

February 2009

To the Teacher

Living with the river - Te Awa

This unit of work focuses on rivers, streams and other waterways in the Taranaki environment.

It aims to give children awareness, knowledge, skills, attitudes and values to take responsibility for this important part of their environment. The information within the unit is aimed at Levels 3 and 4 but with a little creativity can be adapted to suit all class levels. The curriculum objectives offered are by no means comprehensive but offer some guidance for teachers planning within the science, social studies and technology curricula.

The material within the unit is sourced from a number of places with the majority coming from Taranaki Regional Council documents and the expertise of council staff associated with freshwater resources. The activities don't need to be completed in any particular order. For example the Photo Interpretation could be an introductory or an evaluation exercise.

It is hoped that you find this unit of use and we welcome any feedback. Please feel free to photocopy the material within the unit at your discretion. If you would like more assistance or our Information Officer to help with a field trip or class visit, please don't hesitate to contact the Taranaki Regional Council.

Yours faithfully
B G Chamberlain
General Manager

per: R J Ritchie
Senior Information Officer

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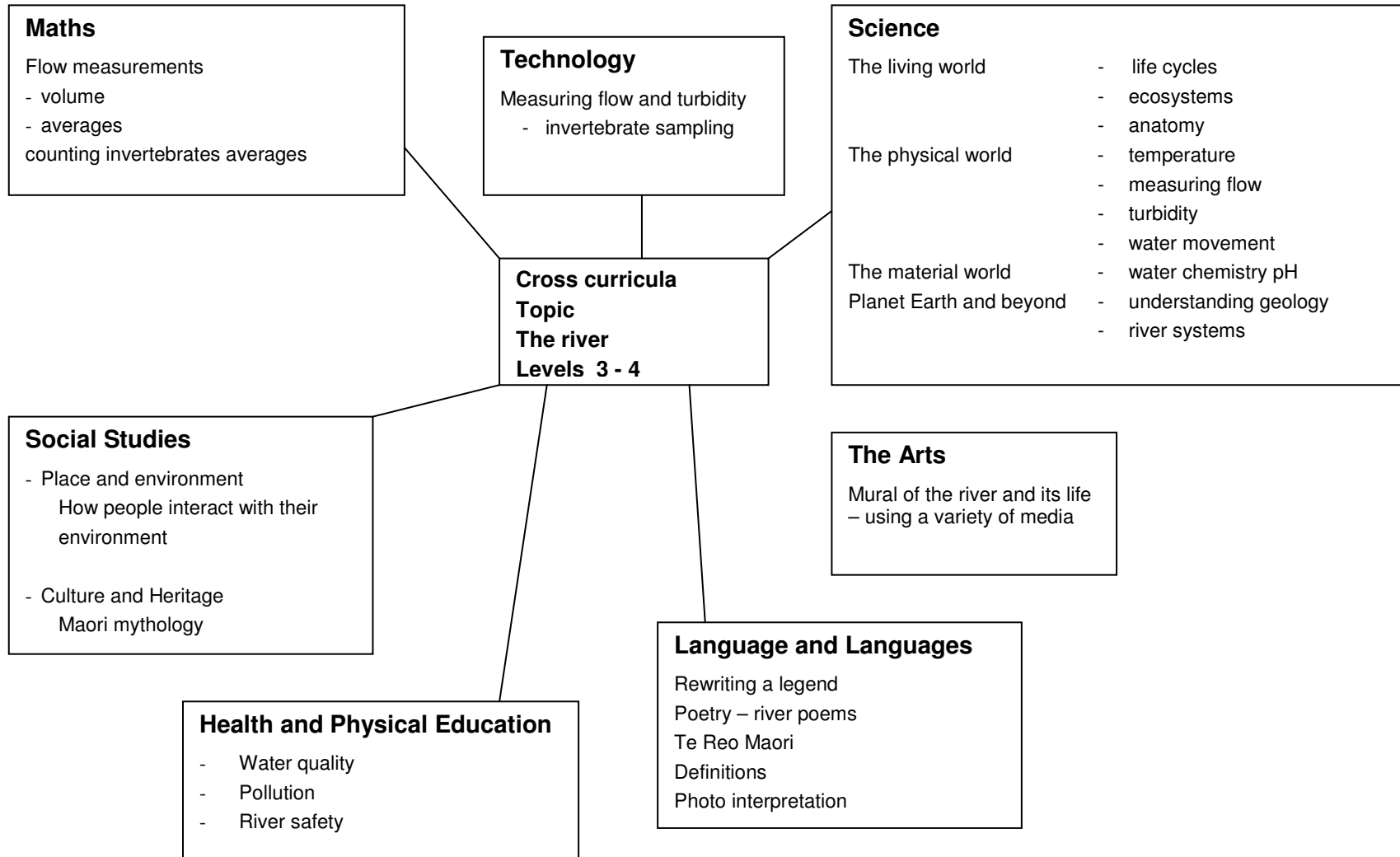
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Curriculum Links - Maths

Statistics

Children will have opportunities to recognise appropriate statistical data for collection, and develop the skills of collecting, organising, and analysing data, and presenting reports and summaries.

Number

Children will have opportunities to:

develop an understanding of numbers, the ways they are represented, and the quantities for which they stand;

develop accuracy, efficiency, and confidence in calculating – mentally, on paper, and with a calculator.

Measurement

Children will have opportunities to:

develop knowledge and understanding of systems of measurement and their use and interpretation;

develop confidence and competence in using instruments and measuring devices.

Social Studies

Place and Environment: Achievement objectives

Aims Students will gain and apply knowledge, ideas, and skills to understand interactions between people and environments.

Level 1 Using a range of skills, students will demonstrate their understandings of how a natural feature and a cultural feature in the local area affect people, and how people affect these features.

Level 2 Using a range of skills, students will demonstrate their understandings of how and why people perceive their local area differently.

Level 3 Using a range of skills, students will demonstrate their understandings of people's perceptions of different environments and the reasons for these perceptions.

Level 4 Using a range of skills, students will demonstrate their understandings of how and why the interactions between people and the environment change over time.

Culture and Heritage: Achievement Objectives

Aims Students will gain and apply knowledge, ideas, and skills to understand the bicultural identity and heritage of people in Aotearoa New Zealand.

Science

Making sense of the living world

Achievement aims

In their study of the living world, students will use their developing scientific knowledge, skills, and attitudes to:

- ❑ gain an understanding of order and pattern in the diversity of living organisms, including the special characteristics of New Zealand plants and animals;
- ❑ investigate and understand relationships between structure and function in living organisms;
- ❑ investigate and understand how organisms grow, reproduce, and change over generations;
- ❑ investigate local ecosystems and understand the interdependence of living organisms, including humans, and their relationship with their physical environment.

Making sense of planet Earth and beyond

Achievement aims

In their study of planet Earth and beyond, students will use their developing scientific knowledge, skills, and attitudes to:

- ❑ investigate the composition of planet Earth and gain an understanding of the processes which shape it;
- ❑ investigate the geological history of planet Earth and understand that our planet has a long past and has undergone many changes;
- ❑ investigate how people's decisions and activities change planet Earth's physical environment, and develop a responsibility for the guardianship of planet Earth and its resources.
- ❑ Earth science features of local and national significance should be emphasised.

Making sense of the physical world

Achievement aims

In their study of the physical world, students will use their developing scientific knowledge, skills, and attitudes to:

- ❑ gain an understanding of the nature of physical phenomena from practical investigation and the consideration of scientific models;
- ❑ explore and establish trends, relationships, and patterns involving physical phenomena.

Making sense of the material world

Achievement aims

In their study of the material world, students will use their developing scientific knowledge, skills, and attitudes to:

- ❑ investigate the nature and properties of substances, identify patterns in these properties, and understand why chemists group substances in the ways they do;

- ❑ apply their knowledge of the properties of substances to the safe and appropriate use of these in the home, in industry, and in the environment;
- ❑ investigate reactions, and applications of these, in chemical processes.
- ❑ investigate the positive and negative effects of substances on people and on the environment, eg petroleum, fertilisers.

Technology

Contents: Environmental: Community

Technological knowledge and understanding

- ❑ students investigate an environment, eg, a stream bed;
- ❑ teacher arranges for an expert to talk about the stream bed ecological community;
- ❑ students visit the stream community to view the environment and interaction that takes place.

Technological capability

- ❑ students consider the needs of specific animals in terms of water quality, temperature, protection from predators, access to food;
- ❑ students in groups devise and apply methods for capturing, identifying and releasing animals for study purposes;
- ❑ students compare findings from one site to another.

Technology and society

- ❑ students investigate how rivers have been used by society for water uptake, waste disposal, electricity generation, recreation etc;
- ❑ students survey people to see how they feel about water pollution, the need for clean water, etc.

Assessment

- ❑ students write a report on their findings and send data in.

Introduction

Wonderful water

The water on the earth is constantly being recycled. It has been used over and over again by people, animals and plants throughout history.

Water is in the food we eat and drink and wastes we produce.

Our life is sustained by it. We use it to swim in, fish in and travel on. Our animals use it. We clean in it. Millions of products are made from it.

About 70% of our bodies are water and fruit and vegetables may consist of 90% water.

Water is used to generate electricity, irrigate our plants put out fires and water our animals.

As well as this over 50% of the world's species are supported by flowing fresh water. In New Zealand, 27 species of native fish live in fresh water as well as hundreds of species of invertebrates.

River facts

Taranaki has over 540 named rivers and streams including 148 significant waterways. The largest in terms of water flow being the Waitara followed by the Patea. These rivers contain many fish and invertebrate species (eg mayflies and bugs etc).

In Taranaki we use around 4 232 litres of surface water per second. Thirty eight percent of that is for community supply. Who do you think uses the rest? Rivers that originate on the mountain drop in summer by 50% of their normal flow.

Did you ever wonder why rivers still have a lot of water in them even when it hasn't been raining for days/weeks, there's no snow melting, and the ground is dry? The rivers are being filled up by water coming from out of the ground in the form of springs and seepages which brings us on to the topic of groundwater.

Groundwater is water which occurs in formations below the earth's surface. In Taranaki we use 21 588 cubic metres per day but recharge is 4 600 000 cubic metres per day.

The purpose of this study is to focus on the importance of the river as a source of fresh water and the need to keep it unpolluted and conserved for ourselves and future generations.

We will examine some effects of human impact on water and how we can look after our precious fresh water resource.

Activity 1: Class discussion

On a blackboard or large piece of paper discuss:

Possible Answers

What is a river?	(a flow of water over land)
Where does a river begin?	(a lake, mountain headwater)
Where does a river end?	(at the sea or lake)
Where does the water come from to fill a river?	(rainwater, groundwater)
What is taken out of a river?	(water, fish, rocks, sand)
Why are most towns by a river?	(water supply, treated waste discharge, transport)
What is special about Taranaki rivers?	(many radiate from the mountain)
What lives in rivers?	(fish, microscopic bugs, invertebrates)

How many of us have used a river recently?

Have you? had a swim
 gone fishing
 been canoeing
 gone for a walk by the river

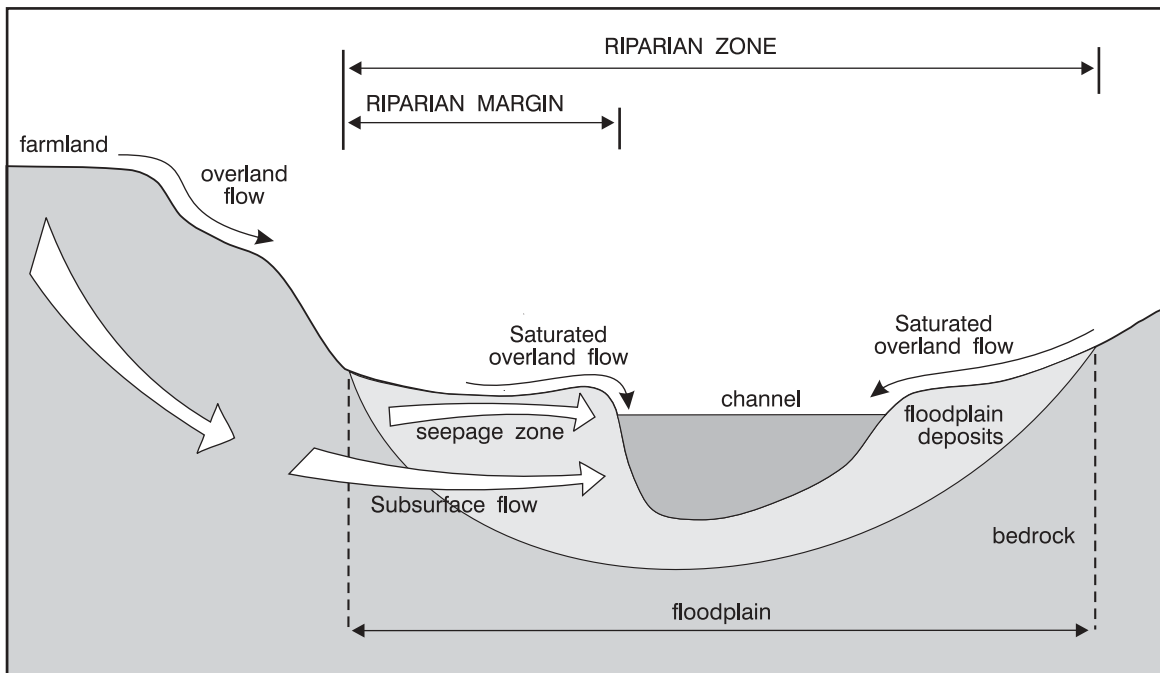
If you haven't done any of these things, you have probably used water from a river by drinking water or washing.

Activity 2: Mapping and diagram of river terms

Cross section of a river

Below is a diagram of a river with the appropriate terms included.

This diagram shows the river and how water flows into it.



From the definitions below draw and label a diagram to show the following:

confluence	where rivers flow into one another
estuary	widening channel of a river where it meets the sea
meander	curve or bend in a river
tributary	stream or river that flows into a larger one
wetland	an area of marshy land
mouth	where the river meets the sea
source/headwaters	the beginning of a river
catchment area	area of land draining into a river
watershed	the dividing line on a ridge between two river systems
weir	low dam built across a river to control its flow.

Activity 4: From mountains to the sea

Water flows from high ground (hills, mountains, etc) to low areas, valleys, flats and eventually to the sea.

All land that brings water into a particular river is said to be part of that river's catchment. Some rivers have smaller tributaries as part of their catchment.

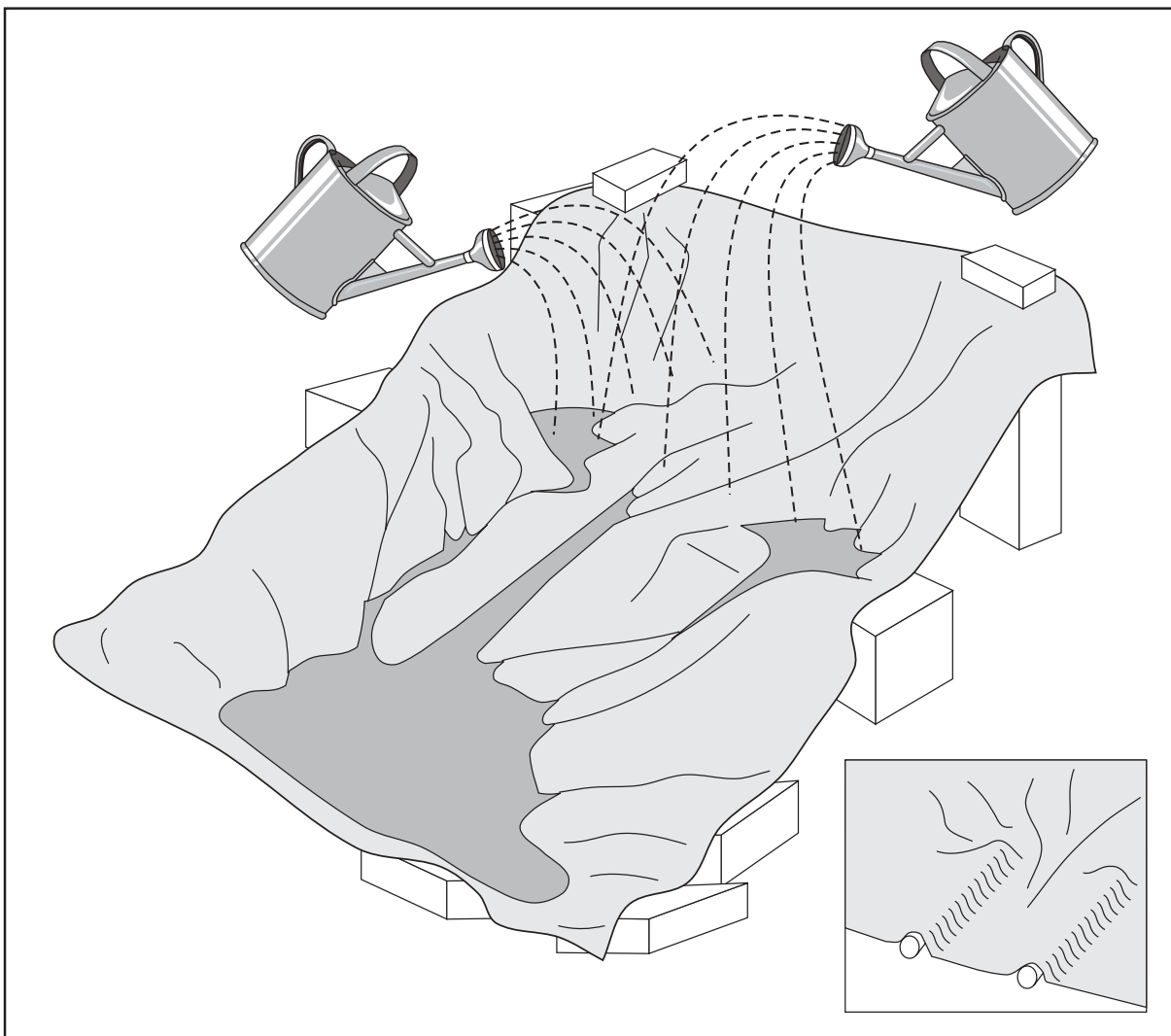
For example the Waitara and Patea Rivers have several other streams and rivers (tributaries) which bring water into them.

Experiment 1

Using a sheet of polythene and props such as boxes, bricks and blocks, screwed up paper etc, create an artificial landscape.

Sprinkle water over the landscape to simulate rain falling.

Observe how the water behaves on different terrain.



Activity 5: Pollution

Because rivers drain the land they also carry in them any pollutants that are washed from the land, such as fertilisers, weed killers, other chemicals and bacteria.

Experiment 2

Create an artificial landscape similar to the one in experiment 1.

Put some material such as an old towel or foam sponge with some detergent or food colouring in it.

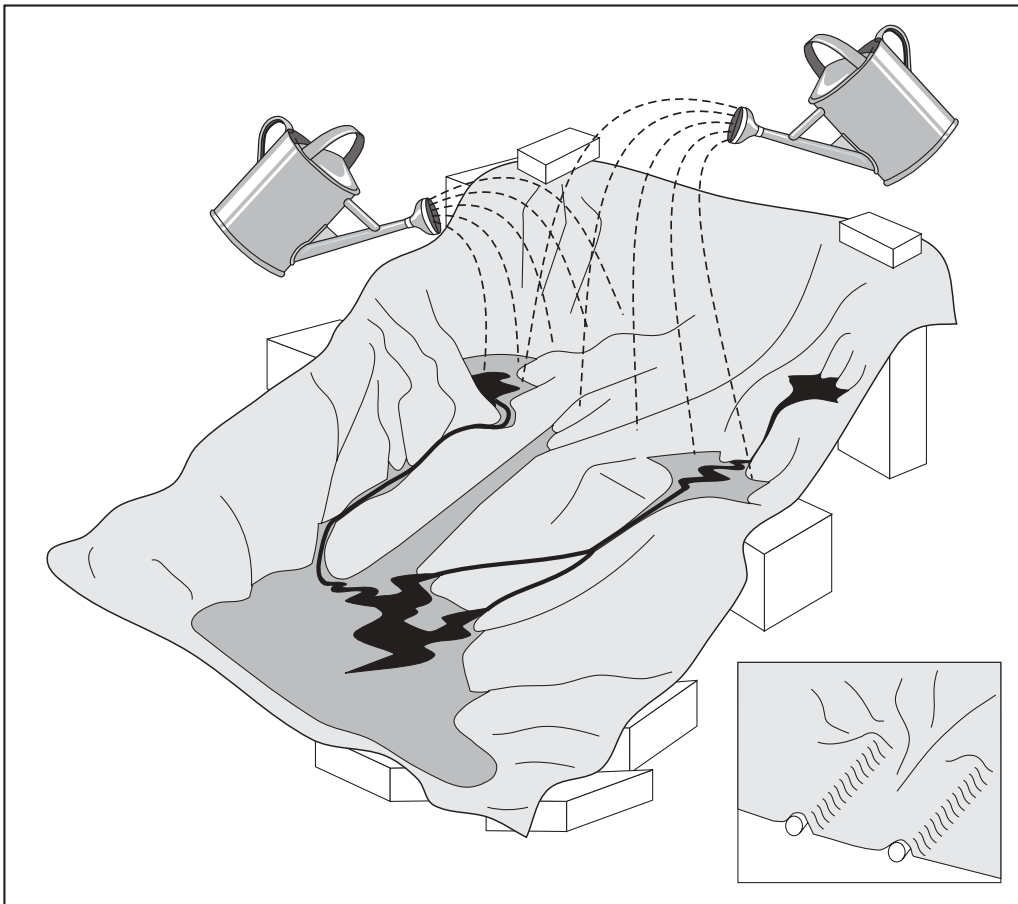
Sprinkle water over the landscape as before.

Observe how the chemicals wash through and drain into the rivers.

This shows how the rain on land carries chemicals in the rivers polluting them and thereby eventually the sea.

Question – what are some of the ways we can avoid pollution of our waterways?

Note: You can also apply wet sand and dirt to the polythene to show how this gets washed into the river and carried along.



Activity 6: Water temperature

The temperature of water is of great importance when it comes to monitoring waterways.

Scientists monitor water temperatures closely as this can have quite an effect on stream life, especially in summer when air temperature is higher and waterways are shallower and lower in flow.

Rivers that have little shade are particularly vulnerable to increased water temperature.

The water temperature problem can be made worse if heated water is being discharged into a river.

Warm water temperature can affect streams in the following ways:

❑ **Less dissolved oxygen in water**

Warmer water holds less dissolved oxygen than cooler water. As well organisms in the water such as fish and invertebrates use more oxygen in warmer conditions as their metabolism increases.

❑ **More plant and algae growth**

Warmer temperatures enable plants to grow more vigorously and can lead to more algae and plants clogging waterways. This plant life uses oxygen from the water during the night.

❑ **Greater sensitivity to toxic waste, parasites and diseases**

Warmer temperatures stress most aquatic organisms and make them more prone to other stress. The larvae of some fish are even less tolerant of extreme temperatures.

❑ **Decreased invertebrate communities**

Stonefly numbers decrease with water temperatures over 19 °C.

Temperatures between 21 and 24 °C may be lethal to many invertebrates.

Certain undesirable life may flourish in high temperatures (eg, sewage fungus’).

What causes increased water temperature?

- warm water being put into the waterway. This may come from surface run-off or from an industrial discharge.
- low flow conditions allowing shallow waterways to heat up more easily due to increased surface area and heating from boulders etc in the stream.
- sediments which absorb more heat and sometimes decrease the depth of waterways increasing surface area.
- removal of vegetation around waterways allowing the sun to shine directly onto the water.

Activity 6: Water temperature (cont'd)

Riparian planting

(Riparian means alongside a waterway)

One of the best ways to reduce water temperatures is to plant trees and other vegetation along the sides of waterways.

As well as keeping the water cooler riparian planting also has the benefits of:

- reducing run-off of pollutants into waterways
- reducing the impact of flooding
- providing habitat for wild life
- providing shelter
- reducing riverbank erosion
- reducing algal growth on the stream bed

Activity

Practise using a thermometer correctly.

Using the same thermometer, ask several children to read it and write down as accurately as possible their reading.

Compare the differences in different children's readings. This emphasises the need to be accurate and provides a more realistic measurement.

Ensure children are aware of the scale of the thermometer and what each incremental line means.

Practise taking the temperatures in different water bodies in the environment (it is important to keep the thermometer in the water body when reading the thermometer).

For example: a puddle
 the school pool
 the goldfish bowl
 the local river

Also measure air temperature comparing full sun with shade.

talk about the differences and try to explain them.

Experiment 3

Measure the water temperature in the tray of water that has been in the direct sun all day and compare the measurement with a tray of water that has had shade over it.

For more information or if you would like to be involved in some riparian planting contact the Taranaki Regional Council.

Activity 7: Chemistry – pH

Rivers have all sorts of pollutants in them, some of them naturally occurring, many of them caused by humans.

One of the tests that scientists do to see if there is pollution in water is a pH test.

A pH test tells us if the water is acidic or alkaline.

The scale goes from 0 (very acidic) to 14 (very alkaline).

Each pH step away from neutral is a ten-fold increase in acidity or alkalinity, eg pH3 is 10 times more acidic than pH 4.

Most river and stream waters in Taranaki are slightly alkaline, eg pH from 7 to 8.

Sometimes scientists find water is acidic. This can be caused by some acid spill into the water such as an accidental spill of trade waste. Acidic water can kill fish living in a waterway and make the water very toxic. Sometimes scientists find the water is very alkaline. This can be caused by excessive lime fertiliser or detergents in the water. This can cause too much plant growth in the waterway and block it or use up valuable oxygen in the water.

Experiment 4

You will need 3 beakers or jars, pH indicators and colour match sheets (provided), an acid solution such as vinegar dissolved in water 50/50, an alkaline solution such as baking soda or bleach mixed with water (10 ml of bleach in 50 ml of water makes a good alkaline solution) and a sample of river water.

Mix each solution and place the indicator sticks in each one, match the stick against the colour chart to determine the pH level of your samples.

If you require more pH indicator sticks please contact the Taranaki Regional Council Information Officer.

How can we avoid pollution to keep a natural pH in our waterways?

Activity 8: Measuring river flow – maths- physics

River flow measurements provide us with a lot of valuable information such as:

- ❑ what the normal flow of the river is, so it can be compared from year-to-year
- ❑ how much water can be safely allocated to a resource user such as a factory, while there is still enough water left for other users
- ❑ when the river is approaching a flood level where people need to be warned.
- ❑ River flow is measured in cubic metres per second (cumecs) one cumec equals 1000 litres per second.
- ❑ For example a river may be said to have a flow of 4 cumecs or 4000 litres per second.

NB: Safety

Sometimes it isn't safe to take measurements in a deep part of a river so you may just choose to measure a safer small section of the river.

For practice, take the following data and apply them to the formula.

Depth measurements

0.5, 0.7, 0.9, 1.0, 1.1, 1.5, 1.2, 1.0, 0.9, 0.2.

River width 12 m

Time to flow 10 m = 16 secs

What is the flow? Answer 3.375 cumecs or 3375 litres per second.

Activity 9: Turbidity

Turbidity is a measure of water clarity. Lack of clarity is usually caused by sediments being mixed up in the water.

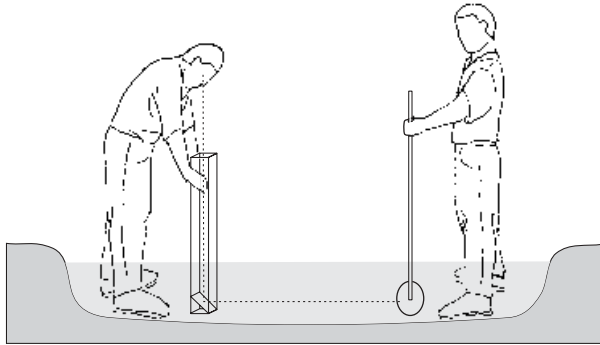
Very turbid water looks dirty and can affect the quality of the water for the life within a river.

It can cut down light and affect plant growth and high turbidity can make it difficult for fish to feed as they can't easily see their prey.

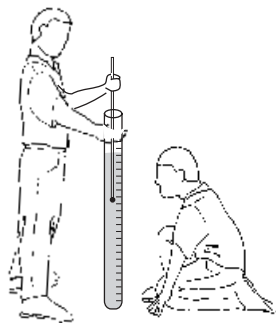
Turbidity can also make water less visually attractive. People usually prefer to play, swim and fish in crystal clear water than murky turbid water.

Scientists measure turbidity in a number of ways – from using a periscope type apparatus to view an underwater disc; to using a tube filled with river water and a stick with a disc on the end to see at what distance you can see through the water.

Below are some illustrations of turbidity testing.



The person is looking through a periscope at a disc held in the water. When the disc disappears from sight the distance is noted. Work across a stream.



The person pulls the rod up until they can see the black disc on the bottom of the rod. Another person checks the measurement on the side of the tube.

Activity

Think about the things that could make water more turbid, eg, rain washing over muddy ground with no plants. Design and build your own turbidity measuring device. Fill a glass jar with river water and see if you can easily see through it.

Try this again after disturbing the substrate (sand, stones) on the riverbed.

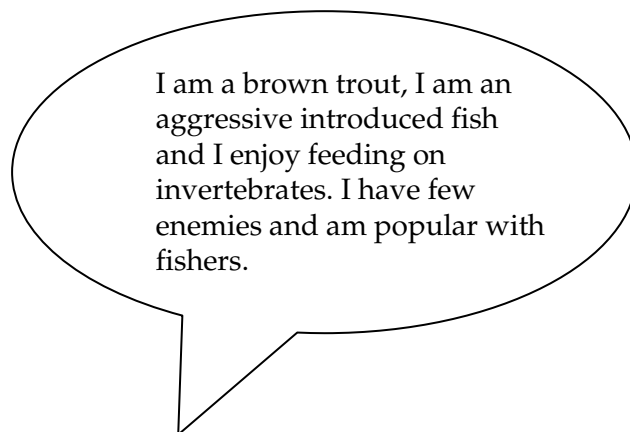
Activity 10: Art-illustration

As a method of evaluation and to help children express some of what they have learned about river life and issues.

This art activity could be done across two pages of an exercise book or on a piece of paper horizontally.

Ideally it could be done across a long classroom wall.

- ❑ The first task is to put on the river itself with a section the entire length of the wall coloured blue to represent the water. This can be done with paint or crayon or something which doesn't take too much time. This could be done on the floor then transferred to the wall.
- ❑ The next step is to add to the wall illustrations of rocks, animals, plants, riffle sections, invertebrates.
- ❑ Above the water children can place trees and other plants, people fishing, houses, factories, discharges, intakes etc.
- ❑ It would be easier if the children choose to do their pictures separately and then add them on as they finish them.
- ❑ The pictures can also have captions or speech bubbles with them to show some knowledge they have gained. For example, a detailed illustration of a trout with a speech bubble saying:



- ❑ Children can also use collage or prints on the mural. See the appendix for information on what to write

Activity 11: Maori Tikanga and Reo

Maori legend of Mount Taranaki

Legend has it that Mt Taranaki was once part of the central North Island mountains.

Mt Taranaki was said to have had a fight with Tongariro over Pihanga (a female mountain). Mt Taranaki was banished and fled. Its path being the Whanganui River.

Mt Taranaki then headed north and rested for a while on the way and this place of rest is said to be the Ngaere swamp. Mt Taranaki then moved to its present location.

It still cries for Pihanga and some people say that the tears from Mt Taranaki form the Patea River.

Some people also think that one day Mt Taranaki will return to the central North Island again. Watch out if it does!

Language

The children can take the above story and write it in their own words, perhaps embellishing it with some of their own descriptive language.

Maori Reo

au – force of water eel	ehu – muddy	wai – water	tuna -
inu – drink	tōtara – a native tree	papa – over the ground	
puna – spring	awa – river	waipuke – a flood	
waka – canoe	iti – small	nui – large	rangi – sky
tāheke – cascade	kiri kiri – stony	tokanui – boulder	
one - sandy	whenua – land	kura – reddish colour	
manga – a small river or stream	puke – hill	rua - two	
awa awa – a valley formed by river			
ko Pātea te awa o tōku iwi – Patea is the river of my tribe			

See if you can match some words to find out the meanings of some of these river names.

Whenuakura	Mangaone	Waitotara	Pukerua
Manganui	Waiau	Mangarangi	Pukepapa
Waiiti	Waipuna	Mangapapa	Mangatuna
Mangawhero	Waiinu	Mangaehu	Wainui

Activity 12: Written language – Poetry

Below is a poem taken from School Journal, Part 4, Number 1, 1991.

As you tickle and play
around boulders and over stones
like a fisherman casting for trout,
the spring sunshine turns you
into a ribbon of iridescence.

Leaving behind shingle flats,
covered with yellow broom,
you flow through
grasslands rolling down
below black birch and rimu-covered hills.

When ten-tiered West Coast torrents fall
on endless days,
swollen from vassal tributaries' ceaseless spews,
you tumble and plummet,
cutting away banks
carrying debris swaying high
in perpetual dance
on muddy waters.

In control you wind in and out,
plunging through gorges,
booming fortissimo: "out of my way!"

Reaching a town
with buildings stretched unfenced
along your banks,
you strain to meet them,
but you never will,
for beyond, welcoming you ...
calls, pre-eminent, the irresistible sea.

MARLENE BENNETTS

- ❑ This poem uses personification (giving an inanimate object a human quality) to describe the river.
- ❑ Simile is also used in 'like a fisherman casting for trout'.
- ❑ Alliteration is used 'spring sunshine' and 'below black birch'.
- ❑ It also uses a number of words to describe its movement, for example, tumble, plummet, plunging, reaches, wind.
- ❑ A number of quality describing words are also used, such as vassal, ceaseless, pre-eminent, irresistible.
- ❑ This poem provides an excellent model for children to use descriptive writing.

Activity

- ❑ Give the children an opportunity to observe the river either at normal flow or in flood and write a poem of their own, other words they may wish to use are meander, cascade, swift, eddying, swirl.
- ❑ This poem can also be used for an illustrated poem exercise and may make a good blackboard poem for a handwriting exercise.

Activity 13: River life

Food chain/life cycles/water quality indicators

Invertebrates (animals without backbones) live in our rivers.

There are many varieties and they are an important part of the food chain.

The most common stream invertebrates are insects in their larval stage including mayflies, caddisflies and midges.

These larvae feed on plant debris and algae in the river; some also feed on other insect larvae.

Fish feed on these invertebrates. These fish may include cockabully, whitebait species and trout.

Bigger fish such as eels and trout feed on these smaller fish and river birds may feed on them also.

Humans sometimes eat eels and large fish like trout and this ends the food chain.

Life cycles

Insects are probably the most successful creatures living in the rivers.

These river living insects have adapted from living on land and spend much of their life in the water. They have modified their breathing systems by having gills which take in the oxygen from the water.

These insects also have an abundant supply of food in the river, living off tiny plant and animal matter in the river.

Most of the adults then leave the water and return to the air. Why you ask!

Moving to outside the river enables the adults to lay their eggs upstream, or in other rivers or areas with better conditions.

It would be very difficult for this to happen if the insect stayed in the river.

The larvae spend their time feeding and growing, while the adults purpose is to breed and ensure their eggs are dispersed.

Many adults have a very short life.

The life of some common river insects

Mayfly (Ephemeroptera)

The mayfly gives us an example of incomplete metamorphosis, ie, it changes from egg to larvae (nymph) to adult.

The mayfly nymph can be found on rocks on the river bottom in swifter flows and cleaner water.

It has three tail filaments which help to keep it facing the current. Its paddle-shaped gills on the side of its body help it extract oxygen from the water.

When the mayfly emerges it has two adult stages. First it has opaque wings and then it moults and emerges as a winged adult. The adult has mouth parts but does not feed. Its sole purpose is to mate and after spending a year in the water as larva, it may live for just a day or two or perhaps only hours.

Activity 13: River life (cont'd)

Caddisfly (Trichoptera)

The caddisfly gives us an example of complete metamorphosis, ie, it changes from egg-to-larvae-to-pupae-to-adult.

The larvae live on the river bed usually building a portable case to live in or nets to catch food.

This case gives it physical protection and camouflage as it builds its case from sand grains, leaf or bark or other convenient local materials.

The materials are held together with silk from the insect's body. Some species make their case from this silk alone.

Some caddisfly build silken nets between rocks on the riverbed and feed on the algae and bits of vegetation that are swept into it.

They then pupate in these cases.

They emerge from the water. The adult looks similar to a moth except with hairy wings and curved whip-like antennae.

The adults lay their eggs from dusk onward during the summer, crawling under the water surface to lay eggs on rocks and vegetation.

Activity

Draw the life-cycles of the two invertebrates described above showing the difference between complete and incomplete metamorphosis.

Research the life-cycle of other insects to compare with the caddis and mayfly.

Water quality indicators

As well as being part of the food chain and having interesting life cycles these invertebrates tell us how healthy a waterway is.

Some can only live in the cleanest water and some can live in water that is of poorer quality.

Scientists choose a river site and collect the invertebrate species in a net and then identify the creatures.

Each creature is given a grade from 1 to 10. 1 being very tolerant to polluted water, 10 being very sensitive to polluted water.

For example most mayflies have a score of between 7 and 10, this means they usually live in quite high quality water.

Refer to 'A Photographic Guide to Freshwater Invertebrates of Taranaki' for sensitivity scores. This book is available from the Taranaki Regional Council.

Caddisfly species scores generally average around 5-8 but some are as low as 2 and as high as 10.

Worm-like creatures range from 1 to 3 on the sensitivity scale, suggesting they can live in somewhat polluted water as well as clean waterways.

Scientists then count up the number of different creatures they find and average the scores of all the creatures they find and multiply by a scaling factor of 20 to give the river site a score.

Activity 13: River life (cont'd)

For example if 30 creatures were found and their combined score was 195 this would be divided by 30 to find the average which would be 6.5

This would then be multiplied by 20 to give a score of 130 for this river site.

Typically as we progress down the mountain the site scores decrease as more pollution impacts on the river and water quality is lowered.

Activity

Invertebrate sampling

Equipment - sieve or net, brush, white sorting tray, magnifying glass, identification sheet, bugbox

Method

- ❑ Find a safe river site where water is running gently over the rocks (a riffle)
- ❑ Holding the net or sieve downstream brush the under surface of the rocks so the invertebrates float into the net or sieve
- ❑ Empty the sieve or net into the sorting tray and identify them using the bugbox guide
- ❑ Average the sample and multiply by 20 to give your site a score
- ❑ Try the procedure at several sites for comparison.

Activity 14: Stormwater or sewage where does it all go?

Stormwater or sewerage where does it all go?

What is stormwater?

- ❑ Stormwater drains stop our streets from flooding. Stormwater is the rainwater that comes off our properties and paved areas such as paths and roads.
- ❑ This water drains into grates and underground pipes and eventually finds its way to a stream or river and then to the sea.
- ❑ If pollutants get into this water, they will go into a waterway and perhaps kill some fish or make the water unhealthy to swim in.
- ❑ Stormwater should always be clean water.

What is sewage?

- ❑ Our sewerage system collects and disposes waste water. This wastewater includes water from our toilet and sinks. This water contains liquids that need to be especially dealt with at a sewage treatment plant.

What shouldn't go into a sewerage system?

- ❑ Solvents, oil based paints, thinners, herbicides and insecticides and other toxic chemicals should not go into the sewer, as they can kill environmentally friendly bacteria and other organisms required by sewage treatment plants.
- ❑ Stormwater shouldn't go into the sewerage system. If it does it can overload the system, especially in heavy rainfall, causing sewage to overflow into other properties and streams.

Some hints

- ❑ Wash your car on the grass rather than on the street but not somewhere that goes into stormwater.
- ❑ Waste oil from your car should go to your service station for recycling.

Activity 15: River safety

- ❑ Every year many New Zealanders lose their lives in or near rivers.
- ❑ Rivers often have a fast continuous flow and contain dangerous objects in and around them.
- ❑ Below are some things to watch out for when dealing with rivers and some do's and don'ts. The information is provided by the 'Water Safety Council':

River swimming

- ❑ Check for downstream hazards (these may include boulders, or other material in the river which could snag you or hold you under)
- ❑ Avoid swimming under a bridge
- ❑ Ensure the water isn't too fast or too deep
- ❑ If you get caught in the current, do not fight it but head downstream to a suitable landing beach.
- ❑ Never attempt to come ashore amongst trees or river debris.

Falls

- ❑ Be careful when walking near a river
- ❑ Avoid unstable river banks and grassy slopes

Fishing

- ❑ Fish in the company of others
- ❑ Avoid fishing during periods of high flow
- ❑ Watch your step and observe river characteristics

If you fall in, keep calm and float downstream to a suitable landing beach.

Crossing a river

- ❑ Never attempt to cross a river if the water is discoloured, there is the sound of rolling boulders, or the sign of debris and trees being carried along in the water
- ❑ Do not cross if the water is over your thigh and moving
- ❑ Do not cross if the water is moving faster than your walking pace
- ❑ Look for a crossing place that has an even river bed
- ❑ Look for a crossing place where there are easy entry and exit points.

Diving

- ❑ Never dive into a river unless you are sure of its depth
- ❑ Don't jump off waterfalls.

Activity

Discuss river safety in the class, perhaps relate stories when somebody got into trouble around a river.

Visit the river looking for possible river hazards.

Activity 16: Photo interpretation

Use the photos provided to promote discussion about rivers. Some sample questions are offered. Alternatively these photos could be part of a wall display with the questions below.

Photo 1: Mountain Stream

- Where in Taranaki might this photo have been taken? (near New Plymouth)
- Where did this waterway probably originate? (Mt Egmont/Taranaki)
- How did the rocks in the river probably come from? (volcanic activity)
- What benefit would trees provide to this waterway? (shade for fish, protect river bank, stop nutrients getting into the water)
- What time of year was the photo probably taken? (winter, based on snow)

Photo 2: Farming

- In this photo the animals have direct access to the stream. What is likely to happen to the water because of this? (the bank would be unstable causing it to collapse into the stream, cows pollute the stream)
- How would the water quality be improved if a fence was built and trees planted along the stream bank? (water temperature lowered, cleaner water, less algal growth)
- How else is water used in dairy farming? (washing, irrigation)
- Why is Taranaki suitable for dairy farming? (good annual rainfall and fertile soils)

Photo 3: Industry

- What is happening here? (warm water is being sprayed into the river)
- Why is the water being sprayed? (to cool it before it enters the stream)
- What purpose do the plants on the bank serve? (help hold the bank and filter run-off and provide shade)
- What do industries use water for? (cooling, adding water to products, washing)
- How can industry affect the river? (taking water, discharging used water, accidental spills)
- Note: It is fine for industries to use water as long as they don't have any negative effect.

Photo 4: Fish kill

- What has happened here? (some fish have been killed)
- What may have caused this to happen? (perhaps some pollution has got into the river)
- How can we avoid fish being killed? (by being careful as to what goes into the river)
- What other effects may this incident have had on the river? (made it dangerous to swim in or drink from)
- What should happen to the people who are responsible for this? (maybe they need help to prevent this happening or if they are doing it carelessly – prosecution)

Activity 16: Photo interpretation (cont'd)

Photo 5: Grate

- What is the purpose of the grate? (to stop large objects going in)
- What sort of drain is this? (stormwater)
- What sort of water should not go into this drain? (sewage or toxic waste)
- Why are these drains painted like this? (to inform the public not to put wastes down them)
- How might waste affect the river? (kill the fish, pollute the stream)

Photo 6: Hydro station

- How is water being used here? (electricity generation)
- Is water being polluted by this process? (no)
- What effect could a dam have on the river? (could stop fish passing through)
- What is above these pipes? (a dam)
- Where is the water leaving this building going? (back to the river)

Photo 7: River fun

- How are these people using the river? (swimming, having fun)
- What other recreational uses are there for a river? (boating, fishing, splashing)

Why is it important to have good quality water for recreation? (so that people don't get sick or dirty from the river).

Appendix





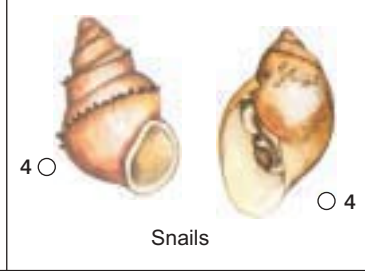
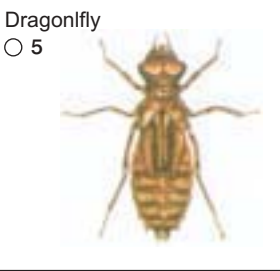
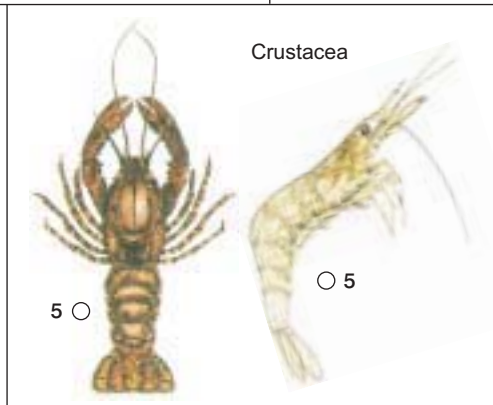
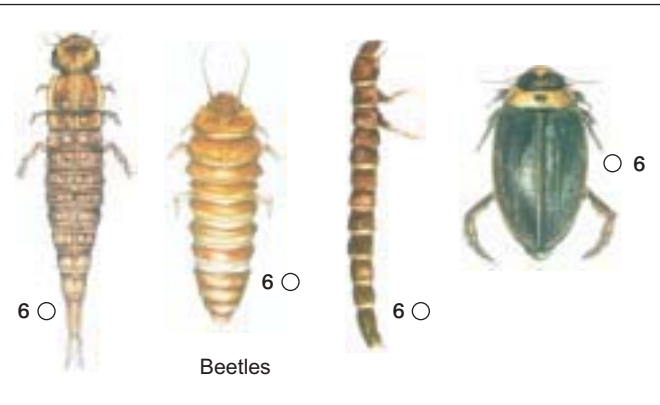
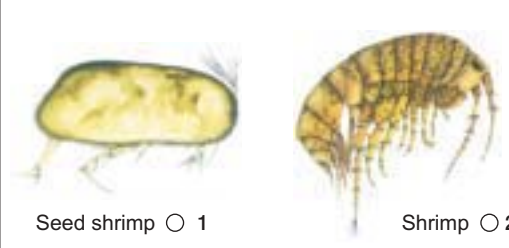
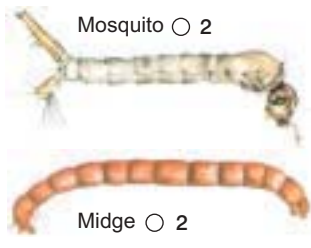
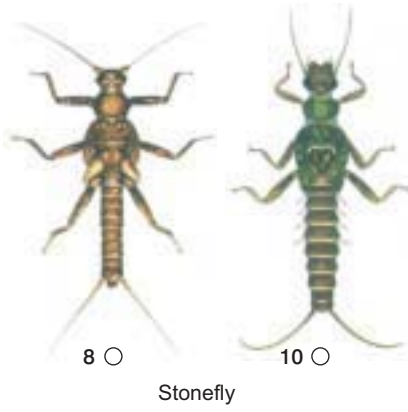
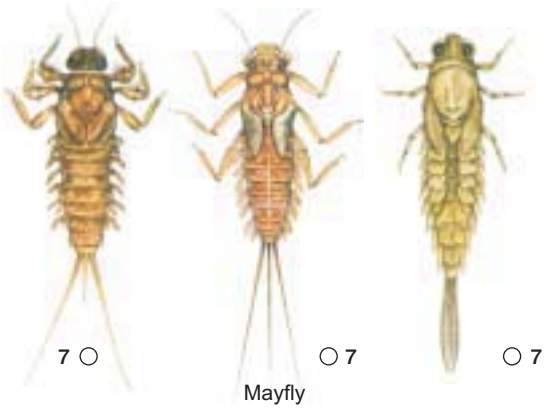
Identification Sheet

Name:

Site:

School:

Date:



Others

Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7

