Water is mankind’s most precious resource.

Stainless steel is an ideal material to handle this element of life.

Let us take you on a guided tour of the known and more obscure applications of this material in a water context.
Water - Globally, a scarce resource

There is a lot of water on earth, around 1.4 million km³, but more than 97% of it is salty. Just 2.5% is available as fresh water.

Of the fresh water, about 70% is frozen in polar icecaps and glaciers. Much of the rest lies deep underground in aquifers, beyond human reach.
Human civilisation essentially depends on less than one percent of the total water on our planet.

Stainless steel plays an increasingly important role in making water available to a growing world population - and keeping the water cycle intact.
A century ago, urban development in the desert was limited to oases and few places with access to fresh water.

Today, desalination technology has made it possible to build big cities on the coast.
There are two simple ways to desalinate sea water:

- By evaporating sea water and condensing the steam. As the salt does not go into the steam, the resulting condensate is perfectly suitable for drinking.

- Reverse osmosis. Sea water is passed through a special membrane that removes the salt.
But these simple desalination methods require sophisticated technology in a large-scale industrial application. Successful desalination requires a corrosion-resistant material that can withstand aggressive seawater and brine.

High-performance stainless steels, including duplex, are the perfect choice.
Sanitisation: Healthy water for everyone

In remote or less developed parts of the world, water may be available, but often it contains germs or chemicals.

Small and rugged stainless steel units are available that can process contaminated ground and surface water and guarantee dependable water supply.
To create white paper it is necessary to bleach the brownish wood fibres. Traditional processes use chlorine. Large amounts of pollutants are released into the wastewater. Sometimes this has disastrous effects on the immediate environment.
Some paper mills have now switched from chlorine to ozone bleaching. A typical medium-sized plant saves 17,000 tonnes of chlorine every year - that is the contents of 700 road tankers. The economic side-effect is a cost saving of about US$ 9m.

Ozone is an extremely aggressive gas, so corrosion-resistant materials are required.

Stainless steel is the standard material for this application.
Stainless steel does more for us than we may know.

Most of the food we eat is prepared, transported and stored in stainless steel equipment.

So is much of our water.
Drinking water is gathered from wells, rivers or lakes using the natural biological cleaning and filtering process of the soil.

However, while this water is perfectly fit for human consumption, potable water can be quite corrosive.

Many waterworks have switched to stainless steel for pipes, process equipment and reservoirs.
Many of our water reservoirs - whether they be underground reservoirs or water towers - are decades old. Being made of concrete, they typically require repair and renewal of coatings at regular intervals - a time-consuming and costly operation. Chipped coatings and bubbles may create hygiene problems.
Welded stainless steel liners provide solutions that are made to last.

Availability of water is enhanced, and the hygienic conditions in the reservoir are improved.
Earthquakes are among the most catastrophic events that shake the world.

Along with the possible collapse of building structures, an interruption to the water supply is one of the greatest dangers to public health after an earthquake.
This is why some countries have systematically introduced free-standing stainless steel water reservoirs.
Stainless steel is extremely ductile, so these reservoirs can stand considerable deformation without breaking or leaking.

It blends well with the urban environment.
Stainless steel is also used for underground pipework, especially the connection between the water mains and houses. Flexible joints enable the supply lines to remain intact during earthquakes.

But even without earthquakes, up to one third of the valuable drinking water is lost through leaks in distribution systems. This is a particular problem in dry countries, where water is precious. Stainless steel helps to minimise these losses.
Stainless Steel - Water for the growing world

Tokyo's Way To Conserve Water

Public Road

Private Land

Stop Valve

Water Meter

Ferrule With Saddle

Flexible Joint Socket

Corrugated Stainless Steel Pipe (S31600)

Water Main

> 0.6 m
Corroding plumbing can be a concern to every homeowner or tenant.

Some materials can also leach noxious substances into water and create serious health problems.
Stainless steel today has successfully made its way in a mass market like plumbing. An innovative joining technique, called press fittings, has enabled stainless steel to become a serious alternative in the field of domestic plumbing. With the help of easy-to-handle hydraulic tools they make joining operations quick and safe.
Depending on codes of practice and regulations, also capillary fittings are successfully used with stainless steel.
The ductility of stainless steel makes it possible to produce flexible metallic tubes. They reduce the number of joints to an absolute minimum.

Bellows-type flexible tubes are a solution that has been derived from connectors in the process industry.
Composite tubes are made of an ultra thin stainless steel tube surrounded by a thicker outer polymer layer. The stainless steel provides hygiene, durability and safety. The polymer protects the inner layer against damage and wear.
Hot water must have drinking water quality - despite the elevated temperatures. These temperatures can create favourable conditions for bacterial growth. It is important to avoid rough surfaces, corroded areas and cracks, where bacteria could breed. Some leading manufacturers use stainless steel for the water contact surfaces of their hot water boilers.
Room heating absorbs a large proportion of our non-renewable fossil fuel resources. With the sun being abundantly available, stainless steel solar panels can be used to heat water for domestic purposes.
Solar Panels

The systems depend on black-chromated stainless steel. Specially embossed sheets are welded into a sandwich to form channels through which the water can flow. The black surface traps the heat so efficiently that the system even works in less sunny climates.
Solar Panels

The solar panels also function as roofing elements. The absence of a conventional roof reduces costs and makes solar energy even more economical.

Other systems can easily be added to existing roofs.
Stainless steel rooftop tanks provide potable hot water. They are used in dry climates and other environments where a consistent level of pressure in the public system cannot always be guaranteed.
In some industrial processes, hygiene and purity requirements on water may exceed the usual drinking water standards, for example in the food processing and pharmaceutical industries.

Ultra-violet (UV) treatment of water efficiently neutralises germs. Stainless steel is ideal for hygienically demanding applications. It is the obvious material for this process.
Stainless steel is used for lining swimming pools - both in the erection of new pools and in the refurbishment of existing ones.

It is often the most economical long-term solution as it avoids the hygiene and cleaning problems associated with mortar joints.
In climates with cold winters, frost damage is avoided. Erection work can even be carried out off-season, when it would be too cold to work with conventional tiles.
Stainless steel liners are also used for indoor swimming pools. Usual grades are a perfect choice for applications in contact with the pool water, like pool liners and accessories.

The atmosphere above the pool surface contains chlorides. Repeated cycles of condensation and drying may lead to extreme levels of chloride concentrations on structural components inaccessible for cleaning, for example fasteners for suspended ceilings.

Even for these extreme corrosive conditions, suitable high-alloy stainless steels are available. Specialist advice should be sought to select a suitable grade.
Sewage treatment

The composition of sewage may vary strongly. Along with corrosion, abrasion and biofilms affect the materials used in this harsh environment. Many waste water plants now include stainless steel for mechanical separators, pipework and submerged components to ensure a long service life and minimise downtime.
Special techniques are often used to clean industrial waste water before it is returned to the natural cycle. Ozone and UV treatment are current options.

Normal oxygen naturally occurs in molecules made up of two atoms. Ozone consists of three oxygen atoms per molecule. Ozone is unstable and tends to disintegrate quickly into \( \text{O}_2 \), releasing a “vagabond” oxygen atom. This atom is extremely reactive and aggressively oxydises organic substances. This property is used to remove dangerous contaminations from water.
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As in the case of potable water, UV radiation can be used on waste water to remove germs.

Stainless steel withstands both the aggressive waste waters and ozone.
The sewage systems in our cities are typically decades old, many of them half a century or more. In an innercity environment, the renewal of defective sewage pipes can be a problem, generating unacceptable traffic disruption.

Historical urban sites with narrow roads and sensitive historic buildings in the neighbourhood can make the situation even more difficult. Fortunately, stainless steel provides a solution.

The road is only dug up in a few - normally unobtrusive - places. Short pieces of stainless steel pipe are joined by orbital welding and pushed into the existing leaking pipe. With a minimum of disturbance for the local population, an efficient and lasting repair solution is applied.
Sources of further information

There is a lot that stainless steel can do to ensure a safe supply of drinking water and the functionality of the water cycle. More detailed information is available from the stainless steel development associations that exist around the world.

Their advisors can provide you with information about stainless steel equipment suppliers, grades, fabrication techniques and regulatory requirements.

More information can also be found on worldstainless.org
### Stainless Steel - Water for the growing world

#### Credits

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