



Teacher's Note: Sustainability in the Catchment

Each student receives two handouts:

1. the figure showing a sustainable and unsustainable catchment (p105)
2. a page of labels (opposite)

Students are to cut out the labels then match them to sites 1 – 9 on the figure, colour the figure in appropriately then paste in books.



Exercise 30: Sustainable Catchments

Match these labels to sites (1) to (9) on the figure of sustainable/ unsustainable catchment. Colour appropriately then paste in book.

Sustainable catchment	Unsustainable catchment
A clear bay provides a pleasant environment for human activities and encourages the growth of seagrass to maintain a healthy environment for aquatic life.	Poorly sited public facilities and unplanned use of the beachfront can cause coastal erosion and destroy the attractiveness of the area.
A clear river mouth enables navigation of boats upstream and ensures the most efficient discharge of river water and nutrients into the bay.	Poorly maintained farmland contributes to: <ul style="list-style-type: none"> • erosion • decline in yields and farm income • deteriorating farm water supplied • silting of streams
Carefully sited public facilities and a well-managed beach ensure a pleasant and stable environment for future generations.	Poor quality dirty water results from soil being washed into the storage from the cleared hills. The storage gradually becomes filled with silt.
The high quality of the water in the storage is maintained because the water has been 'filtered' by the forested area. The water is clear and suitable for farm, domestic and industrial use.	Cultivation down the slope is more likely to cause soil erosion and create massive scars in the landscape.
Well managed farmland which maintains a good groundcover of trees, grasses or crops helps to: <ul style="list-style-type: none"> • minimise erosion • increase yields and farm income • maintain high quality farm water supplies • prevent silting of streams 	A bay polluted by rubbish and the discharge of wastes and sediments from the river is unattractive to humans and unsuitable for aquatic life.
Forests on steep slopes protect the soil and maintain water quality. National Parks provide wildlife habitats and cater for recreational areas and tourism.	Over-clearing of forests on steep slopes exposes the land, leading to landslips and erosion of the soil. Eroded soil is eventually washed into streams.
Contour cultivation and a system of contour banks, waterways and conservation cropping enables the use of land while minimising soil erosion.	When trees are not maintained along stream banks or on farms, soil suffers from erosion by water and wind.
Trees along stream banks help prevent streambank erosion. Strips of trees provide windbreaks to prevent soil erosion, shade and shelter for livestock and wildlife, and improve the appearance of the farm.	Cultivation and over-grazing on steep slopes can lead to erosion.
Treatment of industrial and domestic wastes ensures that discharges do not harm the environment.	Uncontrolled discharge of industrial and domestic wastes can harm the environment by lowering water quality, making it unsuitable for human use, and possibly killing fish and other aquatic life.



The discussion of the principles of Ecologically Sustainable Development leads into the following case studies. Each case study is a development proposal. Students work in groups to assess whether the proposal is in keeping with the principles of ESD and then produce a report with their recommendation – (either approval or non-approval).

Precautionary Principle - an example would be if you were trialing a new drug. It's not introduced until a full assessment has been completed in case there are any unknown side effects. This same principle should be applied in managing the environment.



Point ii) - keeping the drug analogy: a possible scenario would be a new drug being available to treat acne however it may cause a weight increase - would you take the drug?

Intergenerational Equity: Suppose a wealthy landowner had bought the land surrounding Avoca Beach in 1950 and has developed it as a private resort complex - thereby denying access to the public to the beach. Did this purchase consider the needs of future generations?



Improved valuation

Point 1 - environmental assessment of proposed development should include costings on the loss or damage to environmental features present. For example: a costing on the proposed fast ferry service might include a financial assessment of the impact on features we take for granted:

- mangroves - filtering mechanism, sediment control, erosion protection.
- sea grass beds – fish / prawn nursery



Point 2 – How do we assess the effects of pollution? Need to measure the features of the environment before approval in order to assess impact.

Point 3 - life cycle of goods

The full life cycle of a big Mac includes - farming and agriculture producing raw materials such as beef, bread roll, paper packaging - labour in cooking and serving - disposal of packaging

While many companies price structure take into account all of those steps in producing the merchandise there is very little, if any, account of the disposal of the product. eg – Styrofoam

Point 4 - Examples of incentives would be aluminium can recycling, deposits on bottles, cheaper prices for recycled goods.

Additional resource – McLibel Website

Principles of Ecologically Sustainable Development

From 1992 the government agreed to support ecologically sustainable development(ESD). The principles of ESD are:

- **Precautionary Principle (“If your not sure, don’t do it”)**

If what you are going to do might damage the environment then it’s better not to do it.

When deciding whether to develop the catchment you should:

- i) avoid, where possible, damage to the environment
- ii) look at all the options and rate them in terms of risk to the catchment.

- **Intergenerational Equity (the welfare of future generations is considered)**

Consider the future - we need to make sure that what we do now keeps the environment healthy or in a better condition for future generations.

- **Conservation of biological diversity and ecological integrity-**

It is most important that we conserve biological diversity and keep ecosystems in a healthy state.

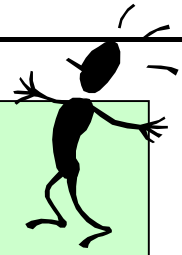
- **Improved valuation, pricing and incentive mechanisms:**

- ⇒ The financial value of the environment needs to be included when planning changes to the environment.
- ⇒ polluter pays, if people pollute then they should pay to fix up the environment
- ⇒ when working out the cost of a product or service, the cost of recycling or disposal should be included (full life-cycle costs)
- ⇒ Structures should be put in place to keep the cost of solving environmental problems as low as possible

Outcomes

After completing this section students should be able to:

- produce a report / presentation based on a problem solving exercise
- understand the roles of various agencies / stakeholders in managing the catchment



Teacher's note: Case Studies

Only three group case studies are presented here as it is hoped that teachers will use the Rumbalara Website to access current community issues posted there by local community groups. Alternatively, students may wish to explore local issues from their area. Newspaper clippings make good starting points.

In developing a report for or against the proposal or issue, students should be encouraged to consider all points of view and to measure these against the 4 principles of **ecologically sustainable development (ESD)**.

A scaffold for writing such a report is available opposite.

These case studies could also act as starting points for Stage 5 individual projects for some students.

Report Scaffold for the Case Studies:

<p><i>Introduction</i></p> <p>This paragraph should clearly state:</p> <ul style="list-style-type: none">• what the proposal or issue is• where the site is and its current use• who the stakeholders are
<p><i>Arguments for the proposal</i></p> <p>This section should</p> <ul style="list-style-type: none">• list the benefits of the proposal• describe who would benefit and how• examine any long term benefits of the proposal for the region• state any evidence of communtiy support for the proposal
<p><i>Precautionary Principle</i></p> <p>This section should examine:</p> <ul style="list-style-type: none">• the environmental threats the proposal or issue presents• whether these threats are serious or irreversible• whether other options exist or have been considered• conditions which might be imposed to prevent serious damage
<p><i>Intergenerational equity</i></p> <p>This section should consider whether the proposal or issue could have long term effects:</p> <ul style="list-style-type: none">• on health• on biological diversity• on the productivity of the environment
<p><i>Conservation of biological diversity and ecological integrity</i></p> <p>This section examines:</p> <ul style="list-style-type: none">• whether or not the proposal or issue will threaten individual species within the environment• what studies or data would be needed to ensure no harm to individual species• how to ensure that ecosystems are protected• the need for guidelines to prevent ecosystem damage during development
<p><i>Improved valuation, pricing and incentive mechanisms</i></p> <p>This section discusses:</p> <ul style="list-style-type: none">• the value of the environment under consideration (eg attracts tourists, better fishing, etc)• what additional pollution or wastes the proposal might generate• how that pollution or wastes could be limited (and who pays for this)• how wastes will be disposed of (and who has the responsibility for this)• what incentive structures exist to ensure that the developer will develop environmentally friendly solutions to any problems encountered
<p><i>Conclusion</i></p> <p>The final paragraph contains a firm recommendation for or against the proposal and states the main reasons behind your group's decision. This section could also state any conditions or guidelines that you feel should be imposed on the developer.</p>

Case Study 1 - Development at Kincumber

Scenario:

Your group represents a Sydney based Development Company that wishes to build a housing estate at Kincumber.

The area of land is shown on the map attached. The land borders on Kincumber Creek and also an area of wetland.

The following documentation is provided:

- Characteristics of site
- A report from NSW Fisheries
- Wetlands appraisal
- A report from National Parks and Wildlife Service (NPWS)
- Section 90 questions

The process:

Your group is to study the map and the DA. Each person in the group reads one of the reports provided - and needs to become an “expert” on that information.

What you need to do:

Your group must produce a report that addresses the questions in Section 90 for your development and makes a recommendation for or against the proposal.

Your report should follow the **Report Scaffold for the case study**.

CHARACTERISTICS OF THE SITE

LOCATION: The proposed site is located next to Kincumber Creek within the township of Kincumber.

Kincumber lies six kilometres to the southeast of Gosford, approximately 80 kilometres north of Sydney, on the Central Coast of New South Wales.

LAND USE: Land use is controlled under the Gosford Planning Scheme (as amended). Six principal land uses occur – urban investigations, residential, industrial, special uses, open space and conservation.

The dominant proportion of the population resides within the urban centres lining the coast and Brisbane Water. Selected industrial areas exist, for example, Erina. The wetlands, major ridgelines and coastal cliffs are zoned as Open Space or Conservation with their long-term value for environmental protection and the retention of their existing natural character.

NEW SOUTH WALES FISHERIES

REPORT ON THE PROPOSED HOUSING DEVELOPMENT SITE AT KINCUMBER

The proposed development may impact on Kincumber Creek.

Kincumber Creek is expected to support a variety of marine fauna, including fish and crustaceans. The distribution of fauna types in the creek varies according to the site being sampled.

The seagrass habitat is important to many species as a source of food, shelter and protection. The adjacent mangrove and saltmarsh communities enhance the value of this habitat.

Various studies on the NSW Central Coast have emphasised the “nursery” role of seagrass beds and mangroves in providing temporary habitat for many young fish. The seagrass beds are also important in providing a habitat for many invertebrates.

Fish likely to be found in the area around the mangroves include silver buddies and flat tail mullet. The seagrass beds tend to attract yellow-finned bream. Sand whiting can be found in sandy habitats along the creek and Trevally in the estuaries.

School prawns are likely to be found in significant numbers in Kincumber Creek and The Broadwater. The provision of cover seems to be an important factor in maintenance of a nursery habitat for many of these species.

Invertebrates such as worms, molluscs, small crustaceans and insect larvae are essential elements in the food chain.

The investigation shows a general lack of diversity outside the mangroves and seagrass beds.

An oyster farm is located 300m south of the entrance of Kincumber Creek. Oyster productivity can be influenced by poor water quality; high levels of turbidity and non-filterable residue are most damaging.

NATIONAL PARKS AND WILDLIFE SERVICE

A REPORT ON THE PROPOSED HOUSING DEVELOPMENT SITE AT KINCUMBER

The site and areas surrounding it have the capacity to support various forms of wildlife.

The vegetation along Kincumber Creek and the estuarine waters attract a large diversity of birds. Several bird species are migratory waders, which are protected under the terms of the Japan Australian Migratory Birds Agreement. These species are particularly dependent upon the creek with its shallow water and regularly exposed mud flats with several species using the saltmarshes and the mangrove communities landward.

The shallow waters and mangroves are also important components of bird habitats providing night roosts, nesting areas and feeding areas.

The area is found to have Bush Stone Curlews that are classified as threatened fauna and scarce bird species such as the Mangrove Heron and Buff-banded Rail.

The lack of much groundcover in the area creates an environment generally unsuitable for mammals. Bats are the most common species to be sighted. The occurrence of native mammals is further lessened by the presence of dogs and cats.

It is highly probable that neither amphibians nor reptiles would be permanent residents within the area due to much unsuitable habitat.

WETLANDS APPRAISAL

SOURCE: GOSFORD CITY COUNCIL

REPORT ON THE PROPOSED HOUSING DEVELOPMENT SITE AT KINCUMBER

The low sloping foreshores of Kincumber Creek and surrounding areas have produced extensive wetlands. The foreshores are diverse in ecological structure and detail. It is regarded as a significant ecosystem, which must meet the minimal disturbance requirement outlined in the relevant policy.

The wetland site is the area generally defined by the common edge between the Casuarina forest and Eucalyptus forest, often bordering residential blocks (refer to Figure 1). The area extends down to the mean high tide watermark covering approximately 20 hectares.

Wetland degradation has been common in the past. The area of mangroves has not substantially changed since 1954, but the area of saltmarsh has been reduced from ten to four hectares as a result of the intrusion of other residential development.

At present, various threats to the condition of the wetland exist. Such threats include uncontrolled access and formation of indiscriminate tracks, compaction of soil and destruction of ground cover vegetation, siltation of the creek and increased turbidity, dumping of non-biodegradable rubbish and the growth of noxious weeds.

Specific land uses immediately adjacent to the creek such as Frost Reserve and the Kincumber Pumping Station also interact with the wetland ecology. In addition, there is the potential for illegal cutting of mangroves and Casuarinas where they back onto recently developed subdivisions and residents may attempt to reclaim the public reserve along Kincumber Creek for their own purposes.

Case Study 1 - Development at Kincumber

SECTION 90 CONSIDERATIONS

The following points are taken from the Environmental and Planning Act (section 90) that must be considered when presenting a developmental application to Gosford.

- a) the impact of that development on the environment (whether or not the subject of an environmental impact statement) and, where harm to the environment is likely to be caused, any means that may be employed to protect the environment or to mitigate that harm;
- b) the effect of that development on the landscape or scenic quality of the locality;
- c) the effect of that development on any wilderness areas in the locality;
- d) the social effect and the economic effect of that development in the locality;
- e) the character, location, siting, bulk, scale, shape, size, height, density, design or external appearance of the development;
- f) the size and shape of the land to which that development application relates, the siting of any building or works on that land the area to be occupied by that development;
- g) whether the land to which that development application relates is unsuitable for that development by reason of its being, or likely to be subject to flooding, tidal inundation, subsidence, slip or bushfire or any other risk;
- h) the relationship of that development to other development on adjoining land or on other land in the locality;
- i) whether the proposed means of entrance to and exit from that development and the land to which that development application relates are adequate and whether there is adequate provision for loading, unloading, manoeuvring and parking vehicles within that development or on that land;
- j) the amount of traffic likely to be generated by the development, particularly in relation to the capacity of the local road system and the probable effect of that traffic on their movement of traffic on that road system;
- k) whether public transport services are available and adequate for that development;
- l) whether utility services are available and adequate for that development;
- m) whether that development is likely to cause soil erosion;
- n) the public interest.

Case Study 2 - Marina Development

Scenario:

Your group represents a boating club that uses Brisbane Water. They wish to develop a marina for their use. This involves less than 30 vessels (so no Environmental Impact Study is required).

The process:

You are provided with

- a map of Brisbane Water showing the location of sensitive areas such as wetlands and seagrass beds
- a UBD street directory for the Central Coast

You need to choose a site for your marina.

You need to consider such things as:

- access to the marina for both boats and road vehicles
- environmental considerations
 - pollution risk (sewerage, fuel, antifouling paints etc)
 - noise
 - wash, erosion
 - acid-sulfate soils
 - habitat loss (wetlands, mangroves, seagrasses)
- visual impact and heritage considerations
- the impact of your development on the surrounding area

Three agencies are linked to this development - Waterways, NSW Fisheries and Department of Land and Water Conservation.

What you need to do:

Your group must present a proposal for your marina. This will include:

- a drawing of the marina in its setting;
- an explanation of the benefits of the chosen location;
- a report to Council (using the **Report Scaffold for the case studies**) explaining the proposal and recommending that they approve the development because you have considered the environmental implications.

References

- Gosford City Councils Brisbane Water Plan of Management
Section 11.2 (Marinas and Recreational Boating Facilities)

Case Study 3 - Sydney / Gosford Ferry Proposal

The proposal to develop a regular 'Super-Ferry' service between Gosford and Sydney has aroused the community. Read the following newspaper articles and then answer the Questions that follow:

Case Study 3 - Sydney / Gosford Ferry Proposal

1. List the concerns expressed by the Community
2. List the benefits of the proposal.
3. The ferry won't be built until approval is given to operate within Brisbane Water. Should approval be given on the basis of the modelling done by the operators?
4. How can the communities concerns be addressed scientifically?
5. Where can the community get reliable information on the impacts?
6. Hold a mock Council meeting to consider whether or not the ferry should be approved.

USING THE BRISBANE WATER CATCHMENT UNIT TO LEAD INTO A STUDENT RESEARCH PROJECT

The following section may assist teachers and students in developing a student research project that will meet the requirements of the Stage 4/5 Science syllabus.

Stage 4 projects may be all group efforts but at least one project in Stage 5 must be an individual effort.

It is hoped that this unit of work will stimulate students to want to study further aspects of their local area.

The project may be used to enter competitions. Information about these competitions and past projects in this area can be found at the following:

- BHP Science Awards (<http://www.Bhp.com.au/scienceawards/student3.htm>)
- The Earthworm Environmental Awards (see ASTA's internet site for more details <http://www.asta.edu.au>)
- CREST (<http://www.csiro.au/communication/csiroedp/crest.htm>)

Another good resource is the Science Stages 4/5 support document p115-147.

The following example is presented to show how a project may follow on from this unit of work.

NB Lessons may have gaps between them depending on the teaching plan and duration of the project. It is anticipated that a project will span about 4 weeks.

- Lesson 1**
- (a) Discuss criteria for a successful project e.g. teacher may have a proforma.
 - (b) Discuss various ways in which the project can be presented.
e.g. video essay
photographic essay
survey
practical report
research assignment
 - (c) Decide on assessment.
 - (d) Homework – think about an issue/question that you would like to investigate.

Lesson 2 Brainstorm research topics e.g.

- A personal history showing how the local area has changed
- Water-holding capacity of different soils and the implications for plants growing in these soils
- A report on local endangered species
- A study of a local waterway (Streamwatch)
- An airwatch study
- The effect of fertiliser on plant growth
- Factors effecting seagrass growth
- Mangroves in the Brisbane water catchment
- Use the Internet link to Rumbalara to investigate an issue identified by local groups as being of concern.

Homework – students select a research topic/question and present a draft plan of what they intend to do before starting the project. This is an assessable part of the project and important in skills development.

This plan is checked by the teacher to determine if the project

- meets the criteria
- is achievable in the set time frame
- does not involve activities that are dangerous or cruel

Lesson 3 Mid project progress report. This could be the presentation of a log book of activities, or a report to the class.

It is up to the teachers to decide how much time is spent in class on the project.

Lesson 4 This lesson should occur after the data collection phase of the project. Students may need assistance with putting the results together in a meaningful way.

Lesson 5 Presentation of reports. Peer assessment may be a part of this process.



