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Problems and management of water resources in India

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Abstract
Water is precious natural resource for sustaining life and environment. Its development and management play a vital role in agriculture production. Effective and sustainable management of water resources is vital for ensuring poverty reduction, environmental sustenance, and sustainable economic development. In view of the rapid increase in population, urbanization, and industrialization, the demand for water for meeting various requirements is continuously increasing. Therefore, we are facing numerous challenges in the water sector, which include reducing per capita water availability, the decline in groundwater table in many areas, and saltwater intrusion in coastal aquifers. The quality of surface water and groundwater is also deteriorating because of increasing pollutant loads from various sources. Climate change may also adversely affect the availability and distribution of water resources. The present article deals with the relevant problems pertaining to development and management of water resources in India.

Keywords: surface water, groundwater, drought, flood, contamination, recycling

1. Introduction
Water is one of the most essential natural resources to human life. In fact, since 60% of the human body is water, it can be said that water is life itself. Without water, no field of human activity can be complete. Today, the world is debating if the flow of information is more important than the flow of energy. That is a good question. But the flow of water is still more important. It is fundamental to the economy and to ecology – and to human equity. The issue of water is becoming still more critical in view of climate change and related environmental concerns. Water is central to some of the flagship programs in India. The modernization of India may be largely dependent on the modernization of its water management. This is not surprising since India supports 17% of the global population but has only 4% of the world's water resources. Better and more efficient use of water is a challenge for Indian agriculture and industry alike. It requires to set new benchmarks in both villages and in the cities.
In India, 54% of people are dependent on farming for their livelihood. Yet, their share of national income is only 14%. To make agriculture more remunerative and to improve the prosperity of farming communities, the Indian government has introduced many new projects such as water for every farm, per drop more crop and doubling farm incomes by 2022.
Under the 'Make in India' mission, India is working to sharply increase the share of manufacturing in its GDP. From the current 17% of GDP, efforts are being made to take it to 25% by 2025. Industry requires a large volume of water. This is particularly true for the manufacture of electronic hardware, computers, and mobile phones. And these are all focus areas for 'Make in India'. Currently, 80% of water in India is used by agriculture and only 15% by industry. In the coming years, this ratio may change. The total demand for water will also rise. The efficiency of water use and reuse, therefore, has to be built into the blueprint of industrial projects. Business and industry need to be a part of the solution.

2. Surface water management
Surface water management involves dealing with potential flooding from sewers, drains and groundwater and the run-off from land, watercourses and ditches that can follow from heavy rainfall. Sustainable drainage systems aim to manage surface water run-off to reduce flood risks whilst enhancing biodiversity and amenity benefits through an integrated approach using a variety of water management techniques. At polypipe we have an established

portfolio of engineered, easily maintainable systems including geocellular and piping systems, designed for surface water management in both urban and rural applications.

3. Ground water management

Groundwater in India provides for about 60% of the country's irrigation needs, 85% of rural drinking water requirements and 50% of urban water needs. Unmindful exploitation of groundwater on large scale has led to a sharp decline in groundwater level and deterioration of water quality in major parts of the country. As per 2013 data, 4% of groundwater assessment units in the country are in a critical state and 10% in a semi-critical state due to over-exploitation and contamination. The reasons for this over-exploitation and contamination include increasing demand of groundwater for agriculture, industrial and drinking purposes; change in cropping pattern and growing of paddy and cash crops that consume large quantities of water; scanty rainfall in arid and semi- arid regions; flat rate/ free subsidized electricity for extracting groundwater in certain states; haphazard sewage and waste disposal; large groundwater extraction during droughts when all other sources shrink; and rapid pace of urbanization resulting in reduced natural recharge to aquifers.

Development of groundwater resources in different areas of the country has not been uniform. Highly intensive development of groundwater in certain areas in the country has resulted in over-exploitation leading to declining in groundwater levels. As per latest assessment of groundwater resources carried out jointly by CGWB and the States as of 2013, total annual replenish able groundwater resources of the country have been estimated as 447 Billion Cubic Metres (BCM). Net annual groundwater availability is estimated at 411 BCM. Annual groundwater draft for the entire country is estimated at 253 BCM per year. The stage of groundwater development is 62%.

Mass awareness movement is required for restrained exploitation of groundwater. Decadal fluctuation analysis of water level has been done by Central Groundwater Board (CGWB) to assess the change in water level over last 10 years. Pre-monsoon (March/April/May, 2016) water level data when compared with the decadal average (2006-2015) indicate that more than 50% of the wells have registered decline in groundwater level, mostly in the range of 0-2 m, in almost all the States/UTs of the country, except few States namely Arunachal Pradesh, Goa, Pondicherry, Tamil Nadu and Tripura. The decline of more than 4 m was observed in pockets in the States/UTs of Andhra Pradesh, Chhattisgarh, Dadra & Nagar Haveli, Delhi, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Telangana and West Bengal.

4. Drought management

Significant regional variations exist in India when it comes to the experience with water. On the one hand, groundwater sources are being savagely exploited and depleted in some of the northern and western states. On the other hand, in eastern and north-eastern states, there is the challenge of overflowing rivers and regular flooding. Year after year, this damages human habitation and is leading to tragedies in countless families.

Only a multi-stakeholder and multi-pronged approach can address such calamities. This includes achieving an interlinking of rivers where feasible. It also necessitates a basin-wide management of river systems to both keep rivers clean as well as serve the purpose of different types of users.

The drought has many definitions, but mostly it originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration in a particular area, a condition often perceived as "normal". It is also related to the timing (i.e., the principal season of the occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity. There can be *Meteorological Drought* (degree of dryness and the duration of the dry period), *Agricultural Drought* (links various characteristics of meteorological or hydrological drought to agricultural impacts), *Hydrological Drought* (associated with the effects of periods of precipitation shortfalls on surface or subsurface water supply), and *Socio-economic Drought* (associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought).

5. Flood management

In India, flood protection measures using embankments were in existence for centuries. This is evident from the old embankments constructed by private individuals for the protection of their lands. The inadequacy of the individual efforts in the sphere of flood control led to the governmental interest in the problem chiefly during the past century. As a result of this, a number of well-planned embankments were constructed on some of the rivers, which were causing recurrent flood damage. These measures were mainly to give protection to the commanded areas of the canal systems in northern India, and the deltaic tracts of east flowing rivers in Orissa, Andhra Pradesh, and Tamil Nadu.

6. Contamination management

The Central Pollution Control Board (CPCB) carries out water quality monitoring of river Ganga from Gangotri to West Bengal. Comparison of observed water quality (2017) with bathing water quality criteria indicates that Dissolved Oxygen which is an indicator of river health has been found to be within acceptable limits of notified primary water quality criteria and satisfactory to support the ecosystem of the river across all seasons and for an almost entire stretch of river Ganga. Biochemical Oxygen Demand (BOD) is found above the acceptable limit in part of stretches downstream of Haridwar to Kannauj, at Kanpur, at Allahabad, at Varanasi; and some stretches in West Bengal (e.g. Bahrampore, Serampore, Palta, Dakhshineswar, Howrah, Garden Reach, Uluberia and Diamond Harbour).

The river water quality monitoring carried out in 2017 indicates improvement in water quality trends as compared to 2016. The Dissolved Oxygen levels are improving at 33 locations and are above the quality requirements of 5 mg/l. Biological Oxygen Demand (BOD) levels are reducing which is an improvement, at 26 locations and coliform bacteria count is reducing which is an improvement, at 30 locations.

7. Recycling management

Water recycling reclaims water from a variety of sources then treats and reuses it for beneficial purposes such as agriculture and irrigation, potable water supplies, groundwater replenishment, industrial processes and environmental restoration. Water reuse can provide alternatives to existing water supplies and be used to enhance water security, sustainability, and resilience. In this respect, the government should make suitable legislation to regulate utilization of recycled water in different ways.

8. Recommendation

It should be proposed a policy shift in water resources management, from the conventional style of investment in major infrastructure projects, to undertaking grass-root level activities with participation of local communities which could ensure equitable access of water. It is also aimed at fostering a culture of evidence and data-backed policy decisions for efficient management of water resources in the country. In a view of limitations on availability of water resources and rising demand for water, sustainable management resources has acquired critical importance. To supplement its present resources, we have to find unconventional solutions involving recycle and reuse of water, rainwater harvesting, etc. It is possible to store surplus monsoon run-off in ground water reservoir, we have to go back to the era when people valued and conserved each drop.

9. Conclusion

Most of the water planning and development in the country has been done as per administrative boundaries rather than by using river basins as the hydrological unit. This has led to water conflict as most river basins are shared by several states and water demand for meeting domestic, industrial and agricultural needs within each state has gone up significantly. In the absence of river basin management plans and active river basin authorities, these issues have intensified.

The variability of water resources across India demands a basin-by-basin analysis. Variation in rainfall means replenishment is unevenly distributed over time. This makes the management of water including with storage facilities for recharge, even more important than just absolute quantity of water availability.

A localized water management approach is need of the hour. It should empower village and neighborhood communities and build their capacity to manage, allocate and value their water resources. Any 21st century water policy must factor in the concept of the value of water. It must encourage all stakeholders, including communities, to expand their minds – and to graduate from allocating a quantum of water to allocating a quantum of benefits. Of course, this quantum of benefits will be dynamic. It will inevitably be linked to the mapping and forecast of livelihood patterns in human society.

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