How healthy is your lake?

Whether fed by rivers, streams or underground springs, lakes collect everything rain washes down from the surrounding **watershed**. Today, these fragile **ecosystems** are feeling the effects of runoff from asphalt, automobiles, septic wastes, fertilizers, household cleaners and other **pollutants**.

In its natural state, a lake can support many different kinds of plants and animals. Insects, **crustaceans** and fish hide among tangled plants in a tree-lined shore. Insects and fish **spawn** in rocky shores or gravel beds close to shore. And cold, clear, clean water provides the healthiest environment for wildlife and people.

Is your lake healthy? Here's an easy to way to find out. Learn about the importance of oxygen, algae, fish, bottom life and sediment in making a safe, comfortable home for aquatic life. Then give your lake a check-up. Your teacher can help you decide if your lake is healthy.

Vocabulary words

Aquatic: Plants and animals that live in water are aquatic.

Crustaceans: Aquatic animals that have a hard outer shell and jointed limbs; for example, a crayfish.

Ecosystem: The community of plants and animals that share a common environment.

Photosynthesis: The process where plants make food from light and nutrients.

Pollutant: A waste material that contaminates the water, air or soil, making it harmful for living things.

Spawn: To lay eggs.

Watershed: The land area that sends rain and snowmelt to a river or lake.

Making Water Quality Analysis Easy for You

HACH

ISO 9001 Certified

HACH *COMPANY*
Toll-free (USA only): 800-227-4224
Telephone: 970-669-3050
Fax: 970-669-2932
http://www.hach.com

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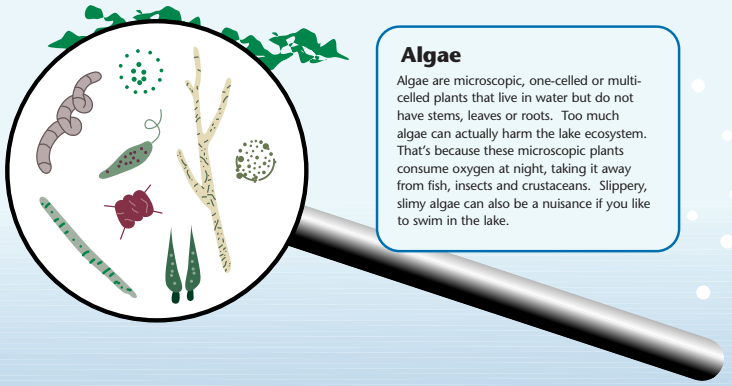


Algae

Algae are microscopic, one-celled or multi-celled plants that live in water but do not have stems, leaves or roots. Too much algae can actually harm the lake ecosystem. That's because these microscopic plants consume oxygen at night, taking it away from fish, insects and crustaceans. Slippery, slimy algae can also be a nuisance if you like to swim in the lake.

Fish

Some fish, like trout, are very sensitive to changes in water quality. If the lake doesn't have enough dissolved oxygen, or if the water is too warm, trout will die. Other fish, such as carp and catfish, flourish in warmer temperatures and can tolerate lower dissolved oxygen. If your lake has many trout, then it is probably very healthy.

Oxygen

Oxygen dissolved in water is essential because **aquatic** plants and animals need dissolved oxygen to live. Cold water can hold more oxygen than warm water because gases are more easily dissolved in cold water.

Most oxygen dissolved in water comes from the atmosphere. Oxygen enters the water more readily when mixing occurs, as in waves on the lake's surface. Algae and plants that live in the water produce oxygen during daylight hours through **photosynthesis**.

Bottom life

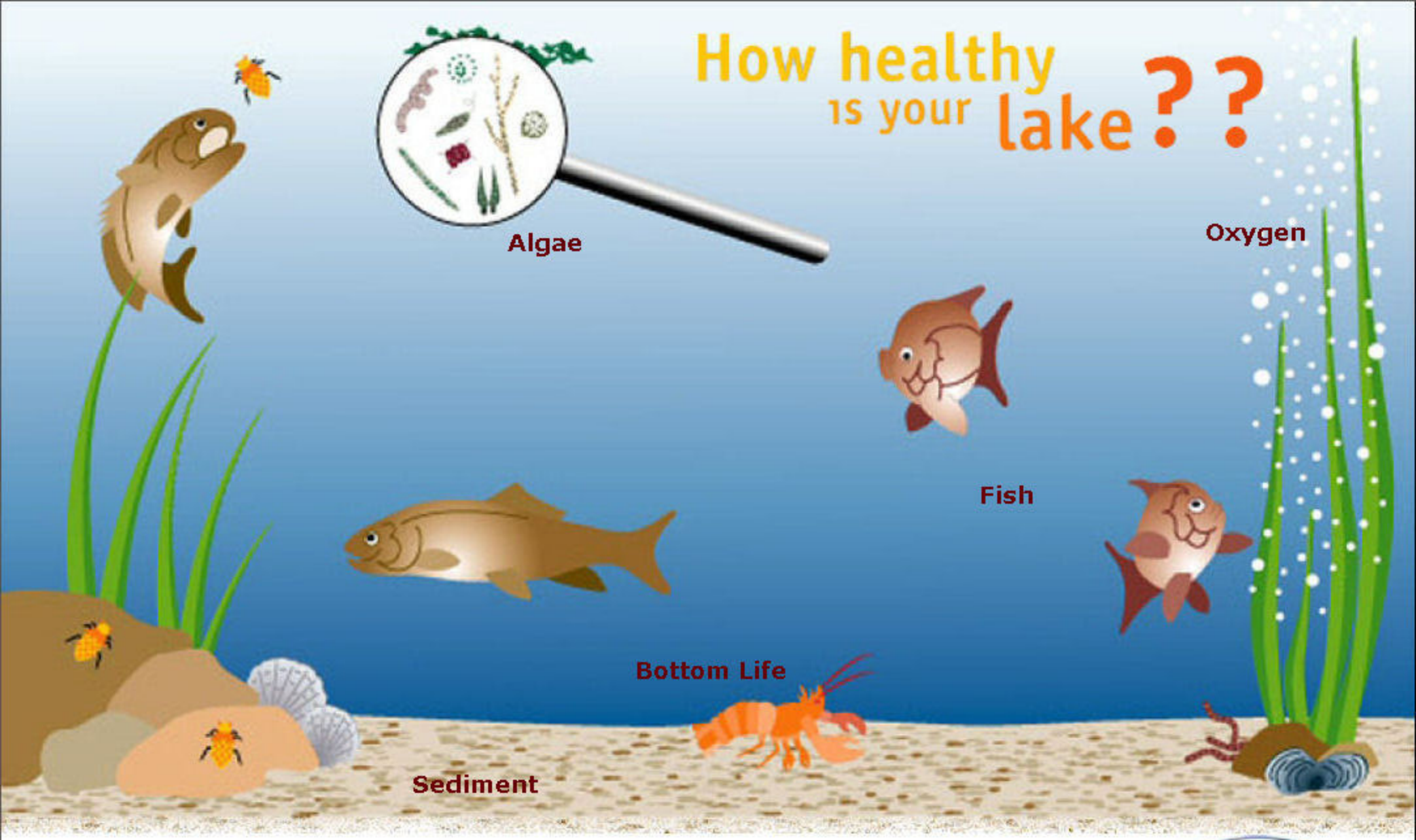
Many insects live on the bottom of a lake and can be seen with the unaided eye. These bottom dwellers are a food source for fish, crustaceans and other insects. They are sensitive to dissolved oxygen levels and water temperature patterns.

Using a net, collect some organisms from the bottom of your lake. What did you find? Finding a variety of insect larvae, nymphs and beetles indicates a healthy lake.

Sediment

A lake's bottom can be composed of rock, gravel, sand or silt. Rock and gravel provide feeding and spawning places for fish and insects, while sandy or silty areas provide poor habitat and low dissolved oxygen levels. Particles of silt and clay settle on the lake bottom, smothering fish eggs and insects that live there.

Sediment can be suspended in the water. This makes the lake look cloudy. Cloudy or turbid water clogs fish gills and prevents eggs from developing properly. Healthy lakes are clear and not noticeably green or tan in color.


How healthy is your lake??
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Oxygen:

Oxygen dissolved in water is essential because aquatic plants and animals need dissolved oxygen to live. Cold water can hold more oxygen than warm water because gases are more easily dissolved in cold water.

Some of the oxygen dissolved in water comes directly from the atmosphere. Oxygen enters the water more readily when mixing occurs, as in waves on the lake's surface. Algae and plants that live in the water also produce oxygen during daylight hours through photosynthesis.

Fish:

Some fish, like trout, are very sensitive to changes in water quality. If the lake doesn't have enough dissolved oxygen, or if the water is too warm, trout will die. Other fish, such as carp and catfish, flourish in warmer temperatures and can tolerate lower dissolved oxygen. If your lake has many trout, then it is probably very healthy.

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Useful Terms

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Crustaceans:	Aquatic animals that have a hard outer shell and jointed limbs; for example, a crayfish.
Ecosystem:	The community of plants and animals that share a common environment.
Photosynthesis:	The process where plants make food from light and nutrients.
Pollutant:	A waste material that contaminates the water, air or soil, making it harmful for living things.
Spawn:	To lay eggs (refers to animals that normally lay a large number of eggs, such as fish and insects).
Watershed:	The land area that sends rain and snowmelt to a river or lake.

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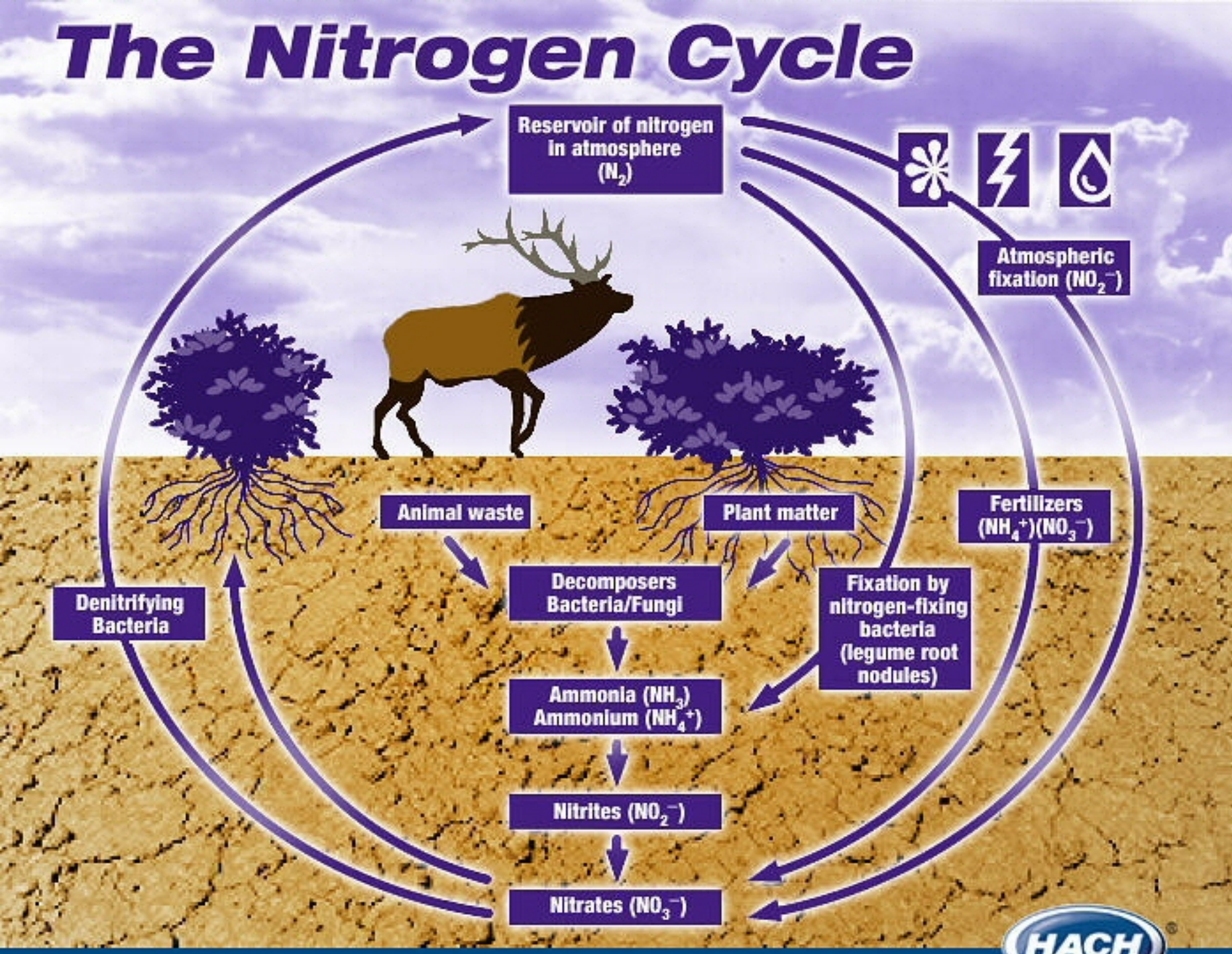
The Nitrogen Cycle



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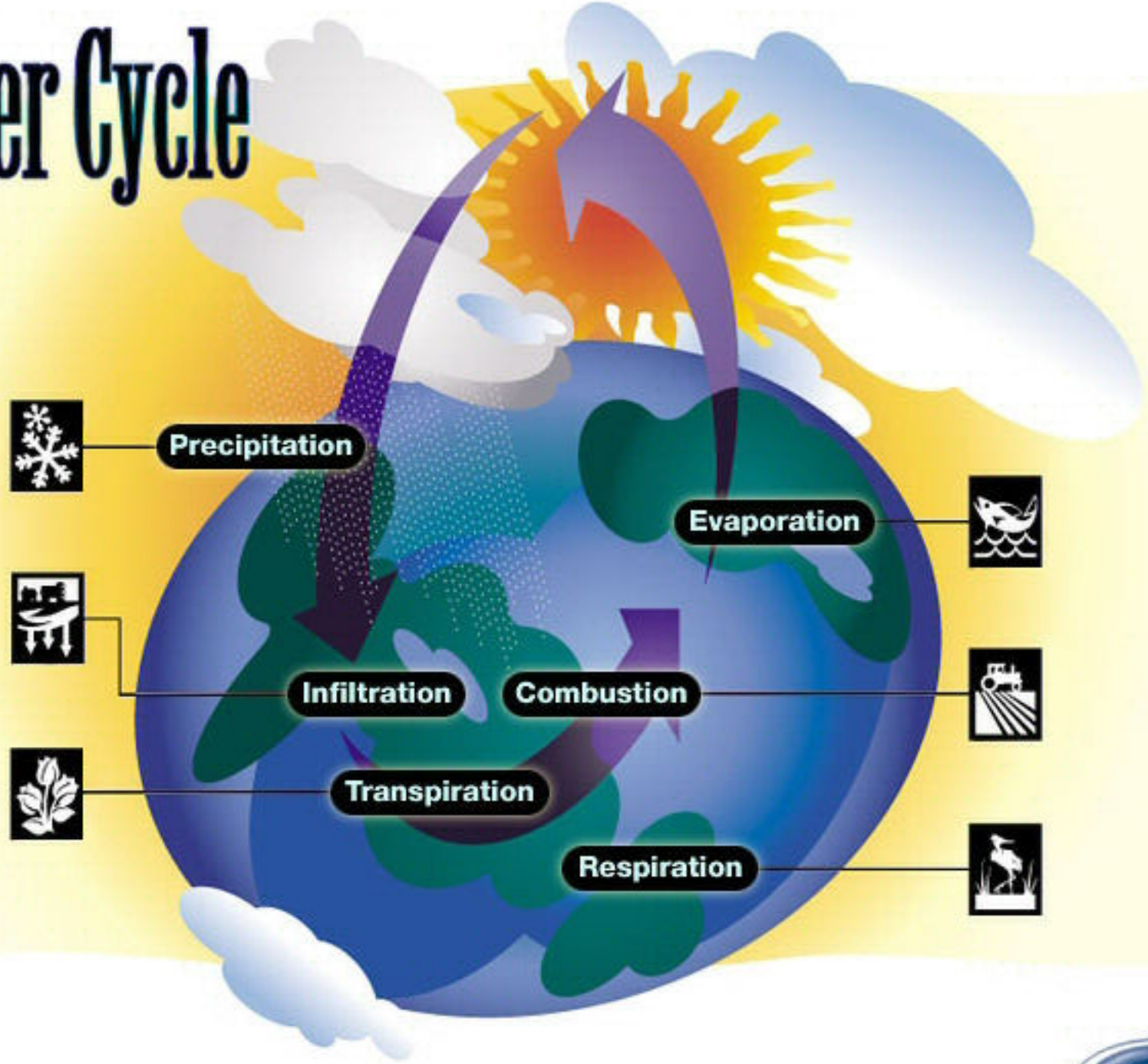
The Water Cycle



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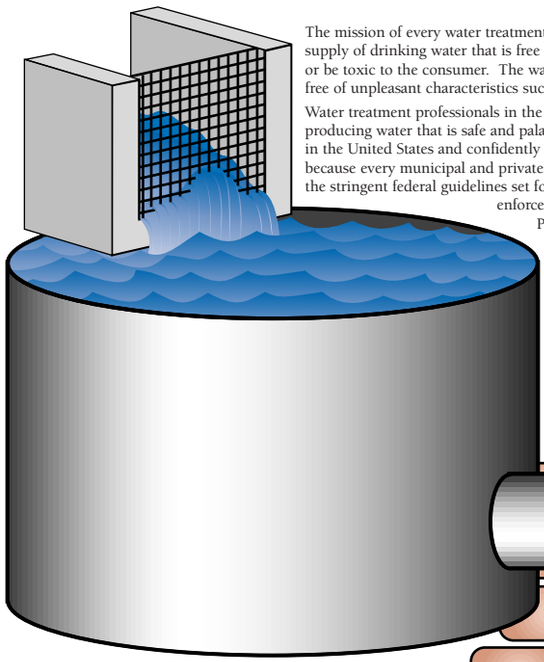
A Closer Look at Water Treatment



The mission of every water treatment professional is to provide a continuous supply of drinking water that is free of contaminants that can cause disease or be toxic to the consumer. The water must also be palatable — that is, free of unpleasant characteristics such as color, turbidity, taste and odor.

Water treatment professionals in the United States do an excellent job of producing water that is safe and palatable. You can go virtually anywhere in the United States and confidently drink water from the tap. That's because every municipal and private water treatment facility must meet the stringent federal guidelines set forth in the Safe Drinking Water Act and enforced by the United States Environmental Protection Agency.

The methods used to treat water depend on the characteristics of the raw water. Surface water sources (rivers, lakes, and reservoirs) generally require more extensive treatment than ground-water sources (well water) because of greater exposure to contamination. Most water treatment processes include a multi-step approach to ensure that finished water meets established standards.

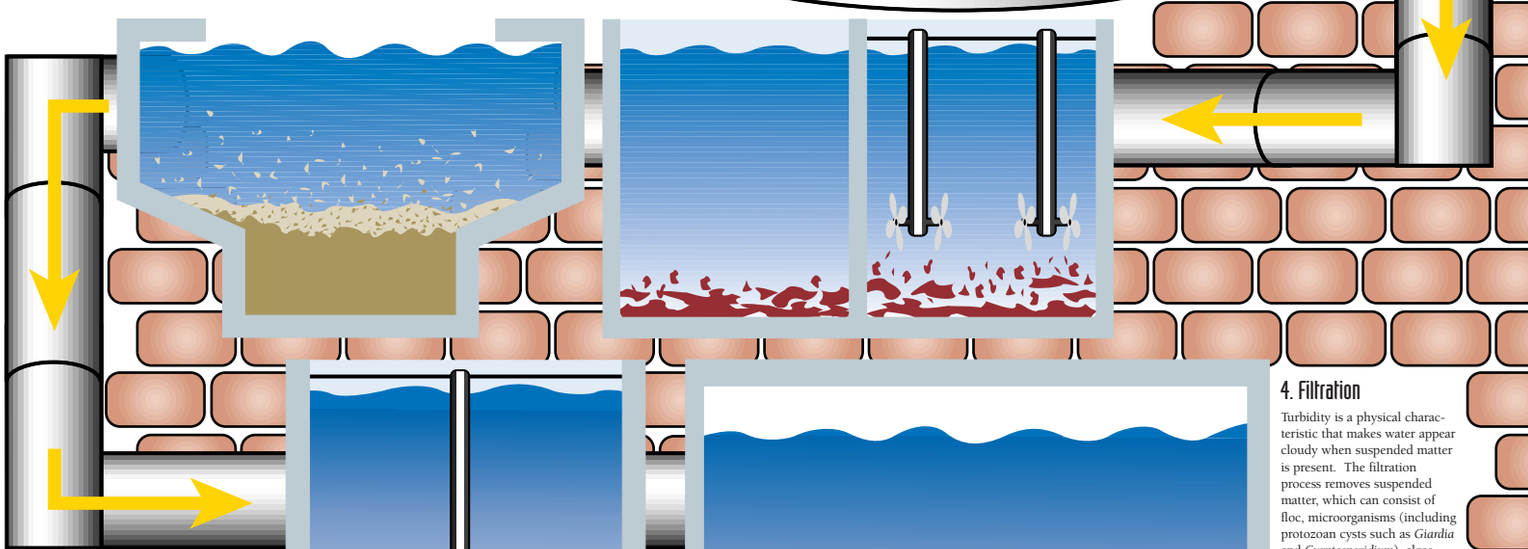
1. Preliminary Treatment

Preliminary treatment or pretreatment is any physical, chemical or mechanical process used on water before it undergoes the main treatment process. During preliminary treatment, screens can be used to remove rocks, sticks, leaves and other debris; chemicals can be added to control the growth of algae; and presedimentation can settle out sand, grit and gravel from raw water.

2. Coagulation, Flocculation and Clarification

To remove small particles that are made up of microbes, silt and other suspended material in the water, treatment chemicals such as alum are added to the water and mixed rapidly in a large basin. The chemicals cause small particles to clump together (coagulation). Gentle mixing brings the clumps together to form larger groups of particles (floc). During flocculation, the heavy, dense floc slowly settles out of the water in large tanks.

Clarification occurs in a large basin where water is allowed to flow very slowly. Sludge, a residue of solids and water, accumulates at the basin's bottom and is pumped or scraped out for eventual disposal. Clarification is sometimes called sedimentation.



3. Softening and Stabilization

When water is too hard (i.e. contains too much calcium, magnesium or other minerals), it forms scale causing a variety of problems in pipes. Hard water can also result in laundering and washing problems. Conversely, when too many of these minerals are removed, water can cause corrosion in pipes. That is why drinking water plants attempt to maintain a desirable balance between hardness and softness. This is accomplished by adding minerals to soft water and removing them from hard water. (Measure hardness as $CaCO_3$ with a Hach titration procedure based on the USEPA-approved method.)

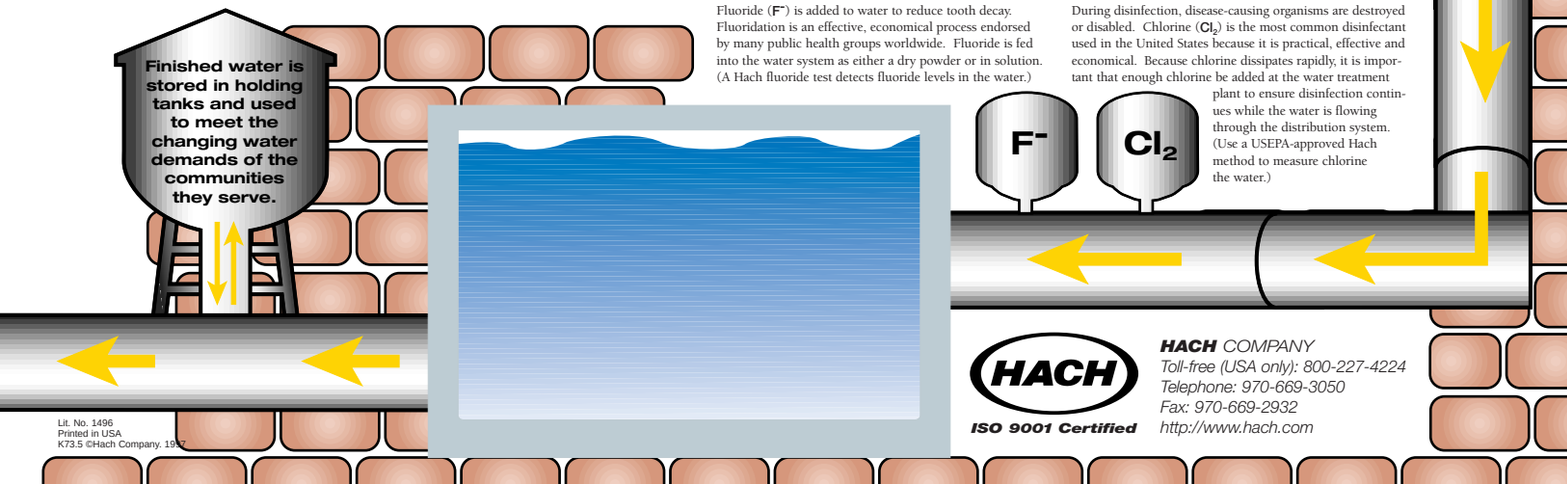
4. Filtration

Turbidity is a physical characteristic that makes water appear cloudy when suspended matter is present. The filtration process removes suspended matter, which can consist of floc, microorganisms (including protozoan cysts such as *Giardia* and *Cyrptosporidium*), algae, silt, iron and manganese precipitates from ground-water sources, as well as precipitants which remain after the softening process. These suspended materials are filtered out when water passes through beds of granular material, usually composed of layers of sand, gravel, coal, garnet, or related substances. (Measure turbidity with a Hach turbidimeter.)

5. Fluoridation & Disinfection

Fluoride (F^-) is added to water to reduce tooth decay. Fluoridation is an effective, economical process endorsed by many public health groups worldwide. Fluoride is fed into the water system as either a dry powder or in solution. (A Hach fluoride test detects fluoride levels in the water.)

During disinfection, disease-causing organisms are destroyed or disabled. Chlorine (Cl_2) is the most common disinfectant used in the United States because it is practical, effective and economical. Because chlorine dissipates rapidly, it is important that enough chlorine be added at the water treatment plant to ensure disinfection continues while the water is flowing through the distribution system. (Use a USEPA-approved Hach method to measure chlorine the water.)



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HACH COMPANY
Toll-free (USA only): 800-227-4224
Telephone: 970-669-3050
Fax: 970-669-2932
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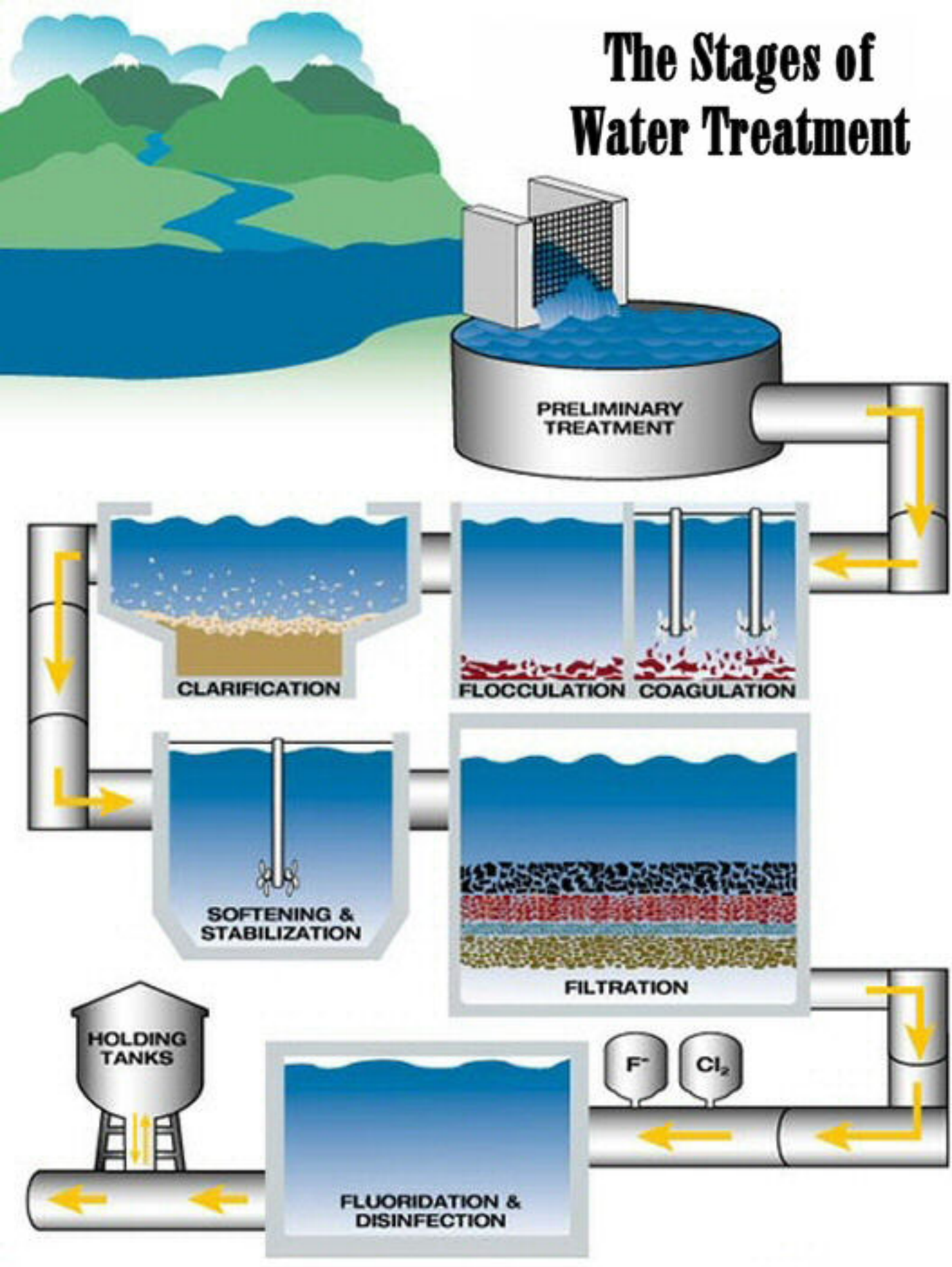
The Stages of Water Treatment



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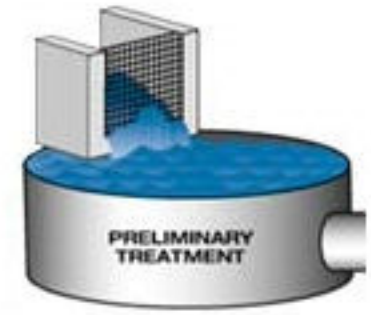
Preliminary Treatment



Preliminary treatment or pretreatment is any physical, chemical or mechanical process used on water before it undergoes the main treatment process. During preliminary treatment:

- screens may be used to remove rocks, sticks, leaves and other debris;
- chemicals may be added to control the growth of algae; and
- a presedimentation stage can settle out sand, grit and gravel from raw water.

Coagulation

After preliminary treatment, the next step is coagulation. Coagulation removes small particles that are made up of microbes, silt and other suspended material in the water. Treatment chemicals such as alum are added to the water and mixed rapidly in a large basin. The chemicals cause small particles to clump together (coagulate). Gentle mixing brings smaller clumps of particles together to form larger groups called "floc". Some of the floc begins to settle during this stage.

Flocculation

During the flocculation stage, the heavy, dense floc settles to the bottom of the water in large tanks. As you can imagine, this can be a slow process! Once the floc settles, the water is ready for the next stage of treatment.

Clarification

Clarification occurs in a large basin where water is again allowed to flow very slowly. Sludge, a residue of solids and water, accumulates at the basin's bottom and is pumped or scraped out for eventual disposal. Clarification is also sometimes called sedimentation.

Softening and Stabilization

When water is too "hard" (i.e. contains too much calcium, magnesium or other minerals), it forms scale and causes a variety of problems in pipes. Hard water can also result in laundering and washing problems, because it reduces the effectiveness of soaps and detergents.

Conversely, when too many of these minerals are removed, water can become too "soft". Soft water can cause corrosion in pipes.

Drinking water plants attempt to maintain a desirable balance between hardness and softness. This is accomplished by adding minerals to soft water and removing them from hard water. (Measure hardness as $CaCO_3$ with a Hach titration procedure based on the USEPA-approved method.)

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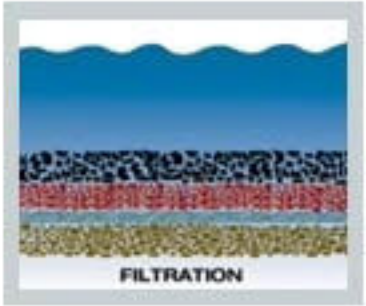

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Holding Tanks

Finished water (the term water treatment professionals use) is stored in holding tanks. The tanks provide a water reserve to meet the changing water demands of the communities they serve.