POTABLE WATER

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Drinking water

Drinking water

Drinking water is water that is intended to be drunk by humans. Water of sufficient quality to serve as drinking water is called **potable water** whether it is used as such or not. Although most fresh water sources are drinkable by humans, they can be a disease vector or cause long-term health problems if they do not meet certain water quality guidelines.

Most nations have water quality regulations for water sold as drinking water, although these are often not strictly enforced outside of the developed world. Virtually all municipal water systems deliver a single quality of water, whether it is to be used for drinking, washing or landscape irrigation.

Mineral Water

Water resources

Water resources are sources of water that are useful or potentially useful to humans. It is important because it is needed for life to exist. Many uses of water include agricultural, industrial, household, recreational and environmental activities.

Virtually all of these human uses require fresh water. Only 3% of water on the Earth is fresh water, and over two thirds of this is frozen in glaciers and polar ice caps.

Water demand already exceeds supply in many parts of the world, and many more areas are expected to experience this imbalance in the near future. The framework for allocating water resources to water users (where such a framework exists) is known as water rights.

Water and conflict

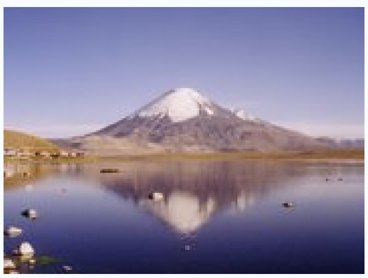
Throughout history, water resources have occasionally been the source of conflict. Examples include:

- Well poisoning
- Privatization and Water Pricing in India [1], Kerala farmers vs. Coca-Cola
- Privatization and Water Pricing protests in Cochabamba, Bolivia in 2000

Nevertheless, some claim that the issue does not get the attention it deserves, in particular with regard to security.

Sources of fresh water

Surface water



A lake

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation and sub-surface seepage.

Although the only natural input to any surface water system is precipitation within its watershed, the total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs, the permeability of the soil beneath these storage bodies, the runoff characteristics of the land in the watershed, the timing of the precipitation and local evaporation rates.

All of these factors also affect the proportions of water lost through discharge to the oceans, evaporation and sub-surface seepage.

Human activities can have a large impact on these factors. Humans often increase storage capacity by constructing reservoirs and decrease it by draining wetlands. Humans often increase runoff quantities and velocities by paving areas and channelizing stream flow.

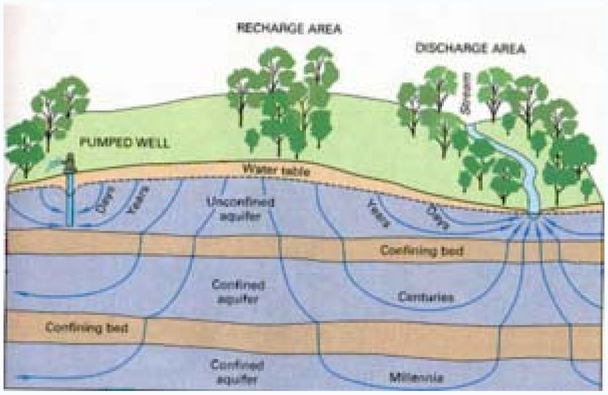
The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water.
For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time.

Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill in when average stream flow is below the power plant's need.

Nevertheless, over the long term the average rate of precipitation within a watershed is the upper bound for average consumption of natural surface water from that watershed.

Natural surface water can be augmented by importing surface water from another watershed through a canal or pipeline. It can also be artificially augmented from any of the other sources listed here; however in practice the quantities are negligible. Humans can also cause surface water to be "lost" (i.e. become unusable) through pollution.

Sub-surface water



Sub-Surface water travel time

Sub-Surface water, or groundwater, is fresh water located in the pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between sub-surface water that is closely associated with surface water and deep sub-surface water in an aquifer (sometimes called "fossil water").

Sub-surface water can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that for sub-surface water, storage is generally much larger compared to inputs than it is for surface water. This difference makes it easy for humans to use sub-surface water unsustainably for a long time without severe consequences. Nevertheless, over the long term the average rate of seepage above a sub-surface water source is the upper bound for average consumption of water from that source.

The natural input to sub-surface water is seepage from surface water. The natural outputs from sub-surface water are springs and seepage to the oceans.
If the surface water source is also subject to substantial evaporation, a sub-surface water source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a sub-surface water source may cause the direction of seepage to ocean to reverse which can also cause salinization. Humans can also cause sub-surface water to be "lost" (i.e. become unusable) through pollution. Humans can increase the input to a sub-surface water source by building reservoirs or detention ponds.
Water in the ground are in sections called aquifers. Rain rolls down and comes into these. Normally an aquifer is near to the equilibrium in its water content. The water content of an aquifier normally depends on the grain sizes. This means that the rate of extraction may be limited by poor permiability.

Desalination

Desalination is an artificial process by which saline water (generally ocean water) is converted to fresh water. The most common desalinization processes are distillation and reverse osmosis. Desalinization is currently very expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas. The most extensive use is in the Persian Gulf.

Frozen water

An iceberg as seen from Newfoundland

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. Glacier runoff is considered to be surface water.

Threats to fresh water

There are many things that are a threat to the Earths fresh water supply. Here are a few of them.

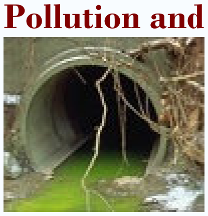
Climate change

Climate change will have significant impacts on water resources around the world because of the close connections between the climate and hydrologic cycle. Rising temperatures will increase evaporation and lead to increases in precipitation, though there will be regional variations in rainfall. Both droughts and floods may become more frequent in different regions at different times, and dramatic changes in snowfall and snowmelt are expected in mountainous areas. Higher temperatures will also affect water quality in ways that are not well understood. Possible impacts include increased eutrophication. Climate change could also mean an increase in demand for farm irrigation, garden sprinklers, and perhaps even swimming pools.

Depletion of aquifers

Since competition for water is growing, underground aquifers are becoming depleted. This is mainly due to irrigation by groundwater. Millions of small pumps are currently taking water out of aquifers to irrigate crops. Irrigation in dry areas such as India is supplied by groundwater.

Pollution and water protection



Polluted Water

Water pollution is one of the many concerns of the world today. World governments have strived to find solutions to eliminate this problem. One of these suggestions is the Kyoto Protocol. Many programs strive to protect our water resources. They are usually funded by donations from generous people.

Uses of fresh water

Uses of fresh water can be categorized as consumptive and non-consumptive (sometimes called "renewable"). A use of water is consumptive if that water is not immediately available for another use. Losses to sub-surface seepage and evaporation are considered consumptive, as is water incorporated into a product (such as farm produce). Water that can be treated and returned as surface water, such as sewage, is generally considered non-consumptive if that water can be put to additional use.

Agricultural

A farm in Ontario

It is estimated that 70% of world-wide water use is for irrigation. In some areas of the world irrigation is necessary to grow any crop at all, in other areas it permits more profitable crops to be grown or enhances crop yield. Various irrigation methods involve different trade-offs between crop yield, water consumption and capital cost of equipment and structures. Irrigation methods such as most furrow and overhead sprinkler irrigation are usually less expensive but also less efficient, because much of the water evaporates or runs off. More efficient irrigation methods include drip or trickle irrigation, surge irrigation, and some types of sprinkler systems where the sprinklers are operated near ground level. These types of systems, while more expensive, can minimize runoff and evaporation. Any system that is improperly managed can be wasteful. Another trade-off that is often insufficiently considered is salinization of sub-surface water.

Aquaculture is a small but growing agricultural use of water. Freshwater commercial fisheries may also be considered as agricultural uses of water, but have generally been assigned a lower priority than irrigation (Aral Sea and Pyramid Lake).

As global populations grow, and as demand for food increases in a world with a fixed water supply, there are efforts underway to learn how to produce more food with less water, through improvements in irrigation methods and technologies, agricultural water management, crop types, and water monitoring.

Industrial

A power plant in Poland

It is estimated that 15% of world-wide water use is industrial. Major industrial users include power plants, which use water for cooling or as a power source (i.e. hydroelectric plants), ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent.

The portion of industrial water usage that is consumptive varies widely, but as a whole is lower than agricultural use.

Household

Drinking water
It is estimated that 15% of world-wide water use is for household purposes. These include drinking water, bathing, cooking, sanitation, and gardening. Basic household water requirements [2] have been estimated by Peter Gleick at around 50 liters per person per day, excluding water for gardens.

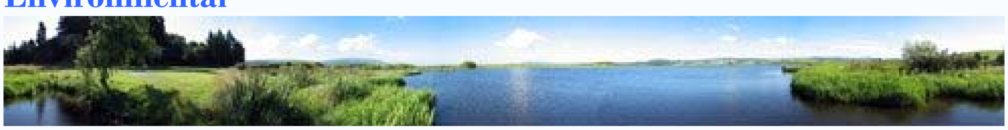
Most household water is treated and returned to surface water systems, with the exception of water used for landscapes. Household water use is therefore less consumptive than agricultural or industrial uses.

Recreation

Whitewater rapids

Water has a lot of recreational value.
Recreational water use is a very small but growing percentage of total water use. Recreational water use is mostly tied to reservoirs. If a reservoir is kept fuller than it would otherwise be for recreation, then the water retained could be categorized as recreational usage. Release of water from a few reservoirs is also timed to enhance whitewater boating, which also could be considered a recreational usage. Other examples are anglers, water skiers, nature enthusiasts and swimmers.
Recreational usage is non-consumptive. However it may reduce the availability of water for other users at specific times and places. For example, water retained in a reservoir to allow boating in the late summer is not available to farmers during the spring planting season. Water released for whitewater rafting may not be available for hydroelectric generation during the time of peak electrical demand.

Environmental

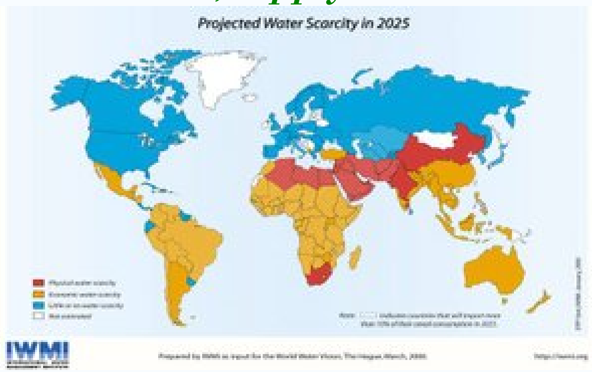


A natural wetland

Explicit environmental water use is also a very small but growing percentage of total water use. Environmental water usage includes artificial wetlands, artificial lakes intended to create wildlife habitat, fish ladders around dams, and water releases from reservoirs timed to help fish spawn.

Like recreational usage, environmental usage is non-consumptive but may reduce the availability of water for other users at specific times and places. For example, water release from a reservoir to help fish spawn may not be available to farms upstream.

World water, supply and distribution



Projected water distribution in 2025

Food and water are two basic human needs. As the picture shows, in 2025, water shortages will be more prevalent among poorer countries where resources are limited and population growth is rapid, such as the Middle East, Africa, and parts of Asia.

By 2025, large urban and peri-urban areas will require new infrastructure to provide safe water and adequate sanitation. This suggests growing conflicts with agricultural water users, who currently consume the majority of the water used by humans.

Irrigation Techniques to Change

Threats to water resources

Assessing future national and regional water resources is a complex business. Our resources are a mixture of river flows; water captured from rivers and stored in reservoirs; and water pumped up from aquifers beneath the ground—essentially a natural reservoir.

Climate change will alter many of the variables in this complex equation. Rainfall will generally be higher, but concentrated in fewer bursts of rain and more in winter. This suggests that more reservoirs may be needed—especially as water from "flash" flooding is less likely to end up in aquifers.

The regional spread of rainfall is also likely to change, with more rain in the north and west but less in the south and east. That might suggest the need for more water transfers between regions.

Water stress in the Southeast may be increased by the greater rates of evaporation of soils and from the surface of reservoirs, and the growing risk of having several years of summer drought in succession. To exacerbate this, the Southeast—and in particular the Thames estuary—is expected to witness rapid development and new housing.

Meanwhile, there will be more demand for water for farm irrigation, garden sprinklers and perhaps even swimming pools. This will change both the absolute demand for water and the seasons when it is needed.
To balance higher demands at times of declining supply might require new, tougher approaches to water conservation and restrictions on use, such as hosepipe bans.

Climate change is also likely to impact on water quality in rivers. High temperatures and low flows provide ideal conditions for the accumulation concentration of pollutants and the growth of toxic algae in rivers and lakes—a process called eutrophication.

As the water in our rivers becomes warmer, many more people may want to swim in them. This could bring rivers within the scope of European rules on the quality of bathing water for the first time, with potentially costly implications for clean-up standards at water treatment works upstream of bathing areas.

Community work in progress. Water well at Kassana Community Health.

In many parts of Africa, communities and elected officials understand the water and sanitation principles the Global Water Forum has already been established as an open, multi-stakeholder participatory process, which builds on the knowledge, experience and input of the global water community and seeks to enable multi-stakeholder participation and dialogue to influence water policy-making at a local, regional, national and global level, thus ensuring better living and respect for the principles of sustainable development to achieve the Millennium Development Goals. The World Water Forums are built on the knowledge and experience of different types of organizations active in the global water policy. It is a venture founded on the principles of collaboration, partnerships and innovation.

Success stories based on local community involvement typifies the determination and commitment of African countries to water and sanitation. The success of a community-driven water initiative in the rural areas showcases local community involvement in water management solutions for Africa which, despite potentially plentiful supplies of water, suffers a critically low rate of access to water and sanitation.

The political will of the various countries in Africa is clearly visible and speaks volumes for the continent's determination to share experiences and find solutions for water problems."
Water supply and sanitation infrastructure are two of Africa's top development strategy priorities, being fundamental to health, social, economic, environmental and gender-related development.

However, one of the main issues Africa has to face is the lack of financial resources to ensure the sustainable exploitation and management of the available water resources.
The direct participation of the communities in the conception and implementation of the development project involves the "working together to solve problems" process - This process nurtures citizens' collective action in partnership with a government committed to decentralization, and involves financial assistance and the supply of equipment by the government and donor agencies.

In Africa it is absolutely vital to provide the rural areas with potable water. Without this arrangement, people would have had to travel kilometers to reach water points, often contaminated with organic waste, and fecal germs and bacteria, causing the spread of diseases such as dysentery, cholera and diarrhea.

The World Bank and the European Union have been providing some African authorities with money to equip and channel the springs, and build adduction networks, establish standpipes and tanks, and to equip all public buildings with a collection system for rainwater.

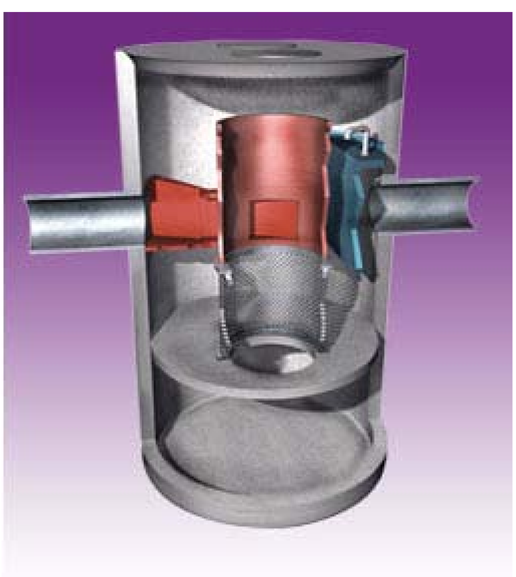
The implementation of the "working together to solve problems" system in the management of drinking water delivery infrastructure provides tangible improvement to the socio-economic situation of the communities and reinforces the participative low currency income available in most of the rural households.

Many solutions have been implemented to remediate this critical potable water availability situation using different innovative equipments.

Here is a listing of just a few of the most advanced water equipments:

Desalination Technology

Today, more than ever, Sea Water is becoming a growing source of water supply as others are diminishing. **ICG** can supply ANY technology which is available in the world today to tackle desalination issues.



Stormwater: Continuous Deflective Separation Inline Unit

These units use patented continuous deflective separation technology to effectively and efficiently remove suspended solids, sediments, trash, debris, oil, and grease, along with floatable materials, from storm water flows.

Recycle and Reverse Osmosis System

This new water recycle and reverse osmosis system can supply up to two high volume, in-line aqueous cleaners with heated, deionized water. The 1012 R/O combines carbon ion exchange technology and reverse osmosis to both purify incoming water and recycle/deionize process water. It is ideal for multiple-shift operations or locations with poor quality tap water.

High purity water is commonly produced by Reverse Osmosis (RO) technology. This energy efficient method of water purification is accomplished by pressurizing incoming potable water and forcing it through a semi-permeable membrane.
An RO will reject approximately 95-99% of all dissolved solids including bacteria, viruses and pyrogens.

RO systems are impacted by incoming water quality (measured in Total Dissolved Solids), water temperature, feed water pressure, and pretreatment.
The RO feed water must be pretreated in order to prevent membrane damage and/or fouling. Proper pretreatment is essential for reliable operation of any RO system and varies based on the nature of the feed water. Common types include media filtration, water softeners, carbon filters, chemical injection systems, and cartridge filters.

Reverse Osmosis Systems

Reverse osmosis is the process in which water is forced by pressure through a semi-permeable membrane. The water forced through has been filtered down to about 1/1000 of a micron. In most cases, an RO system is not needed, but when required RO systems will produce high quality water.

Propeller Pumps

Submersible propeller pumps are generally regarded as the best choice for pumping large volumes of water at relatively low heads.
Typical application areas for this series of pumps include storm-water stations, sewage-treatment plants, land drainage, irrigation, aquaculture and water attractions.
The pumps in this series have capacities ranging from 100 to 5000 liters per second.

Cylindrical Tank

The same great environmental and operational features as our rectangular tanks at a lower price. Cylindrical tank geometry requires less steel and assembly labor than rectangular tanks of the same capacity. Lighter weights and lower prices make these models the ideal choice for installations where visual impact is not a concern.

Continuous Backwash Filtration

This Filter is a continuous backwash, upflow, deep bed, granular media filter. The filter media is cleaned by a simple internal washing system. This unique recycling system requires no supplemental backwash pumps or storage tanks. Energy consumption is low and chemical additives may not be required.

This Filter is capable of handling high levels of suspended solids. This solids loading capacity may eliminate the need for pre-sedimentation or flotation steps in the treatment process. Flexibility is a major feature of this filtration system. The wide range of heights and diameters allows custom design for site and application requirements.

These Filter units are available in above ground package unit and concrete basin design. Single package units are available with feed rates of 14-600 USgpm for smaller flow applications.

High capacity Filters are frequently installed in concrete basins, reducing the cost per square foot of filter area. In concrete installations, the filter cells, each consisting of one or more filter modules, share a common filter bed. Cones at the bottom of each module distribute the sand to the airlift pumps and sand washers. The shape of the sand beds is formed by the surrounding concrete walls.

For more information read the ***White Paper on Challenges of Water Scarcity*** by clicking the following link: Addressing Our Global Water Future
from the Center for Strategic and International Studies (CSIS) / Sandia National Laboratories