

# VCE Environmental Science

Implementation of VCE Study Design for  
2022 – 2026

Introduction and overview of Units 1 to 4

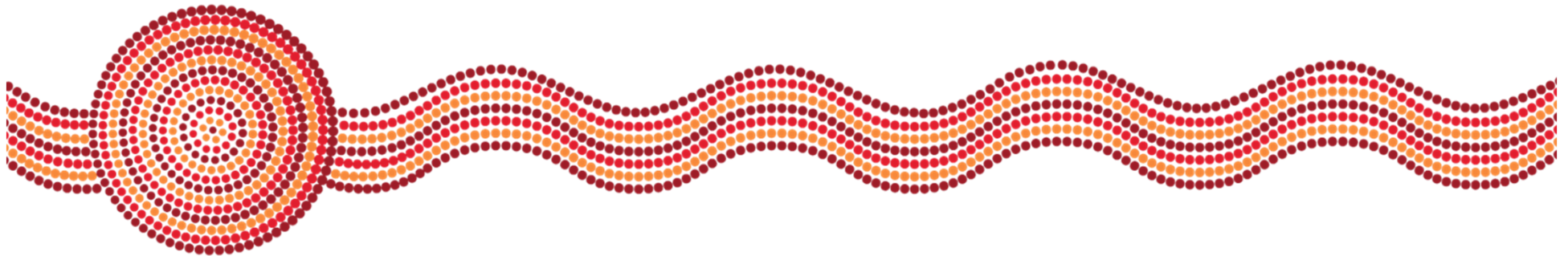


# Acknowledgment of Country

*I would like to acknowledge the traditional custodians of the many lands across Victoria on which we are all living, learning and working from today.*

*For myself, located at Fairhaven, I acknowledge the Eastern Maar Peoples as the traditional custodians of the land.*

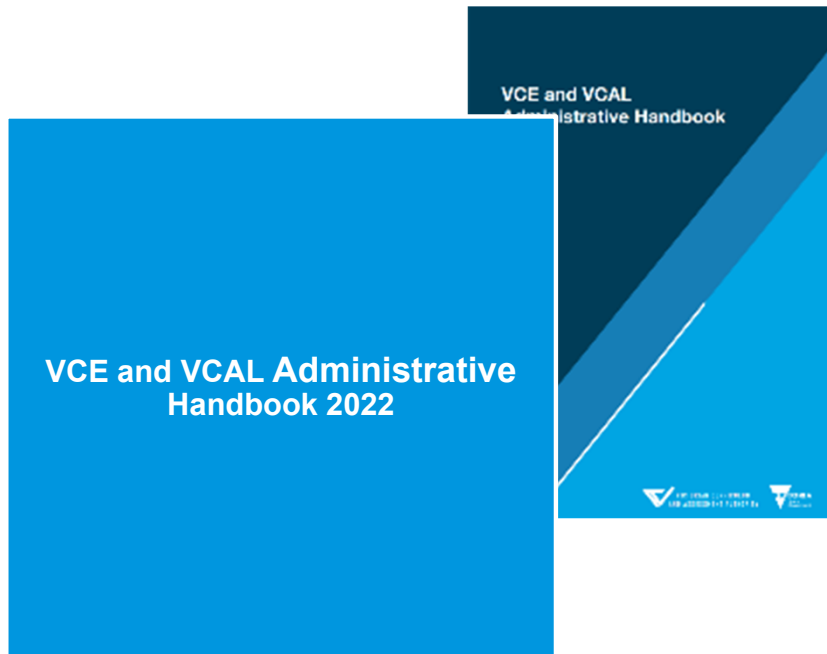
*I would like to pay my respects to Elders past, present and emerging, for they hold the memories, traditions, culture and hopes of all Aboriginal and Torres Strait Islander peoples across the nation, and hope they will walk with us on our journey.*



# Purpose

- Outline implementation support resources
- Explain the key requirements of the revised study design
- Provide an overview of the content of VCE Environmental Science
- Consider VCE assessment principles in relation to assessment tasks

# VCE resources



## New study design support materials: updated webpages

<https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/environmentalscience/Pages/Index.aspx>

- ***VCE Environmental Science Study Design 2022-2026***
- **VCE Environmental Science support materials:** planning advice; teaching and learning activities and plans; assessment advice
- **VCE examination specifications 2022-2026**
- **VCE sample examination**
- **Implementation videos: Introduction; Units 1&2; Units 3&4**
- **Live Q&A sessions in 2022:**
  - February: Units 1&2; Units 3&4;
  - Term 1: Unit 3 School-assessed Coursework audit advice
  - Term 3: Unit 4 School-assessed Coursework audit advice

# VCE Environmental Science 2022-2026 Structure

## Scope of study, Rationale, Aims

Cross-study specifications

Terms used in this study

4 Units



**11 Areas of Study**  
Key Knowledge (and relevant  
Key Science Skills)



**Assessment**  
1. Satisfactory completion-  
certification  
2. Levels of achievement

# Aims of VCE Environmental Science (p 3)

Two specific aims for the study:

- develop knowledge and understanding of Earth as a dynamic and complex set of four interrelated systems – atmosphere, biosphere, hydrosphere and lithosphere – that undergo natural change over various time scales and that affect, and are affected by, human activities
- understand that sustainable, solutions-focused responses to environmental challenges involve innovative thinking as well as responsible decision-making that is influenced by both regulatory frameworks and the values, knowledge and priorities of multiple stakeholders

# Cross-study specifications (pages 7-14)

- **Key Science Skills**
- **Scientific Investigation**
  - Scientific investigation methodologies
  - Logbooks
  - Unit 4 Scientific poster
- **Critical and creative thinking**
- **Ethical understanding**
- **Individual and collaborative scientific endeavour**
- **Aboriginal and Torres Strait Islander knowledge, cultures and history**



# Key Science Skills (pp 7-9)

- Contextualised for VCE Environmental Science
- Progressively higher demonstration of skill across Units 1 to 4
- May focus on a specific skill, or a progression of skills in the context of an investigation
- Deploy in different contexts



# Key Science Skills *revised* (pp 7-9)

VCE Enviro Study Design 2016–2021	VCE Enviro Study Design 2022–2026
Develop aims and questions, formulate hypotheses and make predictions	Develop aim and questions, formulate hypotheses and make predictions
Plan and undertake investigations	Plan and <b>conduct</b> investigations
Comply with safety and ethical guidelines	Comply with safety and ethical guidelines
Conduct investigations to collect and record data	<b>Generate, collate</b> and record data
Analyse and evaluate data, methods and scientific models	Analyse and evaluate data and <b>investigation methods</b>
Draw evidence-based conclusions	<b>Construct evidence-based arguments</b> and draw conclusions
Communicate and explain scientific ideas	<b>Analyse, evaluate and</b> communicate scientific ideas

# Integration of key knowledge and key science skills

## Key science skills:

- are not an ‘add on’ to the key knowledge
- may be explicit in key knowledge
- may be implicit, allowing flexibility for teachers to choose when/how to include in teaching and learning programs

Key science skill	Key knowledge examples of the inclusion of key science skills
<ul style="list-style-type: none"><li>• select appropriate sampling techniques in fieldwork (including grids, quadrats, transects and mark-recapture)</li></ul>	<p><b>Unit 1 Area of study 1</b></p> <ul style="list-style-type: none"><li>• interrelationships within ecological communities as represented by food chains, food webs, energy and biomass pyramids</li></ul> <p><b>Unit 1 Area of Study 3 and Unit 4 Area of Study 3</b></p> <ul style="list-style-type: none"><li>• techniques of primary qualitative and quantitative data generation relevant to the investigation</li></ul> <p><b>Unit 3 Area of Study 1</b></p> <ul style="list-style-type: none"><li>• practical techniques used for assessing species diversity: sampling with grids; transects and different shaped quadrats, including consideration of edge effects and mark-recapture</li></ul>

# Scientific Investigation (p 9-12):

asking questions; testing ideas; using evidence

- Opportunities for teacher-facilitated, student-adapted and student-designed investigations across Units 1 – 4
- **Scientific investigation methodologies** for 2022-2026

## Study Design:

- Case study
- Classification and identification
- Controlled experiment
- Correlational study
- Fieldwork
- Literature review
- Modelling
- Product, process or system development
- Simulation

# Practical work

- Central component of learning and assessment
- Includes activities such as laboratory experiments, fieldwork, simulations, modelling and other direct experiences described in the scientific investigation methodologies
- A minimum of 10 hours of class time to be devoted to student practical activities and scientific investigations across Areas of Study 1 and 2 for Units 1 to 4.
- A minimum of 7 hours to be devoted to Area of Study 3 in Units 1 and 2
- A minimum of 10 hours to be devoted to the student-designed investigation in Unit 4, Area of Study 3.

## Fieldwork

A variety of techniques may be used for fieldwork, as determined by schools:

Technique	Examples
Counting	Citizen science projects: birds; frogs; bats Energy surveys
Measuring	Water quality: salinity; pH; dissolved O <sub>2</sub> ; temperature
Environmental quality surveying	Noise pollution scales Use of bi-polar scales: aesthetic values
Sketching and photography	Use of 'before' and 'after' photographs at the same location to show the effects of an environmental management strategy
Questionnaires and interviews	Stakeholder opinions about a proposed development or whether to introduce a carbon tax

# Logbooks (p 10)

**Logbook of practical activities maintained for each of Units 1 to 4 for recording, authentication and assessment purposes.**

**The presentation format of the log book is a school decision and no specific format is prescribed. It's purposes may include:**

- **reporting on an investigation or activity**
- **responding to questions in a practical worksheet or problem-solving exercise**
- **writing up an investigation as a formal report or as the basis of a scientific poster**
- **providing a basis for further learning, for example, referenced in class discussions about demonstrations, activities or practical work**

## Aboriginal and Torres Strait Islander knowledge, cultures and histories

Key knowledge	Examples of resources for Units 1 and 2
<b>U1 AoS1</b> Biotic/abiotic components	Management of water resources by Aboriginal peoples <a href="https://www.resources.qld.gov.au/data/assets/pdf_file/0007/1408282/aboriginal-peoples-manage-water-resources.pdf">https://www.resources.qld.gov.au/data/assets/pdf_file/0007/1408282/aboriginal-peoples-manage-water-resources.pdf</a>
<b>U1 AoS2</b> Managing environmental challenges	Use of cultural fire practices to encourage native grasses to regenerate and produce new feed, to reduce scrub and fuel to prevent intense bushfires, and to promote biodiversity <a href="https://landcareaustralia.org.au/project/traditional-aboriginal-burning-modern-day-land-management/">https://landcareaustralia.org.au/project/traditional-aboriginal-burning-modern-day-land-management/</a>
<b>U2 AoS1</b> Treating pollution	Student-designed solution to local water pollution in the Kimberley <a href="#"><u>Student combines sugar and shells to filter contaminated water - Water Source (awa.asn.au)</u></a>



# Aboriginal and Torres Strait Islander knowledge, cultures and histories

Key knowledge	Examples of resources for Unit 3
<p><b>Area of Study 1</b> Ecosystems as sources of renewable services: provisioning services; cultural services</p>	<p>Native foods as a provisioning service - health benefits of Kakadu plums as food and pharmaceuticals <a href="https://www.abc.net.au/news/2021-07-22/health-benefits-of-kakadu-plum/100204168">https://www.abc.net.au/news/2021-07-22/health-benefits-of-kakadu-plum/100204168</a></p> <p>Landscape as a cultural service – sense of place - vandalism of the Kooyang Stone Arrangement at Lake Bolac <a href="https://easternmaar.com.au/media-release-destruction-of-the-kooyang-stone-arrangement/">https://easternmaar.com.au/media-release-destruction-of-the-kooyang-stone-arrangement/</a></p> <p>Cultural and ecological significance of plants <a href="https://research.unimelb.edu.au/research-updates/indigenous-plant-use">https://research.unimelb.edu.au/research-updates/indigenous-plant-use</a></p>
<p><b>Area of Study 2</b> Management strategies</p>	<p>Six case studies related to the cultural importance of environmental science water management projects <a href="https://www.mdba.gov.au/sites/default/files/pubs/rivers,%20the%20veins%20of%20our%20country_1.pdf">https://www.mdba.gov.au/sites/default/files/pubs/rivers,%20the%20veins%20of%20our%20country_1.pdf</a></p>

# Terms used in this study (pp15-18)

- **Data and measurement**
- **Errors and uncertainty**
- **Stakeholders and decision-making**
- **Sustainability principles:** conservation of biodiversity and ecological integrity; efficiency of resource use; intergenerational equity; intragenerational equity; precautionary principle; user pays principle
- **Sustainable development:** meets present needs without compromising future generations' needs
- **Systems thinking:** Earth systems thinking; circular economy thinking
- **Value systems:** anthropocentrism; biocentrism; ecocentrism; technocentrism

# Units 1 and 2 Structure

Unit titles	Area of Study titles
<b>Unit 1:</b> How are Earth's dynamic systems interconnected to support life?	<b>Area of Study 1:</b> How are Earth's systems organised and connected? <b>Area of Study 2:</b> How do Earth's systems change over time? <b>Area of Study 3:</b> How do scientific investigations develop understanding of how Earth's systems support life?
<b>Unit 2:</b> What affects Earth's capacity to sustain life?	<b>Area of Study 1:</b> How can we manage pollution to sustain Earth's systems? <b>Area of Study 2:</b> How can we manage food and water security to sustain Earth's systems? <b>Area of Study 3:</b> How do scientific endeavours contribute to minimising human impacts on Earth's systems?

# Unit 3 and 4 Structure

Unit titles	Area of Study titles
<b>Unit 3:</b> How can biodiversity and development be sustained?	<b>Area of Study 1:</b> Why is maintaining biodiversity worth a sustained effort? <b>Area of Study 2:</b> When is development sustainable?
<b>Unit 4:</b> How can climate change and the impacts of human energy use be managed?	<b>Area of Study 1:</b> How can we respond to climate change? <b>Area of Study 2:</b> What might be a more sustainable mix of energy sources? <b>Area of Study 3:</b> How is scientific inquiry used to investigate contemporary environmental challenges?

# Curriculum and assessment programs

- **Each school is different:**
  - different contexts in which students operate
  - different circumstances in which schools are situated
- **Students will have different:**
  - strengths and talents
  - available resources
- **Schools have flexibility in:**
  - designing curriculum programs that meet the needs of their cohort and the context in which they are learning
  - developing assessment programs that are aligned to the *VCE Environmental Science Study Design* and comply with VCE assessment principles.

# Planning template



Provide details of the outcome, time period (Term/Week–Term/Week), key knowledge and key science skills (from the study design)	List and describe the learning activities that will be used to provide appropriate opportunity for students to demonstrate satisfactory achievement of the outcome (this includes practical activities, demonstrations and excursions/field work)	List and describe the assessment tasks that will be used to assess students level of achievement. Include an estimate of when each task will occur	
<b>Unit 1, Outcome 1:</b> <insert outcome statement – see page 14 of VCE study design>			
<b>Anticipated teaching time allocation:</b> <insert as appropriate; e.g. Term 1 Week 1 – Term 1 Week 6>			
<b>Key knowledge:</b> <ul style="list-style-type: none"> <li>&lt;Select as appropriate. See pages 14–15 of VCE study design&gt;</li> </ul>	<b>Env. Science Units 1–4 Key science skills:</b> <ul style="list-style-type: none"> <li>&lt;Select as appropriate. See pages 11–12 of VCE study design&gt;</li> </ul>	<Consider a range of resources when developing appropriate learning activities; e.g. VCE Advice for Teachers located on the VCAA website: <a href="http://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/environmentalscience/advice-for-teachers/Pages/Index.aspx">www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/environmentalscience/advice-for-teachers/Pages/Index.aspx</a> – ensure that any activities directly sourced from a public resource are <u>contextualised</u> to your school/provider’s approach>	<Select and describe as appropriate. See page 17 of the VCE study design. Include an estimate of when the task will occur>

Whilst designed specifically for schools seeking to deliver a VCE study for the first time, the [VCE Curriculum and Assessment Plans](#) are a useful tool for all teachers in planning assessment.

# Units 1-4 School-based Assessment

## Two forms of assessment for each outcome:

- **Satisfactory completion of an outcome (S or N)**
  - Units 1-4
- **Levels of achievement**
  - school-based in Units 1 and 2
  - School-assessed Coursework (SAC) moderated against external examination in Units 3 and 4)

# VCE assessment principles

The VCE Assessment Principles state that assessment will be:

- *valid and reasonable*
- *equitable*
- *balanced*
- *efficient*



# VCE Assessment principles

## Valid

- fair and reasonable
- designated task type
- conducted under fair conditions for all students
- clear instructions included



## Equitable

- accessible to all students
- doesn't privilege or disadvantage certain groups of students
- alternative tasks (if set) are comparable in scope and demand

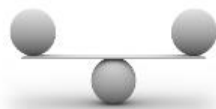


# VCE Assessment principles



## Balanced

- variety of task types used
- variety of conditions used
- allow students to demonstrate different levels of achievement
- suitable criteria, descriptors, rubrics or marking schemes used
- representative parts of outcomes, key knowledge and key skills are assessed



## Efficient

- minimum number of assessments
- precision vs efficiency
- minimise undue workload/stress on students
- part of the regular teaching and learning program
- avoid under or over assessment of the outcome
- completed mainly in class and within a limited timeframe

# Integrity and Authentication

**The integrity of VCE Assessments is of a paramount concern to maintain the integrity of the VCE qualification:**

- teachers and schools need to develop and implement robust authentication strategies to ensure that the student's submitted work is clearly their own

**Effective schools will build a culture of integrity and trust underpinned by teaching and learning practices of ongoing formative assessment to gather knowledge and evidence of student abilities**

# Units 1 and 2 Assessment

- Underpinned by VCE Assessment Principles
- All assessments at Units 1 and 2 are school-based, including procedures for assessment of levels of achievement
- List of selected tasks to choose from for Outcomes 1 and 2 in Unit 1 (p 23)
- List of selected tasks to choose from for Outcomes 1 and 2 in Unit 2 (p 28)
- If multiple tasks are selected for Outcome 1 and/or 2, they must be different
- Same task cannot be selected more than once across Outcomes 1 and 2
- **Unit 1 Outcome 3:** A report of a student-adapted or student-designed scientific investigation
- **Unit 2 Outcome 3:** A response to an investigation into a pollutant or food/water security issue.

# Units 3 and 4 Assessment

- **Unit 3 School-assessed Coursework: 20 per cent of study score**
- **Unit 4 School-assessed Coursework: 30 per cent of study score**
- **End-of-year examination: 50 per cent of study score**

***For Outcomes 1 and 2:*** Four designated School-assessed Coursework tasks in Units 3 and 4. Each task can only be selected once across Units 3 and 4.

For each task the time allocated should be **approximately 50-70 minutes for a written and 10 minutes for a multimodal or oral presentation**

***For Outcome 3:*** communication of the design, analysis and findings of a student-designed and student-conducted scientific investigation through a structured scientific poster and logbook entries

# Revised VCE Environmental Science Assessment

## School-based Assessment tasks: Units 3 &4 Outcomes 1 and 2

Outcome	Assessment tasks
Unit3 Outcome 1 <b>Biodiversity</b>	<ul style="list-style-type: none"><li>• presentation of recommendations using <b>evidence-based decision-making</b>, including analysis and evaluation of generated primary data</li><li>• designed or practical response to a real or theoretical environmental <b>issue or challenge</b></li><li>• analysis and evaluation of a case study, secondary data or a media article, with reference to <b>sustainability principles and stakeholder perspectives</b></li><li>• application of <b>Earth systems thinking</b> in the evaluation of responses to an environmental scenario, issue, challenge, or case study</li></ul>
Unit3 Outcome 2 <b>Environmental management</b>	
Unit 4 Outcome 1 <b>Climate change</b>	
Unit4 Outcome 2 <b>Energy options</b>	

# New Unit 4 Outcome 3 Scientific poster format

Maximum: 600 words

20 – 25% of space allocated to communicating main finding



## Title as an investigation question

Student name

Introduction

Methodology and methods

Results

References and acknowledgments

Discussion

Communication statement  
reporting the key finding of the  
investigation in response to the  
investigation question as  
a one-sentence summary

Conclusion

# VCE Environmental Science scientific poster example

## Unit 1 Area of study 1 or Unit 2 Area of study 2

### Are tea leaves or coffee grounds better natural fertilisers?

Stu Dent

Introduction

Methodology and methods

Results

References and acknowledgments

Used coffee grounds  
make a better natural  
fertiliser for tomato  
seedlings than tea leaves

Discussion

Conclusion



# Formative vs summative assessment

- How will you know where your students are 'at' in terms of satisfactory completion of an outcome?
- How will you identify student strengths/weaknesses in content/skills?
- How will you determine what do your students know and what can they do?
- How will you determine what your students don't know and what they can't they do?
- How will you teach and assess to address any issues?
- How can feedback be provided to students about their progress in VCE studies?
- How can SAC tasks be formative as well as summative assessments?

# VCE resources

- **Administrative information for School-based Assessment**
- **VCAA Bulletin and Notices to schools**
- **School calendar and assessment policy**
- **Statistical moderation reports**
- **School-based assessment audit reports**
- **School-based assessment coursework reports**
- **Examination reports**
- **The school teaching and learning program**

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