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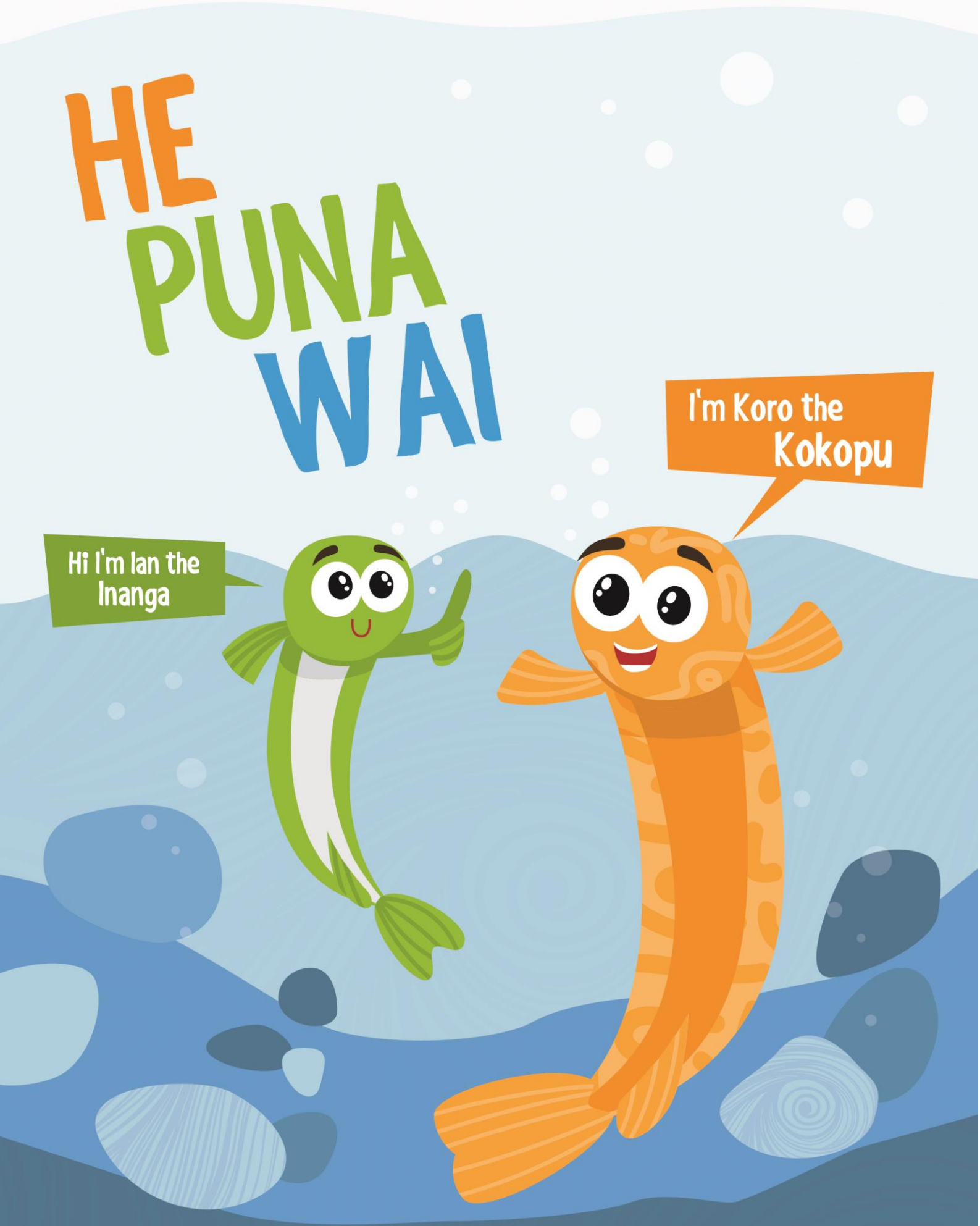
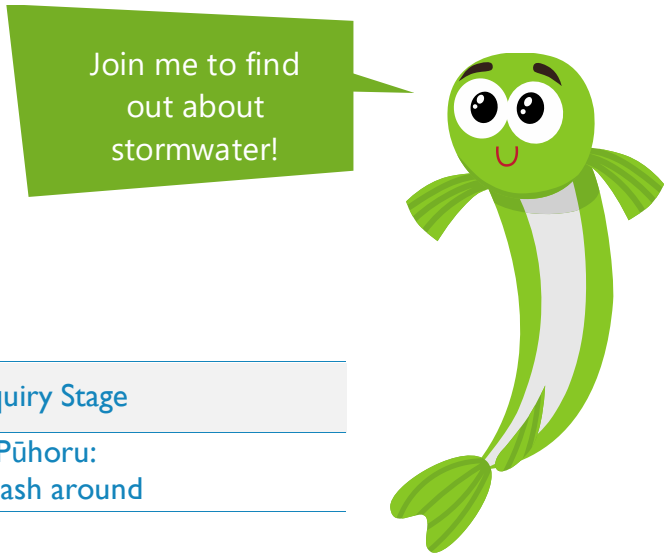


Stormwater

NPDC

Stormwater



Activity	Subject Areas	Inquiry Stage
5	Science and English	3. Pūhoru: Splash around

Overview

Let's investigate stormwater: where it comes from, where it goes and how we can have an effect on it.

Key Concepts	• Stormwater is rainwater that does not soak into the ground and flows across urban areas. It can carry harmful chemicals or pollutants with it as it flows into waterways. • Stormwater pollution can affect the mauri (life force) of an area.

Curriculum links

New Zealand Curriculum

Learning Areas	Levels	Years
Science: Nature of Science: Investigating in Science Science: Planet Earth and Beyond English: Reading, visual language	3-4	5-8

Learning intentions

Students are learning to:

- Understand what stormwater is.
- Investigate the stormwater system, where water goes when it rains and how it connects to other water.

Success criteria

Students can:

- Describe what stormwater is.
- Identify stormwater features in their environment.

Background information: Stormwater

What is stormwater?

Stormwater is water that flows across urban areas. It flows down outside drains, gutters, pipes and streams, and eventually ends up in the sea. Stormwater is not treated or filtered on its way to the ocean, so anything that goes in the stormwater system ends up and streams and the sea.

Ranginui, Papatūānuku and stormwater

At the dawn of creation, Ranginui (the Sky Father) and Papatūānuku (the Earth Mother) were joined closely in the darkness. From Ranginui and Papatūānuku came their children, the atua (supernatural beings who existed before humans). The children/atua separated their parents despite their reluctance. Ranginui is said to still cry tears for Papatūānuku. His tears are the rain that falls on the earth, providing sustenance for all their children and grandchildren living in the space created between them. This rain can become stormwater in urban landscapes.

Habitat loss

Naturally a stream or river has a variety of habitats within it. These stream habitats are called pools, riffles and runs. Pools are deep and slow flowing; riffles are shallow and fast-flowing over rocks; runs are deep with fast-flowing water. This habitat variety is important for a healthy ecosystem where a variety of fish and invertebrates can live. In nature, when there is heavy rainfall, streams and rivers fill up and spread over the area beside the rivers. This area is called a flood plain.

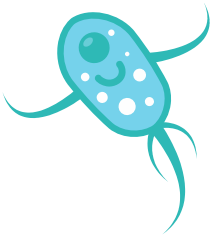
Over time, as people have built houses and roads near streams, many waterways have been changed from their natural state. For example, a stream may have been straightened so it flows around a sports field, or a stream may have been put through a pipe so it can go under a road. Nowadays, rain is collected on roads and piped into streams. Because of these changes we now have more trouble with flooding and pollution.

Stream animals can lose their natural habitats when we put barriers in streams or change their flow. There is now growing awareness of the effects of altering streams. Councils and other agencies are working together to turn some stormwater structures back into more natural streams that can still support life. This can be called reclaiming or daylighting.

Stormwater pollution

Stormwater can carry harmful chemicals or pollutants with it. Water flowing down stormwater drains carries chemicals, litter and sediment, which can then end up in streams and the sea.
Pollutants are substances and items that are harmful to our waterways. If we think of stormwater as Ranginui's (the Sky Father's) tears, it is important to avoid contaminating this water on its way through Papatūānuku (the Earth Mother).

Stormwater pollutant problems

Pollutant	Definition of pollutant	Examples	Why is it a problem?
 **Litter**	Rubbish, man-made objects that are thrown away.	Fast food waste, wrappers, plastics, debris.	Birds and fish eat plastic, mistaking it for food.
 **Sediment**	Sediments include muds, dirt, sand, silt, and clays delivered by water.	Dirt, mud and sand, for examples from building sites.	Sediment fills up the spaces between the rocks in the streams. This removes the hiding spaces for fish.
 **Nutrients**	Nutrients are naturally occurring elements.	Nutrients are found in fertilisers such as nitrogen and phosphate.	If too many nutrients get into the water, there will be lots of growth of algae which will then use up the oxygen in the water (fish and insects need oxygen to breathe).
 **Bugs from animal wastes**	Any animal waste or material from animal guts that would make you sick.	Dog poo, cow poo, animal urine, E. coli, decaying animals, animal wastes.	If there are microbes (bugs from animal wastes) in the water, swimming or eating shellfish could make you sick.
 **Heavy metals**	Particles of metal, invisible to the naked eye, that are suspended in the water.	Zinc, copper, mercury, lead, etc, from vehicle brake pads, roofs and paint.	These particles of metal are eaten by shellfish which can be passed on to us, making us sick.

Note: Small amounts of some pollutants such as sediment, nutrients and microbes are natural and not a problem for streams. For example: nitrates occur naturally in soil, where they are a major source of nitrogen for plants, helping them grow. However, large amounts of nitrates can be toxic to animals and create problems such as excessive weed and algal growth.

What is sediment?

Sediment from land includes mud, dirt, sand, silt and clay that is delivered by water. Waterways receive sediments from surrounding land, which is a natural process. However, where there is significant erosion, earthworks and increased sediment, this can cause problems for streams. Sediment can heat the water, decrease visibility, harm the gills of animals and change stream habitats.

Mauri and stormwater pollution

People, animals, plants and the environment are connected through mauri: a vital life force that exists in all living things. The mauri of the water and streams/awa should be nurtured and protected. In a healthy, unpolluted stream mauri is strong, and the atmosphere feels healthy and vibrant. Pollution can alter mauri and cause it to be unsafe, from a cultural perspective. This may mean that food is no longer safe to gather there.

Other background information

Videos: The three waters: https://vimeo.com/218610926
Websites: NIWA website https://niwa.co.nz/freshwater-and-estuaries/stormwater-management/stormwater-an-introduction

Learning experience: Stormwater

These are suggestions only. Ideas are intended to be altered to suit your students and their needs.

Resources

Student Activity Sheet 5a and 5b:	Stormwater bingo page 7 & 8
Presentation:	Stormwater

Reflect on learning so far

- Consider ideas/concepts from previous activities, revisiting the concept that all water is connected.
- Review the water cycle and explain how water moves in the environment from land to sea to sky.

Introducing stormwater

- Discuss what students think stormwater is, then form a collective definition. Refer to background notes for guidance.
- Introduce the concept of a catchment: an area of land that is drained by a river or streams, surrounded by hills, mountains or ridges.
- Discuss the water cycle with students: rain or snow falls onto hills, mountains and the landscape and then moves downhill to estuaries and groundwater, eventually ending up in the sea. Water moves in a cycle. In the sea or lakes, water heats up and evaporates, moving as a gas up to clouds or as mist. See: Te Ara: New Zealand's water cycle: https://teara.govt.nz/en/diagram/18154/new-zealands-water-cycle

Have we always had stormwater in the landscape?

Stormwater is a part of the urban landscape and modern life but before densely populated areas started occurring, there was no need for a stormwater system. Streams and natural features would take water away without any problem. As we create more impermeable surfaces (surfaces that water cannot filter through to the soil beneath, such as concrete driveways) we need a stormwater system to cope with all the water that doesn't seep into the ground.

Investigating local stormwater

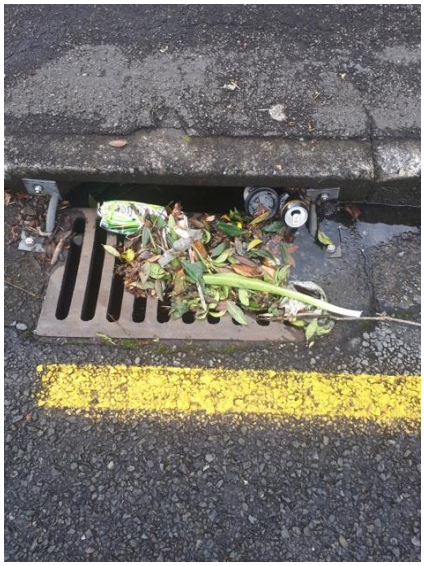
- Walk around your school with a watering can or bucket of water and investigate which surfaces are *permeable* (let water soak through them) and *impermeable* (don't let water soak through). Observe where water drains, where it travels and where it ends up in your school.
- Explore water in your neighbourhood. Notice the slopes, drains, gutters and other stormwater features. Use the stormwater bingo activity sheet to help guide your experience (see pages 7 & 8).

Mountains to sea/ki uta ki tai

In a Māori worldview, all things in nature, including us, are connected. The river, the estuary, the people and the sea are not thought of as individual elements but are interrelated. The health of our environment directly affects our own health both physically and spiritually.

Questions to consider:

- Does water always go from mountains to sea/ki uta ki tai?
- How do we, as people, contribute to this natural cycle?



Mauri and stormwater pollution

Discuss how mauri (the life force) of the water and streams can be affected by pollution. Altering the natural course of a waterway and interfering with the flow can also have detrimental effects on the cultural heath and/or mauri of a waterway.

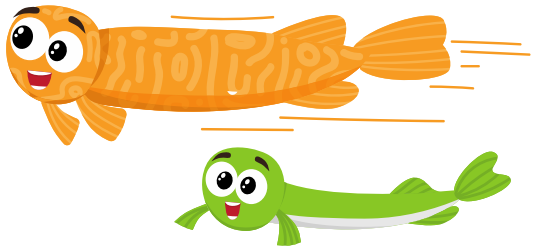
Extending learning

- Explore the stormwater drains in your school and find out where they go.
- Investigate your local stormwater network using the GIS mapping tools at the New Plymouth District Council website: https://www.newplymouthnz.com/Council/About-the-Council/Online-Services/Maps. Add the stormwater layer under 'utilities' and then zoom in on your area.

Other resources

- LEARNZ stormwater: http://www.learnz.org.nz/water172/bg-standard-f/stormwater
- Stormwater: Environment Canterbury education resource: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=8&ved=2ahUKEwjeyeWtvrPkAhVp7HMBHfxdCEkQFjAHegQIARAC&url=https%3A%2F%2Fwww.ecan.govt.nz%2Fdocument%2Fdownload%3Furi%3D3073897&usg=AOvVaw2hyuSkn2Vhr1YGabsM8cGz

Student Activity Sheet 5a
Stormwater Bingo



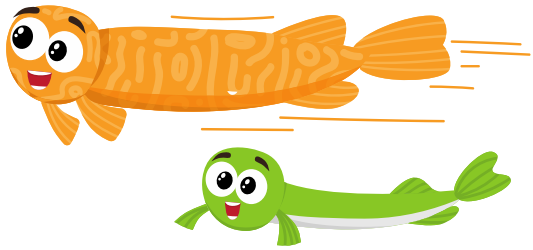
Name: _____

Can you see any of these water features or parts of the stormwater system in or near your school?

Stream	Stormwater pipe	Rainwater tank	Rain
River	Stormwater drain	Culvert	Downpipe
The sea	Permeable surface	Pond	Manhole
Gutter	An impermeable surface	Pollutants	Stormwater outfall

Found a line? (across, down or diagonal) You've got BINGO! Can you get them all?

Student Activity Sheet 5b
Stormwater Bingo



Name: _____

Search for each of the features below. How many can you find?
When you find an item, draw a picture in the box or answer the question.

Water coming out of a pipe Where do you think the water comes from?	**Manhole** Why do you think we need manholes?	**Gutters along the street** Where does the water go?	**Stormwater pond, lake, stream or creek** Where do you think this water came from?
Downpipe from the roof of a building Where does the water go?	**Trees** What do you notice around the tree?	**Pollutants – rubbish, oil, fertilisers, etc** Do you see anything that might cause harm to the streams?	**Something that stores rainwater for later use** (rain tank) *What is the water used for?*
Dirt or sediment How could we stop dirt getting into the stream?	**Lawn or playing field** Do you thing water will soak in quickly or slowly?	**Oil on the ground** Where is this oil going to end up when it rains?	**Culvert or pipe** What do you think the pipes are for?
Sloped ground What do you see that might slow the water down?	**Interesting find** You pick something that has to do with water.	**Animals interacting with water** What are they doing?	**Paved surface** Where does the rain go?

Stormwater actions

Here are some actions that you can take at home and at school to help waterways and reduce the risk of pollution:

- Wash your car on a grassy area so that the soapy water soaks into the ground rather than running directly into a drain. Or take your car to a carwash that recycles water.
- Use a drip tray to collect waste engine oil from your car or motorbike and recycle it at your local transfer station.
- You may be able to recycle your paint at the Resene Colourshop. Otherwise, let leftover paint dry in the can, then peel off and dispose of it in the rubbish bin. Wipe paint brushes with newspaper and paint on paper until the paint is almost gone. Dispose of this paper in the rubbish bin too. Then, when the brushes are looking clean, do a final rinse at an inside sink or on a grassy or unsealed area where all wash-water can soak into the ground.
- Dispose of your rubbish in the bin or if you see litter on the footpath, pick it up before it gets to the stormwater drains.
- Have a look at this school project where the students used litter traps inside the drains to investigate what was going down. This could be done around your school. https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=3252

See the Zero Waste Directory at: https://www.zerowastetaranaki.org.nz/zero-waste-directory/#dicM for information about how to safely dispose of hazardous household waste, including garden chemicals, batteries, old gas bottles, oil and other items.

Have you seen a problem with stormwater?

If you notice gushing water, a missing manhole lid, a blocked drain, pollution, flooding on public property (parks, roads, footpaths) or someone putting something other than water down a stormwater drain (such as paint or oil), please contact New Plymouth District Council on 06-759 6060.