

less as one proceeds from the Former Punjab to the Former Sind. Assuming that water of good quality exists down to 400 feet over 19 million acres in the Former Punjab, a total of 1,900 million acre feet is stored in the aquifer. This is equal to about 33 years' supply at our projected irrigation rates. The length of time during which this water can be used to supplement river waters depends on the rate of mining, that is, the magnitude of the differences in the rates of pumping from and recharge to the aquifer. Mining at the rate we have suggested would lower the water table to 400 feet in a little more than a century.

Ground water of poor quality cannot be used without dilution by surface flow. If dilution water is not available, poor quality water, when pumped, must be disposed of in some harmless fashion. Possibilities exist for disposing of some saline water in the Thar Desert. The construction and operation of wells so as to draw only water of useful quality from underground sources will become an increasingly important consideration as the degree of development of the water resources of the Indus Plain approaches the ultimate level.

From the foregoing discussion it is evident that two important operational problems arise in the control of salinity in water management. The first is how to design and operate tubewells so as to skim off a relatively shallow layer of low-salinity water that overlies a much deeper layer of saline water. The second is to determine the proper proportion of tubewell effluent to be exported from the area by drains, so as to maintain with the heavy consumptive use during the economic life of the projects, the salt recirculated by tubewells to the crops at concentrations below those that will seriously inhibit plant growth. These problems are treated mathematically in the next two sections.

Tubewell Operation in Skimming a Shallow Layer of Fresh Water from a Deep Layer of Saline Water.

In using tubewells for mining and for the recovery of fresh water lost by seepage from the canal distribution system, difficult design and operating problems may be expected. The difficulties derive in part from the irregular areal and vertical distribution of zones of saline water, and in part from the need to locate well-screens properly below a water table that is falling and in a region in which the depth to the interface between fresh and saline layers is changing. The objective in each project area is to pump the wells so as to obtain the annual volume of tubewell effluent required for agriculture, and to operate the system so as to minimize the salt content of this water.

Much of the land affected by waterlogging and salinity in the Former Punjab consists of relatively small areas scattered in patches in the