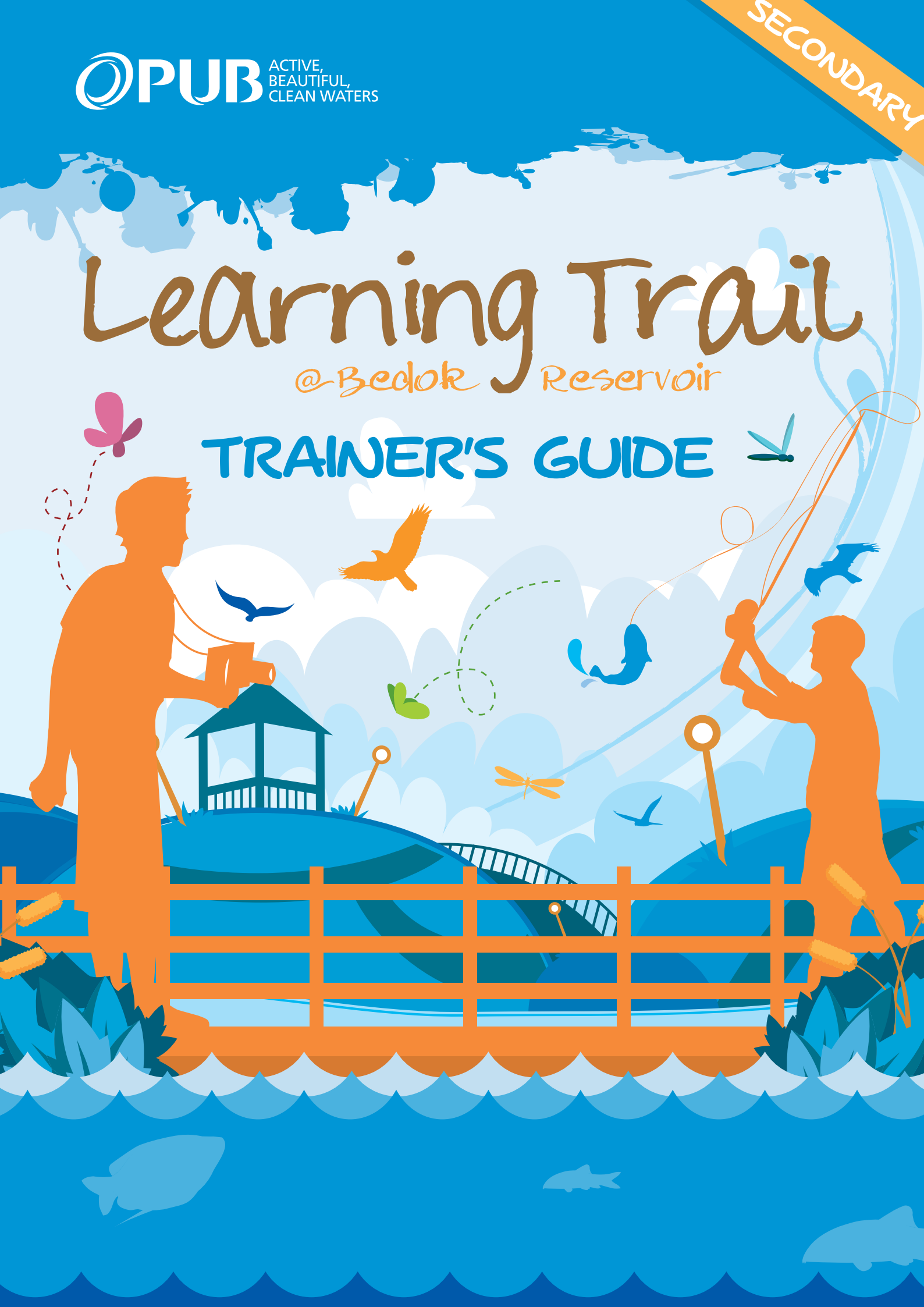
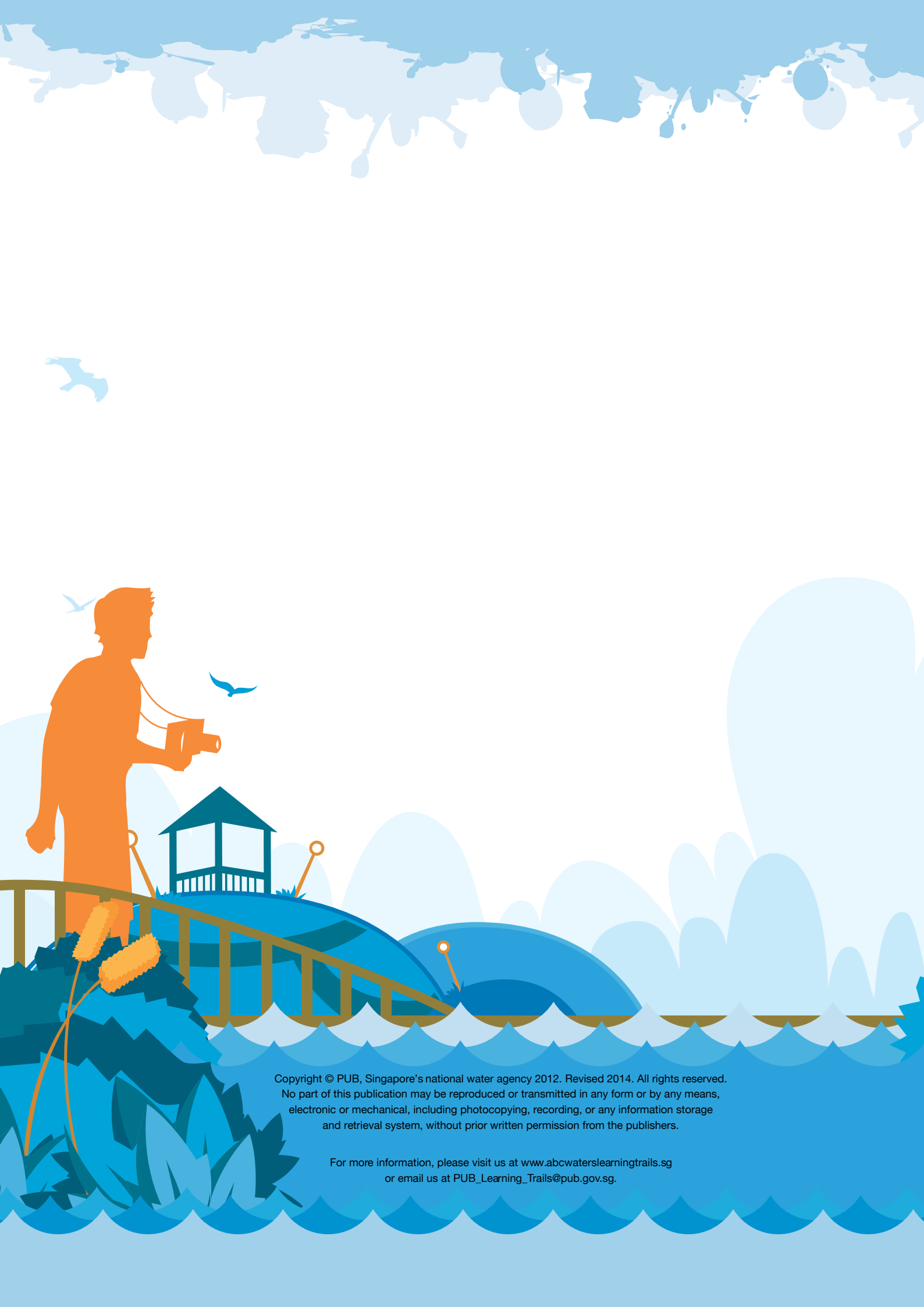


Learning Trail

@ Bedok Reservoir

TRAINER'S GUIDE





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For more information, please visit us at www.abcwaterslearningtrails.sg
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Objectives of the Active, Beautiful, Clean (ABC) Waters Learning Trail @ Bedok Reservoir

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 Bedok Reservoir. 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 @ MacRitchie

Level: Lower Secondary Students (13 – 15 years old)

Programme Duration: 2 hours – 2 hours 30 min

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?

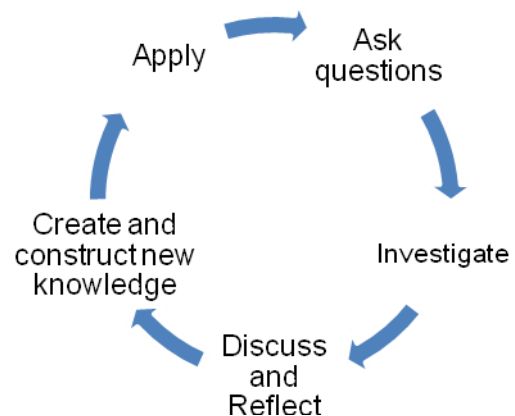
The inquiry-based approach focuses on student constructed learning, as opposed to teacher or guide-transmitted information.

This process aims to enhance learning through:

1. Increased student involvement
2. Multiple ways of knowing

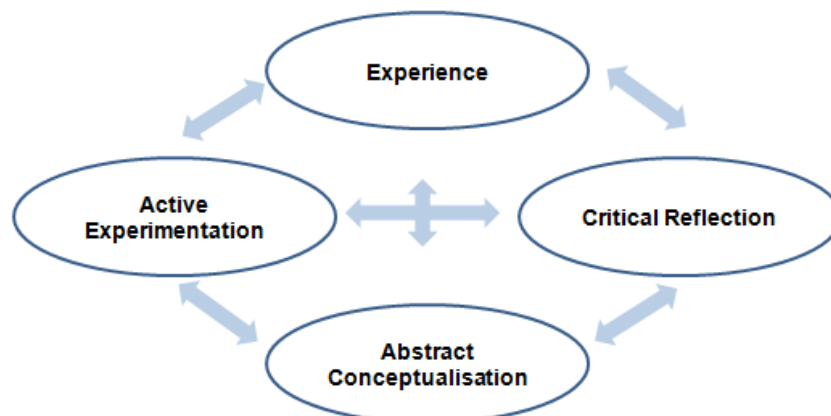
This is achieved by:

- 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 Bedok Reservoir 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
- If there is a heavy downpour or the Lightning Category 1 is still not cleared:
 - Do not start the trail
 - Take shelter and conduct the extension learning activity
- 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 sheltered area 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 shelter.

Summary of the ABC Waters Learning Trail @ Bedok Reservoir

Station	Duration	Location	Main Points	Subject Links	Page No.	Materials
-	20min	Car park drop off point	Introduction <ul style="list-style-type: none"> • 'Water Sustainability' game. • What is water sustainability? • Our Water Story and the Four National Taps. • First National Tap – Local Catchment Water. 	Geography <ul style="list-style-type: none"> • Understanding the environment • Managing the changing environment National Education <ul style="list-style-type: none"> • No one owes Singapore a living. • We have confidence in our future Science <ul style="list-style-type: none"> • Science and (water) technology 	2-3	Student booklets, 'Water Sustainability' cards
1	30min	Fishing Deck	Bedok Reservoir and ABC Waters Concept <ul style="list-style-type: none"> • 'Reservoirs in Singapore'. • History of Bedok Reservoir. • Water sustainability at Bedok Reservoir. • Water Cycle and Journey of Water at Bedok Reservoir. • 'Journey of Water' Game • Concept of ABC Waters Programme. • Identifying features at Bedok Reservoir. • Map reading. 	Geography <ul style="list-style-type: none"> • Understanding the environment • Managing the changing environment • The human environment Science <ul style="list-style-type: none"> • Process skills • Water and technology 	3-7	Rope, 'Reservoirs in Singapore' cards, compass, 'Journey of Water' cards

Station	Duration	Location	Main Points	Subject Links	Page No.	Materials
2	30min	Fishing deck and shady grass patch near the deck	Water Quality at Bedok Reservoir <ul style="list-style-type: none"> • Link between water quality and water sustainability – importance of good water quality for life. • Test for some water parameters. • Evaluate water quality at the reservoir. • Limitations of this water testing activity. 	Geography <ul style="list-style-type: none"> • The physical environment • Managing the changing environment Science <ul style="list-style-type: none"> • Process skills • Diversity • Measurements • Ethics and attitudes 	8-9	Pail with a rope, data logger with temperature, pH and dissolved oxygen sensors, water containers and/or water monitoring kits
3	20min	Along the pathway beside the Berlin Wall up to Forest Adventure	Life around Bedok Reservoir <ul style="list-style-type: none"> • Biodiversity of Bedok Reservoir. 	Geography <ul style="list-style-type: none"> • Understanding the environment • Managing the changing environment • The physical environment Science <ul style="list-style-type: none"> • Diversity • Interactions • Ethics and attitudes 	10-11	Optional: nature guide books, birds or plants identification cards

Station	Duration	Location	Main Points	Subject Links	Page No.	Materials
4	30min	Beside PA Water Venture	<p>Keeping Bedok Reservoir Active, Beautiful and Clean</p> <ul style="list-style-type: none"> • Observe the area around Bedok Reservoir. • Infer the type of land use and assess the types of developments around Bedok Reservoir. • Observe and identify human activities and their impact on Bedok Reservoir. • Infer how these activities can affect the water quality and biodiversity of Bedok Reservoir. • Suggest ways to minimise the negative impact of these activities. 	<p>Geography</p> <ul style="list-style-type: none"> • Understanding the environment • Managing the changing environment • The human environment • The physical environment <p>Science</p> <ul style="list-style-type: none"> • Ethics and attitudes <p>Social Studies</p> <ul style="list-style-type: none"> • Caring for our environment 	12-13	

Station	Duration	Location	Main Points	Subject Links	Page No.	Materials
-	20min	Sheltered area near the cafe	Debrief and Reflection <ul style="list-style-type: none"> • Reiterate the role of ABC Waters Programme. • Reflections on water sustainability and activities at Bedok Reservoir. • Concluding points. 	Geography <ul style="list-style-type: none"> • Managing the changing environment • Interdependence where water is important to humans for survival and for economic functions • Managing water resources to ensure sustainability Science <ul style="list-style-type: none"> • Science and technology (creation of reservoirs) National Education <ul style="list-style-type: none"> • No one owes Singapore a living • We have confidence in our future 	14-15	
Total Duration: 2 hours 50min - 3 hours						
EXTENSION ACTIVITY						
-	1-1.5hr	As preferred	Extension Activity – Problem based Activity <ul style="list-style-type: none"> • Discuss and come up with a ten-year plan for MacRitchie Reservoir. 	Geography, National Education and Social Studies	16	

Lesson Plan for the ABC Waters Learning Trail @ Bedok Reservoir

Introduction

Duration: 20min

Location: Open area near the carpark drop-off point

Learning Points:

- “Water Sustainability” game
- What is water sustainability?
- Our Water Story and the Four National Taps
- First National Tap – Local Catchment Water

Trainer’s Notes	Cross Reference/ Materials
<p>1. Welcome students to Bedok Reservoir.</p> <p>2. Distribute the booklets to students and ask them to write their names.</p> <p>3. Explain the aims of the trail as on page 2 of this trainer’s guide and the themes that they will learn.</p> <p>4. “Water Sustainability” game.</p> <ul style="list-style-type: none"> • Conduct a card game to better understand Singapore’s water challenges: <ul style="list-style-type: none"> ○ Small country with a small land area. ○ Limited freshwater. ○ High population density. ○ Rapid population growth. ○ Water needs associated with commercial and industrial activity which are necessary for economic growth. • Show three cards with the numbers: 5.3 million, 715.8 and 152 (refer to Annex 4). • Ask students to brainstorm or generate questions which will give these numbers as the answers. • Conduct the debrief for the activity: Answers: <ul style="list-style-type: none"> ○ 5.3 million: What is the population of Singapore? ○ 715.8 square km: What is the land area of Singapore? ○ 152litres: How much water does each person use per day? Reiterate that this is domestic, and not industrial consumption. <p>5. What is water sustainability?</p> <ul style="list-style-type: none"> • Water sustainability involves the creation of new water supplies and conservation of existing water sources, to ensure sufficient water to meet 	<p>Pg 2</p> <p>Pg 3</p> <p>Pg 5</p>

<p>the needs of the current population and future generations. It also refers to equal access to water within the population.</p> <ul style="list-style-type: none"> • Suggested points to lead students to understand water sustainability in Singapore: <ul style="list-style-type: none"> ○ Singapore’s Four National Taps: Local Catchment Water, Imported Water, NEWater and Desalinated Water. ○ 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 space for water storage. However, Singapore’s land area has been maximised; two-thirds of Singapore is now water catchment area to collect rainwater for our water supply. • To update these figures, refer to these sources: <ul style="list-style-type: none"> ○ Singapore population and land area (Department of Statistics Singapore at www.singstat.gov.sg) ○ Water consumption (PUB – the national water agency at www.pub.gov.sg) <p>6. Conduct a safety briefing:</p> <ul style="list-style-type: none"> • Students should inform you or their teacher if they are not feeling well, or if they have been injured, bitten by an animal (ants) or stung by an insect (bees, wasps). • 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. • 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 sheltered area. <p>7. Give students 3 min of preparation time to:</p> <ul style="list-style-type: none"> • Apply mosquito repellent • Use the washroom • Buy a drink or drink water <p>8. Start the trail – let students navigate their way to the first station.</p>	<p>(optional: compasses)</p>
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Station 1: Bedok Reservoir and ABC Waters Concept

Duration: 30min

Location: Fishing Deck

Learning Points:

- “Reservoirs in Singapore” game
- History of Bedok Reservoir
- Water sustainability at Bedok Reservoir
- Water Cycle and Journey of Water at Bedok Reservoir
- “Journey of Water” game
- Concept of ABC Waters Programme
- Identifying features at Bedok Reservoir
- Map reading

Trainer’s Notes	Cross Reference/ Materials
<p>1. On the way to the first station, talk to the students about the reservoirs in Singapore.</p> <ul style="list-style-type: none"> • Ask students how many reservoirs and waterways Singapore has. (17 reservoirs, 32 major rivers and more than 7000 km of canals and drains) • What are the new reservoirs? (15th – Marina Reservoir, 16th – Punggol Reservoir, 17th – 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, stormwater collection ponds and reservoirs before it is treated for the drinking water supply. Two-thirds of Singapore is used to collect rainwater for our water supply. Used water is collected through a separate system.) • Highlight that although Singapore is resource scarce, we can and have found our way to survive and prosper. 	Pg 3
<p>2. “Reservoirs in Singapore” game.</p> <ul style="list-style-type: none"> • Ask for eight volunteers. Distribute the rope and reservoir cards (refer to Annex 6) out to them. • Students use the rope to form the outline of Singapore on the ground. • They should hold their reservoir cards (e.g. MacRitchie, Marina, Pandan etc.) and stand in their correct locations on the “Singapore island”. 	
<p>3. Discuss the history of Bedok Reservoir using the timeline on page 4.</p>	Pg 4
<p>4. Water sustainability at Bedok Reservoir.</p> <ul style="list-style-type: none"> • Bedok Reservoir was constructed under the Sungei Seletar – Bedok Water Scheme. • Together with the Serangoon and Punggol Reservoir it supplies water to the eastern part of Singapore. 	Pg 5

<ul style="list-style-type: none"> • Bedok Reservoir was designed as a collection point for rainwater collected from eight catchment areas located in Bedok, Tampines and Yan Kit. These catchments were equipped with a collection pond and a pumping station to pump rainwater from the pond to the reservoir. • A water treatment plant (Bedok Waterworks) was built about 400m west of the reservoir to treat the water from both reservoirs in the Sungei Seletar – Bedok Water Scheme. <ul style="list-style-type: none"> ○ Two pumping stations facilitates the transfer of raw water from Sungei Seletar Reservoir to Bedok Reservoir, and then to the treatment plant. • 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 that we have enough water to meet the population’s needs. 	
<p>5. The Water Cycle and Journey of Water at Bedok Reservoir.</p> <ul style="list-style-type: none"> • In the Learning Trail, we learn about the Four National Taps and focus on the Local Catchment. • Bedok Reservoir is an urban water catchment. <ul style="list-style-type: none"> ○ It collects rainwater from the drains and canals that flows from Yan Kit, Tampines and Bedok town. ○ Important not to litter into the drains as the water that flows through these drains will eventually reach the reservoirs. <p>6. “Journey of Water” game.</p> <ul style="list-style-type: none"> • Distribute the “Journey of Water” cards (refer to Annex 5) and ask students to arrange them in the correct order. • Refer to page 5 and run through the answer: Rain → Urban Areas → Reservoirs → Water Treatment Plants → Taps • Remind students that while water is readily available here, it is a scarce and precious resource. We must manage and use it wisely whether in school or at home. 	Pg 5
<p>7. Concept of ABC Waters Programme.</p> <ul style="list-style-type: none"> • Ask students, "What does the ‘ABC’ in ‘the ABC Waters Programme’ stand for?" (Active, Beautiful and Clean) • Briefly highlight the concept of PUB’s Active, Beautiful Clean Waters Programme. <ul style="list-style-type: none"> ○ Waterways and reservoirs have been transformed into beautiful and clean streams, river and lakes, creating a vibrant City of Gardens and Water. ○ These new community spaces also bring people closer to water so that they can better appreciate and cherish this previous resource. <p>8. Observe and identify the features in Bedok Reservoir and the surroundings based on the map.</p> <ul style="list-style-type: none"> • Explain that ABC Waters sites are designed to create community spaces to get people closer to water by integrating the parks, reservoirs and 	Pg 6-7

waterways and the community.

- Point out the Floating Deck, Fishing Deck and the Seating Gallery. These are the main features of Bedok Reservoir.
- Ask the students to imagine the reservoir without any of these features. They provide the community with spaces to enjoy recreation close to the water so they can appreciate this resource.
- Get the students to tick the features that they can spot.
- Get the students to tick on why they think Bedok Reservoir is important or significant.

9. Ask students to move on to the next station.

Station 2: Water Quality at Bedok Reservoir

Duration: 30min

Location: Fishing Deck and shady grass patch near the deck

Learning Points:

- Link between water quality and water sustainability – importance of good 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
<ol style="list-style-type: none"> 1. Lead or let students navigate to the next station near the Fishing Deck. <ul style="list-style-type: none"> • Ask students to turn to pages 8 and 9 and explain that they will be collecting some water from Bedok Reservoir for testing. 2. Bring students to the water collection point to observe the water: <ul style="list-style-type: none"> • 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? (Part of water sustainability is being able to obtain good quality water that is free from pollution. Maintaining the quality of raw water in our reservoirs and waterways reduces the cost of water treatment. It is also important for supporting life in and around it.) 3. Tie the rope of the pail to the Fishing Deck railing and collect some water. Pour the water into one water kit and bring students to a shaded area to put down their bags, out of the way of other visitors. 4. Ask students to refer to pages 8 and 9 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 and 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 8 and 9, explaining each parameter as you go (what each parameter is and some implications of the readings). Demonstrate how the Dissolved Oxygen 	<p>Pg 8-9</p> <p>Materials: Pail with a rope, data logger with temperature , pH and dissolved oxygen sensors, turbidity discs, water container and/or water monitoring kit</p>

(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 students. Ensure that no student is allowed to collect water directly from the reservoir and that no equipment falls into the reservoir. Give teams 5-10 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. Analysis: natural if there is no oil or rotting smell.
 - There may be debris washed down from upstream after a rain. Explain that it is important not to throw rubbish anywhere within a catchment area. Throwing litter within a catchment area will pollute the waterways and eventually the reservoir.
 - **Colour** – the water should be slightly green or yellow in colour (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°C.
 - Ask students what factors can affect water temperature (expected answers: weather conditions, rain).
 - Reiterate that temperature can affect the amount of dissolved

gases, like dissolved oxygen (the higher the temperature, the lower the amount of dissolved oxygen).

- **Dissolved Oxygen** – this should be at least 4ppm (parts per million), below which the water will be too low poor to support aquatic life.
- **pH** – pH of 6.5 – 8.2.
 - pH scale ranges from 0 to 14 with pH 0 being very acidic, pH 7 being neutral and pH14 being very alkaline. Most aquatic organisms survive well in a pH range that is near neutral.

11. Suggested debrief questions:

- How do pollutants affect the water quality in the reservoir? (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 in to the drains, all this will be collected in the reservoir.)
- What can we do to prevent pollution in the reservoirs or waterways? (By throwing rubbish responsibly into bins, not polluting our drains with chemicals, not feeding fishes in waterways or reservoirs, use phosphate-free detergent (when car owners wash their cars using detergents with phosphate, it can adversely impact the water quality in the reservoir))

12. Conclusion.

- The quality of water is generally good and within the normal range.
- Can you drink this water from the reservoir? (No, there are other parameters we did not test for to check if the water is safe for drinking – e.g. bacteria count, algae count, etc. Water in the reservoir has to undergo water treatment before it is potable and safe to drink.)
- Where does the water in Bedok Reservoir come from? (It comes from the rain as well as the rainwater collection points in Bedok, Tampines and Yan Kit Catchments.)

13. Limitations of this water testing activity.

- Only one measurement was taken at one location at a certain time and water was only collected on the surface. A better testing method requires many measurements at several locations around the reservoir, at several times of the day and at different depths.
- Limited numbers of water parameters were tested. Other possible parameters include of bacterial count, heavy metal testing etc.
- Limitations in the accuracy of the water testing kit.

14. Ask students to move on to the next station.

Station 3: Life around Bedok Reservoir

Duration: 30min

Location: Along the pathway beside the Berlin Wall up to Forest Adventure

Learning Points:

- Biodiversity at Bedok Reservoir

Trainer's Notes	Cross Reference/ Materials
<p>1. Ask students to observe the area around them and tell you what they see (plants, animals, etc.)</p>	Pg 10
<p>2. Life around Bedok Reservoir.</p> <ul style="list-style-type: none"> • Ask the students to try to spot the animals and plants that are listed on pages 10 and 11 of the booklet. • Tell the students to take a look at the information on midges. Educate the students about its life cycle, characteristics and significance of midges at Bedok Reservoir. <ul style="list-style-type: none"> ○ Midges are a group of insects that do not bite humans nor carry or spread diseases. ○ Its life cycles is about 2-3 weeks depending on the temperature of the water. ○ Midges in Singapore have been observed to be active during the cooler parts of the day such as early morning between 5 – 7am and late evenings between 7 – 10pm. ○ Midges swarms are not new in Singapore. Several events were recorded at Lower Peirce Reservoir in the 1990s, Lower Seletar Reservoir in 1971 and 2006, Pandan Reservoir in 1991, 2008 and 2010, and Bedok Reservoir in 1991, 2011 and 2012. ○ The eggs of midges can be found very deep in the soil and are very small and thus very hard to fully eradicate. ○ Midges are attracted to light. In order to prevent midges from disturbing the residents in the night, a strong light is shone from the pumping station onto the water so the midges will be attracted to it. ○ Discuss potential ways of controlling the midges' population. Examples: <ul style="list-style-type: none"> – Introducing more predators into the habitat so that the ecosystem is controlled. – Controlling the water level so the eggs that reside on the rocks at the water edge will dry up. ○ Measures taken by authorities: <ul style="list-style-type: none"> Immediate term <ul style="list-style-type: none"> – Routine monitoring of adult midges at residential and commercial areas surrounding reservoirs. – Regular scraping and disposal of midges' eggs. – Biological control by regularly applying the non-chemical 	Pg 10-11

based larvicide *Bacillus Thuringiensis Israelensis* (BTI) to prevent the development of the larvae into pupae.

- Fogging along the embankments above the reservoir water surface and canal edges to exterminate adult midges.
- Installing netting along the water's edge and light beams at the pumping station to keep midges away from residential areas.
- Introducing wetlands to reservoirs. Wetlands help to cleanse the water naturally and, promote the creation of habitats for predators that control the population of these midges.

Longer term

- PUB has commissioned a study on midges with NUS and is working with NEA to review measures currently being taken to identify longer term solutions.

3. Discuss the overall rating of biodiversity at Bedok Reservoir and the limitations of the survey.

- High/low – depends on the variety of living things observed.
- Some limitations of the survey:
 - It was conducted only at a certain time of the day and observation was done only along the pathway.
- Students should continue to spot and record animals as they continue their route.

4. Ask students to move on to the next station.

Station 4: Keeping Bedok Reservoir Active, Beautiful and Clean

Duration: 30min

Location: Beside PA Water Venture

Learning Points:

- Observe the area around Bedok Reservoir
- Infer the type of land use and assess the types of developments around Bedok Reservoir
- Observe and identify human activities and their impact on Bedok Reservoir
- Infer how these activities can affect the water quality and biodiversity of Bedok Reservoir
- Suggest ways to minimise the negative impact of these activities

Trainer's Notes	Cross Reference/ Materials
<p>1. Bedok Reservoir and its land use</p> <ul style="list-style-type: none"> • Ask students Ask students to observe the developments around Bedok Reservoir and identify the types of land use they see. It should be mixed or man-made land use. • Ask the students the types of developments they commonly see along the reservoir. They should notice that the reservoir is surrounded by residential areas, mainly condominiums and housing estates. • Ask the students why this is so. Discuss the appeal of waterfront living, how this has led to the mushrooming of condominiums around the reservoir, and how this will affect the prices of homes around the reservoir. • Ask the students if they would like to stay near the reservoir. • Ask the students what entices them to stay near the reservoir. • Discuss the availability or accessibility to amenities, lifestyle options and transportation. • Ask the students if there should be more developments around the reservoir. If they agree, ask them to cite examples. For example, shopping centres, a bus interchange, condominiums and an MRT station. Discuss the positive or negative impact that these developments might have on the reservoir. <p>2. Rate the impact</p> <ul style="list-style-type: none"> • Ask students what visitors can do at the park. • Ask students to observe the activities that are going on around the park and note it down in the booklet. • Ask students to evaluate the human impact of these activities. • Ask students to infer whether the activities are of a positive or negative nature. • Ask students to give an overall rating of human impact on Bedok Reservoir. • Discuss how the negative impacts can be mitigated. For example: <ul style="list-style-type: none"> ○ At the national level: <ul style="list-style-type: none"> – Heavier littering fines can be imposed. 	Pg 12

- | | |
|---|--|
| <ul style="list-style-type: none">– Public education through exhibitions, brochures and talks on the role of the community in protecting our reservoirs.– Schools and private enterprises – involvement in looking after parks and reservoirs to foster a sense of ownership and pride.○ At an individual level:<ul style="list-style-type: none">– Organize a community involvement programme with friends to volunteer to clean-up the catchment closest to your home.– Educate your friends by volunteering to run a Learning Trail and introduce them to the ABC Waters Programme. | |
|---|--|

5. Ask students to move to the next area for debrief.

Debrief and Reflection

Duration: 20min

Location: Open area near the cafe

Learning Points:

- Reiterate the role of ABC Waters Programme
- Reflections on water sustainability and activities at Bedok Reservoir
- Concluding points

Trainer's Notes		Cross Reference/ Materials
<p>1. Suggested debrief questions:</p> <ul style="list-style-type: none"> • How many reservoirs do we have in Singapore today? (17) • Why do we need so many reservoirs? (They collect and store rainwater for our water supply.) 		Pg 3
<p>2. Recap.</p> <ul style="list-style-type: none"> • Link the observations and results from the Learning Trail to the role of the ABC Waters Programme at Bedok Reservoir: To integrate parks (green), waterbodies (blue) and community (orange): <ul style="list-style-type: none"> ○ Waterbodies – Quality of water <ul style="list-style-type: none"> – Recap water quality tests results. Overall the water is clean. ○ Environment – Enhancing biodiversity <ul style="list-style-type: none"> – How many plants/trees did they see? – How many animals did they see? Highlight rare/interesting ones. ○ Community – Human activities and its impact <ul style="list-style-type: none"> – Ask students to share the activities they recorded down earlier and how these can affect the water quality and biodiversity of the reservoir. – Discuss possible solutions to manage these impacts. – Highlight that it is everyone's responsibility to care and protect our environment. 		<p>Pg 7-11</p> <p>Pg 14</p>
Human Activities	How can we manage this? (Solutions)	
General users, joggers, people who come for walks and picnics	<ul style="list-style-type: none"> • Educate users on the consequences of their actions. • Educate users not to feed the animals. • Enforce laws. 	
Feeding of animals – eg fish	<ul style="list-style-type: none"> • Gently ask the person to stop what he/she is doing if it adversely affects the reservoir water. 	
Vandalism		
Fishing	<ul style="list-style-type: none"> • Restrictions of fishing grounds (not to include inlets) • Release all fishes caught back to the reservoir to maintain biodiversity and balance of the 	

	<p>ecosystem.</p> <ul style="list-style-type: none"> • Educate fishermen. • Use only artificial baits to maintain the reservoir's water quality. • Enforcement of laws. 	
<p>3. Suggest some ideas to encourage visitors to care for its waters and surroundings.</p>	<ul style="list-style-type: none"> • By setting a good example. • Conduct educational walks, walks and events there. • Through banners, campaigns, etc. 	<p>Pg 14</p>
<p>4. Your Reflections</p>	<ul style="list-style-type: none"> • Ask students to answer the reflection question on page 15. • What is water sustainability? <ul style="list-style-type: none"> ○ 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 does Bedok Reservoir enrich the lives of Singaporeans? (E.g. provide a community space for people to relax and exercise, for family and community bonding) • What new activities would you suggest for Bedok Reservoir? • What would you do to ensure that a small nation like Singapore can enjoy water sustainability in the long term? <ul style="list-style-type: none"> ○ Keep our waterways clean. Do not dispose any waste solids or liquid into our waterways. ○ Conserve our water. ○ Explain to people the consequences of their actions if you encounter such anti-social behaviour. 	<p>Pg 15</p>
<p>5. Concluding points.</p>	<ul style="list-style-type: none"> • Through the Learning Trail, we have gained better understanding of : <ul style="list-style-type: none"> ○ The importance of the Active, Beautiful, Clean Waters (ABC Waters) Programme. ○ More about Bedok Reservoir and how it came to be. ○ 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. 	
<p>6. Ask students to fill in the feedback forms.</p>		

Extension Activity: A Problem-based Activity

Duration: 1 – 1.5hours

This can be conducted as a post trip activity or a wet weather programme at a sheltered area.

Trainer's Notes	Cross Reference/ Materials
<ol style="list-style-type: none">1. Divide the class into 2 or 4 teams.2. Suggested time: 45mins for teams to develop their plan on minimising human activities or involving the community at Bedok Reservoir. Guide them as they answer the scaffold questions provided on page 22.3. Gather the class and let each team make their presentations (5 min), followed by a 1-2 minute question and answer session.4. Give your comments after each presentation and summarise the points raised after all teams have presented.	Pg 16 Flipchart paper, markers (for each team)

References

- *Water for All: Conserve, Value, Enjoy – Meeting our water needs for the next 50 years.* PUB Public Document. (2010).
- 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. Sunblock and cap
5. Raincoat or umbrella (in case of rain)
6. Ziploc bag for waterproofing valuables (e.g. camera, hand phone)
7. A pen, or pencil and eraser

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

Optional

- Snacks
- Digital camera or camera hand phone

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:	Bedok 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 prolonged 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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 coordinate/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	<ul style="list-style-type: none"> - 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.						<ul style="list-style-type: none"> - 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
							<p>levels of PSI above 100, it is advised to delay the departure for the location, until Lightning Category 1 is lifted.</p> <ul style="list-style-type: none"> - 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	Themes Covered	Lower Secondary Curricula
1	History and background of Bedok Reservoir	<p>Geography</p> <ul style="list-style-type: none"> • Understanding the environment: <ul style="list-style-type: none"> ○ The physical environment as a natural resource • Managing the changing environment: <ul style="list-style-type: none"> ○ 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	<p>Science</p> <ul style="list-style-type: none"> • Process skills: <ul style="list-style-type: none"> ○ Observing, comparing, using apparatus, analysing and inferring • Diversity of matter: <ul style="list-style-type: none"> ○ Solutions (chemicals or minerals) and suspensions (turbidity) • Measurements: <ul style="list-style-type: none"> ○ Use of measuring instruments ○ Physical quantities and units • Ethics and attitudes: <ul style="list-style-type: none"> ○ Show an appreciation that water is a precious resource and the need to conserve it. • pH: <ul style="list-style-type: none"> ○ Testing for water quality <p>Geography</p> <ul style="list-style-type: none"> • The physical environment: <ul style="list-style-type: none"> ○ Components of the physical environment (natural vegetation) ○ The inter-relationships of all the components in the physical environment ○ The hydrologic cycle (evaporation, transpiration, condensation, rainfall, runoff) • Managing the changing environment: <ul style="list-style-type: none"> ○ Water resources ○ Pollution

No	Themes Covered	Lower Secondary Curricula
3	ABC Waters Concept	<p>Science</p> <ul style="list-style-type: none"> • Process skills: <ul style="list-style-type: none"> ○ Observing, inferring • Science and Technology in society (creation of reservoirs) <p>Geography</p> <ul style="list-style-type: none"> • Understanding the environment: <ul style="list-style-type: none"> ○ Environment through maps (map symbols) • The human environment <ul style="list-style-type: none"> ○ The human environment is a product of interaction with the physical environment
4	Life at Bedok Reservoir	<p>Science</p> <ul style="list-style-type: none"> • Diversity of plant and animal life: <ul style="list-style-type: none"> ○ Classification of plants and animal life • Interaction: <ul style="list-style-type: none"> ○ Population, community and ecosystem • Energy: <ul style="list-style-type: none"> ○ Photosynthesis – land and water ○ Energy transfer process in the ecosystem • Ethics and attitudes: <ul style="list-style-type: none"> ○ Show an appreciation of the importance for ma to understand and maintain the connections among living things <p>Geography</p> <ul style="list-style-type: none"> • Understanding the environment: <ul style="list-style-type: none"> ○ The physical environment as a natural resource • The physical environment: <ul style="list-style-type: none"> ○ Natural vegetation and people ○ The inter-relationships of all the components in the physical environment • Managing the changing environment: <ul style="list-style-type: none"> ○ Protecting and conserving the environment at different levels (individual, national and international)

No	Themes Covered	Lower Secondary Curricula
5	Human activities and impact	<p>Science</p> <ul style="list-style-type: none"> • Ethics and attitudes: <ul style="list-style-type: none"> ○ Impact of Man’s actions on the environment ○ Show an appreciation of man’s responsibility to have care and concern for living things and the environment <p>Geography</p> <ul style="list-style-type: none"> • Managing the changing environment: <ul style="list-style-type: none"> ○ The impact of human activities on the environment (local) ○ Protecting and conserving the environment at different levels (Individual, national, international) <p>Social Studies</p> <ul style="list-style-type: none"> • Caring for our environment: <ul style="list-style-type: none"> ○ Land, air and water pollution ○ Solutions to tackle land, air and water pollution
6	Water supply and treatment	<p>National Education</p> <ul style="list-style-type: none"> • No one owes Singapore a living: <ul style="list-style-type: none"> ○ We find our own way to survive and prosper, turning challenges into opportunity • We have confidence in our future: <ul style="list-style-type: none"> ○ Untied, determined and well-prepared, we have what it takes to build a bright future for ourselves, and to progress together as one nation <p>Science</p> <ul style="list-style-type: none"> • Science and technology (creation of reservoirs) <p>Geography</p> <ul style="list-style-type: none"> • Managing the changing environment: <ul style="list-style-type: none"> ○ Water as a scarce resource ○ Response 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 Singapore’s water resources through the Four National Taps) ○ Interdependence where water is important to humans for survival and for economic functions ○ Water resources: measures to ensure water sustainability (pricing, public education, diversification of water resources through the Four National Taps strategy)

Annex 4: “Water Sustainability” Cards

5.3 million

152

715.8

Rain

Urban Areas

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

ABC Waters Site(s)

Reservoirs

Water Treatment Plant

Taps

Bedok

MacRitchie

Lower Seletar

Punggol

Serangoon

Pandan

Jurong Lake

Upper Peirce

Lower Peirce

Upper Seletar

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. Water Monitoring Kits with pH strips, turbidity discs, thermometer and dissolved oxygen tablets, glass vial and pH vial
8. Plastic bag to collect used pH strips and water which has been tested

Optional:

9. Charged data loggers including temperature, pH and Dissolved oxygen sensors
10. Bird and insect cards, nature guide books
11. Camera
12. 4-5 compasses



Acknowledgements

Springfield Secondary School

Environmental Health Institute,
National Environment Agency

National Parks Board,
Flora & Fauna Web
<http://florafaunaweb.nparks.gov.sg>





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.

