ever, the groundwater hydrologist must have a full understanding of the aquifer being studied, must be aware of alternative modeling approaches, and must be cognizant of model limitations and restrictions imposed by simplifying assumptions. Used appropriately, models can be powerful decision-making aids. Used inappropriately, they can lead to erroneous and sometimes damaging proposals.

5.24 SALTWATER INTRUSION

Saltwater contamination of freshwater aquifers presents a serious water-quality problem in island locations; in coastal areas; and occasionally inland, as in Arizona, where some aquifers contain highly saline waters. Because fresh water is lighter than saltwater (specific gravity of seawater is about 1.025), it will usually float above a layer of saltwater. When an aquifer is pumped, the original equilibrium is disturbed and saltwater replaces the fresh water. Under equilibrium conditions, a drawdown of 1 ft in the freshwater table will result in a rise by the saltwater of approximately 40 ft. Pumping rates of wells subject to saltwater intrusion are therefore seriously limited. In coastal areas, recharge wells are sometimes used in an attempt to maintain a sufficient head to prevent seawater intrusion. Injection wells have been used effectively in this manner in southern California.

A prime example of freshwater contamination by seawater is noted in Long Island, New York [25]. During the first part of this century, the rate of pumping far exceeded the natural recharge rate. The problem was further complicated because stormwater runoff from the highly developed land areas was transported directly to the sea. This precluded the opportunity for this water to return to the ground. As pumping continued, the water table dropped well below sea level and saline water entered the aquifer. The result was such a serious impairment of local water quality that Long Island was forced to transport its water supply from upper New York State.

5.25 GROUNDWATER RECHARGE

The volumes of groundwater replaced annually through natural mechanisms are relatively small because of the slow rates of movement of groundwaters and the limited opportunity for surface waters to penetrate the earth's surface. To supplement this natural recharge process, a recent trend toward artificial recharge has been developing. In 1955, over 700 million gallons of water per day were artificially recharged in the United States [26]. This water was derived from natural surface sources and returns from air conditioning, industrial wastes, and municipal water supplies. The total recharge volume was equal, however, to only about 1.5% of the groundwater withdrawn that year. In California, for example, artificial recharge is presently a primary method of water conservation. During the period 1957–1958 a daily recharge