decisions to be made. (In the multiwell model there are 150 "valves".) These are as follows: the x-decision, investment in surface and groundwater storage to increase overall flow available for agriculture and to decrease the discharge of sweet water to the Arabian Sea; the w-decision, function pertaining to emulsion sealants for canal lining; the y-decision, the size, depth, and operating capacity of the tubewell (or tubewells); the z-decision, the agricultural component of tubewell discharge (gross benefits depend upon the cropping pattern and the distribution of water during the growing seasons); the u-u' decision, crops to augment evaporation; and the s-decision, the capacity of drains for carrying off surface flow from the area.

The mathematical problem consists in determining the proper setting of each of the foregoing "valves" (i.e. making the proper investment decisions) so to maximize the economic benefits of the system. It should be noted that the settings built into the model include a "zero" setting. That is, for example, it is possible to study the efficacy of a design that does not entail tubewells but depends entirely on evaporation and surface drains for outflow.

The stochastic nature of the hydrologic regime is reproduced by the introduction of random components into several portions of the simulation. Two types of random component generators are available in the program for use with the normal (Gaussian) probability distribution and with the log-normal probability distribution. Appropriate statistical parameters such as means, standard deviations, and serial correlation coefficients were obtained by statistical analysis of hydrological data from the Indus Plain. A significant feature of the computer program is its ability to utilize synthetic 50-year traces or flow sequences of rainfall, river, and canal flow as inputs as well as the trace corresponding to the real (historical) record. The synthetic traces are generated by a theoretical stochastic process using statistical parameters adjusted by calibration with the historical record; the traces are distinguishable from the real records by standard statistical tests. These replicate synthetic flow sequences provide a valuable means of evaluating a given tubewell scheme design more exhaustively and accurately than by using only the historical trace. This follows from the fact that the magnitudes of high and low rainfall and runoff that were observed during the period of record may not be representative of highs and lows that inhere in the population, and which could occur during the economic life of the project.

Computer Program for the Multiwell Model

Twenty-five tubewell models of the type shown in Figure 7.20 were combined in the multiwell model to simulate the response of the groundwater in an area subject to pumping from several wells. Since the basic unit itself