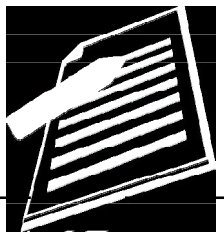

21

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OUR WATER RESOURCES

Water is so important for life that we can not imagine life without it. The evolution of life itself took place in the water. In the evolution of all kinds of life, water has played an important role. The amount of water found in the living beings is 65 per cent and 65 to 99 percent in plants. This clearly shows the need and utility of water. Water which is a precious gift of the nature has several uses. Water is very essential for the development.

From the point of view of availability and suitability, the potable water is limited in India. Morever, it has highly unown geographical distribution. Another disturbing issue is day by day deteriorating quality of water. It is a matter of great concern for all of us. Besides coordinating the demand and supply of the water, there is a need to keep the balance among different sources of water. Hence conservation of water resources is an essential requirement.

OBJECTIVES

After studying this lesson, you will be able to

- know different sources of water;
- explain the meaning of water budget;
- explain the uneven distribution of water;
- know the utility of water;
- understand the utility and distribution of different sources of irrigation;
- locate important river valley projects on the map;
- explain the need of the water management;
- explain the impact of flood and draught on the life of the people;
- explain the meaning of watershed development;
- explain the methods of conservation of water resources.

21.1 WATER RESOURCES

Water is the most valuable resources of nature. This is renewable and inexhaustible resource but is in trouble these days. Demand of water has been increasing continuously its supply decreasing. If we look at the water resources of India in the global contect, India has 4 percent water whereas she is housing 16 percent of the world's population. It means the per capita availability of water is quite low in our country. India ranks first in the world in irrigated area. One-eighth area of the country is flood prone and one-sixth area is under the grip of drought. Nature of monsoon is mostly responsible for this. Food grains and other agricultural products are required in large quantity for the growing population. For this reason the use of water for irrigation of crops has been increasing. The demand for water has increased in the cities due to rapid urbanization, industrialization, and modernization. In addition, the demand for water has been increasing for sewerage and for removing all kinds of wastes.

21.2 SOURCES OF WATER

There are four main sources of water: (i) Surface water (ii) Underground water (iii) Atmospheric water, and (iv) Oceanic water. In our daily life we use only surface water and underground water. Let us study them in detail.

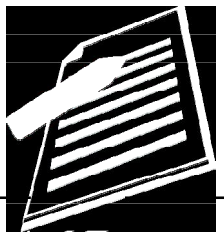
(A) Surface water – The main source of surface water is precipitation. About 20 percent part of the precipitation evaporates and mixes with the environment. A part of the running water goes underground. The large part of surface water is found in rivers, riverlets, ponds and lakes. Remaining water flows into the seas, oceans. Water found on the surface is called surface water.

About two – third of the total surface water flows into three major rivers of the country – Indus, Ganges and Brahmaputras. The water storage capacity of reservoirs constructed in India so far is about 17400 billion cubic metres. At the time of independence, the water storage capacity was only 180 billion cubic metres. Hence water storage capacity has increased about ten times.

Table 21.1 INDIA : Distribution of surface and underground water according to river basins

(Figures in billion Cubic metre)

River basin	Surface water flow		Underground water	
	Annual flow	Usable capacity	Renewable	Usable Capacity
1. Indus	71.3	46.0	26.5	24.3
2. Ganga	525.0	250.0	171.0	157.0
3. Brahmaputra	629.0	24.0	27.0	24.0
4. Godavary	110.5	76.3	40.7	37.0
5. Krishna	70.0	58.0	26.4	24.0
6. Kaveri	21.4	19.0	12.3	11.3



7. Mahanadi	68.9	50.0	16.5	15.0
8. Narmada	45.7	34.5	10.8	9.9
9. Tapi	14.9	14.5	8.3	7.6
10. Other rivers	365.4	11.82	74.0	68.2
Total	**1952.1**	**690.3**	**431.32**	**395.6**

The storage capacity of usable water in the Ganges basin is the maximum, but in spite of maximum annual flow, the storage capacity of usable water is the least in Brahmaputras basin. The storage capacity in Godavary, Krishna, Mahanadi and Indus is sufficient. If storage capacity of usable water is seen in terms of ratio, then Tapi river basin is 97 percent. Annual water flow in the three major rivers of India – Indus, Ganga and Brahmaputras is more. Hence water storage capacity of these rivers can be increased.

(B) Underground water

Rain water percolates into the earth's surface and becomes underground water. The process of percolation also take place from the surface water. Large amount of water gets collected under the Earth's surface by these two methods. This is called underground water. According to Central Underground Water Board renewable underground water capacity in India (1994-95) was about 4310 billion cubic metre per year. Out of this about 3960 billion cubic metre water is available for use.

The distribution of undergrounds water is not the same everywhere. Availability of underground water depends upon the amount of rainfall, nature of rainfall, nature of land and its slope. In the areas of high rainfall where the land is almost plain and has porous rocks, the water easily percolates there. Therefore underground water is available in plenty at shallow depths in these areas. In the areas like Rajasthan where the land is plain and has porous sandy soil, the underground water is available in lesser amount at greater depths due to lack of rainfall. In the north-eastern areas of the country, where the land is sloppy, the conditions are not suitable for percolation of water inspite of more rainfall. With the result underground water is available in less quantity at greater depths in these areas also. There are large resources of underground water in the plains of Ganga – Brahmaputra and in coastal plains. The availability of underground water is less in peninsular plateau, Himalayan region and desert areas.

Use of underground water capacity

Underground water is used on a large scale in the areas where the rainfall is comparatively less. Underground water is used on a large scale in Punjab, Haryana, Rajasthan, Tamil Nadu, Gujarat and Uttar Pradesh whereas Andhra Pradesh, Madhya Pradesh, Maharashtra, Karnatake and Chhattisgarh are such states where inspite of less rainfall, the use of underground water is less. There is a great need to develop underground water resources here.

INTEXT QUESTIONS 21.1

1. What is the main source of surface water?

_____

2. In which river basin is usable underground water available?

_____

3. How much part of the country comes under floods and drought every year?

_____

21.3 WATER BUDGET

Water Budget means – the balance between the available water in the country and the water under use. There is a great variation in the distribution of water resources in space and time. Water is available in sufficient quantity during rainy season. As the dry season sets in, there is a shortage of water. The reserves of our surface and underground water are about 23840 billion cubic metres. Out of this only 10860 billion cubic metre water is required for use.

The unit of measurement of amount of water is cubic metre or hectare metre. If water standing one metre deep on a perfectly level area of one square metre, then the total volume of whole of that water would be one cubic metre. In the same way, if water standing one metre deep on a perfectly level area of one hectare then the total volume of water would be one hectare metre.

You have already studied about the nature and distribution of rainfall in chapter 17. In India, 90 percent rainfall take place during the short period of three months from june to August. There is a great variation in the number of rainy days in India. Average number of rainy days on the western coast is 137. In Rajasthan average number of rainy days is reduced to less than 10. There is a variation in the nature of rainfall also. The rainfall may be heavy and continuous in the areas of more rainfall where as the rainfall may be low and intermittent in the areas of less rainfall. Hence, there is a great variation in the regional distribution of rainfall. About 8 percent areas of the country receive more than 200 cm rainfall, 20 percent areas receive rainfall between 125 to 200 cm. and remaining 30 percent areas, receive less than 75 cm, rainfall. Uneven distribution of rainfall is responsible for the uneven distribution of surface and underground water.

INTEXT QUESTIONS 21.2

1. Define the water budget.

_____

2. State the two units of measurement of water?

   (i) _____(ii)_____

3. In which part of the country is the duration of rainfall longest?

   _____

4. What is the proportional share of land area in the country which receive more than 200 cm rainfall?

   _____

5. Mention the main component responsible for the uneven distribution of water.

   _____

21.4 UTILITY OF WATER

Population in India has been increasing continuously. Population of the country has increased about three times since independence. Due to this increase in population demand for water has increased in all the spheres. Demand for water has increased comparatively more for drinking, irrigation and industries. On the other hand, per capita annual availability of water has been decreasing continuously. In 1951 per capita annual availability of water was 5177 cubic metre per person which has decreased to 1829 cubic metre per person annually in 2001. In the coming years by 2025 per capita availability of water is expected to become 1342 cubic metres annually. It is to be noted that the water crisis arises when the per capita availability of water falls 1000 cubic metres annually. Today many countries have started facing the water crisis. They have to import water.

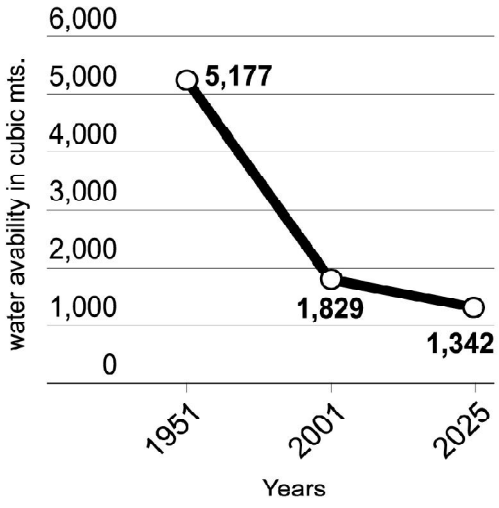


Fig 21.1 Decreasing availability of water annually

There are various uses of water. We need water for drinking, domestic use, irrigation, industries, public health, cleanliness and for flushing or draining sewage or human waste. Water is continuously needed for generation of hydro-electricity. You can not imagine fishing, forestry and water sports without great amount of water. In this way, water is essential for all kinds of developmental work. Its use is essential in all spheres of life. Due to rapid growth of urban population, the demand for water in urban areas has increased tremendously.

Table 21.2 INDIA : Changing pattern of use of water 1990-2050 (figures in billion cubic metre)

Use	1990	2000	2010*	2025*	2050*
Domestic	25	33	42	52	60
Irrigation	460	536	653	770	800
Industry	15	30	79	120	130
Energy	19	27	44	71	120
Others	30	33	35	37	40
Total	**549**	**659**	**853**	**1050**	**1150**

** Estimated*

India is an agricultural country. Hence plenty of water is needed for irrigation. 536 billion cubic metre water was used for irrigation in the year 2000. It is 81 percent of the total water used. The remaining percentage of water was used for domestic, industrial and other purposes.

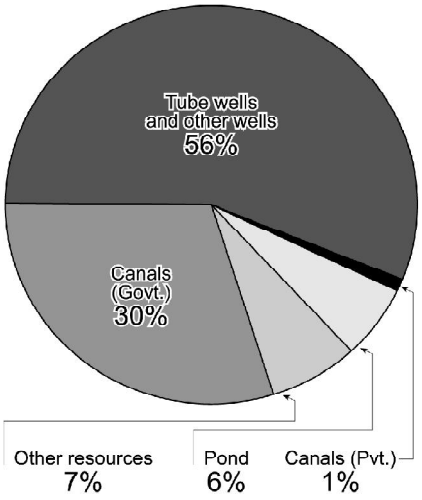


Fig. 21.2 Use of water

There has been a rapid increase in the irrigated area in India since independence. Total irrigated areas in 1999-2000 was 8.47 crore hectare. The maximum capacity of the use of water for irrigation in India is 11.35 crore hectare metre. But about three-fourth water of this capacity is being used.

The demand for irrigation in India has been increasing continuously. The reasons for the increasing demand of irrigation are as follow-

1. Regional and seasonal variations in the distribution of rainfall.
2. Wide and uncertain gaps in rainfall season.
3. Growing demand of water for commercial crops.
4. Changing cropping pattern.

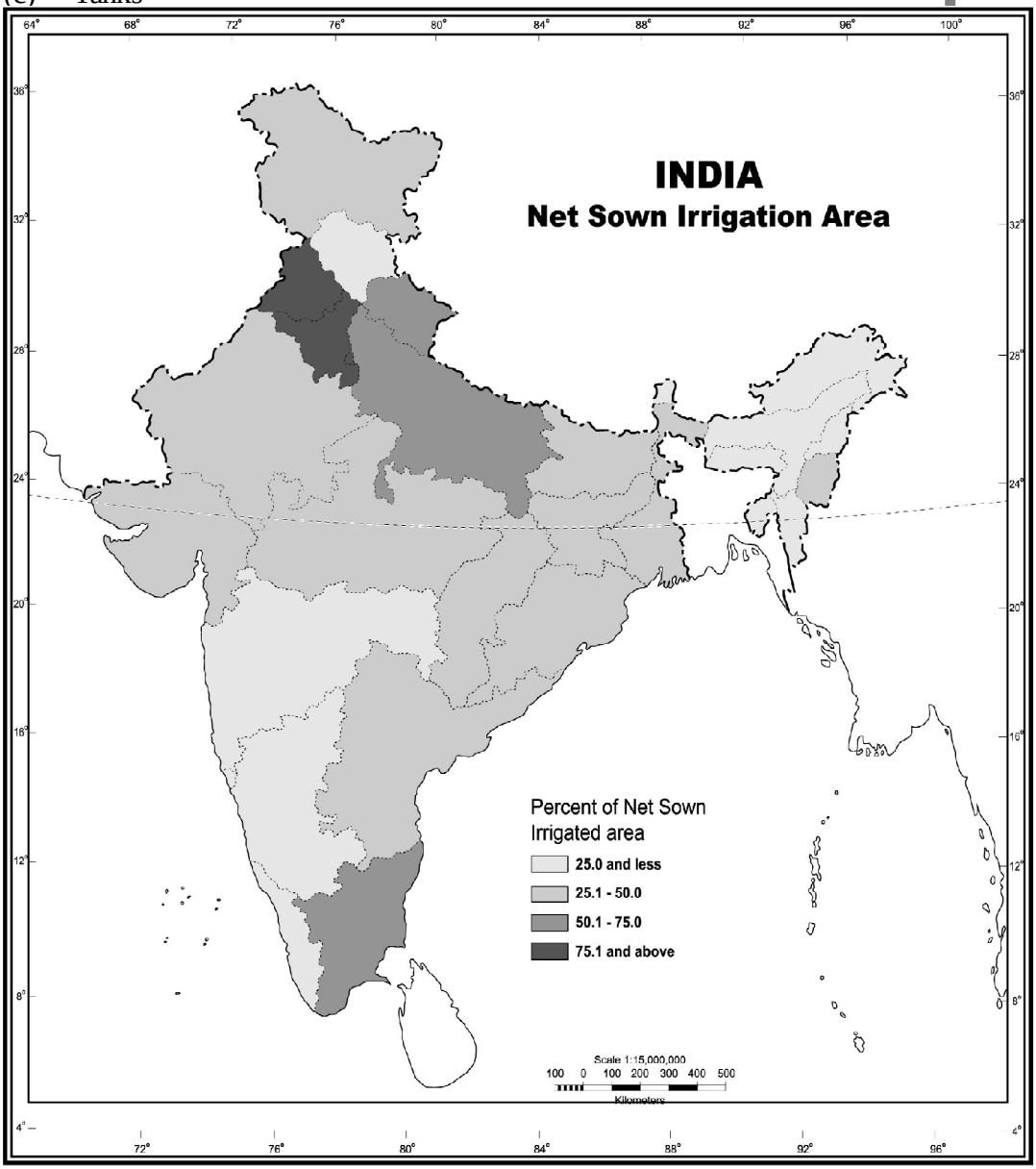
21.5 MEANS OF IRRIGAION

There are three main means of irrigation in India:

(a) wells and tubewells

(b) canals, and

(c) Tanks



Based upon Survey of India Outline Map printed in 1990
The territorial waters of India extened into the sea to a distance of twelve nautical miles measured from the aporopriate base line.
The boundary of Meghalaya shown of this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified
Responsibility for correctness of internal details shown on the map rests with the publisher.

Fig. 21.3 Net sown irrigated area

(A) WELLS AND TUBE-WELLS

Irrigation by wells is an old practice in India. It has greatly increased with the use of diesel and electric pumping sets. Irrigated area by wells and tubewells in 1950-51 was only 59 lakh hectares which has increased to 30 million hectares in 1997-98. During this period total irrigated area has increased from 30 percent to 57 percent.

There are large reserves of underground water in the alluvial plains of north India. Digging and constructing wells and tubewells is easy and cost of their construction is also comparatively less. Therefore irrigation by wells and tubewells here is popular. On the other hand, Gujarat, Goa, Rajasthan and Maharashtra are such states where only about 60 percent irrigation is carried on by wells and tubewells.

(B) CANALS

Canals were the main means of irrigation upto 1960. Canals contributed about 40 percent in the total irrigated area of the country. In 1996-97 it came down to about 31 percent. About 1.74 crore hectare area was irrigated by canals in 1996-97. Half of this area (52.5 percent) is limited to the states of north-India. Haryana, Orissa, Karnataka, West Bengal, Andhra Pradesh and Punjab are worth mentioning for canal irrigation. Jammu-Kashmir, Mizoram, Assam and Tripura are such states which are greatly depend upon canal irrigation because there is lack of other means of irrigation in these states. Mizoram which has the least irrigated area completely dependent upon canals for irrigation.

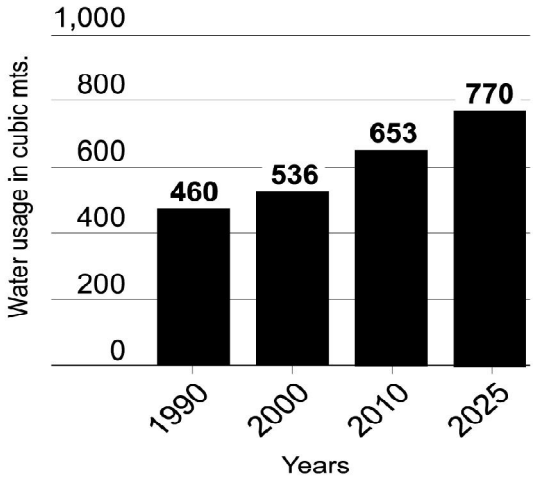
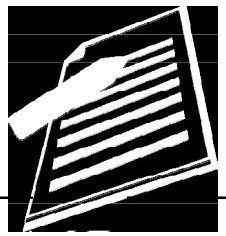


Fig. 21.4 Water availability

(c) TANKS

The contributions of tanks in irrigation has reduced. About 6 percent of the irrigated area is irrigated by tanks. Irrigation by tanks is popular in peninsular plateau area. Tamil Nadu is the leading state in the irrigation by tanks. About 22 percent area is irrigated by tanks here. In the states of Orissa, Maharashtra, Karnataka, Kerala and West Bengal tanks are used for irrigation.



INTEXT QUESTIONS 21.3

1. How much is the per capita average annum availability of water in India?

   _____

2. When arises the water crisis?

   _____

3. Which is the main means of irrigation in India? How much percent of land is irrigated by this?

   _____

4. In which part of the country is the irrigation done mainly by tanks?

   _____

21.6 RIVER VALLEY PROJECTS

To make India economically self sufficient and to improve the standard of living of the people, development efforts were initiated soon after the independence. Among these activities special emphasis was laid on the development of river valley projects. River valley projects were multipurpose projects. The main objectives of these projects are flood control, prevention of soil erosion, provision of water for irrigation, drinking and for industries, genration of electricity, transport, entertainment, conservation of wild life and development of fisheries.

Table No. 21.3 Major River Valley Projects of India

Name of the Project	River	Constructed dam/reservoir	Beneficiary states
1	2	3	4
1. Damodar Valley	Damodar	Dames:- 1. Tilaiya 2. Konar 3. Maitlhon 4. Panchet hill	 1. Jharkhand 2. W. Bengal
2. Bhakra Nangal	Satluj	1. Bhakra 2. Nangal 3. Pong Reservoir – Gobind sagar	1. Punjab 2. Himachal 3. Haryana 4. Delhi
3. Hirakud	Mahanadi	1. Hirakud 2. Tikkarpara 3. Naraj	1. Madhya Pradesh 2. Orissa 3. Chhattisgarh
4. Tunghadra	Tungbhadra	Canals with dams Tungbhadra dam	1. Karnataka 2. Andhra Pradesh
5. Nagarjuna Sagar	Krishna	Nagarjuna Sagar Dam	Andhra Pradesh
6. Narmada Valley	Narmada	Proposed dams	1. Madhya Pradesh 2. Maharashtra

		1. Sardar Sarovar 2. Narmada Sagar 3. Burgi	3. Gujarat 4. Rajasthan
7. Kosi	Kosi	Three units – 1. Kosi Barrage 2. Kosi Shaktigrah 3. Hanuman Nagar	1. Bihar 2. Jharkhand 3. Nepal
8. Chambal Valley	Chambal	Dams:- 1. Gandhi Sagar 2. Rana Pratap Sagar 3. Jawahar Sagar 4. Kota Barrage	1. Rajasthan 2. Madhya Pradesh
9. Indira Gandhi Canal	Beas-Satluj	Dam on Ravi Beas and Satluj Pong	Rajasthan

21.7 RAIN WATER HARVESTING

Rain water harvesting generally means collection of rain water. Its special meaning is a technique of recharging of underground water. In this technique water is made to go underground after collecting rain water locally, without polluting the same. With this, water during the time of scarcity local domestic demand can be met.

Now the question arises – After all why do we need water harvesting? Three main reasons are responsible for this:-

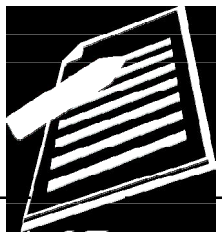
1. Scarcity of surface water
2. Growing dependence on underground water.
3. Increasing urbanization.

(A) Urban Scenario – Total amount of rain water recovered in an area is called 'rain water reserve'. Effective management of rain water reserve is called 'potential water harvesting'. Think for a while the area of the roof of your house is 100 square metres and the 'average rainfall' of this area is 60 cms. Suppose the water on the roof has neither flowed, percolated nor evaporated then there will be 60 cms, high water on the roof.

Volume of water = Area of the roof X Amount of annual rainfall
= 100 x 60 cms = 100 x .6 = 60 cubic metres

In other words, a family can collect 60,000 litre water in a year. All water related needs of this family can be met with this. On an average a person needs 10 litre water for drinking daily. If your family consists of 6 members, then you need 6x10x365 = 21900 litres water. Remaining (60,000 – 21,900) = 38,100 litre water can be used in dry weather when there is a scarcity of water.

(B) Rural Scenario – The tradition of water harvesting is very old in India. But the utility of water harvesting has never been felt so much as it is today. Even today the people living in the areas of water scarcity try to do their domestic work by

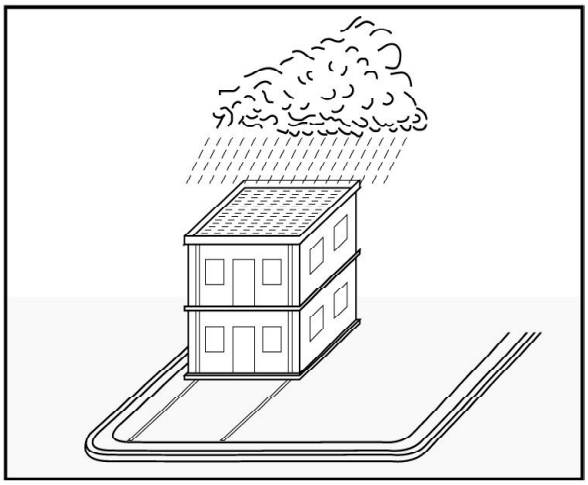


adopting old methods. Deepening and dredging of wells, tanks and ponds are included in these methods. Water harvesting in the small channels (locally known as bawli) is an important traditional method in the areas of water scarcity. Now we can be in a better and secure situation by adopting new technique of water harvesting. Think for a while. If the people living in 5,87,000 village engage themselves for harvesting rain water of their 2000 lakh hectare area, there will be lot of water available for use. On an average a village comes under the radius of 37,500 lakh cubic metre rain water reserve. By this calculation we come to know that there is great potential of rain water harvesting.

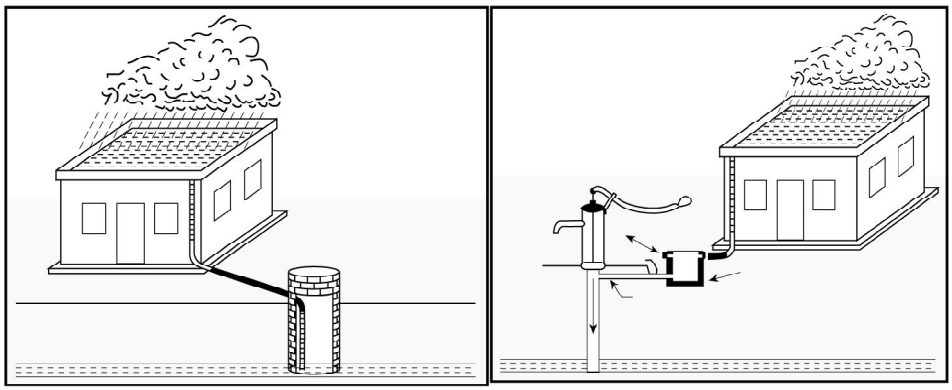
21.8 METHODS OF RAIN WATER HARVESTING

We can adopt different methods for rain water harvesting according to need, available facilities and environmental conditions. The following methods are worth mentioning–

1. **Construction of potholes –** We can harvest water in small ditches constructed in those areas where there is not much underground water. These ditches may be constructed 1-2 metre wide and 2-3 metres deep. Their shape could be anything. These ditches are filled with roubbles and sand. Rainwater can easily percolate through these.
2. **Construction of trenches –** In the lower regions where porous rocks are found after making trenches of 0.5 to 1 metre width, 1 to 1.5 metre depth and 10 to 15 metre length, these are filled with roubbles. These trenches should be made parallel to the slope of the land.
3. **Use of wells –** The wells which have become dry and are not being used at present can be used for water harvesting.
4. **Handpump -** Stored rainwater can be made underground with the help of filter by running handpumps in the areas of lack of underground water.



(a) Recharge through Trench



(b) Recharge through abandoned Dug Well *(c) Recharge through Hand Pump*

Fig. 21.5 : Methods of water harvesting

INTEXT QUESTIONS 21.4

1. What is called rain water reserve?

   _____

2. Name any two methods of rain water harnesting.

   (i)_____(ii)_____

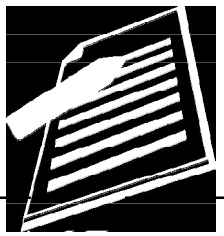
3. Which are the main objectives of river valley projects?

   _____

21.9 NATIONAL WATER POLICY

Water is national valuable reserve. It is essential for the Govt. to evolve policy for the development and management of water resources so that surface and underground water is not only properly used but also served for the future. Nature of rainfall has also compelled us to think in this direction. 'National Water Policy' was formulated and accepted in September 1987. It was revised in 2002 and presented as 'National Water Policy' 2002 when many problems arose in the previous policy during the course of time. Water is an important constituent of ecosystem. It should be considered essential for all kinds of life. It should be developed, conserved and managed in a planned manner. It is essential to think about its social and economic aspects of water as large areas of the country suffer due to drought and floods every year. It causes not only the loss of property and human life but the wheel of development is also stopped.

The problems of floods and drought are not limited to the boundaries of a particular state. This requires thinking at the national level. Several problems arise in planning and working on water resources. Among these continued nutrition of atmosphere, proper transfer and rehabililation of men and animal, health security of dams are



such problems which can be tackled in a specific period. The problem of standing water and salinity in the soil arise in some areas. More exploitation of underground water in many areas of the country have posed serious challenge. It is essential to think about all these problems under a general policy.

The production of food grains in the decade of 1950 was 500 lakh tons which rose to 2080 lakh tons in 1999-2000. We have to increase the amount of food grains to 3500 lakh tons in 2025. The demand of water would increase in domestic, industries, energy production sectors etc. Water resources are already less, those will become further less in future. Quality of water is also an important aspect. Pollution of surface and underground water, has been increasing. Main sources of water pollution due to human activities include domestic waste water, industrial effluents and chemicals used in agricultural. Sometimes water pollution is also caused by natural factors. Erosion, landslides, decomposition of plants and animals are the main nature sources of water pollution. Three fourths of the total surface water in our country is polluted.

21.10 WATERSHED DEVELOPMENT

The meaning of watershed refers to an area whose water flows towards a point. The planned use of this water can deliver better results. Related area may be a village or a group of villages in the form of a unit. All kinds of land like agricultural, waste lands and forests may be included in this area. Maximum use of the land is possible by adopting watershed programme; The overall development with proper utilization of water in the area is considered to be watershed development.

(A) Benefits of watershed development – The following benefits can be achieved by water-shed development-

1. Supply of water for drinking and irrigation.
2. Increase in bio-diversity.
3. Loss of acidity in the soil and free for standing water.
4. Increase in the agricultural production and productivity.
5. Decrease in the cutting of forests.
6. Increase in the standard of living.
7. Increase in employment.
8. Increase in personal get together by participation of local people.

(B) The results of water shed development – Notwithstanding a huge amount of expenditure made by the Govt, (20 billions dollars by 2000) on watershed development,we have not been able to achieve desired results so far. The following factors are responsible for this:-

a. lack of scientific thinking
b. imperfect techniques

Notes

c. indifferent attitude of local population

d. lack of coordination among various departmental agencies, and

e. absence of independent ministry.

(c) River linkages – Large areas of the country suffer from droughts and floods. Droughts and floods are two sides of the same coin. 'National water Development Authority' was constituted in 1982 to solve this problem. The main objects of its constitution was to identify only the national water network. Finally National water Development Authority identified linkage of 30 rivers. Large rivers have mainly been included in this programme. Authority has recommended starting of work on 6 places of river linkages and their completion has to be carried out in three stages.

Ist STAGE - In the first stage, main peninsular rivers – Mahanadi, Godavary, Krishna and Kavery have been included.

IInd STAGE - In the second stage, linking of small river basins of peninsular India have been recommended. Ken, Betwa and Par-Tapi reivers are included in this.

IIIrd STAGE – In the third stage there is a provision for linking tributaries of Ganga and Brahmputras with one-another.

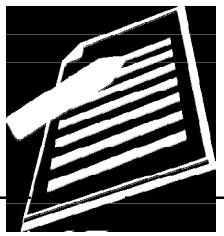
(D) Benefits of rivers linkages – All round development of an area is possible by joining basins. The irrigation of about 250 lakh hectare additional agricultural area is possible by surface water after the success of this programme. Underground water will be available to irrigate additional agricultural area of about 100 lakh hectares. With the result, irrigated area will increase from 1130 lakh hectares to 1500 lakh hectares. Additional hydro-electricity of about 340 lakh kilowatt will be generated. Besides these benefits, many other benefits like flood control, water transport, water supply, fishing, removal of acidity from the soil and control on water pollution will also be achieved. But these benefits can not easily be achieved. Much money and time has to be spent on these projects. According to an estimate a large sum of Rs 560 thousand crore are required to complete these projects.

21.11 METHODS OF WATER CONSERVATION

If there is no water, there is no life. Hence water conservation is essential. Future generation may be in difficulty due to scarcity of water. The participation of an individual, society and the Govt. is essential for water conservation. The following methods can be adopted for water conservation –

1. Dams and reserveors should be constructed on rivers so that river water does not go waste into the seas and oceans.

2. The water of rivers should be saved from pollution by urban waste at all costs.



3. Serious efforts should be made to control floods.
4. Water should be used properly.
5. Mass awakening should be around for water conservation.
6. Solicit active participation of the people in all the activities related to water conservation and efficient management.
7. Potable water should not be used for gardening, washing of vehicles and cleaning of household.
8. Saving of reservoirs from pollution
9. Broken pipelines of water should immediately be repaired.
10. Every drop of water is precious, this should be popularized among the masses.
11. Such crops should not be grown in rain fed areas which require more water.
12. There should be stress on afforestation.

21.12 A CASE STUDY : EFFORTS OF TARUN BHARAT SANGH TOWARDS WATER CONSERVATION

Tarun Bharat Sangh was established in 1985 under the guidance of Shri Rajendra Singh. It started with Hamirpur village of Thanagazi Tehsil in Alwar district of Rajasthan. The residents of Thanagazi area under the guidance of Tarun Bharat Sangh achieved such a miracle which could not be achieved by Central Water Authority while searching of the Sarswati in Wester Rajasthan and Bhabha Atomic Research Centre together. Tarun Bharat Sangh is a Non-Governmental Organization (NGO). Arvari river was reborn with a bhargirath efforts of this organization spanning over 15 years. Previously the river was dry and barren. There are two branches of Arvari river. The total length of these is 45 kilometres. Its watershed area is spread in 503 square kms.Parts of Jaipur, Dausa and Alwar districts are included in this.

Previously, there used to be agricultural in an unirrigated area here. There were no means of irrigation. Agriculture used to be done only on 10 percent of the land. Agriculture was entirely dependent upon rain. *There was one cropped agriculture. To remove the water searcity in the area,* Tarun Bharat Sangh with the help of villagers cleaned and deepend the tanks and ponds. Besides this, they also vowed to construct ponds on the sloppy parts of the hilly region. A village was chosen for this work in 1985-86. The results were very encouraging. Seeing this other villagers started competing in getting and making ponds constructed in their areas 'Save water' and **'Johar Andolan'** were started in 1996. 3500 ponds have so far been constructed in this area. The villagers themselves have constructed more than 70 ponds. Water level of underground water has risen after construction of these ponds. Water is available throughout the year in wells, tanks, ponds and rivers. Agricultural has also changed. Greenery dominates everywhere. Animals have become healthy and smart. Cows and buffaloes have started giving more milk.

The standard of living of the people has improved. The families below poverty line are also able to earn 40-50 thousand rupees per annum. Migration of people from villages to cities has stopped. Even migrated families have now started coming back to their villages.

The residents of 70 villages in Arvari river basin have constituted a unique 'parliament' of 150 members. This 'parliament' has been named as 'Arvari Sansad' after the name of Arvari river. The members of 'Arvari Sansad' took oath on the banks of the river in Hamipur on 26th January 1999. The constitution of Arvari Sansad came into effect from this day. This is such a **sansad** which not only frame the rules and laws but follow them also. All residents of the area follow these rules and laws strictly and also got them followed by others.

Arvari sansad has framed some rules and laws keeping the need of the people. Ecological balance and land in mind. The following are worth mentoring among them:-

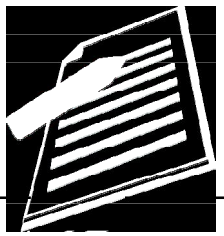
1. Ban on growing crops such as sugarcane, rice and chillies which require more water.
2. No one will use the river water for agriculture after **Holi** and before end of rainy season.
3. No industrial unit will be established in watershed area.
4. Recommended growing of millets, Jwar-Bajra and Maize.
5. Allowed to grow vegetables in the lower parts of the river.
6. Ban on hunting and cutting of green trees.
7. No person with an axe will enter into recently developed 'Bhairon Dev Manas' sanctuary.
8. The whole region has been declared as an area of bio-diversity
9. Ban on sending food grains and vegetables outside the region
10. Ban on grazing of animals by the people living outside the watershed area.

Today Arvari river has become very useful for the residents of the area. The people of the area worship this river also. Fair and festivals are celebrates. Arvari Sansad has established 'Arvari temple', Arvari treasury' and 'Arvari Sectariate'. Such programmes are being carried on in other areas also. In this connection very encouraging programmes are going on in Gujarat, Madhya Pradesh and Chhatisgarh. The Govts. should give protection and encouragement to such concepts. Such programmes should specially be carried on in rainfed areas.

INTEXT QUESTIONS 21.5

1. Mention any four problems related to the planning and practice of water resources.

   a._____b._____c._____d._____



2. Which are the three factors of water pollution?

   a._____b._____c._____d._____

3. How much amount was spent by 2000 on watershed development by the government of India in our country?

   _____

4. Why and when was constituted the National Water Development Authority?

   _____

5. How many river linkages have been identified by the National water Development Authority?

   _____

WHAT YOU HAVE LEARNT

Water in the most important and precious resources of nature. This is the basis of life. There are various uses of water. It is used for drinking, domestic work, irrigation, industries and energy sectors. India is an agricultural country. It has a long growing season. Hence there is maximum use of water in irrigation, wells, tubewells, canals, and tanks are the important sources of irrigation. There is maximum use of wells and tubewells in irrigation.

The distribution of water in India is very uneven. Duration of rainfall, nature of rainfall nature of level and slope of land are responsible factors for uneven distribution of water. River valley projects have played an important role in the development of water resourced, flood control and appropriate use of water. These have contributed greatly in the economic development of the country and in the conservation of resources. The conservation of water resources has become necessary due to scarcity of water, diversity in temporal and terrestrial distribution of water, increasing demand for water by a large growing population and changing atmospheric conditions. Special emphasis has been given on rain water harvesting and water-shed development programmes for this. If these programmes are carried out honestly. Then water crisis can never arise in India. Among there rain water harvesting programmes can be completed in low budget with the active cooperation of the people. There is a great need to change out thinking about water resources. Many social organization, councils and individuals have done commendable work in this field. Barren and backward areas have adopted on the path of development with their cooperation.

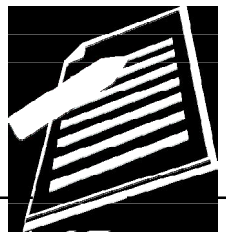
Water-shed development and linking rivers together is very expensive time consuming and complex. But this work can be completed by cooperation among different state govts, strong will power of the centre and cooperation of the people.

TERMINAL QUESTIONS

1. Answers the following questions in brief-
   (i) What is the meaning of water resources?
   (ii) Mention the main sources of surface water.
   (iii) Why is more underground water available in the northern great plains of the country?
   (iv) Explain the objective of river valley projects.
   (v) State the meaning of rain water harvesting.
   (vi) Explain the meaning of water shed.
   (vii) Mention three stages of river linkages.
2. Differentiate among the following –
   (a) Surface water and underground water.
   (b) Rain water harvesting and water shed development.
3. Why is distribution of water uneven in India? Explain with examples.
4. "Underground water is a reliable and continued resource of water supply". Prove the logic of this statement.
5. Describe main methods of rain water harvesting.
6. Which benefits can be achieved by water shed development? Mention them.
7. Why are desired results not achieved by watershed development projects? Give reasons.
8. Why is water conservation essential? Explain different methods of water conservation.
9. Evaluate the utility and applicability of water-shed development programmes in India.
10. Show the location of the following in the map –
    (i) Satluj (ii) Mahanadi (iii) Krishna
    (iv) Tungbhadra (v) Rana Pratap Sagar dam
    (vi) Sardar Sarovar dam (vii) Narmada Sagar dam.

II. PROJECT WORK

Adopt any suitable method of rain water harvesting for your village / town / city. Prepare a brief report on the basis of its following and results.



ANSWERS TO INTEXT QUESTIONS

21.1

1. Precipitation
2. Plains of Ganga - Brahmaputra
3. One - eighth area of the country is flood prove and one-sixth area is under the grip of drought.

21.2

1. Water Budget means - the balance between the available water is the country and the water under use.
2. Cubic metre or hectare metre
3. The western coast.
4. 8 percent
5. Uneven distribution of rainfall is responsible for the uneven distribution of surface and underground water.

21.3

1. 1829 cubic metre person (2001)
2. The water crisis arises when the per capita availability of water falls 1,00,000 metres annually.
3. Wells and tube-wells are the mains means of irrigation in India. 57 percent (1997-98) of land is irrigated by this.
4. Peninsular plateau.

21.4

1. Total amount of rain water recovered is an area is called 'rain water reserve'.
2. Construction pot holes, construction of trenches, use of wells, handpump (any two)
3. Flood control, control on soil erosion, water for irrigation and drinking, water for industries etc.

21.5

1. Continued neutrition of atmosphere, proper transpher and rehabilitation of men and animal, health, security of dams (any four)
2. a. domestic waste water, b. industrial effluents,

   c. Chamicals used in agriculture.

3. 20 billions.

4. 'National Water Development Authority' was constituted in 1982 to solve the problem of drought and flood.

5. 30

HINTS TO TERMINAL QUESTIONS

1. (i) Refer to section 21.1
   (ii) Refer to section 21.2
   (iii) Refer to section 21.2 (B)
   (iv) Refer to section 21.6
   (v) Refer to section 21.7
   (vi) Refer to section 21.10
   (vii) Refer to section 21.10 (c)
2. (a) Refer to section 21.2 A and B
   (b) Refer to section 21.7, 21.8 and 21.10
3. Refer to section 21.3
4. Refer to section 21.2 (B)
5. Refer to section 21.8
6. Refer to section 21.10 (A)
7. Refer to section 21.10 (B)
8. Refer to section 21.11
9. Refer to section 21.10
10. Refer to maps