2020 VISION
CLEAN WATER

Unit 3: Clean Water

Ireland generally has a good supply of fresh water but the quality of this resource can be an issue in some geographical locations. We depend on surface and groundwater as sources of drinking water but water is also important as a habitat and as an amenity for us all to enjoy. The most widespread threat to water quality is pollution from municipal sewage and agricultural activity.

Teaching Point

Water is a valuable resource with many uses but it is vulnerable to pollution. We need to manage and protect our water resources to ensure that they are of good quality and that we use them in a sustainable way. In particular, treating and distributing drinking water is very resource intensive in terms of chemicals, energy and cost so we should use it sparingly.

Outcome

Students will:

- Understand the importance of water for drinking, for amenity use and as a habitat.
- Understand how human activity impacts on water and water quality.
- Consider how changing the way we use water at home, in business and industry could reduce demand leaving more of our resources for amenity use and nature.
- Learn about different agencies involved in provision and protection of water.
- Understand that water is an important resource in their local community.

Eco Eye Clip and Comprehension

(NB remember to print and prepare these in advance).

Protecting our Blue Flag beaches

Beaches are important for amenity and tourism, and the Blue Flag tells us that the beach is clean and the water is good quality for bathing. While water quality is monitored at Blue flag beaches, pollution from sewage and litter can cause problems.

Protecting our drinking water

Water is a precious resource and quality is very important, particularly when it comes to drinking water. Sewage, agriculture and forestry can all have a negative impact on water quality. This clip looks at the consequences for the people of Galway when drinking water became contaminated and at how the problem can be tackled with appropriate water treatment.

Water pollution

The EPA monitors the quality of all of our waters including our rivers and in this clip Duncan Stewart joins a scientist in the field and in the laboratory to look at how this is done and to hear about some of the causes of pollution in our rivers.

Watch the clips (choose some or all) and complete the comprehension exercises.

Activities

1. Map work

Use EPA on-line maps and aerial photographs at www.epa.ie to view water quality and water features in your local area (or use Scoilnet maps). Alternatively, photocopy the 1st Edition Ordnance Survey Map for the area. Give students the following tasks;

- List the water resources in your area (or county) including rivers, lakes, beaches or estuaries, coastal waters and groundwater.

- Using the EPA maps look at the water quality in your area by clicking in the tick box beside water quality and water features in the list of layers on the left. Use the zoom tool to look at the area of your choice. The legend on the left will give you details of the water quality in the area.

It may be useful to point out that water classified as Eutrophic is water polluted by nutrients like nitrogen and phosphorus, mainly from agricultural manures, fertilisers, sewage and detergents.

2. Brainstorming

- Ask the students to list all the uses of water in their area.
- Look at water treatment plants, factories, domestic uses, agriculture, dams, weirs and tourism.
- If there are areas where water quality is poor in the area, consider the possible reasons for this.

3. Individual work

Using what has been seen and learned from the clips identify and describe the main possible sources of water pollution in the local area. Look at the possible numbers of septic tanks, agricultural sources, industrial sources or domestic sources. Is there domestic sewage treatment in the area? If so is it primary, secondary or tertiary treatment? (for an explanation of these types of sewage treatment see end of lesson).

4. Working in pairs/small groups

Visit the EPA website at www.epa.ie 'Environment in Focus' section, and find information on water quality in Ireland. Alternatively give each pair of students the summary of the press release on water quality at the end of the lesson and ask them to produce a list of five key facts on the topic of water quality. Present these to the class and discuss.

BE AWARE OF SAFETY ISSUES – STUDENT SHOULD BE FULLY BRIEFED ON SAFE PRACTICE BEFORE UNDERTAKING FIELDWORK NEAR WATER!!

5. Investigation - fieldwork

Structure you fieldwork around the following steps!

Step 1: Identify key aims or formulate a hypothesis

Step 2: Identify and get the background material required

Step 3: Identify the main methods of gathering your information

Step 4: Identify the main results and draw a conclusion

Step 5: Identify some achievable actions, which may help the situation

Step 1: Aims or hypothesis

Test the hypothesis that "Rivers are more polluted downstream than upstream of urban centres".

Aims:

- Identify two sampling sites on a local river, one upstream and one at least 1 km downstream of the discharge from the sewage treatment plant.
- Carry out a visual inspection of the riverbanks, riverbed and water samples. (Consider the health and safety aspects of students inspecting river banks particularly downstream of a town discharge).
- Carry out a simple chemical survey of a water sample.
- Take a kick sample of the riverbed to identify biological indicators of water quality

Step 2: Preparation and background materials

- If you have not completed the initial activities visit the EPA website at http://www.epa.ie/environment/water/ where you can use the links and maps to find up to date information on the water quality in your local area (rivers, lakes, estuarine and coastal waters, groundwater and bathing water)
- Refer to school science department for equipment and effective methods of use

- Find a simple identification key such as those available from The Field Studies Council (FSC) through their website - http://www.field-studies-council.org/publications/foldout.aspx
- Prepare recording sheets and practice basic tests
- Identify two safe sites on the river for testing

Step 3: Methods of data gathering

1. Visual survey

Divide students into groups of four to six. Firstly carry out the visual survey.

- Each group will look at the riverbank and riverbed for signs of litter, sewage, dumping or algal slime.
- Each group will then take a water sample in a jar and record any smell, colour or floating slime or silt.
- All of these results are to be recorded carefully on the recording sheet for the site.

2. Chemical survey

- Using clean jars each group will take water samples from the river.
- Carefully label each sample jar stating river name, location i.e. upstream or downstream of town give townland name if known, date and time of sampling.
- Test for pH, temperature, foam and dissolved oxygen. (If dissolved oxygen is to be measured in this way a separate sample is needed. Shaking the jar to produce foam is aerating the sample i.e. putting oxygen into the water – so there is not much point in measuring the dissolved oxygen after you shake it.)
- Foam can be tested by shaking the jar of water for one minute and then timing the length of time it takes the bubbles to disappear.
- Dissolved oxygen can be measured by the use of drops of methyl blue in a water sample from each site. Take a jar of water back to the class from each site. Carefully label each

sample. When you return to school put a few drops of methyl blue in each jar. Then put them in a dark press. The rate of clearing of the blue stain is an indication of the amount of oxygen in the water. A high level of oxygen is a good indication of water quality.

- Use pH indicator paper to record the pH and a thermometer to record the water temperature.

3. Biological survey

- Place a hand net in the river and kick up a sample of the riverbed upstream of the net. Sand, stones and samples of the river life will land in the net.
- Empty the contents of the net into a basin and try to identify the samples of river life that you can see.
- Use your identification key to check if the species found are good indicators of water quality. Record all your findings and return the sample to the river.

Repeat these tests and activities at one other site along the river making sure that one site is upstream and one site is downstream of the urban centre.

Step 4: Results and conclusions

- Back in the classroom each group combine their individual results and report to the class. A consensus result for the class should be established. From these results draw a meaningful conclusion and prove or disprove the hypothesis.
- Each individual student should then write up a report on the investigation describing the four steps of the investigation. This should take the form of an A4 type presentation with the results presented as graphs and tables. The use of diagrams and photographs as well as the use of Information Communication Technology (ICT) should be encouraged.

Step 5: Action

- Prepare a wall display, poster, web page or leaflet on the investigation and the key results. Display the project in school, in the local library or Local Authority office.

- Write to the local newspaper reporting on the investigation and highlighting the significant environmental issues.
- Invite speakers from your Local Authority and local environmental groups to discuss the issues with your class.

2020 VISION
CLEAN WATER

WATER PRESS RELEASE

Date released: Dec 16 2009, 11:00 AM

The EPA today released the latest report on key indicators of the aquatic environment, Water Quality in Ireland 2007 – 2008, which summarises the most recent national water quality assessments.

Key Findings:

30% of our rivers sampled were of high ecological status in 1987. By 2008 this had dropped to 17%, located in less densely populated, less developed and less intensively farmed areas. The suspected causes of this dramatic loss are nutrient inputs, siltation, and acidification associated with activities such as forestry, agriculture and housing development.

New Water Framework Directive classification systems

Using the new and more demanding Water Framework Directive status assessment system, good or high status was assigned to:

- 49% of rivers
- 55% of lakes and
- 60% of estuarine and coastal waters

85% of groundwaters were in good status. These figures indicate that almost half of the river and lake water bodies, and 40% of the estuarine water bodies examined are in a condition that will require remedial measures to restore these waters to ensure compliance with the requirements of the Water Framework Directive.

Deterioration of groundwater quality is also a major cause for concern. The level of bacterial and nutrient contamination in our groundwaters is increasing and faecal coliforms were detected in more than half of the groundwater locations sampled.

The Water Quality in Ireland 2007-2008 report deals with:

- 13,200km of river and stream channel
- 433 lakes
- 89 tidal water bodies
- 275 groundwater sources.

2020 VISION
CLEAN WATER

Sewage Treatment

Primary treatment (physical process)

The pre-treated sewage flows into primary settling tanks. The sewage enters at the centre of the tank and rises. The solids settle to the bottom and form a sludge. The settling tanks have a skimmer mechanism at the top to remove floating particles and a scraper on the floor of the tank to gather the sludge. The clear liquid at the top of the settling tank is transferred to the secondary treatment system.

Secondary treatment (biological process)

This process involves the bacterial breakdown of the nutrients in the effluent. Secondary treatment systems can be broadly categorised as suspended growth such as activated sludge, or attached growth such trickling filters, or a combination of the two processes. In attached growth systems, the waste is aerobically oxidised by micro-organisms as the effluent trickles down through a percolating filter, which is usually a large concrete tank loosely packed with stones. The stones act as a support for the micro-organisms which grow on the surfaces as a slime, and the loose packing allows a good circulation of air. The waste may also be broken down aerobically in an activated sludge unit. This consists of an aeration tank and a settling tank. The effluent is fed into an aerated tank that is kept oxygenated by large mechanical agitators which feed air/oxygen needed to support the growth of micro-organisms. Suspended micro-organisms (called activated sludge) decompose the organic matter. The sludge may have a retention time of 5 to 6 days in this unit and the dissolved oxygen level is not allowed to fall below 2 p.p.m. in order to prevent anaerobic digestion. The liquid from the aeration tank flows into a settling tank where the sludge settles. Some of the sludge is recycled back to the aeration tank.

2020 VISION
CLEAN WATER

Tertiary treatment (chemical process)

This involves the removal of phosphates and nitrates from the effluent resulting from secondary treatment. Phosphates come from washing powders and washing-up liquids. Nitrates come from organic materials in sewage and agricultural sources.