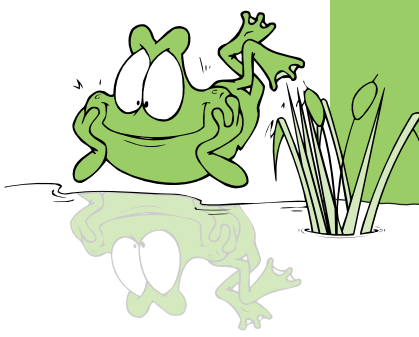
Science - Contents



Runoff Rates

I

FOCUS

- How does water interact with various surfaces?

OBJECTIVES

- Identify pervious and impervious surfaces in your school
- Understand impacts on the rate and volume of runoff

CSF II LINKS

SCIENCE
- 4.1 / 4.2 Physical Science
- 4.1 Chemical Science

SOSE
- 4.1 Geography

BACKGROUND

Water responds in different ways when applied to surfaces in urban environments. Different surface types have varying degrees of 'permeability' (ability to soak up water). A 'pervious' surface allows water to infiltrate and be absorbed (soak in). An 'impervious' surface does not allow liquid to penetrate. Impervious surfaces generate the most urban stormwater runoff.

NOTES

The results of this activity can be used to extend the SOSE activity *'Scrutinise the Schoolyard'* and aid in evaluation of the school's impact on local stormwater issues.

LEARNING TASKS

1/ Brainstorm the variety of surfaces that exist in school that rain would fall on such as grass, compacted / loose soil, leaf litter / mulch / ground covers, ashphalt / concrete / bricks, gravel / sand & iron.

2/ Estimate the area of each surface in relation to the total schoolyard area. Estimate a fraction or percentage value.

3/ Discuss why each surface type has been used.

4/ Introduce and define the terms 'pervious' and 'impervious'.

5/ Venture outside and predict the way water will behave on each surface and why. Students then follow the instructions provided on the worksheet.

6/ Evaluate findings and discuss.
- Predict how runoff might be altered if surfaces are already very wet
- Estimate the percentage of water leaving the school, compare to the estimates in the Maths activity *'The Size Of The Problem'*

7/ Add details about surface types to the school map and discuss:
- How is our school impacting on stormwater?
- Could we make better use of the rain?
- Could alternative surfaces be considered?

MATERIALS

- ***'Runoff Rates'*** **Student Worksheet**
- **Clipboard**
- **Watering cans**
- **Water**
- **School maps**
- **Pencil**

EXTENSION

Code each surface type on the map or construct an overlay to indicate pervious and impervious surfaces within the school. Publish findings in the next school newsletter.

ASSESSMENT

Did students understand the relationship between surface types, runoff & the impact on stormwater?

Runoff Rates - Student Worksheet

Name:

MATERIALS

- **Worksheet**
- **Clipboard and pencil**
- **Watering can and water**

AIM: Find out which areas in your school are good at soaking up (absorbing) water and which areas create urban stormwater runoff.

INSTRUCTIONS:

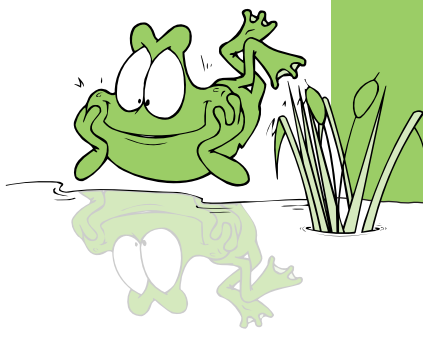
1 Explore your school grounds to locate as many different types of surfaces as you can.
2 At each surface, complete the WHAT, WHERE and HOW details in the table below.
3 Sprinkle water over each surface and watch what happens.
Use the 'Look for' column on the right to help with observations.
4 Record your OBSERVATIONS.

WHAT is the surface?	WHERE is it?	HOW is it used?	OBSERVATIONS	LOOK FOR
				Surface details • Dry • Wet • Flat • Sloped • Clean • Dirty **Runoff amount** • All of water • Little water **Speed of runoff** • Very quick • Slow **Soaking speed** • Very quick • Slow **Runoff quality** • Very clean • Polluted **Pollutant types:** • Litter • Soil • Vegetation

5 Finish the following sentences

a These surfaces are good at absorbing (soaking up) water

b These surfaces produce a lot of stormwater runoff



Runaway Rain

I

FOCUS

- What happens to the rain that falls on our school?
- How has the natural water flow altered over time?

OBJECTIVES

- Understand the features of the schoolyard affecting stormwater runoff
- Be aware of the school grounds as a stormwater source

CSF II LINKS

SCIENCE
4.1 / 4.2 Physical
SOSE
4.1 / 4.2 / 4.3 Geography

BACKGROUND

Urbanisation has influenced natural water flow patterns considerably. Urban areas, with impervious surfaces, drains, gutters and pipes, generate high levels of runoff. This runoff is collected quickly and enters waterways downstream via the stormwater system.

NOTES

The results of this activity can be used to extend the SOSE activity *'Scrutinise the Schoolyard'* and aid in developing an evaluation of the school's role in local stormwater issues.

LEARNING TASKS

1/ Discuss what the land might have looked like before the school existed:
- Landform - flat, undulating or sloped
- Vegetation - type, distribution, abundance
- Drainage - discharge points

2/ Students predict what happened to rain on the site in 1788:
- Where would it have soaked in / run off?
- Direction of flow
- Where would it go after leaving the site?

3/ Discuss the changes that have occurred throughout history:
- What new features have been added?
- How have surfaces changed?

4/ Tour the school grounds. Allocate one feature from the Student Worksheet for each student pair to focus on.

5/ Return to class and compile results of each pair. Use the class results to update the *'Scrutinise The Schoolyard'* school maps.

MATERIALS

- **Photocopies of school map see SOSE activity *'Scrutinise the Schoolyard'***
- **Overlays for marking additions to the map**
- ***'Runaway Rain'* Student Worksheet** - to be used as a class prompt copied for each student

EXTENSION

Investigate the path of water after leaving the school (could be part of the field trip). Where does the water, and pollution, end up? Discuss with students ways the school could make better use of stormwater.

ASSESSMENT

Could the students predict and demonstrate the likely path of stormwater? Did students comprehend the impact of slope, surfaces, spouting and drains on the direction of runoff flow?

Runaway Rain - Student Worksheet

Name: **Group No:**

MATERIALS

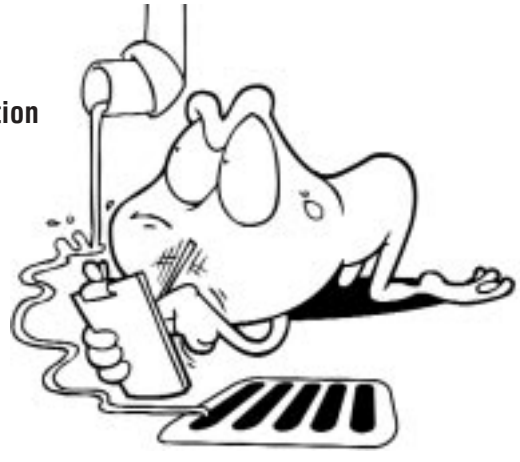
- **Photocopy of school map**
- **Clipboard and pencil**
- **Student Worksheet**

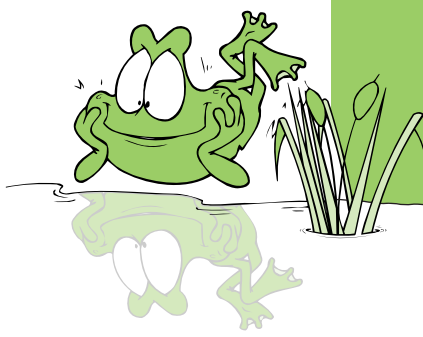
INSTRUCTIONS

1. Explore your school grounds to observe the features listed for your group number.
2. Record your OBSERVATIONS on your school map by shading areas, adding details and drawing arrows.
3. Add the details neatly to the original map upon returning to the classroom.

Group No	Record the following features	Consider these questions about the features
1	Roof tops	What direction do they direct water?
2	Spouting	Where does it direct stormwater?
3	Downpipes	Where are they located?
4	Man-made drains	How does water flow into them. Where does it go?
5	Natural drains	Are there areas where water will naturally flow?
6	Surfaces	Where will water soak into the ground? Where will it runoff?
7	Slope	In what direction do surfaces slope?
8	Degree of slope	How does this affect the speed of runoff?
9	Low-lying areas	Where might water collect?
10	Barriers	Do garden beds, buildings or mounds redirect water?
11	Exit points	Where does stormwater leave the school grounds?
12	Outside the school	Can you see where stormwater might flow after leaving the school?
13	Into a waterway	Can you predict where water from your school might end up?

Draw arrows to show the direction of runoff flow





Waste Watching

M

FOCUS

- Do we have a litter problem at our school?
- Is our school contributing to stormwater pollution?

OBJECTIVES

- Classify litter collected from the schoolyard
- Identify where and why litter 'hotspots' exist

CSF II LINKS

SCIENCE
4.1 Chemical

SOSE
4.1 Geography

MATHS
4.1 / 4.2 Chance & Data

BACKGROUND

When designing a pollution reduction strategy an important step is to identify the type, location, and density of pollution. In a schoolyard, litter is the most visible pollutant type, and thus is the focus for this study. This activity is an excellent benchmark tool for your stormwater program as it may be repeated at the end of the program.

NOTES

'Waste Watching' complements several activities within this resource package including the English activity, *'Learning About Littering'* the Maths activity *'Trashy Trends'*, and the SOSE activities *'The 3R's of Education', 'Scrutinise The Schoolyard'* and *'Let's Do Something!'.*

LEARNING TASKS

1/ (Optional introduction) Using students' knowledge and experience of the yard and the results gathered from the survey in 'Learning about Littering', discuss the questions:

- Do we have a litter problem in our school? In what respect?
- Where is litter frequently located?
- What type of litter is most common? Are some days worse?

2/ Prepare to conduct litter surveys to investigate the issues above. Zone the school using a map and assign groups to areas.

- Groups complete preliminary details about their zone.

3/ Students survey their area at the end of lunchtime for 10 minutes every day for one week, collecting litter items from the ground into buckets and returning to a central area. Put litter on a tarp to sort, count and record.

⚠ **SAFETY: Students must wear gloves and use tongs to handle litter. Sharp or dangerous objects should be reported to the teacher.**

- Record details that may influence results on the Tally Sheet.

4/ At the conclusion of the week, review and discuss results.

5/ Add litter 'hotspots' to school maps see SOSE activity *'Scrutinise The Schoolyard'*

MATERIALS

- ***'Learning about Littering'* Results Sheet**
- **School maps SOSE activity *'Scrutinise The Schoolyard'* (optional)**
- ***'Waste Watching'* Student Worksheet**
- **Clipboard**
- **Pencil**
- **Rubber gloves and tongs**
- **Litter buckets**
- **Tarps**

EXTENSION

Use SOSE activities *'The 3R's of Education'* or *'Let's Do Something'* for activities that can be used as a direct follow-up.

ASSESSMENT

Were students already aware of existing issues regarding playground litter? Did they successfully record results and add details of contributing factors?

Waste Watching - Student Worksheet

Name: _____

AIM Classify litter collected from the schoolyard and identify litter 'hotspots'

METHOD

1. Choose an area in your schoolyard to survey and fill in parts A, B, C and D
2. After lunch each day spend ten minutes to collect litter using tongs, rubber gloves and a bucket.
3. Sort your litter on a tarp and fill in part E.
4. Discuss results with your class.

MATERIALS

- **Tongs**
- **Rubber gloves**
- **Bucket**
- **Tarp**

⚠ **SAFETY: Do not handle sharp or dangerous objects. Report these to your teacher.**

(A) Survey Area

_____

_____

(B) Bin Details

- Number of bins _____
- Location of bins _____

_____

(C) Additional Details

- Weather conditions
- Number of students observed in the area
- Year levels in the area
- Was the canteen operating?
- Date of last clean up
- Is there a bin roster?

Day 1 _____

Day 2 _____

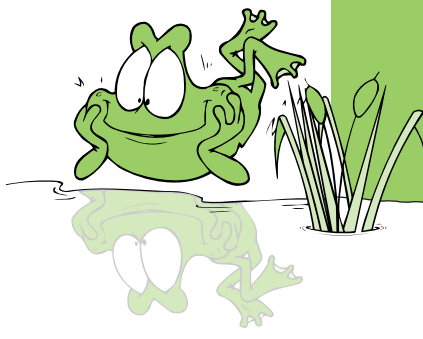
Day 3 _____

Day 4 _____

Day 5 _____

(D)

	Number of Items					
Litter Item	**Day One**	**Day Two**	**Day Three**	**Day Four**	**Day Five**	**TOTAL**
Plastic						
Milk / Juice container						
Glass						
Paper or cardboard						
Food scraps						
Aluminium foil or cans						
Other						



Pollution On The Move

M

FOCUS

How do various pollutants behave in water?

OBJECTIVES

Identify if pollutants dissolve, float, suspend or settle
Make observations and record results in a web

CSF II LINKS

SCIENCE
- 4.2 Chemical
- 4.2 Physical
- 4.1 / 4.2 Biological

ENGLISH
- 4.1 Writing

BACKGROUND

Stormwater pollution can behave in any of the following ways. It may dissolve in water (eg. fertilisers, salt, pesticides), float on water (eg. oil, polystyrene, plastic bottles), be suspended in water (eg. clay, plastic bags) or settle from water (eg. sand, glass). The behaviour of the pollution will affect the impact it has on a waterway eg. settled pollution smothers aquatic plants, floating pollution can be eaten by animals and suspended pollution can block out light.

NOTES

This activity is best completed outdoors and it is recommended that the oil (and any other slick forming substances) be given to students last as they may influence the behaviour of other pollutants if added earlier.

LEARNING TASKS

1/ Provide a few minutes for students to experience the pollution samples you've supplied.

2/ Clarify the terms, 'dissolve', 'float', 'suspend' and 'settle'.

3/ Ask students to predict the behaviour of each pollutant on their worksheet.

4/ To complete the experiment students work collaboratively and make group decisions.

⚠ **SAFETY: Students must wear rubber gloves and be warned of the dangers with handling items such as turps, detergent, paint and fertiliser.**

5/ Upon immersing each item in water students should:
- Use the swirling stick to mix the substance
- Allow ample time for behaviour to become obvious
- Make observations and record in the appropriate box

6/ Encourage students to hypothesise and test the behaviour of items such as plastic bottles or bags full of water.

7/ Discuss predicted and actual results, drawing conclusions about each item and it's behaviour.

MATERIALS

- ***'Pollution On The Move'* Student Worksheet**
- **Large tubs of water**
- **Rubber gloves**
- **Swirling stick**
- **A variety of pollutant samples**
- Glass bottles
- Plastic bags
- Detergent
- Polystyrene
- Plastic bottles
- Clay and sand
- Leaves and clippings
- Salt
- Turps / Paint
- Oil
- Fertiliser
- Soil

EXTENSION

Look for examples of each pollutant type while on the field trip. Can your observe it's impacts on water quality, plants, animals and human activity?

ASSESSMENT

Did students work co-operatively in groups? Were their experimental results correct? Were they able to identify an impact of pollutants on waterways?

Pollution On The Move - Student Worksheet

Name:

AIM Identify if pollutants dissolve, float, suspend or settle in waterways

METHOD

1 Chose a sample and record 'Sample Type' in Table 1
2 Predict its behaviour in water as either
DISSOLVE, FLOAT, SINK or SUSPEND
3 Wearing rubber gloves, test the sample in your tub of water and record your findings
- Use a swirling stick to mix the substance
- Observe your sample for 2 minutes

4 Predict the impact that each pollutant may have in a waterway
5 If time permits complete the experiment on other pollutant samples.
6 Fill in Table 2 using your class results

MATERIALS

- **Pollution**
- **Tub of water**
- **Swirling stick**
- **Rubber gloves**

Table 1

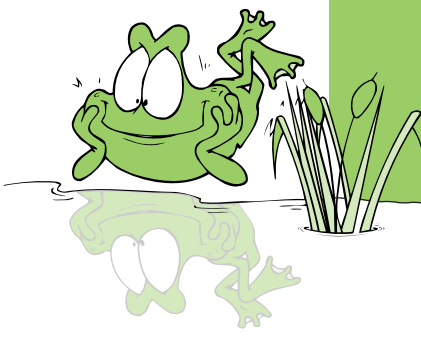
Sample	Sample Type	I predict it will	My experiment found it	Its impact in a waterway environment could be
Eg	Polystyrene cup	Sink	Floats	
1				
2				
3				

Fill in the following table using the results from your whole class

Table 2

Show which pollutants fit into the four categories

Dissolve	Float	Sink	Suspend



Disappearing Act

M

FOCUS

- How quickly do common litter items decompose?

CSF II LINKS

SCIENCE
4.1 / 4.2 Chemical

OBJECTIVES

- Identify biodegradable items
- Suggest consequences for our environment

BACKGROUND

Natural items such as vegetation and food scraps decompose rapidly and return essential nutrients to the soil. Highly manufactured items such as plastics, foil, and metals take much longer to degrade and can release toxic chemicals. Filters in cigarette butts can take 15 years to break down and contain pollutants including cadmium, arsenic and lead.

NOTES

These experiments could be conducted as a whole class activity, or by small groups who present their findings as: written science reports; or as an oral presentation. The experiments can be started during your studies of stormwater and extend over a longer period.

LEARNING TASKS

1/ Collect a variety of items from the classroom or schoolyard bin - two of each kind. Discuss the packaging:

- What is made from?
- Is minimum packaging used?
- Is it environmentally friendly?
- Why is it used?
- Could it be reduced?
- Will it decompose?

SAFETY: Students should wear gloves or use tongs throughout the experimental period. Identify hazards associated with the breakdown of the litter eg. fungal spores.

2/ Each student experiments with two identical litter samples:

- Bury one item in the ground. Use icy pole sticks to identify its location (chose a site protected from vandalism, or use a large tub in the classroom).
- Label the other item and place in a tub of water

3/ Once a week over a designated period (one month is ideal), students carefully dig up buried litter and view soaking litter.

- Is the item changing in size, shape or structure?

4/ At the end of the experiment, assist students in making comparisons and conclusions about the decomposition rate in the two situations:

- How does this relate to stormwater issues?
- What does this mean for our environment?
- What can we do?

MATERIALS

- ***'Disappearing Act'* Student Worksheet**
- **Shovel**
- **Rubber gloves**
- **Various litter items**
  These may include uneaten fruit, paper bags, containers, foil, wrappers or straws.
- **Tubs of water**
- **Icy pole sticks**
- **Marker Pens**

EXTENSION

Publish results in the school newsletter along with a list of suggested actions.

ASSESSMENT

Did students make detailed observations throughout the experiment? Could they compare results and draw conclusions regarding the need to reduce, reuse, recycle and compost?

Disappearing Act - Student Worksheet

Name: _____

AIM To identify if an item is biodegradable and if it decomposes faster in soil or water

METHOD

1. Chose a litter item to study
2. Collect two samples of the litter item
3. Bury one sample in the ground and mark locations with an icypole stick
4. Label the second sample and put in a large tub of water
5. Once a week collect your samples and use the table below to record your observations

- **Remember to write as many notes as you can to describe what you see, smell and feel.**

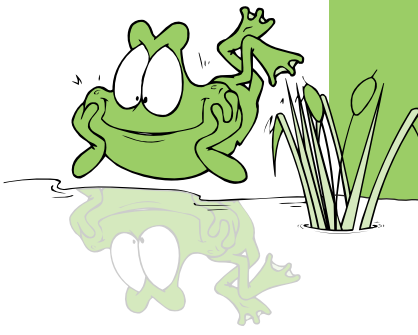
I am studying: _____

MATERIALS

- **Two similar litter items**
- **Icypole stick**
- **Marker pens**
- **Container of water**
- **Area of soil**

	OBSERVATIONS		
DATE	**BURIED LITTER ITEM**	**LITTER ITEM IN WATER**	**DIFFERENCES**

CONCLUSION



Trap The Trash

C

FOCUS

- Can we prevent pollution from entering waterways?

OBJECTIVES

- Design and construct a litter trap
- Test and evaluate the design

CSF II LINKS

SCIENCE
- 4.1 Physical

TECHNOLOGY
- 4.1 / 4.2 Materials
- 4.1 / 4.2 Systems

BACKGROUND

To combat pollution travelling from our streets to our creeks, pollution traps are being developed and modified. These include trash racks, oil and litter booms and sediment traps. Their aim is to stop litter from getting into waterways. Devices are quite successful when checked and emptied regularly with contents recycled or carried away to landfill sites.

NOTES

This activity can be carried out by individuals but may be more effective if completed in pairs or small groups. Further information on litter traps can be found in the Stormwater Education Manual (statewide) or by searching the web.

LEARNING TASKS

1/ Discuss
- Is it possible to stop all pollution being created?
- How can we stop pollution going into the waterways?

2/ Revise the varieties of stormwater pollution and the ways in which it can behave, see the Science activity *'Pollution On The Move'*.

3/ Distribute the Design Plan to students who choose a pollutant target group, a suitable trap type and plan their design in consideration of the stated criteria.
- Sketches should be labelled to indicate materials, methods of construction and design features

4/ Students construct their pollution trap using the materials. provided

⚠ **SAFETY: Care must be taken when using wire, wire cutters and scissors**

5/ Test the pollution trap and evaluate its success.

6/ Complete the evaluation and analyse advantages and disadvantages of the design.
- What factors might affect the success of the trap?

7/ Students demonstrate their pollution traps for the class and explain how various design features affect its functional and aesthetic value.

MATERIALS

- ***'Trap The Trash'* Student worksheet** - enlarged to A3 if necessary
- **Variety of materials that could include:**
  - Wire
  - Scissors
  - Shadecloth
  - Straws
  - Plasticine weights
  - String
  - Polystyrene
  - Icypole sticks
  - PVA glue
  - Plastic containers
- **Large tub of water for testing**
- **Pollution samples**

EXTENSION

Contact the local council to see what measures they have in place to trap pollution. What type of traps do they use, where are they located and how successful are they?

ASSESSMENT

How well did groups plan, construct and evaluate their pollution trap? Did the design consider the purpose of the trap and the behaviour of the pollution?

Trap The Trash - Student Worksheet

Pollution to Target:

Group Members:

Your trap might:
- Float on the surface
- Fit in drain pits
- Suspend in the water
- Catch drain outputs

Your trap must:
- Collect pollution but allow water through
- Be easy to clean
- Be sturdy and reliable
- NOT cause flooding

Your trap might collect:
- Litter
- Vegetation
- Soil
- Chemicals

Evaluation: