HAND PRINT™
action towards sustainability

The Secret of a Spring

A Share-Net Resource Book

Reading-to-learn curriculum materials to support
Mathematics, Technology, Natural Sciences, Language,
Life Orientation and Social Sciences learning areas

Acknowledgments

The Handprint resource books have been compiled by Rob O'Donoghue and Helen Fox of the Rhodes University Environmental Education and Sustainability Unit. Lawrence Sisitka was responsible for coordination and review, and Kim Ward for editorial review and production for curriculum and Eco-School use. Development funding was provided by CAPE. Cover illustrations are by Tammy Griffin.

Knowledge and activity support materials have been adapted from various sources including the Internet, and web addresses have been provided for readers to access any copyright materials directly.

For this particular resource book, thank you to Lausanne Olvitt for permission to use extracts and photos from material developed for the Gold Fields environmental education course, run through Rhodes University. Also thank you to Lorraine Mullins for an extract from his document on the history of Grahamstown's water. Finally, thank you to Professor Fred Ellery, a wetland specialist working at Rhodes University, who shared his valuable knowledge and resources on wetland functioning and Darcy's Law.

Available from Share-Net
P O Box 394, Howick, 3290, South Africa
Tel (033) 3303931
sharenet@wessa.co.za

January 2009
ISBN 978-1-919991-02-3

CEE
Centre for Environment Education

RHODES UNIVERSITY
Where leaders learn

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY UNIT

CAPE ACTION FOR PEOPLE AND THE ENVIRONMENT
C·A·P·E

WESSA
PEOPLE CARING FOR THE EARTH

RCE
REGIONAL CENTRE OF EXPERTISE
ON EDUCATION FOR
SUSTAINABLE DEVELOPMENT

ACKNOWLEDGED BY

UNITED NATIONS
UNIVERSITY

mazda
Wildlife Fund
The Driving Force Behind Conservation

SOUTH AFRICAN
national
biodiversity
institute
SANBI

Eco-Schools

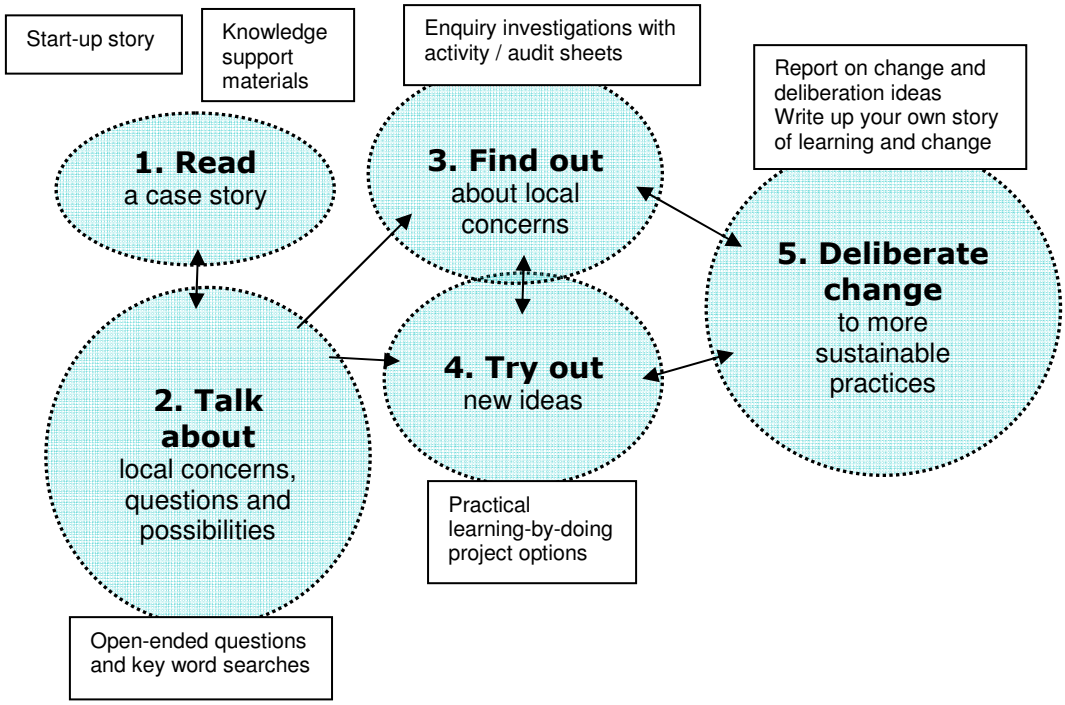
RESOURCE BOOKS

The **Handprint Resource Books** have been designed for creative educators who are looking for practical ideas to work with in the learning areas of the National Curriculum. The focus is on **sustainability practices** that can be taken up **within the perspective that each learning area** brings to environment and sustainability concerns.

The resource books are intended to provide teachers with authentic start-up materials for change-orientated learning. The aim is to work towards re-imagining more sustainable livelihood practices in a warming world. Each start-up story was developed as a **reading-to-learn** account of environmental learning and change. Included are copies of the knowledge resources that informed those involved in the actual learning experiences described here. Working with local cases of learning and change has allowed us to develop the resource books around **locally relevant knowledge resources** and **practical learning activities** that relate to our African context. We are grateful to teachers and Eco-School support groups who have willingly shared their learning experiences and activities.

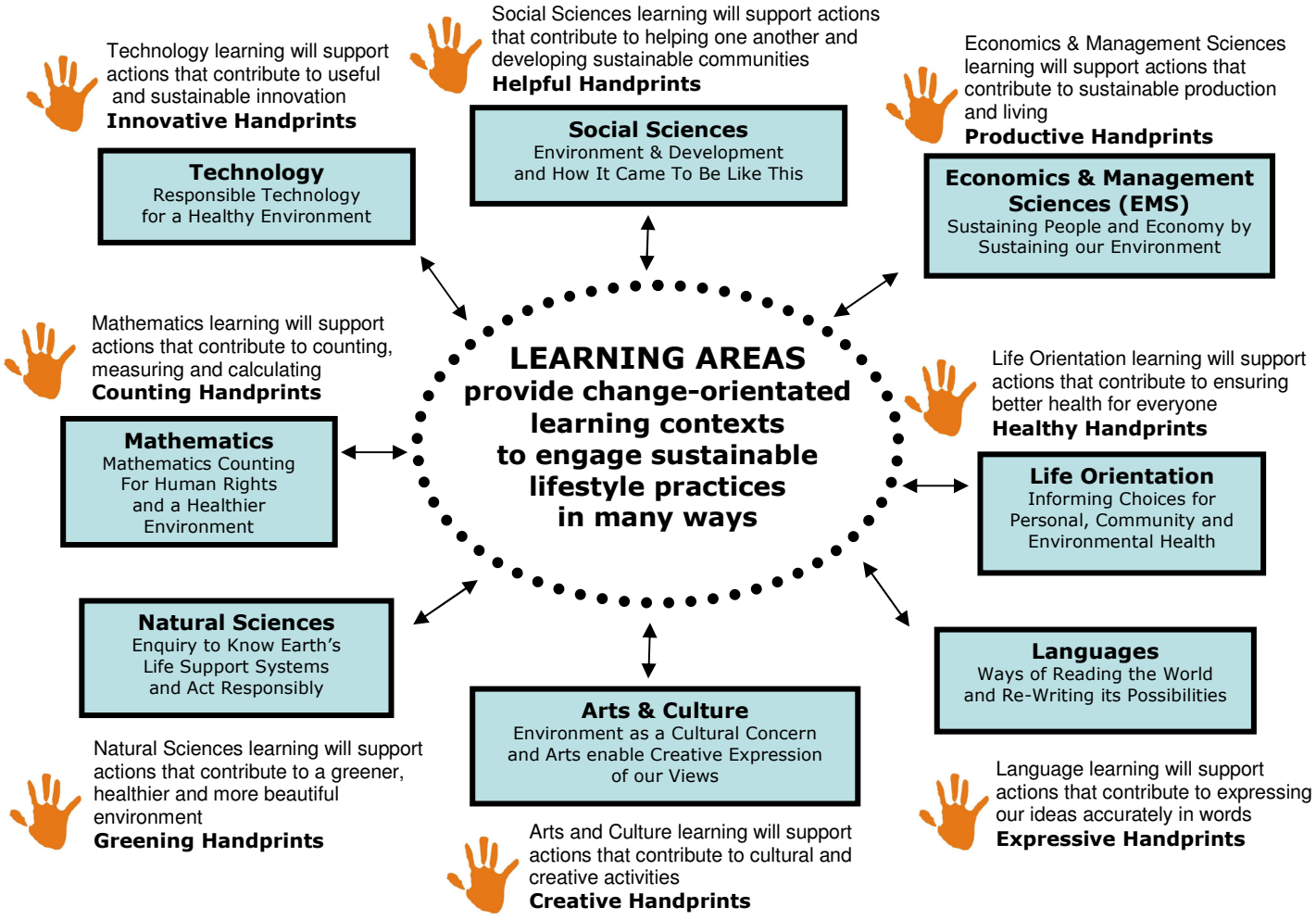
The **Handprint Resource Books** are an attempt to work from authentic cases of environmental learning and change. They combine some of the best teaching and learning tools that are being used to support change-orientated learning in the everyday realities of our South African schools. The resource books include:

1. **Start-up stories** with **knowledge support materials** (*Reading for information to build up a picture*)
2. Questions to **talk** about *(Talking to clarify issues and to plan local enquiry)*
3. Tools to **find out** about local concerns (*Writing about and reporting on local issues*)
4. Things to **try out** (*Writing up and reporting on what has been tried out)*
5. Ideas to **deliberate** (*Discussing, weighing up and recording decisions that will allow us to 're-imagine and re-write' our sustainability practices in a warming world).*



1-2 Start-up story to situate	2-4 Local learning engagement	5. Reporting and reflection

Change-orientated learning & the curriculum



The activities in this book can be used to support learning in the **Natural Sciences**, **Technology**, **Mathematics**, **Social Sciences**, **Life Orientation** and **Language** learning areas, and can contribute to the development of **Greening**, **Innovative**, **Counting**, **Helpful**, **Healthy** and **Expressive Handprints**.

Teachers should consult the learning outcomes and assessment standards and should adapt the activities to suit their grade requirements.

CONTENTS

Starting points

Ideas and Tools for Local Learning

Knowledge & Activity Support Materials (SM)

School story

Return to the Spring

Key words					
E. coli	hazardous	uncontaminated	polluted	toxic	turbidity

Our natural science class has spent the last two days exploring water health and the consequences of poor water quality on our lives. It became very real to us when Mrs Jacobson, our teacher, brought in newspaper articles and emails on the water crisis we had experienced last year. I remembered how many homes, including our school, had been without water for a number of days. Water in my tap at home was a dirty brown colour for a few weeks. People were saying the water was toxic. I hadn't understood why all this had happened and why the water would be toxic, or even what that really meant. But it had been frightening.

One of the emails **(SM 1.1)** reported how the water shortage in Grahamstown had been caused by a lightning storm. This had damaged an electrical cable and the pumps had stopped. Nobody realised this and the reservoirs ran dry. The reason why the tap water had been brown was that when fresh water flowed into the empty reservoir it stirred up all of the sediment (silt) which then washed into the pipes.

I realised why people had been fearing that the water was polluted and dangerous to drink when I read another email **(SM 1.2)** about the 35 000 fish that had died at Rhodes University's Experimental Fish Farm as a consequence of the water quality. The last email our teacher gave us to read showed us the importance of reliable information. Two water quality experts had tested the water and found that although the silt, ammonia and calcium carbonate was not safe for fish, it was safe for humans to drink **(SM 1.3)**.

One of the learners had noticed an interesting article **(SM 2)** on the fresh water spring, three kilometres outside of Grahamstown, that became one of the most frequented and talked about sites during this time. As a class we decided to focus our investigation activities on this spring.

Grahamstown residents collect spring water

Mrs Jacobson divided us into three groups. The first group explored the origins of the spring and a history of its use. They read an **historical report** on Grahamstown's water, written by Lorraine Mullins **(SM 3)** and **interviewed** two people: Mark Hazel, a man knowledgeable about the spring and Angela Barberton, a local activist who has been responsible for maintaining the condition of the spring. They also found a document about how Nguni people traditionally collected water **(SM 4)**.

The second group investigated how the spring works. They asked an expert on wetlands, from the Environmental Science department at Rhodes

University, to take them on a **field visit** to teach them about the spring.

I was in the third group that **audited** the spring's water quality. We tested smell, whether the water was clear or turbid and if it was contaminated with E. coli.

Group 1 found out that the road to Bathurst used to become impassable during heavy rains, because of a wetland. To solve this problem the British corps of Engineers dug a large hole by the side of the road, filled this with stones and put a pipe across the road so that when the wetland flooded, the water was diverted under the road. In the 1980s there was a landslide and the road was washed away. When it was rebuilt the spring was retained with a shorter pipe from which a steady stream of water has gushed ever since.

Spring water gushes from this pipe

Group 2 discovered that the spring is at the headwaters of a wetland. They learned how the vegetation, the moles and natural filtration were producing the cool spring water that had been collected over the years and which the Grahamstown community began to collect during the water crisis **(SM 5)**.

Our group reported that the quality of the spring water was good. The turbidity was very low and it was uncontaminated with E. coli **(SM 6 & 7)**. While we were at the spring we had the opportunity to interview five people who were collecting water. It was interesting to find out that issues have arisen over use of the spring. Interviewees expressed resentment at the no-stopping red lines that had been recently painted in front of the spring where people normally park their cars when collecting water. The reasoning was a concern for users' safety. The interviewees complained that they now have to walk about 500m carrying their buckets and bottles. Others break the law and now park in the red zone to collect the spring water. Regularly there are reports of people being fined.

Through our various investigative exercises including reading documents, interviewing people, undertaking a field trip and a water quality audit, we found out that the spring has had a long history, is sustained by ecological processes and is safe to drink. However, issues have arisen over the safety of the users that have affected their easy access to the spring causing resentment towards the local municipality.

Glossary

E. coli: *Escherichia coli*, bacteria that indicate that there are faeces in the water, and that can make you sick.

Hazardous: something that is risky or dangerous.

Contaminated: water is contaminated when it contains pollution that causes harm or discomfort to humans or other living organisms, or that damages the environment.

Polluted: unclean or impure.

Toxic: harmful, destructive, or deadly to humans, animals and plants.

Head waters: source of a stream, river or wetland.

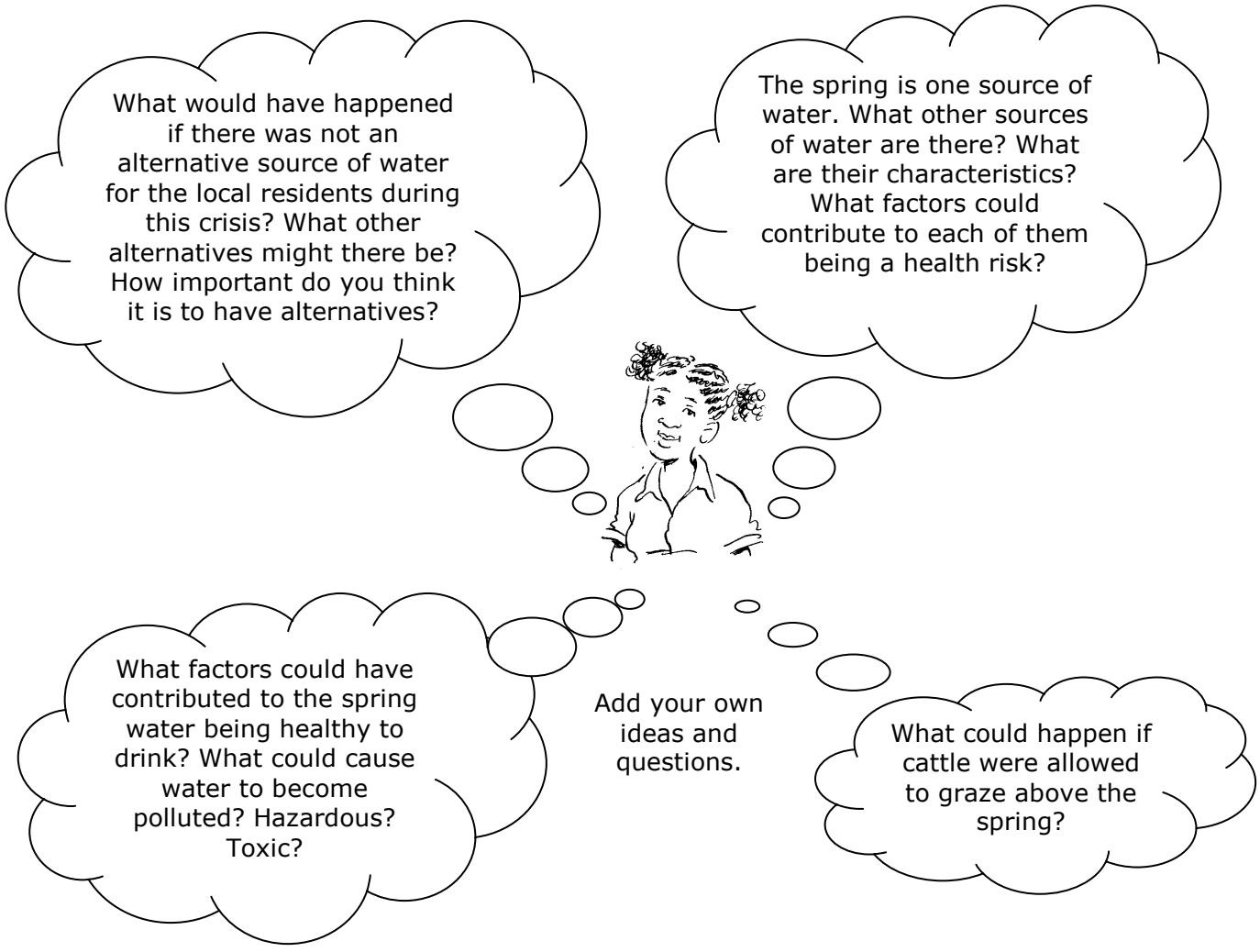
Turbidity: describes how clear, thick or muddy water is.

Wetland: land such as marshes and bogs that hold a lot of water, and that is sometimes covered by water in the form of lakes, ponds and rivers. Wetlands support plant and animals that are specially adapted to living in water saturated situations.

Comprehension Questions

1. What factors contributed to the water crisis?
2. Why was the water in the taps brown?
3. Why did 35 000 fish die at Rhodes University's Experimental Fish Farm?
4. Who do you think was affected during this water crisis? How were they affected?
5. How did people cope with this crisis?
6. What different information did the three emails provide? **(SM 1)**
7. What did you find interesting about the article on the spring? **(SM 2)**
8. After reading the historical report, what new information did you learn about the spring? **(SM 3)**
9. What interesting facts did you learn about the way Nguni people used to collect and store water? **(SM 4)**
10. Using **SM 5** think about what ecological processes sustain the spring? (What role do the moles and natural vegetation play in creating the spring?)

Discussion Points



FINDING OUT ACTIVITY

Audit all the potential water sources in your catchment (streams, rivers, dams, springs, wetlands etc). Two methods to do this would be:

1. A map reading exercise of your local catchment using a 1:10 000 scale. Identify all potential water sources on your map.
2. Go on a field trip with the purpose of identifying all water sources. While on this trip draw a map of the area and locate all the water sources on it. You could invite an expert in rivers to accompany you and act as a guide for the learners.

TRYING OUT ACTIVITIES

Activity 1: Purifying water

Imagine there is a water crisis in your home town. To treat the water you could boil the water, or use Jik (household bleach) to kill any germs or bacteria. Add a teaspoon of Jik to every 25 litres of water and leave to stand for 2 hours. Jik is very strong and kills all the bacteria, making the water safe to drink. Compare the costs, time taken and taste for these two different techniques. Research other options through interviewing local people, reading and using the Internet if available.

Activity 2: Make a wetland in a coke bottle

Cut out the side of a coke bottle, using a sharp knife, so that it looks like the picture. Fill the coke bottle with coarse sand and then the finer sand. Place the large stones at the top of the 'catchment'. Get the learners to simulate rain. You could make a rain maker using a tin can with holes knocked in the bottom using a nail and hammer. Decide on how much 'rain' you would like to have e.g. a cup. Then measure how much water flows out of the wetland and time how long it takes.

Equipment needed
2l plastic coke bottle
sharp cutting knife
coarse sand
a few large stones
fine sand
some leaves/ sticks

This exercise can help learners understand the flood attenuation function of wetlands.

Activity 3: Home water audit

Using SM 5 and 6 your learners should do a water audit at home, check for leaks and report back on their findings. If the learners find that there are leaks, encourage them to fix them. This exercise could be preceded with a discussion on the value and use of water, using SM 7.

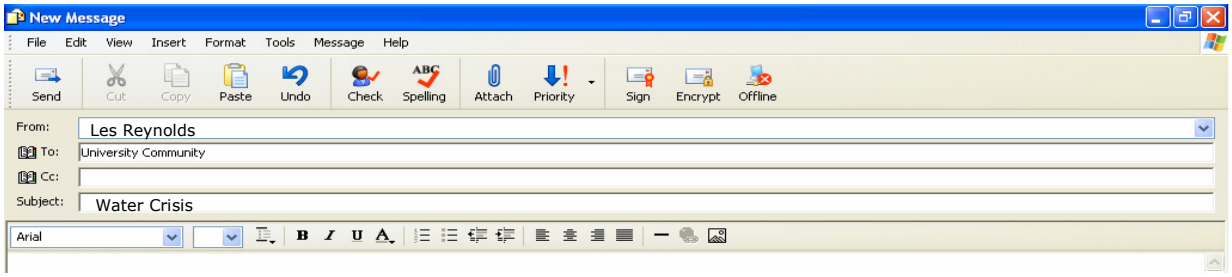
DELIBERATION IDEAS

To deliberate is to think carefully about, to consider, to discuss in a focused way, to weigh up and debate. Here are some ideas to support this process in your learners.

- Facilitate a discussion with your learners about what they could do in a water crisis.
- Try a role playing game. Members of the class take on the role of the KCC, a member of council, a traffic officer, the landowner downstream from the spring or spring users. Facilitate a debate between the different actors on what should be done about the rapid increase in people visiting the spring to collect water. Is it a safety risk? Who has decided that it's a safety risk? And if it is, what should be done about it? (**SM 2** and **SM 3** contain information that could guide your discussion).

EMAILS WRITTEN DURING THE 2006 WATER CRISIS

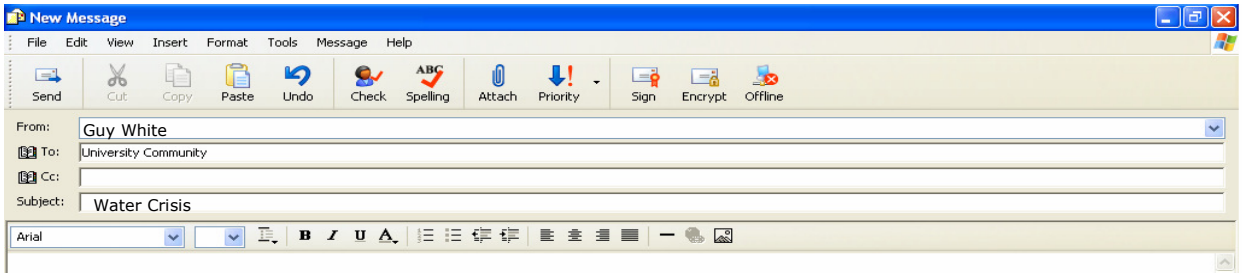
Support Material 1.1



To: University Community 13 October 2006, 10.03

The University and parts of town have no water. On investigation it has been told to me that the power lines feeding the Waainek pump station are down. Municipal electricians are trying to establish the fault and effect repairs as soon as possible. We are placing water tankers around
the campus to assist with toilet flushing. I have asked the Municipality to assist in this regard. However the schools also need assistance.
I apologise for this inconvenience and will keep you informed of progress.
Thank you
Les Reynolds
Director: Estates Division

Support Material 1.2



02 Nov 2006, 10:53

THIS IS AN URGENT MESSAGE TO ALL STAFF AND STUDENTS

Please be aware that serious concerns have been voiced over the toxicity levels of the Municipal water supply. According to Martin Davies of the Department of Ichthyology and Fisheries Science, over 35 000 fish at the University's Experimental Fish Farm have died over the last few days as a result. He says that trout fingerlings are seen as an accepted early warning system of polluted water. The deaths of these fish together with behavioural abnormalities which has been observed are indicative of the presence of heavy metal pollutants in the water.

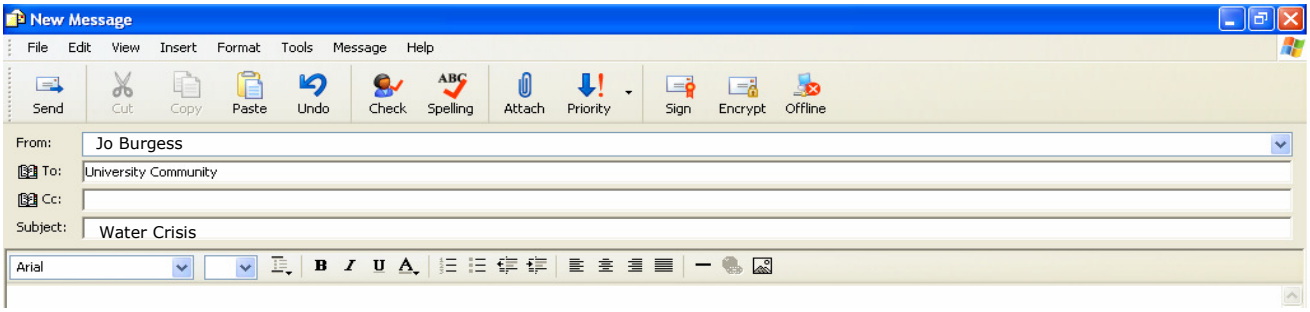
The particles are extremely toxic to human beings and cannot be removed through cooking or boiling water. Samples of water are currently being tested in the University's Biotechnology Department but results of these tests will only be available by tomorrow.

In the meantime you are requested NOT to drink water from any taps on campus (or at home) and not to cook with this water if your home or residence was affected by the recent water outage.

The University is making plans to bring further supplies of bottled drinking water to Grahamstown for distribution to residences. Please also note that all food served in the residences has been prepared with 'safe water'. The University has been forced to adjust menus and serving timetables as a result of the current problems and regrets any inconvenience. Those affected are asked to be patient as we attempt to manage the situation.

Guy White
Director: Communications & Development Division, Rhodes University

Support Material 1.3



02 Nov 2006, 18:00

The Department of Biochemistry, Microbiology and Biotechnology has finished testing numerous samples of water which were taken at several points on campus each day last week (from Monday 30 October to Friday 3 November). Samples of water taken from the Department of Ichthyology and Fisheries Science were found to contain levels of some silt and two compounds, ammonia and calcium carbonate, which were harmful to trout, but well within the safety limits for human consumption. The levels of silt in the water made it unpleasant to drink, but the particles were not dangerous to human health. The concentration of ammonia in the water was much lower than the safe limit for human drinking water, but higher than the limit for breeding fish.

The hardness of the water (i.e. whether it will scale your kettle), which is measured as the amount of calcium carbonate, was also too high for trout but safe for people. The water hardness was measured as 134 mg/L; trout can only tolerate 100 mg/L but humans can safely drink water with three times that amount. Metal concentrations were measured in the water samples and it was found that there were some metals in the silt, but that the water itself contained no metal concentrations above the South African water quality safety guidelines. In summary, the tap water on campus was safe (if unpleasant) to drink.

We do not know the cause of the colour and odour associated with the water over the weekend and this week. While we have not performed any testing and have no lab results that demonstrate that the tap water is currently unsafe for drinking, we would advise anyone concerned about the water quality to continue to use the alternative water sources that are being provided.

Dr Jo Burgess (046 605 8625) & Prof Rosemary Dorrington (046 607 6442)

THE SPRING

Grocott's Mail **3 November 2006**

This past week the Spring, just beyond the N2/Port Alfred flyover, has been supplying many Grahamstown households with clean safe water during our water crisis of no water from municipal sources. Since the forming of the Kowie Catchment Campaign (KCC) in 2003 this Spring has been cared for by Champions of the KCC. The aim of the KCC is to educate EVERYONE that clean fresh water is vital to our good health and this last week we have had a practical demonstration of this fact.

Five to six cars at a time have been parked off the road by the spring, as people have hurried down the steps to collect their water. Because of all the recent rains the water is gushing out and quickly fills buckets, cans and bottles full and overflowing. As these happy residents leave, new thirsty customers are arriving. This continuous movement of people and cars has been exciting.

KCC volunteers, as part of care of the Kowie streams, saw the need to make the Spring accessible to people who pass by. Since the first surveys of the many streams through Grahamstown, work has been ongoing at the spring. Steps were the first item to be made then the protection of the bank surrounding the outlet pipe. All the materials have been collected from scrap heaps at no cost except transport, energy and enthusiasm. Modification takes place on a regular basis.

Some people who visit the Spring distribute rubbish and worse wee or relieve themselves close to the spring. It is a crime to pollute fresh water and any area surrounding fresh water. It must be kept clean for the health of the whole community. And this is the purpose of the KCC: to educate people about the necessity of caring for the many streams that run through Grahamstown.

The KCC is a group of volunteers who are passionate about clean water. Would you like to join the KCC? The KCC is looking for Champions. A Champion can be a school, a church, an organisation, a business, a club, a group of friends or an individual. A Champion takes on the care and responsibility of a stream or part of a stream to see that it is clean of rubbish and alien vegetation on an ongoing basis year by year. People adjoining the streams are encouraged to be aware of keeping the stream clean and where necessary the residents are educated why they should keep the stream clean.

Where does the present Spring water go? All the water from the Kowie ditches flow into the Bloukraans River below Fort England. This in turn flows into the Kowie River. We who live in Grahamstown have a duty and responsibility to see that Port Alfred receives clean, safe water.

After our water crisis of no clean water in Grahamstown this last week, I trust that everyone wants to be a Champion. Our ditches can be made to look beautiful and a source of pleasure to everyone as green areas of refreshment containing clean water where children can safely play. We need enthusiastic Champions. Come and join us.

Angela Barberton

HISTORICAL ACCOUNTS

Mr Mullins told us that he had written up a history of water in Grahamstown for the KCC and he gave us a copy of this booklet that contained the following information about the water supply to Fort England from the spring on the Bathurst road.

A reservoir was built in Hope's Garden in 1850 for the benefit chiefly of the 32nd Light Infantry at Fort England. The tank collapsed in heavy rains and was replaced by a smaller one, which still exists and was even used in the 1973 drought. What would have been the source of that water? It is likely that it would have been led or piped from "The Spring" (Umthombo in Xhosa) that gushes from the hillside next to the Kowie road at a level above Hillsview Road where the tank is situated. The Spring was an important source of water supply to Fort England from the beginning. In 1827 Dr. William Parrott, then in 1828 Holloway of the Royal Engineers, gave reports mentioning that "a mountain stream and a small spring" supplied "sufficient" water. However Holloway also described the quarters as unsatisfactory, "with an indifferent supply of water, overrun with vermin and totally unfit for the reception of British troops."

Grahamstown has recently become very interested in that spring. Angela Barberton, a leading member of the Kowie Catchment Campaign's committee, had noticed that people frequently stopped there to refresh themselves, causing damage to the area. Together with her right-hand man, Barney Kepe, she built up the surrounds and the pathways, supplying also a rubbish bin.

In 2006 a crisis arose with the town's water quality, when fingerlings in the experimental ponds at the Rhodes University Department of Ichthyology and Fisheries Science died in large numbers. The University warned against drinking from the tap, importing quantities of bottled water. It was subsequently found that though the presence of ammonia and calcium carbonate had caused the death of the fishes, the water was safe for humans, though perhaps unpleasant to drink. Citizens from all walks were immediately attracted to The Spring, armed with containers, many continuing to make regular use of it even now. As a result, as well as damage again to the spring, a traffic problem has arisen. Angela Barberton and Nikki Köhly of KCC looked for citizen support. In May 2007 they proposed a meeting with concerned parties. Kevin Bates of the Makana Department of Parks & Recreation and also a KCC member, initiated two meetings on their behalf. The first was with the Provincial Roads Engineer, Mr. Thys Groenewald; the second, on the 10th of March 2008, involved the Roads Department, Makana officials, a councillor and the Rotary Club, which was keen to 'adopt' The Spring. Mr. Groenewald was insistent that safety was a major concern, and the proposal to create a parking area west of the spring at a cost of R280 000 appears to be the first step to be taken. Other improvements have been proposed, which the Municipality and Rotary are looking into.

Mr Hazel reported that the spring had originally been contained by the British Army Corps of Engineers. This was through an underground hole they had dug out and filled with rocks with a pipe running under the road to Bathurst. They had done this because every rainy season the road would be cut off because of wash-aways and mud.

In the 1986 there was a landslide and what was left after the road had been repaired was the contained spring with the short pipe that we have today. The water from this pipe now runs under the road through a culvert and the road has been built up so that it is not washed away each season.

Reference

Mullins, R. L. G. 2008. Grahamstown's Water Supply - a brief History 1812 to 2008. (draft). KCC, Grahamstown.

SWEET WATER & THE TRADITIONAL PRACTICES OF THE NGUNI PEOPLE

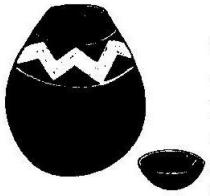
The early peoples of southern Africa had common sense ways of collecting and storing "sweet" water, not unlike people in other parts of the world. This passage looks at Nguni water collecting practices. *(Comments and scientific observations are in brackets so that readers might see the practical wisdom behind some water collection myths and techniques of the past).*

Today many people of Nguni origin will sniff, smile and hold up "sweet" water collected from a river, spring or well for their daily household needs. *(Water quality scientists today still have people smell and taste household water. Human senses give a refined indication of whether water is good and clean and fresh).*

Historically water was usually collected in areas where people could hear it running over stones or dripping down rocks. *(Well oxygenated water supports natural biological cleaning processes).* If a spring was for human use, it was protected by a circle of rocks with a small outlet. Cattle drank elsewhere.

A water source would always be approached with care so as not to frighten crabs and other small water animals. When disturbed, their movement would stir up sediments and the collector would have to wait for the silt to settle. The surface film was brushed aside for "sweet" water to be collected. *(Sediments and surface films have higher bacteria numbers than the middle waters of pools and rivers. Today scientists take water samples below the surface film taking care not to suck up sediments. In this way scientists can get consistent and reliable measures of bacterial contamination.)*

Clay pots were filled with water and covered with a collecting bowl, a piece of skin or mat made from incema (*Juncus kraussii*) grass. The water would thus stay cool and fresh. *(Water evaporating through the sides of a porous clay pot cooled the contents. Most water bacteria cannot reproduce in cool, dark conditions. Some micro-organisms envelop themselves in a calcium secretion in the pores of clay pots. Cleaning the pots would have cracked this calcium secretion, thus killing the bacteria and also strengthening the pots).*



There were many other customs and traditional practices surrounding water. Children were warned that urinating in a river would change them to the opposite sex. *(When people urinate or defecate in water it potentially increases harmful diseases such as bilharzias. The bilharzias parasite is passed on from human urine and faeces to small water snails. From these its life cycle takes the disease back to people through river water.)*

Another practice was not to collect water from a river after a heavy rain at the start of the annual rainy season. Indigenous commonsense told people to put out pots to collect rain-water. River water would again be collected four days after the rains stopped and the water had cleared. *(Heavy rains wash human and animal wastes into rivers. There is thus a rapid increase in faecal bacteria and disease. In Kwazulu-Natal health workers have to warn rural people not to collect river water after heavy rains as few remember this earlier practise of collecting rain-water for four days).*

Reference

Share-Net. Sweet Water and Traditional Practices of the Nguni People. In the Audit Water Quality Pack, SWAP. Umgeni Valley project, Howick.

DARCY'S LAW

The rate of flow of groundwater (V) is related to two things.

- hydraulic conductivity/ permeability of the soil (K)
- the slope of the water table (S)

An equation to understand this is: V = KS

Texture and soil structure affect the permeability of the soil. Texture is how big the soil particles are i.e. are they clay (<0.002mm), silt (0.002-0.05mm) or sand (0.005-2mm)? Water moves much slower through clay soils compared to sandy ones. The soil structure is the arrangement of soil particles into units called peds. Peds are natural clusters of soil. The addition of organic matter to sandy soil can help create peds, which in turn help the soil retain moisture for longer periods.

Moles which are abundant at the headwaters of the spring are affecting the soil structure and therefore permeability of the soil. They could, therefore, be contributing to the abundant flow of the spring water. When it rains, their mole hills fill up with water. To prevent drowning the moles actively burrow to allow the water to get through. This increases the amount of water contributing to the groundwater flow that feeds the spring. The soil's permeability in the area is therefore being improved. This is important because soil in Grahamstown is clay rich and therefore tends to hold water.

AUDITING WATER USE IN YOUR HOME

Knowledge & activity support material 6

Do you know how much water you use every day?
To measure the amount of water in difficult places such as under taps place a black plastic bag in the sink or under your tap to collect it when you run water. Then pour the water into a measuring container such as a cup or a litre bottle.

STEP 1: Name the activities in your home which use water.

STEP 2. Measure the amount of water used in each of the activities.

2.1 If you have a water meter, find it and read it at the same time every day for two days and then again after seven days at the same time.

2.2 Check your property for leaks.

2.3 Measure the amount of water you use for various activities. Then count the number of times you repeat each activity by the number of ticks in each column.

ACTIVITY TIME	**6-12 am**		**12-6 pm**		**Total ticks**	**Total Litres**	**Average litres**
	Ticks	Litres	Ticks	Litres			
1. Washing							
2. Drinking							
3. Washing							
4. Bath							
5. Shower							
7. Washing car							
8. Cooking							
9. Livestock and pets							

STEP 3. Reading the meter at home

	First reading	**Second reading**	**Reading after 1 week**
	1.	2.	3.
24 hours water use	2-1 =		
Total water used in a week	3-1=		
Average daily use for a week	3-1/number of days between readings		

FINDING LEAKS AND FIXING THEM

Leaks: find them and stop them

The first step to water conservation in the home is to check for leaks. Studies have shown that dripping taps and leaking toilets can account for as much as five percent of all water used inside the home. For example a dripping tap can waste as much as 60 litres in a day or 1800 litres per month. Leaks are not only wasteful but also expensive; particularly if it is hot water that is leaking. (The water replacing the leaking hot water in the geyser needs to be heated. Geysers can use half the electricity used in your home.) Fortunately most leaks are relatively easy and inexpensive to repair; as will be shown.

Finding leaks

Check all the immediately obvious places for leaks such as dripping taps, water trickling into your toilet bowl or dripping over the flow pipe. The toilet is one of the biggest sources of leaks in the home. If you hear water trickling into the bowl long after you have flushed the toilet, it is leaking. Some toilet leaks are more difficult to detect because the trickle into the toilet bowl is silent. Try pressing a piece of toilet paper against the inside back surface of the bowl. If the paper gets wet; you've found a leak. Another way to check for a slow toilet leak is to put about 12 drops of red or green food colouring into the toilet cistern. Wait for about 15 minutes. Watch the water in the bowl; if it becomes coloured then you've found a leak. (Don't let anyone use the toilet while you're conducting this test).

Did you know? A leaking toilet can waste up to 100 000 litres of water in one year. That's enough to take three full baths every day.

Did you know? There are well over one hundred thousand leaking toilets in South Africa right now and usually people don't even know it. When you have fixed all the visible leaks you need to be certain that you don't have any hidden water leaks such as those in underground pipes. To do this you will need to check the water meter.

1. Locate your water meter: It is usually situated where the main water supply lines enter your property.

2. Check your water meter: Once you have located your water meter, check to see that water is flowing through it. Some municipalities now lock new water meters. Although they don't advertise this, you can ask them for a key. If your water meter is the digital type, you will have to check the readings over a period of about one hour, making sure that nobody in your house uses water while you are conducting this test. (Remember that a toilet cistern or a geyser can take a while to fill before the water flow is totally shut off.) If the reading changes, water is flowing through the meter and you most probably have a leak in your piping system.

3. Read the meter twice: Take the first reading at night after the day's water use has ended, or when the whole family goes out for a period. Ensure that nobody uses water during the period while you are conducting this test. Take a second reading in the morning, or when the family returns, before any water is used.

4. Find the difference: If the figures differ then you've probably discovered a leak. Subtract the first from the second figure to tell you how much water has leaked out.

5. What to do if you are losing water

If your water meter shows that you have a leak in your water supply pipes, call in a plumber and have him repair the leaks. If the plumber is going to replace a pipe, ask him to install some kind of corrosion-resistant pipe, such as high density polyethylene, particularly under paved areas.

Stopping leaks

Repairing a dripping tap or leaking toilet is usually fairly simple. If you intend to do your own repairs, you will require a few basic tools such as adjustable jaw pliers, a vice grip, a 200mm shifting spanner and a flat point screw driver. If you feel uncomfortable with do-it-yourself repairs, ask a friend who has some experience, or call in a plumber.

A word of caution: *Before carrying out any repair on your water system, close the stopcock in the main water supply pipe to your school or home. This stopcock is usually located next to your water meter.*

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.

A word of caution: *When you have to replace a tap washer, be careful not to over-tighten the tap. A new washer will feel comparatively "soft" and will be damaged if it is over-compressed. To avoid damaging the chrome you can wrap a cloth around the tap.*

8 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 the 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:

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

If the water level is at the top of the flash valve overflow pipe or at the level of the outside overflow pipe, then the float valve may be closing off with the water level set too high.
Check this by flushing the toilet and then lowering the float valve setting. This is done either by bending (when bending, hold with one hand and bend with the other - otherwise you can break the plastic socket) the float arm slightly downward or, if the valve is fitted with a screw-type adjuster, by turning the screw to lower the float slightly. The water level should now rise to the level below the overflow, and the float valve should close off. If the water level continues to rise and the cistern starts to overflow again, then the float valve washer needs replacing. If the water level is below the two overflow level, but water is trickling into the toilet bowl, the flush valve's washer needs replacing.

7 Step Guide to Replacing the Float Valve Washer

1. Close the stopcock.
2. Remove the split pin and the float arm.
3. Unscrew the cap.
4. Withdraw the plunger using water pressure to push it out (open the stopcock slightly).
5. Screw the brass plunger apart to remove the washer held inside it.
6. Fit a new washer and re-assemble parts.
7. Open the stopcock and check that the float valve closes off when water reaches the full level.

8 Step Guide to Replacing a Typical Cistern Flush Valve Washer

1. Close the stopcock.
2. Disconnect the lifting wire from the lever arm.
3. Remove the split pin and the side float.
4. Withdraw the spindle assembly.
5. Unscrew the bottom flange and remove the washer.
6. Install a new washer with the sloping side uppermost.
7. Re-assemble the parts.
8. Open the stopcock and test.

HAVE YOU SAVED SOME WATER TODAY?

From the moment we open our eyes in the morning, until we go to sleep at night, we use water for various purposes, from brushing our teeth, to bathing, cooking and washing clothes.

In South Africa, different communities receive their potable water in different ways. Some people, such as those living in cities and towns, have taps in their houses, while others have to fetch water from a tap in their yard or from a public standpipe. An estimated 6 million people in South Africa (2004 figures) do not have access to clean water.

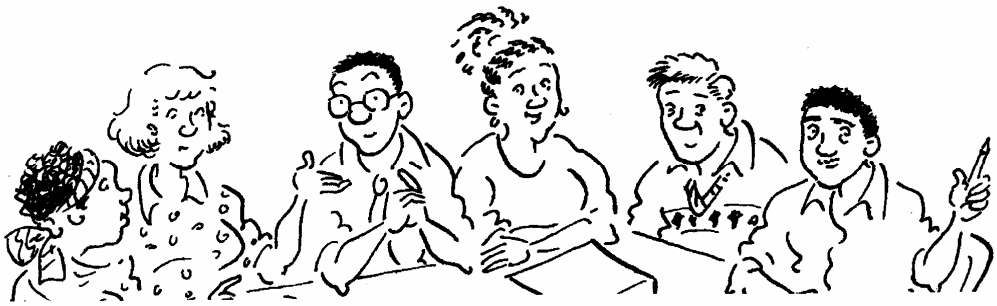
This means that these communities have to collect their water from 'unsafe' sources, such as rivers and streams. Today, as the world becomes increasingly urbanised, people use more water in their homes than ever before. According to Johannesburg Water, during the mid-nineteenth century, people would have managed with about 18 litres per person per day. By the 1940s this had increased to about 70 litres per person per day. By the end of the twentieth century this had increased further to about 160 litres.

How much water do we use in our homes?

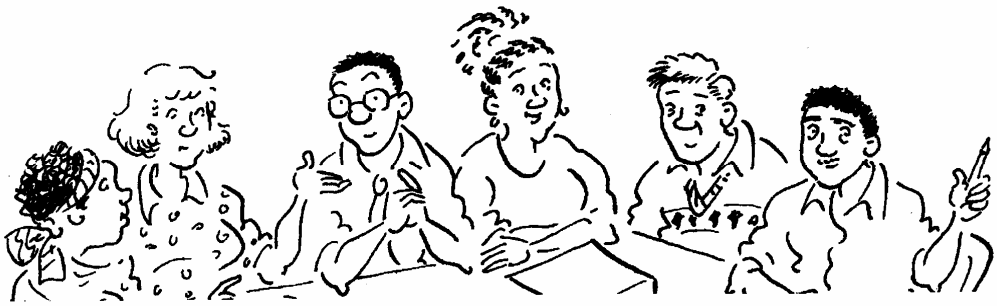
Consider how much water you use at home. Taking a bath uses an average 80 litres of water, while a shower uses about 30 litres of water. Flushing the toilet alone uses about nine litres of water, as does washing your face or hands. Another ten litres is used for brushing teeth. Drinking and cooking uses up about ten litres of water a day. We use even more water outside our homes. Did you know that watering the garden with a sprinkler can use up to 600 litres of water every hour? Those of us fortunate enough to have water supplied to our houses, who have baths, showers and hosepipes, and maybe even swimming pools, need to examine carefully how we use water at home. South Africa is a water scarce country and we need to save as much water as we can.

What can we do to save water?

- Time your shower to keep it under five minutes. You'll save up to 4 000 litres a month.
- By putting a two-litre plastic bottle full of water in the cistern of your toilet you can save up to 7 300 litres of water a year.
- Fix those leaky taps. A leaking tap could waste up to 30 litres an hour.
- Turn off the water while you brush your teeth and save up to 15 litres a minute.
- If you have a flush toilet, put food colouring in your toilet tank. If it seeps into the toilet you have a leak. A leaky toilet can waste up to 30 litres an hour.
- Use a broom instead of a hose to clean your driveway and sidewalk.
- To save water and time consider washing your face or brushing your teeth while in the shower.
- Bathe your pets outdoors in areas that need water.
- Don't use running water to thaw food.
- If you have a washing machine, match the water level to the size of the load when doing laundry.
- Soak your pots and pans instead of letting the water run while you scrape them clean.
- Cook food in as little water as possible. This will also retain more of the nutrients.



NOTES



NOTES

HAND PRINT™
action towards sustainability

Handprint resource books available from Share-Net

TITLE	LEARNING AREAS COVERED (BROADLY)
1. Reusing Shower and Bath Water	Language Natural Sciences Technology
2. The Buzz on Honey Bee Economics	Language Natural Sciences Social Sciences Technology Economics & Management Sciences
3. Have you Sequestrated your Carbon?	Language Natural Sciences Technology Mathematics
4. Did you Grow your Greens?	Language Natural Sciences Social Sciences Life Orientation Arts & Culture
5. Clearing Invasive Weeds	Language Natural Sciences Technology
6. The Secret of a Spring	Language Natural Sciences Social Sciences Life Orientation Technology Mathematics
7. The Secret of the Disappearing River	Language Life Orientation Social Sciences Economics & Management Sciences
8. Creative Garden Design	Language Natural Sciences Technology
9. Recycling, Waste Reduction and Creative Re-use	Language Social Sciences Life Orientation Arts & Culture Technology Economics & Management Sciences
10. Worming Waste	Language Natural Sciences Technology
11. Growing Mother-tree Seedlings	Language Natural Sciences Technology
12. Rooibos: a Biodiversity Economy at Risk	Language Natural Sciences Economics & Management Sciences

Many more Handprint resource books are in the planning stages. These resource books and many others for teacher educators and teachers are available electronically in pdf format on www.tessafrica.net. The Handprint resource books can also be downloaded from www.handsforchange.org.

The adaptive use of these resource books for educational purposes is encouraged. Anyone wishing to develop their own resource or adapt one, can contact Share-Net sharenet@wessa.co.za for a version in Microsoft Word.

HAND PRINT™
action towards sustainability

This handprint is of a 10-year-old girl, Srija, from a school in Hyderabad, India, who was involved in a project taking action for sustainability. Her handprint can be taken as a symbol for positive action.

Increase your handprint. Decrease your footprint.

Human impact on the Earth has tripled since 1961 and our human footprint is now 25% bigger than the planet can support. In other words we are using 25% more natural resources and services than the planet can create and provide. The 'Ecological Footprint' is one way to measure what area of land and water the whole human population requires to produce the resources it consumes and to absorb its wastes, and we now need 25% more area than is available on the whole planet. This means that the planet is simply being damaged beyond what it can repair, and this cannot continue without causing very serious threats to all life, including our own.

Education is a key way to achieve the changes we need to live in a manner that the planet can support. Environment and Sustainability Education (an environmentally focussed approach to Education for Sustainable Development – ESD) is a move away from seeing education just as a means of producing the skills to carry on doing what we are doing. It develops the abilities needed to address the big issues affecting the planet, and builds the capacity in communities to make important decisions about their future. Environment and Sustainability Education calls for action.

The Handprint is one measure of Environment and Sustainability Education action. The idea is to decrease the human footprint and to make the world more sustainable. The Handprint is a new approach or 'tool' being developed by the Centre for Environment Education (CEE), in Ahmedabad India, with many partners across the globe. The purpose of the Handprint is to help measure **positive action for change** at different levels. We all need to decide **what we can do** at the individual, community, national and global level in order to increase our Handprint, and decrease our Footprint.

"Through our actions, we add substance and vigour to the quest for sustainable living."
The Ahmedabad Declaration 2007: A Call to Action, 4th International Conference for Environmental Education