year 7 science

For the Australian Curriculum

Water: Learn it for life!

waterwise Queensland

Great state. Great opportunity.

Queensland Government

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Water cycles

Introduction

Many Queensland towns and cities were hit by devastating floods in December 2010 and January 2011. Soon after, north Queensland was hit by a giant cyclone. There was water everywhere! In the midst of the massive operation to rescue people and move them to higher ground, people in affected areas were asked to conserve water. To understand the complexity of the water processes and issues involved in responding to a natural disaster, students need to understand how water cycles through their catchments and how drinking water is treated to safe standards in reticulated areas.

In this unit, students will explore the natural water cycle in their catchment, how safe drinking water is treated and supplied to towns in your area and the underlying science behind these processes. They will also learn about water professionals such as water treatment technicians, plumbers and operations and maintenance technicians who help solve water supply problems on a regular day and during natural disasters.

This unit focuses on the movement of surface water and the treatment of drinking water supplies from surface sources. If your area is dependent on groundwater sources, it is still important for students to understand these processes—but these ideas will not be specifically addressed in this unit. If your local town has a drinking water supply that comes solely from bores or rainwater tanks, you could expand discussions to include the catchment of a town near you that treats its surface water for drinking.

Some elements of this unit could be taught in partnership with your local high school.

Choose an event or natural disaster context that is appropriate for your community. For instance, an event could be a breakdown at the water treatment plant and a natural disaster could be an extended drought. This unit provides an example of a flood disaster scenario. Adapt the activities to address your chosen disaster scenario.

The *Water: Learn it for life!* curriculum resource lesson activities referred to in this unit can be found online at ‹www.derm.qld.gov.au›. Select 'Education resources' in the 'Resource Centre' box on the right side of the web page.

This unit is designed to address Australian Curriculum: Science descriptors for Year 7 for both Chemical Sciences and Earth and Space Sciences sub-strands and should take approximately 12 weeks to complete.

Australian Curriculum links for this unit

General capabilities

Critical and creative thinking

Ethical behaviour

Science—Year 7

» Science Understanding

Earth and space sciences

Water is an important resource that cycles through the environment.

Some of Earth's resources are renewable, but others are non-renewable.

Chemical sciences

Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques.

» 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.

Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management.

People use understanding and skills from across the disciplines of science in their occupations.

» Science Inquiry Skills

Questioning and predicting

Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge.

Planning and conducting

Collaboratively and individually plan and conduct a range of investigation types, including field work and experiments, ensuring safety and ethical guidelines are followed.

In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task.

Processing and analysing data and information

Construct and use a range of representations (including graphs, keys and models, and digital technologies as appropriate) to represent and analyse patterns or relationships.

Summarise data from students' own investigations and secondary sources and use scientific understanding to identify relationships and draw conclusions.

Evaluating

Reflect on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected and identifying improvements to the method.

Use scientific knowledge and findings from investigations to evaluate claims.

Communicating

Use scientific language and representations, and digital technologies as appropriate, to communicate ideas, findings and solutions to problems.

Achievement Standard—Year 7

By the end of Year 7, students pose questions and apply scientific concepts to everyday problems and make general predictions based on their experiences. They plan procedures for investigations that take into account the need for fair testing and use equipment that improves fairness and accuracy. They communicate their observations and data clearly, summarise their data where appropriate and suggest improvements to their methods

Students predict the effect of single changes on systems involving living things and suggest ways to classify organisms based on observable differences. They distinguish between pure substances and mixtures and plan appropriate methods to separate mixtures. They explain why some resources are not renewable and describe changes to water during the water cycle. They describe how unbalanced forces change the motion of objects and how changes in the position of objects in space cause other observable effects. They identify where science knowledge is used to propose solutions to problems and describe examples of where people use science in their work. They describe how evidence has led to an improved understanding of a scientific idea.

Links to other learning areas

Maths—number, data

Literacy—interpret and analyse a variety of graphical and textual material

Assessment

In Part 1 of the unit, students will investigate the natural water cycle in their local catchment and review their understanding of changes of state. They will draw a flow chart of the natural water cycle in their catchment or a catchment in their region that supplies drinking water—describing the changes of state that occur during the water cycle.

In Part 2 of the unit, students will build on their understanding about how human activities have changed the water cycle in their catchment and investigate experimentally how drinking water is treated to a safe standard. A student assessment task could be either:

- their experimental report on the design of a filter in the Elaborate phase, or
- a flow chart describing the process they would recommend for purifying and disinfecting water after a natural disaster with a given selection of materials.

Cross-curriculum priority: Sustainability

This unit provides a rich opportunity to discuss sustainable water management issues—particularly those related to your local catchments. The issues that relate to the organising ideas of Sustainability could include:

- the importance of water to human and ecosystem wellbeing
- the connectivity of water sources in Queensland which sustain ecosystems
- the complexity of the systems that underpin both the natural and human water cycles
- the importance of managing and using water resources responsibly to ensure sufficient water supplies for the future
- the relevance of social justice issues to the management of water resources both in Australia and internationally.

Awareness of and understanding about sustainable water management issues encourages students to take action to address these issues. Enabling actions include:

- monitoring water quality in your local creek or water body to inform management decisions
- revegetating a cleared area in or near your school to improve the biodiversity of your area
- making a personal or school commitment to reduce water use
- monitoring home or school water use
- developing a promotional campaign to reduce school or community water use.

Cross-curriculum priority: Aboriginal and Torres Strait Islander histories and cultures

Aboriginal and Torres Strait Islander communities have a rich cultural connection to their waterways and seas. This sense of identity can be explored in this unit. Local community elders could be invited to share their stories—particularly those relating to water.

For ideas about how to develop partnerships with local Aboriginal and Torres Strait Islander communities go to the Department of Education and Training website at ‹www.education.qld.gov.au›, select 'Indigenous Education and Training' and download the 'Embedding Aboriginal and Torres Strait Islander Perspectives in Schools (EATSIPS)' document. It includes information and additional links to assist with developing protocols for engaging Aboriginal and Torres Strait Islander community members.

The Queensland Studies Authority also provides useful support materials. Go to ‹www.qsa.qld.edu.au›, select 'P-12 Approach', 'Indigenous perspectives', 'Support materials', 'Working with Aboriginal and Torres Strait Islander guest speakers'.

Linking locally

Contact your local natural resource management specialist to gather locally relevant information about the 'water story' in your area. They can also suggest relevant projects that the students could undertake to reduce human impact on their catchment. You could invite them to speak to your class about their work and ideas for action. These specialists could include:

- Council catchment or water resource management officers
- members of Landcare or catchment groups
- Department of Environment and Resource Management or Regional Natural Resource Management (NRM) body staff.

Unit overview

The unit is divided into two parts, each with its own 5 Es cycle of learning. The first part of this unit—Water journeys—focuses on the natural water cycle and movement of water through your catchment or catchments—including the catchment responsible for your local drinking water supply.

A TWLH chart has four columns: 'what we Think we know', 'what we Want to learn', 'what we Learned' and 'How we know'. It is used to:

- **elicit students' prior understanding**
- **identify questions students would like answered**
- **record learning as it occurs through the unit.**

Part 1—Water journeys

Engage	Students analyse a media article about shortage of drinking water supplies during a flood and identify questions they can investigate. A TWLH chart and a word wall are used to track learning in this unit.
Explore	Students complete simple activities which introduce focus questions such as: • Where does the rain come from? • How does water move through our area? • What happens to water when it evaporates? • What is a flow chart and why is it useful? • How old is our water? • What is a catchment? • What is our catchment? • Is water a renewable resource?
Explain	Students share their ideas and, with your help, negotiate an understanding of the focus questions raised in the Explore phase. They also review their ideas from Year 6 about what happens to water as it changes state from ice to liquid to vapour. The class adds their new ideas to the 'L—what have we learned' and 'H—how we learned it' columns of the TWLH chart.

Elaborate	Students apply their ideas about condensation and evaporation to explain how a solar still works. They consolidate their ideas about the water cycle in your local catchment by devising a class role-play about the journeys that a water molecule can take through the water cycle in your catchment.
Evaluate	Students work in groups to create a flow diagram or conceptual diagram of the water cycle as it applies in your catchment. They need to focus on describing changes of state that occur during the water cycle and what factors influence these changes. A work sample of a similar assessment task for Year 7 Science can be found on the Australian Curriculum website at ‹www.australiancurriculum.edu.au› by inserting the words ‘water cycle’ as the search term. The work sample provided reflects a generic water cycle. In this assessment task students explicitly demonstrate their understanding of the water cycle by applying their ideas to their local catchment. Students reflect on their learning so far and revisit the questions that they asked in the Engage phase about the media article and complete the TWLH chart. They revise their understanding of the words on the word wall chart. Your local waterway or beach can be a special place for many people. Students can consider how local Aboriginal or Torres Strait Islander people view these special places using Uncle Ernie’s Framework. It draws on a more holistic ‘way of knowing’ and is an interesting approach to developing students’ thinking skills—particularly their systems’ thinking skills. Uncle Ernie’s Framework is described in ‘My Land, My Tracks’ which can be accessed from the Department of Education and Training website at ‹education.qld.gov.au›. Select ‘Schools and educators’, ‘Indigenous education’, ‘Educational Services’, ‘Cultural Awareness’, and then ‘The Local Story’. You could show students a video presentation by Louise Alexander, who effectively explains each area of the Framework for a student audience. Use the search engine term ‘Uncle Ernie’s Framework’ to find the Framework and the video.

Teaching and learning sequence

Part 1—Water journeys

The first part of this unit focuses on the natural water cycle and movement of water in your catchment or catchments, including the catchment responsible for a local drinking water supply.

» Engage (one session)

Analysing a media article

1. To set a real-world context for this unit, students analyse a media article such as 'Water supplies critical in the valley' that highlights some of the difficulties of supplying safe drinking water to residents during floods and other natural disasters. The article can be found at ‹www.thechronicle.com.au/story/2011/01/14/water-supplies-critical-in-valley-toowoomba›.

e-Coli (or *E. coli* as a biologist would write it) is an abbreviation of the name of a type of bacterium which is found in the gut of humans and other warm-blooded animals. It is usually very beneficial because it assists in the digestion of food. It is excreted in faeces and, if found in water samples, indicates that the water has been contaminated by human or animal faeces. The scientific name of the bacterium is *Escherichia coli*.

To start, display the title of the article and ask students to predict what they think the media article is about. Ask students to identify any words or phrases that are unfamiliar to them and to predict which words in the article are scientific words. Examples of scientific words or phrases for the 'Water supplies critical in the valley' could include: testing, e-Coli, water treatment plant.

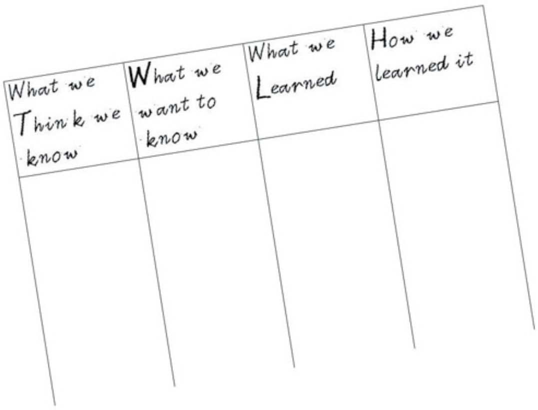
2. Discuss the words and phrases in the article, particularly the science-related phrases, and summarise the story.
3. Ask students a series of true or false questions about the information solely in the article. Examples of questions for the 'Water supplies critical in the valley' article are included in Resource 1.
4. Using a think-pair-share strategy, students list questions about the water story in the media article.

   a. Identify the problems facing the community. Problems could include:
   - The water treatment plant could be flooded and not operating.
   - There could be additional sediment and contaminants in the water prior to treatment.
   - There could be wash-outs with broken water pipes which cause leakages in the water distribution system.

   b. What solutions are required? Solutions could include:
   - trucking drinking water (either bulk or bottled) into the community
   - fixing the water treatment plant
   - fixing the washed-out or broken supply pipes.

In a think-pair-share activity, students spend some time individually thinking about and recording their ideas. They then share their ideas with a partner and decide on the list for their pair. Two pairs of students form teams of four to develop a team list.

c. Who would be needed to solve the problems?
- water truck drivers for emergency supplies
- people to monitor the flow of the flood waters (hydrographers)
- people to get the water treatment plant working again (water plant construction engineers and operation and maintenance technicians)
- plumbers to fix broken pipes
- people to monitor the water treatment process and the quality of the water passing through the water treatment plant (water treatment technicians).



TWLH chart

Eliciting student prior knowledge about the topic is an important part of the unit. Identify alternative ideas and misconceptions that the students have about the topic which will enable you to design learning experiences that prompt the students to question their ideas and to build new conceptual frameworks.

TWLH chart

5. Begin a TWLH chart by asking students what they think they know already about the 'water story' in their local area.

   The focus questions listed in the Explore phase below could be used as prompts. Students can add questions in the 'What do we need to know' column. You could suggest some additional questions such as 'How old is our water?'.

Word wall

6. Begin a word wall chart to record the new words for this unit. Divide the chart into two columns—everyday words and scientific words.

» Explore (three or four sessions)

Students will complete activities to explore ideas about the 'water story' in your area. Some examples of focus questions for the Explore activities include:

- Where does the rain come from?
- How does water move through our area?
- What is a flow chart and how do we design one?
- What happens to water when it evaporates?
- How old is our water?
- What is a catchment? What is our catchment?

Some ideas for Explore phase activities include:

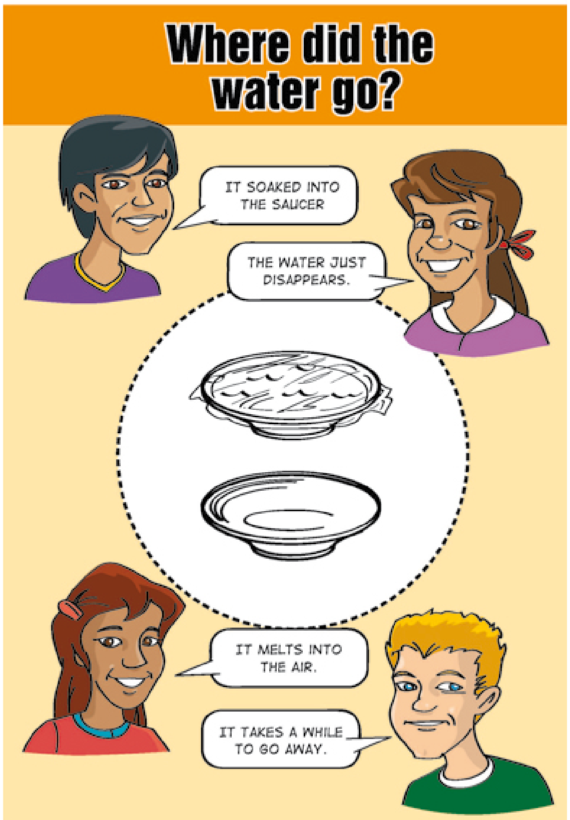
Activity 1 – Where does our drinking water come from? Group and class activity

If possible, invite a guest speaker to visit your class to explain water supply in your community. Before the expert's visit, students prepare questions they will use to interview the guest. Lesson 3 in Unit 1 of the Year 6 and 7 *Water: Learn it for life!* resources includes more detailed instructions about how to structure a specialist guest visit to your class.

Activity 2 – What is a catchment? What is our catchment? How does water move through our area? **Group activity**

Use Google Earth, Google Maps or aerial photos to track where your local waterway comes from and where it goes. Other ideas from the Year 6 and 7 *Water: Learn it for life!* resources include:

- making a model of the catchment, which could be done quickly by simply using a tray filled with sand and some twigs and other items to represent different land use types (Unit 1 Lesson 5)
- creating a class catchment map on calico (Unit 2 Lesson 4)
- drawing a coloured chalk representation of your catchment on concrete in an appropriate covered outdoor area in the school
- creating a Google Map of your catchment containing images of key features taken by students.



Source: Hunt J & Thrupp R. (2008). *Conversations about science*. Central Queensland University: Bundaberg.

Activity 3 – What happens to water when it evaporates? **Class activity**

Use the 'Where did the water go?' concept cartoon (Resource 2) to identify students' prior knowledge about the evaporation. Ask students to share their ideas with the class.

Investigate the question by setting up two saucers of water in your classroom for a couple of days—one covered with cling wrap and one without. This activity could be done as a class demonstration or as a group task.

Ask students to predict what they think is going to happen, to observe what did happen and to record their ideas in their journals. You will explain what happened in the Explain phase of the unit.

The same concept cartoon could be used again at the end of the unit to assess student learning over the unit. In their 'water' journal, students identify the response that they think is correct and explain their choice. If students have an alternative idea, they record that idea and explain it.

Activity 4 – What is a flow chart? **Group activity**

Flow charts are a visual text tool for representing and analysing processes. They are used extensively in science and engineering fields. In the context of this unit, a flow chart will be used as a diagram that sequentially shows the steps or processes of the water cycle in your local area.

In this activity, each group will practise the flow charting skills they need for the assessment task by planning a class celebration (Resource 3).

Activity 5 – How old is our water? Thinking like a geologist. **Class activity**

Geologists are scientists who gather evidence about the different types of rocks and landforms to work out how places have changed over time. How long do geologists believe water has been on the surface of the Earth?

This activity was adapted from: Clary R. & Wandersee J. (2009). *How old? Tested and trouble-free ways to convey geologic time*. Science Scope, National Science Teachers' Association.

Clapping time

1. One way to understand how long different periods of time take to pass is to use hand claps. We can represent the passing of each year by one clap of the hands every second. Ask a student to volunteer his or her age. The class claps it out. Clap out the ages of two or three students.
2. Europeans landed in Australia 240 years ago. How long will it take to clap out 240 years that Europeans have been settled in Australia? How long is 240 seconds? If there are 60 seconds in a minute, how many minutes in 240 seconds? [4 minutes]
3. Aboriginal people have been in Australia for at least 60,000 years. If there are 60 seconds in a minute, how many minutes are there in 60,000?[1000 minutes] If there are 60 minutes in an hour, how many hours would it take to clap out 60,000 years? [about 16.7 hours]
4. Geologists think that the Earth was formed about 4.5 billion years ago. The heat generated from the Earth's core caused massive eruptions from huge volcanoes, releasing gases into a primitive atmosphere; one of these gases was water vapour. By about 3.8 billion years ago, the Earth cooled to below 100°C and the water vapour in the atmosphere condensed—forming the seas and oceans we have today. If 3.8 billion years is 3,800,000,000 years, how many hours would you have to clap out 3,800,000,000? [about 120 years]
5. For this activity you can choose any touch-down points in history that are of interest to your class.
6. Complete the activity with a creative thinking exercise. Think about the water that is in your body. Where might that water have been in at least 3.8 billion years? If possible, you could invite a geologist as a guest speaker to your class.

Activity 6 – Is water a renewable resource?
Group activity

In groups, students use print and electronic references to devise their own definition for renewable and non-renewable resources. They use their definition to decide if water is a renewable or non-renewable resource and justify their position in a whole-class discussion (Resource 4).

» Explain (two or three sessions)

Students share their ideas and, with your help, negotiate an understanding of the focus questions explored in the previous phase. They also review their ideas from Year 6 about what happens to water as it changes state from ice to liquid to vapour.

Ask students to recall how water moves through their catchment. Discuss how much of the water enters the catchment as rain. Discuss where the rain that falls in your catchment comes from—how clouds condense from water vapour formed by evaporation from water bodies and via transpiration in plants. Apply these abstract ideas to your local environment as much as possible. Discuss the fact that the water cycle takes place on a scale that is much larger than just one catchment. The rain that falls on your catchment may have evaporated from Western Australia or the Indian Ocean, for instance.

When using models and analogies, be sure to encourage students to evaluate the model using questions such as: what are the benefits of using the model; what are the limitations of using the model; why do scientists use models?

Students review their ideas about what water is and how it behaves when it changes state from ice to liquid to water vapour. To understand how water behaves, students first need a mental picture of a water molecule. You can introduce (or review) the idea that water is made of minute water molecules and create physical models of water molecules using plasticine, for instance.

Why are water molecules sticky? One end of the water molecule has a slight positive charge and the other end of the water molecule has a slight negative charge. What happens when two water molecules come close together? How would they line up? Students can demonstrate their ideas with their plasticine models.

Did you know that there are over 8×10^{24} water molecules in a cup of water? That is an 8 followed by 24 zeros.

When introducing the idea that water is made of molecules, don't emphasise the idea that a water molecule is made of two hydrogen atoms and one oxygen atom. It is useful for students to have a workable idea about how water molecules behave when they are heated and change state before they are introduced to the idea that the water molecule is made of atoms. Otherwise, some students gain the misconception that water molecules break into their component atoms when they change state.

The idea that a water molecule has a positive charge at one end and a negative charge on the other end explains why water seems to be 'sticky'; but it doesn't explain what happens when water changes state from a liquid to a gas.

The learning object 'Matter and evaporation' (TLF1490) can be used to observe how water molecules behave when water changes state. Revisit the concept cartoons.

The movement of water through plants from the roots and then out of the leaves (transpiration) is another component in the water cycle. While students don't need to know exactly how this occurs, it can be useful to show them. They can tie plastic bags on the ends of shrub branches overnight to observe the puddle of water that forms in the bottom of the bag (Years 6 and 7, Unit 1, Lesson 6—Optional activity). Show students the six minute long David Attenborough segment from 'The private life of plants' which graphically demonstrates how water moves through plants. You can find the segment from 11.36 minutes in the 'Growing' episode of 'The private life of plants'. Alternatively, you can find the segment on YouTube by searching for 'water transport in plants'.

Finally, link these ideas back to the students' experience of the water cycle in their local area. For instance:

- Where does the rain come from?
- What are the distinctive features of your catchment?
- How does water flow through your catchment?
- Where does it evaporate?
- Where does the energy come from to power the movement of water and the water cycle?
- Where does it condense?
- What kinds of vegetation are in your catchment? How does water move through the vegetation?

Focus on the natural aspects of the water cycle without human impacts. Students will explore the human elements of the water cycle in the second part of the unit.

The class adds their new ideas to the 'L—what have we learned' and 'H—how we learned it' columns of the TWLH chart.

Is water a renewable resource?

A class discussion about whether water is a renewable resource provides an opportunity to highlight the idea that there can be many 'right' answers to a question depending on the way the term is defined and the particular focus of interest.

For instance, if a renewable resource is defined as a resource that is renewed or replenished by natural processes, then water on Earth could be regarded as a renewable resource. If the focus of the discussion, however, is on local drinking water supplies, it could be argued that water is a non-renewable resource as it is possible to deplete these resources.

The discussion is also useful for addressing some of the sustainability organising ideas by highlighting the importance of conserving water supplies and maintaining the health of local water ways.

» Elaborate (two or three sessions)

Activity 1 – Solar still. **Hands-on activity**

Students apply their ideas about condensation and evaporation to explain how a solar still works. Show students the equipment and materials to make a solar still (Resource 5). Ask students to predict what kind of liquid they will get in the small cup in the centre of the still. Students work in groups to complete the worksheet while they make and use a solar still.

This activity was adapted from: Project WET Foundation. (1995). *Project WET Curriculum and Activity Guide*. Project WET: Bozeman (Montana), USA.

Activity 2 – Water's incredible journeys role-play

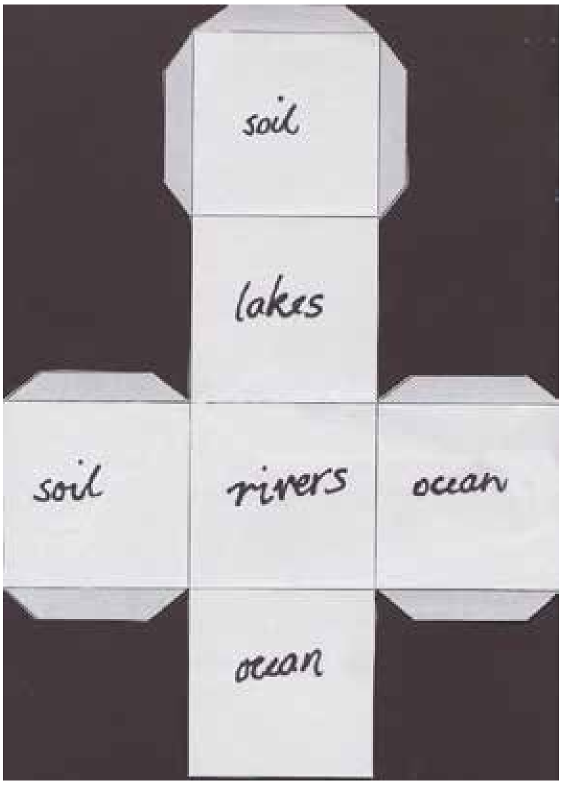
Students consolidate their ideas about the natural water cycle in their local catchment by devising a class role-playing activity about the journeys that a water molecule can take through the water cycle.

1. Ask students to identify the different places that a water molecule can go as it moves through and around the Earth. Discuss the idea that the movement of water depends on energy from the Sun and on gravity. Also discuss the idea that the water molecule may not go anywhere for a very long time—for instance, when the water is contained in a confined aquifer. However, make sure that students realise that most groundwater moves through aquifers, albeit very slowly.
2. Explain that the students will role-play the water cycle by setting up stations around the classroom that represent places that a water molecule can take as it moves through the water cycle. The stations for this activity are: clouds, rivers, ocean, animals, plants, lakes, soil and aquifers. Divide students into six groups and assign each group at least one station. The 'rivers' group is also responsible for the 'ocean' station and the 'animals' group is also responsible for 'plants' station.
3. Each group makes and illustrates a label for each station by folding a piece of stiff A4 card in half. Place the station cards at convenient points around the room.
4. For each water cycle station, the group lists all possible destinations that a water molecule could go to after it leaves their particular station. For instance, from the 'cloud' the water molecule can move to the lake or the river or the soil or the ocean.

   Students can refer to water cycle diagrams or posters for additional ideas for possible water molecule destinations. For example, they could compare the 'Water Cycle Poster' that is the first of a series of posters you can find by entering the term 'water cycle series' in a search engine. The posters in the series can be ordered from the Queensland Department of Environment and Resource Management and are accompanied by guidelines which can be downloaded. Students can view online videos and animations about the water cycle.

In a class discussion, each group justifies their ideas about the possible destinations that a water molecule might have from their stations. A list of possible destinations from each water cycle station could be:

Station	Destinations
clouds	rivers, ocean, soil, lakes
rivers	ocean, animals, plants, aquifers, clouds, soil
ocean	clouds, plants
animals	soil
plants	clouds
lakes	clouds, soil, aquifers
soil	clouds, aquifers, plants
aquifers	rivers, soil, plants, oceans, lakes



Example of a die for the 'clouds' station

5. The group uses a mathematical net of a cube to make a die for each station. Before folding the die, students label each side of the cube with a different destination. They could also illustrate the side of a cube with an appropriate icon. As most of the stations have less than six possible destinations for the water molecules, students can repeat the most likely pathways on the remaining blank sides of the cube.

6. To play the game, divide the class in two. One half of the class plays game with the dice while the other half watches and records the water cycle journey of the players.

   Divide the half of the class that are playing into six groups—one group per station. Each student at a station rolls the die to determine which station they go to next. The players move from station to station, rolling the die at each station to determine where they go next. Finally, the groups swap places.

   Alternatively, if you have sufficient space, you could make multiple copies of each station die to enable the whole class to play simultaneously.

Optional activity – Simulating evaporation and condensation

Once all the students have moved around the cycle, add a new rule to the role-play. Revise the idea that water molecules in water vapour are whizzing around separately and very quickly; but in liquid water, the water molecules stick closely together and roll around each other. Explain that the students can represent these ideas by pairing up with another student when the water molecule is condensed in the liquid phase (on the ground) and separating again when they are in the vapour phase (moving towards the cloud). Students could discuss whether the water molecules in the cloud are single (in vapour form) or paired (in liquid form). Students role-play the water cycle game again with the new pairing rule.

Student reflection

Students suggest ways in which the water cycle role-play can be changed or improved.

Ask students to imagine that the water cycle role-play is taking place in their local catchment. Where would they place the stations of the water cycle in their local catchment?

» Evaluate (two sessions)

1. Students work in groups to create a flow chart of the water cycle as it applies in your catchment. They need to describe the changes of state that occur during the water cycle and where the energy that drives the water cycle comes from.
2. Students reflect on their learning so far and revisit the questions they asked in the Engage phase about the media article. Explain that in this part of the unit they investigated the natural water cycle and in the next part of the unit, they will explore some of the human impacts on elements of the water cycle—including where their drinking water comes from.

Embedding Aboriginal and Torres Strait Islander perspectives

Your local waterway or beach can be a special place for many people. Students can consider how local Aboriginal or Torres Strait Islander people view these special places using Uncle Ernie's Framework. It draws on a more holistic 'way of knowing' and is an interesting approach to developing students' thinking skills, particularly their systems' thinking skills. Uncle Ernie's Framework is described in 'My Land, My Tracks' which can be accessed from the Department of Education and Training website at ‹www.education.qld.gov.au› Select 'Schools and educators', 'Indigenous education', 'Educational Services', 'Cultural Awareness', 'The Local Story'.

You could show students a video presentation by Louise Alexander, who effectively explains each area of the framework for a student audience. Both the framework and the video can be found using the search engine term 'Uncle Ernie's Framework'.

Unit overview

The second part of the water cycles unit—Pure water—focuses on the quality of water in our waterways and how that water can be treated for drinking purposes using various separation techniques.

Part 2—Pure water

Engage	Students reread the media article about using water wisely during a flood event. They list the questions that relate to types of contaminants that might be found in the water and how the water can be treated for drinking. Examples of focus questions are listed below. You introduce the idea of cleaning water using a 'mystery water filter' cup. Students begin to construct a new TWLH chart for this part of the unit.
Explore	Students will complete the first series of simple activities which introduce focus questions about mixtures, solutions and suspensions such as: • What happens to the water that flows through our catchment? • What is a mixture? • What is a solution? • What is a suspension?
Explain	Students share their ideas about the differences between solutions and suspensions and these terms are explained. Students are also introduced to terms such as solute and solvent.
Explore	Students will complete the second series of simple activities which introduce focus questions about drinking water treatment such as: • How do we clean dirty water? • Is the water safe to drink? • Which water professionals are responsible for supplying, testing and treating drinking water? • What areas of science are needed so they can do their job?
Explain	Students discuss how different contaminants can be separated from raw catchment water to produce clean water suitable for drinking. The roles of the water professionals responsible for drinking water supply are discussed.
Elaborate	Students plan and implement a fair test to investigate how to clean a dirty water mixture and communicate their findings in a report. To develop systems-thinking skills, students use an Earth-system approach to analyse the interactions that occur between the sub-systems of atmosphere, geosphere, hydrosphere and biosphere during a natural disaster.

Evaluate	Students reflect on their learning using a DIGA strategy (describe, interpret, generalise, apply). Students apply their understanding of the water treatment process by designing a flow chart that demonstrates how water can be cleaned during a natural disaster. A work sample of a similar assessment task for Year 7 Science can be found on the Australian Curriculum website at ‹www.australiancurriculum.edu.au› by inserting the word 'purifying' as the search term. Students explain how different water workers contribute to fixing water supply issues that can arise during a natural disaster.

Teaching and learning sequence

Part 2—Pure water

The focus of the second part of this unit is on the quality of water in our waterways and how that water can be treated for various purposes. Raw water in waterways and dams is a mixture of various pure substances and other contaminants which can be separated from the raw water by various separation techniques to produce water fit for drinking.

» Engage (one session)

Students reread the media article about using water wisely during a flood event. They identify the questions that specifically relate to the quality of the source water for their town (or a nearby town) and how the water can be treated for drinking. Include focus questions such as:

- What happens to the water that flows through our catchment?
- What contaminants are found in the source water for drinking water supply?
- How is water treated to make it safe for drinking?

This activity was adapted from the article: Walker M, Kremer A & Schluter K. (2007). Dirty water challenge. *Science and children*; Summer: 26–9.

Mystery filter

1. Introduce the idea of cleaning water using a 'mystery filter' made from two or three plastic cups with small holes in the bottom for drainage. The cups are filled with a small amount of different filter materials such as sand, gravel, cotton wool or pieces of paper towel.

   When making the mystery filter, use layers of filter material less than two centimetres thick or the water will move through the filter too slowly. The cups are placed on top of each other and the cups are covered completely with alfoil so the students can't see how the filter works.

2. Show students some dirty water made by mixing soil with tap water in a clear container. Ask students to predict what will happen when you pour the dirty water into the top of the mystery cup.

3. Hold the mystery filter over an empty cup and pour some of the dirty water into it. Students compare the water from the mystery filter with the original dirty water.

4. Discuss where dirty water comes from and what you need to do to make it clean.

Whizzy's incredible journeys—family journey

5. Read the family journey from 'Whizzy's incredible journeys' pick-a-path big book to trace Whizzy the waterdrop's journey through a dam and a water treatment plant to a house.
6. Ask students for their initial ideas about how water is treated in the water treatment plant on pages 6 and 7. The big book can be ordered from the Queensland Department of Environment and Resource Management's Water Learn it for life! website. One copy is provided free of charge to all Queensland schools.
7. Students begin a new TWLH chart for this part of the unit. Record the students' initial ideas on the chart. Ask students to explain their own ideas about:
   - What is a mixture?
   - What is a solution?
   - What is a suspension?
   - What happens when something dissolves?

» Explore A (four sessions)

There are a number of scientific concepts that students need to grapple with in this part of the unit. To make this unit easier to understand, students first explore and explain ideas about mixtures, solutions and suspensions before they explore and explain ideas about the separating techniques used to purify water for drinking.

Exploring mixtures, solutions and suspensions

Activity 1 – What happens to water that flows through our catchment? The story of a river.

Class activity

1. Review student ideas about the local catchment that supplies drinking water. Revisit the catchment models or maps designed in Part 1 of this unit. Discuss the land uses in the catchment.
2. Ask students to predict what effect the different land uses in a catchment would have on the quality of water in the river or dam. Talk about the kinds of materials that rain would pick up as it runs off the surface of the catchment.
3. Conduct the 'story of a river' activity that can be found in Lesson 5 in Unit 2 in the *Water: Learn it for life!* curriculum resource for Years 6 and 7. This is a whole-class demonstration in which you start with a large clear container of water displayed in front of the class. Read the 'story of a river' which describes the effect that different land uses in a catchment have on the quality of the rainwater run-off in the catchment.
4. As each land use is mentioned, a student pours a sample representing the contaminants from that land use that could find its way into the river. For instance, as you read about the 'national park', a student tips a canister of mulch into the container of water.

Activity 2 – What is a mixture?

Hands-on activity

Working in groups, students use a predict-observe-explain approach to investigate what will happen if they mix a teaspoon of dirt in half a cup of water. Firstly, ask students to predict what they think will happen when they mix the dirt with the water and to explain the reasons for their predictions. Students then mix the dirt in the water and then observe what happens as it settles. Finally, students explain their observations.

Activity 3 – What is a solution?
Demonstration

Dissolve a teaspoon of cooking salt in a clear plastic cup of water. Ask students to predict what will happen to the light when a torch shines through the cup. Ask students to observe what happens when you shine the torch through the cup of salty water.

Activity 4 – What is a suspension?
Demonstration

Ask a student to mix a small piece of clay in half a cup of water. It will take a while. Students predict how long it will take for the clay to settle out. Ask students to predict what will happen to the light when a torch shines through the cup. Ask students to observe what happens when you shine a torch through the clay suspension. In preparation for Activity 6, explain that light is scattered as it shines through the clay suspension. This is because clay is a substance that is insoluble in water.

Activity 5 – What dissolves? **Group activity**

Each group receives four clear plastic cups and some sand, sugar, salt and chalk. Their task is to design a fair test to decide which of those four substances are soluble and which are insoluble. Students predict which substances are soluble and which are insoluble before they conduct their fair test.

» Explain A (one session)

Mixtures, solutions and suspensions

1. Discuss the 'story of a river' activity. Explain that the bowl of water became a mixture as more and more materials were added to it. In fact, the bowl of water became a mixture of mixtures—because chemists have identified different kinds of mixtures.
2. Divide the class into groups. Based on their experiences with the Explore phase activities, ask the groups to identify different types of mixtures and to list the reasons why they think each type of mixture is different.
3. Each group represents their initial ideas by drawing a picture of each type of mixture they identified. Groups share their ideas with the class. Give the groups the opportunity to rework their ideas about representations of mixtures.
4. Explain the scientific terms that a chemist uses to describe these different types of mixtures—solutions and suspensions. Ask the students to explain the differences between solutions and suspensions and devise class definitions. When talking about solutions, introduce the terms solute and solvent.
5. Discuss why an understanding of different types of mixtures might be important if you wanted to treat 'raw' water in a catchment for drinking purposes.

Particles and mixtures

1. Use the students' drawings of different types of mixtures to explore the various ways the particles in the mixture behave.

Note: Strictly speaking, a chemist would say that table salt is made of sodium and chloride ions which are held together in a crystal formation by their electrostatic attraction: sodium ions have a positive charge and chloride ions have a negative charge. When salt crystals dissolve in water, the charged ends of the water molecules are attracted to the oppositely charged ion, either sodium or chloride, and the salt crystals are pulled apart until all the sodium and all the chloride ions are separately surrounded by water molecules. Unless you are introducing the students to ionic bonding, it is better to avoid talking about it with primary students.

2. Starting with water—review the idea that water is made of water molecules rolling around each other. When you add some substances like salt or sugar, the salt or sugar completely disappears. This happens because the salt or sugar molecules completely mix with the water molecules. This is why the light from the torch can shine right through the solution without being scattered.

   You can simply represent the salt or sugar as particles in the solution using same-coloured dots surrounded by water molecules (See note above).

3. In contrast, other substances such as clay don't dissolve completely in the water but remain as tiny clumps of clay particles. That is why torchlight is scattered by the clay–water mixture in Activity 5. These substances are insoluble in water. The mixtures formed by water and insoluble substances are called suspensions.

» Explore B (one session)

Purifying water

Activity 1 – How do we clean dirty water?
Hands-on group activity

Students use a range of materials to make a filter to clean the dirty water made in Activity 2 (Explore A). Filter materials could include cotton wool, filter paper, tissue paper, paper towels, sand or gravel. Use a separate plastic cup with holes in the bottom for each filter material and limit the depth of the filter material to one centimetre. Explain that the thicker the layer of filter materials, the slower the filter will work.

Activity 2 – Who cleans our drinking water?
Group activity

Working in groups, students predict the roles of the people needed to restore drinking water processes after a natural disaster that damages the water treatment plant and the distribution pipe system to houses.

Activity 3 – To drink or not to drink?
Group activity

Provide each group with a cup of clear water—it is not to be drunk. Don't provide any other information about where the water came from and ask each group to predict if the water is safe to drink. They need to decide on their claim (the water is safe to drink or not to drink) and then provide reasons to justify their position. Groups report their ideas to the class.

» Explain B (two sessions)

Separating techniques

1. Discuss student ideas about how the dirt can be separated from the water. For instance, they may suggest:
   - scooping the mulch or detritus off the top with a sieve—and you could introduce the idea of filtering
   - pouring the water off carefully to leave the heavier sand on the bottom of the cup—and you could introduce the idea of decanting.
2. Students could explain why the different filter media work and how they work. Different sized kitchen sieves are useful for showing how different filter materials filter out particles of different sizes and why it is a good idea to start with the sieve with the biggest holes first so that the fine filters don't get clogged. Explain the terms filtrate and residue.

How big is a...? animation

Discuss the idea that the contaminants in water are all different sizes. Use the 'How big is a...' animation which simply shows the relative sizes of very small and invisible things—human hair, dust mite, pollen grain, white blood cell, red blood cell, a yeast cell, a bacterium and a virus. To find the animation on the Cells Alive website, enter the phrase 'How big is a animation' in a search engine.

Optional activity – Sorting cards

You could make sets of sorting cards of the items mentioned in the animation. Before watching the animation, students predict the relative sizes of these examples. They work in groups to place each card in order from largest to smallest. After watching the animation, allow the groups to update the order of their sorting cards. Discuss the fact that water molecules are very much smaller than a virus particle.

A dust mite and a pollen grain are made of many cells (multicellular). Yeast, white blood cells and red blood cells are single cells. *E. coli* and *Staphylococcus* are bacteria cells—still single cells. Ebola virus and Rhinoviruses are both viruses—as their name suggests.

Making water drinkable learning object

Use a learning object such as 'Making water drinkable—Water treatment' (L3130) as a whole-class activity to investigate the basic processes of water treatment. A series of questions for this learning object is provided in Lesson 7 in Unit 2 of the Years 6 and 7 *Water: Learn it for life!* curriculum resource.

Coagulation and flocculation

Explain that clay particles form a suspension when mixed with water, and are difficult to remove from water in the water treatment process because the particles are negatively charged and repel each other. The clay particles jiggle around in the mixture and remain suspended—hence the term 'suspension'.

If there is clay in the raw water to be treated, a substance can be added to the clay suspension that helps clump the clay particles together to form larger clumps. The substance, such as alum, is positively charged and attracts the negatively charged clay particles. This step is called coagulation.

Eventually these clumps become large enough to form a visible gel-like mass called a floc which becomes heavy enough to fall to the bottom of the tank as sediment. This step is called flocculation.

Optional activity – Making a floc

If you have access to some pool flocculant or some alum from your local high school, you could demonstrate how this technique works with the clay suspension students made in the previous Explore activity. Make sure that you follow the prescribed safety procedures.

Is clear water safe to drink?

1. Review the student ideas from Activity 3 in the previous Explore phase about whether water that looks clear is safe to drink. Discuss the idea that 'invisible' bacteria, viruses and other microbes could be in the water and that some of these microbes can cause disease. It is an opportunity to raise students' awareness about the effect that these waterborne diseases have globally, particularly on children. You can find an effective PowerPoint presentation on the topic at ‹www.duarte.com/work/5000000-preventable-deaths-per-year/›.
2. Explain that drinking water in Australia has been treated to the standards set by the Australian Drinking Water Guidelines and is safe to drink. Once water is treated, it is disinfected before it is distributed to homes.
3. Add new learning to the TWLH chart.

» Elaborate (two sessions)

1. Working in groups of two or three, students plan and implement a fair test to investigate how to clean a dirty water mixture. Explain that each group will participate in a class challenge to see who can create a filter that produces the cleanest water in the shortest time. Negotiate the challenge criteria with the class before they start. How are they going to judge the clarity of the filtrate? How are they going to measure the 'speed' of the filter? How will they combine these measurements to select a winning filter?

This activity was adapted from the article: Walker M, Kremer A & Schluter K. (2007). Dirty water challenge. *Science and children*; Summer: 26–9.

2. Make a large bucket of dirty water and provide a supply of plastic cups, filter paper, sand, and gravel of different sizes or any other suitable material. Ask students to predict the effect of using thick layers of filtering material. Recommend that they make the layers of each filtering material only one or two centimetres thick. Hopefully, this will conserve your supply of filter materials!
3. Review how to design a fair test and discuss why each filter material will need to be tested on its own before combining the materials. How are they going to measure and record their results? Once the materials are tested individually, students can test the combinations of filter material.
4. Students evaluate their results so far and decide on the design of their final filter. Before building their final filter, each group will need to justify their design to you using their experimental results. You could ask such questions as:
    - What is your filter design?
    - How did you use your experimental results to decide on the filter design?
    - Are there any potential problems with this design?

    Students then build their filters.
5. Once the filters are built, line up the filters in front of the class. Ask the students to predict which filter will be the most effective. Test each filter with about half a cup of dirty water.
6. To finish the activity, discuss the problems that they had making the filters and how they could improve their design. Discuss why they still can't drink the water even if it is clear. What other contaminants are still in the water? Students can be prompted to suggest that there could still be salt, nutrients or bacteria in the water. What other techniques are required to remove these contaminants?
7. Compare the activity to the way that water treatment process engineers design and monitor the water treatment plant that supplies their drinking water.
8. Students write a scientific report or student journal entry about their findings from the investigation, including a recommendation for the most efficient combination of filter material to clean dirty water.

Optional activity –Drama

Students could act out a drama similar to the 'water cycle adventure' described in Lesson 7, Unit 1 of the *Water: Learn it for life!* Year 6 and 7 resource—but adapted to reflect the local water treatment process.

The following activity was adapted from the article: Robeck E. (2011). An Earth system approach to understanding the *Deepwater Horizon* oil spill. *Science Scope*; 34(6) February.

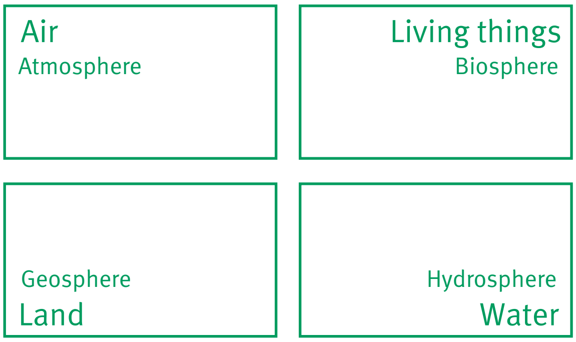
Optional activity – Earth systems thinking task

Floods and cyclones can have a devastating effect on humans and ecosystems. They also provide an interesting and complex context to discuss the interactions between the various components of environment with Year 7 students. Students apply a systems-thinking approach to develop a deeper understanding of the impact of flood events. This tool enables them to ask questions and explore other ideas.

A systems-thinking approach takes a holistic view of the interacting parts of system rather than a reductionist approach which studies each part of a system in isolation.

1. Briefly introduce the Earth systems diagram boxes (Resource 6) and explain that we can think about the overall Earth system as being composed of four interacting sub-systems: land, water, living things and air (Figure 1). These sub-systems have scientific names: geosphere, hydrosphere, biosphere and the atmosphere.

Figure 1



2. Ask the students to suggest components for the 'air' category that might be relevant to a flood disaster. Ideas could include 'clouds, rain, weather, humidity'.

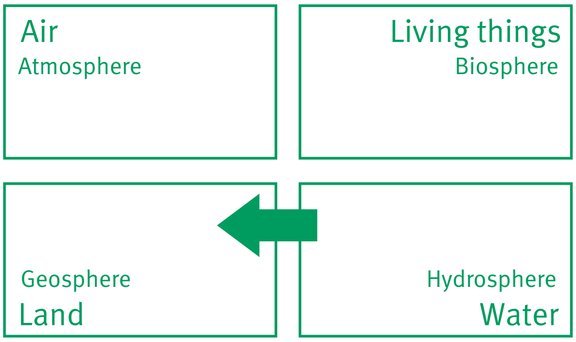
The following table (Table 1) provides some suggestions for the components that make up the Earth system categories.

Table 1: Earth system components

Air	Living things
clouds	plants
rain	animals
weather	humans
humidity	microbes
Land	**Water**
sediment	water
rocks	rivers
soil	oceans
topography	lakes
dam	drains
towns	

3. Ask students to think about how one sub-system might affect another sub-system in your natural disaster scenario of choice (Figures 2a–d).

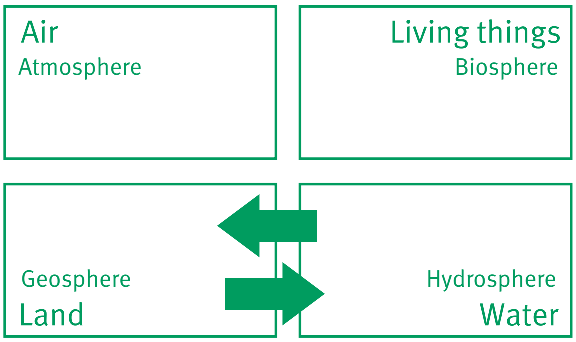
Figure 2a



If you used a flood scenario, you could add a one-way arrow between 'water' and 'land' (Figure 2a). How did one of the water components interact with or affect one or more of the land components? The water affected the land by washing the soil off the paddocks and eroding the river banks.

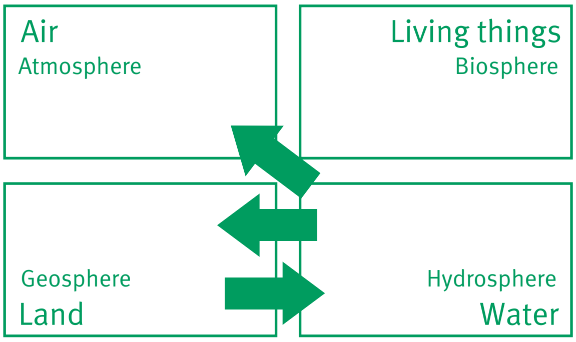
The land affected the water by making it muddy (Figure 2b).

Figure 2b



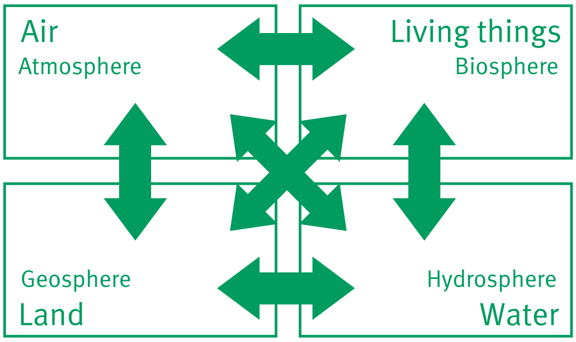
Students will need to think more creatively to find links between the land and the air or the water and the air (Figure 2c).

Figure 2c



4. They continue to devise possible interactions between pairs of different Earth systems—one pair at a time until all possible combinations have been explored (Figure 2d).

Figure 2d



5. Initially students work individually to label the diagram with their ideas about possible interactions between sub-systems and then discuss their ideas with their group and the class. This task will generate new questions which students could research further, if you have time. Students could represent their ideas using a concept map.

» Evaluate (two sessions)

Students apply their understanding of the water treatment process by designing a flow chart that demonstrates how water can be cleaned and disinfected during a natural disaster. Review how to create a flow chart with students.

A work sample of a similar assessment task for Year 7 Science can be found on the Australian Curriculum website at ‹www.australiancurriculum.edu.au› by inserting the word 'purifying' as the search term. Students explain how different water workers contribute to fixing water supply issues that can arise during a natural disaster.

Student reflection

Students reflect on their learning through the unit using a DIGA tool:

- **D**escribe the learning experiences in the unit
- **I**nterpret the learning by asking students to consider questions such as:
  - What did this mean to me?
  - Why did we do it?
  - What did I learn from this?
  - What effect will this have on my future learning?
- **G**eneralise the experience or concepts learned
- **A**pply the learning to other activities by asking questions such as:
  - How does what I have learned apply to...?
  - How can I use this learning in other subjects?
  - How can I use this learning to improve my skill in ....?

Adapted from ‹www.eduweb.vic.gov.au/edulibrary/public/teachlearn/student/diga.pdf›

Water careers and science

1. Revisit students' initial ideas about the people that would be required to restore the drinking water supply of a town affected by a disaster such as a flood or a cyclone. In this activity students consider the range of areas of science that different water professionals use to do their job.

2. Now that students know more about the water treatment process, ask them to suggest the water supply professionals who would play a role in restoring the supply. These people include water treatment technicians, plumbers, hydrographers, operations and maintenance technicians, and water treatment process engineers. You will need to define the correct terms for these careers. For instance:
   - hydrographers monitor the quantity, quality and flow of the intake waterway for the water treatment plant
   - operations and maintenance technicians fix the treatment plant pipes and infrastructure and also any damaged reticulation pipes in the town
   - water treatment technicians monitor the water quality of the water as it moves through the treatment plant to ensure that it meets the Australian Drinking Water Guidelines before it is distributed to the town.

   Water professionals use different areas of science to do their job.

3. Working in groups, students view one of five water career video vignettes to identify the different roles of each water career and add them to the second column of the table in Resource 7. The videos about the first four careers can be accessed from the H2Oz website at ‹www.h2oz.org.au/› by selecting the 'Immerse yourself' button on the top right corner of the webpage. The videos are located on YouTube. Contact your school computer technician if you are having trouble accessing them.

   The video profile of a civil engineer in the water industry can be found on the 'Ace day jobs' section of the ABC website by entering the key terms 'civil engineer' in the search engine on the ABC home page.

   The five water careers in the urban water treatment industry described in the videos are:
   - hydrographer
   - water treatment technician
   - operations and maintenance technician
   - wastewater treatment plant operator
   - civil engineer.

   Assign one of the water careers showcased in the videos to each group.

4. Students predict the areas of science the person needs to fulfil that role. They complete the third column on Resource 7. If they don't know the name of the specific area of science, they could describe the kind of knowledge the person needs.

   Explain that the specific role of a water professional will vary from water treatment plant to water treatment plant. Students will probably mention that some roles are shared across a number of the featured water professionals.

5. Each group completes the worksheet in Resource 7 and shares their ideas with the class. You will need to provide some of the required technical terms.

   Complete the TWLH chart. Review the words recorded on the 'word wall' chart that students have learned in this unit.

Analysing a media article

Toowoomba Chronicle
14 January 2011

Water supplies critical in the valley

A water crisis has enveloped south-west Queensland in the wake of the devastating floods.

The Lockyer Valley towns of Withcott, Helidon and Gatton have run out of water while only two to three days supply remains in Laidley.

A disaster management group is working closely with Queensland Urban Utilities to provide an alternative water supply.

Bottles of water are being distributed in Gatton and Hatton Vale, with a limit of three per person.

Lockyer Valley CEO Ian Flint said residents needed to cut their water use to an absolute minimum.

"We ask (Lockyer Valley) residents to please conserve water for absolute essentials, and we're getting tanked water, and bottled water delivered this morning to alleviate the situation, but we're really facing running out of water," he said.

Meanwhile, advice for Toowoomba residents to boil their water before use which was issued on Tuesday morning was lifted yesterday. Deputy Mayor Paul Antonio said the advice was a precautionary measure.

"Testing indicates the water is fine," he said.

"We were just recommending residents who didn't feel comfortable about using the water to boil it."

Chinchilla residents remain under strict instruction to boil their water for three minutes prior to consumption until further notice.

It came after e-Coli was detected in the town's supply.

Dalby has remained on stringent water restrictions since the town's water treatment plant was critically damaged by floodwaters.

While repairs have been carried out, a new rise in the Condamine River was yesterday threatening to again take the treatment plant off-line.

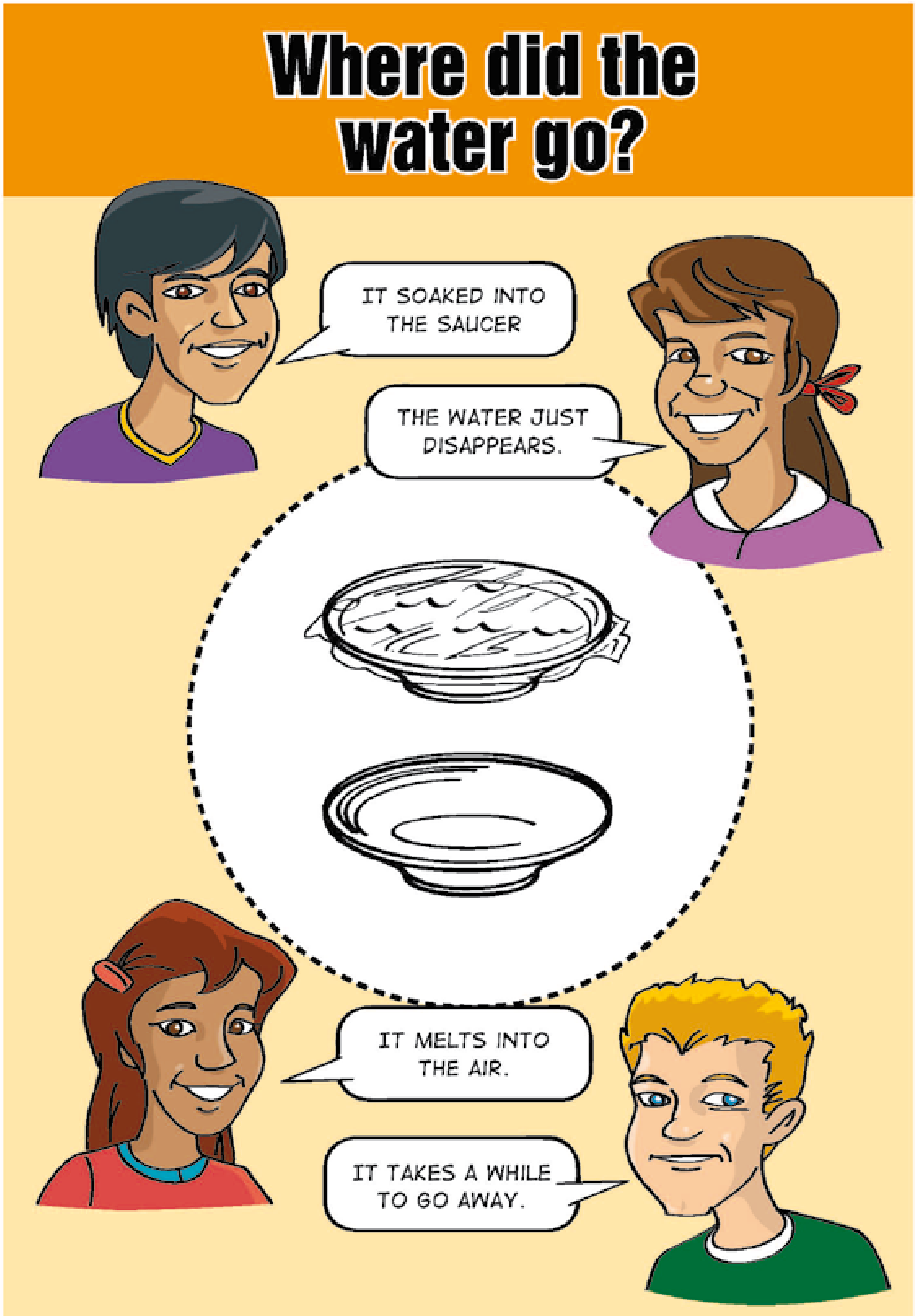
True or false?

Using the information in the *Toowoomba Chronicle* article, answer the following True or False questions by circling the correct answer.

Q1 The towns of Withcott, Helidon, Gatton and Laidley ran out of water.	True	False
Q2 Residents in the Lockyer Valley were asked to boil their water.	True	False
Q3 Floodwater from the Condamine River damaged Dalby's water treatment plant.	True	False
Q4 e-Coli can contaminate drinking water if the water treatment plant is damaged.	True	False
Q5 Queensland Urban Utilities is responsible for managing the disaster response.	True	False
Q6 Enough drinking water is stored after treatment to last for at least a couple of days.	True	False
Q7 Residents in flood-affected areas should water their gardens.	True	False
Q8 Water treatment plants are built high above flood height.	True	False
Q9 e-Coli can cause human health problems.	True	False
Q10 Water produced by water treatment plants is tested regularly to ensure that it is safe to drink.	True	False

Source: ‹www.thechronicle.com.au/story/2011/01/14/water-supplies-critical-in-valley-toowoomba›
Accessed 30 April 2011. Used with permission.

Where did the water go?



Source: Hunt J & Thrupp R. (2008). Conversations about science. Central Queensland University: Bundaberg. Used with permission.

Resource 3

What is a flow chart?

» Your task

Your group is responsible for organising your next class celebration. The group can choose the theme of the celebration and the event includes food and decorations.

You can use the following instructions to begin your flow chart:

1. Brainstorm the steps needed to organise the celebration.
2. Write each step on a separate piece of scrap paper.
3. Move the pieces of paper around to work out the sequence in which the steps would need to be taken.
4. When your group is satisfied with the sequence of steps, glue the pieces of paper onto a large sheet of paper.
5. Add the arrows to show the order in which the steps will need to be completed.

Resource 4

Is water a renewable resource?

»Your group task

Work as a group to research the meaning of the terms: renewable resources and non-renewable resources. Discuss the meanings and write a group definition of these two terms. Now use your definitions to decide whether water is a renewable or non-renewable resource. List the reasoning behind your group decision and be prepared to justify it in a class discussion.

1. Use web and hardcopy reference sources to answer the following questions:

   A. What is the meaning of the term 'renewable resource'?

   B. What is the meaning of the term 'non-renewable resource'?

2. As a group, discuss the meanings you found and in your own words write a group definition for each term.

   A. Renewable resource:

   B. Non-renewable resource:

3. Is water a renewable resource?

   A. As a group decide on your answer and circle one of the following:

   Water is a **renewable** resource.   Water is a **non-renewable** resource.

   B. Our reasoning is:

The solar still activity

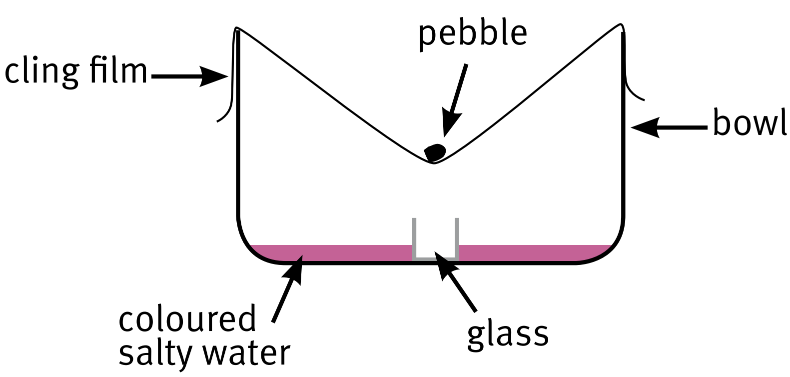
» Predict–Observe–Explain

The solar still is a device that uses solar energy to purify water. Different versions of a still are used to desalinate seawater, in desert survival kits and for home water purification.

Be careful! It is very easy to splash salty water into the small cup in the middle of the solar still.

Before you begin this activity, write your prediction below. What do you think will happen? What will you get in the small cup in the middle of the solar still?

The Solar Still



Method

1. Take all the equipment out to a sunny, level place.
2. The teacher will pour 1 cm of the coloured salty water into your ice-cream container.
3. Place a small piece of Blu-Tack on the bottom of the small cup so that it will stick to the bottom of the ice-cream container.
4. Carefully place the plastic cup in the middle of the ice-cream container, making sure no salty water splashes into the small plastic cup.
5. Cover loosely with cling film so that it sags slightly in the middle. Seal the film to the rim of the ice-cream container with a large rubber band.
6. Place the pebble in the middle of the film above the cup.
7. Leave the still for at least half an hour (the longer the better).
8. Remove the cling film and take out the cup without splashing any water into or out of the cup.
9. Record your observations about the water in the plastic cup on this worksheet. Is it coloured? What does it taste like? You can taste the water using a straw.
10. Complete the worksheet by explaining your ideas about why you got your results.

» Predict

I think that ______________________________

because ______________________________

» Observe

Our group found that ______________________________

» Explain

I think that ______________________________

Use the following words in your explanation:

- evaporate
- liquid
- vapour
- condense
- molecules.

Resource 6

Earth systems diagram

Air Atmosphere	Living things Biosphere
Geosphere Land	Hydrosphere Water

Resource 7

Water careers and science

Water careers	Roles	Areas of science
Hydrographer		
Water treatment technician		
Operations & maintenance technician		
Wastewater treatment plant operator		
Civil engineer		

Teacher answers: Water careers and science

Water careers	Roles	Areas of science
Hydrographer	• Measures the quality and quantity of water • Undertakes field studies • Uses data loggers • Does bathymetric surveys • Uses technology	• Measuring water flow—physics • Measuring water quality—chemistry
Water treatment technician	• Takes water samples • Checks pH, chlorine residuals, turbidity, colour of the water	• Using scientific equipment and analysing results—chemistry
Operations & maintenance technician	• Maintains sewage pump stations and reticulation system • Clears pipe blockages • Connects new houses to the water main and installs water meters • Keeps the workplace safe	• Deciding how pumps and reticulation systems work—engineering
Wastewater treatment plant operator	• Maintains pumps, sewage farm and grounds • Takes samples and measures • Plumbing • Welding • Lab work • Vermin and weed control • Revegetation	• Deciding how pumps work—engineering • Using scientific equipment and analysing results—chemistry • Identifying insects —entomology • Maintaining the health of the catchment—ecology
Civil engineer	• Plans, designs, constructs, operates and maintains water supply systems	• Designing and building structures—engineering, physics, mathematics • Deciding how different materials work—material science • Computer modelling how water systems work • Testing water flows—hydrology