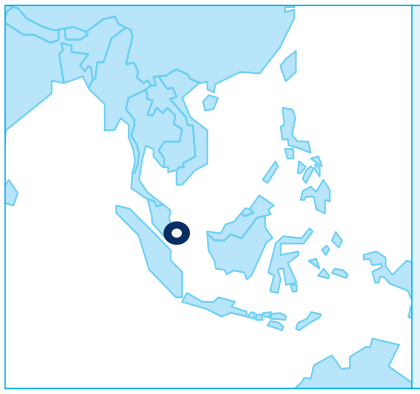
City Water Stories:
Singapore

the international water association



Population
- Current 5.61 million.
- 1.3% population growth in 2016.

Geography
- Island city-state, South East Asia.
- Area: 719.1 km^2.

Main challenges
- No natural water resources.
- Rising demand for water.
- Sustainability.

Main solutions
- Source diversification: NEWater and Desalinated water.
- Water demand management.
- Investing in research and technology.

Urban Water Management

With limited land to collect and store rainwater, Singapore faced drought, floods and water pollution in the early years of nation building. These challenges inspired Singapore to strategize and seek innovative ideas, develop capabilities and secure a sustainable supply of water.

Currently, Singapore has built a robust and diversified supply of water from 4 different sources – water from local catchments, imported water, NEWater (high-grade reclaimed water) and desalinated water. Both NEWater and desalinated water have allowed Singapore to be more resilient towards weather variability.

Water demand in Singapore is currently about 430 million gallons a day (mgd), with homes consuming 45% and the non-domestic sector taking up the rest. By 2060, total water demand could almost double, with the non-domestic sector accounting for about 70%. By then, NEWater and desalination will meet up to 85% of Singapore's future water demand.

The nation's tap water is well within the World Health Organization's drinking water guidelines, making it suitable for drinking directly from the tap without further filtration.

PUB, Singapore's National Water Agency, also believes everyone in Singapore has a stake in water – as a necessary resource, an economic asset and an environmental treasure.

Singapore's Water Strategy

Through the years, PUB has embarked on an integrated, effective and cost-efficient way to meet the nation's water needs with investments in research and technology to treat, recycle and supply water. Today, Singapore is internationally recognised as a model city for water management and an emerging Global Hydrohub – a leading centre for business opportunities and expertise in water technologies.

PUB's holistic approach to water management can be refined into three key strategies:

1. Collect Every Drop: As a city-state with limited land for rainwater collection, it is important to make every drop of rain count. PUB plans to increase Singapore's water catchment from two-thirds to 90% of the nation's land area. With separate rainwater and used water collection systems, good land use planning policies and strong environmental controls, the collected rainwater is protected from pollution.

2. Reuse water endlessly: Recycling water is the most sustainable and cost-effective way to increase Singapore's water supply. To increase the recycling rate, PUB plans to (i) Reclaim used water from industrial sources for non-potable use; (ii) Increase water recovery from water reclamation and NEWater treatment; and (iii) Reduce losses from PUB's supply by encouraging seafront companies to use seawater for cooling processes.

3. Desalinate more seawater: As an island surrounded by the sea, desalination is a natural option for Singapore. PUB will continue investing in R&D to further improve the economic viability of desalinating seawater.

Case Study: NEWater

NEWater, a pillar of Singapore's water sustainability strategy, is high-grade reclaimed water. Produced from treated used water that is further purified using advanced membrane technologies and ultra-violet disinfection, it is ultra-clean and safe to drink. NEWater has passed more than 150,000 scientific tests and is well within World Health Organisation requirements.

Twice a year, NEWater undergoes rigorous audit processes by an external audit panel comprising international experts in engineering, water chemistry, toxicology and microbiology. This high-grade reclaimed water has consistently been awarded top marks for its high quality, safety and for exceeding international standards.

Singapore's Journey to Become a Water-Wise City

A closer look at how Singapore is satisfying the IWA Principles for Water-Wise Cities

1 Regenerative Water Services

Replenish Waterbodies & their Ecosystems

- Capturing rainfall & injection of NEWater into reservoirs to augment yield.

Reduce the Amount of Water & Energy Used

- Water Conservation Awareness Programme.
- Reduce Unaccounted-For-Water.
- Deep Tunnel Sewerage System.

Reuse, Recover, Recycle

- NEWater, (high-grade reclaimed water) from advanced purification of treated used water.
- Reclaiming bio-gas from wastewater treatment & converting it to produce energy for the waste water treatment plants.

Apply a Systemic Approach for Integration with Other Urban Services

- Co-locating a Water Reclamation Plant with an Integrated Waste Management Facility.

Increase the Modularity of Systems and Ensure Multiple Options

- Four National Taps: Local catchment water, Imported water, NEWater, Desalinated water with multiple plants and conveyance options.

2 Water Sensitive Urban Design

Enable Regenerative Water Services

- Encouraging rain gardens, swales in new & existing developments that are being upgraded for storm water treatment.

Design Urban Spaces to Reduce Flood Risks

- "Source-Pathway-Receptor" approach to enhance flood protection.
- Code of Practice on Surface Water Drainage.

Enhance Liveability with Visible Water

- Active, Beautiful, Clean Waters (ABC Waters) Programme developed by PUB - transforming drains, canals & reservoirs into community spaces in partnership with private developers and public agencies.

Modify & Adapt Urban Materials to Minimise Environmental Impact

- The National Environment Agency (NEA) evaluates all pollution impacts from all proposed development. PUB works with NEA to ensure minimum environmental impact.
- Earth Control Measures (ECM) guidelines to minimise silt runoff from construction sites into drainage system.

3 Basin Connected Cities

Plan to Secure Water Resources & Mitigate Drought

- Building infrastructure ahead of demand, and expanding NEWater and desalination capacities in the long run.

Protect the Quality of Water Resources

- Designated protected catchment area, and regulations to minimise risks of pollution to water supply sources.
- Separate systems to convey rainwater and used water.

Prepare for Extreme Events

- Marina Barrage, a barrage at the heart of the city, protects the upstream low lying land areas during heavy rainfall coupled with high tide.
- "Source-Pathway-Receptor" approach to strengthen overall flood resilience.

4 Water-Wise Communities

Empowered Citizens

- SGfuture engagement series.
- "Friends of Water" programme.

Professionals Aware of Water Co-Benefits

- PUB holds regular dialogues with Professional Bodies e.g. the Singapore Institute of Architects, Institute of Engineers Singapore and Professional Engineers Board, to bring them on board and at the same time gather feedback from the practitioners.

Transdisciplinary Planning Teams

- Urban Redevelopment Authority (URA).

Policy Makers Enabling Water-Wise Action

- Strong political will and policy direction.

Leaders that Engage and Engender Trust

- Leaders provide progressive vision and governance structure to enable sustainable urban water management through coordination and integration.

5 Building Blocks for Singapore on the journey to water-wise cities

Vision

Ensuring an efficient, adequate & sustainable supply of water.

Governance

All aspects of water management handled by one Government agency – PUB, Singapore's national water agency, and under the Ministry of Environment and Water Resources. This allows optimisation of the whole system.

URA as the central planning authority that integrates urban planning across the various sectors of water, waste, transport , architecture and landscaping.

Knowledge & Capacity

Enhance local and international knowledge sharing and capacity building with the launch of the Singapore Water Academy.

PUB organizes the Singapore International Water Week, a global platform to share and co-create innovative water solutions.

Planning Tools

Water Master Plan, long term plan to ensure water supply is sufficient for projected demands.

URA's Master Plan translates the long term strategies of the Concept Plan, integrating water considerations.

Implementation Tools

Pricing water to recover both the full cost of its production and supply.

Various legislation and schemes to encourage water conservation.

People-Private-Public approach.

Continued investments in the future, through research funding from the National Research Foundation.

Build a strong industry ecosystem to support PUB's mission.