

## The Jockey Club “Ridge to Reef” Environmental Education Programme Geography (Junior Secondary) lesson plan – “Ridge to Reef”

- (1) Topic: Unit 4 The trouble with water  
 (2) Duration: 4 lessons (40 mins per lesson)  
 (3) Venue: normal classroom setting

Related Sustainable development goals

SDG 6  
SDG 11



(4) Teaching Procedures:

	<b>Lesson 1</b>	<b>Lesson 2</b>	<b>Lesson 3</b>	<b>Lesson 4</b>
Sub-topic:	Oyster reef under “Ridge to Reef”	Soil erosion, water pollution and reef	Conservation of Oyster Reef from the Ridge	Oyster reef conservation measures (benefits & obstacles), sustainable oyster reef conservation
Core question:	A. What is oyster reef? What are the functions of oyster? What is “Ridge to Reef”?	B. What are the impacts of soil erosion and water pollution on the oyster reef habitat?	C. How to conserve our oyster reef?	D. What are measures & obstacles in protecting oyster reef and its relevance to Sustainable Development Goals (SDGs)?
Prior knowledge:	Students acquired some basic knowledge about the circulation of water in the environment.	Students acquired some basic knowledge about water cycles, river processes and oyster reef, etc.	Students should have basic knowledge on the impacts of upstream soil erosion and water pollution on oyster reef	Students acquired some basic knowledge about oyster reef conservation measures and the ecological functions of earthworms
Key Concepts:	A1 Water cycle A2 River process A3 Upstream erosion A4 Oyster reef A5 Ridge to Reef	B1 Soil erosion B2 Water pollution B3 Organic chemical/ pollutants B4 pH value B5 Eutrophication	C1 Oyster reef C2 Water pollution C3 Oyster reef conservation	D1 Spongy city D2 Sewage Treatment D3 Benefits and Costs (Obstacles) D4 SDGs

	Knowledge			
Aims and objectives		1. To understand the water circulation between land, air and sea and the major river process, such as upstream erosion. 2. To describe the characteristics, function and formation of oyster reef/ mudflat. 3. To understand the concept of “Ridge to Reef” using oyster reef as an example.	1. To describe the damages to oyster reef habitats caused by serious soil erosion and water pollution. 2. To understand the impacts of damaging oyster reef in affecting the water quality.	1. Identify the causes of soil erosion and water pollution on ridge 2. Think of feasible measures to conserve oyster reef
				1. To discuss the benefits of Sponge City & Sewage Treatment measures for oyster reef protection. 2. To identify the obstacles of oyster reef conservation. 3. To discuss and explain how conserving oyster reef can be sustainable.

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Aims and objectives	Skills (subject/ generic skills)	<ol style="list-style-type: none"> <li>1. To extract and interpret geographical information from the graphs, passages and photographs.</li> <li>2. To summarize and organize the information using tables and flow charts.</li> <li>3. To practice English listening, writing skills and to develop language skills across the curriculum.</li> </ol>		<ol style="list-style-type: none"> <li>1. Make inferences and draw conclusion from geographical data</li> </ol>	<ol style="list-style-type: none"> <li>1. To extract and interpret geographical information from the graphs, passages and photographs.</li> <li>2. To summarize and organize the information using tables.</li> </ol>
	Value/ Attitude	<ol style="list-style-type: none"> <li>1. To build awareness of the importance of oyster reef in improving the water quality.</li> <li>2. To appreciate the beauty of nature and develop a sense of responsibility in conserving the environment.</li> </ol>	<ol style="list-style-type: none"> <li>1. To build awareness of the existing environment problems, such as pollution and soil erosion.</li> <li>2. To appreciate the beauty of nature and develop a sense of responsibility in conserving the environment.</li> </ol>	<ol style="list-style-type: none"> <li>1. Be willing to conserve oyster reef habitat</li> <li>2. Understand how the ecological functions of earthworm help oyster reef conservation</li> </ol>	<ol style="list-style-type: none"> <li>1. To build awareness of the existing environment problems, such as pollution and soil erosion.</li> <li>2. To appreciate the beauty of nature and develop a sense of responsibility in conserving the environment and willingness to adapt sustainable development in daily life</li> <li>3. To show respect for diversity towards conservation strategies.</li> </ol>

## Lesson 1

Time	Teacher's activities	Student's activities	Remarks/ T&L materials
<b>Setting – recall</b>			
<b>5min</b>	To distribute worksheets and learning materials to students.  The teacher states clearly the learning outcomes of the lesson and open up a new topic.	Students receive a booklet/ worksheet and the learning materials.	<ul style="list-style-type: none"> <li>● PPT</li> <li>● Worksheet</li> </ul>
<b>Development</b>			
<b>10min</b>	The teacher recall student's memory about the water cycle and introduce the major river processes.  Q. How does water circulated between land, air and sea? Q. What are the major processes involved along the river? Q. How mudflat forms at the river mouth?	Students refer to the PPT and worksheet and complete the questions.  Students are required to read the provided materials and answer the questions.	<ul style="list-style-type: none"> <li>● PPT</li> <li>● Worksheet p.2,3</li> </ul>
<b>15min</b>	The teacher introduces the characteristic, function and formation of oyster reef.  Q. What is oyster reef? Where do oysters live? Q. How oyster adapt to the mudflat and grow? Q. What are the functions of oyster reef?	Students refer to the PPT and worksheet and complete the questions.  Student looks at the video and answer the questions.	<ul style="list-style-type: none"> <li>● PPT</li> <li>● Worksheet p.4</li> <li>● Video: <a href="https://www.youtube.com/watch?v=bYD2DlinVpw">https://www.youtube.com/watch?v=bYD2DlinVpw</a></li> </ul>
<b>5min</b>	The teacher uses the example of mudflat/ oyster reef to explain the concept of "Ridge to Reef".	Students refer to the PPT and worksheet and complete the questions.	<ul style="list-style-type: none"> <li>● PPT</li> <li>● Worksheet p.2-4</li> </ul>
<b>Conclusion</b>			
<b>5min</b>	The teacher summarizes and remind students about the concept of "Ridge to Reef" and formation of oyster reef habitats.  The teacher asks students questions to ensure their understanding of the lesson contents.	Students complete their worksheet to conclude what they have learnt in the lesson. (For revision at home)	<ul style="list-style-type: none"> <li>● PPT</li> <li>● Worksheet</li> </ul>

## Lesson 2

Time	Teacher's activities	Student's activities	Remarks/ T&L materials
<b>Setting</b>			
<b>5min</b>	<p>Quick review on the water cycles, river processes mentioned in the last lesson.</p> <p>Q. How does water circulated between land, air and sea? Q. What are the major processes involved along the river? Q. What are the functions of oyster reef? How it forms? The teacher asks questions and picks students to answer.</p> <p><b>The teacher introduces the lesson theme: Impacts of soil erosion and upstream pollution in disturbing the oyster reef habitat.</b></p>	<p>Students recall their memory and knowledge learnt in the last lesson.</p> <p>Students look at the figures and some respond to the questions.</p>	<ul style="list-style-type: none"> <li>• PPT Figure 1: Water cycle Figure 2: River processes</li> <li>• Worksheet p.2-4</li> </ul>
<b>Development</b>			
<b>10min</b>	<p>The teacher introduces the impacts of soil erosion on the oyster reef habitat in the downstream.</p> <p>Q. What happens if there is too much/ too little sediment depositing on the lower stream? Q. What are the impacts of soil erosion to the oyster reef habitats?</p>	<p>Students refer to the PPT, learning materials and worksheet and complete the questions.</p>	<ul style="list-style-type: none"> <li>• PPT</li> <li>• Worksheet p. 5,6</li> </ul>
<b>15min</b>	<p>The teacher introduces the problem of upstream water pollution caused by the release of organic and chemical pollutants from human activities.</p> <p>Q. What happened to the reef if there are too much chemical pollutants in the river? Q. What happened to the reef if there are too much organic pollutants in the river? Q. What are the impacts of water pollution to the oyster reef habitats?</p>	<p>Students refer to the PPT and worksheet and complete the questions.</p> <p>Students are required to read the provided materials and answer the questions.</p>	<ul style="list-style-type: none"> <li>• PPT</li> <li>• Worksheet p.6</li> </ul>
<b>5min</b>	<p>The teacher introduces the negative impacts causes by the destruction of oyster habitats.</p> <p>Q. What would happen to the environment if the oyster and its habitats were being destroyed?</p>	<p>Students refer to the PPT and worksheet and complete the questions.</p>	<ul style="list-style-type: none"> <li>• PPT</li> <li>• Worksheet p. 4,7</li> </ul>
<b>Conclusion</b>			
<b>5min</b>	<p>The teacher summarizes and remind students about the impacts of soil erosion and water pollution bought by chemical and organic pollutants to the oyster reef habitats.</p> <p>The teacher asks students questions to ensure their understanding of the lesson contents.</p>	<p>Students complete their worksheet to conclude what they have learnt in the lesson. (For revision at home)</p>	<ul style="list-style-type: none"> <li>• PPT</li> <li>• Worksheet p. 5-7</li> </ul>

### Lesson 3

Time	Teacher's activities	Student's activities	Remarks/ T&L materials
<b>Setting</b>			
<b>5min</b>	<p>To recall the upstream water pollution causes by showing pictures of pollution sources.</p> <p>Q. What are the sources causing water pollution in the upstream?            Q. What are the negative impacts of water pollution on the river ecology?            Q. How will upstream water pollution affect the oyster reef?</p> <p>Introduce the lesson theme: Possible conservation measures on oyster reef from the impacts of upstream water pollution</p>	<p>Students recall their memory and knowledge learnt in the last lesson.</p> <p>Students look at the pictures and respond to the questions.</p>	<ul style="list-style-type: none"> <li>• PPT</li> <li>• Worksheet</li> </ul>
<b>Development</b>			
<b>15min</b>	<p>To help students identify how human activities on ridge will affect oyster reef.</p> <p>Q: What human activities on the ridge will lead to soil erosion?            Q: What human activities on the ridge will lead to water pollution?            Q: How will they affect oyster reef</p>	<ul style="list-style-type: none"> <li>• Students look at the pictures and respond to the questions.</li> <li>• Students finish the flowcharts and tables.</li> </ul>	<ul style="list-style-type: none"> <li>• PPT</li> <li>• Worksheet</li> </ul>
<b>15min</b>	<p>The teacher instructs students to discuss and propose feasible and specific measures that can help conserve oyster reef</p> <p>Q. What are some possible measures that can be adopted to protect the oyster reef?            Q. Are they feasible and specific?</p> <p>The teacher can invite some groups to present their ideas and ask follow-up questions</p>	<ul style="list-style-type: none"> <li>• Students discuss and suggest possible conservation measures with reference to the given picture in the worksheet.</li> </ul>	<ul style="list-style-type: none"> <li>• PPT</li> <li>• Worksheet</li> </ul>
<b>Conclusion</b>			
<b>5min</b>	<p>The teacher summarizes the measures for oyster reef conservation and the ecological functions of earthworm in conserving oyster reef</p>		<ul style="list-style-type: none"> <li>• PPT</li> <li>• Worksheet</li> </ul>

## Lesson 4

Time	Teacher's activities	Student's activities	Remarks/ T&L materials
<b>Setting</b>			
<b>4min</b>	<p>Quick review on students' understanding on the oyster reef conservation measures</p> <p>Q.What are some possible measures that can be used to protect oyster reefs?</p> <p>Q. How effective/feasible are the measures ?</p> <p>Q.What are the ecological functions of earthworms?</p> <p>The teacher asks questions and picks students to answer.</p> <p>The teacher introduces the lesson theme:</p> <ul style="list-style-type: none"> <li>• Two strategies in oyster reef conservation</li> <li>• Benefits and obstacles of the measures in protecting oyster reef</li> <li>• The relationship between oyster reef conservation and SDGs</li> </ul>	<p>Students recalled the memory and knowledge learnt in the last lesson.</p> <p>Students look at the figures and respond to the questions.</p>	<ul style="list-style-type: none"> <li>• PPT</li> </ul> <p>Figure 1: Organic fertilizer</p> <p>Figure 2: Leave no trace</p> <p>Figure 3: Tree planting campaigns</p> <p>Figure 4: Ecological functions of earthworms</p>
<b>Development</b>			
<b>16min</b>	<p>The teacher introduces the measures and obstacles in protecting the oyster reef.</p> <p>Strategy 1: "Building Sponge City"</p> <p>Q1. What is "Sponge City" and what are some examples of the design and its benefits ? (Teacher check answers with students on Task 4.1.1)</p> <p>Q2.How could "Building Sponge City" help protect the oyster reef?</p> <p>Q3.What is the possible opposition of "Building Sponge City" in conserving oyster reefs ?</p> <p>Strategy 2: "Implementing Large Scale Sewage Treatment Plan"</p> <p>Q1.What is the objective of "HATS" ?</p> <p>Q2. How could the "HATS" strategy help protect the oyster reef? (Teacher check answers with students on Task 4.2)</p> <p>Q3.What is the possible opposition of the "HATS" in conserving oyster reefs ?</p>	<p>Students finished reading and watching a video on "Sponge City" and reading on "HATS" for flipped learning. (students already finished Task 4.1.1 &amp; 4.2)</p> <p>Students refer to the worksheet and complete the questions.</p>	<ul style="list-style-type: none"> <li>• Worksheet p.1-4</li> </ul> <p>ANS:</p> <p><b>Strategy 1:</b></p> <p>Q1</p> <ul style="list-style-type: none"> <li>• A "sponge city" can absorb and store excessive water during rainstorms</li> <li>• Examples of the design: <ul style="list-style-type: none"> <li>• -Green roofs,</li> <li>• -Permeable pavements</li> <li>• -Constructed wetlands</li> </ul> </li> </ul> <p>Q2</p> <ul style="list-style-type: none"> <li>• A "sponge city" can absorb and store excessive water during rainstorms</li> <li>• With less rainwater discharged into the sea, it helps lower the risks of mudflat or oyster reef being flooded by seawater</li> </ul> <p>Q3</p> <ul style="list-style-type: none"> <li>• Large-scale engineer work</li> <li>• High building and maintaining cost of permeable road surface</li> <li>• Might involve large-scale demolishing and resettling work</li> </ul> <p><b>Strategy 2:</b></p> <p>Q1</p> <ul style="list-style-type: none"> <li>• To improve the water quality of the harbour.</li> </ul> <p>Q2</p> <ul style="list-style-type: none"> <li>• Helps improve the water quality of the harbour and thus provides a more pleasant habitat for oyster reefs.</li> </ul> <p>Q3</p> <ul style="list-style-type: none"> <li>• Construction of long pipes and sewage treatment plants are needed</li> <li>• Large-scale demolishing and resettling work might require</li> <li>• Required to pay for sewage treatment cost</li> </ul>

			<ul style="list-style-type: none"> <li>• Increase their financial expenses</li> </ul>
<b>17min</b>	<p>The teacher briefly introduces the Sustainable Development Goals (SDGs), allows students to discuss how these SDGs make a balance between the economic, social and environmental aspects and how oyster reef conservation relates to these SDGs in 5 minutes</p> <p>Then, teacher invites 2 groups for presentation and offers feedback to students</p> <p>Q1. Identify in which aspects (economic, social &amp; environmental) the SDG11 belong to</p> <p>Q2. How does oyster reef conservation ( Building ‘Sponge city’) relate to these SDGs?</p> <p>Q3. Identify in which aspects (economic, social &amp; environmental) the SDG14 belong to</p> <p>Q4. How does oyster reef conservation ( Large-scale sewage treatment plan’) relate to these SDGs?</p>	<p><b>Students are required to read the provided materials for flipped learning and answer the questions before lessons</b></p> <p><b>Students refer to the worksheet and have 5 mins group discussion and complete the questions</b></p> <p><b>2 groups of students make presentation</b></p>	<ul style="list-style-type: none"> <li>• Worksheet p.5-7</li> </ul> <p>ANS:</p> <p>Q1</p> <ul style="list-style-type: none"> <li>• Economic, social and environmental aspects</li> </ul> <p>Q2</p> <ul style="list-style-type: none"> <li>• Economic: (E.g. Constructing artificial wetland) to reduce surface runoff and soil erosion and thus lower the risk of flooding and the negative impacts it brings</li> <li>• Social: Create water-friendly space for residents and store flood water to alleviate flooding</li> <li>• Environment: Helps reduce surface runoff and soil erosion</li> </ul> <p>Q3</p> <ul style="list-style-type: none"> <li>• Economic, social and environmental aspects</li> </ul> <p>Q4</p> <ul style="list-style-type: none"> <li>• Economic: Help improve water quality, sustain marine resources and income of fishermen</li> </ul> <p>Better water quality of the harbour can help promote tourism (HK)</p> <ul style="list-style-type: none"> <li>• Social: Help provide a pleasant environment to residents and a better water quality help sustain the marine resources, which increases food supply and security</li> <li>• Environment: Help improve water quality of the harbour and thus provide habitats for different living species</li> </ul>
<b>Conclusion</b>			
<b>3min</b>	<p>The teacher summarizes and reminds students about</p> <ul style="list-style-type: none"> <li>• Two strategies in oyster reef conservation</li> <li>• Benefits and obstacles of the measures in protecting oyster reef</li> <li>• The relationship between oyster reef conservation and SDGs</li> </ul> <p>The teacher asks students questions to ensure their understanding of the lesson contents.</p>	<p>Students answered the questions to show what they learnt in the lesson.</p>	

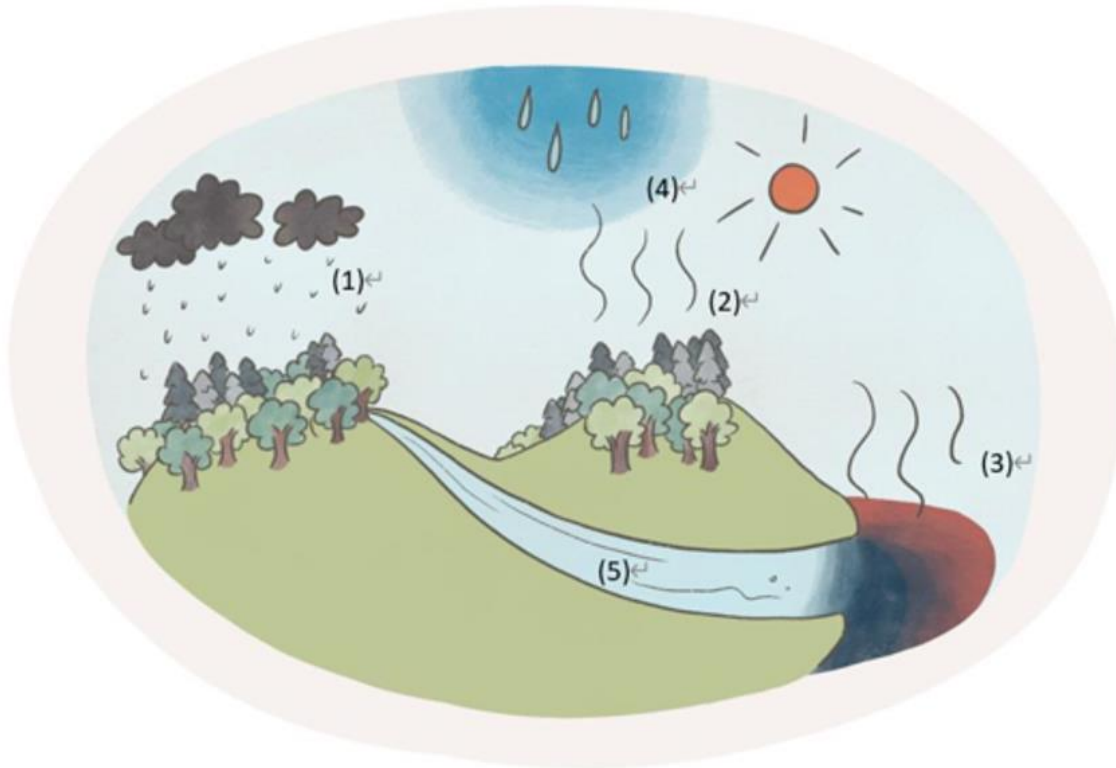
*What is an oyster reef? What is “Ridge to Reef”?*



**Lesson 1 – Oyster reef under “Ridge to Reef”**



# 1.1 Water Cycle

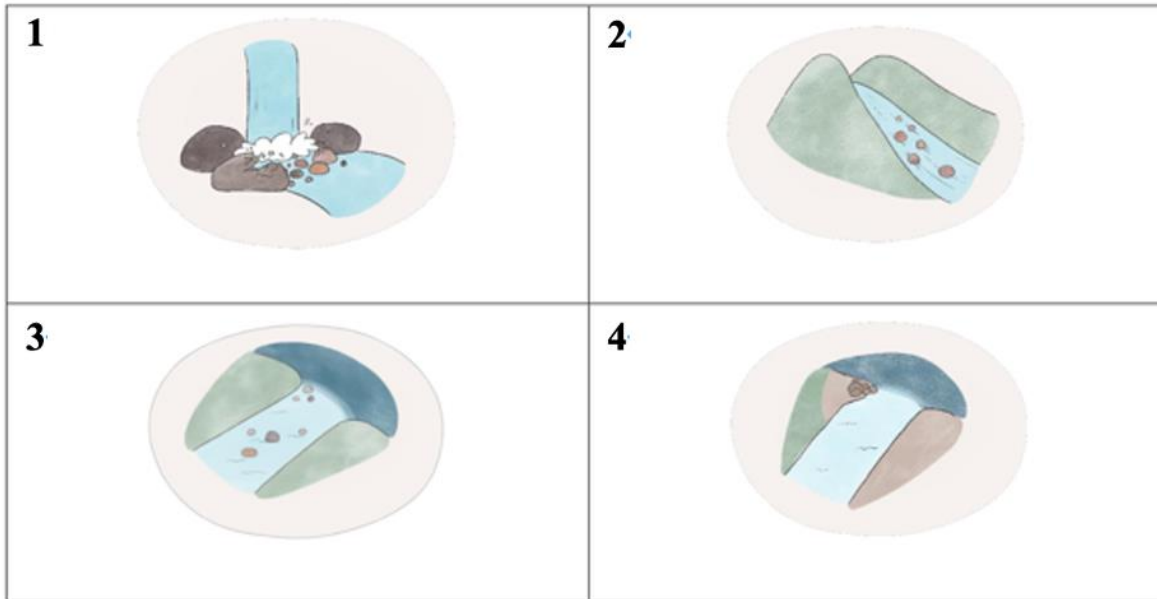


Can you name the processes in the water cycle?

- (1) Precipitation
- (2) Transpiration
- (3) Evaporation
- (4) Condensation
- (5) Overland flow

# 1.2 Major River Processes

In overland flow, water flows down the slope along a river.



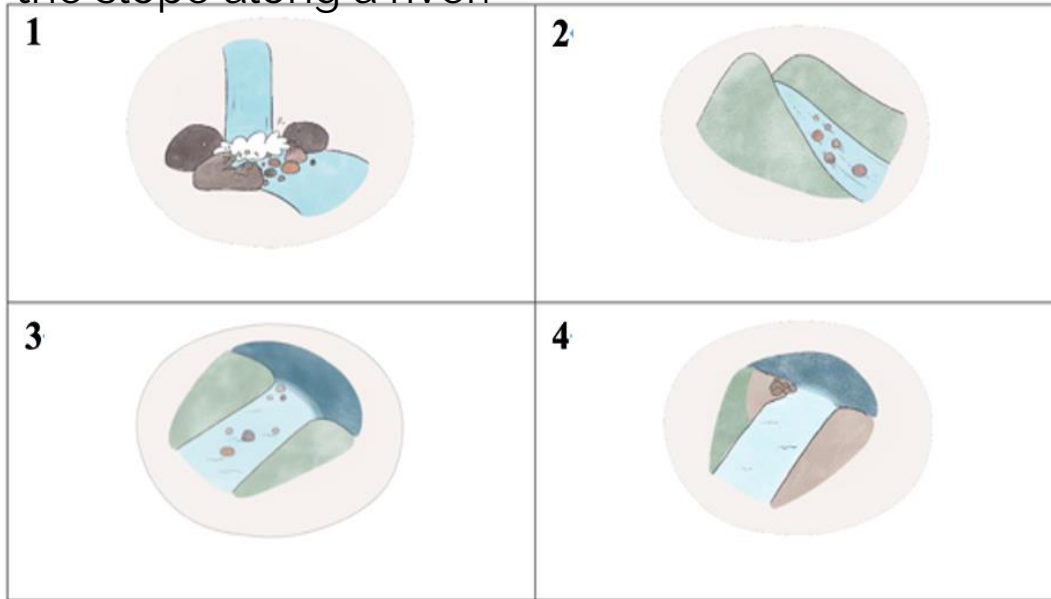
Q1. What are the major river processes involved?

- Step 1 **Erosion**
- Step 2 **Transportation**
- Step 3 **Deposition**

Q2. In Step 4, what landform will be formed when the sediments deposited at the river mouth? **Mudflat**

# 1.2 Major River Processes

In overland flow, water flows down the slope along a river.



Q3. Explain the formation of a mudflat

Water erodes the rock and soil in the upper course of the river



The eroded materials would be brought downstream



When loads arrive at the river mouth, the river gradient becomes gentler and the tide affects the flow of the river. Thus, the flowing speed of load is reduced, and it would deposit and form mudflats.

# 1.3 Characteristics and functions of oyster reef



Q1. What is the habitat shown? Can you describe about it?

- Mudflat
- Gentle gradient
- Deposition of sediments (silt and sand)
- Water body at the surrounding

## Q2. How is mudflat affected by high tides and low tides?

	High Tide	Low Tide
Effects on mudflat	<ul style="list-style-type: none"><li>Mudflat is <b>covered</b> at high tide</li></ul>	<ul style="list-style-type: none"><li>Mudflat is <b>exposed</b> at low tide</li></ul>
Effects on oysters	<ul style="list-style-type: none"><li>Oyster is <b>inundated</b>, and oyster shell <b>opens</b></li><li>Oysters consume <b>plankton</b> by <b>filtrating</b> seawater</li></ul>	<ul style="list-style-type: none"><li>Oyster is <b>exposed</b></li><li>Oyster shell <b>closes</b> to minimize <b>evaporation</b> from their bodies</li></ul>



# What are the benefits of oyster reefs to the environment?



What are the benefits of oyster reefs to the environment?



Q1. What could oyster reefs provide for other species?

- Construct **habitats** for other species
- Increase **biodiversity**

## What are the benefits of oyster reefs to the environment?

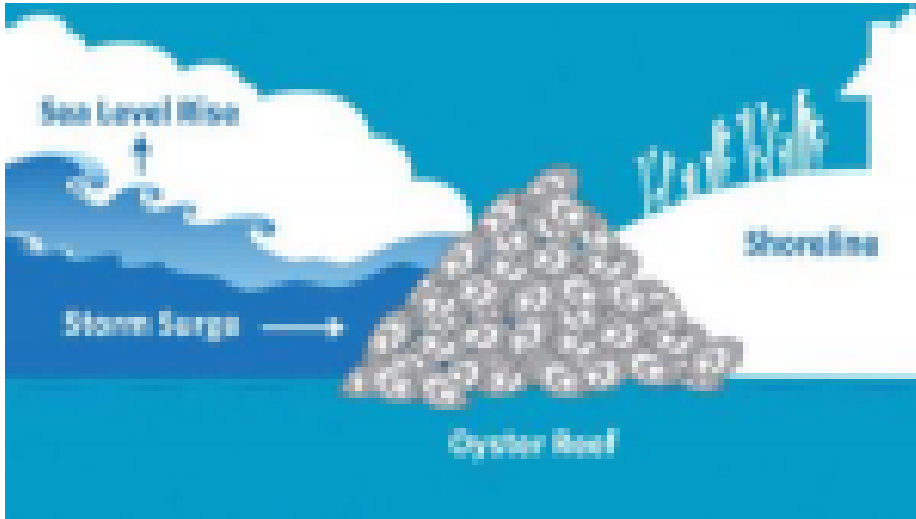


Q2. Why oyster reefs function as natural water filters?

- Remove organic pollutants
- Improve water quality



## What are the benefits of oyster reefs to the environment?



Q3. How can oyster reefs help stabilize the shoreline?

- During storm surge
- Act as a **barrier**
- **Absorb wave** energy
- **Reduce** damage

What are the **IMPACTS** of **soil erosion** and **water pollution**  
on the oyster reef habitat?

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**Lesson 2 - Soil erosion, water pollution and reef**

# 2.1 Impacts of soil erosion

General Question:

How different rates of soil erosion hinder the formation of mudflat and the oyster reef?

Too little sediment deposition	Too much sediment deposition
	



# Q1. What happens if there is too little sediment depositing on the lower stream?

If there is too little material eroded in the upper course



Sediments deposited at the river mouth would not be enough to form mudflat



It will permanently being flooded by seawater

- Too litte:



## Q2. What happens if there is too much sediment depositing on the lower stream?

- Too much (serious soil erosion):



If there is too much material eroded in the upper course



Sediments deposited at the river mouth would increase



It will permanently cover and emerge on the water

### Q3. How would the different rates of soil erosion hinder the formation of oyster reef habitats?



Oyster grow on the mudflat



If the amount of deposited material decreases at the river mouth

If the amount of deposited material increases at the river mouth

The oyster will be exposed

The oyster will be covered and inundated by excessive sediment

The changes in sediment content of mudflat will affect their growth.





# 2.1 Impacts of water pollution



Read the figures and answer question 1 and 2

General Question:

How happens to the oyster if there is water pollution?

Chemical pollutants	Organic pollutants
 An illustration showing a factory with smokestacks and buildings on the left bank of a river. The water is dark and labeled with 'pH = 2'. In the foreground, several oysters are shown on the riverbed, appearing dead or distressed.	 An illustration showing a farm with cows and pigs on the left bank of a river. The water is dark and contains a large red mass of algae. In the foreground, several oysters are shown on the riverbed, appearing dead or distressed.
<p><i>Vocabularies:</i> Heavy metal, wash downstream, pollute, toxify, soil and water</p>	<p><i>Vocabularies:</i> Nutrients, eutrophication, algae and red tide, oxygen</p>

Q1. What happens if there are too many chemical pollutants in the river?



## Chemical pollutants



*Vocabularies:*

*Heavy metal, wash downstream, pollute, toxify, soil and water*

- ▶ Heavy metal will be washed downstream and pollute/toxify the soil and water.





Q2. What happens if there are too many organic pollutants in the river?

### Organic pollutants



*Vocabularies:*

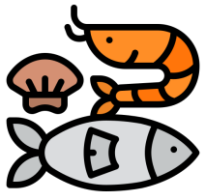
*Nutrients, eutrophication, algae and red tide, oxygen*

- ▶ The organic waste will release nutrients into the river and lead to eutrophication. It favors the growth of algae and red tide, which further use up the oxygen in the water



Q3. What are the impacts of water pollution on the oyster and its habitats?

Chemical pollutants	It lowers the <u>pH value</u> of water (increases the <u>acidity</u> ) and kills oysters.
Organic pollutants	It causes <u>suffocation</u> of oysters and other marine species.





## 2.3 Damages to the environment in a long run

General Question:

What would happen to the environment if the oyster reef was being damaged?

Hint: Recall 1.2! What are the functions of oyster reef!



		
Loss of <b>natural habitat</b> for other species	Loss of filtering function leads to <b>poor water quality</b>	Shoreline becomes <b>unstable</b>

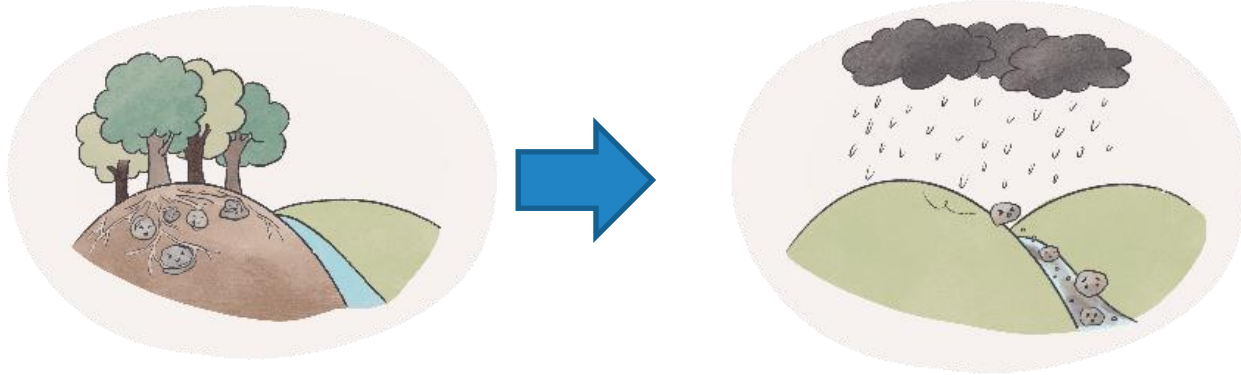
*How to **conserve** our oyster reef?*



**Lesson 3 – Conservation of oyster reef from the ridge**

# 3.1 Causes of soil erosion on ridge

## A. Deforestation



Cutting of trees on upstream will cause the soil to be loosen as they are not held by tree roots. The soil is then exposed and removed by water easily, causing soil erosion.

# 3.1 Causes of soil erosion on ridge

## B. Overgrazing and Overcultivation



**Q: What are the farming activities found on upstream?**

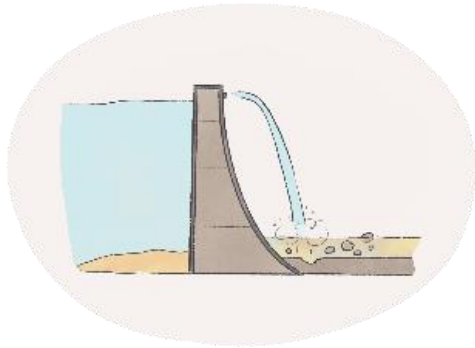
Raising of livestock and commercial farming

**Q: What will happen if the farming activities are not limited (exceed the carrying capacity of the land)?**

Farmers remove the **vegetation** for farming purpose, thus the land become unprotected. Farmers **farm** and **graze** excessively on the slope, causing the soil to be removed easily. This leads to serious soil erosion.

# 3.1 Causes of soil erosion on ridge

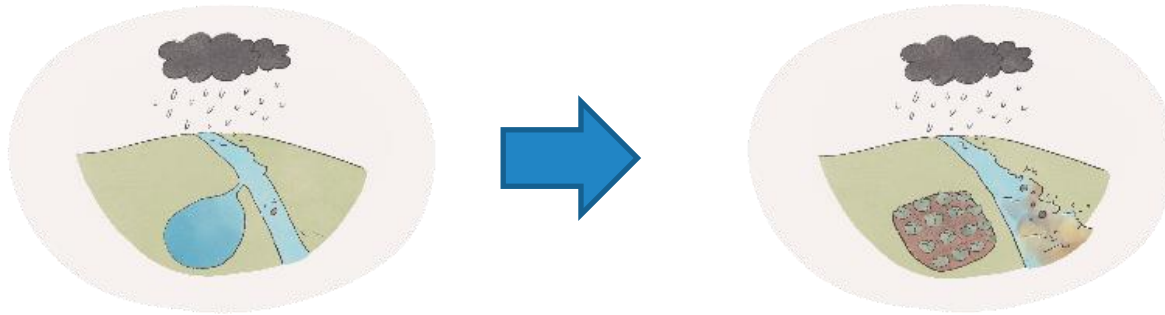
## C. Building of dams



Building of dams in the upper course will cause the amount of sand in the lower course (~~increase / decrease~~). This will increase the river **velocity** and lead to more serious soil erosion.

# 3.1 Causes of soil erosion on ridge

## D. Reclamation



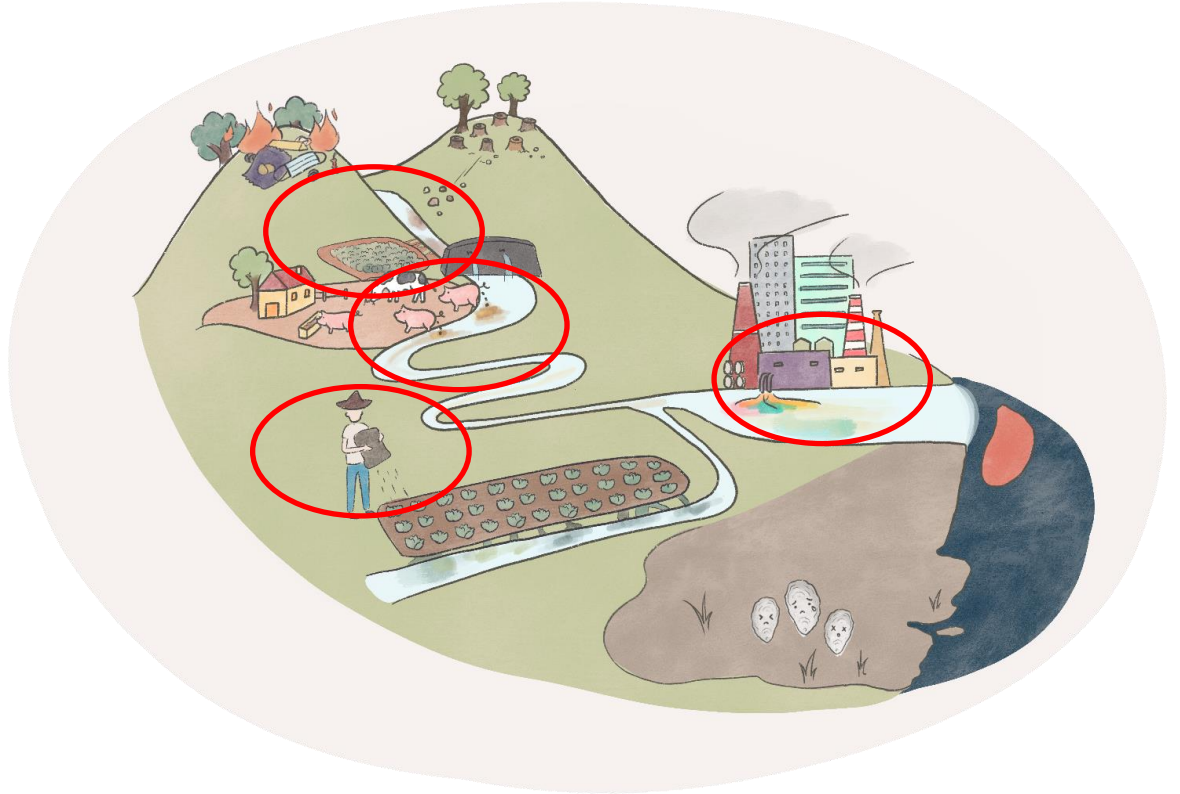
After the lakes are **reclaimed**, it loses the function of adjusting river **discharge**. When **flooding** occurs, soil in the lower course will be removed easily, causing serious soil erosion.



## 3.2 Causes of water pollution on ridge

What sources of water pollution can you spot in the picture?

They are organic or chemical pollutants?



## 3.3 Conservation of oyster reef at source

Refer to what have we learnt in 3.1 and 3.2. Can you think of some measures to **reduce the impacts and conserve our oyster reef**?

Discuss with your group members.



You can think of the measures from the perspectives of **reducing soil erosion** and **reducing water pollution**

# 3.3 Conservation of oyster reef at source

## **Reduce soil erosion on ridge**

- Tree planting campaign/ afforestation
- Contour farming
- Conserving lakes
- Clean up hiking trails

## **Reduce water pollution**

- Build sewage treatment plant/ implement sewage treatment
- Adopt polluter-pays principle
- Implement and enforce law to prohibit illegal sewage discharge
- Use earthworm to decompose excessive amount of organic matter in farmland

What are *measures & obstacles* in **protecting oyster reef**  
and its *relevance to Sustainable Development Goals (SDGs)*?

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## Lesson 4 - Measures, obstacles and SDGs

# 4.1 What is Sponge City?



**READ** the passages (W.S. P.1) and **SCAN** the QR code to learn more about Sponge City.

YouTube Link	QR Code
<a href="https://www.youtube.com/watch?v=8mem133ZEQc&amp;t=2s">https://www.youtube.com/watch?v=8mem133ZEQc&amp;t=2s</a>	





## 4.1.1 Q1 Examples on Sponge City Design (Benefits)

Examples	Benefits
<p data-bbox="34 230 253 265"><u>Green roofs</u></p> 	<ul data-bbox="1039 230 1904 456" style="list-style-type: none"><li>• Clean and (drain away/ <b>store</b>) rainwater</li><li>• (Increase/ <b>reduce</b>) amount of water going into sewage systems</li></ul>
<p data-bbox="34 538 450 573"><u>Permeable pavements</u></p> 	<ul data-bbox="1039 538 1879 707" style="list-style-type: none"><li>• Allow rainwater to infiltrate at once</li><li>• (Increase/ <b>reduce</b>) urban flooding during heavy rain</li></ul>
<p data-bbox="34 792 440 827"><u>Constructed wetlands</u></p> 	<ul data-bbox="1039 792 1850 1013" style="list-style-type: none"><li>• (Drain away/ <b>store</b>) rainwater and reduce urban flooding</li><li>• Provide a pleasant habitat for wildlife</li></ul>

## Q2. How could the “Sponge City Design ” help protect the oyster reef?


- A “sponge city” can **absorb** and **store** excessive water during rainstorms.
- With less rainwater discharged into the sea, it helps **lower** the risks of mudflat or oyster reef being **flooded by seawater**.

## 4.1.2 Examples on Sponge City Design (Costs/obstacles)

Examples	Guiding questions	Potential costs
<p data-bbox="54 244 272 277"><u>Green roofs</u></p> 	<ul data-bbox="678 244 1244 467" style="list-style-type: none"><li>• What <b>facilities</b> or <b>work</b> are required to ensure a green roof can run smoothly?</li></ul>	<ul data-bbox="1302 244 1702 353" style="list-style-type: none"><li>• <b>Large-scale engineer work</b></li></ul>
<p data-bbox="54 553 465 586"><u>Permeable pavements</u></p> 	<ul data-bbox="678 553 1244 1013" style="list-style-type: none"><li>• Permeable pavers are a bit <b>more expensive</b> than ordinary pavers</li><li>• Impermeable pavers require less <b>maintenance</b> than permeable pavers</li></ul>	<ul data-bbox="1302 553 1792 773" style="list-style-type: none"><li>• High building and maintaining <b>cost</b> of permeable road surface</li></ul>



## 4.1.2 Examples on Sponge City Design (Costs/obstacles)(cont')

Examples	Guiding questions	Potential costs
<p data-bbox="54 244 459 277"><u>Constructed wetlands</u></p> 	<ul data-bbox="678 244 1174 408" style="list-style-type: none"><li>• What is required to build a constructed wetland in a city?</li></ul>	<ul data-bbox="1302 244 1818 408" style="list-style-type: none"><li>• Might involve large-scale <b>demolishing</b> and <b>resettling</b> work</li></ul>

## Q2 From Q1, can you conclude what is potential opposition from the “Sponge City Design ” ?

- a large-scale engineer work needed for setting green roofs
- a high building and maintaining cost of permeable road surface
- involves large-scale demolishing and resettling work when building constructed wetlands.

## 4.2 What is Harbour Area Treatment Scheme? (Benefits)



**READ the passage to learn more HATS.**

Q1. What is the objective of “HATS” ?

- To improve the water quality of the harbour.

Q2. How could the “HATS” strategy help protect the oyster reef?

- The scheme helps improve the water quality of the harbour and thus provides a more pleasant habitat for oyster reef.

# 4.2.1 What is the Polluter Pays Principle? (Costs/obstacles)



## **READ passages to learn more Polluter Pays Principle?**

Q1. What are facilities and policies are adopted to ensure the implementation of "HATS" ?

What is the potential opposition from the Scheme ?

Facilities and policies	Potential opposition
<ul style="list-style-type: none"><li>• Construction of long pipes and sewage treatment plants are needed which occupies a lot of space</li></ul>	<ul style="list-style-type: none"><li>• Large-scale demolishing and resettling work might require</li></ul>
<ul style="list-style-type: none"><li>• Polluters need to pay for the cost of sewage treatment</li></ul>	<ul style="list-style-type: none"><li>• Increase their financial expenses</li></ul>

## 4.3 Sustainable Development Goals (SDGs)




Read the following information extracted from the website 'Sustainable Development Goals' by The United Nation. Discuss in small groups about



- ▶ **Q1. Identify how these SDGs make a balance between the economic, social and environmental aspects**
- ▶ **Q2. How oyster reef conservation relates to these SDGs**

## 4.3.1 SDG 11

<b>Goals</b>	<b>Aspects</b>	<b>Oyster reef conservation relates to these SDGs ( Building 'Sponge city')</b>
<p>“By 2030, substantially <u>decrease the direct economic losses</u> relative to global gross domestic product <u>caused by disasters</u>, including water-related disasters”.</p> 	<p><b><u>ECONOMIC</u></b></p>	<p>Q: How can 'Sponge city' help reduce economic losses caused by disasters? (Constructing artificial wetland) to <b>reduce surface runoff</b> and <b>soil erosion</b> and thus <b>lower the risk of flooding</b> and the <b>negative impacts</b> it brings</p>

## 4.3.1 SDG 11

<b>Goals</b>	<b>Aspects</b>	<b>Oyster reef conservation relates to these SDGs (Building 'Sponge city')</b>
<p>“Provide universal access to safe, inclusive and <u>accessible, green and public spaces</u> in particular for women and children, older persons and persons with disabilities” by 2030.</p> 	<p><b><u>SOCIAL</u></b></p>	<p>Q: How can 'Sponge city' help provide a pleasant environment and protect lives of residents?</p> <p>It can create <b>water-friendly space</b> for residents and store <b>red flood water</b> to alleviate flooding</p>

## 4.3.1 SDG 11

### Goals

“By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air pollution.”



### Aspects

**ENVIRON**  
**MENTAL**


**Oyster reef conservation relates to these SDGs (Building ‘Sponge city’)**

How can ‘Sponge city’ conserve the environment?


It helps **reduce surface runoff and soil erosion**




## 4.3.2 SDG 14

<b>Goals</b>	<b>Aspects</b>	<b>Oyster reef conservation relates to these SDGs (i.e. Large-scale sewage treatment plan )</b>
<p>(E.g. "By 2030, increase the <u>economic benefits</u> to small island developing States and least developed countries from the <u>sustainable use of marine resources</u>, including through sustainable management of fisheries, aquaculture and <u>tourism</u>."</p> 	<p><b><u>ECONOM</u></b> <b><u>IC</u></b></p>	<p>Q: How can 'Large-scale sewage treatment plan' help increase economic benefits?</p> <ul style="list-style-type: none"><li>• It helps improve the <b>water quality</b> thus help sustain the <b>marine resources</b> and <b>income</b> of fishermen</li><li>• <b>Better water quality</b> of the harbour can help promote <b>tourism</b> (HK case)</li></ul>

## 4.3.2 SDG 14

<b>Goals</b>	<b>Aspects</b>	<b>Oyster reef conservation relates to these SDGs (i.e. Large-scale sewage treatment plan )</b>
<p>“<u>Prohibit</u> certain forms of fisheries <u>subsidies</u> which contribute to <u>overcapacity</u> and <u>overfishing</u>, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies by 2020 ”</p> 	<p><b><u>SOCIAL</u></b></p>	<p>Q: How can 'Large-scale sewage treatment plan' improve and protect lives of residents?</p> <p>It helps provide a <b>pleasant environment to residents</b> and a better water quality help <b>sustain</b> the <b>marine resources</b>, which increases <b>food supply and security</b></p>

## 4.3.2 SDG 14

Goals	Aspects	Oyster reef conservation relates to these SDGs (i.e. Large-scale sewage treatment plan )
<p data-bbox="19 390 763 611">“Sustainably <u>manage and protect marine and coastal ecosystems</u> to avoid significant adverse impacts by 2020.”</p> 	<p data-bbox="826 390 1180 496"><b><u>ENVIRONMENT</u></b> <b><u>AL</u></b></p>	<p data-bbox="1222 390 1908 551">How can “Large-scale sewage treatment plan” conserve the environment?</p> <p data-bbox="1222 625 1812 846">It helps improve the <b>water quality</b> of the harbour and thus <b>provide habitats</b> for different living species</p>

# Unit 4

## The Trouble with Water

(Worksheet\_Teacher's version)

## Lesson 1 - Oyster reef under “Ridge to Reef”

### Q. What is an **oyster reef**? What is “**Ridge to Reef**”?

#### **Lesson objectives:**

1. To describe the characteristics, functions and formation of oyster reef/ mudflat.
2. To understand the concept of “Ridge to Reef” using oyster reef as an example.

#### **Key concept:**

- Water cycle, upstream erosion, oyster reef, Ridge to Reef

### 1.1

## Water cycle

How does water circulate between land, air and sea? Study Figure 1a and complete the question below.

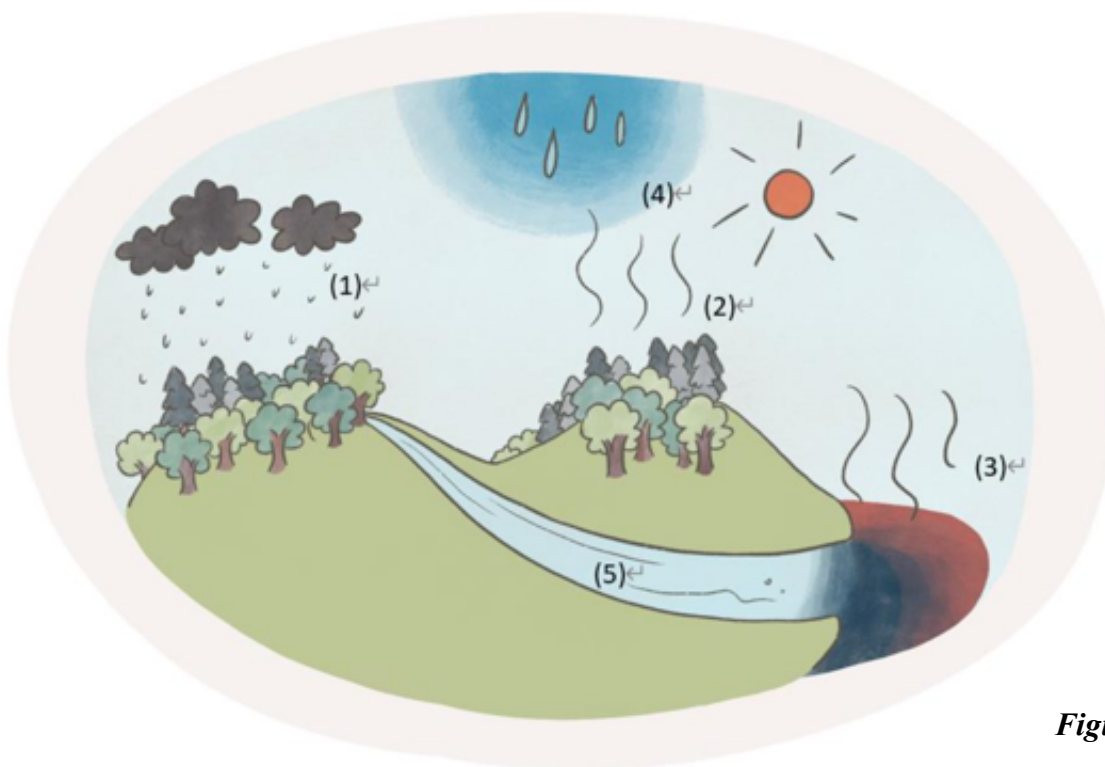


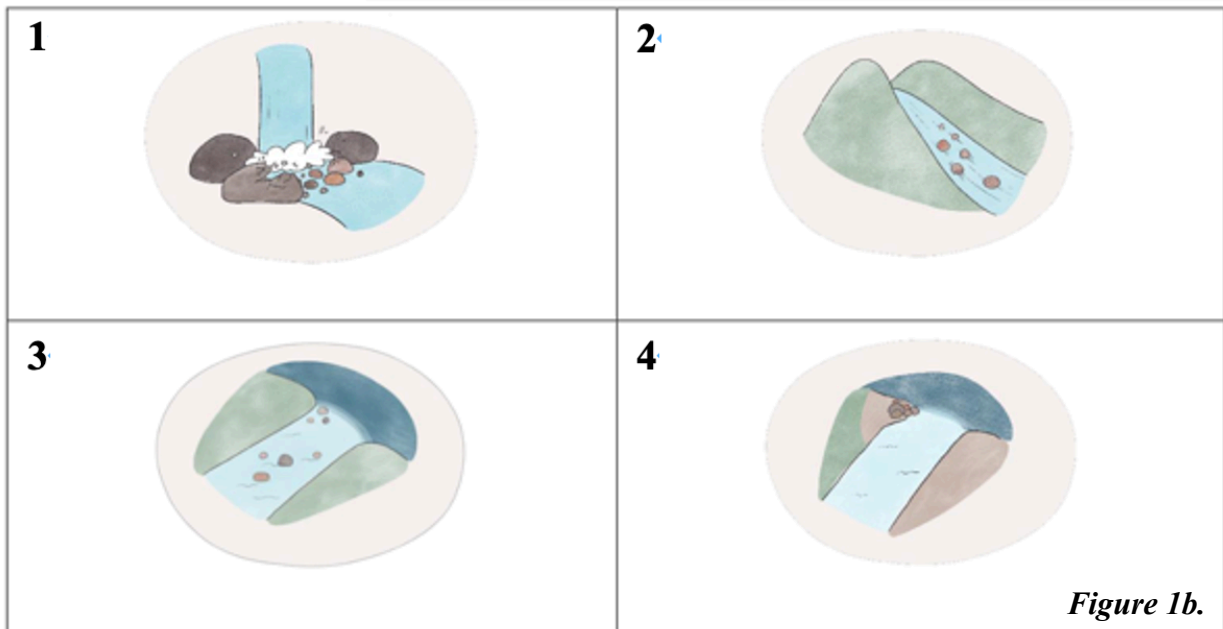
Figure 1a.

Q1. Which part of the water cycle does each of the above numbers represent? State the answers below.

(1) <u>Precipitation</u>	(2) <u>Transpiration</u>
(3) <u>Evaporation</u>	(4) <u>Condensation</u>
(5) <u>Overland flow</u>	

## 1.2 Major river processes

During (5) Overland flow, water flows down the slope along the river. Refer to Figure 1b, identify the major river processes and answer Question 1 to 3.



Q1. What are the major processes involved along the river?

Step 1	Erosion
Step 2 and 3	Transportation
Step 4	Deposition

Q2. In step 4, after the sediments deposited at the river mouth, what kind of landform will form gradually? Mudflat

Q3. Explain the formation of the landform you answered in Q2. (\*\* Hint: follow the steps!)

Step 1	Water erodes the rock and soil in the upper course of rivers.
Step 2 and 3	The eroded materials would be brought downstream.
Step 4	When loads arrive at the river mouth, the river gradient becomes gentler and the tide affects the flow of the river. Thus, the flowing speed of load is reduced, and it would deposit and form mudflats.

### 1.3 Characteristics and functions of oyster reef

In 1.2, we learned the formation of mudflat. Actually, oyster reef lives in similar habitats. The figure below shows the living environment of oysters, can you describe and name the habitat of oysters?





*Figure 1c.*

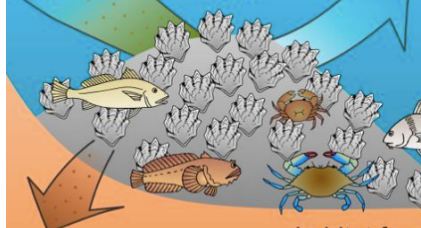
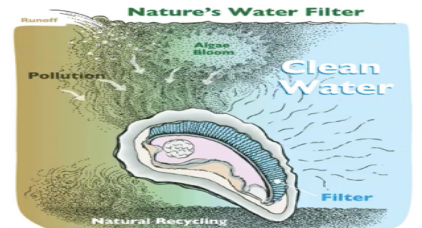
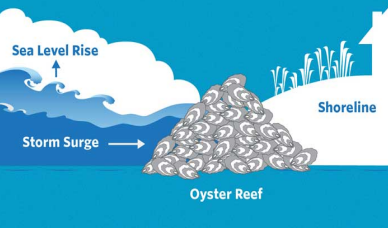
**Q1.** Refer to Figure 1c., describe and identify this habitat?

There is a gentle gradient and deposition of sediments of silt and mud, and there is water body in the surrounding, this habitat is called mudflat.

**Q2.** Mudflat is affected by high and low tides. Complete the following table to learn how oysters adapt to the characteristics of mudflat and grow.

	<i>High tide</i>	<i>Low tide</i>
	 <p><i>Figure 1d.</i> Source: (HKU)</p>	 <p><i>Figure 1e.</i> Source: (HKU)</p>
<b>Effects on mudflat</b>	<ul style="list-style-type: none"> <li>Mudflat is (<b>covered</b>/ exposed) at high tide</li> </ul>	<ul style="list-style-type: none"> <li>Mudflat is (covered/ <b>exposed</b>) at low tide</li> </ul>
<b>Effects on oysters</b>	<ul style="list-style-type: none"> <li>Oyster is (exposed/<b>inundated</b>), oyster shell (close/<b>open</b>)</li> <li>Oysters then consume <b>plankton</b> by <b>filtrating</b> seawater</li> </ul>	<ul style="list-style-type: none"> <li>Oyster is (<b>exposed</b>/inundated), oyster shell (<b>close</b>/open) to minimize <b>evaporation</b> from their bodies</li> </ul>

**Q3.** After we learned the characteristics of oyster reefs. Do you know what are the benefits of oyster reefs to the environment? Refer to the figures below and vocabularies provided to finish Question 1 and 3.

		
<p><i>Vocabularies:</i>  <i>construct habitat, other species</i></p>	<p><i>Vocabularies:</i>  <i>natural water filters,</i>  <i>remove, organic pollutants,</i>  <i>improve water quality</i></p>	<p><i>Vocabularies:</i>  <i>barrier, absorb, wave energy,</i>  <i>reduce damage, to the</i>  <i>shoreline</i></p>
<p><b>Figure 1f.</b>          Source:          (www.pierceatwood.com)</p>	<p><b>Figure 1g.</b>          Source:          (Clean Green Energy          India)</p>	<p><b>Figure 1h.</b>          Source:          (The Nature Conservancy)</p>

**Q1.** What could oyster reefs provide for other species?

Oyster reefs could construct habitats for other species and this helps increase biodiversity.

**Q2.** Why oyster reefs function as natural water filters?

They remove organic pollutants and improve water quality.

**Q3.** How can oyster reefs help stabilize the shoreline when there is a storm surge?

Oyster reefs act as a barrier that absorbs wave energy and this reduces damages to the shoreline.



## Lesson 2 - Soil erosion, water pollution and reef

### Q. What are the **IMPACTS** of soil erosion and water pollution on the oyster reef habitat?

#### **Lesson objectives:**

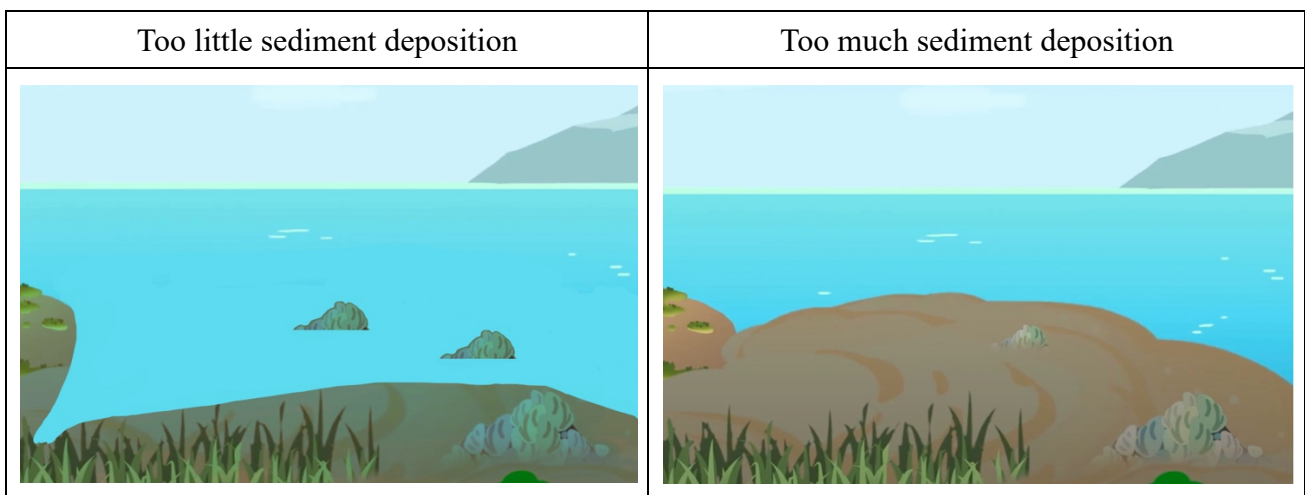
1. To describe the damages to oyster's habitat caused by soil erosion and water pollution.
2. To understand the impacts of damaging oyster reef in affecting the water quality.

#### **Key concept:**

- Soil erosion, Water pollution

### 2.1 Impacts of soil erosion

In the previous lesson, we learnt the importance of upstream erosion in shaping the mudflat. Next, we will discuss how different rates of soil erosion hinder the formation of mudflat and the oyster reef.



Q1. What happens if there is too little or too much sediment depositing on the lower stream?

- Too little:

If there is too little material eroded in the upper course, the sediments deposited at the river mouth would not be enough to form mudflat/ permanently being flooded by seawater.

- Too much (serious soil erosion):

If there is too much material eroded in the upper course, the sediments deposited at the river mouth will increase, and it would emerge on the water permanently.

What are the **causes of serious soil erosion** in the upper course?  
We will discuss it in the next lesson!



Q2. How would the different rates of soil erosion hinder the formation of oyster reef habitats?

Oysters grow on the mudflat.

→ If the amount of deposited material increases at the river mouth, the oyster will be covered/ inundated by excessive sediment.

→ If the amount of deposited material decreases, the oysters will be exposed.

The changes in sediment content of mudflat (habitat) will affect their growth.

## 2.2 Impacts of water pollution

Expect soil erosion, serious water pollution will also damage the oyster's habitat. Read the figures and use the vocabularies provided to finish Question 1 and 2.



Chemical pollutants	Organic pollutants
<p><i>Vocabularies: Heavy metal, wash downstream, pollute, toxify, soil and water</i></p>	<p><i>Vocabularies: Nutrients, eutrophication, algae and red tide, oxygen</i></p>

Q1. What happens if there are too many chemical pollutants in the river?

Heavy metal will be washed downstream and pollute/ toxify the soil and water.

Q2. What happens if there are too many organic pollutants in the river?

The organic waste will release nutrients into the river and lead to eutrophication. It favors the growth of algae and red tide, which further use up the oxygen in the water

Q3. What are the impacts of water pollution on the oyster and its habitats?

Chemical pollutants	It lowers the <u>pH value</u> / increases the <u>acidity</u> of water and kills oysters.
Organic pollutants	It causes <u>suffocation</u> of oysters and other marine species.

**Where** do chemical and organic pollutants come from? What are the **causes of water pollution**?  
We will discuss it in the next lesson!





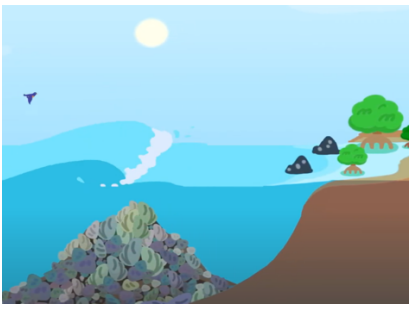
## 2.3

### Damages to the environment in a long run

We learnt the functions of the oyster reef in lesson 1. So, what would happen to the environment if the oyster reef was being damaged?

*Hint: Recall 1.2! What are the functions of oyster reef?*

Q1. Refer to the figures, list the negative environmental impacts caused by the damage of oyster reef.

		
Loss of natural habitat for other species	Loss of filtering function leads to poor water quality	Shoreline becomes unstable

## Lesson 3 – Conservation of oyster reef from the ridge

### How to **conserve** our oyster reef?

#### **Lesson objectives:**

1. Identify the causes of soil erosion and water pollution on ridge
2. To think of some feasible and specific measures to conserve the oyster reef

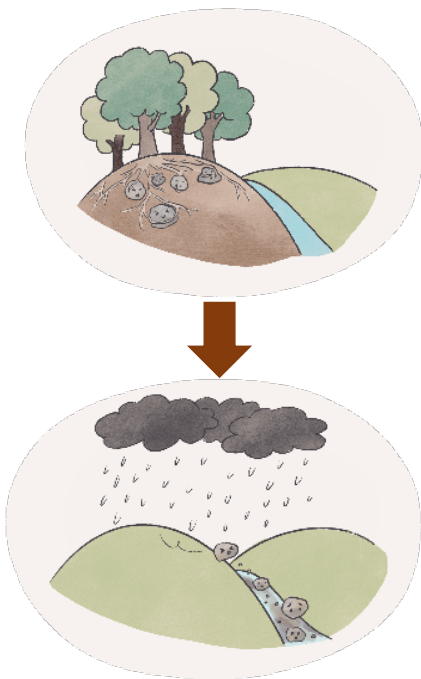
#### **Key concept:**

- oyster reef, water pollution, oyster reef conservation

### 3.1 Causes of soil erosion on ridge

Q1. Refer to the figures below showing different causes of soil erosion on ridge. Identify the cause and explain how it will lead to soil erosion.

#### A. Deforestation



Cutting of trees on upstream will cause the soil to be loosen as they are not held by tree roots. The soil is then exposed and removed by water easily, causing soil erosion.

#### B. Overgrazing and overcultivation



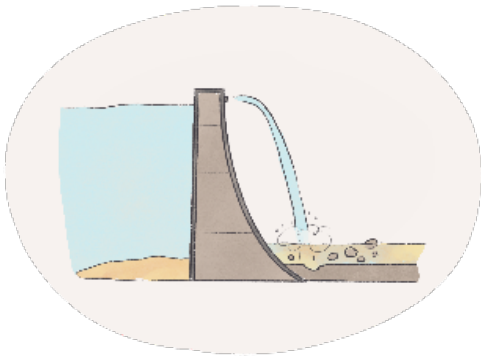
- What are the farming activities found on upstream?

#### Raising of livestock and commercial farming

- What will happen if the farming activities are not limited (exceed the carrying capacity of the land)?

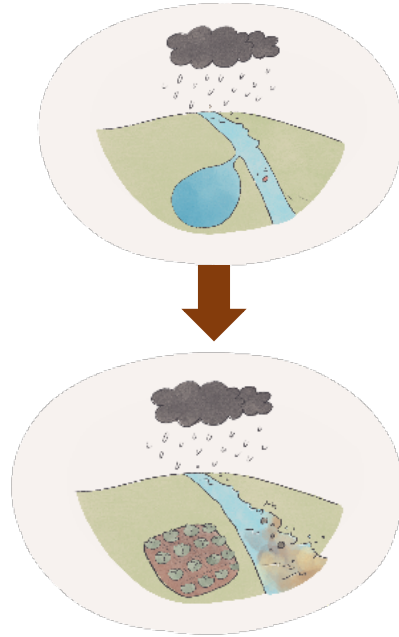
1. Farmers remove the vegetation for farming purpose, thus the land become unprotected.
2. Farmers farm and graze excessively on the slope, causing the soil to be removed easily. This leads to serious soil erosion.

C. Building of dams



Building of dams in the upper course will cause the amount of sand in the lower course (increase / decrease). This will increase the river velocity and lead to more serious soil erosion.

D. Reclamation



After the lakes are reclaimed, it loses the function of adjusting river discharge. When flooding occurs, soil in the lower course will be removed easily, causing serious soil erosion.

3.2

**Causes of water pollution on ridge**

Q2. Look at the picture below showing the human activities from the ridge to reef. What are the sources of water pollution you can see? Are they organic or chemical pollutants?



Summarise them in the following table.

Source	Organic/Chemical
1. <u>Agricultural waste</u>	<u>Organic</u> /Chemical
2. <u>Livestock waste</u>	<u>Organic</u> /Chemical
3. <u>Municipal and industrial sewage</u>	Organic/ <u>Chemical</u>
4. <u>Use of chemical fertilisers</u>	Organic/ <u>Chemical</u>

### 3.3 Conservation of oyster reef at source

Q3. Refer to what have we learnt in 3.1 and 3.2. Can you think of some measures to reduce the impacts and conserve our oyster reef? Discuss with your group members.



*You can think of the measures from the perspectives of **reducing soil erosion** and **reducing water pollution**.*

#### Reduce soil erosion on ridge

- Tree planting campaign/ afforestation
- Contour farming
- Conserving lakes
- Clean up hiking trails (or other acceptable answers)

#### Reduce water pollution

- Build sewage treatment plant/ implement sewage treatment
- Adopt polluter-pays principle
- Implement and enforce law to prohibit illegal sewage discharge
- Use earthworm to decompose excessive amount of organic matter in farmland  
(or other acceptable answers)

## ***Lesson 4 - Measures & obstacles for oyster reef protection and its relevance to Sustainable Development Goals (SDGs)***

***Q: What are **measures & obstacles** in protecting oyster reef and its relevance to **Sustainable Development Goals (SDGs)**?***

### **Lesson objectives:**

1. To discuss the benefits of Sponge City & Sewage Treatment measures for oyster reef protection
2. To identify the obstacles of oyster reef conservation
3. To discuss and explain how conserving oyster reef can be sustainable

### **Key concept:**

- Sponge City, Sewage Treatment, Benefits and Costs (Obstacles), SDGs

### **4.1 What is Sponge City?**

In Lesson 3, we learned some oyster reef conservation measures. In this lesson, we will learn 2 more measures for oyster reef protection. Read the following passages and scan the QR code to watch the video and learn more about Sponge City.

***Hint: Recall 3.3 Conservation of oyster reef at source!!!***

Sponge City means that a city could function like a sponge that has great “resilience” (strength) to environmental changes and natural disaster. The stormwater could be absorbed, stored, infiltrated and cleaned during rainy days, and could be “released” and utilised as needed to enhance the ecological function of the city and reduce the flooding in the city.




This concept promotes reducing urban development through natural drainage of rain and reduce largescale artificial channel improvement works.



**(Video on “Sponge City Design”)**

## 4.1.1 Examples on Sponge City Design (Benefits)

Q1. After watching the video on “Sponge City Design” and circle the right answer.

Examples	Benefits
<p style="text-align: center;"><b><u>Green roofs</u></b></p>  <p>(Source: Brand Hong Kong)</p>	<ul style="list-style-type: none"> <li>• Clean and (drain away/ <b>store</b>) rainwater</li> <li>• (Increase/ <b>reduce</b>) amount of water going into sewage systems</li> </ul>
<p style="text-align: center;"><b><u>Permeable pavements</u></b></p>  <p>(Source: Enviro Limited.)</p>	<ul style="list-style-type: none"> <li>• Allow rainwater to infiltrate at once</li> <li>• (Increase/ <b>reduce</b>) urban flooding during heavy</li> </ul>
<p style="text-align: center;"><b><u>Constructed wetlands</u></b></p>  <p>(Source: DSD.gov)</p>	<ul style="list-style-type: none"> <li>• (Drain away/ <b>store</b>) rainwater and reduce urban flooding</li> <li>• Provide a pleasant habitat for wildlife</li> </ul>




Q2. How could the “Sponge City Design ” help protect the oyster reef?

A “sponge city” can absorb and store excessive water during rainstorms. With less rainwater discharged into the sea, it helps lower the risks of mudflat or oyster reef being flooded by seawater.



## 4.1.2 Examples on Sponge City Design (Costs/obstacles)

Q1. Based on the Guiding Questions, complete the following table.

Examples	Guiding Questions	Potential costs
<p><b><u>Green roofs</u></b></p>  <p>(Source: Brand Hong Kong)</p>	<ul style="list-style-type: none"> <li>• What <u>facilities</u> or <u>work</u> are required to ensure a green roof can run smoothly?</li> </ul>	<ul style="list-style-type: none"> <li>• Large-scale engineer work</li> </ul>
<p><b><u>Permeable pavements</u></b></p>  <p>(Source: Enviro Limited.)</p>	<ul style="list-style-type: none"> <li>• Permeable pavers are a bit more expensive than ordinary pavers</li> <li>• Impermeable pavers require less maintenance than permeable pavers</li> </ul>	<ul style="list-style-type: none"> <li>• High building and maintaining cost of permeable road surface</li> </ul>
<p><b><u>Constructed wetlands</u></b></p>  <p>(Source: DSD.gov)</p>	<ul style="list-style-type: none"> <li>• What is required to build a constructed wetland in a city?</li> </ul>	<ul style="list-style-type: none"> <li>• Might involve large-scale demolishing and resettling work</li> </ul>

Q2 From Q1, can you conclude what is potential opposition from the “Sponge City Design ” ?

There is a large-scale engineer work needed for setting green roofs, there is a high building and maintaining cost of permeable road surface and it might involve large-scale demolishing and resettling work when building constructed wetlands.

## 4.2

### What is Harbour Area Treatment Scheme? (Benefits)

Besides “Sponge City Design” measure, we will also discuss “Sewage Treatment Plan” for oyster reef protection.

As the water quality in Victoria Harbour affects many people in Hong Kong, the Government initiated The Harbour Area Treatment Scheme (HATS).

The HATS is collecting and treating the sewage on both sides of Victoria Harbour. The scheme came into full operation at the end of 2015.

(Source: GovHK)

Q1. What is the objective of “HATS” ?

To improve the water quality of the harbour.

Q2. How could the “HATS” strategy help protect the oyster reef?

The scheme helps improve the water quality of the harbour and thus provides a more pleasant habitat for oyster reef.

## 4.2.1

### What is the Polluter Pays Principle? (Costs/obstacles)

HATS and other sewerage facilities require a significant amount of resources for daily operation in order to sustain our efforts for protecting the marine environment.

In accordance with the polluter pays principle, those who create waste have a responsibility for helping to pay to clean it up, thus the Sewage Services Charging Scheme is implemented.

(Source: GovHK)

Q1. What are facilities and policies are adopted to ensure the implementation of “HATS” ? What is the potential opposition from the Scheme ?

Facilities and policies	Potential opposition
Construction of long pipes and sewage treatment plants are needed which occupies a lot of space	Large-scale demolishing and resettling work might require
Polluters need to pay for the cost of sewage treatment	Increase their financial expenses

## 4.3 Sustainable Development Goals (SDGs)

- From 4.1 and 4.2, we learned 2 measures for oyster reef protection: “Sponge City Design” and “Sewage Treatment Plan” respectively. Next, we will discuss their relevance to Sustainable Development Goals (SDGs).

**Hint: Recall 4.1& 4.2 for the 2 oyster reef protection measures!!!**



Read the following information extracted from the website of ‘Sustainable Development Goals’ by The United Nation. Discuss in small groups about



**Q1. Identify how these SDGs make a balance between the economic, social and environmental aspects**

**Q2. How oyster reef conservation relates to these SDGs**

### 4.3.1 SDG 11: Make cities and human settlements inclusive, safe,

Complete the following table to identify in which *aspects* (economic, social & environmental) the mentioned SDGs belong to and *their relevance* with oyster reef conservation measures.




<p>Goals</p> 	<p><b>Aspects:</b> economic, social &amp; environmental</p>	<p>Oyster reef conservation relates to these SDGs (i.e. <b>Building ‘Sponge city’</b>)</p>
<p>“By 2030, substantially <u>decrease the direct economic losses</u> relative to global gross domestic product <u>caused by disasters</u>, including water-related disasters”.</p>  <p>(Source: pngtree)</p>	<p><b>Economic</b></p>	<p><b>Q: How can ‘Sponge city’ help reduce economic losses caused by disasters?</b></p> <p><b><u>(E.g. Constructing artificial wetland) to reduce surface runoff and soil erosion and thus lower the risk of flooding and the negative impacts it brings</u></b></p>

<p>“Provide universal access to safe, inclusive and <u>accessible, green and public spaces</u> in particular for women and children, older persons and persons with disabilities” by 2030.</p>  <p>(Source: Timeout)</p>	<p><b>Social</b></p>	<p><b>Q: How can ‘Sponge city’ help provide a pleasant environment and protect lives of residents?</b></p> <p><u>It can create water-friendly space for residents and store flood water to alleviate flooding</u></p>
<p>“By 2030, <u>reduce the adverse per capita environmental impact</u> of cities, including by paying special attention to air pollution.”</p>  <p>(Source: Brand Hong Kong)</p>	<p><b>Environmental</b></p>	<p>How can ‘Sponge city’ conserve the environment?</p> <p><u>It helps reduce surface runoff and soil erosion</u></p>

**SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development**  
**(Target: 14.1-14.3, 14.6, 14.7)**

4.3.2

Complete the following table to identify in which *aspects* (economic, social & environmental) the mentioned SDGs belong to and *their relevance* with oyster reef conservation measures.

<p>Goals</p> 	<p><b>Aspects:</b> economic, social &amp; environmental</p>	<p>Oyster reef conservation relates to these SDGs (i.e. <b>Large-scale sewage treatment plan</b> )</p>
<p>“By 2030, increase the <u>economic benefits</u> to small island developing States and least developed countries from the <u>sustainable use of marine resources</u>, including through sustainable management of fisheries, aquaculture and <u>tourism</u>.”</p>  <p>(Source: Association of Caribbean States)</p>	<p><b>Economic</b></p>	<p><b>Q: How can ‘Large-scale sewage treatment plan’ help increase economic benefits?</b></p> <p><u>It helps improve the water quality thus help sustain the marine resources and income of fishermen</u></p> <p><u>Better water quality of the harbour can help promote tourism (HK case)</u></p>
<p>“<u>Prohibit</u> certain forms of fisheries <u>subsidies</u> which contribute to <u>overcapacity and overfishing</u>, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies by 2020.”</p>  <p>(Source: Marine Stewardship Council)</p>	<p><b>Social</b></p>	<p><b>Q: How can ‘Large-scale sewage treatment plan’ improve and protect lives of residents?</b></p> <p><u>It helps provide a pleasant environment to residents and a better water quality help sustain the marine resources, which increases food supply and security</u></p>

“Sustainably *manage and protect* *marine and coastal ecosystems* to avoid significant adverse impacts by 2020.”



(Source: UNCTAD)

**Environmental**

How can “Large-scale sewage treatment plan” conserve the environment?

It helps improve the water quality of the harbour and thus provide habitats for different living species