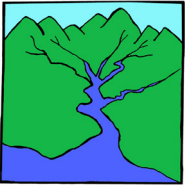


Catchments

teacher information pack



Catchments



What is a Catchment?

A catchment is an area of land that collects water. The water drains to the lowest point via rivers, creeks, lakes, groundwater, and wetlands. In urban catchments, gutters, drains and channels direct this water to rivers and the sea. We all live in a catchment.

Use a catchment map to identify your catchment area.

- Locate your suburb and identify features such as rivers, creeks, main roads, wetlands, the coastline and pollution control devices (litter traps).
- Use the map and a piece of string to calculate the length of a river or creek in your catchment area.

Consider the impact of urban development on the flow of water through a catchment.

With urban development there is an increase in water run-off from buildings, roads, paths and car parks. These sealed surfaces prevent rainwater from infiltrating the soil, which may lead to flooding. Drains, underground pipes and concrete channels are used to change natural water flows and reduce flood risks.

- Discuss the **Catchment change** images in terms of ecological sustainability.
- Use the **Water absorption and run-off** images to compare rural and urban catchments.

Run-off = rainwater flowing across surfaces

Run-off in rural and urban areas	
Native Woodland	0-2% run-off
Rural Development	40% run-off
Rural Towns	70% run-off
Urban Areas	95% runoff

Where does all this water go?

Stormwater run-off is transported, via the stormwater system, to the nearest waterway.

- Take a walk in your local area, or use the **Stormwater Series** photographs, to identify features of the stormwater system such as gutters, pipes, side-entry pits, drains and channels.
- Contact local councils for stormwater system diagrams and stormwater management information.
- Arrange the **Stormwater Series** photos in order, then create a diagram, storyboard or model to illustrate the flow of water through the catchment.

STORMWATER = RAIN WATER + POLLUTION

Related Topic

THE WATER CYCLE:

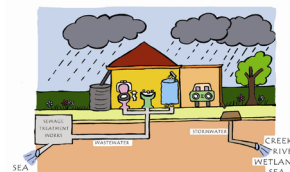
The movement of water from the atmosphere to the earth and back again.

Key concepts: precipitation, run-off, storage, evaporation, infiltration and transpiration.

Stormwater or wastewater?

Stormwater and wastewater have different sources and are transported through different pipes. Unlike wastewater, stormwater is NOT treated before it enters our waterways.

- Use the **Stormwater/Wastewater** picture to explain the difference between stormwater and wastewater:
- You may like to investigate wastewater treatment plants as an extension activity. Contact SA Water or United Water for more information.



Wastewater is also called sewage

Stormwater pollution

Stormwater pollution is a major concern in urban areas. Local councils have Stormwater Pollution Prevention Officers who work with business and industry to minimise stormwater pollution. Contact your local council to find out more.

- Brainstorm a range of land uses in the local catchment area, then make a list of possible pollution problems associated with each. (eg. Roads - oil, Farms - fertilisers, Shops - litter)
- Make a list of different pollutants that could be carried along in the stormwater system. Consider rooftops, footpaths, roads and channels. Use the **Stormwater series** photos as a starting point.
- What can be done to reduce stormwater pollution in the school yard and surrounding streets? How can we educate the community? Most schools and surrounding streets have litter problems! (Clean Up Australia survey 2003)
- Consider the problems created by stormwater pollution when it enters rivers, creeks and the sea. Think about the impacts on birds, bugs, fish, frogs, plants and people. For more information see the **Pollution impacts** fact sheets.



Pollution Canister Activity

In this activity students will be looking at different stormwater pollutants that end up in our waterways. They are asked to describe human activities that create pollution problems and to generate pollution solutions.

- Prepare pollution canisters. (instructions below)
- Organise students into small groups and give each group a pollution canister. Ask students to look at the material in their canister and work as a group to answer the following questions. Students record their answers and report back to the class.
- WHAT type of pollution is in the canister?
- HOW does it end up in our waterways? (human behaviours that lead to this pollution entering the stormwater system.)
- WHAT problems could this pollution cause in our waterways? (impacts on plants/wildlife, flooding, stagnation)
- HOW can we stop this from happening? Generate pollution solutions.
- Explore the values and attitudes associated with littering.

Extension: Display the pollution canisters for a month and observe any changes (ie. settling, decomposition and colour change). Test the water quality in each pollution canister.

Pollution Canisters

You will need:

- Seven sealable storage containers (large glass jars will do the job).
- Water to fill the containers.
- Pollution
 - ⊙ grass clippings
 - ⊙ leaves
 - ⊙ soil
 - ⊙ detergent
 - ⊙ brown playdough (for dog poo)
 - ⊙ litter (chip packets, food wrappers, bottle tops etc)
 - ⊙ cooking oil and soy sauce (for car oil).



How to:

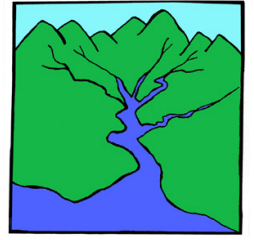
- Three quarter fill each container with water
- Add a different pollutant to each container
- Seal the containers. Tape the lids if necessary.



NOTE: The water in some of these canisters becomes a bit smelly after a few weeks so ensure that they don't leak.

Catchments worksheet

What is a catchment?



Which catchment is your school in?

Which catchment area do you live in?



Why do you think catchment areas are named after rivers and creeks?

List some of the land uses in your catchment

Describe five differences between stormwater and wastewater.

Illustrate and explain the flow of stormwater in an urban catchment.

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Create a poster, pamphlet or powerpoint display that could be used to teach others about stormwater pollution problems and solutions.

What can we do about water pollution? Choose two types of water pollution. Draw the cause and a solution for each.

Cause	Solution

Cause	Solution

Stormwater series



down pipe



roadside gutter



stormwater outlet



stormwater pollution

Stormwater series



Side entry pit



litter trap (trash rack)



roof gutter



drainage channel

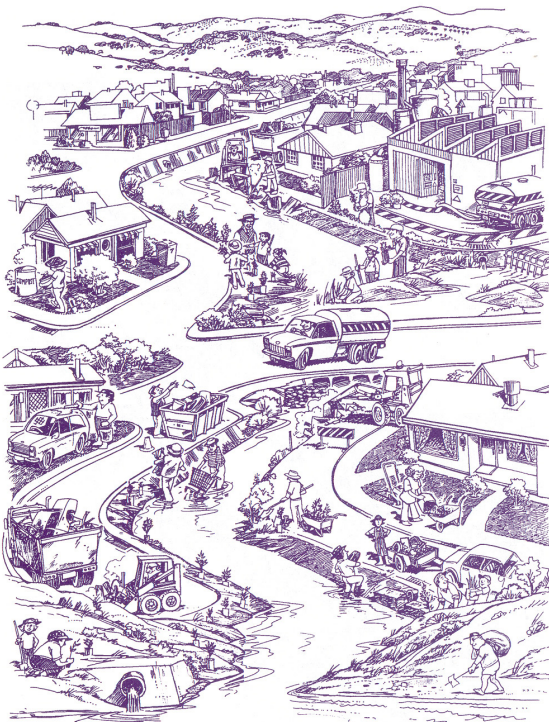
Catchment change



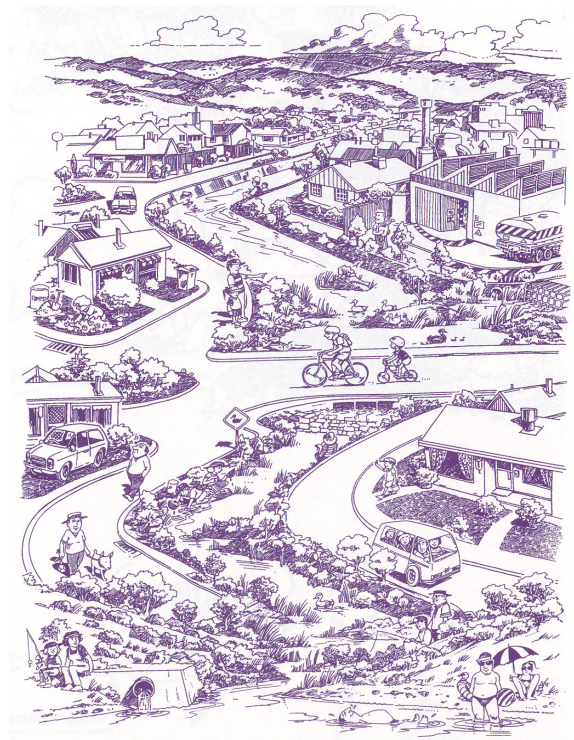
How it was



How it is



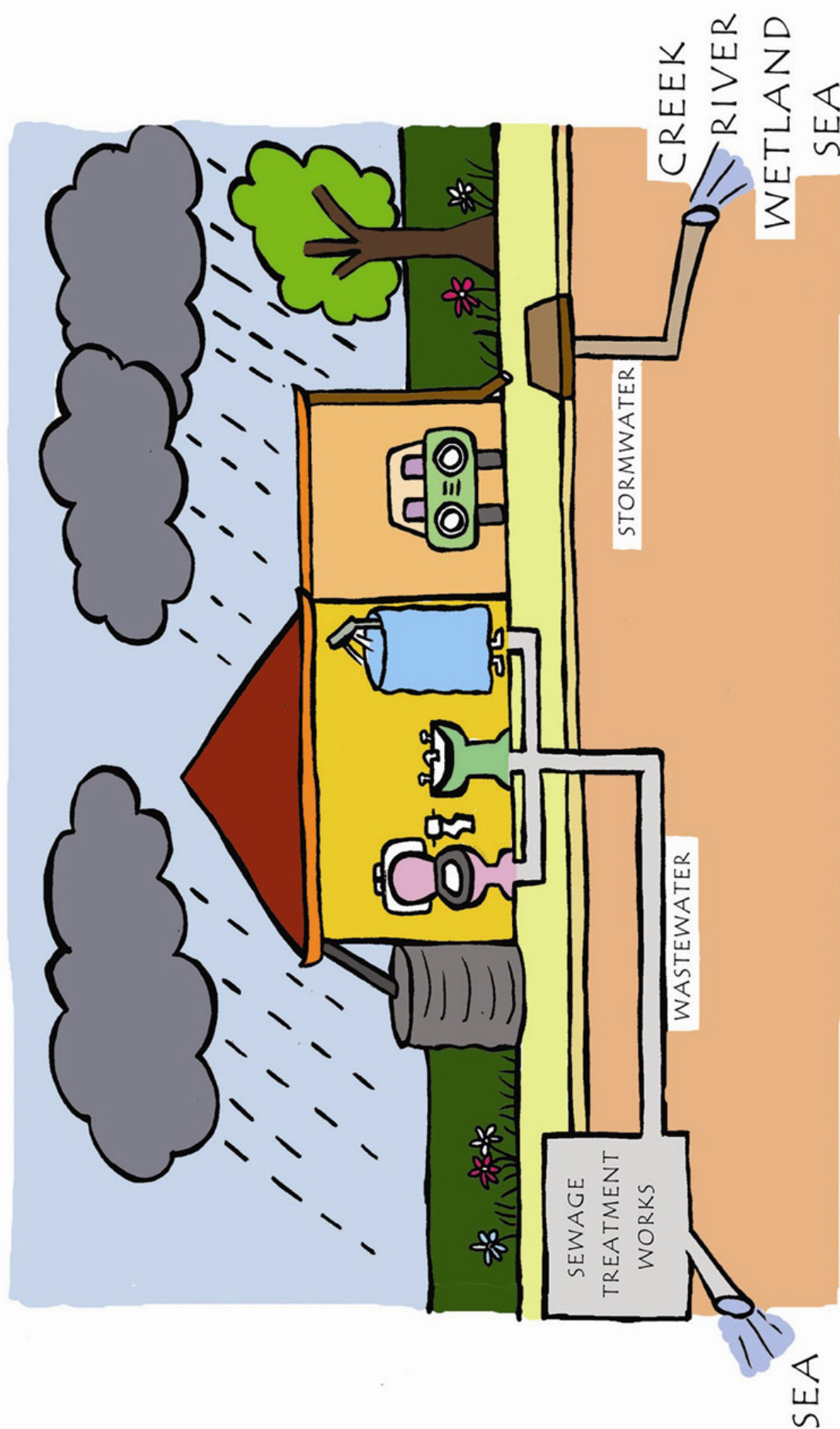
What we can do



The future

Illustrations by George Aldridge from Watercare: a curriculum resource for schools - Years 6-10, DENR, 1996

Stormwater/Wastewater



Pollution impacts: Detergent

What is it?

Detergents are cleaning compounds with four major chemical ingredients - builders, surfactants, functional additives and other additives:

- *Builders* remove the hardness of wash water by increasing the pH (optimum detergent pH is 10). A common one is sodium tripolyphosphate, a type of **phosphate** (see plant section below).
- *Surfactants* lower surface tension allowing bubbles to form, and making grease and oil mix better with water.
- *Functional additives* include substances that allow the builder to perform other cleaning functions; substances that prevent dirt resticking; bleaches.
- *Other additives* include brighteners and perfumes.



How does it reach our waterways?

- People washing their vehicles and other items on roads and driveways
- Spray from windscreen wipers.
- Septic tank overflows into the stormwater system, waterways or groundwater.
- Some of the ingredients in detergents, particularly phosphates, can also reach our waterways if wastewater is not treated adequately.

Which things around your house are detergents?

- ⊙ Wool wash
- ⊙ Car wash
- ⊙ Dishwashing liquids
- ⊙ Laundry washing powder
- ⊙ Laundry liquid

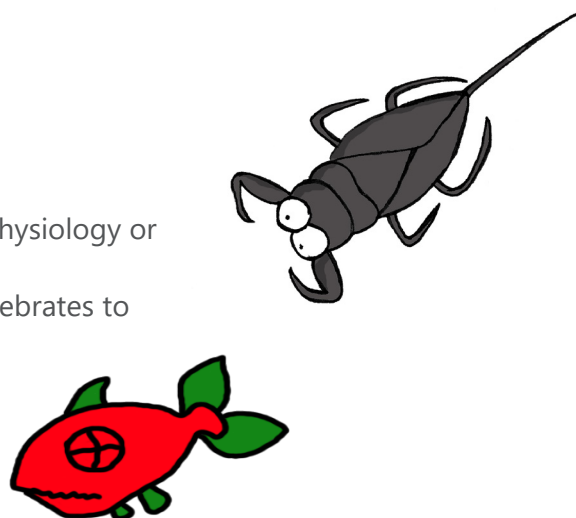
About 30% of the phosphorus in household wastewater is from detergents.

The rest is mostly from human and food wastes.

How does detergent affect animals?

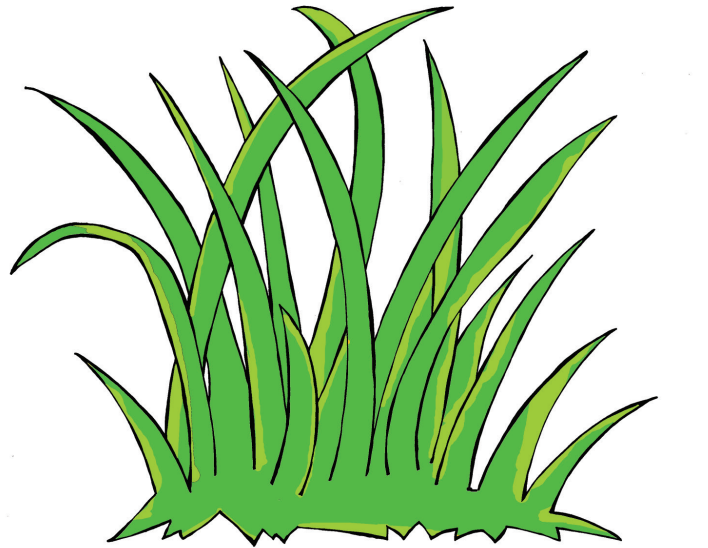
Detergent in waterways can:

- kill some aquatic invertebrates
- cover the skin and suffocate adult frogs
- influence the hormones of fish and frogs; changing their physiology or behaviour
- lower the surface tension that enables some aquatic invertebrates to 'skate' on or hang from the surface of the water, causing them to sink and drown
- cause irritation to eyes, skin and mucous membranes.



Are plants affected?

Yes! Phosphate, an ingredient in some detergents, contains phosphorus which is a nutrient that helps plants and algae to grow. This may be a good or bad thing. If detergent is washed via the stormwater system into waterways, or poorly treated wastewater is piped into rivers or the ocean, high levels of phosphate can cause nuisance plant growth and algal blooms. However, treated wastewater is a very valuable resource because this nutrient-rich water can be re-directed to water ovals, wood lots, vineyards and crops.

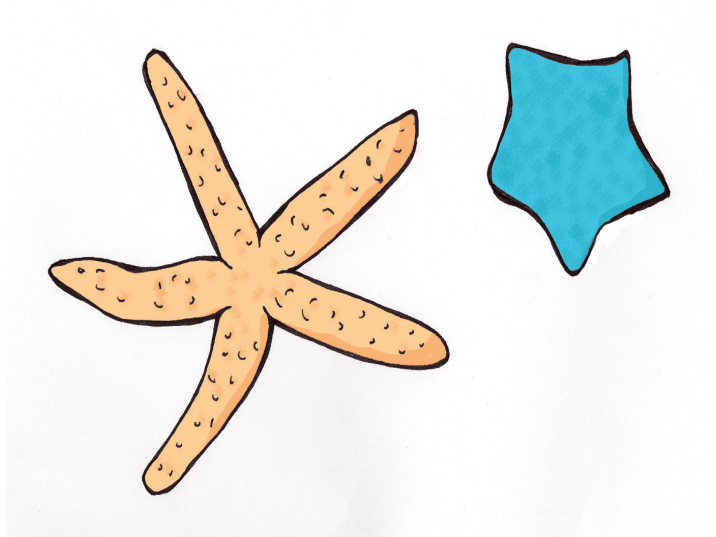


What about people?

Apart from being responsible for detergents entering our waterways, people are also affected by them. In lakes, rivers and the ocean, foam from detergents can be unsightly. Detergent chemicals can irritate the eyes and skin of swimmers, and some algal blooms which grow because of high phosphate levels can make people sick if they have contact with the water.

DON'T wash your car on the road or driveway

DO buy and use phosphate-free detergents.



Did you know?

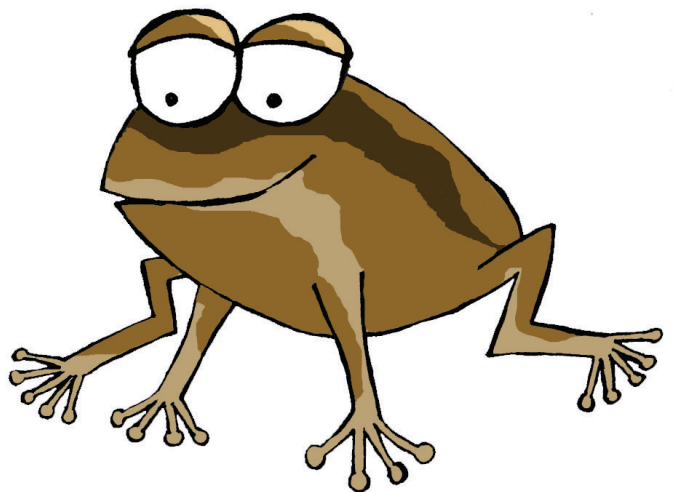
Some frogs produce a surfactant that allows them to create foam nests for their eggs. These foam 'bubbles' are very stable and don't burst, even in tropical weather, for several days.

The foam you sometimes see on a beach is not usually pollution - it's natural! When seaweed dies, natural surfactants are released which allow air bubbles to last much longer than usual before they burst. Waves and the wind whip this into a foam which can last for more than a day.

An experiment to try!

A fun surface tension experiment from Fizzics Education.

<https://www.fizzicseducation.com.au/150-science-experiments/force-movement-experiments/soap-powered-boat/>



Pollution impacts: Oil

What is it?

Mineral oil is a substance found trapped between sheets of rock, which formed millions of years ago from the deposition of dead plants, animals and tiny organisms.

This crude oil can be refined into a number of products such as petrol, diesel, kerosene, lubricating oils and asphalt.

The oil that reaches our freshwater environments is usually lubricating oil or a fuel oil such as petrol or diesel.



How does it reach our waterways?

- It is washed from the surface of roads, driveways, petrol stations and transport depots.
- Sometimes people deliberately dump used oil into gutters, drains or waterways.
- In the marine environment, spills from ships often involve crude oil, in large quantities.

Oil spills happen more often in freshwater than in the ocean (and cause more damage) but are less publicised!

How does oil affect animals?

Spills of sticky oils such as crude oil can:

- destroy the insulation and waterproofing properties of feathers and fur
- make it hard for birds to fly, making them vulnerable to attack, or drowning them
- attract some fish which think it is floating food
- give ulcers or stomach bleeds to wildlife that eat it by accident
- disguise the scents that mothers and young use to recognise each other, leading to abandonment and starvation of young
- enter animal burrows.



Refined oil products such as diesel and petrol are not sticky but are much more poisonous than crude oil. In the environment, or when eaten, these oil types can:

- poison wildlife
- injure wildlife by damaging their airways, lungs, eyes, skin, mouth and nose and internal organs
- interfere with breeding by making the animal ill or affecting their behaviour
- make animals more susceptible to bacterial and fungal infections
- damage fish eggs
- kill plants which provide food, shelter and nesting places for animals.



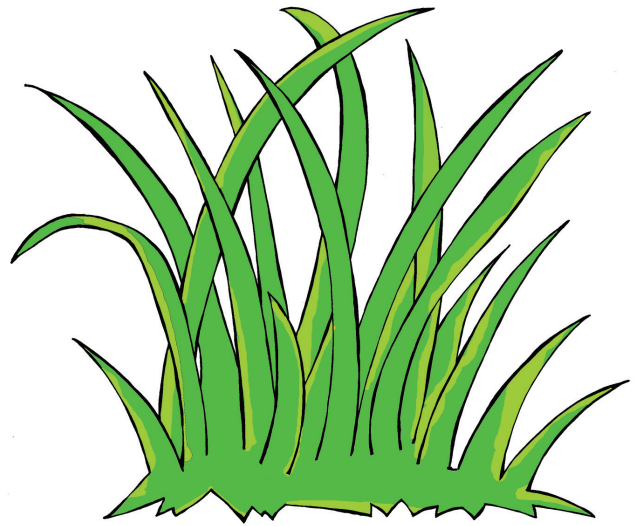
Are plants affected?

In coastal areas oil can:

- damage habitats such as seagrasses, mangroves and estuaries which are breeding grounds for many fish and crustaceans.
- coat the pneumatophores of mangroves or affect their salt balance, killing them
- coat the roots and lower portions of saltmarsh plants, poisoning them
- stay in the sediment for a long time, preventing the colonisation of mangrove seedlings.

In freshwater environments, oil can:

- become trapped in sediment at the bottom of lakes and wetlands, poisoning plant roots
- coat and kill the plants and algae growing in and along the edge of waterways.



What about people?

Aside from causing oil spills, people are also affected by them.

In coastal areas oil can disrupt swimming, boating, diving, affect fishing and decrease the tourist trade.

In freshwater, oil can pollute drinking water supplies, disrupt recreation activities, look unsightly and taint fish.

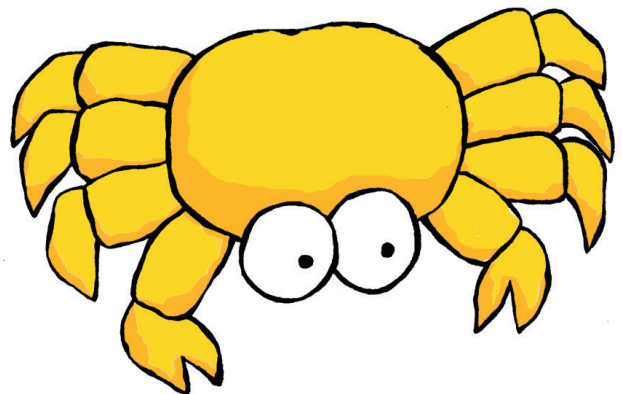


More information

The Australian Maritime Safety Authority website has an excellent education section with:

- classroom projects such as an oil spill clean up and bioremediation exercise
- details of major oil spills in Australia
- responses to oil and chemical spills
- the effects of oil spills on different groups of marine wildlife
- garbage pollution from vessels
- legislation and regulations.

<https://www.amsa.gov.au/audiences/teacher-or-student>



Pollution impacts: Animal Poo

What is it?

Animal poo is made up of food that has been partly digested, fats, dead cells and bacteria. In domestic animals it can also contain chemicals from medicines such as worm and flea tablets.

We all know where poo actually comes from, but when we look at the effects on waterways we need to look at terrestrial animals and birds as well as aquatic animals for the source.

How does it reach our waterways?

- Pet owners leaving animal droppings on foot paths, gardens and parks where it can be washed into stormwater drains or waterways.
- Ducks and other waterbirds pooing in ponds, wetlands and creeks.
- Animals such as sheep and cattle pooing while walking in creeks and along rivers.
- Hosing down areas where animals gather, such as sheds, pens and cages, and allowing that water to reach a waterway.
- Being washed over land by rain, particularly in heavily grazed areas.



Four million dogs Australia-wide each produce up to half a kilogram of poo a day!

In most council areas, leaving your dog's poo behind when you go for a walk is considered littering and there is a fine for not picking it up. The average fine is \$100 - that's a very expensive walk!

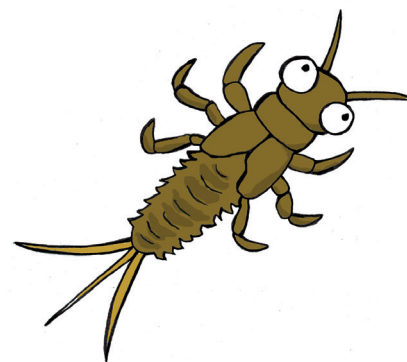
How does animal poo affect animals?

In water, animal poo can:

- break up into smaller pieces and interfere with the way some aquatic animals feed or breathe
- kill other animals if it contains medicines designed to kill fleas or worms
- change the colour of the water or make it murky, making it hard for some animals to find food or see where they are going.

However, animal poo is also a food for some aquatic invertebrates as it contains many nutrients.

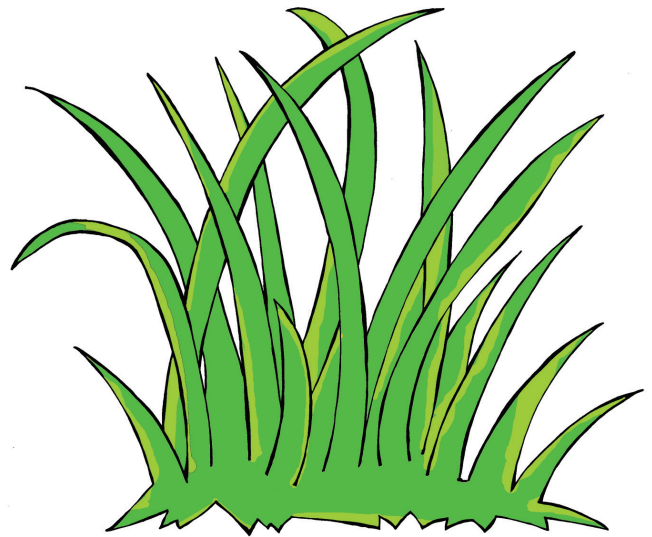
Scavengers such as yabbies, worms and some insect larvae will eat bits of animal poo, along with other organic material, that settles to the bottom or drifts past.



Are plants affected?

Yes, and these effects can be good or bad:

- ✗ When animal poo mixes with water it usually breaks up. This can make the water murky, which can block sunlight for plants growing underwater, or increase the water temperature because the particles will absorb heat.
- ✗ If there is a lot of undigested food the bacteria breaking this material down will use up dissolved oxygen in the water. When oxygen levels become too low, aquatic plants may become stressed or die.
- ✓ Animal poo also contains nutrients such as phosphate and nitrate, which will help aquatic plants and algae to grow.
- ✗ High levels of nutrients can cause nuisance growth of algae which can change the colour of the water, smell and use up dissolved oxygen as it rots. Some types can even make animals sick.



What about people?

People are responsible for some of the animal poo that reaches our waterways, and are also affected by it because it smells, people don't like swimming in it and it may contain bacteria or other organisms, such as roundworm, which can make people sick.

What can I do about the poo?

In urban areas, dog poo is probably the most common type of animal poo you're likely to see.

You can be a responsible dog owner by:

- Always remembering to take a plastic bag or pooper scooper with you when you go for walks
- Taking it home or making sure you put it in a bin
- Not thinking your little 'bit' won't be a problem.

More information

A fun music video from Hornsby Shire Council encouraging dog owners to scoop up dog poo:

<https://youtu.be/klfocCxHYcs>



Pollution impacts: Organic Material

What is it?

Any part of a once living organism is considered organic material. This may be decomposing plant or animal matter, and waste from humans, animals, rotting food or agricultural waste.

This fact sheet will define organic material as algae and any part of a plant such as leaves, flowers, bark, twigs, branches, stems and fruit.

How does it reach our waterways?

- Falling or blowing in from plants in streets, gardens or stream-side.
- Grass clippings falling into the gutter.
- Deliberately dumping leaves or grass clippings.
- Grass clippings and leaves running off of ovals and parks into gutters or waterways.



Council street sweepers are out on our roads everyday of the week, sweeping up organic material such as leaves so that they don't block stormwater drains or end up in local waterways.

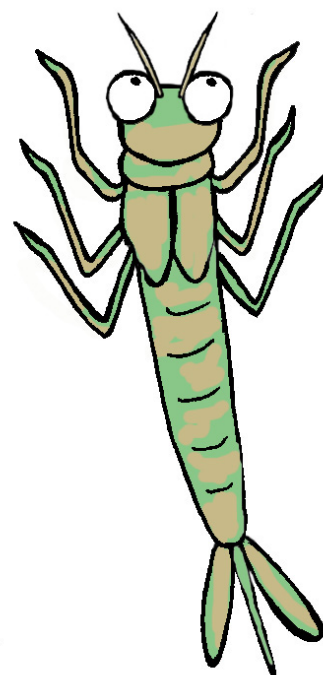
How does organic material affect animals?

Organic material in waterways can:

- settle and smother animals living on the bottom
- use up the dissolved oxygen in the water when it rots
- make the water murky as it breaks down, making it hard for animals to see where they are going, find food or see predators
- sometimes contain chemicals such as pesticides and herbicides which can poison invertebrates; or contain naturally toxic chemicals from garden plants
- tiny pieces of organic material can interfere with the way some animals feed or breathe.

However, in a well balanced system, organic material:

- is a food for many invertebrates
- creates shelter from predators, fast flowing water and floods
- provides places to lay eggs
- provides a surface for microscopic algae, bacteria and other organisms to grow on, which are great food for animals like snails to scrape off.



Are plants affected?

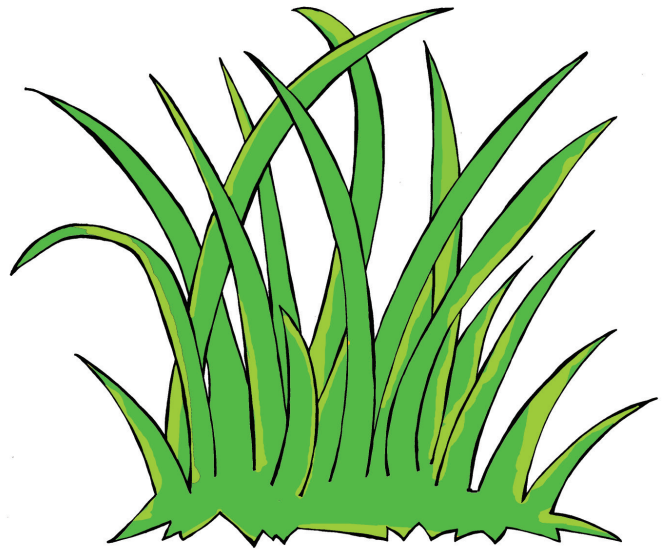
Aquatic plants are affected by organic material in similar ways to aquatic animals.

Organic material can:

- float and block the sun for plants and algae living below
- sink and smother plants on the bottom
- make the water murky when it rots, which will block sunlight
- use up the dissolved oxygen in the water when it rots.

Organic material also contains nutrients which plants and algae can use to grow. That's why compost is so good for plants!

However, too many nutrients in a waterway can cause nuisance plant growth and algal blooms, which can lead to problems.

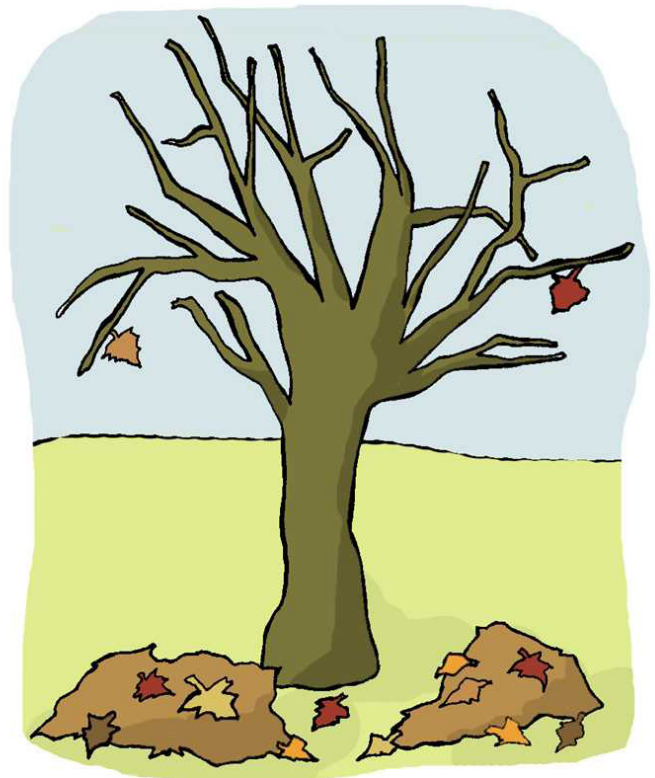


What about people?

No one likes murky, smelly water in their local creek or river, or flooding from a blocked street drain.

So what can you do to help?

- Make sure you sweep up the grass clippings and leaves from the street gutter next to your house.
- Never dump organic material in a stormwater drain or waterway.
- Choose your garden plants carefully, particularly if they will grow out over the road or a creek.
- Choose plants that are native to your area, or position non-natives where you can rake up the organic material they produce.
- Compost organic material from your garden so that you can re-use the nutrients.
- Always cover your trailer when you are taking garden clippings to the dump so they don't blow away.



Water absorption and run-off as we change our land-use

1. As it once was.....Native Woodland



Image by Janet Pedler

Tree canopy with diverse understorey of shrubs, herbs & grasses, covering of leaf litter and no hoofed animals. Special riparian plants line the creek zone.

Impermeable surfaces

Almost none

- rocks and stones.

Run-off leaving catchment 0-2%



Permeable surfaces ☺☺☺

Ground covered & protected by native plants

- slows water
- protects soils
- aids absorption of rain, soaks in or never reaches ground.

What could the water take downstream with it?

Almost nothing!

- soils well protected
- no erosion
- no pollution in catchment.

Water absorption and run-off as we change our land-use

2. When we began to farm it.....Rural Development



Image by Janet Pedler

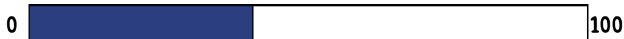
Much of the scrub is cleared and hoofed animals graze heavily, including along the creekline. The land is dotted with vineyards and a dirt road has been made.

Impermeable surfaces 🐾

Land Management has created many places water will run-off:

- grazed paddocks with little cover packed hard by animal hoofs
- packed hard, dirt road.

Run-off leaving catchment 40%



Permeable surfaces 🌿

Ground still protected by:

- pasture grasses & vines
- remnant woodland.

What could the water take downstream with it?

- Products of farming activities
- animal faeces & urine
- soil from hills & creek
- pesticides & fertilisers
- leaves from introduced, deciduous plants.

Water absorption and run-off as we change our land-use

3. As we moved to the country.....Rural Living

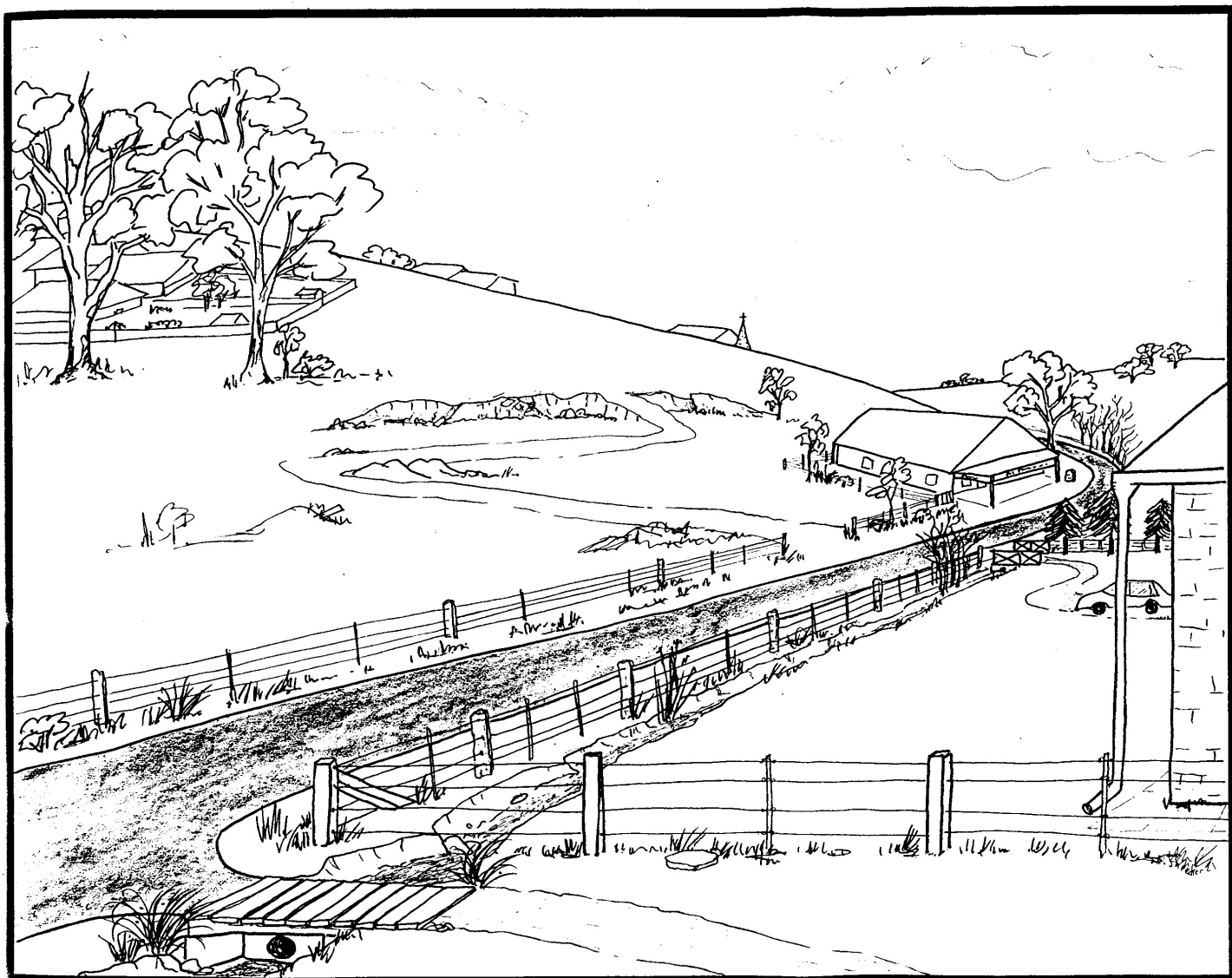


Image by Janet Pedler

Small blocks are sold, houses and hobby farms are built. A bitumen road has been made, water is piped under bridges, roadside scrub disappears.

Permeable surfaces 🍃

Grassed ground and plants that will slow or absorb water are becoming more scarce.

Impermeable surfaces 🏠🚗

Keeping rain on the land to grow plants is no longer a priority; water runs straight off:

- house roofs
- bitumen road
- bare ground

Run-off leaving catchment 70%



What could the water take downstream with it?

Products of rural living:

- human & animal sewage
- soil from hills & creek
- pesticides & fertilisers
- leaves from introduced, deciduous plants
- oils & greases from roads.

Water absorption and run-off as we change our land-use

4. Now we are settled.....Urban Living

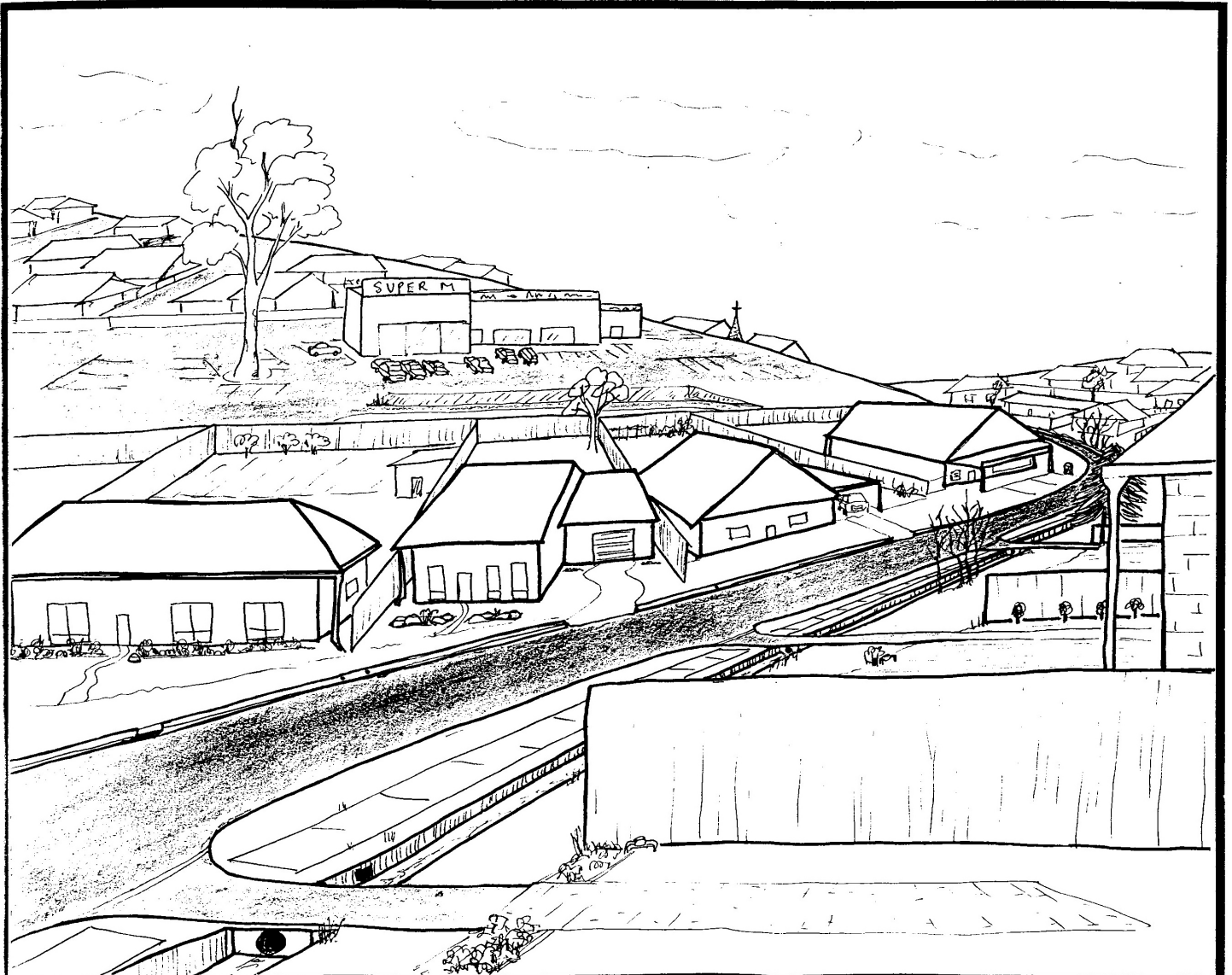


Image by Janet Pedler

Houses dominate, many more people live on the same area and it is sewered. The rain falls on built surfaces and a stormwater system pipes it into the cemented creekline.

Impermeable surfaces 🐾🐾🐾

Stormwater must be removed quickly to prevent flooding. It runs off:

- houses & buildings
- bitumen roads & carparks
- paving & cement paths
- cement gutters & drains.

Permeable surfaces

Tiny areas of garden.

What could the water take downstream with it?

Products of urban living

- dog & cat faeces
- pesticides & fertilisers
- leaves from introduced, deciduous plants
- oils, greases & detergents
- litter.

Run-off leaving catchment 95%

