



Water for All: Conserve, Value, Enjoy



SINGAPORE
QUALITY
AWARD

for business excellence

2008 WINNER



2008 SQA Application Report Executive Summary



Contents

Foreword

Organisational Profile	01 - 05
Category 1: Leadership	06 - 10
Category 2: Planning	11 - 13
Category 3: Information	14 - 16
Category 4: People	17 - 23
Category 5: Processes	24 - 28
Category 6: Customers	29 - 35
Category 7: Results	36 - 50
Key Awards	51 - 52
Abbreviations	53 - 54



FOREWORD



PUB, Singapore's national water agency, plans, manages and safeguards Singapore's water resources. Our mission is to ensure an efficient, adequate and sustainable supply of water. From rainwater collection to used water treatment, the entire water loop is managed by PUB. By closing the water loop, PUB has put in place the Four National Taps, a

long term strategy that ensures Singaporeans will have a sustainable supply of water for generations to come.

Over the last 45 years, PUB has helped transform Singapore from a water scarce nation to one where countries worldwide now look to for water solutions. Thanks to the foresight of our leaders, good water management and the effective use of technology, Singapore is fast being recognised internationally as a model city in sustainable water management. As a testimony to this, we were proud to be conferred the prestigious Stockholm Industry Water Award in 2007.

At a time when the world is battling water shortages, floods and global warming, there is an urgent need for a global platform for stakeholders to come together to face the global water challenges. The inaugural Singapore International Water Week (SIWW) and the Lee Kuan Yew Water Prize that PUB organised in June 08 made a resounding impact. The event attracted 8,500 participants from 79 countries. SIWW 2009 with the theme Sustainable Cities – Infrastructure and Technologies for Water which promises to be even bigger and better, will help turn Singapore into a global hub for water solutions.

On the local front, through our Active, Beautiful and Clean Waters programme, PUB takes a public, private and people (3P) partnership approach to encourage the community to value and enjoy water. The ABC Waters programme is one that excites us at PUB and I hope all Singaporeans too, as it makes water a feature of our cityscape, brings waterfront living to the heartlands and transforms Singapore into a City of Gardens and Water.

Our latest icon, the Marina Barrage, which will be opened to the public in November, is a good example of our integrated approach to water management. Built across the Marina Channel, the Marina Barrage is a dam that forms Singapore's first reservoir in the city, bringing along with it three benefits: water supply, flood control and a host of recreational possibilities, turning the downtown area into a water "piazza".

Winning the SQA marks a significant milestone for PUB. It is national recognition for the many years of work that has gone into building an integrated water resources management system for Singapore. The Award serves to further inspire our staff to continue their pursuit of excellence.

We are proud to share with you the learning experience of our SQA journey through this summary SQA application report. We have outlined our strategies, systems and processes that have worked for PUB and we hope that you will find some of them applicable for your organisation too.

Thank you.

KHOO TENG CHYE
CHIEF EXECUTIVE, PUB





ORGANISATIONAL PROFILE

"The Story of Singapore and water is a story of a modern miracle...in the 1970's and 1980's, if I had been asked whether Singapore would achieve self-sufficiency in water, I would have said "impossible". But the impossible has happened. Singapore has moved towards achieving self-sufficiency at a time when many experts believe that water scarcity will be a major challenge for the world...we can justifiably develop the brand: Singapore: the water city."

Kishore Mahbubani

*Dean and Professor at the Lee Kuan Yew School of Public Policy
National University of Singapore*

ORGANISATIONAL PROFILE

ORGANISATIONAL DESCRIPTION

PUB is the national water agency of Singapore. It was formed on 1 May 1963 as a statutory authority to take over the production and supply of electricity, water and piped gas from the then City Council. On 1 Oct 1995, PUB's electricity and piped gas undertakings were corporatised to Singapore Power Ltd, with the intent of liberalising the electricity market. PUB remained the water authority and was also reconstituted to take on the new role of regulating the electricity and piped gas industries.

PUB's role changed again on 1 April 2001, with the transfer of the regulatory role to the newly-formed Energy Market Authority. At the same time, the Sewerage and Drainage Departments from the Ministry of the Environment became part of PUB, reflecting the completely integrated approach by which water is managed in Singapore.

The integrated approach is important because water is such a strategic resource to Singapore. This is not because the island lacks rainfall, but because its size - 700 sq km - is a limiting factor in collecting and storing rainwater. With a population of 4.7 million, competing uses of land for housing, businesses, roads, airports, industry and many others, further limit the space available for water catchments and reservoirs.

Under the terms of 2 water agreements with Malaysia signed in 1961 and 1962, Singapore has been importing water from Johor. However, the rapid urbanisation and population boom in the 1960s and 1970s resulted in water shortages, with largescale water rationing in 1963, frequent floods during the monsoon season, and badly polluted rivers. Water quickly became a national security issue. Consequently, policies and programmes were put in place to tackle the basic problem of water scarcity.

PUB soon realised that dependence on imported water was not something that could be sustained as Singapore continued to grow. We therefore began to explore alternative sources of water, such as desalination. Although such alternatives proved too costly at the time, the seeds were sown for decades of water research which would eventually bear fruit. The need to be self-sufficient in water was reinforced by ups and downs in Singapore's relationship with Malaysia. Relations hit a trough in 2002 when talks on new water sources and pricing, being negotiated as part of a package of bilateral agreements, broke down. This spurred a renewed focus on ensuring that Singapore could sustain its growth indefinitely into the future without relying on imported water. Such sustainability was achieved by the beginning of the 21st century thanks to 2 major thrusts: technological innovations and institutional restructuring to enable the "closing of the water loop" (see Figure 1).

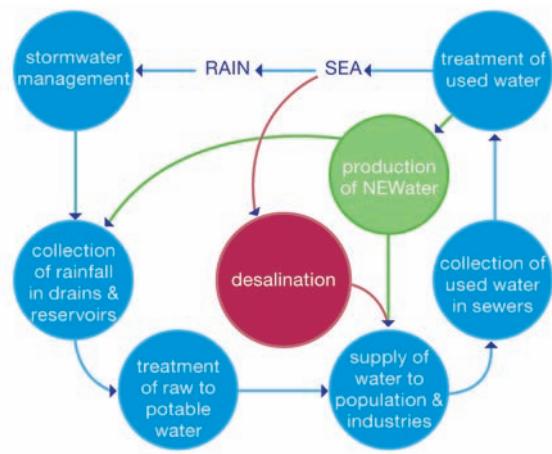


Figure 1: The Water Loop

"Closing the water loop" was an expression coined in 2001, when PUB was merged with the Sewerage and Drainage Departments. It describes the integrated approach by which PUB manages the whole water cycle as a system: from the sourcing of water by rainwater collection in reservoirs, desalination or import; to the treatment and distribution of drinking water; and the collection of used water, which is then treated and discharged, or reclaimed to produce NEWater. Technology was key in closing the water loop and to producing recycled water on a scale unprecedented anywhere in the world.

This holistic approach to water resource management has earned PUB many accolades, including the prestigious Stockholm Industry Water Award 2007. Mr Lars Gunnarsson, Chairman of the Award Committee, referred to PUB's approach as "an exemplary model of integrated water management in a framework of good policy and innovative engineering."

With the 4 National Taps (Local Catchment Water, Imported Water, NEWater and Desalinated Water) Strategy in place, PUB has succeeded in ensuring a diversified and sustainable supply of water for Singapore.



Figure 2: The 4 National Taps Strategy

We have now entered a new phase in water management. To continue providing water for all, PUB is calling on all Singaporeans to share in ownership of our waters: to play a part in conserving water, valuing water by keeping water catchments and waterways clean, and building a relationship with water so that everyone can enjoy the water resources.

This is encapsulated in PUB's tagline: "Water for All – Conserve, Value, Enjoy".

1. ORGANISATIONAL ENVIRONMENT

Every day, across Singapore, in homes, schools, offices and industries, 4.7 million people go about their lives knowing that a turn of the tap brings enough clean, safe water for all their needs. Due to PUB's careful planning, sound watershed management, effective water treatment processes and continued investments in Research & Development (R&D), Singaporeans have been enjoying good quality drinking water for the last four decades. Our tap water is well within the World Health Organization (WHO) drinking water guidelines and is suitable for drinking without any further filtration.

PRODUCTS AND SERVICES

The products and services serving our customers are listed in Figure 3.

CUSTOMERS	PRODUCTS & SERVICES
WATER FOR ALL	<ul style="list-style-type: none">• Water Supply• Used Water• Drainage
CONSERVE, VALUE, ENJOY	<ul style="list-style-type: none">• Water Conservation Programme• Active, Beautiful, Clean (ABC) Waters Programme

Figure 3: PUB's Product & Services

OUR VISION AND MISSION

PUB's Mission is "To ensure an efficient, adequate and sustainable supply of water". To realise our Mission, PUB aligns the entire organisation to keep a constant focus on its 5 Strategic Thrusts (Figure 4).

MISSION	
To ensure an efficient, adequate and sustainable supply of water.	
VISION	
Water for All: Conserve, Value, Enjoy	
5 STRATEGIC THRUSTS	
Water for All	Water supply strategy (4 National Taps Strategy)
Conserve, Value, Enjoy	Water demand strategy including 3P approach (i.e. getting our 3P partners to use water wisely, keep our waters clean and use them for recreation)
Competence	Getting our people to be technically competent through investing in training, technology and creating an environment that promotes innovation
Connections	Connecting with our customers, community, companies and other countries so that they understand and work with us
Creating Value	Making sure that we add value to our work and ensure sustainability of our water resources in the most cost-effective way (i.e. essence of Price-Minus Strategy)

Figure 4: PUB's Mission, Vision, Values & 5 Strategic Thrusts

We have had good results in ensuring an efficient and adequate supply of water. Sustaining the water supply, however, calls for more than water conservation programmes. There needs to be a shared responsibility to keep water clean. Accordingly, PUB adopts a holistic 3P (Public, Private & People sectors) approach. This is encapsulated in PUB's tagline, "Water For All: Conserve, Value & Enjoy" as shown in Figure 5.

- "Water for All" represents our commitment to ensure the robustness, reliability and sustainability of our water supply.
- "Conserve, Value, Enjoy" projects PUB's 3P approach in reaching out to our stakeholders and involving the community in our work.

The tagline is also PUB's Vision.



Figure 5: PUB's Tagline

OUR VALUES

PUB's Values are essential and enduring tenets. 5 Values have been distilled and guide our actions as we journey towards achieving our Vision. The 5 Values are captured in the acronym "VOICE" as shown in Figure 6.

VALUES (OR VOICE)	
VALUE	We value our environment, our water resources and our people; and we ensure value for money in everything we do.
CONSCIOUS	We do not merely represent PUB. Together, we are the PUB.
OWNERSHIP	We relentlessly pursue knowledge and innovation to create value.
INNOVATION	Through respect and a positive work environment, we motivate our staff to develop to their highest potential.
CARING	We provide service to our customers with professionalism and integrity.
EXCELLENCE	We provide service to our customers with professionalism and integrity.

Figure 6: PUB's Values – VOICE

EMPLOYEE PROFILE

The total number of employees was 3,117 as at 31 January 2008, comprising the following:

Employees	Profile
Division I (28%)	Graduate staff, Principal Technical Officers, Senior Technical Officers, Management Support Officers
Division II (27%)	Technical Officers, Senior Technicians, Senior Corporate Support Officers
Division III (35%)	Higher Technicians, Technicians, Corporate Support Officers
Division IV (10%)	Assistant Technicians, Office Attendants

Figure 7: Profile of Employees

MAJOR EQUIPMENT AND FACILITIES

PUB is responsible for Singapore's 14 impounding reservoirs and 16 stormwater collection ponds, all of which collect raw water. The 3-in-1 Marina Reservoir, to be ready by 2009, will be our 15th reservoir. The source of our imported water is rivers in Johor. Raw water is treated at PUB's waterworks – 6 waterworks in Singapore and 3 waterworks in Johor. Treated water is then supplied to our customers through a dense network of 5,313 km pipelines and 13 service reservoirs.

Used water is collected through the sewerage reticulation network, comprising 3,250 km of sewers and 96 pumping stations with 180 km of pumping mains. PUB is currently developing the Deep Tunnel Sewerage System to intercept used water from existing sewers and divert them to the tunnels, thereby phasing out the pumping stations. The first phase of 48 km of tunnels has been completed and will be fully operational by end 2008. Used water is treated in 6 Water Reclamation Plants that are covered and equipped with odour treatment facilities. There are 4 NEWater factories in Singapore, with a 5th to be constructed in Changi by 2010. Another major facility is the WaterHub, which brings together technology, learning and networking for the water industry. It provides facilities to set up international R&D centres, a venue for training local and international water industry workers, and a networking platform to promote the capabilities and technological expertise of Singapore's water industry.

MAJOR TECHNOLOGIES

PUB leverages technology in virtually every aspect of its management and operations. For example:

a) Potable Water

The Marina Barrage at the new 3-in-1 Marina Reservoir acts as a tidal barrier. It prevents high tides from causing floods in low-lying areas inland, and creates a body of freshwater behind it. The first in the world, it has won the ASEAN Outstanding Engineering Achievement Award 2007 and the IES Prestigious Engineering Achievement Award 2007. Apart from the Marina Barrage, our waterworks feature the IT-based SCADA system, which centrally monitors and controls the treatment processes.

b) NEWater

PUB is among the first in the world to treat used water using advanced reverse osmosis membrane technology. The end-

product, NEWater, is one of Singapore's most strategic innovations.

c) Used Water

The Deep Tunnel Sewerage System, which will meet Singapore's needs for handling used water throughout the 21st century, was conferred both the ASEAN outstanding Engineering Achievement Award 2005 and the IES Prestigious Engineering Achievement Award 2005. The Water Reclamation Plants also use IT-based SCADA for central monitoring and control of used water treatment.

d) Desalinated Water

This 4th National Tap is produced using seawater reverse osmosis membrane technology. The advent of membrane technology has allowed the desalination of seawater at a much lower cost.

PUB makes strategic, continual and substantial investments in R&D. This lets us take advantage of technological breakthroughs to augment and improve our water supply. The Technology and Water Quality Office in PUB ensures that Singapore will always have a safe, sustainable and continuous water supply. Test-bedding, demonstration plants and pilot plants are in the pipeline to bring better and more sophisticated technologies onstream.

As water increasingly comes from non-conventional sources, there is a need to monitor and analyse its quality in an integrated manner, so that the water we produce is always safe for consumption. PUB's water quality data management system serves as a central repository for all water quality data, and allows a structured organisation of data with analytical, trending and reporting capabilities. Six sigma tools are used to interpret data and reduce process variations. These tools are built into the Integrated Water Management System to enable seamless analysis and reporting of key information for operators and management.

HEALTH, SAFETY, SECURITY AND EMERGENCY PREPAREDNESS

Because water is a critical and strategic national resource, PUB is committed to ensuring the continual protective security and emergency preparedness of the entire national water infrastructure. We are also committed to ensuring occupational health and a safe working environment for our employees at all times. The Health, Safety, Security and Emergency Preparedness unit oversees these.

REGULATORY ENVIRONMENT

Being part of the Singapore Civil Service, PUB abides by the policies of Government Instruction Manuals (IMs). We are governed by relevant legislation including the Public Utilities Act and Sewerage and Drainage Act.

2. ORGANISATIONAL RELATIONSHIPS

RELATIONSHIP WITH PARENT ORGANISATION

We are one of the statutory boards under the Ministry of Environment and Water Resources. We report directly to the Ministry, which provides policy guidance for our overall operations and administration.

RELATIONSHIP WITH CUSTOMERS

In relation to Figure 3, our customers can be classified into 2 categories:

a) Water For All Customers

This most important segment of customers includes all 1.2 million households (93%) and businesses (7%) that use our products and services in the water loop.

b) Conserve, Value, Enjoy Customers

PUB aims to influence this segment of customers to conserve water, value our waters by keeping the catchments clean, and enjoy our waters. While they do not directly contribute to our revenue, engaging these customers contributes to our ability to serve our Water For All customers. For instance, by keeping catchments clean, Conserve, Value, Enjoy customers help us to achieve a sustainable water supply.

RELATIONSHIP WITH PARTNERS

Likewise, PUB's partners are categorised as:

a) Water For All Partners

This group of partners provides engineering services and solutions. They also work with us on technological R&D.

b) Conserve, Value, Enjoy Partners

PUB adopts a 3P approach to engage these partners in raising awareness of the importance of water and to take joint ownership of our water resource. This group also promotes water messages.

c) Competence, Connections and Creating Value Partners

This group of partners helps to build up PUB's internal competence, strengthen our network around the world and create value in terms of cost efficiency and services.

RELATIONSHIP WITH SUPPLIERS

Suppliers play a crucial role in intensifying, developing and expanding the national water management infrastructure to continue ensuring water for all. They include consultants and contractors implementing our projects.

3. ORGANISATIONAL CHALLENGES

COMPETITIVE ENVIRONMENT

Although PUB has tackled the basics to ensure Singapore's viability with a clean and adequate water supply, comprehensive programmes and reviews still need to be planned and executed to ensure sustainability.

With the developments of major national water projects such as NEWater, Deep Tunnel Sewerage System and Marina Barrage, a thriving water industry eco-system of more than 50 international and local companies was created. PUB collaborates closely with the water industry to develop water solutions to meet Singapore's future water challenges. In addition, PUB also nurtures and facilitates local based water companies in competing for a share in the growing global water market.

PUB has won a number of awards, the most significant being the Stockholm Industry Water Award in 2007, which is the equivalent of the Nobel Prize for the water industry. Under Category 7.2b Market Results, PUB shows good results in many of its KPIs when compared with overseas utilities companies. It is important that PUB continually and proactively improves its services through innovation, comparative studies and benchmarking. Internet scanning of available comparisons and conducting of benchmarking

studies with other water utilities show us how we fare against other similar utilities. All water utilities companies, big or small, offer valuable lessons for improving our processes.

We participate actively in both local and international forums, sharing knowledge and best practices with partners and overseas counterparts. For instance, PUB has been much sought after internationally to share experiences with NEWater and Integrated Water Resources Management. We also collaborate with many renowned research institutes worldwide, including Delft-Hydraulics, Veolia Water, Global Water Research Coalition, and the American Water Works Association.

ORGANISATIONAL DIRECTIONS

1. WATER FOR ALL

With the 4 National Taps firmly in place and with the aim of reducing dependency on imported water, PUB continues to increase its water supply through the expansion of local catchment and increasing NEWater production capacity. Desalination continues to be an option to meet future needs.

PUB recognises that it is important not just to supply enough water but also to keep it affordable. PUB has maintained the price of potable water since 2000 despite the rising cost of fuel, materials and treatment of more urbanised catchment water. We have also been able to reduce NEWater prices because of constant improvements in efficiency.

As Singapore expands its water catchment area from half to two thirds of the island, the catchment will be more urbanised, bringing in poorer quality water that costs more to treat. It is thus critical to keep these areas clean, since all water that flows into our reservoirs is harvested for drinking. At the same time, technological innovations are vital to curbing, if not reducing, the cost of water treatment.

2. CONSERVE, VALUE, ENJOY

The Water Conservation and ABC Waters Programmes continue to be the twin approaches under Conserve, Value, Enjoy.

The Water Efficient Homes and Water Efficient Buildings are flagship programmes to encourage water conservation. A new initiative that targets industries called the 10% Challenge was also launched in March 2008.

Instead of a traditional "hands-off" approach, PUB has adopted a 3P strategy – involving the Public, Private and People Sectors – to encourage environmental stewardship. The Active, Beautiful, Clean Waters Programme epitomises this, aiming to transform utilitarian drains into beautiful focal points, like playgrounds and concert venues, for communities to enjoy. Through enjoyment, it is hoped Singaporeans will take greater ownership of and, in the long term, cherish and protect this precious resource.

3. COMPETENCE, CONNECTIONS AND CREATING VALUE

In June 2008, PUB organised the first Singapore International Water Week, an annual event that will firmly establish Singapore's position as the world's platform for water solutions. The Water Week, attended by 8,500 participants from 79 countries, is anchored by five

international events, the highlight being the prestigious Lee Kuan Yew Water Prize. The Water Week which is a multi-agency effort, aims to create a platform for ministers, senior government officials, top industry leaders, leading water specialists and practitioners to meet and discuss policies, business solutions and water technologies. It focuses on best practices, successful case studies and practical applications of water technologies.

STRATEGIC CHALLENGES

As a forward-looking and highly adaptive organisation, we look beyond the 3-year horizon to identify possible challenges and driving forces that could strategically impact us in the long run.

1. SECURITY THREATS

The arrest of Jemaah Islamiyah members in Singapore in 2001 revealed that water pipelines at the Singapore-Johor causeway were among targets that this terrorist group was preparing to attack. It is crucial that PUB maintains preparedness and vigilance. The formation of the Health, Safety, Security and Emergency Preparedness unit is a strong commitment from PUB to ensure protection of key water installations and pipes.

2. BEYOND OUR MISSION:

SINGAPORE – THE GLOBAL HYDROHUB

Some 40 years ago, water was a strategic vulnerability; its shortage threatened the nation's very survival. Today, water has been turned into a strategic strength, a new growth industry for which Singapore is uniquely positioned to capitalise on. Singapore is now developing a new economic cluster around water, as it has done successfully for electronics, petrochemicals and biopharmaceuticals.

As environmental consciousness reaches new heights around the world, countries are increasingly seeking sustainable solutions to water management issues. The global water industry is currently estimated to be worth S\$400 billion. Singapore aims to enlarge its share of the global water market to 3% over the next decade. PUB is actively attracting major global water players to use Singapore as a launch-pad for the region, as well as a base for testbedding and pilot projects for new technologies. Our efforts will continue to be aligned to the vision of transforming Singapore into the Global Hydrohub.