



Figure 1. Map showing approximate land-surface subsidence in Fort Bend County, 1943-87.

**INTRODUCTION**

Land-surface subsidence resulting from the lowering of water levels that accompany ground-water development in areas of the Texas Gulf Coast has been described in numerous reports, newspapers, and magazines since the 1950s. Gabrysch and Bonnet (1975, figs. 8-10), Gabrysch (1984, figs. 13-15), and Gabrysch and Coplin (1990, figs. 13-17) presented subsidence maps of the Houston-Galveston region, including Fort Bend County, for a number of time periods. Most of the subsidence has been in the Houston area. This report, prepared in cooperation with the Fort Bend Subsidence District and the Harris-Galveston Coastal Subsidence District, presents contour maps of land-surface subsidence in Fort Bend County that occurred during 1943-87 (fig. 1) and 1973-87 (fig. 2).

Fort Bend County is underlain by a thick section of unconsolidated lenticular deposits of sand and clay. The deposits include the principal aquifers in the county—the Evangeline aquifer and the overlying Chicot aquifer. Within these aquifers, the interbedded sands and clays are saturated with water almost to the land surface. The sand layers generally are connected laterally, but the clays retard the vertical movement of water, creating confined (artesian) conditions within the aquifer. The sands are fine to medium grained, and the combined layers yield large quantities of water. The clays are principally montmorillonite, the most compressible of the clay minerals.

**LAND-SURFACE SUBSIDENCE**

Subsidence of the land surface is the consequence of a load being applied to a compressible material. The load, or stress, causing subsidence in Fort Bend County is equal to the decline in artesian pressure (decline in water level times the specific weight of water) caused by ground-water withdrawal. The clay layers are the compressible material.

Average withdrawal of ground water in Fort Bend County during 1986 was about 53 million gallons per day (Locke, 1990, p. 10). Larger amounts of ground water have been withdrawn in adjacent Harris and Waller Counties; but since 1977, withdrawals in the three-county area have declined. Maximum ground-water withdrawals in Fort Bend, Harris, and Waller Counties between 1943 and 1977 occurred during 1974 when pumpage was about 506 million gallons per day (Gabrysch, 1980, p. 21). Subsidence resulted from the ground-water withdrawals in these counties. In Fort Bend County, the largest declines (and the largest load on the clay layers) have been in the eastern part of the county, adjacent to Harris County.

The land-surface subsidence maps (figs. 1 and 2) are based on differences in elevations of bench marks (permanent reference marks), which were determined by conventional surveying methods. Levels to determine elevations were run in 1943, 1973, and 1987 by the National Geodetic Survey and its predecessor agency, the U.S. Coast and Geodetic Survey. Results of the surveys indicate that the maximum subsidence of the land surface in Fort Bend County during 1943-87 was in the far eastern part (adjacent to Harris County), where about 4 feet of subsidence occurred. About 2 of the 4 feet of subsidence occurred during 1973-87. During 1943-87, the land in the far western part of Fort Bend County subsided less than 0.5 foot. Less than 0.25 foot of subsidence was measured in the same region during 1973-87.

**SELECTED REFERENCES**

Gabrysch, R.K., 1969, Land-surface subsidence in the Houston-Galveston region, Texas, in International Symposium on Land Subsidence, Tokyo, Japan, 1969, Proceedings: International Association of Hydrological Sciences Publication 88, p. 43-54.

———, 1980, Development of ground water in the Houston, District, Texas, 1970-74: Texas Department of Water Resources Report 241, 49 p.

———, 1984, Ground-water withdrawals and land-surface subsidence in the Houston-Galveston region, Texas, 1906-80: Texas Department of Water Resources Report 287, 64 p.

Gabrysch, R.K., and Bonnet, C.W., 1975, Land-surface subsidence in the Houston-Galveston region, Texas: Texas Water Development Board Report 188, 19 p.

Gabrysch, R.K., and Coplin, L.S., 1990, Land-surface subsidence resulting from ground-water withdrawals in the Houston-Galveston region, Texas: Harris-Galveston Coastal Subsidence District Report 90-01, 53 p.

Locke, G.L., 1990, Ground-water withdrawals, water-level changes, land-surface subsidence, and ground-water quality in Fort Bend County, Texas, 1969-87: U.S. Geological Survey Water-Resources Investigations Report 90-4012, 155 p.

Winslow, A.G., and Doyel, W.W., 1954, Land-surface subsidence and its relation to the withdrawal of ground water in the Houston-Galveston region, Texas: Economic Geology, v. 49, no. 4, p. 413-422.

Winslow, A.G., and Wood, L.A., 1959, Relation of land subsidence to ground-water withdrawals in the upper Gulf Coast region, Texas: Mining Engineering, v. 11, no. 10, p. 1,030-1,034.

**EXPLANATION**

- 0.5 — Line of equal land-surface subsidence—Interval 0.5 foot. Datum is land surface
- Boundary of study area
- o Data point—Benchmark where subsidence measured

**APPROXIMATE LAND-SURFACE SUBSIDENCE IN FORT BEND COUNTY,  
TEXAS, 1943-87 AND 1973-87**

By  
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1998

Base from U.S. Geological Survey digital data, 1:100,000  
Universal Transverse Mercator projection  
Zone 15

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