DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

TO ACCOMPANY MAPS
OPEN-FILE REPORT 78-460

HYDROGEOLOGIC MAPS OF A FLOOD DETENTION AREA PROPOSED BY SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, GREEN SWAMP AREA, FLORIDA

By

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ABSTRACT

Information about the hydrogeology of that part of the Green Swamp area which has been designated by Southwest Florida Water Management District as the flood detention area is given on seven maps. The maps show (1) core-hole numbers, (2) sand thickness, (3) clay thickness, (4) clay vertical hydraulic conductivity, (5) clay leakance, (6) depth to Floridan aquifer, and (7) altitude of top of Floridan aquifer. The data were obtained from 85 core holes drilled in 1977 and from 24 core holes drilled previously. The 127 square-mile study area is part of the headwaters of the Withlacoochee River and the Little Withlacoochee River. The data will be useful in future water-resources planning and in a concurrent interpretive study of the Green Swamp area.

INTRODUCTION

The possibility of inducing recharge to the Floridan aquifer in the Green Swamp area of Florida has been a subject of interest for about two decades. Two reports about the general hydrology of the Green Swamp (Pride and others, 1961, and Pride and others, 1966) included brief discussions on water conservation. Grubb (1977) reported on the hydrogeology in the Green Swamp--specifically, on thicknesses of sand and clay and how these thicknesses relate to the potential for downward leakage.

This report presents information about the hydrogeology of the uppermost sediments in that part of the Green Swamp area which has been designated by Southwest Florida Water Management District as the flood detention area. Of particular concern are the quantities relating to recharge potential: thickness and vertical hydraulic conductivity of clay. When these values are known, the leakance of the clay confining bed can be calculated. Other hydrogeologic parameters investigated are sand thickness, depth to the top of the Floridan aquifer, and altitude of the top of the Floridan aquifer. The intent of this report is to present hydrogeologic data in a concise, illustrative manner. The information will be useful in future water-resources planning and in evaluating recharge potential of the sediments in a separate interpretive study.

The area investigated is in the central part of the area designated by Pride and others (1961) as the Green Swamp area (sheet 1, inset). The southern extremity of the study area is about 10 miles north-northwest of Lakeland and 25 miles east-northeast of Tampa. Rainfall in this area averages 52 inches per year and the average air temperature is 72°F. Throughout the 127 square-mile study area, the altitude of land surface ranges from 87 to 115 feet. This area is part of the headwaters of the Withlacoochee River and the Little Withlacoochee River.

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Conversion Factors

For use of those readers who may prefer to use metric units rather than U.S. customary units, the conversion factors for the terms used in this report are listed below:

Multiply U.S. customary units	By	To obtain metric units
inches per year (in/yr)	25.40	millimeters per year (mm/yr)
inches (in)	25.40	millimeters (mm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers (km)
square miles (mi^2)	2.590	square kilometers (km^2)

APPROACH

Data for this investigation were obtained from 85 core holes drilled in 1977 and from 24 core holes drilled previously. The core holes were generally drilled: (1) as close as possible to the center of each section; (2) in areas where limestone was described by Pride and others (1966) as being within 25 feet of land surface; and (3) only in those parts of the proposed flood detention area which had been acquired by Southwest Florida Water Management District at the time of drilling.

Core samples were obtained at each site by rotary drilling to the top of limestone using a phosphate barrel. If core recovery using the phosphate barrel was poor, a split-spoon technique was used. Cores were lithologically described and samples of clay were selected for laboratory determination of vertical hydraulic conductivity. Single-point resistance, natural gamma-ray, and caliper logs were run in each core hole. These logs were used for lithologic correlation and for characterization of the sediments penetrated when core recovery was less than 100 percent.

Core hole locations and numbers are shown on sheet 1. The first two letters represent the county name, that is, LK for Lake County, PK for Polk County, and SM for Sumter County. The first two digits represent the year when the site was chosen and the last two digits represent the sequence in which the site was chosen for a particular county-year combination.

RESULTS

Sand thickness and clay thickness are shown on sheets 2 and 3, respectively. Each sheet shows total thickness of predominantly sand or predominantly clay strata. For more than half of the core holes, the sum of sand thickness and clay thickness is equal to the depth to the Floridan aquifer. For the remainder of the core holes, the sum is not equal to the depth to the Floridan because of the presence of layers of silicified limestone or chert or both in the sections. The six core holes marked with asterisks on sheets 2 through 7 were drilled in areas of apparent subsidence of underlying limestone--a condition also known as buried sinkholes. The sand or clay thickness may be anomalous at these locations.

Vertical hydraulic conductivity is the volume of water at the existing kinematic viscosity that will move vertically in unit time under unit vertical hydraulic gradient through a unit area of material measured horizontally. The vertical hydraulic conductivity of clay in the study area is shown on sheet 4. The clay recovered was categorized according to color, rigidity, and sand content, and average values of hydraulic conductivity were determined for each clay type. This method made it possible to estimate hydraulic conductivity at core holes when no samples were analyzed in the laboratory. Composite values of hydraulic conductivity were calculated for test sites having more than one clay type by the expression:

$$k' = \frac{\sum_{n=1}^{m} b_n}{\sum_{n=1}^{m} \frac{b_n}{k_n}}$$

assuming a steady-state condition develops; the head above and below the clay layers does not change with time. The thicknesses of the individual clay layers of different vertical hydraulic conductivities are b_1, b_2, b_3, and so forth, and their respective vertical hydraulic conductivities are k_1, k_2, k_3, and so forth. The number of different clay layers is m. Sheet 5 shows the leakance of the clay beds. Leakance is calculated by dividing the vertical hydraulic conductivity by the total clay thickness. For this calculation, the clay thickness shown on sheet 3 must be converted to inches. When leakance and vertical head difference are known, recharge to the Floridan aquifer can be calculated. Recharge, inches per year, is equal to the leakance, in year^{-1}, multiplied by the head difference, in inches, between the water-table aquifer and the Floridan aquifer. This head difference is generally between 0 and 6 inches in the proposed flood detention area. The only exception is near the Withlacoochee River and the Little Withlacoochee River, where the head difference is approximately the same but in the reverse direction, indicating that water leaks upward at these locations. Recharge may be increased substantially by increasing the head difference between the water-table aquifer and the Floridan aquifer. This can be accomplished artificially by pumping from the Floridan aquifer or by pumping in conjunction with development of conservation pools on the land surface. Anomalous values of vertical hydraulic conductivity and leakance may exist at the six locations of buried sinkholes.

South of the Withlacoochee River in Polk County, the Floridan aquifer is less than 10 feet below land surface and small isolated outcrops of silicified limestone occur. Sheet 6 shows, by the symbol "X", places where silicified limestone outcrops were located by field observation during the drilling effort. The silicified limestone in these areas is discontinuous both at land surface and within and under the clay layer. The outcrops may, however, be continuous with the Floridan aquifer, thus affording direct ground-water recharge.

The depth to the top of the Floridan aquifer and the altitude of the top of the Floridan aquifer are shown on sheets 6 and 7, respectively. The uppermost formation of the aquifer in the area of investigation is the white, fossiliferous, granular and porous Ocala limestone.

SELECTED REFERENCES

Pride, R. W., Meyer, F. W., and Cherry, R. N., 1961, Interim report on hydrologic features of the Green Swamp area in central Florida: Florida Geol. Survey Inf. Circ. 26, 96 p.

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Grubb, H. F., 1977, Potential for downward leakage to the Floridan aquifer, Green Swamp area, central Florida: U.S. Geol. Survey Water Resources Inv. 77-71.