Water treatment

Water that has been collected and stored in catchments, or obtained from underground water sources, must be treated to make it fit for human consumption. Once drinking quality water has been used, it is classed as wastewater and piped to a sewage treatment plant where it is recycled, reused or returned to the waterways.

Most stored surface water and most groundwater requires treatment because it may contain:

- algae, bacteria and viruses
- mosquitoes and other insects
- vegetation, roots and branches
- chemicals such as salt, and manganese and iron leached from rocks
- soil and sediment
- pollution
- litter.

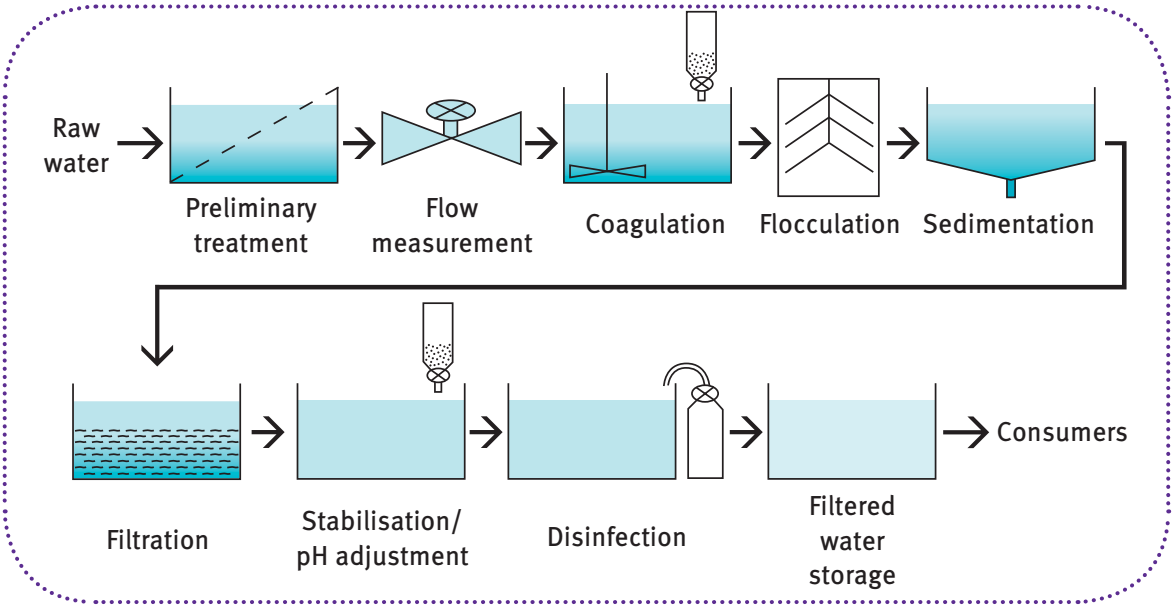
Water is treated to provide consumers with high-quality drinking water, free from objectionable tastes. Treated water minimises:

- risk of dangerous diseases
- exposure to organisms and chemicals that are harmful to health
- corrosion of reticulation systems, household pipes and fittings
- staining of household fixtures such as baths and basins.

Water treatment processes

When water is sourced from groundwater, dams, reservoirs, rivers or weirs, water treatment plants generally use three treatment phases to produce high quality water:

1. Chemicals such as alum are added to the water during the mixing and settling phase. Mud and sediment adhere to the alum and fall to the bottom of the settling tank. The sediment-free water is syphoned off and the sediment removed from the tank.
2. The sediment-free water enters the filtering phase in which the water passes through sand and gravel filters to remove other impurities and particles.
3. Finally a chemical treatment phase, using chlorine to kill any disease-causing germs, is undertaken to prevent the growth of germs in the treated clean water before the water reaches the consumer. The chemical 'balance' of the water might also be adjusted at this stage to prevent corrosion in pipes or the build-up of scale deposits.



In some places, the quality of the raw (source) water is high enough that only the chemical treatment phase is needed. This is often found with groundwater, which has been purified by natural filtration processes within the aquifer.

A reliable and affordable supply of safe drinking water is essential for community health; so too is efficient and safe treatment of wastewater. Because the wastewater system treats sewage, it is quite different—and separate—from the stormwater system in which the water is not treated at all, only piped into local waterways or out to sea.

Sewage is the liquid and solid waste that is discharged from kitchens, laundries, toilets and bathrooms from households and similar industrial facilities. While sewage is 99.9% wastewater, it may also contain toilet waste, paper, micro-organisms, soap, shampoo, chemicals, metal, food scraps and oil. Wastewater must be treated before the water is returned to the environment or recycled because untreated wastewater would have a negative impact on the environment when released.

Water quality

Human health, and the health of our environment, depends on the quality of the water we drink, and of the wastewater that is returned to the environment. Water that enters and leaves the human use cycle must be treated to ensure:

- safe drinking water
- adequate sanitation
- prevention of waterborne disease
- maintenance of healthy fresh water ecosystems.

88% of global health problems are estimated to be caused by water contamination.

(Source: World Health Organisation)

A range of factors in the human use of water affect its quality, particularly the ways in which we manage our waste, both wastewater and landfill. Micro-organisms in waste can contaminate water systems from which drinking water may be sourced. Using or drinking untreated water can result in the spread of waterborne diseases.

Methods of detecting and controlling the large number of potential contaminants of water sources are well developed. Advances in technology provide a wide range of options for treating water and ensuring that water quality matches intended use—for example, domestic, industrial, or agricultural.

Waterborne diseases

Waterborne diseases caused by drinking water containing pathogens kill more than 5000 children worldwide every day. Water treatment technology used in developed countries like Australia provides clean drinking water, reducing risk of contamination and disease. Many developing countries, however, lack access to this technology and often have serious health problems caused by water contamination.

The broad categories of pathogens causing waterborne diseases are:

- viruses—hepatitis A, polio
- bacteria —cholera, dysentery, typhoid, salmonella (food poisoning), trachoma (blindness)
- protozoa—giardiasis
- helminths—intestinal parasites such as hookworm and tapeworm, bilharzia, guinea worm.

Access to water is a basic human need and a fundamental human right, yet over a billion people in the world live without safe, clean water to drink.

(Source: Water Aid Australia)

Treatment of sewage and wastewater

Sewerage pipes from houses and buildings take water and solids from the kitchen and cooking areas, bathroom, toilet and laundry to the nearest sewage treatment plant, where it is treated (generally in three steps) so that the effluent, when returned to the waterways, has minimal adverse effect on water quality and the environment.

»1. Primary treatment

At the treatment plant, the water is passed through screens that catch any solids in the water such as toilet paper, human waste and rubbish. The screened sewage is then put into a primary settling tank where fine solids settle to the bottom of the tank, while oil and grease float to the surface and are removed. At this stage the water is not suitable for return to the environment or for reuse.

»2. Secondary treatment

This is a biological process where a variety of micro-organisms or microbes use the wastes as a food source in controlled situations. The water passes into an anaerobic (no oxygen) zone, then into an anoxic (mostly oxygen-free) zone, and finally into an aerobic zone in which there is excess oxygen.

Almost all nutrients and solids have been removed from the water by the end of the secondary treatment stage. The micro-organisms are easily removed from the water because they stick together to form a sludge which sinks, separating from the treated effluent. These micro-organisms are collected and reused in the sewage treatment process.

The majority of sewage treatment plants discharge effluent to the natural environment at the completion of this secondary process. They must follow strict guidelines and standards and have approval from the Department of Environment and Resource Management. Some sewage treatment plants continue treatment to the tertiary level.

»3. Tertiary treatment

The effluent of the secondary treatment stage contains some residual nutrients including phosphates and nitrates. Tertiary treatment further processes this effluent to the point where it can be safely used for a variety of purposes, including irrigation. With growing use of recycled water, tertiary treatment will be increasingly used. Water processed through tertiary treatment plants may be treated to make it the highest quality, known as purified recycled water (PRW). PRW will be used to supplement drinking water supplies when required.

Sewage treatment process