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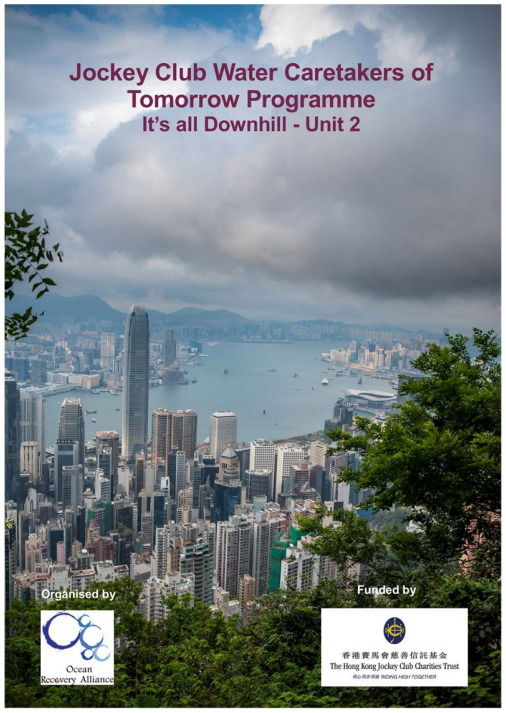
同心同步同進 RIDING HIGH TOGETHER

Teacher Notes for
Unit 2: It's All Downhill

About the Jockey Club Water Caretakers of Tomorrow Programme:

The Jockey Club Water Caretakers of Tomorrow Programme is a collaboration funded by The Hong Kong Jockey Club Charities Trust and developed by Ocean Recovery Alliance, Ltd. It is an educational curriculum programme designed for students in Form 1-3 early secondary school in Hong Kong. Through a combination of both inquiry-based and project-based learning, students develop understanding and appreciation for our water systems and functions, at both the local and global levels. They learn how to assess threats such as pollution and habitat destruction, while also developing ways to mitigate them. This understanding will empower our youth to take an active role as caretakers of our water resources of the future, and to share their commitment with their families and communities.

Using the Lessons in the Classroom



The Jockey Club Water Caretakers of Tomorrow Programme consists of eight units. The units have been developed to allow for using as many as your time and your curriculum will allow. Each unit can stand alone, although it is strongly recommended that Unit 1: Miraculous Water, be implemented first as it lays the groundwork for the other units. Please note that there is repetition in some of the topics covered in each of the units. This is intentional. As it is likely that most teachers will not be able to complete all of the eight units, the curriculum has been designed to contain as many of the important concepts as possible, within each unit. Teachers are encouraged to pick and choose from the range of topics and activities in each unit, such that unnecessary repetition is avoided.

Teacher Notes and Student Notes

Each unit consists of Teacher Notes and Student Notes. The Teacher Notes include information about skills accessed, materials needed, recommended assessments, suggested extensions, cross-curricular links and other information that could help determine how the Unit and the individual lessons might fit into a teacher's curriculum. In addition to this, Teacher Notes will contain links to websites with background material that can deepen the teacher's understanding on the topics covered in the unit.

The Student Notes can be printed out for the students to use throughout the unit. It includes background information, instructions for all the activities, as well as space to record their learning. The students should also have access to the Student Notes online as many of the activities and additional information are linked to websites on the internet.

It is also recommended that students keep their own "learning log" or journal to record their progress in understanding the issues as well as the actions they might take.

Extensions

All the lessons contain "Extensions" which provide additional rigor or challenges for students. These suggestions for enrichment can help to streamline the lessons to the grade level, curricular or differentiation needs of your own students. Some of the extensions utilize case studies or contain more photographic material or recommended websites, all of which might be suited to students with different learning styles.

Safety in the Classroom and in the Field
Teachers will go over their school's rules for safe and responsible behaviour both inside and outside the classroom, before doing all of the activities in the units. The Teacher Notes will, however, identify particular safety concerns to be aware of in specific activities.

Student Action and Social Responsibility
The aim of every unit in this project is to build student understanding of water resource issues. Through that understanding, it is hoped that they will be motivated to work toward positive change individually, locally and globally. It is, however, important that their teachers communicate the importance of their being sensitive to the complexities of cultural norms and political processes.

Objectives of Unit 2: It's All Downhill

At the end of the lessons in this unit, students will be able to:

- describe the physical features of the watershed and its relationship to the water cycle

- show the links and interactions in a watershed
- identify and describe the watershed they live in, using maps
- connect land use with impact on the watershed
- design a product or develop an outdoor activity that communicates an understanding of watersheds

Student skills table

Lesson	Critical thinking	Supporting Opinions with evidence	Applying scientific principles	Data collection	Graphing and Data Analysis	Reading for Understanding	Using technologies for mapping	Research and/or Presentation
1								
2								
3								

Cross-curricular Links:

Lesson 1: Physical *Science* (reading scientific text, experiment with gravity), *Humanities/Geography* (map reading, identifying land uses, communities, Extension activity relates water resources to population) *Art* (use a quote to inspire a drawing)

Lesson 2: Physical *Science/Earth Science* (reading scientific text about groundwater, experiments, reading tables, interpreting data), *Mathematics* (calculate groundwater use per capita) *Humanities/Geography* (comparing water use of different countries), *Language Arts* (writing a story about a sinkhole on school grounds)

Lesson 3: *Physical Geography* (interpreting weather and climate data, evaluating geoengineering solutions), *Humanities/Geography* (population needs, land use, map reading), *Language Arts* (writing a children's book)

Unit Vocabulary - refer to Student Notes

Student Notes includes all the vocabulary and definitions that the students should know in order to understand the topics covered.

Materials and Technology Needed

	Activity						
Lesson	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	Jars, cylinders, balls, long flat surface that can be angled	Access to internet	Access to internet	Access to internet	Access to internet	Access to internet	Access to internet. Paper and art supplies for making drawings, if not done in worksheets.
2	Access to internet	Clear plastic cups, small pebbles, sand, clay, water, Soil, tray, water bottles, bottle top with hole drilled in	Access to internet	Access to internet	Plastic cups, tub of ice cream, Clear fizzy drink, food colouring, Some of the following: Small gummy bears, chocolate chips, crushed cookies, breakfast cereal, or crushed ice. Straws, spoons, cake sprinkles	Access to internet	
3		Access to internet	Access to internet	Access to internet	Extension activity requires access to internet		

Unit Introduction:
Go over the Student Aims and the Vocabulary with the students

Lesson 1

Objectives: In this lesson, students will understand:

- States or phases of water
- Phase changes of water
- Unique physical and chemical properties of water
- Properties of solutions
- Turbidity and its importance as a water quality indicator

1- Have students complete the photo match which gets them to start thinking about what types of bodies of water one might find in a watershed.
2- Have them complete the interview questions to access their prior knowledge on the topics. They can return to these questions at the end of the unit, to see how much they have learned. Please note that many of these questions are the same as the interview questions in Unit 1. If you have done Unit 1 with your students, please have them cross out questions 1-6 and only complete questions 7-14.

Activity 1: I'm on a Roll
Follow the instructions in Student Notes for the experiments in this activity. The students should predict what they think will happen in each experiment, as well as their best idea about why this has occurred. After the experiment is over, ask the students what they think this has to do with understanding the way watersheds work.

Activity 2: Connect the Dots
Follow the instructions in Student Notes for this activity.

1. The students use the link provided to learn how to determine watershed boundaries.
2. They can estimate the watershed boundaries by using topographical features that might determine the direction of water flow, such as ridge lines.

Activity 3: That is a Whopping Big Watershed!
Follow the instructions in the Student Notes. Students are encouraged to compare the watersheds of the world's largest rivers. Alternatively, they can do the National Geographic watershed labelling activity (30 minutes).

Activity 4: What's Inside My Watershed?
Students use Google maps or Google Earth to investigate what kinds of land use comprise their watershed after they have determined its boundaries.

Activity 5: Hong Kong Contours
This brief map reading activity highlights the way contour lines can be understood. Ask the students why it is important for information like this to be used in city planning.

Activity 6: Slip Sliding Away
Students follow the prompts. Divide the items on the website among the class. Students could work in groups of two or three. They share interesting facts about how Hong Kong protects its people from the dangers associated with steep slopes.

Activity 7: The good news and bad news:
1- Students watch some of the videos on the links, to learn about the effects of water in their watershed.
2- Encourage students to select different quotes for their drawings and after they have completed them, consider doing a Gallery Walk in which half of the class stays with his/her drawing to explain it and the other half walks around like in an art gallery. Then reverse.

Lesson 2: Water travels underground too

Objectives: In this lesson, students will understand:

- What aquifers are composed of
- What groundwater is and how surface permeability affects it

Activity 1: Aquifer
Students follow the prompts to watch videos about groundwater and answer the questions.

Activity 2: Aquifer in a plastic cup
Students follow the instructions in Student Notes for all of these experiments. As an extension, the students can build their own, more sophisticated aquifer as an individual project.
Ask why it might be difficult to clean up polluted groundwater.

Activity 3: Who is Using Aquifers?
Students follow the prompts. They interpret graphs and tables to answer questions about groundwater use.
Discussion points might include the factors involved in some countries using more groundwater than others.

Activity 4: Recharging an Aquifer
Students watch videos about recharging aquifers and answer questions to check for comprehension.

Activity 5: Polluted Aquifers

This activity is edible science. Make sure students do not have allergies to any of the ingredients used.

1- Students construct their aquifer based on what they learned about their composition. They need to draw a sketch of the different layers and the function of each.
2- Students follow the prompts for the experiment.
3- Bon apetit!
4-After students research groundwater contamination, they make a small sketch of the sources of this contamination.

Activity 6: A drip at a time
This activity highlights the more mysterious, beautiful effects of water seeping underground: cave systems and underground waterways. Encourage any of the students who have been to caves, to share their experience and/or pictures with the class.

1- Students watch some videos and answer some questions
2- After learning about what a sinkhole is, let the students have some fun imagining a sinkhole opening on school grounds and writing a story about it!

Lesson 3: Changing Environment

Objectives: In this lesson students will understand

- The effects of major weather events on watersheds
- Difference between weather and climate
- Possible effects of global warming on watersheds

Activity 1: Review the Water Cycle
This is a review of the water cycle before talking about weather and climate.

Activity 2: Local and Regional Weather Information
Students follow the prompts to look at websites about weather and answer questions about this.

Activity 3: Destructive Weather Events
Students research the effects of typhoons and mudslides. Then they consider the effects of "disaster as entertainment" in the movies they watch.

Activity 4: What is Climate?
1- Students follow the prompts to research climate data and respond to questions.
2- They watch some short videos about the effects of increased levels of CO_2 in the atmosphere and how Hong Kong's climate could be affected.

Activity 5: Is Geoengineering the Solution?
1- Students read about sea level rise, as an example of one of the effects of global warming.
2- Decide as a class which solutions might be best for Hong Kong to reduce the effects of global warming.
3- What conclusions were reached and why? Consider setting this activity up as a debate or other format.

Extension
If there is time or inclination, students can follow a typhoon's path on the website provided.

Lesson 4: Using the Land Wisely

Objectives: In this lesson, students will understand

- The need for regulations on land use
- Factors that must be considered in allocating land for different uses
- The effects of different land use on our watershed

Activity 1: Why We Need
Students are asked to consider the unique aspects of land use in Hong Kong.

Activity 2: The Big Land Carve-Up
1- Students interpret a pie chart about land use in Hong Kong.
2- They are asked to consider the function of government regulations regarding land use.

Activity 3: Avoiding Danger
1- Students use a website to research about Hong Kong's unique topography and the natural dangers associated with these.
2- They should write about what they learn, using the prompts provided.

Activity 4: Hong Kong Land Use
Students reflect on the effects of land use planning in Hong Kong, pertaining to their own quality of life.

Activity 5: Effects of Different Land Use on our Watershed
In this activity, student are able to identify different land uses in terms of positive and negative effects on the watershed. This should utilize the knowledge they have gained throughout the unit.

Activity 6: Looking Forward
The students will produce a product for the younger students in their school, which will get across the most important things they have learned about watersheds. They are given the choice of a diorama, a children's story book or an educational walk in their watershed.