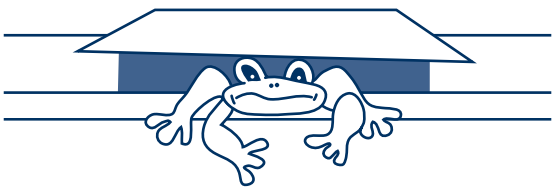
stormwater education manual

Contents: Local Section



How to use this material

This material has been designed for students/teachers of Yr 3 - 8. It provides information and activities on water quality issues at specific locations around the City of Greater Geelong, associated with stormwater. It is designed to be used in conjunction with the Waterwatch Education Kit, but can also be used as an independent study.

Each unit of work is designed around a specific area of Geelong. These areas have been chosen as each has it's own issues relating to stormwater. Although site specific, many of the activities can be adapted to suit other areas. The lessons provide a starting point for teachers rather than providing an entire unit of work.

The activities and information have been prepared using the Curriculum and Standards Framework II Key Learning Areas of Science and Studies of Society and Environment for Levels 3,4 and 5.

Maps enclosed with the manual have been produced for each unit of work. The areas shown on these maps are stormwater sub-catchments, unless otherwise labelled. They can be photocopied and reproduced for class use.

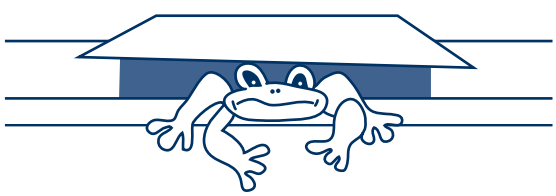
Some of the activities may have an **F** symbol next to the name of the activity. This symbol indicates that a Council provided facilitator is required to complete the lesson satisfactorily.

Acknowledgements

Anne-Marie McCarthy, Corangamite Waterwatch Regional Coordinator for providing the manual. Diane Luscombe, City of Greater Geelong Environment Officer for providing the illustrations. Jane Ryan, Project Officer, Waterwatch Victoria; Tarnya Kruger Catchment Education Officer, Waterwatch Victoria; Catherine Barnes, Education Officer, Corangamite Catchment Management Authority; Sue Longmore, Swan Bay Integrated Catchment Facilitator; Simone groves, Education Officer, Barwon Regional Waste Management Group; Diane Tilley, Lecturer, Gordon Institute of TAFE; Kerry Sidaway, Environmental Curriculum Consultant, Department of Education; Bruce Humphries, Senior Environmental Planner, Bernie Cotter, Manager Environment Unit, City of Greater Geelong.

Thank you to the following organisations for permission to adapt material:

Barwon Region Water Authority - Barwon River Environment Trail (1997), CDS Technologies , Ecologic - Pilot Stormwater Awareness Kit (2000), Melbourne Water - Port Phillip Bay Environmental Study - Primary Education Kit, Drains to the Bay (1996), Ribbons of Blue - Western Australia, Swan Bay Catchment Awareness Project - Schools Education Kit (1997), Waterwatch Victoria - Waterwatch Education Kit (1997), NOW Inc.- The Waterways of Ocean Grove, California Coastal Commission - Save Our Seas (1993).



We All Live in a Catchment

Summary
Students look at the Barwon River Catchment

CSF Learning Outcomes
SOSE 3.3 Australia's People & Places
4.1 Geography
5.2 Geography

Aim
For the students to become aware of the entire catchment rather than a section of the river

Materials
Barwon River Catchment Map (see page 4)
Poster sheet of a catchment (provided at rear of manual)

Advanced preparation
Photocopy Barwon Basin Map

Activity
1. Look at the Barwon River map provided. Mark in familiar features along the river. eg. West Barwon reservoir, towns, industry, Barwon River estuary.
2. As a class make a list of influences on the river. These might include industry, farming, grazing, urban development, weirs, roads, clearing. What would the river look like if there was no industry and major towns? Discuss how these factors influence the quality of the water in the river, the look of the river and the life that may live in the river.
3. On the map, highlight areas where stormwater run-off might be an influence.

   Extension: Visit an area of the river where stormwater enters. Look upstream and downstream. Are there any differences? Possible changes may be in vegetation, wildlife, appearance. Describe/draw your impressions.

Background

The Barwon River begins in the Otway Ranges over 100 kilometres from Geelong. The Otway Ranges is an area of very high rainfall where steep slopes are covered with dense vegetation. Two small streams, the East and West Barwon, merge as they come out of the mountains to a central plain to form the Barwon River. They are fed by many small tributary streams, which also flow out of the ranges.

The West Branch has a major reservoir close to its headwaters. The West Barwon Reservoir was completed in 1965. Water from the reservoir travels via a channel to Wurdee Boluc where it is treated before being piped to townships as drinking water.

Two major rivers enter the Barwon River before it enters Geelong. The Leigh River flows into the Barwon at Inverleigh and the Moorabool River enters the Barwon at Fyansford. Both these rivers come from high rainfall areas.

After passing through urban Geelong, the Barwon River crosses rural land, skirting the freshwater swamp of Reedy Lake and into Lake Connewarre.

Two breakwaters designed to prevent seawater reaching Geelong are built in this stretch of river.

The first, located at Breakwater was built in 1837 and the second is at the western end of Lake Connewarre.

The river forms a channel again at the eastern end of Lake Connewarre and broadens out into an estuary to enter Bass Strait at Barwon Heads.

Drains to the River

Summary

Students investigate the stormwater drains visible from Yollinko Boardwalk, Newtown

Learning Outcomes

Science 3.1 Biological Science
4.1 Chemical Science
5.4 Chemical Science
5.4 Physical Science

Aim

For students to become aware of the drains entering the river and their potential impacts.

Materials

Waterwatch Test Kit
Record Sheet

Advanced preparation

Photocopy Results Sheet (Pg. 7)

1. Take a trip to the Yollinko Boardwalk. Look at the drains entering the river. Where do these come from? On your record sheet record how many drains you can see. Describe the main one you can see.
2. Discuss as a class what might be carried down these drains and how you can prevent pollution from entering the river.
3. Using the Waterwatch test kit find out how healthy the water is in this section of the Barwon River. Record the results on the record sheet. As a group work out what each of the results might mean. (Hint: Use the table provided).
4. Test and compare results above and below the drains.

Background

From the Yollinko boardwalk/platform you can see a large cage structure on the side of the river. This is called a trash rack. This drain brings water from Highton from what was once Kardinia Creek. The creek was filled in because of flash flooding in the Highton Shopping Centre. A stormwater pipe was laid along its course.

Trash racks like this were designed to reduce the amount of litter and solids from entering the river. While it reduces the input of large types of litter, a great deal of smaller litter and invisible nutrients can enter the river. Grease, oil and animal droppings can also be washed into the river.

People can help reduce the amount of pollutants entering the river by not dropping litter in the street, washing cars on the lawn rather than on sealed surfaces, scooping up animal droppings and sweeping up grass clippings.

Table 1

Chemical and Physical Water Quality Guidelines for Freshwater in the Geelong Region

(taken from the ANZECC Guidelines 2001)

What do your results mean?

Parameter	Units	Excellent/Good	Fair/Poor	Degraded
Conductivity	uS	0-800	800=5000	>5000
pH	-	6.0 - 8.0	8.0 - 9.0 5.0 - 6.0	>9.0 - <5.0
Turbidity	NTU	0 - <20	>20 - <50	>50
Dissolved Oxygen	%Sat	>70 - <130	70 - 40 130 - 160	<40
Phosporus	mg/L	0 - <0.025	>0.025 - <0.1	>0.1

KEY: < = less than > = more than

(TABLE 1 SOURCED FROM CORRANGAMITE WATERWATCH FIELD MANUAL)

Record Sheet

Q.1 How many drains can you find entering the river here?

Q. 2 What are some of the substances you can see that have been washed into the river from stormwater drains?

Q. 3 How could you prevent some of the pollution from being washed into the Barwon River?

TEST THE WATER

How healthy is the Barwon River? To find out we need to test for:

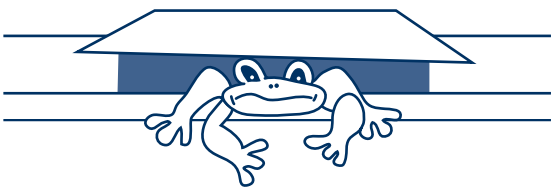
- Turbidity (how clear the water is)
- Salt levels (conductivity or salinity)
- How much excess nutrient there is (phosphorus)
- Temperature
- How acid or alkaline the water is (pH)

Record your results below. Location:

Test	Test Results
Turbidity	NTU
Temperature	ßC
Salinity/Conductivity	EC
pH Level	Units
Phosphorus	mg/L

Look at Table 1 to compare your findings and interpret your results.

How healthy does this indicate the Barwon River is?



Lake Connewarre

Summary

Students will focus on Lake Connewarre looking at its importance in the Barwon River catchment.

Learning Outcomes

SOSE 3.1 Australia's People & Places
4.3 Geography
5.4 Geography

Aim

For students to realise the importance of Lake Connewarre in the Barwon River catchment.

Materials

Map of the Barwon River Catchment including Lake Connewarre (provided in reference section)
Bird Identification Book (Optional)

Activity

1. Take an excursion to Lake Connewarre. Sit quietly for 10 minutes. Try to identify some of the birds you can see/hear. Look at the habitat requirements for these birds. Can you see any shelter for the birds? Where would the birds live?
2. Using the Waterwatch kit test some of the water? Is there a difference in the salinity of the water to the river? Why do you think it is more salty?
3. Is the phosphorus level different to that of the river? What other influences might there be on the levels of nutrients in Lake Connewarre? (Refer to Table 1 on pg. 7)
4. Discuss as a class how important a lake such as Connewarre is in terms of its ability to reduce potential levels of pollution entering the sea.
5. Look at the map to see where the second break is located. What function do you think this serves?

Background

Lake Connewarre receives the Barwon River water before it is released into Bass Strait at Barwon Heads. It is an important breeding ground for many birds and provides a flight path for many migratory bird species including the Orange-bellied Parrot.

The salinity of the water is influenced by the tides at Barwon Heads. There are two breaks installed in the river to prevent the flow of salt water into the river at Geelong. This was done in the 1800's when the river water was used for drinking.

It is important that nutrient levels in the lake are kept consistent. The lake is shallow, approximately 1m in depth providing opportunity for excess reed and algal growth if nutrient levels fluctuate too high.

The lake acts as a filtration system for the marine environment by allowing many pollutants travelling down the Barwon, to settle or be absorbed by reeds and plants. If the lake is further polluted by run off and stormwater inputs it places stress on the plants and animals, potentially allowing excess nutrients to flow through to Barwon Heads and the ocean.

Balyang Sanctuary Local Laws

Summary

Students examine the laws/rules for Balyang Sanctuary, Marnockvale Road, Newtown

Learning Outcomes

SOSE	3.1	Australia's People & Places
	4.2	Economy & Society
	5.1	Economy & Society

Aim

For the students to become aware of why certain laws are made and whether they are effective.

Advanced preparation

Contact councils Local Laws Unit and Open Space Planning Unit to obtain copies of local laws and guidelines (refer to Contacts List)

Activity

1. List all the laws/guidelines that are recommended for our parks and sanctuaries. Students could work in a small group or as a class.
2. What other laws are in place to protect our streets, waterways, and parks? Why have these laws been introduced? Are they always effective? Why/why not?
3. How do these laws affect issues such as stormwater and stormwater pollution?
4. What rules would you implement if you were in charge of Balyang Sanctuary? How would you make sure these rules were obeyed?

   Extension: Look at the signs at Balyang. What could be changed? Design signs to try to encourage people to look after Balyang Sanctuary.

Background

Balyang Sanctuary is an 8 hectare reserve in a highly developed urban area of Geelong. The entire area is subject to flooding when the Barwon River floods.

The sanctuary has always attracted a variety of bird life as the lake provides an abundant food source, protection from the elements and suitable roosting areas.

When the Princes Bridge was built over the Barwon River in 1965, Shannon Avenue was re-routed across the swampland, dividing it in half. In 1972 the swamp was modified to create an artificial lake with three islands. The maximum depth of the water is 750mm. Two islands are joined by a bridge with the third providing a haven for wildlife.

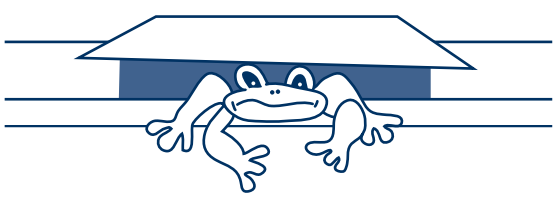
Balyang attracts a number of birds including cormorants, pelicans, egrets, swans, coots, moorhens, ducks, swallows, magpie larks and other species of small birds.

Guidelines are in place to help preserve the area and to ensure that Balyang is a safe haven for wildlife.

There are a number of guidelines and by-laws in place to protect sanctuary areas like Balyang. Fishing in the sanctuary is prohibited, as is swimming. Dogs are permitted provided they are on a leash. All wildlife and plants are protected, and bins have been provided for rubbish.

During summer, a common problem at Balyang and in many other water bodies in Geelong is blue green algae. When algal levels exceed safe limits, warning signs alerting the public to the bloom are erected. It is recommended that any contact with the water be avoided. This is because of toxins that the blue green algae can release into the water.

Stormwater is the primary source of nutrients for Balyang as the lake receives the drainage from a large area of Newtown.



Feathers & Detergents Don't Mix!

Summary

Students look at the effect that stormwater pollutants can have on birds

Learning Outcome

Science 3.1 Biological Science
4.1 Chemical Science
5.2 Chemical Science

Aim

To investigate the effect of detergent on feathers

Material

- Glass/jar
- Fresh water
- Feathers
- Detergent

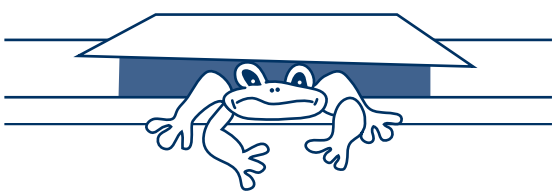
Advanced Preparation

Homework - the children should try to collect a feather prior to the lesson.
Photocopy the results sheet on p. 13.

Activity

1. Fill a glass or jar with clean fresh water. Dip a feather in the water. Pull the feather out. Record on your record sheet how the feather looks and feels.
2. Add detergent to the glass of water. Put the feather into the detergent and water mixture. Pull the feather out. Record what your feather looks and feels like now.
3. Discuss how the feather stayed dry the first time the students dipped it in the clean water. Why do birds feathers need to be waterproof?
4. Dip the feather back into the fresh water. Did it make a difference? Why/why not?
5. Discuss the use of detergents in urban areas such as Geelong. What might happen to birds if they are exposed to detergents? How can we reduce the likelihood of detergents entering areas like Balyang Sanctuary?

   Extension: Extend this activity by completing the effect of oil on feathers lesson (Pg. 14).



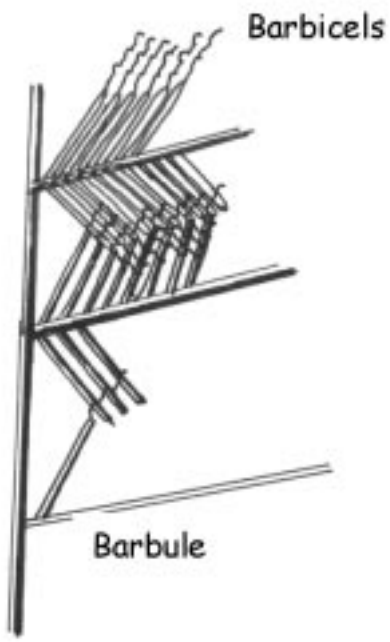
Background

Feathers are made of keratin, the same protein that makes hair and nails. Each feather has a central shaft (quill) upon which are two rows of soft barbs, which interlock to provide insulation. A trapped layer of air beneath and between the feathers makes the feathers waterproof.

Next to a birds tail is a gland that secretes oil. This oil is particularly important in water birds because it waterproofs the surface feathers. If the oil is removed from the feathers by detergents, the bird may be unable to fly, leaving it vulnerable to predation or may die from cold.

Most detergents entering the stormwater network come from car washing in inappropriate areas. Washing the car on the road or in the driveway allows for the detergent to be carried directly into the drains. Washing the car on the lawn allows for some of the detergent and the associated nutrient to be absorbed into the lawn prior to entering the drain. This does little or no damage to the lawn and helps lessen the impact on waterway areas.

(see EPA postcard at the back of the manual and diagram on page 22).



Results Sheet

A dry feather feels ----------

A dry feather looks ----------

A feather dipped in water feels ----------

A feather dipped in water looks ----------

A feather dipped in detergent feels ----------

A feather dipped in detergent looks ----------

A feather dipped in oil feels ----------

A feather dipped in oil looks ----------

If a birds feathers are covered in oil or detergent ----------

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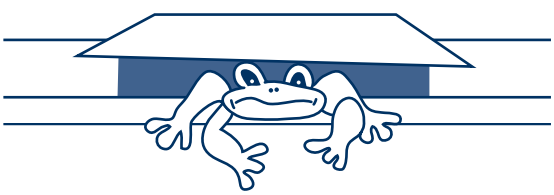
We can prevent this by: ----------



Feathers & Oil Don't Mix!

Summary

Students look at the effect that stormwater pollutants can have on birds

Learning Outcome

Science 3.1 Biological Science
4.1 Chemical Science
5.2 Chemical Science

Aim

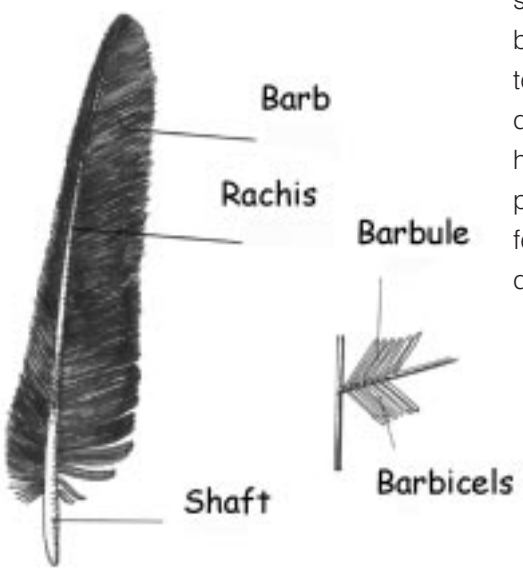
To investigate the effect of oil on feathers

Materials

- Glass/jar
- Fresh water
- Feathers
- oil
- Gateway Sanctuary stormwater sub-catchment map (provided)

Advanced Preparation

Homework - the children should try to collect a feather prior to the lesson

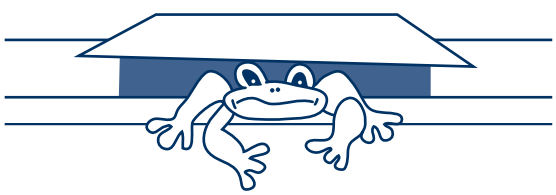


Activity

1. Fill a glass or jar with clean fresh water. Dip a feather in the water. Pull the feather out. Record on your record sheet how the feather looks and feels.
2. Add oil to the glass of water. Put the feather into the oil and water mixture. Pull the feather out. Record what your feather looks like now.
3. Discuss how the feather stayed dry the first time the students dipped it in the clean water. Why do birds feathers need to be waterproof?
4. Discuss how oil might enter a waterbody ie. Gateway Sanctuary. What might happen to birds if they are exposed to oils? How can we reduce the likelihood of oil entering areas our waterways.

Background

Feathers are naturally waterproof because of oils secreted by glands on the birds. If birds feathers become covered in oil from our roads, the oil clings to the natural oil, clogging the birds feathers damaging the structure of the feather. When this happens the bird cannot fly leaving it vulnerable to predators such as cats. The bird cannot dry its feathers, leaving it vulnerable to chills and ultimately death from exposure.



Balyang Sub-Catchment

Summary
Students examine the Balyang sub-catchment

Learning Outcomes
SOSE 3.3 Australia's People & Places
4.1 Geography
5.2 Geography

Aim
To investigate possible pollutant sources for Balyang Sanctuary

Materials
- Balyang Sanctuary stormwater sub-catchment map (provided in reference section)

Advanced Preparation
Photocopy the map for each student/pair
Photocopy Results Sheet

Activity
1. Students walk the sub-catchment area shown on the map.
2. A survey of the type and amount of litter found in the streets shown in the sub-catchment can be undertaken. This can be done using shopping bags and wearing gloves. Alternatively, if rubbish cannot be picked up a record sheet should be used to record the type and amount of rubbish seen.
3. If this much rubbish is produced in an area approximately 1/5 of the entire catchment area, work out how much the entire catchment produces. This will give an indication of how much rubbish can enter areas like Balyang when it rains carrying the rubbish through the stormwater system.

   Extension 1: Compile a list of the rubbish produced in the classroom, weigh the rubbish. Convert this to tonnes/ha produced in the catchment

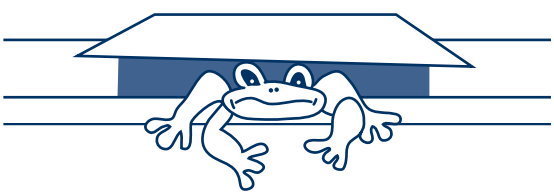
   Extension 2: On a field trip to Balyang Sanctuary, look for signs of rubbish entering Balyang Sanctuary at the stormwater inlets.

Background
The catchment area draining into Balyang Sanctuary extends from Noble St in the north to Shannon Ave in the east and as the crow flies from Windmill St south to the river. The area marked on the map is a sub-catchment. It is an area containing a school, gardens and a residential area.

The stormwater inlets are located at the northern end of Balyang Sanctuary. These are covered over by water when the lake is full.

Rubbish found at Balyang may not have been dropped at the site but may have been carried in by stormwater.

N.B. Care must be taken while doing this lesson. Tongs should be used, where possible. Any sharp items SHOULD NOT BE PICKED UP BUT NOTED ONLY.



Begola Wetlands

F

Summary

Focus on the sub-catchment draining to the litter trap at Begola Wetlands which is in Emperor Drive, Ocean Grove

Learning Outcomes

SOSE 4.3 Geography
5.2 Geography

Aim

The students will see the connection between land form/shape and stormwater design

Materials

Begola wetland stormwater sub-catchment map. (provided in reference section).

Advanced Preparation

Photocopy the map for each student.
This lesson should only be done with the assistance of a facilitator provided by the City of Greater Geelong.
Contact Council's Environment Unit on
Ph: 5227 0270

Activity

1. Visit the Begola Wetlands sub-catchment. The area shown on your map is only a small part of the Begola stormwater catchment. As you walk around the sub-catchment mark in the side entry pits in the gutter. You can do this accurately by counting the house blocks as you walk.

   Side entry pits are located next to the road and comprise of openings along the gutter which enable stormwater to enter the underground drainage network.

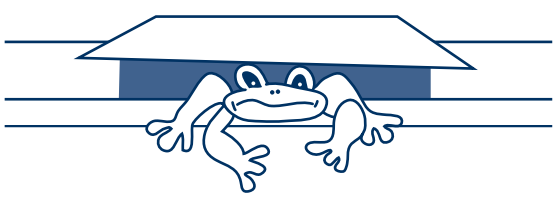
2. Take notice of the slope of the land. Mark it on the map. Which way will the water flow when it rains? Where will the water enter Begola Wetlands?

3. Walk to the litter trap at the Emperor Drive end of Begola Wetlands. Once the lid of the trap is lifted you can see the types of material that the litter trap stops from entering the wetland. A plan showing this type of litter trap is on page 19. What can you see in Begola that didn't get stopped by the trap? Make a list of the material you can see in the trap? Draw the structure as accurately as possible.

Extension:

1. Arrange to visit the litter trap when it is being emptied to see all the material it has collected. This happens approximately every three months.

2. Sitting very quietly, listen to the sounds of some of the frogs. It is best to do this after rain or early in the day. (See the background on page 40)

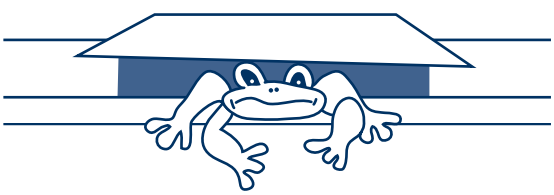


Background

Begola Wetlands is a natural wetland on the eastern side of Ocean Grove. It is one of the first of a chain of dune wetlands and lakes that exist between Ocean Grove and Swan Bay. It was previously an ephemeral wetland, meaning that it used to regulalry dry up during summer. It now holds water more permanently, except in very dry seasons. It is fed exclusively by urban stormwater, from a 110ha residential (housing) catchment.

The wetland is rich in birdlife, including the threatened Lathams Snipe. It also contains several frog species, including the Southern Brown Tree Frog, Spotted Marsh Frog and the Common Eastern Froglet.

The interpretation boards at either end of the reserve provide more information about the frogs lcoated in this wetland.



Design a Litter Trap

Summary

Students design a litter trap

Learning Outcomes

SOSE	4.1 Economy & Society
	5.3 Geography
Science	3.2 Forces and their effects
	5.4 Forces and their effects

Aim

Students analyse the requirements and limitations for the design and implementation of a gross pollutant trap

Materials

Background information on CDS Technologies Gross Pollutant Traps (pg. 19)

Advanced Preparation

Students will need to have visited the litter trap at Begola Wetlands or be familiar with what litter traps are, what they look like and the pollutants they catch.

Activity

1. Based on your observations from your trip to Begola, discuss the positive and negative aspects of the litter trap, ie. environmental, economical, social etc.
2. Design a litter trap for use in a catchment area like the one at Begola Wetlands. Make a list of what you think you might need to make and test your litter trap. Take into account the limitations you discussed as well as the ones mentioned in the background notes.
3. Make the litter trap you designed. When it is finished, test it in a simulated drain or wetland area.

Background

Litter traps are designed to trap gross or large pollutants. They do not trap very small materials or very fine sediment. They also do not trap nutrients or oils, petrol or other liquid pollutants. The following is a list of the sizes of pollutants that are trapped by commercially available litter traps.

CDS Technologies - Gross Pollutant Trap Fact Sheet

The CDS Gross Pollutant Trap has been installed on Emperor Drive within the Begola Wetlands Reserve. It collects gross pollutants and sediments from a 12ha residential catchment.

Most gross pollutant traps are very large and therefore require open, clear areas to enable these to be installed.

Once installed a gross pollutant trap must be cleaned at regular intervals (3 - 4 months) and after heavy rain or storm events. This involves the use of specialist heavy machinery.

Key Features of the CDS litter trap:

Capture 100% of gross pollutants more than 0.5mm in size (0.5mm is the size of

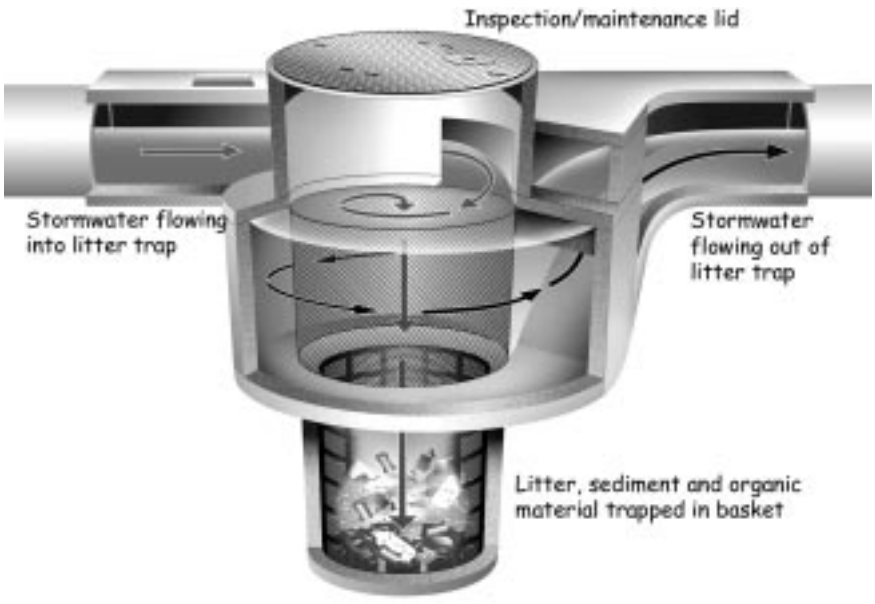
Capture 70 - 90% of sediments greater than 0.25mm in size (0.25mm is the size of

Capture 90 - 93% of particles greater than 500 microns in size. (500 microns is the size of

80 - 90% retention of oil and grease

The pollutants are caught in a basket at the bottom of the trap, which needs to be emptied by suction or lifting out the basket.

The CDS pollutant trap can be inspected by lifting the two fibreglass inspection lids, located over the centre of the collection pit and diversion weir. Only a council officer is permitted to lift these lids.



Frogs at Yollinko

Summary

Students survey the frogs to be found at Yollinko wetland, Newtown

Learning Outcomes

Science 3.1 Biological Science
4.1 Biological Science
5.2 Biological Science

Aim

For the students to realise that frogs are important and that their presence can be an indicator of water quality.

Materials

Tape recorder

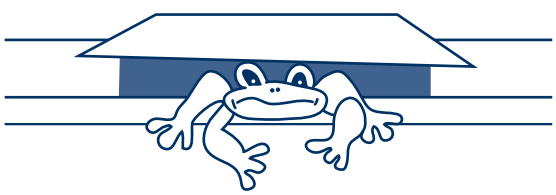
Activity

1. Students visit Yollinko. Sitting very quietly they listen for the sounds of some of the different frogs.
2. If the frogs are heard, their sounds can be taped and taken back to the classroom for identification. It is best to do this activity early in the morning after rain if possible.
3. If frogs are heard, their sound can be triangulated to identify possible habitats. This is done with three students forming a triangle around the sound and gradually moving with the sound to find the approximate area where the frog may be. Frogs live in many areas around the water, but may also be found in grass or in the trees.

   N.B: Students are not permitted to climb into reed beds as these areas contain not only many bird nests but also snakes.

Background

Tapes of frog calls are available through the Gould League. Contact details can be found at the back of this manual.



Pobblebonk!

Summary

Students recreate the sound of the Pobblebonk Frog.

Learning Outcomes

Science 3.3 Biological Science
4.1 Physical Science
4.2 Biological Science

Aim

For students to gain an appreciation of frogs and become more aware of their calls.

Materials

- Poly Pipe (Check WasteWerks for off cuts)
- Plastic Covers
- Tape of frog calls from Gould League (Optional)

Advanced preparation

Lengths of pipe for each child to work in pairs
Lengths may vary in length from 30cm to 1.4m to produce different pitch in sound.

Activity

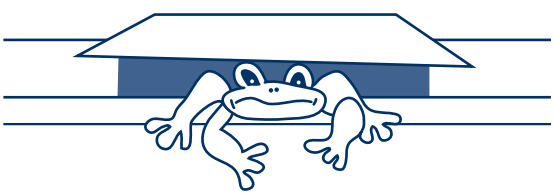
1. Listen to the sound a Pobblebonk Frog (Eastern Banjo Frog) makes. What does it sound like?
2. Research how the (Pobblebonk) frog makes it's sound. Students try to replicate the sound.
3. Using the poly pipe, seal one end using a plastic cover. Students experiment to try to replicate the sound of the Pobblebonk.
4. One method for producing the sound is to place both hands around the pipe and bounce the capped end on a carpet piece or outside next to a tree. This should produce the low sound. You can raise the pitch by pouring water inside the pipe.

Background

The Eastern Banjo Frog is also known as the Pobblebonk because of the hollow resonant sound of its call. It often sounds like water drops in a pipe.

Frogs create the sound of their calls by trapping air in the sac beneath their chin. They pump this air backwards and forwards across their vocal chords.

Tapes of frog calls are available through the Gould League. Contact details can be found in the Contacts/Reference section of this manual.



Car Wash!

Summary

Students will discover the phosphorus levels of car wash detergent

Learning Outcomes

Science 4.1 Chemical Science
5.2 Chemical Science

Aim

To discover how much excess nutrient is contained in one car wash.

Materials

- Bucket
- Car wash detergent
- Water
- Waterwatch Phosphorus kit (High Range)
- Gateway Sanctuary stormwater sub-catchment map (Provided)

Activity

1. Take a bucket of water and test its phosphorus levels.
2. Mix up one bucket of car wash detergent according to the directions on the bottle (usually one capful to a bucket of water).
3. Using the Waterwatch Phosphorus test kit, test the car wash solution to find out the level of nutrient potentially washing down the drain when we wash the car.
4. What did you find from the phosphorus test? What would the rating be for the water and each of the detergents based on the guidelines in Table 1 on page 6.
5. How can we reduce the amount of nutrient washing down the drain and into waterbodies like Gateway Sanctuary?

   Extension: Do this activity with a variety of detergents. Record the names of the detergents tested and the amount of phosphorus in each.

Background

Phosphorus is just one of the nutrients washed into the lake systems such as Gateway Sanctuary in Leopold through stormwater drains.

When we wash our car, it is often easiest to do it on the street or our driveway, however this enables the excess water run into the gutter and into the stormwater drain.

Gateway Sanctuary is a constructed and revegetated parkland which includes a series of interwoven waterbodies. These were designed as ornamental waters however they are maturing into an interesting artificial wetland.

Although artificial wetlands are designed to minimise the impact of excess nutrients on the river or bay, not all the excess is used by plants, leaving plenty of nutrients available for algal blooms. When it rains heavily, this excess is flushed through Gateway Sanctuary to Lake Connewarre and onto Bass Strait, impacting on the plants and animals which use this waterway.

Phosphorus in Your Catchment

Summary

Students will calculate how much phosphorus one sub-catchment can produce.

Learning Outcomes

SOSE 4.2 Geography
5.2 Geography

Aim

To calculate potential Phosphorus input from a given area

Materials

- Gateway Sanctuary stormwater sub-catchment map (provided)
- Results from Car Wash! (p. 22)

Advanced Preparation

Students will need to have completed the Car Wash Activity

Activity

1. Given the probability that every house in your sub-catchment has one car, and washes their car once a month, calculate how much phosphorus your sub-catchment produces per year.
2. Discuss ways to prevent this happening.

   Hint: Use the map provided to count the house blocks!

   Use the following formula:

   House blocks X mg/L (amount of phosphorus) from your sample X 12 (months/year)

   The total amount of phosphorus entering the sub-catchment over one year is ..... mg/L.

Emily Street Lake

Summary

Students examine the catchment draining into the small lake in the Emily Street, Point Lonsdale.

Learning Outcomes

SOSE 3.2 Australia's People and Places
4.1 Geography
5.1 Geography
5.2 Geography

Aim

Students investigate the sub-catchment to become familiar with influences on water movement

Materials

Emily Street stormwater sub-catchment map (provided in the reference section).

Advanced Preparation

Photocopy the sub-catchment map provided.

Activity

1. Examine the sub-catchment by walking the area. Mark on the map:
   - side entry pits - stencilled
     - not stencilled
   - open drains,
   - vacant blocks of land
   - blocks with houses
2. When you reach the lake, mark on the map the inlet and outlet points. These can be seen when walking around theEmily Street lake.
3. Also plot any vegetation at the wetland, both water plants (aquatic) and plants living on land (terrestrial).
4. Discuss as a group what you have on your maps. Why are the items you marked significant? Make a list of the benefits of vegetation in a catchment. Why is it important?

Background

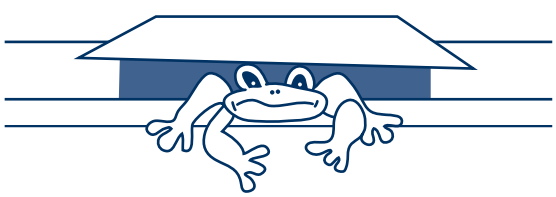
The Emily Street lake collects stormwater from the western side of Point Lonsdale. It is a small, purpose built lake, designed to catch the stormwater from houses and the street. The lake assists with flood prevention and also assists with reducing the nutrient, sediment and bacteria as it drains to Lake Victoria.

Constructed lakes and wetlands can provide a habitat for a diverse range of creatures including frogs, waterbirds and invertebrates.

It can provide one solution to problems associated with urban run off or stormwater. It offers a flood retention system but also enables the water to be cleansed via natural processes. Water draining into the Emily Street lake carries with it pollutants including litter, animal droppings, oil, petrol, detergents and fertilisers. The pollutants cannot only make an area unsightly but they can also contain excess nutrients and bacteria.

Water plants help to reduce nutrients such as nitrate and phosphate by using these for their growth. These nutrients are thought to be one of the causes of algal blooms in wetlands and rivers around Geelong each year.

Although naturally occurring, algal growth and blooms may increase from the impacts of detergents, fertilisers and animal faeces.



What's the Water Like?

Summary

Students look at the water quality entering the lake at Emily Street.

Learning Outcomes

Science	3.2 Chemical Science
	4.2 Chemical Science
SOSE	5.2 Geography

Aim

To compare the quality of the stormwater entering the lake to the water in Lake Victoria

Materials

- Waterwatch Test Kit
- Results Sheet (p 27)

Advanced Preparation

Students should have worked through the previous lesson, (p 24).

Activity

1. Students visit the lake at Emily Street. In two groups test the water entering the lake via the Emily Street drain and the water leaving at the outlet to Lake Victoria.
2. Tests should include the Waterwatch tests; Temperature, Dissolved Oxygen, Phosphorus, Turbidity.
3. Record the results on the results sheet provided.
4. Make comparisons between the results. If the results were different, look at the contributing factors to improvement in water quality. If the results were not substantially different, try to establish what else could be done to improve the quality of the stormwater entering the lake.

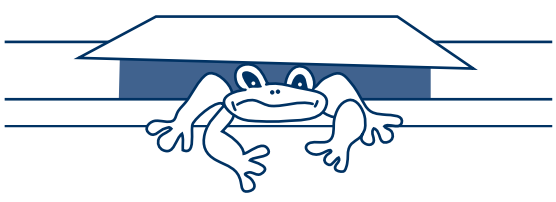
   Extension: Complete the monitoring over a period of time, particularly after rain events. Compare the results you get after rain events to regular monitoring.

Background

Artificial lakes and wetlands are designed to minimise the impacts of pollution such as excess nutrient and bacteria from animal waste. It should also minimise the impact of the excess sediment carried by stormwater.

What's the Water Like Results Sheet

	Emily Street Drain	Outlet to Lake Victoria
Temperature		
Dissolved Oxygen		
Phosphorus		
Turbidity		



What Makes Algae Grow?

Summary

Students will see the effect of fertilisers (phosphorus-based) on algal growth

Learning Outcomes

SOSE	4.3 Geography
	5.4 Geography
Science	3.1 Biological Science
	4.1 Chemical Science
	5.4 Biological Science
	5.2 Chemical Science

Aim

To observe what happens to fertiliser and detergent when they enter our waterways.
To classify pollution sources

Materials

- 2/3 jars
- Fresh/rain water
- Fertiliser (garden fertiliser)

Activity

1. Fill two jars with the fresh/rain water. Into Jar One stir 1tbs of fertiliser. Jar Two should only contain rainwater. Leave the lids off.
2. Leave both jars on a window sill for two weeks. Discuss what happens. (Algae in Jar One should grow faster than the algae in Jar Two).

Alternate:

1. Half fill each jar with fresh/rain water. Label jars 1,2,3. Into Jar One, stir 1tbs detergent. Into Jar Two, stir 1tbs of fertiliser. Leave Jar Three as fresh/rain water.
2. Leave the jars on a windowsill for one week. Every second day add another teaspoon of the fertiliser and detergent.
3. At the end of the week assess which jar shows the most growth? Why? How might nutrients enter our waterways? What problems might this cause within a water body such as the Emily Street lake, or in the bay where it all eventually ends up? (Refer to the activities on page 24 & 26).

   Extension: Where should the jars be emptied at the end of the experiment? Down the drain? On the lawn?

NB: Make sure you wear rubber gloves when handling any fertilisers.

Lara Mapping

Summary

Students will focus on the residential area of Lara

Learning Outcomes

SOSE 3.3 Australia's People & Places
4.3 Geography
5.2 Geography

Aim

Students will become more familiar with aspects of a local environment

Materials

- Hovells Creek Stormwater sub-catchment map (provided in the reference section)
- Pencil

Advanced Preparation

Copy the map provided for each student or pair.

Activity

1. As a class walk around Lara township. On the map provided or a copy of a Melway map, mark your school, the shops, factories, sports ovals, the golf course, the petrol station.
2. Each student or students in pairs, choose an area to study more closely. It may be one street block.
3. On their maps they should mark in the types of buildings, businesses and structures that effect stormwater, either in a positive way or a negative way. Discuss ways to improve the negative impacts.

   Extension: Water quality testing as outlined in the Waterwatch Education Kit.

Background

Hovells Creek starts near Mt Anakie and flows south east passing through Lara and out to Limeburners Bay into Corio Bay. It is a major waterway in the area with numerous land uses occurring within its catchment.

Hovells Creek was originally called Duck Ponds Creek when it was settled in the 1840's. Lara was originally known as Duck Ponds. Prior to its development the town had a lake of approximately 15ha. Lara Lake School opened on the west side of Hovells Creek. Lara Primary School was built on the other side of the creek in 1965. The lake was drained in the 1870's, but it has been recreated as a wetland and recreation reserve, now known as Lara Lakelands.

Lara is subject to flooding, as it is low lying, at the foot of the You Yangs.

Lara now has a population in excess of approximately 7000 with rapidly expanding residential areas, three primary schools, numerous reserves, commercial areas, wetlands and industry. Out of town, there is a golf course and numerous farming areas and activities.

Where Does it Go?

F

Summary

Students will begin to understand what happens to stormwater in Lara

Learning Outcomes

SOSE 4.3 Geography
5.2 Geography

Aim

The students will see the connection between the street, the drain and Hovells Creek.

Materials

Hovells Creek Estuary stormwater sub-catchment map (provided in the reference section)

Advanced Preparation

Photocopy the map for each student
Contact Council's Environment Unit on Ph 5227 0270 to inspect the litter trap.

Activity

1. Walk around the area shown on the sub-catchment map. The area shown is only a small part of the Lara stormwater catchment. As you walk around the sub-catchment mark in the side entry pits in the gutter. Side entry pits are located next to the road and are comprised of openings along the gutter which enable stormwater to enter the underground drainage network.
2. Take notice of any litter or pollution you can see as you walk around. Where do you think this goes?
3. Arrange with the Council to visit the litter trap installed underground at the corner of Turner Ave and Station Lake Road when it is being emptied next.
4. Discuss where the stormwater goes when it goes down the drain at the side entry pit. On the Hovells Creek Estuary map follow the path of the water after it hits the ground. Where does it end up? Discuss the impacts of the water flowing to Corio Bay.
5. Using the map look at some of the other landuse activities around Lara. Do these have positive or negative impacts on the quality of stormwater.

Background

Rocla® CleansAll® Gross Pollutant Trap

A Rocla® CleansAll® Gross Pollutant Trap has been installed at the corner of Station Lake Road and Turner Ave, Lara.

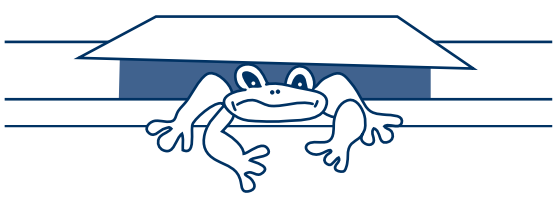
Gross pollutant traps are generally very large and can only be installed where sufficient land can be set aside for their construction.

Once installed the trap must be cleaned at regular intervals and after heavy rain events. This involves specialist heavy machinery and a team of trained people.

Key features of the Rocla® CleansAll®:

- Capture of all gross pollutants greater than 0.3mm
- Capture more than 95% of all free oils and greases
- Capture of sediment greater than 0.6mm
- Pollutants are caught in a basket which needs to be emptied every three months, depending on the load, particularly after storm events
- Emptying the unit can either be by suction or lifting the basket
- The unit can be inspected by lifting the inspection lid

NEED NEW FILE



We can all do something!

Summary
Students will focus on community action

Learning Outcomes
SOSE 4.3 Geography
5.3 Geography

Aim
Students will try to encourage community awareness within the Lara town centre.

Materials
Hovells Creek Estuary Inset Map (provided in the reference section)

Advanced Preparation
Students should have an understanding of stormwater issues
Develop a key for mapping land use

Activity
1. Students could work in small groups. Using the Hovells Creek Estuary - Inset Map, walk around the blocks shown. Take note of the types of business and landuse in this small area. (These can be marked on the map)
2. In groups the students should select at least one of the businesses or land use managers to focus on.
3. In groups discuss the stormwater issues which may be created or contributed to by your focus business. The impacts they may be having could be positive as well as negative.
4. Brainstorm ways in which the business could minimise their impact on the stormwater system in Lara.
5. How can you as students get businesses to take notice of where their stormwater goes? In groups, come up with ideas for getting the message out to the community. Follow through on the more realistic ideas. Some ideas may be designing a flyer, letter, poster or bookmark.

   Extension: Contact the Lara Litter Prevention Taskforce to visit the school. Contact the Barwon Region Waste Education Centre on Ph: 5277 9656

Background
Prior to sending any flyers or posters out, businesses should be alerted by the teacher that the project is being undertaken.

Mangroves!

Summary

Students will focus on the white mangrove community located within the lower reaches of Hovells Creek, and the features that help it survive.

Learning Outcomes

Science	3.1 Biological Science
	4.1 Biological Science
	5.2 Biological Science
SOSE	4.1 Geography
	5.1 Geography

Aim

For the students to develop an understanding of the importance of ecosystems such as those associated with mangroves.

Materials

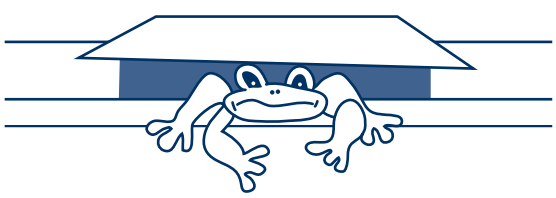
Student Activity Sheet (page 34, 35)

Advanced Preparation

Prepare for the excursion as per school guidelines.
Copy the student sheet for each student
Discuss the Background information with the students

Activity

1. Take a class trip to the mangroves. Access to the boardwalk can be accessed from Cummins Road, Hovell Park (Melway Ref: Map 432 K2). Bus parking is available.
2. As you walk along the boardwalk, focus the students attention on land features such as the Corio Landfill site, Geelong Grammar School, the saltmarsh growing under the boardwalk, the boardwalk they are walking on, the shape of the estuary.
3. Work through the Student Activity Sheet.



Student Activity Sheet - Hovells Creek Estuary

This trip is for you to discover what makes an estuary unique.

As you walk along the boardwalk make a list of the things you can see.
List 3 ways the estuary has been changed by human activity. *eg. The landfill site*

Once you reach the mangroves sit down and close your eyes and listen quietly. What can you hear and smell?

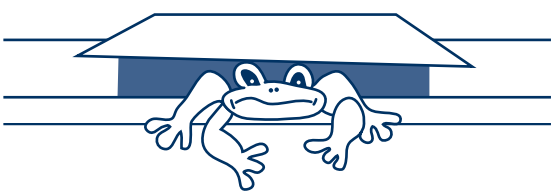
How do mangroves cope with living in a salty environment? Without breaking their leaves, look closely at the leaf. Scratch the surface and dab on your tongue. Describe the taste.

Do you think the mangrove can excrete any pollutants in this manner?

Look around you. What pollutants can you see? How do the pollutants end up here?

Look over at the tip. How many birds can you see? Bird droppings are high in nitrogen? Why might this be a problem in an estuary?

Name or draw three plants/animals living in the estuary.

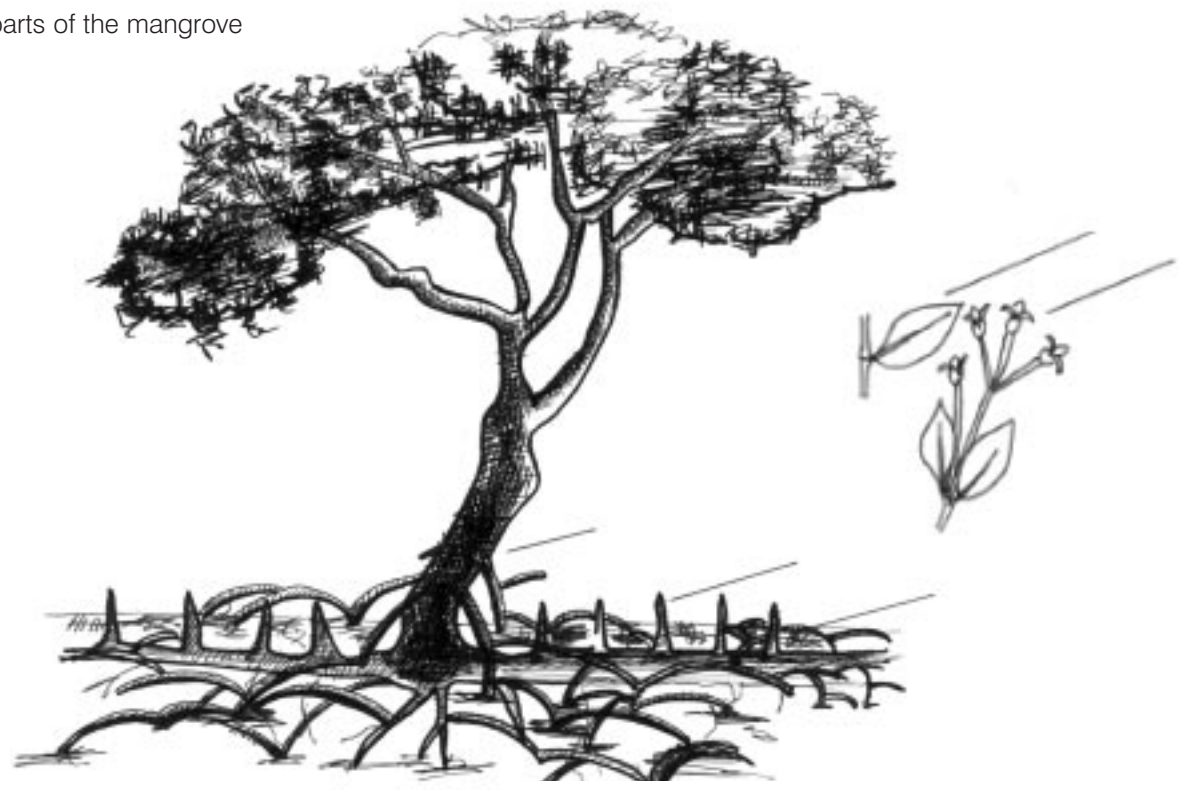


Look again at the mangroves. What can you see that is unusual compared to other plants?

Like other trees, mangroves breathe through their roots as well as their leaves. Why do mangroves need aerial roots called pneumatophores?

When the tide rises and covers the roots, how does the tree keep breathing?

Label the parts of the mangrove



Background

Victoria has only one species of mangrove, Avicennia marina, the Grey or White Mangrove. The White mangrove can be found in two areas in Geelong, Barwon Heads and Limeburners Bay at the mouth of Hovells Creek.

Limeburners Bay has been classified as a Ramsar site, which means that it has international significance as a wetland. Limeburners Bay has the most extensive stand of mangroves and the largest intact saltmarsh complex in Port Phillip Bay.

Mangrove trees are a special kind of tree that have roots, leaves and stems that are specially adapted for life in seawater. Mangroves are only found in estuaries where the waves are not strong and silt builds up. They trap the sediment around their roots preventing erosion of the shoreline. White Mangroves also have pneumatophores or aerial roots. These grow off the shallow underground roots and extend through the mud into the air. This helps the roots of the tree to have access to oxygen particularly at high tide. If the tree is put under stress, it produces more aerial roots to try to cope.

Leaves on the White Mangrove are also very important. Living in a very salty environment can put many plants under stress. The mangrove copes by secreting excess salt into some of it's leaves just prior to them dropping. These leaves often turn yellow before they fall. Often the salt forms crystals on the leaf, which are washed off by the rain.

Mangrove seeds germinate while still attached to the parent plant. The young seedling is dropped and floats for about three days after which it develops roots and establishes itself in the mud, often close to the parent tree.

(FROM UNDERWOOD & CHAPMAN, COASTAL MARINE ECOLOGY OF TEMPERATE AUSTRALIA 1995)

Limeburners Bay and Estuary

Summary

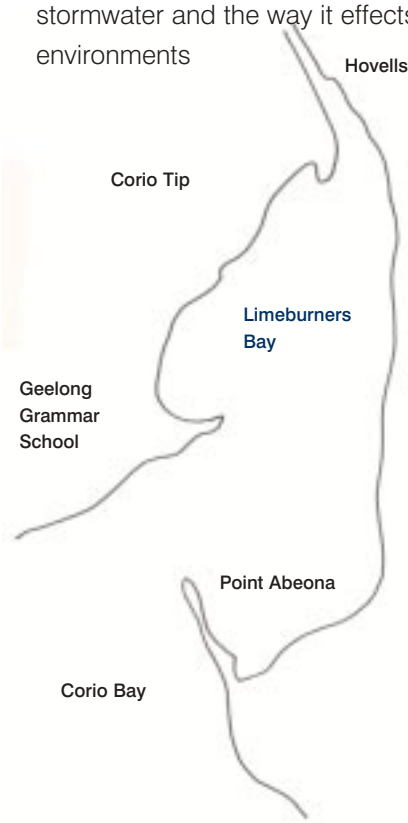
Students will focus on Limeburners Bay and the effect stormwater can have on marine areas.

Learning Outcomes

Science	3.1 Biological Science
	4.1 Biological Science
	5.2 Biological Science
SOSE	3.3 Australia's People & Places
	4.3 Geography
	5.2 Geography

Aim

For students to make the connection between stormwater and the way it effects marine environments



Materials

- Boxes and art materials for construction of diorama or 3D model.

Advanced Preparation

Collection of materials

Trip to the Hovells Creek Estuary (p. 33)

Activity

1. Following the trip to the Hovells Creek Estuary (p. 33), discuss the further impacts of stormwater. That is, the bay itself.
2. Focus on the impact stormwater may have and the possible strategies for reducing this impact.
3. Students should then be able to construct a diorama of a before pollution and after pollution scenario of the bay, incorporating the seagrass beds, whiting and mullet nursery areas.
4. Older students may be able to construct a 3D model of the bay individually or in groups. The model should include the bay, mudflats, seagrass beds, saltmarsh, the mangroves and the river. It may even be a whole catchment model. This could be done as a special project.

Background

The estuary formed at the mouth of Hovells Creek forms the beginning of Limeburners Bay. In the estuary freshwater from Hovells Creek mixes with the seawater of Corio Bay.

Estuaries are an important coastal feature as they provide habitat for a diverse number and type of organisms.

Within the estuary, many small ecosystems exist and interact to form a larger ecosystem. Mudflats, salt marsh, mangroves, running freshwater and seagrass colonies all interact with each other forming the estuary, each supporting a different array of flora and fauna.

Fauna such as the frogs living in and near Hovells Creek cannot regulate the salt in their bodies as the mangroves can. Frogs will swim upstream to freshwater as the tide comes in to avoid being exposed to excess salt.

Limeburners Bay is an important area for whiting and mullet. It is here that the young whiting and mullet grow from juveniles to adults ready to breed. They do not breed here but leave Limeburners Bay to spawn.

Seagrass is also important in the bay as it forms the primary habitat for whiting and mullet, offering food and protection from predators.

Human impact can have a huge impact on one or all of these ecosystems. Stormwater from rural areas near Mt Anakie, Lara and Melbourne Road all drains into Hovells Creek. Things like litter, fertiliser, detergent, sewage, road runoff such as oil, petrol and rubber, household waste and animal waste can pollute this stormwater.

Travelling down Hovells Creek, the stormwater eventually ends up in Limeburners Bay and then into Corio Bay.

Frogs at Jerringot Wetland

Summary

Students look at the frog habitat provided at Jerringot Wetland, located in Barwon Heads Road, Belmont.

Learning Outcomes

Science	3.1 Biological Science
	4.1 Biological Science
	5.2 Biological Science
SOSE	4.1 Geography

Aim

Students will be able to see the relationships existing at Jerringot Wetland.

Materials

Jerringot wetland stormwater sub-catchment map (provided in the reference section).

Advanced Preparation

Photocopy the map for students

Activity

1. Visit Jerringot Wetland. Walk around the wetland area (be careful not to trample on vegetation).
2. Mark in brown on your map where the stormwater drains enter the wetland.
3. Mark major features that are built nearby. Eg. golf course, industry, roads, Council depot.
4. On your map, mark in green the areas where you think frogs may be able to live.
5. Walk to the bird hide. Sit quietly for 5 minutes. If you can hear any frogs, make a note of what their call sounds like.

Extension:

1. As a group choose a frog, either from the list or a favourite. Research and present the information to the class including making the call of the frog.
2. Contact the Amphibian Research Centre on Ph: (03) 9354 4718 to arrange a visit & talk about various frog species.

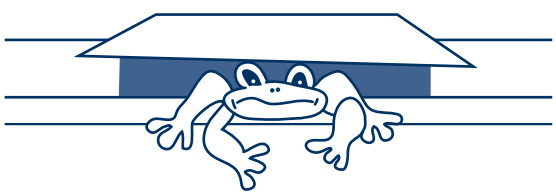
Background

Stormwater runoff into wetlands can create many problems for any frogs that may live there.

There are five species of native frogs known to live at Jerringot Wetland. Further information on each of the frogs can be found on page 40.

1. Growling Grass Frog (*Litoria raniformis)*
2. Southern Brown Tree Frog *(Litoria ewingii)*
3. Spotted Marsh Frog *(Limnodynastes tasmaniensis)*
4. Pobblebonk (Banjo) *(Limnodynastes dumerili)*
5. Common Froglet *(Ranidella signifera)*

Sometimes the frogs may be known by two common names but if you look for the scientific name, the information you find should be accurate.



Frogs at Jerringot

Growling Grass Frog
(Litoria raniformis)

This is a widespread but only locally common frog, whose population numbers are thought to be in decline. This frog preys on other frogs and is active during the day.

Adult Growling Grass Frogs are bright emeral to dull olive green with brown and/or gold blotches on a warty back.Tadpoles are pinkish-grey with yellow fins. The eggs float in a jelly raft.

Call: “crawark-crawark-crok-crok”

Southern Brown Tree Frog
(Litoria ewingi)

A widespread and common species found in flooded grassland and marshes. An agile climber and jumper. Eats insects and is even capable of leaping to catch insects in mid flight.

Adults have pale fawn, cream, orange or light brown sides. Tadpoles are pale golden-yellow to dark grey and the fins clear. Eggs are in a jelly clump usually attached to submerged vegetation.

Call: creeeeeeee-creee-cree- cree-cree

Spotted Marsh Frog
(Limnodynastes tasmaniensis)

One of the most common of all Victoria’s frogs. Usually found around water and in dry periods it shelters in cracks in the ground, usually under rocks.

Adults usually have large olive green blotches on their back and sometimes have a yellow, red or orange stripe. Tadpole are olive grey, dark grey, or black and the fins light grey.

Call: kuk-kuk-kuk OR “click”

Pobblebonk (Banjo) Frog
(Limnodynastes dumerili)

Common and widespread burrowing frog may often be found in large numbers at night, particularly after rain.

Adults are a mixture of dark and light brown with a smooth white or mottled belly. Tadpoles are large, dark brown or black and the fins are dark grey/brown.

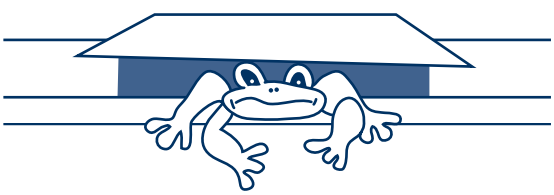
Call: “bonk” (sounds like a banjo)

Common Froglet
(Crinia signifera)

A small ground dwelling frog it is one of Victoria’s most common frogs. Commonly found under logs and other debris in moist depressions or near water.

Adults have a white or muddy white belly, with black or dark brown mottling. Tadpoles are light grey or brown all over with scattered dark flecks.

Call: “crick, crick, crick, crick”



Litter Round-Up!

Summary

Focus on the sub-catchment feeding Jerringot Wetland, located in Barwon Heads Road, Belmont.

Learning Outcomes

SOSE 3.3 Australia's People & Places
4.3 Geography
5.2 Geography

Aim

Students will assess the impact of human activity on Jerringot Wetland.

Materials

- Jerringot Wetland sub-catchment map (provided in the reference section)
- Plastic Bags (to collect the rubbish)
- Gloves
- Tongs - optional
- Sharps container - optional (teacher use only)

Advanced Preparation

Students should be given strict instructions about the type of litter they can and cannot pick up, particularly about letting a teacher know where "sharps" are so that these can be collected by an adult.

Activity

1. Visit Jerringot Wetland. Using the sub-catchment map, conduct a survey as you walk around the sub-catchment surrounding Jerringot Wetland.
2. Walk along the footpath on Settlement Road. Follow the footpath down to Breakwater Road.
3. Record the pollutants you find along the way as well as where these were found. (If students carry a plastic bag each they could even pick some of this up and take it back to school for a follow up lesson!)
4. On your return to school, create a graph showing the locations and types of the litter in the sub-catchment you surveyed.
5. Identify from your graph the main areas that may contribute to the pollutants entering Jerringot Wetland.
6. Think of ways in which these might be reduced.

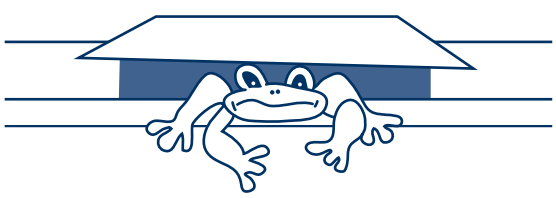
Background

The catchment that drains into Jerringot Wetland is a large one. The entire catchment stretches as far north as High Street and the corner of Roslyn Road in the Belmont shopping area.

Much of the sub-catchment marked on your map near Jerringot is made up of industries, such as motor mechanics, service stations and car yards as well as a few residential properties.

Remember that ideas for reducing litter and pollution need to be cost effective both in implementing and in maintenance.

Note: Care must be taken while doing this lesson. Tongs should be used, where possible. Any sharp items SHOULD NOT BE PICKED UP BUT NOTED ONLY.



Frog Tank

Summary

Students set up a frog tank in the classroom

Learning Outcomes

Science 4.1 Biological Science
5.2 Biological Science

Aim

For students to appreciate frogs and the requirements they have to survive.

Materials

- Glass fish tank
- Soft mesh screen
- Tight fitting lid
- Food
- Light (UV Fluorescent tube is recommended)
- Water
- Live food
- Frogs (see page 43 for regulations)

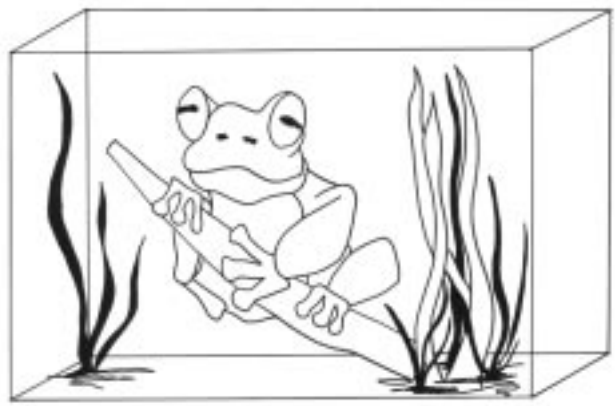
Advanced Preparation

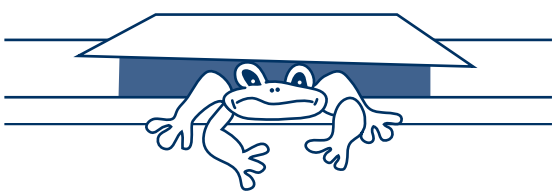
Before setting up any type of enclosure for use in the classroom, it should be fully researched. Students and teachers need to be aware that frogs have special requirements and require more specialised care than many classroom pets.

Activity

1. Set up a frog tank in your classroom. Students will need to be aware that many of the frogs local to the area are very small and like to hide so patience will be needed to see them during the day.
2. Students can keep a record of the times when they see the frogs, hear the frogs, the food they eat and how much. A roster of care may be created so that the entire class feels in some way responsible for the survival of the frogs.

   Note: The frogs not only need a source of fresh water but also an area of dry ground suitable for burrowing and plants to hide under.





Background

Australian frogs can be a popular inclusion to classrooms as well as a great learning tool.

Many of the local frogs are available as pets. They are small frogs but provide an excellent opportunity for students to feel real ownership of the responsibility of keeping frogs in our wetland areas safe.

Information about setting up a frog enclosure can be gained from Bruce Newell at Reef & River Aquatics in East Geelong.

The approximate cost for establishing a local frog enclosure is approximately $150 (May 2001).

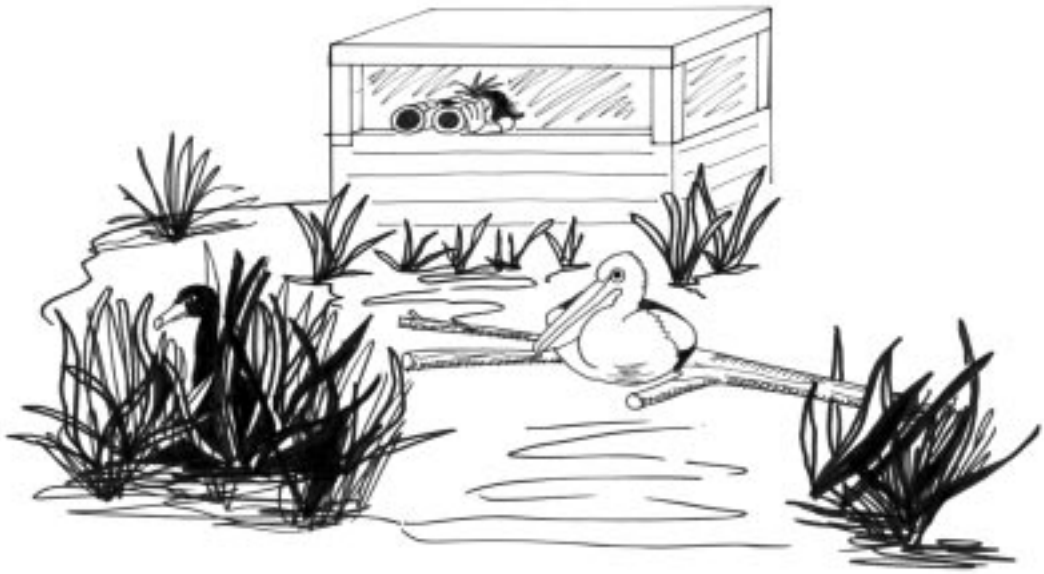
Consideration must also be given to the food requirements, as frogs require live food such as crickets. The cost of these may be as much as $8/week.

Further contact details are available in the contacts section at the back of this document.

All frogs are protected by law in Victoria.

A licence will be required to keep certain species of frogs. No frog or tadpole can be caught or released into the wild.

Licences can be obtained by contacting the Game and Wildlife Licencing Hotline on Ph: (03) 9412 4992 between 9.00 - 12.00 Monday - Friday or download the application from www.reefandriver.com.au/reptile.htm



Catchment Litter

Summary

Students compare the potential stormwater pollutants in the two Rippleside stormwater sub-catchments.

Learning Outcomes

SOSE 4.3 Geography
5.1 Geography

Aim

To compare the types of pollutants found in different land use areas.

Materials

Rippleside Beach stormwater sub-catchment maps (provided in the reference section).

FOR EACH GROUP:

- Ruler
- Measuring cup
- 4 xDowel/Rope in 1 metre lengths
- Record Sheet

Advanced Preparation

Photocopy the Rippleside map at the back of the manual for each student group.

Activity

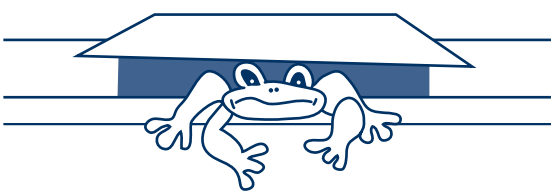
1. Using the scale indicator on your map mark out 1km linear sections of each sub-catchment. Don't forget there are two sides to a street!
2. Randomly select 10 points per kilometre. Mark these on your map. Make sure the points you mark are in stormwater runoff areas. eg. gutters, footpaths, in carparks.
3. Visit the sub-catchment and carry out quadrat surveys at each point you marked on your map.
4. Quadrat surveys can be done using 4 x 1m lengths of dowel/rope or similar. For each quadrat record what you found including the amount for each different type of litter. Include organic matter. This can include leaf litter, grass clippings etc.This can be measured using a measuring cup. Do this for each sub-catchment.
5. Work out how much litter you found for each kilometre (linear).
6. If the litter you found, plus the rest of the sub-catchment could potentially end up in the bay via the Rippleside drain, find a formula for calculating how much litter could potentially end up in the bay.

Background

Two sub-catchments have been highlighted on the catchment map provided. One is in an industrial area while the other is in a commercial and residential area. Both drain directly to Rippleside Beach.

This catchment is unique in that its drainage system is completely underground. There are flood retarding basins near Weddell Road but these then drain to Rippleside Beach in underground pipes.

The catchment has a number of different land uses including a number of sporting and recreational ovals and parks, education facilities, nursing homes, golf course, stockyards, cemetery, areas of industrial land, a large contaminated site and numerous commercial and residential areas.



Stormwater Pollution + Seagrass

Summary

Students see the damage stormwater can have on seagrass colonies

Learning Outcomes

Science	3.1 Biological Science
	4.1 Chemical Science
	5.2 Biological Science
SOSE	5.4 Geography

Aim

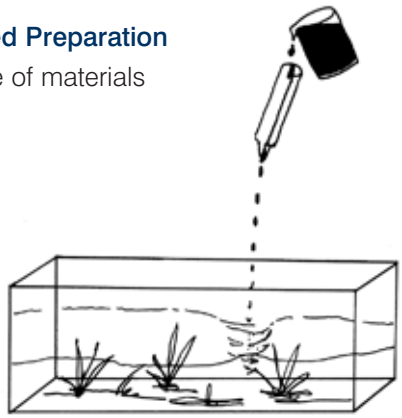
To discover the impacts different stormwater pollutants can have on seagrass/marine areas.

Materials

- Fish tank
- 6 jars - approximately 250ml
- Soft drink bottle
- Saltwater (see recipe on following page)
- Silt/sediment (see following page)
- Elodea (aquatic plant available from Aquarium shops)

Advanced Preparation

Purchase of materials



Activity

1. In a fish tank create a model of a seagrass colony using mud made up of fine silt/sediment and elodea and saltwater.
2. Let the tank settle over night. Prepare each jar with freshwater and one of the pollutants you have discussed in class. i.e. fertiliser, detergent, paper, plastic, sediment, organic matter (leaf litter etc), oil. Mix each of these well.
3. Using the soft drink bottle cut lengthways as a funnel, pour the first jar into the tank. Note what happens in the tank.
4. Pour each of the jars of stormwater solutions into the tank one at a time, each time recording how the tank looks and what is happening inside the tank.
5. Discuss your findings.
6. Leave the tank for one week. When you come back look at the condition of the tank and the plant life. Did the plants survive?

Background

Excess nutrient from detergents and fertilisers places stress on plants and animals and in the long term can create excess algal growth.

Excess sediment makes the water turbid reducing the sunlight available to the plants such as seagrass. In great quantities it can also smother colonies of seagrass. As a major habitat in the bay for creatures such as seahorses, the presence of seagrass helps protect and feed many marine creatures found in Corio Bay.

Organic material such as leaf litter is brooken down by bacteria in the water which uses oxygen and releases nutrients into the water resulting in a loss of water quality.

Seawater Recipe

- 35 grams of Sea Salt
- 965 mls of fresh water
- Mix well ensuring the salt dissolves into the water.

Silt/Sediment

This can be obtained from an area such as a garden. Granules of sediment should be less than one millimeter in diameter.

Effects of Pollutants

Summary

Students compare different types of pollutants that enter Swan Bay through the stormwater system

Learning Outcomes

Science	3.1 Chemical Science
	4.1 Chemical Science
	5.4 Biological Science
	5.2 Chemical Science
SOSE	4.2 Geography
	5.4 Geography

Aim

To observe what happens to a number of household products when they enter our waterways. To classify pollution sources

Materials

Jars or beakers (large are best; approx 500ml)
Substances: (film canister of each)

1. detergent
2. Soil
3. liquid fertiliser
4. sand
5. oil
6. clay
7. seawater or salt
8. leaves/grass clippings

Advanced Preparation

Collection of jars and materials

Activity

1. Label each jar listing the substance.
2. Half fill 7 of the jars with tap water. Mix each substance with the water in a separate jar. Compare the solutions.
3. Did all substances dissolve? What happened in the ones that didn't dissolve?
4. Add seawater or 1tbs of salt to each of the jars. This is what happens to the water when the river or the drain enters the bay and becomes mixed with the salty water.
5. Record the reactions and the effect this may have on an ecosystem.
6. Discuss the effects of each of these on life in the river, life in the bay.
7. Leave each jar on the windowsill for a week. Watch the changes. Record and discuss changes.

Background

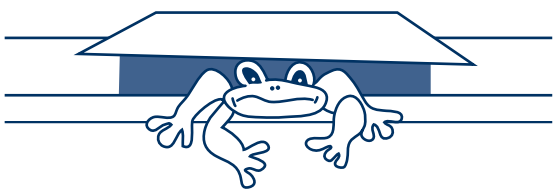
When substances such as soil and clay are dissolved in freshwater, the cloudiness created reduces sunlight needed for plant growth. This is called turbidity. This also reduces the oxygen levels in the water.

When clay is dissolved in salt/seawater the particles drop out more quickly as they clump together and become heavier (flocculation). This can smother seagrass beds.

When sand is carried into fresh and saltwater the particles sink to the bottom making the depth of the water more shallow, which can warm the water reducing the amount of dissolved oxygen.

Leaves and fertiliser washing into freshwater and seawater increase nutrient levels, increasing plant and algal growth. Oil and detergent float on top of the water in both fresh and seawater, suffocating aquatic life.

All pollutants are a problem whether they are entering rivers (freshwater) or the bay (seawater).



Bird in a Trap!

Summary

Students will gain an understanding of the impacts of their litter and pollutants on animals in Swan Bay

Key Learning Outcomes

Science	3.1 Biological Science
	4.1 Chemical Science
	5.2 Biological Science
SOSE	3.3 Australia's People & Places
	5.2 Geography

Materials

- Elastic bands
- Rubbish Items eg. 6 pack rings, fishing line, shopping bag.
- "A Gutful of Plastic" Poster (provided in the reference section)

Activity

1. Students make their hand into the shape of a bird, such as a Pied Cormorant or one of the other birds they may have seen around Swan Bay. Place an elastic band around each student's hand as shown.

2. One end around the little finger and one around the thumb stretched across the back of the hand. Have the children try to remove the band without using their other hand, teeth or anything else!
3. How many birds were able to remove the elastic band? What would happen if animals couldn't break free? How would birds and other animals get entangled? What sort of other materials might cause problems? Are these the only dangers an animal or bird might face in Swan Bay? What are some of the others? How do these pollutants end up in the bay? What can we do to stop this occurring?
4. Students come up with ways to stop this problem occurring, ie. design better bins, break apart the rings, tie knots in plastic bags in case they do blow out of bins.

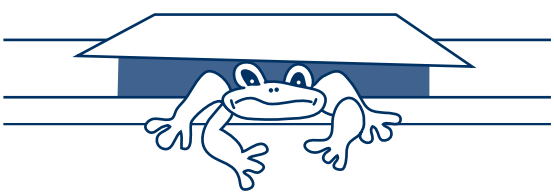
Background

Litter, particularly plastic, affects many marine animals, including birds. Marine mammals, birds and fish can become tangled in nylon fishing line, plastic packets or other plastic debris.

Once tangled an animal may not be able to break free. It can become weak or even die.

Often marine animals will also mistake plastic and rubbish for food and eat it. This is very dangerous as plastic is not easily digested. (Refer to A Gutful of Plastic Poster)

Frequently the plastic and rubbish that ends up in the bay is carried there by stormwater, often from quite a distance away.



Seahorse Tank

Summary

Students set up a seahorse habitat/tank

Learning Outcomes

Science 4.1 Biological Science
5.2 Biological Science

Aim

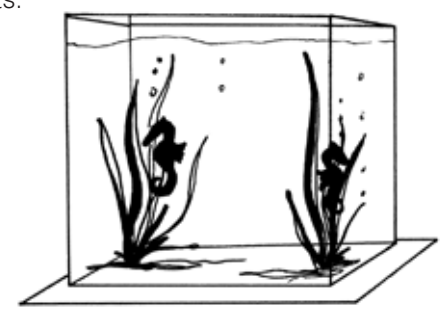
For students to appreciate seahorses and the requirements they need to survive.

Materials

- 46cm glass tank, taller than it is wide
- Air driven filter
- Saltwater
- Thermometer
- Food - live or frozen brine shrimp
- Coral sand
- Plant
- 2 Seahorses (available from Reef & River)*

Advanced Preparation

Before setting up any type of enclosure for use in the classroom, it should be fully researched. Students and teachers need to be aware that the Pot-bellied Seahorse has special requirements and requires more specialised care than many classroom pets.



Activity

1. Set up a seahorse tank in your classroom.
2. Students should keep a record of the behaviour of the seahorse and the food it eats and how much food it requires over time.
3. A roster of care may be created so that the entire class feels involved in the care of the seahorse.

   Note: Seahorse are available from Reef and River and are specially bred at Beauty Point in Tasmania, for the pet trade.

Background

The Pot-bellied Seahorse is commonly found in waters off the southern coast. Pet seahorses have a life expectancy of six to nine years and will grow to around nine inches.

Sea horses are an ideal classroom pet. Although expensive to set up, a seahorse tank provides an ideal opportunity for students to experience a marine creature they would otherwise rarely see.

Information regarding the set up of a seahorse tank can be sourced from Bruce and Kathy Newell at Reef & River Aquatics. A basic set up will cost from $250.

Extension: Visit the Marine Discovery Centre in Queenscliff.

Organic Breakdown

Summary

Highlights what happens to different types of organic material when it washes into Swan Bay.

Learning Outcomes

Science	4.1 Biological Science
	4.2 Chemical Science
	5.4 Biological Science
	5.2 Chemical Science
SOSE	5.4 Geography

Aim

To illustrate what happens to material when it enters the marine system.

To demonstrate the process of decomposition

Materials

- 2 Jars with lids (large jars are best)
- Compost material (leaves, twigs, food scraps, newspaper, grass clippings, water)
- Seawater

Advanced Preparation

Collection of jars

Collection of compost materials

Activity

1. Fill each jar to halfway with seawater. Fill the rest of the jar with the compost material.
2. Repeat the process with the second jar. Label each jar clearly.
3. Place one jar in direct sunlight. Place the other in a darkened cupboard.
4. Students can predict what they think will happen to each jar (develop a hypothesis or theory). Which jar will decompose first? Will the water change colour?
5. After 4-5 weeks, students can check the jars to check their hypotheses. Do the jars smell? What has produced this smell? Has the water changed colour? Why? Why would one decompose faster than the other?
6. If plastic were added to one of the jars would the result have been the same? Why?
7. How would this effect an area like Swan Bay, given that it is a shallow, calm marine area?
8. Keep the samples for the following lesson.

Background

The water that flows along our gutters and roads collects a variety of materials, such as soils, grease, oil, litter and organic material. It also collects many dissolved materials that we cannot see such as nutrients, dissolved metals, bacteria and pesticides.

The urban areas provide the greatest source of potential pollutants. These include:

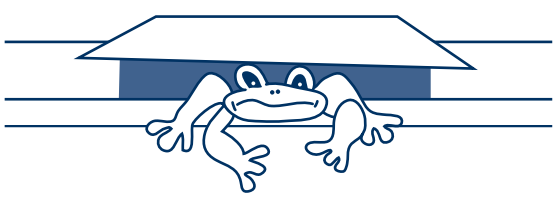
- detergents with phosphates
- insecticides and herbicides
- bleaches and drain cleaners
- lawn fertilisers and chemicals
- septic tank overflows
- animal waste such as dog droppings
- paints and thinners

Some of the chemicals entering waterways sink into the sediment and eventually make their way into the food chain. Grease and oils can coat food sources and animals making it difficult for them to breathe.

Nutrients in water are natural. Like vitamins they are essential for growth. Large amounts of nutrients can cause rapid growth of algae, smothering other plant life such as seagrass. This blocks sunlight from reaching the leaves of the seagrass in a similar way to sediment.

As algae grows, spreads and dies as part of its natural life cycle, it is decomposed by bacteria which uses up much of the available dissolved oxygen in the water. This is the oxygen which animals like crabs, worms and molluscs use to breathe. This process of removing oxygen by decomposing plants is called eutrophication.

	Excellent	Good	Fair	Poor	Degraded
Dissolved Oxygen	81 - 110%	71 - 80% 111 - 130%	51 - 70% 131 - 150%	41 - 50%	< 40%



Every Living Thing Needs Oxygen

Summary

Students compare the oxygen levels of two different seawater environments

Learning Outcomes

Science 4.2 Chemical Science
5.3 Chemical Science

Aim

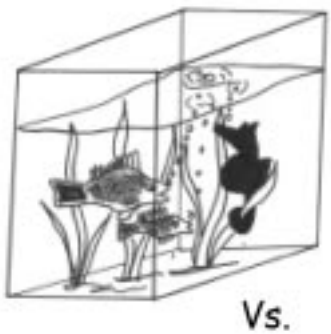
To look at the effects of organic decomposition on oxygen levels.

Materials

- The organic sample from Organic Breakdown
- Dissolved Oxygen Test Kit (obtained from the Waterwatch Kits)

Advanced Preparation

Students will need to have completed the Organic Breakdown lesson (p. 50)



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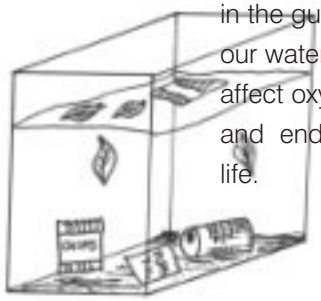


LOW RESOLUTION
NEED NEW FILE

Activity

1. Dilute the contents of the jar into 500ml of seawater. Let the material sink to the bottom so the sample is as clear as possible (no longer than 30 minutes)
2. Test this sample for how much oxygen is dissolved into it.
3. Collect another sample of seawater from Swan Bay. Test this for oxygen using the same method.
4. Discuss your findings, create a record/worksheet based on the ratings given on the previous page.

Background

As organic material breaks down it uses oxygen and releases nutrients. In an area like Swan Bay, which is very shallow and has a low wave action, this can create problems for animals and plants.

Sea horses need oxygen levels above 90% saturation, as do many of the fish species breeding in Swan Bay.

Organic pollution such as leaf litter, grass clippings, paper, food scraps and animal faeces are often left in the gutters and on the footpaths, washing into our waterways when it rains. These pollutants affect oxygen levels reducing the available oxygen and endangering the seahorses and other marine life.

Mapping & Decisions (Drain Stencilling)

F

Three activities form one small unit of work. (page 52 - 55)

Summary

Students map the location of the side entry pits in their sub-catchment

Learning Outcomes

SOSE 4.1 Geography
5.4 Geography

Aim

To make others aware of stormwater pollution

Materials

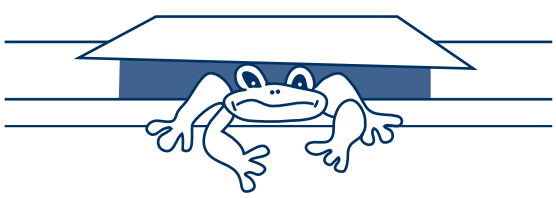
- Map of a sub-catchment near the school (contact Council's Environment Unit for a copy of the map)

Advanced Preparation

This activity should be done with the assistance of a facilitator provided by the City of Greater Geelong.
Contact Councils Environment Unit on
Ph: 5227 0270

Activity

1. Discuss with students what happens when pollutants enter the stormwater system through the side entry pits (SEP).
2. Walk the sub-catchment locating each of the side entry pits. Mark these on the map. If there are a lot of SEP lids you may have to decide which would be the most effective to stencil.
3. Discuss the message that you will be stencilling. Some examples of messages used are:
   - This drains to the Barwon River
   - This drains to Corio Bay
   - This drain is just for rain
   - Rubbish the streets, you rubbish the beach
   - Bin it or Swim in it!
4. From the five options below which animal symbol will you use to accompany the message and why? Discuss why you think these animals have been chosen.



Tell the world!

Summary

Students alert the residents in the area about their activities.

Learning Outcomes

SOSE 4.3 Geography
5.3 Geography

Aim

To inform the public about the drain stencilling and stormwater issues

Materials

- Paper
- Computer

Advanced Preparation

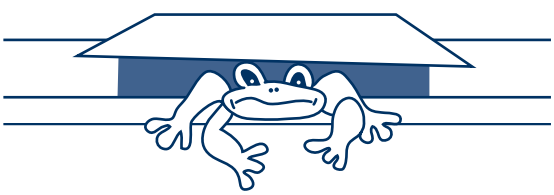
Students should have completed the mapping activity on page 54. Locating the drains to be stencilled.

Activity

1. Students design a flyer to distribute to the residents in the area to inform them about the drain stencilling. Discuss the information that needs to go on the flyer.
2. You should include information about when, where, why, and who.
3. You may also request that the resident might move their cars to allow access to the pit lids.
4. When the flyers have been designed and approved for distribution, the students could deliver these as a class activity. Make sure all students are supervised during this activity.

Extension: EPA Postcards on stormwater pollution are provided with examples of messages.

1. Run a school competition for the best poster highlighting the issues about stormwater pollution.
2. Design a book mark to give as a present with five tips on preventing stormwater pollution.



Take Action!

F

Summary

Students stencil the side entry pit lids with messages aimed at stormwater awareness

Learning Outcomes

SOSE 4.3 Geography
5.4 Geography

Aim

To create an understanding that the gutter is connected to the stormwater system and our waterways, both fresh and marine.
To inform members of the community

Materials

- Stencils
- Stencil Paint
- Background paint
- Brushes
- Witches hats
- Safety Vests
- Masking Tape
- Cloths/Rags
- Rubbish bag

All materials supplied by council

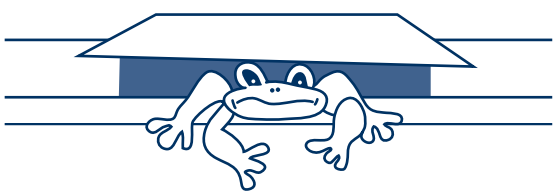
N.B: For schools in the Swan Bay Catchment, the Swan Bay facilitator should be contacted to ensure consistency of drain stencilling throughout the area. See contacts list at front of manual.

Advanced Preparation

This lesson should only be done with the assistance of a facilitator provided by the City of Greater Geelong. Contact Council's Environment Unit on Ph: 5227 0270

Activity

1. The side entry pit lid must be completely dry for paint to adhere effectively.
2. Groups of 3-4 students can work together on one side entry pit lid. A responsible adult should supervise each group. Everyone should be wearing a safety vest.
3. Thoroughly clean the lid with a brush, placing all the rubbish into the rubbish bags you brought.
4. Place four strips of masking tape on the side entry pit lid. The two side strips should be 60cm and the top and bottom should be 70cm. This provides uniformity across the city.
5. Paint this square using the background paint. Allow this background paint to dry. While waiting, students could do a collection of litter that may be in the area.
6. Lay the stencil flat in the centre of the background. While someone holds this firm, apply a small amount of paint to the paint brush. Dab the paint on the surface rather than using brush strokes.
7. Complete this method for each side entry pit lid to be stencilled.
8. When finished clean the brushes in water. Make sure this is in a container and not poured down the drain!

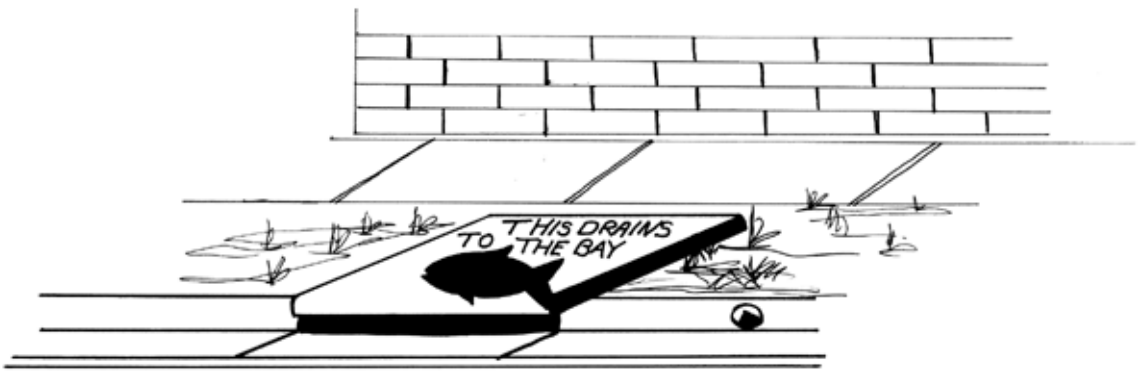


Background

Many people are not aware of the connection between stormwater and pollutants in the rivers and the bay. Often when people see rubbish at the beach or in the river, the response is that people have littered at the beach or at the river. Usually this is not so.

When it rains, rubbish that is in our streets and in the gutter, washes down the side entry pits and flows underground in the stormwater pipes. Anything in the stormwater system, including pollutants drains into our waterways.

Drain stencilling is one way of alerting people to the connection between stormwater and the environment.



Find-a-Word…

A	B	S	O	R	B	S	T	N	E	I	R	T	U	N
S	A	H	C	O	S	D	O	O	L	F	I	S	N	T
H	N	O	E	O	O	R	M	W	T	A	P	E	O	T
O	I	P	A	F	R	O	G	S	A	E	P	D	I	R
V	M	S	N	P	O	I	L	L	T	U	L	I	T	R
E	A	S	T	I	O	N	O	C	I	A	E	M	A	E
L	L	N	N	S	D	R	I	B	B	H	S	E	T	T
L	S	I	A	R	M	M	A	M	A	R	I	N	E	A
S	E	A	G	R	A	S	S	F	H	Y	D	T	G	W
C	A	R	U	Q	U	A	L	I	T	Y	E	R	E	M
R	H	D	T	I	W	E	T	L	A	N	D	N	V	R
E	O	E	T	A	A	N	S	T	N	A	L	P	D	O
E	R	R	E	I	T	V	E	E	A	G	L	A	R	T
K	S	L	R	R	E	V	I	R	L	O	O	H	C	S
I	E	F	P	A	R	T	R	E	T	T	I	L	E	

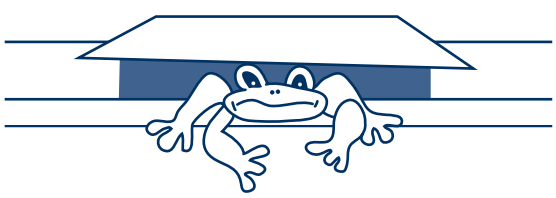
Find the words and complete the message!

Absorb	Litter trap	Hovells Creek	Birds	Ocean
Animals	Drains	River	Nutrients	Corio Bay
Rippleside	Filter	Water	Roof	Gutter
Floods	Quality	Sediment	Plants	Marine
School	Vegetation	Frogs	Shops	Habitat
Seahorse	Algae	Wetland	Seagrass	Stormwater

Message:

_____

_____



Your School Drains to …

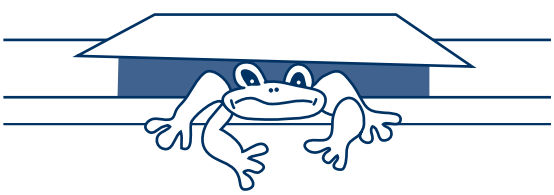
School	Drains To...	Melways Ref.
Ashby P.S	Corio Bay	451 J1
Barwon Heads P.S	Barwon River - Bass Strait	233 C10
Barwon Valley School	Balyang Sanctuary - Barwon River	451 F7
Bell Park North P.S	Cowies Ck - Corio Bay	441 G4
Bellaire P.S	Barwon River	451 C12
Bellarine S.C (Drysdale)	Lake Lorne	238 C12
Bellarine S.C (Ocean Grove)	Lake Victoria - Swan Bay	234 F4
Belmont High School	Barwon River	451 E11
Belmont P.S	Barwon River	451 H10
Catholic Regional College	Corio Bay	401 E6
Ceres P.S	Barwon River	450 A11
Chilwell P.S	Barwon River	401 A8
Christ the King P.S.	Corio Bay	452 K9
Christian College		
Drysdale Campus	Port Phillip Bay	238 G8
Highton Campus	Waurn Ponds Creek - Barwon River	465 B2
Waurn Ponds Campus	Waurn Ponds Creek	464 K3
Clairvaux P.S	Waurn Ponds Creek - Barwon River	465 D2
Clifton Springs P.S	Kewarra Creek - Port Phillip Bay	238 B7
Clonard College	Corio Bay	441 E11
Corio Bay S.C.	Corio Bay	432 A9
Corio P.S	Corio Bay	432 D7
Corio South P.S	Corio Bay	431 K9
Corio West P.S	Corio Bay	431 K7
Covenant College	Cowies Ck - Corio bay	441 C2
Drysdale P. S.	Port Phillip Bay	238 G8
Flinders Peak S.C	Corio Bay	432 C5
Fyans Park P.S	Barwon River	451 D5
Geelong College	Corio Bay	451 G5
Geelong East P.S	Barwon River	452 G11
Geelong Grammar	Corio Bay	432 K6

Your School Drains to …

School	Drains To...	Melways Ref.
Geelong High School	Corio Bay	402 P7
Geelong North S.C	Cowies Ck - Corio Bay	441 H5
Geelong South P.S	Barwon River	401 G9
Grovedale P.S	Waurn Ponds Ck - Barwon River	465 K5
Grovedale S.C	Waurn Ponds Ck - Barwon River	465 E9
Grovedale West P.S	Waurn Ponds Ck - Barwon River	465 E8
Hamlyn Banks P.S	Corio Bay	441 E7
Herne Hill P.S	Corio Bay	441 F10
Highton P.S	Barwon River	451 C10
Holy Family P.S	Corio Bay	441 G6
Kardinia International Coll	Corio Bay	441 E5
Lara Lake P.S	Hovells Ck - Corio Bay	422 K8
Lara P.S	Hovells Ck - Corio Bay	423 D4
Leopold P.S	Corio Bay	468 E2
Mandama P.S	Waurn Ponds Creek - Barwon River	465 E6
Manifold Heights	Corio Bay	441 F12
Matthew Flinders S.C	Corio Bay	401 D5
Montpellier P.S	Barwon River	451 B9
Moolap P.S	Corio Bay	453 G10
Nazareth P.S	Waurn Ponds Ck - Barwon River	465 E7
Nelson Park School	Corio Bay	441 G6
Newcomb Park P.S	Corio Bay	452 K8
Newcomb S.C	Corio Bay	452 K10
Newtown P.S	Corio Bay	451 G3
Norlane S.C	Cowies Ck - Corio bay	431 H10
Norlane West P.S	Cowies Ck - Corio Bay	431 H12
North Shore P.S	Corio Bay	432 C12
Oberon High School	Waurn Ponds Creek - Barwon River	465 G2
Oberon P.S	Waurn Ponds Creek - Barwon River	451 H12
Oberon South P.S	Waurn Ponds Creek - Barwon River	465 G3

Your School Drains to …

School	Drains To...	Melways Ref.
Ocean Grove P.S	Blue Waters Lake - Barwon River	234 B5
Our Lady's P.S	Corio Bay	441 E12
Our Lady Star of the Sea	Lake Victoria - Swan Bay	234 F4
Oxford Christian P.S	Barwon River	452 H11
Portarlington P.S	Port Phillip Bay	239 G3
Rollins P.S	Corio Bay	441 E3
Rosewall P.S	Corio Bay	432 E5
Roslyn P.S	Barwon River	451 E11
Sacred Heart College	Barwon River	451 G4
St. Anthony Catholic	P.S, LaraHovells Creek	422 J3
St Francis Xavier P.S	Corio bay	432 A7
St Johns Lutheran	Corio Bay	401 B4
St Josephs S.C	Barwon River	451 E4
St Leonards P.S.	Port Phillip Bay	241 J6
St Margarets P.S	Barwon River	452 E8
St Mary's P.S	Corio Bay	401 J7
St Patricks P.S	Corio Bay	441 J12
St Robert's P.S	Barwon River	451 H6
St Thomas Aquinas P.S	Corio Bay	432 B12
Surfside P.S	Lake Victoria - Swan Bay	234 F4
Tate St P.S	Barwon Rive	r452 F8
Wallington P.S	Lake Connewarre - Barwon River	
Western Heights S.C		
Barton Campus	Cowies Ck - Corio Bay	441 F4
Quamby Campus	Corio Bay	441 F9
Minerva Campus	Corio Bay	441 E11
Whittington P.S	Barwon River	452 K12



Contact / Reference List

Environmental Organisations

City of Greater Geelong
Environment Unit
P.O. 103, Geelong
Ph: 5227 0270
Website: www.geelongcity.vic.gov.au

Barwon Water
P.O. Box 659, Geelong
Ph: 1300 656 007
Website: www.barwonwater.vic.gov.au

Corangamite Catchment Management Authority
64 Dennis Street, Colac
Ph: 5232 9100
Website: www.ccma.vic.gov.au

Corangamite Waterwatch Program
Barwon Water, Lonsdale Street, Geelong.
Ph: 5226 9268
Website: www.barwonwater.vic.gov.au

Department of Natural Resources & Environment
State Govt. Offices, Little Malop St, Geelong
Ph: 136 186
Website: www.nre.vic.gov.au

Environment Protection Authority
State Govt. Offices, Little Malop St, Geelong
Ph: 5226 4825
Website: www.epa.vic.gov.au

Bird Observers Club of Australia
P.O. Box 185, Nunawading, Vic.
Ph: 9877 5342
Website: www.birdobservers.org.au

Birds Australia
415 Riversdale Road, East Hawthorn, Vic.
Ph: 9882 2622
Website: www.birdsaustralia.com.au

Gould League of Victoria
Genoa Street, Moorabbin, Vic
Ph: 9532 0909
Website: www.gould.edu.au

Marine & Freshwater Research Institute
P.O. Box 114 Queenscliff, Vic
Ph: 5258 3344
Website: www.nre.vic.gov.au/mafri/discovery

Waterwatch Victoria
Dept. Natural Resources & Environment
1/250 Victoria Pde, East Melbourne
Ph: 9412 4072
Website: www.vic.waterwatch.org.au

Amphibian Research Centre
P.O. Box 959, Merlynston, Vic
Ph: 9354 4718
Website: www.frogs.org.au

Barwon Region Waste Management Group
(Barwon Waste Education Centre)
103 Roseneath Street, Nth. Geelong
Ph: 5277 9656