near canals can be delayed until the ground water elevation has been lowered to an extent that recycling will not be excessive.

The summary of the cost analysis is shown in Tables 7.4 and 7.5 for four designs of tubewell systems for the Former Punjab and Former Bahawalpur. It was assumed that the average annual rate of irrigation water as delivered to farmlands was 3.5 acre feet per net cultivated acre in the non-saline area, and 1.15(3.5) = 4.0 acre feet per net cultivated acre in saline areas. Effective rain increases these rates to 3.9 and 4.4 feet per year.

In three of the designs in which the ground water was mined, it was assumed that the average rate of drawdown of the water table would be 3.33 feet per year; in thirty years the water table would be lowered from 10 feet to 110 feet. The average recharge rate was assumed to be 0.67 feet per year after the water table had been lowered to depths exceeding ten feet. The specific yield was set at 0.25 (25 percent). In the non-saline areas the net pumping rate was 1.55 feet per year and the gross rate, allowing 15 percent for recycling, was 1.77 feet per year. In saline areas the rates were less than these as calculated in our water budget. Mined water in saline areas was 2.9 maf/yr; 1.0 maf/yr of this, it was assumed, would be discharged to waste lagoons and desert areas, and the remaining 1.9 maf/yr would be diluted with surface water and used for agriculture. In each of the three designs it was assumed that the entire aquifer of the northern plain of 30 million acres would be mined. The net acreage that would be cultivated in the Former Punjab and Former Bahawalpur under the foregoing assumptions would amount to 16.4 million acres of which 13.6 million acres would be in the non-saline areas and 2.8 million acres in regions underlain with water having salinity in excess of 2000 milligrams per liter. The total amount of pumping required would be 49.5 maf/yr in northern plain, or an average of 49.5/16.4 = 3.0 acre ft/yr per net cultivated acre; 56 percent of the pumps would lie within the net cultivated area and 44 percent would be outside. Although the total water supply was the same in each of the three designs, the capital investment in tubewells differed. With an average spacing of tubewells of 6000 feet on a rectangular lattice (826 acres per tubewell), 2180 wells would be used to supply water for each million net cultivated acres, the total number of wells in the other designs was inversely proportional to the square of the spacing.

Power costs were estimated at 0.05 rupees per kilowatt hour. Drawdowns of the wells were estimated using a transmissivity of 100,000 gallons per day per foot. Conventional formulas were used to determine other friction losses.

It was assumed that construction of salt export drainage works could be postponed for a ten-year period, and in Tables 7.4 and 7.5, item 3 has been discounted to include this saving in capital investment in drainage.