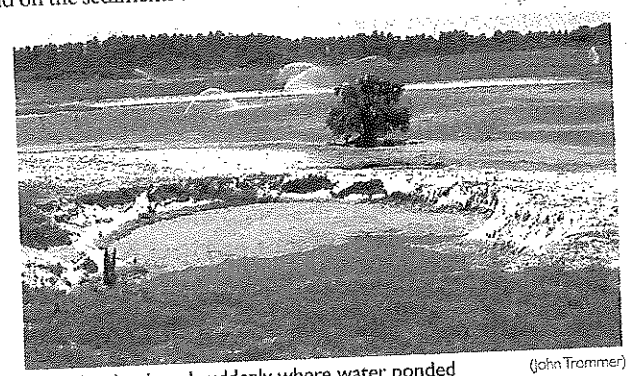
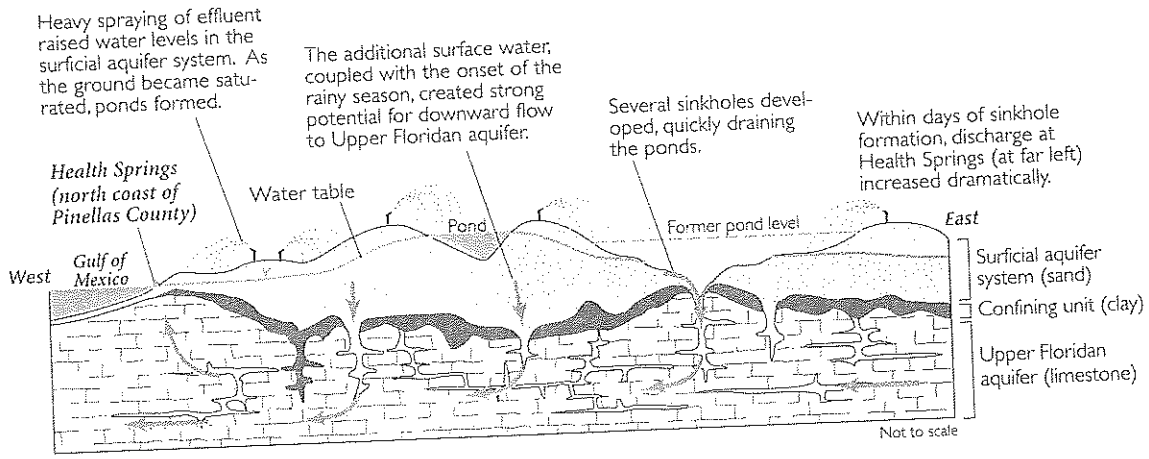
Excessive spray-effluent irrigation inducing sinkholes by surface loading

In April 1988 several cover-collapse sinkholes developed in an area where effluent from a wastewater treatment plant is sprayed for irrigation in northwestern Pinellas County. The likely cause was an increased load on the sediments at land surface due to waste-disposal activities, including periodic land spreading of dried sludge as well as spray irrigation. The 118-acre facility is located within a karst upland characterized by internal drainage and variable confinement between the surficial aquifer system and the Upper Floridan aquifer.

Spray-effluent volume applied for 1988 was equivalent to 290 inches per year (Trommer, 1992). Ponding of effluent occurred as the surficial sediments became saturated. The increased weight or load of the saturated sediments probably contributed to the ponding by causing some subsidence. At the beginning of the rainy season, several cover-collapse sinkholes developed suddenly, draining the effluent ponds into the aquifer system.



Sinkholes developed suddenly where water ponded due to excessive spray-effluent irrigation. (John Trommer)



LINKING SURFACE AND GROUND WATER

Within several days of sinkhole formation, discharge at Health Springs, 2,500 feet downgradient in the ground-water flow path, increased from 2 cubic feet per second to 16 cubic feet per second (Trommer, 1992). Water-quality sampling of the spring during the higher flow detected constituents indicative of the spray effluent. Within 2 weeks, discharge at Health Springs had dropped to the normal rate of 2 cubic feet per second. The existence of a preferential ground-water flow path linking the upland spray field with the spring was confirmed by timing the movement of artificially dyed ground water between a well in the spray field and the spring (Tihansky and Trommer, 1994). The ground-water velocity based on the arrival time of the dye was about 160 feet per day, or about 250 times greater than the estimates of the regional ground-water velocity (0.65 feet per day) in this area.

The dye-tracer test demonstrates how sinkholes and enhanced secondary porosity can provide a pathway directly linking surface-water runoff and the aquifer system. Sinkholes beneath holding ponds and rivers can convey surface waters directly to the Upper Floridan aquifer, and the introduction of contaminated surface waters through sinkholes can rapidly degrade ground-water resources.

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