CHAPTER

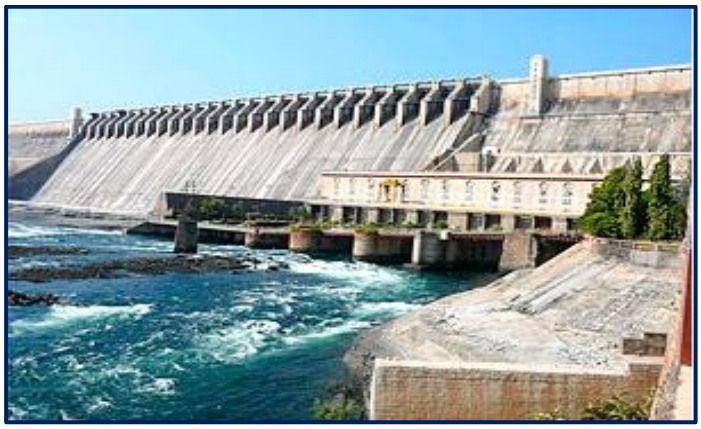
06

Water Resources

Introduction:

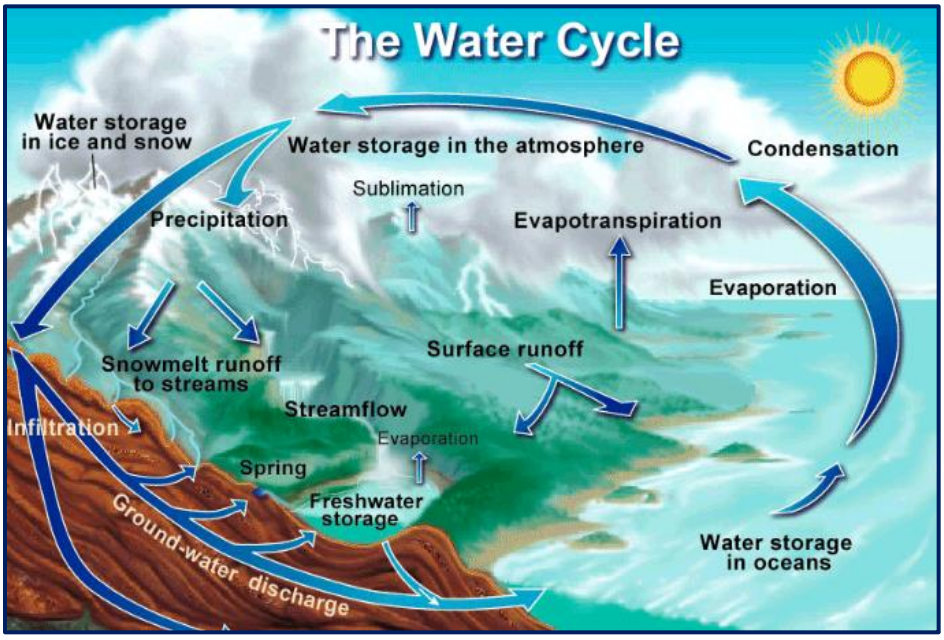
India contributes about 2.45% of the world's land area, 4% of the world's water resources and 16% of the world's population. India receives an annual rainfall of 4000 cubic km, and surface and groundwater resources which is 1869 cubic km. But only 60% (1122 cubic km) from these two useful and usable water sources.

1. Indian Water Resources:



India contributes about 2.45% of the world's land area, 4% of the world's water resources and 16% of the world's population. India receives an annual rainfall of 4000 cubic km, and surface and groundwater resources which is 1869 cubic km. But only 60% (1122 cubic km) from these two useful and usable water sources.

2. Surface Water Sources



Rivers, lakes, lakes and tanks are the four main sources of surface water in India. There are approximately 10,360 rivers and tributaries and each tributary is more than 1.6 km long. The average annual flow rate across all river basins in India is estimated at 1,869 cubic km. But about 690 cubic km or 32% of this water can be used due to weather, hydrological and other issues. The size of the catchment / river valley and the rainfall in its area controls the flow of water in the river. River water availability is more during the rainy season than in other seasons in India. In India, Ganga, Brahmaputra and Indus have vast water sources. The catchments of the Ganga and Brahmaputra and Barak rivers fall into the high rainfall area and therefore have 60% of the water resources and only 33% of the surface area in India, but much of the water is not used. On the other hand, in the Peninsula Rivers such as Godavari, Krishna, Kaveri, etc. means that the flow of seasonal water is small, but most of its water is used.

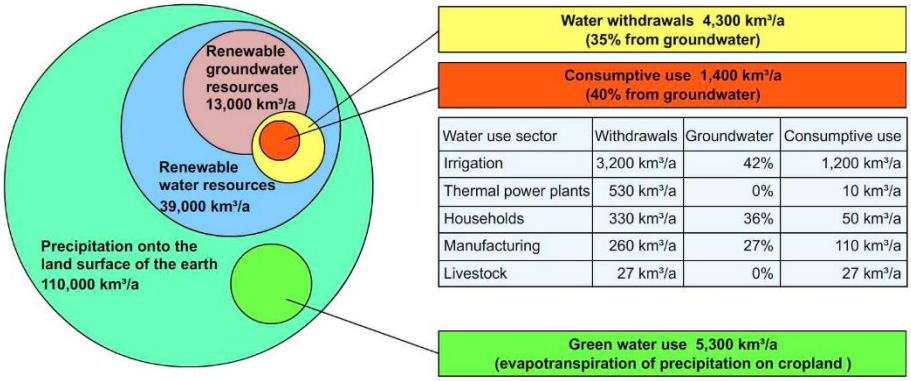
3. Groundwater Resources

There are approximately 432 cubic km of total underground aquifers available in India. The Ganga and Brahmaputra valleys account for 46% of the total amount of renewable groundwater resources. Groundwater consumption is high compared to rivers in the North West and parts of Southern India. The countries most used for groundwater are Punjab, Haryana, Rajasthan and Tamil Nadu. Low-lying countries of moderate use are Gujarat, Uttar Pradesh, Bihar, Tripura and Maharashtra. Countries with low groundwater consumption are Chhattisgarh, Odessa, Kerala, etc. It is envisaged that if water use continues at the current level, there is a good chance that it will slow down development and create social ills.

4. Lagoons and Backwaters

Some regions of India have lost their coastline and as a result have built many lakes and ponds. Examples of these regions are Kerala, Odessa, and West Bengal. Due to brackish water-bodies, these water resources are used for fishing and watering certain types of paddy plants, coconut, etc.

5. Water demand and utilization



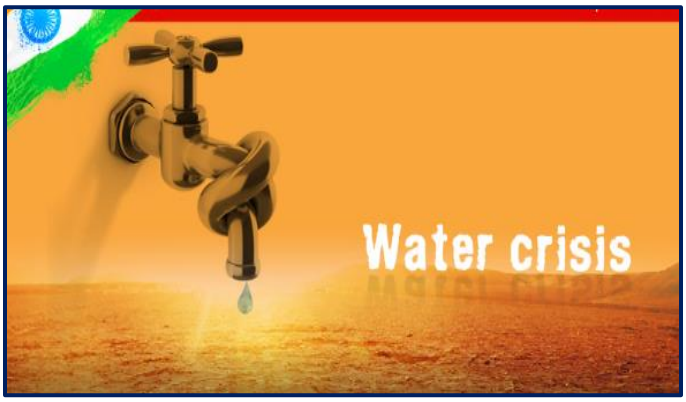
Water use sector	Withdrawals	Groundwater	Consumptive use
Irrigation	3,200 km³/a	42%	1,200 km³/a
Thermal power plants	530 km³/a	0%	10 km³/a
Households	330 km³/a	36%	50 km³/a
Manufacturing	260 km³/a	27%	110 km³/a
Livestock	27 km³/a	0%	27 km³/a

Agriculture, an important part of the Indian economy, alone uses about 89% of the surface water and 92% of the groundwater. Most development projects, projects in river valleys such as Bhakra-Nangal, Hirakund, Damodar Valley, Nagarjuna Sagar, Indira Gandhi Canal project, etc. and five-year programs were started to provide water in the agricultural sector and increase agricultural productivity. Apart from this, surface and groundwater use for domestic purposes is 90% and 3% and in industry there are 2% and 5%, respectively.

6. Need for Irrigation Water

The need for irrigation is very high in India due to local variability and temporary rainfall. Since winter and summer are very dry in most parts of India. Therefore, without irrigation farming cannot be done in these areas. Some crops such as rice, sugarcane, jute and others need a lot of water to grow. Irrigation helps to grow more crops, provides more agricultural production, and with HYV seeds provides higher yields faster. For example, Punjab, Haryana and Western Uttar Pradesh with more than 85% of the source area under irrigation. The total net irrigation area in Punjab under springs and tubes is 76.1% as it is 51.3% in Haryana. These provinces use most of their groundwater resources and as a result, it is a major factor in the depletion of these resources. Apart from this in Rajasthan and Bihar, the level of fluoride in groundwater is also increasing due to the excessive withdrawal of this resource. Although in West Bengal and Bihar, arsenic levels have increased for the same reason.

7. Emerging Water Problems



Rapid population growth and pollution from various sources such as industry, agriculture, and domestic resources are major causes of declining access to safe drinking water. Individual water availability in India is also declining day by day.

8. Deteriorating Water Quality

Water quality means water that does not contain foreign impurities that cause contaminated water i.e. micro-organisms, chemicals, industries and other waste. These toxic substances cause water pollution by dissolving or hanging in lakes, streams, rivers and seas. Occasionally, such contaminants flow into the ground and contaminate groundwater. The most polluted rivers in India are Ganga and Yamuna.

9. Water Conservation and Management:

Water conservation and management becomes necessary after reducing access to clean water and increasing its need for population growth. For Sustainable Development and Maintaining a Quality of Life, the Government must encourage people to use water resources development, rainwater harvesting, recycling and reuse of water, and shared water use for long-term quality water.

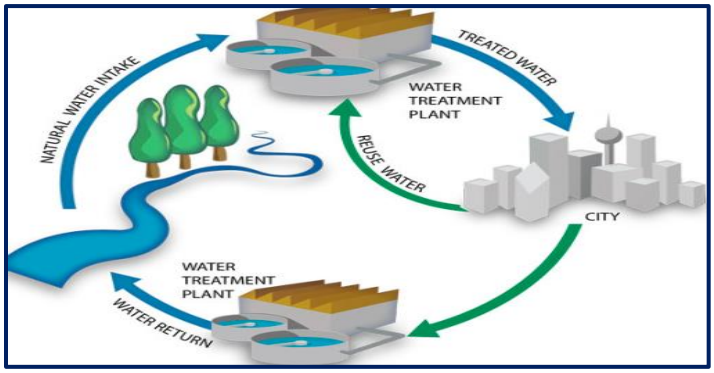
10. Preventing Water Pollution

Availability of water resources is declining rapidly. It is evident that hilly areas have relatively small populations, with high levels of water in their rivers. Although the plains are densely populated and therefore have low water levels in their rivers, here water is widely used for irrigation, domestic and industrial activities. Plains also play a key role in polluting water resources by removing agricultural waste (chemical fertilizers and pesticides) and solid and domestic waste and industrial waste. In summer, the runoff from rivers is always high due to the small amount of water that can seep into these pollutants. The water level of the country's water resources at 507 stations is regulated by the Central Pollution Control Board (CPCB), in collaboration with the State Pollution Control Boards. Analysis of data recorded at these channels shows that major rivers in India are highly polluted by pollution and germs. The Yamuna River is the most polluted river in the country between Delhi and Etowah. Some of the most polluted rivers are the Sabarmati in Allahabad, Gomati in Lucknow, Kali, Adyar, Cooum River(everywhere), Vaigai in Madurai, Day in Hyderabad and Ganga in Kanpur and Varanasi. Groundwater is also polluted due to the accumulation of toxic metals, which produce nitrates in various parts of the country.

11. Provisions of legislation and regulations to prevent river pollution

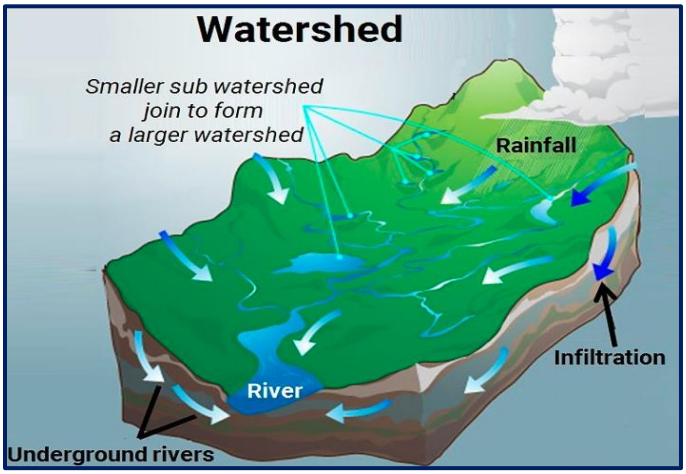
Government has taken various measures to reduce river and water pollution but due to some obstacles, these appeared to be ineffective, e.g. The Water (Pollution Control and Pollution Control) Act of 1974, as well as the Environmental Protection Act of 1986 have not been effective as in 1997, 251 pollution plants were established along rivers and lakes. The Water Cess Act of 1977, which was designed to prevent pollution, was also ineffective. So, there is an urgent need to raise public awareness of the importance of water for health. It will lead to a reduction in pollution from agricultural activities and industrial emissions.

12. Recycling and Reuse Water



Recycling and Reuse is the easiest and best way to save clean water and make it available to all. Industries can use low quality water and their wastewater to cool and extinguish fires, which can reduce water costs in them and save clean water. Water can be collected after washing and washing dishes, washing clothes and cars can be the best way to farm. Today, recycling and recycling of water is limited to a few people but there is a large amount of water for recycling.

13. Watershed Management

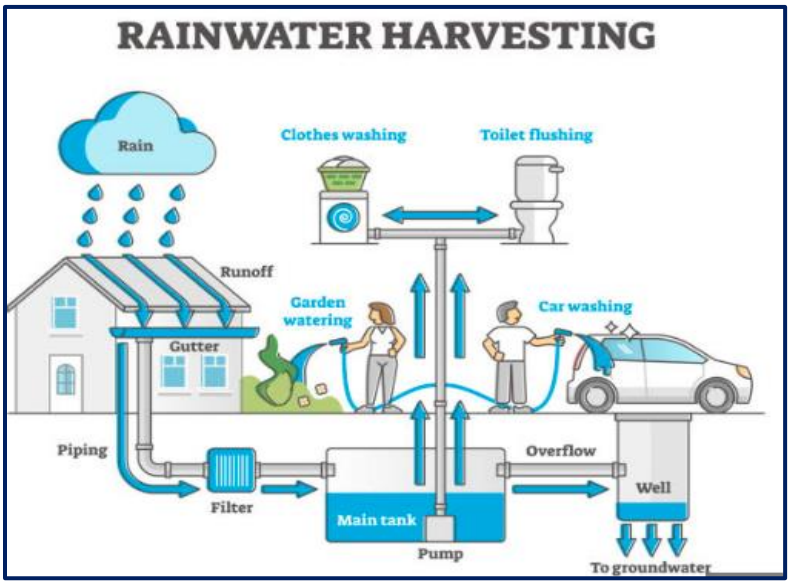


River water management basically refers to good water management and conservation.
Water management includes:

1. Groundwater sources.
2. Prevent water flow.
3. Storage and recharge of groundwater by various means such as drainage tanks, rechargeable sources, etc.
4. The conservation, rehabilitation and sustainable use of all natural resources (land, water, plants and animals) and human resources.
5. Create a balance between natural and social elements.
6. Public participation is the key to the success of the Watershed Development program.
   There are various Watershed Development Programs and administrative programs initiated by both Central and State Governments at national and provincial levels in India such as:
7. Haryali Sponsored by the central government while gram panchayats in various districts perform in partnership with the community. This program enables people to save water used in a variety of ways such as drinking, watering, fishing and planting forests.
8. The Neeru-Meeru (Water and You) Program in Andhra Pradesh and Arvary Paani Sansad (Alwar, Rajasthan) are examples of government-initiated river development programs.

Under these two programs many boreholes were constructed, Johad ponds, exploration dams, etc. were built to harvest water with the help of community participation. Tamil Nadu is the only district that has made the construction of water harvesting facilities compulsory for houses.
Construction of a building outside a water harvesting building is not permitted. Despite having programs like these, most Indians still do not know about the benefits of water development and water management. Therefore, there is a need to encourage more people to participate in this program.

14. Rainwater Harvesting



Rainwater harvesting is a cheap and environmentally friendly method that directs us to store rainwater in boreholes, boreholes and refill groundwater for various uses. There are various benefits of rainwater harvesting as follows:

1. Increases water availability.
2. Check the level of groundwater depletion.
3. Improves groundwater quality through purification of pollutants such as fluoride and nitrate.
4. Prevents soil erosion and flooding.
5. It can be used to prevent saltwater intrusion into coastal areas, if it is used to recharge aquifers.

There are many ways to harvest rainwater from India. With conventional rainwater harvesting techniques, water is usually collected in any surface water area, namely ponds, ponds, irrigation tanks, etc. in rural areas. Alternatively, a Kund or a tank is the last reservoir covered under the lower tank. This process is widely used in Rajasthan. Rainwater harvesting can be done in open areas even on the roofs of houses and the collected water can be used for domestic use by many people and reduce their reliance on groundwater.

15. Other method

To solve the water shortage problem, we can use salt water in arid, dry and coastal areas after desalination processes. By connecting rivers, water can be transferred from residual water to water sources.

16. Highlights of India's National Water Policy, 2002

The National Water Policy, 2002 sets out the priorities for the distribution of water in the following order namely drinking water, irrigation, hydropower, navigation, industry and other uses. The main objectives of this policy are to provide water to all people and animals, to constantly monitor surface and groundwater levels, to raise awareness of water as a rare resource, to create awareness of human conservation through education, principles, motivations and barriers, etc.

Questions For Practice

1. What is the mean annual flow in India?
(a) 1,869 cubic km
(b) 1,988 cubic km
(c) 1,698 cubic km
(d) 3,869 cubic km

2. Which chemical has concentrated in water in Bihar?
(a) Salt (b) Salinity
(c) Fluoride (d) Arsenic

3. Which one is not related to watershed development project?
(a) Haryali
(b) Neeru-Meeru
(c) Arvary Paani Sansad
(d) Van Mahotsav

4. How much percent of surface water in India can be used?
(a) 22% (b) 25%
(c) 32% (d) 35%

5. Identify the sector that consumes the highest amount of water in India?
(a) Industry (b) Agriculture
(c) Domestic (d) None of these

6. Haryali program is related to development of?
(a) Forest Cover
(b) Watershed Development
(c) Soil Conservation
(d) Food Grain Production

7. The total useful water resources of India are?
(a) 1122 cubic km
(b) 1222 cubic km
(c) 1322 cubic km
(d) 1422 cubic km

8. Environment Protection Act was implemented in?
(a) 1974 (b) 1986
(c) 1988 (d) 1997

9. What is the share of India in the world's water resources?
(a) 1% (b) 2%
(c) 3% (d) 4%

10. Which of the following figures in cubic kilometers correctly shows the total annual precipitation in India?
(a) 2,000 (b) 3,000
(c) 4,000 (d) 5,000

11. What is India's share of the world's water resources?
(a) 1% (b) 2%
(c) 3% (d) 4%

12. How much groundwater is used for Agriculture?
(a) 72% (b) 82%
(c) 85% (d) 92%

13. What percentage of the Net investment area is irrigated in Punjab?
(a) 65% (b) 75%
(c) 80% (d) 85%

14. Which of the following types describes water as a source?
(a) Abiotic Service
(b) Non-Renewable Resources
(c) Biotic resource
(d) Bicycle Service.

15. The total number of useful Indian water resources are?
(a) 1122 cubic km
(b) 1222 cubic km
(c) 1322 cubic km
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16. How much of the earth's surface is covered by water?
(a) 51% (b) 61%
(c) 71% (d) 81%

17. What percentage of India's excess water can be used?
(a) 22% (b) 25%
(c) 32% (d) 35%

18. Which chemical has concentrated in water in Bihar?
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19. Which of the following rivers have the most underground water source in the world?
(a) Indus (b) Brahmaputra
(c) Ganga (d) Godavari

20. Which part of the river has the highest water?
(a) Mountain (b) Easy
(c) Delta (d) Valley

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Solutions

1. (a)	**4. (c)**	**7. (a)**	**10. (c)**	**13. (d)**	**16. (c)**	**19. (c)**	**22. (d)**	**25. (a)**	**28. (d)**
2. (d)	**5. (b)**	**8. (b)**	**11. (d)**	**14. (d)**	**17. (c)**	**20. (a)**	**23. (d)**	**26. (c)**	**29. (c)**
3. (d)	**6. (b)**	**9. (d)**	**12. (d)**	**15. (a)**	**18. (d)**	**21. (d)**	**24. (d)**	**27. (c)**	**30. (a)**