MESSAGE IN A PLASTIC BOTTLE

A cross-curriculum guide to reducing plastic waste

Years 7 – 10 / Mathematics / Science / English / Geography / Leadership

GOVERNMENT OF WESTERN AUSTRALIA

WASTE AUTHORITY
WA...TOO GOOD TO WASTE

WasteSorted Schools

ACKNOWLEDGMENTS

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TABLE OF CONTENTS

WASTESORTED SCHOOLS PROGRAM

The WasteSorted Schools program provides support to schools across Western Australia (WA) to promote responsible waste management behaviours, with a focus on waste avoidance and resource recovery. It also develops positive environmental values in students and the whole school community.

WasteSorted Schools is a program of the Waste Authority and offers resources and support for schools to plan, implement and maintain waste minimising projects such as recycling, composting and worm farming.

The program helps schools to set up infrastructure and provides resources aimed at changing attitudes and behaviour in regard to sustainable waste management.

The program is free and available to all schools in Western Australia.

Students at Emmanuel Catholic College collect mobile phones for recycling.

Becoming a WasteSorted School

The first step to becoming a WasteSorted School is to complete the online professional learning module. This module will provide you with important information about managing waste at your school and guide you through steps to assessing waste, becoming accredited, setting up infrastructure and involving the whole school and community. You will learn about project ideas, resources and support available for your school.

The module takes approximately one hour to complete. It is divided into sections with a short quiz at the end of each section. Participants receive a certificate upon completion that can be used towards professional learning.

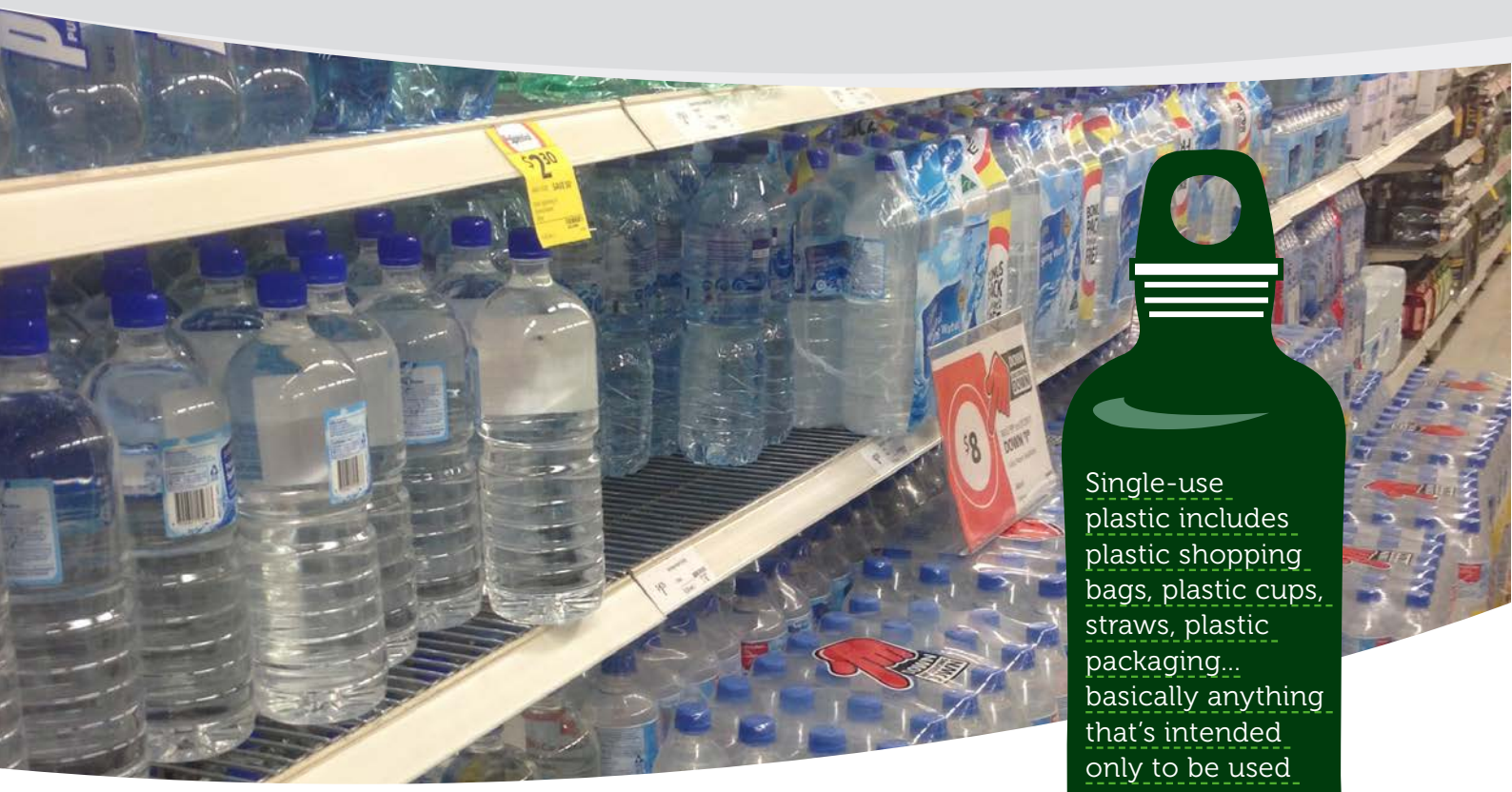
The benefits of being a WasteSorted School include free resources and support including:

- a waste audit with the WasteSorted Schools incursions officer (Perth only) or a kit to run your own audit
- WasteSorted Schools accreditation
- workshops
- staff presentations at your school
- curriculum linked resources
- presentations with student leadership groups
- assistance to set up projects such as worm farms and compost
- access to grant funding to implement WasteSorted Schools projects.

Australian Sustainable Schools Initiative
A Partnership of the Australian Government, the States & Territories

Please visit the WasteSorted Schools website for more information about the program www.wastesortedschools.wa.gov.au.

WasteSorted Schools is a proud member of the WA Australian Sustainable Schools Initiative Alliance. Through being involved with the WasteSorted Schools Program schools can take action to reduce their ecological footprint and increase their social handprint. For more information visit the Department of Education website, www.det.wa.edu.au/curriculumsupport/sustainableschools/detcms/portal.



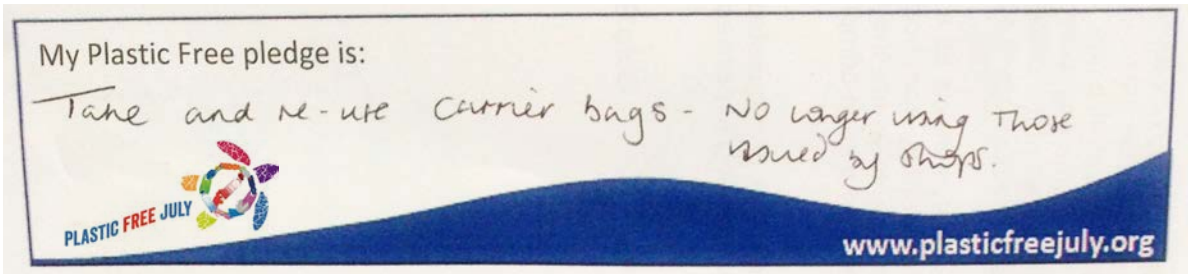
Single-use plastic includes plastic shopping bags, plastic cups, straws, plastic packaging... basically anything that's intended only to be used once and then discarded.

BOTTLED WATER BACKGROUND INFORMATION

Why study bottled water?

Bottled water is a product that students are familiar with and can relate to. Bottled water has been marketed to create a feeling of desire and need even though clean tap water is readily available in Australia. Many students consider bottled water as a healthy alternative to soft drink and some may also believe it's a safer choice than drinking tap water.

This bottled water unit encourages students to question their understanding and assumptions of bottled water including cost, the waters' source, how it is marketed, the plastic waste it creates and how that plastic waste is disposed of. We hope that by looking at the issue from multiple angles and in different learning areas the students will come to the same conclusion as we have; that bottled water is a wasteful product and that we should reduce our consumption of it. The topic of bottled water also provides a platform to discuss reducing our use of other types of single-use plastics like straws and plastic bags. The leadership section gives students an opportunity to take action by pledging to reduce single-use plastic waste.



A student from Mindarie Senior College pledges to take her own bags and no longer use those supplied by shops.

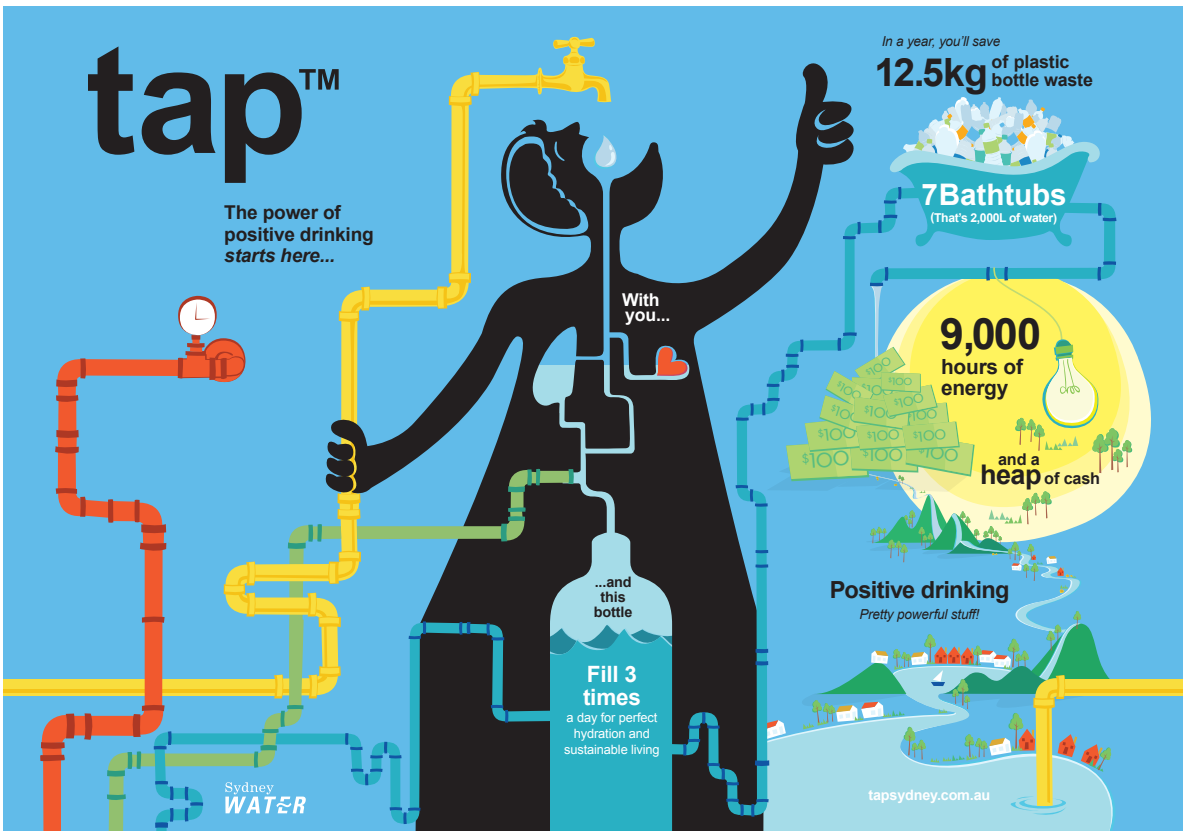


Image provided by Sydney Water.

Bottled water statistics

Water, soft drinks, juice and other drinks are commonly sold in polyethylene terephthalate, commonly known as PET, plastic bottles. In 2011/12 Australia consumed over 116,000 tonnes of PET plastics. In Australia, the recycling rate for this type of plastic is around 53 per cent with the remainder going to landfill. Of the PET that is recycled, more than three-quarters is exported for recycling because we don't have the capacity in Australia to recycle all of the plastic waste we produce *(2011/12 National Plastics Recycling Survey, PACIA).*

When it comes to bottled water:

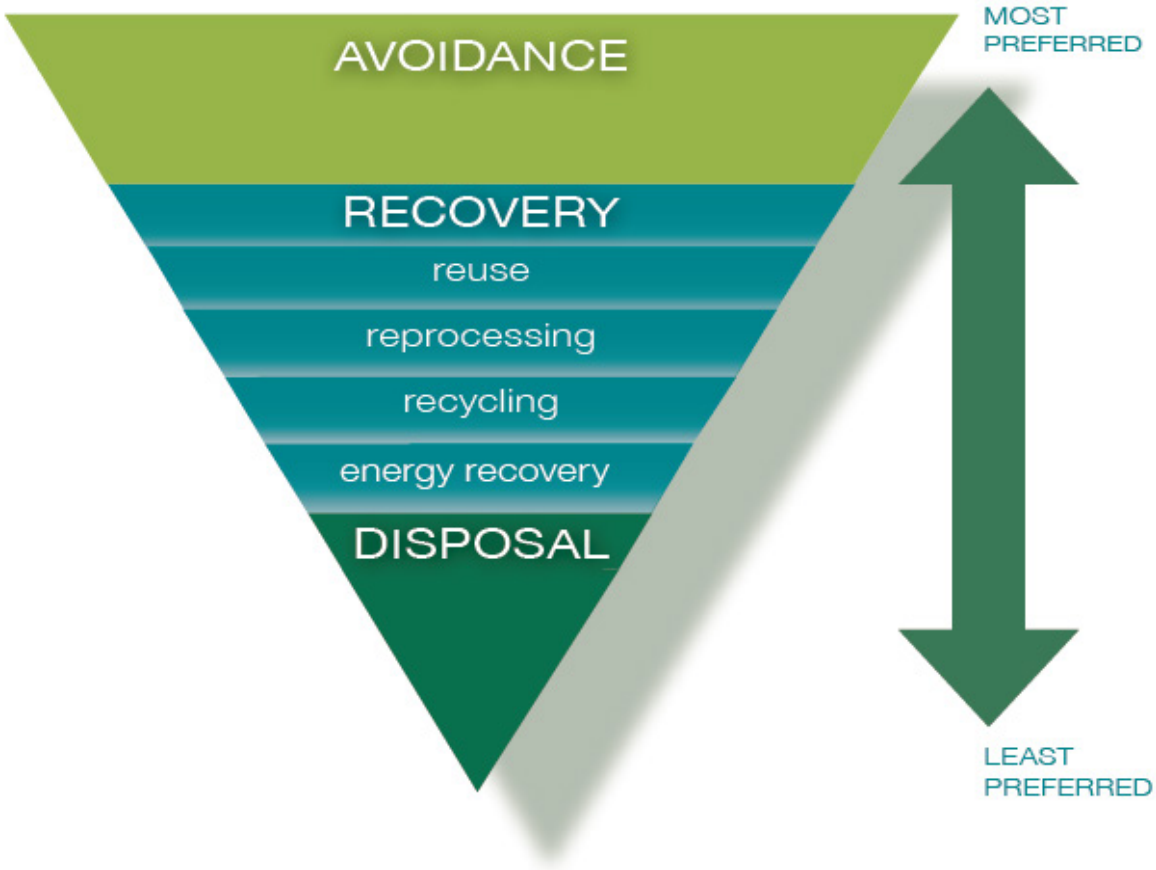
- Australians spend more than half a billion dollars a year on bottled water
- Australia produced 582.9 million litres of bottled water in 2009/10
- producing and delivering a litre of bottled water can emit hundreds of times more greenhouse gases than a litre of tap water
- a litre of bottled water is often more expensive than a litre of petrol
- it is estimated that more than 145.7 million litres of oil was used in the production, transportation, refrigeration and recycling or disposing of bottled water in Australia in 2009/10.

Source: Do Something, Go Tap campaign http://dosomething.net.au.

More bottled water facts are available at: www.cleanup.org.au/PDF/au/clean_up_australia_bottled_water_factsheet.pdf.

Avoiding waste is the highest priority

We often justify our decision to buy a product like bottled water by telling ourselves that the packaging can be recycled. Recycling makes us feel good and while recycling is more desirable than sending PET plastic to landfill, it is important to consider the environmental impact of transporting our recyclables long distances and the energy and resources required for processing. The best option is to avoid buying single-use plastics like water in a bottle by carrying your own reusable bottle.



Visitors to Perth city can reduce plastic by filling up with filtered still or sparkling water.

Inspiring stories about reducing plastic

There are many inspiring stories of individuals, organisations and towns that are reducing their use of plastic. This is a brief summary of some of our favourites.

- **Bundanoon:** The Australian town of Bundanoon, in the NSW Southern Highlands, has decided to neither sell, nor giveaway, bottled still water, within the town precinct www.bundyontap.com.au.
- **Monte Sant' Angelo school:** Monte Sant' Angelo Mercy College banned the sale of bottled water at the canteen in 2010 and installed filtered water fountains for the students www.smh.com.au/environment/water-issues/sale-of-water-is-banned-and-thats-just-lubbly-bubbly-20100727-10uer.html.
- **Plastic-free July:** Plastic-free July began in Perth and encourages people to pledge to reduce their consumption of single-use plastic in July. In 2014, more than 14,000 people from 69 nations around the world participated in refusing single-use plastic, www.plasticfreejuly.org.
- **City of Fremantle:** In 2014 the City of Fremantle voted on a new law to ban retailers from providing single-use plastic bags www.abc.net.au/news/2014-07-24/fremantle-votes-to-ban-plastic-bags-for-a-second-time/5619920.
- **City of Perth:** In 2013 the City of Perth trialled water fountains that supply fresh, filtered still or sparkling water www.perth.wa.gov.au/newsroom/featured-news/australian-first-perth-trials-public-drinking-fountain-alternative.

Plastic-free swaps

This plastic bottle guide is designed to get your students thinking about the broader issue of single-use plastic. We've put together some simple swaps so you and your students can make more sustainable choices at home and at school.

Fruit and vegetable bags *- take your own reusable cloth bags to buy fruit and vegetables.*

Cling wrap and snap-lock bags *- pack sandwiches in reusable containers or use a sandwich wrap.*

Plastic bottles *- take your own drink bottle everywhere you go.*

Other drinks *- try making your own juices to take with you or buy a freshly squeezed juice in a reusable cup.*

Plastic bags *- take your own bag shopping.*

Coffee cups *- take your own reusable coffee cup.*

Straws *- Say 'no thanks' to straws.*

Packaging *- there are some great places in Perth where you can purchase items from bulk bins without any packaging. Simply take your own bags and use these stores to stock up on nuts, seeds, dried fruit, flour, pasta, cereal, spices and more.*

PLASTIC BOTTLE CURRICULUM GUIDE

Overview

In this guide you will find a set of activity instructions for each learning area plus a leadership activity, snippets of inspiration cards and a quiz. The table below provides a brief overview of the key activities undertaken by each area.

Subject	Suitable for	Description of activities
English	Years 7 - 10	Students watch *The Story of Bottled Water* and use this as inspiration to write a persuasive speech that encourages teachers and students to stop buying bottled water.
Maths	Years 7 - 10	Students compare bottled water and tap water by calculating: • the distance water travels by tap and bottle • the cost of tap water compared to bottled water • the amount of plastic waste their school produces and how much it costs to dispose of it.
Science	Year 7 - 8	Students carry out a scientific investigation on the properties of bottled and tap water including taste, odour, pH, fluoride, chlorine and pesticides.
Geography	Years 9 - 10	Students conduct an inquiry project and investigate the impacts of the production and consumption of bottled water. They study the supply chain and life of the product (including plastic recycling, disposal to landfill and litter that ends up in the ocean).
Leadership	Years 7 - 12	The leadership activity provides instructions to help students to launch their own campaign to encourage their school community to stop buying bottled water (and other plastic products) for a day, a week or a month.
Snippets	Year 7 - 12	Twenty snippet cards designed to inspire your students to choose a topic and develop their own project on bottled water. The links range from discussion points to investigations and are designed to complement the activities developed for English, maths, science and geography.
Quiz	Year 7 - 12	The bottled water quiz features multiple choice questions. It is a useful tool to engage the whole school and could be done as a form activity, at year group meetings or at a school assembly.

All activities are linked to the Australian Curriculum. Full details of the links are provided at the end of each subject's activity instructions.

Using bottled water as a cross-curriculum unit

This guide is designed to be used as a cross-curriculum unit with all subject areas looking at the topic of bottled water from different angles. Subjects can do the activities in isolation but the lessons will have greater impact if more learning areas are involved. In addition, there are opportunities for sharing across subject areas and year levels. To help with cross-curriculum planning, we've highlighted a few ways that subject areas can share their learning with one another.

	English	Maths	Science	Geography	Whole school
English		Invite a maths class to share calculations (e.g. cost comparison of bottled and tap water). This could be used in persuasive speeches.	Invite a science class to share investigation results. Results could be used in persuasive speeches.	Invite a geography class to share research on impacts of production and consumption. This research could be used in persuasive speeches.	Share one of your student's persuasive speeches at an assembly.
Maths	Invite an English class to debate which is more persuasive, statistics or language, in convincing people to drink tap water (extension activity).		Invite a science class to share their results and have your class produce graphs (on taste and odour preferences).	Invite a geography class to share their research on cost of bottled water and where it comes from (Inquiry question 1) or to share graphs and statistics on bottled water (e.g. How much PET plastic is recycled?).	Share the school survey results in the newsletter or at an assembly.

By tackling bottled water as a cross-curriculum topic we hope to have a greater impact on students' learning and aim to see students taking positive action to reduce their use of plastic.

	English	Maths	Science	Geography	Whole school
Science	Invite an English class to share taste tests results for additional analysis or invite an English class to present persuasive speeches to highlight why tap water is a better choice.	Invite a maths class to share their results on the cost and distance travelled by bottled water.		Invite a geography class to share what happens when plastic ends up in the ocean (inquiry question 6).	Share the investigation results online or at an assembly.
Geography	Invite an English class to present persuasive speeches including actions we can take to reduce plastic waste (Inquiry question 7).	Invite a maths class to share their research on cost of bottled water and where it comes from (Inquiry question 1).	Invite a science class to share what happens when plastic ends up in the ocean (Inquiry question 6).		Share some of the students' research including suggestions about how to reduce our use of plastic.
	If your class is creating an online jigsaw such as Padlet, other subject areas could have their own page to make contributions.				
Leadership	The leadership students could visit classes or talk at assembly and encourage students to make pledges to reduce plastic.				

Content versus skills

Some subject areas, like geography and science, lend themselves well to the topic of sustainability and bottled water because the topic can be addressed directly through the curriculum content (such as the impact of production of goods). We have found, however, that subjects such as English and maths are just as valuable because the topic of sustainability can be addressed through skills such as persuasive writing or data collection and analysis. These skill-based subjects have very strong curriculum links and the activities for these subjects are more easily adapted to meet the curriculum needs across a range of year levels.

Linking to other subjects

We haven't written activity instructions for all learning areas, however, you might choose to expand on the topic of bottled water to include more learning areas. Here are a few curriculum-linked suggestions for other subjects:

- History: Students could look at the history of bottled water. Many of the brands have a long history associated with healing properties and spa resorts. The history of bottled water is covered well here: http://researchbank.swinburne.edu.au/vital/access/manager/Repository/swin:14906.

  Year 10 students could look at how the history has strongly embedded bottled water in our popular culture and design advertisements (print or digital) to try to bring back the tap as a form of popular culture. Alternatively, Year 10 students could look at the environmental movement.

- Visual Art: Watch the National Geographic documentary on how scientists and artists collaborate on an Alaskan voyage. Their goal is to create art from the plastic debris they find and raise awareness about its impact on oceans and wildlife http://video.nationalgeographic.com.au/video/141204-gyre-video-complete.

  Alternatively, study the work of environmental artist John Dahlsen at www.johndahlsen.com or www.youtube.com/watch?v=DfVi01FZD5I.

  You will find other great links and ideas in the snippets section of this document.

Students at Lynwood SHS make a pledge to reduce plastic by using reusable containers instead of cling wrap.

Using leadership to take action

We have provided a leadership activity so that students can take positive action from their classroom learning. The leadership activity helps students to launch their own campaign to encourage students to stop purchasing bottled water (and other plastic products) for a day, a week or even a month. The campaign encourages staff and students to make a pledge to reduce their use of single-use plastics like bottles, straws, plastic bags and coffee cup lids.

The instructions are simple and suitable for students to follow with, or without, the direction of a teacher. Having the support of a teacher is likely to lead to greater success with the project.

The leadership activity could be completed by:

- a student leadership team
- a group of inspired students (perhaps from a number of different year groups / learning areas)
- a class of students
- a gifted and talented student group
- school staff.

Sharing the bottled water project with your school community

Here are just a few ways you can engage your school community in the bottled water message:

- get your class to present at an assembly
- put photos and stories in the newsletter
- put up display boards with photos and plastic-free pledges
- get your class to produce a poster to display around the school
- use some of the bottled water facts from the background information as daily announcements
- conduct a quiz in mentor groups or form (a quiz is available as part of this package).

The Sydney Zoo encourages visitors to drink tap water too.

To print or not to print? We would love your class to reduce waste by not printing activities, discussion questions and worksheets. Consider using electronic whiteboards, projectors, whiteboards and other shared displays for the activities provided. If you do decide to print, try sharing handouts, working in groups and use double-sided printing or reused paper where possible.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ENGLISH: BRING BACK THE TAP!
Background Information for teachers

Curriculum focus

English: Language, Literacy.

NAPLAN: Persuasive writing.

See list of curriculum links at the end of the English activity instructions for more information.

Aim: **Students use bottled water as a topic to develop an understanding of persuasive techniques.**

Summary of activities:

There are seven activities in this package.

1. Set the scene with a taste test
2. Persuasive techniques in bottled water TV commercials
3. Persuasive techniques in *The Story of Bottled Water*
4. Symbols and images in *The Story of Bottled Water*
5. Practicing the language of persuasion
6. Persuasive group presentations
7. Taking action on bottled water.

Suitable for: Years 7 – 10.

Duration: About two weeks (8 – 10 lessons).

Background information

For more information and statistics on bottled water in Australia please see the bottled water background information in the introduction to this guide.

Cross-curriculum links

This guide is designed to be used as a cross-curriculum unit with many subject areas looking at the topic of bottled water from different angles. This creates opportunities for sharing across subject areas and year levels.

You could invite:

- a maths class to share calculations (e.g. cost comparison of bottled and tap water)
- a science class to share investigation results
- a geography class to share research on impacts of production and consumption.

Information shared by these subjects could be used in persuasive speeches.

You might also like to share one of your student's persuasive speeches at an assembly.

ENGLISH: BRING BACK THE TAP!
Activity Instructions

Activity 1. Set the scene with a taste test

For this activity you will need: Bottled water, tap water, clean cups and labels (e.g. A, B).

1. Set up cups; one set labelled A (filled with bottled water) and one set labelled B (filled with tap water).
2. Ask for student volunteers to taste both samples, A and B. Which one tastes better? Ask the students to record their choice without discussing it with others (as this can bias their answers). Collate the results from some, or all, of the students in your class and then reveal the answer.
3. Think, Pair, Share: What are some of the positives and negatives of tap water?

Students from Mindarie Senior College tested tap and bottled water. More than half preferred the tap water.

Activity 2. Persuasive techniques in bottled water TV commercials

For this activity you will need: A projector and computer with access to the internet and speakers.

1. View the presentation on persuasive techniques in advertising with your class. www.slideshare.net/LHaghighi/common-persuasive-techniques-in-advertising

   Techniques covered in the presentation include:

   - Bandwagon
   - Repetition
   - Testimonial
   - Emotional appeal
   - Humour
   - Rhetoric question.

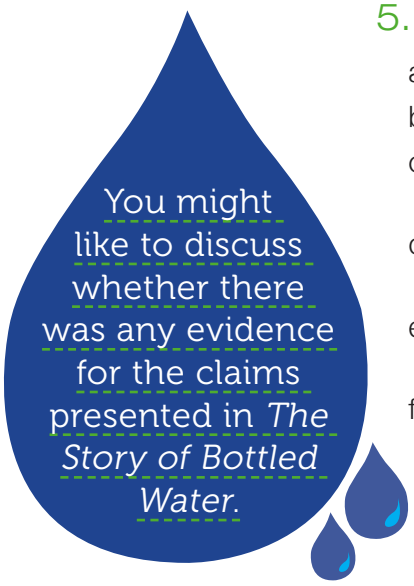
2. Watch the Mt Franklin advertisement www.youtube.com/watch?v=YPVu6L1rZHE.
3. As a class discuss the audience, purpose and persuasive techniques used in the Mt Franklin advertisement.
4. Look at the website www.fijiwater.com/the-water and discuss the audience, purpose and persuasive techniques used in the Mt Franklin advertisement.
5. Homework (optional): Ask students to collect six examples of different persuasive techniques used in advertisements (print media or commercials). Have them identify the audience, purpose and persuasive technique used in each.

Activity 3. Persuasive techniques in *The Story of Bottled Water*

For this activity you will need:

- A projector and computer with access to the internet and speakers.
- Five sheets of butcher's paper (with questions already on them) and pens to record responses.

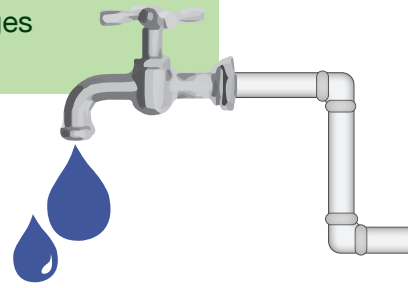
1. Watch *The Story of Bottled Water* www.storyofstuff.org/movies-all/story-of-bottled-water.
2. Set up pieces of butcher's paper around the room with the following headings:
   a. What tricks do companies use to get us to drink bottled water?
   b. What are the benefits of choosing tap water instead of bottled water?
   c. How did the movie use language to convince us to drink tap water?
      Think about emotional words, humour, repetition, testimonials, rhetorical questions, inclusive language (Year 10).
   d. How did the speaker use body language, facial expressions, tone, pausing and pacing to persuade us?
   e. How did the speaker use other elements (images, music, sound) to persuade us?
3. Break up class into groups. Each group spends a few minutes writing responses on the sheet of paper. Rotate groups and ask participants to read what the last group wrote and then add their own ideas.
4. Get the final group at each station to feedback to the class. Display these around the room for future reference.



5. Ask students to reflect individually:
   a. What is the purpose of *The Story of Bottled Water*?
   b. Who is the intended audience? (Year 9)
   c. What are the main ideas presented in *The Story of Bottled Water*?
   d. Were both sides of the issue presented to the viewer? Why was it presented like this?
   e. Would you consider drinking less bottled water after watching this? Why?
   f. Challenge: Did *The Story of Bottled Water* use first person language ('I' or 'we') or second person language ('you')? What impact does this have on the viewer?

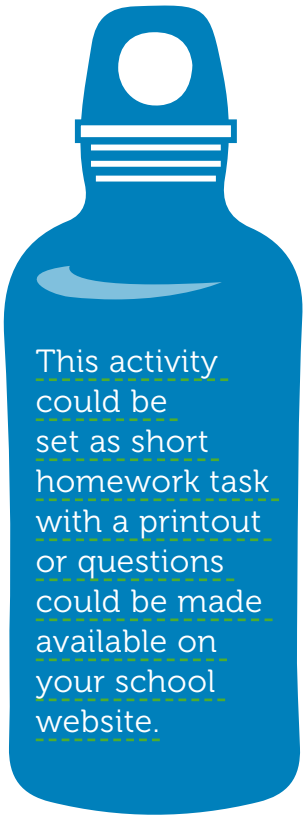
Activity 4. Symbols and images in *The Story of Bottled Water*

For this activity you will need: A projector to display images and questions.



Ask the students to complete the following questions about the symbols and images used in *The Story of Bottled Water*.

1. Look at Image 1 to Image 4.
   a. What symbols are common in these four images?
   b. What do you think these symbols make the viewer think?
   c. Who is the person meant to represent?
2. What childhood story is represented in the first image? What is this supposed to make the viewer think?
3. What is image two supposed to remind the viewer of? What characteristics are associated with the person in this image?
4. The images in this movie help to tell the story. What do you think is being shown in:
   a. Image 3?
   b. Image 4?
5. What makes image 5 humorous? What is this image making fun of?
6. What was the speaker talking about when image 5 was shown?
7. Why do you think humour was used for the topic shown in image 5?
8. What story is image 6 telling?
9. **Challenge:** Was any evidence quoted by the presenter to support any of these images? Which ones?



This activity could be set as short homework task with a printout or questions could be made available on your school website.

Image 1. *Nestle advertisement*

Image 2. *The trench coat*

Image 3. *Drinking fountain*

Image 4. *The factory*

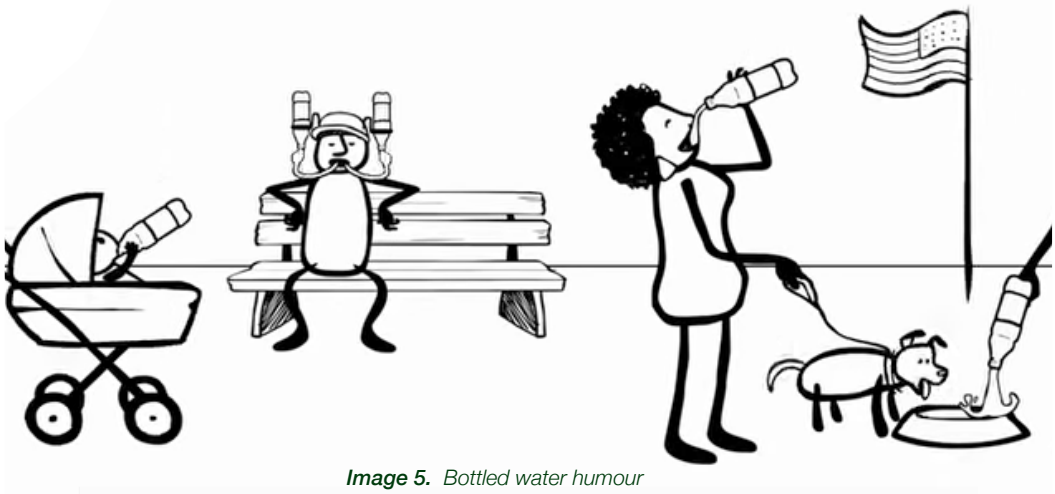


Image 5. *Bottled water humour*

Image 6. *The tap*

These images were sourced from *The Story of Bottled Water*
www.storyofstuff.org/movies/story-of-bottled-water

Activity 5. Practicing the language of persuasion

For this activity you will need:

- eight sheets of butcher's paper and pens
- four copies of the transcript of *The Story of Bottled Water* (http://s.bsd.net/stuff/default/page/file/ef602537b9c44b688b_kim6iyz0t.pdf) or student access to a computer and the file, and copies of each of the questions set for Topic 1, 2, 3 and 4.

1. Put students into eight groups and assign two groups to each topic.
   - Topic 1: Rhetoric
   - Topic 2: Tone, pacing and pause
   - Topic 3: Body language and facial expressions
   - Topic 4: Emotive language.
2. Model the above persuasive techniques to students.
3. Move the students into their groups and allow them time to work through the questions.
4. Ask each group to feedback to the whole class as the 'experts' on their topic.

Topic 1. Rhetoric

a. Read the transcript of *The Story of Bottled Water.*

b. Identify and record or highlight any rhetorical questions used.

c. Which of these rhetorical questions has the biggest impact on your group? What does the question make you think about? How does the question make you feel?

d. Write as many rhetorical questions as you can to convince your class to stop using the thick plastic bags you get from clothing/shoe/electronic/other stores.

(extension: Can you vary the tone, pace or pause to give the rhetorical questions more impact?).

e. When asked, share your rhetorical questions with the class.

Topic 2. Tone, pacing and pause

a. Read the extract below from *The Story of Bottled Water* (or re-watch this segment),

'I was curious about where the plastic bottles that I put in recycling bins go. I found out that shiploads were being sent to India. So, I went there. I'll never forget riding over a hill outside Madras where I came face to face with a mountain of plastic bottles from California. Real recycling would turn these bottles back into bottles. But that wasn't what was happening here. Instead these bottles were slated to be downcycled, which means turning them into lower quality products that would just be chucked later. The parts that couldn't be downcycled were thrown away there; shipped all the way to India just to be dumped in someone else's backyard.'

b. What kind of tone (happy/sad/angry/excited/other) did the presenter use in this part of *The Story of Bottled Water*? Did the presenter's tone suggest this was a good solution or bad solution to recycling?

c. Experiment with the tone of your voice pacing (fast/slow) and pause to convince your class that it is a fantastic thing to ship plastic bottles to India.

d. When asked, you will present this to the class.

Topic 3. Body language and facial expressions

a. Read the extract below from *The Story of Bottled Water*,

'There are many more things we can do to solve this problem. Lobby your city officials [local government] to bring back drinking fountains. Work to ban the purchase of bottled water by your school, organisation or entire city. This is a huge opportunity for millions of people to wake up and protect our wallets, our health and the planet. The good news is: it's already started. Bottled water sales have begun to drop while business is booming for safe refillable water bottles. Yay!'

b. Experiment with body language and facial expression to make these solutions look fun and easy. Now experiment with body language and facial expressions to make these solutions look difficult

c. When asked, you will present the text to make solutions look difficult (extension: Can you make your tone, pace or pause match?).

Topic 4. Emotive language

a. Read the transcript of *The Story of Bottled Water.*

b. Identify and record as many emotive words as you can.

c. Which of these emotive words has the biggest impact on your group? How do the words make you feel?

d. Write your own short speech using emotive words to convince your class to stop using the thick plastic bags you get from clothing/shoe/electronic/other stores.

e. When asked, present your speech to the class.

Curriculum extensions

- You could extend this activity by having groups consider other devices like alliteration, metaphors, simile, hyperbole and inclusive language ('I' or 'we').
- You could study the transcript in more detail, checking for evidence of arguments.

Image provided by Sydney Water.

Activity 6. Persuasive group presentations

For this activity you will need: A projector, speakers, access to the internet.

1. Watch the short clip www.wingclips.com/movie-clips/the-lorax/selling-air and discuss with students, 'Have we been conned in to buying bottled water?'.
2. Ask the students to 'Think, pair, share' to find out what concerns they and their partner have about tap and bottled water. How can they address these ideas and issues in their presentation?
3. Put students in groups of three. Ask each group to research, design and deliver their own five minute persuasive presentation to convince people to choose tap water over bottled water.

The presentations can be tailored for different year groups to meet the Australian Curriculum. In particular, focus the presentation on:

- *Year 7*: promoting the point of view of view that 'tap is best' and showing the audience a new way of seeing tap water.
- *Year 8*: reflecting the diversity of viewpoints on tap water.
- *Year 9*: presenting tap water in aesthetic and playful ways to convince people to choose tap water.
- *Year 10*: using the presentation to influence people to stop buying bottled water and to choose tap water instead.

Alternative presentation topics:

- The sale of bottled water should be banned at all schools in WA.
- Bottled water is safer than tap water.
- Companies should pay more to extract water for bottling.
- Councils should provide more drinking fountains in public places.
- Random rewards for people with reusable water bottles will help reduce plastic water bottle purchasing.

Full curriculum links for each year are provided in the tables at the end of the English activity instructions.

Presentations

Teacher facilitates timing, as guided below. Repeat until each group has done their presentation.

5 minutes presentation

2 minutes questions and answers

3 minutes feedback

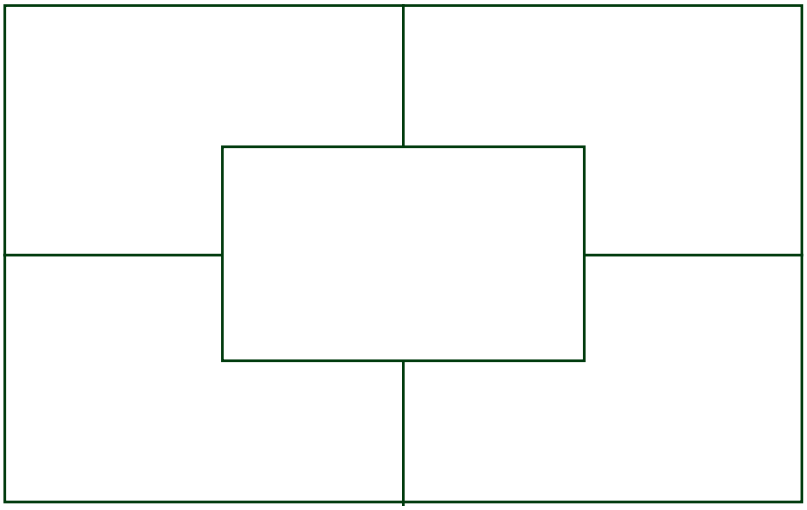
Reflection questions

1. After the presentations, ask students to consider:
    a. What was the purpose of your presentation?
    b. What kind of body language did you use in your presentation?
    c. How did you use your voice to sell the argument (e.g. tone, pitch, pace, pause)
    d. What other elements did you include (images, music, sound) to add interest and meaning?
    e. What persuasive/evocative language did you use in your presentation (Year 9)?
    f. How did you use rhetoric in your presentation (e.g. irony, parody, metaphors)?
    g. What symbols, icons and graphics did you use to add to your argument (Year 9)?

Activity 7. Taking action on bottled water

For this activity you will need: A projector, speakers, access to the internet and butcher's paper.

Placemat



1. Hand out butcher's paper and ask students to draw the placemat (above).
2. In their own corner of the placemat, students write what they think should be done about plastic water bottles at school and in the community.
3. After a few minutes they discuss their responses.
4. Ask students to agree on actions in their group and write these in the middle of their placemat.
5. Watch the ABC News report on the bottled water ban at Monte Sant' Angelo Mercy College in North Sydney at www.youtube.com/watch?v=KRth6eOO1xQ . Discuss this idea with students.

Student leadership

Inspired students might like to participate in, or organise, an event to encourage other students to join them in giving up plastic bottles for a day, a week or month. The details of this campaign are outlined in the student leadership section of this document.

Reduce comes before reuse and recycle. Start by saying no to bottled water.

Extension or Assessment

- Collect student notes and presentation preparations for assessment.
- Students write a newsletter article for your school stating what you think you should do to reduce plastic bottle waste at your school or in your community.
- Students make a mini movie for another waste topic modelled on *The Story of Bottled Water.*
- Students prepare a letter to lobby their local council to install more drinking fountains.

Useful websites and further resources

- Splash ABC – persuasive text student worksheet

  http://splash.abc.net.au/res/teacher_res/8-persuasive-texts/TR_8_eng_studentsheet_persuasive_text_structures.pdf.

- Gruen Transfer (ABC) www.youtube.com/watch?v=-z_NLq72cyM
  - The Pitch – selling ice to Eskimos. Time, 15:58 - 20:18 minutes.

ENGLISH: CURRICULUM LINKS

Year 7:

LITERACY	**Literacy; Interacting with others**	
	Identify and discuss main ideas, concepts and points of view in spoken texts to evaluate qualities, for example the strength of an argument or the lyrical power of a poetic rendition (ACELY1719)	Activity 2, 3
	Use interaction skills when discussing and presenting ideas and information, selecting body language, voice qualities and other elements (for example music and sound) to add interest and meaning (ACELY1804)	Activity 4, 5
	Plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements to promote a point of view or enable a new way of seeing (ACELY1720)	Activity 6
	Literacy; Interpreting, analysing, evaluating	
	Analyse and explain the ways text structures and language features shape meaning and vary according to audience and purpose (ACELY1721)	Activity 2, 3
	Compare the text structures and language features of multimodal texts, explaining how they combine to influence audiences (ACELY1724)	Activity 2, 3

Year 8:

LANGUAGE	**Language; Language for interaction**	
	Understand how rhetorical devices are used to persuade and how different layers of meaning are developed through the use of metaphor, irony and parody (ACELA1542)	Activity 3, 4, 5
	Language; Text structure and organisation	
	Analyse how the text structures and language features of persuasive texts, including media texts, vary according to the medium and mode of communication (ACELA1543)	Activity 2, 3, 4

LITERACY	**Literacy; Interacting with others**	
	Interpret the stated and implied meanings in spoken texts, and use evidence to support or challenge different perspectives (ACELY1730)	Activity 2, 3 4
	Use interaction skills for identified purposes, using voice and language conventions to suit different situations, selecting vocabulary, modulating voice and using elements such as music, images and sound for specific effects (ACELY1808)	Activity 5, 6
	Plan, rehearse and deliver presentations, selecting and sequencing appropriate content, including multimodal elements, to reflect a diversity of viewpoints (ACELY1731)	Activity 6
	Literacy; Interpreting, analysing, evaluating	
	Analyse and evaluate the ways that text structures and language features vary according to the purpose of the text and the ways that referenced sources add authority to a text (ACELY1732)	Activity 2, 3, 4
	Use comprehension strategies to interpret and evaluate texts by reflecting on the validity of content and the credibility of sources, including finding evidence in the text for the author's point of view (ACELY1734)	Activity 2, 3, 4
	Literacy; Creating texts	
	Create imaginative, informative and persuasive texts that raise issues, report events and advance opinions, using deliberate language and textual choices, and including digital elements as appropriate (ACELY1736)	Activity 6

Year 9:

LANGUAGE	**Language; Language for interaction**	
	Understand that roles and relationships are developed and challenged through language and interpersonal skills (ACELA1551)	Activity 4, 5
	Language; Text structure and organisation	
	Understand that authors innovate with text structures and language for specific purposes and effects (ACELA1553)	Activity 3, 4
	Language; Expressing and developing ideas	
	Explain how authors creatively use the structures of sentences and clauses for particular effects(ACELA1557)	Activity 3
	Analyse and explain the use of symbols, icons and myth in still and moving images and how these augment meaning (ACELA1560)	Activity 4

LITERACY	**Literacy; Interacting with others** Listen to spoken texts constructed for different purposes, for example to entertain and to persuade, and analyse how language features of these texts position listeners to respond in particular ways (ACELY1740)	Activity 2, 3
	Use interaction skills to present and discuss an idea and to influence and engage an audience by selecting persuasive language, varying voice tone, pitch, and pace, and using elements such as music and sound effects (ACELY1811)	Activity 5, 6
	Plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements for aesthetic and playful purposes (ACELY1741)	Activity 6
	Literacy; Interpreting, analysing, evaluating Explore and explain the combinations of language and visual choices that authors make to present information, opinions and perspectives in different texts (ACELY1745)	Activity 2, 3, 4
	Literacy; Creating texts Create imaginative, informative and persuasive texts that present a point of view and advance or illustrate arguments, including texts that integrate visual, print and/or audio features (ACELY1746)	Activity 5, 6

Year 10:

LANGUAGE	**Language; Text structure and organisation** Understand how paragraphs and images can be arranged for different purposes, audiences, perspectives and stylistic effects (ACELA1567)	Activity 3, 5
LITERACY	**Literacy; Interacting with others** Identify and explore the purposes and effects of different text structures and language features of spoken texts, and use this knowledge to create purposeful texts that inform, persuade and engage (ACELY1750)	Activity 2, 3, 4, 5, 6
	Use organisation patterns, voice and language conventions to present a point of view on a subject, speaking clearly, coherently and with effect, using logic, imagery and rhetorical devices to engage audiences (ACELY1813)	Activity 5, 6
	Plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements to influence a course of action(ACELY1751)	Activity 5, 6
	Literacy; Creating texts Create sustained texts, including texts that combine specific digital or media content, for imaginative, informative, or persuasive purposes that reflect upon challenging and complex issues (ACELY1756)	Activity 6


WasteSorted
Schools
MATHS
MATHS
MATHS

MATHS: BAN THE BOTTLE
Background Information for teachers

Curriculum focus

Mathematics: Number and Algebra, Measurement, Statistics and Probability

See list of curriculum links at the end of the maths activity instructions for more information.

Aim: **Students compare bottled water and tap water in terms of unit cost and waste. They develop and conduct a survey to investigate if the school community would support the ban of selling bottled water.**

Summary of activities:

There are nine activities in this package.

1. Set the scene: How does the class feel about banning bottled water?
2. Compare the cost of tap water to the cost of bottled water.
3. Compare the distance travelled by bottled water and tap water.
4. Calculate the waste produced from Polyethylene terephthalate (PET) plastics waste production.
5. Recycling plastics at school.
6. Did your learning impact on your feelings?
7. Conduct a survey about bottled water.
8. Conduct a fundraising activity (optional).
9. Conversions for other plastics.

Suitable for: Years 7 – 10.

Duration: About two weeks (8 lessons) plus homework time for students to gather responses to the surveys.

Background information

For more information and statistics on bottled water in Australia please see the bottled water background information in the introduction to this guide.

Cross-curriculum links

This guide is designed to be used as a cross-curriculum unit with many subject areas looking at the topic of bottled water from different angles. This creates opportunities for sharing across subject areas and year levels. You could invite:

- an English class to debate which is more persuasive, statistics or language, in convincing people to drink tap water
- a science class to share their results and have your class produce graphs (on taste and odour preferences)
- a geography class to share their research on cost of bottled water and where it comes from (Inquiry question 1) or to share graphs and statistics on bottled water (e.g. How much PET plastic is recycled?).

You might also like to share the school survey results in the newsletter or at an assembly.

MATHS: BAN THE BOTTLE
Activity Instructions

Activity 1. Set the scene: How does the class feel about banning bottled water?

1. Share this statement with students:
   Our school canteen (or community) should stop selling bottled water.
2. Tell students that they will be standing somewhere along the 'line', according to how they feel about the statement. Point out which side of the room is 'strongly agree' and which side is 'strongly disagree'. Ask students to choose a place to stand on the line. Give the students a few minutes to talk to the people near them and discuss why they have placed themselves where they are. Ask several students to explain to the class why they are standing where they are.
3. Ask students to return to their seats and to record their position, and reason for choosing this position, in their books.

This activity will be repeated in Activity 6 to see if students' opinions have changed after learning more about the topic.

Activity 2. Compare the cost of tap water to the cost of bottled water

For this activity you will need: A projector and screen to display the tables and questions in Exercise 1. Exercise 1 can be found at the back of the maths section on page 46.

1. Ask students:
   a. True or False? Some brands of bottled water come from the tap.
      It's true, some brands of bottled water are from natural springs while others are purified tap water.
   b. True or False? Australian consumers pay almost 2000 times more than the cost of tap water to drink from a bottle.
      Students will find out the answer to this in Exercise 1.
2. Have students complete Exercise 1 (page 46) comparing the cost of bottled water and tap water. To avoid printing, please try to put the questions and tables on display.

   There are two options for Exercise 1.
   - Option 1 is unstructured for advanced students.
   - Option 2 is scaffolded for those who need step-by-step instructions.
3. Discuss with students:
   a. Which 'average' (mean, median or mode) did you use for comparing tap water and bottled water?
   b. Does bottled water cost 2000 times the cost of tap water? Why do we buy bottled water when we can get water from the tap for free? What are we paying for when we buy a bottle of water?

Student research option:

We have provided costs of different bottled water brands in Exercise 1. Alternatively, you could ask students to research the cost of different brands of bottled water and compile them in a table. If a geography class is also doing the bottled water curriculum, they could share their research into the costs of different brands.

Filling up with tap water saves money.

Activity 3. Compare the distance travelled by bottled water and tap water

For this activity you will need:

- A projector and screen to display the tables and questions in Exercise 2. Exercise 2 can be found at the back of the maths section on page 49.
- Computer access for each student to calculate distances using a mapping program on the internet (such as Google Maps).

1. Have students complete Exercise 2 (page 49) comparing the distance travelled by bottled water and tap water. To avoid printing, please try to put the questions and tables on display.

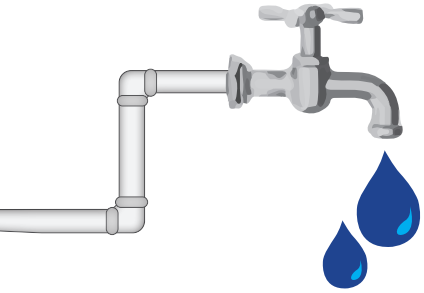
   There are two options for Exercise 1.

   - Option 1 uses the mean, mode, median and range (suitable for Year 7 to 9).
   - Option 2 uses box-and-whisker plots (suitable for Year 10).

2. Discuss with students:

   a. What impact do the large distances have on the mean? Did you use the maximum distance or the mean distance when comparing how far bottled water and tap water travel?

   b. How is tap water transported to your home? How is bottled water transported and stored before it is sold? What environmental impacts are associated with the transport and storage of bottled water?



If your school is not in Perth, you could tailor this activity to your region by using the water supply maps provided on the Water Corporation Education page (posters)

www.watercorporation.com.au/Home/Teachers/Lesson%20plans%20and%20teaching%20resources/Videos%20music%20and%20posters.

Activity 4. Calculate the waste produced from PET plastics waste production

For this activity you will need: A plastic water bottle, scales to weigh the bottle, a projector, screen and speakers to show a short clip and to display the tables and questions in Exercise. Exercise 3 can be found at the back of the maths section on page 53.

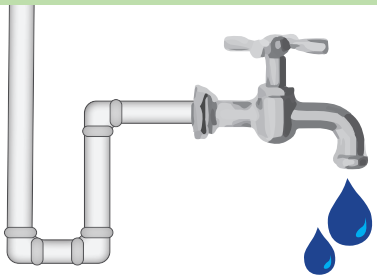
1. Watch the following clips:
   a. Visual display of recycling rates in America
      www.youtube.com/watch?v=OZbTXDkrD1o
   b. Discussion about where recycling goes
      www.dailymotion.com/video/xvn9up_where-does-recycled-plastic-go-to-china-and-back_news
2. Show students a plastic water bottle and ask them to identify the recycling symbol and number on the bottom of the bottle.
3. Use Table 1 in Exercise 3 (page 53) to determine the type of plastic that the bottle is made from.
4. Weigh the bottle and record the weight to use in Exercise 3.
5. Ask students to complete Exercise 3.

Plastic bottles are made from PET (Type 1) plastic. Look for the recycling symbol on plastics and the number enclosed to determine the type of plastic.

Bales of plastic ready for recycling from a Materials Recovery Facility in Bunbury.

Activity 5. Recycling plastics at school

For this activity you will need: A projector, screen, speakers and an internet connection to show a short clip and to display the tables and questions in Exercise 4. Exercise 4 can be found at the back of the maths section on page 55. You will also need to know the number of students in your school, whether you have a co-mingled recycling system and how much an empty bottle of water weighs (from Exercise 3).



The lightest 600mL water bottle produced in Australia weighs just 12.8grams (according to Mount Franklin, 2011). Students could use this figure if you don't have a water bottle to weigh.

1. Ask students:

   a. True or False? The local council picks up my waste at school.

   It depends on your school. Some school's waste is picked up by a contractor while others is picked up by the local council. In Perth, public schools' waste is usually collected by SITA, Perth Waste or VEOLIA.

   b. True or False? It costs money to have waste collected at the school.

   It's true, schools are allocated money to pay for waste collection services.

   c. True or False? PET plastic from water bottles can be recycled into clothing and pens.

   It's true. Watch the clip www.youtube.com/watch?v=zyF9MxlcItw to find out how PET is recycled into polyester.

2. Discuss with students: Do we have co-mingled recycling bins at our school? These bins usually have a yellow lid and are marked with recycling symbols.

3. Complete Exercise 4 (page 55) with the students. You will need to help the students create a table to collect the class data in Question 2.

Activity 6. Did your learning impact on your feelings?

1. Ask students to summarise their learning in the following table:

	Bottled water	Tap water
Cost of water (average) (from Exercise 1)		
Distance travelled (average) (from Exercise 2)		
Waste produced at your school per year (estimated) (from Exercise 4)		
Cost of waste disposal to landfill at your school (estimated) (from Exercise 4)		

2. Rewrite this statement up on the board:
   Our school canteen (or community) should stop selling bottled water.
3. Remind the students that they will be standing somewhere along the 'line', according to how they feel about the statement. Point out which side of the room is 'strongly agree' and which side is 'strongly disagree'. Ask students to choose a place to stand on the line. Give the students a few minutes to talk to the people near them and discuss why they have placed themselves where they are and if their feelings have changed.
4. Ask several students to report back and explain to the class why they are standing where they are.
5. Ask students to return to their seats and to record their new position in their books. Ask them to write one or two sentences about any change in their opinion and what was most significant in changing their opinion.

Activity 7. Conduct a survey about bottled water

For this activity you will need: A projector, screen, speakers and an internet connection to show a short clip and to display Exercise 5. Exercise 5 can be found at the back of the maths section on page 58.

1. Watch clip about how Monte Sant' Angelo Mercy College banned bottled water www.youtube.com/watch?v=yYUmAvo4Ank&list=PLA7E0B83332F6D76F#t=185.

2. Discuss with students:

a. Why do you think the school only targeted bottled water and not the other drinks in plastic PET bottles?

b. Do we sell bottled water at school?

c. Could our school reduce the number of drinks we buy in PET plastic bottles by encouraging students to swap some of their bottled water, juice and soft drinks with tap water?

d. What other alternatives are there to bottled water in schools?

e. Would it be possible to ban bottled water at our school or in our community?

Did you know the City of Perth have installed drinking fountains with chilled sparkling tap water?

www.perth.wa.gov.au/newsroom/featured-news/australian-first-perth-trials-public-drinking-fountain-alternative

3. **Design the survey (optional)**

Use the survey on page 58 or ask the students to design their own survey on bottled water to answer the following questions:

- What type of water do students/teachers consume and which do they prefer (tap, bottle, filtered)?
- Do students/teachers buy bottled water and why?
- What are the students'/teachers' opinions on bottled water and tap water? Do they think one is cleaner, safer, tastier or healthier?
- Do the students/teachers support the banning of bottled water sales?

Jigsaw opportunity: Put the students in groups of 3 or 4. Give each group one of the questions above and ask them to write survey questions for it. Bring the groups together and create a survey.

No time to design a survey? Use the one in Exercise 5.

4. **Conduct the survey:**

   a. Discuss with students:
      - Should we survey everyone in the school or take a sample?
      - If we take a sample, how big should the sample be?
      - Will different samples give different results? How important are those differences?

   b. Have the students conduct the survey and return to class with their results ready to analyse the results.

5. **Analyse the survey:** Ask students to analyse the survey results. This will vary depending on the survey questions but could include:
   - Produce a pie chart to show the types of water people drink
   - Calculate the mean number of water bottles students purchase in a week
   - Use the mean to compare the number of water bottles purchased with other drinks (this could include mean, mode, median and range or a back-to-back stem and leaf plot)
   - Calculate how much waste from bottles is produced by students at the school in a week (students will need to know the weight of a bottle and the number of students at the school)
   - What percentage of the school supports the banning of bottled water sales?
   - Produce a graph to show how students felt about the alternatives to bottled water. Which is the preferred alternative?
   - Produce a two-way table or a column graph to compare the support the banning of bottled water by males and females (or teachers to students)
   - Use a dot plot to compare the number of bottles of water purchased by different groups (e.g. compare teachers and students or compare younger students with older students).

6. Report (optional): Students could collate their results and produce a report on bottled water at school. The report could include cost, distance and waste calculations from earlier exercises as well as survey results. The best reports could be presented to the principal.

Activity 8. Conduct a fundraising activity (optional)

1. Plan and conduct a fundraising event. Students could sell an alternative to bottled water (e.g. fresh juice or chilled cordial) to students who bring refillable bottles. Alternatively they could sell reusable bottles to students who don't own one.
2. As a class, ask students to plan for the fundraiser. Ask students to:
    a. Use their survey results to determine the best product to sell
    b. Discuss the number of items they think they can sell – think about the best / worst scenario
    c. Make a list of items they will need to purchase and calculate their costs
    d. Estimate the cost price of each product they are selling (you may like to discuss with students how this may vary depending on the number sold)
    e. Decide on a selling price
    f. Ask students to write an equation for the revenue (R = SP x n, Revenue = selling price x number of items sold). Students may also like to graph this
    g. Ask students to calculate how many items need to be sold to break even
    h. Ask students to calculate how many items need to be sold to make a 20% profit.
3. Ask students to discuss and decide on roles, develop a marketing campaign, implement their fundraiser as a one off or ongoing business and then celebrate their achievements.

Monte Sant' Angelo Mercy College in NSW raised funds to install cold filtered water stations similar to these ones found at Curtin University.

Activity 9. Conversions for other plastics

For this activity you will need: A projector, screen, speakers and an internet connection to show a short clip and to display Exercise 6. Exercise 6 can be found at the back of the maths section on page 60.

1. Watch the clip on plastic bags from the *Bag It* movie www.youtube.com/watch?v=MRjPkl_4lmM
2. Complete Exercise 6 (page 60).

Extension or Assessment

- Examine the profit and loss statements of the school canteen. How much of the profit is from the sale of water? What percentage is this? How else could the canteen earn this amount without the sale of plastic bottled drinks?
- Investigate where plastics are sent for recycling. They could also analyse the environmental impact of exporting plastics for recycling in China.
    - How far do plastics travel to the recycling plant?
    - How much plastic is exported for recycling?
    - Is there an environmental impact of transporting recyclables to China or other overseas locations? How can you quantify it? You might like to consider both sides of the journey. Would the ships have returned empty if it wasn't for recyclables? www.recyclenow.com/why_recycling_matters/isnt_plastic_export.html

      The following graphs, from the 2011–12 *National Plastics Recycling Survey* (Australian) may also be useful.

      - Figure 23 (page 32): Plastics recyclate export from 1997 to 2011-12 (column graph).
      - Figure 46 (page 58): Destination of plastics reprocessed in Australia (pie chart).
      - Table 10 (page 33): Waste plastics exported overseas by polymer and state (two-way table).

      www.pacia.org.au/Library/PageContentVersionAttachment/b32ecc28-36a3-4087-bd68-33a889cf9aef/r02_05_a10802_nprs_2011_12_report.pdf

Student leadership

Inspired students might like to participate in, or organise, an event to encourage other students to join them in giving up plastic bottles for a day, a week or month. The details of this campaign are outlined in the student leadership section of this document.

References for this lesson

These links were used in the lesson and may provide further background information:

- Source for graphs: *2011/12 National Plastics Recycling Survey (Australia)*
  www.pacia.org.au/Library/PageContentVersionAttachment/b32ecc28-36a3-4087-bd68-33a889cf9aef/r02_05_a10802_nprs_2011_12_report.pdf
- Source for bottled water costs: *Good Food Australia*
  www.goodfood.com.au/good-food/drink/bottled-water-put-to-the-taste-test-20130513-2jh9k.html
- Where does my water come from: *Drinking Water Quality Annual Report 2011/12, Water Corporation*
  www.watercorporation.com.au/-/media/files/about%20us/our%20performance/drinking%20water%20quality/annual-report-2012.pdf

EXERCISE 1: The cost of water

Table 1. The price of water supplied to homes in WA

The *Water Corporation* in WA has a tiered pricing structure for the water supplied to our homes. The pricing structure for annual water use is shown in the table below.

Water use (kL)	Price per kilolitre
0 - 150 kL	$1.381 /kL
151 - 500 kL	$1.841 /kL
Over 500 kL	$2.607 /kL

Water Corporation (2014) www.watercorporation.com.au/my-account/rates-and-charges.

Table 2. Water use per household in WA

In 2008/09 the *Department of Water* conducted a survey on water use. The results are shown below.

Number of people in the house	Water use per year (L per household)
1	106 000
2	212 000
3	318 000
4	424 000
5	530 000
6	636 000

Department of Water (2013) www.water.wa.gov.au/PublicationStore/first/98576.pdf.

Table 3. Cost of bottled water

The WasteSorted Schools team visited a supermarket and recorded the cost of different brands of bottled water. The costs are the standard shelf price and do not include any discounts offered at the time.

Brand	Size of bottle	Cost	Cost per Litre
Fiji	500mL	$1.69	
Deep Spring	600mL	$1.75	
Aqua Pura	1.25L	$1.60	
Mount Franklin	1L	$2.10	
Evian	1.5L	$4.09	
Thank You Water	1.5L	$2.00	
Frantelle	1.5L	$1.45	
Snowy Mountain	1L	$1.29	
Woolworths Select	1L	$1.19	
Pump	750mL	$2.79	
Yaru	500mL	$1.50	
Coles brand	600mL	99c	
Coolridge	1L	$2.40	
Pureau	2L	$2.99	
Waiwera	1L	$3.60	

Prices sourced from a Perth supermarket in October 2014.

Complete one of the following options:

Option 1.

Elise Dalley from *Choice* (2013) claimed that 'Australian consumers pay almost 2000 times more than the cost of tap water to drink from a bottle'. Use the information provided in Table 1, 2 and 3 to determine if this claim is correct.

Option 2.

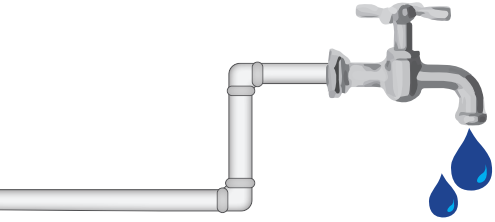
Elise Dalley from *Choice* (2013) claimed that 'Australian consumers pay almost 2000 times more than the cost of tap water to drink from a bottle'. Use Table 1, Table 2 and Table 3 to answer the following questions to determine if this claim is correct.

Part 1. Calculate the cost of water supplied to your household by following the following steps:

1. How many people are in your house, including you?
2. What is your water use per annum (per year)?
3. Convert your household's water use to kilolitres per annum (hint: 1000L = 1kL).
4. Calculate the total cost of your water per annum using these steps
   a. Calculate the cost of the first 150kL.
   b. Calculate the cost of the water from 151 – 500kL.
   c. Calculate the cost of any water over 500kL.
   d. Add these together to calculate the total cost of water per annum for your household.
5. Calculate the cost of water per litre for your household
   (Hint: you will need to use Question 1 and Question 3d).
6. Other students in your class may have a slightly different cost. Write down their cost. Why is it different?
7. What is the range in costs in your class?

Part 2. Calculate the mean (average) cost of bottled water

8. Look at each brand of bottled water in Table 3 and convert each to a cost per litre.
9. Use your answers from Question 8 to calculate mean cost of bottled water per litre.
10. Calculate the median, mode and range in the cost of bottled water per litre.



Alternatively, you could find out the costs of different brands at your local shop and use these.

Part 3.

11. Which is more expensive? Tap water or bottled water?

12. Use your answers to Part 1 and Part 2 to complete this sentence

    'On average, bottled water is _____ times more expensive than tap water'.

13. Was the statement by Elise Dalley correct? Does water from a bottle cost 2000 times more than tap water?

Extension:

How long would it take you to recoup the cost of a bottle of water by refilling the bottle with tap water? You will need to make an assumption about the amount of water you drink in a day.

Filling up with tap water saves money.

Answers based on four people in a household

1. 4
2. 424 000L
3. 424KL
4. a) $207.15 b) $504.43 c) 0 d) $711.58
5. $0.0017 per Litre(4 decimal places)
6. See teacher
7. See teacher
8. See teacher
9. $2.10 per Litre
10. Median = $2.10, Mode = none, range = $2.76
11. Bottled water
12. 1235 times more expensive (based on 4 person household)
13. See teacher

EXERCISE 2: How far does water travel?

Water supply in Perth

The Perth, South West, Goldfields and agricultural regions share a water supply system that draws on surface sources, groundwater and seawater desalination. This is known as the Integrated Water Supply System (IWSS) which provides fresh, clean drinking water to more than 1.7 million people. Surface water comes from eight dams in the Darling Range: South and North Dandalup, Serpentine, Wungong, Churchman Brook, Canning, Victoria dams and Mundaring Weir. Water is also supplied from Stirling and Samson Dams in the South West Region. Groundwater is drawn from the Yarragadee, Leederville and shallow aquifers (Water Corporation, 2012). The desalination plant is located in Kwinana. *Figure 1* shows the proportion of water supplied by surface water, groundwater and desalination.

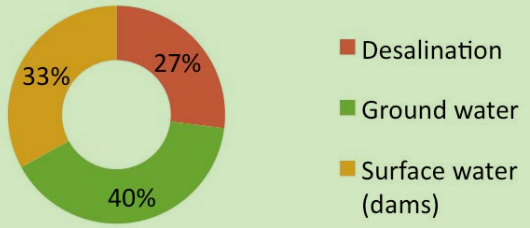


Figure 1. Current Water Sources in Perth (Water Corporation, 2014)

Table 1. Source of bottled water

Brand	Type of water source	Source of water or location of bottling	Cost
Fiji	Artesian	Yaqura, Fiji	$1.69
Deep Spring	Spring	Not supplied	$1.75
Aqua Pura	Purified (tap water)	Salisbury South, SA	$1.60
Mount Franklin	Spring	Bottled in Kewdale, Perth. Water sourced within two hours drive.	$2.10
Evian	Spring	Evian-Les-Bains, France	$4.09
Thank You Water	Spring	Mt Tamborine, QLD	$2.00
Frantelle	Spring	Bottled in Welshpool, Perth (sourced from springs in WA, NSW or VIC)	$1.45
Snowy Mountain	Spring	Daylesford, VIC	$1.29
Woolworths Select	Spring	Gingin, WA	$1.19
Pump	Purified (spring)	Bottled in Kewdale, Perth. Water sourced within two hours drive.	$2.79
Yaru	Spring	Mount Warning, NSW	$1.50
Coles brand	Spring	Not supplied	99c
Coolridge	Spring	Bottled in Welshpool, Perth (sourced from springs in WA, NSW or VIC)	$2.40
Pureau	Purified (Sydney water, tap)	Sydney	$2.99
Waiwera	Artesian	Auckland, New Zealand	$3.60

Option 1. Comparison using means

Suitable for Years 7 - 9

Part 1. Calculate the mean distance travelled by tap water

1. Surface water comes from eight dams in the Darling Range: South and North Dandalup, Serpentine, Wungong, Churchman Brook, Canning, Victoria dams and Mundaring Weir. Calculate the mean distance from your home to each of the surface water sources (dams) listed above.
2. Groundwater is drawn from the Yarragadee, Leederville and shallow aquifers. Calculate the mean (average) distance from your home to each of the two known groundwater sources.
3. The desalination plant is located in Kwinana. How far is this from your home?
4. Use the percentages in Figure 1 to calculate a weighted average for the water supplied to the tap in your home using the formula below.

$$\textbf{Weighted average} = \frac{(27\times D + 40\times G + 33\times S)}{100}$$

where,
D = desalination distance
G = groundwater distance
S = surface water (dam) distance}

Part 2. Calculate the mean (average) distance travelled by bottled water

5. Use Table 1 to calculate the distance travelled by each bottled water brand to your home.
6. What is the maximum distance travelled by bottled water?
7. What is the range?
8. What is the mean (average) distance travelled by bottled water?
9. What would happen to the mean if we removed one or two of the largest distances travelled?
10. How does the distance travelled by bottled water compare to the distance travelled by tap water to your home?

Alternatively, you could find out where the brands at your local shop come from and use these for the calculation in question 5

11. Research: How is tap water transported to your home? How is bottled water transported and stored before it is sold. What environmental impacts are associated with the transport and storage of bottled water? Why is tap water a more sustainable choice?

Answers based on Scarborough

1. Mean = 64km
2. 22.55km (Distance to each known groundwater source: (Distance to each dam: 112km, 99.2km, 88.7km, 51.5km, 49.9km, 28.2km, 28.2km, 55km) 33.3km, 11.8km)
3. 55.9km
4. 45.23km
5. Distance travelled: 6385km, 2689km, 22.2km, 14 239km, 4353km, 24.5km, 3353km, 76.9km, 22.2km, 4360km, 24.5km, 3948km, 5343km
6. 14 239km
7. 14 216.8km
8. Mean = 3449km
9. It would decrease
10. Bottled water travels 314 times further
11. Tap water travels along pipes while bottled water travels by ships, trains and trucks. The bottled water travels much greater distances and uses more energy and fossil fuels than tap water. Burning fossil fuels for transport also creates pollution and greenhouse gases. Often bottled water is refrigerated prior to sale, consuming more electricity and fossil fuels. Tap water is a more sustainable choice because it uses less energy and resources.

'One hundred percent of FIJI Water is from a single source in the pristine, tropical Fiji Islands, an archipelago of over 300 islands nestled in the South Pacific, more than 1600 miles from the nearest industrialized country. It is bottled at the source in the remote Yaqara Valley on the island of Viti Levu.' www.fijiwater.com/faqs

Option 2. Comparison using box-and-whisker plot

Suitable for Year 10

In this exercise you will draw two box-and-whisker plots to help you compare the distance travelled by tap and bottled water.

Part 1. Draw a box-and-whisker plot for the distance travelled by tap water by following these steps:

1. Calculate the distance from each of the 11 known water sources to your home. The water sources are listed in the paragraph about the water supply to Perth.
2. Calculate the mean distance travelled by water to get to your tap.
3. Calculate the standard deviation (Year 10A only).
4. Which water source is the closest to your home?
5. What water source is the furthest from your home?
6. What is the median distance of the water sources from your home?
7. Draw a box-and-whisker for this data (the distance water travels to your tap at home).

Part 2. Draw a box-and-whisker plot for the distance travelled by bottled water by following these steps:

8. Use Table 1 to calculate the distance travelled by each bottled water brand to your home
9. Calculate the mean distance travelled by water to get to your tap.
10. Calculate the standard deviation (Year 10A only).
11. What is the minimum distance travelled by bottled water to your home?
12. What is the maximum distance travelled by bottled water to your home?
13. What is the median distance travelled by bottled water to your home?
14. Draw a box-and-whisker plot showing the distance water travels to your tap at home.

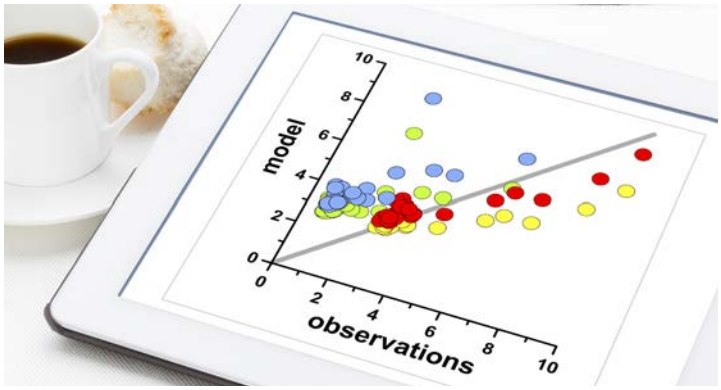
Part 3. Compare the distances travelled

15. Compare the mean distance travelled by tap and bottled water (Q2 and Q9).

16. Which data has the greatest variation? How can you tell?

17. Use the box-and-whisker plots to describe the differences between tap and bottled water.

18. Research: How is tap water transported to your home? How is bottled water transported? What environmental impacts are associated with the transport and storage (refrigeration) of bottled water? Why is tap water a more sustainable choice?

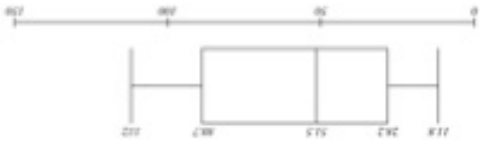


Extension:

Draw a scatterplot of the distance travelled by bottled water and the cost. Is there a relationship? If so, describe how distance and cost are related.

Answers based on Scarborough

1. Distance to each water source: 112km, 99.2km, 88.7km, 51.5km, 49.9km, 28.2km, 28.2km, 55km, 33.3km, 11.8km, 55.9km
2. 55.8km
3. 31.8km
4. 112km, South Dandalup
5. 11.8km, Leederville
6. 51.5km
7. Five point summary; 11.8, 28.2, 51.5, 88.7, 112



Distance tap water travels

8. Distance travelled (km): 6385, 2689, 22.2, 14239, 4353, 24.5, 3353, 76.9, 22.2, 4360, 24.5, 3948, 5343
9. 3449km
10. 3973km
11. 22.2km
12. 14 239km
13. 3353km
14. Five point summary: 22.2, 24.5, 3353, 5343, 14239

Distance bottled water travels

15. Bottled water travels 62 times further than tap water (on average)
16. Bottled water has the greatest variation (as shown by the larger standard deviation)
17. The bottled water distances are much larger and have much greater variation (especially in the top half of brands).
18. Tap water travels along pipes while bottled water travels by ships, trains and trucks. The bottled water travels much greater distances and uses more energy and fossil fuels than tap water. Burning fossil fuels for transport also creates pollution and greenhouse gases. Often bottled water is refrigerated prior to sale, consuming more electricity and fossil fuels. Tap water is a more sustainable choice because it uses less energy and resources.

EXERCISE 3: How much plastic is recycled and where does it go?

Table 1. Total consumption and recycling of plastics in Australia, 2011/12 (by polymer).

Polymer	Plastics Identification Code	Consumption (tonnes)	Domestic recycling (tonnes)	Export for recycling (tonnes)	Total recycling (tonnes)
PET	1	116 838	15 101	47 043	62 144
HDPE	2	405 977	33 668	59 535	93 203
PVC	3	209 465	6 222	2 212	8 434
L/LLDPE	4	212 525	33 658	34 036	67 694
PP	5	216 347	20 323	18 817	39 140
PS	6	23 630	2 994	4 896	7 889
EPS	6	40 335	2 712	64	2 775
ABS/SAN	7	20 619	5 312	0	5 312
PU	7	56 523	6 993	0	6 993
Nylon	7	15 871	860	0	860
Other	7	158 560	8 189	0	8 189
Totals	**-**	**1 476 690**	**136 032**	**166 604**	**302 635**

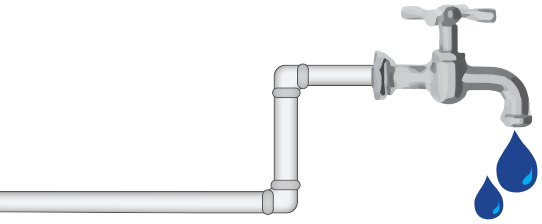
Source: 2011/12 National Plastics Recycling Survey, PACIA

Bottles that don't get recycled end up in landfills.

Recycling plastics in Australia

1. In 2011/12, how many tonnes of PET were consumed in Australia?
2. How many tonnes of PET plastic were not recycled? Where would these go?
3. What percentage of PET plastic is recycled?
4. Of the PET plastics that are recycled, what percentage is exported for recycling?
5. Research: What kind of environmental impacts might be associated with sending plastic overseas for recycling? Where does the plastic go? How far does it travel? What mode of transport is used to get the plastic overseas?
6. How much does an empty bottle of water weigh?
7. In Australia, 15,253.79 tonnes of PET was used in the packaging of bottled water in 2009/10 (Source: www.gotap.com.au/Did%20you%20know/Facts.aspx).
   a. Use the weight of an empty bottle to estimate how many PET bottles were used in 2009/10?

      Hint: convert both the weight of the bottle and the weight of PET into kilograms before calculating the number of PET bottles used in a year.
   b. What percentage of PET plastic goes to landfill each year?
   c. How many PET water bottles end up in landfill per minute?
   d. How does this compare to the rate in America (840 bottles per second)?
   e. What assumption have you made in this calculation?



The lightest 600mL water bottle produced in Australia weighs just 12.8grams (according to Mount Franklin, 2011). Students could use this figure if you don't have a water bottle to weigh.

Answers

1. 116 838 tonnes
2. 54 694 tonnes, these would go to landfill
3. 53%
4. 76%
5. Most of the plastics exported for recycling go to Asian countries (more than 7000km away). A lot of energy and fuel is used to transport plastics for recycling.
6. See teacher (lightest bottle is 12.8g)
7. a) 1,191,702,344 bottles (using 12.8g per bottle)
   Challenge: 1.2 billion bottles
   b) 47% go to landfill (from Table 1)
   c) 1066 per minute
   d) Less (Australians throw out 18 bottles per second)
   e) All bottles are the same size and weigh 12.8g.

EXERCISE 4:
Recycling plastics at school

Table 1. Cost of waste removal at school

Waste Stream	Bin Type	Bin Size	Frequency	Unit	All prices are GST Inclusive		
					PERTHWASTE effective 01/01/2015	SITA effective 01/01/2015	VEOLIA effective 01/04/2013
Co-mingled Recycling	Mobile Garbage Bins	240 Litre	3 or more times/week	per bin	$5.05	$4.96	$6.05
	Mobile Garbage Bins	240 Litre	Weekly	per bin	$5.05	$4.96	$6.05
	Mobile Garbage Bins	240 Litre	Fortnightly	per bin	$5.05	$4.96	$6.33
	Mobile Garbage Bins	240 Litre	Monthly	per bin	$5.05	$4.96	$6.60
	Mobile Garbage Bins	240 Litre	Ad hoc	per bin	$5.05	$4.96	$6.05
	Mobile Garbage Bins	660 Litre	3 or more times/week	per bin	$10.80	$9.22	$9.90
	Mobile Garbage Bins	660 Litre	Weekly	per bin	$10.80	$9.22	$9.90
	Mobile Garbage Bins	660 Litre	Fortnightly	per bin	$10.80	$9.22	$10.45
	Mobile Garbage Bins	660 Litre	Monthly	per bin	$10.80	$9.22	$10.45
	Mobile Garbage Bins	660 Litre	Ad hoc	per bin	$10.80	$9.22	$9.90
	Mobile Garbage Bins	1100 Litre	3 or more times/week	per bin	$14.08	$12.69	$12.10
	Mobile Garbage Bins	1100 Litre	Weekly	per bin	$14.08	$12.69	$12.10
	Mobile Garbage Bins	1100 Litre	Fortnightly	per bin	$14.08	$12.69	$12.65
	Mobile Garbage Bins	1100 Litre	Monthly	per bin	$14.08	$12.69	$12.65
	Mobile Garbage Bins	1100 Litre	Ad hoc	per bin	$14.08	$12.69	$12.10
	Front Lift Bins	1.5 Cubic Metre	Ad hoc	per bin	$27.51	N/A	$26.40
	Front Lift Bins	3.0 Cubic Metre	Ad hoc	per bin	$44.20	N/A	$39.60
	Front Lift Bins	4.5 Cubic Metre	Ad hoc	per bin	$52.24	N/A	$59.40
General waste	Mobile Garbage Bins	240 Litre	3 or more times/week	per bin	$6.38	$7.42	$6.82
	Mobile Garbage Bins	240 Litre	Weekly	per bin	$6.38	$7.42	$6.82
	Mobile Garbage Bins	240 Litre	Fortnightly	per bin	$6.38	$7.42	$7.15
	Mobile Garbage Bins	240 Litre	Monthly	per bin	$6.38	$7.42	$7.37
	Mobile Garbage Bins	240 Litre	Ad hoc	per bin	$8.86	$7.42	$6.82
	Mobile Garbage Bins	660 Litre	3 or more times/week	per bin	$16.70	$14.84	$11.88
	Mobile Garbage Bins	660 Litre	Weekly	per bin	$16.70	$14.84	$11.88
	Mobile Garbage Bins	660 Litre	Fortnightly	per bin	$18.93	$14.84	$16.28
	Mobile Garbage Bins	660 Litre	Monthly	per bin	$18.93	$14.84	$20.68
	Mobile Garbage Bins	660 Litre	Ad hoc	per bin	$18.93	$14.84	$11.88
	Mobile Garbage Bins	1100 Litre	3 or more times/week	per bin	$21.14	$18.89	$15.62
	Mobile Garbage Bins	1100 Litre	Weekly	per bin	$21.14	$18.89	$15.62
	Mobile Garbage Bins	1100 Litre	Fortnightly	per bin	$21.14	$18.89	$21.78
	Mobile Garbage Bins	1100 Litre	Monthly	per bin	$21.14	$18.89	$27.94
	Mobile Garbage Bins	1100 Litre	Ad hoc	per bin	$21.14	$18.89	$15.62
	Front Lift Bins	1.5 Cubic Metre	Ad hoc	per bin	$30.88	$26.32	$26.40
	Front Lift Bins	3 Cubic Metre	Ad hoc	per bin	$51.82	$45.55	$36.96
	Front Lift Bins	4.5 Cubic Metre	Ad hoc	per bin	$69.31	$66.80	$50.99

Source: General Waste Disposal and Recycling Services Price Schedule, CUA36309
http://infopage.gem.wa.gov.au/docs/Buying_Guide_-_36309.pdf

Bales of plastic ready for recycling from a Materials Recovery Facility in Bunbury.

Swan Christian College collect plastics and other recyclables.

Recycling plastics at your school

1. How many plastic bottles of drink (water, soft drink, juice, other) have you purchased at school in the last week? How many of these did you recycle?
2. Create a table in your book to collect the class data on the number of 'purchased' plastic bottles. Your teacher will show you how to do this.
3. Use the table from Question 2 to calculate the average number of plastic bottles purchased per student in your class.
4. How many students attend your school?
5. Use the class average to calculate the total number of plastic bottles purchased by students at your school:
   a. in one week.
   b. one school year (40 weeks).
6. How much does a plastic bottle weigh? How many tonnes of plastic does your school produce each year from drink containers?
7. According to Keep Australia Beautiful, a standard 240L bin can hold 170 containers (http://kab.org.au/wp-content/uploads/2012/07/3_recycling_trade_flyer_pack.pdf). How many 240L bins would your school fill each week with the plastic bottles from drinks consumed?

8. Assume your school has 1.5 cubic metre front-lift general waste bins (skip bin)

   a. Convert 240L to cubic metres.
   b. How many 240L bins could fit in a 1.5 cubic metre bin?
   c. Use the Keep Australia Beautiful figure in Question 7 to calculate how many containers fit in a 1.5 cubic metre bin.
   d. Calculate how many 1.5 cubic metre bins your school would fill each week.
   e. How much would it cost to have these bins collected by PERTHWASTE if:
      i. they all went to landfill (general waste)?
      ii. they all were recycled (co-mingled)?
      iii. 53% of the containers were recycled?
   f. Use your answer to Question 8e (iii) to calculate how much money your school could save in a year if 53% of plastic containers were recycled.

9. Extension: How much money could your school save in one year if students at your school reduced the purchase of drinks in plastic containers by 10% by drinking tap water instead? List your assumptions with your calculation.

Some questions to consider:

- Does your school currently recycle plastic containers?
- What kind of bins does your school have?
- Who collects the bins? How much are the collection costs?

If you don't know the answer, you could investigate by looking around the school for clues or you could ask staff. Alternatively, you could make assumptions and list these with your answer.

Dowerin DHS collect milk bottles, clear plastic bottles and aluminium cans for recycling.

Answers

8. a) 0.24m3 b) 6.25 bins c) 1063 containers
   d) See teacher e) See teacher f) See teacher

EXERCISE 5: Bottled water survey

1. Please tick: Male ☐ Female ☐
2. Tick one. I am a
   - ☐ Student
   - ☐ Staff member (principal, teacher, librarian etc)
   - ☐ Other, please specify _____

Please answer the following questions about your water drinking habits. Tick one option for each question.

3. What kind of water do you drink most often?
   - ☐ Tap
   - ☐ Bottled
   - ☐ Filtered (e.g. using household filter)
4. How often do you drink water from the water fountains (bubblers) at school?
   - ☐ Never
   - ☐ Sometimes
   - ☐ Often
   - ☐ Always
5. How often do you carry a refillable water bottle with you at school?
   - ☐ Never
   - ☐ Sometimes
   - ☐ Often
   - ☐ Always
6. How many bottles of water did you purchase at school in the last week? _____
7. If you buy bottled water at school, why do you buy it instead of drinking from the tap?
   - ☐ I prefer cold water from the fridge
   - ☐ I prefer the taste of bottled water to tap water
   - ☐ I think bottled water is 'cooler' (more fashionable) than tap water
   - ☐ It's more convenient than tap water
   - ☐ Other, please describe:_____

Please answer the following questions about your opinions on bottled water. Tick one option for each question.

8. I think bottled water tastes better than tap water.
   - ☐ Agree
   - ☐ Disagree
   - ☐ Unsure

9. I think bottled water is safer and cleaner than tap water.

- ☐ Agree
- ☐ Disagree
- ☐ Unsure

10. I think bottled water is a waste of money.

- ☐ Agree
- ☐ Disagree
- ☐ Unsure

11. Some bottled water that you buy in shops is filtered tap water.

- ☐ True
- ☐ False
- ☐ Unsure

12. I am concerned about the cleanliness or safety of water fountains (bubblers) at school.

- ☐ Agree
- ☐ Disagree
- ☐ Unsure

13. There are enough water fountains (bubblers) available at school.

- ☐ Agree
- ☐ Disagree
- ☐ Unsure

14. If more water fountains (bubblers) were available at school, I would use them more.

- ☐ Agree
- ☐ Disagree
- ☐ Unsure

15. If the water fountains (bubblers) were of better quality, I would use them more.

- ☐ Agree
- ☐ Disagree
- ☐ Unsure

16. I am concerned about the environmental impact of bottled water (e.g. litter, plastic doesn't break down).

- ☐ Agree
- ☐ Disagree
- ☐ Unsure

17. We should ban the sale of bottled water at the canteen.

- ☐ Agree
- ☐ Disagree
- ☐ Unsure

EXERCISE 6: Plastic bag conversions

1. One million plastic grocery bags are used every minute.
   a. How many bags are used per hour?
   b. How many bags are used per day?
   c. What would the impact be per year?
2. Forty billion (40,000,000,000) plastic bags were eliminated in China after one year of not using them.
   a. How many bags did China save per day?
   b. What are ways that we can reduce the number of plastic bags used each time we visit the grocery store?
3. It costs 22 cents per bag in Ireland at the market.
   a. If you went to the store and used 3 bags to take home your groceries, how much money would you spend on plastic bags each visit?
   b. How much would you spend if you did the same shopping every week for a year?
   c. If you purchase one reusable bag at the grocery store for $1.50 and bring it each time you go to the grocery store, how much money would you save over the course of a month?
4. Three hundred million take-away coffee cups are consumed in one day in the US.
   a. How many coffee cups are used per hour?
   b. How many coffee cups are used per second?
5. The average person in the US contributes 800 pounds of packaging per year to the waste stream:
   a. How many kilograms is this?
   b. How much is this per person, per day?
6. What steps can YOU take to reduce the amount of waste in the form of packaging that you contribute to the waste stream?
7. One million plastic cups are used on US airline flights every 6 hours
   a. How many plastic cups are used each minute?
   b. How many plastic cups are used in one day?
   c. Are there ways you can decrease this number the next time you are flying on an airplane?

By converting these units, you may find yourself converting your ways!

These conversion questions were modified from the Bag It curriculum document available at http://bagitmovie.com/downloads/EducationPacket_7.pdf

Answers

1. a) 60 million b) 1440 million c) 525 600 million
2. a) 109 589 041 bags per day b) Take your own bags
3. a) $0.66 b) $34.32 c) $2.86
4. a) 12.5 million (12 500 000)b) 3472
5. a) 362.8kg b) 1kg per day
6. Buy less packaged food (and more fresh food), buy second hand products, fix things instead of buying new things, borrow or hire items
7. a) 2778 b) 4 million c) Take your own cup

MATHS: CURRICULUM LINKS

Year 7:

NUMBER AND ALGEBRA	**Number and Algebra; Real numbers** Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies (ACMNA158).	Activity 4, 5
	Recognise and solve problems involving simple ratios (ACMNA173).	Activity 2, 5, 9
	Number and Algebra; Money and financial mathematics Investigate and calculate 'best buys', with and without digital technologies (ACMNA174).	Activity 2
STATISTICS AND PROBABILITY	**Statistics and Probability; Data representation and interpretation** Identify and investigate issues involving numerical data collected from primary and secondary sources (ACMSP169).	Activity 7
	Construct and compare a range of data displays including stem-and-leaf plots and dot plots (ACMSP170).	Activity 7
	Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data (ACMSP171).	Activity 2, 7

Year 8:

NUMBER AND ALGEBRA	**Number and Algebra; Number and place value** Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies (ACMNA183).	Activity 2, 3, 4, 5
	Number and Algebra; Real numbers Solve problems involving the use of percentages, including percentage increases and decreases, with and without digital technologies (ACMNA187).	Activity 5
	Solve a range of problems involving rates and ratios, with and without digital technologies (ACMNA188).	Activity 2, 5
MEASURE-MENT	**Measurement; Using units of measurement** Choose appropriate units of measurement for area and volume and convert from one unit to another(ACMMG195).	Activity 5
STATISTICS AND PROBABILITY	**Statistics and Probability; Data representation and interpretation** Investigate techniques for collecting data, including census, sampling and observation (ACMSP284).	Activity 7
	Explore the practicalities and implications of obtaining data through sampling using a variety of investigative processes (ACMSP206).	Activity 7
	Explore the variation of means and proportions of random samples drawn from the same population (ACMSP293).	Activity 7

Year 9:

NUMBER AND ALGEBRA	**Number and Algebra; Real numbers** Solve problems involving direct proportion. Explore the relationship between graphs and equations corresponding to simple rate problems (ACMNA208). Express numbers in scientific notation (ACMNA210).	Activity 2, 5, 9 Activity 5
STATISTICS AND PROBABILITY	**Statistics and Probability; Data representation and interpretation** Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly and from secondary sources (ACMSP228).	Activity 7

Year 10:

STATISTICS AND PROBABILITY	**Statistics and Probability; Data representation and interpretation** Construct and interpret box plots and use them to compare data sets (ACMSP249).	Activity 3

Year 10A:

STATISTICS AND PROBABILITY	**Statistics and Probability; Data representation and interpretation** Calculate and interpret the mean and standard deviation of data and use these to compare datasets (ACMSP278).	Activity 3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SCIENCE: TEST THE TAP
Background Information for teachers

Curriculum focus

Science: Science Understanding (Biological sciences, Earth and space sciences) and Science Inquiry Skills.

See list of curriculum links at the end of the science activity instructions for more information.

Aim: **Students carry out scientific investigations to evaluate and compare the taste and quality of bottled and tap water. They research the impacts of plastic on our oceans and food chains and communicate their findings.**

Summary of activities:

There are six activities in this unit.

1. Taste and odour test on tap and bottled water
2. Testing the tap (physical and chemical properties)
3. Researching the source of bottled water (homework)
4. The science of plastics in our ocean
5. Taking action with *Take 3*
6. Conclusion and communication.

Suitable for: Year 7 (possibly Year 8).

Duration: Approximately five lessons plus homework.

Background information

In this set of activities, students conduct a range of scientific investigations to compare the properties of tap and bottled water. We have extended the unit of work to include research into plastics in our ocean (how they move and how they accumulate in the food chain). Using the scientific tests we would like students to conclude that there is no significant difference between tap and bottled water. Taking into consideration their research into the environmental impacts of plastic, we hope that they conclude that tap water is a more sustainable choice. In some cases, students may prefer the taste of bottled water or perceive a difference in a quality that hasn't been tested (such as fluoride). You might like to challenge these students by doing an additional test with filtered tap water. Be prepared for some debate and discussion on taste, quality, environmental impacts and ethical decisions.

Table 1 on page 66 provides an outline of the Australian drinking water guidelines and potential health risks for each of the variables we suggest your students test.

The WasteSorted Schools team trialled this investigation with the Intermediate Home Drinking Water Test Kit from www.testkits.com.au. The WasteSorted Schools team has a number of free kits available for schools to use. Please contact the WasteSorted Schools team for the kit at wastesortedschools@dwer.wa.gov.au.

For more information and statistics on bottled water in Australia please see the bottled water background information in the introduction to this guide.

Cross-curriculum links

This guide is designed to be used as a cross-curriculum unit with many subject areas looking at the topic of bottled water from different angles. This creates opportunities for sharing across subject areas and year levels. You could invite:

- an English class to share taste tests results for additional analysis or invite an English class to present persuasive speeches to highlight why tap water is a better choice
- invite a maths class to share their results on the cost and distance travelled by bottled water
- a geography class to share what happens when plastic ends up in the ocean (inquiry question 6).

You might also like to share the investigation results online, in the newsletter or at an assembly.

Table 1. Water quality variables

WATER PROPERTIES AND CONTAMINANTS		
Property/ Contaminant	**Potential risk**	**Australian drinking water standard** mg/L unless otherwise specified
pH	Extreme pH levels (less than 4 and greater than 11) may adversely affect health although there is insufficient data to set a health guideline. Low pH can be corrosive while higher pH can cause scale problems in the pipes and taste issues.	Insufficient data to set a guideline for health Suggested pH 6.5–8.5 to prevent corrosion of pipes
Hardness (as CaCO3)	Primarily caused by calcium and magnesium salts. Water that is too soft can be corrosive. Hard water can increase scaling problems. Hard water can also create problems with soaps and detergents (it is difficult to lather).	Soft: 0 – 60 mg/L Good quality: 60 – 200 mg/L Hard: 200 – 500 mg/L Very hard: more than 500 mg/L
Iron	Iron occurs naturally in water in small amounts. High concentrations can stain laundry and fittings. Iron bacteria can cause blockages, taste and odour issues and corrosion.	Insufficient data to set health guideline Ideally less than 0.3 mg/L (for taste)
Copper	Copper in water may come from erosion of natural deposits or from corrosion of copper pipes and fittings by salt or low pH water. High concentrations may cause ill effects in some people and stain water blue/green.	2 mg/L (for health)
Free chlorine	Chlorine is widely used as a disinfectant. It is added to water to control and kill microbes (such as bacteria). May irritate the eyes and nose or cause stomach upset. Can cause odour issues for some people (generally if greater than 0.6mg/L).	5 mg/L
Nitrate and nitrite	Occur naturally. Water containing fertilisers and sewage are sources of nitrate/nitrite. Infants (below the age of six months) are most at risk from becoming ill from drinking water contaminated with nitrate/nitrite. Nitrate is rapidly oxidised to nitrate.	50 mg-NO3/L (as nitrate) 3 mg-NO3/L (as nitrite)
Bacteria	Bacteria occur in sewage and natural water and may indicate that water has been contaminated with animal or human waste (faeces). Sickness from bacteria can cause diarrhoea, cramps, nausea, headaches and can even be fatal.	0

Information and guidelines in the table were sourced from the Australian Drinking Water Guidelines (2011, updated 2013) available on the National Health and Medical Research website www.nhmrc.gov.au/guidelines/publications/eh52.

SCIENCE: TEST THE TAP
Activity Instructions

Activity 1. Taste and odour test on tap and bottled water

For this activity you will need:

- a projector
- speakers
- access to the internet
- bottled water at room temperature
- tap water at room temperature (preferably let it sit overnight to release the chlorine)
- clean cups for taste testing
- labels and pens for marking cups (i.e. Sample A, Sample B).

1. Watch this fun clip about buying bottled air (one minute) www.banthebottle.net/video/buying-bottled-water-is-like-buying-air-it-doesnt-make-sense.
2. Ask students for their reactions to the idea of selling air. Is it different from selling water? What do they think? Are we being duped (tricked)?
3. Ask students 'Do you think you can tell the difference between tap and bottled water in terms of taste or smell?'
4. Ask students to make a prediction. Which type of water students will students prefer the taste and smell of?
5. As a class, discuss how to design and conduct a test for odour and taste of bottled and tap water to determine which the class prefers?
6. In small groups, ask students to conduct the odour and taste test using bottled and tap water. Students might like to use Table 2 to record the results for their investigation.

7. Perform the investigation and compile the class results. Did these match your predictions?
8. Watch a short film clip on a taste test done in New York City. http://abcnews.go.com/WNT/video/bottled-water-tap-water-difference-21202028. How do those results compare with yours? Are you surprised?

Table 2. Taste test data

Record your observations in the table below for the two different samples of water. How do they smell? How do they taste?

Water Sample	Odour	Taste	Other observations
Sample A			
Sample B			
Which sample do you prefer? Sample A or Sample B?			
Why?			
Which sample was the tap water? Was it the one you preferred?			
Compile the data from the entire class. Which sample was preferred overall?			
Are you surprised by the results?			

Activity 2. Testing the tap (physical and chemical properties)

In this investigation students will be required to conduct a range of scientific investigations to see if there is a difference in composition between tap and bottled water.

For this activity you will need:

- Bottled water at room temperature
- Tap water at room temperature, preferably water that has been sitting overnight
- Glassware or plastic containers (two per group)
- Copies of Table 1 (page 66) with the information and guidelines for each property (one copy per group)
- Water testing materials. The WasteSorted Schools team trialled this investigation with the Intermediate Home Drinking Water Test Kit from www.testkits.com.au. The WasteSorted Schools team has a number of free kits available for schools to use. Please contact the team for your kit at wastesortedschools@dwer.wa.gov.au.

WasteSorted Schools used a home drinking water test kit to conduct the bottled water and tap water comparison.

1. Many people have a perception that bottled water is cleaner or purer and is better for them than tap water. Do your students think this? Ask students to brainstorm what they think of when they think of bottled water compared to tap water.
2. Divide students into small groups. Each group will test one property or one contaminant in the tap and bottled water.
    a. pH
    b. hardness
    c. iron
    d. copper
    e. free chlorine
    f. nitrate and nitrate
    g. bacteria (note: the results of this test will be available in 48 hours and might be best done as a demonstration by the teacher).
3. Ask students to design and then conduct an investigation to test bottled and tap water for their assigned variable. You might like to scaffold this for them by asking them to create a table similar to the one we provided in Table 3. Please provide Table 1 (page 66) to each group so that they can read about the property or contaminant they are testing.

4. When each group has their test results, have a jigsaw activity to share the results and information about the property or contaminant tested. Record the class results in Table 4 (page 72) and discuss:

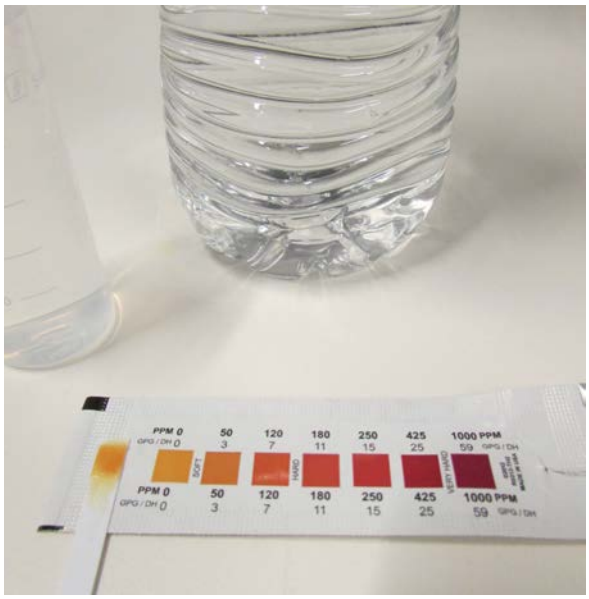
   a. Is there a difference in the composition of tap and bottled water?

   b. Do you think some brands of bottled water come from the tap? Don't give them the answer. The students will research this question in the next activity.

The WasteSorted Schools team conducted this activity and found the following:

	Tap water	Bottled water	Comments
pH	8 (alkalinity 180)	6.5 (alkalinity 0)	Both within safe drinking water guidelines
Hardness	0	0	No colour change for either strip
Iron	0	0	No colour change for either strip
Free chlorine	0	0	No colour change for either strip
Nitrate and nitrite	0	0	No colour change for either strip
Copper	0	0	No colour change for either strip
Bacteria	0	0	Solution turned purple and remained purple (it turns yellow if bacteria are present)

Neither sample contained any bacteria. The solution turns yellow if bacteria are present.



Test strips are used for most tests and are easy for students to use.

Table 3. Water sample recording sheet for individual variable

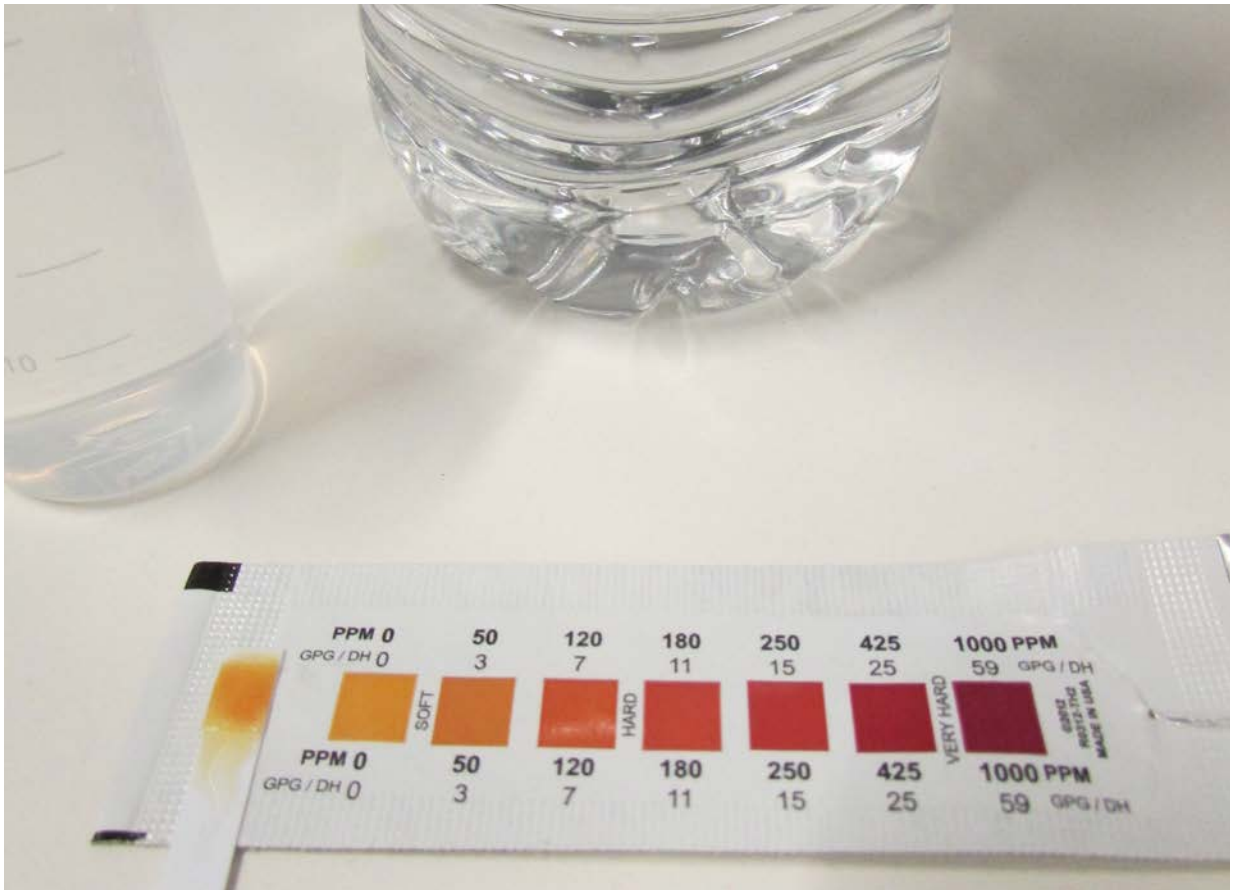
Use this table to plan your group's water quality test and record the results.

Testing for (tick one):			
☐ pH	☐ Hardness	☐ Iron	
☐ Free chlorine	☐ Nitrate/Nitrite	☐ Copper	☐ Bacteria
Aim:			
Hypothesis or prediction:			
Materials:			
Method:			
Results and observations:			
Discussion (be sure to include any sources of error):			
Conclusion:			

Table 4. Water sample recording sheet for class results

Use this table to record the class results

Variable	Who is conducting the test?	RESULTS		Comments
		Tap water	Bottled water	
pH				
Hardness				
Iron				
Free chlorine				
Nitrate / Nitrite				
Copper				
Bacteria				



Activity 3. Researching the source of bottled water (homework activity)

In this activity, students research different brands to discover where the water in bottled water is sourced.

1. Ask students to choose a brand of bottled water (or assign them a brand from the list in the table below). Ask them to find out where the water comes from. Is it from a spring? Is it artesian? Or is it from municipal sources (the tap)?
   You may need to give students a week to do this activity as some students will need to contact the company to find out the answers.
2. Discuss the results with the class. Do some brands of bottled water come from the tap? Do you feel duped (tricked) by bottled water companies?

WasteSorted Schools conducted this investigation with brands from a local supermarket and found this:

Brand	Type of water source	Source of water or location of bottling
Fiji	Artesian	Yaqura, Fiji
Deep Spring	Spring	Not supplied
Aqua Pura	Purified (tap water)	Salisbury South, SA
Mount Franklin	Spring	Bottled in Kewdale, Perth. Water sourced within two hours drive.
Evian	Spring	Evian-Les-Bains, France
Thank You Water	Spring	Mt Tamborine, QLD
Frantelle	Spring	Bottled in Welshpool, Perth (sourced from springs in WA, NSW or VIC)
Snowy Mountain	Spring	Daylesford, VIC
Woolworths Select	Spring	Gingin, WA
Pump	Purified (spring)	Bottled in Kewdale, Perth. Water sourced within two hours drive.
Yaru	Spring	Mount Warning, NSW
Coles brand	Spring	Not supplied
Coolridge	Spring	Bottled in Welshpool, Perth (sourced from springs in WA, NSW or VIC)
Pureau	Purified (Sydney water, tap)	Sydney
Waiwera	Artesian	Auckland, New Zealand

**We used the brands' labels, websites and emails to companies to gather this data.*

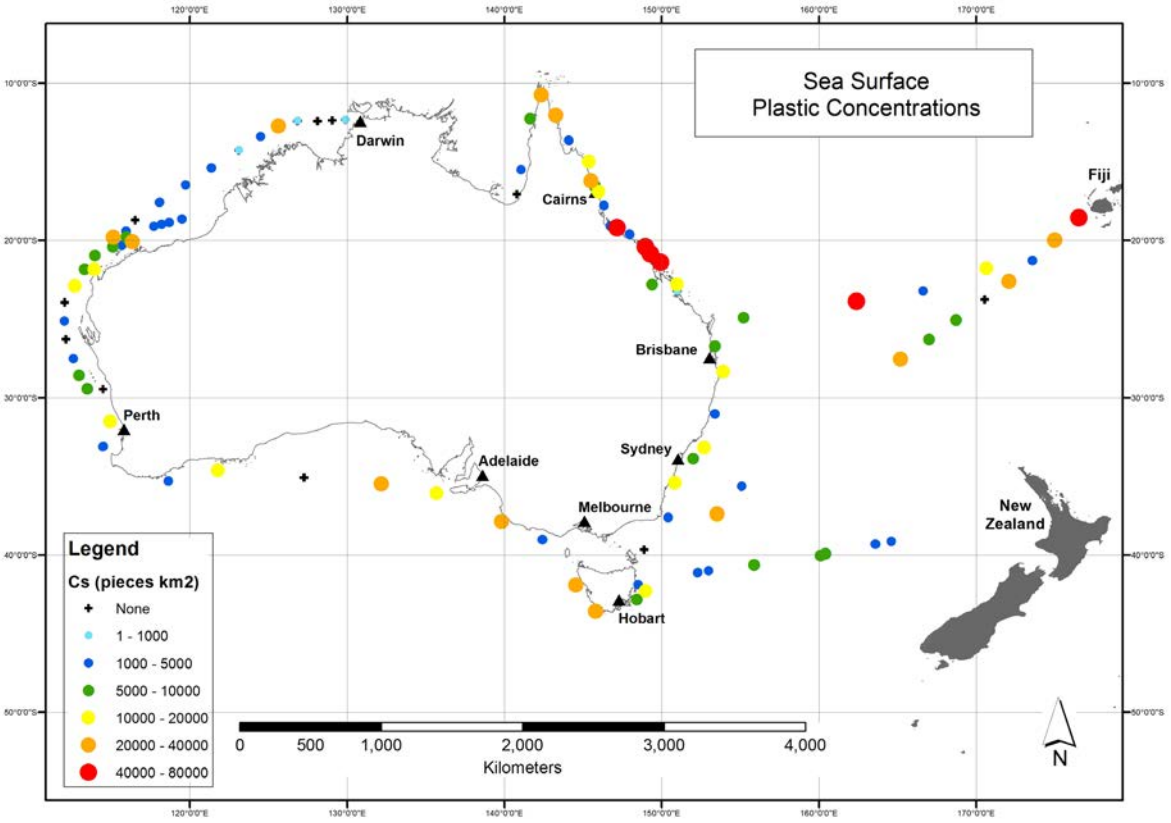
Activity 4. The science of plastics in our ocean

In this activity, students will research how plastics move in our ocean and how plastics impact upon the food chain.

For this activity you will need:

- a projector
- speakers
- access to the internet
- computers for student research.

1. Watch the Seven news clip on plastic in our oceans www.youtube.com/watch?v=os7OuSxP-JA.
2. Discuss with students 'How does this make you feel about plastic?'
3. Watch the video clip on how science is used to chart the garbage patches (3.5 minute0s) www.youtube.com/watch?v=M4UK9Yt6A-s.
4. Give students a chance to look at the website and experiment with how plastics can move through the ocean over time www.adrift.org.au.
5. Watch the clip on the journey to the ocean www.youtube.com/watch?v=vh6MDuxYing.
6. Ask students to research and answer the following questions (they could do this in groups of three or four).
   a. Where do plastics come from? Are plastics a renewable resource?
   b. When was plastic first developed? When did it become widely used? What properties make plastic beneficial for things like food storage?
   c. Science may have provided plastic as a solution to food storage and packaging but it has impacted upon society. What happens to plastic once it enters the ocean?
   d. How has science helped us to understand the way plastic moves in the ocean?
   e. How are plastics in our ocean harmful to marine life?
   f. Draw a food chain to show how plastic accumulates in larger sea life (and even humans).



A map showing the concentrations of plastic found in Australian waters. Image from www.csiro.au.

Extension:

Students could choose a topic to conduct further research such as:

a) How did people shop before the widespread use of plastic? Could we go back to shopping in this way? Have some people already gone back to shopping in this way?

b) How much plastic waste do Australians now produce each year?

c) What percentage of plastics ends up in landfill and what happens to the plastic that is there?

d) What percentage of plastics is recycled and where are they recycled?

CSIRO researcher Denise Hardesty inspects debris on North Stradbroke Island. Image from www.csiro.au.

Activity 5. Taking action with *Take 3*

In this activity, students brainstorm ideas for reducing their use of plastics.

For this activity you will need:

- a projector
- speakers
- access to the internet.

1. Watch the short clip from *Take 3* (two minutes) www.youtube.com/watch?v=bLPXgVCwkXI.
2. Ask students to brainstorm actions we could take to reduce our use of plastic (such as bringing your own bottle, using containers instead of cling wrap) and to reduce plastics getting in our oceans.

Packing a waste free lunch is easy. The students from Dawesville Catholic Primary School do it every day.

Activity 6. Conclusion and communication

1. Ask students to review all of the data from the activities and discuss.
    a. Did the class prefer tap or bottled water in terms of taste and odour?
    b. Was there a difference in water quality between tap and bottled water?
    c. Do you think tap or bottled water is a more sustainable choice? Why?
    d. Is bottled or tap water a more ethical choice?
    e. Which will you choose to drink in the future? Why?
    f. What action could you encourage others to take to reduce the use and impact of plastic?
2. Ask students to compile their findings and present them. Students may choose to communicate their findings by choosing one of the following:
    - a newsletter article
    - a poster advertising tap water
    - a slideshow presentation
    - a film clip
    - a comic strip
    - a debate.

A selection of these final products can then be shared with the entire school through publication in the school newsletter, hanging advertisements around school, sharing a slideshow or film clip at an assembly etc.

Student leadership

Inspired students might like to participate in, or organise, an event to encourage other students to join them in giving up plastic bottles for a day, a week or month. The details of this campaign are outlined in the student leadership section of this document.

Useful websites and further resources

National Geographic article on Great Pacific Garbage Patch

http://education.nationalgeographic.com.au/education/encyclopedia/great-pacific-garbage-patch/?ar_a=1

SCIENCE: CURRICULUM LINKS

Year 7:

SCIENCE UNDERSTANDING	**Science Understanding; Biological sciences** Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112).	Activity 4
	Science Understanding; Earth and space sciences Some of Earth's resources are renewable, but others are non-renewable (ACSSU116).	Activity 4
SCIENCE AS A HUMAN ENDEAVOUR	**Science as a Human Endeavour; Nature and development of science** Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world (ACSHE119).	Activity 4
	Science as a Human Endeavour; Use and influence of science Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE120).	Activity 4, 5
SCIENCE INQUIRY SKILLS	**Science Inquiry Skills; Questioning and predicting** Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124).	Activity 1, 2
	Science Inquiry Skills; Planning and conducting Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125).	Activity 1, 2
	In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task (ACSIS126).	Activity 1, 2
	Science Inquiry Skills; Processing and analysing data and information Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions (ACSIS130).	Activity 1, 2, 6
	Science Inquiry Skills; Evaluating Use scientific knowledge and findings from investigations to evaluate claims (ACSIS132).	Activity 1, 2, 6
	Science Inquiry Skills; Communicating Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133).	Activity 6

Year 8:

Science as a Human Endeavour and Science Inquiry Skills as outlined in the Year 7 table above.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GEOGRAPHY: BOTTLED WATER INQUIRY PROJECT

Background Information for teachers

Curriculum focus

Geography: Geographical Knowledge and Understanding (Geographies of Interconnections), Geographical Inquiry and Skills.

See list of curriculum links at the end of the geography activity instructions for more information.

Aim: **Students identify how the trade of bottled water connects us with people and places around the world. Students will use geographical inquiry skills to research the effects of production and consumption of bottled water on places and environments.**

Summary of activities:

There are three activities in this package.

1. How does bottled water connect us with other places and people?
2. The bottled water life cycle
3. A bottled water inquiry project

Suitable for: Year 9 (and possibly Year 10)

Duration: Four to five weeks

Background information

There are many steps involved in producing and consuming a bottle of water. Each step of the bottled water life cycle has impacts on places and environments. The inquiry project researches these impacts. It is based on the Year 9 work sample portfolio provided on the ACARA website www.acara.edu.au/curriculum/worksamples/Year_9_Geography_Portfolio.pdf.

For more information and statistics on bottled water in Australia please see the bottled water background information in the introduction to this guide.

Cross-curriculum links

This guide is designed to be used as a cross-curriculum unit with many subject areas looking at the topic of bottled water from different angles. This creates opportunities for sharing across subject areas and year levels. You could invite:

- an English class to present persuasive speeches including actions we can take to reduce plastic waste (Inquiry question 7)
- a maths class to share their research on cost of bottled water and where it comes from (Inquiry question 1)
- a science class to share what happens when plastic ends up in the ocean (Inquiry question 6).

You might also like to share some of the students' research, including suggestions about how to reduce our use of plastic, in the newsletter or at an assembly.

GEOGRAPHY: BOTTLED WATER INQUIRY PROJECT

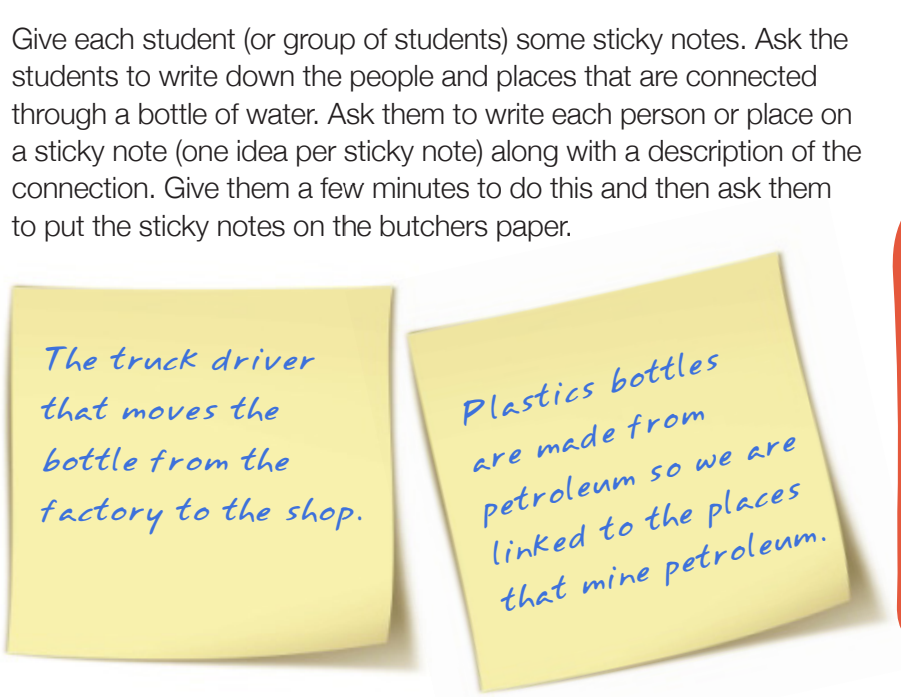
Activity Instructions

Activity 1. How does bottled water connect us with other places and people?

For this activity you will need: A bottle of water (or an image of bottled water), sticky notes, butchers paper with 'bottled water connects us to these people and places' written on it. You will need a projector, speakers and access to the internet.

1. Show students a bottle of water (or an image of bottled water).
2. Ask students to close their eyes, or lower their heads, and imagine the journey of this bottle of water. While they are quiet, ask them some simple questions such as:
   a. Where might the bottled water journey start?
   b. How might the bottled water get to us?
   c. What happens to the plastic after we drink the water?

   Ask students to discuss their ideas with the person next to them then share the responses with the class.
3. On a piece of butchers paper write 'bottled water connects us to these people and places'
4. Give each student (or group of students) some sticky notes. Ask the students to write down the people and places that are connected through a bottle of water. Ask them to write each person or place on a sticky note (one idea per sticky note) along with a description of the connection. Give them a few minutes to do this and then ask them to put the sticky notes on the butchers paper.



Anonymous sticky note brainstorms like this are a good way for students to put up answers in a non-threatening way.

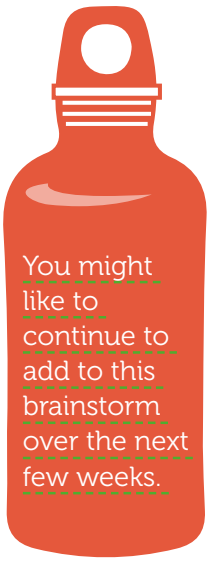
5. Watch the video report on the production of Fiji bottled water
http://www.youtube.com/watch?v=VUeEEvP8m3w

   Ask the students to use more sticky notes to add to their responses about how bottled water connects people and places.

6. Discuss the video (optional)

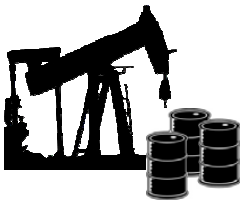
   a. Is the video from a trustworthy site? Who posted the video?

   b. What could you do to check the facts in the video?



Life cycle of a plastic bottle

There are many steps involved in making a plastic bottle of water and throughout the process many natural resources are used. Each step in the process may also have impacts on places and environments.



First, the oil is extracted from the earth

Then the oil is cleaned at the refinery

At a plastics factory the oil is transformed into plastic pellets then bottle pre-forms.

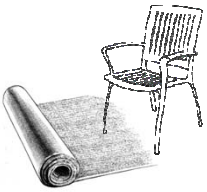
The pre-forms are heated and shaped into bottles.

The bottles are brought to the bottling plant where they are filled with water.

The bottles are ready for you so they are transported to the store.

Most of the plastic bottles are thrown in the bin and end up in landfills. Some are recycled and brought to a factory that turns them into other items like carpet, fleece and other plastic items. Eventually, those items are disposed of in the trash and also end up in the landfill.

You purchase the bottle of water and bring it to your house.

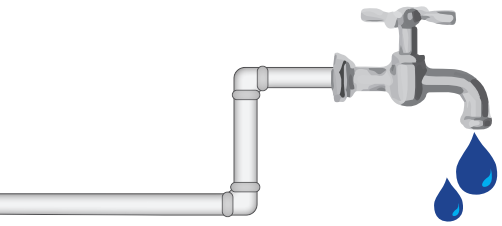


Source: Montgomery County Public Schools
www.montgomeryschoolsmd.org/uploadedFiles/curriculum/outdoored/programs/waterbottlefactpages.pdf

Activity 2. The bottled water life cycle

For this activity you will need: A projector, speakers and access to the internet to show a short clip plus several copies of the bottled water supply chain on the previous page, available for download at www.montgomeryschoolsmd.org/uploadedFiles/curriculum/outdoored/programs/waterbottlefactpages.pdf.

1. Watch the infographic on the life cycle of bottled water
   www.youtube.com/watch?v=glAPkpeKvfE
2. Explain to students that a supply chain is a network of people and activities that help move a product from start to consumption by the end user (National Geographic). A supply chain captures all the processes involved in production or manufacturing of a product. Discuss one or two examples of a supply chain such as fruit at a local farmers market or grocery store.
3. Print the life cycle of bottled water from the previous page and cut it up into small pieces as shown by the cutting lines. Give each student one piece of the life cycle and ask them to put them in order.



There are 10 pieces in the puzzle. You may like to print the life cycle on two or three different coloured pieces of paper so that each student has a different piece of the puzzle. Students will need to group themselves according to the colour of their piece.

4. Discuss with students:
   a. How many times are materials transported in the life cycle of bottled water? What are the impacts?
   b. What other impacts are associated with your piece of the puzzle?

Activity 3. Bottled water inquiry project

1. Split your class into seven groups and assign each group to complete one part of the inquiry task outlined on the next page.
2. Assign time for each group to complete their part of the inquiry project.
3. Ask each group to present their research back to the class. Alternatively, groups could share their research through a collaborative website such as Padlet. Padlet is available for free at http://padlet.com.

This inquiry project is based on the Year 9 work sample portfolio provided on the ACARA website www.acara.edu.au/curriculum/worksamples/Year_9_Geography_Portfolio.pdf.

Scaffolding the project

We have compiled a matrix with our favourite links and videos to share with groups that require scaffolding in this inquiry project. Alternatively, you could use the matrix to conduct a series of lessons with your class instead of the group inquiry project.

Student leadership

Inspired students might like to participate in, or organise, an event to encourage other students to join them in giving up plastic bottles for a day, a week or month. The details of this campaign are outlined in the student leadership section of this document.

Bottled water inquiry project

Investigate the impacts of production and consumption of bottled water on places and environments.

The following questions will assist with your inquiry.

1. **The source of water:** Research the cost, type of water (municipal, spring or artesian), location of water source and location of bottling plant for a variety of brands. To do this you might like to record brands of bottled water available in a local shop (e.g. supermarket) and find out where each is produced. You may need to contact the companies directly to find out where the water is sourced and bottled. How does the water on our supermarket shelf connect us to other people and places?
2. **Impacts of plastic production:** How is a PET plastic bottle made? Where is petroleum mined? What impacts are associated with mining petroleum? How much water and energy are required to make plastic? How does the manufacturing of a plastic bottle connect us to other people and places?
3. **Impacts of water extraction, bottling and transportation:** What types of water are bottled? How does extracting and bottling water impact on people and environments? How is bottled water transported? What impacts are associated with transporting water? How does bottling and transporting water connect us to people and places?
4. **Consumption of bottled water:** How much bottled water is consumed in Australia? How has this changed over time? Which countries consume the most bottled water? What do you know about these countries? Do they have access to clean water? Are they wealthy?
5. **Plastic bottle waste**
   a. How much plastic waste is created from drinking bottled water? What happens to the waste?
   b. We don't just trade the water, we trade the waste too. Plastic is Australia's third largest waste export (after paper and metal). How much PET plastic is exported? Where is it exported to? Why are materials exported for recycling?
   c. How does recycling compare to using raw materials in recycled plastic products? Does it use more energy and water? Is bottled water made from recycled plastic?
   d. How does waste connect us to other people and places?
6. **Impacts of littering:** Some plastic bottles are littered and end up in our oceans. What happens to plastic in our oceans? What are the impacts of plastic in our oceans? How does littering connect us to other people and places?
7. **What actions can we take to reduce our use of plastic?**

   What is the waste hierarchy and what is the most important step on the hierarchy? What are some people (schools, communities) doing in response to the impacts of bottled water and other plastics? What actions could you, the school or the community take to reduce the use of plastic?

Bottled water inquiry project matrix

Inquiry questions	What you need to do	Useful links
1.The source of water: Research the cost, type of water (municipal, spring or artesian), location of water source and location of bottling plant for a variety of brands. To do this you might like to record brands of bottled water available in a local shop (e.g. supermarket) and find out where each is produced. You may need to contact the companies directly to find out where the water is sourced and bottled. How does the water on our supermarket shelf connect us to other people and places?	• Identify at least eight different brands of bottled water, including one that is not from Australia. • Create a table of different brands including cost, type and location. • Describe how the bottled water on supermarket shelves connects us to other people and places	Information about brands: www.fijiwater.com/faqs (Fiji Water) www.coca-colajourney.com.au/contact-us (Pump, Mount Franklin) www.schweppesaustralia.com.au/Footer-Pages/Contact-us.aspx (Coolridge, Frantelle, Ice house) www.noblebeverages.com/contact (Pureau) www.evian.com/en_SG/41-from-the-heart-of-the-Alps (Evian) www.aquapura.net.au/pure_water.html (Aqua Pura) http://yaruwater.com/our-source (Yaru) http://shop.coles.com.au/online/national/contact-us (Coles Spring Water)
2.Impacts of plastic production: How is a PET plastic bottle made? Where is petroleum mined? What impacts are associated with mining petroleum? How much water and energy are required to make plastic? How does the manufacturing of a plastic bottle connect us to other people and places?	• Describe how plastic bottles are made. • Map where petroleum is mined. • Identify environmental impacts (and social impacts) of extracting petroleum and making plastic. • Describe how much water and energy are required to make plastic • Describe how manufacturing plastic. connects us to other people and places	Magic mass production of plastic bottles www.youtube.com/watch?v=sYfcRwMA_k8 How plastic bottles are made www.youtube.com/watch?v=ed7XJeXl3b4 Mining and the environment (ABS, Year Book Australia 2003) www.abs.gov.au/ausstats/abs@.nsf/90a12181d877a6a6ca2568b5007b861c/ce28d7fbe5faa308ca256cae0015da32!OpenDocument Bottled water factsheet www.cleanup.org.au/PDF/au/clean_up_australia_bottled_water_factsheet.pdf Bottled water and energy factsheet http://pacinst.org/publication/bottled-water-and-energy-a-fact-sheet/ Producing bottled water http://cfs-fcee.ca/wp-content/uploads/sites/2/2013/09/BWFD-Factsheet-environmental-impact.pdf

Inquiry questions	What you need to do	Useful links
3. Impacts of water extraction, bottling and transportation: What types of water are bottled? How does extracting and bottling water impact on people and environments? How is bottled water transported? What impacts are associated with transporting water? How does bottling and transporting water connect us to people and places?	• Describe the different types of bottled water – municipal, artesian, spring. • Identify the impacts on people, places and environments of extraction, bottling and transporting water. • How far are some brands of bottled water transported? How is the water transported? What are the impacts of transporting water? • Describe how bottling and transporting water connects us to people and places	What's in a name? www.coolclearwater.com.au/articles/BottledWater/CHOICEcomauSept07.pdf Watch the short clip about some of the impacts of bottled water www.youtube.com/watch?v=fZcnflfJ3u4 (American documentary) Impacts of bottled water http://coolaustralia.org/bottled-water-secondary/ Impacts of bottled water http://gracelinks.org/2379/bottled-water-and-water-conservation Bottled water and energy factsheet http://pacinst.org/publication/bottled-water-and-energy-a-fact-sheet/ Bottled water factsheet www.cleanup.org.au/PDF/au/clean_up_australia_bottled_water_factsheet.pdf Impacts of production and transporting http://documents.foodandwaterwatch.org/doc/TakeBackTheTap_web.pdf#_ga=1.129386252.1408464220.1410830761
4. Consumption of bottled water: How much bottled water is consumed in Australia? How has this changed over time? Which countries consume the most bottled water? What do you know about these countries? Do they have access to clean water? Are they wealthy?	• Identify how much bottled water is consumed in Australia each year. • Graph the consumption of bottled water over time, either in Australia or around the world. • Identify the top five countries consuming bottled water. • Graph water consumption per capita and GDP / clean water / other factors and identify any patterns.	www.bottledwatermatters.org/article/erroneous-article-national-geographic%E2%80%99s-online-green-living-section Statistics per capita and total consumption www.bottledwater.org/files/2011BWstats.pdf Map www.nationmaster.com/country-info/stats/Lifestyle/Food-and-drink/Bottled-water/Consumption#-graph Refers to when Australian started buying bottled water http://coolaustralia.org/bottled-water-secondary/ How much bottled water is consumed in Australia www.bundyontap.com.au/bottledwater.html Trend in bottled water consumption www.smh.com.au/environment/water-issues/could-this-mean-the-end-of-the-line-for-the-plastic-water-bottle-20130302-2fcu1.html

Inquiry questions	What you need to do	Useful links
5. Plastic bottle waste a) How much plastic waste is created from drinking bottled water? What happens to the waste? b) We don't just trade the water, we trade the waste too. Plastic is Australia's third largest waste export (after paper and metal). How much PET plastic is exported? Where is it exported to? Why are materials exported for recycling? c) How does recycling compare to using raw materials in recycled plastic products? Does it use more energy and water? Is bottled water made from recycled plastic? d) How does waste connect us to other people and places?	• How much PET plastic is recycled compared to the amount sent to landfill in Australia? How might this affect the future of landfills in Perth? • Identify the amount (or percent) of PET plastic that is recycled compared to the amount sent to landfill. • Describe how this might affect the future of landfills. • Identify where plastic is exported to • Explain why plastic is exported. • Compare raw materials, energy and water used in recycling compared to creating new plastic products. • Describe how waste connects us to people and places.	Impacts of bottled water http://coolaustralia.org/bottled-water-secondary/ Percentage of plastic recycled and percentage exported (page 6) http://www.packagingcovenant.org.au/data/Publications/R03-03-A11011_NPRS_2012-13_Report_FINAL1.pdf What happens to our waste? www.news.com.au/finance/business/adam-minters-book-junkyard-planet-tells-fascinating-story-behind-global-scrapping-industry/story-fnda1bsz-1226817580799 Why water bottles don't contain recycled plastic www.crikey.com.au/2011/06/03/why-arent-bottles-recycled-people-dont-want-water-that-tastes-funny/
6. Impacts of littering: Some plastic bottles are littered and end up in our oceans. What happens to plastic in our oceans? What are the impacts of plastic in our oceans? How does littering connect us to other people and places?	• Describe how plastic breaks down in our oceans. • How does plastic impact on the environment and on people. • How does littering plastic connect us to other people and places?	Plastic oceans www.youtube.com/watch?v=cwTDvqaqPlM ABC Behind the news www.abc.net.au/btn/story/s3591476.htm Surfing for Change www.youtube.com/watch?v=q1Pb6cEC_gw Seven news clip www.youtube.com/watch?v=os7OuSxP-JA Journey to the ocean www.youtube.com/watch?v=vh6MDuxYing CSIRO survey of coast www.smh.com.au/environment/dumping-is-trashing-australian-beaches-says-csiro-report-20140914-10gs10.html

Inquiry questions	What you need to do	Useful links
7. What actions can we take to reduce our use of plastic? What is the waste hierarchy and what is the most important step on the hierarchy? What are some people (schools, communities) doing in response to the impacts of bottled water and other plastics? What actions could you, the school or the community take to reduce the use of plastic?	• Describe at least two examples of what schools, businesses, events or local communities are doing to reduce the use of bottled water. • Describe the personal actions you could take. • Describe the actions your school or community could take.	Monte Sant' Angelo Mercy College www.youtube.com/watch?v=6U9-PFfjlyY Sydney water tap pledge http://tapsydney.com.au/pledge/ Plastic free July www.plasticfreejuly.org or www.youtube.com/watch?v=7u01LS9enPQ City of Perth www.perth.wa.gov.au/newsroom/featured-news/australian-first-perth-trials-public-drinking-fountain-alternative Putting a cap on bottled water http://splash.abc.net.au/media/-/m/1239528/putting-a-cap-on-bottled-water Bundanoon www.bundyontap.com.au

GEOGRAPHY: CURRICULUM LINKS

Year 9:

GEOGRAPHICAL KNOWLEDGE AND UNDERSTANDING	**Unit 2: Geographies of interconnetions (Year 9)** The ways that places and people are interconnected with other places through trade in goods and services, at all scales (ACHGK067) The effects of the production and consumption of goods on places and environments throughout the world and including a country from North-East Asia (ACHGK068)	Activity 1, 2, 3 Activity 2, 3
GEOGRAPHICAL INQUIRY AND SKILLS (YEAR 9 / 10)	**Observing, questioning and planning (Year 9 / 10)** Develop geographically significant questions and plan an inquiry that identifies and applies appropriate geographical methodologies and concepts (ACHGS063 / (ACHGS072)	Activity 1, 3
	Collecting, recording, evaluating and representing (Year 9 / 10) Collect, select, record and organise relevant geographical data and information, using ethical protocols, from a range of appropriate primary and secondary sources (ACHGS064 / ACHGS073)	Activity 3
	Evaluate sources for their reliability, bias and usefulness, and represent multi-variable data in a range of appropriate forms, for example, scatter plots, tables, field sketches and annotated diagrams, with and without the use of digital and spatial technologies (ACHGS065 / ACHGS074)	Activity 3
	Represent the spatial distribution of geographical phenomena by constructing special purpose maps that conform to cartographic conventions, using spatial technologies as appropriate (ACHGS066 / ACHGS075)	Activity 3
	Interpreting, analysing and concluding (Year 9 / 10) Evaluate multi-variable data and other geographical information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to make generalisations and inferences, propose explanations for patterns, trends, relationships and anomalies, and predict outcomes (ACHGS067 / ACHGS076)	Activity 3
	Apply geographical concepts to synthesise information from various sources and draw conclusions based on the analysis of data and information, taking into account alternative points of view (ACHGS068 / ACHGS077)	Activity 3
	Communicating (Year 9 / 10) Present findings, arguments and explanations in a range of appropriate communication forms, selected for their effectiveness and to suit audience and purpose; using relevant geographical terminology, and digital technologies as appropriate (ACHGS070 / ACHGS079)	Activity 3
	Reflecting and responding (Year 9 / 10) Reflect on and evaluate the findings of the inquiry to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations; and explain the predicted outcomes and consequences of their proposal (ACHGS071/ACHGS080)	Activity 3

Year 10:

GEOGRAPHICAL KNOWLEDGE AND UNDERSTANDING	**Unit 1: Environmental change and management** The human-induced environmental changes that challenge sustainability (ACHGK070)	Activity 1, 2, 3
GEOGRAPHICAL INQUIRY AND SKILLS	***Refer to table above for Year 9 / 10***	


WasteSorted
Schools
STUDENT
LEADERSHIP

STUDENT LEADERSHIP
Background Information

The Plastic Free Challenge for schools

Encourage as many students, teachers and family members to stop using plastic bottles, plastic bags, straws or take-away coffee cups for a day, a week or a month.

The rules for all participants

1. **Attempt to stop using plastic bottles, plastic bags, straws or take-away coffee cups.**
2. **It's up to you how long you participate. You might decide to join for a day, a week, a month or longer! However long you choose will still make a contribution.**
3. **Optional: Collect any unavoidable plastic bottles, plastic bags, straws or take-away coffee cups you buy. Keep these in a 'dilemma bag' and share it with each other at the end of the challenge. You could create a display of all the plastic students, teachers and families were unable to avoid.**

You might like to extend the challenge to include all single-use plastic. Single-use includes plastic shopping bags, plastic cups, straws, plastic containers and packaging... basically anything that's intended only to be used once and then sent to landfill.

Aim: **A small group of students plan and run a Plastic Free challenge at their school or in their school community.**

Summary of activities:
The challenge could be run by a student leadership group or a group of students that feel inspired to reduce their use of plastic. In this guide students are encouraged to complete six activities:

1. Brainstorm single-use plastic in their lives such as plastic bottles, bags, straws, cups and more
2. Research ideas / alternatives to single-use plastic
3. Meet with the principal to get permission to run the Plastic Free challenge
4. Plan the Plastic Free challenge to encourage other students to stop using plastic bottles, bags, straws, cups
5. Run the Plastic Free challenge for a day, week or month
6. Celebrate.

The activities could be done at lunch time, as an after school activity or as part of form time, homeroom, tutor groups or mentor groups (with permission of teachers or principal).

Duration: The Plastic Free challenge is designed to run for one month but can be run for a day or a week.

Planning time: Students will need 5-6 hours to plan, promote and run the Plastic Free challenge.

Background information

Plastic Free July is an initiative of the Western Metropolitan Regional Council (WMRC) Earth Carers Program. It started here in Perth in 2011. Plastic Free July (PFJ) aims to raise awareness of the amount of plastic in our lives by encouraging people to eliminate the use of single-use plastic during July each year. In 2013, there were 4000 people participating in Plastic Free July including individuals as well as businesses and schools. And, it's not just Perth that gets involved. In 2013, people in New Zealand even got involved.

This guide is designed to help students run a Plastic Free challenge at their school. The Plastic Free challenge is similar to the Plastic Free July Campaign but it doesn't have to be run in July.

There are loads of fantastic resources on the Plastic Free July website (www.plasticfreejuly.org) that students could use to promote the school's Plastic Free challenge.

In addition, a lot of the information in this guide was adapted from information provided on the Plastic Free July Website.

Cross-curriculum links

Students will use these links in the activities outlined in this guide

1. Catalyst ABC TV - Plastic Oceans www.youtube.com/watch?v=cwTDvqaqPlM
2. Plastic Free July www.youtube.com/watch?v=7u01LS9enPQ
3. Beth Terry's story about Living Plastic Free on TEDex www.youtube.com/watch?v=3JXWRVrFiKs
4. List of movies to screen www.plasticfreejuly.org/movie-screenings.html.

Resources

- Access to the internet to watch short video clips
- Access to the Plastic Free July website
- Access to a printer (to print posters from the Plastic Free July website)
- A copy of the movie *Bag It* (78 minutes). This can be borrowed from the WasteSorted Schools team or purchased here for $150 www.newday.com/films/bagit.html.
- Projector and speakers to show the movie *Bag It* or other video clips
- Resources to create posters about the Plastic Free Challenge
- A copy of the pledge forms for students to complete.

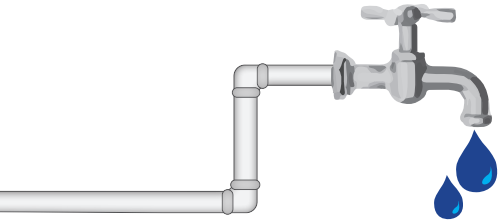
GET INSPIRED TO GO PLASTIC FREE

Activity 1. Getting started

1. Watch Catalyst ABC TV - *Plastic Oceans* (www.youtube.com/watch?v=cwTDvqaqPlM)
2. List as many single-use plastic items as you can. Think about the plastic used by you, other students, teachers and your family.

Teacher's tip:

You could use a placemat activity to brainstorm single-use plastic items with students.



What is single-use plastic?

Single-use includes plastic shopping bags, plastic cups, straws, plastic bottles and packaging...basically anything that's intended only to be used once and then sent to landfill.

Activity 2. Research single-use plastic and share inspiring ideas

1. Watch the short clip on Plastic Free July (www.youtube.com/watch?v=7u01LS9enPQ)
2. Watch Beth Terry's story about Living Plastic Free on TEDex (www.youtube.com/watch?v=3JXWRVrFiKs)
3. Research and share inspiring ideas / alternatives to the single-use plastic items.
   You will find lots of alternatives here:
   www.plasticfreejuly.org/a-z-alternatives.html

Teacher's tip:

You could jigsaw the videos in Activity One and Activity Two.

Optional activity:

What kind of plastic is in your school bin? Conduct an audit and find out.

A Perth school conducts a waste audit to find out how much, and what type of, waste they are sending to landfill.

RUN A PLASTIC FREE CHALLENGE AT YOUR SCHOOL

The next step is to run a Plastic Free challenge at your school. The challenge is quite simple. Encourage as many students and teachers to stop using plastic bottles, plastic bags, straws or take-away coffee cups for a day, a week or a month. You might like to extend the challenge to include all single-use plastic. One way to do this is to encourage students and teachers to make a pledge.

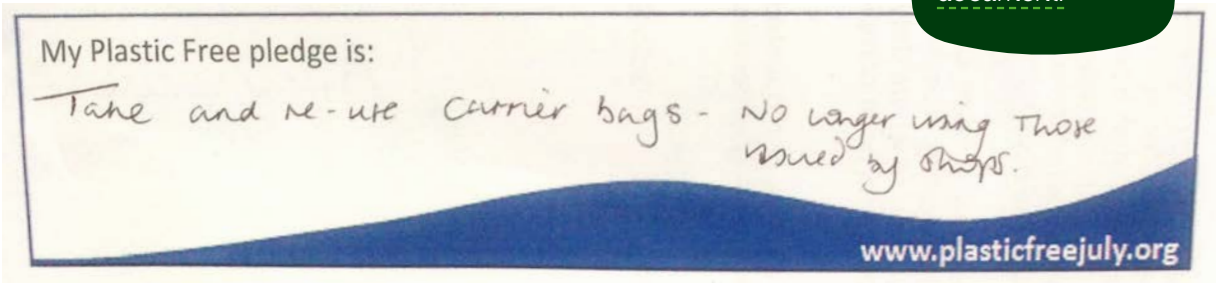
The challenge is outlined on the first page. Click here to go back.

A student from Mindarie Senior College pledges to take their own bags and no longer use those supplied by shops.

Emma's dilemma:

Emma was part of Plastic Free July in 2013. Over the month she had several dilemmas. One evening she was invited to dinner with friends. They ordered too much food and couldn't finish it. Emma had a dilemma. Should she take the food home in a plastic container that the shop offered or should she leave the food to be thrown in the bin? She took the food in a plastic container. She kept the container in her 'dilemma bag' with the other plastic items she couldn't avoid. You might like to create a 'dilemma display' – this might be a display of all the single-use plastic you and other students couldn't help using. For example, some students may travel and need to drink from water bottles because the water is unsanitary. They could collect these bottles and put them on display. By sharing dilemmas students could discover a creative solution!

Pledges are a great way to get others involved. Displaying the pledges publicly helps people to remain committed to their pledge. Blank pledge forms are included at the end of this document.



Activity 3. Get permission from your principal to undertake the Plastic Free challenge

1. Organise a time for your student group to meet and discuss seeking permission from the principal
2. Ask one student to scribe for the group as you discuss your ideas.
3. Discuss and decide on how long you will run the challenge for.

   Will you run the challenge for a month? Students participating could then choose to participate for a day, a week or for the whole month. Alternatively, you could run the challenge for a week or a day.
4. Discuss and decide when you would like to start the challenge.
5. Make a list or set an agenda for the meeting with the principal to make sure you cover all the important details.
   a. What is the Plastic Free challenge? What do you hope to achieve? Why do you want others to participate?
   b. When will the challenge start?
   c. How long will the Plastic Free challenge run for?
   d. Which teachers (if any) are supporting you?
   e. How do students, teachers and parents get involved?
   f. Seek feedback and permission to run the challenge.
6. Decide which students will speak to the principal.
7. Book a meeting with your principal.
8. Present your ideas at the meeting. Remember to smile and show your enthusiasm.

Activity 4. Plan a Plastic Free challenge for your school

Congratulations! Now that you have the permission of your principal, it's time to start planning.

1. Organise a time for your student group to meet and begin planning for the Plastic Free challenge.
2. Ask one student to scribe for the group as you discuss your ideas
3. Discuss and decide how you will promote the challenge to other students and teachers. Some ideas include:
    - **Quiz:** Run a quiz about plastic. A sample quiz is available on page 110.
    - **Screen a movie:** Screen a movie such as *Bag It* over a few lunchtimes or as an after school event (*Bag It* can be borrowed from the WasteSorted Schools Program) and ask students and teachers to pledge

      View the trailer for *Bag It* here: www.youtube.com/watch?v=MRjPkl_4lmM
    - **Put it in the newsletter:** Write an article for the school newsletter. Include the pledge form and ask them to be returned to the office (remember to find out who publishes the newsletter and when the deadline is for submitting an article).
    - **Posters:** Put up posters for the challenge and for any events you are running. You can design your own or use the ones on the PFJ website www.plasticfreejuly.org/posters--flyers.html
    - **Assembly:** Promote the Plastic Free challenge at your school assembly and ask students to pledge at the end of the assembly. You could show a short video (e.g. Part of the *Catalyst* video) to inspire students to make a change.
    - **Lunch time display:** Set up a display at lunch time and encourage people to make pledges. Display the pledges around the school or take a photo of each student with their pledge and post them online (with their permission of course).
    - **School website:** Put events and information on your school website.
    - **Involve the media:** Send media releases to the local newspaper / radio / TV stations www.plasticfreejuly.org/media-releases.html
    - **Share your stories:** Write blogs, share photos and stories on social media like Facebook, twitter and Instagram.
    - For more details or ideas visit www.plasticfreejuly.org/get-your-school-involved.html.
4. Assign different jobs to different students to help get them done.
5. Set a meeting time to continue preparing for the challenge.

Activity 5. Run the Plastic Free challenge

Now you are ready to run your Plastic Free challenge. Don't forget to take photos and share them with the WasteSorted Schools team. We would love to see what you achieve.

If you are running the Plastic Free challenge in July then you can register your school with Plastic Free July and join thousands of others who have also pledged to stop using single-use plastic. You can register here: www.plasticfreejuly.org.

The Plastic Free Challenge for schools

Encourage as many students, teachers and family members to stop using plastic bottles, plastic bags, straws or take-away coffee cups for a day, a week or a month.

The rules for all participants

1. Attempt to stop using plastic bottles, plastic bags, straws or take-away coffee cups.
2. It's up to you how long you participate. You might decide to join for a day, a week, a month or longer! However long you choose will still make a contribution.
3. Optional: Collect any unavoidable plastic bottles, plastic bags, straws or take-away coffee cups you buy. Keep these in a 'dilemma bag' and share it with each other at the end of the challenge. You could create a display of all the plastic students, teachers and families were unable to avoid.

You might like to extend the challenge to include all single-use plastic. Single-use includes plastic shopping bags, plastic cups, straws, plastic containers and packaging...basically anything that's intended only to be used once and then sent to landfill.

Activity 6. Celebrate

It's a good idea to celebrate the end of the challenge and recognise all the students and teachers that participated. Here are some ideas to help you celebrate.

- Hold a celebratory plastic free morning tea at recess. You could invite your local Member of Parliament.
- Design certificates to acknowledge the students that took part or ask the principal to provide a letter congratulating participants for their efforts.
- Design a t-shirt stencil and invite students that took part to bring an old t-shirt (or purchased second hand) that can be printed with a stencil.
- Make wooden badges and give them to participants.

Other ideas

Here are some other ideas to consider. You could run these as part of your school's Plastic Free challenge or as separate activities.

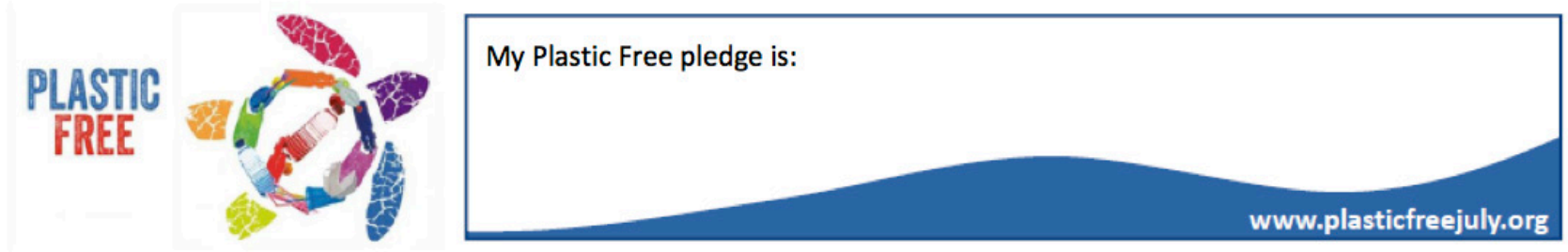
- Hold a nude food day
- Run a nude food workshop
- Participate in a Two Hands cleanup www.plasticfreejuly.org/two-hands-clean-up.html
- Conduct a bin audit and photograph the plastic waste www.plasticfreejuly.org/bin-audit.html.
- Check out what other schools in WA are doing for more ideas www.plasticfreejuly.org/schools.html
- Watch the *Trashed* movie

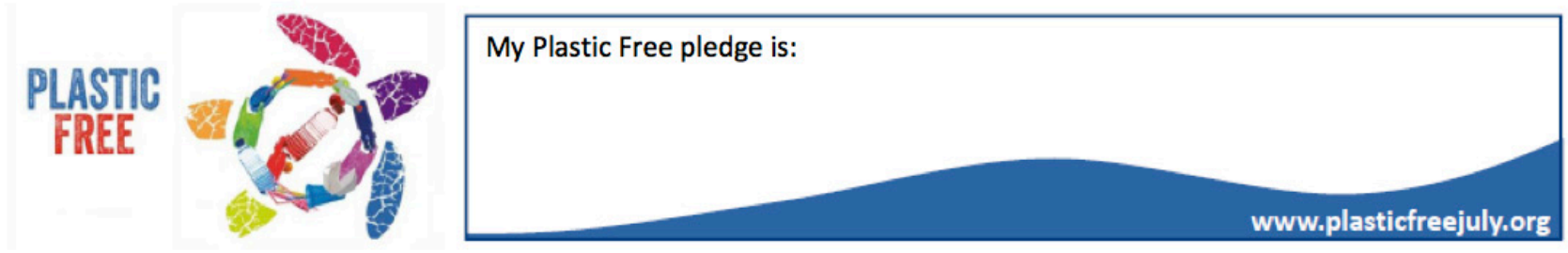
Tip for teachers

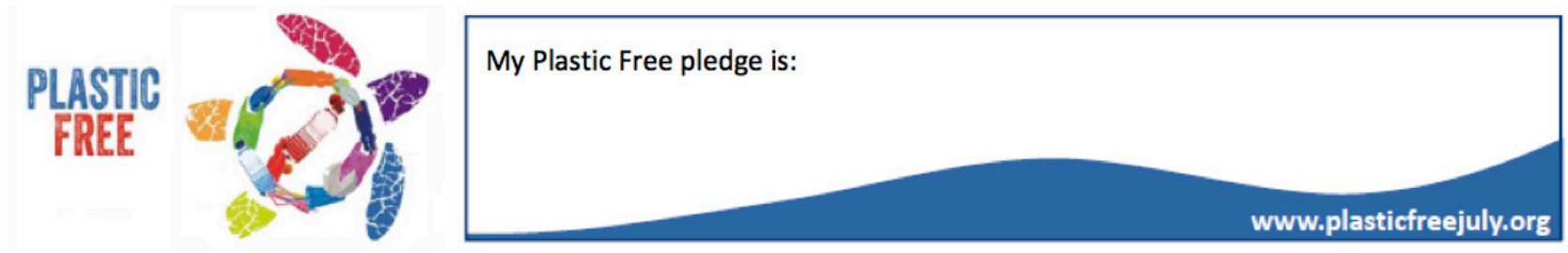
This challenge is designed to complement the lessons in the bottled water unit in the following subjects.

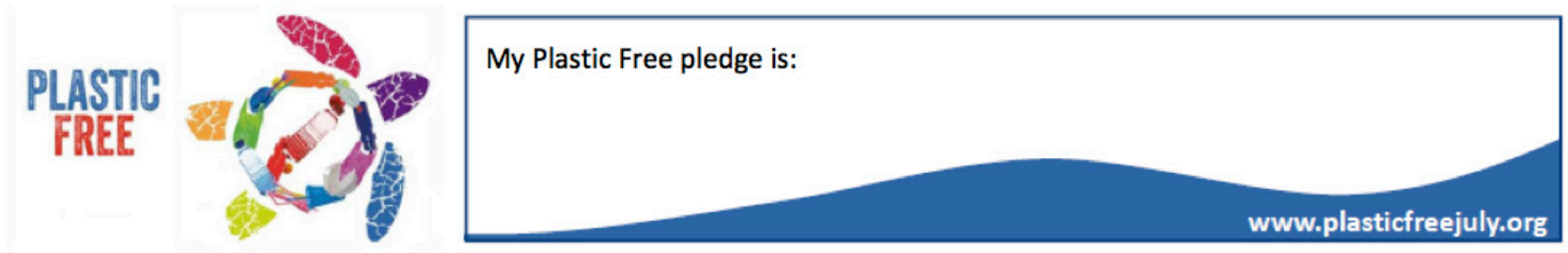
- Maths
- English
- Science
- Geography

These units are available online at: www.wasteauthority.wa.gov.au/wss/curriculum-materials/detail/message-in-a-plastic-bottle-english


PLASTIC
FREE
My Plastic Free pledge is:
www.plasticfreejuly.org


PLASTIC
FREE
My Plastic Free pledge is:
www.plasticfreejuly.org


PLASTIC
FREE
My Plastic Free pledge is:
www.plasticfreejuly.org


PLASTIC
FREE
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WasteSorted
Schools
SNIPPETS
OF
INSPIRATION

SNIPPETS OF INSPIRATION

These 20 snippet cards are designed to inspire your students to choose a topic and develop their own project on bottled water. The links range from discussion points to investigations and are designed to complement the activities developed for English, maths, science and geography.

The cards can be used:

- as individual extension activities.
- as group leadership activities.
- as a whole class to take the learning further, to take action or in place of the in-depth activities outlined in the guide.

Alternatively, you could place the cards in the staffroom to encourage other staff to get their classes involved.

Bottled Water

Research

Is it healthy to drink water from plastic bottles?

Bottled Water

Design your own reusable water bottle

Hold a competition for the best water bottle design or design water bottles for sale as a fundraiser.

Bottled Water

Plastic Art

What examples of plastic bottle art can you find? What about other products like clothes and jewellery? Does art like this reduce or increase consumption? What happens to the material at the end of the artwork's life cycle? Are we just delaying the materials from landfill?

Reuse sculpture by Jacq Chorton.

Bottled Water

Technology solves the problem

Watch the video about a man who invented a machine to convert plastic in to oil www.youtube.com/watch?v=qGGabrorRS8. What do you think? Is it real? Do you think technology is the answer to our waste problem? Or do we need to change our behaviour too?

Bottled Water

Ban the bottle

Watch the video about how Mont Sant' Angelo Mercy College banned the sale of plastic water bottles from their school canteen www.youtube.com/watch?v=KRth6eOO1xQ.

Make a plan to ban the sale of water bottles at your own school. You might also like to plan a fundraiser to raise money to install filtered water fountains.

Bottled Water

What is the plastiki?

What is the plastiki?

Find out all about it at http://theplastiki.com

Bottled Water

Advertising the tap

This Perth bus advertisement shows a drink that has zero sugar and fast hydration.

What else has these characteristics but isn't packaged? Tap water! Do you ever see advertisements for tap water? Design an appealing advertisement to encourage everyone to drink tap water.

Extension: How much would it cost to put your advertisement on a bus or in a public place? Could you find a company willing to put your advertisement up for a day?

Bottled Water

Selling Air

"Our research shows that if you put something in a plastic bottle, people will buy it!" **From the 2012 movie version of Dr Seuss's classic, The Lorax.**

Check out this clip from the movie about selling bottled air www.wingclips.com/movie-clips/the-lorax/selling-air?play=1. Sound familiar?

Now watch the Dupe' video www.youtube.com/watch?v=q3oAv0BjtN4 and visit the Dupe' store www.dupestore.com.au. What do you think? How could you convince others that it is crazy to buy bottled water?

Bottled Water

Access to safe drinking water

In Fiji, one factory produces more than a million bottles daily for the United States, while 'more than half the people in Fiji do not have safe, reliable drinking water.' Discuss.

http://ourworld.unu.edu/en/from-naive-to-evian

Bottled Water

Carrying water

For many people in poverty, finding and carrying safe drinking water can be a challenge. Gather a group of friends and complete this activity about carrying water.

http://hunger.cwsglobal.org/hungerbooklet/environment/demo.html.

How does this compare to carrying a small, stainless steel refillable water bottle?

Bottled Water

The history of bottled water

Many brands of bottled water have a long history associated with healing properties and spa resorts. Research the history of bottled water http://researchbank.swinburne.edu.au/vital/access/manager/Repository/swin:14906.

Bottled Water

Popular culture

Bottled water has become part of our popular culture. You will see people with bottles of water on buses, in cafes, at executive meetings, sports matches, at schools and universities. Some brands of bottled water are also endorsed by celebrities or product placed in movies. Drinking bottled water now seems so appealing and 'cool'.

Can you design an advertisement to reverse this trend and make filling up your bottle with tap water trendy?

Bottled Water

Photographic journal

Watch the National Geographic documentary on how scientists and artists collaborate on an Alaskan voyage. http://video.nationalgeographic.com/video/gyre-video-complete?source=searchvideo

Alternatively, watch the *ABC* interview with Australian artist, John Dahlsen at www.youtube.com/watch?v=DfVi01FZD5I.

Collect plastic debris from your favourite beach, bushland or river and create a beautiful photograph from it. Don't forget to dispose of any waste correctly.

Bottled Water

Water fountains

In 2013, The City of Perth installed water fountains that supply cold, filtered still or sparkling water. Visitors to Perth can bring their own bottle and fill up for a fraction of the cost of bottled water. Curtin University and Edith Cowan University also installed filtered water fountains for their students.

Survey the students and staff at your school. Would they stop buying bottled water if they had access to a fountain that provided cold, filtered tap water?

Bottled Water

The Pitch

On *The Gruen Planet*, two advertising agencies create advertisements to sell a ridiculous product. Watch these two episodes about selling:

a) bottled air www.youtube.com/watch?v=0UBCpVG23R0

b) ice to eskimos www.youtube.com/watch?v=-z_NLq72cyM (from 16:00 – 20:15 minutes).

Work in small teams to create your own advertisement that highlights how ridiculous it is to buy bottled water. You could even vote for your favourite like the panel do.

Bottled Water

The Two Hands Project

What is the Two Hands Project? www.twohandsproject.org

How can you make a difference?

Beehive Montessori school clean-up.

Bottled Water

The Clean Bin Project

A Canadian couple compete against one another to reduce their waste as much as possible for a year. They set some ground rules (they weren't allowed to buy any 'stuff', if they did generate any rubbish when they were out, they had to take it home and put it in their own bin, etc.)

The DVD gives some great ideas about ways to reduce the waste in your own life and challenges us to make some changes. Could you and a friend take on the challenge?

http://cleanbinproject.com

Bottled Water

Unpackaged

Find out all you can about the concept of 'unpackaged'. How does it work? How can you introduce the concept of being 'unpackaged' in to your school canteen? Perhaps you could start with drink bottles that can be refilled with water or juice?

www.youtube.com/watch?v=QZuhhjBNnO0

www.youtube.com/watch?v=VX7WQttnbY4

Bottled Water

Write a song

Watch *Surfing for Change: Where is away?* www.youtube.com/watch?v=q1Pb6cEC_gw.

Write a song to encourage others to give up bottled water.

Bottled Water

Plastic Free July

Watch www.youtube.com/watch?v=7u01LS9enPQ

There are lots of great ideas on the *Plastic Free July* website www.plasticfreejuly.org.

See if you can live without single-use plastic.

PLASTIC FREE JULY

QUIZ: PLASTIC IS NOT SO FANTASTIC!

1. True or False? Most of the PET plastic we put in the recycling bin is shipped to Asia to be recycled.

2. What percentage of Australia's PET plastic is recycled?
   a) 85%
   b) 53%
   c) 25%

3. In 2011/12, Keep Australia Beautiful conducted a branded litter survey, sorting and counting more than 10,000 litter items that showed a brand. Which of these brands contributes the most to the national litter problem?
   a) McDonald's
   b) Coca Cola
   c) Cadbury Schweppes
   d) Coles

Debris littered across a beach on Christmas Island. Image from www.csiro.au.

4. The CSIRO surveyed the density of plastic in Australian waters. How many pieces of plastic did they find in one square kilometre?
   a) 40,000
   b) 1,000
   c) 100,000

"We found that 43 per cent of seabirds have plastic in their gut. Globally, nearly half of all seabird species are likely to ingest debris, eating everything from balloons to glow sticks, industrial plastic pellets, rubber, foam and string."

CSIRO researcher Dr Denise Hardesty.

5. The CSIRO survey also looked at plastic in seabirds. What percentage of seabirds surveyed were found to have plastic in their gut?

   a) 5%
   b) 20%
   c) 53%

6. How many plastic bags do Australians use **each day**?

   a) 1 million
   b) 2 million
   c) 10 million

7. True or False? Some brands of bottled water are just filtered tap water.

8. Which of these is the most sustainable and important thing to do?

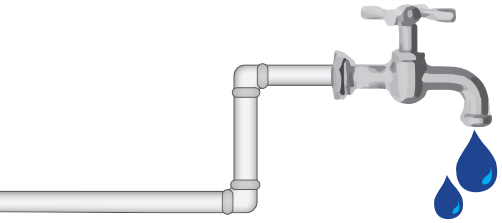
   a) Recycle your plastic bottles (recycle)
   b) Say no to plastic and bring your own drink bottle(reduce)
   c) Reuse your plastic bottle a few times by refilling it (reuse)
   d) Throw your plastic bottle in a bin that goes to landfill

9. In 2013, Caloundra Music Festival (QLD) banned the sale of bottled water and provided free tap water for festival goers. During the four-day festival, how many plastic bottles did the festival save?

   a) 5,000
   b) 10,000
   c) 20,000

QUIZ ANSWERS: PLASTIC IS NOT SO FANTASTIC!

1. True. In 2011/12, 62,000 tonnes of PET plastic was recycled in Australia (approximately half of what we use). Of this, 47,000 tonnes was sent overseas for processing.
2. b) 53%, and that means the other 47% goes to landfill or ends up as litter.
3. a) McDonald's (followed by Coca Cola).
4. a) 40,000 (The CSIRO found that the density of plastic in Australian waters ranges from a few thousand to more than 40,000 per square kilometre).
5. c) 53%



There are a few short podcasts on the CSIRO website from researcher, Denise Hardesty, about what marine debris is, how it impacts wildlife and tips on solving the problem. You could listen to these as part of this quiz.

www.csiro.au/Portals/Media/Plastic-on-the-coasts-is-ours.aspx

6. c) 10 million
7. True, at least two brands that we know of come from municipal sources (the same source as our tap water).
8. b) Reduce is at the top of the waste hierarchy. It's best to say no to plastic and bring your own bottle.
9. c) 20,000

Source:

1. 2011/12 National Plastics Recycling Survey (Australian) , page 6 www.pacia.org.au/Library/PageContentVersionAttachment/b32ecc28-36a3-4087-bd68-33a889cf9aef/r02_05_a10802_nprs_2011_12_report.pdf
2. 2011/12 National Plastics Recycling Survey (Australian) , page 6 www.pacia.org.au/Library/PageContentVersionAttachment/b32ecc28-36a3-4087-bd68-33a889cf9aef/r02_05_a10802_nprs_2011_12_report.pdf
3. Keep Australia Beautiful, National Branded Litter Study Annual Results 2011/12 http://kab.org.au/wp-content/uploads/2013/02/KAB-National-Branded-Litter-Study-11-12.pdf
4. CSIRO www.csiro.au/Portals/Media/Plastic-on-the-coasts-is-ours.aspx
5. CSIRO www.csiro.au/Portals/Media/Plastic-on-the-coasts-is-ours.aspx
6. Keep Australia Beautiful WA, Plastic Bag Factsheet www.kabc.wa.gov.au/litter-information.html
7. WasteSorted Schools, email communication directly from brands.
8. Position Statement on the Waste Hierarchy | Waste Authority WA
9. Caloundra Music Festival www.caloundramusicfestival.com/about/keep-it-green/byo-h2o-bottle-campaign