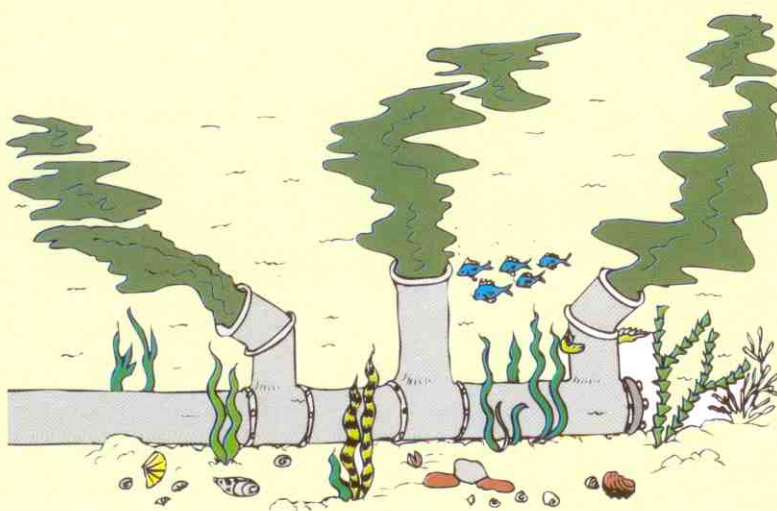


DURBAN'S SEWAGE TREATMENT WORKS



Each day, Durban Metro's Wastewater Management Department has to deal with 435 million litres of **domestic** and industrial **sewage**. As this is a **waterborne** system, about 99.5% of the sewage is water. This used water, also known as liquid waste, has to be 'cleaned-up' or treated to certain standards before it can be put back into the rivers or the Indian Ocean. There are 35 sewage treatment works in the Greater Durban Metropolitan Area. They operate 365 days a year and are staffed 24 hours a day in 3 shifts.

Two of the works, Southern and Central, discharge **sewage effluent** into the sea through ocean **outfall pipes**. This effluent includes both the liquid sewage and a certain amount of the solid wastes. These pipes are about 4 km long. The treated sewage is released during the last 400 m of pipe through a series of chimney-like **diffusers**, at a depth of 60 m. An offshore current is responsible for spreading the effluent over a wide area. The **micro-organisms** in the sea are given the job of cleaning up the sewage. The ocean and beaches are carefully **monitored** each week to make sure that the health of the public and the environment is not endangered.



The remaining treatment works discharge final effluent into river systems. These land-based treatment works use natural micro-organisms (bacteria) found in the sewage to help with the 'clean-up' process. These micro-organisms feed on **biodegradable pollutants** in the liquid waste, causing them to **decompose** quickly. The Department of Wastewater Management helps the micro-organisms to do their jobs faster and more thoroughly by giving them just the right amount of food, oxygen and heat. The full process is described on the poster of the Northern Sewage Treatment Works which is found in the pocket at the back of this file.

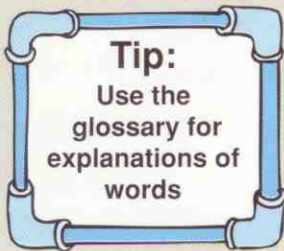




THE WORKS: UNDERSTANDING SEWAGE TREATMENT

It is highly recommended that learners visit one of Durban Metro's sewage treatment works. To arrange this phone the Education Office of the Department of Wastewater Management at 3024784 for more details.

- Using the poster of the Northern Sewage Treatment Works, which can be found in the pocket at the back of this file, take pupils through the sewage treatment processes. A description is provided at the back of the poster.
- Hand out A4 copies of the treatment works and ask learners to explain the process by completing the blocks in their own words.
- Explain and discuss the following terminology

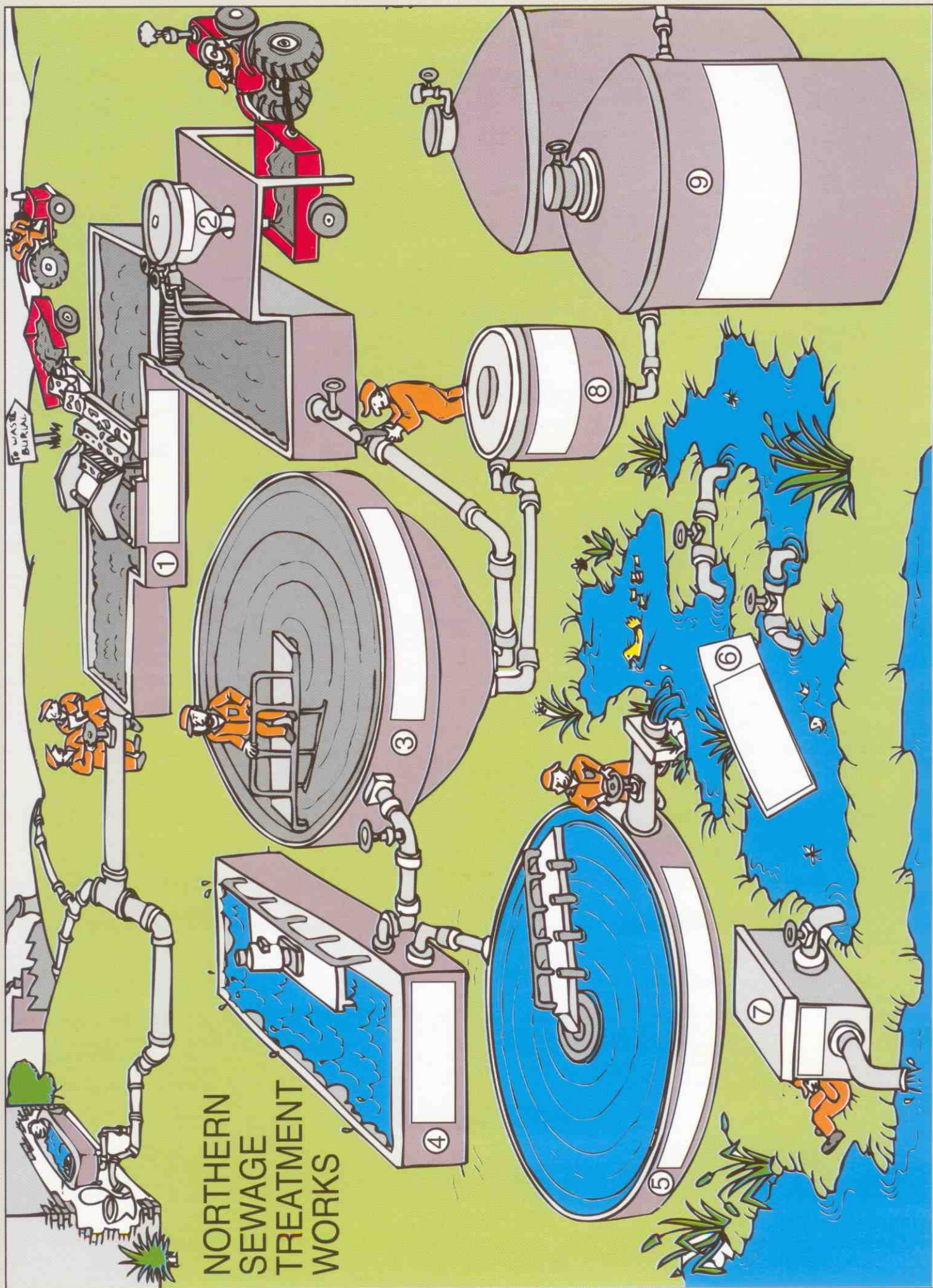


- biological** processes (eg. the breakdown of bacteria through decomposition)
- physical** processes (eg. the settling of sludge in tanks)
- chemical** processes (eg. the chlorination of the sewage effluent)
- mechanical** processes (eg. the screening of sewage)
- aerobic** cleansing (eg. by bacteria in aeration tanks)
- anaerobic** cleansing (eg. by bacteria in sludge digesters)

Ask learners to identify and describe where and how these processes are used in the treatment of sewage. It may be useful to colour-code the process above. Ask learners to colour in their picture of the works using the colours that describe the processes that are taking place in each of the numbered sections.



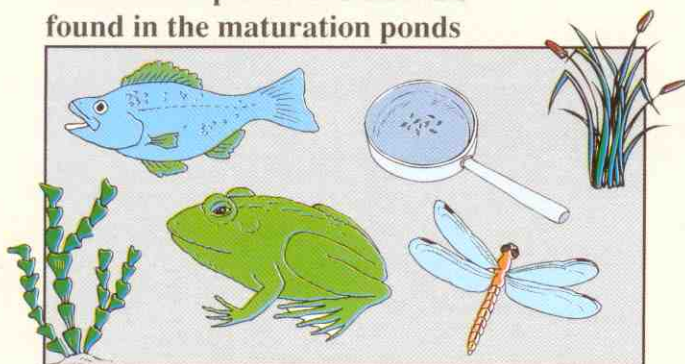
NORTHERN SEWAGE TREATMENT WORKS





PONDS FOR POLISHING SEWAGE:

Some of the plants and animals found in the maturation ponds



bright idea!

The booklet "Hands On Stream and Pond Life", is available from Umgeni Water or Share - Net. It may be useful for identifying the creatures and finding information about what they eat.

- During the visit to the treatment works, ask the learners to observe and record the full variety of plants and animals that live in the maturation ponds. (For safety reasons and to prevent over-trampling of the edges of the ponds, it may be wise to select only 2 or 3 learners to explore the ponds under the supervision of the excursion leader. A teacher can help the other learners to get on with the Bird Watching Activity suggested in this section.)
- Once back at school, ask the learners to share their findings with the class. In small groups, learners should then develop a
 - food chain or
 - food web
 that may occur in the maturation ponds.
- During this activity learners can be introduced to the following concepts. Where relevant they should identify these in their study of the ponds:
 - ★ producers (autotrophic)
 - ★ consumers
 - ★ herbivores
 - ★ carnivores
 - ★ omnivores
 - ★ decomposers
 - ★ energy flow
 - ★ ecology
 - ★ living and non-living components
- Ask learners to explain and discuss how the plants and animals do their 'job' of further 'cleaning-up' or polishing the sewage in the ponds.

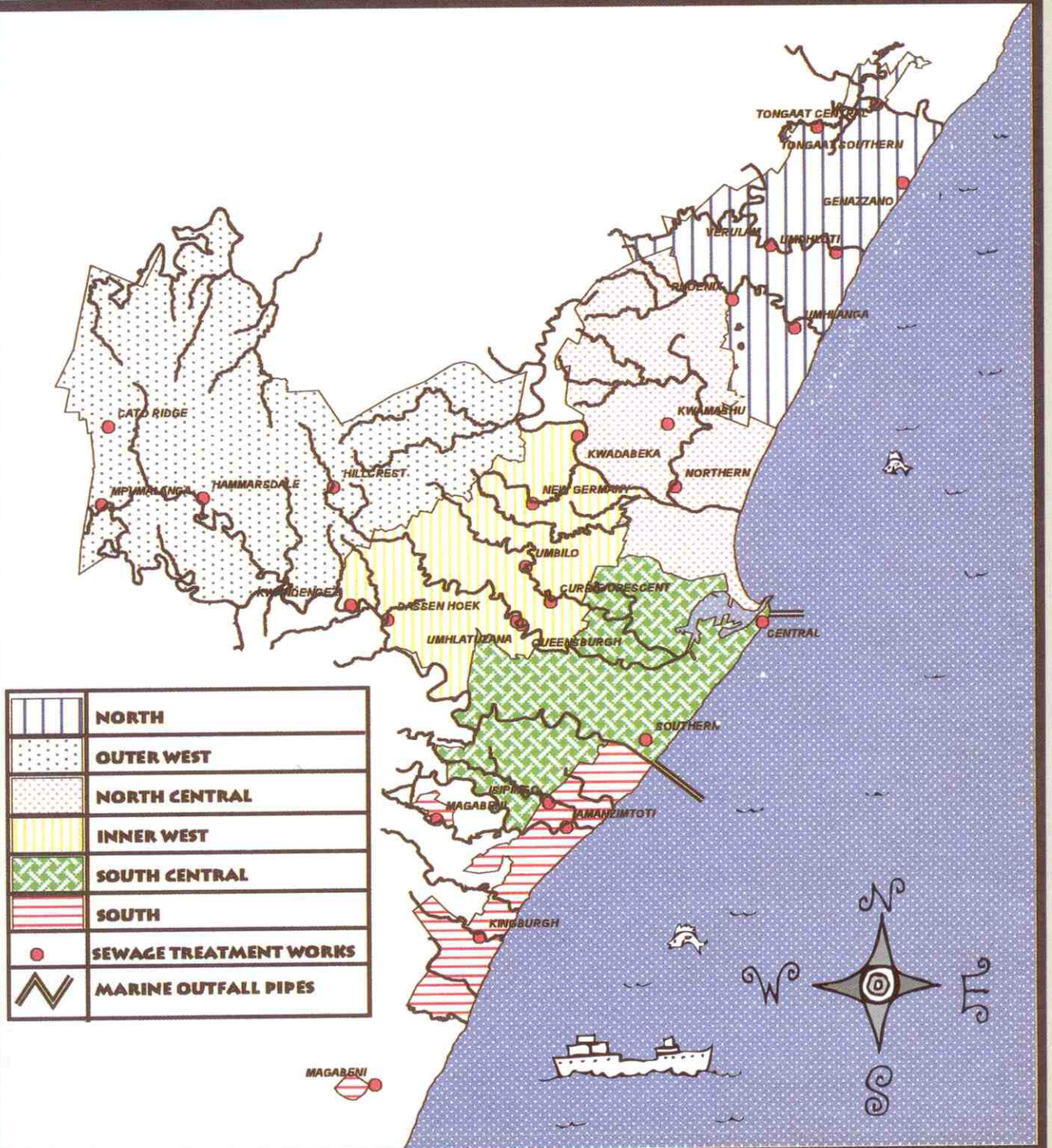


DURBAN METRO'S SEWERAGE SYSTEM

Pin up the A2 Durban Metro Sewerage Map which can be found in the pocket at the back of this file.

- Discuss the words **sewage** and **sewerage** with the learners.
- Provide each learner with an A4 copy of the Durban Metro Sewerage Map.
- Ask them to locate and count the following:
 - the sewage treatment works
 - the marine outfall pipes
- Ask learners to work out the route that their sewage, from home and school, is likely to follow.

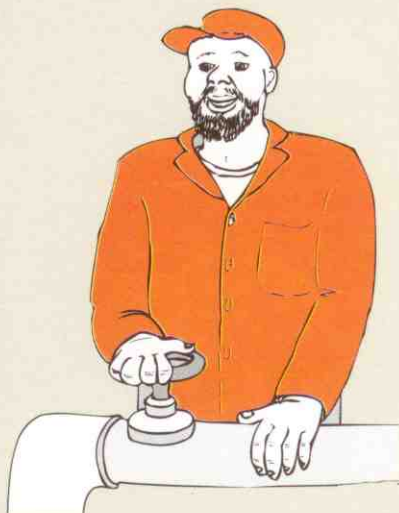
DURBAN METRO SEWERAGE MAP





THE PEOPLE WHO WORK AT THE SEWAGE TREATMENT WORKS:

Let the learners have fun role-playing the different careers. Photocopy (if possible enlarge) a number of copies of the Sewage Works Career Cartoons and pin them up in the classroom for learners to read. Prepare strips of paper with the 7 career titles. In groups of seven, have each learner select one of the careers out of a hat. Each one then has a chance to role-play their chosen career while the others have to guess. If arranged the day before, learners can even bring props, i.e. items that will support them in their role play. It may include clothing or equipment. Each group can select the most entertaining role-play and these can be presented to the whole class.



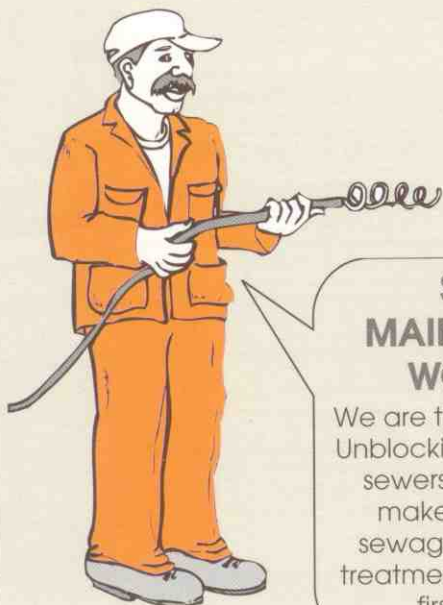
OPERATORS:

We operate the equipment that cleans the sewage. This involves working with pumps, pipes, valves, engines and generators.

CHEMISTS:

We do very specialised and complex tests on the sewage to make sure that the treatment process is working properly. We have to be very sure that the treated sewage meets all the legal requirements.





SEWER MAINTENANCE WORKERS:

We are the drain doctors! Unblocking and repairing sewers is our job. We make sure that the sewage gets to the treatment works in the first place.

LABORATORY TECHNICIANS:

We regularly test sewage - before, during and after the treatment process. All of this is done to make sure that the quality of treated sewage, that is finally discharged into nature, is of a high standard.



ENGINEERS:

Designing sewage treatment works and sewer systems is what we do. We also check that all construction goes strictly according to the plans!



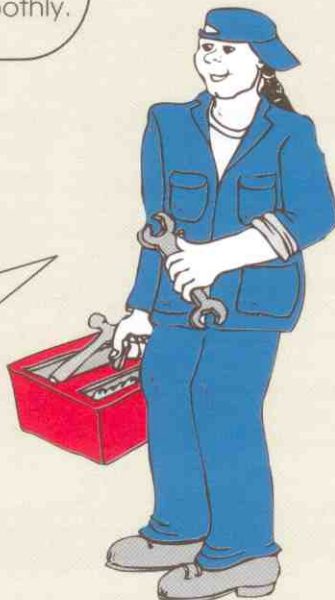
SUPERINTENDENT:

The buck stops with me! As the manager of the treatment works I have to make sure that the administration, operation and maintenance functions are all running smoothly.



FITTER-'N'-TURNERS:

We maintain and repair the pumps, pipes and just about anything that needs to be kept in good working order at the treatment works. We are the handy-men around here!



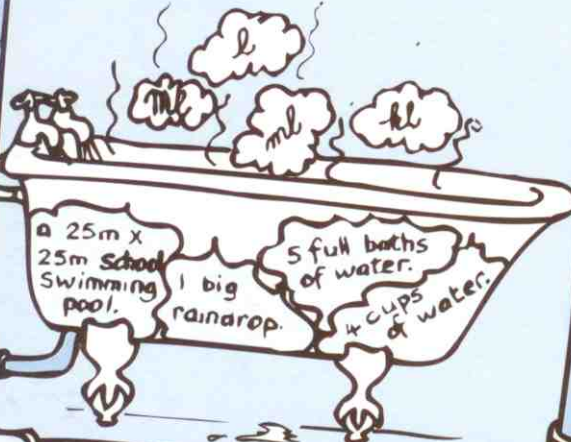
MATHS DOWN THE DRAIN!



Work hard
and you'll all
be flushed with
success!

① From the bathtub, select the matching abbreviation and volume for each measure.

1 millilitre = = 1 big raindrop
1 litre = =
1 kilolitre = =
1 megalitre = =



③ Circle the correct answer from each box.

a) 1 l = 1000 ml 100 ml 10 000 ml

b) 1 ML = 1000 ml 1000 l 1000 kl

c) A teaspoon holds 15 ml 5 ml 50 ml

d) A teacup holds 250 ml 1 l 750 ml

e) A kl equals 1000 ml 1000 l 1000 ML

f) A bucket holds 100 l 1 l 5 l

g) A full bath holds 100 l 10 l 1 kl

h) A ML is 10 1000 1 000 000 times bigger than a litre.

i) 100 ml = 100 000 kl 100 000 l

HARD TO BELIEVE!!

Altogether, Durban's 5 biggest sewage treatment works treat **350 MEGALITRES** of sewage EVERY DAY! That's like 12 Soccer fields each 1 metre deep in sewage every day!

④ EVEN SEWAGE COSTS

a) At land-based sewage works, sewage is given the FULL TREATMENT, which costs about 23c per Kl. Complete the following sentence by writing 23c as rands:- THIS SEWAGE COSTS R _____ per Kl TO TREAT.

b) At marine-based sewage works, sewage is only PARTIALLY treated, which costs about 11c per Kl. Write 11c as rands in the following sentence:- THIS SEWAGE COSTS R _____ per Kl TO TREAT.

② Do you know these basics?

How many ml in 1 l? _____

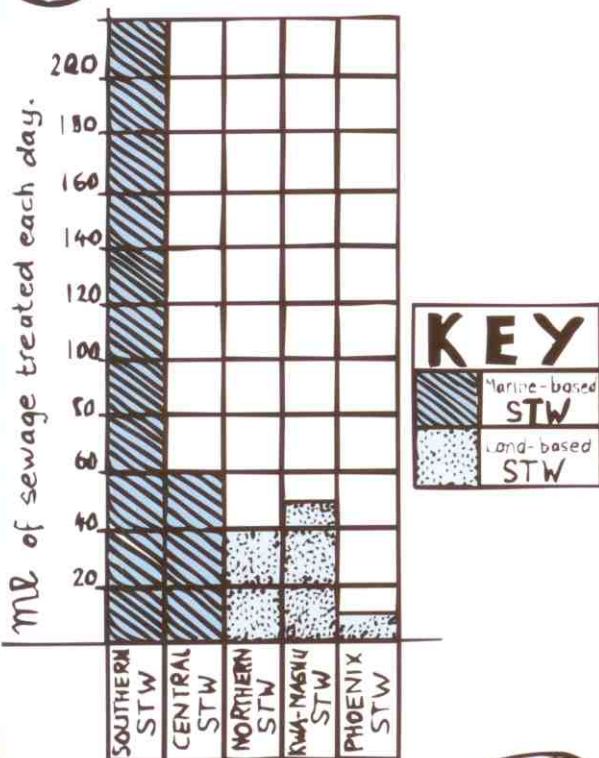
How many l in 1 kl? _____

How many kl in 1 ML? _____

How many l in 1 ML? _____

How many ml in 1 ML? _____

⑤ Study this bar-graph carefully. Note that S.T.W. stands for Sewage Treatment Works.



What does each block on the vertical or Y-axis of this graph stand for?

⑥ How many ML of sewage are treated per day at:

- a) Southern STW _____
- b) Central STW _____
- c) Northern STW _____
- d) Kwa-Mashu STW _____
- e) Phoenix STW _____

⑦ Next, work out how many ML of sewage are treated per day at:

- a) Southern STW _____
- b) Central STW _____
- c) Northern STW _____
- d) Kwa-Mashu STW _____
- e) Phoenix STW _____

⑧ Now, work out how many litres of sewage are treated per day at:

- a) Southern STW _____
- b) Central STW _____
- c) Northern STW _____
- d) Kwa-Mashu STW _____
- e) Phoenix STW _____

⑨ How much does it cost in rands to treat the sewage every day at:

- a) Southern STW _____
- b) Central STW _____
- c) Northern STW _____
- d) Kwa-Mashu STW _____
- e) Phoenix STW _____

f) Calculate the TOTAL cost of treating sewage in Durban's 5 biggest sewage treatment works PER DAY? _____

g) Sewage works operate every day of the year. What is the total cost of treating sewage in Durban's 5 biggest Sewage treatment works PER YEAR? _____

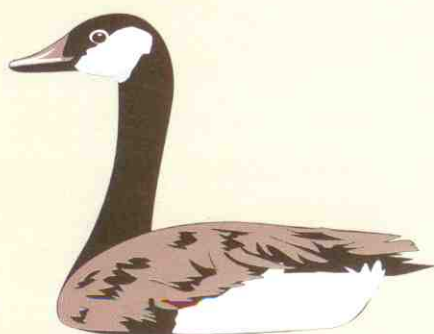
DISCUSS... Who actually PAYS for the treatment of Durban's sewage? Discuss the matter of local taxes, payment for services and the government's MASAKHANE campaign.

HOW DID YOU COPE WITH THIS WORK-SHEET?



BIRD WATCHING!

- Ask each learner to identify and draw simple sketches of 5 different birds during their visit to the sewage treatment works. They should make notes about beak and leg shapes and colouring, feathers and markings, where each bird was seen and what it was busy doing.
- While observing the birds, learners should think about and discuss the different beak shapes and how these are adapted for different styles of feeding. The same should be done for feet, with discussion on which birds are adapted for perching, swimming or standing on the ground, etc.
- Back at school, learners can use this information, together with library books or other relevant resources, to identify the birds, find out what they eat and discover other interesting facts. They should also discuss why these birds gather in large numbers at the sewage treatment works.
- Ask learners to re-do their sketches neatly and write up their information about each bird on separate pages. At the end of this exercise, the best ones on each species of bird can be collated into a booklet, ring-bound and put into the school library.



The booklet, "Some Common Waterbirds", available from Share - Net and Umgeni Water will be useful for this activity.