WATER-LEVEL FLUCTUATIONS

Water-level fluctuations in the Clayton aquifer are related to seasonal changes in precipitation, evapotranspiration, and rates of pumping. Observed annual fluctuations in mean daily water levels during 1980 ranged from 11.2 ft at well 5L1 in Clay County to 40.2 ft at well 12L20 in Dougherty County.

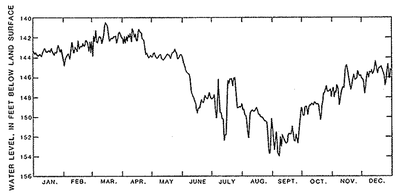

Figure 11.—Mean daily water levels in the Clayton aquifer at well 7N1 at Cuthbert, Randolph County, 1980.

CUTHBERT AREA

Water levels in the Clayton aquifer in the Cuthbert area are affected primarily by seasonal changes in local and regional pumping and precipitation (fig. 11). During 1981, water levels in observation well 7N1 near the outcrop area in Cuthbert fluctuated 13.3 ft between the highest recorded water level in March and the lowest level in September. Sharp, small-scale fluctuations throughout the year reflect changes in local pumping.

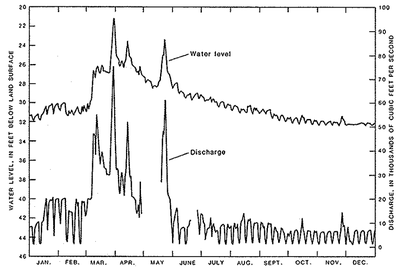

Figure 12.—Mean daily water levels in the Clayton aquifer at well 5L1 at Fort Gaines, Clay County, and average daily stream discharge at gaging station 02343801 near Hilton, Early County, 1980.

FORT GAINES AREA

In the vicinity of Fort Gaines, water levels in the Clayton aquifer are affected by changing reservoir stages and Chattahoochee River stages caused by operation of the Walter F. George Lock and Dam. South of the Walter F. George Reservoir, the water level in well 5L1 at Fort Gaines rose 10.7 ft from January 6 to March 31, 1980, corresponding to a rise in river stage produced by increased discharge from the lock and dam (fig. 12). A comparison of 1980 mean daily water levels at well 5L1 and the average daily stream discharge at gaging station 02343801 near Hilton, Early County (See location, fig. 17.), indicates that when there was an increase in river discharge (stage) downstream from the dam, ground water that normally discharged into the river backed up into the aquifer causing the water level in the well to rise.

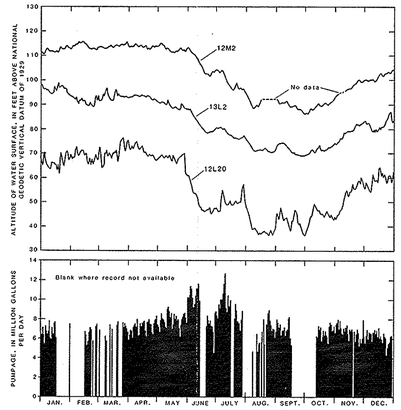

Figure 13.—Estimated mean daily pumpage from the Clayton aquifer by the city of Albany, and mean daily water levels in the Clayton aquifer at wells 12M2, 13L2, and 12L20 near Albany, Dougherty County, 1980.

ALBANY AREA

In the Albany area, water levels in the Clayton aquifer are primarily affected by changes in local pumping. During 1980, mean daily water levels in the Clayton aquifer at wells 12L20, 13L2, and 12M2 near the center of pumping at Albany showed annual fluctuations of 40.2, 29.6, and 29.3 ft, respectively (fig. 13). A comparison of mean daily water levels in these wells with the estimated average daily pumpage from the Clayton aquifer by the city of Albany indicates that the fluctuations correspond to seasonal variations in pumping at Albany.

Mean daily water levels in well 11L2, in western Dougherty County, fluctuated 39.1 ft during 1980 (fig. 14). This fluctuation was primarily in response to seasonal irrigation pumping. Records indicate that from 1974 to 1977, mean monthly water levels in this well fluctuated an average of about 2.3 ft annually (fig. 23), mainly because of seasonal changes in regional pumping. The annual water-level fluctuations were 12.5 ft in 1977 and 29 ft in 1981. The increased fluctuations in those years correspond to seasonal increases in irrigation pumping.

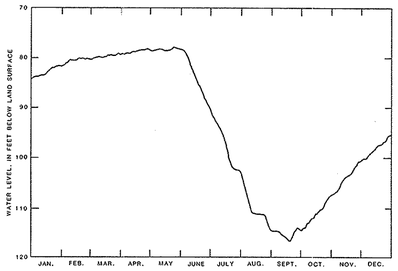

Figure 14.—Mean daily water levels in the Clayton aquifer at well 11L2, western Dougherty County, 1980.

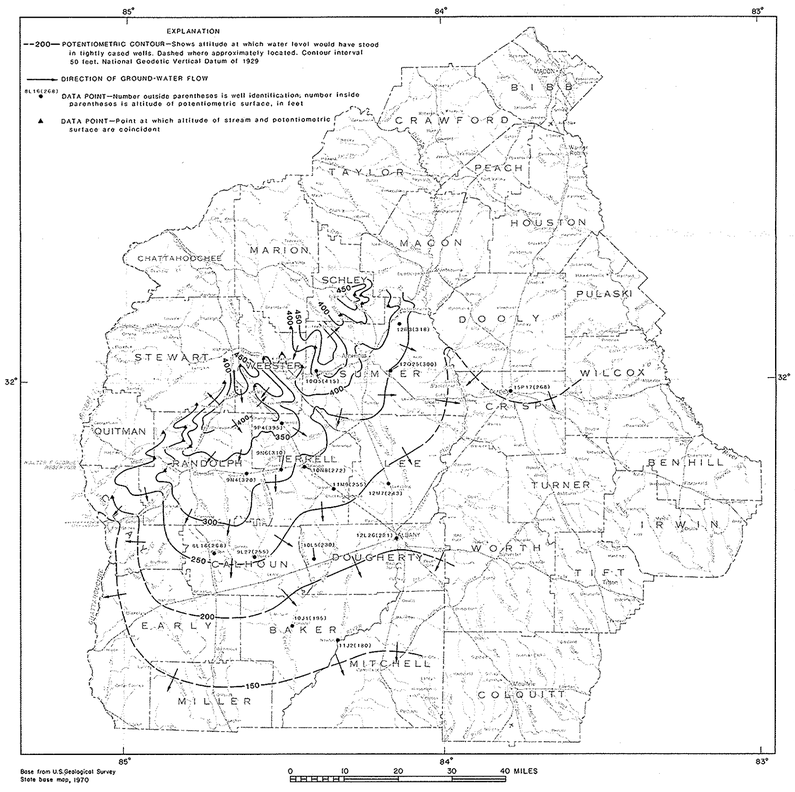

Figure 15.—Inferred predevelopment potentiometric surface of the Clayton aquifer.

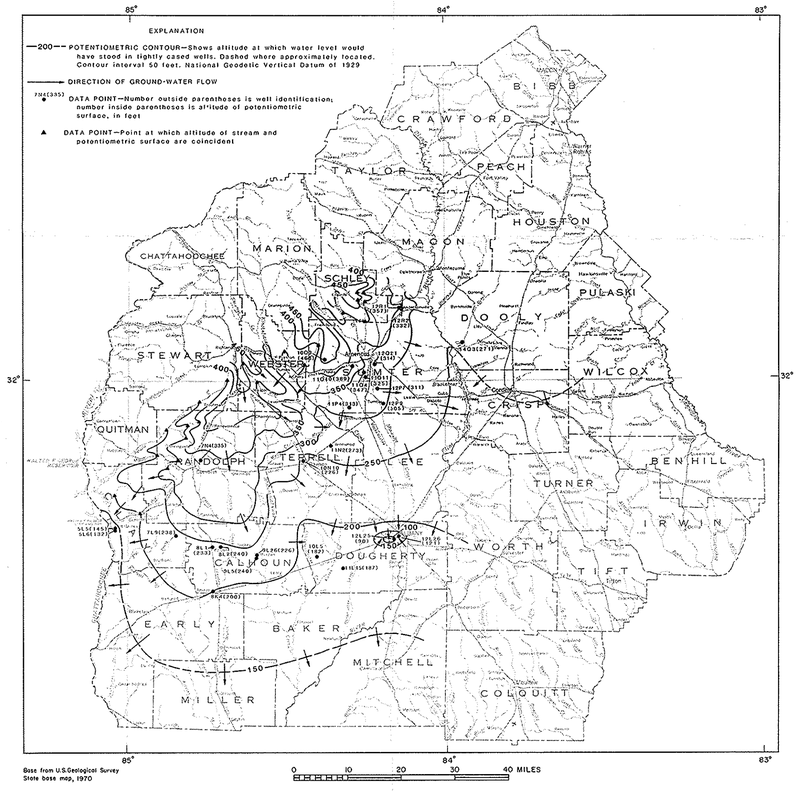

Figure 16.—Estimated potentiometric surface of the Clayton aquifer, 1954.

Figure 17.—Potentiometric surface of the Clayton aquifer, March 1981.

POTENTIOMETRIC SURFACE

The potentiometric surface of an aquifer is an imaginary surface representing the altitude to which water would rise in tightly cased wells that penetrate the aquifer (Lohman, 1972, p. 8). Potentiometric levels are highest in areas of recharge and lowest in areas of discharge; thus, ground water moves from areas of recharge toward areas of discharge. In some areas, pumping can lower the potentiometric surface and form a cone of depression.

The potentiometric surface of the Clayton aquifer (figs. 15-17) was based on control-well data and, within and near the outcrop area, on the observed sensitivity of potentiometric altitudes to rivers and streams. The small triangles at streams on figures 15 to 17 represent areas where the altitude of the stream surface is considered to be nearly coincident with the altitude of the potentiometric surface. Although there are no data to indicate the extent of water-level fluctuations in the outcrop area, annual water-level fluctuations probably range from about 5 to 20 ft depending on the location and amount of precipitation. For example, the water level in well 7N1 (fig. 26), about 3 mi south of the outcrop area at Cuthbert, Randolph County, showed average annual water-level fluctuations ranging from less than 5 ft to about 20 ft during 1965-81. In addition, the volume of water pumped from the Clayton aquifer in the outcrop area is small because withdrawals are mainly for domestic use. Consequently, water-level fluctuations in the outcrop area from pumping and natural fluctuations are probably too small to alter the configuration of the potentiometric surface at the contour interval used in figures 15-17.

PREDEVELOPMENT SURFACE

The predevelopment potentiometric surface of an aquifer represents the natural condition of the aquifer before man-induced stresses, such as pumping, were applied. The inferred predevelopment potentiometric surface of the Clayton aquifer, based on data collected between 1891 and 1924, is shown in figure 15.

Predevelopment flow directions within the Clayton aquifer generally were from the outcrop area southward and toward major rivers and streams. Two major discharge areas--the Chattahoochee River to the west, and the Flint River to the east--were drains in the ground-water flow system. This naturally occurring discharge is indicated by potentiometric contours that bend upstream in an inverted "V" pattern, showing that the hydraulic gradient is toward the stream. Potentiometric contours also indicate that two major ground-water divides were present--one to the southwest between the Chattahoochee and Flint Rivers, and a second to the southeast between the Flint and Ocmulgee Rivers--that generally correspond to interstream drainage divides. In the outcrop area, these interstream areas were sites of major aquifer recharge.

ESTIMATED 1954 SURFACE

The estimated 1954 potentiometric surface of the Clayton aquifer is shown in figure 16. Potentiometric data used to construct this surface were collected during 1950-55. Unpublished data from the files of the U.S. Geological Survey indicate that, with the exception of the Albany, Dawson, and Fort Gaines areas, water levels in the Clayton aquifer underwent little or no change during this period. The potentiometric surface shown in figure 16 is considered to be most representative of 1954, because data for the areas of greatest stress were collected during 1953-55. Where data were available for multiple time periods, the data for the year closest to 1954 were used.

In Dougherty, Terrell, Clay, Sumter, and Calhoun Counties, ground-water withdrawals caused water-level declines and altered the configuration of the predevelopment potentiometric surface. By 1954, a cone of depression had developed in Albany, Dougherty County, and the principal direction of ground-water flow was toward the center of pumping. Water-level data from old city well 3 at Americus, Sumter County, indicate that a cone of depression existed there as early as 1942. Because data for this well are lacking for the period 1953-55, the cone of depression is not shown in figure 16.

MARCH 1981 SURFACE

The March 1981 potentiometric surface of the Clayton aquifer is shown in figure 17. Ground-water withdrawals since 1954 caused water levels to decline, thereby changing the configuration of the potentiometric surface. As a result, the major ground-water divide between the Chattahoochee and Flint Rivers became less pronounced and the cone of depression at Albany expanded.

By March 1981, agricultural pumping northwest of Dougherty County caused the cone of depression at Albany to expand northwestward. The principal direction of ground-water flow in parts of Dougherty, Terrell, Lee, Randolph, and Calhoun Counties was toward the area of greatest withdrawal, which was in the Albany area (Hicks and others, 1981, p. 25).

In the Fort Gaines area, the water level in the Clayton aquifer was affected by construction of the Walter F. George Lock and Dam and the subsequent filling of the reservoir. During 1957-61, pumping of 3 to 12.6 Mgal/d to dewater the construction site lowered the water level as much as 80 ft. Upon cessation of pumping, the water level made a full recovery (Stewart, 1973). Filling the reservoir in 1963 caused the water level in the aquifer to rise, both upstream and downstream from the dam. This rise in water level shifted the 150-ft water-level contour at Fort Gaines on the 1954 surface (fig. 16) southward to the position shown on the 1981 surface (fig. 17).

HYDROGEOLOGY OF THE CLAYTON AQUIFER OF SOUTHWEST GEORGIA.

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Cartography by Willis G. Hester