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# GROUNDWATER IN INDIA

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## ABSTRACT

The three major Groundwater Provinces are the Northern Montane Zone, the Indo-Gangetic Alluvium and the Peninsula which are sub-divided into minor units on Stratigraphic basis. Out of an assessed 1440 million acre feet of total surface water resource a year, the quantity used is around 200 million acre feet only. Broad assessments of underground water indicate availability of 270 million acre feet and the area of availability for exploitation is around 135 million hectares, comprising of 60 million hectares of unconsolidated formations, 15 million hectares of semi-consolidated formations and 60 million hectares of consolidated formations.

Supply of potable water to each and every village is one of the major objectives of the Sixth-five year Plan(1980-85). In drought areas, groundwater is the only source of supply for drinking and irrigation purposes and at times is over-exploited.

Fluorosis, a disease due to high fluoride content in water, has been reported from several States in India. The National Environmental Engineering Research Institute has developed the 'Nalgonda Technique' and the Geological Survey of India successfully devised methods using serpentine and magnesite for defluoridation of water.

## INTRODUCTION

Upto 1979-80, an irrigation potential of 56.7 million hectares was created in the country, consisting of 26.7 million hectares under major and medium projects and 30 million hectares covered by minor surface and groundwater sources. The Government of India proposes to provide assured irrigation facilities to an additional 25 million hectares by surface flow, apart from 10 million hectares by increased use of groundwater in the next 15 to 20 years. An

investment of over Rs.10,000 crores has been allocated in the(ref.1) Sixth Plan(1980-85) for the development of irrigation potential which can generate employment for 11 millions. The Government (ref.2 also proposes to provide clean drinking water facilities to all the problem villages whose number is estimated at 205,000. About Rs.2,000 crores would be required for this. A National Water Development Corporation and a National Groundwater Development Corporation are proposed, the former to ensure optimum utilisation of available water for irrigation and put an end to the ugly inter-State water disputes by linking the different river basins and the latter to ensure fuller utilisation of groundwater potential in the country(ref. 3, 4).

## GROUNDWATER SOURCES

### Geological aspects

Auden(ref. 5) divided India into three major Groundwater Provinces, viz., the Northern Montane Zone, the Indo-Gangetic Alluvium, and the Peninsula. The Principal Geological Formations are,

1. Ancient crystalline and metamorphic rocks(Archaeans)
2. Cuddapahs and Vindhyans
3. Gondwanas
4. Deccan Traps
5. Mesozoic and Tertiary sedimentary rocks of extra-Peninsular India
6. Recent and sub-Recent
   - (i) Older and Newer Indo-Gangetic alluviums
   - (ii) Deltaic alluvium
   - (iii) Lateritic rocks
   - (iv) Desert deposits.

Three important formations of soil and rock in India have a bearing on the yield of groundwater, the consolidated hard rock formation comprising of either trap basalts or other types of rocks like slates, granites, gneisses etc, all these occupying an area of nearly 1.2 million sq. km. Borewells may yield about 10,000 to 30,000 gallons per day. The semi-consolidated formations cover about 0.05 million sq. km. and comprose sandstones, limestones and conglomerates. Tubewells and deep dug wells in such areas may yield about 35,000 gallons per hour at a drawdown of 6 m. The unconsolidated formations in India consist mainly of sand, gravel, boulders, laterites, soils and clays. Yield can be as much as

165,000 gallons per hour. There are about 25,000 deep tubewells, 1 million shallow tubewells and 7 million dug wells in the country. Broad assessments of underground water made by geologists, mainly of the Geological Survey of India and the Central Groundwater Board, indicate availability of 333,100 million cu.m(270 million acre feet). Rao( ref. 6) estimates the total groundwater including already used water at 255,000 million cu.m.

Groundwater for irrigation and drinking

The government has announced an ambitious national perspective plan for water resources development which aims at harnessing major inter-State rivers. The plan, estimated to cost Rs.50,000 crores, envisages provision of additional irrigation to 25 million hectares by surface water and 10 million hectares by increased use of groundwater. The revised Sixth Five Year Plan has fixed a target of 8.5 million hectares by the end of 1982-83.

TABLE 1

Target for Additional Irrigation (million hectares)

| Year | Surface water | Groundwater | Total |
|---|---|---|---|
| 1978-79 | 0.25 | 1.05 | 1.30 |
| 1979-80 | 0.25 | 1.25 | 1.50 |
| 1980-81 | 0.30 | 1.40 | 1.70 |
| 1981-82 | 0.35 | 1.55 | 1.90 |
| 1982-83 | 0.35 | 1.75 | 2.10 |
| Total | 1.50 | 7.00 | 8.50 |

Source: Draft Sixth Five Year Plan(Revised), 1978-83.

The tentative target for the Sixth Plan, further revised and recently approved, is 15 million hectares additional irrigation potential. The target by the turn of the century is 113 million hectares. It is clear that groundwater will have play a major role in this programme.

The number of problem villages, those that are located in areas where the nearest water sources are either 1.6 km away or which are endemic to water-borne diseases, has been put at 205,000 and the Government proposes to provide clean drinking water facilities to all of them by the end of the Sixth Plan period at an estimated cost of Rs.2,000 crores. As it is there is considerable over-exploitation of groundwater, particularly in Coimbatore where the water table has gone down to 150 feet now. This must be prevented at all costs and conjunctive use of surface and groundwater sources has to be planned properly.

## Fluorosis

The content of fluorides in groundwater in certain pockets of India has been determined and the range has been categorised as 0-1.5, 1.5-4.0, 4-8 and over 8mg/l in arid and semi-arid belts, and as 0-1.5, 1.5-5 and more than 5mg/l. In certain exceptional cases like Sagalia in Gujarat, the fluoride concentration has been found to be 19.0 ppm.(ref. 7). This has led to an ailment called 'knock-knee'. The National Environmental Engineering Research (ref.8) Institute, Nagpur has evolved a method to overcome this problem and named it 'Nalgonda Technique'. It involves the addition of two readily available chemicals, sodium aluminate or lime and filter alum to water in sequence followed by flocculation, sedimentation and filtration. A few pilot plants have been set up at selected places and the method has been found effective. The recent researches by the Geological Survey of India led to the discovery of a natural mineral serpentine which can absorb large quantities of fluorides from waters(ref. 9). Doctors of the Osmania Medical College, Hyderabad experimented successfully with serpentine as a defluoridating agent in the treatment of patients suffering from fluorosis.

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