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The Ultimate NCERT Revision Guide for Class 12 Geography

India: People and Economy (Part 2) – 12th Geography, 2026-27 / New NCERT

Chapter 4: Water Resources

NCERT Notes Class 12 Geography Chapter 4 – Water Resources

For CBSE Board, CUET and UPSC preparation • Unit III: Resources and Development

Also see for this chapter: NCERT Solutions

Contents

1 Water as a Resource: The Big Picture

Water is the one resource that keeps every other resource working. Crops, industry, drinking supply and even power generation all depend on it. Yet usable freshwater is scarce. About **71 per cent** of the earth's surface is covered with water, but freshwater is only about **3 per cent** of the total, and only a tiny part of that is within easy reach for people. This chapter looks at how much water India has, where it comes from, who uses it, and how we can save it.

1.1 Why Water Scarcity Is the Coming Challenge

Demand for water keeps rising as population and the economy grow. At the same time, supplies are shrinking because of over-use and pollution. This gap is what we call water scarcity. It is made worse by the fact that water is spread unevenly over space and time: some regions get heavy monsoon rain, others stay dry for most of the year.

- **Rising demand** – more people, more farms, more factories, more cities.
- **Shrinking supply** – over-extraction of groundwater and pollution of rivers and lakes.
- **Uneven spread** – rainfall is concentrated in the monsoon and varies sharply from place to place.

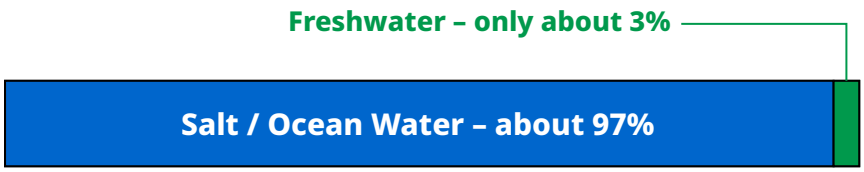
Because clean water is limited, disputes over sharing it are growing among communities, regions and states. Careful assessment, efficient use and conservation are therefore needed for steady development.

Water is a Cyclic Resource

Water moves in a continuous cycle: evaporation, condensation, rainfall and runoff. So it is **renewable**, but the amount available for use at any place and time is limited. "Cyclic" does not mean "unlimited". The MCQ answer for the type of resource water belongs to is **abiotic and renewable (cyclic)**.

1.2 Global Water Stock at a Glance

Almost all the water on earth is salty ocean water that cannot be drunk or used for farming without costly treatment. The slice that is actually freshwater is small, and most of it is locked in glaciers and deep aquifers. The chart below shows why the usable share is so thin.



Earth's surface is about 71% water, but usable freshwater for humans is a very small fraction.

Why a Coastal Country Can Still Be Thirsty

States with long coastlines, like Kerala and Tamil Nadu, are surrounded by sea water. But sea water is salty, and turning it into freshwater (desalinisation) is expensive. So nearness to the sea does not solve the drinking-water problem. This is why rainwater capture matters even on the coast.

2 Water Resources of India

India holds a large share of the world's people but a much smaller share of its water. The country has about **2.45 per cent** of the world's land area, **4 per cent** of the world's water resources, and more than **17 per cent** of the world's population. So the pressure on each unit of water is high. This section breaks down how much water India actually has and how much of it can be put to use.

2.1 The Water Balance: From Rainfall to Usable Supply

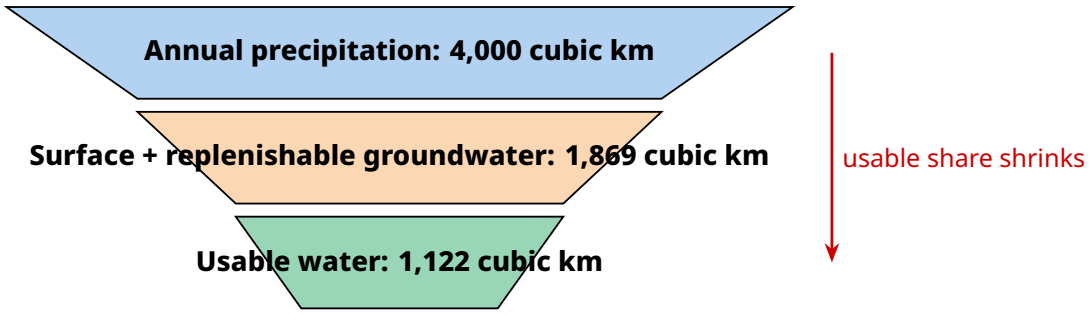
Every year, precipitation gives India about **4,000 cubic km** of water. Not all of it can be captured. After runoff to the sea, evaporation and seepage, the water available from surface flow and replenishable groundwater is about **1,869 cubic km**. Of this, only around 60 per cent can be put to good use, so the total usable water is about **1,122 cubic km**.

Total Usable Water Resource of India

$$\text{Usable water} \approx 60\% \times 1{,}869 \text{ cubic km} = 1{,}122 \text{ cubic km}$$

Out of 4,000 cubic km of annual precipitation, only about 1,122 cubic km is finally available for beneficial use.

The funnel below shows how the big rainfall figure shrinks step by step into the small usable figure.



Remember the Three Numbers

For MCQs and short answers, lock in the chain **4,000** $\rightarrow$ **1,869** $\rightarrow$ **1,122 cubic km**. Precipitation, then available, then usable. Examiners love asking which number is the "total usable" water.

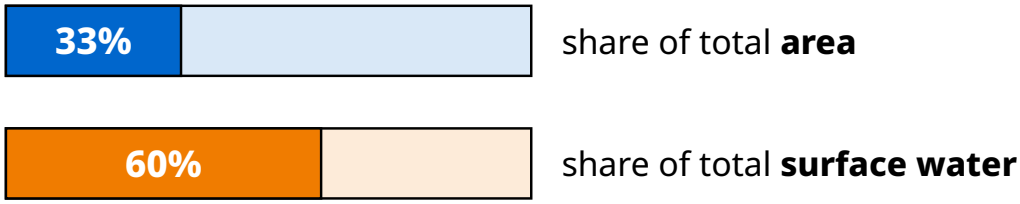
2.2 Surface Water Resources

Surface water is the water we can see flowing or standing on land. There are **four major sources**: rivers, lakes, ponds and tanks. India has about **10,360 rivers** and tributaries that are longer than 1.6 km each. The mean annual flow in all the river basins together is about 1,869 cubic km, but only about **690 cubic km (32 per cent)** of this can be used, because of the terrain, the timing of flow and other limits.

- Flow in a river depends on the size of its **catchment area (river basin)** and the rainfall in that catchment.
- The **Ganga, Brahmaputra and Barak** rivers have high rainfall in their catchments. Though they cover only about one-third of the country's area, they carry **60 per cent** of the total surface water.

- South Indian rivers like the **Godavari, Krishna and Kaveri** have already been heavily tapped, while the Brahmaputra and Ganga still have much unused flow.

Ganga-Brahmaputra-Barak basins



Why the East Carries More Water

A small area can hold a big share of water if its rainfall is high. The eastern Ganga-Brahmaputra-Barak belt proves this: about one-third of the area but 60 per cent of the surface water, because the monsoon is heaviest there.

2.3 Groundwater Resources

Groundwater is water stored below the surface in soil and rock. India's total replenishable groundwater is about **432 cubic km**. The way different states draw on this store varies a lot. Where farming depends on wells and tubewells, groundwater is pulled out fast.

- **High use**: Punjab, Haryana, Rajasthan and Tamil Nadu draw a large share of their groundwater.
- **Moderate use**: Gujarat, Uttar Pradesh, Bihar, Tripura and Maharashtra.
- **Low use**: Chhattisgarh, Odisha and Kerala still tap only a small part of their potential.

If the present trend continues, demand will catch up with supply, which can harm development and trigger social tension.

Surface Water vs Groundwater Numbers

Do not mix the figures. **Total available surface + groundwater = 1,869 cubic km**; **replenishable groundwater alone = 432 cubic km**; **usable surface water = 690 cubic km**. Writing 432 as the "total water of India" is a common slip.

2.4 Lagoons and Backwaters

India has a long and, in places, deeply indented coastline. Where the coast curves inward, lagoons and lakes form behind sand bars. **Kerala, Odisha and West Bengal** have large surface water in these lagoons and backwaters. The water is usually

brackish (slightly salty), so it is used mainly for **fishing** and for irrigating special varieties of paddy, coconut and similar crops.

Kerala's Backwaters

The famous backwaters of Kerala are working water bodies, not just tourist routes. Local people fish in them and grow salt-tolerant paddy along their edges. This shows how even brackish water becomes a resource when matched to the right crop.

3 Water Demand and Water Use

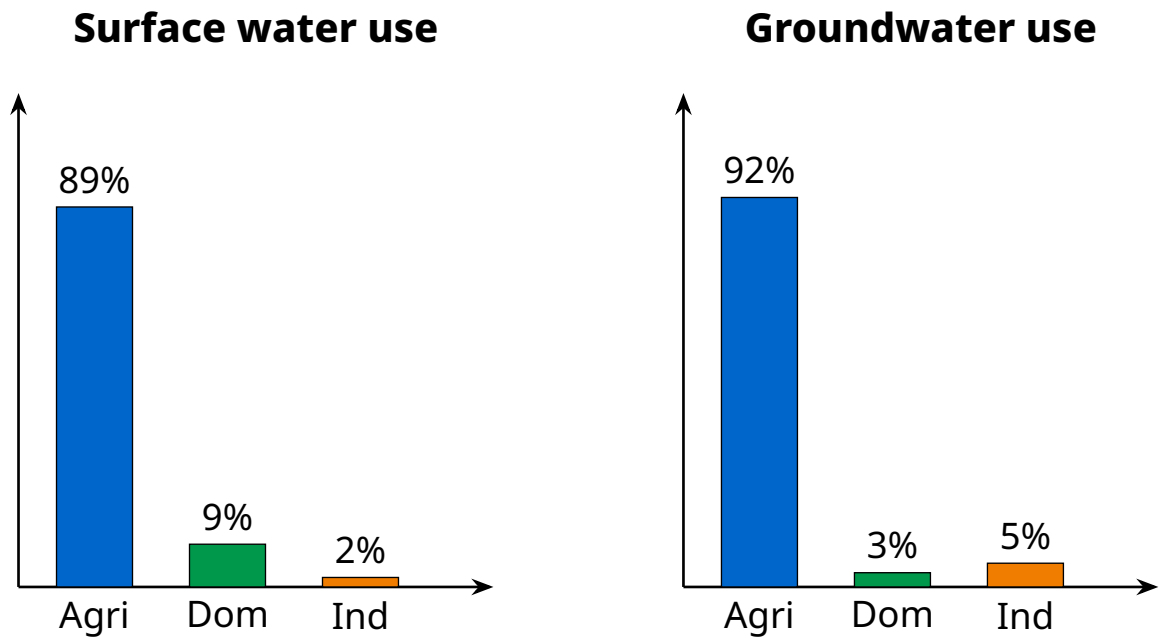
India has long been an agrarian country, with about two-thirds of its people depending on agriculture. So irrigation has been a top priority in development planning, and many multipurpose river valley projects were built to support it. The result is that India's water demand today is shaped above all by the needs of farming. This section looks at who uses water and why irrigation dominates.

3.1 Sector-wise Share of Water Use

Agriculture is by far the biggest user of water. It takes about **89 per cent** of surface water and **92 per cent** of groundwater. Industry and the domestic (household) sector use much less, though their shares are expected to grow as the country develops.

Sector	Share of surface water	Share of groundwater
Agriculture (irrigation)	89%	92%
Domestic (households)	9%	3%
Industry	2%	5%

The two bar pairs below make the dominance of farming clear at a glance.



Why Farming's Share May Fall in Future

As industry and cities grow, their water demand rises. The total pie of water is roughly fixed, so a bigger industrial and domestic slice means agriculture's *share* drops, even if the volume used in farming barely changes. That is why the question "why will the agricultural share decline?" is answered by the rising needs of the other two sectors.

3.2 Demand of Water for Irrigation

Irrigation is the planned supply of water to crops. India needs it because rainfall varies so much in space and time. Large parts of the country, such as the **north-west and the Deccan plateau**, are short of rain and prone to drought. Winter and summer are mostly dry. Even wet states like West Bengal and Bihar suffer dry spells when the monsoon breaks or fails. Some crops, like **rice, sugarcane and jute**, simply need a lot of water that only irrigation can supply.

- Irrigation makes **multiple cropping** possible (more than one harvest a year).
- Irrigated land gives **higher yields** than unirrigated land.
- **High-yielding varieties (HYVs)** need steady moisture, which only assured irrigation provides.
- The **Green Revolution** succeeded mainly in Punjab, Haryana and western Uttar Pradesh, where irrigation is well developed.

Green Revolution and the Well

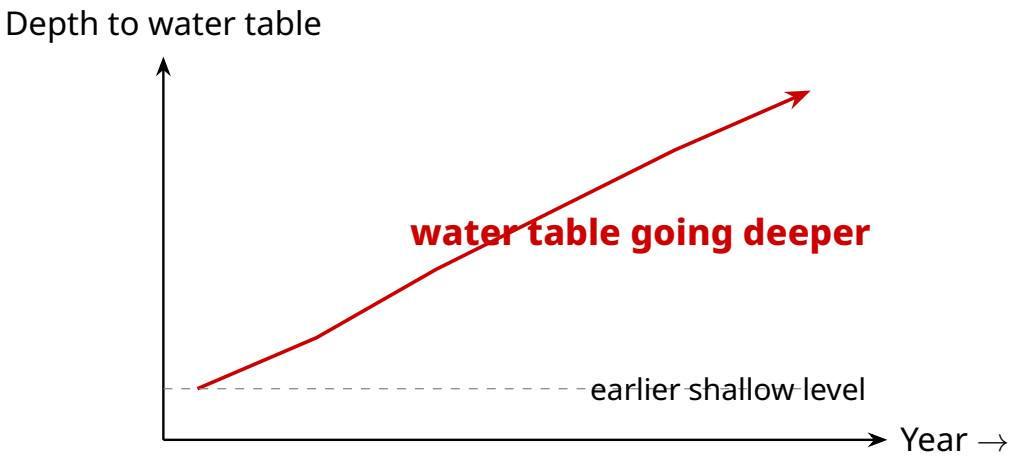
In Punjab and Haryana, more than 85 per cent of the net sown area is irrigated, and a large part of this comes from wells and tubewells (76.1 per cent

in Punjab, 51.3 per cent in Haryana). Cheap power and tubewells made wheat and rice profitable, but the same pumps are now draining the groundwater store.

3.3 Groundwater Depletion in the Irrigation Belt

Heavy reliance on wells has a cost. In Punjab, Haryana and western Uttar Pradesh, over-pumping has pushed the **groundwater table down**. Over-withdrawal also concentrates harmful substances in what water remains.

- **Falling water table**: pumps must go deeper each year, raising cost.
- **Fluoride**: rises in Rajasthan and Maharashtra with over-withdrawal.
- **Arsenic**: increases in parts of West Bengal and Bihar.
- **Salinity and waterlogging**: intensive canal irrigation can raise salts in the soil.



Cause-Effect Chain for the 5-Marker

Frame the answer as a chain: **cheap power + tubewells** → **over-pumping** → **falling water table** → **higher pumping cost + fluoride/arsenic**. A chain shows the examiner you understand the process, not just the facts.

4 Multipurpose Projects and Sources of Irrigation

Since farming drives India's water demand, the country has built large projects to store and spread river water. These are called **multipurpose river valley projects** because each one serves several goals at once: irrigation, power, flood control and drinking water. Alongside these big projects, farmers also draw water through wells, tanks and canals. This section covers the main projects, the sources of irrigation, and how India's irrigation has grown.

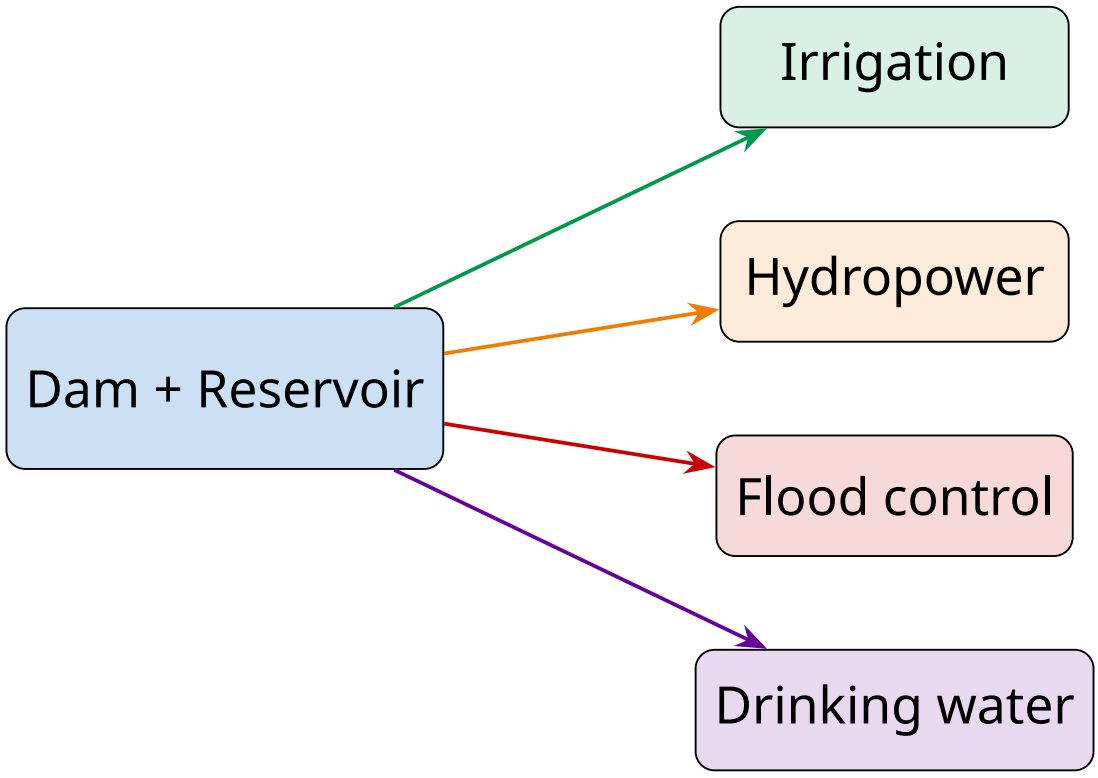
4.1 Multipurpose River Valley Projects

A multipurpose project dams a river to create a reservoir, then uses the stored water for many purposes together. They were given a high priority in the Five Year Plans to raise farm output. Knowing the project, its river and its state is enough for most questions.

Project	River	Region / State
Bhakra-Nangal	Satluj	Punjab / Himachal Pradesh
Hirakud	Mahanadi	Odisha
Damodar Valley (DVC)	Damodar	Jharkhand / West Bengal
Nagarjuna Sagar	Krishna	Telangana / Andhra Pradesh
Indira Gandhi Canal	Satluj-Beas	Rajasthan

- **Irrigation**: stored water feeds canals that water dry farmland.
- **Hydropower**: falling water turns turbines to make electricity.
- **Flood control**: the reservoir holds back peak monsoon flow.
- **Drinking water and recreation**: supply to towns, plus fisheries and tourism.

The diagram below shows how one dam delivers many benefits from a single store of water.



One Store, Many Uses

The strength of a multipurpose project is that a single reservoir does several jobs at once. The same Bhakra-Nangal dam waters Punjab's fields, lights its towns and tames the Satluj's floods. This is why these projects were called the "temples of modern India".

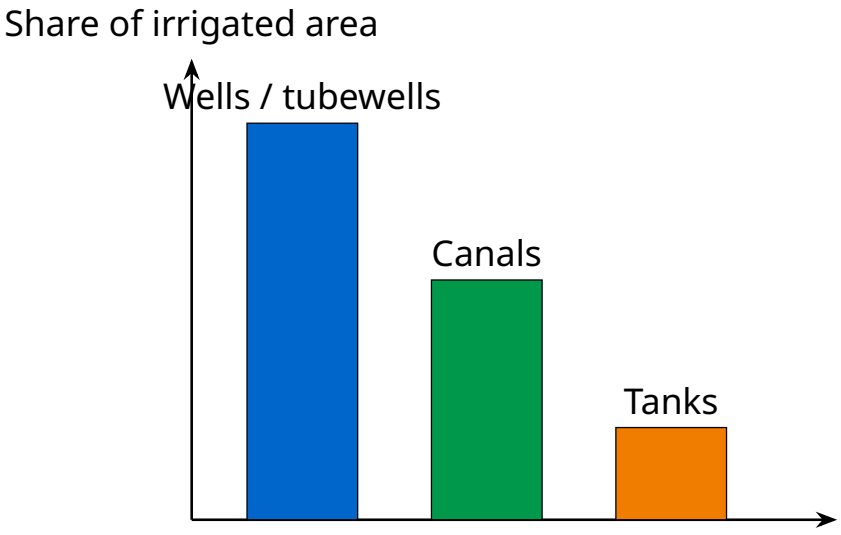
Project-River Pairs

Lock the pairs with first letters: **B**hakra-**S**atluj, **H**irakud-**M**ahanadi, **D**VC-**D**amodar, **N**agarjuna-**K**rishna. "DVC on Damodar" even shares the same letter, so it is the easiest to recall.

4.2 Sources of Irrigation

Farmers reach water through three main sources: wells and tubewells, canals, and tanks. The share of each varies across the country with the terrain and the depth of the water table.

- **Wells and tubewells**: the largest source today; common in the alluvial plains of Punjab, Haryana and Uttar Pradesh where groundwater is reachable.
- **Canals**: important in the northern plains where rivers carry water all year and the land is flat enough for gravity flow.
- **Tanks**: small reservoirs, common in the hard-rock plateau of peninsular India, especially Tamil Nadu and Andhra Pradesh.



Why Tanks Suit the South

The peninsular plateau is made of hard rock, so groundwater is hard to reach and rivers are seasonal. Rainwater is therefore stored in surface tanks during the monsoon and used later. Geography decides the source: plains favour

wells and canals, plateaus favour tanks.

4.3 Benefits and Costs of Large Projects

Big dams brought clear gains, but they also created problems. A balanced answer mentions both sides.

Benefits	Costs / concerns
Assured irrigation, higher yields	Displacement of people from submerged villages
Cheap hydroelectric power	Loss of forest and farmland under the reservoir
Flood control downstream	Waterlogging and salinity in over-irrigated canal areas
Drinking water and fisheries	Heavy cost and silting that cuts reservoir life

Always Give Both Sides

For a project-evaluation question, never list only the benefits. A top answer pairs each gain with a cost: power but displacement, irrigation but salinity. Balance earns the higher band.

5 Emerging Water Problems and Quality

Two pressures are squeezing India's water at the same time. First, the amount of water per person is falling as the population grows. Second, the water that remains is getting dirtier from industrial, farm and household waste. Together these shrink the supply of *usable* water even further. This section explains the per-capita problem and how water quality is judged and protected.

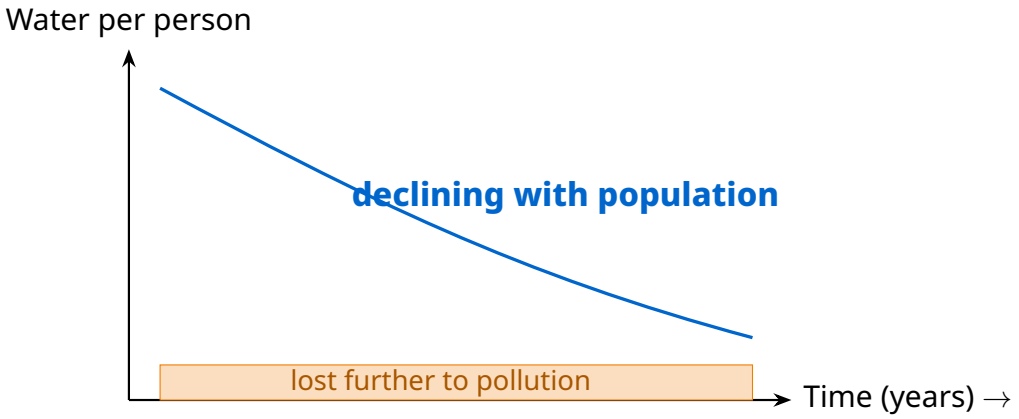
5.1 Falling Per-Capita Availability

The total water in the country does not grow, but the number of people sharing it does. So the water available per person keeps dwindling year after year. Pollution then removes part of even this shrinking share, because dirty water cannot be used for drinking or farming without treatment.

Per-Capita Water Availability

$$\text{Per-capita water} = \frac{\text{Total usable water}}{\text{Population}}$$

With usable water roughly fixed and population rising, the value of this ratio falls every year.



5.2 Deterioration of Water Quality

Water quality means how pure the water is, or how free it is from unwanted foreign substances. Water gets polluted when micro-organisms, chemicals, industrial waste and other matter enter it. These either dissolve or stay suspended, making the water unfit for human use and harming aquatic life. Pollutants can also seep down and contaminate groundwater.

- **Sources of pollution**: agricultural drains (fertilisers and insecticides), domestic waste (solid and liquid), industrial effluents.
- **Worst season**: pollution peaks in **summer**, when river flow is low and pollutants are less diluted.
- **Cleaner stretches**: upper hilly reaches of rivers stay cleaner because population there is thin.
- **Most polluted river**: the **Yamuna** between Delhi and Etawah is the most polluted stretch in the country.

Why Summer Pollution Is Worse

The concentration of a pollutant depends on how much water dilutes it. In summer, river flow drops, so the same load of waste sits in less water. Concentration rises and the river becomes more harmful, even if the waste added has not increased.

Polluted Rivers on the Map

Beyond the Yamuna, badly polluted rivers include the Sabarmati at Ahmedabad, the Gomti at Lucknow, the Vaigai at Madurai, the Musi at Hyderabad, and the Ganga at Kanpur and Varanasi. Groundwater in many places carries excess fluoride, nitrates and heavy metals. Knowing one or two named examples strengthens a quality-deterioration answer.

5.3 Effects of Contaminated Water and the Law

Drinking or using unclean water harms health. It spreads water-borne diseases and lets toxic metals build up in the body. The Central Pollution Control Board (CPCB), with the State Boards, monitors water quality at 507 stations and reports that **organic and bacterial contamination** is still the main problem in rivers.

- **Health impacts**: diseases like cholera, typhoid and diarrhoea; long-term harm from fluoride (skeletal damage) and arsenic.
- **Key laws**: the **Water (Prevention and Control of Pollution) Act, 1974**; the **Environment Protection Act, 1986**; the **Water Cess Act, 1977**.
- **Weak point**: these laws have not been enforced effectively, so their impact has been limited.

Don't Confuse the Acts

The **1974 Act** controls water pollution directly. The **1986 Act** is the broad environment protection law. The **1977 Cess Act** charges a fee on water use to fund pollution control. Mixing up their years and purposes is a frequent error.

Remember the Pollution Laws

Use **"74-77-86"** in order: **74** Water Act → **77** Water Cess → **86** Environment Protection. The numbers climb just like the scope of the laws widens.

6 Water Conservation and Management

Because freshwater is getting scarcer while demand rises, India must conserve and manage water carefully. Desalinisation of sea water is too costly to count on, so the country has to make good policies and adopt practical measures instead. The main tools are preventing pollution, recycling and reuse, watershed management and rainwater harvesting. This section covers each, plus the major government schemes.

6.1 Preventing Pollution, Recycle and Reuse

The first step is to stop water from getting dirty in the first place, and the second is to use the same water more than once. Public awareness is central: people who understand the value of water cut waste and reduce the pollutants they release.

- **Prevention**: control farm, household and industrial discharge into rivers; build public awareness.
- **Recycle and reuse**: reclaimed wastewater can cool machines and fight fires in industry.
- **Household reuse**: water from bathing and washing utensils or vehicles can

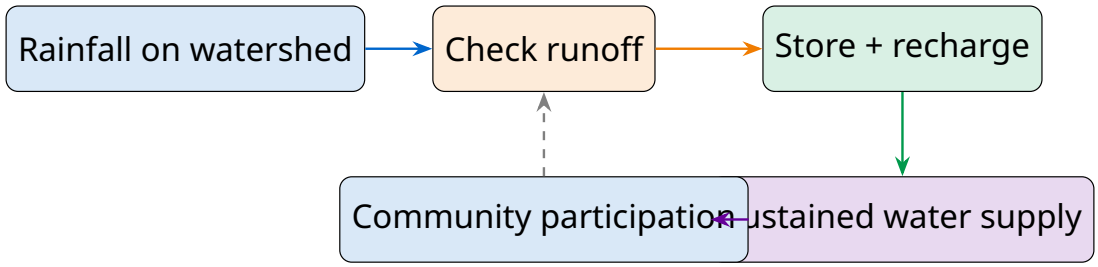
water gardens, saving clean water for drinking.

Match Water Quality to the Job

Not every task needs drinking-quality water. Gardening, cooling and fire-fighting can run on lower-grade reclaimed water. Reserving high-quality water for drinking and saving the rest for other jobs is the core idea of recycle and reuse.

6.2 Watershed Management

A watershed is the area that drains into a common point, such as a river or a tank. Watershed management means the careful care and conservation of surface water and groundwater in that area. It prevents runoff, stores rainwater and recharges groundwater through structures like **percolation tanks and recharge wells**. In its wider sense it balances the use of all natural resources (land, water, plants, animals) and people within the watershed.



- **Haryali**: a central watershed project run by Gram Panchayats for drinking water, irrigation, fisheries and afforestation.
- **Neeru-Meeru** ("Water and You") in Andhra Pradesh and **Arvary Pani Sansad** in Alwar, Rajasthan, build percolation tanks, johads (dug-out ponds) and check dams through people's effort.
- **Tamil Nadu** has made rooftop water harvesting compulsory: no new building can come up without it.

Ralegan Siddhi: A Success Story

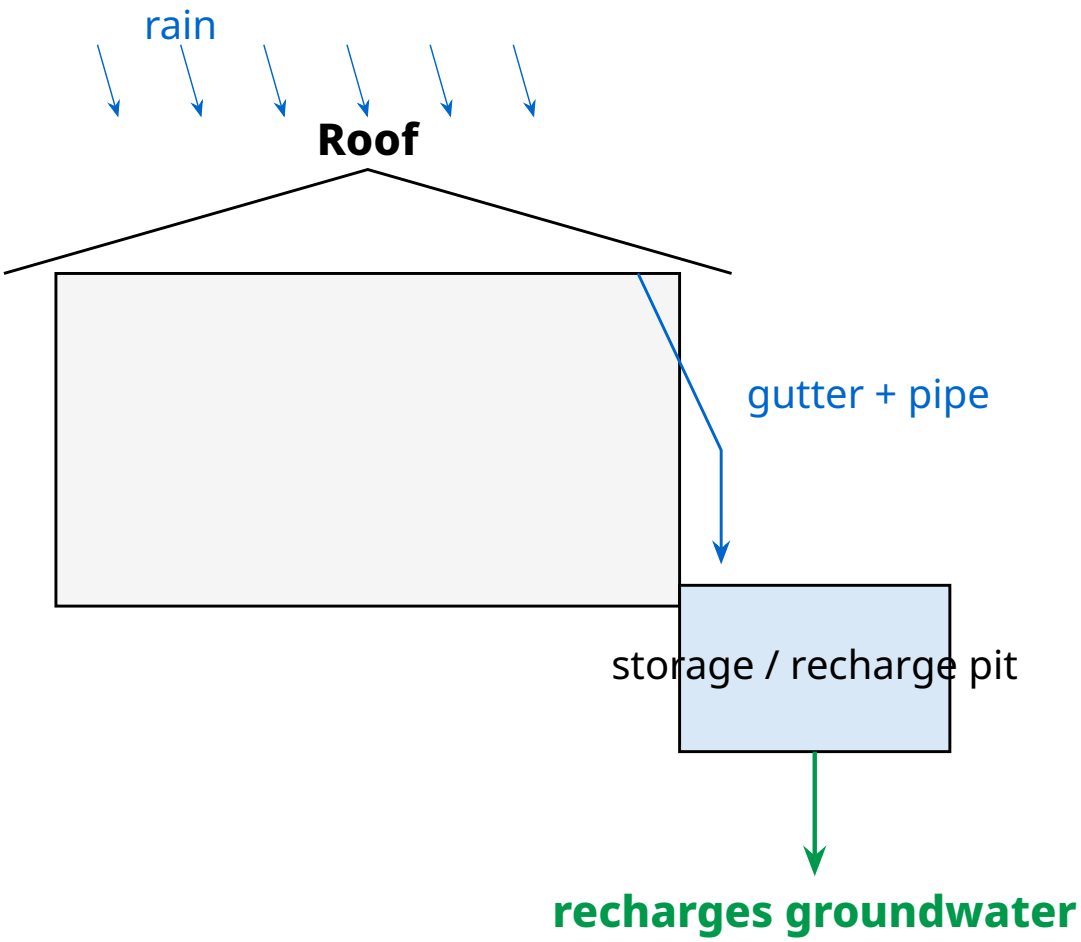
Ralegan Siddhi, a village in Ahmadnagar, Maharashtra, turned from poverty and illicit liquor in 1975 into a model of watershed development. Through voluntary labour, percolation tanks, a ban on water-hungry sugarcane, and crops with low water need, the wells filled even in summer. The key lesson: **watershed success depends on community participation**, not just engineering.

6.3 Rainwater Harvesting

Rainwater harvesting is a method to capture and store rainwater for use, and also to recharge groundwater aquifers. It is a low-cost, eco-friendly way to save every

drop by guiding rain into borewells, pits and wells. It raises water availability, slows the fall of the water table, improves groundwater quality by diluting contaminants like fluoride and nitrate, checks soil erosion and flooding, and blocks salt-water intrusion on the coast.

- **Rooftop harvesting**: rain from roofs and open spaces is led into storage or recharge pits.
- **Traditional rural methods**: lakes, ponds and irrigation tanks store surface rain.
- **Rajasthan's Kund / Tanka**: a covered underground tank built near a house or village to store rain.
- **Urban benefit**: cities, where demand has outrun supply, gain the most from harvesting.



Four Wins of Rainwater Harvesting

"RAISE" the water: **R**echarge aquifers, **A**rrest salt-water intrusion, **I**mprove groundwater quality, **S**top soil erosion and flooding, **E**xtra availability all year. One word, five benefits.

6.4 Government Schemes and National Water Policy

The Centre and states run several programmes to secure water. Knowing one line on each is enough for an exam.

Scheme / Policy	Key aim
PM Krishi Sinchayee Yojana (2015-16)	"Har khet ko pani" and "Per drop more crop": protective irrigation and water-use efficiency on every farm.
Atal Bhujal Yojana (Atal Jal)	Improve groundwater in 8,220 water-stressed Gram Panchayats across seven states; shift the mindset from use to conservation.
Jal Kranti Abhiyan (2015-16)	One "Jal Gram" in each of 672 districts; pollution control and mass awareness for water security.
National Water Policy, 2012	A unified national water law; treat water as an economic good after meeting drinking, sanitation and food-security needs.

Slogan = Marks

Tie each scheme to its slogan or number: **PMKSY = "Per drop more crop"**, **Atal Jal = 8,220 Gram Panchayats**, **Jal Kranti = 672 districts, one Jal Gram each**. Slogans and figures make answers precise.

Other Long-Run Remedies

Beyond local action, India can move water from surplus basins to deficit ones by **inter-linking of rivers**, and treat brackish or sea water by **desalinisation** where it is affordable. But the single most important issue for households and communities is the **pricing of water**, which decides how carefully people use it.

7 Quick Reference Summary

This final section pulls together the key numbers, terms and exam pointers for fast revision the night before the paper. Use it to self-test: cover the right column and recall it from the left.

7.1 Key Figures to Memorise

Quantity	Value
Earth's surface covered by water	about 71%
Freshwater share of total water	about 3%
India's share of world land / water / people	2.45% / 4% / 17%+
Annual precipitation in India	about 4,000 cubic km
Available surface + replenishable groundwater	1,869 cubic km
Total usable water	1,122 cubic km
Usable surface water	690 cubic km (32%)
Replenishable groundwater	432 cubic km
Rivers / tributaries longer than 1.6 km	about 10,360
Agriculture's share (surface / ground)	89% / 92%

7.2 Key Terms in One Line Each

- **Catchment area / river basin**: the land from which a river collects its water.
- **Replenishable groundwater**: groundwater that is naturally refilled by rain and seepage.
- **Brackish water**: slightly salty water, common in lagoons and backwaters.
- **Watershed**: the area draining to a common outlet; the unit of watershed management.
- **Rainwater harvesting**: capturing and storing rain for use and for recharging aquifers.
- **Desalinisation**: removing salt from sea or brackish water to make it usable.

Three Exam-Favourite Questions

Be ready for: (1) the **availability and spatial spread** of water in India, (2) why **Punjab, Haryana and Tamil Nadu** have high groundwater development and the depletion that follows, and (3) **watershed management** and its role in sustainable development.

Two Final Traps

First, water is **abiotic and cyclic (renewable)**, not a biotic or non-renewable resource. Second, the highest water use is in **irrigation**, not industry or domestic use. These two MCQs are nearly always set.

7.3 Exam Focus: Question Patterns

This chapter is a steady scorer in the CBSE board paper and appears in CUET (Geography) and UPSC prelims as well. The questions cluster around a few predictable themes, so practise these shapes.

Marks	Type	Likely question
1 mark	MCQ	Type of resource water is; sector with highest use; south Indian state with highest groundwater development.
3 marks	Short answer	Factors depleting water; why Punjab-Haryana-Tamil Nadu have high groundwater development; why agriculture's share may fall.
5 marks	Long answer	Availability and spatial spread of water in India; watershed management and sustainable development; depletion leading to social conflict.

- **Always quote a figure**: 1,122 cubic km usable, 89/92 per cent farm use, 432 cubic km groundwater. Numbers lift a plain answer.
- **Always name an example**: Yamuna for pollution, Ralegan Siddhi for watershed success, Tamil Nadu for compulsory rooftop harvesting.
- **Link to sustainability**: connect conservation methods to long-term development, which is the line UPSC and CUET reward.

The Spatial Distribution Answer

For "availability and spatial spread of water in India", cover three points: total figures (4,000 / 1,869 / 1,122 cubic km), uneven spread (Ganga-Brahmaputra-Barak hold 60 per cent of surface water in one-third of the area), and the causes (monsoon concentration, varied rainfall, terrain). Structure beats length.

7.4 Continue Your Revision

These notes pair with the other Collegedunia resources for this chapter and the chapters around it. Use the solutions to practise the exact exercise questions, and the neighbouring chapters to see how land, water and minerals fit together as resources.

Download the Full NCERT Solutions PDF

Related Collegedunia Resources

Same chapter, other resources:

- NCERT Solutions
- NCERT Book PDF
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Continue learning:

- Ch 3: Land Resources and Agriculture
- Ch 5: Mineral and Energy Resources
- Class 12 Geography - All Chapters