Jalvigyan Sameeksha—a publication of
Indian National Committee on Hydrology
Vol. VII, No. 2, December 1992

Water Conservation in Drinking Water Supply

By

P.S. Rajvanshy

Ministry of Urban Development, Nirman Bhawan, New Delhi

Abstract: *Conservation is defined as preservation against loss or waste Conservation & management of water resources are essential to meet the ever growing demand of water from all sectors. In this paper, loss of water through evaporation, seepage control in a canal system, leakage par water supply systems in urban areas and their repairs have been highlighted. The electronic leak detectors used for finding leakages and what corrective action to be taken have been foccused. Finally Control on wastage by adopting a Rational pricing policy has been presented.*

Introduction

The strategies for conservation in the field of domestic use have to be necessarily different from that for use in irrigation and industry. Conservation generally implies preservation against the loss of waste. But in the larger context it also implies rational exploitation of the water resources and to increase availability of water by creating storage reservoir. In this way to store the excess water during the monsoon and avoid wastage by flowing into the sea. The spatial and temporal variations in the precipitation require storage of water and its utilisation during the time when it is needed most. In case of drinking water supply, the demand of water is maximum during summer and hence the stored water has to be kept available for the entire year. This naturally makes the water susceptible to loss by evaporation, seepage in the dry season. The rate of evaporation in some arid areas is very high. This loss of water in comparison to the rain fall is very high. Also, alongwith loss of water by evaporation on the water surface, water is lost by evaporation from the soil moisture and the extent of loss through evaporation of soil moisture is very high. From the figures worked out about the availability of water by Central Water Commission, it is clear that the quantum of water utilisation through surface structures is about 690 Km.^{3}. The loss of water by evaporation of the moisture is also around 600 Km^3. This calls for immediate action for reducing the loss by evaporation of soil moisture. The total figures of the demand worked out for different purposes by the Central Water Commission are sometimes misleading because the actual demand is based on the requirement of water for drinking purposes and does not contain the loss involved in transmitting the water from the point of storage reservoir to the point of delivery. Since there are variations in the extent of rain-fall and the period during which it is made available, a more detailed study is required to be carried out for different regions separately. A more clear picture can be presented if for every State the actual availability of surface water and the demand for different uses is worked out and then steps are taken to allocate the quantities for different uses. As per the national policy, highest priority has to be given to the drinking water and, therefore requirement of drinking water should be first fully met and allocated and then water should be considered for other different uses.

Management of Demand :

It is generally realised that the demand of drinking water should be rationally worked out

and any scope ot wastage should be kept to the minimum. In rural areas the major problem is to increase the availability of water in non-monsoon areas. The water is generally drawn from the ground sources and, therefore steps shou ld be taken to ensure that excessive drawal of water from ground sources is not done for the irrigation purposes. For increasing the supply in rural areas, strategies such as rain water, harvesting and desalinetion of sea or breakish water are promising. The demand of water in the urban areas is more than the per capital demand in the rural areas and, therefore, there is a higher scope of wastage of water in the urban areas. The loss of water that occurs can be controlled by reducing evaporation losses and also to limit the loss of water through seepage from the storage tanks. Reuse of water by adopting cheaper methods of treatment of waste water can also reduce the per capita consumption. In this regard CPHEEO has taken positive steps and revised the norms of drinking water in the Manual recently released by Ministry of Urban Development. The comparative figures for supply of water to communities have been reduced to minimum and according to it now the norm prescribed is to supyly 40 litres per capital per day. For communities with population of 20,000 water is supplied through stand-post. For communities having population of more than 20,000 to 1 lakh, the per capita supply is 100-150 litres per capita per day for those with population of more than 1 lakh the supplies are 150 to 200 litres per capita per day.

Loss of Water Through Evaporation :

Evaporation of water from open water surface is caused on account ef excessive temperature, presence of high wind velocities, solar energy entering water vaporises it and the transfer mechanism consisting of dry air increases the quantum of loss. The solar energy entering the water is usually reduced by suspending a sheet above the surface reflecting more of the incoming solar radiation than does a natural water surface or a combination of the above. The evaporation control methods involve the reduction of surface area and volume ratio. An introduction of a monmolecular layer formed by a chemical shedding the the water surface and the floating covers used to provide a mechanical barrier preventing vapour transfer or reduces the sum energy from reaching the water surface. In Gujarat and Rajasthan where rate of evaporation is very high and also in Madras where the availability of water is very little in comparison to the demand, various control measures had been adopted to reduce the evaporation losses. Cetyle stearyl alcohal has been found very effective in reducing the evaporation losses. National Chemical Laboratory Pune is trying to develop Alkoxy Ethanols which are found to withstand high wind velocities. After these alcohals are found to withstand high wind velocities in the field and they are commercially available, it will be possible to conserve substantial portion of water lost through evaporation.

Seepage Control :

The loss of water in canal system or in the impounding reservoirs takes place through evaporation and through seepage. While evaporation of water from Canal system or from impounding reservoirs results only in loss of water without other side effects, the loss of water through seepage has many side effects. Seepage also leads to other problems such as breach in the embankment, water logging and increased salinity in the adjacent area. In case of reservoirs used for effluent storage, seepage losst leads to damage to ground water as well as harmful effects on agricultural land. With appropriate lining of the reservoirs/ponds, the seepage loss could be minimised Particularly in arid and semi-arid regions storage of water in seepage proof tanks provides water for human beings as well as livestock and in some cases for irrigation also. One way of reducing the loss is also to

increase the run off through catchment areas. Certain emulstions and sodium corborate can be used for treatment of the catchment area.

Re-use of Waste Water :

In case of urban water supply systems, the strategy to be adopted is not only to aim at the increased availability of water but it is also aimed at utilising the waste water by intercepting it and adopting cheper methods of treatment for reusing it for gardening and arboriculture purposes. Anaerobic treatment methods do not require too much use of energy and mechanical equipment and, therefore, are low in maintenance costs. The waste water after anaerobic treatment can be utilised for gardening purposes. This can be done for towns having population of more than 1 lakh.

Leakage Detection :

Leak detection and repairs is one of the most cost effective measures for conservation of water in urban areas. Especially in older or poorly maintained water systems, a large share of the supply often seeps out through broken pipes and other faults in the distribution network. Many major cities in the country are losing as much as 17 to 44% of their water supplies in this way. These are costly losses because this unaccounted for water is secured, stored, treated and distributed but never reaches the user. The major portion of leakage has service connections through corroded service pipes, couplings, ferrules and disused connections. The leakages also result in deterioration of water buality causing outbreak of water borne diseases. Regular and continuous leak detection and preventive maintenance programme needs to be compulsorily adopted in all urban water supply projects.

In areas of 24-hour supply in residential districts, it is possible to assess the total wastage occuring both in the water mains and the consumer's premises when the consumption is at a minimum which is likely to occur at midnight in purely residential areas. The difference between the minimum night flow in the system and the accountable flow at midnight divided by the average daily flow at mid-night can provide the percentage of waste in an area. Levels of wastage upto 10% may be considered as low, 10 to 20% as average, 20 to 50% as excessive and over 50% as alarming. Remedial measures are called for levels above 20%.

In intermittent supplies only leakage related to water mains are assessed. Waste in mains in such cases is assessed in a zone by closing all the taps or stop cocks in the house service connections. The percentage of wastage in intermittent supplies is the ratio of the flow in the mains with stop cocks or tap closed to the average daily domestic consumption. For any component of a water supply, the information on population, average daily flow, consumption by industry or trade, minimum night flow (in case of continuous supply) or flow in mains with all stop cocks or taps closed in intermittent supply, and transfer of flow from one zone to the other, is required for estimation of the waste. The steps required for estimation of waste are as follows :-

(i) estimation of total daily consumption of the sub-zone by computation or by flow gauging and studying the water consumption pattern of sub-zone for the day.

(ii) Flow Test for measurement of waste through the leaks by isolation of sub-zones and by means of in integrating type water meter or mobile waste water meter; and

(iii) Step Test to assess and localise the leakage in various parts of the sub-zone by internal valves. For assessing the flow of water in the sub-zones, use of mobile waste water flow meter is generally recommended. These meters are integrating rate of flow type meters that can be mounted on a trailer and

are used for measuring the waste flow in sub-zone. The rate of flow with reference to time is recorded on a drum chart. These meters are electro-meganetic type and are not required to be inserted in the pipe line but can measure the flow by suitably positioning meter over the pipeline from which the flow has to be measured.

Instruments :

The electronic leak detectors are used for finding out leakages in the pipeline. This instrument consists of a pick up amplifier and a headphone. The sound vibrations created by water escaping through leaks in pipes are selected and magnified by a magnetic pick up and converted to electrical impulses. These are sensitive and can pin-point the position of the leaks. The other instruments which are used are the electronic pipeline locator and electronic valve box locator. These instruments are used to locate the burried pipe and valves underground. For the location of the valve box, the electronic valve locator is used and for location of pipes the help of electro-magnetic induction and wireless signals is taken. The existence and exact alignment of underground metallic pipelines can be found by the pipeline locator.

Corrective Action :

After the location of the leaks in the pipes prompt repairs to pipes and valves are to be undertaken and flow test of the sub-zones run to determine the extent and efficacy of the corrective measures. If retesting proves that there are further leakages, they have to be attended to, until the losses in the zone are reduced to the minimum. The experience of waste assessment surveys indicates that a few major leaks in a zone of sub-zone contribute to about 75% of the total loss. Sizeable reduction in wastage can be brought about by locating and remedying promptly all such leaks first. Sometimes, it is prudent in a zone to go in for the sounding of probable leaks in pipes without being preceded by waste assessment. The leaks are usually noticed at or near ferrule connection and in corroded G I. house service pipes or in the joints of mains and house service pipes. The savings in water resulting from this programme more than offsets the investments. In addition to the favourable direct cost benefit analysis due to saving of water, the secondary benefits accruing out of such surveys are easy for updating of distribution system drawings, maintaining valves, hydrants and stop cocks, the improved quality of water in the system due to prevention of back flow of pollution into the mains in non-supply hours and above all the public goodwill earned due to the improved supply. Some of these cannot exactly be quantified.

Control on Wastage by Adopting a Rational Pricing Policy :

Unless the user is billed, it is difficult to achieve economy in use of any commodity. Water is no exception. Thus, no water conservation method can succeed unless pricing policy on water is rationalised. The water charges now being collected in some sectors like irrigation are far below from the sustainability considerations. In case of canal irrigation water, the rate charges is not being sufficient even to meet the maintenance cost leave alone the recovery of capital cost and accumulating interest. In case of supply of water for drinking purposes in many places, the rate of water is subsidised. It can be argued that the minimum need of water is subsidised. It can be argued that the minimum need of water should be provided to the poor population at a subsidised cost but the subsidy required for this purpose should be recovered from the richer sections of the population by enhancing the rates of water who consume more quantities of water. The loss of water due to wastage is directly proportionate to the cost charged to

the users. If water is supplied at a nominal cost, the wastage is going to be high. There is, therefore, a strong case for increase in the water rates to meet atleast the operation and maintenance charges for water supply for irrigation purposes. A farmer who use the ground water for irrigation has to pay for the electric charges for pumping the water in comparison to the water supplied to a farmer through a flow irrigation system. The disparity between the two should be removed by bringing the water rates of irrigation at par with the rate that a marginal farmer has to pay for electric charges.

National Policy :

As per the National Policy Document, it has laid down for fixing priorities for the use of water resources, it has been agreed that highest priority should be given for drinking purposes and, therefore, after assessing the quantity of water needed for each State for drinking purposes, a plan should be prepared to make it available from existing sources as well as by taking measures for developing new sources of water as early as possible. Since the supply and quality of water depend upon vegetation and the soil in the water shed areas, it is necessary that the river basin management technique should be adopted for equalising variable supply of water and to supplement increased evailability in the lean periods. This can be achieved partly by creating storage reservoirs and partly through water shed management When water is mismanaged, a high percentage is lost through evaporation in water sheds. Moreover, as a result to poor management of water sheds the seasonability of water flow becomes more accute. Floods that destroy lands in the river basin become more frequent during wet season and there is increase in the frequency of drought during the dry or low rainfall season.

The quality of water in the river basin is subjected to the pollution caused by urbanisation and industrialisation. In order to maintain good quality of water various laws have been enforced in the country which include Water Control and Prevention of Water Act and the Environment Protection Act, The main thrust of these legislations is to remove pollutants from the water discharged by the towns and by the industries and to make it fit for use by the users located down stream of the river.

In view of the above, it is desirable that efficiency of utilisation of water should be important and awareness of water as a scarce resource should be fostered. Conservation consciousness should be promoted through education, regulations, incentive and disincentive.