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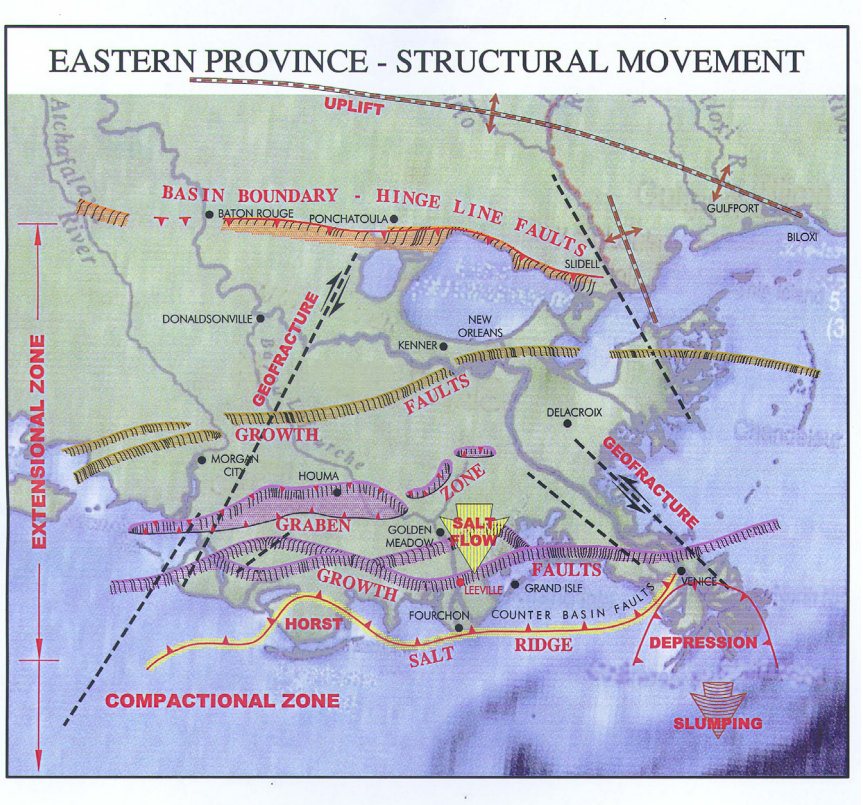
EFFECTS OF FAULT MOVEMENT ON FLOOD PROTECTION LEVEES AND LAND SUBMERGENCE IN SOUTH LOUISIANA



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Abstract

Floodwall breaches that occurred at the Seventeenth Street Canal, the London Avenue Canal and the Industrial Canal in the New Orleans area during Hurricane Katrina in 2005, which caused most of the flooding and loss of life and property in the area, were at locations where deep-seated geological faults underlie the structures. Faults were a contributing factor to the floodwall failures. Seeps along the faults and severe street, structure, and sewer line breaks occurred before the storm and continue at several locations since the breaches have been repaired.

Known geological faults underlie the flood protection levees at numerous other locations in south Louisiana and have contributed to levee instability and in some instances levee failure. The faults underlie other infrastructure elements throughout the region including existing and proposed locks, floodgates, highways, bridges refineries, pipelines, etc. and pose a serious, largely un-evaluated natural hazard.

Sinking and tilting of blocks bound by faults and geofractures and accelerated by modern tectonic activity in the northern Gulf of Mexico region has also been identified as a primary cause of much of the loss of coastal wetlands, deterioration of barrier islands and sinking of ridge lands that has occurred in coastal Louisiana during the last half century.

Movement is occurring on deep-seated faults that are part of the regional tectonic framework of the Gulf Coast Salt Dome Basin. South Louisiana lies atop two province level linked tectonic systems (Eastern and Central Provinces) that are in effect giant gravity slump cells. Each has onshore and offshore components. While the offshore components are contracting and mounding up the gulf bottom, the onshore components are expanding or pulling apart, thus creating depressions. Primary driving processes of the systems, and resulting fault movements, are basin subsidence, sediment loading, salt movement, gravity slumping, and isostatic adjustment. Secondary processes, which may result in localized subsidence, are sediment compaction, soil de-watering and fluid withdrawal (ground water, hydrocarbons and produced water).

Fault movement has been occurring on some regional faults for more than 100 million years. Some faults have moved during the Pleistocene Epoch, prehistoric Native American times, historic times and modern decades. Shock waves from earthquakes with remote epicenters (i.e. the Alaskan Earthquake of 1964) have triggered movement on some South Louisiana faults causing secondary local earthquakes. When accompanied by earthquakes, fault movement effects may include liquefaction, breakup of floating marsh mats and other damage to landforms and human-made structures.

Fault movement affects all surface features including ridges, barrier islands, wetlands, flood protection levees, highways, and coastal communities. Rates, magnitude and frequency of movement have been determined for some faults. The movement data coupled with a process-response model developed from the research provide the basis for risk analysis. Many elements of the proposed coastal restoration and flood protection plans under consideration by the state and federal governments will be affected by these unevaluated hazards. Without consideration of fault hazards the safety of area residents, their families and property are at risk and billions of tax dollars will be wasted.