

Sources Of Water

Introduction

Water is a transparent and nearly colorless chemical substance that is the main constituent of Earth's streams, lakes, and oceans, and the fluids of most living organisms. Its chemical formula is H_2O , meaning that its molecule contains one oxygen and two hydrogen atoms that are connected by covalent bonds. Strictly speaking, water refers to the liquid state of a substance that prevails at standard ambient temperature and pressure; but it often refers also to its solid state (ice) or its gaseous state (steam or water vapor). It also occurs in nature as snow, glaciers, ice packs and icebergs, clouds, fog, dew, aquifers, and atmospheric humidity.

Water covers 71% of the Earth's surface. It is vital for all known forms of life. On Earth, 96.5% of the planet's crust water is found in seas and oceans, 1.7% in groundwater, 1.7% in glaciers and the ice caps of Antarctica and Greenland, a small fraction in other large water bodies, 0.001% in the air as vapor, clouds (formed of ice and liquid water suspended in air), and precipitation. Only 2.5% of this water is freshwater, and 98.8% of that water is in ice (excepting ice in clouds) and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products. A greater quantity of water is found in the earth's interior.

Water on Earth moves continually through the water cycle of evaporation and transpiration (evapotranspiration), condensation, precipitation, and runoff, usually reaching the sea. Evaporation and transpiration contribute to the precipitation over land. Large amounts of water are also chemically combined or adsorbed in hydrated minerals.

Safe drinking water is essential to humans and other lifeforms even though it provides no calories or organic nutrients. Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack access to safe water and over 2.5 billion lack access to adequate sanitation. There is a clear correlation between access to safe water and gross domestic product per capita. However, some observers have estimated that by 2025 more than half of the world population will be facing water-based vulnerability. A report, issued in November 2009, suggests that by 2030, in some developing regions of the world, water demand will exceed supply by 50%.

Water plays an important role in the world economy. Approximately 70% of the freshwater used by humans goes to agriculture. Fishing in salt and fresh water bodies is a major source of food for many parts of the world. Much of long-distance trade of commodities (such as oil and natural gas) and manufactured products is transported by boats through seas, rivers, lakes, and canals. Large quantities of water, ice, and steam are used for cooling and heating, in industry and homes. Water is an excellent solvent for a wide variety of chemical substances; as such it is widely used in industrial processes, and in cooking and washing. Water is also central to many sports and other forms of entertainment, such as swimming, pleasure boating, boat racing, surfing, sport fishing, and diving.

Surface Water

Definition

Surface water is water that is open to the atmosphere and results from overland flow. It is also said to be the result of surface runoff. These are two ways of saying the same thing.

Examples of Surface Water

Specific sources that are classified as surface water include the following:

- Streams, Rivers, Lakes
- Man-made impoundments (lakes made by damming a stream or river)
- Springs affected by precipitation that falls in the vicinity of the spring (affected means a change in flow or quality)
- Shallow wells affected by precipitation (affected means a change in level or quality)
- Wells drilled next to or in a stream or river
- Rain catchments
- Muskeg and tundra ponds

Advantages and Disadvantages of Surface Water

There are both advantages and disadvantages to surface water:

- **Advantages** – The primary advantages to using surface water as a water source include the following:
 - It is easily located. It takes no sophisticated equipment to find a surface water source.
 - In many parts of the US, considerable data is available on quantity and quality of existing surface water supplies.
 - Surface water is generally softer than groundwater, which makes treatment much simpler.
- **Disadvantages** – The most common disadvantages to using surface water as a water source include the following:
 - Surface waters are easily polluted (or contaminated) with microorganisms that cause waterborne diseases and chemicals that enter the stream from surface runoff and upstream discharges.
 - The turbidity (measured as NTU) of a surface water source often fluctuates with the amount of precipitation. Increases in turbidity increase treatment cost and operator time.
 - The temperature of surface water fluctuates with the ambient temperature. This makes it difficult to produce consistent water quality at a water treatment plant.
 - The intake structure may become clogged or damaged from winter ice, or the source may be so shallow that it completely freezes in the winter. This is a common problem with surface water sources in the arctic.
 - Removing surface water from a stream, lake, or spring requires a legal right, referred to as a water right. Water rights in Alaska are obtained from the Department of Natural Resources (DNR).
 - For many systems in Alaska, the source water is at its worst possible quality during the time

of the year when the community needs to fill or top off its storage tank. This happens late in the summer when glacially fed streams have turbidities of 1000 ntu or greater.

- Using surface water as a source means that the purveyor is obligated to meet the requirements of the Surface Water Treatment Rule (SWTR) of the State Drinking Water Regulations. This rule requires that, in most instances, any surface water source must have a filtration system.
- Surface waters that are high in color, especially color that is the result of decaying vegetation, have the potential to produce high levels of Total Trihalomethanes (TTHM). These chemical compounds are formed when chlorine is added to the water. The problem with the TTHM is that some of them are carcinogenic (can cause cancer) and are referred to as disinfection by-products (DBP).

Frozen Water

Several schemes have been proposed to make use of icebergs as a water source, however to date this has only been done for novelty purposes. The Himalayas, which are often called "The Roof of the World", contain some of the most extensive and rough high altitude areas on Earth as well as the greatest area of glaciers and permafrost outside of the poles

Groundwater

Definition

Groundwater is considered to be water that is below the earth's crust, but not more than 2500 feet below the crust. Water between the earth's crust and the 2500-foot level is considered usable fresh water.

Examples of Groundwater

Groundwater is obtained from the following:

- Wells
- Springs that are not influenced by surface water or a local hydrologic event

Under the Influence

When a well or spring is influenced by an adjacent surface water source or by a local hydrological event, the supply is said to be groundwater under the direct influence of surface water (GUDISW).

Advantages and Disadvantages of Groundwater

There are both advantages and disadvantages to groundwater.

- Advantages – The advantages of groundwater sources in relationship to surface water include the following:
 - Groundwater is not as easily contaminated as surface water.
 - The quality of groundwater, while not always as good as would be preferred, is stable throughout the year.
 - Groundwater sources are generally lower in bacteriological count than surface water sources.
 - Groundwater is available in most locations throughout the continental US and Alaska.
- Disadvantages – When comparing groundwater sources with surface water, the following are disadvantages to using groundwater:
 - Once a groundwater source is contaminated, it is difficult for it to recover. There is no easy way to remove the contaminants.
 - Groundwater usually contains more minerals than surface water, including increased levels of hardness. Because groundwater is in contact longer with minerals, there is more time to bring them into solution.
 - Removal of groundwater normally requires a pump, thus increasing operation cost.
 - Groundwater is more susceptible to long-term contamination from fuel spills.
 - Groundwater supplies often have high levels of iron and manganese, thus increasing treatment cost and/or causing stains on plumbing and the clothing of customers.
 - Wells in the coastal areas are subject to salt water intrusion into the aquifer and well. This contamination is difficult to predict and costly to treat.

Sources of contamination can be hidden from sight.

Rainwater

Collecting your own rainwater is an excellent way to conserve this precious resource. A basic rainwater collection system catches rainwater from your roof or other surface and channels it into a container for storage.

Rainwater itself is generally clean, but it can pick up microorganisms, pollutants and debris when it hits your roof. This is why systems for rainwater use inside your home often include filtration or other treatments for safety.

Outdoor rainwater collection systems don't need as much treatment because the water is typically used outside. One of the easiest rain collectors to make is a repurposed old garbage can. Whereas, you can install a rainwater cistern if you want a larger system.

There are many different uses for collected rainwater no matter what type of rainwater harvesting system you have.

1. Drinking and cooking

Rainwater can actually be very high-quality water for human consumption. It's relatively pure and doesn't contain any chlorine or other chemicals, which are often used to sanitize city tap water. The problem starts when rainwater is collected from roofs or other dirty surfaces. You can

make rainwater safe to drink by installing a filtration system, boiling or distilling the water. Some systems can also directly collect clean rainwater to use for drinking.

2. Bathing and laundry

Washing clothes accounts for about 22 percent of indoor water use in the United States. Showers take 17 percent, and baths 2 percent. If you used harvested rainwater for all of these, you could reduce your municipal water use by over 40 percent. Depending on how clean you want your washing water, you could use either treated or untreated rainwater. SFGate has some suggestions on how you can treat rainwater to use for showering.

3. Flushing toilets

This is another huge water drain. Toilets use almost 27 percent of water in your home. To use collected rainwater instead, try keeping a bucket of it next to your toilet. When you need to flush, pour the rainwater straight into the bowl of the toilet. This will automatically flush your toilet. Make sure your bucket can hold the amount of your toilet's tank. For instance, if you have a toilet with a 6 gallon (22.7 liter) tank, use at least a 6 gallon bucket of water

Another option is to plumb a pipe for rainwater directly into your house and connect it to your toilet for flushing. Check out a very low-tech method to do this.

4. Watering lawns, gardens and houseplants

Rainwater is naturally designed to water plants, and it can easily be used for your indoor and outdoor gardens. You can use rainwater in watering cans to water plants by hand. You can also attach any rainwater storage tanks directly to an automatic irrigation system.

Passive systems to conserve and collect water in your soil are also helpful. Plant garden beds along the edges of your driveway, or at the bottom of a hill, to take advantage of water's natural movement. Also, try planting a raingarden at the ends of your eavestroughs to catch any excess runoff.

5. Composting

Water is essential for proper decomposition of your compost pile. Make sure you water your compost with the rest of your garden. Harvested rainwater is also good for compost tea. Home Composting Made Easy describes a simple way to make compost tea.

6. Water for wildlife, pets or livestock

You can use recycled rainwater for birdbaths, troughs, or other containers for wildlife to visit. Rainwater is also typically safe for pets or livestock to drink or wash in, especially if you have a method to collect clean rainwater directly.

7. Outdoor ponds and water features

Rainwater can be filtered for use in fountains or other water features with pumps that could get clogged. Otherwise, you can fill outdoor ponds and pools with any type of collected rainwater.

8. Rinsing vegetables

Dirty rainwater is great for rinsing vegetables straight from your garden, especially root vegetables. Try filling a large bucket with rainwater, adding some carrots, potatoes, beets or other hard vegetables, and swish them together to knock the soil off.

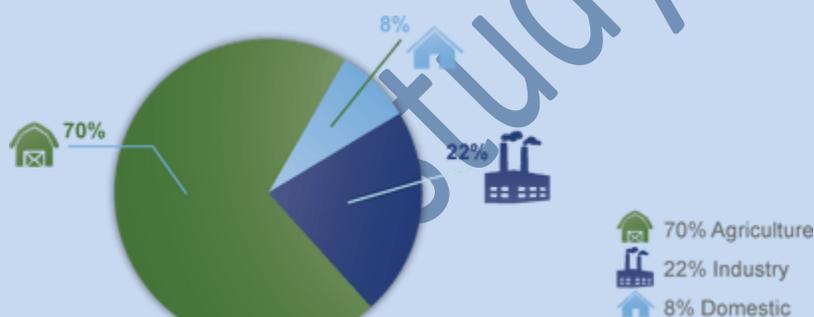
9. Washing vehicles and equipment

Washing outdoor items is another excellent use for untreated rainwater. Cars, garden tools, lawnmowers, tractors and even the driveway and sides of your house are all perfect candidates.

10. Fire protection

A rainwater catchment system with a large storage tank could give you some extra protection if you live in an area prone to wildfires. Make sure you also install a good pump so you can access the water quickly if needed.

Uses of Water – Domestic, Agriculture and Industrial



Water used for domestic purposes

Water is used for many different things at home. Water is used for cooking, cleaning, drinking and for sanitation. Providing sufficient drinking water and sanitation for people in the developing countries in the world is one of the greatest challenges at the present time. Two thirds of the 330 million living in 20 African countries lack access to safe drinking water. The increasing number of human population all around the world makes it difficult to supply the safe drinking water to everyone especially in the developing countries.

Water used for agriculture

Agriculture made use of the most water in the world. This is particularly in the case of Africa, Asia and South America. The use of water for irrigation per person varies greatly throughout the world.

Water use for industries

About 1/4 of water is used in the industry. Reference has been made in substantial use of water for cooling and power generation. Water also has a significant role to play as an input for most manufacturing industries especially food processing, brewing and soft drink manufacturing, chemicals and textiles. Much of the water used by the industries, is discharged back into rivers and coastal water causing a significant amount of pollution.

Reference

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