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RESEARCH ARTICLE

STRATEGIC ANALYSES OF INTER LINKING OF RIVERS IN DROUGHT- PRONE TAHSILS OF JALGAON DISTRICT - MAHARASHTRA

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ABSTRACT

Inter-Linking of River (ILR) is a water conservation method to reduce the irregular distribution of water and for providing solution to minimize floods and droughts in India. The Rivers in semi –arid drought – prone tahsils are life-line of livelihood. The rivers play a vital role in the lives of the drought – prone tahsils people. Proper management of river water is the need of the hour. Indian agriculture largely depends upon Monsoon which is always uncertain in nature. Hence, there is a severe problem of lack of irrigation in one region and water logging in others. Damage to crops due to drought and pitiable drainage facility could be managed. Depleting and decreasing status of water resources may be one of the most critical resource issues of the 21st century. To overcome the major problems of droughts, water scarcity and floods in different parts of Maharashtra, a massive river interlinking project has been considered for implementation by the Government of India recently. It is expected to provide extra irrigation intensity in the country, increasing water availability for drinking and industrial purposes, mitigating effect of drought and floods and power generation capacity to a certain extent. In order to study and examine the probability of diverting the excess waters, the Government of India constituted the National Water Development Agency (NWDA) in 1982. This paper highlights the concept of inter-basin transfer of water, related issues and concerns of interlinking of rivers, economic and ecological benefits leading to sustainable development of region as well as adverse impacts due to inter-basin water transfer. Drought and Flood are natural disasters caused by climate change which are the major water concerns in the country happens due to heavy and low rainfall. However, it summarizes the findings of the Strategic Analysis of this Project. Considering the future demands, conservation and management of water resources are very essential.

INTRODUCTION

Due to uneven distribution of rainfall and water bodies throughout India, there are problems of water scarcity in certain parts of the country and floods in other. The nation at present spends about Rs. 150 billion per annum on drought relief and another Rs. 300 billion per annum on flood relief (Kalyanaraman, 2004). To solve these problems, the Government of India has come up with a plan of interlinking 37 major rivers of India to distribute water equally amongst all the states. The River Interlinking Project (RIP) has two components - the Himalayan and the Peninsular. 30 links have been identified, of which 14 are proposed in the Himalaya component and 16, in the peninsular component (Bandyopadhyaya *et al*., 2002). The recent revival of the idea of interlinking of 'surplus' basins with 'deficit' basins has been the result of work done by the National Water Development Agency (NWDA) Water is undoubtedly the most important natural resource on the planet, as it sustains all aspects of life in a way that no other resource can.

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United Nations agencies and the World Bank have claimed that these scarcities will escalate in the future, creating serious problems for humankind and the environment. India needs to adopt a crystal-clear water mission that can help us to use available water resources to fields, villages, towns and industries round the year, without harming our environment. India's National Water Development Agency (NWDA) has suggested the interlinking of rivers of the country. This proposal is better known as the Inter-River Linking Project (IRL). It is a mega project that engages money, resources, engineering, management and human understanding. It is designed to ease water shortages in western and southern India and aims to link 30 major rivers. It is expected that properly planned water resource development and management could alleviate poverty, improve the quality of life, and reduce regional disparities, better law and order situation and manage the integrity of the natural environment. The core objectives of the paper are to understand the historical background of Interlinking River Projects and to discuss issues and challenges pertaining to Interlinking River Projects. The idea of drawing water from the rivers in eastern India, which have larger runoff, in comparison to certain places in the peninsular region, where the precipitation levels are much lower, can be

seen as an extension of that practice. Krueger *et al*., (2007) highlight that properly planned water resource development and management has the ability to alleviate poverty, improve the quality of life, and reduce regional disparities and to maintain the integrity of the natural environment. Shah *et al*., (2007) layout seven reasons why revisiting the river linking issue is a good idea.

Review of Literature

The idea of linking rivers is not new. It was Sir Arthur Cotton who had originally proposed the connecting of rivers more than a century ago, and Dr. K. L. Rao, the Minister of Power and Irrigation in the Cabinet of Smt. Indira Gandhi, renewed this proposal in 1972. Both were doubtlessly eminent engineers. Cotton's major concern was for inland navigational network and Dr. Rao's concern was for irrigation and power. (Shiva and Jalees, 2003) The then-Ministry of Irrigation (now the Ministry of Water Resources) conceived a plan for "National Perspectives for Water Development" in August 1980 (Ministry of Water Resources, 1980). This paved the way to set up the National Water Development Agency (NWDA) in 1982 to work out basin wise surpluses and deficits and explore possibilities of storage, links and transfers, has identified 30 river links, which would connect every major river in the Indian territory, and has prepared a feasibility report on six of these. According to Bandyopadhyaya and Praveen (2003), the proposal claims to package an uncertain and questionable idea as a desirable one. Rath (2003) called the ILR a 'pie in the sky' because he, like many others, is skeptical of the government's capacity to mobilize the kind of investable funds ILR demands.

Objectives

- Transfer the water in dry and semi-dry parts of the scarcity areas in the study region from water excess areas.
- Enhance the efficiency of multiple water storage structures.
- Conserve the water by taking it through canals, ducts, drains, nalas, natural drains, etc. in the drought-prone areas.
- Recommend proper sites and methods for artificial recharge to expand ground water recharge in the area.
- Increase the efficiency of different water storage structures

Methodology and Data base

In this study for identification of potential sites of river linking use Land sat Satellite images, SOI Topsheet and DEM. Using Arc GIS 9 software prepare DEM Aspect map, hill shade map, Absolute relief, Relative relief and channel network. Canal network digitization also has done using Arc GIS 9 software. Using Overlay thematic maps technique identify potential sites of river link. The research work has been done to conduct the studies on the descriptions and influence of proposed Girna – Bori, Anjani, Tittur and Aad Nadi Links Project. The related information has been collected from many states and central govt. water departments. Extensive review of literature was done to collect information and get a proper understanding of the kind of research. In literature review, research information from 1980 to 2010 was collected and studied. The secondary data was collected from magazines, books, internet, journals, etc. Literature review has shown prior research work done in this area. Significant inputs were found in the subject matter with reference to interlinking rivers projects.

The Study Area

The region selected for the study is the drought-prone tahsils. They are located in the Jalgaon district of Maharashtra State. There are 09 drought-prone tahsils identified by V. Subramaniam, (Review Committee, 1987). These tahsils are Amalner, Dharangaon, Parola, Erandol, Chalisgaon, Bhadgaon, Pachora, Jamner and Muktainagar. Looking into its delicate ecology and poor socio- economy, the study region is one of the most vulnerable regions of Maharashtra State. The topography of the region is hilly, plateau, undulating and rolling. It lies between $20^{o}11'$ to $21^{o}13'$ North latitudes and $74^{o}46'$ to $76^{o}24'$ East longitudes (Fig.1). The average annual rainfall is 682.8 mm. The South-West monsoon season contributes about 89 per cent of the annual rainfall. August is the rainiest month, and the study region gets little rain during the later part of the summer and post monsoon months. However, South-West monsoon season period is not the period of continuous rainfall. There may be breaks of about a week, month or more with no rainfall activity. So for in the study region, details studies using Remote Sensing & Geographical Information system have not been carried out to analyze the drought severity, intensity and duration considering the South West monsoon period. The study region having the total area around 6994.54 sq.km and accounts 2.27 per cent of the Maharashtra state area. The forest area is only 72419 hectare. The population of the study region is 21, 21,832 as per recent census. The climate of the study region is sub-tropical, semi-arid type with moderate to severe summer, moderate winter and having erratic. The temperature starts rising after the month of February and reaches it's maximum in the month of May with a mean daily maximum of 43º Celsius and mean minimum of 22º Celsius.

Criteria for rivers interlinking

The concept of linking of rivers or inter-basin transfer of water is essentially based on the availability of surplus of water in the donor river especially at the point of diversion to the deficit river basin. The surplus or deficit in a basin is determined on the basis of availability at 75% dependability, import, export, and existing and future needs. A river basin is said to be reasonably in surplus of water, if the surplus water is available after meeting the irrigation needs of at least 60% of the cultivable area in the basin. Only this water from such a basin can be diverted to deficit basins. In the recipient/deficit river basin, it is proposed that, at least, 30% of the cultivable area is covered under irrigation. This is one of the most effective managements of surface water resources, as according to protagonists, it is an economically viable, technically feasible and environmentally sound and viewed as the future main stay for the sustainable development of any region confronting water deficit.

Status of water resources in the study region

The average surface runoff water resources availability in the study region has been estimated as 2326 Million m^3. This is only 0.12 % of the national supply. There are considerable

spatial and temporal variations in average water availability. The average water resources availability is more in the southern part of the study region. It is because of Ajanta, Hatti and Satmala ranges.

The per capita availability of land in the study area has declined from 0.49 hectare in 1981 to 0.33 hectare in 2011and is projected to slide down to 0.12 hectare in 2041(Fig. 2).

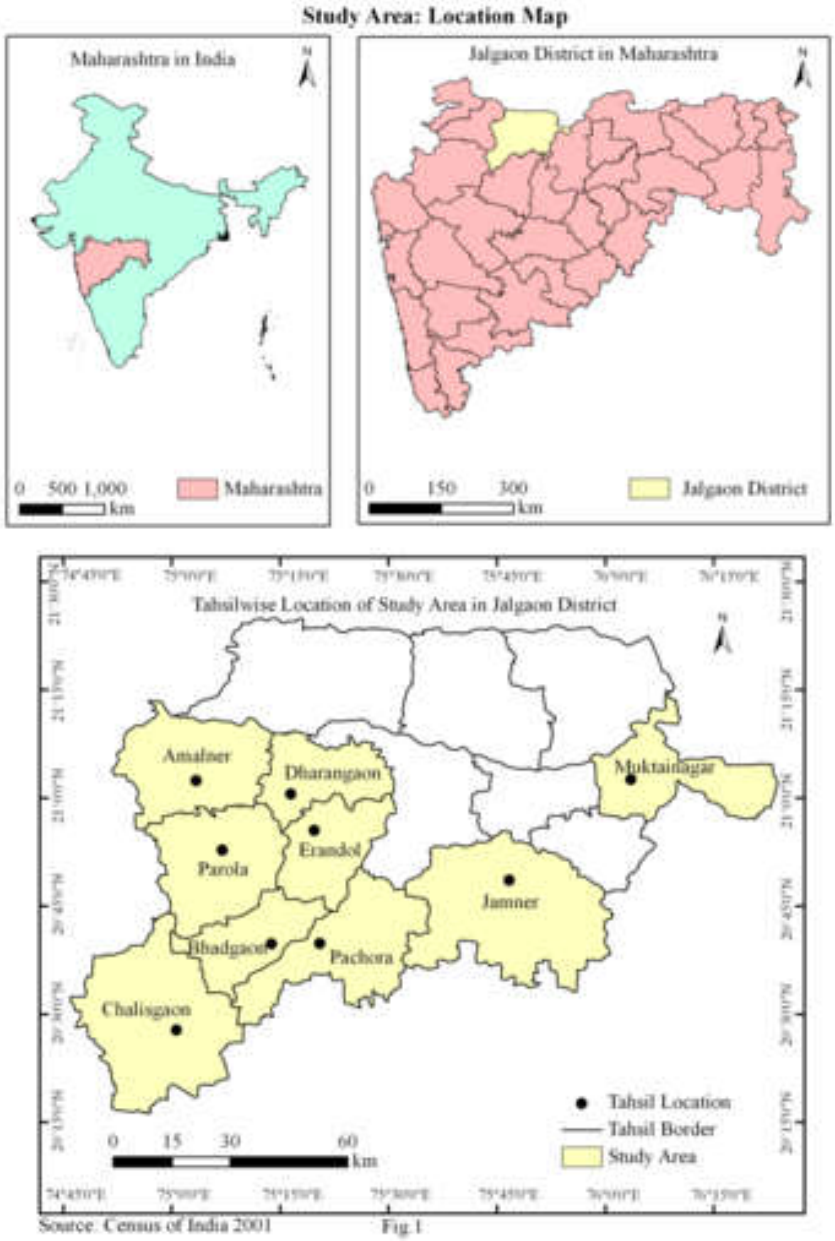


Fig. 2. Per capita land, water and population availability in the study region (2011)

In the north western part average water resources availability is very less due to the leeward and irrespective locations. The per capita water availability is getting reduced year by year due to growing population. The demand for domestic agricultural and industrial uses of water has been putting pressures on limited water resources. In 1981, the per capita water availability in the study region was about 1638 m^3 (Fig.3). This has reduced to about 1096 m^3 in 2011. The gap between demand and suppl^y of water is widening day by day due to growing population. In the study region also the demand for water is steeply increasing. The projected per capita availability of water in 2041 will be 894 m^3 only. These figures indicate that during the period i.e. upto 2041 there will be severe water scarcity. The increasing human and animal population has reduced the availability of land over the decades.

River Linking Project in the study region

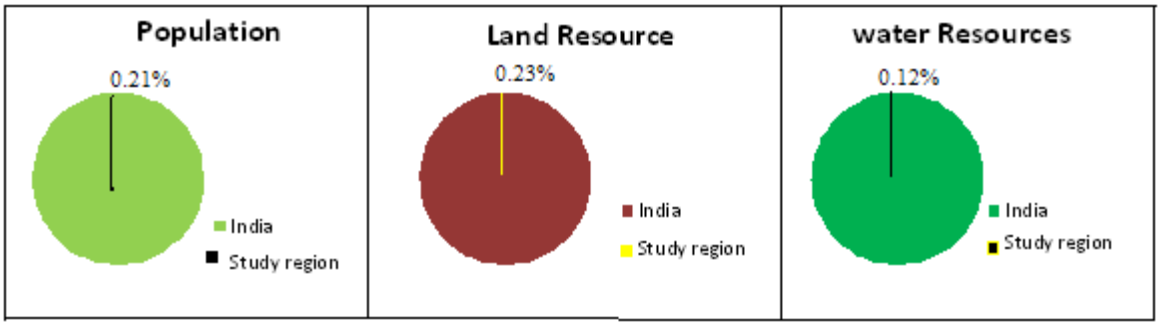
River linking project on small scale was started in August 2005 in the study region located in Jalgaon district. While Tapti's left side tributaries Girna, Bori, Anjani and Waghur are important rivers, with Girna Dam being a major source of water supply at the south west corner of the district. As a result of it, implemented the idea of river linking very seriously and following river links came into existence.

1. Interlinking of Girna and Bori River

The Girna Major project is situated on the border of the two districts - Nasik and Jalgaon. In 2005, Nasik district obtained the high range of rains and the Girna dam was full till the middle of July 2005. During that period, 64,000 cusecs water

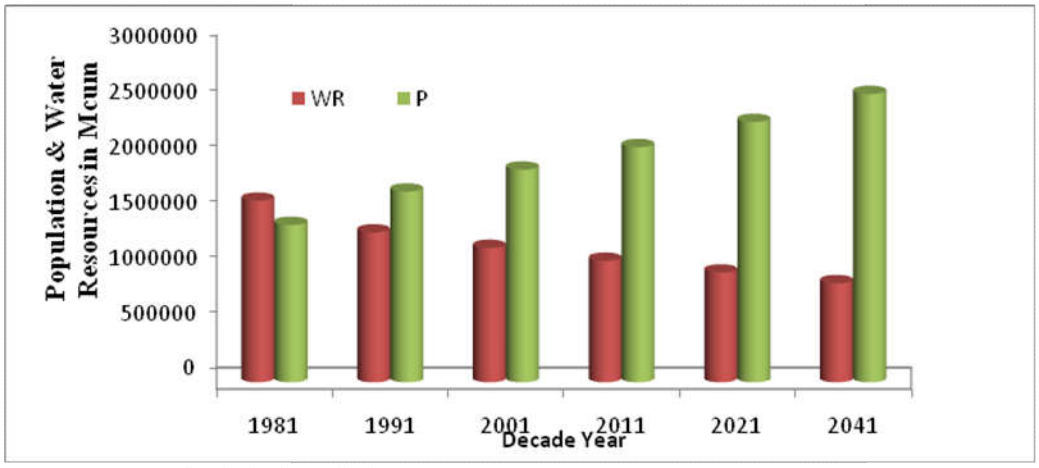
was released in the Girna River from the Tapi River in the interest of flood management and finally it was released into the Arabian Sea. For regular irrigation purposes, the Girna project has Paznan left bank canal which flows towards Jalgaon district.

River by traveling a distance of 6 km by power of gravity (Fig. 4). The Bori River flows 35 km towards the eastern side and reaches the Bori dam situated in the Jalgaon district. In this way, water traveled 68 km. The capacity of the Bori dam is 1,400 M.c.ft.



Source: Census Handbook of Jalgaon district, 2011

Fig. 2. Per capita land, water and population availability in the study region (2011)



Source: Census Handbook of Jalgaon district, 2011

Fig. 3. Decade Year wise Population & Water Resources

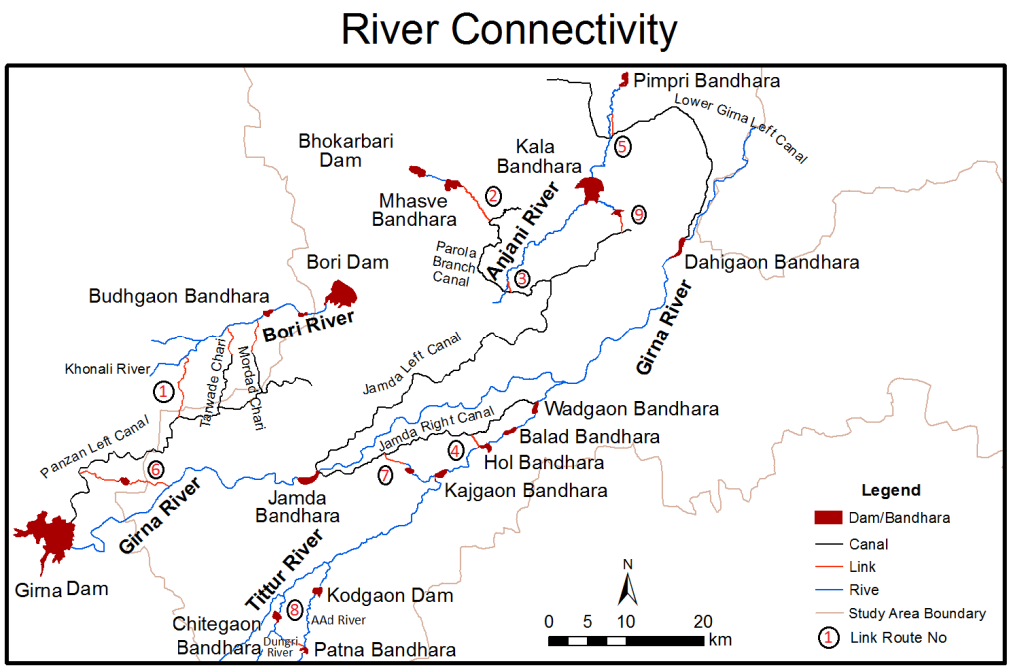


Fig. 4.

The excess flood waters in the Paznan left bank canal were diverted. Then, the canal was breached at 31st km and water was diverted into a local nalas. It flows and joins the Bori

After continuous mitigated efforts, some extra works on the canal and constant watch, 1100 m.c.ft water was collected in the Bori dam. Water supply of the Parola town of the Jalgaon

district and 73 villages depended on the water of the Bori dam. The water problems of Parola town and these villages were completely addressed. Hence, the problems of 15 villages on the side of the Bori River were minimized.

2. Filling of Mhaswa and Bhokarbari Project

The run over water was released from the Girna dam into the Girna River. From there, it was diverted to the Jamada Left Canal through Jamada Weir. It connected to the Parola branch canal; then the water reached the Mhasve bandara. From here, water was channelized to the Bhokarbari dam. This long journey of the water of 132 km has enriched the Bhokarbari and Mhaswa projects. Due to this strategy, the problem of drinking water and irrigation water was solved to a great extent. The mechanism of the interlinking is shown in map.

3. Interlinking of Girna –Anjani Rivers

The excess water was released from the Girna dam into the Girna River and then into Jamada Weir, water was diverted to the Jamada Left Canal and from here to Parola branch canal and then water was released in Anjani River. This way, water travelled 127 km. The problem of drinking water of Erandol town and other villages were solved.

4. Interlinking of Girna and Tittur Rivers

The overflowing water was released from the Girna dam into the Girna River. Then it was released through the Jamda bandara, diverted into the Jamda right canal. From this canal, the water passed into a brook and then successively into the Tittur River, Hol bandara, Balad bandara, Wadgaon bandara and back again into the Tittur River. This way, water travelled 84 km. Because of this skillful strategy, the problem of not only drinking water, but also irrigation water was solved to a great extent.

5. Filling of Pimpri bandara

The overflowing water was released from the Girna dam into the Girna River and then through the Jamda bandara, the Girna River and Dahigaon bandara successively. From there the water passed into the Lower Girna Canal and then through the stream. This water was channelized and realized into the Anjani River and then stored in the Pimpri bandara. In this last stage, the water travelled 186 km. due to the reason of this skillful strategy, the problem of not only drinking water, but also irrigation water was solved to a great extent (Fig.4).

6. Link of Girna Dam Panzan left bank canal to Girna River

The overflowing water was released from the Girna dam into the Panzan left bank canal. The excess flooded water in the Panzan left canal was diverted. From there the water was channelized and transferred to the Girna River.

7. Filling of Kajgaon bandara

The excess water was released from the dam of Girna the river of Girna and then through the Jamda bund, it was diverted into the Jamda right canal. From Jamda right canal, the water passed into a small brook. After that, it was transferred into the Kajgaon bandara and back again into the Tittur River. Thus, the water travelled about 76 km. In this way, the problem of drinking water and that of irrigation water was solved (Fig.4).

8. Filling of Patna and Kodgaon bandara

The overflowing water was released from the Aad Nadi into Patna bandara and then through the Patna bandara the water was channelized and reached into the Kodgaon dam and back again into the Aad Nadi. This way, water was travelled more than 56 km. Thus, the problem of not only drinking water, but also irrigation water was met to a great extent.

9. Links of Aad Nadi Dongri River and Tittur River

The overflowing water was released from the Aad Nadi into Patna bandara. From there, it transferred to a brook through the Patna bandara. Then, it reached into the Dongri River and then through Dongri River water was channelized and fed into the Tittur River at Ganeshpur village. Through the Tittur River the water was channelized and reached into the Chitegaon bandara. In this way, it travelled 15 km. It greatly helped to solve the problem of drinking water as well as irrigation water to some extent.

Table 1. Proposed River Linking Projects in the study region and volume of water diverted

Sr. No.	River Link	Volume of water to be diverted (Mcum)	Cost (Lakh Rs.)
	Girna dam to Girna, other River, canals,projects, k.t. weirs,bandaras and tanks		
1	Girna and Bori River	20.843	222.242
2	Girna Mhaswa and Bhokarbari Project	19.521	202.121
3	Girna –Anjani Rivers	18.114	156.234
4	Girna and Tittur Rivers	14.358	101.271
5	Girna and Pimpri bandara	13.142	119.231
6	Panzan left bank canal - Girna River	19.118	200.147
7	Girna and Kajgaon bandara	5.269	82.856
8	Aad Nadi - Patna and Kodgaon bandara	9.4	25.25
9	Aad Nadi - Dongri River and Tittur River	7.235	12.148
	Total diverted water in Mcum.	127.000	1,121.500

Source: Irrigation Division Jalgaon, 2005.

RESULTS AND DISCUSSION

This research highlights the description including size, area and location of proposed inter basin water transfer Girna – Bori, Anjani, Tittur, rivers. Linking which is a part of peninsular river development component (Fig.4). It is one of the proposed links of NPP (National Perspective Plan) to minimize the problem of flood and droughts in the study area. The Ministry of Water Resources and Central Water Commission formulated a National Perspective Plan (NPP) for Water Resources Development in 1980, considering large scale inter basin water transfer proposals for transfer of water from surplus regions to deficit regions. Girna – Bori, Anjani, Tittur rivers (G-B, A, T Link) aimed at making available of water to the acute water short and drought prone region as the study region. Interlinking of rivers is definitely a good solution for the scarcity of water, but interlinking has to take place after a detailed study so that it does not cause any problem to the environment or aquatic life. If water transferred from water abundant rivers to water-deficit areas, there would

be adequate supply for everyone in every part of the country. It also appears to promote national integration and a fair sharing of the country's natural water wealth. India's river linking project shows and promises a great concern for water conservation and optimum use of available water resources. Undoubtedly, it is the need of the hour to have a water mission like as IRL, which will enable availability of water to the fields, villages, towns and industries throughout the year, even while maintaining environmental purity to combat with both fold and drought simultaneously.

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