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SALT-WATER ENCROACHMENT BATON ROUGE AREA, LOUISIANA

Water Resources Pamphlet No. 17

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Baton Rouge, La.
November 1965

STATE OF LOUISIANA

DEPARTMENT OF CONSERVATION
GEOLOGICAL SURVEY
and
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In cooperation with the

UNITED STATES GEOLOGICAL SURVEY

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1964 (See Morgan, C. O.)

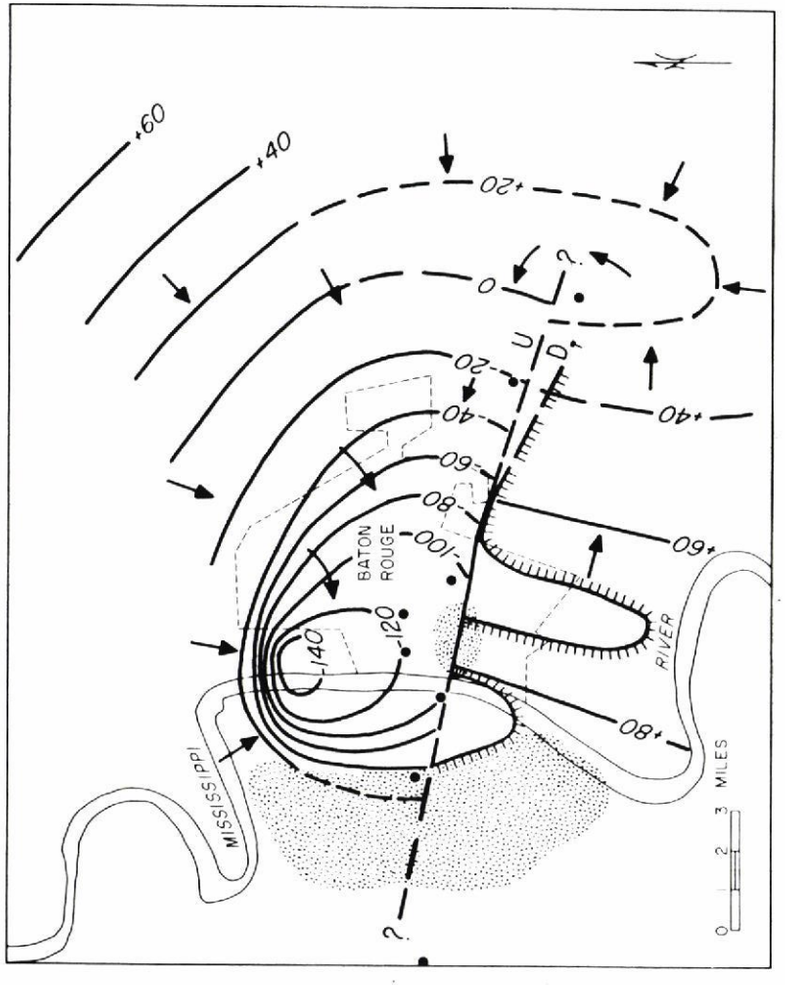

Figure 4. Salt-water front, water-level contours, and location of fault in the "2, 000-foot" sand as determined during the 1965 test-drilling program.

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fault is shown to be eastward in figure 4 rather than northward toward pumping centers as shown in figure 2. The map in figure 4 also shows a large area where the aquifer is very thin or missing, the estimated trend of the fault, and by contours, the abrupt change in water levels caused by the fault.

This winter (1965) test holes will be drilled at the approximate locations shown in figure 4 to establish the areal extent of the fault and its affect on the direction of ground-water movement. The fault discovered in the test-drilling program functions as an effective barrier that prevents northward movement of the salt water immediately south of the heavily pumped area. If future testing shows the fault to extend as far or farther than shown in figure 4, the threat of salt-water contamination at pumping centers will be reduced further.

between sites 2 and 3, based on water levels and the position of beds, indicates that a fault with a 350-foot displacement has caused hydraulic isolation of the deeper aquifers to the south. Figure 3 is a generalized cross section showing the position and displacement of the fault. As indicated in figure 3, there has been little or no displacement of the shallow aquifers and, consequently, salt water is free to move northward in these beds toward pumping centers.

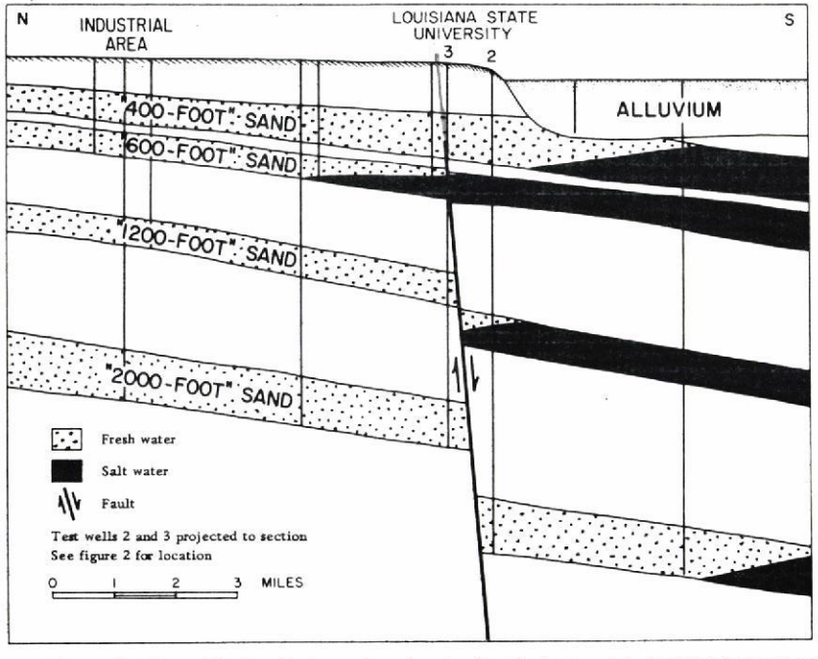

Figure 3. Generalized geologic section showing the displacement by faulting determined during the 1965 test-drilling program.

Test drilling at the remaining sites established a westward trend of the fault and provided data on water levels, salt-water fronts, and water quality.

This fault has materially changed the estimated direction and rate of flow of ground water in the area. The direction of flow in the "2, 000-foot" sand south of the

ILLUSTRATIONS

Because of the economic importance of ground water to this area, an investigation was begun in 1964 to confirm the estimates of Morgan and Winner. This investigation might be classified as a "crash program" because, based on the data available, it was feared that the leading edge of the salt-water fronts in some aquifers would reach some pumping centers in as little as 5 to 10 years. In order to obtain the necessary geologic and hydrologic information, this investigation required drilling a series of test holes to a depth of slightly more than 3, 000 feet; making electrical logs in each test hole; and installing a series of monitor wells for measuring water levels and water quality with their changes in time. Test-drilling sites were selected on the basis of information given in the Morgan and Winner report. Locations of the eight sites drilled during the first year of the investigation are shown on figure 2. A total of 15 monitor wells were completed and salt-water fronts were intersected in one or more aquifers at 6 of the 8 test sites. At least one well was completed at each site and as many as three wells were completed at two sites.

Test results at the first site did not indicate extremely unusual conditions. The water level in a monitor well installed in the "1, 500-foot" sand was considered normal for that site, but some of the aquifers were very thin or missing.

The results at site 2, however, diverged greatly from those anticipated. The deeper aquifers occurred at depths greater than expected and water levels were above rather than below the land surface in the monitor wells, both completely unexpected events. At test site 3, the major aquifers were penetrated at the anticipated depths and water levels were as much as 115 feet below the land surface, as had been expected. The correlation of aquifers

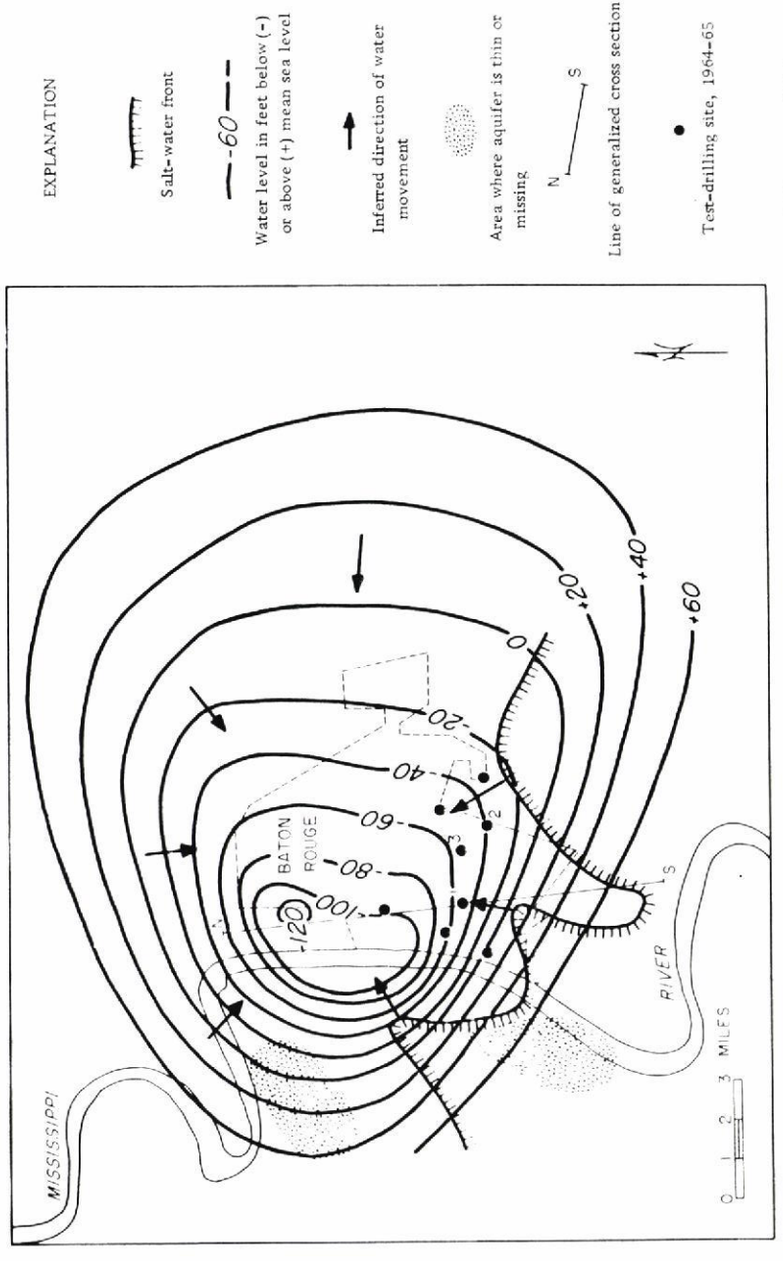

Figure 2. Salt-water front and water-level contours in the "2,000-foot" sand, after Morgan and Winner, 1964.

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SALT-WATER ENCROACHMENT BATON ROUGE AREA, LOUISIANA

By R. R. Meyer and J. R. Rollo

Water Resources Pamphlet No. 17 November 1965

The search for oil and gas in the gulf coast has defined many geologic structures, such as faults, uplifted areas, and salt domes. Many of these structures occur at such great depths that they do not affect the occurrence and movement of fresh ground water. However, broadly uplifted areas have a regional affect on ground-water movement and other structures, such as salt domes, may affect movement in a very local area. It is the purpose of this paper to describe the effects of a fault on the future of the ground-water resources of the industrialized Baton Rouge, Louisiana area.

The central gulf coast is underlain by beds of sand and clay that dip gently in the general direction of the coast. Throughout the geologic past, water from precipitation has entered these beds where they are at or near the land surface and moved slowly downdip. In Louisiana, fresh water is known to occur to depths as great as 3,500 feet.

Salt water that originally occurred in some of the sand beds has been flushed out and replaced by fresh water moving slowly southward. This process has established a front within each sand or aquifer between the fresh water and the southward-extending salt water. These salt-water fronts generally parallel the coast, but in each aquifer, they may be at different distances from the coast.

In the Baton Rouge area, which is about 70 airline miles up the Mississippi River from New Orleans, water for public supply, industrial, and other uses is obtained from 10 principal aquifers. Salt-water fronts occur in each of the principal aquifers in the southern part of the area. The general position of these fronts is shown on the generalized geologic section of the Baton Rouge area in figure 1, (Morgan and Winner, 1964). The largest

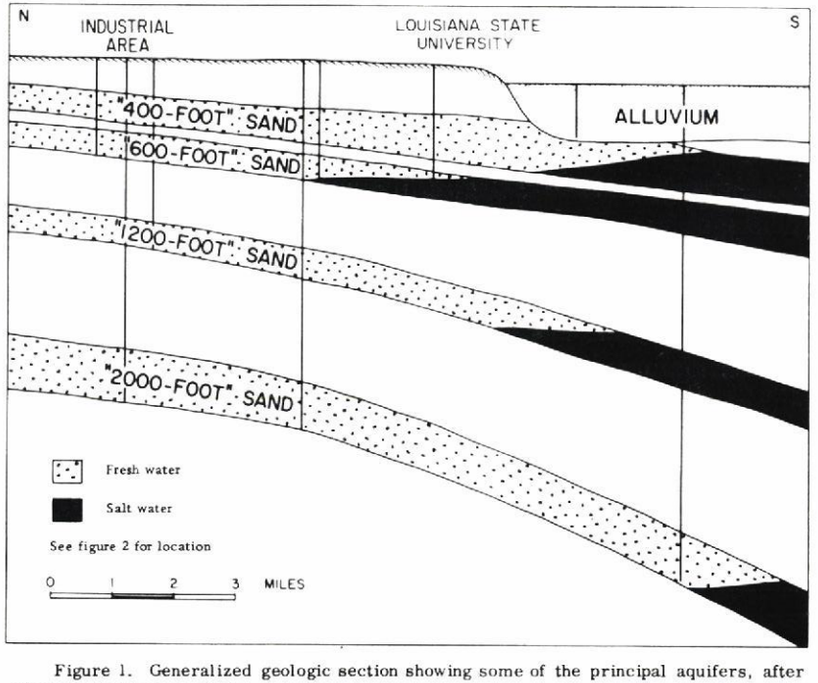

Figure 1. Generalized geologic section showing some of the principal aquifers, after Morgan and Winner, 1964.

ground-water withdrawals are concentrated in the northern part of the area, 2 to 6 miles north of these salt-water fronts. Pumping from these aquifers has gradually increased throughout the years and by 1959 withdrawals exceeded 120 million gallons a day (Morgan, 1961).

Prior to the beginning of large-scale pumping, water levels were generally above the land surface and flowing wells were common. Now (1965), water levels in some aquifers are more than 200 feet below the land surface. These water-level declines have caused the original southward sloping hydraulic gradient to be reversed with the consequent northward movement of ground water from the salt-water front area.

Both hydrologic and geologic data were meager in the area between the pumping centers and the salt-water fronts. Because of this lack of information, correlation and mapping of most deep aquifers were considered to be tentative. Also, adequate information on water levels and hydraulic characteristics of aquifers was lacking in this area. However, Morgan and Winner (1964) analyzed all existing data and prepared a report stating their conclusions. Principally on the basis of electrical logs of oil-test wells, they mapped the salt-water fronts in each aquifer. From the meager water-level data available and using average permeability and porosity values determined for the area, they made rough estimates of the rate of salt-water movement toward pumping centers. They also mapped areas where the aquifers were very thin or not present. As an example, figure 2 shows Morgan and Winner's interpreation of the location of the salt-water fronts in the "2,000-foot" sand, the altitude of the water levels, and the areas in which the aquifer is missing. Arrows have been added to show general direction of ground-water flow inferred from the water-level contours.