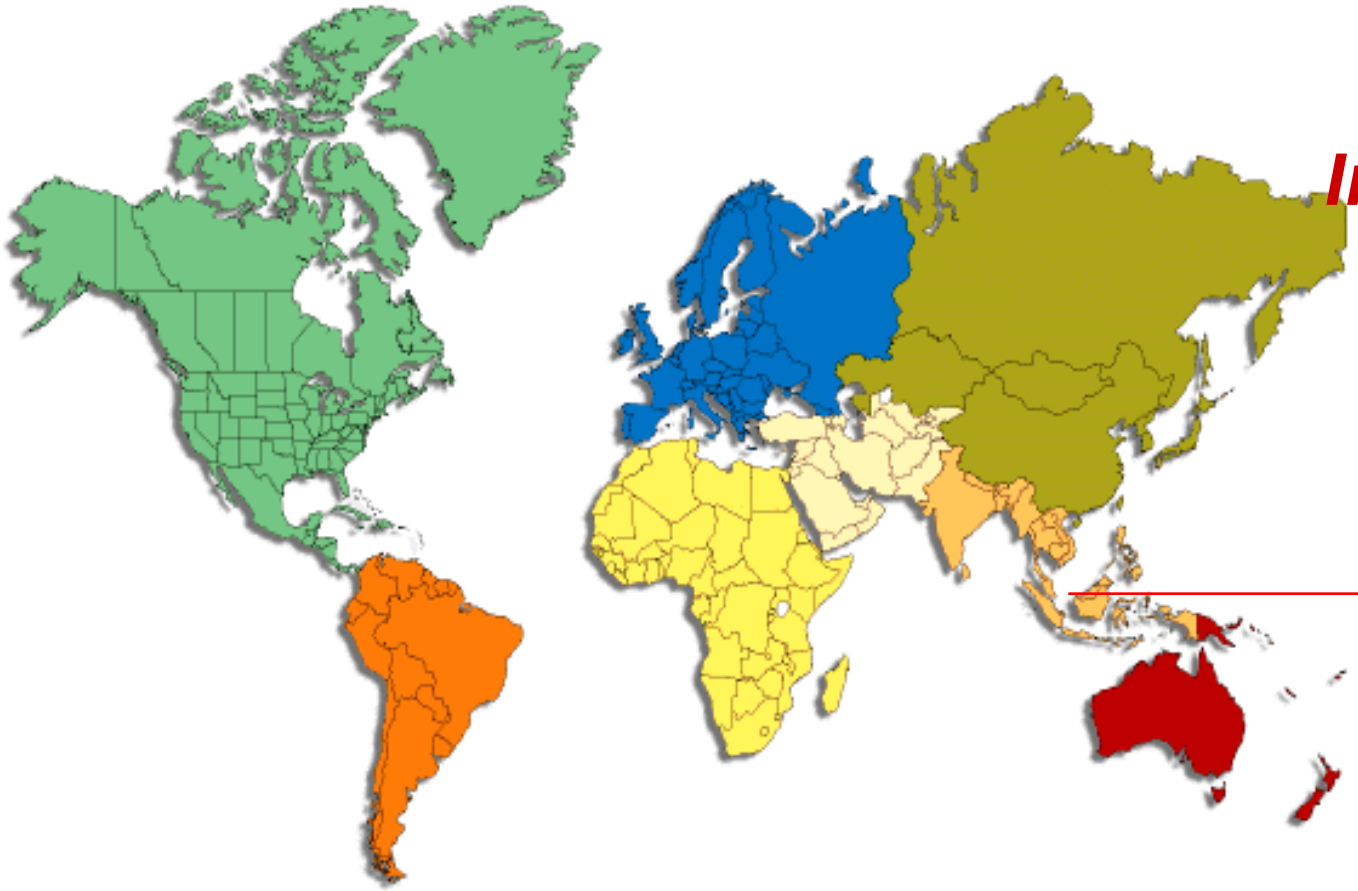
Water for All
Conserve, Value, Enjoy
PUB



Overview of Singapore Water Management

Mr Tay Teck Kiang
Deputy Director (Water Supply Network)

Country Information





Singapore

Land Area	**710 km^2**
Population	**5.18 mil (Jun 11)**
Average Annual Rainfall	**2,400 mm**
Average Water Demand	**1.73 mil m^3/day**

PUB : Part of Singapore's MEWR Family

Ministry of the Environment and Water Resources

To deliver and sustain a clean and healthy environment and water resources for all in Singapore.

National Environment Agency

To ensure a sustainable quality environment in Singapore

- ***Clean Land***
- ***Clean Air***
- ***Public Health***

PUB

Water for All: Conserve, Value, Enjoy

To ensure an efficient, adequate and sustainable supply of water

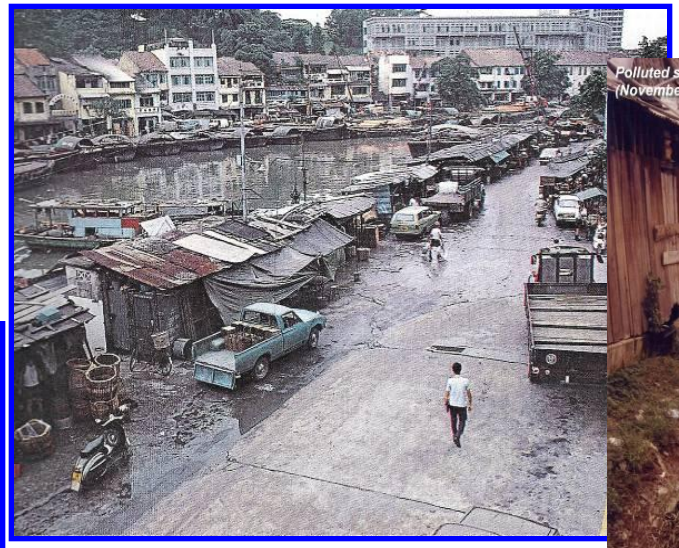
- ***Water Supply***
- ***Used Water***
- ***Drainage***

Early Days of Singapore 1950s -Population = 1m, Demand = 142,000m3/d





Scarce water resources



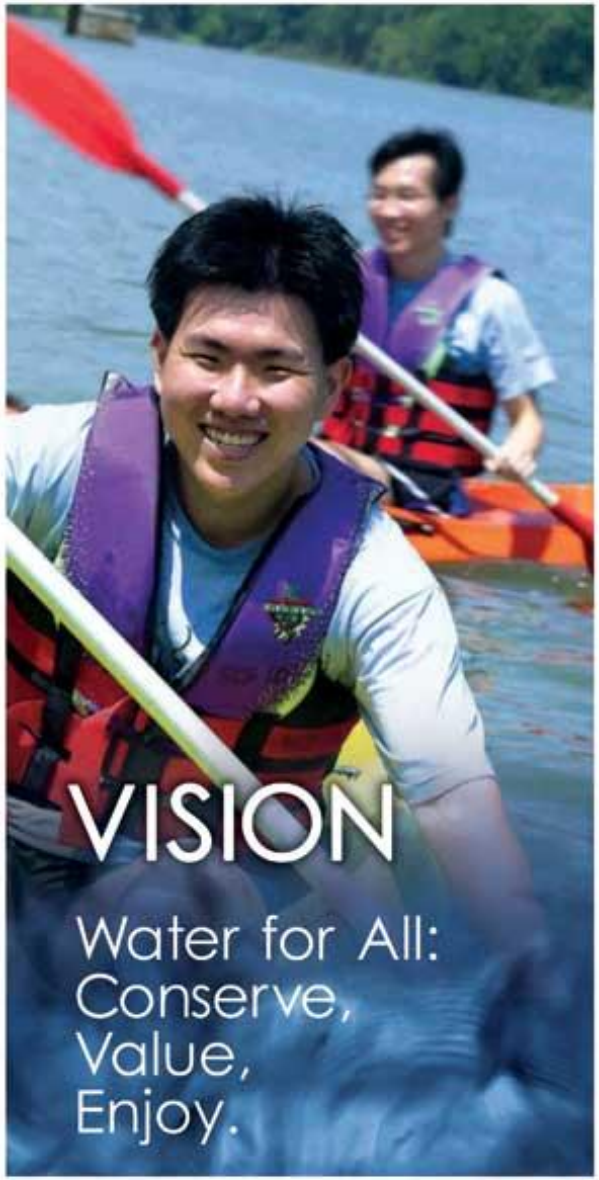


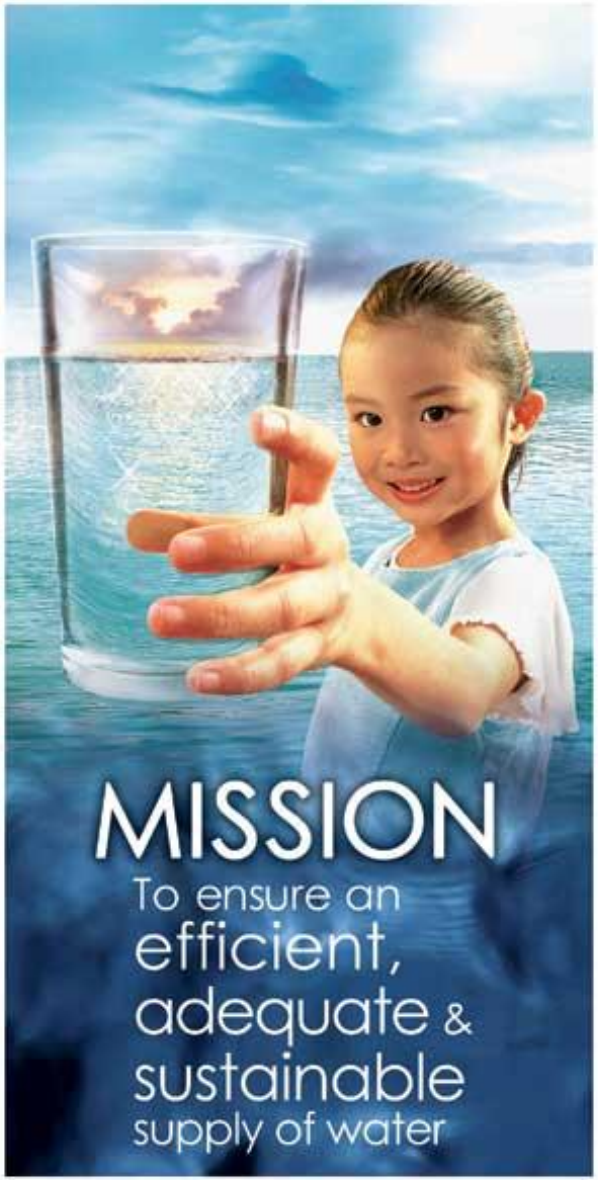
Poor living condition

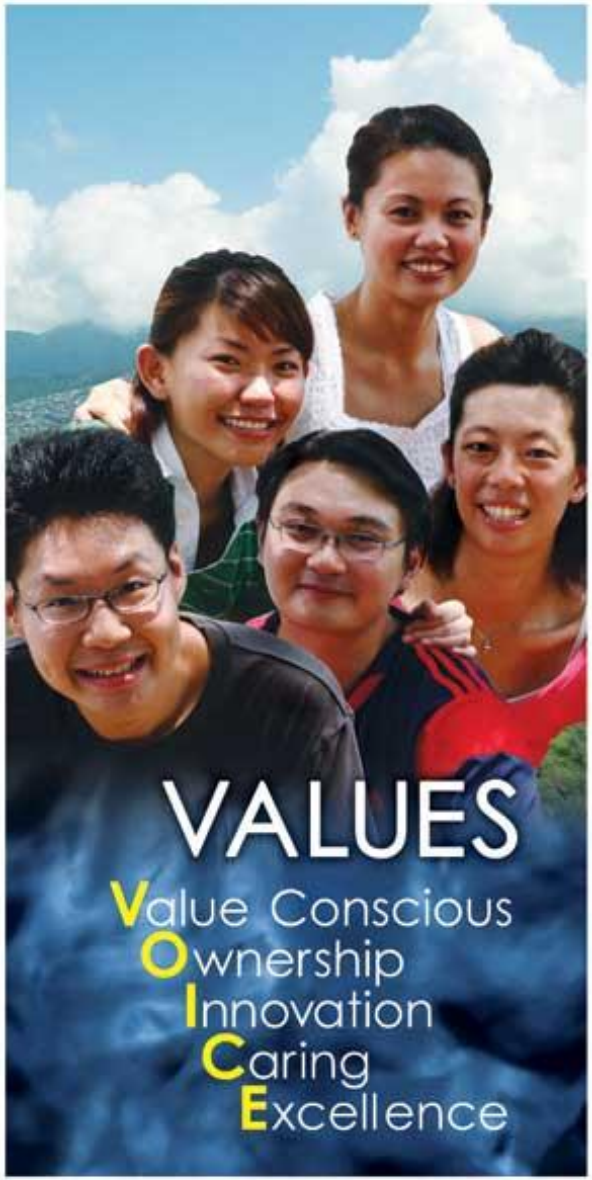


Water Bill Payment







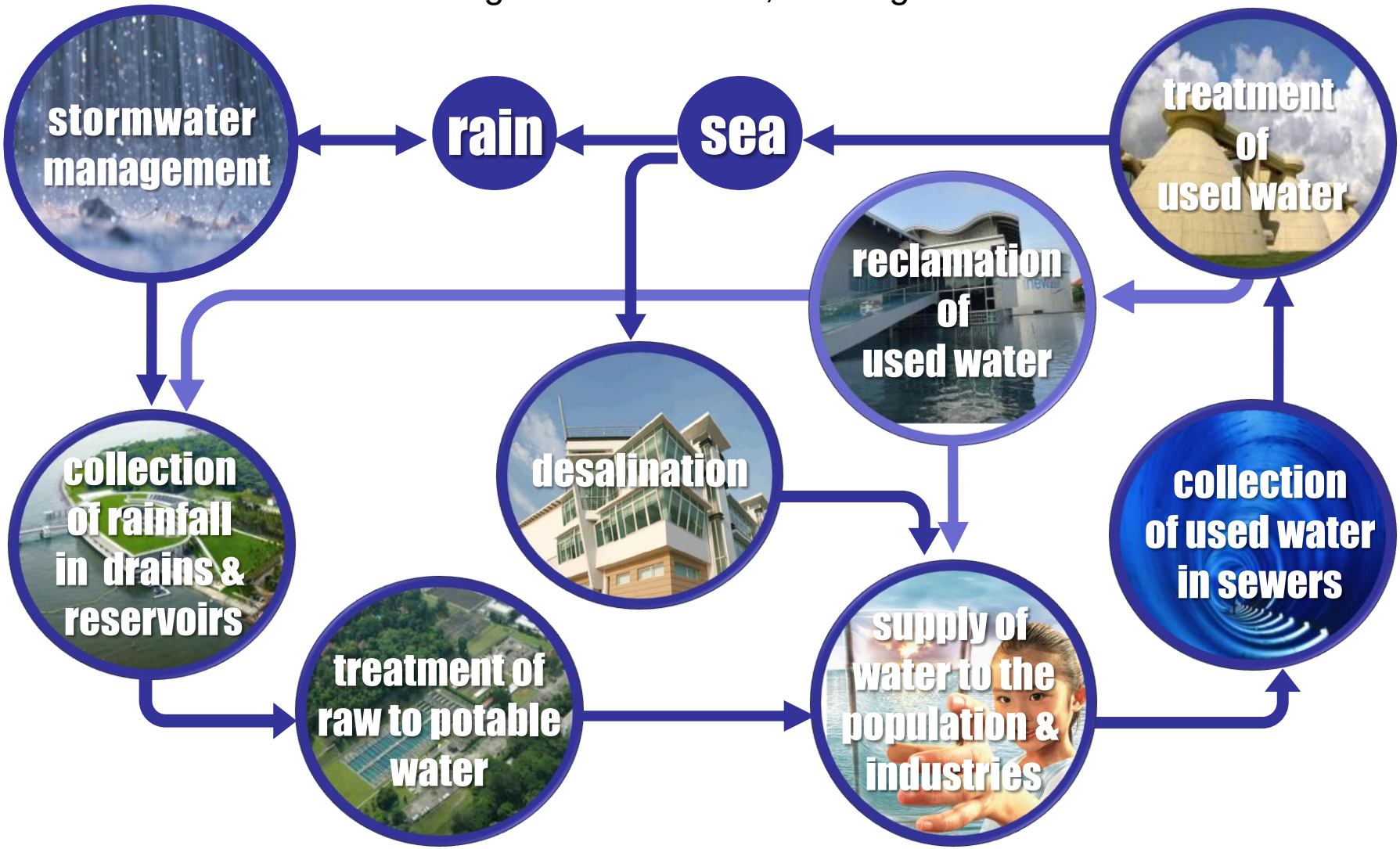


PUB

Water for All: Conserve, Value, Enjoy

The Water Loop

From sourcing, collection, purification and supply of drinking water, to treatment of used water and turning it into NEWater, drainage of storm water



Ensuring Water Sustainability for Singapore

4 National Taps



Local catchment

Imported water

NEWater

Desalinated water

"Water for All"

3P Approach



"Conserve Water"

"Value Our Water"

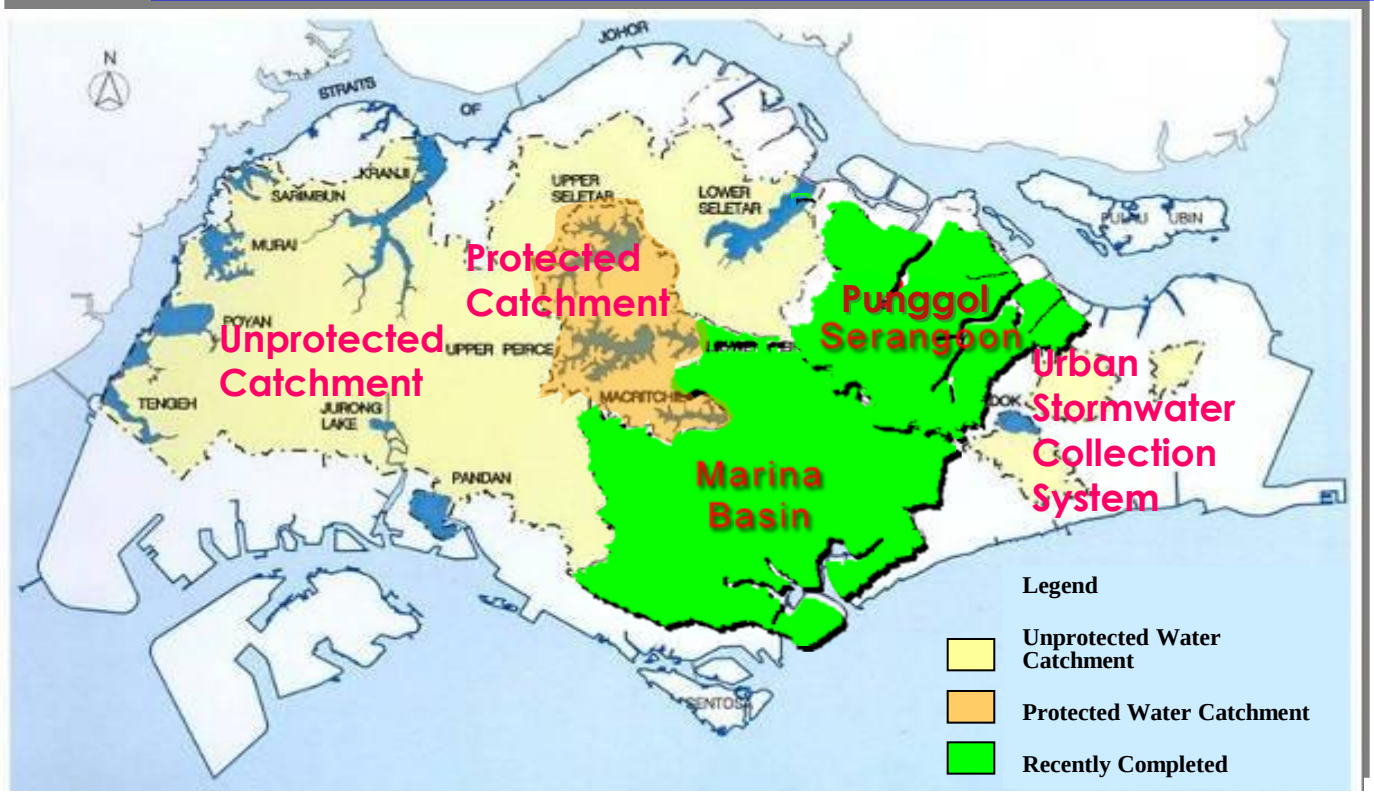
"Enjoy Our Waters"

"Conserve, Value, Enjoy"

FOUR NATIONAL TAPS



Local Catchments : Harvesting Every Drop









- Punggol-Serangoon Reservoirs and Marina Reservoir completed
- Catchment area increased to two thirds in 2011
- Potential to reach 90% in future with R&D

Local Catchments: Marina Barrage

Creating a reservoir in the city

- **Urban catchment - 1/6 of Singapore**
- **3-in-1 function: water storage, flood control, lifestyle attraction**
- **Officially opened by the Prime Minister on 31st Oct 08**
- **> One million visitors to date**











Second National Tap

Imported Water from Johor

- Two water agreements with Johor, Malaysia
  - 1961 to 2011
  - 1962 to 2061

Third National Tap

NEWater

- Kranji
- Bedok
- Ulu Pandan NEWater Plant by Keppel Seghers – DBOO
- Sembcorp NEWater Plant - DBOO

NEWater capacity currently meets 30% of Singapore's water needs and will increase to 50% by 2060

Fourth National Tap

Desalinated Water

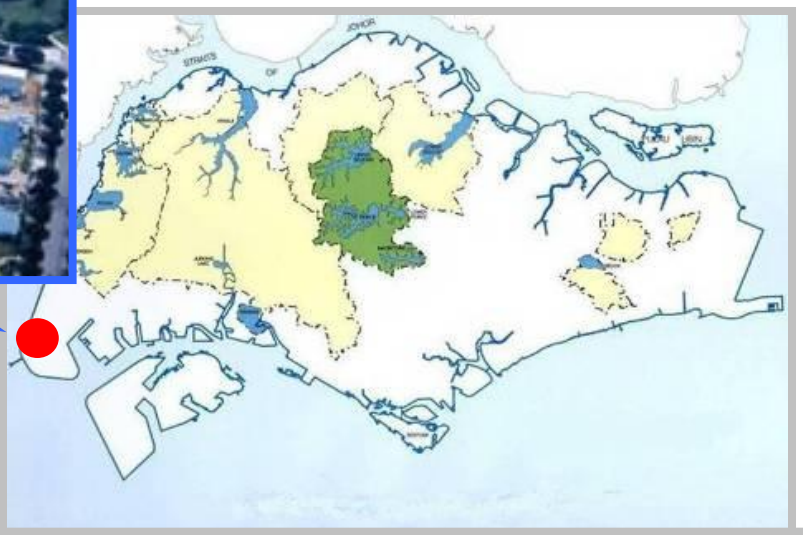
SingSpring Desalination Plant











- ✓ **Officially opened by PM Lee on 13 Sep 2005**
- ✓ **136,000 m^3 per day**
- ✓ **20 year DBOO plant by SingSpring Pte Ltd, a Hyflux subsidiary**

Ensuring Water Sustainability for Singapore

4 National Taps



Local catchment

Imported water

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"Conserve Water"

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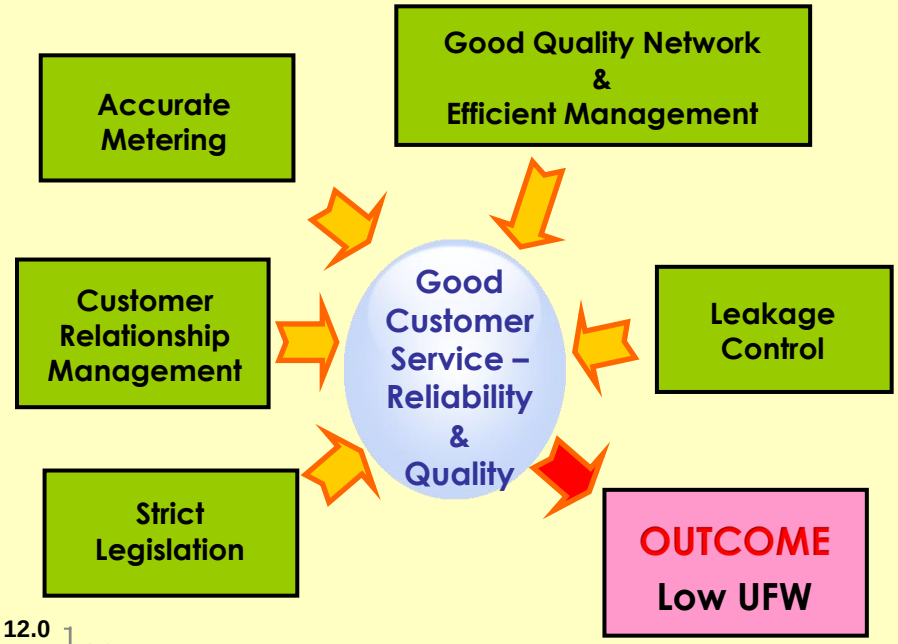
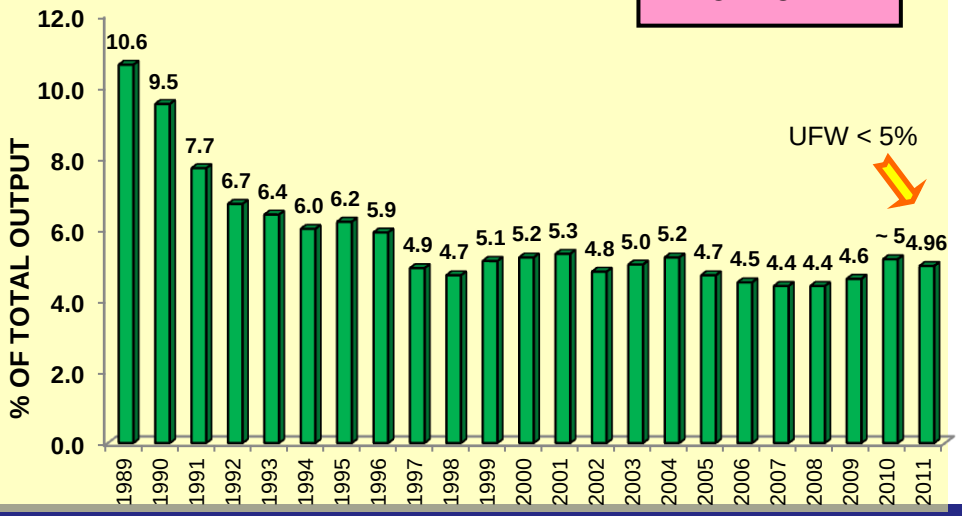
Water Demand Management

UFW Control

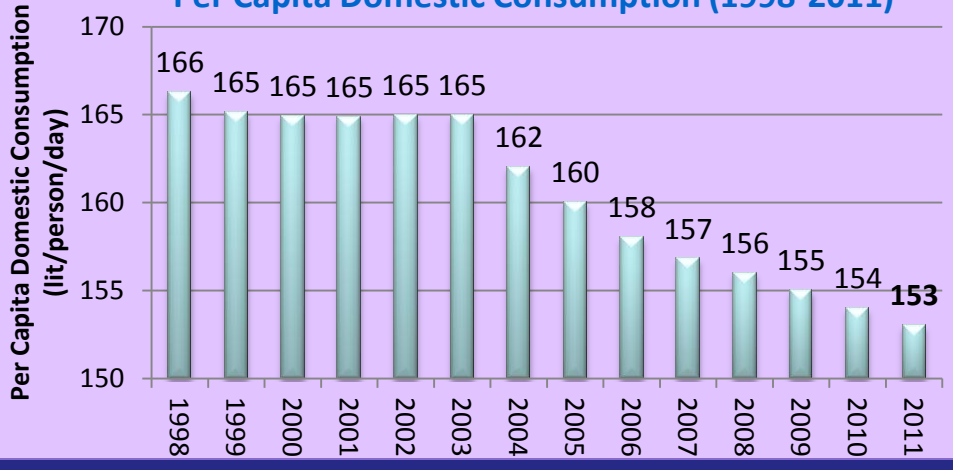




Water Conservation



Per Capita Domestic Consumption (1998-2011)



Overview of Water Supply System



Service Reservoir

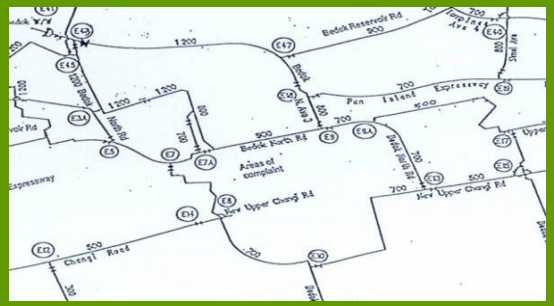
Industrial

Commercial

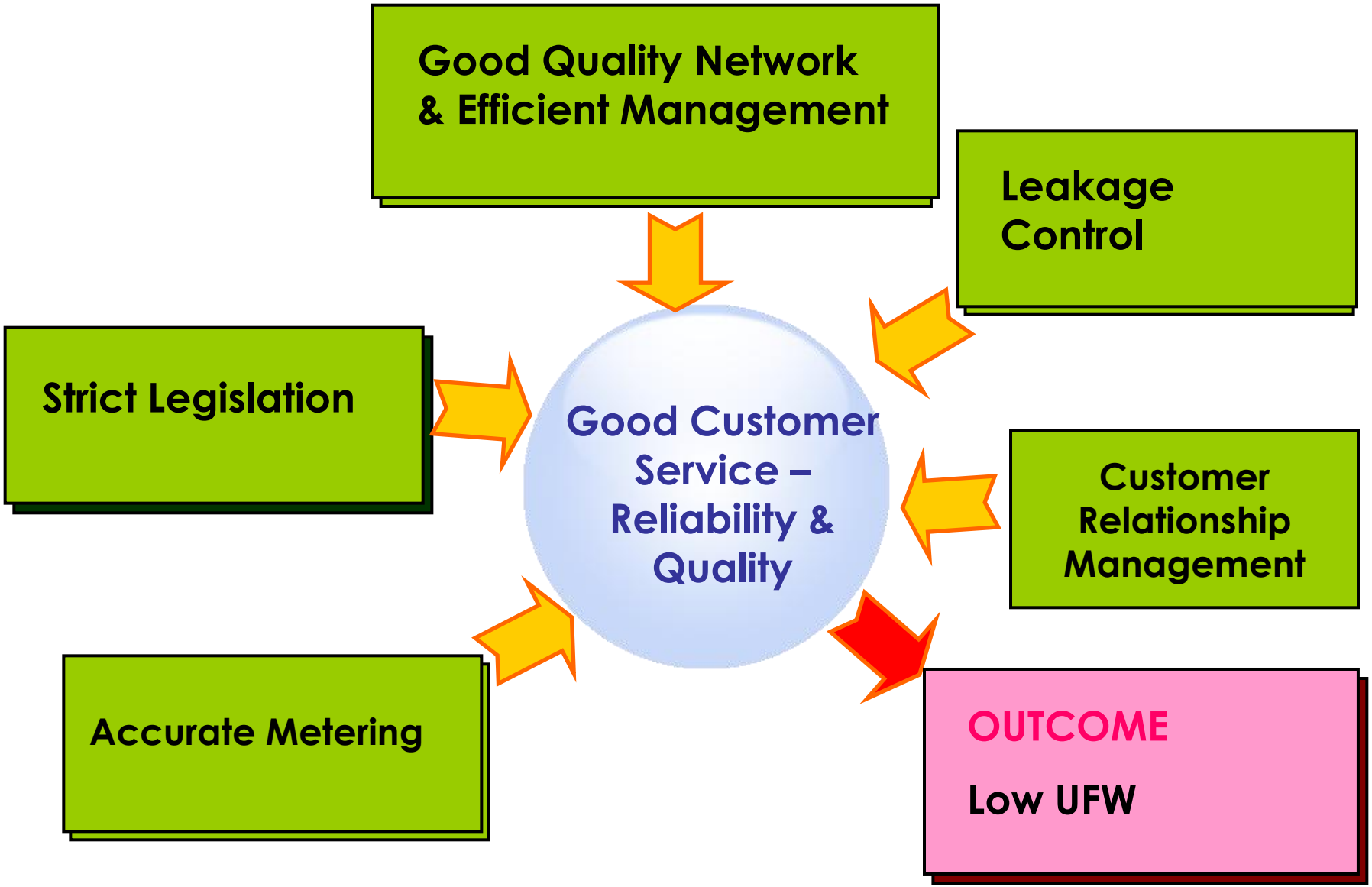
Waterworks

Domestic

Pipelines



Integrated Network Management System



Good Quality Network & Efficient Management

New Network

- Good planning & design – sizing of pipes, location of valves, alternate supplies, etc
- Strict supervision & control on workmanship
- Use Good quality / corrosion resistant material
  - Connections : Copper
  - Mains (100 – 300 mm) : cement-lined DI
  - (≥ 700 mm) : cement-lined steel



Existing network

- Servicing and maintenance of valves / hydrants



- Mains Renewal Programme
  - Unlined CI mains and GI connections (in 80s / 90s)
  - Old problematic CI Mains (2000 – 2004)
  - Asbestos Cement Mains (2003 – 2008)



- Ongoing pipe replacement programme

Active Leakage Control

Dynamic Leak Detection Programme

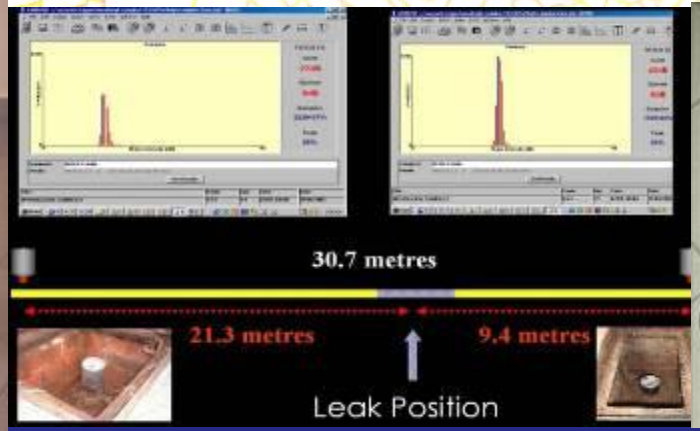
- Divide Singapore into ~ 300 zones
- Frequency of checks based on age/material type of mains & leak history
- Use of advanced leak detection equipt including leak localisers
- Cover 10 – 20 km length of pipes / day

Dry weather flow by other PUB in charge of drains and waterways











Accurate Metering

100 % metering for usage and billing

Type of meters in use

- Electromagnetic meters at waterworks
- Class C volumetric meters at households
- Compound meters to capture both low and high flows in non-domestic premises



Electromagnetic meter



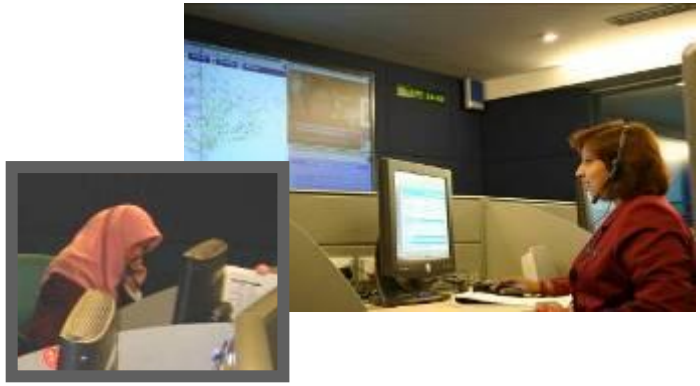
15 mm meter
(Replace every 15 yrs or > 4,000 m3)



Compound meter
(Replace every 2-7 yrs)

Customer Relationships Management

- **Quick Response to Public Reports**
  - **24 x 7 Contact / Operations Centre:**
    - ✓ **PUB – One**
    - ✓ **WSOC**



PUB-One

- **One-stop contact centre for Board's services**
- **Customers can contact us thru: Telephone, Email, Fax, SMS, VoIP, WebChat**



WSOC (Water Service & Operations Centre)

- **Quick response service van crew**



Strict Legislation – Deter Illegal Draw-Offs

- **Very Few Cases**
- **Strict Enforcement**
- **Public Utilities Act**
- **Prosecution in court - Max Penalties:**
  - **$50,000 fine or;**
  - **3 years jail term or;**
  - **both fine & jail term**



UFW - Sustainable Work Processes Involving Everyone

Effective Management, Staffing & Training



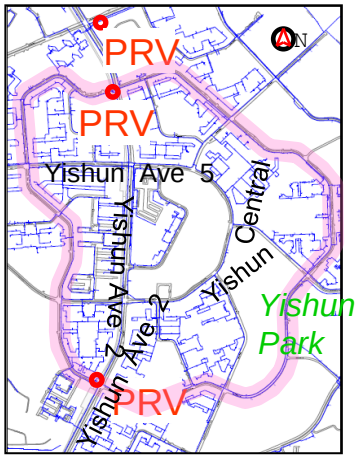
[Planning & Design](#)
- Proper positioning of valves
- Optimise network design



[Mainlaying](#)
- Use good quality pipes
- Good worksmanship



[Network management](#)
- Maintenance of network
- Replace old/leaking mains
-Proper Records - AIMS



[Network Optimisation](#)
- Optimise system pressure
- Reduce likelihood of leaks



[Leakage Control](#)
- Dynamic leak detection
- 24/7 contact centre



[Proper accounting through Metering](#)
- use good quality and accurate meters
- Size meters according to usage



[Enforcement](#)
- high penalty
- very few cases

3-Prong Water Conservation Strategy



Conserve: Pricing

- Volume-based billing
- Regulated by Ministry (Environment & Water Resources)

		Potable Water			Used Water	
Tariff category	**Consumption block (m3 per mth)**	**Tariff (¢/m3)**	**WCT[1] (%)**	**Total (¢/m3)**	**WBF[2] (¢/m3)**	**SAF[3] (¢/appliance)**
Domestic	1 to 40	117	30	152	30	300
	Above 40	140	45	203	30	300
Non-domestic	All units	117	30	152	60	300

1: Water Conservation Tax – Tax on consumption to reinforce the water conservation message

2: Waterborne Fee – Volume-based used water fee

3: Sanitary Appliance Fee – Fixed used water fee based on the number of sanitary appliances

Conserve

Domestic

The 10-Litre Challenge





Installation of Dual Flush LCFCs (Mandatory from July 2009)



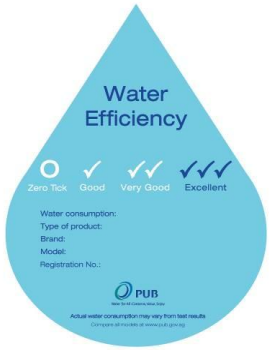
Water Volunteer Groups (WVGs)



Enhanced Water Efficient Homes

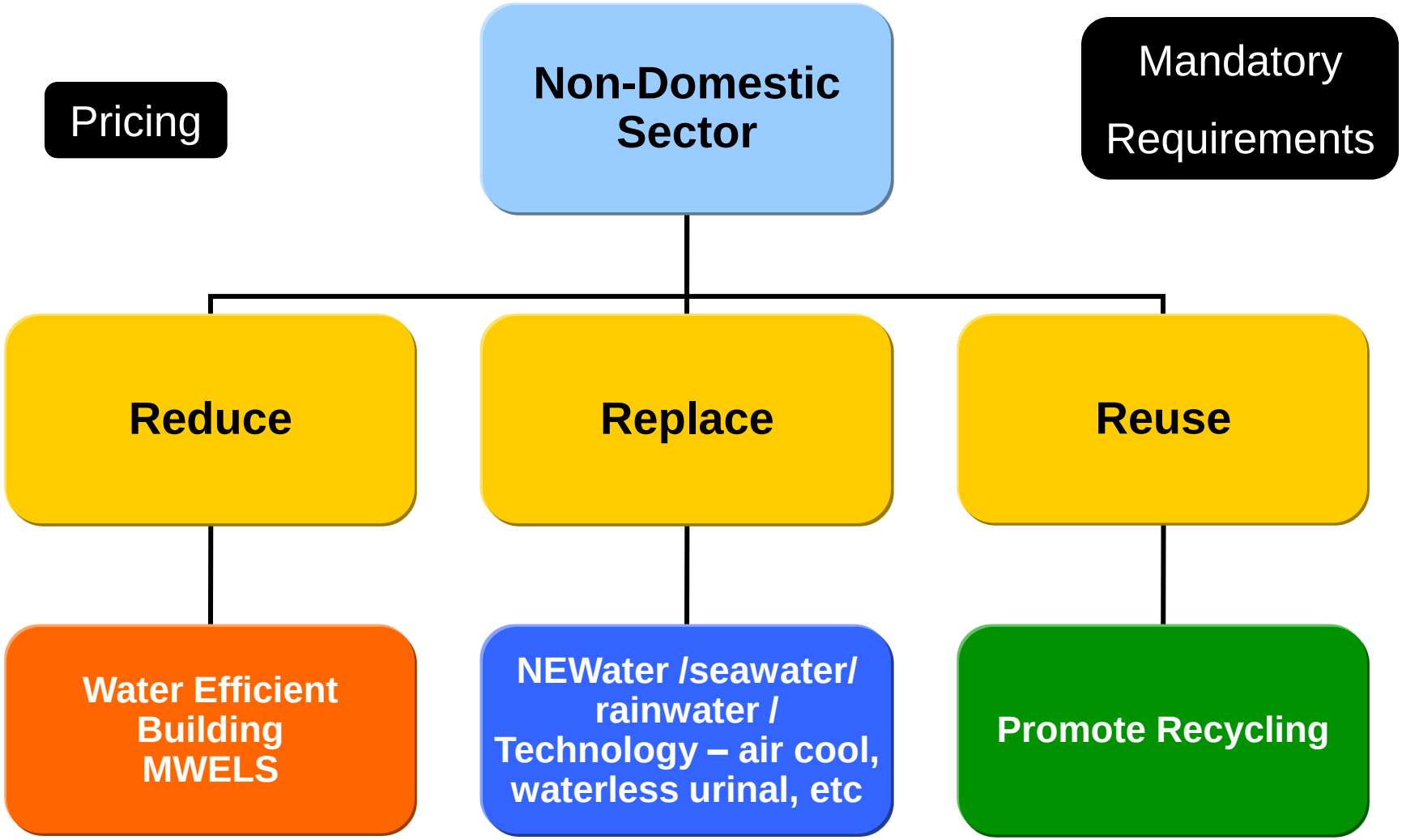


Website Portal



Water Efficiency Labeling Scheme (Mandatory from July 2009)

Water Conservation Framework for Non Domestic Sector



Non-Domestic: 10% Challenge

- To challenge the non-domestic sector, particularly the hotels, schools, commercial buildings, government office buildings, etc, to work towards becoming a WEB and save 10% of their monthly water consumption.

10 percent challenge

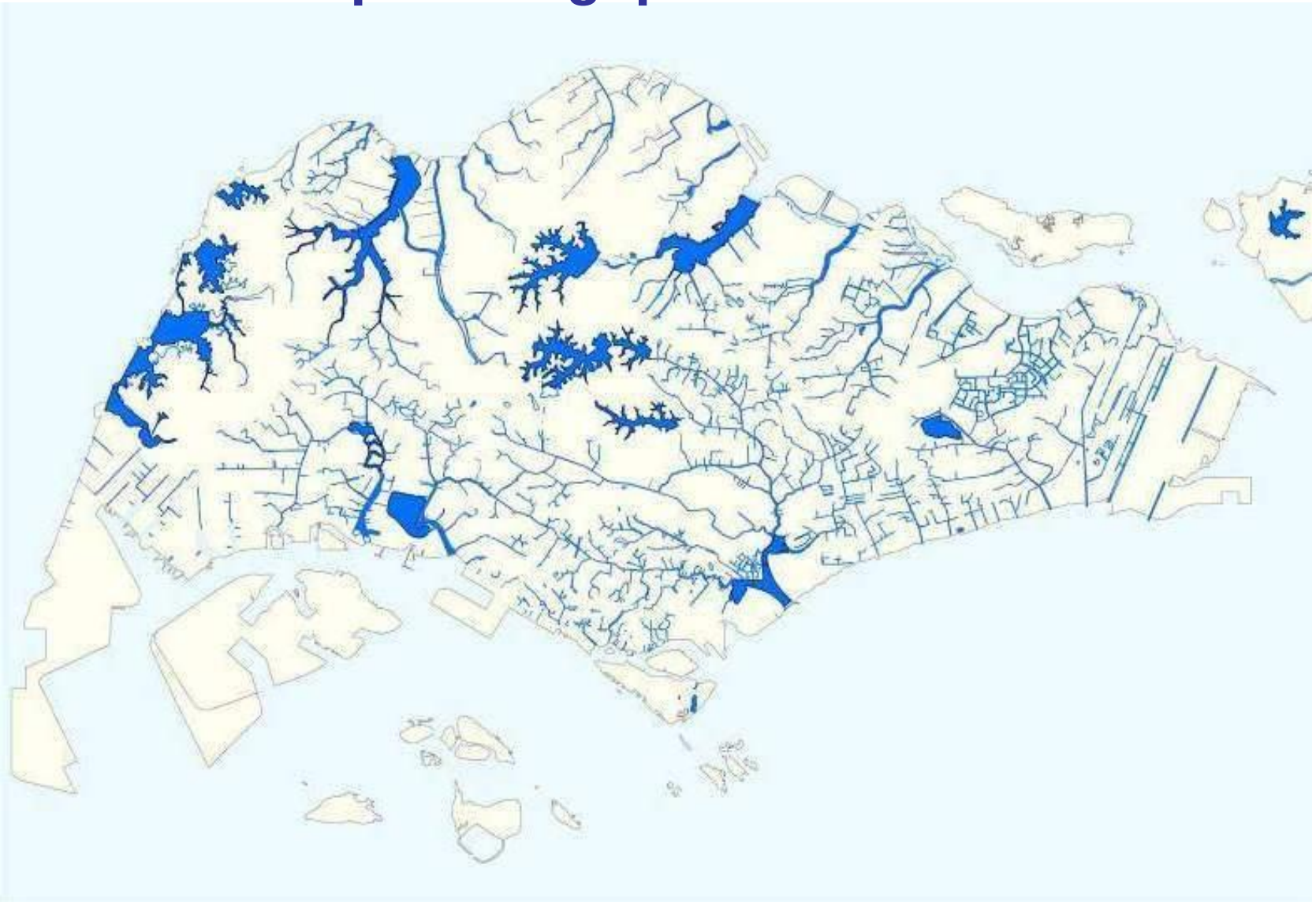
- 10% Challenge Website portal
- Water Efficiency Manager Course
- Water Efficient Building Design Guide
- Water Efficiency Management Plan



Water Efficient Building (WEB)

To-date, more than 2,300 buildings/premises are certified as Water Efficient Buildings

The Blue Map of Singapore



ABC Waters Programme

ABC
Active, Beautiful, Clean Waters for All

Launched in 2006, ABC Waters Programme is about:

A. ACTIVE

New recreational spaces

B. BEAUTIFUL

Integration of waters with urban landscape

C. CLEAN

Improved water quality

Cultivating environmental responsibility among people







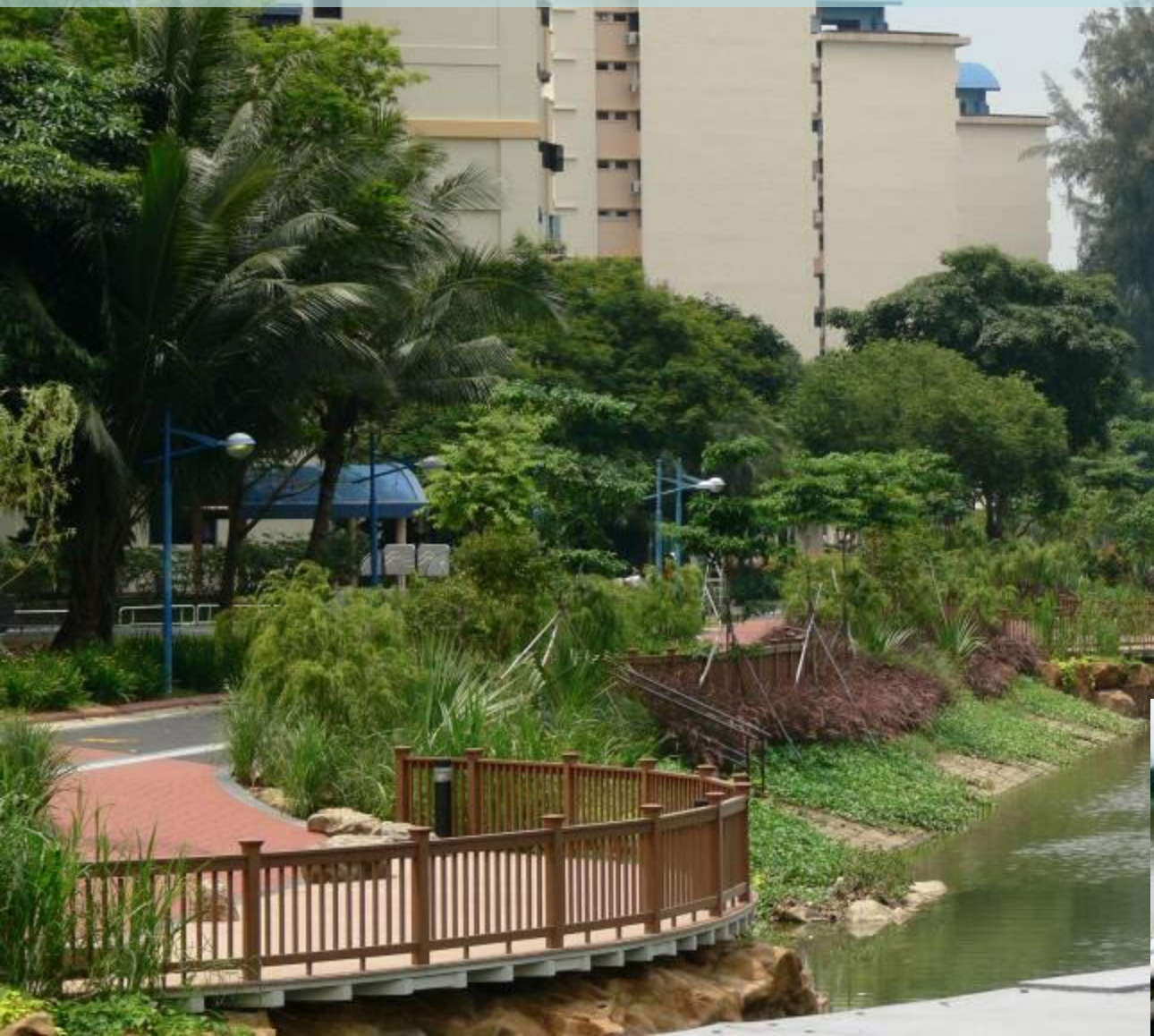
"… Turn Singapore into a city of gardens and water"

Prime Minister Lee Hsien Loong,
At ABC Waters Public Exhibition Opening
(Feb 07)

Completed ABC Waters project – Kolam Ayer Waterfront

New features include floating platform for performances and educational interactive water features
Completed in Apr 2008









Completed ABC Waters project – Bedok Reservoir

Completed in June 2008





New Features:

- Landscaping along the banks
- Floating deck with performance stage and fishing deck
- Viewing Galleries on reservoir banks





Completed ABC Waters project – Pandan Reservoir

Fishing & viewing platform



Amenities Centre



Before



After



Completed Project - Sengkang Floating Island



A fixed bridge connecting floating island to the Anchorvale CC

A floating boardwalk connects the island and the park

The floating island helps to filter water while providing a transition from community club to park

Artist Impression. Design subject to amendment

Completed ABC Project - Kallang River-Bishan Park











Growing the Water Sector

- National Research Foundation set aside S$330mil over five years to grow the water industry


Prime Minister Lee Hsien Loong

PM to head new research and innovation body


Research council approves 3 key areas to boost economy

- 2015 Targets:
  i. Increase value-add from S$0.5bn to S$1.7bn
  ii. Double number of jobs to 11,000

- Agencies
  – Funding:
  – Key Agencies:

National Research Foundation
Prime Minister's Office, Republic of Singapore

Ministry of the Environment and Water Resources

Ministry of the Environment and Water Resources

PUB
Water for All: Conserve, Value, Enjoy

PUB, the national water agency

EDB SINGAPORE

Economic Development Board

ie Singapore
INTERNATIONAL ENTERPRISE SINGAPORE

SPRING singapore
Enabling Enterprise

NUS National University of Singapore

National University of Singapore

NANYANG TECHNOLOGICAL UNIVERSITY

Nanyang Technological University

A*STAR SINGAPORE
Agency for Science, Technology and Research

National Environment Agency

PUB
Water for All : Conserve, Value, Enjoy

Research and Development Strategy

DIRECTOR (TECHNOLOGY)

INTELLIGENT WATERSHED MANAGEMENT

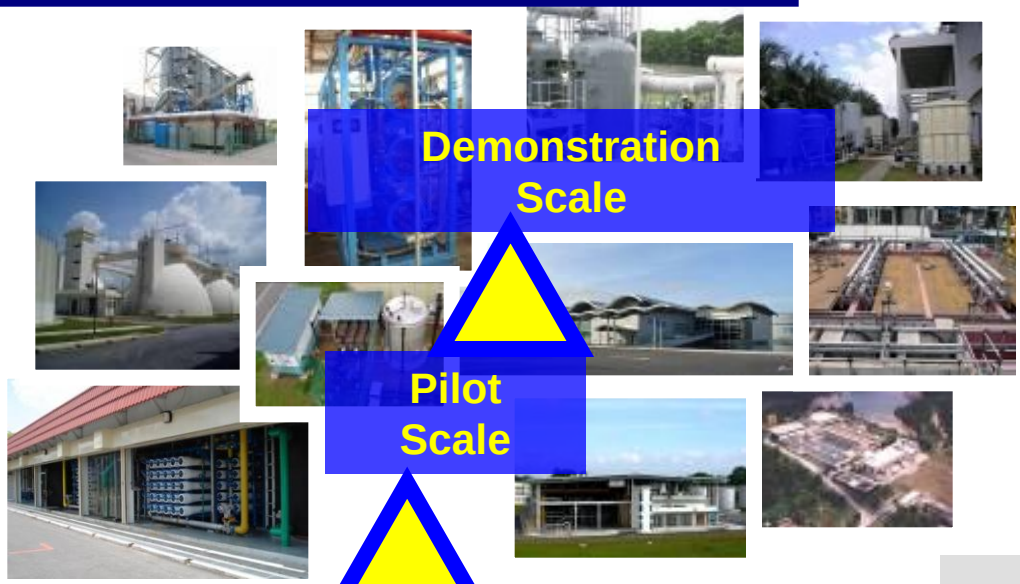
MEMBRANE

NETWORK MANAGEMENT

USED WATER TREATMENT

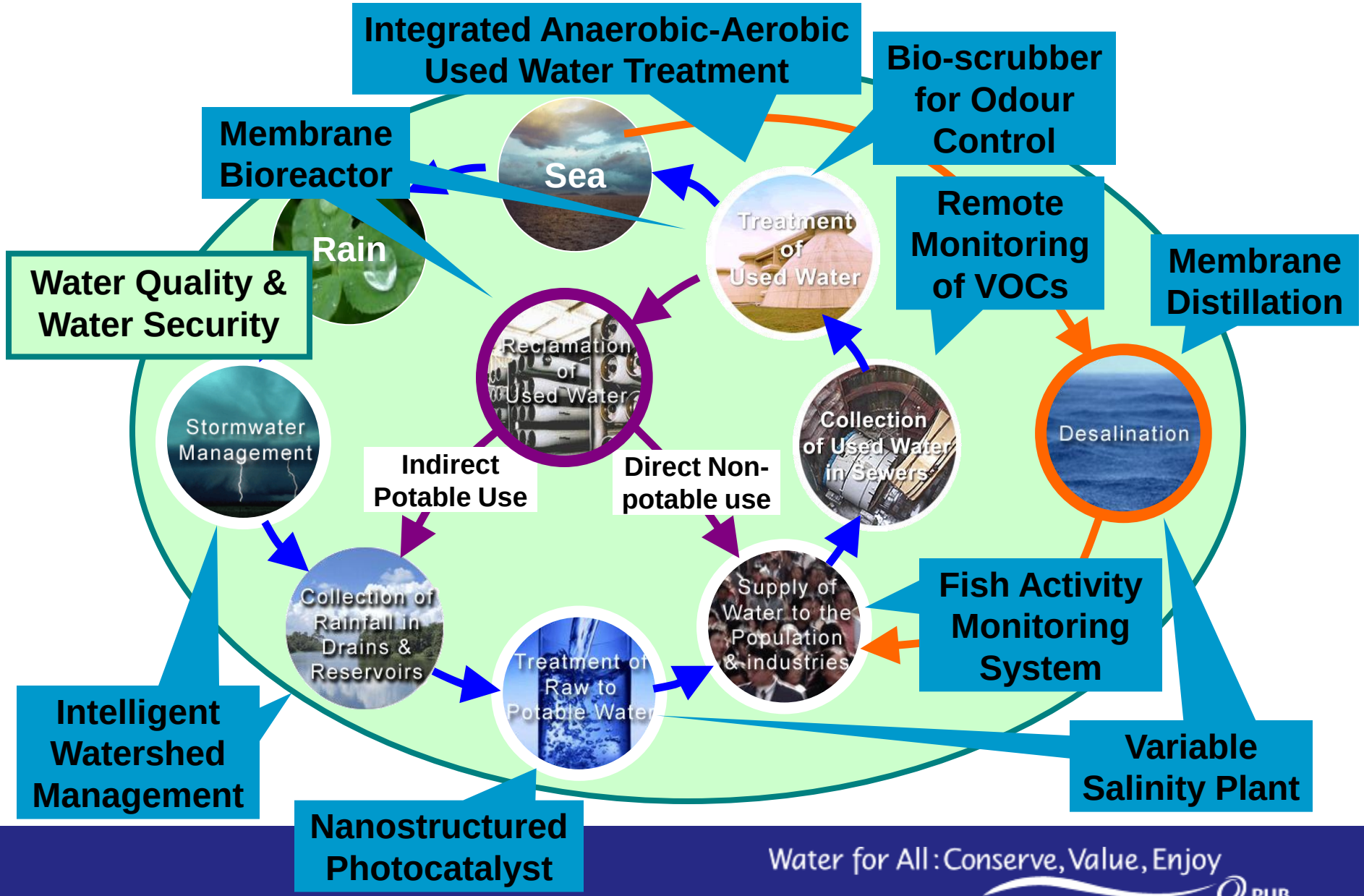
WATER TREATMENT

WATER QUALITY

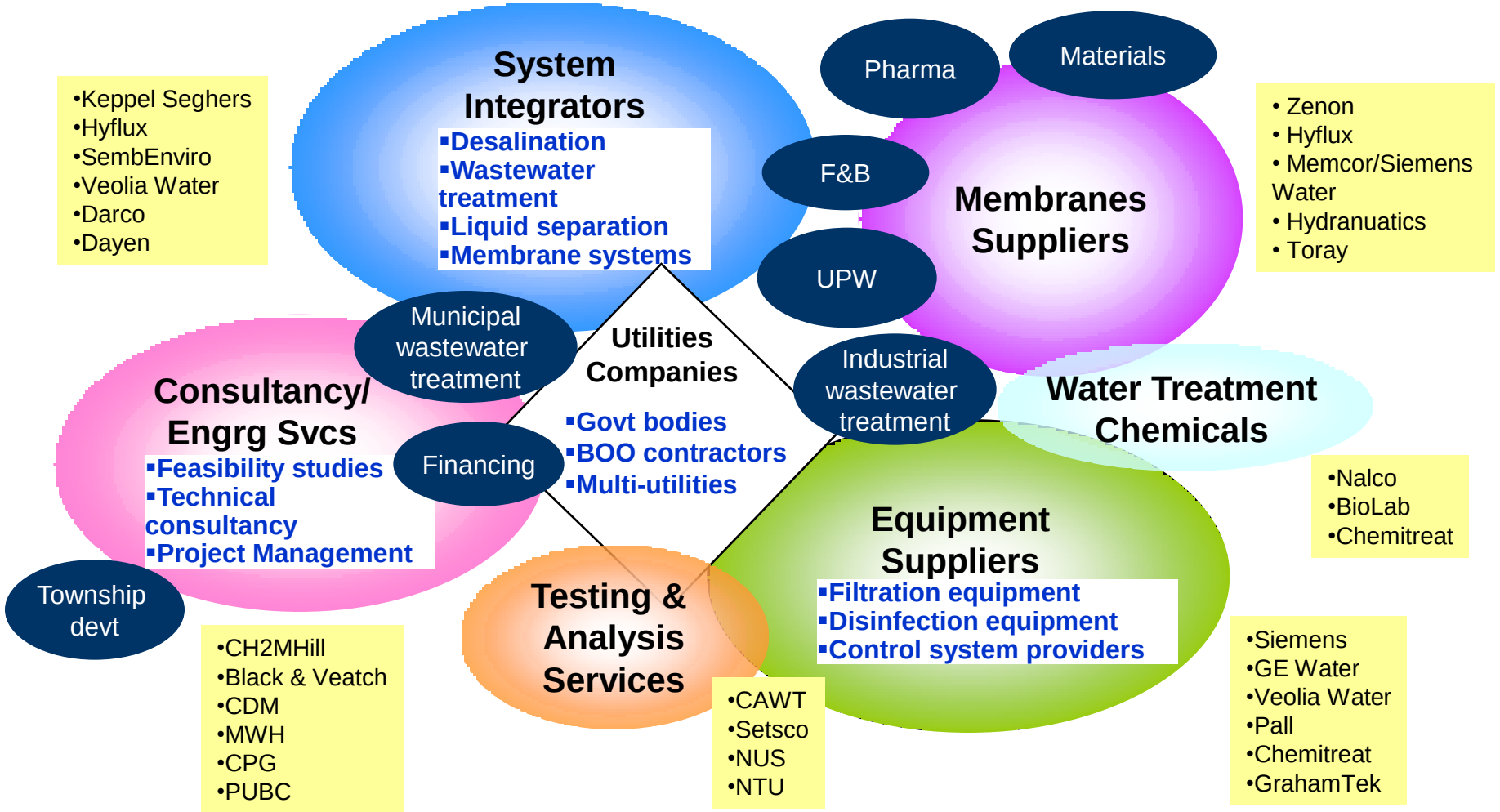


Centre for Water Research, The University of Western Australia
kiwa Partner for progress
eawag aquatic research
YALE UNIVERSITY Faculty of Engineering
Awwa Research Foundation
NANYANG TECHNOLOGICAL UNIVERSITY
TNO
DVGW
WL | delft hydraulics
CAWT
NUS National University of Singapore
THE UNIVERSITY OF TOKYO
UNSW
Global Water Research Coalition
CWR CENTRE FOR WATER RESEARCH
ILLINOIS UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
ivt aachen
Berkeley University of California

Research and Development in our Water Loop



A vibrant Singapore Water Industry



Singapore International Water Week

The Global Platform for the Sharing and Co-Creation of Innovative Water Solutions



- Inaugural event started in 2008
- Gained traction as a premier global water event
- **Key highlights** include **Lee Kuan Yew Water Prize, Water Leaders Summit** *(by invitation only)*, **Water Convention, Water Expo & Business Forums**
- 5th SIWW held in conjunction with World Cities

Programme	Concept
Lee Kuan Yew Water Prize	An international water prize to recognise the achievements of individuals and/or organisations in the development of breakthrough water technologies
Water Leaders Summit	A by-invitation, high-level event bringing together global water leaders to discuss pertinent water issues and policy solutions
Water Convention	A leading-edge international technology conference to share and discuss technical solutions
Water Expo	An international water technologies exhibition showcasing leading water technologies and products
Business Forums	A platform for networking, business matching & sharing of market opportunities

Singapore International Water Week

The Global Platform for the Sharing and Co-Creation of Innovative Water Solutions

SIWW 2012 saw:

- More than 19,000 delegates
- 104 countries/regions
- S$13.6 billion worth of announcements
- 750 participating companies at the Water Expo

SIWW 2014 (1 – 5 June 2014)

- Discussions and opportunities focused on the ***cities-water-environment nexus***, ***municipal*** *and* ***industrial*** areas, and ***innovative technologies and solutions***
- **Why you should attend:**

❑ Uncover business opportunities in **growing** water sectors such as *industrial sector, smart water, desalination* etc.

❑ Build relationships with leaders from water, cities and environment via **structured networking opportunities**

❑ A **thematic** Water Expo for better profiling and marketing





Thank you






SINGAPORE QUALITY AWARD for business excellence 2008 WINNER

INNOVATION EXCELLENCE AWARD 2006 WINNER