SOME ASPECTS OF SUSTAINABLE GROUND WATER MANAGEMENT

Shrikant D Limaye, Director, Ground Water Institute, 2050 Sadashiv Peth, Poona 411 030, India. E-mail: limaye@vsnl.com

In order to plan for a sustainable of supply of water from ground water resources, the following ratios are generally taken into account:

1. (Long term mean annual recharge : Total volume of aquifer storage) and

2. (Annual pumpage : Long term mean annual recharge)

If the second ratio is small, say less than 10%, there could be much more scope for ground water development, thereby increasing the ratio up to 50% or even more. If the first ratio is small, the system has a large inertia, making it rather less sensitive to annual recharge variations caused by occasional droughts. However, if this ratio is more than 50%, as is the case with some non-extensive, hard, fractured rock aquifers, the system is very sensitive to availability of annual recharge and a couple of successive drought years could jeopardize the sustainability.

Resource management for sustainability of ground water supply in any region should also take into account the location of that region in the following matrix:

A: Resource Volume: A1 - Small
A2 - Modest
A3 - Large

B: Demand for Domestic & Irrigational Use: B1 - Small
B2 - Modest
B3 - Large

C: Technical & Financial Capability: C1 - Small
C2 - Modest
C3 - Large

Situation like (A1, B3, C1) would be very difficult to manage while on the other hand a situation like (A3, B1, C3) would be very easy. Most of the practical scenarios lie in-between.

In the arid regions of west and central Asia, conjunctive use of surface water and ground water through recharge wells and use of efficient irrigation methods are effective technologies in management of water resources. Development of salt-tolerant varieties of crops makes it possible to use even the marginally brackish water resources. Cultivation of high value crops for export is practiced to help the economical viability of irrigational development. Desalination of salt water is done for meeting a part of the domestic water demand of some urban areas.

In the Monsoon climatic zone of south and south-east Asia, there is too much of surface water during 3 to 4 months of Monsoon rains, while water scarcity is experienced during rest of the year. This region includes very large alluvial aquifer systems like those of Indus, Ganga, Irawati and Mekong, as well as non-extensive, hard rock aquifer systems in basement complex and basalts. Soil and water conservation techniques are practiced here in order to even out the availability of water throughout the year, by increasing the recharge from Monsoon rainfall.

In the National Water Policy in India, ground water has been considered as an important resource because almost 80% of rural water supply, 50% of irrigational water supply and 50% of urban domestic and industrial water supply is obtained from ground water. In a large country like India, which is sub-divided into several States, it is possible to have over-developed sub-basins with falling water table and water-logged sub-basins with rising water table, in the same State. It is, therefore, advisable to consider a sub-basin as a unit for ground water management.

The following aspects are important in sustainable resource management in India:

1. *In areas with rising water table and water-logging problem:* This problem is mainly in the command area of irrigation canals, where inefficient use of canal water by farmers, close to the canal, causes water-logging of lower lands. Efficiency of surface water use can be increased by charging for water on volumetric basis, increasing the tariff and ensuring prompt rotation of canal irrigation. Conjunctive use of

surface water (canal water) and ground water should be encouraged.

2. *In areas with falling water table:* In these areas, Recharge Augmentation is a Positive approach and Pumpage Control is a Negative approach, to be taken temporarily only in emergency. Soil and water conservation techniques, including afforestation, contour bunding, stream bunding, percolation tanks, farm ponds etc. are practiced for recharge augmentation in these areas.

3. *In coastal areas:* Here, it is necessary to resort to recharge augmentation plus cultivation of salt-tolerant crops (Tomatoes, Egg plants, Cotton etc.) Solar desalination of sea water is possible for meeting the domestic needs of small, coastal villages.