



# MODULE 1

## WATER IN THE ENVIRONMENT

### The topics covered in this module are:

- Water and its importance
- Climate and water
- Sources of water
- Hydrological cycle

## OBJECTIVE (S) OF THE MODULE

The trainer informs the following module objectives to participants:

- Learning the critical importance and basic components of water
- To understand and realize the linkages between climate and water, impacts of climate change on water resources
- Explaining the hydrological cycle in detail

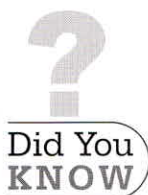
## WATER AND ITS IMPORTANCE

Water is the most precious of naturally occurring resources on planet Earth and one of the five eternal elements (viz. Earth, Water, Fire, Air and Ether). It is an essential part of the world's ecosystem and without it life would be impossible.

Historically many of the great early civilizations flourished around rivers and major waterways:

Mesopotamia the so-called cradle of civilization was situated between the major rivers Tigris and Euphrates; the ancient society of the Egyptians depended entirely upon the Nile; the Indus Valley Civilization in India flourished along the once famous Saraswati river.

Water has been central to human development, abating out thirst and watering our crops. Not only is water vital to the planet, it is also important to all living creatures and humans in particular. As a result water in many cultures has a divine and religious importance.



*Water comprises 70% of the human body weight and is vital to all life forms.*

Large metropolises owing their success in part to their easy accessibility to water

- Chicago
- New York
- Hong Kong
- Tokyo
- Berlin
- Buenos Aires
- Shanghai
- London
- Mumbai

### NEED & IMPORTANCE



Plants and Animals also Require Water for Survival

Type of water	Total water (%)	Available groundwater (%)
1. Ice	80	-
2. Water (Flowing)	20	-
(a) Ponds	0.2	1
(b) Soil	0.04	0.2
(c) Rivers	0.02	0.1
(d) Environment	0.02	0.1
(e) Groundwater	19.7	98.4

We can survive without food for a long time but can't survive without water. It is necessary not only for daily life but also for developmental activities of mankind. An individual man consumes about 61 thousand liters of water for drinking purposes in his whole life.

There is no imagination about life without water, so we can ensure our future for utilizing water with proper management.

The following quotation proves very true for water-  
*'Rahiman pani rakhiye bin pani sab soon; Pani gaye na ubre moti manas choon'*



Did You  
KNOW

*We can survive without food for a month but not more than 5 to 7 days without water.*

All plants and animals must have water to survive. If there was no water there would be no life on earth. Agriculture is the largest user of water.

Aside from drinking it to survive, people have many other uses for water. These include the following:

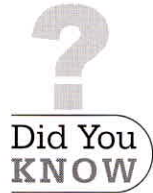
- Washing one's body and clothes
- Washing, cooking and eating utensils;
- Keeping houses and communities clean
- Recreation; such as swimming pools
- Keeping plants alive in gardens and parks

Water is also essential for the healthy growth of farm crops and farm stock and is used in the manufacture of many products. It is most important that the water which people drink and use for other purposes is clean water. This means that the water must be free of germs and chemicals and be clear. Water that is safe for drinking is called potable water.

Disease-causing germs and chemicals can find their way into water supplies. When this happens the water becomes polluted or contaminated and when people drink it or come in contact with it in other ways they can become very sick.



Water that is not safe to drink is said to be non-potable. Throughout history there have been many occasions when hundreds of thousands of people have died or become sick because disease-causing germs have been spread through a community by a polluted water supply. As such, people in many countries make sure that drinking water supplies are potable. Water supplies are routinely checked for germs and chemicals which can pollute water. If the water is not safe to drink it is processed. All the action taken to make sure that drinking water is potable is called water treatment.



*The ozone layer is called life protecting umbrella because it acts as an umbrella. It protects us from the fatal UV radiations.*

## CLIMATE AND WATER

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Water in the environment is found in three following forms.

In its LIQUID FORM, rains meet the basic water demands by humans, animals, and plants. Its runoff into streams sustains eco-systems and, along with percolation into aquifers, ensures long term storage underground and supply for human use.

The oceans are the world's primary source of WATER VAPOUR that feeds precipitation. Atmospheric water vapour is a greenhouse gas which, together with carbon dioxide, is responsible for Earth's surface temperature being well above freezing point.

In WATER'S FROZEN FORM, sea ice and snow cover tend to cool the planet by reflecting the sun's incoming solar radiation. Glaciers, especially those at mid-latitudes, provide water storage and summer supply for both agriculture and different areas around the globe.

Thus, water appears in nature in all three common states of matter and may take many different forms on earth; namely-

### GASEOUS

- Water vapour and clouds

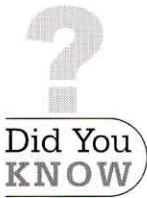
### LIQUID

- Rivers, lakes and aquifers in the ground

### SOLID (THE ICE)

- The polar oceans, icebergs and ice caps

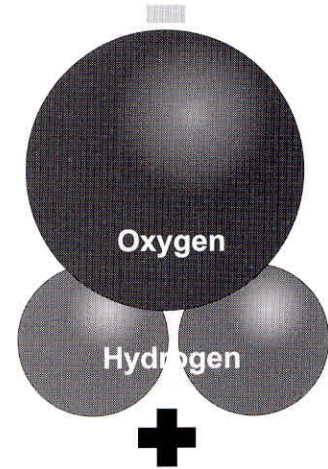
Water covers more than two thirds or 71% of the world's surface, rendering the planet its famous green and blue appearance. Water bodies such as the rivers, lakes and especially the oceans provided the platform for life to begin millions of years ago, and the oceans and seas have become most bio-diverse ecosystems in the world over the years.



*A single molecule is made of two other particles, two atoms of Hydrogen (H) and an atom of Oxygen (O). The equation is  $2H_2 + O_2 = 2H_2O$ .*

## What makes water important in the climatic system

Clean water is an essential resource for HUMAN LIFE AND HEALTH, ECONOMIC GROWTH and ECOSYSTEM VITALITY. The needs of water supplies adequate for human use including drinking water, industrial application, irrigated agriculture, hydropower, waste disposal, and the protection of human and ecosystem health are critical. Water systems are stressed by population growth, pollution, and exploitation. These stresses are intensified by climate variations and changes that alter the hydrologic cycle.

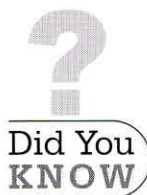


### Activity

The trainer asks participants about the role of water in world transport. Will trade be easy without waterways?

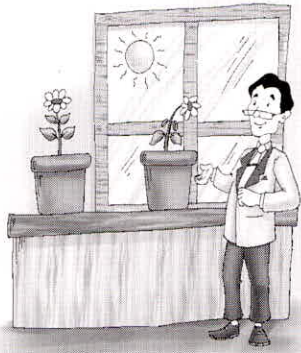
## What do we already know about the role of water in the climate system

Water acts together with other external forces that affect the climate system, such as increase in atmospheric carbon dioxide ( $CO_2$ ) or changes in solar radiation, for example, models and observations show that water vapour increases as the climate warms, which in turn tends to further warm the atmosphere. It is also known that liquid water, in the shape of clouds, reflects sunlight but also holds heat near the Earth's surface like a greenhouse gas. Quantifying this interaction between water vapour, clouds, and heat exchange near the Earth's surface is the key to understanding climate sensitivity and the factors governing climate change.



*A warming atmosphere is known to increase surface evaporation; which, barring an increase in precipitation, reduces soil moisture, groundwater storage, and stream flow.*

## Activity



Trainer waters two flower pots. He puts one pot in direct sunlight and another in the training room. Which pot would dry faster? Why? Ask the participants.

## What we don't know about the role of water in the climate system

The intensity of the effect of water on climate is not accurately known, because the current water vapour-cloud-climate feedbacks are incompletely understood. Uncertainties related to such feedbacks are

a key source of the differences among various climate models that project human-induced climate change. Limited observations of the hydrologic state of the Earth System further restrict understanding. For example, soil moisture and groundwater are not well monitored globally, confounding attempts to understand interactions between land surface changes and the water cycle, and hindering efforts to explain the local hydrologic response to precipitation and temperature variations. We do not understand well how warming in the arctic and ensuing melting of permafrost will affect the release of methane and nitrous oxide, greenhouse gases that also contribute to planetary warming.

Painting  
Borrows  
from Nature  
- The  
yellow of  
the sun  
combines  
with the  
blue of  
water to  
create the  
green of  
our living  
world.

Source: Water and  
Climate Change:  
What's the  
Connection by OUR  
WATER COMMONS

## How the relationship between water and climate is a significant one

- The living world influences the climate mainly by regulating the Water Cycle and the huge energy flows associated to it.
- If Vegetation is removed, Natural Biosphere regulation is broken.
- Urbanization, Deforestation and Wetland Destruction destroy water retentive landscapes and lead to the Loss of Precipitation loud vapours blow away, creating deserts.
- The natural Sequestration of Carbon in the soil is undermined.
- Dry lifeless soil traps Solar Heat, increasing temperature and Reducing Precipitation over the affected areas.

## Climate change and the water cycle

Changes in the hydrological cycle have the potential to impact water resources, and hence people's lives. Over the next century, climate and hydrological models predict that, in many parts of the globe, changes in weather patterns will lead to more floods and droughts.

The changes that occur may be as follows-

- Higher temperature means there is more evaporation from the ground
- Warmer air can hold more water vapour [Hint: The fog disappears as sun rises!]

- Intense rainstorms increase the risk of flooding. Much of the water runs off into rivers and streams, doing little to dampen soil
- The above, combined with increased temperatures, increases the risk of drought.

## Activity

Discussion to be led by the Trainer

### Effects that changing climate bears

Discuss how with the increase in the Earth's temperature there will be dramatic impacts on the water available in the world; and India in particular. With a rise in temperatures, the glaciers and snow which are vital sources of the Gangetic plain rivers will retreat and become scarce. As a result, less melted water will feed into the rivers reducing the water level and eventually leading to them becoming merely seasonal rivers, flowing during the monsoon months and dry during the other months.

Explain that the monsoon weather patterns will become increasingly erratic, with up to 40% less rainy days and an unequal spread of the rains over the country, with some areas experiencing drought and other areas experiencing severe flooding. This will result in a significant and devastating reduction in surface water resources in the country. An increase in sea levels will also result in the salination of many coastal surface and groundwater resources. This means that freshwater suitable for human use will be mixed with saltwater, that will render it unusable domestically.

## SOURCES OF WATER

### Activity

What is a water source? Why does municipal supply of water fall in summer? Discuss.



Flowing Water Body

Life is possible on earth due to the presence of water. Nearly three-fourth of the earth's surface is covered with water. Water is also found under the earth's surface. It is present in the air in the form of water vapour. About 70 percent of the human body is water. The bodies of all plants and animals contain water.

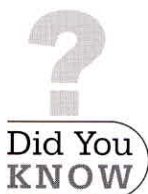
The earth's largest water source is the oceans. This is salt water, which is beneficial to humans for many things, such as traveling and maintaining natural cycles, but it is not useful for drinking. Consuming saltwater can actually be very harmful to humans. There are five oceans: the ATLANTIC, PACIFIC, INDIAN, SOUTHERN, AND ARCTIC. Together they contain approximately 97% of earth's water.

The majority of freshwater is frozen, mainly in the form of glaciers and ice caps. A glacier is a large body of slowly moving frozen water that, if it were instantly melted, would be converted into a river. An ice cap is a miniature sheet of ice found at high elevation, such as in the mountains. Other frozen water sources include permanently frozen ground, or permafrost; icebergs; and ground ice.

The second largest freshwater source is groundwater, which is water that lies below the surface of the earth. It exists almost everywhere in the world, although, in some situations, a person would have to dig quite deep to access it. It may not be healthy for human consumption if it is not processed.

The groundwater represents about 30% of the fresh water. Most of the water that people use, however, comes from rivers and lakes, which falls under a category known as surface water. Surface water represents the smallest amount of water on Earth (about 0.3% of fresh water).

Majorly, the sources of water are classified as rain, surface water and groundwater.



*Only 0.4% of total of water in the world is available for humans.*

### Activity

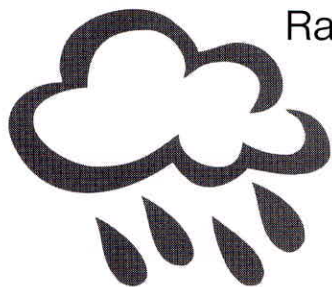
Fill a glass with water. Put an ice cube in it and wait for five minutes. Why does the water level rise? Can you explain the rise in sea level? How does this happen?

### Activity

How many of you have a tube well installed at your house? Does it go dry in summer? Why? Ask the participants.

#### Answer Hint

The level of groundwater is fluctuated, as per precipitation water enters into the ground. When rain falls, for example, it percolates or seeps down into the ground. It is often collected in aquifers, which are natural water storage compartments formed between the rocks below the earth's surface. Groundwater is an important water source for human consumption.



### Rain

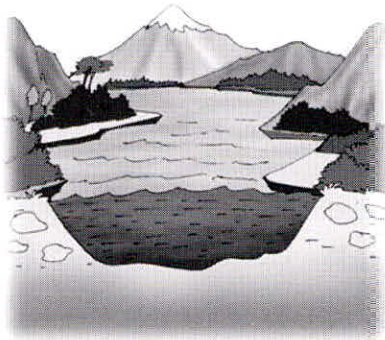
Rain is the prime source of all water. A part of the rain water sinks into the ground to form groundwater; part of it evaporates back into atmosphere, and some runs off to form streams and rivers which flow ultimately into the sea. Some of the water in the soil is taken up by the plants and is evaporated in turn by the leaves. These events are spoken of as 'water cycle'.





### Characteristics of Rain Water

- Rain water is the **PUREST WATER** in nature
- **PHYSICALLY**, it is clear, bright and sparkling
- **CHEMICALLY**, it is very soft water containing only traces of dissolved solids (0.0005 percent)
- **BACTERIOLOGICALLY**, rain water is **FREE FROM PATHOGENIC AGENTS**



Surface Water

### Surface Water

Surface water originates from rain water. It is the main source of water supply in many areas. It is prone to contamination from human and animal sources. As such, it is never safe for human consumption unless subjected to sanitary protection and purification before use.

The sources of surface water we are going to discuss in the module are river, reservoir, stream, pond and lake.



### Characteristics of Surface Water

- Surface water picks up the characteristics of the surface over which it passes.
- If water flows across a parking lot, gasoline, oil, and other contaminants may be carried by or dissolved into the water.
- Water may pick up fertilizers, road salts, radioactivity, and biological contaminant from farms, as well as countless other biological, physical, and chemical pollutants.

### River

Rivers are flowing bodies (lotic) of water. There are rivers on every continent (except Antarctica). Rivers are a significant component of the Earth's water cycle and the sculpting of the Earth's topography as they carry huge quantities of water from the land to the sea.

The water in rivers comes from many different sources. Rivers can begin as lakes or as springs that bubble up from underground or can also start as rain or melting snow and ice high up in the mountains.



Did You  
KNOW

*All of the earth's rivers contain only about 0.0001% of the earth's water. That doesn't sound like very much, but rivers can do some amazing things.*

Rivers start as very small streams and gradually get bigger as more and more water is added. Heavy rains and spring meltwater add so much water to some rivers that they overflow their banks and flood the surrounding landscape.

Rivers grow bigger when tributaries (smaller streams) join the main river.



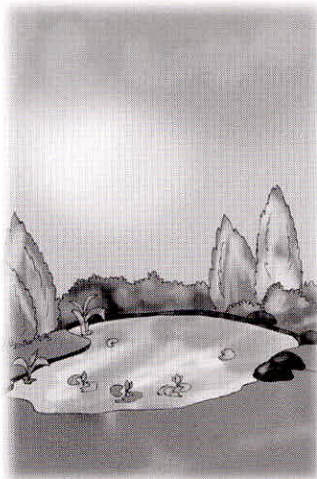
Reservoir

## Reservoir

These are artificial lakes constructed usually of earthwork in which large quantities of surface water are stored. Dams built across rivers and mountain streams also provide large reserves of surface water.

The area draining into the reservoir is called 'catchment area'. Most of the big cities derive their water supply from impounding reservoirs; one disadvantage of storing water for a long period in reservoirs is the growth of algae and other microscopic organisms. But the reservoirs usually furnish a fairly good quality of water.

The water is usually clear, palatable and ranks next to rain water in purity. It is also generally soft and considered to be free of pathogenic organisms.



Pond

## Pond

A pond is a small area of still, fresh water. It is different from a river or a stream because it does not have moving water and it differs from a lake because it has a smaller area. Some ponds are formed naturally, filled either by an underwater spring, or by rainwater and other ponds are man-made. The existence has been well known since ancient times. Most of them have been used as water storage systems and sources for different purposes. A wide variety of man-made bodies of water are classified as ponds. Some ponds are created specifically for habitat restoration, including water treatment. Others, like water gardens, water features and Koi ponds are designed for aesthetic ornamentation as landscape or architectural features. Fish ponds are designed for commercial fish breeding, and solar ponds designed to store thermal energy. Many ponds in our country need immediate necessary attention for restoration works.

## Lake

A lake refers to a body of relatively still (lentic) fresh or salt water of considerable size, localized in a basin, which is surrounded by land apart from a river, stream or other kind of moving water that serves to feed or drain the lake. It is usually inland and not part of



Lake

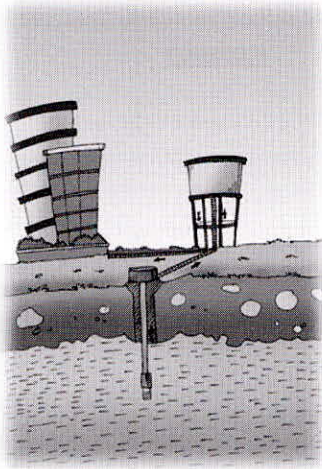
the ocean and therefore distinct from lagoons and is larger and/or deeper than ponds.



Did You  
KNOW

*India's largest freshwater lake is Kolleru Lake (Andhra Pradesh) and highest lake is Devtal Lake, Garhwal (Uttarakhand).*

## Groundwater



Groundwater  
Extraction

Groundwater is the water located in the saturated zone beneath the Earth's surface. Although it is an integral component of the global water cycle, many people imagine groundwater refers only to lakes or rivers in underground caverns. Groundwater is actually surface water that has migrated from the surface through the soil and get stored in porous soils and rocks.

Typically, the water sits in tiny pores or spaces between the smallest soil or rock particles, or narrow cracks in the rock itself. Only in exceptional cases does water get stored in openings that are many meters across.

Groundwater comes from two primary sources. When it rains, water infiltrates into the soil until it reaches the water table in an aquifer. Aquifers can also acquire water from rivers and streams draining into the soil.



Read  
and  
Repeat

### Characteristics of Groundwater

- ◆ It is likely to be free from pathogenic agents;
- ◆ It usually requires no treatment or little treatment;
- ◆ The supply is likely to be certain even during dry season;
- ◆ It is less subject to contamination than surface water.

## Importance of Groundwater

Groundwater is a vital source of water throughout the Earth. It is estimated to comprise 98 percent of the earth's available fresh water. Put another way, groundwater is 60 times as plentiful as freshwater found in all of the earth's lakes and streams combined.

Groundwater is available for use throughout large portions of India. In many areas and outback communities, particularly in semi-arid and arid zones, it is the only dependable source of water.

Groundwater is a finite resource. It is replenished only when surface water seeps into aquifers. This process of aquifer replenishment is called recharge. Aquifers become depleted if groundwater extraction rates exceed recharge rates.

Aquifer depletion affects communities, agriculture and the industries that rely on groundwater supplies. Depleted groundwater reserves can also affect the

environment - for example, by reducing river flows that depend on flows from shallow groundwater, or by drying out ecosystems such as some wetlands that depend on groundwater inputs to sustain water levels, known as groundwater - dependent ecosystems.

Like the rivers and surface water, aquifers and groundwater can become contaminated. This affects communities or businesses that rely upon fresh water supplies. It is therefore important to minimize or avoid activities that may impair the quality and quantity of groundwater available to humans and the environment.

### Activity

Discussion to be led by the trainer

The overexploitation of groundwater has resulted in a number of problems, such as decrease of water table, sea water ingress in coastal areas and groundwater pollution in different parts of the country.

*How do you think India can overcome this problem? Write some measures and discuss them with the participants.*

## Understanding Concepts

### Aquifer

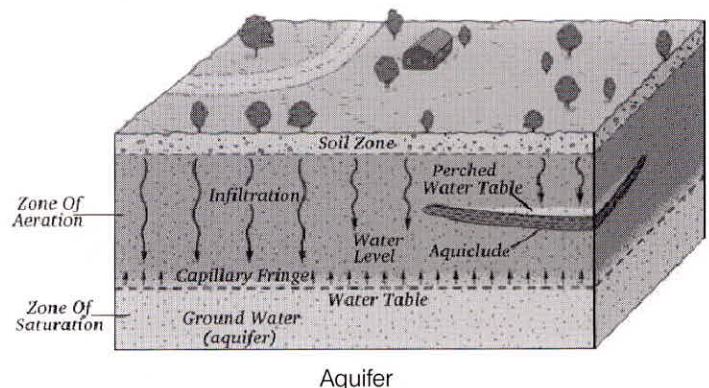
An aquifer is an underground geological formation which transmits and contains appreciable quantities of groundwater. Water in the ground travels slowly through pores or fractures, depending on the type of sediment or rock material the aquifer is made of.

Aquifers can vary markedly in the quality and quantity of water they hold and the extent of their connectivity with other aquifers or surface water bodies. There are two main types of aquifers: unconfined and confined.

### Unconfined Aquifers

Unconfined aquifers are characterized by the absence of a low-permeability (confining) layer above them. Their watertables are typically close to the surface and roughly trace the changes in the land surface (topography).

These aquifers are an important source of groundwater in India because of their relative shallowness and hence ease of access. In low-lying areas, groundwater from these aquifers is often released as natural springs, streams and wetlands.



## Confined Aquifers

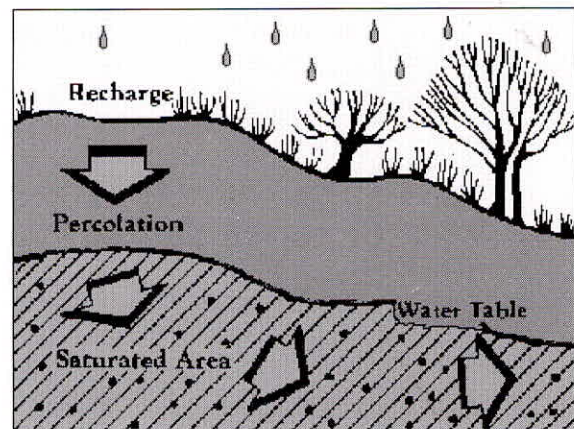
Confined aquifers are permeable rock units deep under the ground and overlain by less permeable layers. Replenishment occurs in areas known as recharge zones where the aquifer is unconfined and which may be a long distance from the confined portion of the aquifer.

Pressure from the recharge zones creates high water pressure in the aquifer beneath the confining layer. Sometimes the pressure is so great that, where there is a break in the confining layer, water naturally rises and bubbles to the surface without the need of a pump. This is called artesian flow. The watertable in a confined aquifer is called the piezometric surface and does not necessarily follow the land surface.

## Groundwater Recharge

The recharge is the replenishment of water to a groundwater system from the ground surface. It can occur naturally or artificially. Infiltration of rainfall below the ground surface and its movement to the water table is a widespread pattern of natural recharge.

Aquifers can also be recharged from surface water infiltrating the ground from water bodies such as rivers, streams, lakes, ponds, reservoirs and wetlands. It is possible to artificially recharge an aquifer for subsequent recovery or environmental benefit.



Recharge of Groundwater

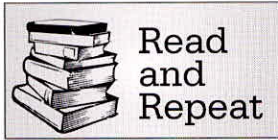
## Groundwater Discharge

Discharge is the process by which water leaves an aquifer. For unconfined aquifers, groundwater generally flows from recharge areas on higher ground to low-lying discharge areas.

Groundwater can discharge from an aquifer in a number of ways. Where the flow from an aquifer is slow and spread over a large area, it discharges by seepage; where it is localized and rapid, it discharges through a spring. Groundwater can discharge directly into streams, rivers, lakes and wetlands where they intersect the groundwater table.

A river may receive water from an aquifer through its bed - a process that may not be visible. Discharges to rivers account for most of the flow from aquifers. In drought, groundwater maintains surface water supplies for human use.

Groundwater is intricately connected with surface water through recharge and discharge and commonly affects the volume and quality of rivers, lakes and wetlands. When aquifers exceed their storage capacity, excess water flows to surface water bodies.



Read  
and  
Repeat

Water managers need to know recharge volumes and the rate at which water is transmitted through the aquifer to avoid over extraction. Following terms are also important to learn:

**AQUIFER** - Rocks and soils that hold and transmit usable quantities of water.

**WATERTABLE** - The top of the saturated portion of sub-surface zone.



Well

## Well

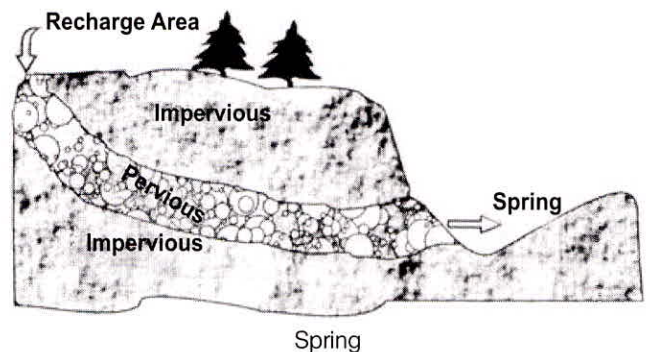
Traditionally wells are an important source of water. Even today, they are an important source of water supply in many communities. Technically, wells are of two kinds - Bore Well and Tube Well.

**Bore well** - Well that is excavated by hand or by means of a power auger (the material being brought up, for the most part, by the auger).

**Tube well** - A tube well is a type of water well in which a long 100-200 mm (5 to 8 inches) wide stainless steel tube or pipe is drilled into an underground aquifer. The lower end is fitted with a strainer, and a pump at the top lifts water for irrigation. The required depth of the well depends on the depth of the water table.

## Spring

When groundwater comes to the surface and flows freely under natural pressure, it is called a 'spring'. Springs may be shallow or deep. Shallow springs dry up quickly during summers, whereas deep springs do not show seasonal variations in the flow of water.



In some geographic areas (especially in mountainous areas), springs constitute an important source of water. Springs are simpler to exploit, as no pumping is needed to bring the water to the surface. Springs are exposed to pollution.

## Activity

Have you heard about hot and cold springs, under water and deep sea springs? Share with the audience.

## HYDROLOGICAL CYCLE (WATER CYCLE)

The movement of water on the earth's surface and through the atmosphere is referred to as the hydrologic cycle. Sun is the driving force of the hydrological cycle. Water is taken up by the atmosphere from the earth's surface in vapour form through evaporation. It may then be moved from place to place by the wind until it is condensed back to its liquid phase to form clouds. Water then returns to the surface of the earth in the form of either liquid (rain) or solid (snow, sleet, etc.) precipitation. Water transport can also take place on or beneath the Earth's surface by the flow.



To introduce this particular concept the trainer asks if any participant can define 'hydrological cycle' then discusses it to explain further. Draw a diagram of hydrological cycle. Also read the following definition of 'Hydrology' to the participants:

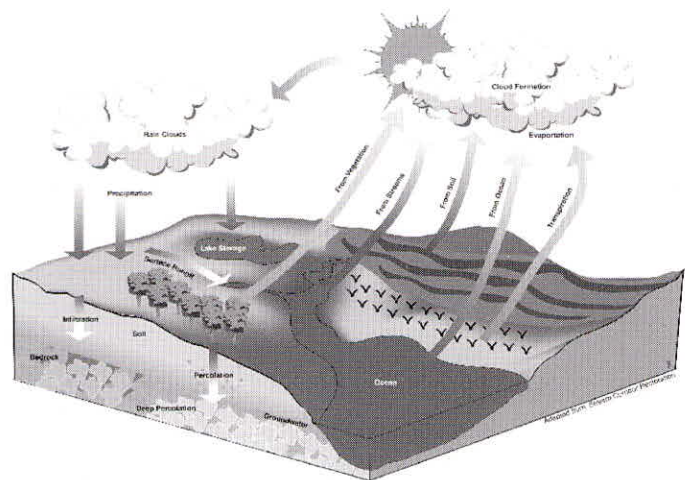
Hydrology is the study of the movement, distribution, and quality of water on Earth and other planets, including the hydrologic cycle, water resources and environmental watershed sustainability.

The hydrologic cycle is used to model the storage and movement of water between the biosphere, atmosphere, lithosphere and hydrosphere. Many processes work together to keep Earth's water moving in a cycle. There

are five processes at work in the hydrologic cycle: condensation, precipitation, infiltration, runoff, and evapotranspiration. These occur simultaneously and, except for precipitation, continuously. Water vapour condenses to form clouds, which result in precipitation when the conditions are suitable. Precipitation falls to the surface and infiltrates the soil or flows to the ocean as runoff. Surface water (e.g., lakes, streams, oceans, etc.), evaporates, returning moisture to the atmosphere, while plants return water to the atmosphere by transpiration.

### Activity

What would happen if Earth's water stopped moving in a cycle? Discuss.



The Hydrologic Cycle

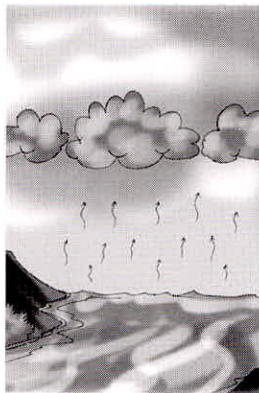


Water Reaching the Atmosphere



**Did You  
KNOW**

*There is exactly the same amount of water on earth now as there was when the dinosaurs existed, millions of years ago. The water keeps going around and around. The water you drink today may have once flowed down the Ganga or the Kaveri; it may have washed the idols in a temple or watered the crops in Karnataka. This is because of Water Cycle.*



Evaporation

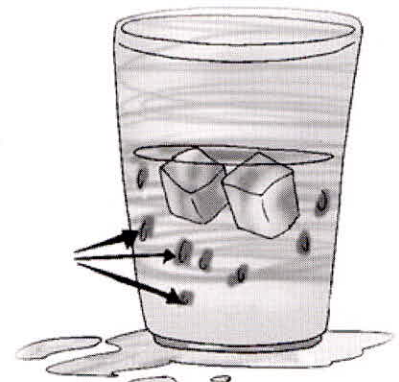
### Evaporation

Evaporation is the process where a liquid, in the case of water, changes from its liquid state to a gaseous state. Liquid water becomes water vapour. Although lower air pressure helps promote evaporation, temperature is the primary factor. For example, all the water in a pot left on a table will eventually disappear. It may take several weeks. But, if that same pot of water is put on a stove and brought to a boiling temperature, the water will evaporate more quickly.

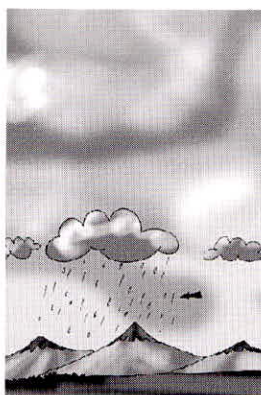
During the water cycle some amount of water in the oceans and freshwater bodies, such as lakes and rivers, is warmed by the sun and evaporates. During the process of evaporation, impurities in the water are left behind. As a result, the water that goes into the atmosphere is cleaner than it was on earth.

### Condensation

Condensation is the opposite of evaporation. Condensation occurs when a gas is changed into a liquid i.e. when the temperature of the vapour decreases. When the water droplets formed from condensation are very small, they remain suspended in the air. These millions of droplets of suspended water form clouds in the sky or fog at ground level. Water condenses into droplets only when there are small dust particles present around which the droplets can be formed.



Formation of Water Droplets



Precipitation

### Precipitation

When the temperature and atmosphere pressure are right, the small droplets of water form larger droplets and precipitation occurs. The raindrops then fall on earth. As a result of evaporation, condensation, and precipitation, water travels from the surface of the Earth goes into the atmosphere, and returns to Earth again.

### Activity

Why does air from an air cooler feel moist than air under a fan? Explain with reference to process of precipitation. What can be other examples of this type? Discuss.





*A drop of water may spend 2 to 3 weeks in a river, 100 years in a lake or 1000 years in a glacier.*

## Did You KNOW

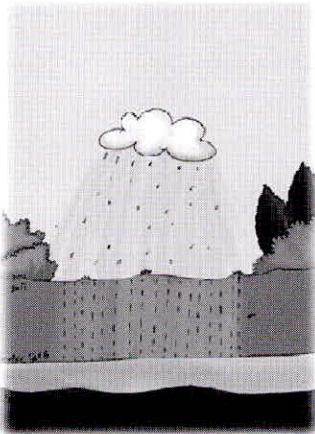
### Surface runoff

Much of the water that returns to Earth as precipitation runs off from the surface of the ground, and flows downhill into streams, rivers, ponds and lakes. Small streams flow into larger streams, then into rivers, and eventually the water flows into the ocean.

Surface runoff is an important part of the water cycle because, through surface runoff, much of the water returns again to the oceans, where a great deal of evaporation occurs.

### Activity

Take two plastic mugs M & J. Puncture them with holes on sides and base. Fill mug-M with hard sand, pebbles, stones and rocks. Fill mug-J with soft black or yellow soil. Now slowly pour two glass of water in both mug M & J. Which mug will show faster run-off? Why? Explain.



Infiltration

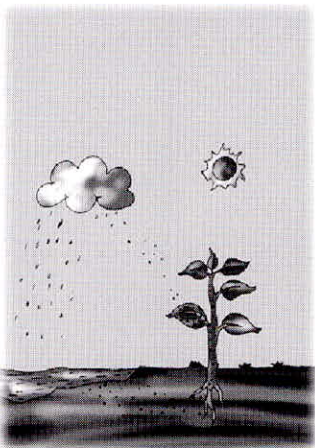
### Infiltration

Infiltration is an important process where rainwater enters into the ground, through the soil and underlying rock layers. Some of this water ultimately returns to the surface at springs or in low spots downhill. Some of the water remains underground and is called groundwater.

As the water infiltrates through the soil and rock layers, many of the impurities in the water are filtered out. This filtering process helps clean the water.

### Activity

Trainer can explain the process of infiltration with the help of a sponge or folded tissue. Take the help from the participants to demonstrate this activity.



Transpiration

### Transpiration

One final process is important in the water cycle. As plants absorb water from the soil, the water moves from the roots through the stems to the leaves. Once the water reaches the leaves, adding to the amount of water vapour in the air. This process of evaporation through plant leaves is called transpiration. In large forests, an enormous amount of water transpires through leaves.

## LESSONS LEARNED



- Life would not be possible without water as water is an essential component of the world's Ecosystem.
- Water comes in all three forms of the matter: Gaseous (water vapour and clouds), Liquid (rivers, lakes and aquifers in the ground) and Solid (the polar oceans, icebergs and ice caps).
- The living world influences the climate mainly by regulating the Water Cycle and water in turn acts with other agents of nature to influence the climatic conditions.
- Vegetation has a close relationship with the natural biosphere; removing vegetation interrupts natural biospheres. Hence Urbanization, Deforestation and Wetland Destruction destroy water retentive landscapes and lead to the Loss of Precipitation and negatively affect the fertility of the soil.
- A warmer climate in the polar caps leads to melting of the polar ice, which increases the sea level and may also result in Salination of coastal surfaces and groundwater resources.
- Rain water is the purest water in nature, followed by groundwater and Surface Water.
- Many processes work together to keep Earth's water moving in a cycle, together they are called a part of 'Hydrological Cycle'. There are five processes at work in the hydrological cycle: condensation, precipitation, infiltration, runoff, and evapotranspiration.
- Changes in the hydrological cycle have the potential to impact water resources, and hence people's lives can be affected too.



