



INTRODUCTION

A map showing the base of fresh ground water in Louisiana was first prepared by Rollo in 1960. With subsequent investigations and the collection of additional data, the need to update Rollo's map became apparent. In 1984 the U.S. Geological Survey began a cooperative investigation with the Louisiana Department of Transportation and Development to refine knowledge of the base of fresh ground water in Louisiana.

This map defines the altitude of the base of freshwater in Louisiana, shows areas where no major aquifer contains freshwater, and also shows areas where sands that contain saltwater in intermediate zones between deep zones of freshwater and land surface are found.

Freshwater, for this report, is defined as water that contains a chloride concentration of less than 250 milligrams per liter. Water that contains this concentration of chloride meets the U.S. Environmental Protection Agency secondary drinking water standards (U.S. Environmental Protection Agency, 1979).

Data for this map were obtained from recently published maps by interpretation of electric-resistivity logs of water and oil wells. (For method of calculation of water quality from electrical logs, see Turcan, 1966.) Map data from some recent studies were modified for this map, and map data from parts of the base-of-freshwater maps by Harder and others (1967), Whiteman (1972), Rogers (1981), and Ryals (1982) were used unmodified. Data from approximately 2,000 electric-resistivity logs were used for this project. More than 1,000 of these logs were from test water wells drilled by the Louisiana Department of Transportation and Development and the U.S. Geological Survey. Water-quality analyses from many of the test water wells confirmed the interpretation of the electrical logs. The majority of the electrical logs used for this map were made during the past 20 years. However, a few of the logs used were made over 40 years ago.

The major aquifer that contains the deepest freshwater of each area is contoured individually. As most major aquifers are separated from each other by thick clay intervals, the base of freshwater may change abruptly. For example, in northern Vernon Parish, where the base of freshwater changes from within the Cockfield aquifer to within the Catahoula aquifer, the base of freshwater changes approximately 1,500 ft (feet) within a 10-mile (mi.) distance. South of Baton Rouge, the base of freshwater changes more than 2,000 ft in less than 5 mi. Each aquifer is identified on this map, accompanied by contour lines showing the altitude of the base of freshwater. These areas do not represent the total areal extent of the respective aquifer, but only the area where the deepest freshwater occurs in that respective aquifer.

The contours for this map have variable intervals but generally are on 100-foot intervals above or below sea level to a depth of 1,000 ft. For depths 1,000 ft below sea level, the contour interval is 500 ft. To show detail in the areas where the base of freshwater is within the shallow alluvial aquifers in northern Louisiana, a contour interval of 50 ft is used. In gray areas, none of the major aquifers contains freshwater. To obtain the maximum depths of freshwater below land surface where the altitude of freshwater occurrence is above sea level, subtract this value from land surface elevation. Where the occurrence of the altitude of freshwater is below sea level, add the value to the land-surface elevation.

BASE OF FRESHWATER

The depth to the base of freshwater is highly variable. Freshwater can be found as deep as 3,500 ft below sea level in southeastern Louisiana, but fresh ground water cannot be found at any depth in a few parts of the State.

Some areas that recently contained freshwater may now contain saltwater. For example, pumping wells near the down-dip limit of freshwater within a sand causes saltwater to move laterally toward the center of the wells. In the areas mapped as the saltwater front, they may yield water of increasing salinity. Pumping from the upper part of a sand in the transition zone will cause saltwater to move vertically toward the well, and saltwater may eventually contaminate the well.

In some areas, the only fresh ground water occurs in shallow aquifers. Locally these shallow aquifers have been contaminated by saltwater introduced during the drilling and completion of oil wells, and by upward movement from deep saline aquifers through open boreholes, and by oil and gas related evaporation ponds. Once the contaminated saltwater moves into the aquifer, it flows very slowly down-dip toward natural discharge areas or toward pumping centers. Thus the areas of contaminated freshwater may change with time.

In places, saltwater-bearing sands may occur in intermediate zones between the deep zones and shallow zones of freshwater. The areas where sands contain saltwater in intermediate zones are shown on the map by dot patterns. Within the areas mapped as having intermediate zones of saltwater, most of the interval may contain saltwater, and an isolated deep freshwater-bearing sand may be the basis for contouring. For example, the only freshwater in a test well in St. John the Baptist Parish is in two intervals, 545 to 595 ft and 2,450 to 3,045 ft. In other areas, the intermediate saltwater may occur in only one sand above the freshwater-bearing sand. For example, the only intermediate saltwater-bearing sand in an oil-test well in Rapides Parish is from 920 to 1,000 ft. All other sand beds between land surface and a depth of 2,090 ft contain freshwater.

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LOUISIANA HYDROLOGIC ATLAS MAP NO. 3: ALTITUDE OF THE BASE OF FRESHWATER IN LOUISIANA

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