

The seismicity hazard study concluded that no Delta levee failures are known to be directly attributable to earthquakes, but that a major earthquake in the area today could cause serious damage. There are two reasons for this. First, there have been no serious damage-causing earthquakes in the Delta area since the San Andreas fault ruptured in 1906 (Richter magnitude 8.3)*. Second, the few levees in existence at that time were much lower and subject to much less hydrostatic water pressure.

Earthquakes can cause a number of problems for levees, including liquefaction and settlement. These two factors are of particular concern in the Delta, where levees are founded on and constructed with unconsolidated peat and inorganic soils of low density, low shear strength, and high moisture content. The hazards become greater as the levees are raised to counteract continued land subsidence. Even without another 1906 magnitude earthquake, the Antioch fault earthquake of 1965 (Richter magnitude 4.9) and the Greenville fault earthquake of 1980 (Richter magnitude 5.8) emphasize the potential for higher earthquake magnitudes and the need to consider seismic forces as a potential cause of levee failure.

The Department of Water Resources reviewed the Midland fault because it crosses the central Delta and several recent levee failures are near it, suggesting a possible correlation. The fault was reported to be active and capable of producing a Richter

magnitude 7 earthquake.** However, several more recent studies by the Department and by the Division of Mines and Geology*** conclude that it is inactive, and there is no geologic evidence that the Midland fault is active or has been active for about 20 million years. The Department plotted all earthquake epicenters and recent levee failures in the Delta and superimposed them on a geologic map. There is no apparent correlation between levee failures, epicenters, and the Midland fault.

Levee Maintenance

Maintenance on nonproject levees is performed by many individual districts and landowners. The quality of maintenance varies according to the practices followed by the maintaining entity and does not comply with any set of uniform standards. In some areas, heavy vegetation is allowed to grow on the levee slopes, making it difficult to observe seepage areas, damage by erosion, rodent burrows, cracking, and settlement of organic soils of the levees and their foundations.

Marinas are expanding and boating is increasing, creating additional levee erosion problems. The boating interests are not contributing funds to pay for the added maintenance costs they cause.

Indeed, an argument could be made that a higher level of inspection and repair is needed in the Delta than in other areas

* Richter magnitude of an earthquake is a rating that measures the energy released during the earthquake. The logarithmic Richter scale means that for every upward step of one magnitude unit, there is a 32-fold increase in energy release.

** Greensfelder, Department of Conservation, Division of Mines and Geology.

*** Department of Water Resources, "Revaluation of Seismic Hazards for Clifton Court Forebay, Bethany Dams and Reservoir Patterson Reservoir, Del Valle Dam and Lake Del Valle", July 1979.

Department of Water Resources, "Los Vaqueros Offstream Storage Unit, Engineering Feasibility". July 1981.

California Division of Mines and Geology, "Fault Evaluation Report FER-133", July 30, 1982.