WATER TECHNOLOGY
Investigating water & water quality in South Africa

Share-Net

This pack also supports an Eco-Schools focus on Resource Management.

Learning Area: Technology
Grade: 9

This pack contains:
Activity One: South Africa is rich in natural resources, except for water, a vital but scarce resource. This reading provides a brief background on the water situation in South Africa.
Activity Two: This auditing activity allows learners to monitor water use at school, home and in the community.
Activity Three: This hands-on activity gives instructions on how to make a scaled-down waterworks.
Activity Four: Learners can undertake two simple activities in the home to reduce water wastage.

Learning Outcome 3: The learner will be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment.

Assessment Standard: The learner recognises and identifies the impact of technological developments on the quality of people's lives and on the environment in which they live, and suggests strategies for reducing any undesirable effects.

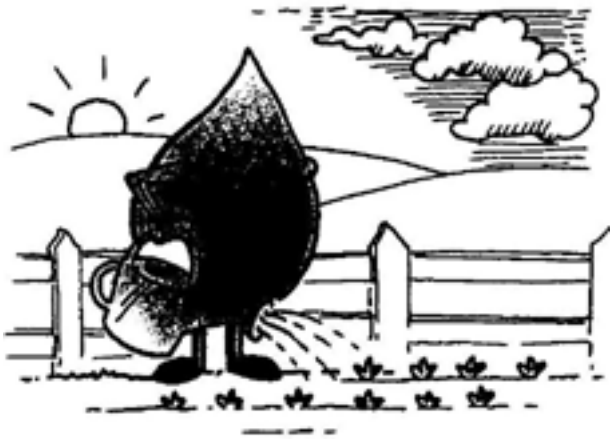
The complete School Water Action Project (SWAP) kit can be obtained through Share-Net, PO Box 365, Howick, 3290, telephone (033) 330 39391, e-mail sharenet@futurenet.co.za. The kit costs R15.

ACTIVITY ONE: TALKING ABOUT THE PLACE WHERE WE LIVE

Finding out more about the South African water situation

South Africa is extraordinarily rich in natural resources – except for water. Water is a vital but scarce resource, distributed unevenly in time (frequent droughts alternate with periods of good rainfall) and space (the eastern half of the country is markedly wetter than the western half). Our average rainfall is less than 500 mm a year, with the driest part of the country receiving less than 200 mm/year and the wettest receiving more than 2 500 mm/year! Rain does not always fall where it is most needed, and some areas of high demand, such as Gauteng, receive less water than they need. Most rain falls in the narrow belt along the eastern and southern coasts. The rest of the country receives only 27% of South Africa's total rainfall. In addition, hot, dry conditions result in a high evaporation rate.

Increasing demand for water, and decreasing water quality, make careful water management a priority in our country. It has been estimated that by the year 2025, South Africa's human population will have doubled, and there will be insufficient water for domestic use, agriculture and industry.



The importance of water

Healthy streams and rivers support a wide variety of water life. Rainwater and cool, tumbling mountain streams contain high levels of oxygen. Low concentrations of nutrient substances which are washed into the system provide both key growth chemicals (eg nitrates) and food (eg rotting plants – detritus). Water plants, in turn, photosynthesise to provide more life supporting oxygen and food sources for water organisms. All of these factors interact as a complex web of life both within the river itself and in its surrounding catchment. Much human activity has unfortunately disrupted these ecological processes and degraded water quality.

Water is also vital for growing the food that feeds our nation, providing employment for people in the many industries around the country, and for our daily living needs. South Africa's water use is similar to the rest of the world. Between 70 and 75 percent of our water is used for agriculture, about 12 percent for industry and roughly eight percent for domestic use *(Caring for the earth: South Africa by John Yeld)*.

Threats to water quality
Industries, agriculture and urban settlements have produced both nutrient concentrates (sewage effluent and fertilisers) as well as toxic substances (poisonous pollutants) which have polluted rivers. Soil erosion and the destruction of wetlands and river vegetation have silted dams in a continuous process that has degraded water quality.

Many of these problems can be identified and then rectified through fieldwork to assess catchment conservation, water life and water quality and through the development of alternative technologies to improve water harvesting, water storage and water quality.

Water harvesting
Well conserved catchments are important for water hold and release water, reduce the frequency and intensity Riverine plants of catchments are the backbone that support

Alternative technologies for harvesting water include litres of rainwater fall on our roofs each year. This is often tanks or containers. In a country that has a low rainfall, it and conserved. Dishes, drums and other containers can However, to ensure that the water is clean, water harvesters sand, are often used.

Water storage

About half of South Africa's annual rainfall is stored in dams. We have about 550 government dams in the country, with a total capacity of more than 37 000 million m^3.

Dams can be beneficial in that they regulate the flow of a river, reduce flood damage and contribute to perennial rather than seasonal flow. However, riverine ecosystems are usually negatively affected by dams. This is because alterations in the quantity of water and timing of periods of high and low flow, temperature and water quality may cause reductions in the biodiversity of riverine organisms below the dam.

Water quality
To ensure that the water we drink and bathe in each day is clean, many people access water that has gone through a purification works. This ensures that the water is filtered, and chemicals are added to kill any germs or bacteria. However not everyone has access to clean water and as a result many people get sick by contracting diseases like cholera. Ensuring that the water you and your family drink is clean is a national priority. Activity Three will show you how a simple water purification system works.

ACTIVITY TWO: WATER AUDIT CHECKLIST

Use this list to do a quick check of local patterns of water-use at school, in and around your home and in your local community.
Tick bad and good practices, noting ideas to save water

BAD

Long showers with big nozzles ☐

Big cistern with a slow leak ☐

Leaking tap ☐

Sprinkler watering of flower beds ☐

Hose car wash ☐

GOOD

Low-flow shower with stop switch ☐

Bottle or bag in cistern or dual flush ☐

Repaired tap with aerator ☐

Trigger nozzle or bucket watering ☐

Bucket car wash ☐

BAD

Uncovered water in the home ☐

Drinking from a bucket with unwashed hands ☐

Animals drinking at a water point ☐

Bathing and washing clothes in a river or spring ☐

A running tap for teeth or drinking ☐

Open gutters ☐

Total Bad ☐

GOOD

Covered water treated with Jik ☐

Using a ladle and cup ☐

Fenced spring with water troughs for animals ☐

Bucket washing with a drain pit ☐

Cup for brushing teeth or drinking ☐

Rainwater tanks ☐

Total Good ☐

ACTIVITY THREE: A WATERWORKS THAT WORKS

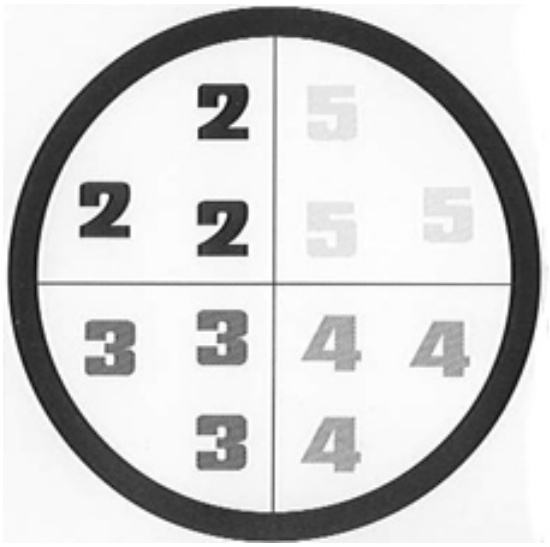
Use this activity sheet to make and use a waterworks that really does work!

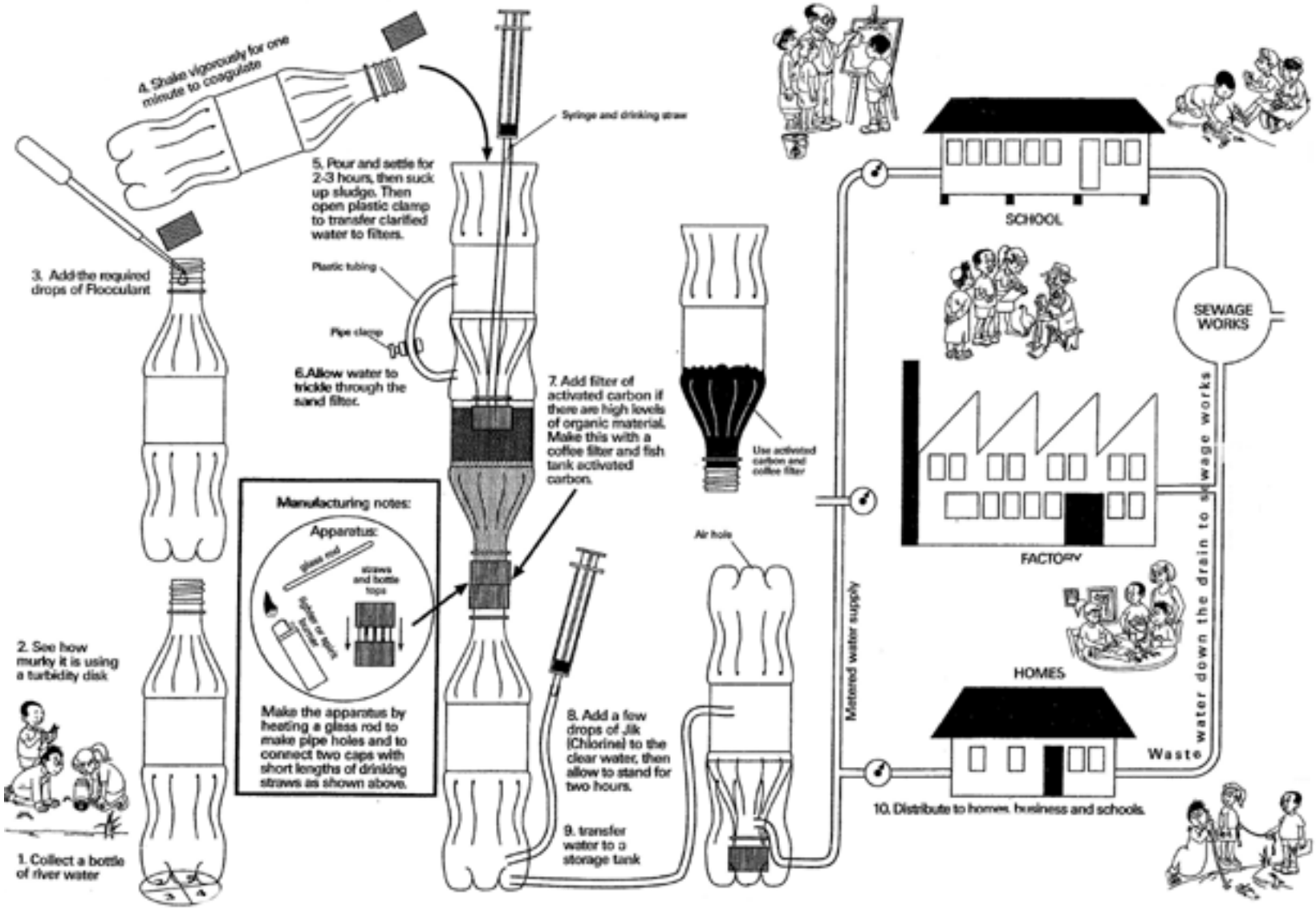
You will need:
- Plastic Coke bottles
- A glass rod
- Drinking straws
- Small syringe
- Fishtank plastic tubing
- Plastic pipe clamp
- Gas lighter or spirit burner
- Turbidity disk * (see below)
- Propettes
- Jik
- Alum flocculant

Optional:
- Coffee filter paper and fishtank
- Activated carbon to make a carbon filter
- Microchem water test kit to test the various stages of the water purifying process

* Turbidity disk
The turbidity sighting disk is based on an early technique of lowering a black washer into a long glass tube of water and noting the depth at which it is no longer visible. The turbidity disk has a circular washer (outer ring scored as 1) and numbers of

differing density (scored 2-5). A measure of clear or murky water (turbidity) can be obtained by noting the image density visible in a 20 centimetre column of water.




4. Shake vigorously for one minute to coagulate
Syringe and drinking straw
5. Pour and settle for 2-3 hours, then suck up sludge. Then open plastic clamp to transfer clarified water to filters.
Plastic tubing
Pipe clamp
3. Add the required drops of Flocculant
6.Allow water to trickle through the sand filter.
7. Add filter of activated carbon if there are high levels of organic material. Make this with a coffee filter and fish tank activated carbon.
Use activated carbon and coffee filter
Manufacturing notes:
Apparatus:
glass rod
straws and bottle tops
Make the apparatus by heating a glass rod to make pipe holes and to connect two caps with short lengths of drinking straws as shown above.
Air hole
2. See how murky it is using a turbidity disk
1. Collect a bottle of river water
8. Add a few drops of Jik (Chlorine) to the clear water, then allow to stand for two hours.
9. transfer water to a storage tank
Metered water supply
SCHOOL
SEWAGE WORKS
FACTORY
HOMES
Waste water down the drain to sewage works
10. Distribute to homes, business and schools.

ACTIVITY FOUR: WATER SAVING ACTION IN THE HOME

Two simple activities to reduce wasting water in your home.

Taps

In most cases a dripping tap is caused by the failure of its washer. Simply replace the worn washer. When you have finished the repair, re-open the stopcock in the main water supply pipe and check the tap for leaks.

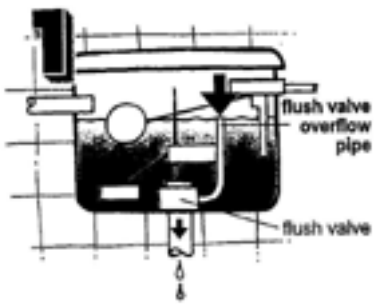
The eight-step guide to replacing a tap washer

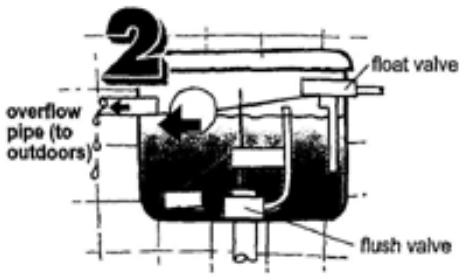
1. Close the stopcock. (The main supply tap to your home.)
2. Open the tap fully.
3. Unscrew the cover.
4. Unscrew the spindle.
5. Unscrew the washer-retaining nut and remove the washer.
6. Fit a new washer and replace the nut.
7. Re-install the spindle and screw down the cover.
8. Close the tap, restore the water supply and check for leaks.

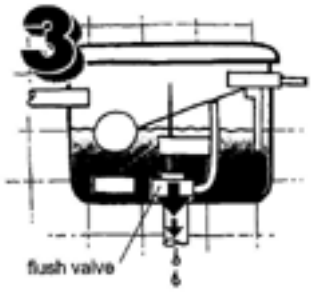
Toilet cisterns

There are two places to look for leaks from your toilet cistern – either the silent trickle into the toilet bowl or a leaky overflow pipe which is dripping outside. If the cistern has been found to be leaking, proceed as described below.

Remove the cistern cover and look at the water level inside. The water level will be in one of the three positions shown below.







1. Water level at flush valve overflow, i.e. float valve closing off with water level set too high, or float valve leaking.

2. Water level at outside overflow, i.e. float valve closing off with water level set too high, or float valve leaking.

3. Water level below both overflow pipes, i.e. flush valve leaking.