monitor water levels and ground water quality in this area to detect any changes which might affect ground water availability.

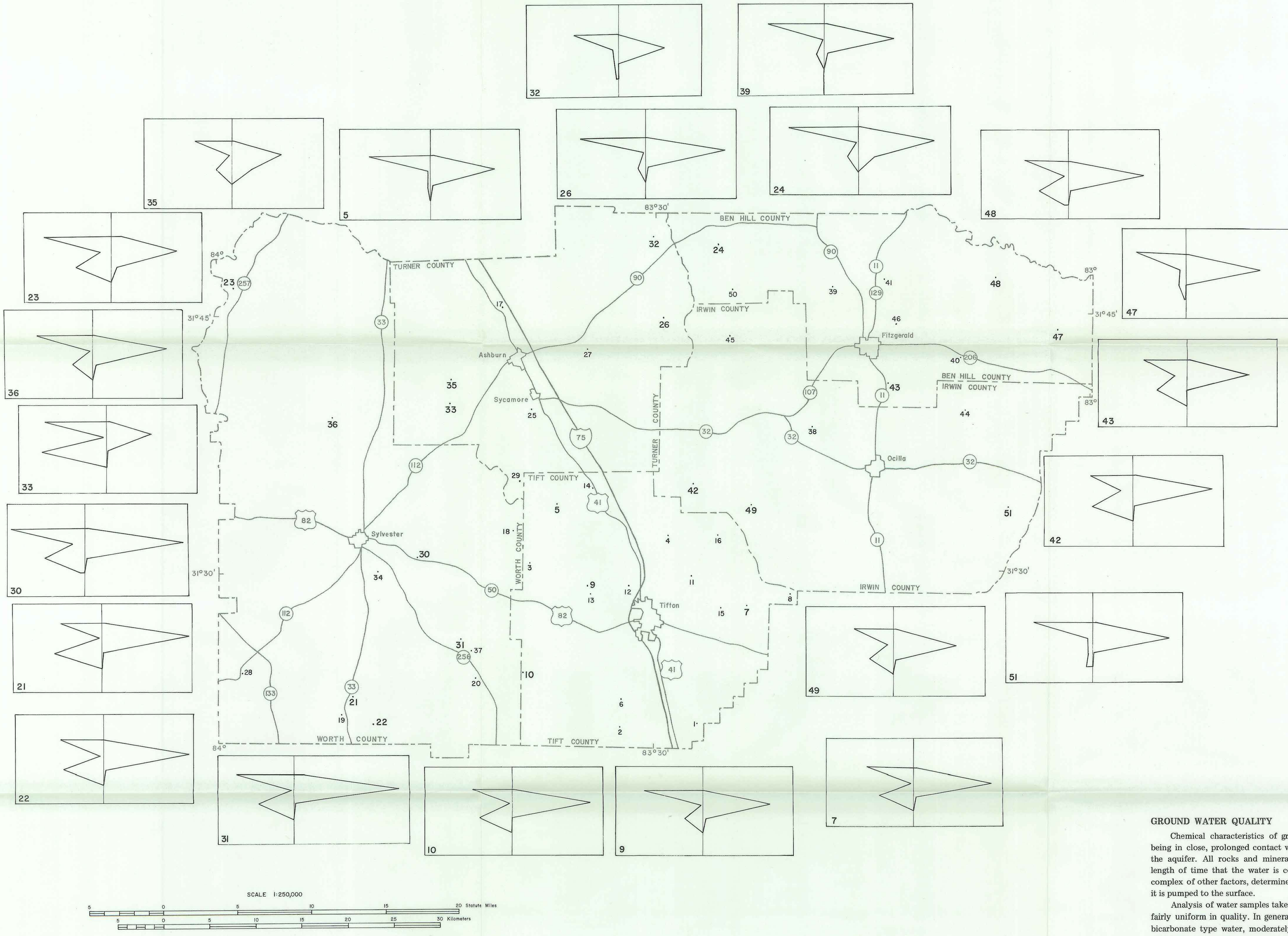
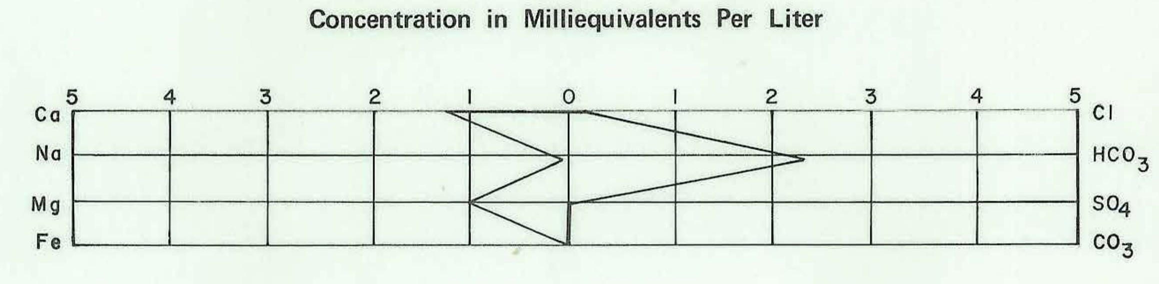


Figure 6. Map showing Stiff Diagrams of selected wells in study area.

23 Identification number of well with Stiff Diagram

34 Identification number of well



Example of a Typical Stiff Diagram

GROUND WATER QUALITY

Chemical characteristics of ground water are the result of the water being in close, prolonged contact with the rocks and minerals that serve as the aquifer. All rocks and minerals are soluble to a certain extent. The length of time that the water is contained underground, combined with a complex of other factors, determines the chemical quality of the water when it is pumped to the surface.

Analysis of water samples taken in the study area shows the water to be fairly uniform in quality. In general, the samples are classified as a calcium bicarbonate type water, moderately hard, but low in total dissolved solids. All chemical constituents examined were within recommended limits for drinking water as set forth by the U. S. Public Health Service (1962), except for local instances of excessive iron. Although a high iron content is not harmful to humans, it does cause iron staining. Since irrigation is becoming an important factor in agriculture of the Coastal Plain, it is worthwhile to note that the chemical quality of ground water in the study area is suitable for irrigation.

The Stiff Diagrams (Stiff, 1951) displayed in Figure 6 are an effective method of showing differences or similarities in ground water composition. Each diagram represents the same dissolved solids from an individual water analysis. It is essentially a graph of major dissolved constituents. By comparing the graphs, differences or similarities in the water types are often apparent. Figure 6 shows the array of diagrams representing typical well waters in the area.