

# CS5 - Stage 6 Senior Science Unit Overview

## Introduction

This document aims to identify activities that can be performed in the Upper Parramatta River Catchment and are relevant to modules in the NSW Stage 6 Senior Science Syllabus. The document will highlight opportunities created by using the Upper Parramatta River Catchment to integrate columns 1, 2 and 3 in the modules and hence enrich learning and manage teaching time more efficiently.

## Water for Living: Pollution in My Day

### Contextual Outline

The Earth's water budget was essentially fixed as it cooled when gaseous water condensed and settled on the cooling planet. Free water exists in liquid form as surface and ground water and it is this water which is available for living things. It is also in the atmosphere as the main gas that absorbs back radiation from the earth to assist in stabilising the earth's surface temperatures and climatic conditions.

The terrain and climate determine the amount of water available for an individual continent. Australia has an arid environment because its water budget is limited in most areas due to a combination of factors, such as the Great Dividing Range, which limits rain coming in from the east, the Papua-New Guinea Highlands, which limit rain entering inland from the north, and very cold atmospheric and ocean currents coming in from Antarctica, which limit rain entering Australia from the south.

The NSW river systems have been disturbed by many factors, including run-off from pastoral systems and the damming and re-routing of others. There are now limits regulating the discharge permitted into the river systems and the health of these systems is continuing to improve.

### Prescribed Focus Areas

| Syllabus Objectives   | Syllabus Outcomes   |
|---|---|
| Students will develop knowledge and understanding of:<br>- The nature and practice of science<br><br>- Applications and uses of science | A student:<br>P2. applies the processes that are used to test and validate models, theories and laws of science, with particular emphasis on first-hand investigations<br><br>P3. assesses the impact of particular technological advances on science |

|   |  |
|---|--|
| - The implications of science for society and the environment   | P4. identifies applications of science that affect society and the environment   |
| <b>Domain: Knowledge and Understanding</b>  |  |
| <b>Syllabus Objectives</b>  | <b>Syllabus Outcomes</b>   |
| Students will develop knowledge and understanding of:<br>- the resources of the Earth<br><br>- internal and external environments   | <b>A Student:</b><br>P6. identifies the origins of Earth's resources<br><br>P7. explains relationships between organisms in the environment  |
| <b>Domain: Skills</b>   |  |
| <b>Syllabus Objectives</b>  | <b>Syllabus Outcomes</b>   |
| Students will develop skills in:<br>11. planning investigations<br><br>12. conducting investigations<br><br>13. communicating information and understanding<br><br>14. developing scientific thinking and problem-solving techniques<br>15. working individually and in teams | A Student:<br>P11. identifies and implements improvements to investigation plans<br><br>P12. discusses the validity and reliability of data gathered from first-hand investigations and secondary sources<br><br>P13. identifies appropriate terminology and reporting styles to communicate information and understanding in science<br><br>P14. draws valid conclusions from gathered data and information<br><br>P15. implements strategies to work effectively as an individual or as a member of a team |
| <b>Domain: Values and Attitudes</b>   |  |
| <b>Syllabus Objectives</b>  | <b>Syllabus Outcomes</b>   |
| Students will develop positive values about and attitudes   | A student:   |

|  |   |
|--|---|
| towards: themselves, others, learning as a lifelong process, science and the environment | P16. demonstrates positive values about and attitudes 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 |
|--|---|

**Core Content**

| Outcomes | Students Learn To:   | Students:  | Skills            | Activities/ Teaching Learning Sequence   |
|----------|--|--|-------------------|--|
| P6, P7   | <p>4. The possible strategies to reduce water pollution can be a personal initiative and a government legislation</p> <p><i>Students learn to:</i></p> <ul style="list-style-type: none"> <li>describe some of the strategies that households use to reduce water pollution</li> </ul> | <ul style="list-style-type: none"> <li>identify data sources, plan, gather, process, analyse and present information and use available evidence to outline ways of reducing water pollution</li> <li>perform a first-hand investigation to determine the amount of water used per household for activities such as               <ul style="list-style-type: none"> <li>water used per toilet flush</li> <li>water use per shower</li> <li>water use by dishwasher</li> <li>water use by washing machine</li> </ul> </li> <li>and identify ways in which it can be reduced</li> <li>identify data sources, gather, process, analyse, solve problems associated with and present information and use available evidence to develop an action plan to use water sustainably both locally and globally</li> </ul> | P11, P13, P14 P16 | <p><b>Information Sheets</b></p> <p>E3 – Environmental Legislation Issues</p> <p>E7 - Water pollution Issues</p> <p>Using the information sheet and the NSW Government website (<a href="http://www.nsw.gov.au">www.nsw.gov.au</a>), if necessary, write a summary of how each of the pieces of legislation affect people in the Upper Parramatta River Catchment. Describe the major pollutants of surface water in the Upper Parramatta River Catchment</p> <p>What impact do these pollutants have on living things in the waterways?</p> <p>Activity 1 AS9 – Home Environment Checklist</p> <p>Activity 2 AS10 – Chemicals in the Home Survey</p> <p>Activity 3 AS13 - Water Use in the Home</p> |

|                   |  |  |            |  |
|-------------------|--|--|------------|--|
| <p>P2, P4, P6</p> | <p>5. Water pollution at the global level impacts on global water<br/> <i>Students learn to:</i></p> <ul style="list-style-type: none"> <li>• discuss types of indicator organisms that are found in safe water supplies and those found in polluted water</li> <li>• define what is meant by a catchment</li> <li>• identify the local catchment area(s) and the sources of water feeding into this catchment</li> <li>• describe possible sources of contamination that may enter catchments</li> <li>• describe the types of tests that are used to monitor and assess local water quality</li> <li>• explain how water quality in one area can impact on the water quality in other areas</li> </ul> | <ul style="list-style-type: none"> <li>• plan, choose equipment or resources for, and perform a first-hand investigation to determine the indicator organisms present in and the chemical purity of water from the local catchment area</li> <li>• gather information on the source of water feeding into the local catchment area using maps or field trips</li> <li>• gather information from secondary sources concerning the use and treatment of local water</li> </ul> | <p>P13</p> | <p>Part of activity in Local Environment below</p> <p><b>Information Sheet-</b><br/> C4 - Geomorphology<br/> Use maps to describe the Upper Parramatta River Catchment</p> <p>See Sydney Water website, <a href="http://www.sydneywater.com.au">www.sydneywater.com.au</a>, Upper Parramatta River Catchment Trust website, <a href="http://www.uprct.nsw.gov.au">www.uprct.nsw.gov.au</a> and local government websites</p> |
|-------------------|--|--|------------|--|

## Unit 8.5 Local Environment

### Contextual Outline

The immediate environment has an impact on all living things in many different ways. Each local environment has unique physical, chemical, geological and biological features that are related to various cycles in operation. The interaction of those features determine the ecosystems that are present and the type and number of flora and fauna the ecosystem is able to sustain. By drawing on their existing knowledge of the local area, students are able to expand their understanding of the scientific concepts that impact on or are caused by biotic and abiotic factors operating in the environment.

The complexity of ecosystems can make them difficult to study and to understand but field study can also be very exciting and rewarding as information is collected, analysed and discussed, leading to a better understanding of the local area. Students should be encouraged to analyse those aspects of the local environment that have been affected by people and propose realistic solutions to the problems that may exist as they undertake field work and develop their report. The report 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, discussion of the relationships that exist in the area and an assessment of human impact on the area.

### Assumed Knowledge

Refer to the Science Stages 4–5 Syllabus for the following:

- 4.10a describe some adaptations of living things to factors in their environment
- 4.10b describe how producers, consumers and decomposers in Australian ecosystems are related, using food chains and food webs
- 4.10c recall the roles of photosynthesis and respiration in ecosystems

### Outcomes

The main course outcomes to which this module contributes are:

A student:

- P2 applies the processes that are used to test and validate models, theories and laws of science, with particular emphasis on first-hand investigations
- P4 identifies applications of science that affect society and the environment
- P6 identifies the origins of Earth's resources
- P7 explains relationships between organisms in the environment
- P8 describes reactions between compounds
- 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 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



### Core Content

| Outcomes | Students Learn To:   | Students:   | Skills             | Activities/ Teaching Learning Sequence   |
|----------|--|---|--------------------|--|
| P2, P7   | <p><b>3. Each local aquatic or terrestrial ecosystem is unique</b></p> <p><i>Students learn to:</i></p> <ul style="list-style-type: none"> <li>• examine trends in population sizes for some plant and animal species within the ecosystem</li> <li>• recall how producers, consumers and decomposers are related using food chains and food webs</li> <li>• outline factors that affect numbers in predator and prey populations</li> <li>• identify examples of parasitism, mutualism and commensalism in the local ecosystem and the role of the organisms in each type of relationship</li> <li>• explain the importance of the role of decomposers in the ecosystem</li> <li>• explain trophic interactions between organisms in the ecosystem using food chains, food webs and pyramids of biomass and energy where appropriate</li> </ul> | <p><i>Students:</i></p> <ul style="list-style-type: none"> <li>• gather and process first-hand and secondary information to identify OH&amp;S issues to identify potential sources of physical, chemical and biological risk before they undertake their investigation of a local terrestrial or aquatic environment</li> <li>• plan, choose equipment or resources for, and perform a field study of a local terrestrial or aquatic ecosystem to: <ul style="list-style-type: none"> <li>– measure abiotic variables in the ecosystem being studied using appropriate instruments, compare with recorded values and relate this to the distribution of organisms</li> <li>– estimate the size of a plant and an animal population in the ecosystem using transects and/or random quadrats and/or capture-recapture and tagging/marketing techniques</li> </ul> </li> </ul> | P11<br>P13,<br>P14 | <p><b>Field Trip</b></p> <p>Use the Streamwatch water bug detective guide to construct a key for macroinvertebrates. Visit the chosen test site. Carry out a macroinvertebrate study of the chosen creek and use the Streamwatch water bug detective guide to determine a pollution rating of the waterway. Use the school data logger, Streamwatch kit or other kit to perform water quality tests. Comment on the correlation between the water quality results and the types of macroinvertebrates present and the water bug pollution rating. Choose one of the macroinvertebrates found and make scale drawings of it. Label 3 adaptations of the macroinvertebrate and relate these to the stream environment in which it lives. Use the habitat assessment sheets AS7 to carry out a habitat assessment of the creek at your test site. What are the predominant plant types at your site? Identify as many as you can. Are any weeds present? Use the weed information sheet to identify as many weeds as you can. Choose one weed and make a scale drawing of it and of its major features including leaves, flowers and any fruiting bodies. Describe the adaptations that make this a successful weed.</p> <p><b>Changes over time</b></p> <p>Examine past water quality data for your site (or the</p> |

|  |   |   |  |
|--|---|---|--|
|  | <ul style="list-style-type: none"> <li>• outline energy flow and cycling of matter in the local ecosystem studied</li> <li>• recall some adaptations of living things to factors in their environment</li> <li>• identify and describe adaptations of a plant and an animal from the local ecosystem</li> </ul> | <ul style="list-style-type: none"> <li>– gather data to describe the distribution of the plant and animal species whose abundance has been estimated</li> <li>– use available evidence to describe observed trophic interactions and distribution and abundance of two plant and animal species found in the area</li> <li>– gather, present and analyse data by:             <ul style="list-style-type: none"> <li>– tabulation of data collected in the study</li> <li>– graphing changes with time in the measured environmental data</li> </ul> </li> <li>• plan, identify equipment or resources for, and perform a first-hand investigation (where appropriate) to determine the indicator organisms present in, and the chemical purity of, water in the local environment being studied</li> <li>• process and analyse information to prepare a report on the field study undertaken of the local ecosystem in which the purpose is introduced, the methods described and the results shown graphically</li> </ul> | <p>nearest available site) obtained from the Streamwatch website, <a href="http://www.streamwatch.org.au">www.streamwatch.org.au</a></p> <p>Present the data in the form of a graph for each parameter to show trends over time.</p> <p>Calculate mean values for each parameter. Account for any variations.</p> <p>Examine aerial photos from 1951 and 2001. Use the photos to list the changes you can observe that have occurred over this 50 year period.</p> <p><b>Report</b></p> <p>Use the above information and the results of your field trip to write a report about the human impact on ecosystems in the Upper Parramatta River Catchment. The report should cover the purpose of the investigation, the methodology and results of investigations.</p> |
|--|---|---|--|

|        |  |  |               |   |
|--------|--|--|---------------|---|
|        |  | and use available evidence to discuss the results  |               |   |
| P2, P4 | <p>4. The impact of humans on aquatic and terrestrial environments varies from place to place<br/>Students Learn to:</p> <ul style="list-style-type: none"> <li>• describe the effects of a range of human impacts on the local environment</li> <li>• outline criteria for local government regulations concerning zoning of the land for such as <ul style="list-style-type: none"> <li>– domestic housing</li> <li>– units</li> <li>– schools</li> <li>– public transport facilities</li> <li>– commercial developments</li> <li>– primary produce</li> <li>– industrial use</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• gather, process, analyse and present information from secondary sources to trace the use of the local environment over the last 50 years</li> <li>• gather information from secondary sources to outline local government regulations on land zoning for domestic, commercial and industrial use</li> </ul> | P12, P14, P16 | <p>Examine aerial photos from 1951 and 2001. Use the photos to list the changes you can observe that have occurred over this 50 year period.</p> <p><b>Information Sheets</b><br/>C6 - Landuse<br/>C8 - Social History<br/>E3 - Environmental Legislation</p> <p>Local Government websites<br/>(Baulkham Hill Shire Council, <a href="http://www.bhsc.nsw.gov.au">www.bhsc.nsw.gov.au</a>, Blacktown City Council, <a href="http://www.blacktown.nsw.gov.au">www.blacktown.nsw.gov.au</a>, Holroyd City Council, <a href="http://www.holroyd.nsw.gov.au">www.holroyd.nsw.gov.au</a>, Parramatta City Council, <a href="http://www.parracity.nsw.gov.au">www.parracity.nsw.gov.au</a>)</p> |