will vary in time with any given set of conditions pertaining to (1) the incoming flux of salt in the canal system; (2) salt initially in the ground water; and (3) the salt crust in the soil near the surface of the ground. To answer this question a mathematical model, called the "Salt-Flow Model", for digital computer simulation was developed and investigated. The effect of many important design parameters such as tubewell depth and pumping rate relative to surface flow was analyzed. The model was an adaptation of the generalized digital computer model described in the next section of this chapter. For the present purpose, a simplified version of the complex of flow vectors was used as shown in Figure 7.15. The flow vectors which are combined in this figure are described in greater detail later in the text relating to Figure 7.20.

When calculating salt build-up characteristics the only external flow vectors of importance are (1) the influx of salt in canal inflow (Q), (2) the efflux of salt by way of drainage (y-z), and (3) the inflow of water free from salt in rainfall, and outflow free from salt in evapotranspiration (net inflow, Q_r). Internal flow vectors are (1) throughput from irrigation water and from rain (u' + r'), (2) recharge from canal seepage (w) and (3) evaporation from the ground water table v. The internal vectors are combined into a single vector for net throughput as shown on Figure 7.15.

The system is in a hydraulically steady state with the water table at constant elevation. That is the inflow of water from canals and rain is equal to the outflow of water in surface drains and in evapotranspiration. Under this assumption the flow net in the aquifer accords with the Poisson equation.[17] The irrigation water is assumed to be distributed by water courses and field ditches uniformly over the area along with rainfall. Evaporation and transpiration also are taken to be uniform over the area of influence of the pump. Horizontal flow across the radial boundary (radius of influence) of each well is assumed to be zero.

In a hydraulic steady state, water that is applied to land for irrigation either is passed off into the atmosphere in evaporation and transpiration or goes through the root zone into the ground water. If a water molecule reaches the ground water table, it is transported through the aquifer along a radial streamline to the tubewell. After reaching the tubewell the molecule is either passed out of the system via drainage ditches or it is returned to the system to be mixed with incoming canal water and used for irrigation. Some water molecules are recycled many times in this manner, having only the possibility of going in the directions denoted by the vectors shown on Figure 7.15.

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(17) The differential equation of Poisson is obtained from equation 7-1 by setting the third term equal to zero.