PUB ACTIVE, BEAUTIFUL, CLEAN WATERS

SECONDARY

Learning Trail

@Sengkang Floating Wetland

TRAINER'S GUIDE

For more information, please visit us at www.abcwaterslearningtrails.sg
or email us at PUB_Learning_Trails@pub.gov.sg.

Contents

Objectives of the Active, Beautiful, Clean (ABC) Waters Learning Trail @ Sengkang Floating Wetland

This place-based inquiry experience aims to help students:

1. Foster a sense of national identity, pride as Singaporeans, and emotional rootedness to the nation.

2. Learn about the Singapore Water Story vis-a-vis Sengkang Floating Wetland. Appreciate Singapore's unique challenges, constraints, and where we have succeeded.

3. Develop leadership skills, instilling core values and the will to prevail, to ensure Singapore's continued success.

4. Understand PUB's ABC Waters Programme which will transform Singapore's pervasive network of drains, canals and reservoirs into beautiful and clean streams, rivers and lakes. By integrating the streams, rivers and lakes with the parks and gardens, new community spaces can be created. These will be bustling with life and activities, and transform Singapore into a City of Gardens and Water, a vision outlined by Singapore's Prime Minister Lee Hsien Loong.

5. Evoke a sense of wonder towards innovations, as students understand water treatment processes that give us clean water.

6. Promote stewardship for our strategic water resource and the need for everyone to play a part to keep our waterways and reservoirs active, beautiful and clean.

Details of the ABC Waters Learning Trail @ Sengkang Floating Wetland

Level: Lower Secondary Students (13 – 15 years old)
Programme Duration: 2 hours
Ratio of Facilitator to Students: 1 : 15 – 20 students
Recommended maximum group size: 80 students (or 2 classes)
Before the Trip:

- Show students and teachers the preparation brief (Annex 1) to help them prepare. Print these only if necessary.
- Fill in the information required for your Risk Assessment Management (RAM) form. Some information is given in Annex 2.

Educational Approaches

This trail uses inquire-based and experiential learning.

What is Inquiry-Based Learning?
The inquiry-based approach focuses on student constructed learning, as opposed to teacher or guide-transmitted information.

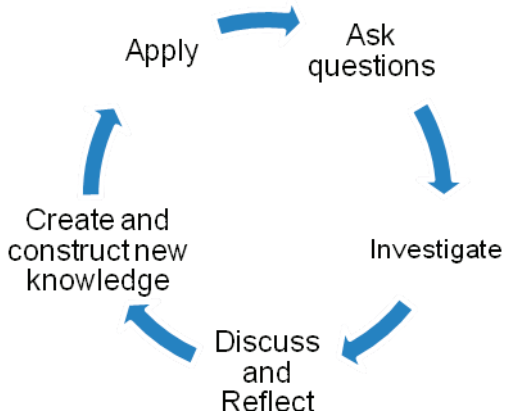
This process aims to enhance learning through:
1. Increased student involvement
2. Multiple ways of knowing

This is achieved by:

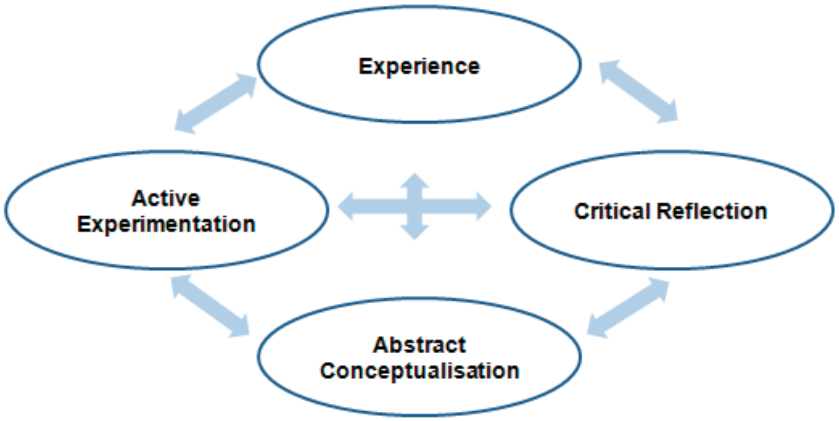
- Starting with an open-ended question or demonstration.

- Gather responses and subsequent questions from students with little comment or direction.

- Requiring students to collaborate on designing experiments or methods of inquiry.



What is Experiential Learning?
Experiential learning is the process of making meaning from direct experience.



Before the Trip

- Brief students on the field trip and what to bring and wear. Refer to Annex 1.
- To prepare students, show students the Pack List (Annex 1). Assign students to carry/be in charge of equipment/materials.
- Conduct a reconnaissance of Sengkang Floating Wetland and familiarise yourself with the area and stations.
- Fill in the Risk Assessment Management (RAM) form required by Ministry of Education (MOE). Suggested information is given in Annex 2.
- Inform the relevant authorities – PUB and NParks and make a booking for your school visit.

Wet Weather Procedure

On the day of the field trip:

- Check the weather forecast and lightning status 1 to 2 hours before the Learning Trail begins:
  - Visit the National Environment Agency website www.weather.gov.sg.
  - Dial the lightning advisory number at 6282-6821 (Sector 11 and 16)
- If there is a heavy downpour or the Lightning Category 1 is still not cleared:
  - Do not start the trail
  - Take shelter at the Anchorvale Community Club and conduct the extension learning activity and other indoor activities
- If lightning or heavy rain persists, stop the programme and plan for another make-up session if possible.
- Should a storm be expected during the Learning Trail, bring students back to the Anchorvale Community Club as soon as possible. If it is impossible to reach the sheltered area in time, students should wait under shelters along the trail and move back to indoor area as soon as they can. Conduct the extension learning activity at the Anchorvale Community Club.

Summary of the ABC Waters Learning Trail @ Sengkang Floating Wetland

Station	Duration	Location	Main Points	Subject Links (See Annex 3 for details)	Page No.	Materials
-	20min	Anchorvale Community Club	**Introduction** • On a Photo Hunt. • What is water sustainability? • Our Water Story and the Four National Taps. • First National Tap – Local Catchment Water. • Concept of the ABC Waters Programme. • Aims of the ABC Waters Learning Trail. • Safety briefing.	**Geography** • Managing the changing environment **National Education (NE)** • No one owes Singapore a living • Singapore is our homeland; this is where we belong, **Social Studies** • Managing our environment **Science** • Science and (water) technology	2-4	Student booklets, 'Water Sustainability' cards (Annex 4)

Station	Duration	Location	Main Points	Subject Links (See Annex 3 for details)	Page No.	Materials
1	20min	Viewing Gallery	**Punggol Reservoir – Past and Present** • "Reservoirs in Singapore" game. • History of Punggol. • Punggol-Serangoon Reservoir Scheme. • Transformation from Punggol River to Punggol Reservoir. • Water Cycle and Journey of Water from Punggol Reservoir. **ABC Water Design Features** • Concept of ABC Waters Programme. • Identifying the key features in Sengkang Floating Wetland. • Map reading.	**Geography** • Understanding the environment • The human environment • Managing the changing environment **Science** • Process skills • Water and technology	5-7 8-9	Rope. "Reservoir in Singapore" cards (Annex 6), compass
2	20min	Pedestrian bridge to Floating Wetland	**Water Quality at the Wetland** • Link between water quality and water sustainability – importance of water quality for life. • Test for some water parameters. • Evaluate water quality at the reservoir. • Limitations of this water testing activity.	**Geography** • The physical environment • Managing the changing environment **Science** • Process skills • Diversity • Measurements • Ethics and attitudes	10-11	Pail (with rope attached), World Water Day Monitoring test kits

Station	Duration	Location	Main Points	Subject Links (See Annex 3 for details)	Page No.	Materials
3	30min	Rain Shelter / Educational Panels about the Floating Wetland	**Singapore's Largest Man-made Floating Wetland** • Understanding the parts and functions of the floating wetland. • Benefits of the floating wetland. **Life Around the Floating Wetland** • Biodiversity. • Types and uses of wetland plants. • Mangrove plants present. • Freshwater and wetland habitats. • Animals around the floating wetlands. **"Journey of Water" game**	**Geography** • Understanding the environment • The physical environment • Managing the changing environment **Science** • Diversity • Interaction • Energy • Ethics and attitudes	12-13 14-17 7	Optional: Nature guide books, birds or plants identification cards 'Journey of Water' cards (Annex 5)
4	10min	End of the Floating Boardwalk / Edge of the Park	**Keeping Punggol Reservoir Active, Beautiful and Clean** • Observe and identify fruit trees. • Observe and identify human activities and their impact at Sengkang Floating Wetland. • Infer how these activities could affect water quality and biodiversity.	**Geography** • Managing the changing environment	18-19	

Station	Duration	Location	Main Points	Subject Links (See Annex 3 for details)	Page No.	Materials

	20min	Anchorvale Community Club	**Debrief and Reflection**
			• Reiterate roles of ABC Waters Programme / Sengkang Floating Wetland:
			  ○ Hydrology/Cleaning of water
			  ○ Ecology/Increasing biodiversity
			  ○ Community/Human activities and impact, and solution
			• Debrief on the Photo Hunt activity.
			• Your reflections
			  ○ Water sustainability
			  ○ Water pricing
			  ○ Activities at Sengkang Floating Wetland
			• Concluding points.
				Geography
				• Managing the changing environment
				• Measures towards water sustainability
				
				Science
				• Science and technology behind water management
				• Ethics and attitudes
				
				Social Studies
				• Caring for our (natural) environment
					8-19
					
					3
					20-21	

Total Duration: 1 hour 30min						
EXTENSION ACTIVITY						
-	1-1.5hr	As preferred	**Extension Activity – Problem-based Activity** • Relationships within the community – food chains and web. • Man's inter-relationship with nature and the ecosystem.	**Science** – relationships within the community – food chains and web; mans' impact on the ecosystem	15	Flipchart paper and markers (for each team)

Lesson Plan for the ABC Waters Learning Trail @ Sengkang Floating Wetland

Introduction

Duration: 20min
Location: Anchorvale Community Club
Learning Points:

- On a Photo Hunt
- What is water sustainability?
- Our Water Story and the four National Taps
- First National Tap – Local Catchment Water
- Concept of the ABC Waters Programme
- Aims of the ABC Waters Learning Trail @ Sengkang Floating Wetland
- Safety briefing

Trainer's Notes	Cross Reference/ Materials
1. **Welcome** students to Sengkang Floating Wetland in Punggol Reservoir. 2. Distribute the booklets to students and ask them to write their names. 3. Explain the **aims of the trail (Treasures on the Trail)** on Pg 2 of this Trainer's Guide and the themes that they will learn. **4. On a Photo Hunt** • One of the trail activities is for students to photograph some significant elements of Punggol Reservoir and Sengkang Floating Wetland. • Individuals or teams have to collect as many of the six photographs as they can. First, they have to use the clues on Page 3 to guess what the six items are. **5. Water Sustainability game:** • Conduct a card game to better understand Singapore's water challenges: ○ Small country with a small land area ○ Limited freshwater. ○ High population density. ○ Rapid population growth. ○ High water needs associated with commercial and industrial activity necessary for economic growth. • Show three cards with the numbers: 5.3 million, 715.8 and 152. • Ask students to brainstorm or generate questions which will give these numbers as the answers. • Accept a few answers and then provide debrief for the activity. The	Pg 2 Pg 3 'Water Sustainability' Cards (Annex 4)

answers are: ○ 5.3 million – What is the population of Singapore? ○ 715.8 square km – What is the land area of Singapore? ○ 152 litres – How much water does each person use per day? Relating to domestic consumption, not including industrial consumption. • What is water sustainability? ○ Water sustainability involves the creation of new water supplies and conservation of existing water sources, to ensure sufficient water to meet the needs of the current population and future generations. It also refers to equal access to water within the population. • Suggested points to lead students to understand water sustainability in Singapore: ○ Singapore's Four National Taps: Local Catchment Water, Imported Water, NEWater and Desalinated Water. Ask if students have visited the NEWater Visitor Centre and Marina Barrage. ○ This trail focuses on our first National Tap – Local Catchment Water. This consists of rainwater collected via drains, canals, rivers, stormwater ponds and reservoirs. ○ What is the relevance of land area? Land area limits the space we can collect rain water from and the space for water storage.	Pg 4
6. **Conduct a safety briefing:** • Students should inform you or their teacher if they are not feeling well, or if they have been injured, bitten by an animal (monkey) or stung by an insect. • They need to look out for potentially dangerous animals like snakes, scorpion, centipede and move away from them if these are encountered. • They are not to enter the reservoir or pollute it. • Stay hydrated by drinking water along the way. • They need to be aware of weather changes and listen to you or their teacher for instructions. Should there be an impending thunderstorm (lightning category 1 warning), the learning trail will be stopped and students will be asked to return to the Anchorvale Community Club.	Pg 4
7. Give students 3 min of preparation time to: • Apply mosquito repellent • Use the washroom • Buy a drink or drink water	
8. **Start the trail – lead students to the first station (Viewing Gallery).**	

Station 1: Punggol Reservoir and ABC Waters Design Features

Duration: 20min
Location: Viewing Gallery
Learning Points:

- 'Reservoirs in Singapore' game
- History of Punggol
- The Punggol-Serangoon Reservoir Scheme
- Transformation from Punggol River to Punggol Reservoir
- Water Cycle and Journey of Water from Punggol Reservoir
- Concept of ABC Waters Programme
- Identifying ABC Waters design features in Sengkang Floating Wetland
- Map reading

Trainer's Notes	Cross Reference/ Materials
1. On the way to the Viewing Gallery, stop at the sign with 17 reservoirs. • Ask students how many reservoirs and waterways Singapore has? (17 reservoirs, 32 major rivers and more than 7,000 km of canals and drains.) • What are the new reservoirs? (15th reservoir – Marina Reservoir; 16th reservoir – Punggol Reservoir and the 17th reservoir – Serangoon Reservoir.) • What does "Local Catchment water" mean? (Singapore uses two separate systems to collect rainwater and used water. Rainwater is collected through a comprehensive network of drains, canals, rivers and stormwater collection ponds and reservoirs before it is treated for the drinking water supply. Used water is collected through a separate system.) • Highlight that although Singapore is resource scarce, we can and have found our own way to survive and prosper.	Pg 4
2. Reservoirs in Singapore" game • Ask for eight volunteers. Distribute the rope and reservoir cards out to them. • Students use the rope to form the outline of Singapore on the ground. • Students with the reservoir name cards then hold their reservoir cards (e.g. MacRitchie, Marina, Punggol and Serangoon Reservoirs) and stand in their correct locations on "Singapore Island".	Rope, 'Reservoirs in Singapore' cards (Annex 6)
3. Concept of the ABC Waters Programme • Briefly highlight the concept of PUB's Active, Beautiful and Clean Waters Programme, where waterways and reservoirs have been transformed into beautiful and clean streams, rivers and lakes, creating a vibrant City of Gardens and Water. At the same time, these new community spaces bring people closer to water so they can better appreciate and cherish this precious resource.	Pg 4

• Explain the significance of some of these reservoirs:
  ○ MacRitchie Reservoir is Singapore's first reservoir.
  ○ The Punggol-Serangoon Reservoir Scheme which saw the creation of Singapore's newest reservoirs. They help to increase the local catchment by tapping stormwater surface run-off from north-eastern part of Singapore.	

4. History of Punggol • Discuss the history of Punggol using the timeline on Page 5.	

5. Water Sustainability and the **Punggol-Serangoon Reservoir Scheme**
• Explain that Punggol Reservoir is under the Punggol-Serangoon Reservoir Scheme (PSRS) and its significance:
  ○ It is located at the north-eastern part of Singapore.
  ○ It is developed to expand Singapore's water catchment areas and increase the country's water supply.
  ○ The reservoirs were created by building dams at the river mouths of Punggol and Serangoon Rivers. Locate these dams on the map on page 5.
  ○ The Scheme started construction works in 2006 and was officially completed in 2011.
  ○ Together with the Marina Reservoir, these reservoirs have increased the water catchment area from half to two-thirds of Singapore's land area.
  ○ Highlight that since Singapore has no natural aquifers and limited natural freshwater sources, it is Singapore's challenge to be self-reliant and find ways to ensure we have enough water to meet the population's needs.
	Pg 5

6. Transformation of Punggol River to Punggol Reservoir • Ask students to point in the direction of where Punggol River used to flow out to the sea (river mouth). • Briefly discuss the different stages of transforming Punggol River into Punggol Reservoir.	Pg 6
7. Map Reading – Navigation • Distribute a compass to each team and ask teams to set their map using the compass. • Alternatively, teams could orientate their maps according to the landmarks around.	Pg 8, 9
8. Observe and identify the **ABC Waters design features** in Sengkang Floating Wetland and surroundings. • Explain that ABC Waters sites uses sustainable design features to keep Singapore's waters clean. • Point out the bioretention swales at Sengkang West way and its functions. Highlight the features of the floating wetland as well. • Ask students to imagine the reservoir with and without the floating	Pg 8, 9

wetland. (The floating wetland makes the area lush, colourful and beautiful and helps keep the water clean.) • Remind them to start taking photos for their On a Photo Hunt activity. 9. Ask students to move to the next station.	

Station 2: Water Quality at the Floating Wetland

Duration: 20min
Location: Pedestrian Bridge to view the Floating Wetland
Learning Points

- Link between water quality and water sustainability – importance of water quality for life
- Test for some water parameters
- Evaluate water quality at the reservoir
- Limitations of this water testing activity

Trainer's Notes	Cross Reference/ Materials
1. Bring students to the pedestrian bridge that leads to the Floating Wetland. 2. Bring students to the **water collection point** to observe the water: • What do they think the water quality is like - good or poor? (Answers vary.) • Why does the water in a reservoir need to be of good quality? (It is a source for our water supply and to support aquatic life.) 3. Tie the rope of the pail to the railing and collect some water. Pour the water into one water kit and bring students to a shaded area to put down their bags. 4. Ask students to turn to the pages 10 and 11 of their booklet. Explain why we carry out this water testing – to see what the water quality in the reservoir is like. It needs to be good as it is for our water supply. Although all the raw water undergoes treatment, the cleaner the water, the easier and cheaper it will be to treat. Also, water in the reservoir sustains aquatic life. The water testing activity during this trail is not an extensive one, but we will have a quick indication of water quality for that day and hour. 5. **Conduct a demonstration** on how to use the water kits. You may also use the data loggers brought by the school. Introduce the World Water Monitoring test kit. Pour water from the pail into an emptied water kit to the fill-line. Highlight that for accuracy, the water needs to be filled exactly to this level. 6. Run through the water parameters progressively, as in pages 10 and 11, explaining each parameter as you go (what each parameter is and some implications of the readings). Demonstrate how the Dissolved Oxygen (D.O.) and pH tests should be conducted. 7. After your demonstration, assign the teams and distribute the test kits to each team. 8. Collect more water from the reservoir in a pail to distribute to the	Pg 10, 11 Materials: pail attached with a rope, thermometer/ data logger with temperature sensor, turbidity discs, water containers/ biodegradable cups

students. Ensure that no student is allowed to collect water directly from the reservoir and that no equipment falls into the reservoir. Give teams 10-15 minutes to complete their tests and record their answers in the "observation" boxes in their booklets. They should not fill in the "analysis" boxes yet. You will analyse the results of all the teams after they have obtained their results.

9. After teams have obtained their readings, gather everyone for debrief. Ask them to give you their D.O and pH bottles. Place these together and start debrief.

10. Discuss the readings obtained and **evaluate the state of the reservoir water**. Expected results:

    - **Debris and Smell** – there should not be any smell. "Nothing" is not considered a good answer as there is usually a natural smell for reservoirs and ponds, due to algae, soil particles and other natural materials in the water. There should not be any oil, rotting, etc. smell as this would indicate pollution. There may be debris washed down from upstream after a rain. Analysis: natural if there is no oil or rotting smell.

      Explain that it is important not to litter. Throwing litter will pollute the waterways and reservoirs. For example, plastic bottles thrown in by inconsiderate people. These bottles are unsightly and non-biodegradable.

    - **Colour** – the water should be colourless or slightly green (due to the presence of some algae, which is normal). Analysis: normal. Some algae is good as this can add to the level of dissolved oxygen in the water.

    - **Turbidity** – this should be as clear as possible. The usual reading is the lightest or second lightest number. Reiterate that turbidity is caused by small particles suspended in the water. It affects the light penetration in the reservoir. The clearer the water, the higher the light penetration – allowing more aquatic plants/algae to grow in the reservoir.

    - **Temperature** – expected results is between 28 – 30^{o}C. Ask students what factors can affect water temperature (weather conditions, rain).

      Reiterate that temperature can affect the amount of dissolved gases, like dissolved oxygen. The higher the temperature, the lower the level of dissolved oxygen. Water temperature also affects aquatic life. The metabolic reactions that are catalysed by enzymes in the body of organisms will be adversely affected when the temperature is too high or too low. High temperatures can kill living organisms.

• **Dissolved Oxygen** – this should be at least 4ppm (parts per million), below which the water will be too low and poor to support aquatic life. Ask students what affects the level of dissolved oxygen in the water (previously mentioned under temperature). o Organic materials that are present in the water will be decomposed by bacteria. These bacteria will use up oxygen in the water. o When the water is turbulent, for example due to windy conditions, more oxygen will be mixed into the water. o When photosynthesis takes place, plants take in carbon dioxide and release oxygen and vice versa when they respire. When there is sufficient light, like on sunny days, aquatic plants will photosynthesise more than they respire and therefore the level of oxygen in the water will increase. • **pH** – pH of 6 – 8. ○ The pH scale is from 0 to 14, with pH 0 being very acidic, pH 7 being neutral and pH 14 being very alkaline. ○ H^+ ions contribute to acidity while OH^- ions contribute to alkalinity. A solution is neutral when there is an equal amount of both ions. Most aquatic organisms survive well in pH range that is near neutral.	
11. Summary. Ask students to turn to page 11. Give them 5 min to answer the water quality questions before you discuss them: • What is your team's conclusion for the water quality in Sengkang Floating Wetland: Overall quality of water is generally good. • Can you drink this water from the reservoir? Why? (No, there are other parameters we still did not test for to know whether the water is safe for drinking – e.g. bacteria count, algae count, etc. Reservoir water has to undergo water treatment before it is potable and safe to drink.) • Where does the water in Punggol Reservoir come from? How do these parameters affect the water quality in the reservoir? (It comes from the rain as well as the drains from the surrounding Sengkang Town housing area also known as urban catchment. If there are pollutants in the rain such as particles or other gases, it could affect the pH or turbidity of the water in the reservoir. If people throw rubbish and chemicals into the drains, all this will be collected in the reservoir.) • What can we do to prevent pollution in the reservoir or any ABC Waters site? (By throwing rubbish responsibly into bins, not polluting drains with chemicals and not feeding fish in waterways or reservoirs.	Pg 11

Use phosphate-free detergent (e.g. when car owners use phosphate-free detergent to wash their cars, this will adversely impact the water quality in the reservoir.) 12. What are the limitations of today's water testing? • Only one measurement was taken at each location – at the water's surface • For a more comprehensive water testing we need to test water from different depths, different times of day, from many locations throughout the year. • Limitations in accuracy of the test kit. 13. Ask students to move to the next station.	

Station 3: Singapore's Largest Man-made Floating Wetland

Duration: 30min
Location: Rain shelter/ Educational Panels about the floating wetland
Learning Points:

- Biodiversity
- Understanding the parts and functions of the floating wetland
- Benefits of the floating wetland
- Types and uses of wetland plants
- Mangrove plants present
- Freshwater and wetland habitats
- Animals around the floating wetland
- "Journey of Water" game

<table>
<tr><th>Trainer's Notes</th><th>Cross Reference/ Materials</th></tr>
<tr><td>
1. Observations at the Floating Wetland

Ask students to observe the wetland around the pedestrian bridge or sheltered area and tell you what they see. (Plants, animals, etc.)
Highlight that the plants are growing on a floating platform.

2. Understanding the parts and function of the Floating Wetland

Bring students to the sign or turn to Page 12 of their booklet. Run through the functions of the main parts of the floating wetland. Ask them to look for these parts:

<table>
<tr><th>Main Parts</th><th>Functions</th></tr>
<tr><td>Wetland Plants</td><td>Clean the water, provide shelter and food for animals, and beautify the reservoir.</td></tr>
<tr><td>Planting Media</td><td>Supports the plant, encourage growth of plant.</td></tr>
<tr><td>Floating Media</td><td>Provides buoyancy for the floating wetland Supports and anchors the plant, enable roots to go through it, supports a community of micro-organisms for additional cleansing.</td></tr>
<tr><td>Plant Roots</td><td>Absorb nutrients from the water including nitrates, ammonia, etc.

Provide a surface for micro-organisms to attach to. These micro-organisms are able to break down pollutants, cleaning the water.</td></tr>
</table>

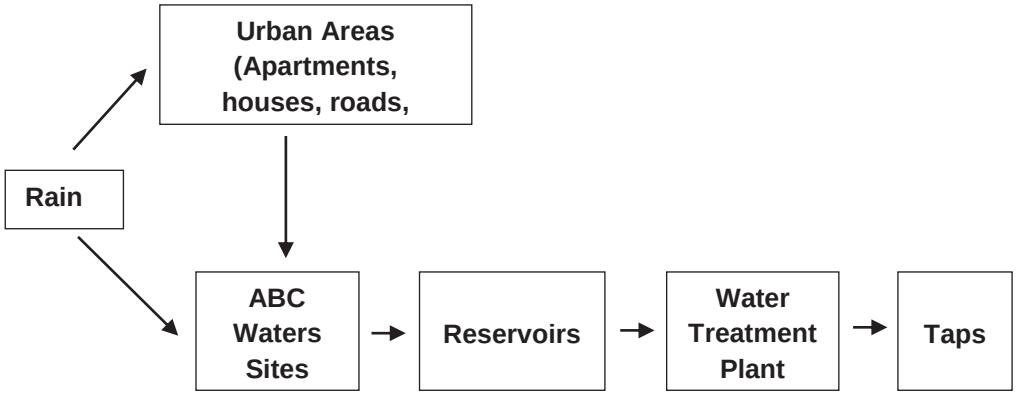
More information about the Floating Wetland:

There are eight planted floating mats. Each mat forms a module.
Floating wetlands are systems that allow wetland plants to grow as a floating mat on the surface of the water rather than rooted to the river bed.
Size of a standard module is 2.3m in width, 4.0m in length and 0.2m in thickness.

</td><td>Pg 12

Pg 13</td></tr>
</table>

○ Each standard module consists of four layers of biomesh matrix of ○ 5cm thickness bonded together using PU foam, and with an internal strengthening mechanism of joiner plates and webbing. Biomesh is ○ made up of recycled polyester fibres, which provides buoyancy for the plants, huge surface area for beneficial microbe colonisation and a ○ rooting matrix for wetland vegetation. ○ The Sengkang Floating Wetland began construction in 2008 and was completed by 2010.	
3. Discuss the **benefits of the Floating Wetland.** • Cleans the water of the reservoir. • Provides a habitat for animals and enhances biodiversity in the area. • Provides food and shelter for the animals • Beautifies the surroundings.	Pg 13
4. More about wetland plants – freshwater wetland habitat and mangrove habitat. • Teams identify wetland plants (Pg 14), and read the signages to find out their uses. • Teams also observe and identify mangrove plants (Pg 15). • More information about wetland plants: ○ There are 8 planted floating mats with 18,500 wetland plants of 18 different species. ○ They were chosen for their cleansing and aesthetic properties. ○ Plants absorb nutrient and pollutants through their roots. ○ The selected species are emergent plants with their roots on the mats and penetrate into the water. Their stems, leaves and flowers are above the water surface. • Discuss the uses of some of the wetland plants. Have teams share their answers.	Pg 14,15
5. **Animal life around the Floating Wetland** • Students are to spot wildlife from the bridge and note what habitat the animals were observed in. • Discuss the overall rating of biodiversity at Sengkang Floating Wetland. (High/low, depends on the variety of living things observed.) • What are some limitations of the "survey"? (E.g. Only at a certain time of the day, only observations from the floating boardwalk)	Pg 16, 17
6. Journey of Water • Distribute "Journey of Water" cards to each team found in Annex 5 and ask student teams to arrange them in the correct order. • Refer to Pg 7 and run through the answers.	Pg 7 "Journey of Water" cards (Annex 5)



- Types of catchment - Rain falling directly onto the reservoir or ABC Waters sites versus urban catchment (rain falling in the housing areas including apartments, houses, roads, town facilities, will go into the reservoir or ABC Waters sites.)
- Punggol and Serangoon Reservoirs are linked by a transfer pipe so water from Serangoon Reservoir flows by gravity to Punggol Reservoir, and water in Punggol Reservoir is then pumped to Upper Peirce Reservoir for storage. This allows us to realise the potential of collecting more water within the Punggol-Serangoon catchment.
- Water is then treated at the water treatment plant before being channelled to our homes, schools and industries.
- Remind students that while water is available at the turn of the tap, water is a scarce and precious resource. We must manage and use it wisely, whether in school or at home.

7. Bring students to a spot on the bridge where they can better observe the mangrove plants.

Pg 15

- Ask students what mangrove plants are. Tropical forests usually found growing in muddy areas along the coast or riverine areas.
- Explain that this was the original habitat of Punggol River.
- Point out the two species, Bakau and Api Api that are growing nearer the water's edge.
- Ask the students to tick the mangrove plants they see.
- What will happen to these mangrove plants since the water salinity has changed from brackish or sea water to fresh water?

8. Point out and identify some of the animals around the floating wetland and mangrove plants using nature guide books (if available).

Pg 16, 17

- Students should continue to spot and record animals as they continue their route.

9. Ask students to move to the next station.

Station 4: Keeping Punggol Reservoir Active, Beautiful and Clean

Duration: 10min
Location: End of the Floating Boardwalk / Edge of the Park
Learning Points:

- Observe and identify fruit trees
- Observe and identify human activities around Sengkang Floating Wetland
- Infer how these activities could affect the water quality and biodiversity of Sengkang Floating Wetland

Trainer's Notes	Cross Reference/ Materials
1. Bring students to the end of the Floating Boardwalk.	
2. Ask students what visitors can do at the park. (Jog, practise Tai Chi, picnic, cycle, etc.)	Pg 18, 19
3. Explore the **fruit trees** around • The surrounding park is planted with many edible fruit trees (e.g. star fruit, chiku, pineapple and dragon fruit) • Ask students to spot some fruit trees nearby (e.g. star apple, pineapple plants, mangosteen tree) near the bridge entrance.	

4. Ask the students to conduct a **human impact survey** on the way back.
• There are many facilities at the park and Sengkang Floating Wetland. Explain that students will now conduct a survey of activities in the area on the route back to Anchorvale Community Club and infer the possible impacts on the water quality and biodiversity of Sengkang Floating Wetland.
• On page 18, students should record:
  ○ All activities observed earlier.
  ○ New activities on the route back.
  ○ Any observations of human impact (e.g. Littering, vandalism).
	Pg 18

5. **Re-trace the route back to Anchorvale Community Club**.
• Remind students that they should:
  ○ Observe and record human activities.
  ○ Complete their photo hunt.
  ○ Spot and observe animals.
• Along the way, point out other mangrove plants: Sea Hibiscus, Sea Lantern Tree and Noni Tree.	

6. On returning to the Anchorvale Community Club, find a quiet shaded spot to conduct a debrief of the Learning Trail.	

Debrief and Reflection

Duration: 10min
Location: Anchorvale Community Club
Learning Points:

- Reiterate role of ABC Waters Programme vis-à-vis Sengkang Floating Wetland
- Debrief On a Photo Hunt activity
- Your Reflections:
  - Water sustainability
  - Water pricing
  - Activities at Sengkang Floating Wetland
- Concluding points

Trainer's Notes	Cross Reference/ Materials
Use the booklet to recap the main learning points: 1. Suggested debrief questions: • How many reservoirs are there in Singapore today? (17) • Why do we need so many reservoirs? (As one of the four National Taps to ensure water sustainability in Singapore.) • Which are the latest reservoirs? (Punggol and Serangoon Reservoirs, created under the Punggol-Serangoon Reservoir Scheme.) 2. **Debrief On a Photo Hunt activity** • Ask which student or teams have completed their photo hunt? • Ask a few students to share what photos they took. • Ask students what they can do with their photos? (Create a photo journal, or post them on Facebook, write a blog about their experience, or the need for environmental consciousness amongst youth.) 3. **Link the observations and results from the Learning Trail to the role of ABC Waters Programme / Sengkang Floating Wetland: To integrate parks (green), reservoirs and waterways (blue) and community (orange)**: • **Hydrology / Cleaning of water** ○ Recap water quality results – overall, the water is clean. ○ Recap how the floating wetland helps to cleanse water. • **Ecology / Enhancing Biodiversity** ○ How many plants did they see? ○ How many animals did they see? Highlight rare/interesting ones. ○ Which mangrove species were observed? • **Community / Human Activities and Impact** ○ Ask students to share the activities they recorded and how these	Pg 3 Pg 19 Pg 10, 11 Pg 12-17 Pg 18-19

could affect the water quality and biodiversity of the reservoir.
    - Discuss possible solutions to manage these activities.
    - Highlight that it is everyone's responsibility to care and protect public facilities.

Human Activities	How can we manage this? (Solutions)
General hikers, joggers, people who come here for walks and picnics Feeding of animals – fishes Vandalism	• Educate users on the consequences of their actions. • Educate users not to feed the animals. • Enforce laws. • Gently ask the person to stop what he/she is doing if it adversely affects the reservoir.
Fishing	• Restriction of fishing grounds (not to include inlets). • Return all fish caught, back to the reservoir to main biodiversity and balance of the ecosystem. • Educate fishermen. • Enforcement of laws. • Restriction to only artificial baits.

4. Suggest some ideas to **encourage visitors to the Punggol Reservoir to care for its water and surroundings**.
    - By setting a good example.
    - Conduct educational walks, talks and events there.
    - Through banners, campaigns, etc.

Pg 18

5. **Your Reflections**.
    - Ask students to answer the reflection questions on Pages 20 and 21.
    - What is water sustainability?
        - Water sustainability involves the creation of new water supplies and conservation of existing water sources, to ensure sufficient water to meet the needs of the current population and future generations. It also refers to equal access to water within the population.
    - How do Punggol Reservoir and Sengkang Floating Wetland enrich the lives of Singaporeans? (E.g. provide a community space for people to relax and exercise, family and community bonding.)
    - What new activities would you suggest for Sengkang Floating Wetland and Punggol Reservoir?
    - What would you do to ensure that a small nation like Singapore can enjoy water sustainability in the long term?
        - Keep our waterways clean. Do not dispose any waste, solid or liquids, into our waterways.
        - Conserve our water.
        - Explain to people the consequence of their actions if you encounter such anti-social behaviour.

Pg 20, 21

6. Concluding Points. • Through the Learning Trail, we have gained a better understanding of ○ The importance the Active, Beautiful, Clean Waters (ABC Waters) programme. ○ More about the Sengkang Floating Wetland and Punggol-Serangoon Reservoir Scheme. ○ The water treatment process that gives us clean water from our taps. ○ To save water whenever possible, at home and in school. ○ The need to care for our waterways and reservoirs and keep them clean. ○ Playing a part towards water sustainability in Singapore.	

Extension Activity: A Problem-based Activity

Duration: 1-1.5hr

This can be conducted as a post trip activity or a wet weather programme at the Anchorvale Community Club.

Trainer's Notes	Cross Reference/ Materials
1. Divide the class into 2 or 4 teams. Assign or let teams choose their angle to solve the problem. 2. Suggested time: 45 minutes for teams to develop their plan in exciting youth about water management in Sengkang West. Guide them as they answer the scaffold questions provided on Page 22. 3. Gather the class and let each team make their presentation (5 minutes), followed by a 1-2 min question and answer session. 4. Give your comments after each presentation and summarise the points raised after all teams have presented.	Pg 22 Flipchart paper and markers (for each team)

References

- *Water for All: Conserve, Value, Enjoy – Meeting our water needs for the next 50 years.* PUB Public Document.

- Tan Yong Soon, Lee Tun Jean and Karen Tan (2009) Clean, Green and Blue. *Singapore's Journey Towards Environmental and Water Sustainability*, Ministry of the Environment and Water Resource.

Annexes

Annex 1: Preparation Brief for ABC Waters Learning Trail

Suggested What-to-bring List for Students (Print only if you have to)

1. A fieldtrip bag (small bag for items below)
2. Water bottle
3. Insect repellent
4. Raincoat or umbrella (in case of rain)
5. Ziploc bag for waterproofing valuables (e.g. camera, hand phone)
6. A pen, or pencil and eraser
7. Cap

Do not bring:
Digital hand held gaming devices, text books, sports equipment for the fieldtrip.

Optional

- Snacks
- Digital camera or camera hand phone
- Sunscreen

Suggested Attire for Students

- T-shirt
- Shorts, or track pants (lighter colours preferable)
- Covered shoes (no slippers)

Annex 2: Suggested Information for Risk Assessment Management (RAM) Form

Risk Assessment Management System
'W Checklist'

PROGRAMME DETAILS			
Activity:	ABC Waters Learning Trail	**Venue:**	Sengkang Floating Wetland, Punggol Reservoir
Outgoing		**Returning**	
Date:	To be filled by teacher	**Date:**	To be filled by teacher
Estimated Time of Departure:	To be filled by teacher	**Estimated Time of Arrival:**	To be filled by teacher
Person-in-charge:	To be filled by teacher	**Assistant(s):**	To be filled by teacher

LOCAL VENDOR CONTACT DETAILS (IF ANY)			
Company name & full address:	Facilitator's Name Singapore Environment Council 1 Kay Siang Road #04-02 Singapore 248922		
Office number:		**Mobile number:**	HP of facilitator
Contact person:	Facilitator's name		

OVERSEAS VENDOR CONTACT DETAILS (IF ANY)			
Company name & full address:	NA		
Office number:	NA	**Mobile number:**	NA
Contact Person:	NA		

WHY
State learning objectives: This programme aims to: 1. Foster a sense of national identity and emotional rootedness to Singapore 2. Learn about the Singapore Water Story, appreciating Singapore's unique challenges and successes 3. Understand one of PUB's long term initiatives – the ABC Waters Programme, which will transform Singapore's pervasive network of drains, canals and reservoirs into beautiful and clean streams, rivers and lakes 4. Better understand ecological and water topics in the Science syllabus 5. Promote stewardship for our strategic water resource and the need for everyone to play a part to keep our waterways and reservoirs active, beautiful and clean
Does the activity meet learning objectives? (Yes / No)

Note: *Please attach the programme / itinerary.*

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
WHAT (GENERAL)									
1.	**Equipment**								
	a) Appropriate equipment is available.								
	b) Appropriate equipment is serviceable.								
	c) Others :								
2.	**Transport**								
	a) Transportation service is reliable (e.g. driver, vehicle).						To be filled by teacher		
	b) Chartered vehicle is appropriate (e.g. using a 4WD for off-road terrain).						To be filled by teacher		
	c) Others :								
3.	**Food**								
	a) Food is provided by licensed caterer / restaurants.								
	b) Nutrition is appropriate.								
	c) Special dietary needs are met.								

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
	d) If self-catering, additional hygiene measures are in place.								
	e) Water is potable.								
	f) Others :								
WHEN (TIMING)									
4.	**Programme**								
	a) Duration of activity is appropriate (e.g. start/stop/rest time).	Participants tired out from the activity	Dehydration/ Physical exhaustion	2	1	2	- The trail will last for 2 hours in the outdoors, with activity stops at the stations.		
	b) Timing of activity is appropriate (e.g. 5km run conducted before 10.30am or after 3.30pm).	Possible heat injuries due to weather	Dehydration/ Physical exhaustion	2	1	2	- Activities at stations will be conducted in shady areas or under available shelter. - Students will not be under the sun for a prolong period of time. - Students will be reminded to hydrate frequently.		
	c) Possible delay in activity (e.g. day hike extended into night).	NA							
	d) Others :								
WHO (PEOPLE)									
5.	**Teachers and Adult Supervisors**								

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
	a) Teacher(s)/adult supervisor(s) are competent to supervise activity and manage participants (e.g. teacher/adult supervisor: participant ratio met for specific activity, female adult supervisor present for overnight activity involving female participants).	Participants fall sick and need attention/ evacuation	Not enough teachers/ adult supervisors	2	1	2	- Facilitators are experienced in supervising/managing students - Program ratio will be 1 facilitator to 20 maximum students.		
	b) Personnel is certified and competent to conduct activity.	Participants risk possible danger when outdoors	Participants may injure themselves	2	1	2	- Facilitators are experienced in conducting activities for students in indoor and outdoor settings.		
	c) Certified First Aider or paramedic is on site.	Injured students do not get the proper first aid.	Minor injuries could manifest to major injuries if not treated well.	3	1	3	- Facilitators are first-aid certified. (please verify) - Should there be any student who is injured, he/she will be accompanied by a teacher/parent volunteer to the nearest shelter to be attended to by the main facilitator.		
	d) Personnel is competent to co-ordinate/execute emergency evacuation plan (e.g. search and rescue).	Students with serious injuries cannot get to the hospital in time.	Injuries could be life threatening.	4	1	4	- Should there be a medical emergency involving the injured student, the main facilitator will call for an ambulance and the teacher/parent volunteer will		

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
							accompany him/her to the hospital.		
	e) Others :								
6.	**Participants**								
	a) Participants understand the objectives of activity.						- A briefing will be given at the start of the Learning Trail.		
	b) Participants are competent for activity (e.g. participate in pre-activity training).								
	c) Participants are aware of and adhere to safety requirements of activity.						- A SAFETY briefing will be given at the start of the programme. Facilitators will reiterate safety points during the programme, when necessary. - Students will be briefed to react if they encounter potentially dangerous animals e.g. snake, monkeys, etc. - Students will be briefed not to enter water bodies; not cause anyone to fall into the water bodies. - Water collection for testing will not be carried out by students, but only by facilitators or teachers.		
	d) Special needs of participants are met.								

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
	e) Medical declaration and information of participants are documented and disseminated to relevant personnel.						- Teacher/s to inform facilitators about any special cases – students with medical conditions.		
	f) Others :								
WHERE (LOCATION)									
7.	**Venue**								
	a) Accommodation is adequate (e.g. number of rooms).								
	b) Fire safety and evacuation route is communicated to all.								
	c) Area map is available for use during activity.	Students find themselves lost.	Injuries may ensue.	1	1	1	- Map of location is included in the student booklets. These are carried by both facilitators and students during the programme. - Students should be with the facilitators at all times.		
	d) Reconnaissance of area is conducted.	Dangerous hazards appear in between time of recon and actual	Injuries may ensue due to unforeseen hazards.	1	1	1	- Facilitators would have conducted a reconnaissance of the location before the date of the learning trail.		

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
		day							
	e) In-country authorities and facilities (e.g. police, national park rangers and hospital) are accessible and/or contactable for assistance and support in the event of an emergency.								
	f) Water conditions (e.g. tides, currents, flash floods) and traffic (e.g. ships, power boats).								
	g) Others :								
WEATHER									
8.	**Inclement Weather**								
	a) Weather forecast and warning (e.g. lightning, flash flood, hot or cold spell, haze).	Sudden down-pour	Participants get drenched which will cause participants to fall ill eventually.	1	1	1	- Facilitators to check NEA Rain animation and PSI level at these timings: ○ 2 hours before LT ○ 1 hour before LT ○ During LT if needed		
		Lightning	Participants strike by lightning	4	2	8	- Before students board bus for the location: In the case of **impending thunderstorm, heavy rain or**		

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
							levels of PSI above 100, it is advised to delay the departure for the location, until Lightning Category 1 is lifted. - If there is **Lightning category 1 or PSI level of equal or greater than 100 during the Learning Trail,** all activities will be stopped and students will be led to take shelter. - If the conditions persist, the programme will be aborted and students brought back to school.		
	b) Others :								

***Note**: Please indicate "N.A." in cells that are not applicable.*

Excursion Checklist		Action Plan	Implementation	
			Action Officer	Follow-up Date
1.	**Communication**			
	a) Establish communication with school and service provider via hand phone, satellite phone and/or other appropriate devices.			
	b) Establish communication with in-country authorities and facilities (e.g. police, national park rangers, hospital) for assistance and support in the event of an emergency.			
	c) Compile contact list of stakeholders (e.g. parents, MFA Duty Office, and in-country medical facilities).			
2.	**Medical**			
	a) Arrange for medical screening and vaccinations for teachers/adult supervisors and participants (if necessary).			
	b) Procure comprehensive travel insurance for all (e.g. International SOS for emergency evacuation).			
	c) Ensure accessibility to medical facilities or personnel in the event of an emergency.			
3.	**Overseas Travel**			
	a) E-register with MFA at least 3 days before departure.			
	b) Monitor and comply with MFA travel advisory on natural disasters, pandemic outbreak, social-political unrest.			
4.	**Others**			
	a)			

Risk Assessment Team comprises:

Name of Officer(s)	Designation

Name of Person-in-charge	Signature	Date

Vetted by:

Name of HOD	Signature	Date

Chief Safety Officer/Principal Checklist

To ensure that the following are completed prior to the programme:

- ☐ Communicate programme details to parents and participants
- ☐ Compile medical information and consent forms
- ☐ Ensure that personnel conducting activity is qualified
- ☐ Ensure that pre-activity training is carried out
- ☐ Ensure that relevant safety and emergency procedures are in place

Submission of Overseas Excursion details to MFA via MFA eRegister (if applicable):

- ☐ Prepare details of itinerary and participants for overseas excursion
- ☐ Enter details for BF01_MFA-MOE form via the Overseas Excursion Management (OEM) Module in the School Cockpit
- ☐ Generate the BF01_MFA-MOE form from the Reports Portal in the School Cockpit
- ☐ Submit BF01_MFA-MOE form as an attachment at www.mfa.gov.sg at least 3 days before departure

Approved by:

Name of Chief Safety Officer/Principal	Signature	Date
Comments:		

Assessment Review:

Name of Person-in-charge	Signature	Date

Annex 3: Subject Links

No	Theme	Lower Secondary School Curricula

1	History and background of Sengkang Floating Wetland and Punggol Reservoir	**Geography**
		• Understanding the environment
		  ○ The physical environment as a natural resource
		  ○ Environment through maps (directions, map symbols)
		• Managing the changing environment (water resources)
		  ○ Water as a scarce resource
		  ○ Responses to the rising demand for water (increase water supply through catchment areas)

2	Water properties – link with flora, fauna, biodiversity and vegetation	**Science**
		• Process skills (observing, comparing, using apparatus, inferring)
		• Diversity of matter
		  ○ Solutions (chemicals/minerals)
		  ○ Suspensions (turbidity)
		• Measurements
		  ○ Use of measuring instruments
		  ○ Physical quantities and units
		• Ethics and attitudes
		  ○ Show an appreciation that water is a precious resource and the need to conserve it
		
		Geography
		• The physical environment
		  ○ Components of the physical environment (rivers, natural vegetation)
		  ○ The inter-relationships of all the components in the physical environment
		  ○ The hydrologic cycle (evaporation, transpiration, condensation, rainfall, run off)
		• Managing the changing environment
		  ○ Water resources
		  ○ Pollution

3	ABC Waters Design Features	**Science**
		• Process skills: observing, inferring
		• Science and Technology in society (dams, man-made floating wetland)
		
		Geography
		• Understanding the environment
		  ○ Environments through maps (map symbols)
		• The human environment
		  ○ The human environment is a product of interaction with the physical environment

No	Theme	Lower Secondary School Curricula

4	Life at Sengkang Floating Wetland and Punggol Reservoir	**Science**
		• Diversity of plant and animal life
		  ○ Classification of plant and animal life
		• Interaction
		  ○ Population, community and ecosystem
		• Energy
		  ○ Photosynthesis – land and water
		  ○ Energy transfer process in the ecosystem
		• Ethics and attitudes
		  ○ Show an appreciation for the importance of man to understand and maintain the connections among living things
		
		Geography
		• Understanding the environment
		  ○ The physical environment as a natural resource
		• The physical environment
		  ○ Natural vegetation and people
		  ○ The inter-relationships of all the components in the physical environment
		• Managing the changing environment
		  ○ Protecting and conserving the environment at different levels (individual, national, international)

5	Human activities and impact	**Science**
		• Ethics and attitudes
		  ○ Impact of man's actions on the environment
		  ○ Show an appreciation for man's responsibility to have care and concern for living things and the environment
		
		Geography
		• Managing the changing environment
		  ○ The impact of human activities on the environment (local)
		  ○ Protecting and conserving the environment at different levels (individual, national, international)
		
		Social Studies
		• Caring for our environment
		  ○ Land, air and water pollution
		  ○ Solution to tackle pollution

No	Theme	Lower Secondary School Curricula

6	Water supply and treatment	**Science**
		• Science and Technology (damming up of rivers)
		
		Geography
		• Managing the changing environment
		  ○ Water as a scarce resource
		  ○ Responses to the rising demand for water (increase water supply through catchment areas, international agreements and technology)
		  ○ Case study of water supply in Singapore (diversification of water resources through the Four National Taps)
		• Interdependence where water is important to humans for survival and for economic functions
		• Water resources: measure to ensure water sustainability (pricing, public education, diversification of water resources through the Four National Taps strategy)
		
		National Education
		• No one owes Singapore a living
		  ○ We find our own way to survive and prosper, turning challenges into opportunity
		• We have confidence in our future
		  ○ United, determined and well-prepared, we have what it takes to build a bright future for ourselves and to progress together as one nation.

Annex 4: “Water Sustainability” Cards

5.3 million

152

715.8

Annex 5: “Journey of Water” Cards

Rain

Urban Areas

(Apartments, houses, town facilities roads, etc.)

ABC Waters Site(s)

Reservoirs

Water Treatment Plant

Taps

Annex 6: “Reservoir in Singapore” Cards

Bedok

MacRitchie

Lower Seletar

Punggol

Serangoon

Pandan

Jurong Lake

Lower Peirce

Marina

Kranji

Annex 7: Suggested Packing List (of Resources) – for Trainers

1. First Aid Kit
2. Insect repellent
3. 4-5 sets of ‘’Water Sustainability” Cards (Annex 4)
4. 4-5 sets of “Journey of Water” Cards (Annex 5)
5. 4-5 sets of “Reservoirs in Singapore” Cards (Annex 6)
6. 4-5 pails with rope attached (for collection of water)
7. World Water Day Monitoring Kits with turbidity discs and thermometer

Optional:

8. Charged data loggers including temperature sensors
9. Bird and insect cards, nature guide books
10. Camera
11. 4-5 Compasses

Acknowledgements

Anchor Green Primary School

Fernvale Primary School

Nan Chiau Primary School

Compassvale Secondary School

Nan Chiau High School

Pei Hwa Secondary School

Ministry of Education, Curriculum Planning and Development Division,
Humanities Branch and Sciences Branch

FairPrice Water Education Fund

PUB, Singapore's national water agency

PUB is the national water agency that manages Singapore's water supply, water catchment and used water network in an integrated way. PUB won the 2007 Stockholm Industry Water Award and was named Water Agency of the Year at the Global Water Awards 2006.

About PUB's tagline: Water for All: Conserve, Value, Enjoy

PUB has ensured a diversified and sustainable supply of water for Singapore with the Four National Taps (local catchment water, imported water, NEWater, desalinated water).

To provide water for all, PUB calls on all Singaporeans to play our part to conserve water, keep our water catchments and waterways clean and build a relationship with water so we can enjoy our water resources. We can then have enough water for all uses – for industry, for living, for life.

PUB SINGAPORE'S NATIONAL WATER AGENCY

www.pub.gov.sg