Teacher guidelines – activity on:
Water resources and water pollution

Generic green skills

Cognitive competencies:

- Environmental awareness and a willingness to learn about sustainable development
- Systems and risk analysis, skills to assess, interpret and understand both the need for change and the measures required

Technological competencies:

- Management systems (waste, energy, water)

Learning objective

Students are expected to:

1. Clarify ideas about water pollution
2. Classify the causes of point-source and non-point source water pollution and identify possible solutions
3. Present a systematic view on a non-point source water pollution

Format

Individual work, group work and whole class

Role of teacher

Facilitator

Resources needed

A4 paper, A3 paper, pens, student worksheet, concept information sheet

Time required

2 hours

Assessment

The assessment will be based on:

Students' answers presented in two tables and a presentation by their group.

Suggested teaching and learning sequences

There are two activities designed for students to understand and identify sources of water pollution.

Activity 1:

During the class:

Students are required to fill in the table below *individually* and justify why each is a true or false statement *during class discussion* (10 minutes).

Only less than 1% of water is available for human use.	
80% of the world's wastewater is largely treated.	
Atmospheric deposition does not cause water pollution.	
The biggest consumer of fresh water resources is the agricultural sector.	
When released into rivers and lakes, greywater becomes a valuable fertilizer.	
If treated, wastewater can be used for fire-fighting, garden watering and toilet flushing.	

This activity is intended to provide students with the opportunity to identify and clarify their ideas about water resources and water pollution.

Activity 2:

Before the class:

Students should be asked in the previous lesson/class to read the information sheet on *Water resources and water pollution* before coming to this class.

During the class:

1. Help students to organize themselves into groups: 5/6 students in a group.

2. Based on the concept information sheet, ask students to classify the following as point-source or non-point source: (10 minutes). One group needs to fill in one table.

   Pollution can occur in different ways. If it is from a single location such as wastewater discharged from an oil factory, it is called ***point-source pollution****. If the source is multiple and different, it is called* ***non-point source pollution.***

Boats in a lake	
Oil dumped in a swale	
Pipe discharge from a wastewater treatment plant into the river	
An animal owner neglecting to clean up their pet's waste	
Homeowner washing a driveway with a hose	
Automobile leaking brake fluid	
Construction site erosion	
Pouring lawn clippings into a canal	
Factory illegally dumping waste into a local waterbody	
Effluent from a failing septic tank	
Pouring antifreeze down the storm drain	
Spraying a garden to eliminate bugs	
Over-fertilizing a garden	
Runoff from a parking lot	

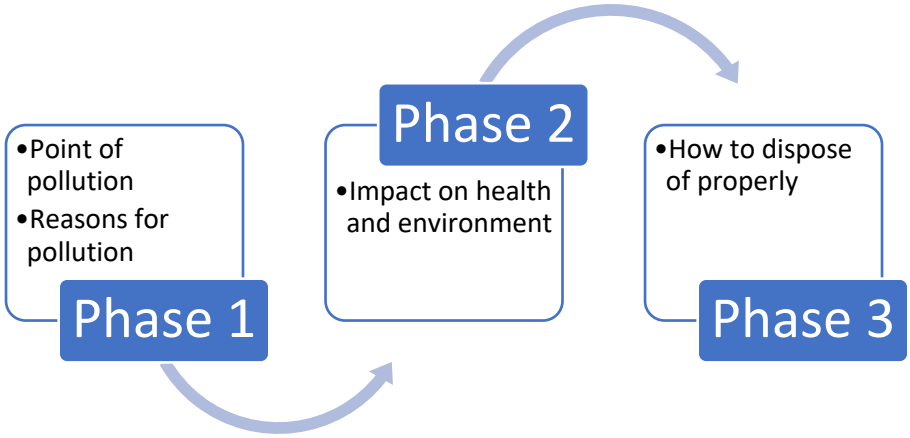
   (NOTE: The table above is retrieved from the internet. For the full citation, please refer to the references)

3. Help students to pick two examples: one from a point-source and one from a non-point source of water pollution (5 minutes)

   (NOTE: Try to ensure that each group chooses different examples. Either you can assign different examples to groups, or you can write what the groups chose on the board, so each group is assigned with different source of pollution.)

4. In groups, students should discuss how the process of pollution occurs and create a diagram for each example. For a non-source pollution help students to think in a systematic way about several factors related to this particular example of pollution.

   An example of a diagram can be seen below. Students need to explain the reasons for pollution, as well as its impact and how to dispose of wastewater properly (35 minutes). Help students during their group work.



   (NOTE: Alternatively, you can ask students to show in which specific phase the pollution occurs without necessarily having to mention disposal mechanisms, such as in "Factory illegally dumping waste into local water body". This is a point-source pollution example and in the production phase dumping into local water body may be happening.)

5. After completing their diagrams, each group should select a presenter to explain the diagram to the rest of class. Each group should have five minutes to present (30 minutes).

6. The other groups should be prompted to ask questions.

Suggested answers/examples of activities

Activity 1:

Below is a true/false activity. Please mark the following sentences as true or false statements and justify why they are true or false.

Only less than 1% of water is available for human use.	*TRUE (Of the 3% fresh water resources, only 0.9% is available on the ground: 87% of which are lakes, 11% swamp, and 2% rivers).*
80% of the world's wastewater is largely treated.	*FALSE (80% of the world's wastewater is released back to the environment without treatment).*
Atmospheric deposition does not cause water pollution.	*FALSE (It is one of the sources of pollution, but not the only one).*

The biggest consumer of fresh water resources is the agricultural sector.	*TRUE (The agricultural sector makes use of fresh water resources of up to 70% for livestock production and farming practices).*
When released into rivers and lakes, greywater becomes a valuable fertilizer.	*FALSE (When released into rivers, nutrients in greywater becomes pollutants. It can be used as fertilizers for plants in the home garden).*
If treated, wastewater can be used for fire-fighting, garden watering and toilet flushing.	*TRUE (If treated, wastewater can be used for multiple purposes).*

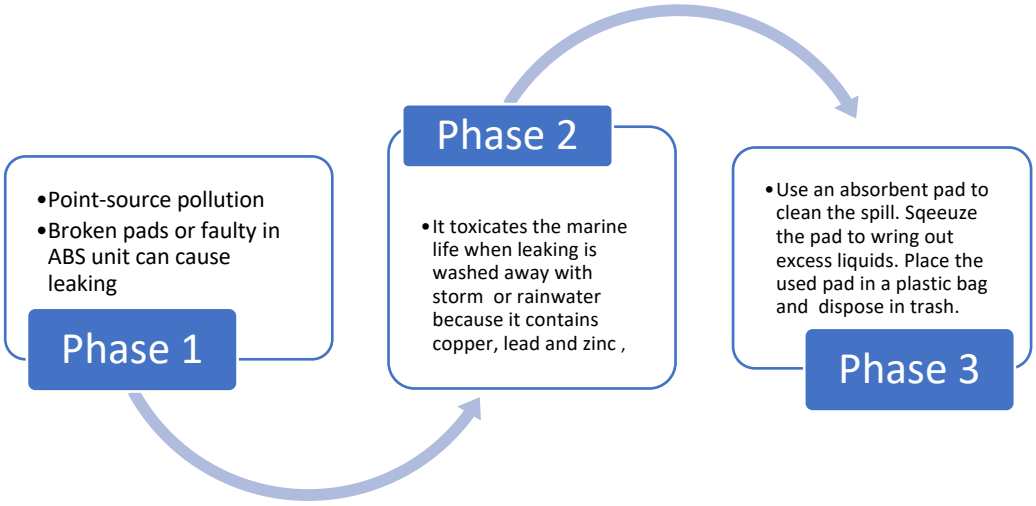
This activity is intended to provide students with the opportunity to identify and clarify their ideas about water resources and water pollution.

Activity 2:

Based on the information in the concept information sheet, please classify the following as point-source or non-point source:

Boats in a lake	*Point source*
Oil dumped in a swale	*Point source*
Spraying a garden to eliminate bugs	*Non-point source*
Pipe discharge from a wastewater treatment plant into the river	*Point source*
An animal owner neglecting to clean up their pet's waste	*Non-point source*
Homeowner washing a driveway with a hose	*Non-point source*
Automobile leaking brake fluid	*Point source*
Construction site erosion	*Point source*
Pouring lawn clippings into a canal	*Non-point source*
Factory illegally dumping waste into a local water body	*Point source*
Pouring antifreeze down the storm drain	*Non-point source*
Effluent from failing septic tank	*Point source*
Over-fertilizing a yard	*Non-point source*
Runoff from a parking lot	*Non-point source*

Diagram example for "automobile leaking brake fluid":



Source: (EPA)

Suggestion:

This activity can be done before you cover the topic. It can be handed out to students in the period before teaching the Water Resources and Pollution Concept. This type of diagnostic assessment can help you identify students' previous knowledge and design a well-adjusted class period.

Reference:

The US Environmental Protection Agency, Midwest Research Institute, Florida Community College Consortium for Pullution Prevention Education and Florida Department of Environmental Protection. (2007, 08 24). *Protecting Our Water Resources: Student Activities for the Classroom.* Retrieved from Stormwater Education Toolkit: http://www.stormwater.ucf.edu/toolkit/vol3/Contents/pdfs/Student%20Activities/student_activities.pdf

EPA. (n.d.). *Clean Water Campaign.* Retrieved from https://cfpub.epa.gov/npstbx/files/cwc_auto_repair.pdf