River Detectives

Teachers Manual

A North Central Waterwatch collaborative project

A monthly monitoring schools program full of ideas and support to help you integrate river health into your classroom.

NORTH CENTRAL
Catchment Management Authority

WATERWATCH
North Central
Communities Caring for Catchments

River Detectives

North Central Catchment Management Authority's Waterwatch Schools program

River Detectives is a project designed to help school students learn about river health and water quality in relation to their local waterways in a hands on and meaningful sense. Upper primary and lower secondary students across the North Central catchment can participate in this nine month water quality monitoring program.

A range of water courses can be monitored, ranging from rivers and creeks, to groundwater, wetlands, irrigation channels and drains.

Students perform chemical and physical tests each month on water collected from their nominated waterbody. They can also choose to participate in an extra monthly activities that compliment their testing program and are linked to their curriculum.

The River Detectives program takes all the hard work out of trying to integrate water quality into your curriculum by providing you with the resources that easily incorporate these topics into existing curriculum.

North Central Waterwatch is happy to announce that North Central Catchment Management Authority's Environmental Education Resource folders **Waterways and Salinity** will be offered to River Detectives schools free of charge in 2007.

North Central Waterwatch would like to acknowledge the following programs for their help and reproduction of materials in this package:

Goulburn Broken Waterwatch
Buloke Stormwater Program
Coliban Water
Waterwatch Victoria
North Central Catchment Management Authority

River Detectives is sponsored by:

NORTH CENTRAL Catchment Management Authority

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Ecowise Environmental.

LOWER MURRAY WATER

Australian Government
Department of Agriculture, Fisheries and Forestry
Bureau of Rural Sciences
Department of the Environment and Heritage

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Photos

During the year, North Central Waterwatch may wish to take photos of your class to include in newspaper articles, reports and promotional materials. We require photo permission forms to be signed by the guardians of each student appearing in any photos to be used for such purposes. It would be a great help to us if teachers could send home copies of the photo permission sheet to be signed by parents, then pass a copy onto Waterwatch staff.

Photo permission form

The North Central Catchment Management Authority (CMA) may take photos during the year as part of North Central Waterwatch activities,. These photos may be published in internal and external communication material.

We require this form to be completed by all persons who appear in any photos taken.

Permission

Date:_____

I, _____(parent/guardian's name), provide permission to the North Central Catchment Management Authority (CMA) to use photographic images of _____(child's name) to appear in internal and external North Central CMA communication material (e.g. reports or editorial material) providing they are not portrayed in a derogatory manner.

Signed: _____

Date: _____

Print Name: _____

Photographs are stored as part of the photographic library maintained by the North Central CMA. Unless consent is withdrawn by the subject, the North Central CMA assumes consent to use the photograph for stated purposes for an indefinite period.

Program Structure and Curriculum Links

What is involved?

River Detectives is a nine month water quality monitoring and environmental education program, designed for late primary school and early secondary school. The River Detectives program takes all the hard work out of trying to integrate water quality into curriculums by providing the resources needed to easily incorporate these topics into existing curriculum.

North Central Waterwatch staff will provide teachers with technical support and training, and are available to assist with activities throughout the year.

Each school involved in the River Detectives program will receive a copy of this teachers manual, a water testing kit, and a copy of the student workbook.

River Detectives Water Testing kits

Each school will receive a water testing kit at the beginning of the year. The kit contains equipment to measure: electrical conductivity (salt), temperature, phosphates, turbidity, and pH. Some equipment will need calibrating throughout the year. Your Waterwatch Facilitator will show you how to do this during the initial training session. Waterwatch will pick up your water testing kit at the end of the year and service it during the holidays. If you require new equipment during the year, please contact your local facilitator.

Teachers manual

This manual provides teachers with background information and copies of the monthly activities. Student workbooks include extra activities, so always keep a copy handy!

Student workbook

The student workbook contains monthly activities and monthly monitoring data sheets. It allows students to keep a record of their progress through the River Detectives program, while doubling as a quick and easy consolidated assessment book for teachers!

Monthly monitoring

The core activity is monthly water quality monitoring. This involves students measuring various physical and chemical parameters of a local waterway. A Waterwatch Facilitator will help your class choose an appropriate monitoring site and show you how to collect samples.

You might like to set students up into small groups of **'parameter professionals'**. Each of these groups is the "expert" on measuring a particular parameter. Next month, they teach the next group how to conduct their test and so forth.

After completing your monthly water tests, fax or email your results to the Regional Waterwatch Coordinator, who will enter them into a regional database. The water quality information your school collects is extremely valuable and helps to build a picture of waterway condition around the region. Your water quality data helps to ensure continued support from our sponsors and our ability to deliver the program free of charge.

Your data is very important. It not only helps the environment, but it helps us help you!

Monthly activities

Monthly activities are setup to coincide with the seasonal fluctuations of aquatic ecology as well as state or national events which occur annually. Schools are not required to complete every monthly activity, however they will add value to your water quality monitoring activities throughout the year.

This year the Monthly Activity Calender is as follows:

- Introduction - What is a catchment
- March - Habitat Survey
- April - Catchment History and Indigenous Australians
- May - Saltwatch
- June - Frog activity
- July - Water conservation
- August - Environmental Flows
- September - Water beastie hunt
- October - Wetlands and Feathery Friends
- November - Stormwater activity

Your Waterwatch Facilitator is available to assist you with the activities when required but most are designed to be self explanatory.

If you require a Waterwatch Facilitator to assist with an activity, please try and book well in advance.

We recommend teachers consider booking a facilitator for the first monthly activity (habitat surveys and introduction to water testing) to assist in site selection, safety and introduction to the program. Other activities that may require Facilitator assistance include:

- **Saltwatch**- Waterwatch and Landcare staff can deliver a range of salinity related activities and provide extra salinity testing equipment.

- **Environmental Flows**- please contact North Central Waterwatch if you are interested in having a guest speaker attend your school to explain environmental flows to your class, or if you wish to play the new 'Run of the River' environmental flows board game developed by the Department of Sustainability and Environment.

- **Water Beastie Hunt**- we recommend having a North Central Waterwatch staff member attend your water beastie hunt. We can help you collect your water beasties, provide identification guides, microscopes, magnifying glasses and beastie catching equipment. We also have a keen eye for identification and know a few great stories about bugs that are guaranteed to keep your class enthused.

It would be great if you could fax us a copy of your Habitat Assessment, Saltwatch and Water Beastie Hunt results. All of this information can be entered into our Waterwatch database and helps us build a full picture of catchment health.

CSF II Curriculum links

This document is designed to assist participating teachers to make the links between the River Detectives activities, especially the regular monthly monitoring to the CSFII. It is specifically aimed at engaging students in levels 3,4 and 5.

Level	Strand	Strand
Science	**Biological Science**	**Chemical science**
Level 3	3.1 Describe environmental factors that affect the survival of living things	
Level 4	4.1 Identify the relationships between living things which help them survive in their habitat.	4.1 Relate properties of common substances to their suitability for a particular use
	4.2 Describe how selected systems of plants and animals function	4.2 Distinguish between physical and chemical change
Level 5	5.1 Describe the biological basis of classification of organisms into major groups.	5.2 Relate the safe use and disposal of common substances to their physical and chemical properties
	5.2 Describe interactions between living things and between living things and their non-living surroundings.	
SOSE		
Level 3	3.1 Explain the contribution of different cultures to the growth of Australia's diverse society	
	3.3 Compare how people use environments in Australia.	
	History	**Geography**
Level 4	4.1 Demonstrate knowledge about how the organization and lifestyle of Aboriginal communities have changed over time	4.1 Locate and explain the distribution of significant natural features in regions of Australia using maps and other geographical techniques.
		4.3 Analyse different views about the use and care of Australian places.
Level 5		5.2 Explain how natural processes and human activities change environments.
		5.3 Explain how peoples use of natural and human environments changes over time.
		5.4 Develop a plan to address impacts of change
English		
All levels	Speaking and listening, interpretation and discussion, reading and writing.	
Math's		
All levels	Space, numbers, measurement.	
Art		
All levels	Produce visual materials representing water issues/values	
Technology		
All levels	Find and convey information through a variety of media	

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<table>
<tr><th colspan="5">Science</th></tr>
<tr><th>Strand</th><th>Biological science</th><th>Chemical science</th><th>Earth and Space science</th><th>Physical science</th></tr>
<tr><td>Level 1</td><td colspan="4">Introduce the students to a basic scientific investigation,
- eg describe types of water (fresh and salt water) in terms of sight, touch and smell.
Talk about simple experiments that investigate the need of plants for water and light.</td></tr>
<tr><td>Level 2</td><td colspan="4">Identify the different forms of motion, such as rolling, floating, sinking and flying.
- Identify how do invertebrates/ bark/sticks/ rocks move within a river?
Investigate the changes in an environment that occur over extended periods of time.
- Outline the life cycle of aquatic plants or different aquatic invertebrates.
Describe weather conditions over a period of time.
- Record and draw using symbols, daily weather patterns over time.
- Make and use a simple rain gauge. Discuss the importance of careful measurements/readings.</td></tr>
<tr><td>Level 3</td><td>Living together
Describe environmental factors that affect the survival of living things (abiotic and biotic).
Investigate what happens to plants and animals if they get flooded.
Investigate the impact of pollution on river health (including impact on flora and fauna).
Structure and form
Identify the main structural features that work together to form systems in plants and animals.
- Describe how body structure assists plants and animals in an aquatic environ.</td><td>Substances: structure, properties and uses.
Classify materials as solid, liquid or gas and describe their characteristics.
eg what are the properties of water as a liquid in river and as ice in the Antarctica.
Reaction and change
Describe examples of changes in common substances.
- Note the importance of water in dissolving processes and discuss the impacts ie in terms of turbidity.</td><td>The changing earth
Describe how the processes of weathering and erosion alter structures (ie riverbanks).
- Describe what factors will accelerate the rate or erosion of stream and riverbanks.</td><td></td></tr>
</table>

Level 4	**Living together** Identify relationships between living things that help them survive in their habitat. - *Examine a simple wetland and construct a food-chain of its inhabitants.* - *Outline the predator/prey, producer/consumer relationships that exist in aquatic environments* Identify the interactions between plants and animals in an aquatic environment. **Structure and form** Describe how selected systems/ structures of plants and animals function. - *Examine the principle of trees as nutrient pumps or the concept of recharge and discharge sites used in salinity management.* - *Describe and sketch the external skeleton of macro-invertebrates and discuss possible features that would influence their position within a food-chain.*	**Chemical reactions** Describe physical and chemical changes in substances that are encountered in everyday life, eg the water cycle.	**The changing earth** Describe natural events and their association with atmospheric change and the possible impact this would have on the water cycle. **Our place in space** Compare the characteristics of the planets in our solar system. Identify the distinguishing features and discuss why earth is called the "blue planet".	**Energy and its uses** Describe the operation of simple devices that transfer or transform energy, such as the waterwheel.
Level 5	**Living together** Identify the basis for biological classification of family/species etc. - *Identify the different families of invertebrates in a sample and identify characteristics of the different families.* Describe the interaction of living things and their non living (abiotic) surroundings. **Structure and form** Identify specific cells in plants and examine how they help plants survive if they are emerged in water. Examine the different pathways of nutrient uptake.	**Substrates** Describe the properties, handling, uses, and the environmental problems that result from inappropriate disposal of a heavy metal, such as mercury, using multimedia. - *Investigate the specific impact that heavy metals may have on water ecosystems.*	**The changing earth** Identify a range of geological resources and determine the social issues associated with the management. - *Explain the relationship between geological structure and changing salinity levels.*	**Forces and the effect** Describe the relationship between force, mass, acceleration and velocity and relate them to slopes and water movement.

Level 6	**Living together** Explain how ecosystems are maintained in terms of energy and matter. - *Explain why there is a limit to the number of links in food chains within an ecosystem and how matter is cycled within an ecosystem with reference to nutrient levels/ photosynthesis and respiration rates.*	**Chemical reactions** Describe the characteristics of chemical reactions and their impacts on local ecosystems. - *Student should focus on reactions that cause changes in pH levels, nutrient uptake and oxygen level. Discuss the implications for water ecosystems if these changes occur.*		

Study of Society and Environment			
Strand	***Geography***	***History***	***Economic and social***
Level 1	**Society and environment** Identify the ways we care and use familiar environments such as local rivers/ streams/creeks/ponds.		
Level 2	**Society and environment (Community and participation)** Examine the changes that have occurred overtime in the local environment and community. - *Construct a timeline or other visual representation to outline the changes over time in the local community and environment.* Examine how and why we use specific resources and how they are used and managed within the local community. - *Describe how some of these resources are used to meet specific needs, such as water consumption.* Explain what it means, and the benefits associated with, being a member of a local community group. - *Use Waterwatch groups as specific examples (it might be a good idea to interview different members of a local Waterwatch group to find out what benefits they see from being involved.*		
Level 3	**Society and Environment (Australia's people and places)** Identify the ways people use a variety of natural and built environments within Victoria. Draw and describe appropriate outline maps, using geographical conventions, to represent land use. Compare the ways people use and affect different environments.. Identify the impact of technological changes overtime in relation to different types of work. - *Describe the changes in dam construction, and/or changing dam infrastructure, which allows for fish passages or the release of environmental flows.*		
Level 4	Locate and explain the distribution of significant natural and built features both regionally and globally using maps and other geographical techniques. - *Discuss the reasons for different features within the local catchment, eg dam walls.* Describe the distribution of people across Australia and identify factors that contribute to the location of Australian populations, eg rivers or large water-bodies. Analyse different views about the use and care of Australian places. - *Identify how different groups/communities have different views on the use and care of our water resources.*		

Level 5	Describe natural processes which change the environment using geographical media such as photos, maps, satellite images, or bioinfomatic websites. Compare the extent to which natural process and human activities alter the environment. - ***What are the possible impacts on local waterways caused by human activities.*** Examine how people's use of natural and human resources will change in the future, eg freshwater supplies. Examine response of environment to change. - *Look at the impact of a stormwater outlet on a waterbody by taking water samples above and below the outlet in the river and compare the results. Discuss the implications of the results in relation to stormwater management.*	Describe key features of community life in ancient and a medieval society. - *Has the use and issue associated with water use and conservation changed overtime?*	Examine ways in which individuals and communities can participate in political focus. - *Small groups could investigate the role that different groups played in the political process of increasing the environmental flow release at Lake Jindabyne on the Snowy River.*
Level 6	Describe the process and interaction between people and major natural systems (eg water cycle) and describe the possible changes that occur to these cycles due to human activities. Predict effects of resource development and use on selected natural/ human environments. Suggest ways to sustainably develop our natural and human environment, eg measures involved in sustainable use of water supplies. Develop a comprehensive strategy to resolve an issue related to the use and management of a natural or human environment.	Identify major environmental events that have occurred in Australia and identify ways that they have impacted on society and the environment, eg drought, floods, water contamination or algae blooms.	Discuss how contemporary issues related to global resource use and management affect the Australian economy. - *Outline the economic, social and environmental issues related to increased environmental flows from Dams.*

English	
Level 1	Write stories about rivers, streams, and puddles. - *Focusing on specific local rivers or streams can add a community/catchment focus.* Interpret and discuss the meaning of text about familiar topics such as rivers, waterfalls, and the coast. Debate or give presentations on water related issues. - *Water for irrigation versus water for the environment, reuse of grey water, water recycling systems.*
Level 2	
Level 3	
Level 4	
Level 5	
Level 6	

The Arts

Level	Explore the theme of water/rivers/ streams through dance, drama and music.
Level 2	Produce visual material about water conservation/ river protection etc - *River murals, brochures or posters.*
Level 3	Create a video about the Waterwatch programme and other related classroom activities.
Level 4	Listen or play "watery music" *- For more advanced classes students could compose "watery music".*
Level 5	
Level 6	

Health and Physical Education

Strand	**Health of the individuals and populations**
Level 3	Identify and explain ways in which people can improve the physical and social environments to enhance health and safety. - *Discuss the importance of clean water in relation to community and individual health.* Identify ways in which people can care for their environment to maintain the health of the community. - *Identify ways in which a community can care for their environment to maintain clean water supply.*
Level 4	Plan and implement strategies to promote personal and environmental health and safety. - *Describe actions that will address specific environmental issues such as clean water supplies.*
Level 5	Describe health issues that are important to young people and describe strategies that are designed to maintain or improve their health. Eg, environmental factors that contribute to the production and distribution of food.
Level 6	

Technology

Strands	*Materials*	***Systems***	***Information***
Level 1	Explain some of the environmental and social implications of using particular materials in products or production. - *Investigate the use of water in production lines.* Students can investigate, design, produce and evaluate equipment for use in Waterwatch fieldwork.	Investigate the input, process and output of systems. - The processes of water recycling, stormwater removal systems and desalinisation systems. Investigate irrigation systems and show the results on a flow chart or model.	Data collected in the Waterwatch programme is appropriate and meaningful information that can be used by students to achieve the outcomes in this strand. Using electronic communication, students can communicate and discuss results with other Waterwatch participants across Australia. Locally students can contribute to their catchment (and State) Waterwatch database.
Level 2			
Level 3			
Level 4			
Level 5			
Level 6			

Integrated Unit Plan and VELS Links

Learning Focus	Waterwatch River Detectives Program Aquatic Ecology

Strands and Domains

Disciplinary Learning		Inter-disciplinary Learning		Physical, Personal & Social Learning
• English • Mathematics • Science • History • Geography		• Communication • ICT • Thinking		• Health & Physical Education • Personal Learning • Interpersonal Development • Civics & Citizenship

Dimensions

English	Maths	Science	History
• Speaking & Listening • Reading • Writing	• Number • Measurement • Chance & Data • Working Mathematically	• Science knowledge & understanding • Science at Work	• Historical knowledge & understanding • Historical reasoning & interpretation
Communication	**Geography**	**ICT**	**Civics & Citizenship**
• Listening, viewing & responding • Presenting	• Geographical knowledge & understanding • Geospatial skills	• ICT for visual thinking • ICT for creating • ICT for communicating	• Civic knowledge & understanding • Community engagement
Health & Physical Education	**Interpersonal development**	**Personal Learning**	
• Movement & physical activity • Health knowledge & promotion	• Building social relationships • Working in teams	• The Individual learner	

Strands and Domains

Focus Questions	Key Understandings for Assessment
Introduction What are catchments and how do they relate to you?	• Identification of small, medium and large catchments (E.g. Kangaroo Creek, Campaspe River, Murray River, Murray Darling Basin). • Spatial acknowledgment of places within catchment • Identification of waterways and courses within the local region
March What is an Aquatic Habitat and what determines its health,? How can we quantify it's health?	• Ability to identify different areas within an aquatic habitat • Acknowledgment of a range of species associated with the waterbody's ecosystem • Using water testing parameters and procedures • Recording data and producing graphic representation
April How long have people been in the North Central region and what are the significant events that have contributed to current waterway health? Who are the traditional owners of your local region and what are the contemporary views of Koori's?	• Ability to list changes in catchment usage since European occupation • Ability to geographically locate the traditional owners of the region in which the students school is situated.
May What is salinity, how can we identify it and what effects does it have on waterways?	• Participation in Saltwatch fortnight • Ability to identify the effects of salt on land and waterways • Creating a map of student water samples with EC values marked
June What are frogs, where do they live and why do they do what they do?	• Identifying the lifecycle of a frog • The affects that water quality has on frogs • Differences between frogs
July People and water – Why, how and when we use it?	• Acknowledgement of where the home and school water comes from • Water is used by humans and the environment • Water conservation techniques
August Environmental Flows Run of the River Activity	• The importance of water to the environment • People and the environment need water at different times for different things
September Macroinvertebrates are one type of animal living in waterways. What are they? How do we investigate them and what can they tell us about water quality?	• Participation in macroinvertebrate surveying; use of macroinvertebrates as an environmental indicator • Completion of a data sheet • Importance of macroinvertebrates to the environment
October Where would you find a wetland and what birds do you find there?	• What is a wetland • Identification of wetlands within the North Central region • What wetland birds can be found in your area
November What types of pollutants can enter waterways via stormwater and what effect can they have on water quality, plants and animals?	• What are pollutants • How do individuals contribute to the pollutants • How can we minimise our impacts

Planning sequence	What students do	Teaching points and questions
Tuning In	**1. Land Use in the Catchment** **2. Catchment Map** **3. Testing the Waters Peer Teaching** **4. Parameter graphing**	• Overall introduction to unit. • Understanding of what a catchment is • Spatial acknowledgment of places within catchment • Identification of waterways and courses within the local region
Activity Cluster **March**	**1. Habitat Surveys** **2. Testing the Waters Peer Teaching** **3. Parameter graphing**	• Physical association with water body being monitored • Identification of a water habitat • Acknowledgment of a range of species associated with the waterbody's ecosystem • What is the health of the waterbody? • Introduce water testing parameters and procedures • Introduce data collection and storage
Activity Cluster **April**	**1. Catchment History Timeline** **2. Indigenous Australians reading and Comprehension activity** **3. Testing the Waters Peer Teaching** **4. Parameter graphing**	• What has changed in the North Central region post European occupation of Australia? • Identification of significant historical and environmental events in the catchments recent history • Identification of indigenous Australians within the North Central Region • How do indigenous Australians interact with waterways in recent history and the present?
Activity Cluster **May**	**1. Saltwatch Activities** **2. Testing the Waters Peer Teaching** **3. Parameter graphing**	• Participation in Saltwatch week • What areas of the catchment are saltier • What effect does salt have on our environment? • Collect and record samples from students home waterways and compare
Activity Cluster **June**	**1. Frog Investigation** **2. Testing the Waters Peer Teaching** **3. Parameter graphing**	• The lifecycle of a frog • The effects that water quality has on frogs • Differences between frogs • Why do frogs call?
Activity Cluster **July**	**1. Water Conservation Water Audit** **2. Testing the Waters Peer Teaching** **3. Parameter graphing**	• Where does your water come from? • Water usage • Water conservation techniques
Activity Cluster **August**	**1. Environmental Flows activity** **2. Testing the Waters Peer Teaching** **3. Parameter graphing**	• Rivers and waterways have varying demands for usage • People, animals and the environment all need water • Water is limited • People and the environment need water at different times for different things

Activity Cluster **September**	**Water Beasties** Water beastie hunt	• Macroinvertebrate investigation • What lives in the aquatic environment? • Why are macroinvertebrates important?
Activity Cluster **October**	**Wetlands and Feathery Friends** Beaks and Feet	• What is a wetland? • Identification of wetlands within the North Central Catchment • What birds can be found in your area?
Activity Cluster **November**	**Stormwater/ Less Litter Lunch**	• How do pollutants enter waterways? • How do we as individuals contribute to the pollutants? • How can we minimise our impacts?
Wrapping up & review	**Final Review of Results**	• What have we learned? • What do we think of the condition of our waterway? • What can be done to improve the condition of the waterway? • Who do we tell?

Want to do something extra?

North Central Waterwatch has strong ties with North Central Landcare network. Your school may be interested in contacting a local Landcare group to see if they are interested in working with your class. This may lead to a local Landcare representative visiting the school and presenting local information to the class; helping out with monitoring; assisting your class with some activities (especially Habitat Surveys and Saltwatch Week); students helping with on-ground works; or perhaps the students might like to report their findings to a local group.

If you are interested in working with a local Landcare group, please contact your local Landcare Coordinator. Let them know that you are a River Detectives school and are looking to be put in contact with a relevant Landcare group. Please remember that in some cases there may not be a group in your local area or local groups may already be fully committed.

North Central Catchment Management Authority

Shire-based Landcare Coordinators' Contact Details

Name	Shire	Address	Email	Mobile	Phone	Fax
Tamara Starbuck	Gannawarra	PO Box 287, Kerang, VIC, 3579	tamara.starbuck@gannawarra.vic.gov.au	0427 509 360	(03) 5450 9351	(03) 5450 3023
Trevor Barker	Loddon	PO Box 21, Wedderburn, VIC, 3518	tbarker@loddon.vic.gov.au	0428 354 177	(03) 5494 1247	(03) 5494 3003
Rhonda Day	Campaspe	PO Box 35, Echuca, VIC, 3564	r.day@campaspe.vic.gov.au	0429 968 917	(03) 5851 3408	(03) 5851 3409
Chris Pollock	Mount Alexander & Macedon Ranges	PO Box 185, Castlemaine, VIC, 3450	c.pollock@mountalexander.vic.gov.au	0427 048 615	(03) 5471 1700	(03) 5471 1749
Virginia Adrian	Mount Alexander & Macedon Ranges	PO Box 185, Castlemaine, VIC, 3450	v.adrian@mountalexander.vic.gov.au	0427 003 052	(03) 54711700	(03) 5471 1749
Kevin Spence	Northern Grampians & Buloke	PO Box 244, St Arnaud, VIC, 3478	spencek@ngshire.vic.gov.au	0408 353 966	(03) 5495 3157	(03) 5495 1026
Pamela Manning	Hepburn & Central Goldfields	PO Box 194, Maryborough, VIC, 3465	pmanning@cgoldshire.vic.gov.au pmanning@hepburn.vic.gov.au	0428 610 628	(03) 5321 6405 Hepburn (03) 5461 0628 Maryborough	(03) 5348 1304 Hepburn
Ben Kroker	City of Greater Bendigo	PO Box 733, Bendigo, VIC, 3552	b.kroker@bendigo.vic.gov.au	0427 853 545	(03) 5434 6393	

Other suggestions

- **Your class could present their findings to other classes. Even better, they could teach another class how to conduct water quality testing.**
- **Your class may like to present your findings to a local government representative (especially if you have suggestions for the improvement or conservation of the local environment).**
- **There are lots of Waterwatch monitors throughout the region who would love to come and talk with the students about their local waterways. Please contact your North Central Waterwatch facilitator to see if there is a willing monitor in your area!!**

Community Stream Sampling Project

Community Stream Sampling and Mapping in the Murray-Darling Basin (MDB) is a three year program funded under the National Action Plan for Salinity and Water Quality (NAP), and managed by the Bureau of Rural Sciences (BRS). The project delivers on the 2004 election commitment to commit $20 million of Australian Government money into identifying and managing underground salt deposits in the MDB.

The main objectives of this program are to:

- build on existing salinity data with the acquisition of new stream sampling and salinity mapping data;
- provide communities within the MDB with the means to identify areas of high salinity risk; and
- prioritise investments for future salinity management by providing comprehensive, comparable data.

Benefits for River Detectives Schools

Schools currently participating in the North Central Waterwatch River Detectives program have the opportunity to be part of the Community Stream Sampling Project. The new project is very easily integrated into the existing monitoring program, with very small changes to current procedures. It has increased the capacity of North Central Waterwatch to provide training assistance, education opportunities and equipment to schools wishing to participate. Schools that choose to participate in the new program will also receive an updated EC meter and a professional sampling pole free of charge!

What is involved?

The only change to the existing water quality monitoring program is a slight increase in quality control requirements. These measures are required to ensure that data generated by the project is of the highest possible standard due to the nature of its end use. It is envisaged that data collected by participants of this program will be stored on a website currently being developed by the BRS and will be accessible to any interested parties.

The extra quality control measures will only add a few minutes to the regular water testing routine and add new breadth to the education value of the program. The measures are:

- Ensuring that the EC meter is calibrated before each use
- Using a meter with a high level of resolution
- Keeping a calibration log

It's that simple!

Please ask your Waterwatch Facilitator for more details on this exciting new project.

Tuning In

WHAT IS A CATCHMENT?

These activities aim to give the student a broad overview of the catchment system in which they live. The concept of connectivity between areas and issues within a catchment is central to this topic/activity.

What students do	Teaching points and questions	Grouping	Special needs
1. **Land Use in the Catchment** 2. **Catchment Map** 3. **Testing the Waters**	• Overall introduction to the unit. • Understanding of what a catchment is. • Spatial acknowledgment of places within a catchment. • Identification of waterways and courses within the local region.	• individual • pairs • groups • whole class	

Background For the Teacher

What is a catchment ?

"A catchment is an area of land, bound by hills or mountains from where all runoff water flows to the same low point. The low point could be a dam, a river or the mouth of a river where it enters the ocean. We all live in a catchment."

The North Central Catchment

The North Central Catchment Management Authority region covers approximately three million hectares or 13 % of the State of Victoria. It extends from the Murray River in the north, to the central highlands in the south. The Mt Camel Range forms the eastern boundary of the region while the internally drained Avon-Richardson basin forms part of the western border. The region includes over 50 urban centres including Swan Hill, Echuca, Donald, St Arnaud, Bendigo, Castlemaine, Maryborough and Creswick.

The North Central catchment is a large catchment that is made up of four sub-catchments. These sub-catchments are bordered by low hills and ridges and are drained by smaller creeks.

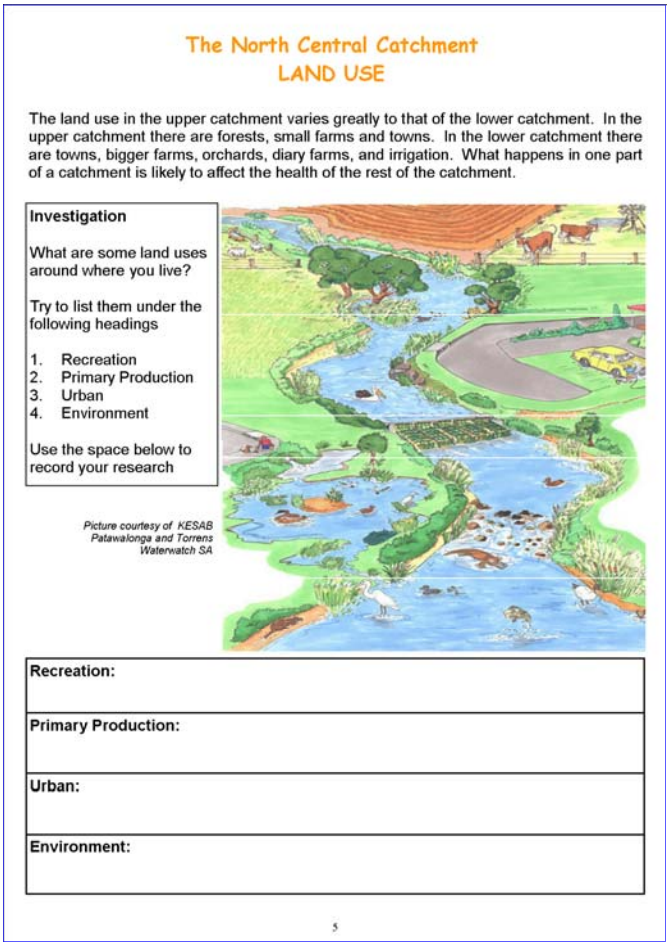
The land use in the upper catchment varies greatly to that of the lower catchment. In the upper catchment there are forests, small farms and towns. In the lower catchment there are towns, bigger farms, orchards, diary farms, and irrigation. What happens in one part of a catchment is likely to affect the health of the rest of the catchment.

The Murray Darling Basin

The North Central Catchment forms part of the Murray Darling Basin System. The system is made up of thousands of rivers, creeks, wetlands and towns extending from Queensland through New South Wales to Victoria and South Australia. Almost all of the waterways join the Murray River and enter the sea at the Coorong in South Australia

Tunning In	**Activity 1** Land Use	Student Workbook Page 5

Introduction	This activity involves students listing land uses in their local water catchment. The activity prompts students to think about the environmental implications of different land uses.
Purpose	The intention of this activity is to introduce the concept of the "Catchment" and raise students awareness of land uses within our region.
Materials	Student workbook
Activity	1. Introduce the concept of a catchment to students. 2. Define the broad land use sectors listed in the activity (recreation, primary production, urban and environment). 3. Conduct a brainstorming activity, getting students to begin thinking about the ways we use land.
Conclusion	Students fill out the activity sheet.
Assessment	Written results can be checked for understanding of land use concept.



The North Central Catchment
LAND USE

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Investigation

What are some land uses around where you live?

Try to list them under the following headings

1. Recreation
2. Primary Production
3. Urban
4. Environment

Use the space below to record your research

Picture courtesy of KESAB Patawalonga and Torrens Waterwatch SA

Recreation:

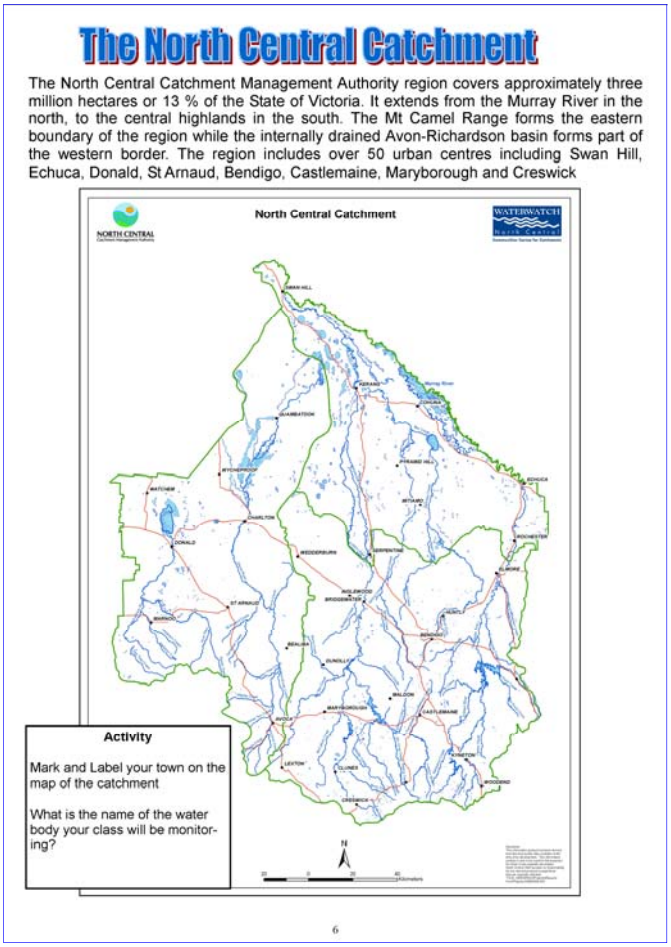
Primary Production:

Urban:

Environment:

5

Tunning In	**Activity 2** Catchment Mapping	Student Workbook Page 5



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North Central Catchment

Activity

Mark and Label your town on the map of the catchment

What is the name of the water body your class will be monitoring?

6

Introduction	Students mark and label their town and waterway they will be monitoring on the map provided.
Purpose	Students gain perspective of where their town and waterway lies within the North Central Region.
Materials	Student workbook
Activity	1. Get students to attempt marking the location of their town using major centres as a guide. 2. Provide students with a more detailed map to check results. 3. Using the more detailed map, students name the local waterway they will be monitoring.
Conclusion	Students will have an understanding of their location within the broader catchment.
Assessment	Maps checked for accuracy of locating town and naming waterway.

Monthly monitoring - Testing the waters

Each month your class will be collecting important information about the water quality and health of your local waterway. Your information, along with information collected by other schools will be used to help draw a picture of the health of that particular waterway. This information can then be used by students, government authorities and agencies, community groups etc. as a guide to the health of waterways in our region.

Collecting Water Samples

Your class will be collecting a water sample from the same site to test each month. If your monitoring site is too far from your school, a teacher or student will collect the water sample each month and bring it to class for testing.

What are we testing for?

You will be using the equipment in your kit to carry out some chemical and physical tests on the water sample you have collected. These tests will provide you with water quality information about your local waterway.

Your class will be testing the water for: salinity (electrical conductivity), turbidity, pH, temperature and in some cases reactive phosphorus. You will also be recording the rainfall each month.

Monthly monitoring activities

There is a brief, curriculum linked, monthly activity that complements the collection of water quality data for each month. These activities are designed to integrate monthly data collection into other areas of the curriculum.

Parameters

Rainfall

Rainfall is measured in millimetres (mm) using a rain gauge.

Once you have completed your water tests for the month use a rain gauge to read and record the rainfall for the last 24 hours. If you don't have access to a rain gauge you can find the nearest Bureau of Meteorology gauge at http://www.bom.gov.au/hydro/flood/vic/rain_river.shtml.

pH

We test for pH to work out if the water is acidic or alkaline.

Animals and plants instream adapt to a certain range of pH, an increase or decrease in pH outside the normal range will cause the loss of some of these species depending on their sensitivity. 7 is neutral pH, the acidity increases as the value decreases (from 6 to 0 is increasingly acidic) and alkalinity increases as the value increases (from 8 to 14 is increasingly alkaline). The measurement unit is pH.

Salinity

Salinity or electrical conductivity is the amount of salt present in the water. Salinity is measured in electrical conductivity units (EC) using an instrument called a conductivity meter.

Salinity can be a problem when present in high amounts. Plants and animals, like us, need a little bit of salt to help them grow. However, when there is too much salt in the water, plants and animals have trouble surviving. Not many plants and animals can live in waterways that are too salty.

Some waterways are very salty because too many trees have been removed from the nearby land for farming and irrigation. When deep-rooted trees are removed, water seeps down through the soil and causes the groundwater or the level of the watertable to rise. As this water moves to the surface it brings with it large amounts of salt that has been stored in the soil and rocks. Most plants can only tolerate a small amount of salt and when the groundwater rises into the root zone of plants they take up the salt in the water which can often kill them.

Turbidity

Turbidity is the cloudiness of the water. Turbidity is measured in Nephelometric Turbidity Units (NTU) using an instrument called a turbidity tube.

When the water is very cloudy or murky the amount of light that passes through the water is very low. Plants need light for survival as it helps them grow. This affects the animals that feed on and live amongst the water plants. Turbidity can be caused by soil particles, decaying plants and chemicals in the water as well as bank erosion.

Clean rivers have a low turbidity of around 1 NTU and murky creeks are highly turbid at around 200 NTU.

Temperature

Temperature is measured in degrees Celsius (°C) using a thermometer.

Temperature can speed up or slow down the rate of many chemical reactions that occur in the water, that is why it is important to record temperature when doing chemical testing.

Ortho or Reactive Phosphorus

Ortho phosphorus is the amount of phosphorus that is available for plants and animals for consumption in the water. Ortho phosphorus is measured in milligrams per litre (mg/L) using a phosphorus testing kit.

Phosphorus is a nutrient that is essential for all forms of life and is an essential part of the food chain. High levels of phosphorus can cause algal blooms (such as blue-green algae), excessive growth of aquatic weeds and a loss of species diversity.

High levels of phosphorus in waterways are often the result of human activities. Rural and urban runoff, sewage effluent and industrial discharges can all contain large amounts of phosphorus from fertilisers, eroded soil, detergents and plant and animal wastes.

Interpreting your results

All the waterbodies you are testing are in different parts of the catchment. When you record your results on the class sheet you will also need to rate them.

The ratings vary depending on which part of the catchment you live in; the upper, middle or lower catchment. We would expect water quality in the upper catchment (where the river/creek starts) to be much better than the lower catchment (at the end of the river/creek).

Water Quality - North Central Waterwatch

Electrical Conductivity (uS/cm)	excellent	good	fair	poor	degraded
Upper catchment	<250	250-500	500-1000	1000-1500	>1500
Lower catchment	<500	500-1500	1500-2500	2500-4000	>4000

Turbidity (NTU's)	excellent	good	fair	poor	degraded
Upper catchment	<5	May-15	15-25	25-35	>35
Lower catchment	<20	20-40	40-50	50-70	>70

Ortho Phosphate (mg/L)	excellent	good	fair	poor	degraded
Upper/Lower catchment	<0.008	0.008-0.03	0.03-0.05	0.05-0.1	>0.1

Temperature (°C)	The temperature should be within 2-3°C of being the average temperature
Upper/Lower Catchment	

pH	excellent	good	poor/degraded
Upper/Lower catchment	7	6-8.5	0-5; 9-14

Water Test Results

School _____

Monitoring site _____

Date of water testing _____ Time_____

RESULTS FOR THE MONTH OF _____

Use the "Interpreting your Results" Poster to find out what the water quality rating is this month for Conductivity (Salinity), Phosphorus, pH and Turbidity.

Water Temperature (°C) _____ Air Temperature (°C) _____

Salinity/Electrical Conductivity _____ (Rating _____)

Turbidity (NTU) _____ (Rating _____)

Phosphorus (mg/L) _____ (Rating _____)

pH _____ (Rating_____)

Rainfall in last 24 hours (mm) _____

Flow Condition (fast, slow, none, dry)_____

Things you noticed about your site this month:

_____

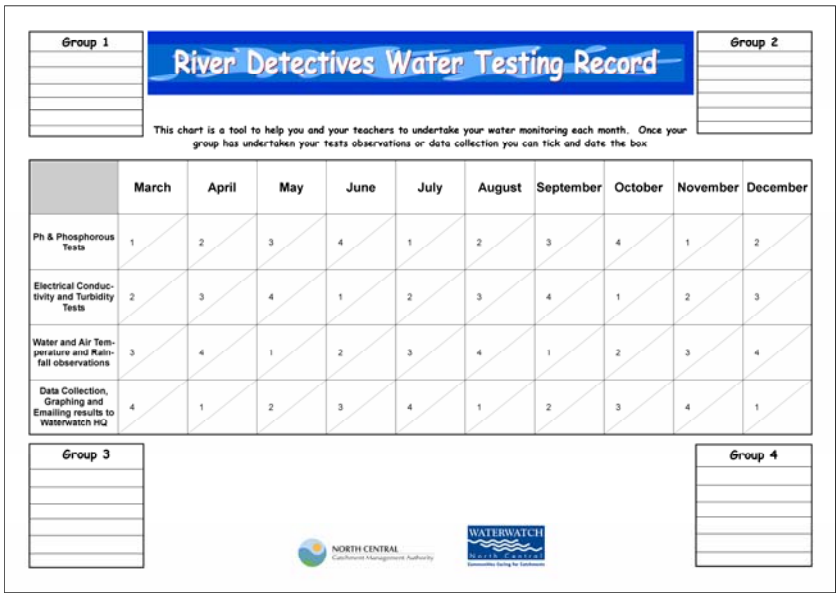
_____

_____

_____

Please Fax or email your results to the Regional Waterwatch Coordinator on 5448 7148 or leigh.mitchell@nccma.vic.gov.au (if email is easier please request an electronic copy of this data sheet).

Introduction	This activity involves initially establishing students as groups of parameter professionals and training the students in physical and chemical testing of the monitored site. It then involves monthly monitoring in which each group peer teaches a new group in the use of equipment and procedure, and then undertakes a new test themselves.
Purpose	1. To undertake regular scientifically based physical and chemical monitoring of a waterway. 2. To use scientific method. 3. To excite students about being involved in science. 4. To provide opportunity for peer teaching.
Materials	• Waterwatch water testing kit • Water Testing Record Chart • Student Workbooks- End of Month Page • Testing Graph Posters
Activity	SETUP 1. Using the "Testing the Waters" information (p.21) give students an overview of all the parameters that will be tested and what the measurements can tell us. 2. Split the class into four groups of Parameter professionals. Using the Water Testing Record Chart each group is assigned a series of tests or observations. 3. Each group needs to be supervised in the procedure, use and purpose of their activities. MONTHLY MONITORING 1. Working in the same group each month the students begin by splitting their group in two. Half will teach/assist the next group to use the equipment and procedures from last month for this month - whilst the others will be taught/assisted in the new test for this month.
Conclusion	Once the testing, observations and recording is complete students can then complete their personal records and graphs in their workbook.
Assessment	Peer teaching can be observed and recorded as opportunity provides. Further to this, students will produce multiple written and drawn pieces via this activity.


Group 1

River Detectives Water Testing Record

Group 2

This chart is a tool to help you and your teachers to undertake your water monitoring each month. Once your group has undertaken your tests observations or data collection you can tick and date the box

	March	April	May	June	July	August	September	October	November	December
Ph & Phosphorous Tests	1	2	3	4	1	2	3	4	1	2
Electrical Conductivity and Turbidity Tests	2	3	4	1	2	3	4	1	2	3
Water and Air Temperature and Rainfall observations	3	4	1	2	3	4	1	2	3	4
Data Collection, Graphing and Emailing results to Waterwatch HQ	4	1	2	3	4	1	2	3	4	1

Group 3

Group 4

NORTH CENTRAL Catchment Management Authority

WATERWATCH North Central

Activity Cluster
March

HABITAT SURVEYING

These activities aim to give students the opportunity to connect with their monitoring site. They use basic observation principles and introduce the importance of habitat whilst identifying the complexity of the aquatic ecosystem

What students do	Teaching points and questions	Grouping	Special needs
1. **Habitat Surveys** 2. **Physical and Chemical parameter graphing**	• Physical association with waterbody being monitored • Identification of an aquatic habitat • Acknowledgment of a range of species associated with the waterbody's ecosystem • What is the health of the waterbody? • Introduce water testing parameters and procedures	• individual • pairs • groups • Whole class	

Background For the Teacher

Conducting Habitat Surveys

This step involves visually assessing the habitat value of the area immediately adjacent to your monitoring site.
The condition of the vegetation in and around a stream provides a good indication of the likely conditions of the aquatic environment. Stream-side vegetation, if it remains intact, makes a good natural buffer against erosion and the transport of sediment into streams and wetlands. When the stream-side vegetation is degraded it provides less protection against land use impacts and the subsequent deterioration of water quality and of conditions for aquatic plants and animals.

Ensure that you conduct your habitat survey in a safe manner.

What is being surveyed and what might it tell us about stream health?

A habitat survey involves looking at the vegetation along the stream and the condition of the banks and stream-bed.

The riparian zone refers to the zone directly adjoining a waterway. It includes bank vegetation, which covers the bank, and verge vegetation, the strip of land up to 30 metres (for the purposes of this assessment) from the waterway channel. The land beyond this is considered to be the surrounding land use area.
Riparian vegetation is a valuable source of food, shelter and breeding habitat for aquatic and terrestrial animals. It also has the potential to stabilise stream-banks and limit the effects of catchment run-off into streams by impeding water flow and trapping sediments and nutrients.

Because of their leaf litter and fallen branches, overhanging trees provide food and energy sources for fish species and other aquatic life, as well as shelter and habitat for birds and animals. Shade provided by overhanging vegetation influences stream temperature and light penetration. Streams and water sources dominated by introduced deciduous plants such as willows have less of these benefits, because the plants lose their leaves in winter and thus cannot supply the year-round shelter and food supply so important for native fish, water-birds and other animals. Fallen branches also provide shelter and habitat for fish.

This is a picture of a river with good habitat value. The water is clean and fast moving and there are rocks and logs in the river. There is thick shrub and overhanging tree cover along the bank, which provides good habitat for native birds, animals and insects.

This is an example of a stream with a poor habitat value. The stream banks are eroded, there is no in-stream habitat apart from a few introduced species and there is no overhanging vegetation around the banks.

Some factors causing changes to stream habitat

Clearing of vegetation along the stream bank and on immediately adjacent land, and allowing stock to access the stream bank zone can both contribute to the degradation of streamside habitat. Stock foraging can lead to soil compaction and increased erosion along the stream bank and wetland fringes; alteration of stream-side vegetation through reduction of plant cover and regeneration; and increases in organic matter content of waterways from stock manure. River management works such as the removal of trees likely to cause snags, construction of levees or channelisation may increase bank erosion, widen streams, reduce habitat for aquatic organisms and change natural water flow and volume of a stream.

Logging (clearing), fire, weed invasion and salinity can also cause severe habitat loss.

Conducting a habitat survey

To assess the health of the habitat around the stream you are monitoring, you will need to look at a number of the factors described and illustrated in this section. For each factor, survey a distance of 100 metres in each direction on both banks (if possible) near your monitoring site.

1. Bank Vegetation

Bank vegetation refers to trees, shrubs, and grasses actually growing on the bank. The canopy is the overhanging tree cover. This vegetation provides food and shelter for aquatic organisms in the form of fallen leaves, twigs and branches.

2. Verge Vegetation

The stream verge is different from the bank. For this stream habitat survey the verge is considered to be the section of land up to 30 metres from edge of the bank. The verge vegetation can be quite extensive but many streams in urban settings have almost no verge vegetation at all.

3. Instream cover

Fish and other aquatic organisms require snags, logs and rocks. These provide shelter from predators and fast flows, provide sites for reproduction, provide sites to establish territories, and serve as markers for navigation. Aquatic plants are also very important for fish and other aquatic creatures; apart from providing food, their presence has a direct effect on the available oxygen in the water, which in turn can affect the type of fish and other animals living in the stream. Protruding snags provide roosting and preening sites for birds.

4. Bank erosion and stability

Streams naturally erode, particularly on bends (meanders). However, changes to adjacent land can cause a stream to become unstable, resulting in continuous erosion along its channel. Such changes result in increased run-off from impervious surfaces and piped tributaries, stock access, or direct interference such as straightening or channelling of the stream. If it has been channelised or stabilised with concrete banks, the stream will obviously be stable with little erosion, but should not be ranked highly as it has no vegetation cover or a greatly reduced one.

5. Riffles, pools and bends

Rocks and debris in the stream may create shallow areas over which the water rushes quickly to form a rapid, which is called a riffle. Upstream of a riffle the water is often quiet and may form a pool. Pools are important in providing deeper areas for fish. Riffles are important for aerating (adding air and therefore oxygen) the water and providing habitat for many invertebrates. Streams that have a number of pools and riffles are able to support more life and greater variety of species than those that do not vary in character at all.

Larger, slow-flowing rivers may not have riffles, but bends in the river can provide different habitats because the cutting action of the water on bends provides deeper areas of different water speed.

The proportion of pools, riffles and bends varies naturally between major, minor and tributary streams, so the rating categories provide descriptions for each of the different stream types.

Ranking your Waterway

Each criterion being measured, (such as bank vegetation) is ranked from `excellent' through to `very poor'. A number score has also been given to each ranking, which will allow you add up all the factors you survey and obtain a total score for the particular site. The scoring system has been designed to give more weighting to conditions that are more important to stream or water-source health. For example, bank vegetation is more important than the proportion of pools and riffles in a stream.

The survey can, if desired, be conducted every 6 months to keep track of changes. It will provide you with one source of ideas to improve the health of your stream. You will find it very informative to walk along as much of the length of your stream as possible and observe the changes. Photographic records are also valuable for monitoring changes.

Keeping a visual record

Sketches

Sketches are useful means of keeping a visual record of your stream, as the examples given show (see printed manual).

Use the section provided on your Stream Habitat Record Sheet to sketch:

- the shape (cross-section) of the stream channel
- a ‘bird's eye' view (looking down from above)

Photographs

A picture is worth a thousand words. Photographs provide an excellent record of exactly how a stream changes. ‘Before' and ‘after' pictures are very valuable in depicting stream alteration. Some streams will change more dramatically than others.

Take care to ensure that you choose a representative portion of the stream for your photographs. Use a 35 mm camera, with 200 or 400 ASA print film.

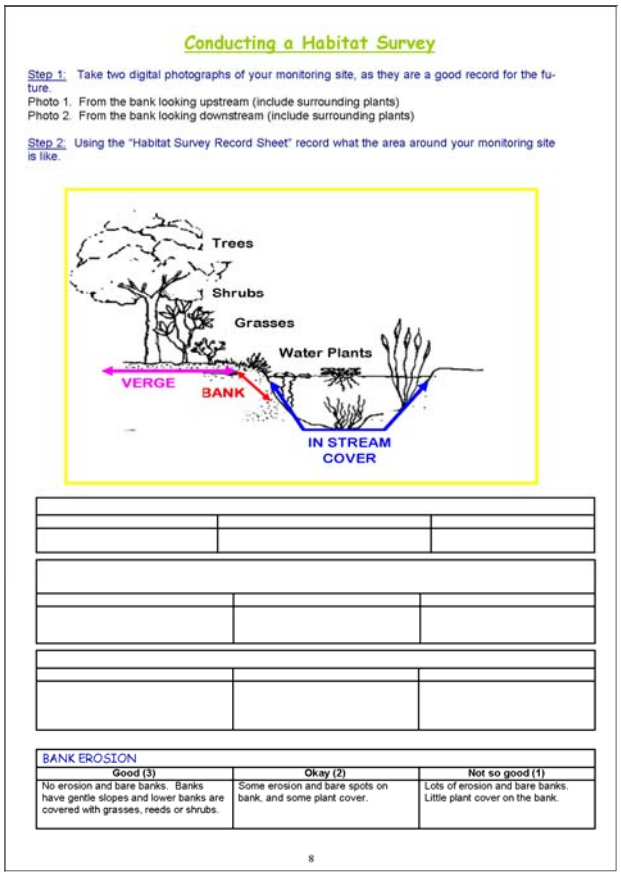
Suggested photographs are:

- from the bank looking upstream (include vegetation)
- from the bank looking downstream (include vegetation)
- a bend in the stream
- from a distance, overlooking the creek and surrounding areas - from an elevated position, if possible.

Make notes on the cross-section and the bird's eye view sketches on your Stream Habitat Record Sheet to show the exact location and direction from which any photographs are taken, so that you have a basis of comparison with future photographs. Record the photograph number from your camera for each shot, to help you identify the photographs.

Activity Cluster March	**Activity 1** Habitat Survey	Student Workbook pages 8 & 9

Introduction	This activity involves students assessing the quality and condition of the habitat present at their monitoring site. Students will assess in-stream and riparian environments.
Purpose	1. Provide students with an understanding of the concept of 'habitat'. 2. Identify different habitats within the monitoring site. 3. Assess the quality of habitat at monitoring site. 4. Introduce concept that habitat condition is not static.
Materials	Student workbook, Waterwatch Facilitator.
Activity	1. Introduce the concept of habitat. 2. Discuss different habitats present at monitoring site and their importance in an ecological sense. 3. Students assess habitat quality using the descriptions provided in the student workbook. 4. Discuss findings
Assessment	Written results can be assessed. Understanding of concepts can be observed during the activity.



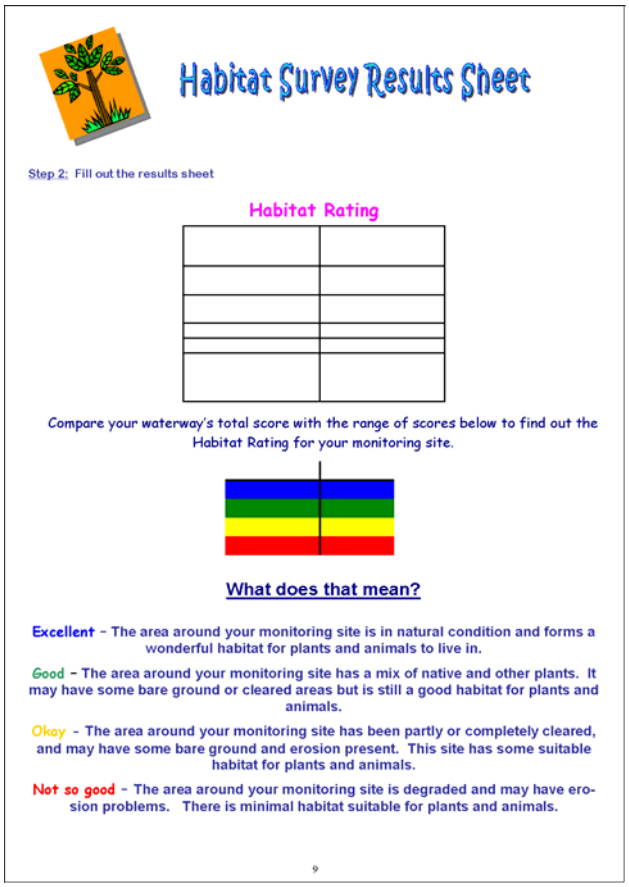
Conducting a Habitat Survey

Step 1: Take two digital photographs of your monitoring site, as they are a good record for the future.
Photo 1. From the bank looking upstream (include surrounding plants)
Photo 2. From the bank looking downstream (include surrounding plants)

Step 2: Using the "Habitat Survey Record Sheet" record what the area around your monitoring site is like.

BANK EROSION		
Good (3)	Okay (2)	Not so good (1)
No erosion and bare banks. Banks have gentle slopes and lower banks are covered with grasses, reeds or shrubs.	Some erosion and bare spots on bank, and some plant cover.	Lots of erosion and bare banks. Little plant cover on the bank.

8



Habitat Survey Results Sheet

Step 2: Fill out the results sheet

Habitat Rating

Compare your waterway's total score with the range of scores below to find out the Habitat Rating for your monitoring site.

What does that mean?

Excellent - The area around your monitoring site is in natural condition and forms a wonderful habitat for plants and animals to live in.

Good - The area around your monitoring site has a mix of native and other plants. It may have some bare ground or cleared areas but is still a good habitat for plants and animals.

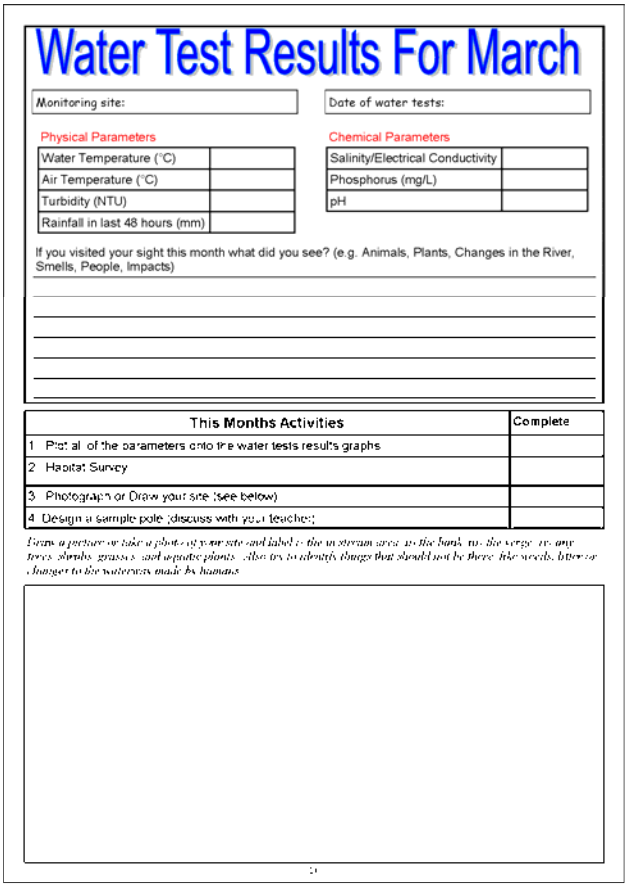
Okay - The area around your monitoring site has been partly or completely cleared, and may have some bare ground and erosion present. This site has some suitable habitat for plants and animals.

Not so good - The area around your monitoring site is degraded and may have erosion problems. There is minimal habitat suitable for plants and animals.

9

Activity Cluster March	**Activity 2** Testing the Waters Peer Teaching	Student Workbook pages 10

Introduction	This activity involves the students measuring various water quality parameters and recording the results. Students will also create a visual record of their site and design a water sampling pole.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data; create visual record of monitoring site; and design and construct a water sampling pole to facilitate water sampling activity.
Materials	Camera (optional), sample pole materials (will depend on students design), water testing kit, Student Workbook.
Activity	1. Students design and create a water testing sample pole. 2. Habitat survey conducted and visual record of site recorded. 3. Students conduct water testing and record results. 4. Peer teaching activity. 5. Results faxed to NCWW.
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity. Problem solving skills can be observed and end results tested (functionality of sample pole).



Water Test Results For March

Monitoring site: | Date of water tests:

Physical Parameters

Water Temperature (°C)	
Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

Chemical Parameters

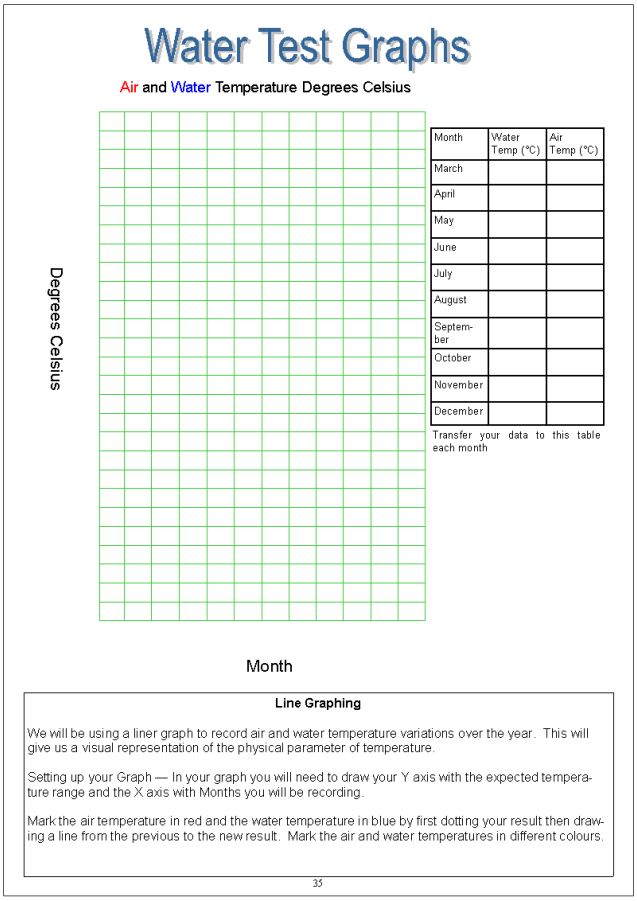
Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

This Months Activities	Complete
1 Plot all of the parameters onto the water tests results graphs	
2 Habitat Survey	
3 Photograph or Draw your site (see below)	
4 Design a sample pole (discuss with your teacher)	

Draw a picture or take a photo of your site and label it - the in stream area - to the bank - to the verge - ie. any trees, shrubs, grasses and separate plants. Also try to identify things that should not be there like weeds, litter or changes to the waterways made by humans

Activity Cluster March	**Activity 3** Parameter Graphing	Student Workbook pages 35,36,37,38,39



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

Month	Water Temp (°C)	Air Temp (°C)
March		
April		
May		
June		
July		
August		
Septem-ber		
October		
November		
December		

Transfer your data to this table each month

Month

Line Graphing

We will be using a liner graph to record air and water temperature variations over the year. This will give us a visual representation of the physical parameter of temperature.

Setting up your Graph — In your graph you will need to draw your Y axis with the expected temperature range and the X axis with Months you will be recording.

Mark the air temperature in red and the water temperature in blue by first dotting your result then drawing a line from the previous to the new result. Mark the air and water temperatures in different colours.

33

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.

Activity Cluster April

The North Central Catchment Over Time

and

Indigenous Australians

What students do	Teaching points and questions	Grouping	Special needs
1. **Indigenous Australians reading and comprehension activity** 2. **Testing the Waters Peer Teaching** 3. **Parameter graphing**	• Identification of indigenous Australians within the North Central Region • How do indigenous Australians interact with waterways in recent history and the present	• individual • pairs • groups • whole class	

These activities aim to give students a human and historical perspective of the North Central Catchment. The changes and developments post European occupation are listed as well as contemporary Aboriginal views and perspectives of waterways

Background For the Teacher

The North Central Catchment Over Time

For thousands of years, Indigenous Nations successfully used the diverse natural resources of the North Central region. In particular, resource utilisation was concentrated along the margins of waterways and wetlands. Despite many thousands of years of use, streams in the region were rich in structural and habitat diversity, and supported a plethora of wildlife prior to European settlement.

In 1836, Major Thomas Mitchell passed through substantial areas of the North Central region. Mitchell gave a positive report and noted promising country for settlement, inland of the Great Dividing Range in Victoria. As Mitchell travelled through the Avoca catchment in the full flush of spring, he painted a picture of widely spaced woodlands "*made ready for the immediate reception of civilised man…*". Mitchell's glowing testimony of the land in the Avoca catchment and similar reviews of the Loddon and Campaspe catchments, accelerated interest and early pastoralists began converging on the more fertile land of the region in the late 1830's.

As a result, land most valuable to Indigenous people for its productiveness, that is, land adjoining waterways and wetlands, was the first to be occupied by European settlers. Consequently, dispossession of land and the demoralisation of Indigenous people took place very quickly.

As well as contributing to the disintegration of Indigenous society, the early squatters of the 1840's significantly impacted on the biological landscape of the North Central region. For example, many of the waterways, particularly in the Campaspe catchment, were exposed to stock grazing, watering and sheep washing (prior to shearing). This resulted in increased erosion rates, altered floristics due to preferential grazing, invasion of exotic weeds, increased stream turbidity, and the increased input of nutrients and bacteria into the waterways. However, these impacts were significantly minor compared to those that would follow with the Gold Rush.

Further environmental impacts followed the Gold Rush of the 1850's that brought a massive influx of gold miners into the region. This led to the establishment of many towns and necessary infrastructure. The discovery of gold also created a huge demand for timber, resulting in the wide-scale clearance of native vegetation. The gold miners needed timber to reinforce the underground tunnels and shafts, and to drive the steam engines. The farmers cleared trees to allow grasslands to expand and to obtain logs for fences and farmyard buildings. In addition, the regional population required firewood for cooking and heating. Quite rapidly, whole areas were denuded of trees, and the remaining forests were intermittently harvested. The combined effect of gold mining and denuded catchments had a profound impact on catchment erosion and deposition processes.

Apart from reef and deep lead mining that were active for many years to follow, the rich alluvial deposits of gold were soon exhausted. While the population declined, many gold miners remained in the North Central region and took up land for agricultural purposes or initiated businesses.

The rapid development of a number of substantial population centres and the scarcity of freshwater in the goldfields, led to the development of the Coliban Water Supply System. In 1866, Malmsbury Reservoir was built on the Coliban River. A number of tunnels and several hundred kilometres of open channels and ditches were constructed to carry water by gravitational flow to the Bendigo-Castlemaine goldfields region via the Coliban Main Channel. The Malmsbury Reservoir was subsequently enlarged in 1887 and 1940.

It was the selectors' need for a permanent water supply that led to the development of what is now known as the Wimmera-Mallee Domestic and Stock Supply System. In 1882, when the Wimmera United Waterworks Trust took over works in the Avoca and Avon-Richardson catchments, natural watercourses were still used as the primary channels. With further settlement in the area in the 1880s, many kilometres of new channels and additional weirs where constructed in the Richardson River to supply selectors with a permanent water supply. The Campaspe Weir was completed on the Campaspe River, 12km south of Rochester in 1882, to address the water needs of local irrigators via channels.

In the 1880s, Banyena Weir was constructed of timber, concrete and rock fill in a channel excavated across a short bend in the Richardson River downstream of Banyena. Following construction of the weir, the original river channel was partially filled to divert all but major flood flows into the new channel and toward the weir.

In 1902, the reconstruction of the Waranga Swamp into the Waranga Basin on the Goulburn River led to large-scale irrigation. The Western Waranga Main Channel is now siphoned under the Campaspe River, 2km north of Rochester at the Campaspe Siphon, to carry irrigation water to the Campaspe and Loddon irrigation regions.

Over the years, increasing demand for domestic, irrigation and stock water have resulted in the construction of several reservoirs and weirs in the North Central region. Namely the Upper Coliban Reservoir on the Coliban River in 1903, Torrumbarry Weir in 1919, Cairn Curran Reservoir on the Loddon River between 1947 and 1956, Lauriston Reservoir on the Coliban River in 1941 and Lake Eppalock on the Campaspe River in 1963.

In the 1960's, Lake Tutchewop was removed from the Avoca/Loddon River systems to become a temporary salt disposal basin for the Barr Creek in the Loddon River System.

Currently, land use distribution is directly related to parameters such as the geology, soil types, climate, water resources and infrastructure available throughout the North Central region. Generally, irrigated agricultural practices are distributed in the fertile low-lying floodplains to the north of the region, which receive less than 400 mm per annum. Alternatively, dryland agricultural practices are distributed throughout the rain-fed elevated rises, low hills and hills in the south of the region which are dependent on an annual rainfall greater than 400 mm.

Activity Cluster April	**Activity 1** Create a Catchment Timeline

Introduction	This activity requires students to construct a timeline of land-use events that have occurred over time in the North Central Region.
Purpose	Raise students awareness of local land-use and water management history in our region.
Materials	Writing materials and access to information in teachers handbook. North Central Region map.
Activity	1. Teachers introduce activity and set the scene. Explain that human use of the land has changed significantly over time and that these changes have not been uniform across the region. 2. Either print the preceding pages containing a brief history of the region, or read to the students. 3. Students construct a timeline, noting major events. Students may work in groups or individually. If working in groups, teachers may like to get each group to do a quick presentation of their timeline.
Conclusion	Students will have an understanding of catchment history in the North Central region, with particular attention payed to the difference between Indigenous and European land-use and inhabitancy length.
Assessment	Written materials can be assessed for understanding of concept.

Indigenous Australians

Indigenous Australians are an important part of the history of traditional management of waterways. Aboriginal people have strong ties and lasting relationships with waterways in the North Central region.

Aboriginal people have lived in Victoria for approximately 40,000 years and many researchers suggest that it is probably longer. Evidence of this occupation has been found in many areas of the state. Things such as tools, burial grounds, paintings and shell middens (like Aboriginal kitchens where the remains of shells of past meals have accumulated – especially found close to waterways or in coastal areas) have been unearthed and give us an idea about the kind of life Victorian Aboriginals led thousands of years ago.

Life was very different in Australia before European settlement. Aboriginal people had to know the land and the plants in detail to be able to survive on this dry and changeable continent.

The waterways and wetlands of the North Central region can provide a ready supply of water, fish and other fauna. Aboriginal camps tend to be close to water, so there are lots of Aboriginal artifacts along rivers and wetlands.

Indigenous People of the North Central region

The **Dja Dja Wurrung** Aboriginal occupied most of the Loddon catchment with the **Baraba Baraba** and **Wamba Wamba** Aboriginal people downstream of Kerang.

The **Dja Dja Wurrung** (also known as Jarra) people occupied the upper reaches of the Campaspe River from Woodend, Kyneton and Malmsbury and as far north as Bendigo. The Macedon Ranges marked the border between the **Dja Dja Wurrung** and the **Wurrundjeri** people. The **Bangerang** people inhabited the lower Campaspe at the Murray River Junction.

The original inhabitants of the Avoca catchment were the tribes of **Jajouweround** and **Wotabaluk** who occupied the lands between the Loddon and Avoca rivers across to Lake Buloke. The **Dja Dja Wurrung** (Avon River) and the **Jardwadjali** (Richardson River) people were the original inhabitants of the Avon Richardson catchment area

Ian Clark 1996 Reconstruction of language areas is based on information available at time of printing. Not suitable for use in Native Title and other land claims.

Map in Student Workbook Page 11

Activity Cluster April	**Activity 2** Indigenous Australians reading and comprehension	Student Workbook Pages 12 & 13

Introduction	This is a reading and comprehension activity based around the experiences of David Tournier, a Koori educator and Cultural Heritage inspector. Students read David's article and then answer various questions relating to the topic matter.
Purpose	Increase students understanding of indigenous perspectives on river health and cultural heritage.
Materials	Student workbook.
Activity	1. Introduce the activity to students, defining key terms and explaining David Tournier's role. 2. Students read the article and complete the questions page. 3. Results can be discussed.
Assessment	Written materials may be assessed for depth of understanding. Discussion can be observed.

David Tournier

David Tournier has a simple but telling analogy for describing the effects of dams and weirs on rivers. "If you put a rubber band around your finger the blood flow is going to stop," he says. "That's what has happened to rivers."

A Koorie educator and Cultural Heritage Inspector, David knows the Kerang region of the Loddon River very well. The son of a Yorta Yorta man and a Ngarrinjirri woman, David was born in Deniliquin and spent a lot of time around Kerang.

"It was my stomping ground when I was younger," he recalls. He has fished there, played football for the Wandella Bombers and, more recently, worked in Kerang for seven years. In 2002 he was part of the Indigenous River Health Forum, run by Caring for Country Victoria and the North Central Catchment Management Authority. The forum sought Indigenous views on managing the waterways of the North-Central region, including the Loddon River.

He has partly surveyed the Kerang region of the Loddon, to establish its cultural significance to Indigenous people, in particular the Barapabarapa and the Yorta Yorta.

"There are at least 2000 registered sites of cultural significance in the area, and we know there are many more. There are scar trees, middens (cooking mounds) and some ring trees. During one survey along a 50 kilometre stretch just north of Kerang, we found 50 mounds, 60 scar trees and four or five ring trees."
David explains that a ring tree is a tree which has had two of its young branches joined together so that they grow into a ring. "The elders say that these trees indicate a woman's site."

David has taught younger Koories how to identify cultural sites along the river and has assisted landowners who think they may have found sites on their land. He talks of a farmer at Lake Kelly who discovered skeletal remains on his property and of a widower near Boort. "She was on land between the Loddon and Serpentine Creek that has very powerful cultural sites and was keen to protect those sites. When I first met her she had all the equipment she needed for fencing in the boot of her car.
"She is part of six generations of land-owners and so would have had her own cultural attachments to the area. It's great that people like her, and the Lake Kelly farmer, are doing things off their own bat and starting to respect the true custodians."

Over the years David has, of course, noted the state of the Loddon River and its catchment. While there are encouraging signs in some places, there is also evidence of neglect.

A favourite swimming hole of David's has been ruined by simple laziness. "When I was young I'd go swimming in the Lower Loddon River near the weir. It was nice and sandy, but now there's too much rubbish there: bottles and stuff.
Livestock in the river are a major problem. Cattle are destroying the river, which includes cultural sites. Cattle and sheep and weed goats need to be kept out of the water.
David disputes the idea that the Loddon was always an ephemeral stream, one that naturally does not flow all year. "It must have had to flow 24/7. It's common sense, just as common sense tells you that your blood doesn't naturally dry up." He tells a story to back up his argument. "About 70 years ago a Mungo descendant and his son travelled regularly from their country near Balranald, New South Wales to Geelong, along the rivers. They were on men's business. The trip took about two weeks and would include travelling along the Darling, Edwards, Loddon and Campaspe rivers. Just past Geelong, at Portarlington, they met a whitefella and his son. The two young boys became lifelong friends and before he died the Aboriginal man passed on sacred artefacts to his friend.

"Twelve years ago the whitefella's son contacted me. He would have been in his late 70's or early 80's by then and was still living in Portarlington. He said he had some things for me. Those sacred artefacts are now in the Melbourne Museum, under lock and key.

David believes that alternative farming (such as harvesting the cumbungi reed), better watering systems on farms, fencing off the river and revegetation with native plants would all help the health of the Loddon.

12

ACTIVITY: DAVID TOURNIER TALKS ABOUT.....

Who were David's parents and where was he born?:

What are some of the registered cultural sites David has found in the Loddon Region?

What is a ring tree?

Figure out how long in years the Lake Kelly farmer's family has been in the area. (This will be an estimate)

What are some of the things David recognises as effecting the health of the Loddon River?

By using the information on page 14 discover who the traditional owners of your area are. By finding out which major catchment your district is a part of you can figure out which aboriginal group lives/lived there.

Imagine you where the 'whitefella or his son' that meet the Mungo descendant and son who had travelled along the rivers. What questions would you ask them and what do you think there answers would be?

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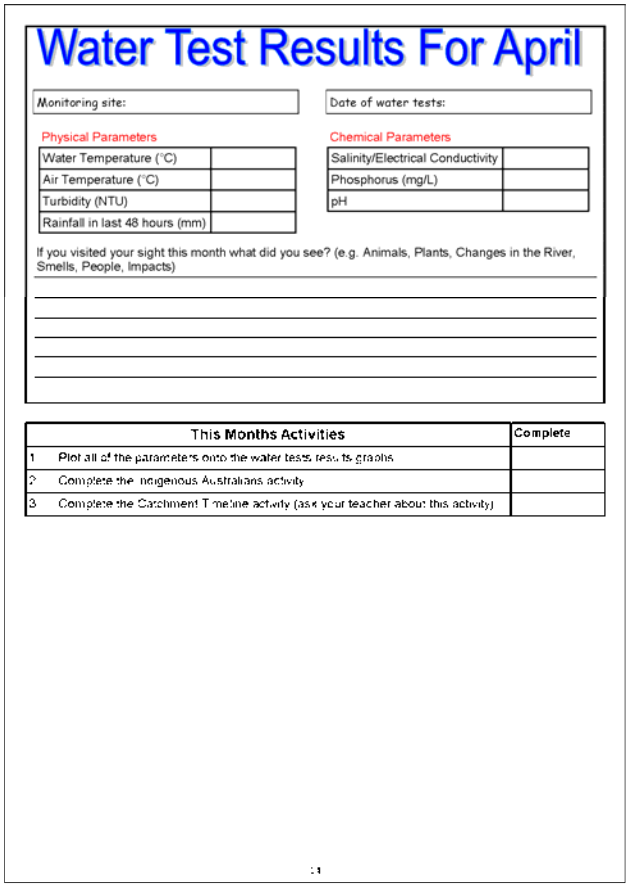
Activity Cluster April	**Activity 3** Testing the Waters Peer Teaching	Student Workbook pages 14

Introduction	This activity involves the students measuring various water quality parameters and recording the results.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data.
Materials	Water testing kit, Student Workbook.
Activity	1. Students conduct water testing and record results. 2. Peer teaching activity. 3. Results are to be faxed to North Central Waterwatch. 4. Students complete Indigenous Australians activity.
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity.



Water Test Results For April

Monitoring site: | Date of water tests:

Physical Parameters

Water Temperature (°C)	
Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

Chemical Parameters

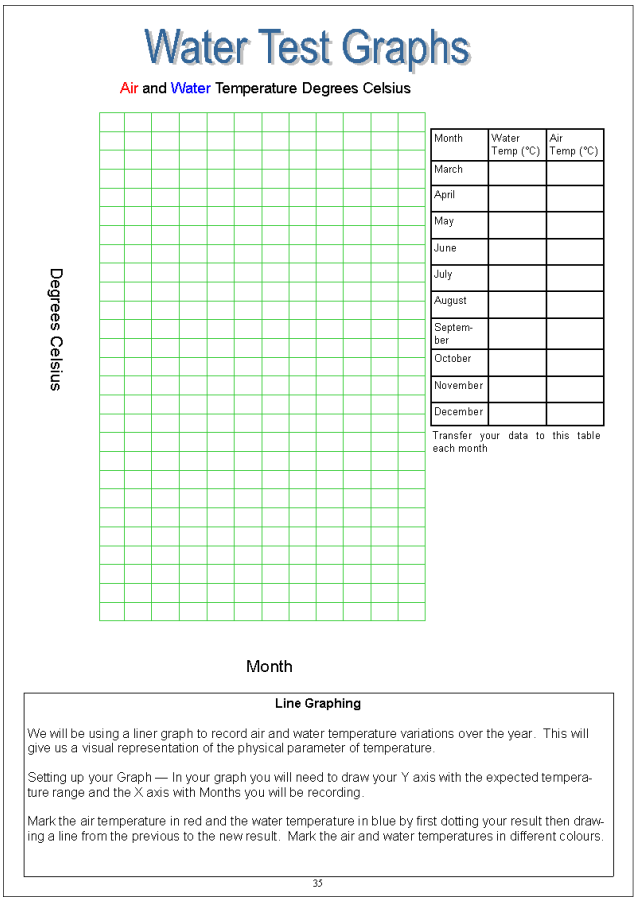
Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

This Months Activities	Complete
1 Plot all of the parameters onto the water tests results graphs	
2 Complete the Indigenous Australians activity	
3 Complete the Catchment Timeline activity (ask your teacher about this activity)	

Activity Cluster April	**Activity 4** Parameter Graphing	Student Workbook pages 35,36,37,38,39

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

Month	Water Temp (°C)	Air Temp (°C)
March		
April		
May		
June		
July		
August		
Septem-ber		
October		
November		
December		

Transfer your data to this table each month

Month

Line Graphing

We will be using a liner graph to record air and water temperature variations over the year. This will give us a visual representation of the physical parameter of temperature.

Setting up your Graph — In your graph you will need to draw your Y axis with the expected temperature range and the X axis with Months you will be recording.

Mark the air temperature in red and the water temperature in blue by first dotting your result then drawing a line from the previous to the new result. Mark the air and water temperatures in different colours.

35

Activity Cluster
May

SALTWATCH

These activities aim to give students an introduction to the broader issues associated with salinity. It provides an avenue for community engagement and peer mentoring.

What students do	Teaching points and questions	Grouping	Special needs
1. **Saltwatch** 2. **Testing the Waters Peer Teaching** 3. **Parameter graphing**	• Participation in Saltwatch week • What areas of the catchment are saltier? • What effect does salt have on our environment? • Collect and record samples from students local waterways and compare	• individual • pairs • groups • whole class	• Waterwatch Facilitator • Saltwatch materials • sampling containers

SALTWATCH WEEK IN 2ND WEEK OF MAY

Each year in the second week in May we take a Salinity Snapshot. **Students are asked to bring along a water sample from their local river, creek, stream, dam or bore to test for salinity.** These results are entered onto a statewide database to give us an idea about what is happening with salinity across the state

Saltwatch week is a great week to be involved in to learn more about salinity in the region. A guest speaker can be organised to come to your school to talk about salinity and run some related activities for your students. Alternatively you may choose to have the students who have been involved in the River Detectives Project deliver a presentation to younger classes about salinity and help them test their water samples. There are a number of salinity related activities that can be downloaded from the internet for Saltwatch Week.

You can register for Saltwatch by getting in touch with your Waterwatch Facilitator.

For more information visit the Saltwatch website at http://www.saltwatch.org.au

Background For the Teacher

Water Salinity Ranges

Salinity is simply a measure of the amount of salt dissolved in the water. Salts are substances such as: common table salt (sodium chloride NaCl), limestone (calcium carbonate CaCO3), and many others. They are picked up by the water as it runs over and through the rocks and soils of the catchment. Low levels of these salts are vital to the growth of aquatic plants and animals but high levels can cause problems for aquatic life and for human uses such as crop irrigation.

Too much salt in soil and waterways is not good for plants and animals that live in it. Plants and animals like us can not drink water that is too salty and plants can not grow in soil that is too salty. This is why salinity is one of the biggest threats to the environment in Victoria.

Use the table below to rate the water samples you have tested for salinity.

For more information on salinity:

Waterwatch Victoria www.vic.waterwatch.org.au

Department of Primary Industries www.dpi.vic.gov.au

or contact one of the North Central Waterwatch staff.

For extra activities, please refer to the Salinity Education Resource.

Salinity reading	What this water can be used for
Less than 800 EC (LOW SALINITY)	Good drinking water for people and animals
800 – 2,500 EC (MODERATE SALINITY)	People can drink this water but it starts to taste salty. This water is still suitable for animals
2,500 – 10,000 EC (HIGH SALINITY)	People should not drink this water. Only some animals can drink this water
Greater than 10,000 EC (VERY HIGH SALINITY)	Don't drink this water! This water is unsuitable for people and for most animals. At 50,000 EC the water has the same salinity as the sea!

Saltwatch results

Class results sheet

School _____

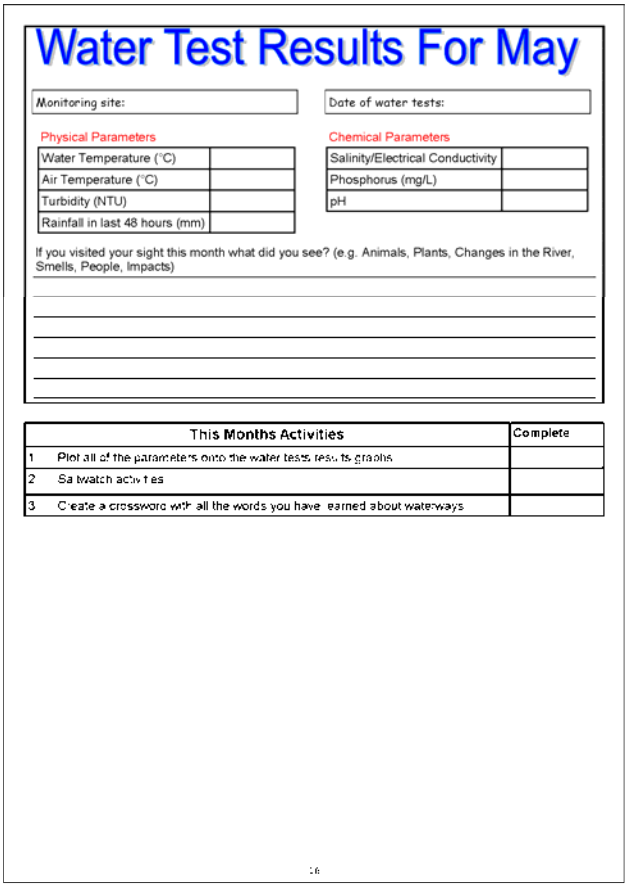
Date _____

Fill out the table below with the different water samples you tested during Salt-watch Week. Using the Water Salinity Ranges table record whether the sample has low, moderate, high or very high salinity.

Date Tested	Where the sample was collected from (Creek/river/dam/bore)	VicRoads or CFA Firemap reference	Salinity (EC)	Salinity range

Activity Cluster May	**Activity 2** Testing the Waters Peer Teaching	Student Workbook page 16

Introduction	This activity involves the students measuring various water quality parameters and recording the results.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data.
Materials	Water testing kit, Student Workbook.
Activity	1. Students conduct water testing and record results. 2. Peer teaching activity. 3. Results are faxed to North Central Waterwatch. 4. Students participate in Saltwatch activities. 5. Students create a crossword with the words they have learned about waterways.
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity.



Water Test Results For May

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Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

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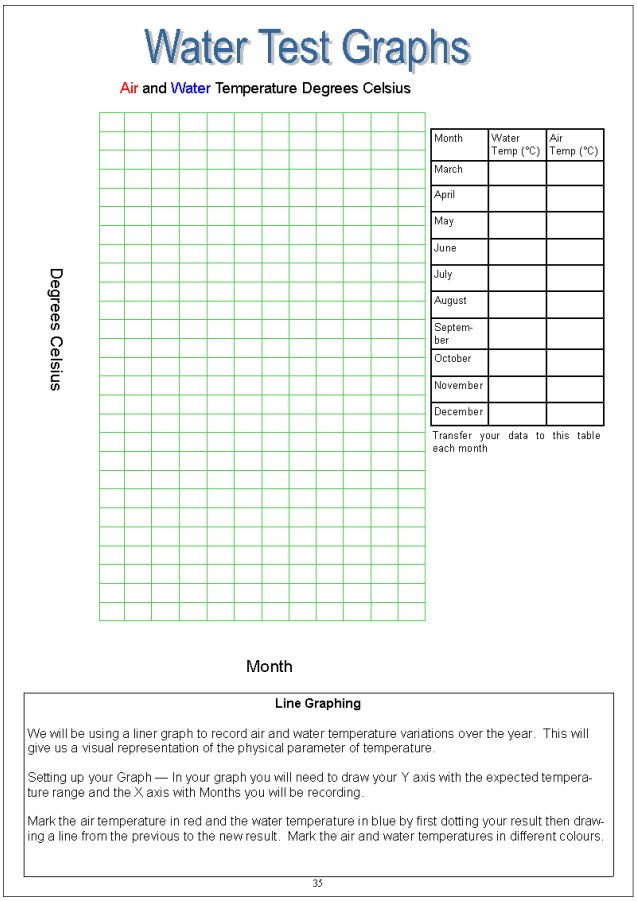
Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

This Months Activities	Complete
1 Plot all of the parameters onto the water tests results graphs	
2 Saltwatch activities	
3 Create a crossword with all the words you have learned about waterways	

Activity Cluster May	**Activity 3** Parameter Graphing	Student Workbook pages 35,36,37,38,39

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

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35

Activity Cluster
June

Frogs, Glorious Frogs

These activities aim to give students the opportunity to explore the biology of frogs and their amazing diversity. It involves an inquiry based ICT approach supported by guiding questions and a comprehension activity.

What students do	Teaching points and questions	Grouping	Special needs
1. **Frog Investigation** 2. **Testing the Waters Peer Teaching** 3. **Parameter graphing**	• The lifecycle of a frog • The affects water quality has on frogs • Differences between frogs • Why do frogs call?	• Individual • Pairs • Groups • whole class	• Computer • Internet access

Background For the Teacher

The activity for June involves students researching 'frogs' using the internet. We have recommended two sites due to their scientific accuracy and 'fun' nature. This activity can be run as an introduction to a frog unit, or as a stand alone activity; you might even want to set the activity as homework for students that have access to the internet. Most of the questions are pretty straight forward and all the answers are contained on the recommended web sites.

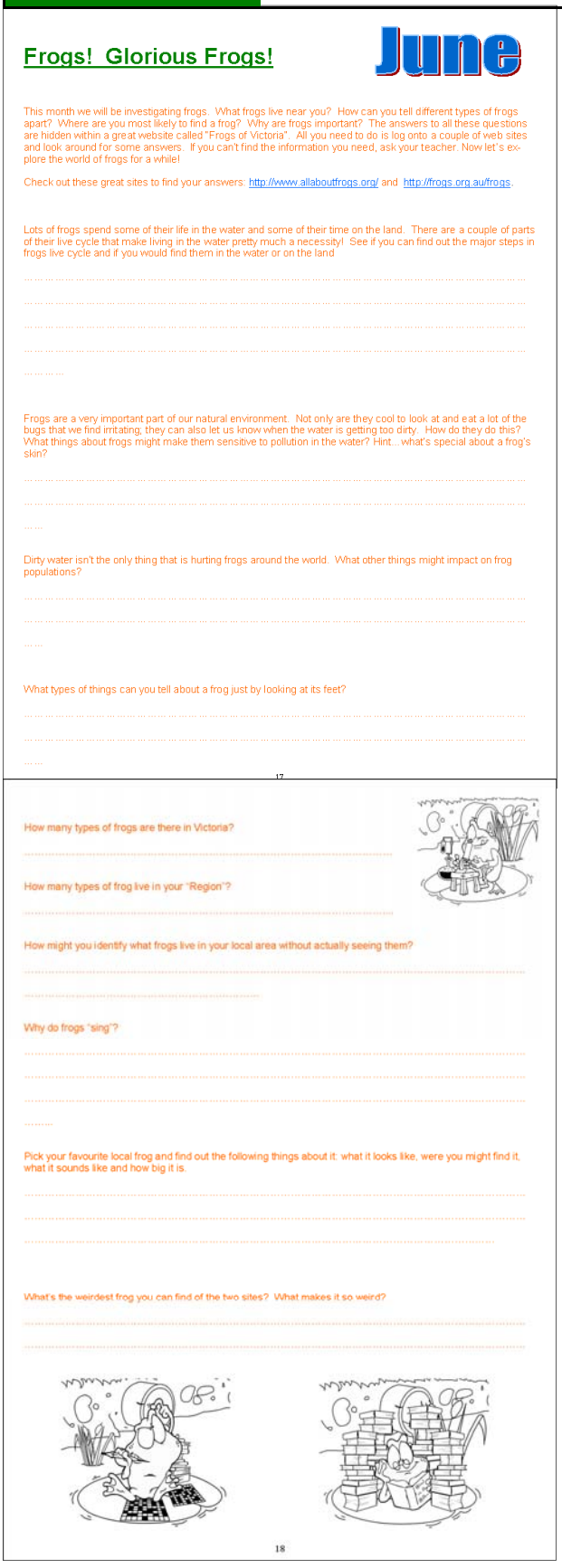
We recommend having a browse through the two sites before running the activity to familiarise yourself with the layout and content. The Frogs of Australia website (http://frogs.org.au/frogs) contains lots of information on the species of frogs found around Australia. Victoria probably has the most comprehensive information posted on the site, with a great region by region rundown of frog species you would expect to find. Try and get the students to listen to the frog calls (they are available on the site) and determine if they have heard them before. Listening to the call of a frog is one of the best ways to identify the species present in a waterway. If you are game, you can get the students to try and imitate the frog calls. If they mimic the call pretty well and do it in the vicinity of a frog of that species, often the frog will call back! This is especially the case with Growling Grass Frogs (*Litoria raniformis*), a threatened species that lives in our region (get the students to have a look at this one; it sounds great, and has an interesting diet…).

The other site, Frogland (http://www.allaboutfrogs.org/), contains heaps of great information about frog biology, threats to frogs, frog behaviour, weird and wonderful frogs, as well as lots of frog stories and interesting frog news.

A few of the students may get mixed up with the 'lifecycle' question. The Frogs of Australia website has a diagram for each frog species that lists the timing of various lifecycle related events (spawning, calling etc.). Frogland gives a full account of the morphological lifecycle of frogs. This is the one we are after. The main phases are: spawn, eggs, tadpoles, metamorphs (this is actually referred to as 'tadpoles with legs' and 'frogs with tails' on the Frogland site) and frogs. Spawn and eggs generally need to be in the water due to the risk of desiccation. Some species have gotten around this with the development of special egg casings and egg storage habits. The Bibron's Toadlet is one such species and is found in our region. Tadpoles are always found in water due to gills being their main means of gas transfer. Metamorphs can be found in the water or on land depending on their stage of development.

Another tricky one is the question about why frogs are sensitive to pollution in the water. There are a couple of answers to this which are equally valid. Eggs and tadpoles are very sensitive to pollution as they are in direct contact with water any chemicals present in the water are likely to be absorbed. Likewise, adult frogs have very special skin; they actually breathe and drink with it! Unfortunately, any chemicals present in the water may be absorbed along with the water.

Activity Cluster June	**Activity 1** Frogs Glorious Frogs	Student Workbook pages 17 & 18



Frogs! Glorious Frogs! June

This month we will be investigating frogs. What frogs live near you? How can you tell different types of frogs apart? Where are you most likely to find a frog? Why are frogs important? The answers to all these questions are hidden within a great website called "Frogs of Victoria". All you need to do is log onto a couple of web sites and look around for some answers. If you can't find the information you need, ask your teacher. Now let's explore the world of frogs for a while!

Check out these great sites to find your answers: http://www.allaboutfrogs.org/ and http://frogs.org.au/frogs.

Lots of frogs spend some of their life in the water and some of their time on the land. There are a couple of parts of their live cycle that make living in the water pretty much a necessity! See if you can find out the major steps in frogs live cycle and if you would find them in the water or on the land

Frogs are a very important part of our natural environment. Not only are they cool to look at and eat a lot of the bugs that we find irritating; they can also let us know when the water is getting too dirty. How do they do this? What things about frogs might make them sensitive to pollution in the water? Hint... what's special about a frog's skin?

Dirty water isn't the only thing that is hurting frogs around the world. What other things might impact on frog populations?

What types of things can you tell about a frog just by looking at its feet?

17

How many types of frogs are there in Victoria?

How many types of frog live in your "Region"?

How might you identify what frogs live in your local area without actually seeing them?

Why do frogs "sing"?

Pick your favourite local frog and find out the following things about it: what it looks like, were you might find it, what it sounds like and how big it is.

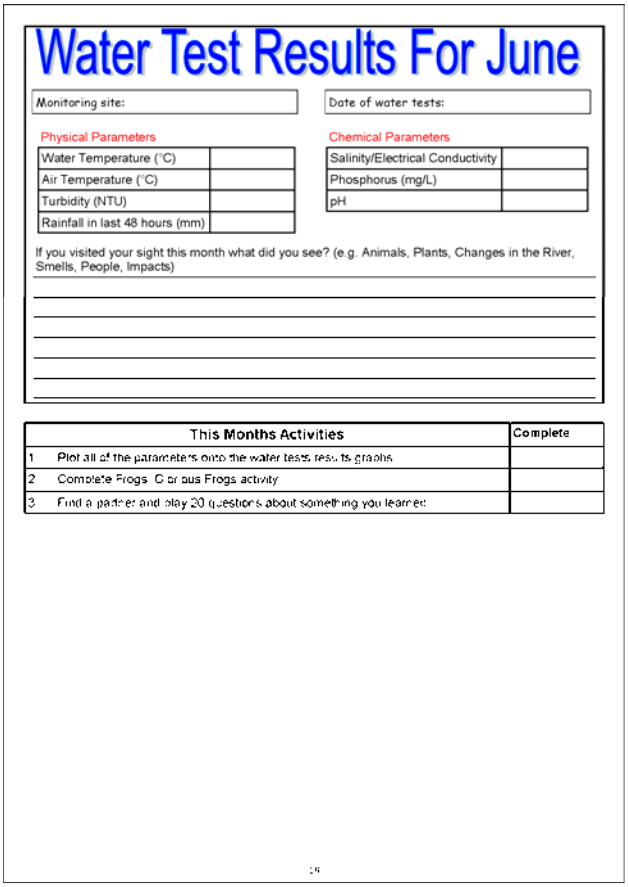
What's the weirdest frog you can find of the two sites? What makes it so weird?

18

Introduction	This activity involves students investigating frog biology and their local diversity through a web based inquiry activity. Students answer questions through an investigation of two web sites.
Purpose	Increase students knowledge of frogs in their local region; frog biology; adaptations of frogs; human impacts on frog populations; and frog identification techniques. This activity also builds on ICT and internet based research skills.
Materials	Student workbook, computer with internet access.
Activity	1. Introduce the activity. Show students how to access the web sites. 2. Allow students time to familiarise themselves with the sites and help with navigation. 3. Students to complete questions using web sites as information source. 4. Teacher to provide support for site navigation and information location (see teacher notes). 5. Discuss answers as a group.
Conclusion	Students gain an understanding of basic frog biology and local diversity. ICT skills are also utilised and developed.
Assessment	Written material can be assessed for understanding of topic matter. Research skill can be observed during activity. Understanding can also be assessed during class discussion.

Activity Cluster June	**Activity 2** Testing the Waters Peer Teaching	Student Workbook page 19

Introduction	This activity involves the students measuring various water quality parameters and recording the results. Students also play a game of 20 questions about this months activities.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data. Reinforce learning through reflection activity (20 questions).
Materials	Water testing kit, Student Workbook.
Activity	1. Students conduct water testing and record results. 2. Results are to be faxed to North Central Waterwatch. 3. Peer teaching activity. 4. Students complete Frogs, Glorious Frogs activity. 5. Students play 20 questions with a partner.
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity. Students can record their 20 questions for assessment.



Water Test Results For June

Monitoring site: | Date of water tests:

Physical Parameters

Water Temperature (°C)	
Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

Chemical Parameters

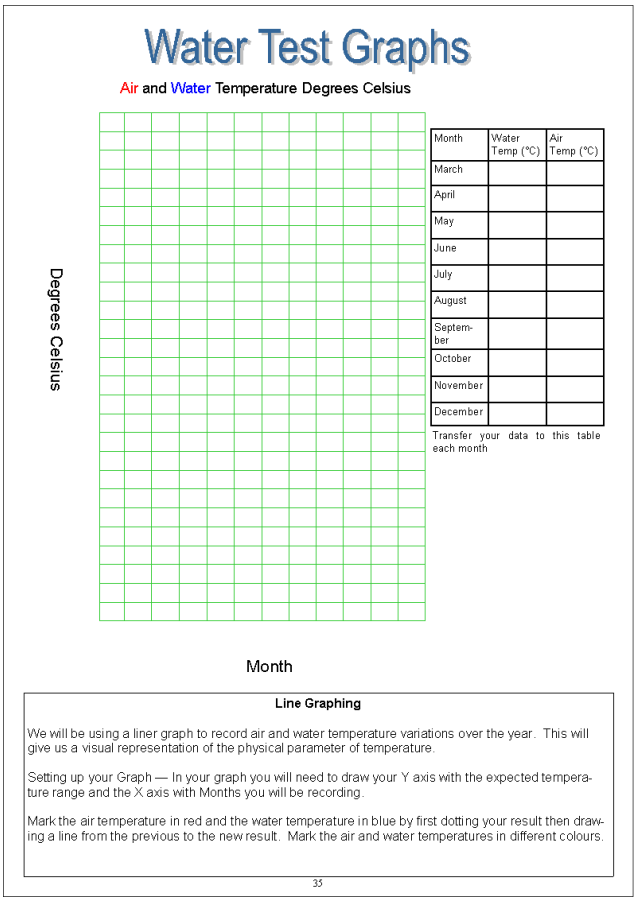
Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

This Months Activities	Complete
1 Plot all of the parameters onto the water tests results graphs	
2 Complete Frogs Glorious Frogs activity	
3 Find a partner and play 20 questions about something you learned	

Activity Cluster June	**Activity 3** Parameter Graphing	Student Workbook pages 35,36,37,38,39

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

Month	Water Temp (°C)	Air Temp (°C)
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

Transfer your data to this table each month

Month

Line Graphing

We will be using a liner graph to record air and water temperature variations over the year. This will give us a visual representation of the physical parameter of temperature.

Setting up your Graph — In your graph you will need to draw your Y axis with the expected temperature range and the X axis with Months you will be recording.

Mark the air temperature in red and the water temperature in blue by first dotting your result then drawing a line from the previous to the new result. Mark the air and water temperatures in different colours.

35

Activity Cluster
July

Water Conservation
every drop counts

These activities aim to give students awareness regarding their personal uses of water—from both a conservation and necessity perspective.

What students do	Teaching points and questions	Grouping	Special needs
1. **Water Audit** 2. **How water wise is your household** 3. **Testing the Waters Peer Teaching** 4. **Parameter graphing**	• Where does your water come from? • Water usage • Water conservation techniques	• Individual • Pairs • Groups • Whole class	

Background For the Teacher

Where does your drinking water come from?

In the North Central catchment, drinking water comes from local rivers and creeks. Some other regions store water in large dams called reservoirs before being pumped out. Some people have rainwater tanks that catch water when it rains and this water can then be used around the home. All water (except rainwater) needs to be treated before it comes out of your tap. The treatment processes make the water tastier and better for us to drink by filtering out any impurities and getting rid of any nasty bacteria/bugs in the water.

DID YOU KNOW

- Over 70% of the planet's surface is water, however **less than 1%** of that is **drinkable water**! The rest is locked up in polar ice caps and oceans. To put it another way- if 100 Litres represents the world's water, little more than half a tablespoon of it is fresh water available for our use!!!!
- It takes **500 litres** of water to produce **1 orange**!
- It takes **50 litres** of water to produce **1 copy of Saturday's newspaper**!
- It takes about **5000 litres** of water to produce **1 kilogram of rice**!

Many people say that water is more valuable than Gold!!
Water is a precious resource that we need to protect and preserve. Australia is the driest continent on earth, 70% of our land is arid! Our hot climate and low rainfall means that water is scarce.

A **clean and fresh water supply** is not just about what comes out of our taps. It is also about being careful with what you put down toilets, drains, basins and sinks. Things like rubbish, car washing water, leaves and grass that end up in street gutters, flow into the stormwater system. These items can cause serious damage to our rivers and streams.

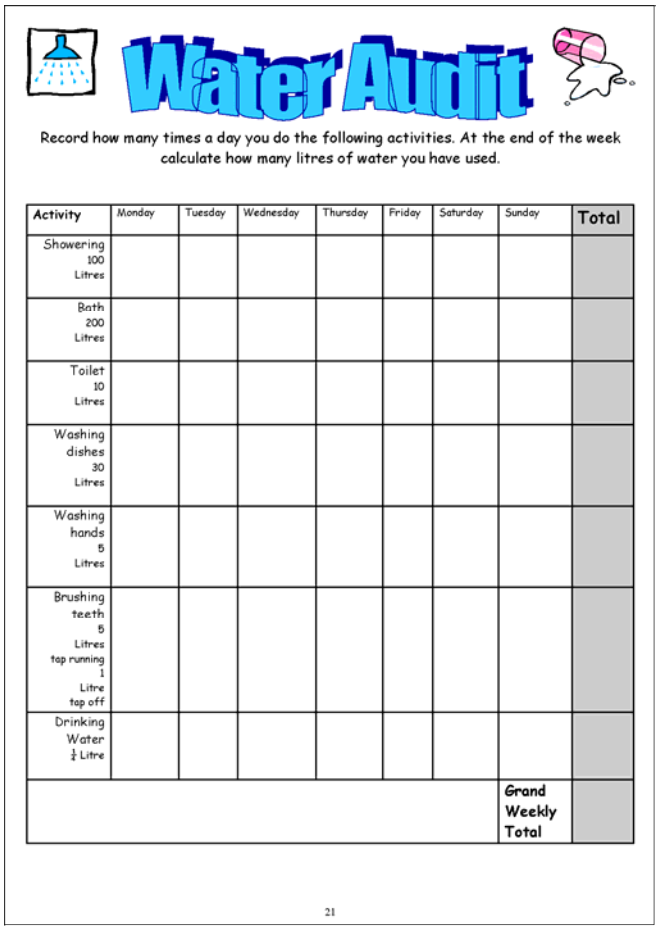
Fresh water is essential for our existence as it allows us to produce food, manufacture goods and sustain our health. Everybody must do their bit to try not to waste water and together we can make a difference.

In the North Central region, average household water use is around 364,000 litres a year (that is a LOT of water!) and it is estimated that the average North Central household uses around 1000 litres of water daily (the equivalent to 6 and a half bath tubs a day!).

This month you will find out how to be water wise and do your bit to save water every day. Complete the River Detectives Water Audit to find out how much water you use in a single day and in a whole week. You might be surprised!

Activity Cluster July	**Activity 1** Water Audit	Student Workbook page 21

Introduction	This activity involves students recording their personal household water use over the period of a week.
Purpose	Raise students self awareness of water use. Students will identify personal water use patterns with the aim of identifying conservation strategies.
Materials	Student workbook.
Activity	1. Introduce activity with discussion on the sources of potable (drinking) water in our region. 2. Introduce types of household water use and the concept of water scarcity. 3. Students complete Water Audit over the period of a week. 4. Students discuss results and make suggestions on how they might reduce their water consumption.
Conclusion	Discuss results of the audit with students with the aim of developing a personal water conservation strategy. A written strategy may be developed if appropriate.
Assessment	Written material and discussion may be observed and assessed.



Water Audit

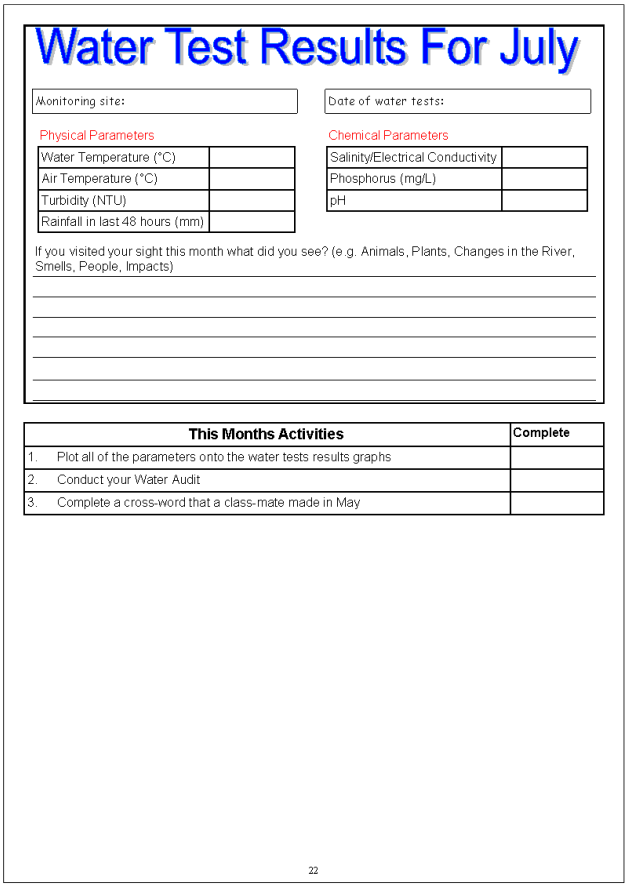
Record how many times a day you do the following activities. At the end of the week calculate how many litres of water you have used.

Activity	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
Showering 100 Litres								
Bath 200 Litres								
Toilet 10 Litres								
Washing dishes 30 Litres								
Washing hands 5 Litres								
Brushing teeth 5 Litres tap running 1 Litre tap off								
Drinking Water ½ Litre								
							Grand Weekly Total	

21

Activity Cluster July	**Activity 3** Testing the Waters Peer Teaching	Student Workbook page 22

Introduction	This activity involves the students measuring various water quality parameters and recording the results. Students also engage in active peer teaching.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data.
Materials	Water testing kit, Student Workbook.
Activity	1. Students conduct water testing and record results. 2. Results are to be faxed to North Central Waterwatch. 3. Peer teaching activity. 4. Students complete the Water Audit. 5. Students complete another students crossword from May activity.
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity.



Water Test Results For July

Monitoring site:

Date of water tests:

Physical Parameters

Water Temperature (°C)	
Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

Chemical Parameters

Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

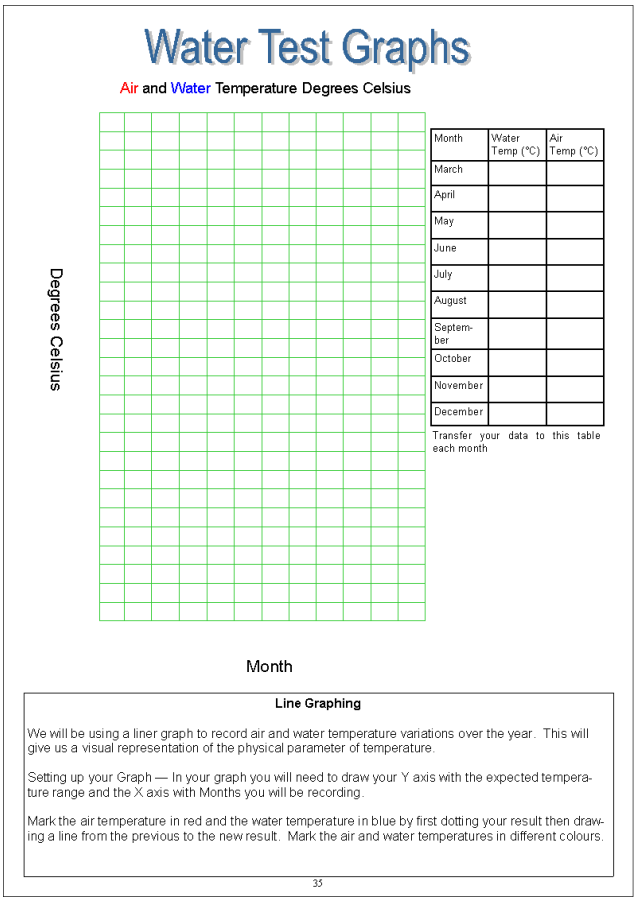
If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

This Months Activities	Complete
1. Plot all of the parameters onto the water tests results graphs	
2. Conduct your Water Audit	
3. Complete a cross-word that a class-mate made in May	

22

Activity Cluster July	**Activity 4** Parameter Graphing	Student Workbook pages 35,36,37,38,39

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

Month	Water Temp (°C)	Air Temp (°C)
March		
April		
May		
June		
July		
August		
Septem-ber		
October		
November		
December		

Transfer your data to this table each month

Month

Line Graphing

We will be using a liner graph to record air and water temperature variations over the year. This will give us a visual representation of the physical parameter of temperature.

Setting up your Graph — In your graph you will need to draw your Y axis with the expected temperature range and the X axis with Months you will be recording.

Mark the air temperature in red and the water temperature in blue by first dotting your result then drawing a line from the previous to the new result. Mark the air and water temperatures in different colours.

35

Activity Cluster
August

Environmental Flows

These activities provide the opportunity to investigate the concept of environmental flows. They provide an introduction and discussion points.

What students do	Teaching points and questions	Grouping	Special needs
1. **Environmental Flows Reading and Comprehension activity** 2. **Testing the Waters Peer Teaching** 3. **Parameter graphing** 4. **Run of the River E Flows game (optional)**	• Rivers and waterways have varying demands for usage • People, animals and the environment all need water • Water is limited • People and the environment need water at different times for different things	• Individual • Pairs • Groups • Whole class	• Run of the River Board Game (optional)

Background For the Teacher

Why Flow is Important in our Rivers?

Rivers are an important part of the catchment. Along their way different plants and animals depend on the river for habitat and food.

In some places, beautiful River Red Gums grow alongside. They drop their branches into the river and fish can shelter amongst them, hiding from the birds perched above. River Red Gums need high flows that cover the river bank every couple of years, wetting their roots to keep them alive and healthy.

Fish also need high flows during the time they want to migrate and spawn (breed). High flows at the right time of year let the fish know when its time to spawn and begin to swim upstream.

In bigger floods water spills over the banks and onto the plains, and fills the wetlands. Colonial birds like ibis and egrets come from all around to make their nests in the rushes and large trees that flourish.

Sometimes the river stops running and all that is left are small pools. Aquatic bugs (invertebrates) and fish take refuge and wait for rain. Exotic or introduced species like carp, do not like it when this happens. But our native animals are tough and can survive periods of low flow, which naturally occur in the summer.

The native plants and animals that live in or near the rivers in Australia are adapted to the natural changes in the flow of the river. Without these changes in flow they cannot complete their lifecycles.

Using Our Rivers

Humans also use rivers for water. We use it everyday in our homes and farmers use it to water their crops. We pump it directly from the river and build dams and reservoirs to hold back and store the water for times when it is hot and dry.

When too much water is taken out of our rivers for use in our homes, towns or for farming, this reduces the water flowing down the river. Where there are dams or reservoirs on our waterways, water is captured in winter when the river would have been running with lots of water and released in summer when it is hot and dry. This forces the river to have a lot of water in it during summer when it would have been naturally low.

These man-made changes have altered the way the water in rivers naturally goes up and down, and some of the plants and animals cannot survive. The fish do not breed, the plants do not set seed, wetlands suffers and exotic species flourish

Role of Environmental Flows

Environmental flow is the water that is released in a river so the plants and animals can survive and reproduce. In rivers that have dams we can release water, called environmental flows, to help the plants and animals. You must remember that the amount of water that is released will depend on the season, so it is as close to natural as possible.

During summer, when some rivers would have been dry very little environmental flows are released, but sometimes we do have big summer storms. This rainfall would have made the river flow for a short amount of time before drying out again. This is called a “fresh” because the water in the small pools is freshened up. We also deliver environmental flows to mimic summer rains.

In winter the river runs higher, but because we catch the water in dams it does not run as high. Environmental flows in winter help the river run higher and sometimes over the bank. This fills wetlands, helps fish migrate and River Red Gums flourish.

In rivers without dams, we have to be careful when we take water out of the river. If we take too much out in summer there will be nothing left for the plants and animals. Sometimes this is difficult because in summer more water is needed to keep farmers crops and cattle, and our gardens at home, alive.

We all need to use water very carefully so there is enough to go around.

To find out more about environmental flows, lets think about how we all use water and what the river needs to stay healthy.

Extension Activity

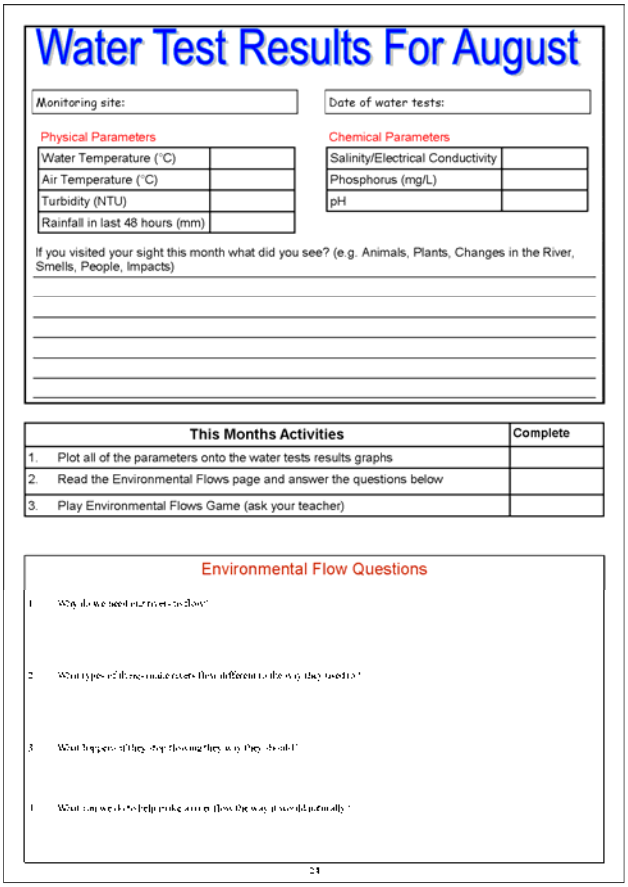
Run of the River - Environmental Flows board game

If your students are interested in environmental flows and would like to participate in an extension activity, let your local Waterwatch facilitator know and they can deliver a copy of the new Run of the River board game. The game has been produced by the Department of Sustainability and Environment and allows students to explore the environmental, social and economic aspects of water trade and environmental flows in a fun and interactive way.

The target audience of the game is early secondary, but has been well received by advanced primary students.

Activity Cluster August	**Activity 1+2** Testing the Waters Peer Teaching and E flows R+C activity	Student Workbook page 24

Introduction	This activity involves the students measuring various water quality parameters and recording the results. Students will also answer questions relating to the Environmental Flows descriptive text.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data.
Materials	Water testing kit, Student Workbook.
Activity	1. Students conduct water testing and record results. 2. Peer teaching activity. 3. Students complete E Flows questions. 4. Results are to be faxed to North Central Waterwatch. 5. Play Run of the River Board Game (optional).
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity.



Water Test Results For August

Monitoring site: | Date of water tests:

Physical Parameters

Water Temperature (°C)	
Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

Chemical Parameters

Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

This Months Activities	Complete
1. Plot all of the parameters onto the water tests results graphs	
2. Read the Environmental Flows page and answer the questions below	
3. Play Environmental Flows Game (ask your teacher)	

Environmental Flow Questions

1 Why do we need environmental flows?

2 What types of human-made events are different to the way they used to?

3 What happens if they stop flowing the way they should?

4 What can we do to help make sure flow the way it would naturally?

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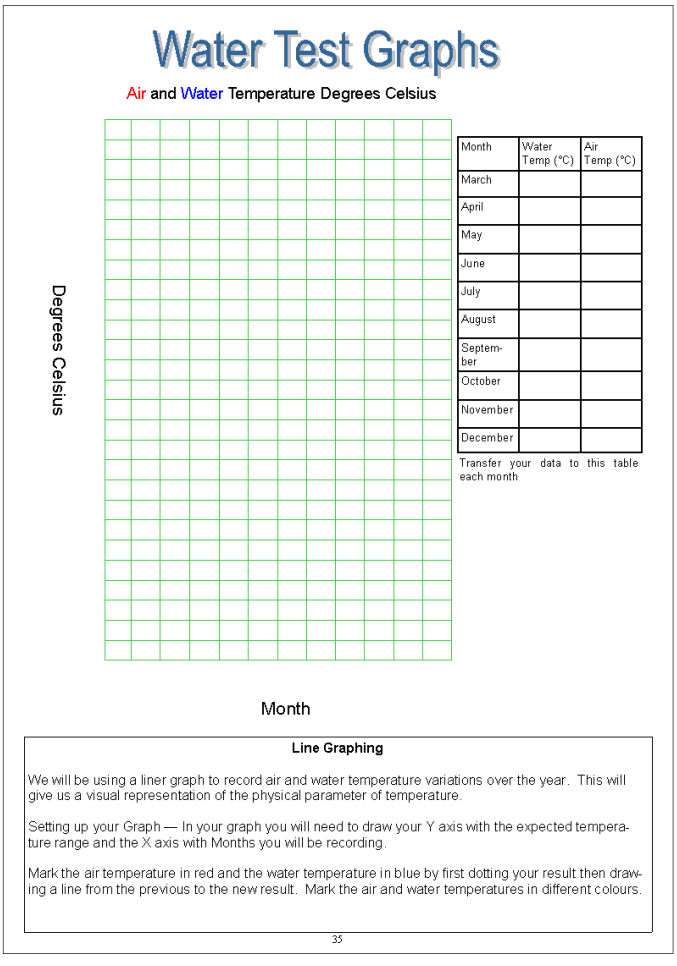
Activity Cluster August	**Activity 3** Parameter Graphing	Student Workbook pages 35,36,37,38,39

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

Month	Water Temp (°C)	Air Temp (°C)
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

Transfer your data to this table each month

Month

Line Graphing

We will be using a liner graph to record air and water temperature variations over the year. This will give us a visual representation of the physical parameter of temperature.

Setting up your Graph — In your graph you will need to draw your Y axis with the expected temperature range and the X axis with Months you will be recording.

Mark the air temperature in red and the water temperature in blue by first dotting your result then drawing a line from the previous to the new result. Mark the air and water temperatures in different colours.

35

Activity Cluster
September

Biological Surveys - Mini Beastie Hunt

These activities aim to introduce students to the macroscopic diversity within the waterway they are monitoring and to participate in a scientific survey used for quantifying river health.

What students do	Teaching points and questions	Grouping	Special needs
1. **Water beastie hunt** 2. **Testing the Waters Peer Teaching** 3. **Parameter graphing**	• Macroinvertebrate investigation • What lives in the aquatic environment? • Why are macroinvertebrates important?	• Individual • Pairs • Groups • Whole class	• Macroinvertebrate survey materials • Waterwatch Facilitator

Background For the Teacher

The biological sampling procedure chosen for River Detectives concentrates on aquatic invertebrates (water bugs). Schools sampling drains and/ or channels may not have a large range of aquatic invertebrates present and may choose to also look at algae, providing that students have access to a microscope. Another option is for your Waterwatch facilitator to bring an invertebrate sample to your school and do your water beastie hunt indoors.
Aquatic invertebrates are useful indicators of stream health because:

- They occupy a central role in the food chains of aquatic systems,
- many live in the water for over a year,
- they cannot easily escape pollution (as some fish can),
- they are sensitive to even quite mild pollutants or changes in water quality, and
- they are also relatively easy and inexpensive to sample

Algae, especially blue-green algae, are also important to monitor (by your Water Authority such as Goulburn Murray Water) because of their potential impacts on human and animal health.

The variety and number of aquatic invertebrates found in a waterbody can be used to indicate the presence of pollution. Chemical testing can then be conducted to confirm the presence and particular type of pollution.

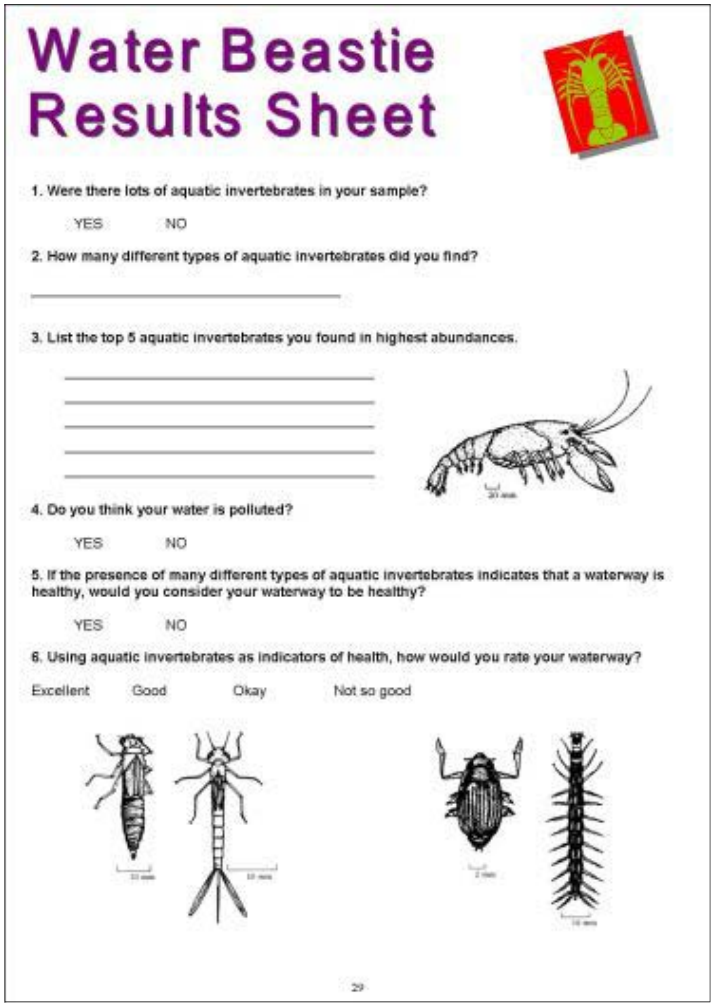
Aquatic invertebrate sampling complements chemical sampling because it can detect the presence of most environmental stresses and may provide general indications about the type of pollutant present. By contrast, chemical and physical tests are highly specific (for example, a test for pH or one for soluble phosphate levels). If the pollutant is not measured by one of the chemical or physical tests conducted at the site then it may go undetected if you were to only conduct these tests.

Furthermore, aquatic invertebrates' life span of up to a year, together with their relative lack of mobility, can make them useful indicators of intermittent pollution. For example, a 'slug' of toxic waste released into a stream after an accident may have an impact on the variety and numbers of the aquatic invertebrate communities that remains evident for several months. By contrast, chemical monitoring, unless conducted when the toxicant is present, is far less likely to detect the event (Taken from the Waterwatch Victoria Website).

For further information on Biological Monitoring visit http://www.vic.waterwatch.org.au

Activity Cluster September	**Activity 1** Mini Beastie Hunt	Book with a Waterwatch Facilitator

Introduction	For this activity students complete a qualitative macroinvertebrate assessment of their waterway.
Purpose	Students gain awareness of invertebrate life present in waterways, their importance and how they can be used as environmental indicators.
Materials	Student workbook, Waterwatch Facilitator.
Activity	1. Waterwatch facilitator introduces the topic matter (can be done by teacher if desired). 2. Students sort and identify macroinvertebrates (provided by Waterwatch facilitator). 3. Students complete worksheet. 4. Results are discussed as a class or in small groups. 5. Final assessment of water quality decided as a class.
Assessment	Students workbooks can be assessed. Understanding of concepts may be observed during the activity. Group work assessed during activity.



Water Beastie Results Sheet

1. Were there lots of aquatic invertebrates in your sample?

YES NO

2. How many different types of aquatic invertebrates did you find?

3. List the top 5 aquatic invertebrates you found in highest abundances.

4. Do you think your water is polluted?

YES NO

5. If the presence of many different types of aquatic invertebrates indicates that a waterway is healthy, would you consider your waterway to be healthy?

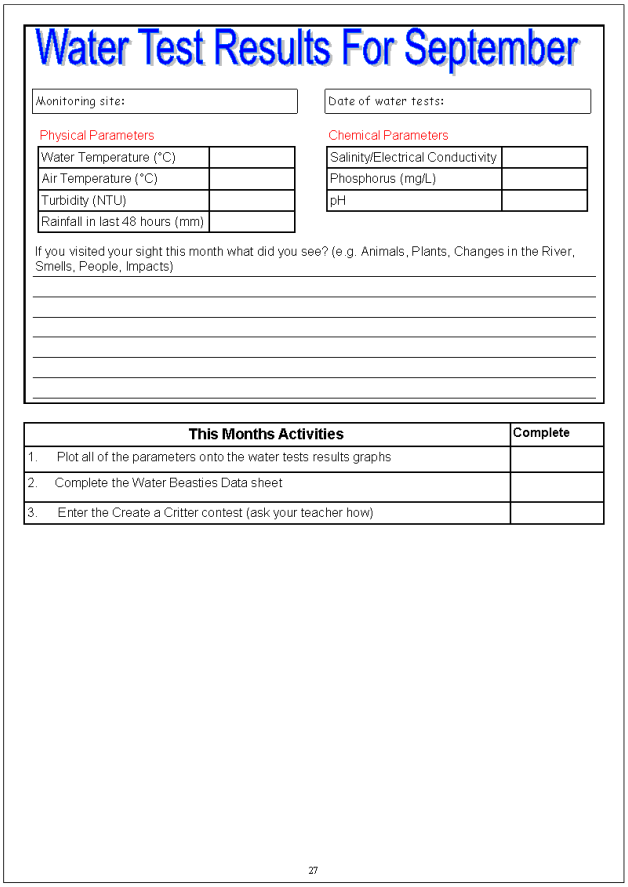
YES NO

6. Using aquatic invertebrates as indicators of health, how would you rate your waterway?

Excellent Good Okay Not so good

Activity Cluster September	**Activity 2** Testing the Waters Peer Teaching	Student Workbook page 27

Introduction	This activity involves the students measuring various water quality parameters and recording the results. Students will do a mini beastie hunt complete a macroinvertebrate survey results sheet.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data.
Materials	Water testing kit, Student Workbook.
Activity	1. Students conduct water testing and record results. 2. Peer teaching activity. 3. Students complete macroinvertebrate activity. 4. Results are to be faxed to North Central Waterwatch. 5. Enter Create A Critter Contest (optional, but very good fun!)
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity.



Water Test Results For September

Monitoring site:

Date of water tests:

Physical Parameters

Water Temperature (°C)	
Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

Chemical Parameters

Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

This Months Activities	Complete
1. Plot all of the parameters onto the water tests results graphs	
2. Complete the Water Beasties Data sheet	
3. Enter the Create a Critter contest (ask your teacher how)	

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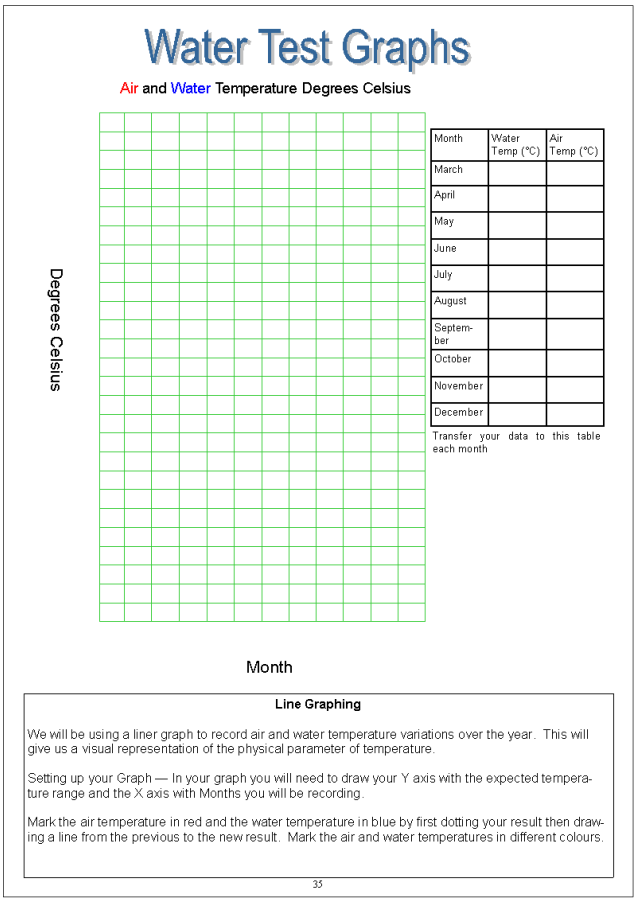
Activity Cluster September	**Activity 3** Parameter Graphing	Student Workbook pages 35,36,37,38,39

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

Month	Water Temp (°C)	Air Temp (°C)
March		
April		
May		
June		
July		
August		
Septem-ber		
October		
November		
December		

Transfer your data to this table each month

Month

Line Graphing

We will be using a liner graph to record air and water temperature variations over the year. This will give us a visual representation of the physical parameter of temperature.

Setting up your Graph — In your graph you will need to draw your Y axis with the expected temperature range and the X axis with Months you will be recording.

Mark the air temperature in red and the water temperature in blue by first dotting your result then drawing a line from the previous to the new result. Mark the air and water temperatures in different colours.

35

Extension Activity

Create-a-Critter Competition

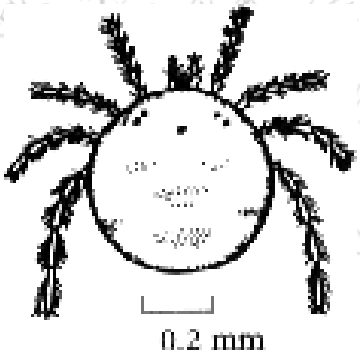
A diverse range of creatures inhabit waterways. Amphibians, fish, mammals, birds and reptiles are some of the larger creatures you may find, but you may also notice much smaller creatures called **invertebrates**. Most of these critters can be seen with the naked eye; however microscopes are useful for seeing more detail and some of the smaller ones. Some invertebrates spend all or part of their lifecycle in the water while others visit the water only for feeding, roosting or breeding. This month you can make your favourite critter from your waterway. You could also research your critters lifecycle, diet, habitat and threats.

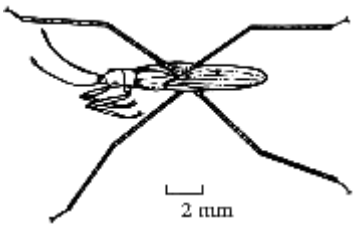
Students are invited to participate in a North Central Waterwatch "Create-a-Critter" competition for the month of September.

Create-a-critter is an opportunity for students to explore their creative and observational skills by creating a critter based on a real aquatic invertebrate. Students participating in this activity are asked to make a three-dimensional model of an invertebrate that spends at least part of its lifecycle in or on the water.

There are plenty of invertebrates to choose from including dragonfly nymphs, diving beetles, backswimmers, water mites, caddisfly larvae, mayfly nymphs, amphipods, and water scorpions just to name a few.

Remember invertebrates are creatures without a backbone so don't make any fish, frogs or platypus!!





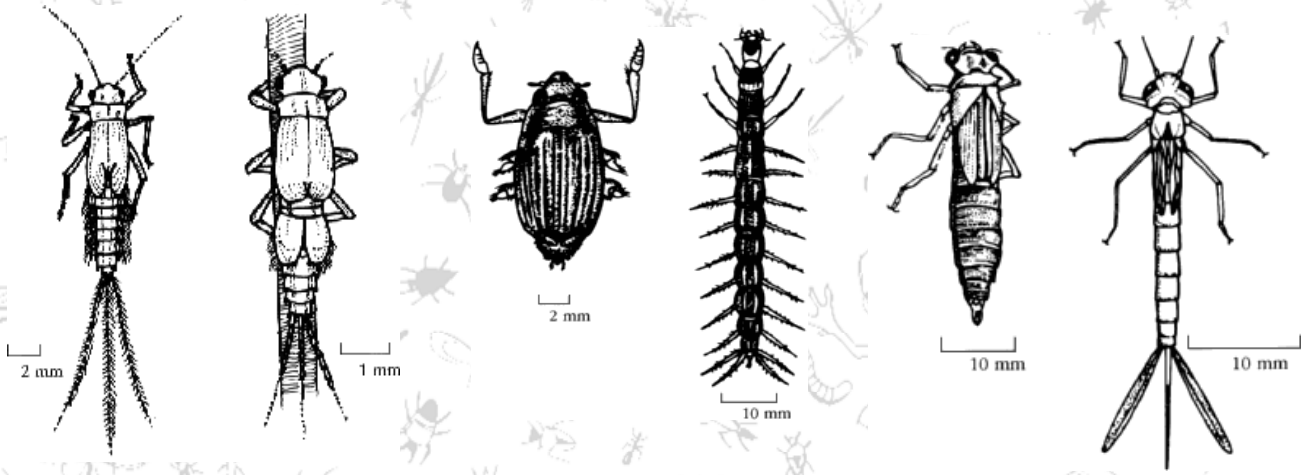
Don't forget to attach your critters common name, your name, grade, school, teachers name and contact phone number onto your critter.

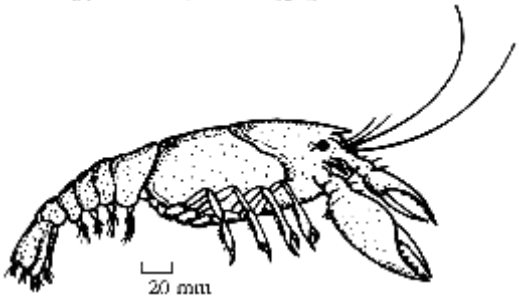
Closing date for the Create-a-Critter Competition is 15th October

You may work individually or as a pair. Send your entries into North Central Waterwatch PO Box 18 Huntly 3551.

There are a range of prizes to be won. Judges will be looking for originality, ingenuity in use of recycled materials and accuracy.

For more pictures of water creatures go to the Waterwatch website http://www.vic.waterwatch.org.au/fortheteacher/manual/sect3c1.htm





Activity Cluster
October

Wetlands

These activities focus on the importance of wetlands for water birds. They also include a focus on species diversity.

What students do	Teaching points and questions	Grouping	Special needs
1. **Wetlands and Feathery Friends** 2. **Beaks and Feet** 3. **Testing the Waters Peer Teaching** 4. **Parameter graphing**	• What is a wetland? • Identification of wetlands within the North Central Catchment • What birds can be found in your area?	• Individual • Pairs • Groups • Whole class	• Activity specific equipment

Background For the Teacher

A wetland is defined as '*an area of land that is usually wet on a regular or semi-regular basis*'. Wetlands differ in size, depth and permanency. Some are merely shallow depressions in the landscape which are full of life and become focal points when they are holding water. 'Wetland' is the general term used for aquatic environments including swamps, billabongs, lakes, salt-marshes, bogs, soaks, mudflats and mangroves.

Wetlands provide a link between waterways and the surrounding land and are therefore very important components of our landscape. They are transitional zones between wet and dry environments, containing a wide variety of aquatic and terrestrial plants and animals. Wetlands form one of the most productive and diverse biological systems on earth.

Wetlands provide vital habitat for breeding and feeding of many plants and animals, as well as fulfilling important roles in reducing the impacts of flooding and maintaining water quality. Many wetlands are dry for most of the year (ephemeral), filling only after rain and can therefore be difficult to identify as wetlands. In North Central Victoria the main threats affecting wetland values are: loss of vegetation, drainage and modification, altered water withdrawal patterns (E.g. diversion for irrigation, construction of dams/weirs), overgrazing, and water pollution)

Beaks and Feet

Birds come in a variety of shapes and sizes and thus like to live in different habitats. Some birds live in trees, while others prefer shrubs and bushes closer to the ground. Some birds are brightly coloured while others blend into their surrounding environment, making them less visible to predators.

This month take a visit to your monitoring site and see how many different types of birds you can find. You will have to be very quiet so you don't scare them away. Look at the shape of the bird's beak and try to work out what their favourite food might be. Also take note of their feet and try to figure out where they live and why their feet look the way they do.

For more information about Bird Watching:

Contact your local Bird Observers Club, Landcare Group or Friends of a Wetland/Park Group to assist your class with their bird watching activities.

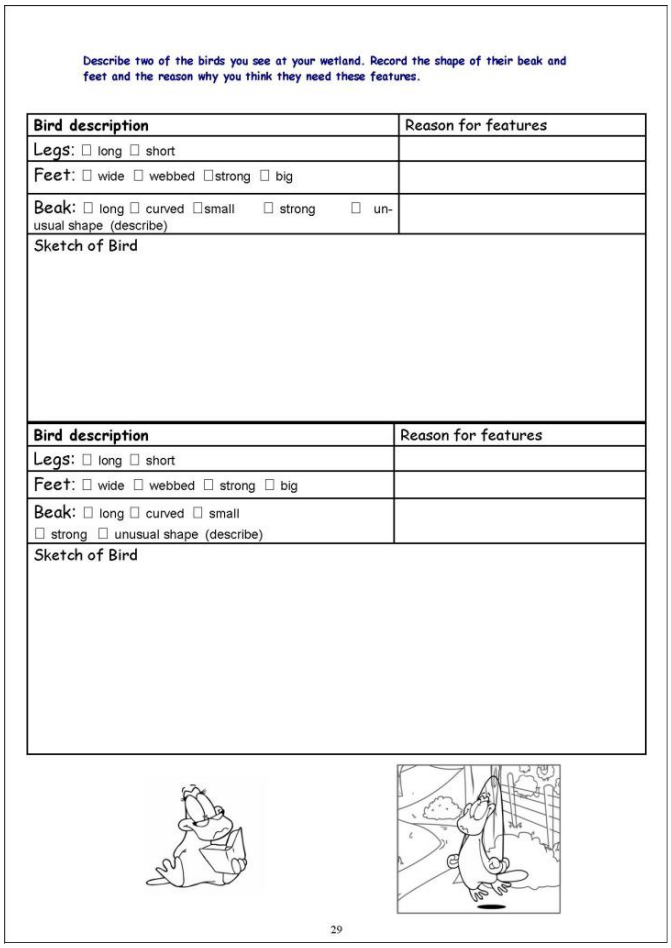
Visit the following websites:

Hints for birding with children: http://home.vicnet.net.au/~osch/hintsfor.htm

Australian Online Bird Guide: http://raysp.com/birds/guide.php3

Activity Cluster October	**Activity 1** Beaks and Feet	Student Workbook page 29, 30

Introduction	After a site visit (reference materials may be used if site visit is not possible), students describe the features of two birds they see. Students will try and give reasons for different morphologies observed.
Purpose	Have students analyse the morphology of species and how it affects the animals habits and life style.
Materials	Student Workbook, binoculars (if available).
Activity	1. Students observe birds in the field (if field trip is not possible, reference books/pictures may be used). 2. Students complete worksheet, thinking about what the different morphologies mean about the animals habits. 3. Class discussion.
Assessment	Student workbooks assessed.

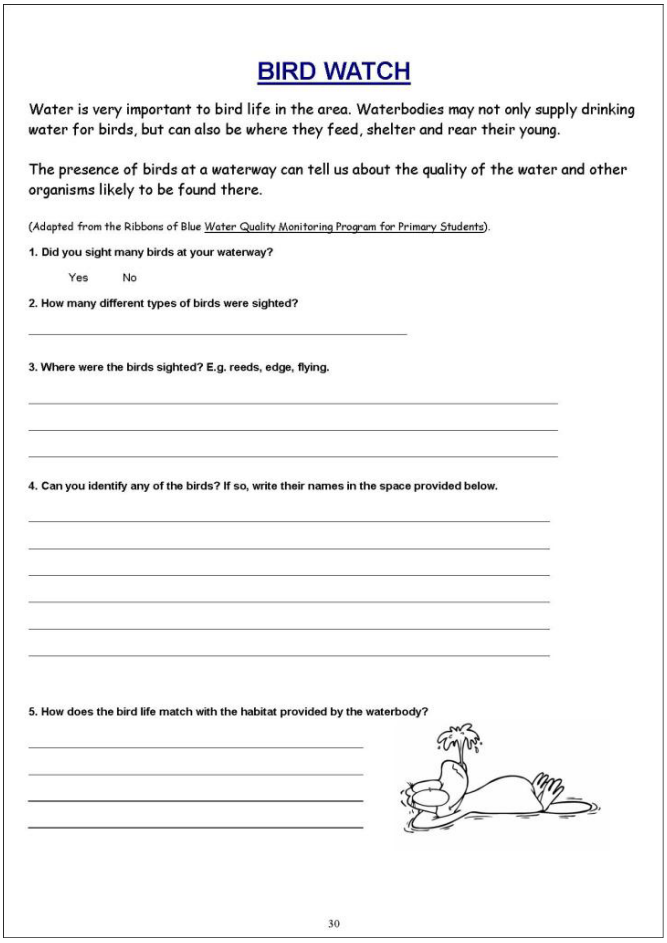


Describe two of the birds you see at your wetland. Record the shape of their beak and feet and the reason why you think they need these features.

Bird description	Reason for features
Legs: ☐ long ☐ short	
Feet: ☐ wide ☐ webbed ☐ strong ☐ big	
Beak: ☐ long ☐ curved ☐ small ☐ strong ☐ unusual shape (describe)	
Sketch of Bird	

Bird description	Reason for features
Legs: ☐ long ☐ short	
Feet: ☐ wide ☐ webbed ☐ strong ☐ big	
Beak: ☐ long ☐ curved ☐ small ☐ strong ☐ unusual shape (describe)	
Sketch of Bird	

29



BIRD WATCH

Water is very important to bird life in the area. Waterbodies may not only supply drinking water for birds, but can also be where they feed, shelter and rear their young.

The presence of birds at a waterway can tell us about the quality of the water and other organisms likely to be found there.

(Adapted from the Ribbons of Blue Water Quality Monitoring Program for Primary Students).

1. Did you sight many birds at your waterway?

Yes No

2. How many different types of birds were sighted?

3. Where were the birds sighted? E.g. reeds, edge, flying.

4. Can you identify any of the birds? If so, write their names in the space provided below.

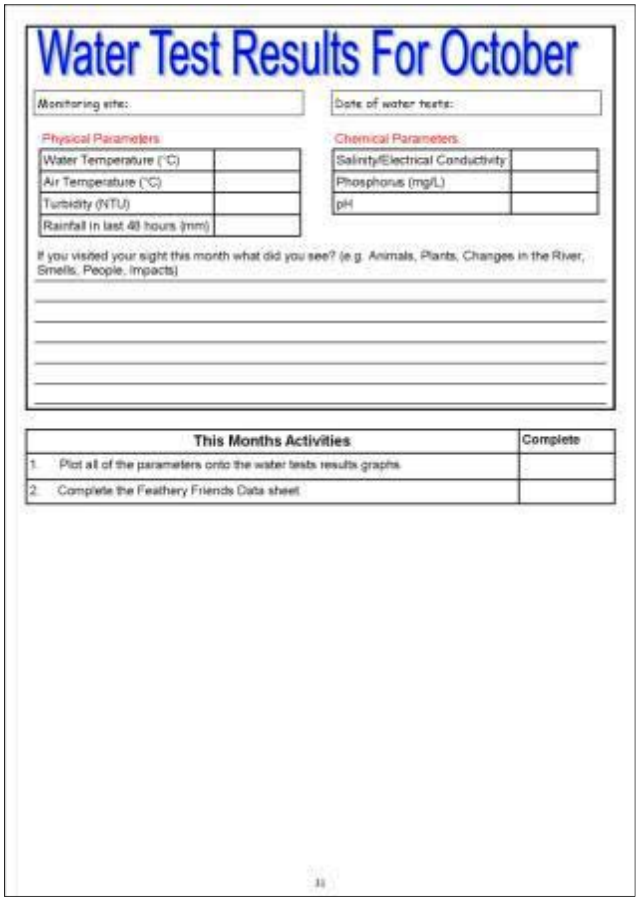
5. How does the bird life match with the habitat provided by the waterbody?

30

Introduction	This activity requires students to assess the diversity of birds present at their local waterway and the types of habitats they inhabit/utilise.
Purpose	Increase students awareness of biodiversity, especially that of their local area. Stress the importance of diversity of habitat types to ensure maximum biodiversity.
Materials	Student workbook, bird identification resource (if available), binoculars (if available).
Activity	1. Students learn about diversity and abundance of birds at their local waterway/wetland. 2. Students compare bird diversity with habitat diversity. 3. Class discussion to clarify link between habitat and biodiversity.
Assessment	Students observational skills may be assessed during the activity, written responses may be assessed.

Activity Cluster October	**Activity 2** Testing the Waters Peer Teaching	Student Workbook page 31

Introduction	This activity involves the students measuring various water quality parameters and recording the results.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data.
Materials	Water testing kit, Student Workbook.
Activity	1. Students conduct water testing and record results. 2. Peer teaching activity. 3. Results are to be faxed to North Central Waterwatch. 4. Feathery Friends activity.
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity.



Water Test Results For October

Monitoring site: | Date of water tests:

Physical Parameters

Water Temperature (°C)	
Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

Chemical Parameters

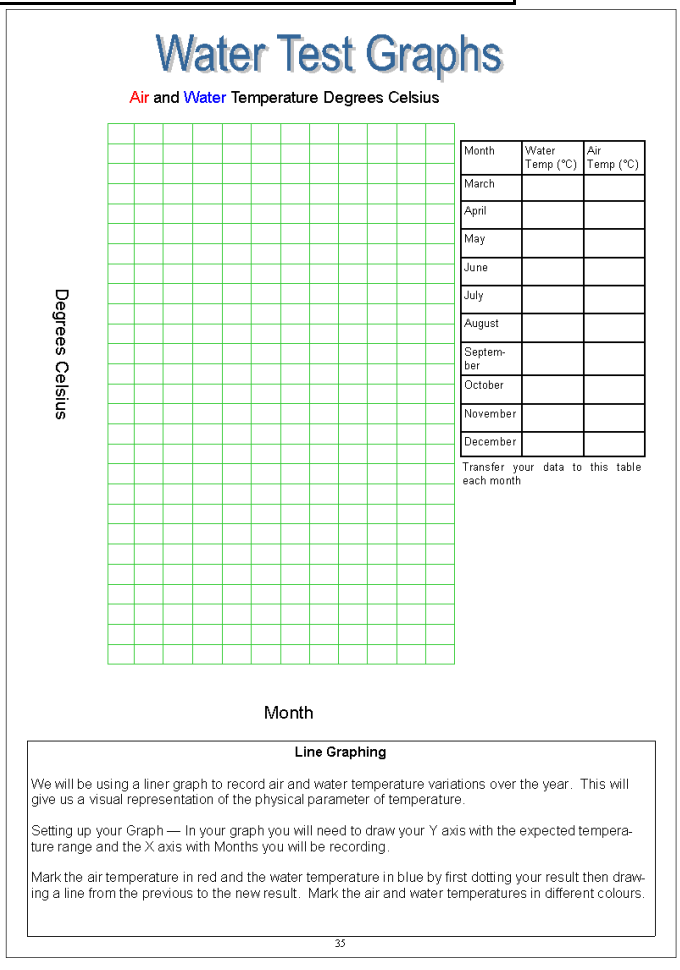
Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

This Months Activities	Complete
1. Plot all of the parameters onto the water tests results graphs	
2. Complete the Feathery Friends Data sheet	

Activity Cluster October	**Activity 3** Parameter Graphing	Student Workbook pages 35,36,37,38,39

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

Month	Water Temp (°C)	Air Temp (°C)
March		
April		
May		
June		
July		
August		
Septem-ber		
October		
November		
December		

Transfer your data to this table each month

Month

Line Graphing

We will be using a liner graph to record air and water temperature variations over the year. This will give us a visual representation of the physical parameter of temperature.

Setting up your Graph — In your graph you will need to draw your Y axis with the expected temperature range and the X axis with Months you will be recording.

Mark the air temperature in red and the water temperature in blue by first dotting your result then drawing a line from the previous to the new result. Mark the air and water temperatures in different colours.

35

Urban Stormwater

Activity Cluster
November

What students do	Teaching points and questions	Grouping	Special needs
1. Less Litter Lunch **2. Testing the Waters Peer Teaching** **3. Parameter graphing**	• How do pollutants enter waterways? • What do we as individuals contribute to the pollutants? • How can we minimise our impacts?	• Individual • Pairs • Groups • Whole class	• Activity specific equipment

Background For the Teacher

Rainwater falls onto a variety of surface types. These surfaces include roads, rooftops, shopping centre car parks, playgrounds, golf courses, parks, gardens and pavements. Some of these surfaces will absorb water (these are **permeable**); however many other surfaces cannot absorb water (these are **impermeable**). Rainwater falling onto impermeable surfaces (E.g. roofs and roads) is generally transported via a series of gutters, drains or pipes to a nearby creek or river. Any pollutants on these surfaces will also be collected by rainwater. For example, rainwater travelling along a road can collect oil, detergents, rubber, cigarette butts, dog droppings, plastic, grass and leaves. This pollution will then enter our waterways, untreated. Rainwater that runs off hard surfaces and enters waterways is called **STORMWATER**.

Stormwater does not include sewage, as this is diverted through a different pipe system for treatment. ***Stormwater*** is water **outside** our homes, whereas ***sewage*** is water that flows down the drains **inside** our homes.

How Does Pollution Affect Our Waterways?

Many types of materials contained within stormwater can have a negative effect on our waterways. Common pollutants include rubbish, oil, soil, fertilisers, animal droppings, leaves, grass, and detergents.

Organic matter (leaves / grass) can block up and choke the natural flow of waterways. This can cause a reduction in sunlight penetration that affects water temperature, which can distress plants and animals living there. As leaves break down and decompose in water they add an increased nutrient load into the waterway. This may lead to large algal blooms when conditions are favourable. The decomposing leaves also release tannins which can affect the quality and colour of the water.

Litter including cans, plastic bottles and bags look unappealing in our waterways and therefore impacts upon aesthetics. Litter can also threaten aquatic animals, reduce recreational uses, and potentially harm our health.

Sediments can smother organisms and plants that reside on the bottom of a waterway. Sediments also increase turbidity, therefore reducing the amount of light that can penetrate the water.

Fertilisers and animal droppings can increase the amount of nutrients in a waterway and promote excess algal growth. This can lead to toxic algal blooms and make the water unsafe for animals and humans to use.

Oils and grease are toxic to animals and plants that live in or near a waterway. Oil and grease slicks also look very unappealing and reduce recreational use.

Waste and Stormwater

The Less Litter Lunch challenge is designed to help your class learn more about waste minimization.

The Less Litter Lunch challenge aims to educate and enhance students understanding of how daily activities affect the environment and that small steps taken by everyone can substantially reduce this impact.

The main learning objectives are to:

- provide understanding of how school lunches can be prepared with very little packaging;
- provide understanding of the methods that can be used to reduce waste at school; and to provide understanding of the ways that waste can be diverted from the general waste stream.

The Audit

Materials required:

- **Scales**
- **Medium sized plastic containers (for holding student lunch waste)**

Start lunch a little bit early one day at the start of the month and get students to carry out the following:

1. Ask a couple of the first students to finish eating to set up some scales and weigh the empty containers. Make a note of the weight of the empty containers on the class results sheet provided.
2. Once all students have finished eating their lunch, ask them to sort their leftovers into the three categories (recyclable, compost, rubbish).
3. After all the students have placed their waste into the appropriate containers get them to weigh the three containers and write down the total weight for each waste category. On the results sheet it is then possible to work out the weight of each type of waste (by simply subtracting the weight of the container from the total weight).
4. Once the weighing has been completed get the students to dispose of the waste in the appropriate manner.
5. Repeat this activity on another randomly selected day towards the end of the month and compare the two results.
6. After completing both lunch audits, fill in the Less Litter Lunch Challenge results sheet and fax it through to North Central Waterwatch on (03) 5448 7148.

NOTE: Follow up this activity with any of the extension activities provided, or get the students to come up with their own extension projects.

Extension activities:

- Discuss ways to pack lunches that minimise waste and reduce the use of packaging.
- Discuss the different types of materials used for packaging food.
- Make a poster of the rubbish produced by the student's lunch after the first audit.
- Design a recycling or composting system for the classroom.
- Develop some tips to reduce litter in lunches and write an article for the school newsletter.
- After each less litter lunch audit make a display of the amount of the rubbish created from the days lunches.
- Draw a graph comparing the differences in amounts of wastes created from the two audits.
- Write an article for the school newsletter about the less litter lunch challenge.

Extension Projects

- The North Central Catchment Management Authority's Urban Stormwater Education Resource is available upon request and can provide you with a wide variety of activities to further your urban stormwater program.

- Establish a compost bin or worm farm at your school or organisation and encourage the community to recycle their organic material into soil. Contact Central Murray Regional Waste Management Group (ph 5465 3102) to help get you started.

- Create a poster or brochure to identify trees in your school or neighbourhood and inform the school community of their growth, features and possible problems.

- Establish a classroom/school roster for litter clean-up in your school area.

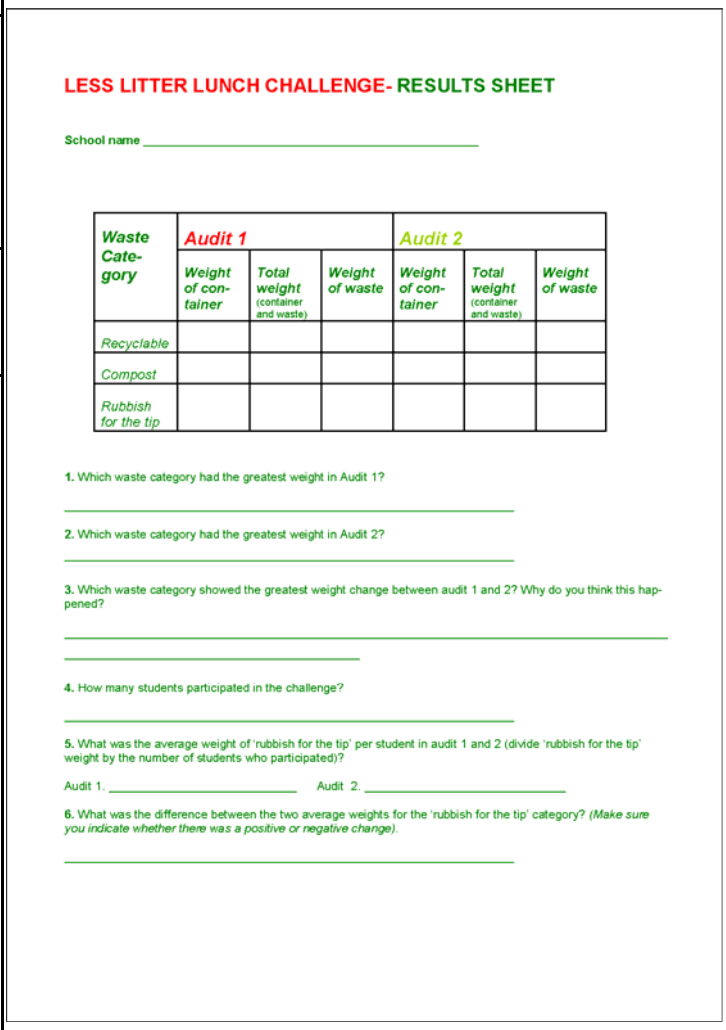
- Get involved in a mini cigarette butt bin campaign to highlight the importance of butting out and binning cigarettes. Contact Central Murray Regional Waste Management Group (ph 5465 3102) if you need help getting started.

- Promote the use of reusable calico bags instead of shopping bags with the school community. Get involved in a "Say No To Plastic Bags" day or week.

- Design and undertake experiments to investigate the rate that different leaves decompose in water.

(Activities adapted from KESAB Gutter Guardians learning opportunities)

Introduction	This activity requires students to conduct two litter surveys during a month, with the intention of reducing the amount of waste produced by the class in the form of lunch packaging etc.
Purpose	Students become aware of the amount of waste their class produces each day (lunch packaging etc) and how this can be reduced. Provide understanding of how perceived waste can be diverted from the general waste stream.
Materials	Scales, medium sized plastic containers (X3) for holding waste, Student workbooks.
Activity	1. Teachers surprise students with the first audit. Waste is sorted and measured (lunch waste). See teacher notes. 2. Discuss waste reduction techniques with students. 3. Discuss implications of waste entering stormwater system etc. This can form the beginning of a Stormwater discussion. 4. Ask students to see if they can reduce the amount of waste (land-fill) in their lunch by the end of the month. 5. Conduct second lunch waste audit towards the end of the month. 6. Compare results through graphs. 7. Write an article for the school newsletter about the Less Litter Lunch Challenge.
Assessment	Written responses may be assessed (Student Workbook), class participation, graphing skills and mathematics may also be observed during activity.



LESS LITTER LUNCH CHALLENGE- RESULTS SHEET

School name _____

Waste Category	Audit 1			Audit 2		
	Weight of container	Total weight (container and waste)	Weight of waste	Weight of container	Total weight (container and waste)	Weight of waste
Recyclable						
Compost						
Rubbish for the tip						

1. Which waste category had the greatest weight in Audit 1?

_____

2. Which waste category had the greatest weight in Audit 2?

_____

3. Which waste category showed the greatest weight change between audit 1 and 2? Why do you think this happened?

_____

_____

4. How many students participated in the challenge?

_____

5. What was the average weight of 'rubbish for the tip' per student in audit 1 and 2 (divide 'rubbish for the tip' weight by the number of students who participated)?

Audit 1. _____ Audit 2. _____

6. What was the difference between the two average weights for the 'rubbish for the tip' category? *(Make sure you indicate whether there was a positive or negative change).*

_____

Activity Cluster November	**Activity 2** Testing the Waters Peer Teaching	Student Workbook page 34

Introduction	This activity involves the students measuring various water quality parameters and recording the results.
Purpose	Further strengthen understanding of water quality analysis and contribute to long term monitoring data.
Materials	Water testing kit, Student Workbook.
Activity	1. Students conduct water testing and record results. 2. Peer teaching activity. 3. Students complete Less Litter Lunch Challenge. 4. Students answer question about land-use around their monitoring site (reinforce prior learning). 5. Results are to be faxed to North Central Waterwatch.
Assessment	Written results can be assessed. Scientific method can be observed and recorded during activity.

Water Test Results For November

Monitoring site: Date of water tests:

Physical Parameters

Water Temperature (°C)	
Air Temperature (°C)	
Turbidity (NTU)	
Rainfall in last 48 hours (mm)	

Chemical Parameters

Salinity/Electrical Conductivity	
Phosphorus (mg/L)	
pH	

If you visited your sight this month what did you see? (e.g. Animals, Plants, Changes in the River, Smells, People, Impacts)

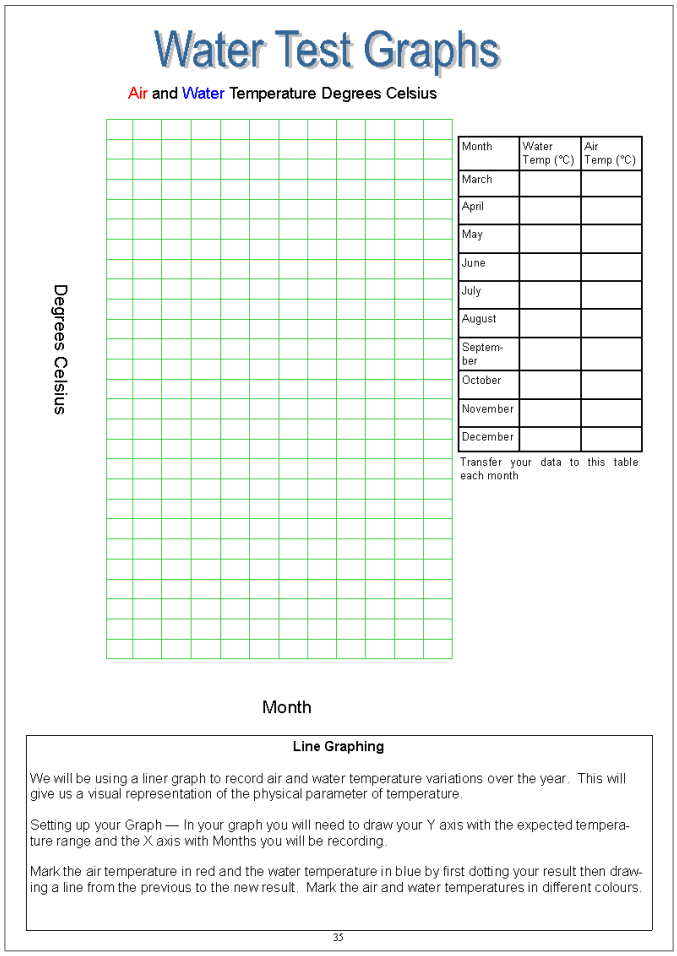
This Months Activities	Complete
1. Plot all of the parameters onto the water tests results graphs	
2. Complete your Less Litter Lunch Challenge	
3. Answer the question below	

What are the types of land-uses around your sampling site? What effects might they have on water quality?

34

Activity Cluster November	**Activity 3** Parameter Graphing	Student Workbook pages 35,36,37,38,39

Introduction	Each month water testing results are entered onto graphs. Each parameter has a different graph type.
Purpose	Develop concept of graphic representation and interpretation of scientific data.
Materials	Student Workbook.
Activity	1. Explain the concept of graphing data. Why we do it, how to interpret graphs etc. 2. After completing water testing, students plot results on graphs. 3. Discuss emerging trends in data.
Conclusion	Students will have a better understanding of graphic representation of data.
Assessment	Students workbooks can be visually assessed. Understanding of concepts may be observed during the activity.



Water Test Graphs

Air and Water Temperature Degrees Celsius

Degrees Celsius

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December		

Transfer your data to this table each month

Month

Line Graphing

We will be using a liner graph to record air and water temperature variations over the year. This will give us a visual representation of the physical parameter of temperature.

Setting up your Graph — In your graph you will need to draw your Y axis with the expected temperature range and the X axis with Months you will be recording.

Mark the air temperature in red and the water temperature in blue by first dotting your result then drawing a line from the previous to the new result. Mark the air and water temperatures in different colours.

35

Extra North Central Waterwatch education and monitoring programs

North Central Waterwatch Frog Monitoring Program

The major aims of this project are to raise people's awareness of the types of frogs that live in the North Central region and to increase the understanding of their distributions. By raising awareness of the types of frogs, their life cycles, preferred habitats, breeding habits, feeding patterns and threats to their survival, North Central Waterwatch hopes to foster an interest in frog conservation among the community.

The program focuses on developing frog identification and surveying techniques in participants, as well as alerting people to some of the issues frogs are facing, in our region and beyond. North Central Waterwatch will be offering information and training sessions, monitoring equipment and technical support through this program.

Each species of frog has a characteristic "call" that can be used to identify them in most cases (sometimes the calls can be very similar between species and other means of identification must be used). Survey participants will use digital voice recorders (provided by North Central Waterwatch) to record frog calls, note certain site characteristics and other information (date/time etc) to return to North Central Waterwatch for analysis. All frog distribution data collected by North Central Waterwatch volunteers will be stored on a database then forwarded to relevant management authorities, providing them with valuable frog distribution information.

Participants, including River Detectives schools, can conduct surveys at any time – providing availability of equipment— with advice provided regarding the most appropriate times to survey. We have also created a range of frog identification sheets to help participants get to know the species of frog they are most likely to find in the North Central region. Please visit **http://www.vic.waterwatch.org.au/inform.php?a=7&b=625&c=626** to view these resources.

North Central Waterwatch—Fish Identification and Mapping Program

When using dip nets to sample macroinvertebrates, a fish or two are often discovered in the sample. This provides the opportunity to find out more about the types and numbers of fish in waterways. North Central Waterwatch has developed an additional fish identification and distribution mapping program to make the most of this opportunity.

This program has been developed strictly for recording "incidental" catches of native and exotic fish species during activities such as macroinvertebrate sampling and recreational fishing.

A series of Fish Identification fact sheets have been developed by North Central Waterwatch to assist identification of fish and to provide the community with information on some of the more common fish found in our waterways. River Detective schools may find the fish identification sheets useful as an education tool. You can find them online at **http://www.vic.waterwatch.org.au/inform.php?a=7&b=625&c=626**