

1. Details of Module and its structure

Module Detail	
Subject Name	Geography
Course Name	Geography 04 (Class XII, Semester - 2)
Module Name/Title	Water Resources – Part 2
Module Id	legy_20602
Pre-requisites	Uses of water, Sources of water
Objectives	<p>After going through this lesson, the learners will be able to understand the following:</p> <ul style="list-style-type: none">• Water pollution• Water conservation• Groundwater pollution• Watershed management• National Water Policy• Jal Kranti Abhiyan
Keywords	Water pollution, water conservation, watershed management, rain water harvesting, National Water Policy, Jal Kranti Abhiyan

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Water resources- India depends on a lot on surface water and groundwater to meet its requirements. Surface water comprises of rivers, lakes, and ponds. Any unwanted particles in water bodies makes water unfit for use is known as **water pollution which is** usually a result of human activities.

Water bodies include lakes, rivers, oceans, aquifers and groundwater. Water pollution results when contaminants are introduced into the natural environment.

Water pollution can be classified as surface water or groundwater pollution. Marine pollution and nutrient pollution are subsets of water pollution.

Sources of water pollution are either point sources or non-point sources. Point sources have one identifiable cause of the pollution, such as a storm drain or a wastewater treatment plant. Non-point sources are more diffuse, such as agricultural runoff.

Pollution is the result of the cumulative effect over time. All plants and organisms living in or being exposed to polluted water bodies can be impacted. The effects can damage individual species and impact the natural biological communities they are part of.

Causes of Water Pollution

Water pollution is caused due to several reasons. Major causes of water pollution are-

1. **Industrial waste-** Industrial wastes contains pollutants like lead, asbestos, mercury and petrochemicals which are very harmful to people and environment. Industrial waste is discharged into lakes and rivers making the fresh water contaminated.
2. **Sewage and waste water-** Sewage, garbage and liquid waste of households, agricultural lands and factories are discharged into lakes and rivers. These wastes contain harmful chemicals and toxins which make the water poisonous for aquatic animals and plants.
3. **Global Warming-** Due to global warming, there is an increase in air and water temperature. This increase in temperature results in death of aquatic plants and animals. This also results in bleaching of coral reefs in water.
4. **Oil pollution-** Sea water gets polluted due to oil spilled from ships and tankers while travelling. The spilled oil forms a thick sludge polluting the sea water

Water Conservation and Management

Water conservation is a practice of using water efficiently to reduce unnecessary water usage. Water conservation includes all the strategies, policies, and activities to sustainably manage the natural resource of fresh water, to protect the hydrosphere, and to meet the current and future human demand.

Since there is a declining availability of freshwater and increasing demand, the need has arisen to conserve and effectively manage this precious life-giving resource for sustainable development. Given that water availability from sea/ocean, due to high cost of desalinisation, is considered negligible, India has to take quick steps and make effective policies and laws, and adopt effective measures for its conservation.

1. Besides developing water-saving technologies and methods, attempts are also to be made to prevent the pollution.
2. There is need to encourage watershed development, rainwater harvesting, water recycling and reuse, and conjunctive use of water for sustaining water supply in long run.
3. Prevention of Water Pollution Available water resources are degrading rapidly.

Facts related to condition of rivers in India-

1. The major rivers of the country generally retain better water quality in less densely populated upper stretches in hilly areas. In plains, river water is used intensively for irrigation, drinking, domestic and industrial purposes.
2. The drains carrying agricultural (fertilizers and insecticides), domestic (solid and liquid wastes), and industrial effluents join the rivers.
3. The concentration of pollutants in rivers, especially remains very high during the summer season when flow of water is low.

The Central Pollution Control Board (CPCB) has established a network of monitoring stations on rivers across the country. The present network is comprising of 870 stations in 26 States and 5 Union Territories spread over the country. The monitoring is done on monthly or quarterly basis in surface waters and on half yearly basis in case of ground water. The monitoring network covers 189 Rivers, 53 Lakes, 4 Tanks, 2 Ponds, 3 Creeks, 3 Canals, 9 Drains and 218 Wells. Among the 870 stations, 567 are on rivers, 55 on lakes, 9 on drains, 12 on canals, 4 on tank, 3 on and creeks, 2 on pond and 218 are groundwater stations.

The data obtained from these stations show that organic and bacterial contamination continues to be the main source of pollution in rivers.

The Yamuna River is the most polluted river in the country between Delhi and Etawah. Other severely polluted rivers are: the Sabarmati at Ahmedabad, the Gomti at Lucknow, the Kali, the Adyar, the Cooum (entire stretches), the Vaigai at Madurai and the Musi of Hyderabad and the Ganga at Kanpur and Varanasi.

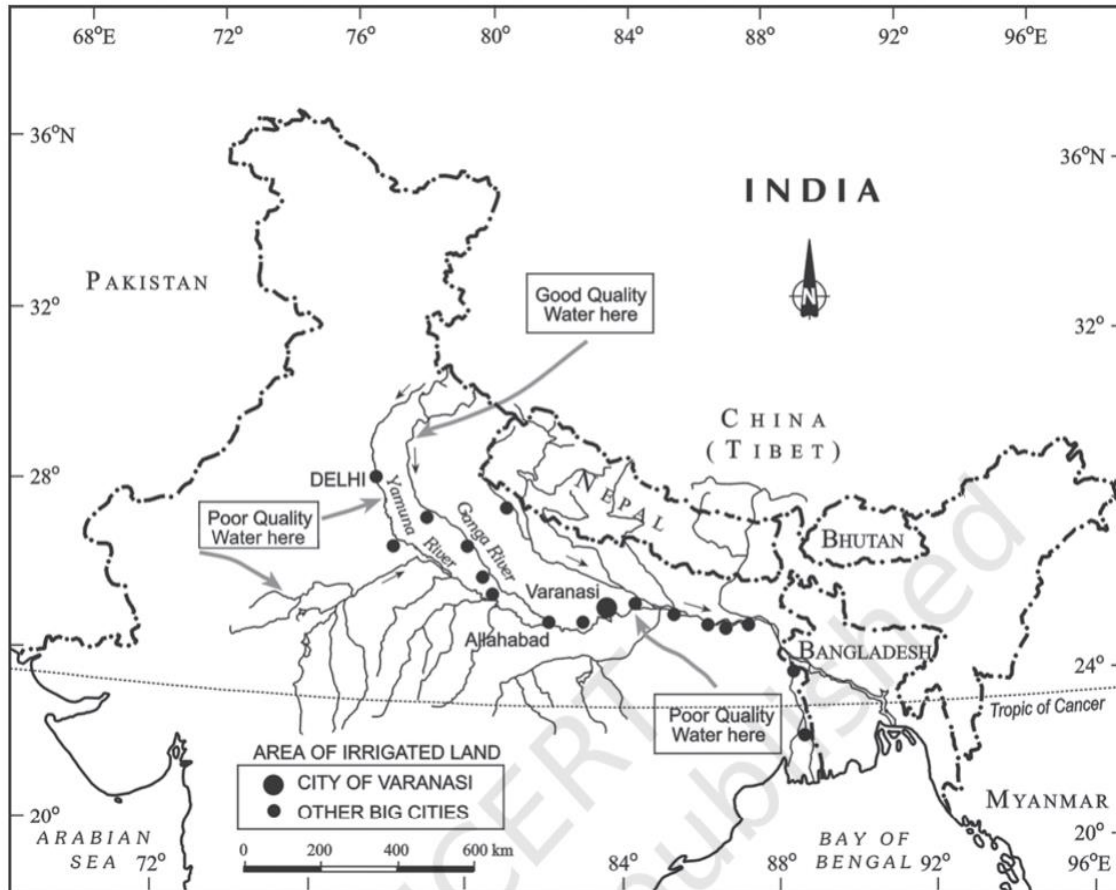


Image 2: The Ganga and its Tributaries and Towns Located on them

Source- NCERT

Groundwater pollution

Groundwater pollution has occurred due to high concentrations of heavy/toxic metals, fluoride and nitrates at different parts of the country. The legislative provisions such as the Water (Prevention and Control of Pollution) Act 1974, and Environment Protection Act 1986 have not been implemented effectively. The result is that in 1997, 251 polluting industries were located along the rivers and lakes. The Water Cess Act, 1977, meant to reduce pollution has also made marginal impacts.

There is a strong need to generate public awareness about importance of water and impacts of water pollution. The public awareness and action can be very effective in reducing the pollutants from agricultural activities, domestic and industrial discharges.

Recycle and Reuse of Water

1. Another way through which we can improve fresh water availability is by **recycle and reuse**.
2. Use of water of lesser quality such as **reclaimed wastewater** would be an attractive option for industries for cooling and firefighting to reduce their water cost.
3. Similarly, in urban areas water after bathing and washing utensils can be used for gardening.
4. Water used for washing vehicle can also be used for gardening.
5. This would conserve better quality of water for drinking purposes. Currently, recycling of water is practised on a limited scale.

However, there is enormous scope for replenishing water through recycling, Watershed Management and Rainwater Harvesting.

Watershed Management

Watershed management basically refers to efficient management and conservation of surface and groundwater resources. It involves prevention of runoff and storage and recharge of groundwater through various methods like percolation tanks, recharge wells, etc. However, in broad sense watershed management includes conservation, regeneration and judicious use of all resources – natural (like land, water, plants and animals) and human with in a watershed. Watershed management aims at bringing about balance between natural resources on the one hand and society on the other.

Integrated Watershed Management Programme (IWMP): The Department of Land Resources, Ministry of Rural development, Government of India is implementing centrally sponsored programmes of Integrated Wasteland Development Programme (IWDP), Drought Prone Areas Programme (DPAP) and Desert Development Programme (DDP) for development of waste/degraded lands through watershed approach. The three programmes were implemented on the basis of separate norms, funding patterns and technical components based on their respective objectives.

Major Activities of the Watershed project are:

- 1) Planting & sowing of multi-purpose trees, shrubs, grasses, legumes and land development
- 2) Encouraging natural regeneration

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- 3) Promotion of agro-forestry and horticulture
 - 4) Measures needed to disseminate technology
 - 4) Soil & moisture conservation measures like terracing, trenching, vegetative barriers etc.
 - 5) Wood substitution and fuel-wood conservation measures
 - 6) Training, extension and creation of a greater degree of awareness among the participants
 - 7) Encouraging peoples' participation

The success of watershed development largely depends upon community participation. The Central and State Governments have initiated many watershed development and management programmes in the country. Some of these are being implemented by nongovernmental organisations also.

1. Hariyali is a watershed development project sponsored by the Central Government which aims at enabling the rural population to conserve water for drinking, irrigation, fisheries and afforestation. The Project is being executed by Gram Panchayats with people's participation.

- The **objectives** of projects under HARIYALI:
 - i. Harvesting every drop of rainwater for purposes of irrigation, plantations including horticulture and floriculture, pasture development, fisheries etc. to create sustainable sources of income for the village community as well as for drinking water supplies.
 - ii. Ensuring overall development of rural areas through the Gram Panchayats and creating regular sources of income for the Panchayats from rainwater harvesting and management.
 - iii. Employment generation, poverty alleviation, community empowerment and development of human and other economic resources of the rural areas.
 - iv. Mitigating the adverse effects of extreme climatic conditions such as drought and desertification on crops, human and livestock population for the overall improvement of rural areas.
 - v. Restoring ecological balance by harnessing, conserving and developing natural resources i.e. land, water, vegetative cover especially plantations.
 - vi. Encouraging village community towards sustained community action for the operation and maintenance of assets created and further development of the potential of the natural resources in the watershed.
 - vii. Promoting use of simple, easy and affordable technological solutions and institutional arrangements that make use of, and build upon, local technical knowledge and available materials.

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2. **Neeru-Meeru** (Water and You) programme (in Andhra Pradesh) and Arvary Pani Sansad (in Alwar, Rajasthan) have taken up constructions of various water-harvesting structures such as percolation tanks, dug out ponds (Johad), check dams, etc., through people's participation.



Image 3: Johad

Source: <https://commons.wikimedia.org/wiki/File:Johad.JPG>

Watershed development projects in some areas have been successful in rejuvenating environment and economy. However, there are only a few success stories. In majority of cases, the programme is still in its nascent stage. There is a need to generate awareness regarding benefits of watershed development and management among people in the country, and through this integrated water resource management approach water availability can be ensured on sustainable basis.

Rainwater Harvesting

Rainwater harvesting is a method to capture and store rainwater for various uses. It is also used to recharge groundwater aquifers. It is a low cost and eco-friendly technique for preserving every drop of water by guiding the rain water to borewell, pits and wells. Rainwater harvesting increases water availability, checks the declining groundwater table, improves the quality of groundwater through dilution of contaminants, like fluoride and nitrates, prevents soil erosion, and flooding and arrests salt water intrusion in coastal areas if used to recharge aquifers.

Rainwater harvesting has been practised through various methods by different communities in the country for a long time. Traditional rainwater harvesting in rural areas is done by using

surface storage bodies, like lakes, ponds, irrigation tanks, etc. In Rajasthan, rainwater harvesting structures locally known as Kund or Tanka (a covered underground tank) are constructed near or in the house or village to store harvested rainwater.

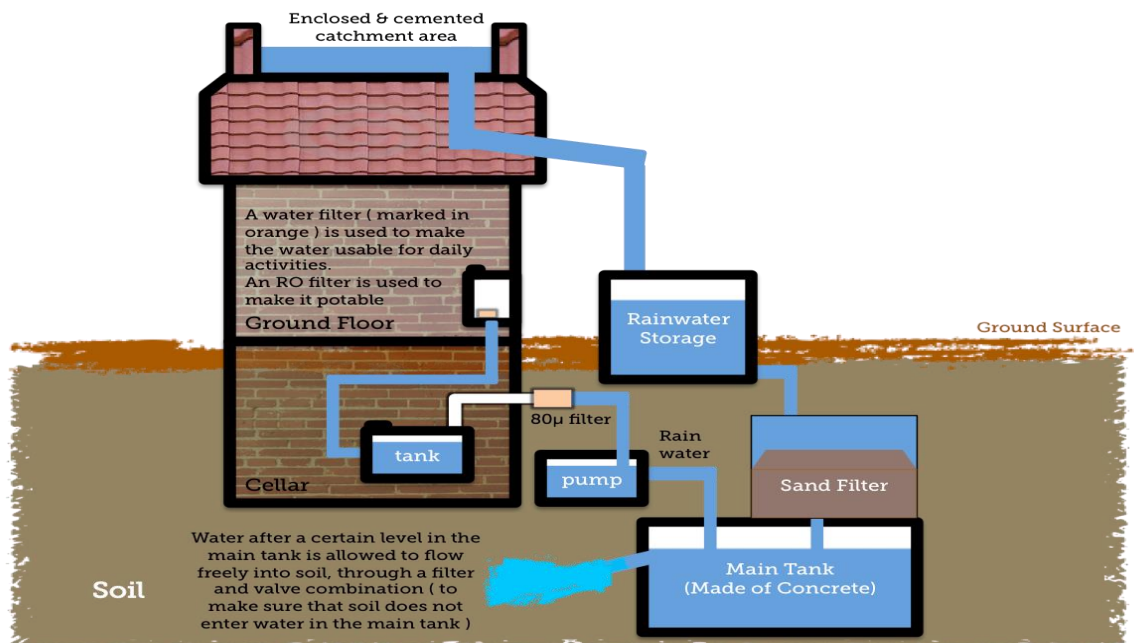


Image 4: Rain water harvesting

Source: https://upload.wikimedia.org/wikipedia/commons/0/0b/Simple_Diagram_to_show_Rainwater_Harvesting.png

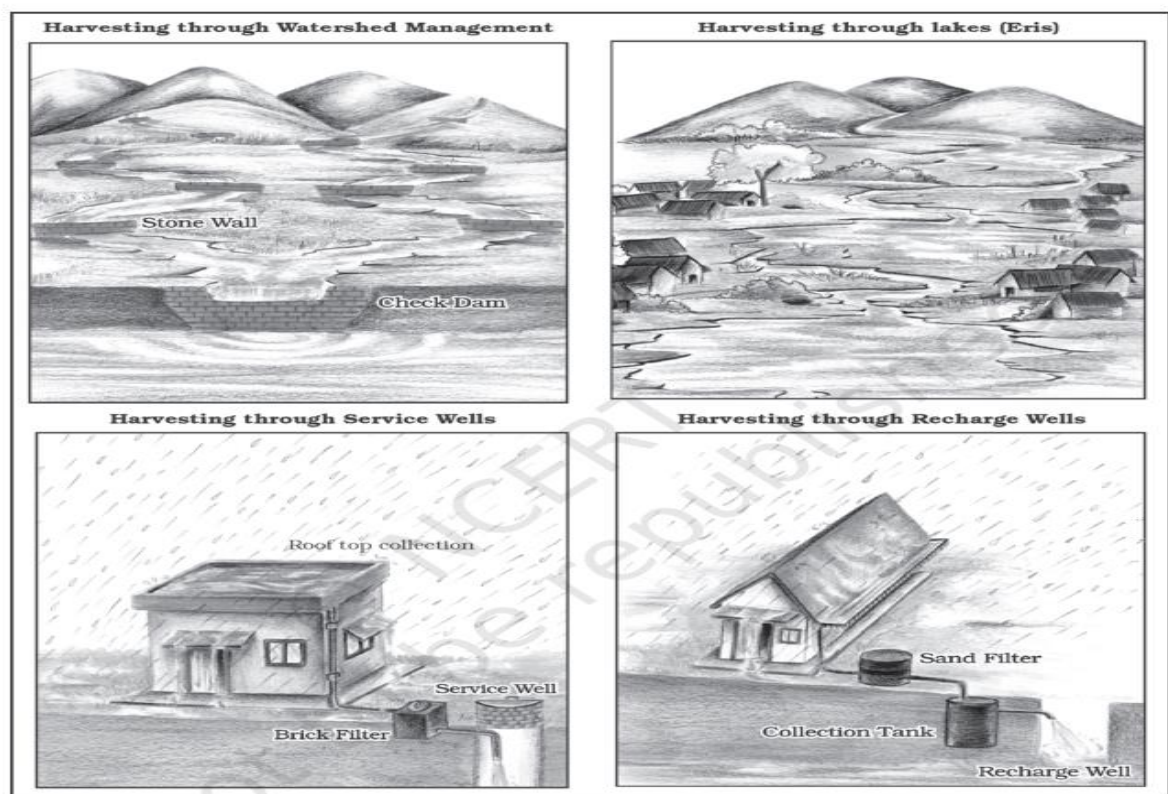


Image 5: various ways of rainwater harvesting

Source- NCERT

There is a wide scope to use rainwater harvesting technique to conserve precious water resource. It can be done by harvesting rainwater on rooftops and open spaces. Harvesting rainwater also decreases community dependence on groundwater for domestic use. Besides bridging the demand supply gap, it can also save energy to pump groundwater as recharge leads to rise in groundwater table. These days rainwater harvesting is being taken up on massive scale in many states in the country. Urban areas can specially benefit from rainwater harvesting as water demand has already outstripped supply in most of the cities and towns.



Image 6: Rainwater harvesting tank

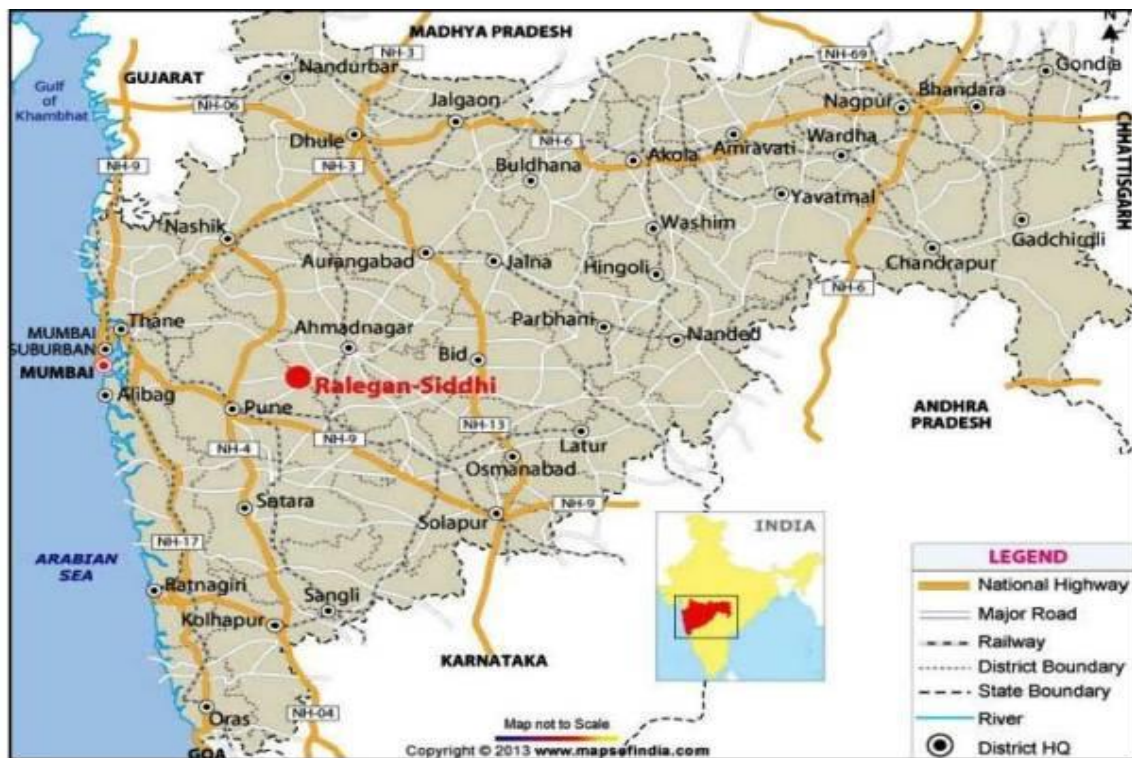
Source: https://commons.wikimedia.org/wiki/File:Rainwater_harvesting_tank,_India.jpg

Tamil Nadu has made water harvesting structures in the house compulsory. No building can be constructed without making structures for water harvesting.

Apart from the above-mentioned factors, the issue desalinisation of water particularly in coastal areas and brackish water in arid and semi-arid areas, transfer of water from water surplus areas to water deficit areas through inter-linking of rivers can be important remedies for solving water problem in India (read more about inter linking of rivers). However, the most important issue from the point of view of individual users, household and communities is pricing of water.

CASE STUDY

Watershed Development in Ralegan Siddhi, Ahmadnagar, Maharashtra:



Ralegan Siddhi is Located in Ahmadnagar district of Maharashtra

Image 7: map of Ralegan Siddhi

Source- https://nwa.mah.nic.in/sdmc/casestudy/ralegan_siddhi.htm

CASE STUDY

Ralegan Siddhi is a small village in the district of Ahmadnagar, Maharashtra. It has become an example for watershed development throughout the country.

Problems before watershed development project-

In 1975 the village was afflicted by drought, poverty prevailed, and trade in illicit liquor was widespread.

Transformation of the village

The transformation took place when a retired army personnel Anna Hazare, settled down in the village and took up the task of watershed development.

1. He convinced villagers about the importance of family planning and voluntary labour; preventing open grazing, felling trees, and liquor prohibition.

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2. Voluntary labour was necessary to ensure minimum dependence on the government for financial aids. “It socialised the costs of the projects.” explained the activist.
 3. Even those who were working outside the village contributed to the development by committing a month’s salary every year.

Work began with the percolation tank constructed in the village. In 1975, the tank could not hold water. The embankment wall leaked. People voluntarily repaired the embankment. The seven wells below it swelled with water in summer for the first time in the living memory of the people. The people reposed their faith in him and his visions.

A youth group called Tarun Mandal was formed.

Steps taken by the village people to improve the condition

- i. The group worked to ban the dowry system, caste discrimination and untouchability.
- ii. Liquor distilling units were removed and prohibition imposed.
- iii. Open grazing was completely banned with a new emphasis on stall-feeding.
- iv. The cultivation of water-intensive crops like sugarcane was banned.
- v. Crops such as pulses, oilseeds and certain cash crops with low water requirements were encouraged.
- vi. All elections to local bodies began to be held on the basis of consensus. “It made the community leaders complete representatives of the people.” A system of Nyay Panchayats (informal courts) were also set up. Since then, no case has been referred to the police.
- vii. A Rs.22 lakh school building was constructed using only the resources of the village. No donations were taken. Money, if needed, was borrowed and paid back. The villagers took pride in this self-reliance.
- viii. A new system of sharing labour grew out of this infusion of pride and voluntary spirit.
- ix. People volunteered to help each other in agricultural operation.
- x. Landless labourers also gained employment.

Today the village plans to buy land for them in adjoining villages. At present, water is adequate; agriculture is flourishing, though the use of fertilisers and pesticides is very high. The prosperity also brings the question of ability of the present generation to carry on the work after the leader of the movement who declared that, “The process of Ralegan’s evolution to an ideal village will not stop. With changing times, people tend to evolve new ways. In future, Ralegan might present a different model to the country.”

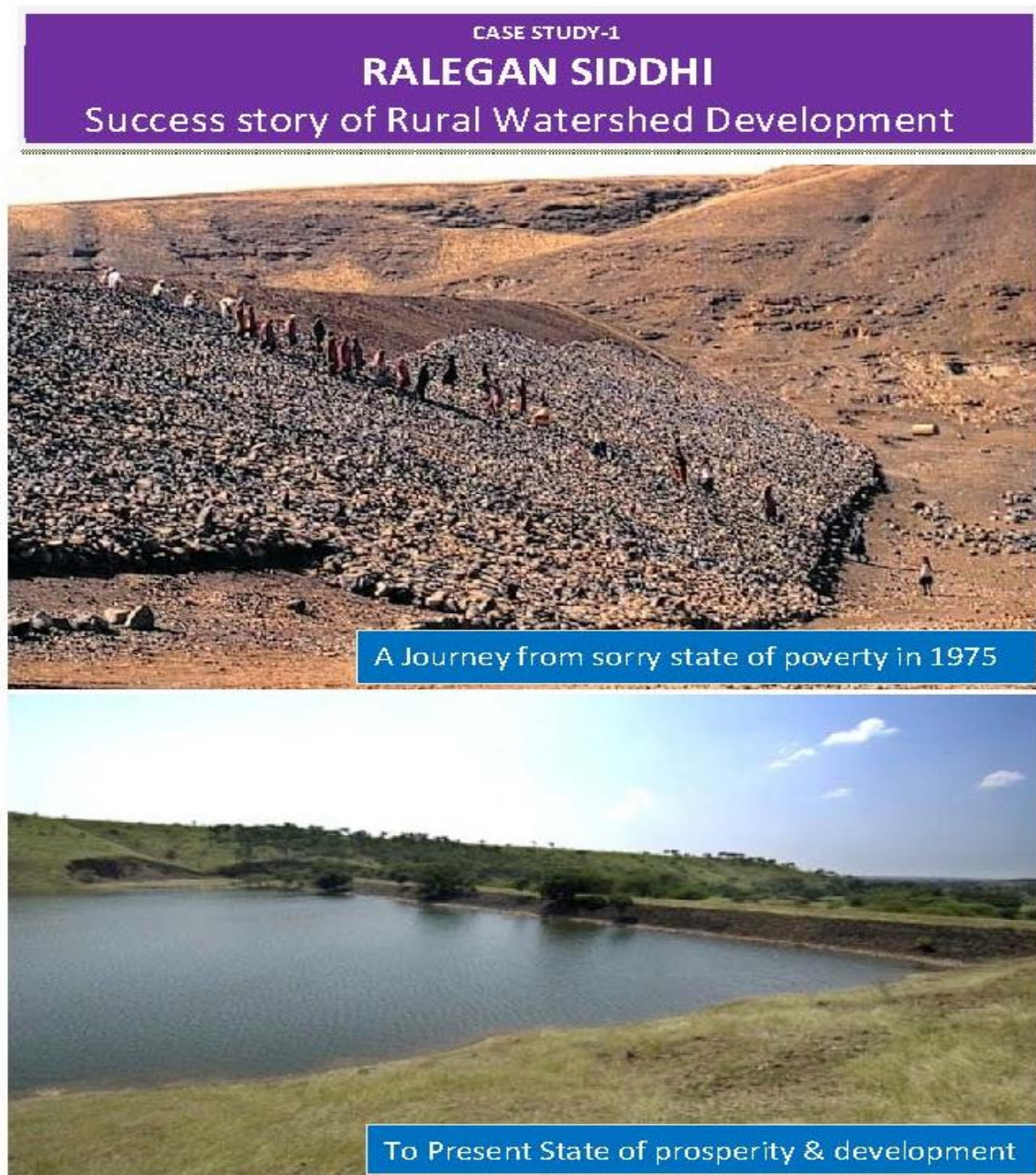


Image 8: Transformation of the village

Source: https://nwa.mah.nic.in/sdmc/casestudy/ralegan_siddhi.htm

National Water Policy

National Water Policy is formulated by the Ministry of Water Resources of the Government of India to govern the planning and development of water resources and their optimum utilization. The first National Water Policy was adopted in September, 1987. It was reviewed and updated in 2002 and later in 2012.

India accounts for 18% of the world population and about 4% of the world's water resources. One of the solutions to solve the country's water woes is to create Indian Rivers Inter-link.

India has been successful in creating live water storage capacity of about 253 billion cubic meter (BCM) so far. In a first, the ecological needs of river have also been taken into consideration.

The major provisions under the policy are:

1. Envisages to establish a standardized national information system with a network of data banks and data bases.
2. Resource planning and recycling for providing maximum availability.
3. To give importance to the impact of projects on human settlements and environment.
4. Guidelines for the safety of storage dams and other water-related structures.
5. Regulate exploitation of groundwater.
6. Setting water allocation priorities in the following order: Drinking water, Irrigation, Hydropower, Navigation, Industrial and other uses.
7. The water rates for surface water and ground water should be rationalized with due regard to the interests of small and marginal farmers.

The policy also deals with participation of farmers and voluntary agencies, water quality, water zoning, conservation of water, flood and drought management, erosion etc.

Jal Kranti Abhiyan (2015-16)

Water is a recyclable resource but its availability is limited and the gap between supply and demand will be widening over time. Climate change at the global scale will be creating water stress conditions in many regions of the world. India has a unique situation of high population growth and rapid economic development with high water demand.



जल बचत - जल संचय

Image 10: Jal Kranti Abhiyan logo

Source- <http://mowr.gov.in/event/download-logo-jal-kranti-abhiyan>

The Jal Kranti Abhiyan launched by the Government of India in 2015–16 with an aim to ensure water security through per capita availability of water in the country. People in different regions of India had practised the traditional knowledge of water conservation and management to ensure water availability.

The Jal Kranti Abhiyan aims at involving local bodies, NGOs and citizens, at large, in creating awareness regarding its objectives.

The following activities have been proposed under the Jal Kranti Abhiyan:

1. Selection of one water stressed village in each 672 districts of the country to create a ‘Jal Gram’.
2. Identification of model command area of about 1000 hectares in different parts of the country, for example, UP, Haryana (North), Karnataka, Telangana, Tamil Nadu (South), Rajasthan, Gujarat (West), Odisha (East), Meghalaya (North-East).
3. Abatement of pollution:
 - Water conservation and artificial recharge.
 - Reducing groundwater pollution.
 - Construction of Arsenic-free wells in selected areas of the country.
4. Creating mass awareness through social media, radio, TV, print media, poster and essay writing competitions in schools.
5. Jal Kranti Abhiyan is designed to provide livelihood and food security through water security.

Jal Jeevan Mission

For a nation of 137 Crore people, assured availability of potable water to all is the key goal of this newly formed ministry of Jal Shakti. To achieve this goal by 2024, Prime Minister Modi announced Jal Jeevan Mission – Har Ghar Jal on the 15 August, 2019 while addressing the Nation on Independence Day from the ramparts of Red Fort.

The mission aims at improving the lives of rural people and reduce drudgery of women, especially girls by providing safe water within the household premises.

Jal Shakti Abhiyan is an intensive time-bound, mission-mode water conservation campaign built on citizen participation to accelerate water conservation across the country.

Jal Jeevan Mission, is envisioned to provide safe and adequate drinking water through individual household tap connections by 2024 to all households in rural India. The programme will also implement source sustainability measures as mandatory elements, such as recharge and reuse through grey water management, water conservation, rain water harvesting. The Jal

Jeevan Mission will be based on a community approach to water and will include extensive Information, Education and communication as a key component of the mission. JJM looks to create a jan andolan for water, thereby making it everyone's priority.



Image 10: Jal Jeevan mission

Source- <https://jalshakti-ddws.gov.in/>

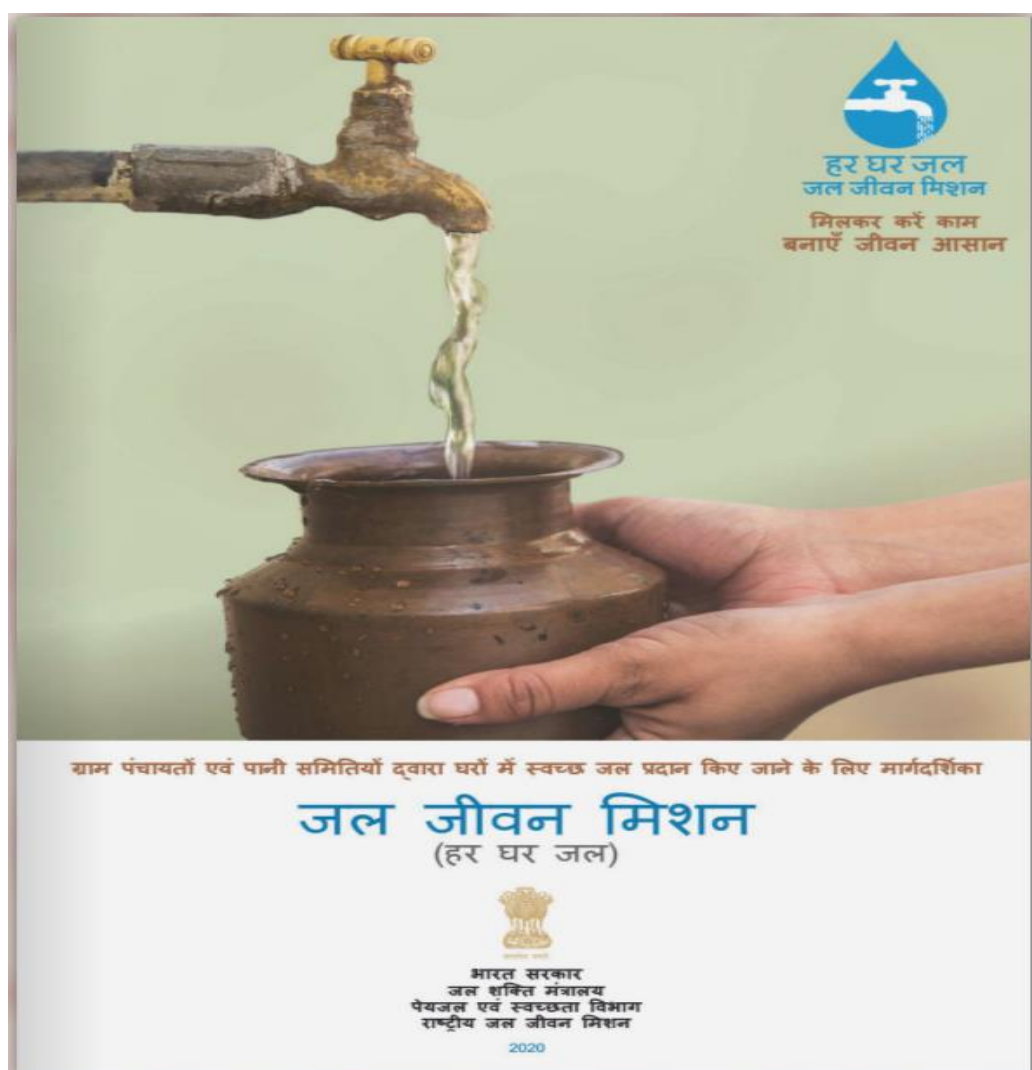


Image 12: Jal Jeevan mission

Source- https://jaljeevanmission.gov.in/sites/default/files/jjm_ebook/mobile/index.html