JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

India's Water Resources Management – Difficulties and Opportunities

Harit Priyadarshi[1] and Manish Kumar[2]

[1]Department of Civil Engineering, Mangalayatan University, Aligarh, UP

[2]Faculty of Engineering & Applied Sciences, Usha Martin University, Ranchi, Jharkhand

E-mail: harit.priyadarshi@mangalayatan.edu.in

Abstract: Water resource management in India has been increasingly difficult in the last 50 years due to many factors, including increasing demand and worsening environmental conditions. India's significant water management challenges can be broken down into the following categories: (a) water availability, variability, and increasing withdrawals; (b) environmental quality; and (c) project construction, among others. (d) water-sharing disputes; (e) water governance, institutions, and (f) challenges resulting from climate and land-use cover changes. Each of these issues is discussed in great length here. According to some experts, water resources management in India should be based on conservation and management of variability. Also included in this memorandum are suggestions on how to deal with the problems and details of recent government initiatives (GoI).

Keywords: Biodiversity, Artificial recharge, climate change,water resources,Water governance.

Introduction:

Water holds a special place among the world's renewable resources. Food production, economic growth, and general well-being depend on it inextricably. In many ways, it is a one-of-a-kind gift from the natural world. Water can be diverted, transported, stored, and recycled, making it one of the most controlled natural resources. Water has a wide range of uses for humans because of these characteristics. Agriculture, hydropower, livestock production, industrial processes, forestry, fisheries, navigation, leisure activities, etc., all rely heavily on the country's surface and groundwater resources [1]. i) drinkable water, (ii) irrigation, (iii) power, (iv) ecology, agro-industries and non-agro-industries and (vi) navigation should be prioritised in water allocation in operation and planning of systems, according to National Water Policy.

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

Snowfall contributes to India's yearly precipitation total of roughly 4000 km^3. Monsoon rainfall amounts to about 3,000 km3 of water. There are two monsoons in India, one in the southwest and one in the northeast, and the rain is influenced by these two local storms. Except for Tamil Nadu, where the north-east monsoon dominates October and November, most of it occurs during the southwest monsoon season between June and September. More than 20 major rivers and several tributaries in the Indian River system. Several of these rivers are year-round, while others are only present for a limited time. The Himalayas are home to rivers like the Ganges, Brahmaputra, and Indus, which convey water throughout the year [2]. Water flows during the lean season are supported by Himalayan snow and ice melt and base flow from the surrounding mountains. According to Lal, more than half of India's water resources are found in the different tributaries of these river basins. Himalayan rivers' average water supply per unit area is nearly double that of the southern peninsular rivers system, illustrating the importance of snow and glacier melt from the high mountains. In addition to the water found in the country's many rivers, groundwater is a valuable resource for various purposes, including drinking, irrigation, and industrial [3]. Over half of the country's irrigation water is derived from this source. A country is classified as water-stressed if it receives fewer than 1,700 cubic metres per capita year, whereas a water-scarce country receives less than 1,000 cubic metres annually. Per capita surface availability of water in India was 2309 m^3 in 1991 and 1902 m^3 in 2001, but this is expected to drop to 1401 m3 in 2025 and 1191 m3 in 2050. There is a pressing need for the country's most significant assets, water and land, to be appropriately managed to improve the lives of millions of people, particularly those in rural areas [4].

Variability in water supply, as well as rising withdrawals:

India's rivers can be divided into four categories: Himalayan, Deccan, coastal, and inland drainage basin rivers. Rivers in the Himalayas are fed by rain, snow & glacier melt. India's three major Himalayan rivers are the Indus, Ganga, and the Brahmaputra. To conserve water and protect civilization and infrastructure from flood damage, the flow of Himalayan rivers must be controlled [5]. The three Himalayan rivers cross international borders. Several important tributaries of these rivers originate in countries that border India. Pakistan and Bangladesh are the following countries these rivers enter after passing through India. As a result, India serves as both an upstream and downstream country. The Mahanadi, Godavari, Krishna, Narmada, Tapi,

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

and Cauvery are among the Deccan's most important rivers. Compared to the Himalayan rivers, these rivers are rain-fed and transport far less silt. Except for the Narmada and Tapi rivers, which run westward into the Arabian Sea, most peninsular rivers empty into the Bay of Bengal. Rivers in India's coastal regions tend to be small in length and area.

The West Coast's rivers flow at a relatively rapid rate. Approximately 4000 billion cubic metres (bcm) of precipitation falls on India each year, and the country's water resources potential is 1869 bcm. Water resources that can be tapped include 690 bcm of surface water & 447 bcm of groundwater, totalling 1137 bcm of usable water. In 2011, India's per capita yearly water supply was approximately 1544 cubic metres, which has since decreased due to population growth. Using the Falkenmark Index, a country is considered water-stressed if its annual renewable water supply falls below 1700 m3. Even though India's lifestyle and water use are vastly different from those in Europe and the United States, diminishing per capita water availability indicates tighter limits in water management [6]. In India, there are three significant challenges concerning the variability of water resources:

i) Floods and droughts are just two of the many problems caused by India's extreme water availability.
ii) There is a substantial regional imbalance between water supply and demand, and the demand for diverse applications is expanding rapidly while the supply is practically constant.
iii) The increasing and increasingly unsustainable withdrawal of water from surface and underground water bodies to meet increasing needs.

Taking too much water out of the system:

Increasing amounts of water are being drained from the surface and underground water bodies to meet growing demand. Withdrawals have harmed rivers in different countries, and some have stopped running all year round. As a result, both the river and the surrounding ecology suffer greatly [7].

Even though groundwater use has provided India with much-needed drinking water and food security, unsustainable extraction at many locations has resulted in water tables falling, resulting in boreholes going dry, rising pumping costs, falling river base flows, and the introduction of

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

harmful substances (such as arsenic) into the water supply. The groundwater in a considerable number of Indian areas has been contaminated somehow. Fluoride, iron, salinity, arsenic, and other contaminants are only a few examples. Excessive groundwater extraction can also lead to land subsidence, which can have a wide range of detrimental effects. A typical year in India is expected to see water availability close to or less than what is needed. In the years of below-average monsoon, the situation would be highly hazardous.

Rather than managing surface water and groundwater individually, it is vital to look at the water resources (i.e. water resource = surface water + groundwater). Reducing water use, preserving water, and transporting water across geographic boundaries are necessary steps in this process. To begin, in areas where water is already scarce, every option should be explored to reduce overall demand. Agriculture uses more than 80% of India's overall demand, and as a result, there is the most significant potential for water savings in agriculture. An estimated 40 to 50 percent of India's surface and groundwater is used for agricultural purposes, according to a recent study [8]. There is a lot of room for improvement here.. As the country's current irrigation water use is between 550 and 600 bcm, increasing these efficiencies by around 20 percent would substantially provide enough water to fulfil the environmental and municipal sectors' needs. Adopting sprinklers, drips, and other water-saving techniques can result in significant financial savings. Farms should be encouraged to conserve water by maximising the number of crops they can produce with each drop of water, especially in locations where water supplies are limited.

Recycle and reuse:

Only a fraction of the water delivered is recycled, and a significant amount of water is lost owing to leaks and thefts in metropolitan water delivery networks at this time. According to some estimates, about 40% of municipal water for drinking purposes is lost owing to leaks or theft in some areas by replacing worn-out pipes, valves, and other components and recycling and reusing water in the municipal and industrial sectors. Saudi Arabia alone produces almost 10 km3 of wastewater per year. Approximately 55% of this water is processed, and 15% is reused in agriculture, landscaping, environmental protection, & industrial cooling [9]. Most Indian towns' drinking water shortages might be alleviated significantly if more water was recycled. Some cities' water troubles can be traced back to poorly planned urbanisation. A few decades ago,

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

broad open regions surrounding Chennai, where aquifers were replenished, and floods were absorbed, were unpaved. As a result of the decreased recharging capacity, water availability has decreased and flooding has increased.

Water, like all free resources, is frequently squandered. As a result, water consumers should be charged a fee to cover the costs of delivering the service and maintaining the infrastructure and a portion of future growth. Metered water should be provided to all customers. The weaker parts of society should be given access to clean water at subsidised rates, but those who consume more than 50 litres per capita per day (LPCD) should be paid at a higher cost to discourage waste. Each river basin should have a water resources development plan that outlines the projects built there, including their location, size, and other relevant details. Using these strategies, we can ensure that the combined effects of all of the projects are manageable and that the basin's carrying capacity isn't surpassed.

Environmental and water quality:

When it comes to environmental and spiritual well-being, high-quality water is a blessing; on the other hand, low-quality water is a burden. Toxic waste dumping from industrial and municipal regions and the return flow of dirty water from orchards and plantations has contaminated many rivers, lakes, and ponds, a primary drinking water source for millions of people. Urban India's sewage is estimated to enter waterways untreated at a rate of more than 50%. The top 10–20 m of the subsurface zone has been contaminated by industrial and other pollutants dumping. Many regions have highly contaminated water coming from hand pumps as proof of this contamination. Some large and medium-sized businesses provide a valuable service by treating wastewater properly, but other industrial units inject waste into aquifers to save money on sewage treatment. This is a problem. Future generations will bear the brunt of poisoned aquifers. In India, 45 percent of children are stunted, and every year, 65,000 children under the age of five die due to poor water and sanitation. According to the World Health Organization, poor water and sanitation contributed 7.5 percent of all fatalities in India in 2002, and 9.4 percent of disability-adjusted years of life. Each year, water-borne infections cause the loss of 73 million working days in India. Clean drinking water and sanitation can help avoid many or most of these deaths, according to the CDC. India has one of the lowest water quality indices in the world. The

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

amount of sewage generated necessitates creating and implementing adequate sewage treatment capacity. To get natural bodies of water back to safe levels, strict oversight and punitive measures are required. Water resources development (WRD) initiatives should all be environmentally friendly, and current projects should be retrofitted to do the same. Assessment and implementation of location-specific environmental flows is necessary for maintaining healthy rivers and ecosystem services.

WRD projects take a long time to plan and build:

A feasibility study is a common first step in developing a WRD project. A detailed project report (DPR) is compiled upon acceptance of this report. Then several approvals, including environmental and investment approvals and interstate approvals, are sought for the project. These approvals can take a long time, perhaps many years, at times. There have been cases where a project has been cancelled despite extensive work on the DPR and obtaining necessary approvals. In the end, it's OK to abandon a lousy project, but only if you've already invested a significant amount of time and money into it. Too often, the cost of a project has already escalated significantly by the time it receives the necessary permissions, and construction can begin.

The entire procedure must be made more efficient for obvious reasons. An initial feasibility study may be developed and extensively scrutinised by key ministries and regulators in the first step. The organisation in question must have the power to decide whether or not the initiative will go forward. All objections and concerns about the project and its effects must be addressed at this stage. Step two should focus on getting the project up and running as efficiently as feasible within the projected time and budget if that decision has been made. A design and implementation committee should decide the best design and other aspects of the project, which should also supervise the construction. Due to agitations, legal cases, and other issues, the project should not be discontinued at this time.

Institutions and governance of water:

India's WRD and management institutions need a significant overhaul in light of the country's wide range and severity of water-related issues. This is partly because water management has evolved dramatically over the past four decades, and the field is becoming increasingly

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

interdisciplinary. For water experts, it's important to know about everything from forestry to geology to meteorology to sociology to law to management, in addition to hydrological concepts. The current organisations must be restructured by bringing in people from relevant backgrounds, and some of the work can be outsourced. With WRD, the government of India (GoI) needs to play several crucial functions as a developer, evaluator, and regulator, which necessitates developing water-related institutions. We'll need many multidisciplinary teams that can handle a variety of difficulties. Experts from the government sector, academic and R&D institutions, and nongovernmental groups and individuals must be involved in developing a robust monitoring framework. Indian water governance issues have been examined in depth by Singh7. A variety of government agencies currently handles water. Inter-sectoral conflicts and governance issues are often the results of this. Such circumstances can be avoided by establishing a common framework for decision-making that includes all of the relevant sectors. Agriculture, drinking water, hydropower, the environment, floods, and climate change are major concerns in India. National planning and decision-making can be centralised in a single authority. Committees for river basin management may be formed at the next level with representatives from such key sectors from co-basin states.

In the water sector, there is currently no R&D institution or think tank with the multidisciplinary staff and infrastructure to take on complex tasks like formulating and implementing an integrated water resources management plan for a significant basin, for example, the Krishna basin. The causes behind this need to be analysed, and remedial steps are taken so that India has several teams that can assist in developing and managing integrated WRD and management in India. The top students in India rarely consider working in the water sector, despite the many problems and opportunities it presents. Providing service conditions and incentives that are on par with those in other industries is essential if the water sector recruits top people. The current state of research and technology about water management in India is discussed in Mujumdar and Tiwari9. Changes in the climate Due to its unique climate, geology, and topography, India is particularly sensitive to the effects of climate change on its water supplies. The amount of snow that falls will decrease as the lower atmosphere warms. glaciers and snow cover, crop water requirements, harsh weather, rising sea levels, marine intrusion, rising temperatures, and so on. The goals of this report's recommendations are reduced vulnerability to climate change and

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

increased societal resilience. Research and development (R&D) must be more concentrated to identify expected changes, where they should be implemented and how.

Conclusion:

An in-depth look at India's water resource management issues is provided in this article, along with recommendations for how to deal with them. These issues stem from various factors, including technical, social, and financial. To develop and implement the answers, a political will must address the issues immediately and strongly.

While this is a promising indicator, the Government of India's commitment/plan for ensuring water security for the country's entire population by 2022–23 is also a cause for hope. Piped drinking water for every rural household is one of the targets, as is providing irrigation to all farms and increasing water efficiency or yield per drop. Other targets include encouraging industries to use recycled/treated water and ensuring zero discharge effluents from industrial units. Other targets include ensuring uninterrupted and clean flow in the Ganga and other rivers and creating additional water storage capacity to ensure. Additionally, the government's efforts to improve water quality will have a long-term impact on the sector. Many WRD initiatives that had been put on hold for a long period have been revived. Some progress has been made in river revitalization projects. Achieving the desired outcomes can be achievable through the development and implementation of water-related technologies and involving the general public more fully in WRD and management.

References:

1. Jain, S. K., Agarwal, P. K. and Singh, V. P., Hydrology and Water Resources of India, Springer Verlag, The Netherlands, 2007.
2. Falkenmark, M., Lundquist, J. and Widstrand, C., Macro-scale water scarcity requires micro-scale approaches: aspects of vulnerability in semi-arid development. Nat. Resour. Forum, 1989, 13(4), 258–267.
3. Lal, M., Climate change – Implications for India’s water resources. J. India Water Res. Soc., 2001, 21, 101–119.
4. Canter, L. and Swor, T., Handbook for Cumulative Effects Assessment and Management, U.S. Army Corps of Engineers, Washington, D.C., USA, 2011.

ISSN- 2394-5125 VOL 7, ISSUE 03, 2020

5. Singh, A., Dipankar, S. and Tyagi, A. C. (eds), Water Governance: Challenges and Prospects, Springer Nature, Singapore, 2019.
6. Mujumdar, P. P. and Tiwari, V. M. (eds), Water Futures of India: Status of Science and Technology, IISc/INSA, India, 2019
7. Dawoud, M. A. and Allam, A. R., Effect of new Nag Hammadi Barrage on groundwater and drainage conditions and suggestion of mitigation measures, Water Res. Manage., 2004, 18(4), 321–337.
8. Gupta, S. K. and Deshpande, R. D., Water for India 2050: First order assessment of available options. Curr. Sci., 2004, 86(9), 1216–1224
9. Padma T. V., India unveils new monsoon forecast model. Source: Sci. Dev. Net, http://www.clivar.org/recent/monsoon_forec2.htm, 2004.