The salt in the system is not in a steady state condition. It can get out of the system only by means of drainage (y-z). It can get into the system by the inflowing distribution system flow (Q). Also it may be in the system initially in the soil or in ground water. Once in the system, the salt ions travel the same paths as do the water molecules. It may be shown that the effect of diffusion of salt ions in the ground water has a negligible effect on the long-term build-up of salt; therefore this mechanism of movement was neglected.

The salt ions initially in the aquifer take different periods of time to travel through to the well, the time increasing with the initial distance to the tube-well. The method for determining the path and times of travel in the various stream tubes was based on an appropriate solution of the Poisson equation.

Figure 7.17 shows the streamtubes obtained for the wedge-shaped element of aquifer of Figure 7.16. An iterative method of numerical solution of the Poisson equation was used which was adapted to machine computation. Ten stream tubes were identified from the stream function grid of Figure 7.17 and show the path lines of the salt ions for the case of a radius depth ratio of 16:5. Many other cases with different geometries were also investigated. In each it was assumed that the permeability of the aquifer was anisotrophic with a ratio of the horizontal coefficient of permeability to the vertical coefficient of ten to one. It was also assumed that the horizontal permeability was sufficiently high that the cone of depression of the water table about the well could be neglected and that for practical purposes the water table could be considered horizontal. All of the flow through the aquifer passes out in the tubewell, therefore, the stream-function at the top of the tubewell screen is marked 0.0 and at the bottom 1.0. Since there is no flow across either the horizontal bottom boundary or the vertical boundary at radius r_o, the stream-function here is 1.0. Along the horizontal upper boundary of the water table the stream-function increases with the square of the distance from the pump since the area on which the throughput from irrigation water is applied increases quadratically with the radius.

The relative times of travel of water and salt through the 10 different stream tubes are of primary interest in determining the salt accumulation rate. They were evaluated from the relative volumes in each stream tube; flow times for constant discharge are proportional to volume. The relative travel times in the flow net of Figure 7.17 for the ten stream tubes were found to be, 1, 1, 2, 3, 4, 6, 7, 9, 13, and 22. A generalized program was developed for finding the travel times through the aquifer and from points within the aquifer and computations were made for different cases.