

THICKNESS OF THE POTABLE-WATER ZONE IN THE FLORIDAN AQUIFER

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The Floridan aquifer is one of the most productive aquifers in the world and is one of the most valuable natural resources in Florida. It supplies potable water to tens of thousands of industrial, commercial, agricultural, and domestic wells in the State and also the municipal supplies for such urban areas as Tallahassee, Jacksonville, Ocala, Daytona Beach, Orlando, Gainesville, St. Petersburg, and the Cape Kennedy area. Withdrawals from the aquifer in these urban areas and in other areas are increasing at a high rate due to the rapid increase in population and industrial development. Thus, information is needed by water managers and planners to aid them in establishing practices for the conservation and utilization of the water in this important aquifer. The purpose of this report is to show graphically the approximate thickness of the zone of potable water in the Floridan aquifer throughout the State. Potable water, as referred to in this report, meets the Environmental Protection Agency (Nat. Acad. Sci., 1973) recommended limits of 250 mg/l (milligrams per litre) of chloride and 250 mg/l of sulfate in public water-supply sources.

The Floridan aquifer is composed of limestone and dolomite beds primarily of Eocene and Miocene age. In northeastern Florida the aquifer also includes limestone and dolomite beds of late Paleocene age (Leve, 1968). The altitude of the top of the Floridan aquifer throughout the State is shown in the inset map. The top of the aquifer ranges from more than 100 feet (30 metres) above sea level in the west-central and north-central parts of the State to more than 1,000 feet (300 metres) below sea level in the southeastern and southwestern parts. The bottom of the Eocene limestone and Paleocene dolomite beds ranges from 1,000 feet (300 metres) below sea level in north-central Florida to about 4,000 feet (1,200 metres) below sea level in the Florida Keys (Chen, 1965, p. 16, fig. 9). The Paleocene limestone and dolomite beds extend downward from about 2,000 feet (600 metres) below sea level to 2,500 feet (760 metres) below sea level in northeastern Florida (Chen, 1965, p. 15, fig. 8). The lower 400 feet (120 metres) contains gypsum and only the uppermost beds yield usable quantities of water.

The aquifer is at or near land surface in much of west-central and north-central Florida. In the remainder of the State it is confined by overlying relatively impermeable beds of sandy clay, clayey sand, and clay, which may be as much as 600 to 700 feet (180 to 210 metres) thick in southern Florida. Major recharge occurs where the aquifer is at or near the surface or where numerous lakes, ponds, and streams are hydraulically connected to the aquifer. Recharge also occurs by downward leakage through confining beds where the water levels of the shallower aquifers are higher than the potentiometric surface (water level) of the Floridan aquifer.

Rainfall entering the aquifer in the recharge areas contains little or no dissolved mineral matter. As the water moves down gradient through the aquifer it picks up dissolved minerals because of the solvent effect of the water on the rocks with which it comes in contact. The quantity and type of dissolved mineral matter depends upon the chemical and physical composition of the rocks; the temperature, pressure, and duration of contact; and the extent of mixing with mineralized water already present in the aquifer. In Florida, this mineralized water could be connate water that was trapped when the rocks were deposited or sea water that entered the aquifer after the rocks were deposited.

The type of mineralization in water in the aquifer varies in different parts of the State: calcium-bicarbonate water occurs in most of northern and central Florida, calcium-sulfate water occurs in southwestern and southern Florida, sodium-bicarbonate water occurs in extreme western Florida, and sodium-chloride water occurs in many of the coastal areas (Stringfield, 1966, p. 134-135). The concentration of mineralization generally increases with depth. Generally, if potable water is available in the aquifer, it will be in the upper part.

The accompanying large map shows the approximate thickness of the zone of potable water in the Floridan aquifer in Florida. The map may also be used in conjunction with other hydrologic data (transmissivity and storage) to estimate the quantity of potable water that may be withdrawn from wells in the aquifer in various parts of the State, and in conjunction with data on the altitude of the top of the Floridan aquifer (inset map), to determine the approximate maximum depth to which wells can be drilled to obtain potable water from the aquifer.

The map was compiled principally from two hydrologic maps—depth to base of potable water in the Floridan aquifer (Klein, 1975) and top of the Floridan aquifer (Vernon, 1973). Additional information was obtained from basic data collected by the U.S. Geological Survey throughout the State and from numerous local and regional investigations conducted by the Survey in cooperation with local, State, and other Federal agencies.

The reports and data used to compile this map span a period of about 15 years. Therefore, this generalized map cannot be used to determine the exact thickness of potable water in the aquifer at any specific location or at any specific time. In preparing the map, no consideration was given to seasonal or long-term changes in thickness or local variations due to pumpage. In many areas in northern and central Florida, and particularly along the

coast, the thickness of the zone of potable water is affected by the fluctuation of the potentiometric surface in response to recharge and discharge. When the potentiometric surface (inset map, Healy, 1975) is lowered by a decrease in recharge or an increase in discharge, highly mineralized water moves either vertically upward from the deeper parts of the aquifer or laterally into the zones of potable water. For example, discharge by thousands of irrigation wells in St. Johns, Putnam, and Flagler Counties seasonally lowers the potentiometric surface in the area and causes highly mineralized water to move upward into the zone of reduced head (Bermes and others, 1963). This movement of mineralized water reduces the thickness of the zone of potable water in the aquifer. As a result, some wells that yield potable water during most of the year yield nonpotable water during the crop-growing season. Also, in urbanized and industrial areas in Duval and Nassau Counties, for example, the potentiometric surface of the Floridan aquifer is gradually being lowered because of increased discharge by numerous industrial, commercial, and municipal wells. The lowering of the potentiometric surface is causing nonpotable water to gradually move upward into the upper zones of the aquifer, thereby decreasing the thickness of the zone of potable water (Leve, 1968).

The large map shows that there is little or no potable water available from the Floridan aquifer in southern Florida and along the east coast as far north as southern St. Johns County. The maximum thickness of the zone of potable water is in central Florida where it exceeds 2,000 feet (600 metres). The areas of major recharge generally conform to the areas of major recharge and highest water levels. For example, the more than 2,000 feet (600 metres) of thickness in southern Sumter, Lake, and northern Polk Counties and the more than 1,000 feet (300 metres) of thickness in northernmost Florida and in Volusia County generally outline major areas of recharge to the aquifer.

Throughout most of Florida the mineralized water below the potable zone may be used for many purposes including commercial cooling and for various types of industrial and agricultural uses. With the progress being made on various desalination methods, the mineralized water may also become an important source of drinking water (municipal supplies) in the future, particularly along the coastal regions and in southern Florida where little or no potable water is available from the Floridan aquifer.

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DEPTH TO TOP OF THE FLORIDAN AQUIFER IN FLORIDA (Adapted from Vernon, 1973.)

EXPLANATION

- 200 — Floridan aquifer at or near land surface.
- 200 — Line of equal depth to Floridan aquifer. Interval 200 feet. Datum is mean sea level.

POTENTIOMETRIC SURFACE, FLORIDAN AQUIFER (Adapted from Healy, 1975.)

EXPLANATION

POTENTIOMETRIC CONTOUR. Shows altitude at which water level would have stood in tightly cased wells that penetrate the Floridan aquifer. Contour intervals 10, 30, and 40 feet. Datum is mean sea level.

EXPLANATION

Thickness of zone of potable water, in feet.

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|----------------|------------------|
| more than 2000 | 750-1000 |
| 1750-2000 | 500-750 |
| 1500-1750 | 250-500 |
| 1250-1500 | 0-250 |
| 1000-1250 | No potable water |

(In this report, water is considered potable if its chloride or sulfate concentration does not exceed 250 milligrams per litre.)

