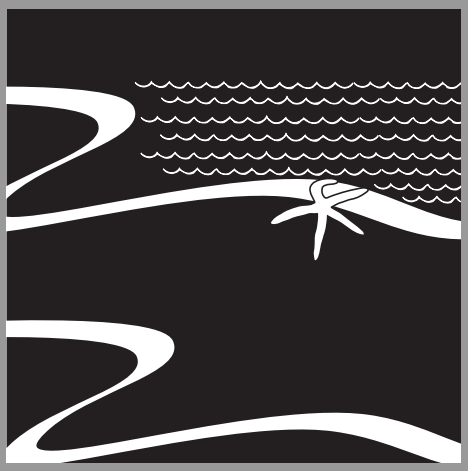
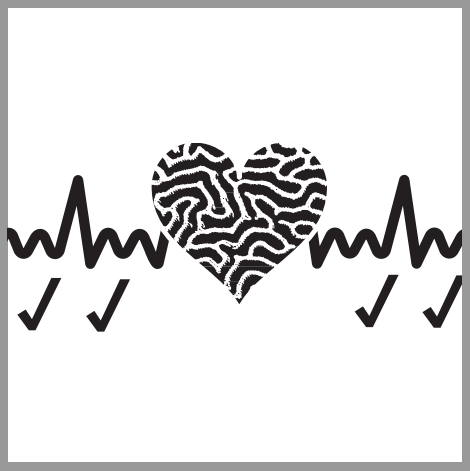
Australian Government

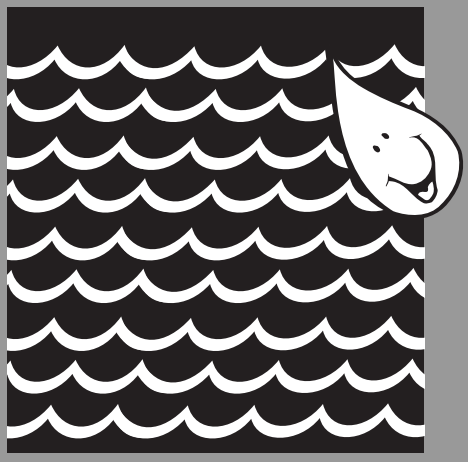
Great Barrier Reef
Marine Park Authority

Reef Beat Catchments to Coast

A Great Barrier Reef Marine Park Authority and Newspapers in Education Initiative







let's keep it great

INTRODUCTION

Reef Beat

Reef Beat – Catchments to Coast is a product of the Great Barrier Reef Marine Park Authority.

Reef Beat – Catchments to Coast provides students and teachers with information about the connectivity between catchments and the Great Barrier Reef. Activities and feature articles included in this program enable students and teachers to learn more about their local catchments and the Great Barrier Reef, while also helping them to become involved in the recovery of our precious land and reef communities by assisting to improve the quality of water entering the Reef.

The feature articles about the Great Barrier Reef found in the NIE section of your local newspaper can be cut, marked on and pasted by even very young students. While for older students they help to develop independent reading skills, improve vocabulary, enhance comprehension and critical thinking and increase their knowledge about the Great Barrier Reef.

The charter of the Great Barrier Reef Marine Park Authority's Education Unit is to deliver education programs and activities about the Great Barrier Reef Marine Park and World Heritage Area throughout Australia.

To meet this charter, the Education Unit has developed a range of new programs and educational activities that deliver key Great Barrier Reef Marine Park Authority messages. These can all be found online at ***www.reefed.edu.au***

For enquiries about the *'Reef Beat'* resource please contact:

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Australian Government

Great Barrier Reef Marine Park Authority

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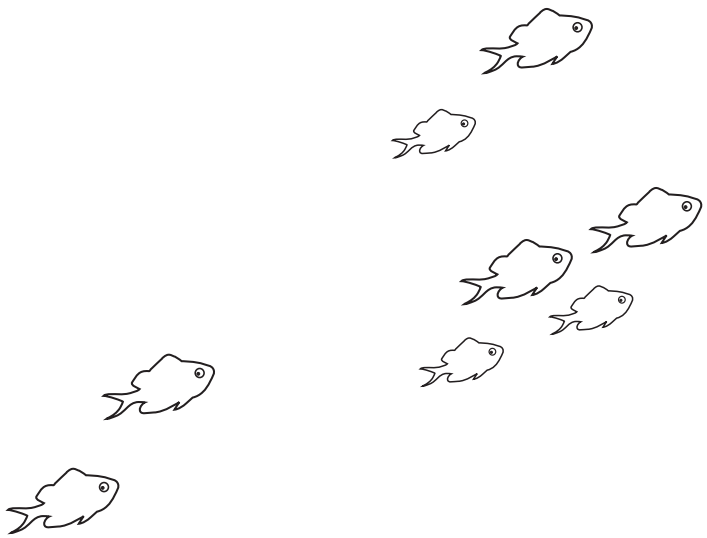


THE RATIONALE

Good water quality is the reason why the Great Barrier Reef is one of the most beautiful, diverse and complex ecosystems in the world. Reefs grow best in waters that have naturally low concentrations of nutrients (nitrogen and phosphorus) and sediments. Excessive amounts of sediments, nutrients and chemical pollutants in the water can harm the Great Barrier Reef and all the living things it supports.

The Great Barrier Reef Catchment is the predominant source of pollution to the Great Barrier Reef Marine Park. The way in which the land is used and managed affects the quality of water in our rivers, estuaries and the Reef, particularly in inshore areas close to the coast.

The Great Barrier Reef Marine Park Authority (GBRMPA) recognises the need for schools to learn more about the effects of poor land management on the Great Barrier Reef. Therefore, the GBRMPA aims to offer support for schools by providing valuable and appropriate information and resources about managing and caring for the Reef. The GBRMPA's goal is to foster an understanding of, and support for, ecologically sustainable reef management in line with Government policy. The GBRMPA is concerned with conservation of biological diversity, environmental protection, economic development, community use and the recognition of the range of benefits that the reef provides.

Through education the GBRMPA promotes:

- An understanding and appreciation of the values of the Great Barrier Reef and its biological diversity
- An understanding of conservation and management issues in the Great Barrier Reef Marine Park
- Appropriate values towards the species, habitats and ecosystems in the Great Barrier Reef Marine Park, and
- Skills useful for understanding the reef environment and the pressures affecting it.

The aim of this resource is to help teachers and students understand the nature of the Great Barrier Reef Catchment and its affect on local marine environments. Students and teachers will learn more about the Great Barrier Reef and the management of human impacts on the land and in the sea. The 'Reef Beat' series will encourage students and teachers to explore catchment to coast matters related to Studies of Society and Environment and Science plus other learning areas in school years 4-9.

The resource also aims to increase awareness about the importance of good water quality and catchment care and the effects of poor water quality on the Great Barrier Reef. Through these messages, all schools are encouraged to actively adopt best environmental practices, both on land and in the water.

WHY GET INVOLVED?

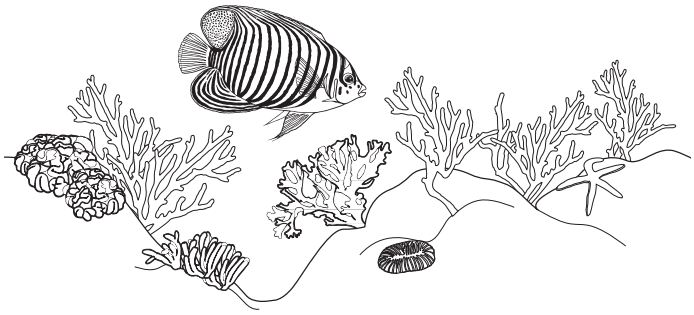
Caring for catchments and better land management is essential to the survival of the Great Barrier Reef.

Catchments link the land to the Reef. Therefore, what we do on the land affects the water that flows into the Reef. It's important to care for catchment areas to ensure they are protected and can provide friendly support to the Great Barrier Reef ecosystem. Protection for 'riparian areas' – vegetation that grows alongside the rivers – is vital as they stabilise riverbanks, 'trap' polluted runoff and provide homes and food for a diverse range of animals.

The Great Barrier Reef is under pressure. Some clear indications include:

- Elevated levels of nutrients and sediments flowing into the Marine Park each year from rivers and estuaries
- Crown of thorns starfish outbreaks
- Coral bleaching events, and
- Continual alarming declines in some of our threatened species, such as dugong and loggerhead turtles.

To turn this around, all communities are invited to become informed about best environmental practices and to adopt a code of behaviour that is best for the Reef.

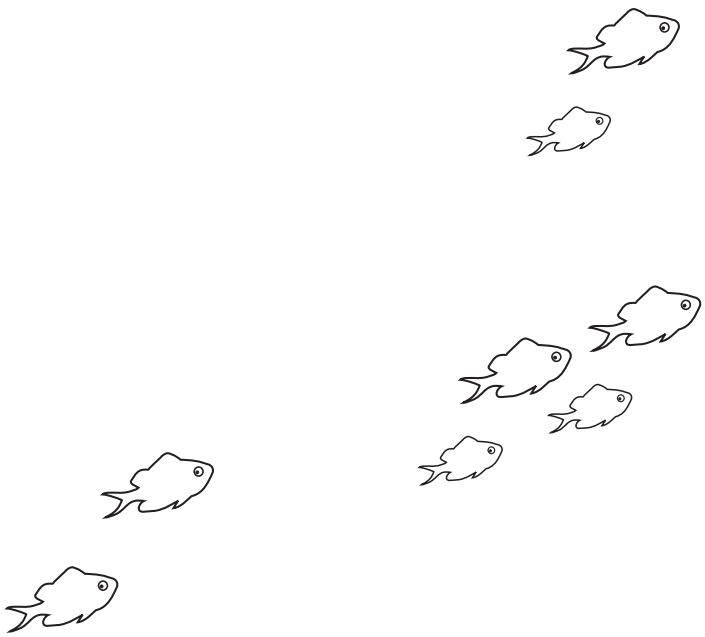


HOW TO USE THIS RESOURCE

The activities within this resource can support teachers:

- When planning learning activities which focus on the Great Barrier Reef Catchment and its connection to the Reef;
- To give students opportunities to explore the current ways we use, value and manage catchments and their impacts on the Great Barrier Reef;
- To take an active role in teaching about catchments and the Great Barrier Reef;
- To contribute to the responsible development of our future citizens and the relationship with both the catchment and the Great Barrier Reef; and
- To empower students to take positive action for sustainable reef management, and to support the principles of ecological sustainability.

You can use this resource to plan, provoke, stimulate, support and inspire your teaching and learning program.



OBJECTIVES

- **To have fun** and appreciate the Great Barrier Reef.
- **To support curriculum** in schools.
- **To promote good classroom practice** and the sharing of it.
- **To promote discussion** of the Great Barrier Reef issues within education.
- **To support, value, and encourage** all individuals involved.
- **To develop ownership and responsibility** in the community for the Great Barrier Reef.
- **To encourage commitment** of individuals, classes, schools, and communities to think, make decisions and take action in order to conserve and protect the Great Barrier Reef Marine Park.

Activities for use with Feature 1 *'Our Reef ecosystem'*

Activities for English

Activity 1

Read the feature article and write your own centre spread for a newspaper.

Guidelines:

- Include an interesting and eye-catching headline.
- The opening paragraph should draw the reader into the story and include who, what, when, where and why.
- Use sub-headings to break up the text.
- Include a by-line on the page.
- Use short paragraphs.
- Include photographs or illustrations you have drawn or find some pictures from travel brochures.
- Use the media releases from the Great Barrier Reef Marine Park Authority website at www.gbrmpa.gov.au, or the 2003 Reef Beat feature articles found in the 'Media Centre' on the Reef ED website at www.reefed.edu.au
- Include a mention of the resources you have used.
- Decide whether it will be a background piece or an analytical piece.
- The centrespread should be planned out well with headlines, sub-headings, text, illustrations/photographs and resources.
- The feature should be 1000 words to 1200 words long.

A guide to feature writing

A feature story is sometimes about a particular topic that is currently in the news. Aims of a feature story may be to provide background information or to provide an analytical piece explaining what has happened and what might occur in the future.

Using viewing opportunities

Activity 2

Visit the GBRMPA website www.gbrmpa.gov.au or Reef ED website www.reefed.edu.au to access images from the *Image Collection* and ask the following types of questions:

- Where is it?
- What is it like?
- Why is it there?
- How should it be altered or managed?

Activity 3

Identify features on photographs and pictures. Interpret information conveyed in a photograph or picture by asking questions such as:

- What title would be appropriate for the photograph?
- What catches the eye?
- What can you see in the background?
- What are the significant details?
- What type of aquatic environment is it?
- What season so you think it is?
- What do you think is outside the photo frame?
- What might happen in the future to this scene?

Activity 4

Encourage questioning and analysis of photographs by asking questions like:

- What do you see?
- How does the picture make you feel?
- What are the issues?
- What are the connections with other places?
- What else could the photographer have shown, but didn't, and why didn't he/she?
- What different options might there be?
- Why did the photographer take the photograph and why did he/she take it in such a way?
- What are he key questions that the photograph raises?

Activity 5

List key words, names, animals, plants, natural resources, lifestyle issues, natural environments, built environments, habitats, views of the coastal waters, uses of water, views of teamwork, environmental ethics, environmental management practices and make links between them. For example:

- Devise a flow chart
- Design a concept map/mind map
- Use key words as flashcards for a classroom game and quiz.

Activity 6

Create signs, posters, television advertisements or web page.

Students can identify:

- Major value of the Great Barrier Reef
- What the Great Barrier Reef provides
- How the area is managed to supply a continuous range of attractions.

They then use this information to produce signs, posters, television advertisement or a web page to promote the Great Barrier Reef.

Activity 7

Read and discuss picture books, fiction and non-*fiction* *materials with a setting, such as Where the Forest Meets the Sea, A House for a Hermit Crab, A fish out of Water* or use other titles from the reference list. Make a frieze of Great Barrier Reef activities including recreational, work-related and environmental activities. Students take turns to make statements about why certain areas of the Great Barrier Reef are important to them.

Activity 8

Design survey questions as a class. Students should ask six people why they might go to the Great Barrier Reef. Graph these results. Students write and illustrate their own reasons for wanting to visit the Great Barrier Reef. Talk with students specifically about the Great Barrier Reef and how it differs from local swimming beaches. Describe the fragile and important natural environment that makes up the Great Barrier Reef. Talk about the coral reef forests, creeks, sandy beaches, old coastal sand dunes, mudflats and mud banks. Introduce terms such as saltmarsh flats, mudflats, tides, intertidal zone and levee banks. As a class, decide upon five reasons for going to the Great Barrier Reef.

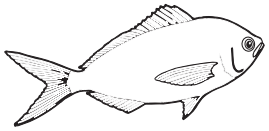
Activity 9

Promote the Great Barrier Reef and its attractions. Try:

- Writing a song or poem
- Producing a play
- Displaying posters in community areas
- Sending letters to others about the Great Barrier Reef
- Talking to students in other classes
- Producing a small booklet and donating it to the school library.

Activity 10

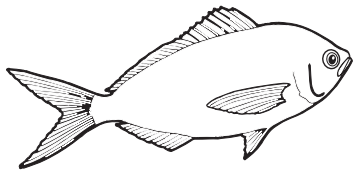
As a class **make a list of actions** that individuals or groups may be able to take to help others understand more about marine areas like the Great Barrier Reef, its fragile environment and issues that affect it. Educating others will help to ensure we are better equipped to meet the challenges and threats to our marine environments in the future. Once the list is compiled, do a PMI (Plus, Minus, Interesting) on each proposed action to determine which are most appropriate.

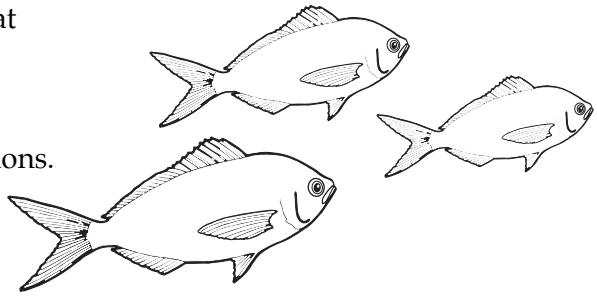


Activity 11

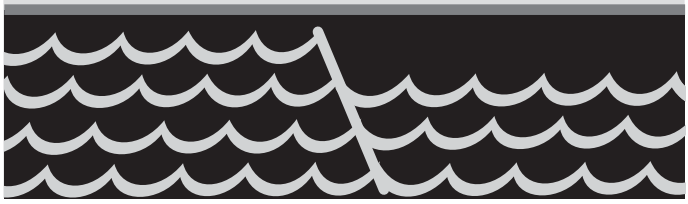
In small groups, give students the task of marketing the Great Barrier Reef to an audience. Some possible forms of expression include a:

- Web page
- Brochure
- Segment for a television show or radio program
- Case study for a journal or newspaper
- T-shirt, cap or bag with an appropriate slogan
- Piece of visual art.





Activities for use with **Feature 2**
'Our catchment area'



Activities for SOSE

Activity 1
Read the second feature article about your catchment area. Talk about what a catchment is and the catchment areas in your regions that flow into the Great Barrier Reef.

Activity 2
View photographs, pictures, postcards, holiday brochures or calendars that feature a catchment area or basin of land which is bounded by natural features such as hills or mountains, from which all run-off water flows to a low point. Locate the natural resources that can be seen.

After viewing, discuss the following:
- What might this area have once looked like?
- Who or what might have once lived in this area?
- What might be living there now?
- In what ways might the area have changed?
- What has remained the same?
- What changes might happen in the future?

Activity 3
Using overhead transparencies and pens or tracing paper and pencils, ask students to draw an outline of the shapes in the photograph/picture and to label these using appropriate language; eg hill(s), valley(ies), river(s), forest(s), bare rock, road(s), drain(s) etc.

Discuss aspects of the pictures/photographs and consider the ways we use and need water, soil, flora and air. List these under the headings below. The lists may include things such as:

Water	*Soil*	*Flora*	*Fauna*	*Air*
Drinking	Farms	Food	Food	To breath
Washing	Remnant vegetation	Shade		Recreation
Recreation	Roads	Shelter		
Irrigation	Towns/cities	Aesthetics		
Watering	National parks	Colour		
Gardens				

Activity 4
List additional natural resources or land uses found in the catchment area. These will vary greatly but some of the following may be found:

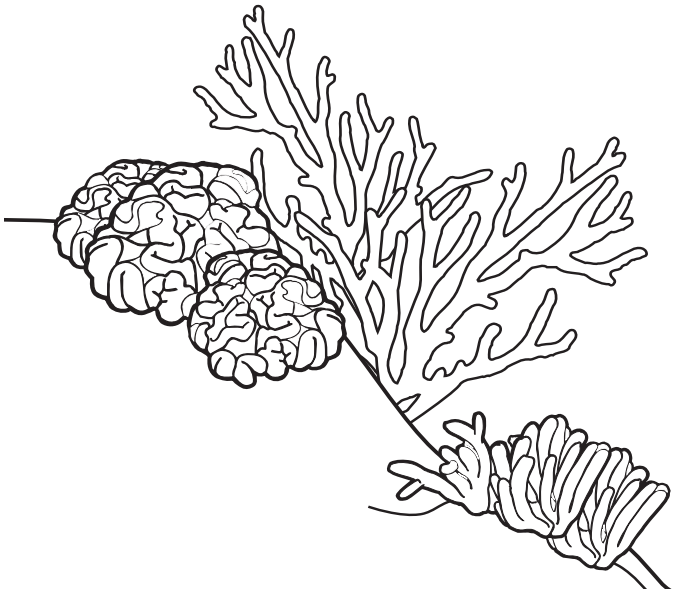
Crops and pastures
remnant vegetation
solar pumps
People
irrigation systems
recreational facilities
Homes
cities and towns
sewerage systems
Gardens
dams
erosion
Domestic animals
wetlands
industries

Discuss the concepts found and encourage students to share and compare their understandings of the terms.

Activity 5

Using students' knowledge of their local area, compare and contrast the catchment images on the Reef Beat feature article page with the area in which the students live. Discussion questions might include:

- What is our catchment like?
- What colours do you see in the catchment? What does this indicate?
- What water sources can be found in our catchment? How does the quality of these waters vary?
- What does the land look like?
- What places use the water before us?
- What places use the water after us?
- Do we have farming in our catchment?
- If so, what type of farming?
- Do we have sealed areas in our catchment? What types?
- Do we have national parks in our catchment?
- What Indigenous or European heritage sites are to be found in our catchment?
- Why might people have settled in our catchment?
- What types of animals live in our catchment?
- How do they survive?
- What types of trees, shrubs, grasses etc are there?
- What do the people who live ere do in the catchment?
- What would the catchment have been like 200 years ago?



Investigate your catchment

Activity 1

Prepare a short description of the landscape features of the catchment in the local area. For example:

Description of area:

Landform			
Plain	Estuary	Mudflat	Billabong
Lowland	Coast	Wetland	Creek
Plateau	Narrow valley	Beach	River
Mountain	Broad valley	Dune	Lake
Cliff	Deep gorge	Hill	Mangroves
Slopes			
Vertical	Steep	Gently sloping	Undulating
Flat			
Vegetation			
Dense forest	Dense mixed species	Grassy woodland	Open scrub Closed scrub
Swamp vegetation	Bracken	Reeds	Rainforest
Cultivated land			
Arable land	Horticultural land	Improved pastures	Parkland
Cane fields	Banana plantations	Pineapple plantations	Mango orchards
Small isolated features			
Isolated trees	Small shelter belts	Groups of trees	Small gardens
Structures			
Buildings	Fences	Walls	Farmyards
Telephone wires	Electricity pylons	Car parks	Quarries
Industrial land	Derelict land	Rubbish dumps	

Students could now describe the local catchment area using descriptive language. Describe in terms of:

- Scale eg large, vast, small, intimate
- Space eg exposed, open, enclosed, tight
- Balance eg harmonious, chaotic, discordant, well balanced
- Movement eg frantic, lively, busy, dead, calm
- Texture eg coarse, grained, rough, smooth
- Naturalness eg undisturbed, remote, unmanaged, wild
- Colour eg colourful, subtle
- Smell eg pleasant, unpleasant
- Beauty eg ugly, uninspiring, attractive, majestic, picturesque

If you live or teach in a rural area, undertake similar activities with your students to consider the features of the catchment. For example, is there evidence of:

- Grass cover
- Area of trees
- Health of plants being cultivated
- Erosion
- Contouring
- Windbreaks
- Stubble retention
- Controlled grazing
- Fertilising
- Muddy creeks
- Dry creek beds.

Consider also whether there is any evidence to suggest a need for contouring, windbreaks, stubble retention, mulching, or controlled grazing of livestock.

Land uses in a catchment

Did you know that activities in the catchment adjacent to the Great Barrier Reef are affecting the quality of water flowing to the Great Barrier Reef World Heritage Area?

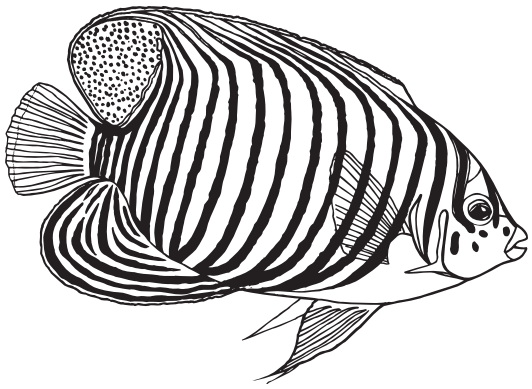
Activity 2

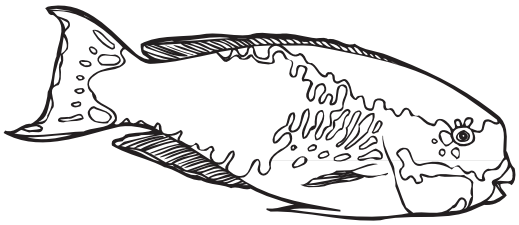
Discuss any known land uses in the catchment. Use a map of the area and fill it in to include class knowledge of land uses in the catchment area.

Activity 3

Consider how water flowing off different land use areas might affect other areas at lower points in the catchment, in particular the Great Barrier Reef. Some land use areas to consider might include:

- Patchy pasture areas covering a moderately steep slope and surrounded by bare soil exposed to rain and water
- Urban areas, streets lined with deciduous trees, bitumen roads, heavy traffic, kerbs, side entry points exposed to rain and water
- Cleared forest areas with only a few larger trees and understorey plants remaining that are exposed to rain and water which drains down to a river
- Creek devoid of stable vegetated riparian zone. A build up of silt in the creek bed causing change to water flows and fish habitats.





Activity 4

Consider these land use issues in your own catchment area and how these might affect areas at lower points in your catchment, in particular the waters of the Great Barrier Reef.

Land use	*Effect on area*	*Effect through catchment area; eg downstream and onto the Great Barrier Reef*

Present results of investigations relating to the different areas of a catchment.

Catchment Issues

Activity 5

The use and abuse of catchments.

The quality of the water coming from a catchment is determined by a variety of factors, the most important being land use within the area. During a visit to your local catchment area, get students to identify the types of land uses they see and reflect on those you may have passed as you travelled there. **Make a checklist** and tick them off as you see them.

Activity 6

List the types of land degradation or pollution that you see (eg soil erosion, soil salinisation, air pollution, stormwater entering the stream/river, industrial waste entering the stream/river, unhealthy trees, weeds and pest animals, degraded stream banks and so on). Identify the causes of these problems and suggest possible solutions, which will help to improve the health of the catchment and its water quality.

Prepare a report in the form of a poster or written report and present to the class.

Type of land use	*Present (✓) or absent (x)*	*Comments*
Grazing - beef cattle		
Grazing - horses		
Grazing - other		
Potato growing		
Fruit orchards		
Market gardening/ vegetables		
Vineyards		
Forests - plantations		
Woodlots		
Native vegetation		
National Parks		
Quarries		
Mines		
Towns/urban areas		
Dams		
Industrial sites		
Salt pans		
Aquaculture farms		
Other - add any others you see		

Decide if any of these land uses are likely to pollute the water that eventually runs into the coastal/ mangrove area and the sea and why?

Activity 7

Discuss with the class what they think is the difference between a healthy and an unhealthy catchment.

Activity 8

Assess the condition of the land around the rivers and creeks in your local catchment.

Activity 9

Describe the land (more than one term may apply) eg flat, gentle slope, steep slope, river valley, hilly.

Activity 10

Identify the land uses eg urban areas, houses, farms, dams, factories, fences, grazing animals, orchards, market gardens, vineyards, roads, railways, field crops, quarries, mines.

Describe the soil

eg dry, moist, wet

colour - red, yellow, brown, white, grey, black

texture - sandy, silty, clay, rocky

erosion - none, sheet erosion, tunnel erosion, gully erosion

vegetation cover - native vegetation, planted trees and shrubs, pasture grasses, crops

What land uses are appropriate for this area in order to protect the quality of the water from the catchment? What should the land not be used for?

Activity 11

Site Evaluation

Using the table below, students should evaluate the condition of the land around them and add other headings to the list as they go.

Site:					
Date:	*Excellent*	*Good*	*Fair*	*Poor*	*Very poor*
grass/pasture cover					
health of trees/shrubs					
tree cover					
humus content of soil					

Is there evidence of:	*Yes*	*No*
crop cultivation		
cattle grazing		
horse grazing		
other animals grazing		
Feral animal damage		
water supply		
sheet erosion		
rill erosion		
gully erosion		
tunnel erosion		
wind erosion		
contouring/terracing		
wind breaks		
woodlots		
remnant trees/vegetation weeds		

Activity 12
Create slogans, which promote involvement in managing a catchment resource in a manner that will ensure the conservation and sustainability of catchment resources and their uses.

Activity 13
Write to lead agencies about measures being undertaken to reduce land degradation and rehabilitate catchments.

Activity 14
Devise a community newsletter encouraging involvement in the development of a catchment management plan to ensure that the vital resources are conserved for the future.

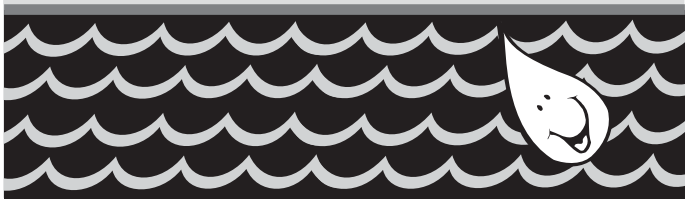
Programs for a healthier catchment
Landcare, Waterwatch, Seagrass Watch, Coastcare, and Dunecare are some of the movements and groups that involve communities and individuals who are concerned about the sustainable management of our land, water, vegetation and marine resources. Investigate these organisations and how they care for catchments and catchment issues. Share findings and agree on an order of priorities for the organisation's programs.

Activity 15
Ask students which program they might most like to get involved with and why. Other possible questions are:
- What is this organisation's focus of concern?
- How does it want the future to be different?
- In what sort of action is it involved?
- How does it work to create change?

Activity 16
Encourage students in groups to list things that would help improve understanding about catchment issues for those who live in the catchment.

Activity 17
Using class meetings, discuss and decide upon how the school can help others know about catchment care and their role in it. Decide on how the school might also get actively involved. For example:
- Form a catchment group and promote a whole-school approach where policies, programs, cleaning practices and so on reflect living sustainability in the catchment
- Develop reduce, reuse and recycle projects
- Adopt a wetland and get involved in bank stabilisation, revegetation, creek and wildlife studies, stormwater quality monitoring and management actions
- Present public environmental education displays and performances to inform and involve the local community about how they can avoid adding wastes to the water flowing into either the rivers or creeks leading to the ocean and the Great Barrier Reef
- Form a Waterwatch group and implement a water quality monitoring program
- Develop action plans for identified sites, as well as the needs of the total catchment and set in motion an environmental program for the care of the catchment.

Activities for use with Feature 3
'Water in our catchment'



Activities for Science

Activity 1

Read feature article 3 and investigate water, soil and slope erosion in catchments.

Activity 2

Using the school grounds, go outside, look around and find small-scale drainage basins that reflect the relationship between valleys and hills on a larger scale. For example, downpipes and rooves on buildings. Consider that the hill tops are those areas where water soaks in, the valley sides are the slopes down which the water moves and the drain is the water channel, gutter, creek or river which collects and takes the water away.

Activity 3

Stormwater runoff has become a major source of pollutants entering many of our urban waterways. When it rains the water either:

- Infiltrates the ground or seeps into the soil to become groundwater
- Becomes run-off which flows across catchment surfaces
- Is lost through evaporation or evapotranspiration.

Kerbs and gutters act as good collection points for various types of litter such as leaf litter, dog droppings, plastics, paper and cans which often end up in the ocean and Great Barrier Reef.

Activity 4

Using the local area, focus on stormwater problems linked to drainage pathways and investigate the slope and water features. Collect information and make a map to show the area where the water soaks in (permeable ground) and where the water runs off (impermeable ground).

Land use and land management can have a profound effect on the quality of run-off generated by water during rainfall. The following activities enable students to investigate the variation in run-off for different types of land surfaces and land uses.

Run-off activity

Activity 5

Use the following instructions to **simulate surface run-off in a catchment:**

You will need four boxes of similar size, a piece of lawn, some soil, four blocks of wood and four buckets.

Use the above materials to replicate land surfaces in a catchment:

1. Put drain holes in one end of each box
2. Fill the boxes with soil
3. Top one of the boxes with a piece of lawn
4. Tilt the box gently on one block of wood and place a bucket at the lower end. Tilt the second, but ungrassed box at the same angle with a bucket at the lower end
5. Tilt the third box to the same degree and make a furrow down the slope
6. Tilt the fourth box at the same angle and make a furrow across the slope. Using a watering can, pour the same amount of water on each box from the same height
7. Use a stopwatch and record sheet to record how long it takes for the water to move through the soil from the start of pouring to the sound of the first drip into the buckets
8. Repeat the actions increasing the angle of the tilt.

Box number and description **Percolation time in minutes**

Box number & description	*0 degree tilt*	*10 degree tilt*	*20 degree tilt*	*60 degree tilt*
1 Grassed				
2 Bare soil				
3 Furrows up and down slope				
4 Furrows across slope				

After completing the above, drain the water away. Dry and weigh the sediment in the buckets to measure the amount of soil lost by erosion. Discuss the following:

- From which area has the most soil been eroded by the water?
- Has any topsoil moved?
- Has any vegetation been torn out by the water?

Observe and comment on:

- Volume of runoff
- Water quality or turbidity of runoff
- Water movement and soil surface during and after runoff.

Discuss which catchments have soil erosion problems and identify possible factors causing this.

Display the catchments for others to view and respond to. Using captions and questions, invite them to use the display and record their observations.

Activity 6

Look for areas on or near the school that have lost most of their vegetation cover. **Identify** areas that can be re-established with local species of grasses, bushes, reeds or trees. **Discuss** what needs to be done, what tools and materials are required and the reasons why something needs to be done. **Draw a plan** of the area indicating where improvements can be made. Discuss and develop the idea and take plans to the Principal and P&C Committee. Undertake natural vegetation replenishment of the school grounds or local watercourse.

Encourage students to **publicise their efforts** in the school newsletter and through articles in their local newspaper.

Water as a land shaping agent in catchments

Water in rivers and creeks, which flows downhill because of gravity, has the ability to remove material from the banks and beds of rivers and creeks and transport it along the water channel. Wind and water can wear away or erode the land's surface, reshape the land, re-arrange features of the land and even modify natural processes. The following activities enable students to investigate water as a land-shaping agent.

Activity 7

Look closely at the local environment for evidence of change. Find evidence of physical processes that change the environment. Discuss the physical processes that change the environment.

Consider the following questions:

- What are identifiable features of the local catchment?
- How were these features produced?
- What natural processes operate in the catchment?
- What human impact can be observed?
- How have human activities affected the catchment?

Activity 8

Focus on the physical landscape of catchments and farming areas. Take note of the shape of the land, the colour of the soil and rocks and note the presence or absence of vegetation. Find out what students already know about the process of water or rivers. Talk about the action of water as an erosion agent and how its action can constantly change the landscape. Investigate land shaping processes by collecting four hand-sized samples of each of the following and see how differing weathering agents can affect them.

- Modelling clay
- Fired clay (an old roof tile or terracotta pot)
- Limestone
- A broken brick
- Concrete.

Make a label for each and attach it to the samples with clear nail polish.

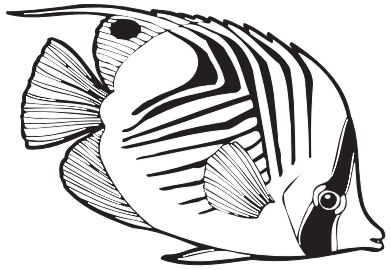
You will need: coarse sandpaper, concentrated lemon juice and water to act as erosion agents and a selection of wide-necked plastic containers with screw-on lids.

Using each of the different erosion agents on each of the samples, simulate weathering and erosion. Note which samples wear the most and which remain nearly unchanged.

Soak the samples in water in plastic containers. Measure the water height when samples are first covered, then again after one hour. Note the difference and observe any bubble formation.

Activity 9

Simulate mechanical weathering in areas that experience temperature extremes by placing the water soaked samples in a freezer overnight and then in the heat during the day. Try simulating chemical weathering by pouring lemon juice over samples and letting this stand for an hour or until the next day. Observe and record findings.



Use a chart similar to the one below to record findings observed. **Write a procedure** to explain what was undertaken in the activities.

Sample	*Sandpaper*	*Resulting debris*	*Water*	*Lemon juice*
Brick	Wears down Unchanged	Powder Gravel pieces	Soaks in Runs off	Fizzes No fizz
Granite	Wears down Unchanged	Powder Gravel pieces	Soaks in Runs off	Fizzes No fizz
Limestone	Wears down Unchanged	Powder Gravel pieces	Soaks in Runs off	Fizzes No fizz
Clay tile	Wears down Unchanged	Powder Gravel pieces	Soaks in Runs off	Fizzes No fizz
Concrete	Wears down Unchanged	Powder Gravel pieces	Soaks in Runs off	Fizzes No fizz

Apply the results by considering the durability of natural rocks and material in different environments in your catchment.

Activity 11

Use the local area and explore the types of natural rocks and materials located along local watercourses. Discuss which could erode riverbeds and banks during a rain event.

Using the information gained, **prepare a flow chart** to illustrate the possible sequence of events or illustrate the various ways material could be carried by water.

Additional Science activities to try include:

Activity 12

Clear as water

Finding a way to clean up water

Your challenge is to design and construct a simple water filtration system that has layers of material.

You will need some 2 litre plastic bottles, yoghurt or margarine containers, tubing, water and filtering materials such as cotton wool, fine sand, charcoal, coarse sand, fine gravel or coarse gravel.

Start with a bottle of fresh water from the tap. Find out what contaminates and pollutes this water as it makes its way through your town or city. Add these contaminants to your fresh bottle of water.

Research what materials are commonly used in commercially made water filters. Make two different types of water filters. Experiment with these by filtering the murky water in your bottle to get rid of the contaminants.

Draw two neat sketches of the two different filters you made. Select your best idea and complete a labelled drawing of it.

OR

Make your filter and write an explanation of how it works. Write a short piece titled 'A day in the life of a water filtration system'.

Evaluate: Does the filter work?
Is the water safe to drink?
Is it suitable for the garden?
What can we do to reduce the amount of contaminants entering the water filtration plant?

Activity 13

Moving Water

Moving water from one container to another

Your challenge is to make a simple model and use it to move water. To do this you can use tubing, containers, tube connectors and water. If you have another idea, discuss it with your teacher.

In planning how to make your model you will need to do some research.

You may also have to consider the materials available to use. Write a record of your work including information about planning and conducting your investigation and evaluate your findings.

Activity 14
Get rid of that smell

Finding a way to remove smells from water
Your challenge is to design and produce a system to remove smells from water.

You will need:
- Filtering materials
- Two containers or pots
- A funnel
- Pipette
- Beaker
- Some scented water
- Activated carbon.

Make a list of materials you could use to simulate a smell in water eg charcoal. Devise a process to remove the smell.

Discuss ideas for your system. Draw up your selected idea and explain how it will work. Make your system and run scented water through it.

Evaluate whether your system works efficiently or whether any modifications or changes are required.

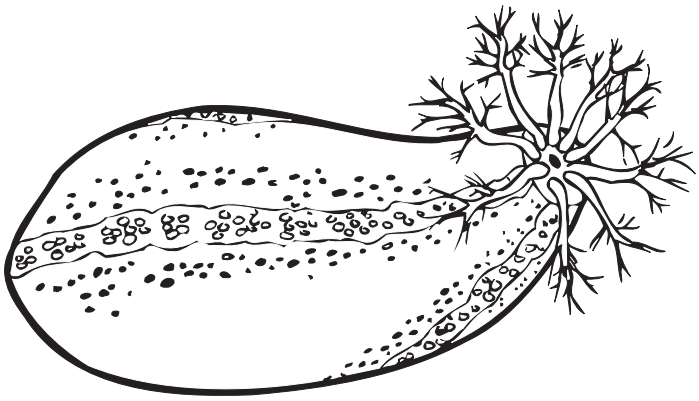
Activity 15
Settle down quickly

Find a way of making murky water settle down quickly
Your challenge is to plan a simple investigation and simulate the process of coagulation (the process by which dirt and other suspended particles are chemically 'stuck together' so they can be removed from the water).

You will need:
- Two small pots
- One stirrer
- One pipette
- Clay powder
- Aluminium sulphate (alum) (found in the spices section of a supermarket)
- Water.

Use one pot containing 100ml of water and a teaspoon of clay as your control. Repeat amounts in the second pot adding 4ml (in two amounts of 2ml) of aluminium sulphate (alum).
Stir, let it settle and then make comparisons.

Record observations and comment on the difference the alum has made. Write a record of your work including information about planning and conducting the investigation. Process your data and evaluate your findings.



Activities for use with Feature 4
'Land use in our catchment'

Activities for Technology

It is suggested that each Design Challenge should be preceded by introductory activities from activities in the section titled "Our Catchment Area – Activities for SOSE". These will support students with a basic knowledge of land uses in catchment areas.

Activity 1
Clear as Mud

Context
Stormwater that enters the Great Barrier Reef from coastal areas is polluted.

Task
You are an engineer and have been asked to design and produce a water filtration system in your laboratory to clean 'mucky' water.

Requirements
Materials – Soft drink bottles, cream, yoghurt, margarine containers, film containers, tubing, filtering materials.
Groups – Work in groups of 3 to 4 students.

Investigate
1. Start with a bottle of fresh rainwater. Find out what contaminates this water as it makes its way over land into the Great Barrier Reef. Add these contaminants to the water.
2. Research what materials are used in commercially made water filters. Make a list of materials you could use to filter your 'mucky' water.

Devise Solutions
Discuss ideas for your water filter.
Draw up your selected idea and explain how it will work.

Produce
Make your water filter and run polluted water through it.

Evaluate
Does your filter work?
What can be done to reduce the amount of contaminants entering the Great Barrier Reef?

Activity 2
Reef Care

Context
The Great Barrier Reef is under pressure and everything we do on the Reef, along the shore and even on the land affects this diverse and fragile ecosystem. The plant and animal communities that make up the Great Barrier Reef need to be protected. The Great Barrier Reef we see today is about 12,000 years old and for most of that time there has been minimal human presence. Around the year 1850, European settlers began populating and settling along the Queensland coastal strip, along the inner boundary of the Great Barrier Reef. During that time, human settlement has impacted the Great Barrier Reef. Nowadays, the water isn't as clean, the coral isn't as healthy, there are fewer fish and some animals and birds aren't as common as they once were.

A lot has changed on the Great Barrier Reef over the last 150 years.
- Pollutant levels have increased and show no signs of abatement
- Fish stocks have depleted in localised areas
- Up to 70-80% of wetlands have been lost in most of the major river catchments adjacent to the Great Barrier Reef
- Nutrients such as phosphate and nitrogen have increased by 200-1500% in river discharges.

As a result, the Great Barrier Reef is now under pressure – from fishing, agriculture, tourism, coastal development, land-based pollution and general overuse. Some significant species of marine animals are having difficulty adapting to these changing conditions and are now threatened. These trends are worrying indications of what may happen to other species and habitats of the Great Barrier Reef in the future.

Task
Design and produce a plan, which could be used to help solve a problem occurring on the Great Barrier Reef. This plan should be able to be presented to the Minister for Environment.

Requirements
Work in small groups.
Each student needs to keep notes on what the group is doing.

Investigate
Make a list of pressures on the Great Barrier Reef. Select an issue that interests your group and research it.

Devise Solutions
Discuss ideas to solve the problem with your group.
Develop a detailed plan, which should include more than one strategy.

Produce
Use a computer to present your plan in the best possible way.

Evaluate
In a five minute presentation to the class, use all of your group members to "sell" your idea.

Activity 3
Litter Traps

Context
There are problems with litter traps in some stormwater outlets that enter waterways that discharge into the Great Barrier Reef. At times of high water flow most of the litter is washed over the traps or pushed through them. A lot of dirt is able to enter the waterways, silting them up. This problem needs to be fixed and at this point a number of additional litter traps are planned for many city areas.

Task
Design a system to filter water entering local waterways to help reduce pollution and silting problems in your local area.

Requirements
Work in groups of 4-5 students.

Investigate
Study a natural wetland. How is the water filtered? Does the water enter the wetland from one or two points? Does the water enter at high velocity? How deep is it? What are the bank characteristics?

Devise Solutions
In your group discuss ideas. Devise a human made system based on the natural wetland filtering system. Your group is tendering for a 'best practice water and litter management solution' in the area feeding into the Great Barrier Reef. Devise a strategy.

Produce
On an A3 sheet of card, produce your plan and strategy. Include diagrams and notes.

Evaluate
Present your system to others and seek feedback on your submission.

Activity 4
What a lot of rubbish

Context
Are we managing the waste that is produced by our schools each day in a sensible way? Probably not! We seem to have a lot of rubbish on the ground and in our drains and this rubbish may end up in our rivers, the sea or the Great Barrier Reef. Much of the rubbish we produce can be reused and recycled or reused in some way. What about our food scraps, paper, cardboard, plastics, cans and liquids?

Task
Design a system to manage our wastes more productively to ensure a more environmentally friendly system, which helps to decrease litter in the Great Barrier Reef.

Requirements
Take into account the resources in the school and the good things already happening to manage waste. Consider what might be undertaken well.

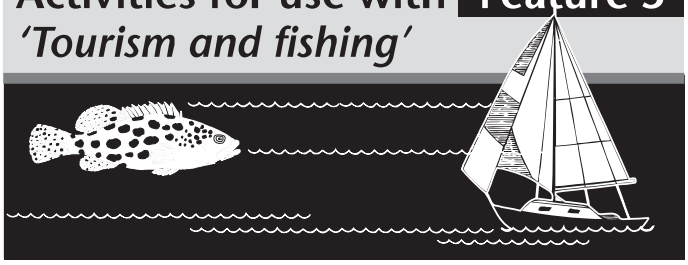
Investigate
What waste is produced?
What waste is continually found in the school grounds?
Does the Local Council provide a rubbish collection or recycling service?
What organisations collect rubbish for recycling? Where do they take it? What do they do with it?

Devise Solutions
Design a system for managing all waste from the school. Take into account – food scraps, bin positions, new equipment needed, costs, restrictions on student movement, foods from the canteen and efficient time use.

Produce
Produce a plan and strategy to implement the system.

Evaluate
Whether the system is operating efficiently and whether changes or modifications might be needed in any parts of the system.

Activities for use with Feature 5
'Tourism and fishing'



Activities across the curriculum

Activity 1

Talk about holidaying and fishing. Find out how much travel and fishing the class has done on the Great Barrier Reef. Ask questions like:

- Who has travelled to the Great Barrier Reef? Where?
- Who has fished on the Great Barrier Reef? Where?

Activity 2

Invite students who have visited the Reef to recall one of their visit to the Great Barrier Reef that affected their idea of 'how things are'. Talk about what happened, how they felt, what they thought and what they learned about the Great Barrier Reef.

Activity 3

Read travel brochures and articles about the Great Barrier Reef as a holiday destination. Identify the most visited places and the major tourist attractions. Draw or write responses to the following questions:

- What can we say about the Reef's tourist sites?
- In what ways are they the same/different?
- Where are the popular reef areas off the coast between Cairns and the Whitsunday Islands, which account for only about five per cent of the total reef area?
- Why might tourists like to go there?
- Where would you like to travel and why?

Activity 4

Use photographs from tourist brochures about the Great Barrier Reef and discuss the following:

- What images are shown in the photographs?
- Which images are not shown? Why?
- What particular features of the Reef are high lighted?
- Are there things that tourists might want to do in the places that are not shown? If so, why might they have been left out?
- What are the tourists in the photographs doing?
- How strongly do the photographs stimulate interest? How do they do this?
- What have people who selected these photographs assumed that tourists want?
- What kind of person might the tourist be?
- Consider how the photographs have been used to show a particular point of view or to persuade the viewer.

Activity 5

Consider what the Great Barrier Reef has to offer tourists and fishers, and write down some catchy phrases that create images of interesting places and spaces on the Reef.

Activity 6

Research how and where tourism and fishing takes place on the Great Barrier Reef.

Activity 7

Investigate the hospitality providers and tour operators who are offering 'educational tourism'. This means they promote the Reef as an ideal holiday destination, but also as a learning experience.

Activity 8

Research operators offering an 'eco tourism' experience. Locate the wilderness or natural areas of the Reef that are visited as part of eco tourism opportunities.

Activity 9

Using a large map of the Great Barrier Reef, mark on natural features that might be of interest to visitors and holiday makers.

Choose places to visit on the Great Barrier Reef and mark them on a map.

- **Label** the locations.
- **Suggest** where more information can be found about the places labeled.
- **Divide** the class into small groups and ask each group to research one of the places students have said they would like to visit including information about the people who live there.
- **Decide** how this information can be creatively and effectively shared by the class.
- **Focus** on the different environments of these places.
- **Design a postcard** highlighting some of the natural attractions of one of them.
- **Design a poster** promoting one of the places.

Activity 10

Read tourist brochures and fishing magazines about the Great Barrier Reef and consider the following questions:

- How is the Great Barrier Reef portrayed?
- What is being offered to the visitor or fisher?
- What kind of visitor or fisher is the material trying to attract?
- How might the organisation be selling reef tourism or reef fishing? (eg creating excitement, emphasising a place's remoteness, describing the hospitality offered and the luxury to be offered).
- What are the tourism brochures and fishing magazines selling?
- Who are they aimed at?
- How do they try to convince you to travel to and fish on the Great Barrier Reef?
- How do they make you feel?
- What kind of language is used to capture your attention or influence you?

Activity 11

Set up a tourism display based on information gathered. Groups of students could be assigned to set up different aspects of the display.

Activity 12

Invite a guest speaker from the tourism or fishing industry to speak to the class. Prepare questions to ask the guest speaker before the visit.

Activity 13

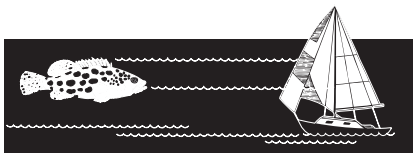
Interview a range of people who visit and fish on the Great Barrier Reef. Develop a profile of tourists and fishers visiting the Great Barrier Reef.

Activity 14

Investigate sites on the Great Barrier Reef that have cultural or spiritual significance to local indigenous groups.

Activity 15

Investigate how tourism and fishing are managed on the Great Barrier Reef. Produce a policy statement/management plan for the Great Barrier Reef.



Activities for use with **Feature 6**

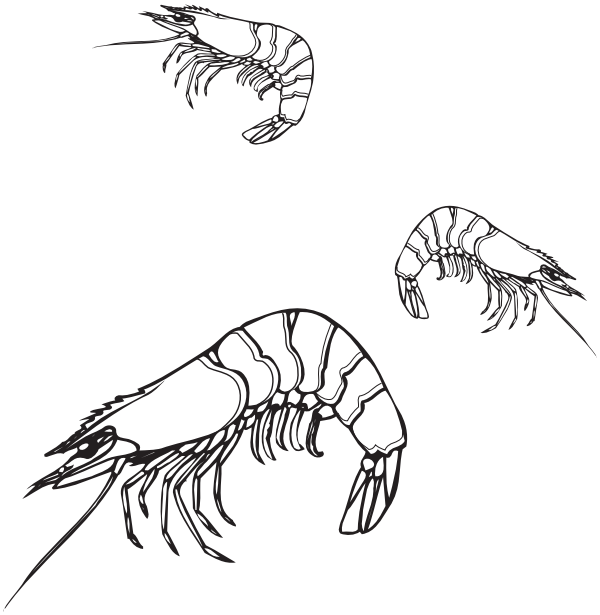
'Agriculture and aquaculture'

Activities across the curriculum

Activity 1

Using students' knowledge of their local area, compare and contrast the agriculture and aquaculture images on the Reef Beat feature article page with the area in which the students live. Discussion questions might include:

- What is our catchment like?
- What colours do you see in the catchment? What does this indicate?
- What water sources can be found in our catchment? How does the quality of these waters vary?
- What does the land look like?
- What places use the water before us?
- What places use the water after us?
- Do we have farming in our catchment?
- If so, what type of farming?



Activity 2

Discuss any known agricultural and aquaculture land uses in the catchment. Use a map of the area and fill it in to include class knowledge of these land uses in the catchment area.

Activity 3

Consider how water flowing off different agricultural and aquaculture land use areas might affect other areas at lower points in the catchment, in particular the Great Barrier Reef.

Land use	*Effect on area*	*Effect through catchment area; eg downstream and onto the Great Barrier Reef*

Present results of investigations

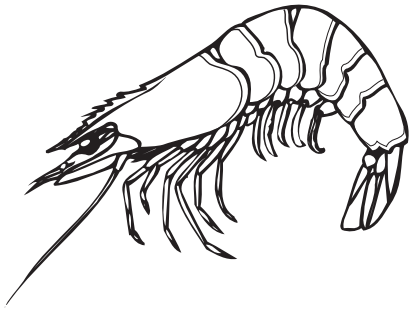
Catchment Issues

Activity 4

The use and abuse of catchments

The quality of the water coming from a catchment is determined by a variety of factors, the most important being land use within the area. During a visit to your local catchment area, identify the agricultural/aquaculture land uses seen or reflect on those known of.

Make a checklist and tick them off as you see or recall them.



Landform	*Present (✓) or absent (x)*	*Comments*
Grazing - beef cattle		
Grazing - horses		
Grazing - other		
Potato growing		
Fruit orchards		
Market gardening/ vegetables		
Vineyards		
Forests - plantations		
Woodlots		
Native vegetation		
Towns/urban areas		
Dams		
Salt pans		
Aquaculture farms		
Other - add any others you see		

Decide if any of these land uses are likely to pollute the water that eventually runs into the coastal/mangrove area and the ocean and explain why?

Activity 5

List the types of land degradation or pollution that you see (eg soil erosion, soil salinisation, air pollution, wastewater entering the stream/river, agricultural waste entering the stream/river, unhealthy trees, weeds and pest animals, degraded stream banks and so on). Identify possible causes of these problems and suggest possible solutions that may help to improve the health of the catchment and its water quality.

Ask students to **develop and prepare a report** that takes the form of a poster or written report and present it to the class.

Activity 6

Discuss with the class what they think is the difference between a healthy and an unhealthy catchment.

Activity 7

Assess the condition of the land around the rivers and creeks in your local catchment.

Describe the land (more than one term may apply) eg flat, gentle slope, steep slope, river valley, hilly.

Identify the land use and describe the soil.

eg dry, moist, wet
colour - red, yellow, brown, white, grey, black
texture - sandy, silty, clay, rocky
erosion - none, sheet erosion, tunnel erosion, gully erosion
vegetation cover - native vegetation, planted trees and shrubs, pasture grasses, crops

What land uses are appropriate for this area in order to protect the quality of the water from the catchment? What should the land not be used for?

Activity 8

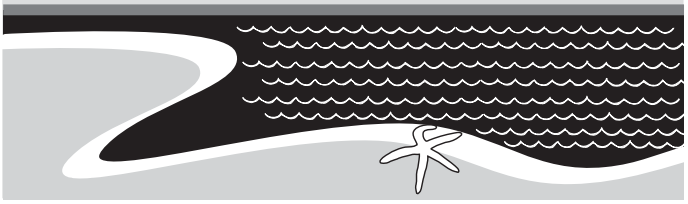
Site Evaluation

Using the table below, students should evaluate the condition of the land around them and add other headings to the list as they go.

Site:					
Date:	*Excellent*	*Good*	*Fair*	*Poor*	*Very poor*
grass/pasture cover					
health of trees/shrubs					
tree cover					
humus content of soil					

Is there evidence of:	*Yes*	*No*
crop cultivation		
cattle grazing		
horse grazing		
aquaculture		
feral animal damage		
water supply		
sheet erosion		

Activities for use with Feature 7 *'The coastal zone'*



Activities for the Arts

Activity 1

Visual Arts

Identify features on the graphics pictured on the Reef Beat coastal zone feature article. Interpret the information by asking questions like:

- What title might be appropriate for these graphics?
- What catches the eye?
- What can you see in the background?
- What are the significant details?
- What type of seascape is it?
- What do you think is outside the photo frame?
- What might happen to this scene in the future?

Activity 2

Organise a class display in the school or local community library on a theme of coastal biodiversity or threatened species. This display could consider species, their habitats and what they need to survive. The display could comprise drawings, photographs and short stories that examine how students feel about these species, what the class is doing to help protect these species and what other people can do.

Activity 3

Visit a nearby beach or sandpit and encourage students to sculpt sand in the shape of a coastal species, marine animal or plant. Ask students to express their feelings about the sand creation and the life form it represents.

Activity 4

Make an alphabet poster series or booklet featuring paintings and linoprints about coastal and marine species.

Activity 5

Many schools, businesses and homes have large "wheelie bins". After obtaining council approval, **make up a large stencil** suitable for the sides or front of these bins with a design of a local or well-known coastal or marine species.

Activity 6

Create silhouettes of a range of coastal or marine species. Draw the coastal setting where they belong. Draw posters to show where the species depicted in the silhouettes would live in the scene and present the poster to the class, asking students which animal goes where. Display posters in a communal area for all to see.

Activity 7

Make sock puppets or other puppet characters that represent a coastal or marine species. Run a "News Bulletin" in which different puppets interview each other about life on the Reef.

Activity 8

Make badges with slogans about preserving and conserving specific coastal or marine plant and animal species. These slogans could describe things that should be done to conserve species eg 'Slow down: Save a Dugong'.

Activity 9

Paint coastal and marine biodiversity murals for local bus shelters, stobie poles or community buildings (obtain permission from your local authority and Council before painting).

Activity 10

Make a papier-mâché likeness of a coastal or marine species. Exhibit it at school with a description of the animal and where it lives.

Activity 11

Design a flag or banner featuring threatened coastal or marine species that live in your area. For example, design a flag with the words "September is Threatened Species Month" and fly it during that month. Find other banners or flags and discuss the importance of simplicity and features that portray the information to 'catch the eye' and grab the audience's attention.

Dance and Drama

Activity 1

Dramatise and choreograph a performance for the theatre, a mime, a puppet show or a dance that highlights the plight of a threatened coastal or marine species. Present the performance in a public forum and interview the audience members after the show to find out what they thought the important messages of the show were.

Activity 2

Make body shapes and movements in response to selected coastal or marine animals and plants eg swaying seagrass.

Music

Activity 1

Create a piece of music using musical elements in response to stimuli such as a dance, story, poem, or picture about coastal plants and animals.

Activity 2

Compose a musical sequence portraying the fascinating creatures of the coastal zone.

Activity 3

Compose lyrics for a threatened species song and put them to music.

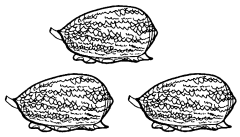
Activities for use with Feature 8
'Mangroves'

Activities for Math

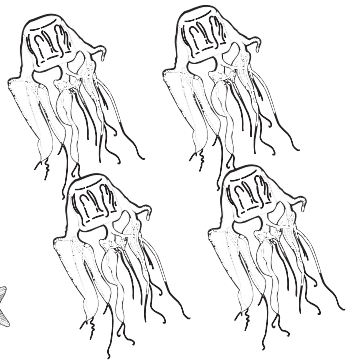
Activity 1
Mathematical Mysteries of the Mud

1. Colour part of each group to match the fraction given

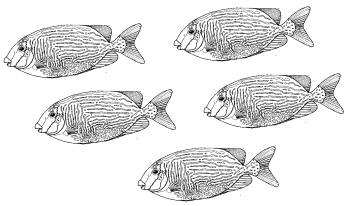
Two thirds 2/3



Three quarters 3/4



Four fifths 4/5



Activity 2

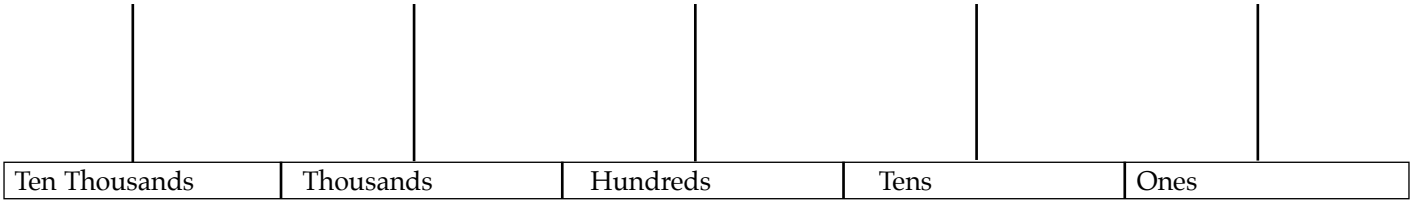
2. Here are some mangrove statistics, there are:
   20 Families of mangrove plant;
   65 Recognised species of mangrove plant; and
   35 Species of mangrove occur in Queensland.

   a. Place the statistics in ascending order (from smallest to biggest)
   b. Place the statistics in descending order (from biggest to smallest)
   c. What is the sum of all the statistics?

Activity 3

3. Did you know that there are 11,600km^2 (square kilometres) of mangroves in Australia?

   a. Write this number in words
   b. What is the place value of the 6 in this number?
   c. Represent this number on the abacus below.

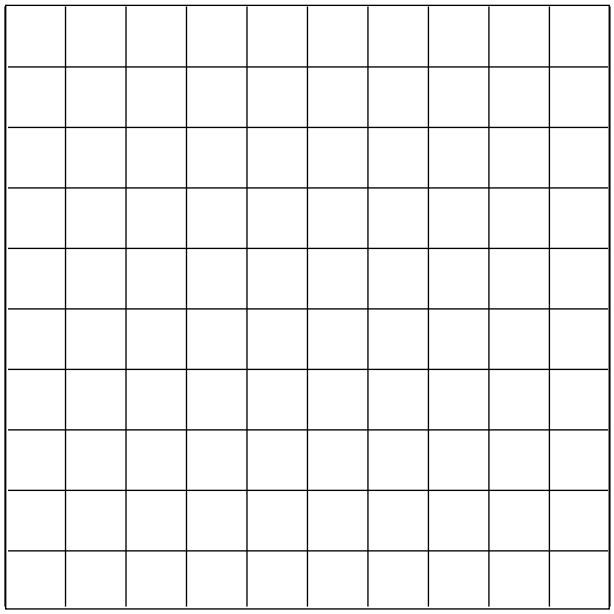


Activity 4

4. The seafood industry is the fifth largest primary industry in Queensland with an annual commercial catch worth several hundred million dollars.

75% of commercially caught fish and prawns depend directly on mangroves at some time in their lives or feed on food chains leading back there.

a. Estimate the value of 4 kg of prawns
b. How many prawns could you purchase with $100
c. Colour 75% on the grid below



d. Represent 75% as a fraction?

Activity 5
Food Chain Figures

Mangrove plants produce about 1kg of litter (mainly leaves, twigs, bark, fruit and flowers) a square metre per year.

Every time the tide retreats it carries a cargo of food out to sea. Studies of the mangroves at the northern end of Hinchinbrook Island have shown that the mangroves export more than 12,500 tonnes of leaf litter a year into the waters of the Great Barrier Reef. This material is spread over 260km^2 (square kilometres.)

Weigh each member of your class and determine how many kilograms your whole class weighs.

Calculate how many times your total class weight is carried out by the tide to the waters of the Great Barrier Reef in one year at the northern end of Hinchinbrook Island?

> ***Hint:***
> 1000 g = 1 kg
> 1000 kg = 1 tonne

Activity 6
Comparing Area

There are 11,600km^2 of mangroves found around Australia and 2,070km^2 of mangroves along the coast next to the Great Barrier Reef.

Use a measuring wheel or large measuring tape to calculate the area (in square metres) of one of the following places in your school:

Basketball court
Netball court
Soccer field
Football field

> ***Hint:***
> 10000 m2 = 1 km2

Remember to calculate the area of these rectangles you should use this formula:

Area = Length x Width

> ***Hint:***
> If you measure both Length and Width in metres your answer will be in square

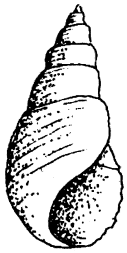
a. How many times would your chosen place fit into the area covered by the mangroves all around Australia?
b. How many times would your chosen place fit into the area covered by the mangroves along the coast next to the Great Barrier Reef?

Activity 7
Species Statistics

Here are some of the common shells that can be found in Australian mangroves. Note the diagrams are not to scale. (Images courtesy of Claridge, D. & Burnett, J. 1993 Mangroves in Focus.)

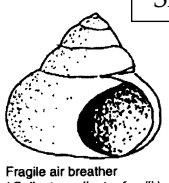
Speckled periwinkle (*Austracochlea concamerata*)

Hercules mud whelk (*Pyrazus ebeninus*)



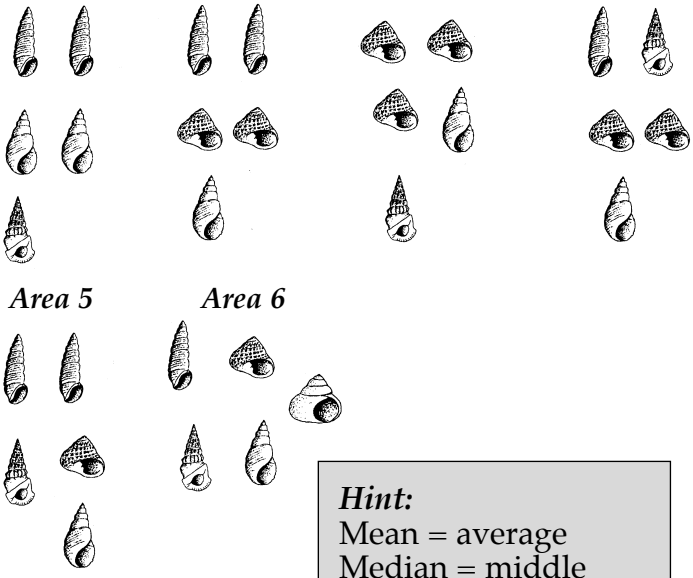
Mangrove australwink (*Littoraria scabra*)

Cerithium cuminji



Fragile air breather (*Salinator salinator fragilis*)

Scientists studying mangroves sampled the types of shells found in six specific areas of a local mangrove, in each of the areas they found the following.



> ***Hint:***
> Mean = average
> Median = middle
> Mode = most common

a. Find the total number of each shell type found throughout the six specific areas.
b. Calculate the mean for each shell type over the six areas. Do you think there is any value in calculating the mean?
c. What was the most common shell type found?
d. How might this information assist the scientist?

Activity 8
Graphing Statistics

a. If  represents 15 snails.

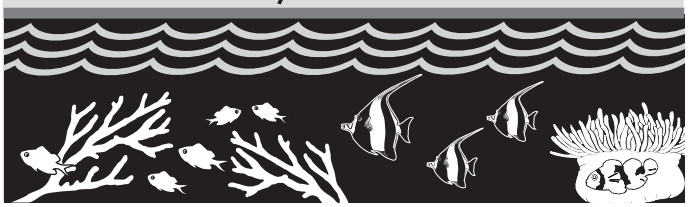
How would 75 snails be represented in a picture graph?

b. Construct a bar graph to represent the total number of each type of snail found in the scientist's study above.

c. Construct a pie graph to represent the total number of each type of snail found in the scientist's study above. You may wish to construct a table with the following headings to help.

Snail Type	Total	Total/30	Total/30 x 360°

Activities for use with **Feature 9**
'Our reef ecosystem'



Activities across the curriculum

Activity 1

Read the feature article about best environmental practices in the Great Barrier Reef catchment and Marine Park. Talk about the meaning of 'ecological sustainability'. Discuss why people need to recognise the importance of:

- Environmental stewardship and conservation
- Good water quality on the Great Barrier Reef
- Catchment care
- Biological diversity on the Reef.

Activity 2

Show your class images of the Reef. **Initiate class discussion** about the interactions taking place and the way the Reef scene makes them feel. How would they feel if they were the only person in the scene or if there were twice as many people there, people with dogs, people with jet skis, lots of litter around or if there wasn't as much coral or as many fish to catch?

Activity 3

Role play the following scenarios:

- You want to stop on an island in the Great Barrier Reef for a picnic. Another family is just leaving a beautiful spot and they have left the area littered with rubbish. What might you do?
- You notice people cutting down and damaging trees and plants on an island. It is an offence to cut down or damage any standing trees or plants. What might you do?
- Reef walking is allowed on the Great Barrier Reef but it is expected that reef walkers do not damage or remove coral. You come across someone stepping on coral and living matter and picking up species that are attached to the reef flat. What might you do?
- You see someone throwing out his or her bait bag whilst fishing on the Reef. This is against the Fishing Code. What might you do?

Activity 4

Discuss different activities that could be undertaken on the Great Barrier Reef.
For example:

- Fish Feeding
- Fishing
- Whale Watching
- Snorkelling
- Turtle Watching
- Observing Seabirds
- Boating.

Have the students come up with some ideas under these headings:

- What is good about these activities?
- How could these activities be bad for the reef?
- What rules should people follow when doing these activities?

Activity 5

Gauge students' feelings and values about the rules they developed by asking them to stand on a continuum. Students who strongly agree should stand at the left of the classroom and students who strongly disagree should stand to the right of the classroom. Students can place themselves anywhere on the continuum based on their feelings. Question students about their placement on the continuum.

Activity 6

Brainstorm how we can all look after the Reef for today and the future.

Activity 7

Discuss how the Reef receives large amounts of waste from deliberate dumping or by natural run-off from the land. Talk with students about what we do at home and school and how these actions affect the Reef.

Activity 8

Identify areas in the school and home that involves water and chart these eg drain, gutters, down pipes, sprinklers, taps, showers, laundries, pools, ponds, toilets, drinking fountains.

Discuss any environmental issues connected with these areas. Draw cause and affect flow charts to show the issue and its effect on the Reef.

Activity 9

Talk with students about leaf litter and both urban and agricultural run-off that is washed into watercourses or drains. Follow its path to the sea and the Reef.

Activity 10

Select an issue they consider has affected the Reef. Write the issue in the centre of the circle and then surround this circle with three additional concentric circles that grow in size.

Students identify first, second and third consequences of the issue – one per outer circle. In groups, students discuss and record why they think it is important to find out about the Reef and its resources, both now and in the future.

Consider questions like:

- What patterns can you see when you look at how the Reef is used now and in the past?
- Is the Reef being used in a sustainable way?
- What do you think we have to do so the Reef will be used sustainably in the future?
- What types of resources do you think the Reef will or won't be able to provide if we continue to use it in the same way as we do now?

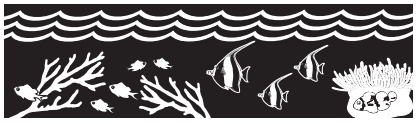
With older students, introduce the concept of sustainable management or ecologically sustainable development. Consider a range of questions (see below). In addition, prepare an effects wheel to illustrate their preliminary thoughts about the issue:

- If we clear vast areas of mangrove habitat, what might this mean in the future?
- If we keep on finding a balance between meeting our present needs for resources while conserving and protecting natural resources for the benefit of future generations, what might this mean for the future?
- How does what we do at home impact on the Great Barrier Reef and coastal zone?

Activity 11

Brainstorm ways the class could get involved in activities for the protection of our waterways and the Great Barrier Reef. **Ask** students to suggest how we can make sure people care and look after the Reef. Students could:

- Contribute to a class article for the school newsletter;
- Prepare a display of special places and features in the Great Barrier Reef and invite other classes or parents to view it and ask questions;
- Speak to other classes about the use and care of Great Barrier Reef areas
- Make a poster to advertise the use of Great Barrier Reef areas; and
- Create a calendar illustrated with Great Barrier Reef environments and/or plants and animals.



Activities for use with Feature 10
'Best Environmental Practices'

Activities across the curriculum

Activity 1

Read the feature article about Reef Guardian projects and activities undertaken by schools in Queensland. In groups, talk about environmental topics and issues that might be important in the local area. Develop a common vision within each group as a way to start thinking about the issues and the local area. Start by asking the groups:

- What do we want our local environment to look like in 10 years time?
- How do we want our local environment to look in 50 years time?

By pinpointing how you want the environment to be in the future, you can identify the issues you think need addressing. For example, if you have a vision of a clean river, perhaps water quality is something you would like to address.

Activity 2

Identify group impacts and understand how our actions affect the local environment in which we live. Ask groups to think about an action they undertake everyday such as driving a car, having a shower, making a meal or using a computer. Write down all the impacts associated with the activity. For example, making a meal can have many different impacts on the environment we live in. If the ingredients have been packaged in plastic, think about the environmental impact of drilling for oil to make the plastic, shipping, manufacturing and the eventual disposal of the packaging. What about the vegetables and meat? There could be pesticides, herbicides and land degradation associated with their production. What about the transport, which brought the goods from their place of production to the table? These are some of the impacts associated with simple processes and choices we make when preparing a meal.

Use similar thinking processes to identify environmental concerns associated with local issues and think laterally about the causes and problems related to these.

Activity 3

Tackle a specific environmental issue in your local environment. Record responses to the following questions:

- Are you particularly concerned about a specific issue and want to take action?
- Is something happening in the local area that you would like to change?
- Are there any groups that are already working on the issue?
- Is there a particular aspect of the issue that you think would be appropriate for a group to work on?
- What can be found out about the issue?

Activity 4

Audit the issue. Gather and record important information about the issue. Find out about organisations in your area that are working on or participate in similar issues to yours.

Activity 5

Identify the problems, address the causes of the issue and start to address the causes of the problem. If litter is a real problem, consider the reasons for the litter existing in the first place and monitor where the litter is coming from. Is it from school students or does litter blow in from a neighbouring area? Are passing cars the source of the litter?

Activity 6

Identify the solutions. Review the following ideas for Reef Guardian activities. Select those of interest to you and get involved to actively conserve and protect local catchment areas and the Great Barrier Reef.

Activities to improve water quality

- Maintain stormwater drains. Keep them free of litter, leaves and dirt.
- Cover and store rubbish in areas where it cannot contaminate or pollute stormwater drains during rain.
- Collect fallen leaves and compost them in mulch gardens.
- Clean all outdoor surfaces using a broom, vacuum or shovel (do not hose or blow them).
- Handle all materials carefully to prevent spills.
- Keep storage containers well away from stormwater drains and in properly covered and bundled areas.
- Mark school and nearby stormwater drains with a suitable sign such as 'This drain leads to the Reef'.

- Create and place signs around the school and surrounding areas to remind others of ways to avoid pollution in the school and local area.
- Participate in local Waterwatch programs to help monitor the water quality in your local waterway.
- Visit local waterways and test the water quality.
- Check the edge vegetation of local water ways for pollution. Clean up areas regularly. Look for weeds and eradicate them.
- Conduct a water quality awareness program within the school community.
- Place articles about water quality in the school newsletter and share ideas to reduce pollution in local waterways and the Great Barrier Reef.
- Organise a display about the school's water quality program in the local shopping centre.
- Develop an education program about water quality that will be useful in your school community.

Activities to reduce litter reduce waste and recycle

- Identify 'hot spots' where litter is most likely to cause environmental impacts. Consider quantities of litter and the effects of different types of litter (eg plastics, food wastes or glass) on the Great Barrier Reef. Identify those who use the 'hot spots'. Work with the school community, especially those who use the 'hot spots', to develop ways to reduce litter.
- Ensure enough litterbins are placed around the school.
- Make presentations at school assembly on why litter is a problem for the Great Barrier Reef.
- Create a 'Litter Monster,' a rubbish bin char acter, to encourage younger students to put litter in the bin.
- Paint bins in attractive colours with reef designs to encourage students to put litter in them.
- Set up separate recycling bins for cans, glass, plastics and paper (check to see what can be recycled in your area).
- Collect food scraps and set up a worm farm for recycling organic waste. Use the resulting compost and worm castings in the school gardens.
- Collect useful items to reuse in art, craft and technology, eg paper, card, material cut-offs, wool, and ice cream containers.
- Hold a 'Litter-free Lunch' day.
- Develop school policies about double-sided photocopying, paper use and reuse re-inking cartridges and composting/worm farming of organic waste.
- Develop an education program about litter and waste reduction and recycling for use in your school community.

Activities to conserve water

- Conduct a water audit of the school.
- Monitor water usage in the school.
- If any taps, drinking fountains, fire hydrants or sprinkler systems are leaking, inform the school administration team.
- Mulch gardens to reduce water loss to evaporation.
- Install flow control devices to reduce the amount of water flowing from the tap.
- Work with the local school community and relevant outside organisations to develop ideas for saving water in the school.
- Put water conservation signs in the toilets, urinals, hand basins, sinks, showers and any other water outlets in and around school buildings.
- Develop an education program that will be useful in your school community to reduce water use.

Activities to conserve energy

- Reduce energy by becoming more aware of where energy is used and taking steps to ensure that fans, lights and electrical appliances are turned off when not in use.
- Use natural lighting whenever and wherever possible.
- Develop ways to reduce electricity used in the school and encourage people to contribute ideas on energy conservation.
- Search out information and resources that will be useful in your school community to save energy.
- Develop an education program that will be useful in your school community to reduce energy.

Activities to ensure appropriate chemical disposal

- When using chemicals it is imperative that none are washed into grassed or soil areas, gardens, storm water drains or gullies that connect to waterways, beaches or the reef.
- Dispose of all chemicals and containers in accordance with the instructions on the container or contact your local council's waste disposal section.

- Locate, identify and list all chemicals used in the school. Assess each for its contribution to the environment and health of the Great Barrier Reef.
- Do not dispose of chemicals down the drain.
- Take care not to spill fuel when filling vehicles or changing oil.
- Use biodegradable chlorine-free toilet paper and phosphate-free cleaning products.

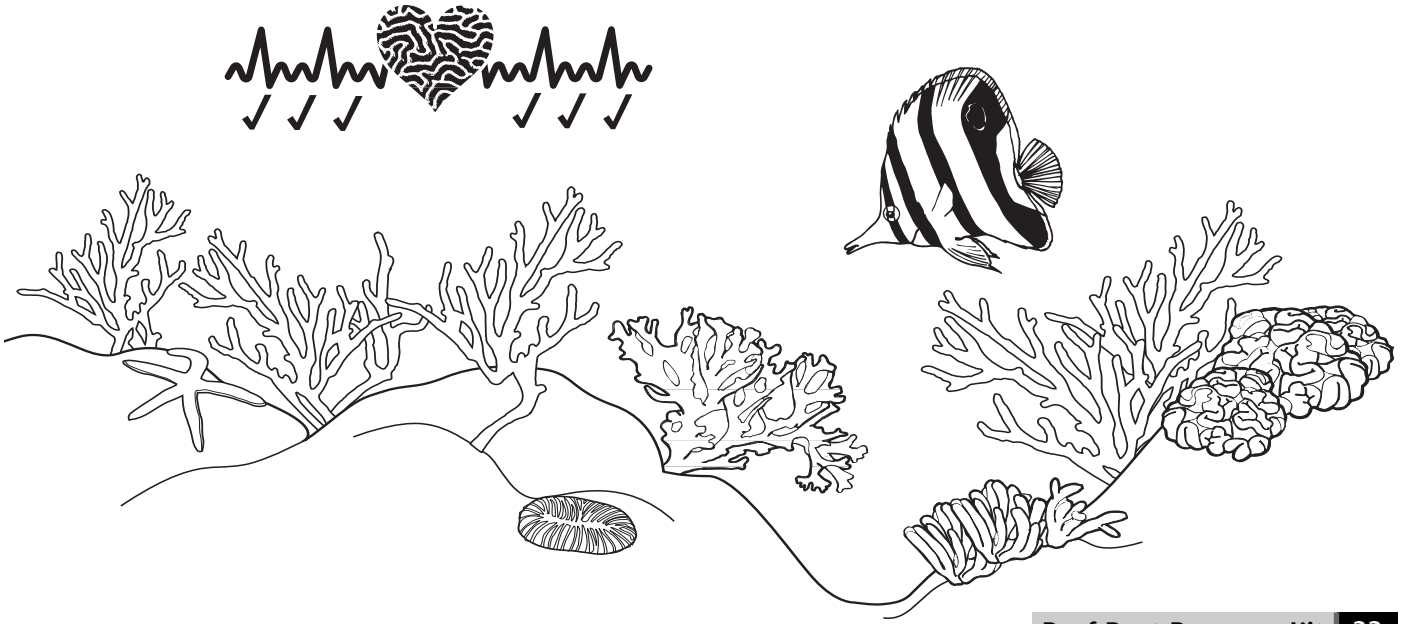
Activity 7

Set the goals for a project and develop an action plan. Some of the things needed might include:

- Form a management team to undertake the Reef Guardian project
- Define roles and responsibilities
- Design and establish a feedback loop for project progress and effectiveness of the team
- Design the project budget
- Design the project timeline
- Set up a project diary, plan for celebrations at each milestone, take into account factors likely to affect progress, allocate time for regular reviews of progress, etc.
- Promote the project and consult widely
- Establish sources of support and a support network
- Assist in integrating the Reef Guardian project into the school curriculum
- Set up photo points for monitoring. By taking a photo at the same point each time, you can see the changes over time
- Monitor and evaluate the action plan over time.

Activity 8

Implement the projects and share them with the Education Unit at the Great Barrier Reef Marine Park Authority (GBRMPA). Please forward information to us at info@reefed.edu.au or contact Angela Colliver on 4750 0850.



The Future of the Great Barrier Reef

Rich Task for use with New Basics Programs

New Basic Referents

Life Pathways and Social Futures
- Learning about and preparing for new worlds of work

Multiliteracies and communications media
- Communicating using languages and intercultural understandings
- Mastering literacy and numeracy
- Active citizenship
- Interacting within local and global communities
- Operating within shifting cultural identities
- Understanding local and global economic forces
- Understanding the historical foundation of social movements and civic institutions

Environment and technologies
- Developing a scientific understanding of the world
- Building and sustaining environments

Targeted Repertoires of Practice

- Generating graphical texts (timeline)
- Swaying opinion through an oral or written presentation
- Collecting, recording and presenting data
- Evaluating on the basis of data
- Justifying decisions
- Locating, recording and comparing historical and cultural information
- Influencing opinion through informative and engaging displays
- Experiencing the exhilaration of physical activity
- Understanding the marine environment and our environmental responsibility
- Making suggestions to minimise environment damage

Significant Questions

Who is responsible for caring for the Great Barrier Reef?
What things can be affected by people visiting the Great Barrier Reef?
What can I do to protect the environment on and around the Great Barrier Reef?

Students will identify and understand the ecology of the Great Barrier Reef and the extent to which it is at risk. They will investigate by collecting, organising and presenting data to create an informative and persuasive presentation.

Identify and investigate groups that have had and currently have an impact on the Great Barrier Reef.

Investigate conservation issues affecting all stakeholders on the Great Barrier Reef.

Construct a timeline to show the historical and cultural impact of various groups of people on the Great Barrier Reef.

Identify the stakeholders utilising responsible environment practices.

Prepare an investigative report on a marine creature from the Great Barrier Reef or surrounding area.

Analyse irresponsible practices and how they affect the environment of the island.

Write a **persuasive exposition** highlighting the environmental risk faced by the creature.

Design a **poster** that encourages conservation of marine environments.

Persuasive Exposition

Intensive Teaching

- Timeline construction and presentation
- Investigate Report genre
- Poster design techniques
- Research skills – locating, note taking
- Drafting and Editing
- Persuasive exposition

Assessment
Timeline
Poster
Persuasive Exposition

Courtesy of Redlynch State School

WEBSITES

- Great Barrier Reef Marine Park Authority
  www.gbrmpa.gov.au
- ReefED
  www.reefed.edu.au
- Reef HQ
  www.reefHQ.org.au
- Coastcare
  www.erin.gov.au/coasts
- Community Biodiversity Network
  www.nccnsw.org.au/member.cbn
- Crustacea Net
  www.crustacea.net
- Fish Web
  www.dpi.qld.gov.au/fishweb
- Marine and Coastal Community Network
  www.mccn.org.au
- Oceans Alive
  www.abc.net/oceans/alive
- Oz Reef Marine Park
  http://ozreef.org
- Threatened Species Network
  www.pegapc.org/~ntsnnsw
- The Coral Reef Alliance
  www.coral.org
- Turtles – Euro Turtle
  www.euroturtle.org
- Turtles
  www.seaturtles.org/store
- Wetland Care
  www.wetlandcare.com.au
- Wet Tropics Regional Natural Resource Management Board
  www.nrmboard.org.au
- Burdekin Dry Tropics Regional Natural Resource Management Board
  www.burdekindrytropics.org.au
- Fitzroy Basin Association
  www.fba.org.au
- Waterwatch Australia
  www.waterwatch.org.au
- Landcare Queensland
  www.landcareqld.org.au
- Conservation Volunteers Australia
  www.conservationvolunteers.com.au
- Greening Australia – Queensland
  www.qld.greeningaustralia.org.au
- National Land and Water Resources Audit
  www.nlwra.gov.au
- National Action Plan for Salinity and Water Quality
  www.napswq.gov.au
- Natural Heritage Trust
  www.nht.gov.au/
- Grantslink
  www.grantslink.gov.au/
- CRC for Coastal Zone, Estuary and Waterway Management
  www.coastal.crc.org.au
- CRC for Catchment Hydrology
  www.catchment.crc.org.au
- CRC for Freshwater Ecology
  freshwater.canberra.edu.au
- Australian Centre for Tropical Freshwater Research
  www.actfr.jcu.edu.au