GROUNDWATER - TOWARDS SUSTAINABLE USE

INTRODUCTION-

Our earth is unique planet. A major part of it uniqueness is attributed to the presence of water, which covers 71% of its surface area. This water is distributed among the oceans, seas, glaciers, rivers, lakes, atmospheric water vapour and as groundwater below the earth's surface. Water has, since the beginning played an important role in the development of mankind. The growth of all major human civilizations has taken place along river valleys. Today water from the surface sources is definitely being used to meet the domestic, agricultural and industrial demands of the country, but GROUNDWATER is by many means a better resource for the fulfillment of these needs. Groundwater includes all the subsurface water, which reaches to a depth, where all the pores spaces and cavities of the soil and rock are completely filled with water (the upper surface of this zone of saturation is called the WATER TABLE). Some of this water even seeps out of the earth in the form of springs to feed rivers and streams. Groundwater is a better resource as-

- It is relatively safer from chemical and biological pollution, to which the surface water is badly exposed.
- Its supply is more dependable, as it is not quickly affected by drought and other climatic changes.
- As it is locally available, therefore it can be easily tapped and a small distribution network minimizes the cost for the same.
- It has suitable composition and does not require much treatment

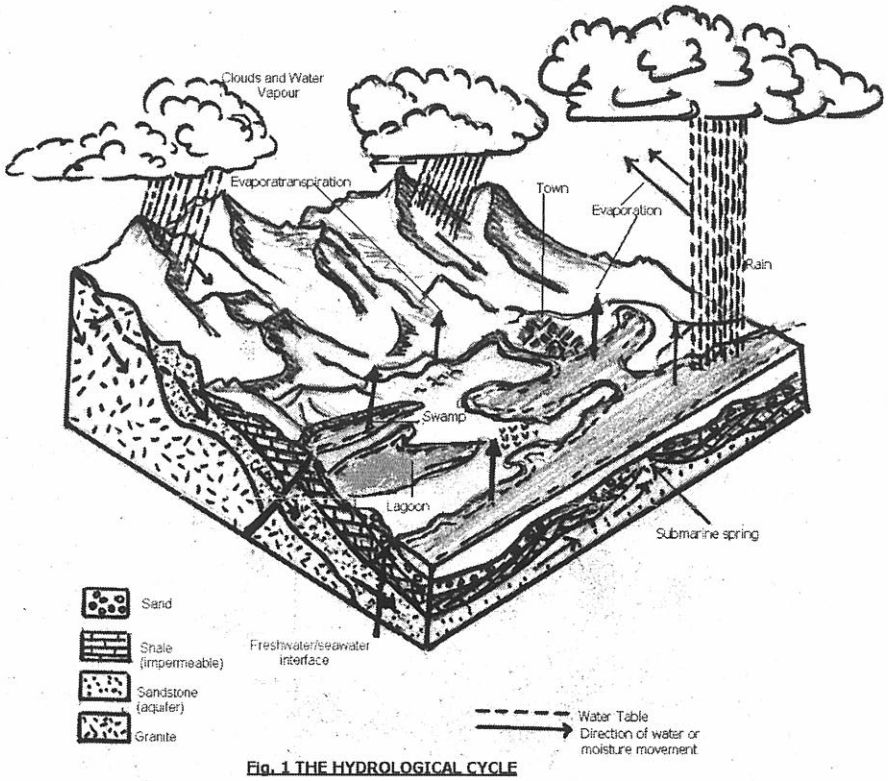

Fig. 1 THE HYDROLOGICAL CYCLE

All groundwater can be thought of as part of the HYDROLOGICAL CYCLE. (Fig.1)

The geologic formations that are saturated with groundwater, as they contain sufficient saturated permeable material, are called AQUIFERS. These may be overlain or underlain by a confining bed (AQUICLUDE, AQUIFUGE or AQUITARD), which is a relatively impermeable material that is stratigraphically next to one or more aquifers.

Aquifers may be UNCONFINED or CONFINED. CONFINED AQUIFERS (are overlain by layers of impervious rocks) are the ones, which push the groundwater through openings on the earth's surface. When the opening is artificial, like the digging of well, an ARTESIAN WELL is formed.

GROUNDWATER POTENTIAL OF INDIA-

India is bestowed with substantial water resources – the total being 178 million hectare meters. However, due to various constraints like physiography, quality, technology etc, only a part of it is utilized. Its been assessed that 67 mham of surface water and 26.5 mham of groundwater can be tapped and used (Manorma yearbook, 1982, pp.463). India's groundwater resources are almost ten times its annual rainfall. (Kumar Shashi Bhushan, 2006, Water resource in India, July 2006, pp.108).

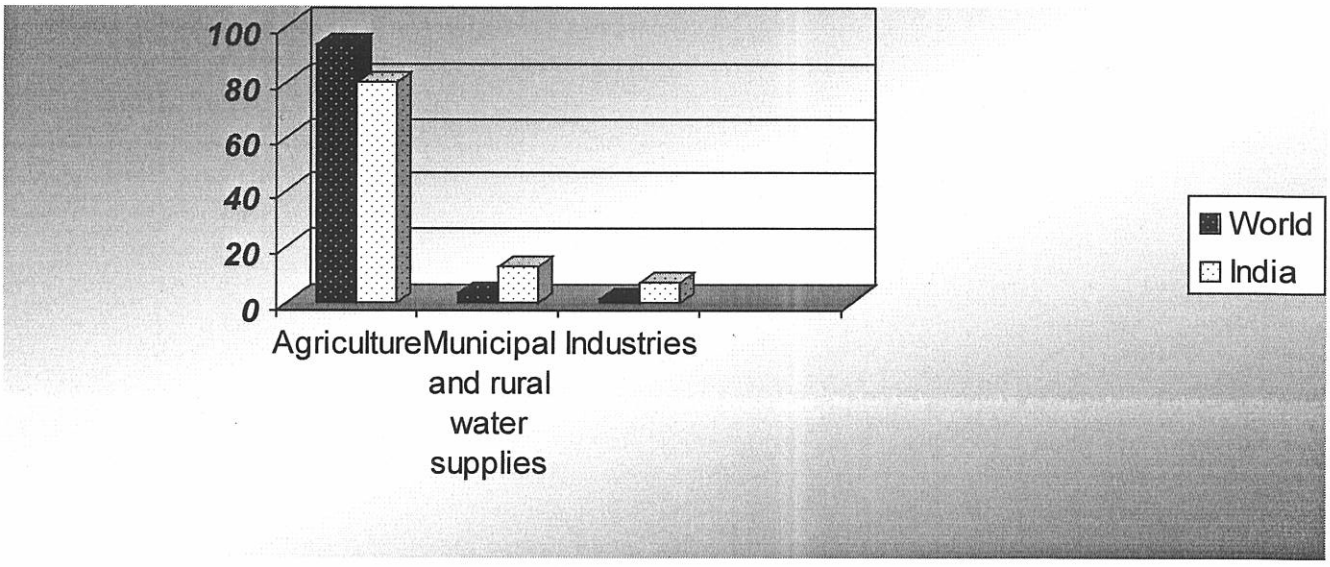

Fig 2 Percentage of water use, out of total available water, for various types of uses, in India and the World (after Khan, 2004 and Kumar,2006)

With the advancement of civilization, the consumption of water is also increasing (Fig 2). This is confirmed by the fact that the per capita availability of water at national level has reduced from about 5177m^3 in 1951 to the estimated level of 1869m^3 in 2001 (Manorma yearbook, 2006, pp.287). Taking account of the current of population rise, it is estimated that by 2025, the per capita availability would fall below 1000m^3 and this would lead to the situation of 'WATER SCARCITY' (Kumar Shashi Bhushan, 2006, Water resource in India, July 2006, pp.108).

Thus its important to plan out the sustainable use of water. Groundwater being a dependable resource, very necessarily, requires proper management. Some methods for its sustainable use may be suggested.

SUSTAINABLE USE OF GROUNDWATER-

In India, though the annual rainfall is enough to meet the water needs, but nearly three quarters of it pours in less than 120 days and that also with so great force, that it causes the water to flow away rapidly leaving no time for its percolation into the ground. Some 1150 km^3 (out of annual rainfall 4000 km^3) of India's rainwater runs off into the seas annually in form of 'REJECTED RECHARGE' (Kumar Shashi Bhushan, 2006, Water resource in India, July 2006, pp.110). Its because of this, that it becomes important to hold water where it falls, as rainwater is the ultimate source of all groundwater. For achieving this RAINWATER HARVESTING SYSTEM development should be encouraged. This system helps to recharge groundwater by capturing and storing rainwater during monsoons and serving as a source of drinking and irrigation during rest of the year. This can be done by constructing various types of structures – *wells* maybe be dug and *tanks* installed for storing rainwater, but care must be taken to desilt them from time to time. This silt, which accumulates, is fertile; therefore can be used in cultivable lands to increase their fertility.

By capturing water where it falls, soil will be able to retain moisture for a much longer time. It would allow the stored water to percolate underground, thus enriching the groundwater reservoir. Constructing *check dams* over drainage areas is a way to capture water where it falls. When this will be done even dried up rivulets will start flowing again.

On slightly higher ground, specially in villages, *ponds* can be constructed to store rainwater and allow it to seep underground. This will help the nearby wells to be filled with water. Also if ground is sloping, some kind of *barriers* can be built to check the rapid flow of water and shallow channels can be dug by their sides to store the rainwater.

Roof water harvesting should also be taken up. In it tiled or RCC roof are used in buildings and eve gutters are provided for collecting roof water, which is then led to be stored in ground level or underground tanks. These tanks should have some filters at their mouth, so that the dust of the roof and the gutters in water is separated and washed out. (Fig. 3)

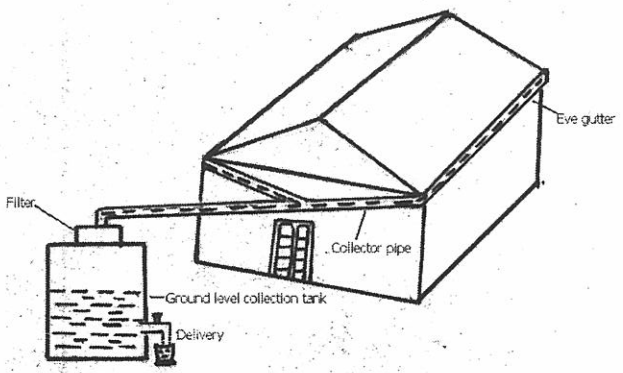

Fig. 3 ROOF WATER HARVESTING STRUCTURE

Thankfully, our country has started to take up rainwater harvesting and groundwater recharge seriously and these have become the main points of its massive integrated Watershed Development Programme. Making it mandatory for school buildings, NGOs involved in water supply and management, housing societies, panchayati raj institutions etc, to harness rainwater and recharge groundwater up to the same extent as has been used by them, will prove to make this programme even more successful.

Another major method of groundwater enrichment is the INTERLINKING OF RIVERS. Between rivers we have the water divide and it is this land in which the infiltration of groundwater can be increased by interlinking the nearby rivers. When water will flow over this land, obviously it'll get time to seep in and be stored as groundwater. It is however true, that such interlinking will cause deficit of water in the

normal course of the river, therefore it is suggested that the excess water, which floods the rivers due to rains and merely flows into the seas, is utilized for this purpose. In this way we can make a beneficial use of huge amounts of water for recharging groundwater reservoirs, which otherwise would just be wasted.

The government is running major river interlinking projects in the country, but these are being met by a lot of opposition, because such projects would lead to mass drowning; human settlements would be destroyed and many rare plant and animal species would become extinct. Also a huge capital investment would be required. Therefore, for interlinking projects very efficient pre-planning is required which should include the careful analyses of the cost involved, provision of homes for the affected people, taking care to rear those rare species of wildlife and plant from beforehand that are present in that particular land area.

For the sustainable use of groundwater, it is important to keep it FREE FROM POLUTION. Today, groundwater is being polluted by discharges from industries, mining activities, flows from irrigation which add chemicals (pesticides, fertilizers etc.) into the river streams, seepage from septic tanks and sewage, animal waste etc. These introduce many physical, chemical, and biological pollutants in the groundwater. There are some mechanisms which may control this, like - *filtration* would remove the suspended particles, thus controlling the physical pollution; *sorption* and *chemical processes like precipitation and oxidation* help to reduce the chemical pollutants (nitrate, potassium, fluoride, arsenic); *microbiological decomposition* checks biological pollution. In addition to this, discharges of pollutants into the groundwater should strongly be controlled.

Planting fast growing trees is a means of naturally recharging groundwater as their roots will go deep into the earth, loosening the hard ground, enabling rainwater to percolate to deeper zones.

Through proper management, wastage of groundwater in agricultural can be controlled. Land should be *ploughed*, because this breaks up the soil, making it easy for rainwater to collect in furrows and soak down slowly. Water should be supplied to fields through *pipes*, rather than open canals and its quantity should be known through installation of meters. 'Drip' and 'Sprinkler' Irrigation, methods should be used as they supply the correct quantity of water to plants. The farmers should develop the wisdom of securing more benefits from the least amount of water. Lining of canals and water channels would minimize seepage losses.

Last, but not the least care must be taken that deep seated aquifers are very sparingly used. This is because it takes years for rainwater to reach these depths and thus they aren't easily recharged. Drilling deep bore wells and using water recklessly will empty these water bearing zones and once emptied, they'll take hundreds of years to become refilled.

CONCLUSION-

Water is the lifeline of mankind and its continual availability is a must for survival. That is why water resources planning and their judicious use is important. This will not only help to meet the demands of the ever growing population, but also to maintain a stock for the future generations.