

# Water for All Conserve, Value, Enjoy



## Active, Beautiful and Clean: A Sustainable Approach to Water Resource Management in Singapore

Presentation by Public Utilities Board

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Ms Peng Cheng Yao

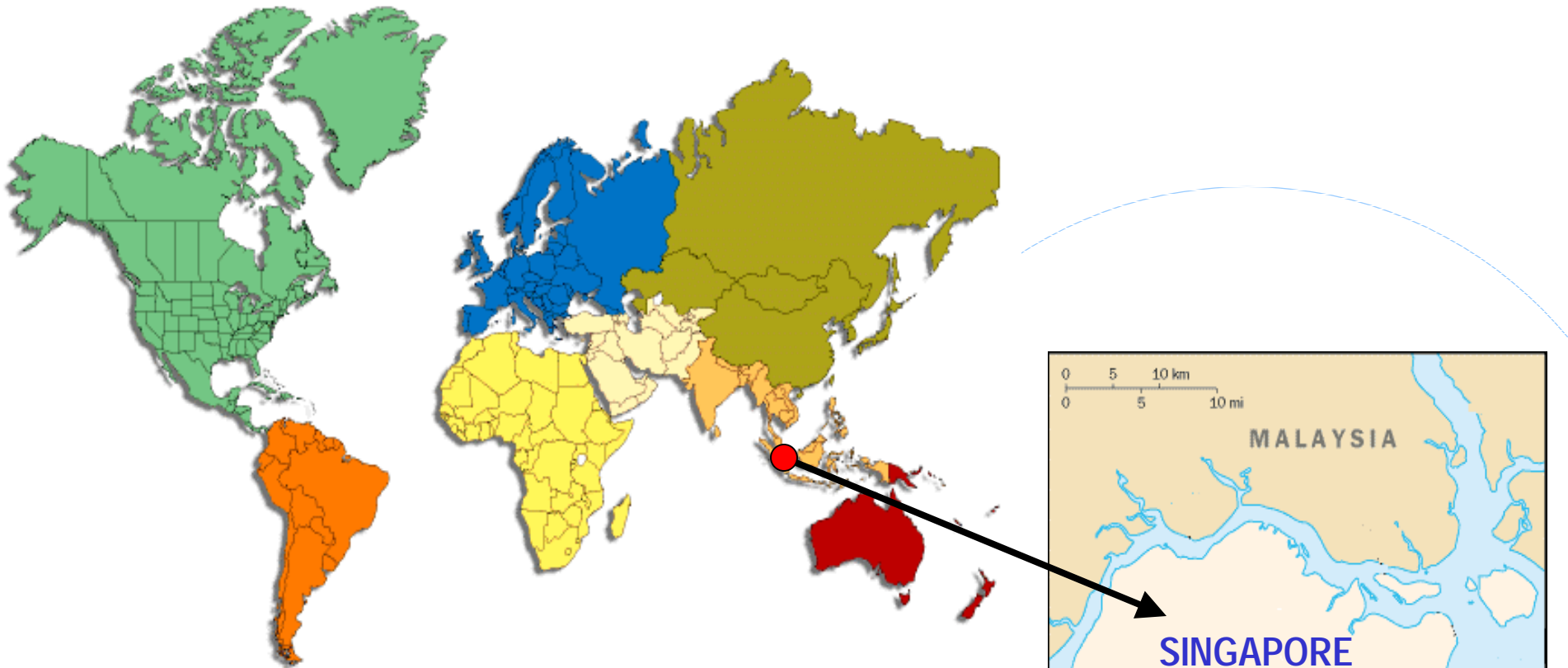
Ms Low E Wen

# Outline

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- Overview of Singapore's Strategies on Water Resources
- ABC Waters Programme
- Broad-based Biodiversity Study of Singapore's Reservoirs

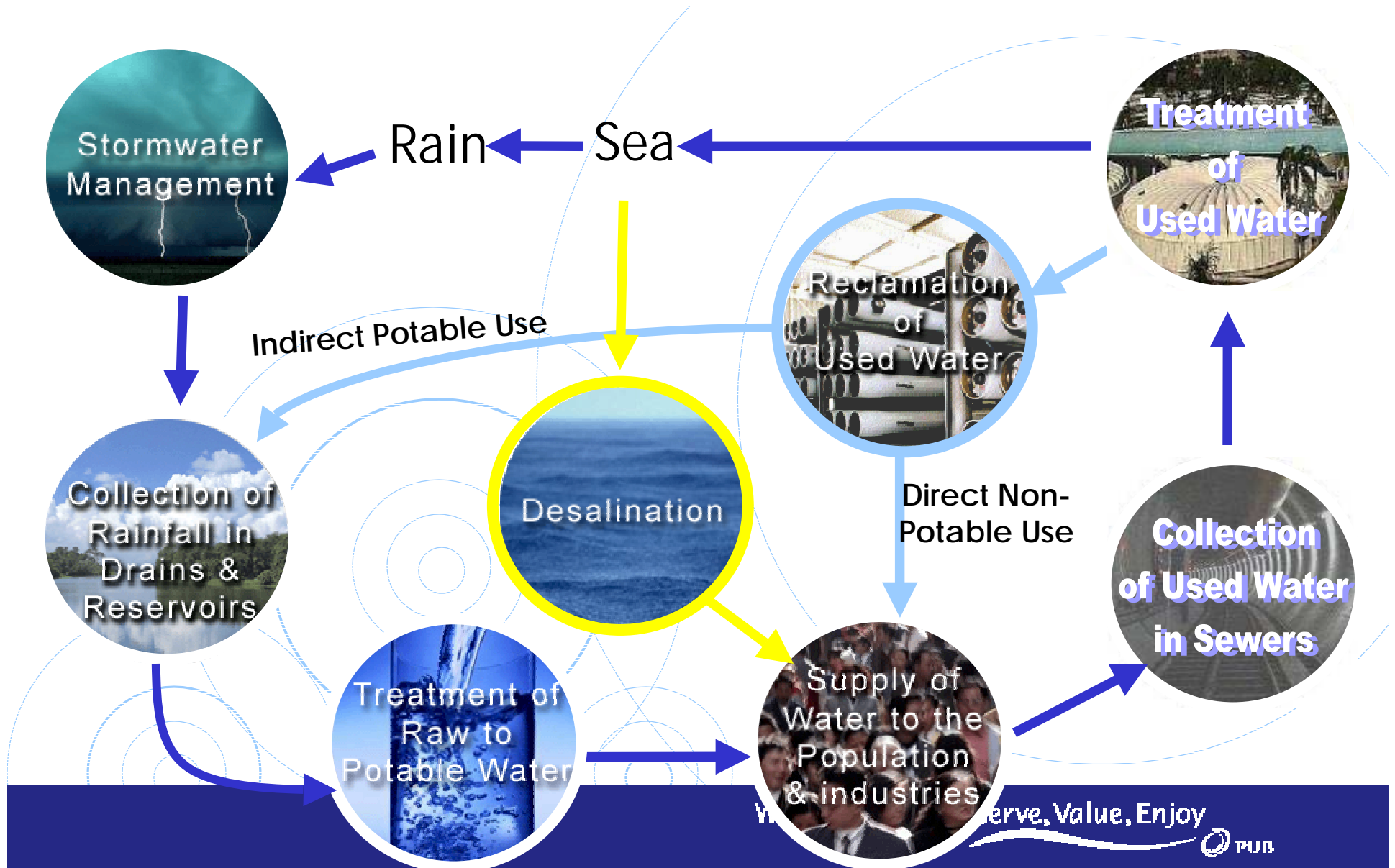


About Singapore

<b>Land Area</b>	<b>700 km<sup>2</sup></b>
<b>Population</b>	<b>4.5 mil</b>
<b>Average Annual Rainfall</b>	<b>2,400 mm</b>
<b>Average Water Demand</b>	<b>1.3 mil m<sup>3</sup>/day</b>

# ***PUB manages the complete water cycle***

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



# Sustainable Water Resources Management Strategies

Water for All  
Conserve, Value, Enjoy



Ensure a diversified and sustainable supply of water for Singapore with the Four National Taps

Adopt a 3P approach to engage the 3P partners to use water wisely, keep the water catchments and waterways clean and build a relationship with & enjoy using our waterways and reservoirs

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# Sustainable Water Resource Management

## 4 National Taps



Local catchment

Imported water

NEWater

Desalinated water

"Water for All"

## 3P Approach



"Conserve Water"

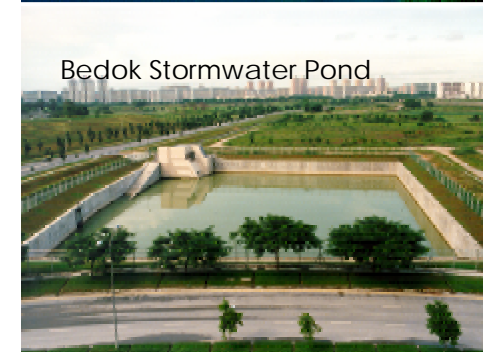
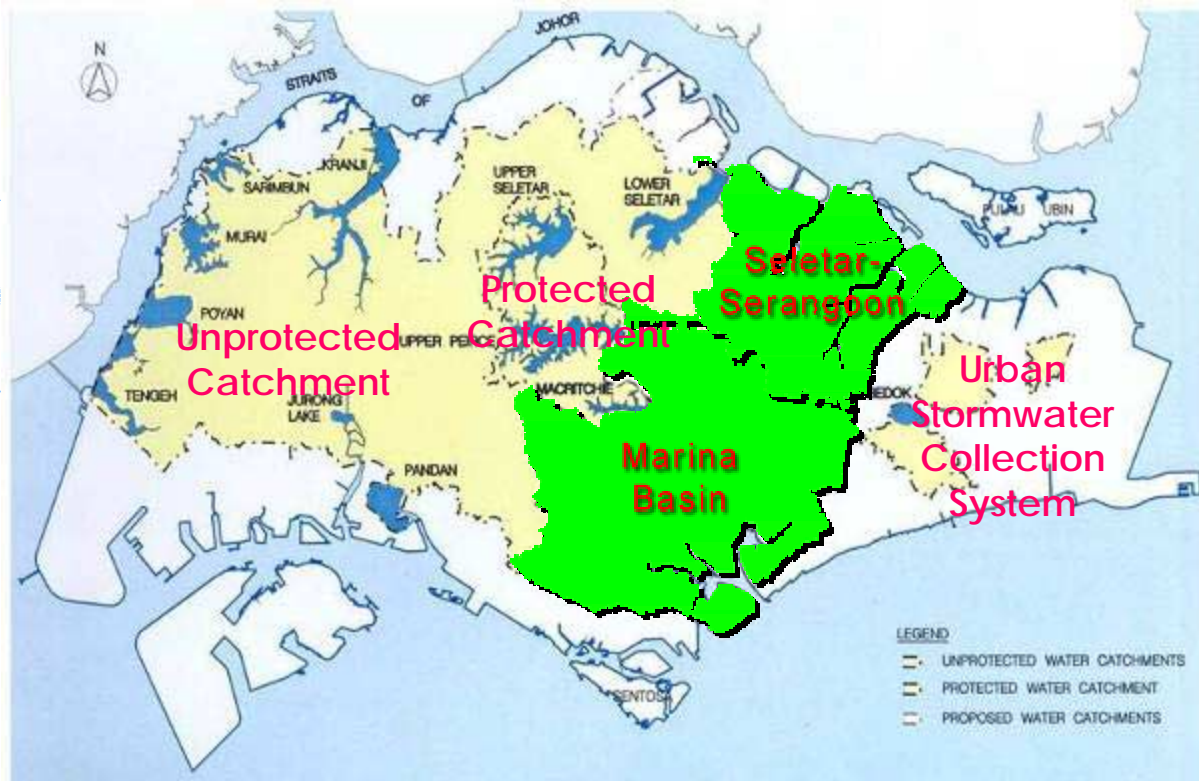
"Value Our Water"

"Enjoy Our Waters"

"Conserve, Value, Enjoy"

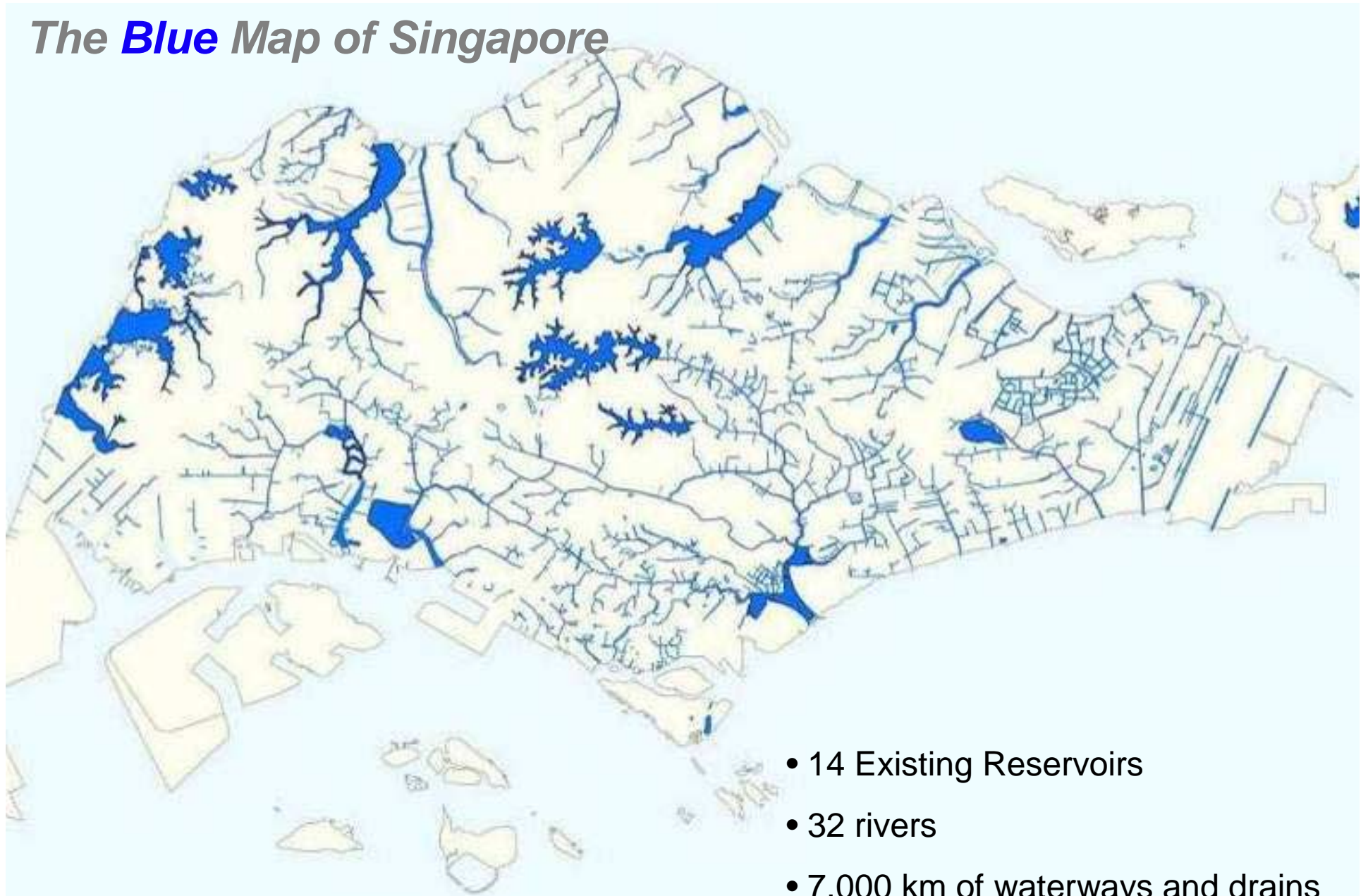
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- Half of Singapore is already water catchment
- Catchment area will be increased from half to two-thirds by 2011
- Need to protect the local catchment

## The **Blue** Map of Singapore



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# ABC WATERS PROGRAMME



## ABC Waters Programme is about:

- **ACTIVE**
  - Providing new community space
  - Bringing people closer to our waters
  - Developing a sense of ownership of our waters
- **BEAUTIFUL**
  - Integrating reservoirs and waterways with the urban landscape
  - Going beyond flood control and water storage
  - Creating aesthetically pleasing lifestyle attractions
- **CLEAN**
  - Improving water quality
  - Public education
  - Building people-water relationships



***“...Turn Singapore into a City of Gardens and Water”***

***– PM, ABC Waters Public Exhibition - Feb 2007***

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# ABC Waters Programme



## What we have done so far:

### Aesthetic / environmental treatment of waterways

- Iconic / Tourist areas
- Residential / Industrial areas
- Integration with parks
- Conservation of nature



Singapore River



Changi Business Park

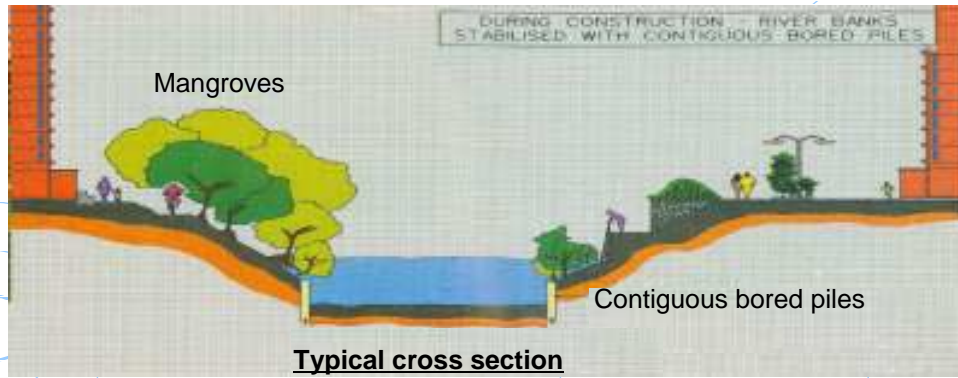


Bukit Panjang Pond



Sungei Api Api

# Sungei Api Api- *Back to Nature*



# Sungei Sembawang



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## Masterplan Approach

- Adopting a **masterplan approach** - watershed managers appointed
- Analyze the potential of our waterways and reservoirs.
  - More than 100 potential sites identified for the next 10-15 years.
- **ABC Waters Framework and Design Guidelines**
  - rain gardens, bioswales, cleansing biotopes to encourage cleansing at source
  - Soften the river/ canal edges
  - Encourage more flora and fauna to flourish

# Kolam Ayer Demonstration Project



## Features

- Landscaped riverbank
- Interactive water features archimedean screws, water wheel, creek
- Floating pontoon



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# Kallang River @ Bishan Park



## Features

- Natural looking river with flowing water
- Integration with park to form a blue-green network
- Interactive water features
- Water edge steps
- Footbridges for connectivity



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# Sengkang Floating Island

## Features

- Floating Island with wetland plants
- Bridge and boardwalk to connect to fruit park, Anchorvale CC and Sengkang Sports Centre
- Fruit pavilion





# Broad-based Biodiversity Study of Singapore's Reservoirs

- Background
- The Biodiversity Study
  - Singapore's Reservoirs
  - Sampling Methodologies
- Discoveries from the study so far
  - Within protected catchments
  - Other reservoirs
- Moving forward

# Background

## Need for Biodiversity Study

- Reservoirs & surroundings have rich biodiversity
- Important repositories of local freshwater and terrestrial life
- PUB's effort to systematically integrate environmental planning into its water resources planning and management

## Active, Beautiful & Clean

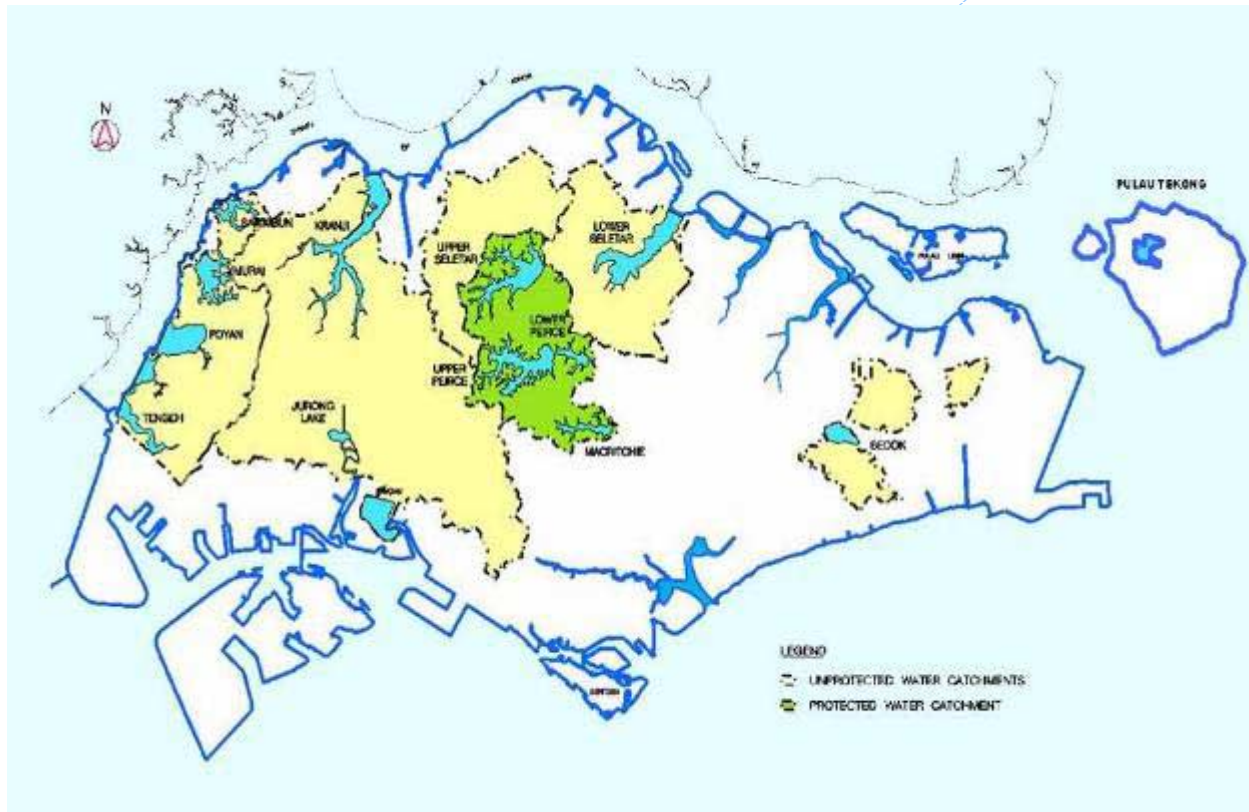
- Bringing People closer to the water
- More contact through recreational use of water
- Fostering Public interest in caring for our waters

## Broad based Biodiversity Study

- Working with the **Raffles Museum of Biodiversity Research** (since Dec 06)
- 3 year study to survey freshwater organisms in all 14 Reservoirs based on internationally accepted sampling methodologies.



# Singapore's Reservoirs



Three reservoirs done: **MacRitchie, Upper Pierce, Bedok,**

On ongoing: **Lower Pierce**

Sporadic: **Western Catchment Reservoirs**

- All 14 reservoirs in Singapore are man-made, mostly created from existing waterways; 3 more to be added by 2010
- Contains wide diversity of plant & animal life ranging from forest-country to open country
- 42-month study to establish good baseline for ecosystem and biodiversities in all reservoirs

# Sampling Methodologies

## Sampling points

- Ad hoc & Permanent points in and around the reservoirs
- Randomly selected transects in disturbed and undisturbed zones of the reservoirs

## Methods Used

- Both active (e.g., hand nets) as well as passive (e.g., traps) methods of capture for sampling
- Quantitative data based on the permanent sampling points using fishing nets and traps
- Visual & Aural Surveys (For Birds)
- Sampling of surrounding forest up to 5-metre from water edges (for Vascular Plants )



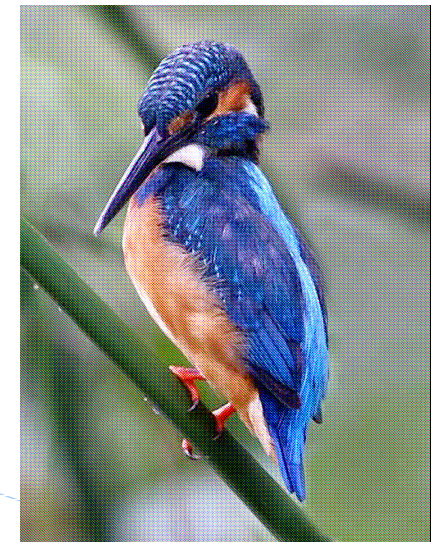
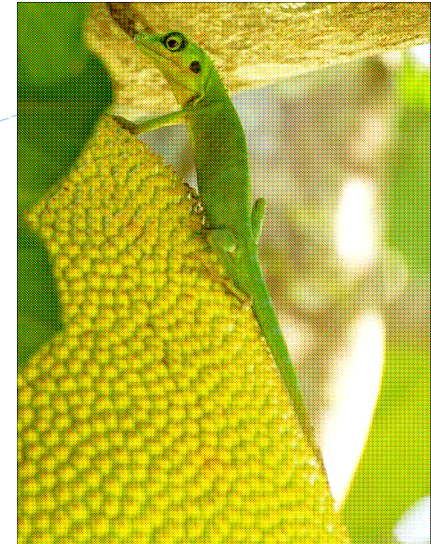
# Protected Catchments - MacRitchie Reservoir

- Rich biodiversity
  - 288 species of organisms (aquatic/terrestrial, native/non-native) were recorded
- Over 90% of species native
  - (8.3%) are alien species
- Part of Central Catchment Nature Reserve
- Native aquatic organisms restricted to reservoir's fringes,



# Protected Catchment - Upper Peirce Reservoir

- Similar to MacRichtie
- 233 species of organisms (aquatic/terrestrial, native/non-native) were recorded
- Over 85% of species native
- Part of Central Catchment Nature Reserve



## Other Reservoirs - Bedok Reservoir

- More of a man-made environment
- 105 species of organisms (aquatic/terrestrial, native/non-native) were recorded
- About half of species (44.8%) are non-native (alien) species



**Red-eared slider**  
(*Trachemys scripta elegans*)

# Western Catchment Reservoirs: Progressing

- Good and interesting records of birds at the reservoirs due to the inaccessibility by public



**Osprey (*Pandion haliaetus*)**



# Discoveries from the Reservoirs (Native) 1



## Malayan water monitor (*Varanus salvator*)

- Doing very well in our reservoirs
- A native species, commonly mistaken as the estuarine crocodile (*Crocodylus porosus*)



## Discoveries from the Reservoirs (Native) 2

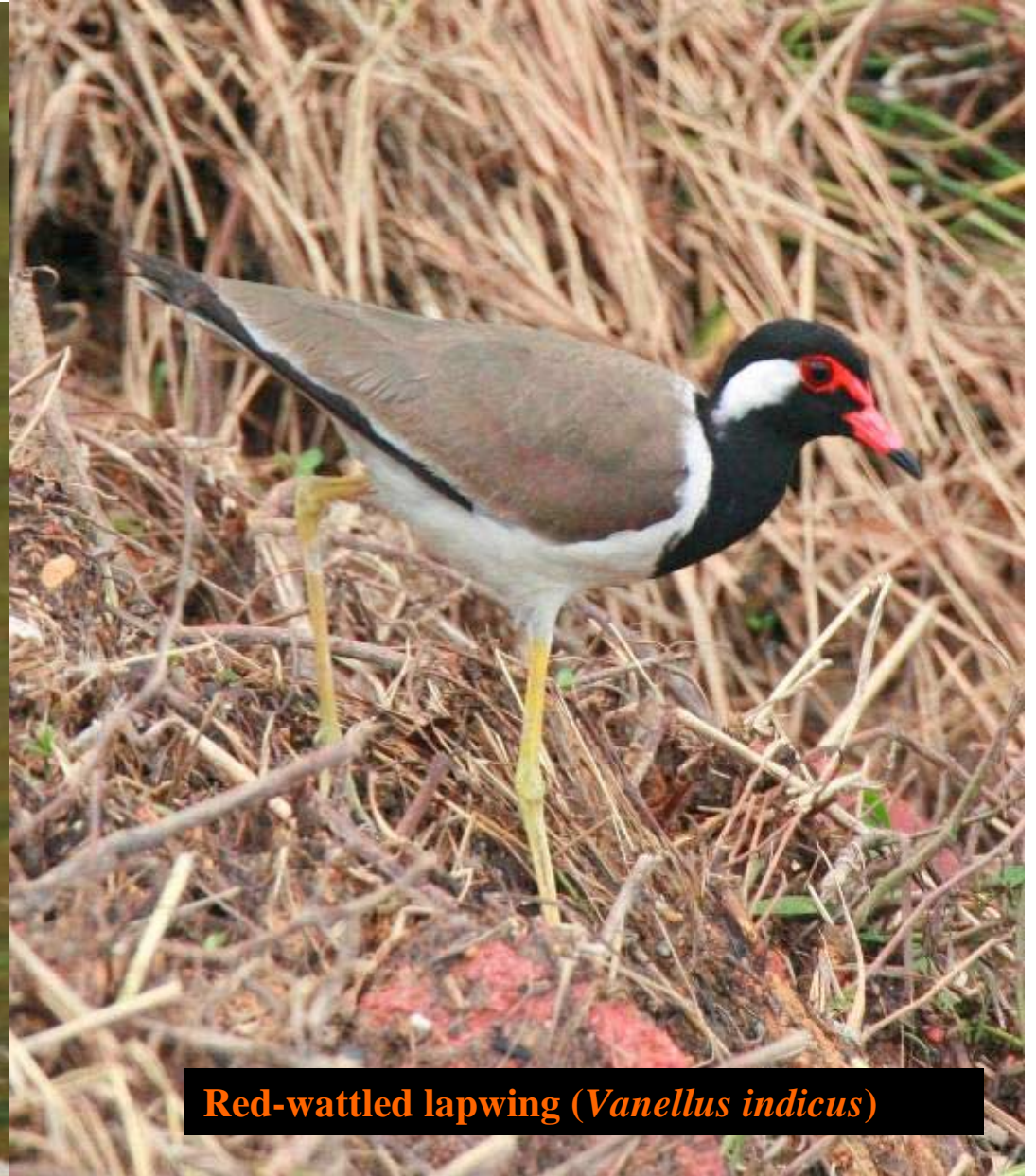


**Lobb's dendrobium (*Dendrobium lobbii*)**



**Crested Serpent Eagle (*Spilornis cheela*)**

## Discoveries from the Reservoirs (Native) 3



# Discoveries from the Reservoirs (Aliens) 1



## Sebarau

(*Hampala macrolepidota*)

- Predatory fish
- Very common in Upper Peirce Reservoir and also present in Lower Peirce Reservoir because of connections between the two reservoirs



## Threadfin acara

(*Acarichthys heckelii*)

- New record of introduced species for Singapore
- Ecologically very similar to the more common eartheater (*Geophagus altifrons*), another alien species
- Has been collected together with the eartheater in Upper and Lower Peirce and Lower Seletar Reservoirs so far

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## Discoveries from the Reservoirs (Aliens) 2



American bullfrog (*Rana catesbeiana*)



Golden apple snail (*Pomacea canaliculata*)

## Discoveries from the Reservoirs (Aliens) 3



**Australian red-claw crayfish**  
(*Cherax quadricarinatus*)

**Cuban slider (*Trachemys decussata*)**

- This is a similar species to the red-eared slider and can be found in the pet trade
- Likely to be released into the reservoir by irresponsible pet owners



# Moving forward

- Study of other 10 Reservoirs
- Working with RMBR
  - Develop suitable bio-indicators using native species
  - Improving capabilities & survey methods
- Integrate Study findings with Reservoir Management Plans
  - Best practices
  - Sensitive Areas
  - Working with other agencies
- Public Education
  - Guidebooks & Coffee
  - Working with Schools etc.





**Thank You**