Cyfoeth Naturiol Cymru
Natural Resources Wales

Activity plan

Water filtering challenge

Time needed for activity

45 minutes

Location

Outdoor area, near a water source

Context

This activity focuses on how peat in the uplands and wetland bogs can naturally filter water. It shares ideas for learners to complete their own water filtering experiment.

Natural Resources Wales' purpose is to pursue sustainable management of natural resources in all of its work. This means looking after air, land, water, wildlife, plants and soil to improve Wales' well-being, and provide a better future for everyone.

Curriculum for Wales

Science and Technology

- **What matters**
  Design thinking and engineering offer technical and creative ways to meet society's needs and wants.
- **What matters**
  The world around us is full of living things which depend on each other for survival.
- **What matters**
  Matter and the way it behaves defines our universe and shapes our lives.

Humanities

- **What matters**
  Our natural world is diverse and dynamic, influenced by processes and human actions.

Objectives

Learners will be able to:

- Make their own simple water filter.
- Experiment with filtering water through various soil types.
- Observe and draw conclusions based on their experiment.

Suggested equipment and resources

- Scissors or craft knife
- Plastic bottles (1.5 or 2ltr bottles)
- Clear beakers or the cut bottoms of the large plastic bottles
- Cotton wool – you could alternatively use a coffee filter paper or piece of cloth
- Gravel or small stones (washed)
- Different samples of local soil and one sample of peat-free compost (to mimic the behaviour of peat)
- Dirty water (mixed soil, mud, dead leaves and water in a large clear container or bottle)
- Stopwatch
- Measuring jug or container
- Worksheet - Water filtering challenge
- Activity plan – Measuring the turbidity of water (optional)
- Resource card – Measuring the turbidity of water (optional)

Background information

Water derived from healthy peatlands is naturally of high quality with few pollutants and low nutrient levels, requiring straightforward treatment once it reaches a water treatment plant. As water infiltrates through the air spaces between the grains of solid material in peat, it is naturally filtered. Debris, leaves, insects, chemicals and minerals are retained in the soil as water drains through.

If left in the ground, waterlogged and in good condition, areas of peat act like a huge sponge and can soak up and retain huge volumes of water, helping to prevent flooding. But, if peatlands are disturbed e.g. drained by man, their capacity to absorb rainwater is reduced, resulting in water flowing quickly and directly into streams and rivers without being filtered.

This activity will attempt to replicate a simple peatland or bog that water flows through, demonstrating the excellent filtering properties of peat and how, if left undisturbed, it can help to retain and naturally filter water.

For learners to fully appreciate and understand the importance of peat it's advisable to have run through our 'Activity plan - Why are peatlands important?' and 'Activity plan - Peatland quiz' before starting this activity.

Before you start this activity!

Do not use peat based compost. Please ask your local garden centre or supplier for peat-free compost. This may involve waiting a little longer for them to order it in. Please check the content and ensure it is 100% peat free. Taking thousands of years to form, peat is a non-renewable resource.

Suggestions to complete this activity

You can begin this activity by asking your learners to think about and describe an area of peat, if they have ever visited one. Explain that they are areas of open and wild land that can be found in different landscapes and locations across Wales but they all have one thing in common – they require damp conditions for peat to form. If your learners have never visited an area of peatland or are unsure, you can use our Resource cards – Photos of peatlands to set the scene.

Can your learners give examples of where peat be found? Peat can be found in:

- **Lowland raised bogs** - Land which was historically an area of standing water such as a lake which has infilled e.g. Cors Caron (Tregaron) and Cors Fochno (Aberystwyth).
- **Blanket bog** - Where peat has accumulated to a depth of at least 0.5m – typically forming in the uplands where drainage is poor and at the top of river catchments, where rainfall is frequent and heavy and the water table is high. Examples include Hiraethog (Denbighshire) the Migneint (Conwy/Gwynedd) and areas of the Bannau Brycheiniog (Carmarthenshire/Powys/Monmouthshire).
- **Lowland fens** - Wet areas which are fed by streams and groundwater. Examples include Cors Erddreiniog (Anglesey) and Crymlyn Bog (Swansea).
- **Quaking bogs** – Wetland habitats where the conditions have been just right over many thousands of years to create peat. Examples include Crymlyn Bog (Swansea) and North West Pembrokeshire Commons.

Having access to aerial photographs, maps of Wales and/or photos of the Welsh uplands could be useful for learners to research and understand the location, landscape and character of these areas:

You could:

- Visit DataMapWales Map Viewer to view and combine spatial data layers.
- For further information on where our nature reserves, trails and open access land are located, visit our 'Places to Visit' webpage.
- You might want to ask your learners if they can think of any role peat has to play in keeping us fit and well. Peat is a natural resource and if peatlands are in good condition and undisturbed (not dug up and drained), they can help keep us healthy as the sphagnum moss naturally filters the water that we drink. As rain drains through the peatland it manoeuvres through air spaces between the grains of solid material, naturally filtering the water. Debris, leaves and insects become trapped and do not drain into rivers and reservoirs. The water that runs off peatlands is therefore usually cleaner, thanks to sphagnum mosses which naturally filter the water.
- The more peat that is left in position and undisturbed, the less work water companies have to do to clean and purify water before they supply it to our homes because the peat does a lot of the hard work for them!
- Before moving forward, you may want to check that your learners understand what a filter is - a device or object that allows water to pass through it, but traps solid particles. You could use a tea bag or coffee filter paper to aid discussion.
- You may also want to explain that each layer of the homemade water filter your learners are going to make has a purpose. On a peatland, the sphagnum mosses and peat soil will filter out debris from rainwater. Mimicking a peatland, the gravel or small stones your learners will be using will filter out large particles that are not dissolved in the dirty water, whereas the 'peat' (compost or soil) will filter out any finer debris.
  As a control and to highlight the important role soil, and in particular, peat plays in filtering water, you could complete the experiment with a bottle that contains no soil and just gravel.

To make their water filter we suggest:

1. Learners work in groups of 3 to 4. Can they collect materials such as soil, mud, dead leaves and water in a large clear container or bottle to make a sample of dirty water?

   Using our 'Activity Plan - Measuring the turbidity of water' and 'Resource card – Measuring the turbidity of water' ask your learners to measure the turbidity level of their dirty water and make a note of the reading.

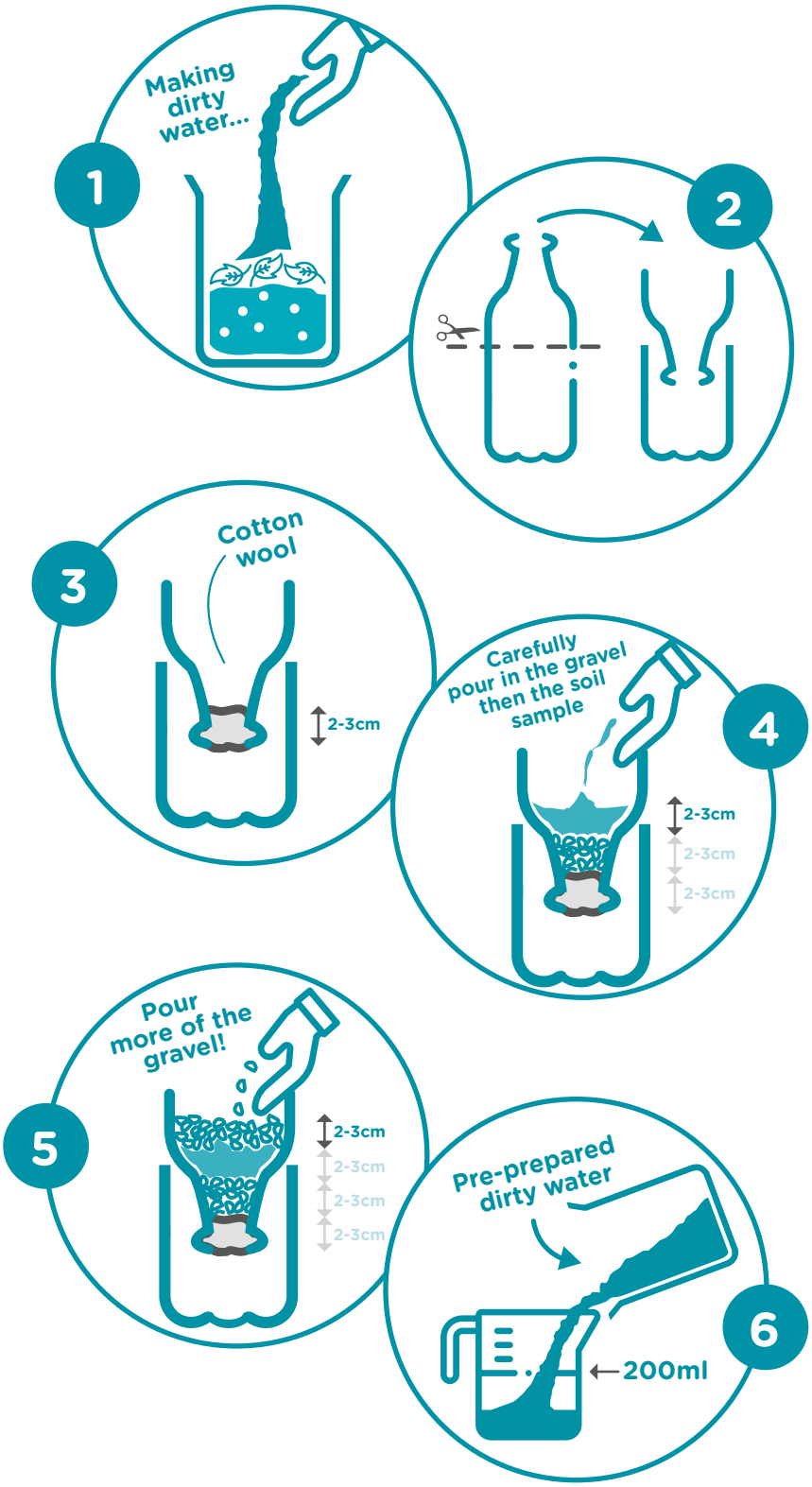
2. Next, leaving their dirty water to one side, you or your learners will need to cut a plastic bottle in half with a pair of scissors or a craft knife. The top half of the plastic bottle (take the lid off) will be stood upside down inside the bottom half of the bottle. The funnel-like top half will be the filter and the bottom half of the bottle will collect the filtered water.

3. With the neck end of the bottle stood upside down, ask your learners to insert a layer of cotton wool in the neck end of the bottle. This needs to be thick enough to prevent the next layer of gravel falling out of the bottle's neck. We suggest approximately 2-3 cm in thickness.

4. A 2-3 cm layer of gravel should be poured in before adding an equal layer of peat-free compost on top. Layers shouldn't be padded down hard as there is a danger that everything will fall out.

5. Next, ask your learners to add one more layer of gravel, 2-3 cm deep.

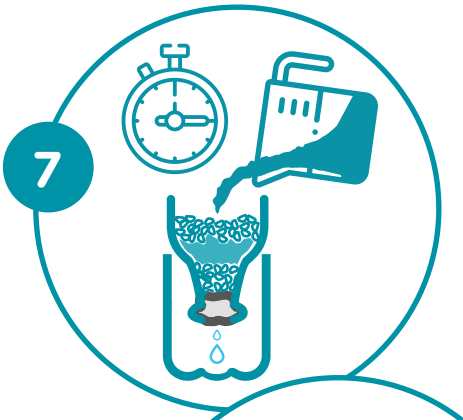
6. Finally, 200ml of the pre-prepared dirty water will need to be poured into a measuring jug or beaker.

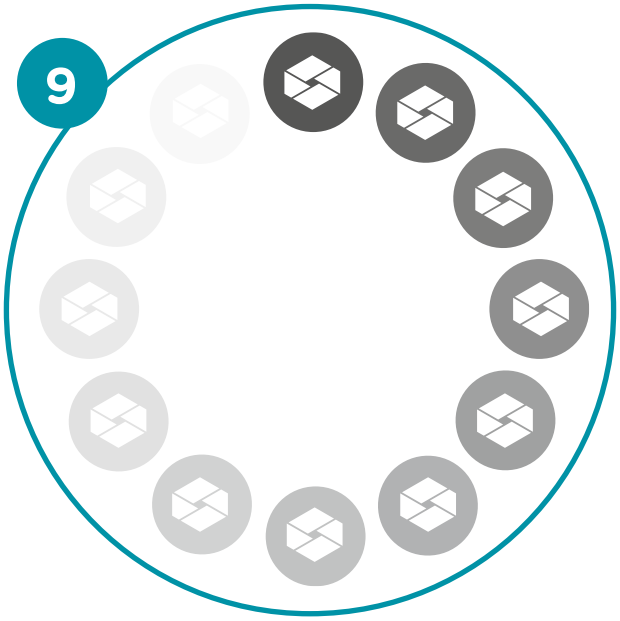


7 Starting a stopwatch, the 'dirty water' should be slowly poured into the into the top of the filter. Does water collect at the bottom of the funnel? Does it run fast or slowly through the soil? As the water passes through the different layers, the dirty water should be filtered out with cleaner water collecting at the bottom of the plastic bottle.

8 Ask your learners to record their findings and observations in the Worksheet – Water filtering Challenge.

9 Using our 'Activity Plan - Measuring the turbidity of water' and 'Resource card – Measuring the turbidity of water' your learners could measure the turbidity of their filtered water. Has the turbidity level decreased now their dirty water has been naturally filtered?





Once your learners have completed their experiment you can explain to them that this is what peatland, if left in situ and in healthy condition, does naturally. To ensure we have enough safe and reliable drinking water, water companies filter water on a large scale with much more technical equipment, ensuring that everything that could be harmful to human health is removed.

You could ask your learners to repeat the experiment with other soil types e.g. a clay or a sandy soil, depending on what you have locally, and record their findings on the worksheet. Alternatively, you could split the soil types amongst your learners and have several groups filtering at the same time, sharing their results on completion.

Once all the experiments has been completed the bottles can be washed and kept for another occasion or recycled.

Please note - This activity is for demonstration purposes only, no one should drink the filtered water.

Suggested key questions

- Which soil type was the most permeable/which soil type allowed water to pass through its layers the quickest?
- Did one of the soil types allow more water to filter through compared to the other soils?
- Ask your learners to consider the creation of a playing field. Which would be best, a soil that lets water flow through quickly or a soil that retains water? Why?
- How turbid (clear) were the water samples? Was one less turbid than others? Why might this have happened? Which soil type filtered the water most effectively?
- Why does the water we consume need to be filtered?
- What can you do as an individual to help protect peatlands?

Suggestions for adapting for different needs/abilities

- Set up the equipment ready for the learners.
- Complete the activity as one group with adult support.
- Ask your learners to investigate and identify their local soil types.
- Ask your learners to self-lead the activity.
- Ask your learners to consider how they could ensure the experiment is conducted as a fair test.

Suggestions for follow up activity/extension

- Challenge your learners to investigate how human actions impact on water quality e.g. pollution, abstractions etc, and consider possible consequences to ourselves and the wider environment if we do not manage water resources sustainably.

Encourage your learners to help our precious peatland habitats by asking them to:

- Create a poster to encourage their parents/the general public to buy peat-free compost and plants grown in peat-free soil.
- Write a letter or email to the school Eco-Council, Headmaster/Group Leader or Caretaker explaining the importance of peat, and asking them to buy peat-free compost and plants grown in peat-free soil for their settings' grounds.
- Investigate and make their own compost at home or at their setting using food waste.

Suggested other resources

- Activity plan – Why are peatlands important?
- Activity plan – Peatland quiz
- Information note – Water quality
- Activity plan – Sustainability glossary game

Suggested additional information

- Find out what is being done to protect Welsh peatlands, check out the National Peatland Action Programme website.

Learning in, learning about, and learning for the natural environment.

Looking for more learning resources, information and data?

Visit **https://naturalresources.wales/learning**

Alternative format; large print or another language, please contact:
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