

progressively more acute as pumping is continued. Eventually, there will be only limited sources of good groundwaters which can be pumped and the disappearance of good waters will become more rapid if the bad waters are not pumped.

It seems important that decisions should be made now, rather than later, as to: *i*) who will pay for pumping the bad waters and, *ii*) how will they be disposed of?

Without pumping, the levels of all groundwaters will continue to rise into root zones in the future as they have risen in the past. Waterlogging of once fertile lands has been progressive in the past in Pakistan. Without a drainage system which is designed with the same care that the distributary system was designed, the problem of land abandonment will become more acute. As lands are abandoned because of waterlogging and salinity, it is reasonable to believe that farmers will be no more able to pay for drainage systems in the future than they are at present or have been in the past.

The two reports which have been cited emphasize advantages of the vertical (pumping) drainage systems over horizontal systems. They point further to the difficult and high costs of integrating a drainage system with the distributary system. It may be true that it would be less costly to dispose of the saline drainages by pumps discharging into special canals than by a horizontal system but, if so, only with the provision that the government, or some other agency, would provide and operate the pumps and dig the canals that would dispose of the bad waters. When pumps no longer yield good waters, the agriculture of Pakistan will be in the same position that it was in before the present pumping episode was started.

#### **Water Quality**

The water quality statistics, employed by the Panel in its initial report and in response to the articles by Ghulam Mohammad, rely on salt concentrations expressed as parts per million of total salt. There is no summary of the percentages of high-sodium, high-bicarbonate groundwaters, or of the concentrations of calcium and magnesium relative to the concentrations of carbonates and bicarbonates. With values for these components in the groundwaters, it is possible to estimate the alkalinity hazards and the effects of the waters on soil permeability. From water analyses based on the concentrations of individual ions, it is possible to estimate the percentage of the applied water which must be passed through and out of the bottom of the root zone to carry salts away fast enough to permit yields 80 per cent as high as those possible on non-saline lands. Also, with these values it is possible to estimate