

# **Science Stage 6**

## **Draft Sample Learning Unit for Earth and Environmental Science**

# Sample Learning Units/Units of Work

## Introduction

In reviewing the *1999 Stage 6 Support Document* the sample programs were revised and changes have been made to incorporate:

- amendments to the syllabuses (2002)
- some of the learning–teaching activities
- a greater focus on assessment for learning in the learning units
- a continuum in the approach to programming and assessment that is consistent with [Science Years 7–10 Advice on Programming and Assessment](#)

Together with the [Stage 6 Support Document \(2007\)](#) the sample learning units/units of work are designed to assist teachers in implementing the *Science Stage 6 Syllabuses*. A learning unit for a Preliminary course module from each of Biology, Chemistry, Earth and Environmental Science, Physics and Senior Science is included.

The level of detail in the learning–teaching and assessment strategies is provided to illustrate one way in which the explicit integration and development of the 8.1 skills module content and PFA emphasis may be undertaken in developing a learning unit.

## Overview of Planning and Programming Learning Units

### Establishing a scope and sequence

The fundamental step in planning is establishing a scope and sequence plan (p 55 of the Support document) which contains the overview of the placement, sequence and duration of proposed learning units. The completed scope and sequence will also identify the outcomes targeted for each learning unit and any specific syllabus requirements including the open-ended investigation (p 35 of the Support document). Evaluation in relation to the *Science Stage 6 Syllabus* requirements of the scope and sequence and the developing units of work in the school's learning, teaching and assessment program for the course is essential.

### **Checklist: Syllabus Requirements**

A school learning–teaching program for Stage 6 Preliminary and HSC science courses must include the following:

- all Prescribed Focus Area, Domain: knowledge, understanding, skills, values and attitudes outcomes
- the three syllabus content elements: Context, Prescribed Focus Areas (PFA) and Domain
- all the Domain: knowledge and understanding and skills content in the modules
- the integration of Modules 8.1 or 9.1 skills content within and across the learning units to develop the full range of skills by the end of the courses
- practical experiences with at least one open-ended investigation in both the Preliminary and HSC courses
- timetabling of 120 hours for each of the Preliminary and HSC courses
- evidence that 80 indicative hours of practical/field work during the Preliminary and HSC courses with no less than 35 hours of practical experiences in the HSC course have been completed
- compliance with:
  - mandatory safety requirements (p 44 of the Support document)
  - regulations related to the use of animals in teaching (p 46 of the Support document).

Planning and programming is a dynamic process involving a number of interrelated activities. In planning the school learning–teaching and assessment program for a course, teachers may choose to use the current units as the starting point, evaluate and revise some current units and design additional new ones, or devise completely new units for the whole program.

### **Gathering evidence of learning**

The *Science Stage 6 Syllabuses* promote an approach to planning and programming that has outcomes as the focus. In the initial stage of the planning process a manageable number of outcomes for the learning unit/unit of work are identified. These targeted outcomes are central to decisions about the required evidence of learning to be observed through the learning, teaching and assessment experiences. Once specific evidence of learning has been identified, strategies to collect the required evidence are selected. Methods of gathering evidence could include informal teacher observation, questioning, peer and self-evaluation as well as more structured formal types of assessment activities.

### **Designing the unit**

In planning the learning units a structure for presenting the teaching sequences needs to be decided. The design of the learning units should enable a clear link to be made between the targeted outcomes, the knowledge, understanding and skills content and the selected suggested integrated learning, teaching and assessment experiences. A [sample page from a learning unit](#) based on the sample learning unit proforma (p 57 of the Support document) identifies the basic elements of a learning unit/unit of work. The annotations show the characteristics of each part. Schools may choose to use or adapt the proforma provided to develop learning units that best meet their needs and circumstances.

### **Mapping the skills content**

In Stage 6 the skills build on the essential content in the *Science Years 7–10 Syllabus*. During the Preliminary and HSC course, it is expected that students will further develop skills in planning and conducting investigations, communicating information and understanding, scientific thinking and problem-solving and working individually and in teams. Each syllabus module specifies content through which skill outcomes for the course can be achieved. Teachers should develop activities based on that content to provide students with opportunities to develop the full range of skills. The [skills content mapping grids](#) can be used as a planning tool by broadly classifying the skills learning experiences into one of three developmental levels. In the learning phase (L) the teacher establishes the student's skill level/prior learning and uses this as the basis for developing student understanding through explicit teaching of the relevant knowledge, understanding and skills components. In the practising phase (P) the student uses the knowledge, understanding and/or skills in tasks to achieve specific goals. The application phase (A) is when the student independently uses the knowledge, understanding and skills in the course of regular work and as a foundation for the development of learning.

Based on an analysis of all of the learning units/units of work the school program should be evaluated and modified to ensure that all the mandated 8.1 (Preliminary) or 9.1 (HSC) skills content is addressed and that there is a continuum in the development of skills content within the course. During the planning and development of the learning units in the school program adjustments to the scope and sequence and skills content mapping grids will need to be made.

### **Programming the learning experiences**

In the programming process, learning experiences are selected and sequenced to cater for the diversity of student learning needs. The lesson sequences in the units of work should highlight how students' knowledge, understanding and skills are developed through explicit, systematic teaching–learning that is clearly linked through the identified module and skill content to the syllabus outcomes for the course.

Assessment for learning (p 26 of the Support document) occurs as an integral part of learning and teaching and involves using a range of strategies to: enhance learning, clarify and promote deeper understanding, plan ways to remedy misconceptions, and develop and incorporate new knowledge, understanding and skills. Strategies should be supportive of the learning process, appropriate to the outcomes being assessed and provide students with feedback on what they have learned and what needs to be done to continue their learning. Assessment for learning encourages self-assessment and peer assessment with students developing and using a range of strategies to monitor and evaluate their own learning and the strategies they use.

The checklist provides a guide to developing learning experiences that are consistent with the requirements of the *Science Stage 6 Syllabuses*.

### **Checklist: Programming Learning Experiences**

To meet syllabus requirements the range of learning experiences and strategies selected for a unit of work should:

- target and address an appropriate and manageable range of knowledge, understanding, skills, values and attitudes outcomes for the indicative time allocated to the module in the syllabus
- make explicit the contexts drawn from the module contextual outline, the selected Prescribed Focus Area (PFA) and the content statements in column 1 devised as the framework to assist students to use their current understanding to develop and apply more specialised scientific knowledge and skills
- relate explicitly the selected skills content from Module 8.1 (Preliminary) and 9.1 (HSC) to the specified module content ([skills content mapping grids](#))
- identify and extend students' prior learning using an appropriate range of strategies (Continuum of Learning on p 7 of the Support document)
- emphasise learning in the lesson sequences that specifically develop the targeted PFAs and values and attitudes outcomes selected for the unit
- integrate assessment for learning as part of the learning-teaching process
- identify specific evidence of learning to be observed through the teaching, learning and assessment (informal and formal) experiences
- provide sufficient variety to meet the needs of a range of student learning styles
- include a balance between informal and formal strategies to provide students with feedback on their learning.

### **Adjusting and amending the learning program**

Teacher reflection and evaluation (p 49 of the Support document) and students' feedback during and following the teaching of lesson sequences and/or the unit of work will result in amendments to the scope and sequence, skills mapping grids and the learning units that together make up the school program.

### **Recording evidence of learning**

The school learning, teaching and assessment program should provide a range of opportunities for students to develop and demonstrate progress towards achievement of the Stage 6 syllabus knowledge, understanding and skills outcomes for the course. By integrating learning and assessment, the teacher can choose which aspects of a student's performance to record. Recording student performance needs to be manageable. Teachers should make decisions about which aspects of student performance in an activity are to be recorded and in what format.

All assessment activities can be used to support learning and to provide feedback to students that enables them to actively monitor and evaluate their own learning. Teachers can use the evidence of learning gathered to extend the process of assessment for learning into the assessment of learning. In a standards-referenced framework this involves teachers making professional judgements about student achievement at key points in the course. The sample HSC course assessment plan (p 51 of the Support document) identifies these key points and the internal assessment mark provides a summation of each student's achievements measured at these points throughout the course. In the assessment plan for the course a variety of tasks should be used to give students the opportunity to demonstrate outcomes in different ways and to improve the validity and reliability of the assessment.

1 This column 1 content point is examinable. It can also provide a contextual focus for teaching and learning.

## Sample Page from a Learning Unit

### Stage 6 Earth and Environmental Science Syllabus

#### 8.3.3: The impact of humans on local aquatic and terrestrial environments will differ with locality

8.3.3 Module Content (column 2 and 3)	Reg	8.1 Skills Content	Suggested Learning–Teaching Experiences and Evidence of Learning*
<p>Students learn to/students:</p> <p>*explain why different groups in the local society have different views of the impact of human activity on the local environment</p> <p>2 Content related to the Prescribed Focus Area outcome (P4).</p> <p>3 These content points contain the mandatory knowledge and understanding content of the syllabus.</p> <p>*identify data, gather, process and analyse first-hand information and use available evidence to assess current human impact on the local biotic and abiotic environment.</p> <p>4 Key words identifying the module 8.1 skill content to be addressed.</p>		<p>Students:</p> <p><b>12.3 gather information from secondary sources by:</b></p> <p>d) summarising and collating information from a range of sources</p> <p><b>13.1 present information by:</b></p> <p>a) selecting and using appropriate media or combinations thereof, for presentations</p> <p>e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p><b>14.1 analyse information to:</b></p> <p>e) make and justify generalisations</p> <p>g) use cause-and-effect relationships to explain phenomena</p> <p>h) identify examples of the interconnectedness of ideas or scientific principles</p> <p><b>13.1 present information by:</b></p> <p>e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p><b>14.1 analyse information to:</b></p> <p>e) make and justify generalisations.</p> <p>5 Module 8.1 skills content with a specific focus in the Suggested Learning–Teaching Experiences.</p>	<p>In a class activity, students</p> <ul style="list-style-type: none"> <li>- use a teacher-developed strip mine for coal in the local environment</li> <li>o find information on the impact of fossicking, of the distinction between an exploration licence, a mineral claim and a mining lease</li> <li>o consider how land use changes over time, eg many mining operations only last for ten years</li> <li>o prepare an outline of the possible views of the different community groups such as residents, Aboriginal peoples, tourists, developers, environmentalists and local government</li> <li>o debate whether the coal strip mine should be developed</li> <li>o discuss why the environmentalists' view of the land use should be regulated</li> </ul> <p>7 Experience that can be used to provide observable evidence resulting from learning–teaching that will allow judgements to be made in relation to the progress towards achievement of the target outcomes. Suggested Evidence of Learning activities are indicated by the use of italics.</p> <p>Individually, students</p> <ul style="list-style-type: none"> <li>- produce a summary table of the different viewpoints of each community group and the main arguments for and against the proposed coal mine that they identified (P4, P13, P14).</li> </ul> <p>Focus Activity Task 3</p> <p>Working as a project team, students</p> <ul style="list-style-type: none"> <li>- discuss the impact of past human activity on the local terrestrial environment of the field site considered in the context of the proposed coal mine development</li> <li>- monitor the team's progress towards the completion of the activity (P15). *Suggested Evidence of Learning activities are in italics</li> </ul> <p>8 Problem-solving, contextually based, team activity undertaken throughout the unit. It integrates the skill and module content and develops students' understanding of the targeted Prescribed Focus Area outcome(s).</p> <p>6 Explicit learning–teaching sequences that provide opportunity for students to develop the knowledge, understanding, skills values and attitudes to demonstrate evidence of learning in relation to the targeted outcomes.</p>

## About the Sample Learning Units

The sample learning units have been designed to assist teachers in implementing the *Science Stage 6 Syllabuses*. Schools may choose to use or adapt these sample units in planning and developing units of work that will best meet the needs of the range of learning styles, abilities, circumstances and expectations of their students.

The sample units provide examples of how a manageable range of targeted knowledge, understanding, and values and attitude outcomes can be addressed. The lesson sequences within the units demonstrate ways that teachers can build on the foundation of scientific knowledge and skills in working scientifically that students have gained from their learning experiences based on the *Science Years 7–10 Syllabus*. The detail described in the Suggested Learning–Teaching Experiences column is provided to show how the targeted outcomes for the unit can be addressed through explicit and systematic learning. The sample learning units also model how an appropriate balance between student-centred and teacher-directed learning can be achieved in the suggested learning-teaching experiences.

In the Stage 6 syllabuses the Prescribed Focus Area (PFA) emphasis is embedded in the module content. The selected learning, teaching and assessment experiences within each unit provide examples that demonstrate how the identified module contexts and the intent of one or more targeted Prescribed Focus Area outcomes (Stage 6 syllabuses pages 12 and 13) are made explicit.

A syllabus requirement is that the module 8.1 skills content is integrated within and across the learning units of the school teaching program so that students have opportunities to develop the full range of skills by the end of the course. The sample units model how this skills content can be explicitly integrated within the specified content of each module. To assist teachers in developing the skills content continuum across all the units in the school program a suggested planning tool is to broadly classify the skills learning experiences into one of three developmental phases: learn (L), practise (P) and apply (A). In each of the sample units, the learning experiences provide opportunities for students to engage in learning, practising and/or applying the skill content for the targeted outcomes. At the end of each sample learning unit an overview is provided that shows the targeted skill outcomes with the skill content coded and mapped to the developmental levels of the learning experiences in each section of the unit.

For consistency with the focus on assessment for learning in Years 7–10, a range of specific evidence of learning experiences have been identified in italics within the Suggested Learning–Teaching Experiences column of the learning unit. These provide examples of evidence of learning that could be used to make judgements about students' progress towards the achievement of the outcomes targeted in the unit. The marking criteria and guidelines ([HSC Assessment in a standards-referenced framework – A guide to best practice](#)) developed by teachers for these experiences could be used to provide students with constructive and meaningful feedback in relation to their achievement of the targeted outcomes of the unit.

### Focus activity

In developing each of the sample units of work, a focus activity has been incorporated which involves students in undertaking and managing a project throughout the unit. The focus activity models how the integrated module and skills content can be used to develop students understanding of the ideas embedded in the targeted Prescribed Focus Area outcome(s). The activity has been designed so that the core knowledge, understanding and skills required for the project are systematically addressed within the content of each section of the module and the project should therefore be able to be completed within the time allocation for the unit. An [overview](#) is provided to

show for each focus activity the PFA emphasis explicitly applied through the learning–teaching experiences in the learning unit provided for each course.

The focus activity in each of the learning units is based around the students using a real world setting of the project management process to create a specific product. By actively engaging in applying their learning in an authentic workplace context students can be encouraged to recognise and use their current understanding to further develop and apply more specialised knowledge and skills. In undertaking and managing the project students develop knowledge of and skills in working individually and in teams (P15) and have the opportunity to learn through problem-solving (P14). In the role of facilitator and advisor, the teacher assists in monitoring the progress of each team.

Project management necessitates the use of tools and techniques to organise activities for a specific purpose and requires the use of effective communication and interpersonal skills. In introducing the activity, and while students are undertaking the focus activity, opportunities may need to be provided for them to review their prior understanding and develop the communication and interpersonal skills – such as active listening, conflict resolution, negotiation skills and team building – that are needed to work effectively with others.

Students may need an introduction to project management methodology. A project can be basically organised into four phases: defining, planning, implementing and reviewing. The table provides an overview of each phase and how the main components of the process can clearly contribute to providing evidence of learning relating to the syllabus outcomes of problem-solving and working in teams.

## **Checklist: Project Management for the Focus Activities**

**Defining** the project includes:

- clarifying the project brief by identifying, analysing and explaining the nature of a problem
- establishing the main elements of the project
- setting the goals that are key to the success of the project
- identifying the timing and deadlines (key dates) to be met
- determining tasks and resources
- assessing constraints and risk including social and ethical concerns
- defining individual and team roles and responsibilities
- showing flexibility and responsiveness to ideas and evidence.

**Planning** the project includes:

- identifying, and describing different strategies that could be used to solve the problem
- choosing the most appropriate strategies to solve the problem
- agreeing on tasks, resources and timelines
- evaluating potential risk factors that could impact on the completion of the project
- identifying the specific roles needed and matching team members to tasks according to the requirements of the task
- negotiating and allocating individual roles and responsibilities
- respecting differing opinions and viewpoints about the issues being considered.

**Implementing** the project includes:

- conducting the investigation using the identified strategies
- modifying the plan and processes where issues are identified or arise during the investigation
- gathering data and communicating information and understanding
- completing progress reports which evaluate the appropriateness of strategies, processes and modifications used in solving the problem
- working effectively in individual roles and as a team to meet timelines and goals
- monitoring team progress to completion of the task
- demonstrating confidence and a willingness to make decisions and to take responsible actions.

**Reviewing** the project includes:

- presenting the product using an appropriate medium
- evaluating the plan, strategies and processes used by the team
- evaluating the effectiveness of the team in completing the task
- acknowledging the role of science in providing information and understanding about issues being considered and the impact of science on aspects of everyday life.

If the focus activity is to be used to gather evidence of student learning the students need to be informed of the criteria that will be used to assess their learning. The [sample feedback template](#) provides an example of one model that could be used with the focus activity to inform students what they need to do to demonstrate evidence of learning in relation to working in a team. It could also be used to provide effective student feedback that enables them to recognise their strengths and areas for development.

### Sample feedback template – Working in a team

<b>Teamwork criteria</b>	<b>Low</b>	<b>Satisfactory</b>	<b>High</b>
Defines team responsibilities	With teacher guidance outlines individual and/or team responsibilities	Defines individual and/or team responsibilities	Demonstrates confidence in describing individual and/or team responsibilities
Identifies and accepts roles	With teacher guidance identifies and accepts specific individual and/or team roles	Identifies and accepts individual and/or team roles specific to the task	Matches team members to roles according to the specific requirements of the task and accepts roles based on the skills of the individual
Sets goals and timelines	With teacher guidance identifies goals and set timelines for the task	Identifies goals and sets timelines	Demonstrates high-level skills in setting realistic goals and timelines
Communicates opinions/ideas	With teacher guidance expresses opinions and ideas	Clearly expresses opinions and ideas	Communicates opinions and ideas succinctly and logically
Uses listening and negotiation skills	With teacher guidance uses active listening and negotiation skills	Demonstrates some skills in active listening and negotiation	Demonstrates high level active listening and negotiation skills
Engages in teamwork	With teacher guidance uses a limited number of strategies to work within the team to complete the task	Identifies and uses a range of cooperative learning strategies to work efficiently as a team member to complete the task	Demonstrates a sound understanding of cooperative learning strategies and uses these to work collaboratively to complete the task
Makes decisions and takes responsible actions	With teacher guidance takes responsibility in a negotiated role to follow a plan to meet goals and timelines	Takes responsibility for roles within the team and works with others to meet goals, timelines and monitor progress of the task	Demonstrates responsibility in a number of roles and in decision-making so that goals and timelines are met and the progress of the task is monitored
Team effectively completes the task	With teacher guidance identifies some processes which assisted the team to complete the task	Describes the effectiveness of some parts of the plan and some processes used by the team to complete the task	Evaluates the effectiveness of the plan and processes used by the team in completing the task

## Overview of Sample Learning Units

Stage 6 Syllabus Module	Unit Target Outcomes	Prescribed Focus Area Emphasis	Focus Activity
<b>Biology</b> 8.3 Patterns in Nature	P1 P3 P6 P11 P12 P13 P14 P15 P16	The PFA emphasis in this unit is on developing students' knowledge and understanding of: - biology as an ever-developing body of knowledge - the relevance, usefulness and applicability of biological concepts and principles.	Your team of four is involved in major research investigating the structure and function of cells. Your manager requests that the team submit an article about your research projects for the magazine produced by your company. The magazine is read widely by the general public and it is also an important resource used by Years 11 and 12 Biology students. The article must be informative, scientifically accurate, interestingly written and be no longer than 4000 words. It must include a brief outline of the investigation methods used by the team and how the findings from this research has increased understanding of the relationship between cells, organs and organ systems in the functioning of multicellular plants and/or animals. You will work as a team to produce the article, with each member negotiating to prepare and present specific investigation methods and findings for inclusion in the article.
<b>Chemistry</b> 8.4 Water	P2 P4 P6 P10 P11 P12 P13 P14 P15 P16	The PFA emphasis in this unit is on developing students' knowledge and understanding of: - the process and methods of exploring, generating, testing and relating ideas - the impact and the role of chemistry in society and the environment - skills in decision-making about issues concerning chemistry, society and the environment	Your chemistry class has been contracted as chemical consultants to undertake an environmental impact study on the development of a desalination plant on the shore of a coastal bay. Your team will prepare part of the report that describes the key scientific principles being applied in the operation of the plant (eg how energy is supplied, how pure water is separated, how the properties of water and water solutions are applied in the separation process), possible social and environmental impacts of the desalination plant, including the possible forms and impact of pollution that may occur, key considerations that will influence where the plant is located and the arrangements for returning wastewater to the bay. You will work in a small team, with each member negotiating to prepare and present specific aspects of the final environmental impact assessment report.
<b>Earth and Environmental Science</b> 8.3 The Local Environment	P2 P4 P7 P11 P12 P13 P14 P15 P16	The PFA emphasis in this unit, through a field study investigation, is on developing students': - knowledge and understanding of the process and methods of exploring, generating, testing and relating ideas - skills in decision-making about issues concerning society and the environment - awareness of science that relate to distinctively Australian environments.	You are part of a team of environmental scientists undertaking an environmental impact assessment of an area which has been selected as a potential site for a major residential development. The team will need to investigate the relationship between geology, landscape, soils, climate, plants and animals with a particular focus on the impact of humans on the local environment. You will work as a project team with each member negotiating to research, report and present a specific part of the final environmental impact assessment report.

Stage 6 Syllabus Module	Unit Target Outcomes	Prescribed Focus Area Emphasis	Focus Activity
<b>Physics</b> 8.2 The World Communicates	P2 P3 P5 P7 P8 P11 P12 P13 P14 P15 P16	The PFA emphasis in this unit is on developing students' knowledge and understanding of: - the process and methods of exploring, generating, testing and relating ideas - how increases in our understanding in physics have led to the development of useful technologies and systems - the contributions physics has made to society, with a particular emphasis on Australian achievements	You are a member of a project team of telecommunications experts whose task is to develop a plan for a safe, energy efficient and sustainable communications system for a mining community in an isolated area of Australia. You will present a short, creative and scientifically accurate presentation on your plan to a local community forum. The report you prepare should include the plan, an outline of how increases in our understanding in physics and the application of present-day understanding of the electromagnetic spectrum have led to the development of useful communication technologies and an evaluation of the social and environmental impacts of the proposed communications system. You will work as a project team with each member negotiating to research, report and present one or two specific technological aspects for the team.
<b>Senior Science</b> 8.2 Water for Living	P2 P4 P7 P9 P11 P12 P13 P14 P15 P16	The PFA emphasis in this unit is on developing students: - understanding of the interrelatedness of people and their surrounds - skills in decision making about water resource management - awareness of science that relate to distinctively Australian environments.	Your Senior Science class has been contracted as consultants by a local government organisation to research and prepare a series of short, creative and scientifically accurate presentations to inform the community about strategies to maintain the quality and sustainability of the local water supplies. The presentation must be no longer than 4 minutes and must include relevant information on the issues and strategies to reduce the impacts and consequences of human activity on water usage and pollution in the local catchment area. You will work as a project team with each member negotiating to research, report and present information for a specific part of the team presentation.

**Science**  
**Stage 6**

**Draft Sample Learning Unit – Earth and Environmental Science**  
**Module 8.3 The Local Environment**

## Sample Stage 6 Earth and Environmental Science Course    Module 8.3 – The Local Environment (30 indicative hours)

### Contextual Outline

The immediate environment has an impact on all people in ways that an Earth and Environmental Science student will learn to recognise and explain. This module allows students to draw on existing knowledge of their own local area and expand on their understanding of geological and climatic concepts through careful analysis of the area. Study of this module must include field experience in the investigation of landforms, rock and soil types as well as biological factors and how all of these interact to form the local environment.

Students will be able to identify and relate the physical and chemical features of their local environment and relate those features to the hydrologic, lithologic and atmospheric cycles in operation. They need to be able to identify and relate landforms, rock types and soils to the resultant natural environments in which they, the plants and other animals of the area, live. In order to judge the impact of human settlement in the area, students will need to investigate the history of the local environment as evident in the rocks, soils and fossils of the area. Where practicable, they could also seek the assistance of local indigenous people in tracing the history of the area before the advent of European settlement.

Finally, students should be encouraged to analyse those aspects of the local environment that have been affected by people, describe the impacts, identify the causes of these impacts and propose realistic solutions to any problems that exist by emphasising ecologically sustainable development strategies. At least one field study will be necessary to identify the geological features of the landscape. The report on any field study should include: a statement of purpose, a clear and detailed definition of the area studied, any background material collected on the area, appropriate presentation of data collected, analysis of data, suggestions of the relationships that exist in the area, and an assessment of human impact on the area.

This module increases students' understanding of the nature and practice, the implications for society and the environment, and the current issues, research and developments in Earth and Environmental Science.

### Assumed Knowledge

*Domain: knowledge and understanding*

Refer to the *Science Years 7–10 Syllabus* for the following:

5.10a) distinguish between biotic and abiotic features of the local environment

5.10c) describe some impacts of human activities on ecosystems

5.11.2c) discuss strategies used to balance human activities and needs in ecosystems with conserving, protecting and maintaining the quality and sustainability of the environment.

This unit of work builds on the essential content of the Prescribed Focus Area and the skills described in the *Science Years 7–10 Syllabus*.

### Targeted Outcomes

P2     applies the processes that are used to test and validate models, theories and laws of science with particular emphasis on first-hand investigations in Earth and Environmental Science

P4     identifies applications of science which affect society or the environment

P7     identifies and describes the physical and chemical features of the environment

- P11 identifies and implements improvements to investigation plans
- P12 discusses the validity and reliability of data gathered from first-hand investigations and secondary sources
- P13 identifies appropriate terminology and reporting styles to communicate information and understanding in Earth and Environmental Science
- P14 draws valid conclusions from gathered data and information
- P15 implements strategies to work effectively as an individual or as a member of a team
- P16 demonstrates positive values about, and attitude towards, both the living and non-living components of the environment, ethical behaviour and a desire for a critical evaluation of the consequences of the applications of science

### **Focus Activity**

Throughout this unit the emphasis applied to learning focuses on developing students understanding of the process and methods of exploring, generating, testing and relating ideas (P2), their skills in decision-making about issues concerning society and the environment and their awareness of areas of Earth and Environmental science that relate to distinctively Australian environments (P4). In developing this sample unit of work, a focus activity has been incorporated to model how these targeted Prescribed Focus Area outcomes can be developed through the module knowledge, understanding content and Module 8.1 skills content.

The focus activity in this learning unit is based around the students using [a project management](#) process to create a specific product. This approach provides an example of how, by actively engaging in an authentic strategy applied in a real-world setting, students can be encouraged to recognise and use their current understanding to further develop and apply more specialised knowledge and skills. In undertaking and managing the project students have the opportunity to work individually and in teams (P15) and to learn through problem-solving (P14).

Students will need access to the internet and a range of software applications including word processors, spreadsheets, databases and presentation and multimedia players to enable them to process, analyse and present information. Throughout the unit and in undertaking the project students will need to have access to individual and shared files for collecting, organising, storing and retrieving data.

Each student will keep an individual logbook/journal that records a summary of what they did each time they worked on the project. It would include ideas, planning, summaries of research information, appropriately acknowledged relevant references, resources with annotations and evaluation of strategies and solutions.

### **Focus Activity: 8.3 The Local Environment**

You are part of a team of environmental scientists undertaking an environmental impact assessment of an area which has been selected as a potential site for a major residential development. The team will need to investigate the relationship between geology, landscape, soils, climate, plants and animals with a particular focus on the impact of humans on the local environment. You will work as a project team with each member negotiating to research, report and present a specific part of the final environmental impact assessment report. This activity is due for completion by the end of this module.

Note: The field study integrates all sections of this module therefore cross-references are made to the appropriate section of the module, eg 8.3.4.

**Resources**

Examples would include:

- texts, references, scientific journals and library resources
- current websites, digital, audio and visual technologies
- guest speakers and excursions
- specific materials, resources and equipment (including safety equipment).

### 8.3.1: Rocks are formed from different materials

8.3.1 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students:</p> <p>*identify common rock forming minerals</p> <p>*distinguish between igneous, sedimentary and metamorphic rock groups in terms of their origins and common mineral composition</p>		<p>Students:</p> <p><b>13.1 present information by:</b> e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p><b>12.4 process information to:</b> c) illustrate trends and patterns by organising data through the selection and use of appropriate methods, including computer assisted analysis</p> <p><b>11.1 identify data sources to:</b> b) determine the type of data that needs to be collected and explain the qualitative or quantitative analysis that will be required for this data to be useful</p> <p><b>12.1 perform first-hand investigations by:</b> a) carrying out the planned procedure, recognising where and when modifications are needed and analysing the effect of these adjustments b) efficiently undertaking the planned procedure to minimise hazards and wastage of resources c) carefully and safely disposing of any waste materials produced during the investigation</p>	<p>Introductory Activity: how can the local environment be interpreted in terms of the interaction of the lithosphere, biosphere, hydrosphere and atmosphere? In a class activity, students: - discuss, with teacher guidance, the concept of Earth as a system with the sub-systems of lithosphere, biosphere, atmosphere and hydrosphere (4.9.3–4.9.6) - recall the differences and interactions between the biotic and abiotic features of the local environment (5.10a) - construct a concept map showing the movement of matter and energy in and out of the lithosphere, biosphere, hydrosphere and atmosphere of the local environment. Students will add information to this concept map throughout the module.</p> <p>In a class activity, students: - use teacher-provided resources to identify the physical and chemical properties of common rock forming minerals that can be used in their identification - discuss simple identification tests - use a key to identify common rock-forming minerals using their physical characteristics.</p> <p>Practical Investigation: how does rate of cooling of saturated solutions affect crystal size? In pairs, students: - perform a teacher-planned first-hand investigation to observe the differences between quickly and slowly cooled saturated solutions - observe the differences between the two cooled solutions (solid 1 and 2) - compare polished igneous rock samples with the two cooled solutions - describe the features of a teacher-prepared sediment sample (formed by silt and pebbles settling in a beaker of water) (solid 3) - discuss how the features of each solid are able to provide information about its origin - compare some unknown sedimentary and igneous (volcanic and intrusive) rock specimens to the three solids above, using a table to summarise their similarities and differences.</p>

8.3.1 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students: *perform a first-hand investigation and use second hand data to classify several common igneous, sedimentary and metamorphic rocks using a key, with particular reference to those rocks in the local environment</p> <p>* identify and describe the geological features of the local environment that determine its natural landforms</p>		<p>Students:</p> <p><b>12.2 gather first-hand information by:</b></p> <p>b) measuring, observing and recording results in accessible and recognisable forms, carrying out repeat trials as appropriate</p> <p><b>13.1 present information by:</b></p> <p>e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p><b>14.2 solve problems by:</b></p> <p>a) identifying and explaining the nature of a problem</p> <p>b) describing and selecting from different strategies those which could be used to solve a problem</p> <p>c) using identified strategies to develop a range of possible solutions to a particular problem</p> <p>d) evaluating the appropriateness of different strategies for solving an identified problem</p> <p><b>12.2 gather first-hand information by:</b></p> <p>a) using appropriate data collection techniques, employing appropriate technologies, including data loggers and sensors</p> <p>b) measuring, observing and recording results in accessible and recognisable forms, carrying out repeat trials as appropriate</p>	<p>Practical Investigation: how can physical characteristics be used to classify rocks?</p> <p>In pairs, students:</p> <ul style="list-style-type: none"> <li>- develop a strategy for placing a selection of unknown igneous, sedimentary and metamorphic rock specimens into groups</li> <li>- report their strategy and classification to the class.</li> </ul> <p>In a class activity, students:</p> <ul style="list-style-type: none"> <li>- discuss the different ways the rocks have been classified</li> <li>- determine further evidence needed to improve the classification</li> <li>- develop a classification table with teacher guidance.</li> </ul> <p>Individually, students:</p> <ul style="list-style-type: none"> <li>- arrange several common igneous and sedimentary rocks into categories that reflect their origin by using a key (colour, mineral composition and texture)</li> <li>- use a key to identify the two types of metamorphic rocks (aligned or non-aligned minerals) from several samples</li> <li>- relate the texture of these rocks to their origin</li> <li>- observe how metamorphic rocks differ from igneous and sedimentary rocks.</li> </ul> <p>Teacher introduces the <a href="#">focus activity</a> which includes a field study of a local environment.</p> <p>Practical Investigation: what are the geological features of the school environment?</p> <p>In project teams, with teacher guidance, students investigate the school environment to:</p> <ul style="list-style-type: none"> <li>- identify and describe rock outcrops</li> <li>- collect samples where possible</li> <li>- use sketches and photographs to record surface features</li> <li>- identify the age of the rocks collected by referring to a geological map of the area</li> <li>- use a topographic map to relate the geology to the natural landforms.</li> </ul>

8.3.1 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students: *identify data, gather, process and present information as a report that identifies and describes:</p> <ul style="list-style-type: none"> <li>- the geological features of the local landscape</li> <li>- the past geological history of the area that can be deduced from evidence in the local rocks, soils or fossils</li> </ul>		<p>Students:</p> <p><b>11.1 identify data sources to:</b></p> <ul style="list-style-type: none"> <li>b) determine the type of data that needs to be collected and explain the qualitative or quantitative analysis that will be required for this data to be useful</li> <li>d) identify and use correct units for data that will be collected</li> <li>e) recommend the use of an appropriate technology or strategy for data collection or information gathering that will assist efficient future analysis</li> </ul> <p><b>12.3 gather information from secondary sources by:</b></p> <ul style="list-style-type: none"> <li>a) accessing information from a range of resources, including popular scientific journals, digital technologies and the internet</li> <li>d) summarising and collating information from a range of sources</li> </ul> <p><b>13.1 present information by:</b></p> <ul style="list-style-type: none"> <li>d) using symbols and formulae to express relationships and using appropriate units for physical quantities</li> <li>e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</li> </ul>	<p>In project teams, students plan the field study investigation by:</p> <ul style="list-style-type: none"> <li>- identifying symbols and relationships on a geological map using teacher-provided resources</li> <li>- using a geological map of the field study area to identify the parent rocks and the geological structures of the area</li> <li>- analysing teacher-provided stimulus material to identify relationships between: rock types/structures; dominant topographic features; soils; flora and fauna (refer to Modules 8.3.2, 8.3.6)</li> <li>- predicting the likely local landscape features from the rock type and geological structures present</li> <li>- gathering information from topographic maps of the area to test their predictions of landscape features and hence describe some effects of the underlying rock type and geological structure on the present-day surface features</li> <li>- accessing information on aerial photographs and collate this with maps to assess the human impact on the area including the consequences of land clearing (refer to Modules 8.3.3, 8.3.5).</li> </ul> <p>Individually, students:</p> <ul style="list-style-type: none"> <li>- complete a teacher-provided scaffold summarising the patterns and relationships between surface features and geology and landscape and human impact</li> <li>- review and update their concept map (page 16) to include additional information on the lithosphere.</li> </ul> <p>In a class activity, with teacher guidance, students:</p> <ul style="list-style-type: none"> <li>- discuss the scientific principles (eg Law of Superposition) and assumptions that need to be made in order to develop a geological history of an area.</li> </ul>

8.3.1 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
		<p>Students:</p> <p><b>14.1 analyse information to:</b></p> <p>a) identify trends, patterns and relationships as well as contradictions in data and information</p> <p>e) make and justify generalisations</p> <p>g) use cause and effect relationships to explain phenomena</p> <p><b>12.1 perform first-hand investigations by:</b></p> <p>a) carrying out the planned procedure, recognising where and when modifications are needed and analysing the effect of these adjustments</p> <p>b) efficiently undertaking the planned procedure to minimise hazards and wastage of resources</p> <p>d) identifying and using safe work practices during investigations</p> <p><b>12.2 gather first-hand information by:</b></p> <p>a) using appropriate data collection techniques, employing appropriate technologies, including data loggers and sensors</p> <p>b) measuring, observing and recording results in accessible and recognisable forms, carrying out repeat trials as appropriate</p>	<p>In project teams, students:</p> <ul style="list-style-type: none"> <li>- use the geological map and their knowledge of the origin of rock types to make and justify their generalisations about the geological history of the field study area</li> <li>- sketch a geological cross section of the field study area using symbols to express relationships between rock types and layers</li> <li>- contribute to a class discussion to develop a summary of the geological history of the area</li> <li>- analyse teacher-provided stimulus material to identify and assess the changes in the field study area in the last fifty years in terms of: vegetation cover and diversity; animal diversity and abundance; water flow and quality and human impact (refer to Modules 8.3.2–8.3.6)</li> <li>- use cause-and-effect relationships to explain these changes</li> <li>- develop a table to summarise the changes suggesting possible causes of the changes.</li> </ul> <p>In project teams, students conduct the field study investigation in which they:</p> <ul style="list-style-type: none"> <li>- identify and describe rock outcrops and collect samples where possible</li> <li>- identify the age of the rocks collected by referring to a geological map</li> <li>- use a topographic map to relate the geology to the landscape</li> <li>- use first-hand counting and sampling techniques and secondary sources to identify the dominant types of plants and animals in the area (refer to Module 8.3.2)</li> <li>- analyse soils in the area for organic content, pH, moisture content and presence of salts (chlorides) (refer to Module 8.3.2)</li> <li>- relate plants and animals to soil types (refer to Module 8.3.2)</li> <li>- relate the presence of particular animals to their requirements within the local environment (refer to Module 8.3.2)</li> <li>- gather information on water flow and quality (refer to Module 8.3.3)</li> <li>- identify current human impact on the local biotic and abiotic environment by using appropriate data collection techniques</li> </ul>

8.3.1 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
		<p>Students:</p> <p><b>13.1 present information by:</b>  d) using symbols and formulae to express relationships and using appropriate units for physical quantities  e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p><b>14.1 analyse information to:</b>  a) identify trends, patterns and relationships as well as contradictions in data and information  b) justify inferences and conclusions</p>	<p>including photography (refer to Module 8.3.5)  - identify an artificial structure that has an impact on surface processes in the field study area (refer to Module 8.3.6).</p> <p>Focus Activity Task 1:  Working as a project team, students:  - develop an appropriate project plan with time lines and identified team roles and responsibilities  - <i>prepare the field report by processing information to assess the importance of data gathered, identifying relationships and justifying inferences and conclusions</i>  - <i>use a variety of pictorial representations including recognised geological symbols to show relationships and present information clearly and succinctly</i>  - <i>annotate all resources used and clearly identify the role of each member of the team and monitor team progress towards completion of the project. (P2, P7, P12, P13, P14, P15)</i></p> <p><i>*Suggested Evidence of Learning activities are in italics</i></p>

### 8.3.2: The properties of local soils affect the local biological environment

8.3.2 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students: *summarise the processes that produce soil</p> <p>*analyse the ways in which the vegetation of an area can be influenced by soil composition and climate</p> <p>*choose equipment, plan and perform first-hand investigations during a local field study to:</p> <ul style="list-style-type: none"> <li>- identify the main parent rock types (if present)</li> <li>- analyse the soil in each area for:               <ul style="list-style-type: none"> <li>- organic content</li> <li>- pH</li> <li>- moisture content</li> <li>- presence of salts (chlorides)</li> </ul> </li> </ul>		<p>Students:</p> <p><b>12.3 gather information from secondary sources by:</b></p> <ol style="list-style-type: none"> <li>a) accessing information from a range of resources, including popular scientific journals, digital technologies and the internet</li> <li>d) summarising and collating information from a range of sources</li> </ol> <p><b>11.2 plan first-hand investigations to:</b></p> <ol style="list-style-type: none"> <li>c) design investigations that allow valid and reliable data and information to be collected</li> <li>d) describe and trial procedures to undertake investigations and explain why a procedure, a sequence of procedures or the repetition of procedures is appropriate</li> <li>e) predict possible issues that may arise during the course of an investigation and identify strategies to address these issues if necessary</li> </ol> <p><b>11.3 choose equipment or resources by:</b></p> <ol style="list-style-type: none"> <li>a) identifying and/or setting up the most appropriate equipment or combination of equipment needed to undertake an investigation</li> </ol> <p><b>12.1 perform first-hand investigations by:</b></p> <ol style="list-style-type: none"> <li>a) carrying out the planned procedure, recognising where and when modifications are needed and analysing the effect of these adjustments</li> <li>b) efficiently undertaking the planned procedure to minimise hazards and wastage of resources</li> </ol>	<p>In a class activity, students:</p> <ul style="list-style-type: none"> <li>- use secondary sources including digital technologies and the internet to review the processes that affect soil formation</li> <li>- assess the idea that the rock type on which a soil forms affects the types of living things found on the soil</li> <li>- discuss ways in which climate could affect soil formation.</li> </ul> <p>Individually, students:</p> <ul style="list-style-type: none"> <li>- use teacher-provided resources to investigate the relationship between climate and soil formation.</li> </ul> <p>Practical Investigation: what techniques can be used in soil analysis to determine organic content, pH, moisture content and presence of salts?</p> <p>In pairs, students:</p> <ul style="list-style-type: none"> <li>- use teacher-selected resources to plan a first-hand investigation to analyse a soil sample for: organic content, pH, moisture content and presence of salts (chlorides)</li> <li>- choose equipment to allow valid and reliable data to be collected</li> <li>- explain why a procedure is appropriate</li> <li>- predict possible issues that may arise and identify strategies to address these</li> <li>- use selected equipment to carry out the planned procedure, recognising where and when modifications are needed and minimising hazards and wastage of resources.</li> </ul>

8.3.2 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students: *identify, gather and process first-hand or secondary data to identify the dominant types of plants and animals in the area studied *relate the presence of particular animals in the local environment to their requirements within the local environment</p>		<p>Students: <b>14.1 analyse information to:</b> a) identify trends, patterns and relationships as well as contradictions in data and information</p> <p><b>13.1 present information by:</b> a) selecting and using appropriate text types or combinations thereof, for oral and written presentations b) selecting and using appropriate media to present data and information e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p><b>14.2 solve problems by:</b> a) identifying and explaining the nature of a problem</p> <p><b>14.3 use available evidence to:</b> b) propose ideas that demonstrate coherence and logical progression and include correct use of scientific principles and ideas c) apply critical thinking in the consideration of predictions, hypotheses and the results of investigation</p>	<p>In project teams, students use the field study data and teacher-selected resources to:</p> <ul style="list-style-type: none"> <li>- construct a table to identify the pattern and relationships of dominant types of plants and animals in the field study area</li> <li>- include in the table a list of the requirements of particular animals and relate these to the features of the environment.</li> <li>- review and update the concept map on page 16 to include additional information on the biosphere.</li> </ul> <p>Focus Activity Task 2: Working as a project team, students: <i>-use ICT to prepare a class presentation to summarise the first stage of their Environmental Impact Assessment. This consists of a site description incorporating the geology, geomorphology, soils, flora and fauna and the relationship of particular animals to their requirements within the local environment. It will include any unique, threatened or endangered species. (P2, P7, P13, P14, P15)</i></p> <p><i>*Suggested Evidence of Learning activities are in italics</i></p>

### 8.3.3: The impact of humans on local aquatic and terrestrial environments will differ with locality

8.3.3 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students:</p> <p>*gather and process information from secondary sources to describe changing vegetation cover, plant and animal diversity and abundance, and water flow and quality in the local environment over the last fifty years</p> <p>*summarise and assess the changes in the local environment in the last fifty years in terms of:</p> <ul style="list-style-type: none"> <li>-vegetation cover and diversity</li> <li>- animal diversity and abundance</li> <li>- water flow and quality</li> </ul> <p>*identify data, gather, process and analyse first-hand information and use available evidence to assess current human impact on the local biotic and abiotic environment</p> <p>*explain why different groups in the local society have different views of the impact of human activity on the local environment</p>		<p>Students:</p> <p><b>12.3 gather information from secondary sources by:</b></p> <p>d) summarising and collating information from a range of sources</p> <p><b>13.1 present information by:</b></p> <p>e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p><b>14.1 analyse information to:</b></p> <p>g) use cause and effect relationships to explain phenomena</p> <p><b>13.1 present information by:</b></p> <p>a) selecting and using appropriate text types, or combinations thereof, for oral and written presentations</p> <p><b>14.1 analyse information to:</b></p> <p>e) make and justify generalisations</p> <p>g) use cause and effect relationships to explain phenomena</p> <p>h) identify examples of the interconnectedness of ideas or scientific principles</p>	<p>In project teams, students use information collected from secondary sources and the field study to:</p> <ul style="list-style-type: none"> <li>- summarise the changes in the field study area over the last fifty years in terms of vegetation cover and diversity, animal diversity and abundance and water flow and quality</li> <li>- develop a photographic display showing changes in the field study area over the last fifty years</li> <li>- construct a flow chart to identify human activities (both urban and agricultural) and use cause-and-effect relationships to explain how each have impacted on the biotic and abiotic environment.</li> </ul> <p>In a class activity, students use a teacher-developed scenario, eg a coal company wanting to strip mine for coal in natural forestland to:</p> <ul style="list-style-type: none"> <li>- find information from secondary sources relating to fossicking, ownership of the minerals on the land and the distinction between an exploration licence, a mineral claim and a mining lease</li> <li>- consider how land use changes over time, eg many mining operations only last for 10 years</li> <li>- prepare an outline of the possible views of the different community groups such as residents, Aboriginal peoples, tourists, developers, environmentalists, local government etc.</li> <li>- debate whether the coal mine should proceed presenting the different views held by different groups in the local community, of the impact of this development on the local environment</li> <li>- discuss why the environment should be conserved and why land use should be regulated (refer to Module 8.3.4).</li> </ul> <p>Individually, students:</p> <ul style="list-style-type: none"> <li>- <i>produce a summary table of the different viewpoints of each community group and the main arguments for and against the proposed coal mine that they identified.</i> (P4, P13, P14)</li> </ul> <p>Focus Activity Task 3: Working as a project team, students:</p> <ul style="list-style-type: none"> <li>- discuss the impact of past human activity on the local aquatic and terrestrial environment of the field study area. This is to be considered in the context of the potential major residential development</li> </ul>

8.3.3 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
			<p>- monitor the team’s progress towards the completion of the activity (P15).</p> <p><i>*Suggested Evidence of Learning activities are in italics</i></p>

### 8.3.4: The need for governments and local councils to design and enact laws to protect the biotic and abiotic environment

8.3.4 Module Content (Columns 2 and 3)	Reg	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students:</p> <p>*identify one environmental issue that requires some government regulation or management, such as:</p> <ul style="list-style-type: none"> <li>– sustainable development</li> <li>– exploration</li> <li>– mining</li> <li>– environmental planning</li> <li>– air and water quality management</li> <li>– land use and rehabilitation</li> </ul> <p>*identify an appropriate local environmental document that aims to address one of the issues above (eg environmental impact study, catchment management plan)</p> <p>*gather, process and analyse information from secondary sources to identify and discuss the scientific basis of the issues in the chosen local environmental document</p> <p>*gather information from secondary sources to discuss one government regulation based on ecologically sustainable development principles on land use</p>		<p>Students:</p> <p><b>12.3 gather information from secondary sources by:</b></p> <ol style="list-style-type: none"> <li>a) accessing information from a range of resources, including popular scientific journals, digital technologies and the internet</li> <li>b) practising efficient data collection techniques to identify useful information in secondary sources</li> <li>d) summarising and collating information from a range of sources</li> </ol> <p><b>12.4 process information to:</b></p> <ol style="list-style-type: none"> <li>d) evaluate the validity of first-hand and secondary information and data in relation to the area of investigation</li> <li>e) assess the reliability of first-hand and secondary information and data by considering information from various sources</li> <li>f) assess the accuracy of scientific information presented in mass media by comparison with similar information presented in scientific journals</li> </ol> <p><b>13.1 present information by:</b></p> <ol style="list-style-type: none"> <li>b) selecting and using appropriate media to present data and information</li> </ol> <p><b>12.3 gather information from secondary sources by:</b></p> <ol style="list-style-type: none"> <li>a) accessing information from a range of resources, including popular scientific journals, digital technologies and the internet</li> <li>b) practising efficient data collection techniques to identify useful information in secondary sources</li> </ol>	<p>In pairs, students:</p> <ul style="list-style-type: none"> <li>- research in the media for an environmental issue affecting a chosen local area requiring some government regulation or management, such as sustainable development, exploration, mining, environmental planning, air and water quality management or land use and rehabilitation</li> <li>- write a short article on the issue that could be submitted by a journalist to a local paper</li> <li>- represent in the article all points of view including the developer, the local residents, the local council and the State government</li> <li>- print the article and circulate to the class for discussion.</li> </ul> <p>Using the internet or a visit to the local council library, students:</p> <ul style="list-style-type: none"> <li>- identify an appropriate local environmental document that aims to address one of the issues above</li> <li>- find environmental factors that would be considered in an environmental impact assessment</li> <li>- identify and discuss the scientific basis of the issues raised in the local environment document.</li> </ul> <p>Individually, students:</p> <ul style="list-style-type: none"> <li>- access and use teacher-provided secondary sources to define ecologically sustainability</li> <li>- assess the reliability of information from secondary sources about government regulations based on ecologically sustainable development of land use</li> <li>- summarise and collate information about environmental law in relation to the various levels of government that are responsible</li> <li>- use teacher-identified resources, to <i>summarise and collate information about the environmental issues that must be considered when mining exploration of an area is planned and undertaken.</i> (P4, P14)</li> </ul>

8.3.4 Module Content (Columns 2 and 3)	Reg	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
		d) summarising and collating information from a range of sources  <b>12.4 process information to:</b> e) assess the reliability of first-hand and secondary information by considering information from various sources	Focus Activity Task 4: Working as a project team, students: - develop a summary of the government regulations that would relate to the Environmental Impact Assessment for their field study area - monitor the team’s progress towards the completion of the activity. (P15)  <i>*Suggested Evidence of Learning activities are in italics</i>

### 8.3.5: The activities of humans can cause systematic habitat alteration

8.3.5 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students:</p> <p>*gather, process and present information about the consequences of land clearing in a particular catchment</p> <p>*assess the impact of human alterations to the environment, including land clearing, in terms of some specific consequences, such as increased runoff, increased soil erosion, changes in river flows, in-stream sedimentation</p> <p>*describe, using examples from the local environment if possible, ways in which artificial structures can disrupt natural surface processes</p> <p>*process and analyse secondary information to prepare a case study on the impact of an artificial structure on natural surface processes</p>		<p>Students:</p> <p><b>13.1 present information by:</b></p> <p>e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p><b>11.1 identify data sources to:</b></p> <p>a) analyse complex problems to determine appropriate ways in which each aspect may be researched</p> <p>b) determine the type of data that needs to be collected and explain the qualitative or quantitative analysis that will be required for this data to be useful</p> <p>e) recommend the use of an appropriate technology or strategy for data collection or gathering information that will assist efficient future analysis</p> <p><b>11.2 plan first-hand investigations to:</b></p> <p>c) design investigations that allow valid and reliable data and information to be collected</p> <p>e) predict possible issues that may arise</p>	<p>In project teams, students:</p> <ul style="list-style-type: none"> <li>- use the field study data and teacher-selected resources to: <ul style="list-style-type: none"> <li>o collate information about the consequences of land clearing (such as such as increased runoff, increased soil erosion, changes in river flows, in-stream sedimentation) in the catchment of the field study area</li> <li>o review and update the concept map on page 5 to include additional information on the hydrosphere.</li> </ul> </li> </ul> <p>Individually, students:</p> <ul style="list-style-type: none"> <li>- observe and record water flow in relation to local roads after heavy rain (if possible)</li> </ul> <p>In project teams, students:</p> <ul style="list-style-type: none"> <li>- review and update the flow chart on page 23 to demonstrate the impact of some land uses (both urban and agricultural) on the river system draining the field study area.</li> </ul> <p>Practical Investigation: how do artificial structures such as road surfaces disrupt natural stormwater runoff?</p> <p>In pairs, with teacher-guidance, students:</p> <ul style="list-style-type: none"> <li>- design an investigation to collect information on the impact of a chosen hypothetical land use on a river</li> <li>- determine the type of data that needs to be collected (both quantitative and qualitative)</li> <li>- recommend the use of the appropriate technology and strategies for the collection of data</li> <li>- predict possible issues that may arise during the investigation</li> <li>- make predictions about the expected outcomes of the investigation</li> <li>- present the predictions and plan of investigation to the class for evaluation.</li> </ul>

8.3.5 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
		<p>during the course of an investigation and identify strategies to address these issues if necessary</p> <p><b>12.1 perform first-hand investigations by:</b>  a) carrying out the planned procedure, recognising where and when modifications are needed and analysing the effect of these adjustments  b) efficiently undertaking the planned procedure to minimise hazards and wastage of resources</p> <p><b>12.2 gather first-hand information by:</b>  b) measuring, observing and recording results in accessible and recognisable forms, carrying out repeat trials as appropriate</p> <p><b>14.1 analyse information to:</b>  c) identify and explain how data supports or refutes an hypothesis, a prediction or a proposed solution to a problem  d) predict outcomes and generate plausible explanations related to their observations  f) use models, including mathematical ones, to explain phenomena and/or make predictions  g) use cause and effect relationships to explain phenomena</p>	<p>In project teams, students:</p> <ul style="list-style-type: none"> <li>- construct models (plaster of Paris, playdough or plasticine™) of a hypothetical landscape before and after construction of a road</li> <li>- investigate water flow over the landscape models using a variable water supply</li> <li>- record results using digital photography</li> <li>- identify and explain how data supports or refutes the prediction and draw conclusions about strategies that could be used to solve the problem</li> <li>- use cause-and-effect relationships to explain the impact of an artificial structure on natural surface processes in the field study area.</li> </ul>

8.3.5 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students: *gather, process and present information from secondary sources on two Australian species that have been declared endangered and use available evidence to outline the reasons why the species have become endangered and the measures taken to ensure their survival</p> <p>*explain how habitat disturbance from soil degradation can advantage introduced species of plants and lead to the reduction or elimination of native flora and fauna species in affected areas</p>		<p>Students: <b>12.3 gather information from secondary sources by:</b> a) accessing information from a range of resources, including popular scientific journals, digital technologies and the internet b) practising efficient data collection techniques to identify useful information in secondary sources d) summarising and collating information from a range of sources <b>13.1 present information by:</b> a) selecting and using appropriate text types, or combinations thereof, for oral and written presentations e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p>	<p>Individually, students: - gather information from a range of teacher-provided secondary sources about two Australian species that have been declared endangered - use available evidence to summarise in a table the reasons why the species have become endangered, the measures taken to ensure their survival and the role of habitat disturbance from soil degradation in placing the animal at risk <i>- use the summary to write a media statement of 200 words to inform the public of the issues and measures to be undertaken to ensure the survival of a chosen species. (P4, P12, P13, P14)</i></p> <p><i>*Suggested Evidence of Learning activities are in italics</i></p>

### 8.3.6: Biodiversity assists in keeping a dynamic balance in the biosphere

8.3.6 Module Content (Columns 2 and 3)	Reg.	8.1 Skills Content	Suggested Learning–Teaching Experiences and <i>Evidence of Learning*</i>
<p>Students learn to/students:</p> <p>*use examples to describe and explain what is meant by biodiversity</p> <p>*outline the potential effects of a loss of biodiversity in destabilised ecosystems</p> <p>*gather information from secondary sources to identify significant sites of biodiversity in the local area</p>		<p>Students:</p> <p><b>14.1 analyse information to:</b></p> <p>d) predict outcomes and generate plausible explanations related to the observations</p> <p>e) make and justify generalisations</p> <p>g) use cause and effect relationships to explain phenomena</p> <p>h) identify examples of the interconnectedness of ideas or scientific principles</p> <p><b>13.1 present information by:</b></p> <p>a) selecting and using appropriate text types or combinations thereof, for oral and written presentations</p> <p>b) selecting and using appropriate media to present data and information</p> <p>c) selecting and using appropriate methods to acknowledge sources of information</p> <p>e) using a variety of pictorial representations to show relationships and presenting information clearly and succinctly</p> <p>f) selecting and drawing appropriate graphs to convey information and relationships clearly and accurately</p> <p><b>14.2 solve problems by:</b></p> <p>a) identifying and explaining the nature of a problem</p> <p>d) evaluating the appropriateness of different strategies for solving an identified problem</p> <p><b>14.3 use available evidence to:</b></p> <p>a) design and produce creative solutions to problems</p> <p>b) propose ideas that demonstrate coherence and logical progression and include correct use of scientific principles and ideas</p> <p>c) apply critical thinking in the consideration of predictions, hypotheses and the results of investigations</p>	<p>In a class activity, students:</p> <p>- use secondary sources to:</p> <ul style="list-style-type: none"> <li>o define biodiversity and identify examples</li> <li>o propose reasons for maintaining biodiversity</li> <li>o use examples of distinctive Australian plants and animals that have special adaptations to soil types, climate and fire to explain what is meant by biodiversity within ecosystems</li> <li>o explain the importance of maintaining a stable ecosystem</li> <li>o make predictions outlining the potential effects of a loss of biodiversity in destabilised ecosystems</li> <li>o participate in a teacher-led discussion on how biodiversity gives flexibility and robustness to an ecosystem and how this can be measured at different levels (genetic diversity within a species as well as diversity among species).</li> </ul> <p>In project teams, students:</p> <p>- use a variety of secondary sources and first-hand information from the field study to identify significant sites of biodiversity in the field study area.</p> <p>Focus Activity Task 5:</p> <p>Working as a project team, students:</p> <p><i>- complete the report in which they identify and explain the nature of the problem and evaluate the appropriateness of the different strategies used for solving the problem</i></p> <p><i>- submit the report and their individual focus activity logbooks</i></p> <p><i>- present a short written report that evaluates the process used by the team and effectiveness of the team in completing the task</i></p> <p><i>- give a class presentation which summarises the key issues in their Environmental Impact Assessment of their field study area. (P4, P12, P13, P14, P15)</i></p> <p><i>*Suggested Evidence of Learning activities are in italics</i></p>

### Overview of Skills Development Module 8.3 The Local Environment

8.3.1: Rocks are formed from different materials	<b>P11</b> identifies and implements improvements to investigation plans	<b>L/P</b>	11.1b,d,e
	<b>P12</b> discusses the validity and reliability of data gathered from first-hand investigations and secondary sources	<b>L/P</b>	12.1a,b,c,d; 12.2a,b; 12.3a,d; 12.4c
	<b>P13</b> identifies appropriate terminology and reporting styles to communicate information and understanding in Earth and Environmental Science	<b>P</b>	13.1d,e
	<b>P14</b> draws valid conclusions from gathered data and information	<b>P</b>	14.1a,b,e,g; 14.2a,b,c,d
	<b>P15</b> implements strategies to work effectively as an individual or as a member of a team	<b>L</b>	
8.3.2: The properties of local soils affect the local biological environment	<b>P11</b> identifies and implements improvements to investigation plans	<b>L</b>	11.2c,d,e; 11.3a
	<b>P12</b> discusses the validity and reliability of data gathered from first-hand investigations and secondary sources	<b>P/A</b>	12.1a,b,d; 12.3a,d
	<b>P13</b> identifies appropriate terminology and reporting styles to communicate information and understanding in Earth and Environmental Science	<b>P/A</b>	13.1a,b,e
	<b>P14</b> draws valid conclusions from gathered data and information	<b>P/A</b>	14.1a; 14.2a; 14.3b, c
	<b>P15</b> implements strategies to work effectively as an individual or as a member of a team	<b>L/P</b>	
8.3.3: The impact of humans on local aquatic and terrestrial environments will differ with locality	<b>P12</b> discusses the validity and reliability of data gathered from first-hand investigations and secondary sources	<b>P</b>	12.3d;
	<b>P13</b> identifies appropriate terminology and reporting styles to communicate information and understanding in Earth and Environmental Science	<b>A</b>	13.1a,e
	<b>P14</b> draws valid conclusions from gathered data and information	<b>L/P</b>	14.1e,g,h
	<b>P15</b> implements strategies to work effectively as an individual or as a member of a team	<b>P/A</b>	
8.3.4: The need for governments and local councils to design and enact laws to protect the biotic and abiotic environment	<b>P12</b> discusses the validity and reliability of data gathered from first-hand investigations and secondary sources	<b>A</b>	12.3a,b,d; 12.4d,e,f
	<b>P13</b> identifies appropriate terminology and reporting styles to communicate information and understanding in Earth and Environmental Science	<b>A</b>	13.1b
	<b>P15</b> implements strategies to work effectively as an individual or as a member of a team	<b>P/A</b>	
8.3.5: The activities of humans can cause systematic habitat alteration	<b>P11</b> identifies and implements improvements to investigation plans	<b>L/P</b>	11.1a,b,e; 11.2c,e
	<b>P12</b> discusses the validity and reliability of data gathered from first-hand investigations and secondary sources	<b>A</b>	12.1a,b; 12.2b; 12.3a,b,d
	<b>P13</b> identifies appropriate terminology and reporting styles to communicate information and understanding in Earth and Environmental Science	<b>A</b>	13.1a,e
	<b>P14</b> draws valid conclusions from gathered data and information	<b>L/P</b>	14.1c,d,f,g
	<b>P15</b> implements strategies to work effectively as an individual or as a member of a team	<b>P/A</b>	

8.3.6: Biodiversity assists in keeping a dynamic balance in the biosphere	<b>P13</b> identifies appropriate terminology and reporting styles to communicate information and understanding in Earth and Environmental Science	<b>A</b>	13.1a,b,c,e,f
	<b>P14</b> draws valid conclusions from gathered data and information	<b>A</b>	14.1d,e,g,h; 14.2a,d; 14.3a,b,c
	<b>P15</b> implements strategies to work effectively as an individual or as a member of a team	<b>A</b>	

## Draft Sample Learning Unit Feedback

Please respond to the following statements by **circling** the appropriate response.

Which Preliminary Course Draft Sample Learning Unit did you teach?

Biology                  Chemistry                  Earth and Environmental Science

Physics                  Senior Science

**School:**                  Government                  Non-government

Other (please specify) \_\_\_\_\_

**Location:**                  Metropolitan                  Non-metropolitan

**Size of school:** less than 100 students                  100–299                  300–499

500–1000                  more than 1000 students

**Total years teaching Stage 6 Science:**                  0–5                  6–10                  11–20                  more than 20

**Number of years teaching this Preliminary course:**                  0–4                  more than 4

For the Draft Sample Learning Unit you taught please provide comments for each of the following questions:

1. Was the unit able to be completed in the allocated indicative time?                  YES                  NO

If NO, please comment.

2. Did the Suggested Learning–Teaching Experiences provide sufficient flexibility to adjust the program during the unit to address your student learning needs?                  YES                  NO

3. Which of the Suggested Learning–Teaching Experiences did you modify or change? Please provide reasons for these amendments.

*You may provide comments and annotations on a copy of the sample learning unit.*

4. Did the learning strategies provide sufficient detail on how to explicitly develop the targeted module 8.1 skills content in the unit?                  YES                  NO

5. Did the Suggested Learning–Teaching Experiences provide appropriate guidance on how to:

- develop the targeted Prescribed Focus Area (PFA) outcomes                  YES                  NO
- emphasise the values and attitudes outcome?                  YES                  NO

6. Could the *Evidence of Learning* activities (assessment **for** learning) be modified or further developed to:

- focus more clearly on syllabus outcomes YES NO
- provide clearer communication to students on the task requirements and/or ways in which they could improve their level of achievement? YES NO

7. Was there an appropriate balance in the unit Suggested Learning–Teaching Experiences between student-centred and teacher-directed learning? YES NO

If NO, please comment.

8. Did the organisation of the Focus Activity into smaller tasks in each section provide sufficient opportunity for you to guide and monitor student learning throughout the unit?

YES NO

9. Did the Focus Activity provide students with a scaffold to structure the development of the targeted thinking/problem solving skills? YES NO

10. Please comment on the effectiveness of the project management strategy for the Focus Activity in:

- engaging students in learning
- consolidating the ideas and understanding within and across the sections of the unit
- developing students' skills in teamwork.

Other comments/suggestions:

Thank you for taking the time to comment on the Draft Sample Learning Unit. Your feedback and suggestions are appreciated. Please send your feedback comments by:

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