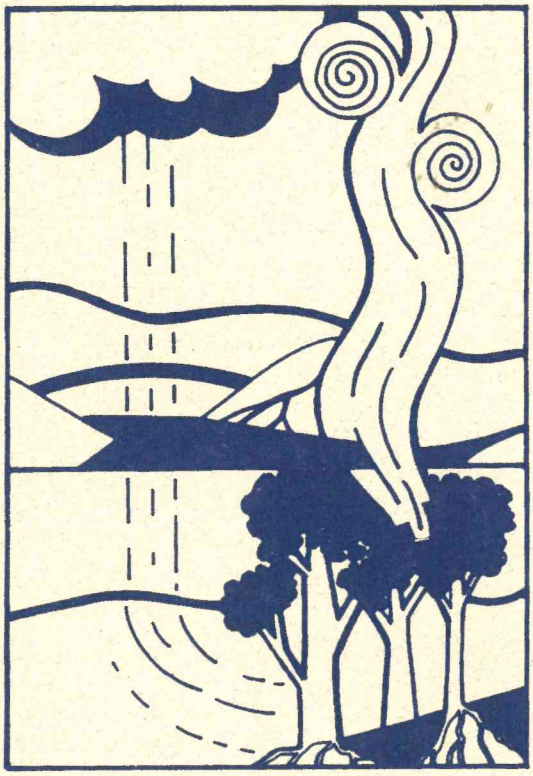
# Catchment Carers' Trail

Years 5-7
Teacher and Student Notes



Notes for a trail as part of an
upper primary school excursion



Department of Conservation and Land Management

WATER CORPORATION

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# Catchment Carers' Trail

## Years 5–7 Teacher and Student Notes

### Main objective

To broaden teachers' and students' understanding of forest management issues that affect the quality and quantity of water collected from forested catchments supplying Perth and rural communities with fresh water.

### Student learning objectives

- To understand what a catchment area is.
- To become aware of how the forest and Helena Reservoir are integral parts ofthe water cycle.
- To realise that quality of water depends on good forest and catchment management practices.
- To understand the need for coordinated management of all forest uses.

This booklet will assist you to:

- Guide your students through activities at marked stations along the trail;
- Plan relevant pre- and post-excursion activities;
- Make the most of your time when visiting The Hills Forest, Mundaring Weir and the surrounding area.

Student Notes in this booklet are clearly marked and may be photocopied for classroom activities. The activity sheet on Page 28 may be completed by students during the excursion day.

Use these Notes in conjunction with the National Soil Conservation Program's *Landcare for Kids* kit and the Water Corporation's *Primary Water Education Topic Sheets.*

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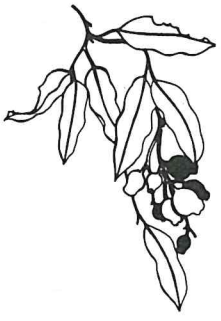

# Acknowledgements

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CALM is also grateful to the Victorian Department of Conservation and Natural Resources and the National Soil Conservation Program for permission to reproduce the cover and pages 7, 8, 9, 11, 17, 18, 19, and 21 from the kit *Our Land: LandCare Activities for Upper Primary*.

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## Water, a Life-giving Resource from Forests

Water is one of the most important resources we obtain from forests. It is vital for all living things. Careful forest management is necessary to ensure that our present and future water needs can be met.

Much of Perth's water needs are supplied by four large reservoirs in the jarrah forest — Canning Dam, Serpentine Dam and the South and North Dandalup Dams. A fifth dam, Helena Reservoir, provides some water to Perth, but the eastern hills, the Wheatbelt, and the Goldfields as far away as Kalgoorlie and Norseman, are its main recipients.

## Where Does the Water Come from?

Moisture-bearing clouds from above the Indian Ocean are carried by winter winds and forced up and over the Darling Scarp, bringing rain to the coastal plain and the western edge of the Scarp. Further east, rainfall declines. The rain falls into catchment areas, with the runoff feeding the dams in State forests.

The Helena Reservoir catchment is the area of land which collects rainfall, and drains by way of surface and underground streams into the Helena and Darkin Rivers and thence into the reservoir. This area of 1 470 square kilometres extends from farmlands as far east as York, south to the Brookton Highway and north to the Great Eastern Highway.

Forty per cent of the water in the reservoir is pumped from the Lower Helena Dam downstream of the Mundaring Weir.

## Do Forests and Their Users Affect Water Supplies?

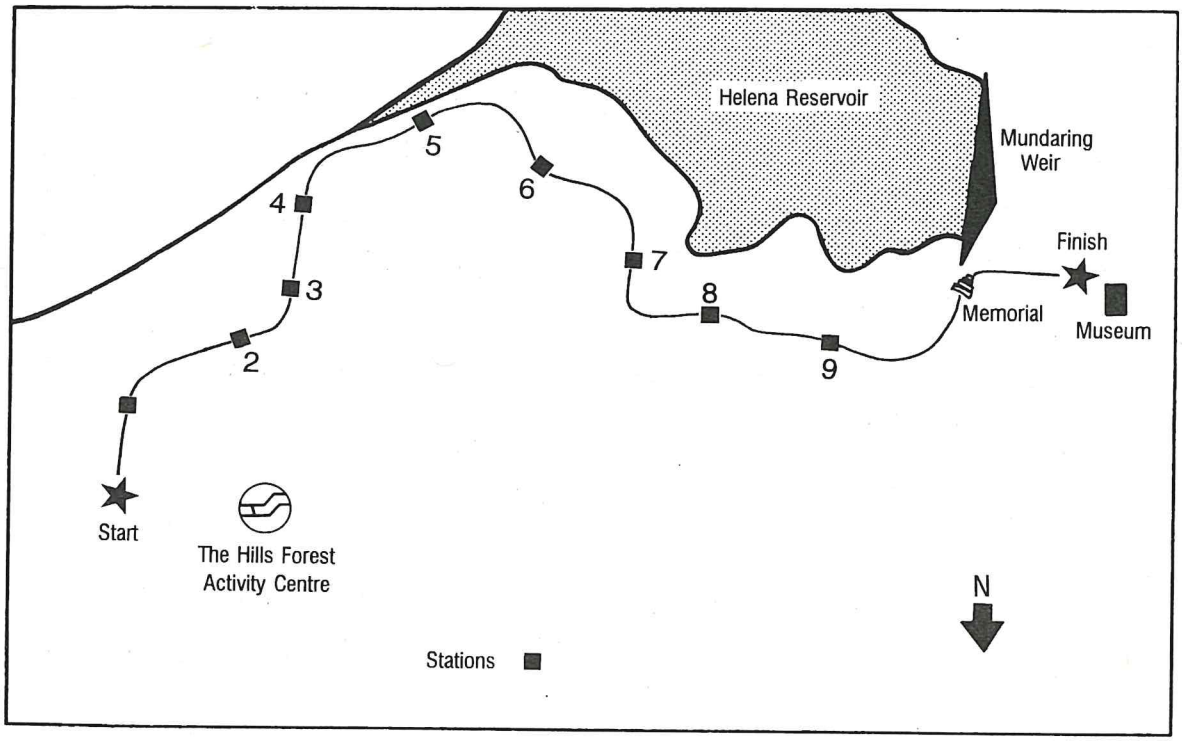
Forests determine the **quantity**, **rate and quality** of water which flows into streams and hence into dams. Although the forests around the Helena Reservoir are managed primarily as a water catchment they have a number of other values: wildlife and nature conservation, timber production, mining, education, honey production, wildflower industry, tourism, recreation and research.

People and their vehicles in the catchment area may increase the risk of water pollution through soil erosion, vegetation loss from dieback disease, and wildfires. To prevent these there must be **integrated catchment management,** the co-ordinated planning, use and management of water, land, vegetation and other natural resources.

The Department of Conservation and Land Management (CALM) therefore works closely with the Water Corporation (formerly the Water Authority of Western Australia), other agencies and the community, and actively promotes the concept that:

Catchment Sharers must be Catchment Carers.

## Welcome to the Catchment Carers' Trail.




The trail runs through the forest, along the side of a stream and the Helena Reservoir to the C.Y. O'Connor memorial above the Mundaring Weir.

Along the trail there are nine stations. These Notes give background information for you and your students on forest management issues that are the basis of activities at each station.

Before starting out on the trail:

you will be greeted by a CALM guide who will orientate you and your students in relation to the reservoir and its catchment area.

the guide will introduce your students to the *Catchment Carers' Conundrum* (p. 28). Along the trail there are clues to sharers of the jarrah forest's resources. As you discover them, write the carer's name in the box provided on the map shown on the same page.

### Remember—Catchment Sharers must be Catchment Carers

Enjoy your walk!

## Student Notes

## STATION 1: Dieback Disease

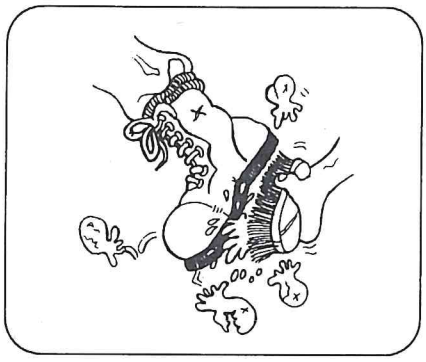
Parts of the jarrah forest are called Disease Risk Areas. These areas are managed to reduce the spread of *Phytophthora cinnamomi*, the fungus that causes dieback disease in plants.

This microscopic fungus lives in the soil and attacks the roots of more than 1000 species of plants, including jarrah, starving them of water and food until they die.

The fungus spreads rapidly in water and moist soil, infecting nearby plants. Infected soil, carried by vehicles, horses or people's shoes, spreads the disease still further.

Risk of infection is greatest during the wet winter months but the fungus spores (reproductive bodies) can survive long, dry periods and become active after rain.

# Dieback Disease



Dieback disease is killing our native plants.

Plants in this area are threatened by this disease.

Your footwear can bring in or pickup infected soil and spread dieback.

Help stop the rot by scrubbing your boots clean before and after you walk.

Department of Conservation and Land Management *Caring ....Naturally*

# Teacher Notes
# STATION 1: Dieback Disease

## Forest Management Implications

Loss of trees and shrubs to dieback may leave soil unprotected and result in erosion. In addition the balance of species in the forest changes as dieback-resistant species, such as marri *(Eucalyptus calophylla),* become dominant.

CALM, in conjunction with other agencies, is engaged in research to try to eradicate dieback. For example, the growth of seedlings from seeds of dieback-resistant jarrah trees is being tested in disease-affected areas. A chemical has been developed to protect small areas of jarrah forest. It is uneconomical, however, for large areas of forest to be treated.

To reduce the spread of dieback, CALM allows only controlled access of vehicles, and walkers are encouraged to clean their shoes before entering the forest. These strategies help to maintain a healthy forest and hence a healthy water catchment.

## Station 1 Activities

### Pre-visit Activity

- Students research and write a report on dieback disease. See CALM Resource Notes nos 11 and 12.

### On the trail

- Students read the Dieback Disease warning sign.
- Students take turns to remove soil from their shoes at one of the installed boot-cleaning stations.

### Focus questions

- What is CALM doing to prevent the spread of dieback?
- How can you help?
- How might water quality be affected by loss of trees to dieback?

# Student Notes

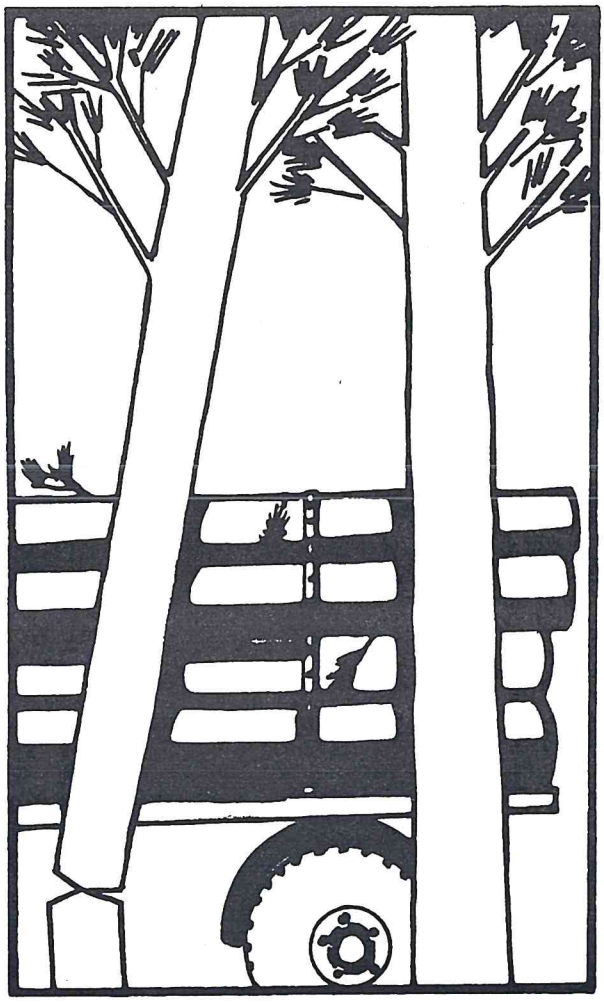
## STATION 2: Timber Production in Water Catchments

Early this century, steam-driven pumps were used to pump water to the Goldfields from the reservoir. The timber from the forests was cut for fuel to drive the pumps.

Timber cutting and 'ringbarking' to kill other trees were encouraged because those in authority wanted greater water runoff into the reservoir.

This extreme disturbance of the catchment did increase runoff, but resulted in the water becoming salty and muddy owing to rising underground water and topsoil erosion (see Station 3 and Station 5 Notes). Pine trees, which grow approximately eight times faster than jarrah trees, were therefore planted in some areas to improve water quality.

The jarrah forests in much of the catchment were ringbarked and repeatedly burnt in the early part of this century, but have since been managed to ensure regrowth. These areas are now covered by healthy forests up to 40 metres tall.



# Teacher Notes

## STATION 2: Timber Production in Water Catchments

### Forest Management Implications

Some of the original pine plantations, including the plantation at this station, have been retained for their timber. The plantation will be thinned by harvesting some of the timber when 15 years old and finally harvested at approximately 25 years.

Today, jarrah forests are not cut down and replaced by pine plantations. Logging is carried out by selectively removing some trees, which encourages the regrowth and structural diversity of the forest.

CALM's current forestry practices, which include retaining unlogged zones bordering streams, ensure that logging does not reduce the quality of the water in State Forest catchments. Today, not one stream in a fully forested catchment managed by CALM is saline.

## Station 2 Activities

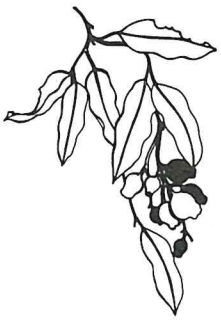
### On the trail

Focus on observation and discussion skills

- Students observe the pine plantation within the forest and discuss when and why pine trees were planted.

### Focus question

- How did cutting down the forest in the early part of this century affect the quantity and quality of the water in the Helena Reservoir?



# Student Notes

## STATION 3: Trees Fight Salinity

Trees draw huge quantities of water from underground through their roots to their leaves. Some of this water is transpired as water vapour into the atmosphere and some is used for plant growth.

A 20-metre jarrah tree can draw an average of 50 litres of water out of the groundwater per day.

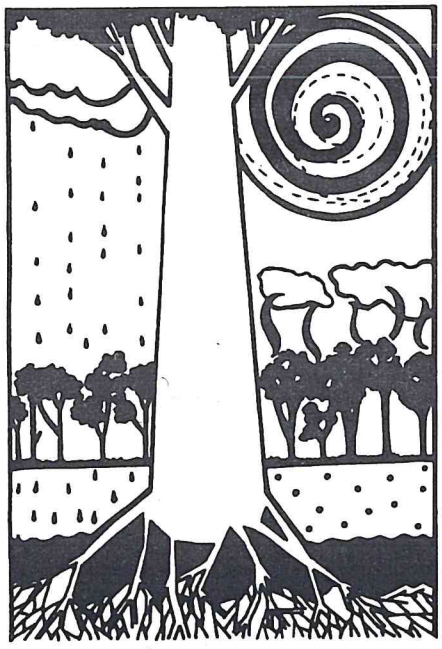
The soils over much of the south-west of Western Australia contain salt. It was originally deposited in the soil as dust, or introduced from rainfall which contains some salts picked up from air masses passing over the Indian Ocean. Salt has been accumulating in the soil like this for thousands of years.

Permanent clearing of forests removes the trees with deep roots which soak up the groundwater. As it rains, more water soaks into the soil, and the level of the groundwater rises and dissolves the salt in the soil. The salty groundwater may rise to the surface, forming salt scalds, or flow into streams and dams turning them salty.

Salinity is the term used to measure the quantity of salt in streams, springs, dams, groundwater or the soil. It is a form of water pollution.

Clearing of land for farming in catchment areas has, in the past, resulted in an increase in salinity of the dams. The broadscale cutting down of trees early this century caused the Helena Reservoir water to turn salty.

Recent research has shown that careful selective logging does not cause streams to turn salty.



# Teacher Notes

## STATION 3: Trees Fight Salinity

### Forest Management Implications

To ensure that water in the Helena Reservoir does not turn saline, CALM and the Water Corporation control clearing of trees within the catchment, particularly along the banks of streams and rivers.

Much research has been done to determine the best balance between cleared and uncleared land. Salinity affects 1.6 million hectares of the State's most productive agricultural land.

Many farmers, with CALM's active encouragement, are now planting trees on cleared paddocks to reverse the salt problem. They are practising agroforestry by combining a softwood (pine) timber crop and grazing. Furthermore, CALM, in conjunction with other investors, is establishing thousands of hectares of hardwood (bluegum and other hardwoods) plantations on already cleared farmland to help reverse the problem of salinity, water-logging, and erosion.

## Station 3 Activity

### Pre-visit activities

- **Landcare for Kids** kit, *Our Land* booklet: 'A Taste of Salt', p.17; 'Travelling with Salt', p.18; 'Guzzle Guzzle', p. 27.

### On the trail

- Students operate the 'interactive' that illustrates how trees draw water from groundwater, thus lowering the level of the water table and preventing salt from being carried into the topsoil and to the surface.
- Students discuss how trees fit into the water cycle.

### Focus questions

- What happens to the water that is drawn out of the groundwater by trees?
- If trees die or are cut down, what might happen to the level of the groundwater? What then happens to the salt in the soil?

### Post-visit Activity

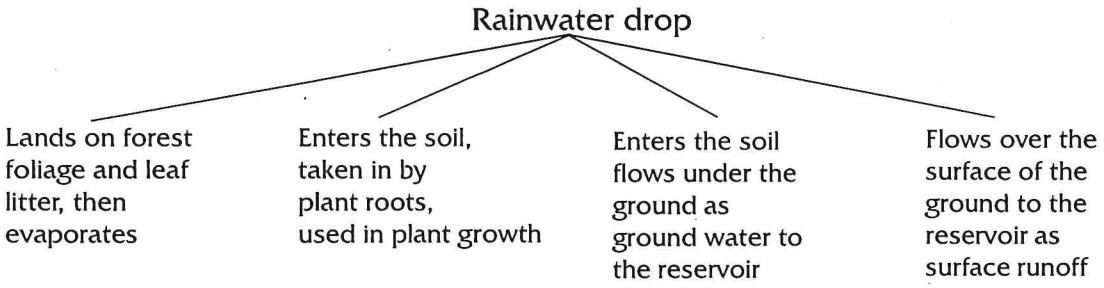
- **Landcare for Kids** kit, *Our Land* booklet: 'A Salty Birth', p. 19.

# Student Notes

## STATION 4: The Catchment and The Water Cycle

The catchment of the Helena Reservoir is the area of land from which water collects and runs into the reservoir. Less than 20 per cent of rainfall (precipitation) actually reaches the reservoir.

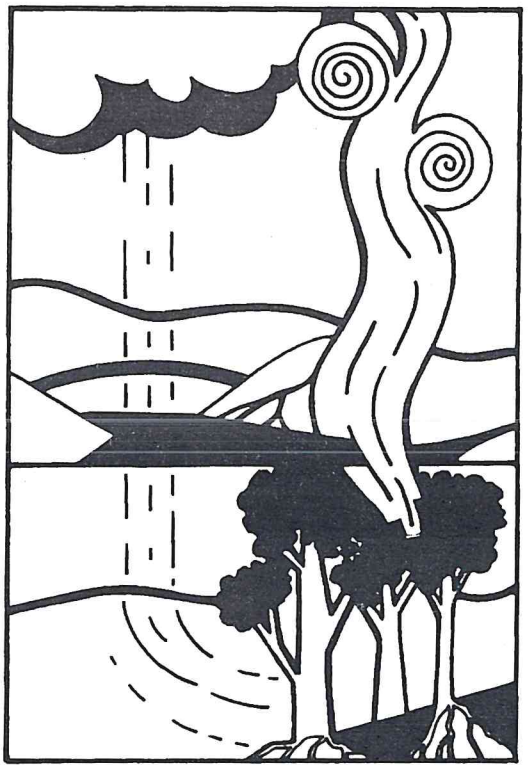
There are a number of pathways that a rainwater drop falling on the jarrah forest catchment may follow and still be part of the water cycle:




Groundwater, the water that occupies the crevices in rock and soil, moves through the topsoil and eventually comes to the surface as a spring or a stream. It may take many years to reach the reservoir.

The amount of surface runoff depends on the density of the foliage and the weather conditions when the rain falls. After a long dry period the soil acts like a sponge, absorbing much of the water, and if rainfall is light and occasional there is less runoff.

If trees form a closed canopy, that is, the foliage of the trees almost touch, the amount of runoff is reduced. On the other hand, widely spaced trees leave the soil exposed to water and wind erosion ( See Notes for Station 5.)



# Teacher Notes

## STATION 4: The Catchment and the Water Cycle

### Forest Management Implications

By building the weir, humans have interrupted the natural water cycle. Water, which would otherwise make its way to the Helena River and eventually reach the ocean, is stored in the reservoir, then extracted and pumped to communities where it can be used.

To ensure maximum runoff without lowering the quality of water, CALM and the Water Corporation together decide on how far apart trees should be spaced. Careful thinning of trees on the catchment can increase the yield of water into the reservoir.

## Station 4 Activities

### Pre-visit activities

- **Landcare for Kids** kit, *Our Land* booklet: 'Making Rain Clouds', p. 7; 'Water Soaks', p. 8;
- View and discuss the Water Corporation's video *What is Groundwater?* and poster *The Water Path.*

### On the trail

- Students gather around the model of the Helena Reservoir catchment. Guide and students discuss the features of the catchment and how it fits into the water cycle.
- Students note their position in the catchment indicated on the model.
- Using the water containers (clouds) provided, students imitate rain falling on the catchment and its boundaries.
- Students observe the pathways of rainfall runoff to the reservoir.

### Focus questions

- Where did the water go when rain fell on the catchment boundary?
- What pathways could the water take to reach the reservoir? Did all the water reach the reservoir?

### Post-visit activities

- Make a model or prepare a mural to represent the Helena Reservoir catchment, Mundaring Weir, pumping stations and the water cycle.

# Student Notes

## STATION 5: Soil Erosion

Soil erosion occurs when soil is washed or blown away by water or wind. This happens when trees, ground-cover plants and ground litter are cleared.

Splash erosion occurs when a raindrop hits bare ground, displacing soil.

More soil is eroded from steep slopes with loose soil because the speed of the water flow increases the movement of soil.

Soil that has been eroded from catchments is carried into streams and rivers and then into dams or reservoirs. It turns them muddy (turbid), often killing local plant and animal life.

Over the years, the soil settles and reduces the amount of water the dam can hold.

## Forest Management Implications

CALM ensures that tree and ground cover plants are maintained to protect the topsoil and decrease the force with which raindrops hit the ground, thus preventing splash erosion. Vegetation also slows down runoff rates, particularly on the steeper slopes around the reservoir, and so reduces the loss of topsoil.

Badly built roads can cause turbidity in water collected from forested catchments. Today, CALM and the Water Corporation ensure that roads and pathways are built so that they slope gently, following the contour of the land. Roads also have drainage channels leading to adjacent vegetation, to slow water movement and therefore prevent erosion.

## Station 5 Activities

### Pre-visit activities

- **Landcare for Kids** kit, *Our Land* booklet: 'The Mighty Raindrop', p. 9; 'Making Catchments', p. 11.

### On the trail

- Students gather around the eroded road (pegged-out area) and compare it with an adjacent vegetated bank. Students using water from the containers (cloud) provided imitate rain falling onto the bare ground of the road, and compare this with rain falling on the vegetated bank.
- Students observe and discuss what happens to the soil and water.

### Focus questions

- What happens to topsoil when all the trees, ground cover vegetation and litter are removed? What measures could be taken to stop erosion?

### Post-visit Activities

- **Landcare for Kids** kit, *Our Land* booklet: 'All Washed Up', p. 21.

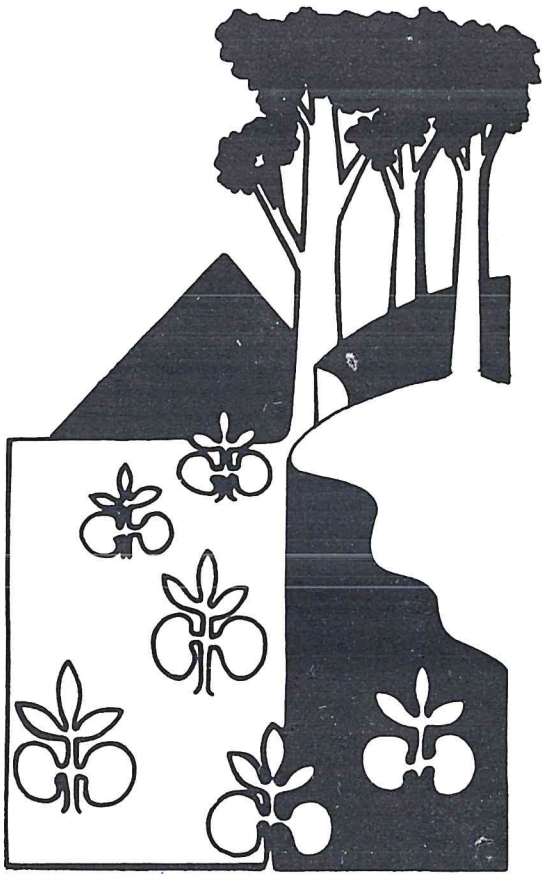
## Student Notes

## STATION 6: Mining and Water Quality

There are four primary minerals mined in Western Australia's jarrah forests. They are bauxite, coal, gold and tin (tantalite). Gravel for roads and building is also quarried from the forest.

These minerals are important to our economy; their value is currently more than $3 000 million a year, with bauxite of greatest value at more than $2 000 million. By law, however, they have to be mined in a way that does not damage the forest or the water quality from catchments.

Bauxite, the raw material of aluminium, is found in the Darling Range. In the Helena Reservoir catchment it is not in sufficient concentrations to be mined. Further south, however, near Jarrahdale and Dwellingup, concentrations are higher and bauxite is mined at three mines that lie within water catchments.



## Forest Management Implications

Strict Government regulations guide the activities of mining companies to minimise the spread of dieback disease and erosion, and ensure rehabilitation of the land. CALM and the Water Corporation helped to form, and now enforce, these regulations.

Mining companies now have to build walls around the mine site to capture runoff and so reduce the risk of erosion. During the wet season, when dieback is most easily spread, the movement of traffic and heavy machinery in and out of the mine site is minimised, and vehicles are thoroughly sprayed with fungus-killing chemicals. Water Corporation representatives inspect the mines and its other operations to ensure these precautions are taken. CALM researchers are consulted to assist in rehabilitation of mined areas back to healthy forest.

## Station 6 Activities

### Pre-visit activities

- Contact the Chamber of Mines and Energy or Alcoa of Australia and invite them to talk to your students about mining in forests and the protection of water quality.

### On the trail

- Students observe the quarry on the opposite side of the reservoir. Granite from this quarry was used to build the Mundaring Weir at the turn of the century.
- Students pick up a small handful of soil and are asked to feel, observe and describe to a partner the colour, texture (smooth, gritty, slippery, coarse, etc.), grain size and shape and the presence of animal and plant matter.

### Focus questions

- What is this soil composed of? Does this soil have air spaces? Would rain water tend to filter through this soil or run off its surface?
- How could a mine site at this point affect water quality in the reservoir?

# Student Notes

## STATION 7: Imagine You Are a Raindrop

The Helena Reservoir can hold 77.13 million cubic metres of water (equivalent to the amount held in one-and-a-quarter million average sized swimming pools!).

It was built in 1902 to provide water for the Goldfields. Later the reservoir size was increased to supply water to agricultural areas.

Before the reservoir was built the Helena River wound through a jarrah forest community consisting of a large variety of plants and animals. Now water covers the lower slopes of the valley for a distance of 16 kilometres.

The building of the weir and pipeline greatly improved the lives of those working in the Goldfields and led to the development of agricultural areas east of the Darling Range. Against this is the loss of the old jarrah forest and a dramatic change in the Helena River valley environment.

A raindrop falling onto the catchment before the reservoir was built might have followed a very different pathway from the one it could follow today.

One hundred years ago, a raindrop could have joined the Helena River flowing into the Swan River and eventually reach the sea. Today, a raindrop may travel eastwards over 500 kilometres in the pipeline to reach the Goldfields.

# Teacher Notes

## STATION 7: Imagine You Are a Raindrop

### Forest Management Implications

The building of the reservoir resulted in the 'opening up' of the surrounding areas; roads were built to bring machinery and building materials to the site, and townships and small communities developed to service the needs of the workers.

Areas of forest in the eastern limits of the catchment were cleared for agriculture because of the availability of water.

Increased access to the surrounding forest has led to an increase in demand for its resources and for recreation. The need for careful management of the catchment to ensure quality of water is thus more important today than ever before.

## Station 7 Activities

### Pre-visit activities

- **Landcare for Kids** kit, *Our Land* booklet: 'Catching Water', p. 10.
  See the Water Corporation's Primary Water Education Topic Sheet: *Perth's Water Supply* (Year 6).

### On the trail

- Students are asked to imagine themselves as a raindrop and to trace in their minds the route they might take to reach the base of the valley. They may choose to be a raindrop falling today or 100 years ago before the building of the reservoir.
- Students, in silence, are placed at points along the trail where they can sit for five minutes. At the end of the period, selected students recount their raindrop pathway.

### Focus questions

- What human need was satisfied by the building of the reservoir? What were the positive results from the building of the reservoir and the pipeline? What changes occurred in the natural environment of the catchment?

### Post-visit Activity

- Students write a narrative, based on their raindrop pathway.

# Student Notes

## STATION 8: Fire Control and Water Quality

What has fire to do with water quality and quantity? The answer is—a great deal!

Wildfires are fires that burn very hot, are almost impossible to control and are dangerous to forests, towns, people's lives and farms. They occur in areas that have not been burnt for many years, and so have large amounts of leaves, twigs, bark and dead plants on the ground, known as ground fuel.

After a wildfire, the landscape is black and charred. If the fire is followed by rainfall, surface runoff may carry ash into streams and then into reservoirs.

If, during the course of a wildfire, the wind blows towards a reservoir, scorched vegetation is blown into the water.

If heavy rainfall occurs before the plants have had time to recover, the unprotected topsoil can be eroded into streams and dams. In this way wildfires can result in considerable water pollution.

Every year, on land that is managed by CALM in the south-west of Western Australia, about 500 wildfires are started. Most are started by arsonists, whilst others are started by accident or lightning.

# Teacher Notes
# STATION 8: Fire Control and Water Quality

## Forest Management Implications

To protect life, property and water quality in catchments, CALM has to minimise the threat of wildfire. The most effective tool is fire itself. Planned (prescribed) fires are lit within forests around towns and farms. These fires do not prevent wildfires but, by burning some of the fuel, they reduce the risk of a fire getting out of control.

Prescribed burns are planned carefully and are lit every 5 to 10 years in spring, early summer or late autumn when it is cool and relatively moist. To stop scorched material blowing into the reservoir, for example, a burn would take place when the wind direction is away from the main water body.

The effects of fire on the ecology of WA forests have been studied for more than 30 years and shown to be highly variable. Many plants can survive a fire, but a fire repeated every two or three years will cause the vegetation to change. Native animals are often able to survive fires, and research has shown that population levels of some birds and mammals return to pre-burn numbers within three to four years. CALM, therefore, allows a period of at least four years between burns.

Prescribed burning is a way of reducing the intensity of a fire once started. To prevent fires being started when conditions are extreme in summer, a total fire ban is imposed, which must be observed by all visitors to the forest.

## Station 8 Activities

### Pre-visit Activity

- As a whole class activity discuss the photographs of fires in CALM Resource Note no.16—*Prescribed Burns: Fighting Fire with Fire.*

### On the trail

- Students look for evidence of fire and discuss the meaning of a 'prescribed fire'. Students observe the exposed trunk of a balga tree and count the number of fire rings. Guide indicates the relevance of the spacing between rings.

### Focus questions

- Under what conditions would you carry out a prescribed burn at this station?
- What might happen if CALM did not carry out prescribed burning?

### Post-visit Activity

- Arrange for someone from the Fire Brigade to talk to the students about how they deal with bushfires in forest catchment areas.

# Student Notes

## STATION 9: Catchment Sharers Working Together

### Remember—Catchment Sharers must be Catchment Carers

The cooperation of those who use and share the forest is essential if CALM and the Water Corporation are to succeed in managing the forest as a water catchment.

Mining companies (Station 6) and timber producers (Station 2) are two groups that share and must care for the forest, but there are also those involved in:

- honey production,
- wildflower and seed production,
- recreation,
- tourism,
- nature study and conservation,
- research and education.

This list could be expanded to include all of us. We all use products that come from forests, such as water and paper.

The different values, interests and goals of these individuals and groups can lead to conflict.

Some examples are:

- The conservationist may object to part of the forest being flooded as a reservoir;
- The holiday maker may wish to water ski on the reservoir;
- The honey producer wants to place beehives within a Disease Risk Area;
- The bush walker needs to light a fire close to the reservoir to brew a cup of tea;
- A mining company wants to mine a rich deposit of bauxite on a steep slope prone to erosion;
- A tourist company wants to build a campsite at a picturesque site next to the Helena River.

Can you think of any more examples?

# Teacher Notes

## STATION 9: Catchment Sharers Working Together

### Forest Management Implications

It is our elected government that develops policies and legislation that reflect the community's values and priorities for forest and catchment use. CALM and the Water Corporation are charged with the responsibility to manage the forested catchments accordingly.

After one of the activities mentioned in the Student Notes—water skiing on the Helena Reservoir—the water could become polluted by oil. Treatment of polluted water is expensive and currently treatment of water, before being pumped eastwards, is minimal. Consequently, recreational activities such as swimming, boating etc on the reservoir are not permitted.

If, however, the community was prepared to pay for full water treatment, recreational activities may be permitted.

Having completed the trail you and your students will understand that management of forested catchments is complex and costly. It is important that all members of the community who use the forest understand the management policies and co-operate to maintain water quality, at an acceptable cost.

## Station 9 Activities

### Pre-visit activities

- Teacher asks students to read the Notes and to suggest and note down other users and examples of conflict between users of the forest. Discuss.

### On the trail

- Along the trail students have looked out for clues that indicate sharers of the forest's resources. Students complete the map and Catchment Carers' Conundrum (see next page), remembering that Catchment Sharers must be Catchment Carers.

### Post-visit activity

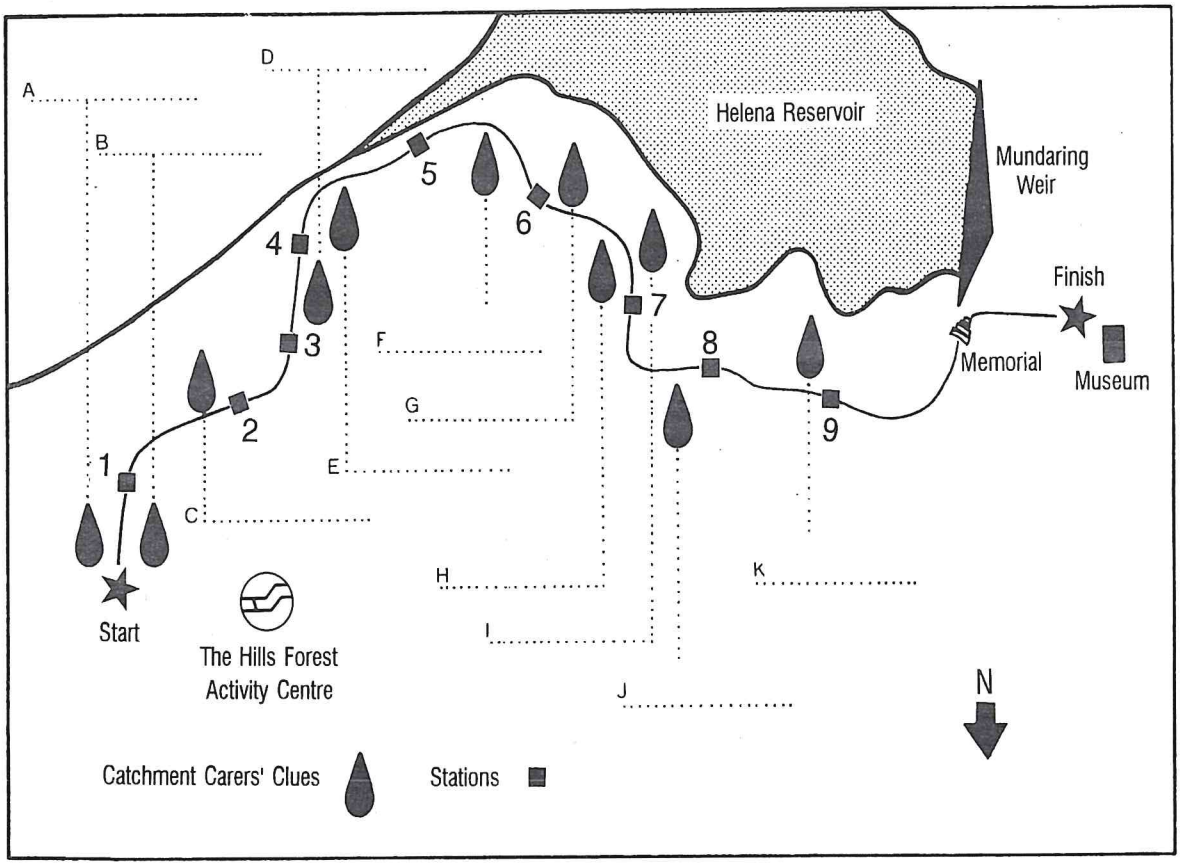
- Students select one hypothetical conflict from the list made during the pre-visit activity. Students resolve the conflict through a class debate.
- Students do a role-play activity "Forest User Roles and Planning Game"—p. 80 from CALM's *Discovering The Hills Forest* teacher resource package.

# Trail Map

To be completed on your excursion day

## Catchment Carers' Conundrum

Search for clues to sharers and carers of the catchment.
Write in their names on this map.




*Now solve this conundrum:*

I have listed every carer
But there's one more left to see
Someone who uses water,
and paper from the tree.
I know — it must be _ _!

*Cut here before copying for your students*

Answers (Clues in italics) in order of occurrence on the trail
**A** - *Teacher* = **Educator; B** - *Trail Guide* = **CALM employee;**
**C** - *Pine tree* = **Forester; D** - *Bush walking sign* = **Recreator;**
**E** - *Operation Foxglove sign* - **Researcher; F** - *Bird nesting box* = **Conservationist;**
**G** - *3 peep holes to quarry* = **Miner; H** - *Beehive* = **Apiarist;**
**I** - *Scenic lookout sign* = **Tourist; J** - *Hakea tree*= **Wildflower grower/seed collector;**
**K** - *Water Corporation sign* = **Water Corporation employee.**

# Catchment Carers' Trail

## POST-VISIT CLASSROOM ACTIVITY SHEET

### 1) Catchment Sharers must be Catchment Carers.

In your own words explain this statement _____

_____

_____

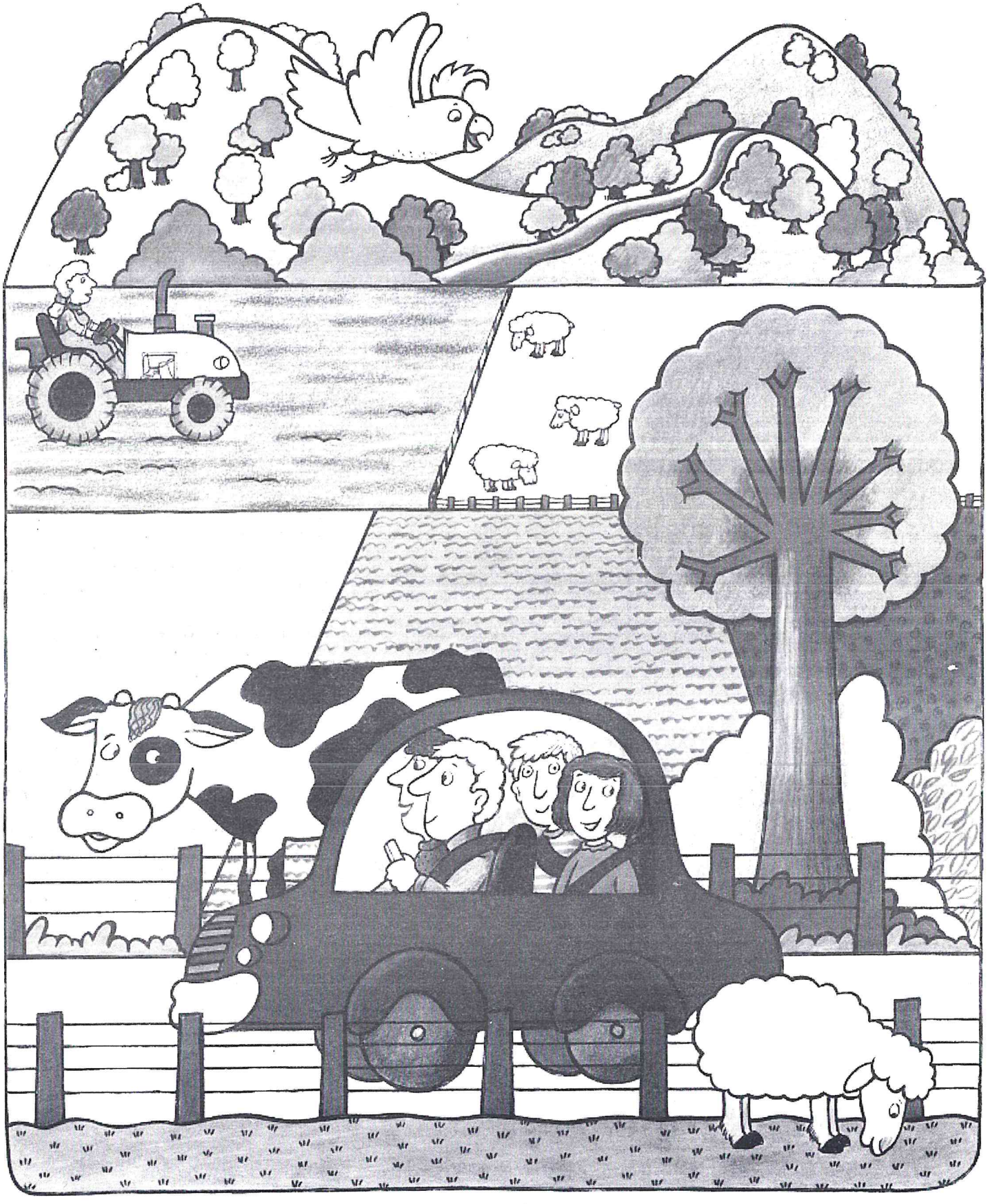
_____

2) **The many sharers of a forested catchment may cause problems that will lower the quality of our reservoir water supply.**
Suggest a solution to each of the following problems:

| Problem | Solution |
|---|---|
| 1. Forest understorey plants throughout the forest are crushed by the many feet of visiting students and tourists. | |
| 2. Forest trees and understorey plants are threatened by the spread of dieback disease. | |
| 3. Dog owners allow their dogs to roam the reservoir shores and introduce harmful bacteria to the water. | |
| 4. Ash and soil blow into the reservoir after a forest wildfire in summer. | |
| 5. Topsoil from a gravel quarry site washes into the reservoir after rain. | |
| 6. Salty stream water turns the reservoir water saline. | |
| 7. A landowner wants to remove trees growing on the edge of a river flowing into the reservoir. | |
| 8. A motor boat owner accidentally pollutes the reservoir water with oil. | |
| 9. Topsoil erosion caused by road building turns the reservoir water muddy. | |
| 10. Individual sharers of the forest use the forest as they please. | |

# Our Land

## LandCare Activities for Upper Primary

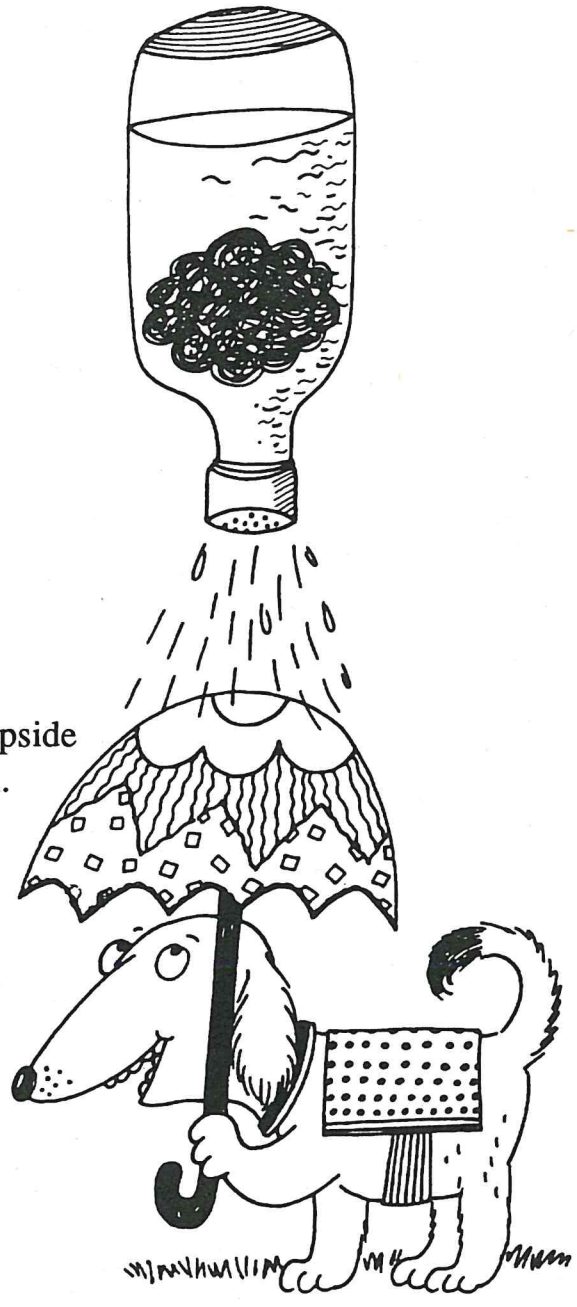


# Making Rain Clouds

In this activity you will make your own special "rain cloud" which will help you discover the effects of rain on different types of land. You will need this cloud for other activities so make sure it is labelled with your name.

## Materials

- plastic drink bottle with a screw lid
- nails
- felt pen (oil based)
- water



## What to Do

1. Remove the cap and carefully make several holes in it, using a nail.

2. Turn the bottle upside down and use felt pens to draw a cloud shape.

3. Fill the bottle with water and replace the cap.

4. Go outside and test your cloud by turning it upside down and shaking it so that rain begins to fall.

## Research

Find out about different cloud types.
Try to identify these clouds in the sky.

Which clouds are rain clouds?

Find out how sailors and farmers can forecast the weather by reading the skies.
Do you know of any other ways of predicting rain?

# Water Soaks

Find out which areas in your school ground are good at soaking up water. Explore your school ground for the areas listed below. Use your rain cloud and observe what happens when raindrops hit the ground in these different spots.

| Area | Observation |
|---|---|
| grassy slope | |
| hard bare slope (where people walk) | |
| moist leaf litter or other mulch | |
| freshly turned soil (garden bed) | |
| low growing plants (creepers & ground covers) | |
| ashphalt/concrete/bricks | |
| other (describe) | |

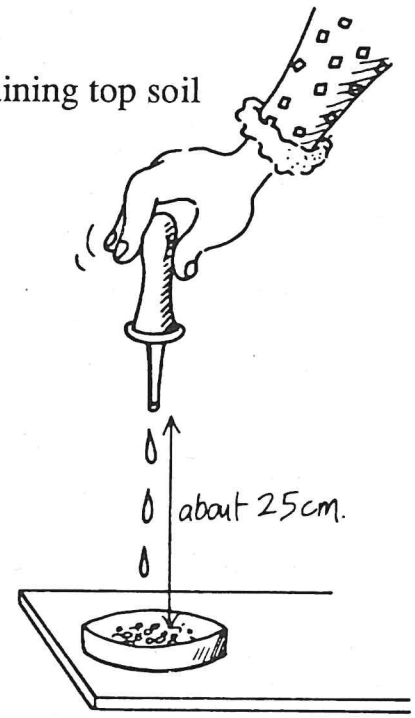

Which areas are best at soaking up water?
Why ?
In which areas does the water run off rapidly ?
Why ?
Next time it rains go outside with an umbrella and look at the same areas again.

# The Mighty Raindrop

A scientist once worked out that more than one kilogram of soil could be blasted into the air from four square metres of bare soil during a violent rainstorm. The following experiment will show you how this can happen.

## Materials

- 3 sheets of white paper
- 1 watch glass, petri dish or a shallow small tin containing top soil
- 1 small jar containing water
- 1 eye dropper
- 1 spoon or icecream stick
- Condy's crystals
- 1 apron or old shirt to protect your clothes
- plasticine




## What to Do

1. Place the first sheet of paper on a flat surface. Put the container of soil in the centre of the sheet.
Sprinkle a few grains of Condy's crystals over the top of the soil.
Using the dropper, let several drops of water fall on to the soil from a height of about 25 centimetres.
What happens ? Do you get coloured splashes on the paper ?
Let your paper dry and label it *splash pattern- flat surface.*

- Are the splash patterns the same ?

- What is the name for this ?
  E_ _ _ _ _ _

2. Repeat this test with the remaining two sheets.
Put the second sheet on a gently sloping surface. (You will need to support the paper using a board or book.)
Use the plasticine to hold the soil container in place.
Label this sheet *splash pattern- gentle slope.*

3. Put the third sheet on a steep slope. Label this one *splash pattern - steep slope.* Show the direction of the slope by drawing arrows.

- Can falling raindrops move soil away ?

- What type of surface is it most likely to happen on ?

# Making Catchments

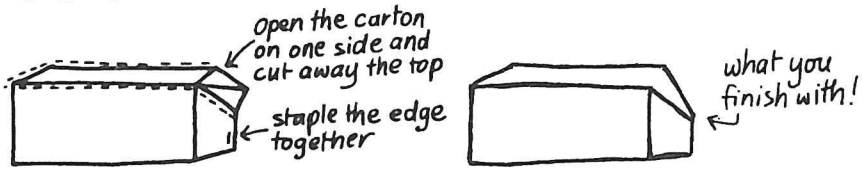
Raindrops land on the ground and are soaked up by the soil and litter. However in heavy rain some water will run down slopes and wash soil away. In this experiment you will make different catchments to see how running water causes soil erosion.

## Materials

- 2 milk or fruit juice cartons (2 litre size)
- scissors
- soil
- mulch material (leaves, bark, sawdust, twigs, grass, clippings etc)
- margarine containers
- watering can or "clouds"(from previous activity)

## What to Do

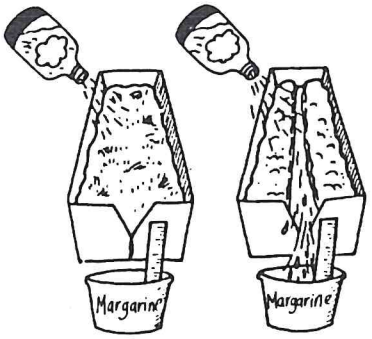
1. With the pouring side face up, prepare the cartons by cutting out the section marked in the diagram.




2. Fill the cartons with soil.

3. Place a layer of mulch material over the soil in one of the cartons.

4. Incline the two cartons to represent a slope.
   Place the margarine containers at the base.



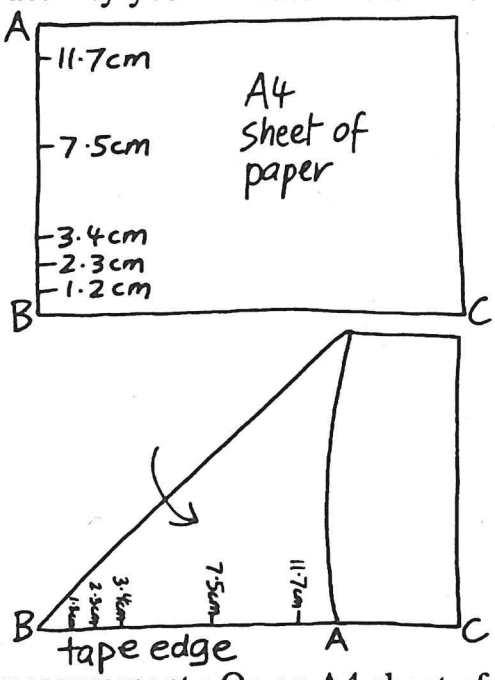

Now you have two different catchments.
Sprinkle the same amount of water over each catchment and measure the time it takes for the water to flow into the container at the base.
Measure the amount of water in the containers.

| | Catchment A | Catchment B |
|---|---|---|
| Water at start | | |
| Water at finish | | |
| Time taken | | |

Which catchment is more likely to have soil erosion problems?

# A Taste of Salt

It's OK to have salt on fish and chips or on the odd baked potato, but in soils it is a real problem. This is because salt kills plants by reducing their ability to take up water. And when salt gets into our water supply catchments we really start to notice the problem. In this activity you will taste water with different concentrations of salt.





## Materials (class activity)

- distilled water (6 litres)
- table salt
- five one litre containers
- cotton wool buds (6 per student)
- 1 sheet of A4 sized paper
- ruler
- pencil
- adhesive tape

## What to Do

1. Prepare a paper cone for salt measurement : On an A4 sheet of paper label the corners A B and C as shown in the diagram.
   Use a ruler to measure the following graduations on the AB edge. (corner B is zero)
   - 1.2 cm = 0.15g - fresh water
   - 2.3 cm = 1.00g - marginal water
   - 3.4 cm = 3.00g - brackish water
   - 7.5 cm = 35.00g - sea water
   - 11.7 cm = 130.00g - Barr Creek(a tributary of the Murray River)

   Turn the paper over and trace the graduations and mark on the grams again.

   Make up the cone by bringing the A corner to the B C edge and securing with adhesive tape. ( Do not overlap the edges)

2. Use your paper cone to measure salt quantities for each solution.
   Pour in salt to required graduation holding cone up to light, to match with the line.

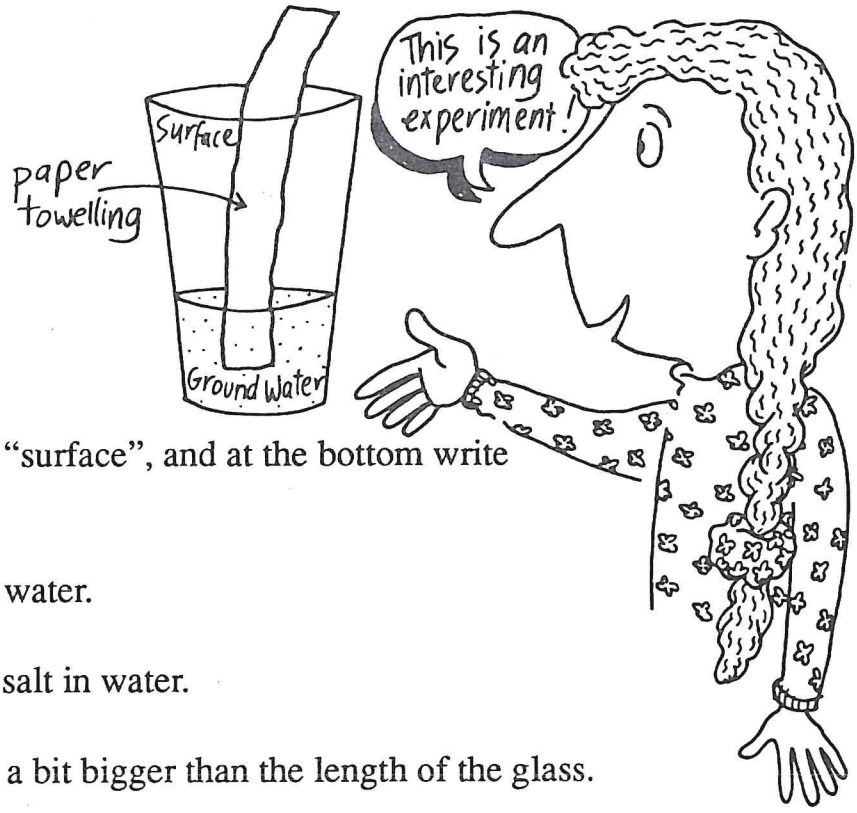
3. Prepare the six salt solutions by filling the one-litre containers with distilled water and adding the measured quantities of salt.

Taste each of the five solutions by dipping cotton buds and placing on your tongue.

# Travelling with Salt

When white people arrived in Australia they did not understand the Australian environment.They used farming methods that worked well in Europe but created disasters for Australian soils.The landscape and soils are different, the climate is different. The white settlers tried to make a living off the land the only way they knew – by clearing vegetation including deep-rooted native trees and grasses. These activities have caused our water tables to rise, bringing salt to the surface in lots of areas.

This experiment will show you how salt rises to the surface so that you will be one step closer to understanding the Australian environment with one of its famous soil robbers - SALINITY.




## Materials

- tall drinking glass
- paper towelling
- water
- salt

## What to Do

1. Near the top of glass write "surface", and at the bottom write "ground water".

2. Fill one third of glass with water.

3. Dissolve two teaspoons of salt in water.

4. Cut a paper towelling strip a bit bigger than the length of the glass. Label the strip "soil".

5. Place the paper towel strip in glass so that one end is dipped in the water and the other end is overlapping the top of the glass.

6. Observe what happens.

7. Tear off a small piece of wet paper at the end of the strip and place it on your tongue. What can you taste?

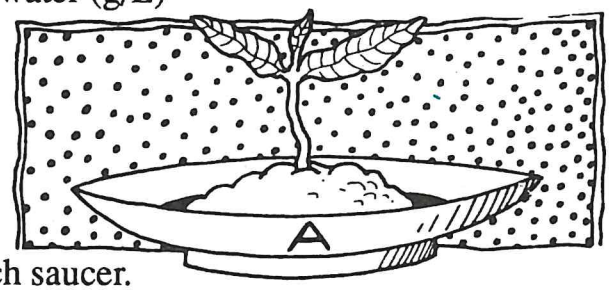
8. Remove towelling from water and place in a warm position. Observe the surface after the water has evaporated.

# A Salty Birth

Salt kills plants by reducing their ability to take up water so they end up dying of starvation.This experiment will show you the effect of salt on seed germination.

## Materials

- seeds (alfalfa, wheat, mung or bean)
- 5 saucers
- cotton wool
- distilled water
- 5 salt solutions of the following concentrations in plastic 'squirt' bottles
  - A- distilled water
  - B - 2.5 grams salt per litre distilled water (g/L)
  - C - 5 g/L
  - D - 10g/L
  - E - 15 g/L




## What to Do

1. Place cotton wool in the base of each saucer.

2. Label saucers A to E.

3. Spread seeds (not too thickly) across the cotton wool in each dish.

4. Water each saucer with its matching solution. Dish A with solution A (distilled water), Dish B with solution B (2.5 g salt per litre) etc.

5. Place saucers in a safe place (need not be in sunlight).

6. Check every day and add solution as necessary to keep the seeds moist.

Count the number of seeds which germinate over a period of two weeks. Record your observations on a chart.
What conclusions can you draw about the effect of salt on germination?

# All Washed Up

When water runs over the soil surface, it can erode the soil in different ways, depending on the type of soil and whether the soil is protected with a cover of vegetation.

## Materials

- a hose with an adjustable nozzle

## What to Do

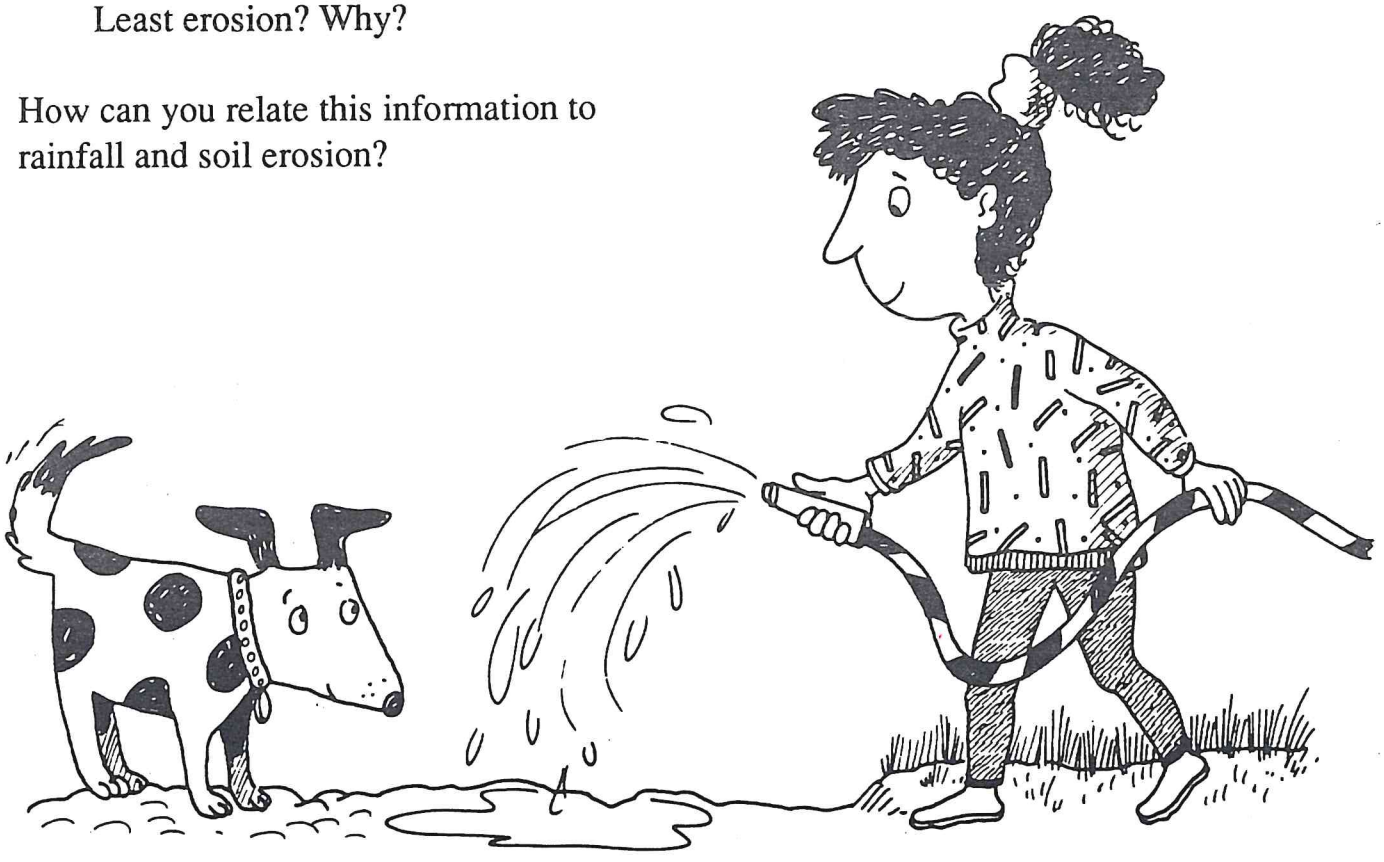
Find an area in your school ground with freshly dug soil such as a garden bed.

1. Set the spray nozzle to a medium spray. Spray onto bare ground and observe soil movement. You may notice small gutters and channels forming as water runs away. Do you know the name for this type of erosion?

2. Do the same activity on steeply sloping and flat bare ground.
   In which situation is there more erosion?

3. Vary the amount of water spray by changing the hose nozzle.
   What type of spray (light, medium or heavy) caused most erosion?
   Least erosion? Why?

How can you relate this information to rainfall and soil erosion?



## CURRICULUM LINKS
### Year 5

**Social Studies**

Western Australian Landscapes. Obj. 1.3.
Natural environments influence human lifestyles and activities. Obj. 2.1.
Heritage of the past. Obj. 1.1, 2.2, 3.1, & 3.6.

**Science**

Plants, matter, water (properties).

**Language (First Steps)**

Oral sharing. Narrative, Recount, and Description writing.

**Education Department Student Outcomes**
(working edition)

**Studies of Society and Environment**

***Strand*: Investigation, Communication and Participation.** At level 3 the student: 3.2 - presents information to explore a key idea.
***Strand*: Place and Spaces.** At Level 3 the student: 3.9 - identifies issues about care of places arising from the different ways in which they are valued.
***Strand*: Natural and Social Systems.** At Level 3 the student: 3.16 - describes an example of a cycle within natural systems and the place of people in it.

**Science**

***Strand*: Earth and Beyond.** At level 3 the student: 3.7 - illustrates ways that use of the earth's resources changes the physical environment.

## CURRICULUM LINKS
### Year 6

**Social Studies**

Water Resources, Obj. 1.1., 1.2., 2.1., 2.3.
Sharing the Environment, Obj. 1.1., 1.2., 1.4., 2.1., 3.1., 3.2., 3.3. ,3.4.
Communities, Obj.2.1.

**Science**

Transpiration (Primary Science Teachers' Source book pp. 17–22)
Rocks; Plant responses; Water pollution control.

**Language (First Steps)**
Oral sharing. Narrative, Recount, and Description writing.

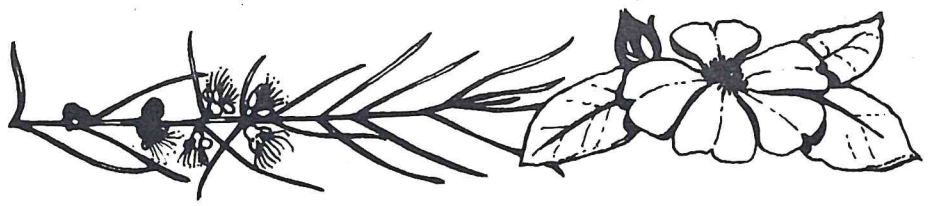
**Education Department Student Outcomes**
(working edition)

**Studies of Society and Environment**

***Strand*: Place and Spaces.** At level 4 the student: describes different views of individuals and groups about issues related to the care of places.
***Strand*: Resources.** At Level 4 the student: 4.13 - describes factors that affect resource use and development.
***Strand*: Natural and Social Systems.** At Level 4 the student: 4.18 - identifies decisions that have to be made by groups and individuals about production and consumption.

**Science**

***Strand*: Life and Living.** At Level 4 the student: 4.13 - identifies events that effect balance in an ecosystem.



## CURRICULUM LINKS
### Year 7

**Social Studies**

Interacting with the Environment. Obj. 1.1, 1.2, 2.10.
Mineral Resources. Obj. 2.1.
Co-operation and Conflict. Obj. 1.3, 2.1.

**Science**

Matter around us - resource conservation (21); living together (28).

**Language (First Steps)**

Informal debates. Narrative, Recount, and Description writing.

**Education Department Student Outcomes**
(working edition)

**Studies of Society and Environment**

***Strand*: Place and Spaces.** At Level 4 the student: 4.9. - describes different views of individuals and groups about issues related to the care of places.
***Strand*: Resources.** At Level 4 the student: 4.13. - describes factors that affect resource use and development.
***Strand*: Natural and Social Systems.** At level 4 the student: 4.18. - identifies decisions that have to be made by groups and individuals about production and consumption.

**Science**

***Strand*: Life and Living.** At Level 4 the student: 4.13 - identifies factors that affect balance in an ecosystem.

## RESOURCES

**# Indicates resources of greatest value to this program**

The Department of Conservation and Land Management (CALM)
Phone (09) 334 0437, or fax (09) 334 0498. CALM has the following resource notes available:

**# Resource Note No. 11,** Jan 1990. *What is Dieback?*
**Resource Note No. 12**, Jan 1990. *Controlling Dieback in W.A.'s National Parks and Forests.*
**# Resource Note No. 16,** April 1988 *Prescribed Burns: Fighting Fire with Fire.*

**The Water Corporation** (formerly the Water Authority of Western Australia) has prepared a number of topic sheets to educate students about water. The sheets contain teacher background notes and many suggested activities which can be done before or after your excursion to the Helena Reservoir catchment. They are available from WA Gould League at $10.00 per copy. Phone (09) 387 6079, or fax (09) 387 3492.

**# Primary Ed. Year 6 Topic Sheet No. 2,** May 1994. *Groundwater in Western Australia.*
**# Primary Ed. Year 5 Topic Sheet No. 8**, Oct 1994. *Catchments: Catching Water at Our School.*
**# Primary Ed. Year 6 Topic Sheet No. 9**, Oct 1994. *Water, More Precious than Gold.*
**Primary Ed Year 6 Topic Sheet No. 11,** May 1995. *Perth's Water Supply.*

**Video:** *What is Groundwater?* $20 per copy.

**Other Resources**
**# Department of Conservation and Natural Resources, Victoria**. *LandCare for Kids.*
Available from Agriculture WA for $10.00. Phone (096) 22 6151, or fax (096) 22 1902.
Distributed to all WA State schools in 1992.

**# Department of Conservation and Land Management**, 1993. *Discovering The Hills Forest—teacher resource package.* Part of an environmental education program on WA jarrah forest for Year 6 and 7 students. Phone (09) 295 2244, or fax (09) 295 3247.

**Rigby**. Science Alive Series. *Water, Water Everywhere.* Unit for Middle–Upper Primary.
Phone (09) 244 1700, or fax (09) 446 1661.

**The Peel District Education Office and the Peel Inlet Management Authority**, March 1991. *Caring for Our Waterways: Peel-Harvey Estuary Education Programme.*

**Water Corporation Regional Offices**. **Perth North**: Phone (09) 440 7868, or fax (09) 440 7722 **Perth South**: Phone (09) 431 8292, or fax (09) 431 8199. The Water Corporation has the following resource notes available:

*Perth's Water Supply System*, Jan 1992.
*Perth's Water Supply,* March 1992. Water Topic 1,
*Water Supply Schemes,* March 1992. Water Topic 2,
*Water Terminology,* Sept 1992. Water Topic 11.
Poster: *The Water Path.*

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