

Canal & River Maintenance Activity Pack

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1. Overview

Waterways provide incredibly important corridors for people and wildlife but need careful maintenance to manage natural and human impacts on them. This practical activity explains the forces that cause banks to erode, and the impact of erosion and human activities on water quality. Students can then discover scientific and engineering ideas which protect canals and rivers.

2. National Curriculum links

- Science – The pH Scale and neutralisation (chemistry), forces (physics) rubbing and friction between surfaces, with pushing things out of the way and resistance to motion of water, how organisms affect, and are affected by their environment.
- Design and Technology - Working characteristics of materials and influencers of real-life design.

- Geography - River processes, hydrology, forces in a watercourse, human and physical processes interact to influence and change landscapes and environments.

3. Resources and materials

- Shallow plastic tub filled with water
- Plants simulating reeds at the edge of a water course (note: plants will need to be replaced from time to time and kept watered during the summer. Try to choose reed-like plants).
- Several types of bank protection
- **Student test kits**
- **Small plastic pots for testing**
- **Bicarbonate of soda**
- **Lemon juice**
- **pH sticks**

Developed with support from



Rolls-Royce

4. Lesson Plan

Learning objectives

- ALL pupils will be able to describe one key feature of erosion.
- MOST will understand why water quality is important.
- SOME pupils will apply the concept of erosion to the challenges of designing canal banks.
- SOME pupils will be able to relate the concept of erosion to the practical application of designing and building a lock.

Prior learning

- Science - An understanding of what forces are.
- Science - Experience conducting basic experiments and recording results.
- Maths - Basic understanding of units of measure (centimetres) .

Activity objectives

Explain the objectives of the lesson and the reason for those objectives (see overview of pack).

An introduction to erosion and bank protection

The lesson will start with discussion around the canal and river picture cards or PowerPoint presentation showing examples of bank erosion and bank protection. Discuss defences / erosion and the visible quality of the water.

The aim of this activity is to get the students to identify erosion in various states and the different states of water quality.

Summarise bank protection used by the Canal & River Trust to protect canals and rivers:

- Concrete wall
- Wood slat walling
- Planting of vegetation in coir matting
- Steel sheet piling
- Gabions

This discussion should lead into ‘Erosion and Theory’.

Practical Demonstration – erosion, forces and environmental impact.

Start Activity 2, Erosion and Theory, with the question to the students: “Why do things erode?”. Ask the students questions based around the previous picture cards. Keep on probing for answers until ‘forces’ are mentioned. Once forces are mentioned move into the first demonstration.

Demonstration: Erosion and Theory

Forces:

Fill the clear plastic shallow tub with a few centimetres of water. Remove potted plants from their pots, place into the water and wait for any loose bits of soil to settle.

Invite a student to start slowly creating a current in the water, pushing on to the plant to demonstrate how water erodes the soil when force is applied to it. Increase the current in the water to push more force onto the plant and demonstrate how more force equals more erosion.

Ask the students questions about what the demonstration is showing, and why the soil is being moved. Keep probing until the students respond with the idea that forces are acting on the soil and discuss what might be happening.

The four main forms of water erosion are:

- **Hydraulic action**

The force of the river, or moving water in a canal, against the banks can cause air to be trapped in cracks and crevices. The pressure weakens the banks and gradually wears them away. Boats with powerful engines can cause more damage as their propellers cause a wash.

- **Abrasion**

Rocks carried along by the river, or moved by (for example) boat traffic on a canal, wear down the bed and banks.

- **Attrition**

Rocks being carried by the river or moved in a canal, smash together and break into smaller, smoother and rounder particles.

- **Solution**

Soluble particles are dissolved into the river.

For more information go to:

canalrivertrust.org.uk/explorers/resources

- and search for the Canal & River Habitats Topic Pack.

Forces discussion

What effect do these forces have on canal banks?

- Canal or river wall collapse.
- Canal or river could start to drain away.
- Damage to foundations of river and canal infrastructure eg: bridges, locks etc.
- Destruction of habitats.

Note: early canal builders recognised that reeds helped to bind banks together and retain soil, so they planted reeds along the sides of new canals.

Demonstration: Types and benefits of bank protection

Use the examples of bank protection to demonstrate benefits and disadvantages of different methods. Ask students to test the different types and discuss what helps to prevent erosion.

- **Wood**

When treated, wood can be a long lasting material eg: some lock gates have been in use for over 50 years.

- **Steel sheet piling**

Makes a strong protective edge, but rots down over time and does not allow plants to grow at the edge, therefore not allowing wildlife to get in and out of water, causing loss of habitat.

- **Concrete or brick**

Makes a very strong bank, but again, plants can't grow against edges, and makes it difficult for wildlife to get in and out of water.

- **Gabions**

Rocks encased in mesh create a strong bank but allow water to flow in between stones and plants to establish in between rocks. Large holes enable water voles to move in and out of water and build burrows in banks.

- **Coir matting**

Coir matting (made out of coconut) can be used to encase plant roots and establish a firm edge whilst allowing animals (like endangered water voles and water shrews) to make holes in the bank. Coir matting is not suitable in an area where boats are moving a lot as the action of boats bashing against the banks tends to damage the coir matting.

Activity (Water Quality)

Now move onto the effect that erosion can have on the environment and therefore the quality of the water itself. Water run-off from fields (from fertiliser) or factories can pollute river and canal water. This could cause harm to waterside plants and plant life in the water, and to micro-organisms in the water and wildlife, affecting the balance of life in a watercourse.

Explain that a good way of measuring the quality of water is to test the pH Level of the water. The pH Scale is a measure of acidity or alkalinity of water soluble substances (pH stands for 'potential of Hydrogen'). A pH value is a number from 1 to 14, with 7 as the middle (neutral) point. Values below 7 indicate acidity, with 1 being the most acidic and 7 being least

acidic. Values above 7 indicate alkalinity, with 14 being the most alkaline.

Discuss testing the pH level of water and what you might do to contain pollution (use a boom for oil or floating pollution / drain off a large area of pollution / remove fish from a pollution incident).

Reiterate the point that acidic water can be very damaging to wildlife and can cause a higher level of erosion. Explain that if a water source is acidic it can be returned to neutral by adding an alkali to it. When dealing with pollution the Canal & River Trust and the Environment Agency have to be very careful about what goes into the water and how they stop pollution from spreading, to avoid further harm to wildlife.

Item	Acid or Alkali	pH Level (1-6 Acid 7 neutral 8– 14 Alkali)
Apple	Acid	3 – 4
Honey	Acid	4
Toothpaste	Alkali	10
Blood	Weak Alkali	7.4
Coffee	Acid	5
Bleach	Strong Alkali	13
Cows Milk	Weak Acid	6

What did we find out?

Ask the students to describe erosion and see how many features of erosion they can remember.

Discuss why water quality is important and what effects pollution can have.

Recap on what canal engineers can do to design better canal and river banks.

5. Follow on activity

Additional learning: students could do their own internet research about the pH of different substances as a follow-on activity.

6. Activity sheet

See following page for Acid / Alkali test activity.

Activity Sheet



Acid / Alkali test

1. Put water into a plastic tub to 3cm level and use a pH stick to measure the pH level of the water.
2. Pour a few drops of lemon juice into the water and test the pH level again.
3. Now collect a level teaspoon of bicarbonate of soda, add it to the water and lemon juice and test the pH again.

Summarise findings

	Result
pH of water at start	
pH of water after adding lemon juice	
pH of water, lemon juice and bicarbonate of soda	

Which common household materials are acid or alkali?