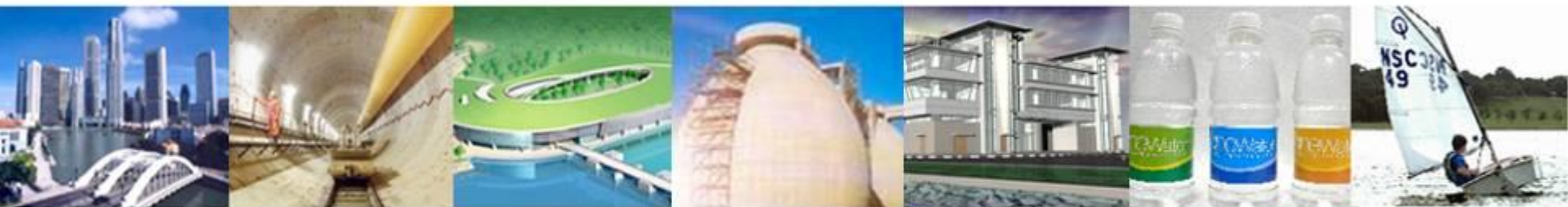


Water for All Conserve, Value, Enjoy



2nd East Asia Ministerial Conference on Sanitation and Health
27 – 29 Jan 2010

Manila, Republic of the Philippines

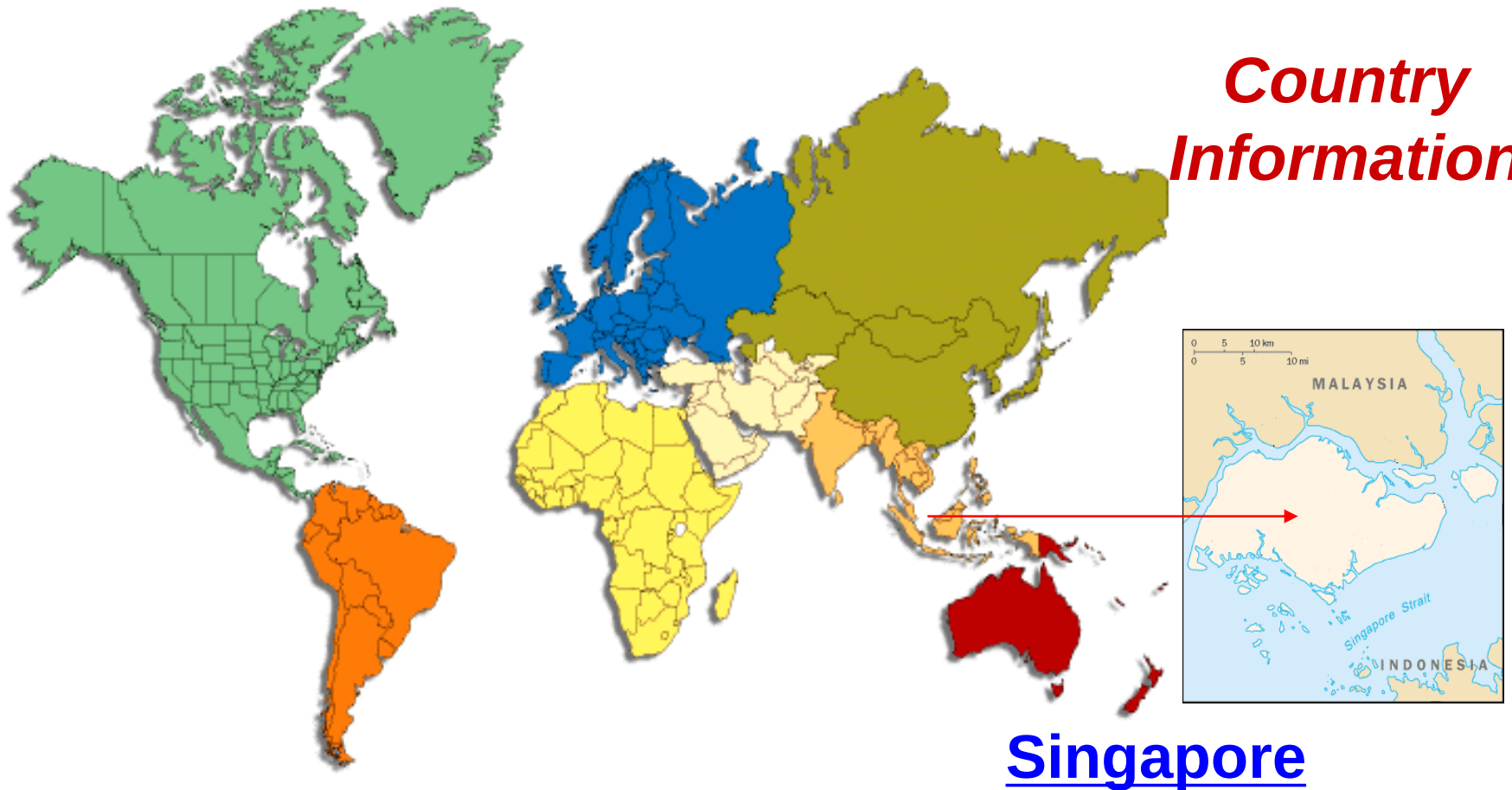
Water Reuse in Singapore

Wah Yuen Long
Director, Water Reclamation Plants Department
PUB Singapore

Presentation Outline

- Introduction
- Water reuse to complement other sources of water
- Water Reuse in Singapore
 - Development
 - For non direct potable reuse
 - Multiple Safety Barriers
 - Public Communication
 - For direct non potable reuse

Country Information



Land Area

707 km²

Population

5 million

Water Consumption

1.6 million m³/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*



Water for All : Conserve, Value, Enjoy

To ensure an efficient, adequate and sustainable supply of water

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

PUB (National Water Agency of Singapore) manages the complete water cycle



Sustainable Water Management

“Water for All”

4 National Taps



Supply

“Conserve, Value, Enjoy”

3P Approach



Demand

Water for All: Conserve, Value, Enjoy

FOUR NATIONAL TAPS

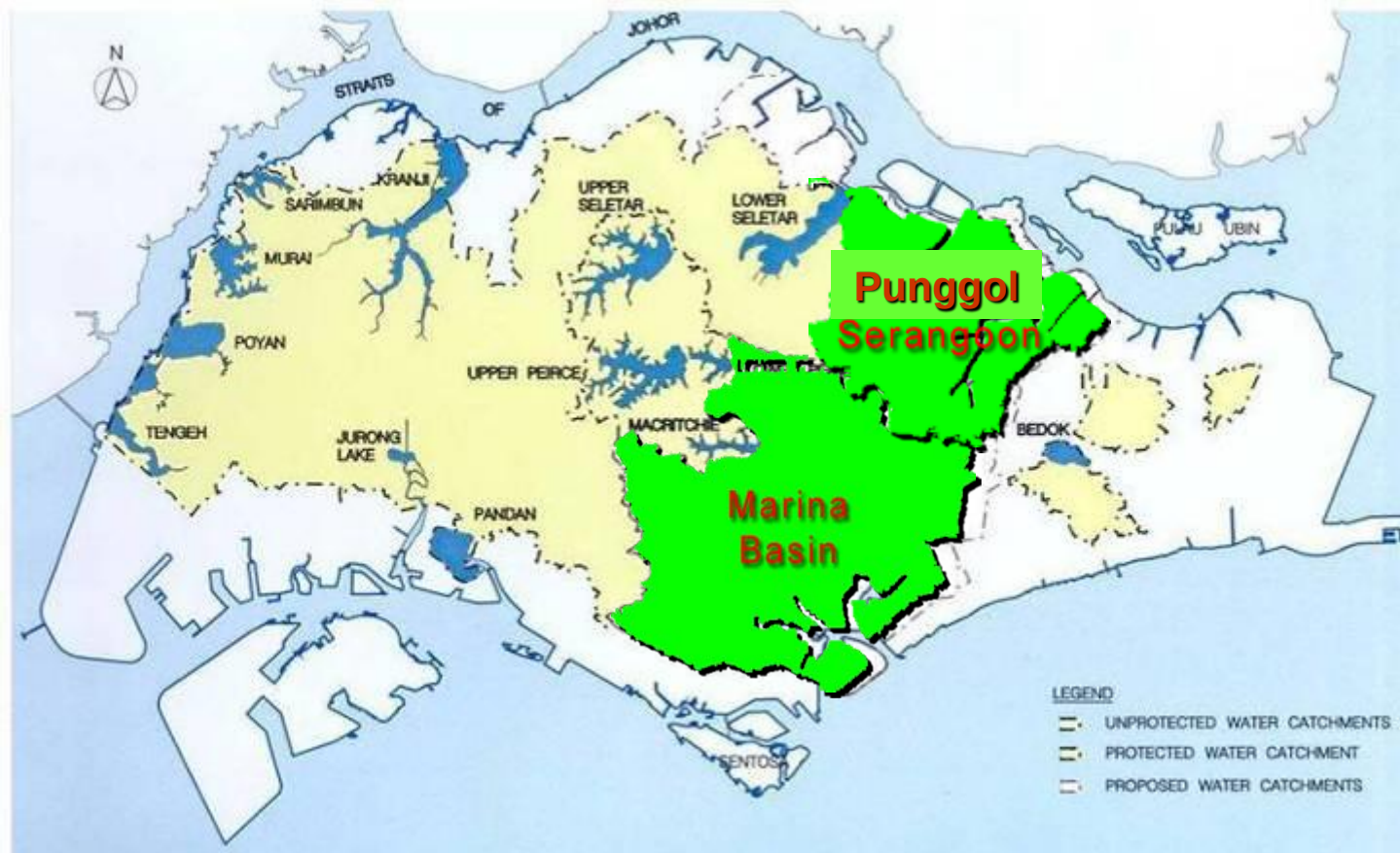


Water for All

Water for All: Conserve, Value, Enjoy



Large scale urban stormwater collection



Catchment area will be increased from half to two-thirds of Singapore by 2011

Imported Water from Johor, Malaysia



Pipelines carrying
water from Johor

Desalinated Water

- One of the largest seawater RO plants (opened in Sep 2005)
- Supply of 30 mgd for 20 years under a DBOO arrangement with SingSpring Pte Ltd



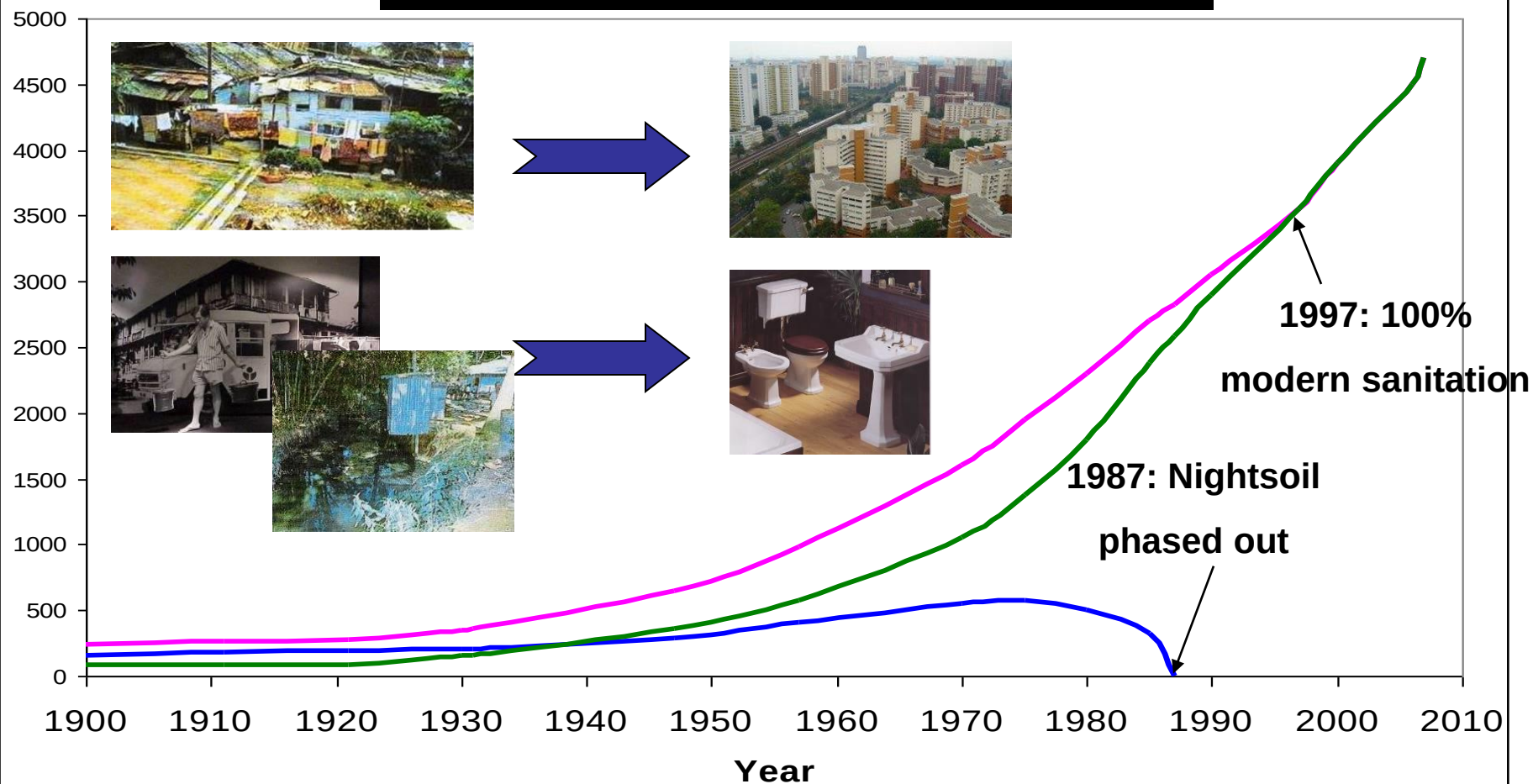
NEWater



Water for All: Conserve, Value, Enjoy

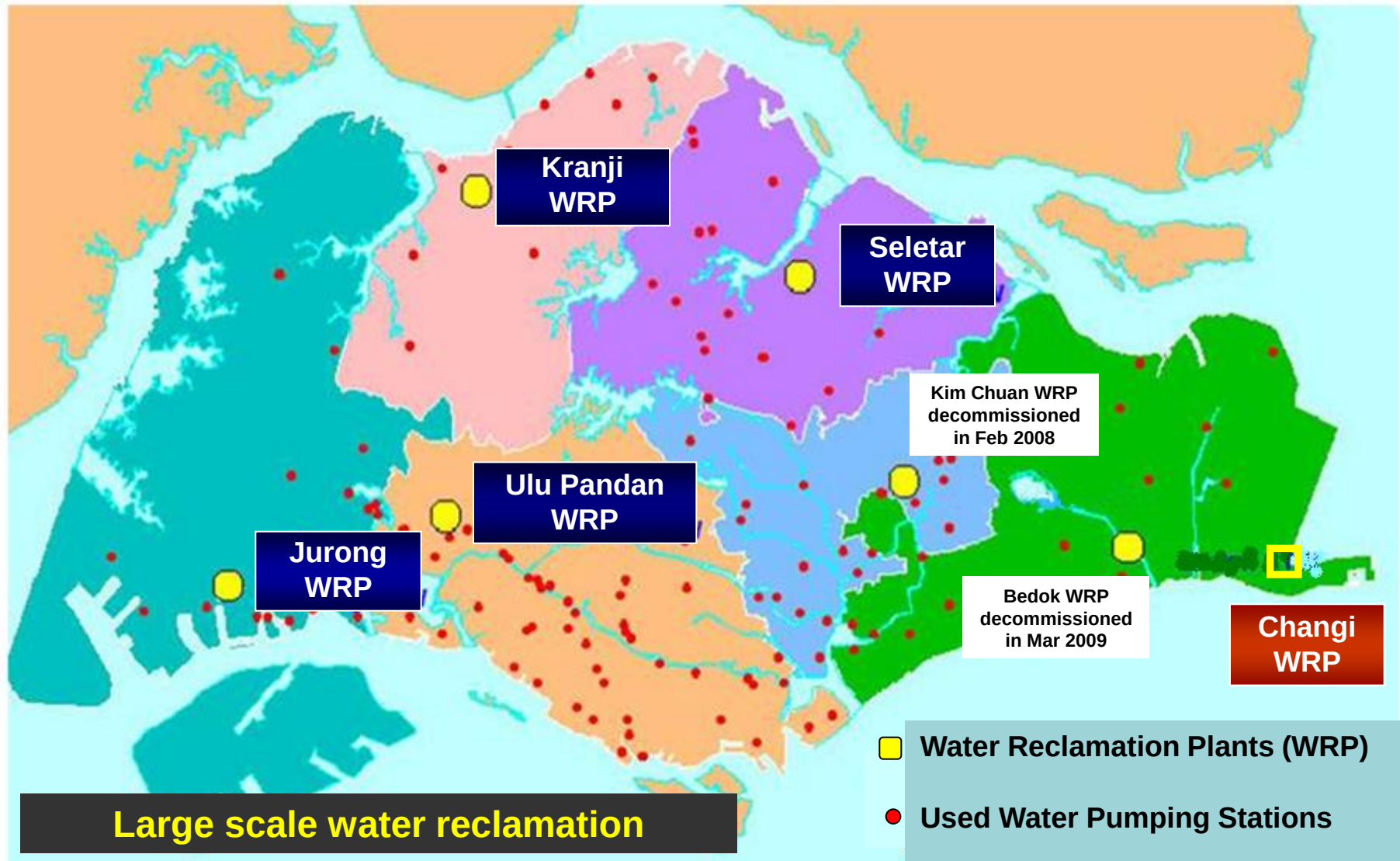
Population
(^{'000})

Sanitation



— Population('000) — Population served by night soil — Population served by modern sanitation

100% sewered with modern sanitation



Conceptualisation of NEWater

- A 2-year NEWater Study was initiated in 1998
- *To ascertain the suitability of using NEWater as a source of raw water*
- 2-year NEWater Study consists:



- 10,000 m³/d Demonstration Plant*
- Sampling and Monitoring Programme (SAMP)*
- Health Effect Testing Programme (HETP)*

- International expert panel audited and set up study protocol

NEWater Treatment Process

Effluent



**Microfiltration or
Ultrafiltration**



**Reverse
Osmosis**



**Ultraviolet
Irradiation**



NEWater

Sampling and Monitoring Programme (SAMP)

- More than 100,000 analysis to date
- 295 parameters tested, more than the 96 parameters stipulated by USEPA and 113 specified by WHO.
- Categories of parameters include, physical, inorganic, organic, radio-nuclides, pesticides / herbicides, used water signature compounds, synthetic / natural hormones.



Praise for S'pore's reclaimed water

Water reclamation plant here uses the best technology in the world, says a world-renowned water quality expert

COMMUNITY COMMENT

There can be no doubt that the water reclamation plant here is the best in the world. It uses the best technology in the world. It is a testament to the ingenuity and innovation of the Singaporean people. The plant is a marvel of engineering and science. It is a source of pride for the Singaporean people. It is a testament to the commitment of the Singaporean government to providing clean and safe water for its citizens. The plant is a source of pride for the Singaporean people. It is a testament to the commitment of the Singaporean government to providing clean and safe water for its citizens.

PANEL: Most have no problem with taste

Most of the people who have tasted the water from the plant have no problem with the taste. They find it to be clean and refreshing. They are proud of the plant and the technology it uses. They are proud of the Singaporean people who have created such a remarkable achievement. They are proud of the Singaporean government for its commitment to providing clean and safe water for its citizens.



Health Effect Testing Programme (HETP)

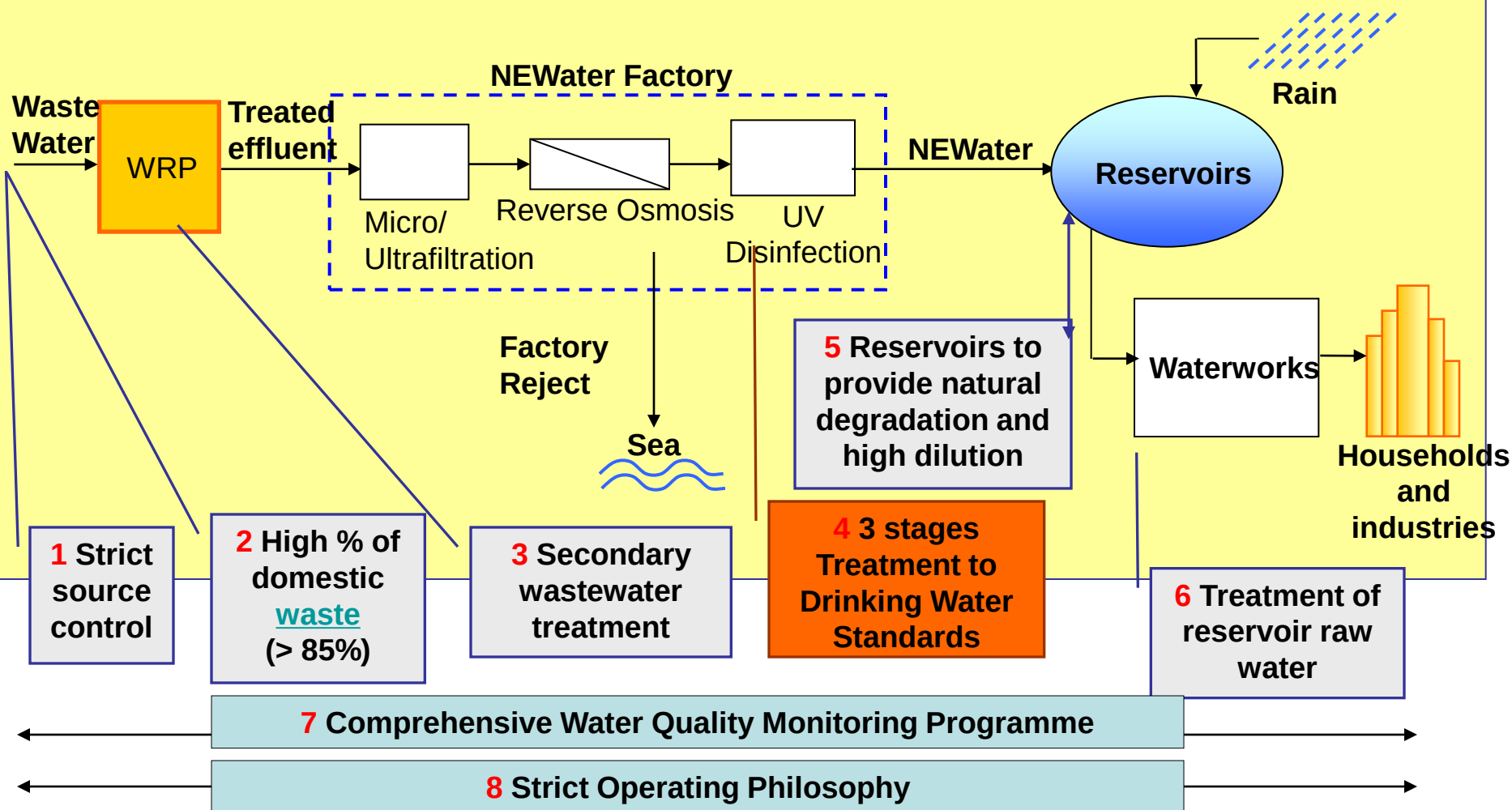
- Complements SAMP in determining the safety of NEWater
- Toxicological assessment of NEWater against reservoir water
- Short and long term health effects on two animal species
 - ✓ *Mice Long term toxicity & carcinogenicity assessment*
 - ✓ *Fish Long term toxicity & carcinogenicity assessment, and estrogenic assessment (reproductive and development)*

International Expert Panel

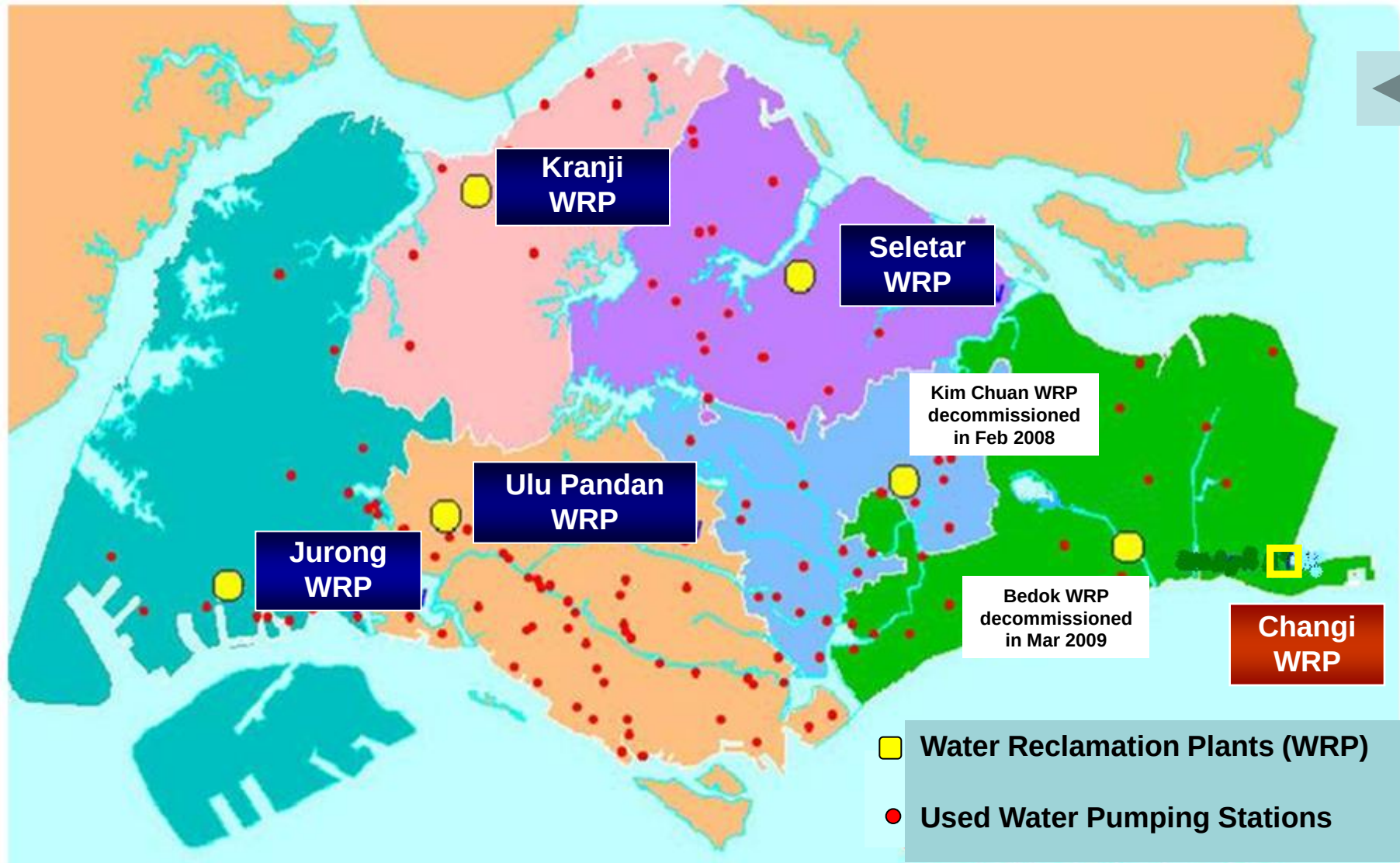
- Comprises both local and foreign experts
- Involved in audit and set up of the study protocol and adoption of latest methodologies, analytical tools and best international practices
- Expert Panel concluded that
 - *NEWater quality is well within international drinking water guidelines/standards*
 - *NEWater is suitable as raw reservoir water for IPU in accordance to international practice*
 - *No adverse health concerns were associated with IPU of NEWater*
- Planned indirect potable use since end 2002
 - Blend with reservoir water
 - Multi safety barriers

Multi Safety Barriers Approach

PLANNED INDIRECT POTABLE USE in SINGAPORE



2) High % of used water from domestic source



Domestic source accounts for more than 85% of used water treated in WRPs supplying to NEWater Factories

Engaging the stakeholders

- Communications with stakeholders is key to success of campaign
 - Media
 - Opinion leaders such as political leaders, water experts, grassroots leaders, business groups etc
 - Public
- Key messages:
 - NEWater is a safe and sustainable source of water supply for Singapore and meets WHO drinking water guidelines
 - NEWater will make the overall water supply system more resilient

Public Sampling

- NEWater bottled in attractive packaging for public sampling
- Distributed at grassroots and national events, and at NEWater Visitor Centre
- 1 million bottles reached in 100 days
- More than 16 million bottles distributed to date



NEWater Visitor Centre

- Pillar of public education campaign
- Officially opened in Feb 2003 by Senior Minister Goh Chok Tong, then Prime Minister, together with opening of first 2 NEWater plants
- State-of-the-art water museum that explains the concept and technology behind NEWater and how it plays a part in Singapore's water strategy
- Multimedia animations and interactive touch-screens
- NEWater plant incorporated as part of the centre to enhance learning experience
- 700,000 visitors to date



Endorsement by leaders

- Top government officials including the then Prime Minister of Singapore showed their support by drinking NEWater publicly



Public support for NEWater

- Strong acceptance of NEWater by the public
- 60,000 Singaporeans toasted to NEWater at 2002 National Day Parade.
- Independent survey by Forbes Research at the end of 2002 confirmed the success of the programme.
 - 98 per cent acceptance rate, with 82 per cent of respondents indicating that they would drink NEWater directly and another 16 per cent would drink it mixed with reservoir water.



Key factors for success

- Groundswell of support in early stages of campaign
- Engage media to be on its side
 - Result is fair and unbiased reporting
- Public endorsement by the country's leaders and water experts



Water for All: Conserve, Value, Enjoy



Water Reuse

- Potable Reuse
 - Indirect
 - Through potable water network
- Non Potable Reuse
 - Direct
 - Through separate network

Non Potable Use

- Major uses
 - Wafer fabrication and electronic process
 - Process cooling & boiler feed
 - Air-con cooling
- Reduce demand for potable water



Conclusion

- Water reuse provides another source. It has also a multiplying effect through using the drop of water more than once
- Multi safety barriers approach adopted in NEWater production ensures that it is safe for planned **indirect potable** use
- Support from stakeholders are critical
- **Direct non potable** use can reduce demand for potable water

Singapore International Water Week 2010

Sustainable Cities: Clean & Affordable Water

- 28 June - 2 July 2010
 - Water Leaders Summit
 - Water Convention
 - Water Expo
 - Business Forum
 - Lee Kuan Yew Water Prize



World Cities Summit 2010

Liveable & Sustainable Cities for the Future

28 – 30 June 2010





Thank you



Water for All: Conserve, Value, Enjoy

