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Pule's River Journey:

An Exploration of the Orange–Senqu River Basin for Children

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PULE'S RIVER JOURNEY:
AN EXPLORATION OF THE ORANGE–SENQU RIVER BASIN FOR CHILDREN
ORASECOM REPORT 009/2014

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Pule's River Journey:

An Exploration of the Orange–Senqu River Basin for Children

Introduction

Hi! I'm Pule from Bloemfontein.

This is the story of an amazing adventure I went on. My cousin Lebo is very, very clever. She's studying for a science degree at the university. She is working on a project where people are finding out more about some of the biggest rivers in this part of Africa. One of these rivers is called the Senqu River in Lesotho. It becomes the Orange River in South Africa where it is joined by another big river called the Vaal River. Lebo is studying the area around all these rivers. This area is called the Orange-Senqu River basin.

Scientists often have to visit different places to find information and that's what Lebo had to do. She asked my parents if I could go with her on her trip to the Orange-Senqu River basin during the school holidays.

You are reading my diary. It has everything in it that I learnt about the Orange-Senqu River basin!

Lebo

Where I live

The Orange-Senqu River Basin area that Lebo is researching

A map of southern Africa that Lebo gave me

20 November

This is the start of my diary. Lebo told me why we are going on this trip. This is what she said: "The Orange-Senqu River basin includes land in four countries – Lesotho, Botswana, South Africa and Namibia. Millions of people depend on the water in the Orange-Senqu River basin area. They use it for farming, making things, mining, drinking and household things like washing and cleaning. But there are many problems in the basin area: soil is being washed away by the rivers, the water is being polluted and in some places, there is not enough water. (This seems strange for a river basin, but that's what Lebo said!)

The Orange-Senqu River is the same river that flows through all four countries. So, what happens at the start of the river in Lesotho can affect the people further down the river in Namibia, over 2 000 kilometres away.

Some problems need to be solved by the governments of Botswana, Namibia, South Africa and Lesotho together. Other problems are being solved by projects that help people who live along the rivers. It's important to make good decisions about how to solve the problems in the river basin. You have to have the right information to make good decisions. That's what Lebo will be doing – getting information on the problems people have with their water. And I'm going to help her!

ACTIVITY

1. Can you find where you live on the map?
2. Is your home in the Orange–Senqu River basin?
3. Use the map to find:
   - two oceans
   - six countries
   - six capital cities

FACT BOX

The Orange–Senqu River is one of the longest rivers in southern Africa, but there are rivers in the world that are much longer. Some of the longest rivers in the world are:

Nile, Africa	6 650 km
Amazon, South America	6 400 km
Yangtze, Asia	6 300 km
Congo, Africa	4 700 km
Mississippi, North America	3 770 km
Zambezi, Africa	2 600 km

22 November

Lebo showed me the places we will be travelling to. I can't believe it – we will be travelling right across most of southern Africa! The length of the Orange-Senqu River is over 2 000 kilometres. It's nearly 2 kilometres from home to my school. So the river flows for over 1 000 times that distance!

ACTIVITY

Find on the map:

- the start of the Senqu River in Lesotho. (Use your finger to trace the river all the way to the sea.)
- dams along the Orange–Senqu River.
- towns and cities along the Orange–Senqu River.
- two rivers that join the Orange River: the Vaal River and the Fish River.

Places we visited

FACT BOX

Did you know that the Molopo River used to reach the Orange River, but it doesn't anymore because it doesn't have enough water in it and sand dunes have now blocked its path?

About rivers

26 November

I showed my teacher the map of where I will be going with Lebo.

I asked him why all the rivers in the Orange-Senqu River basin flow into one big river. First he told me about the way water moves around in the air, in the sea and on the land. He called this the 'water cycle'.

Then my teacher told me about river basins.

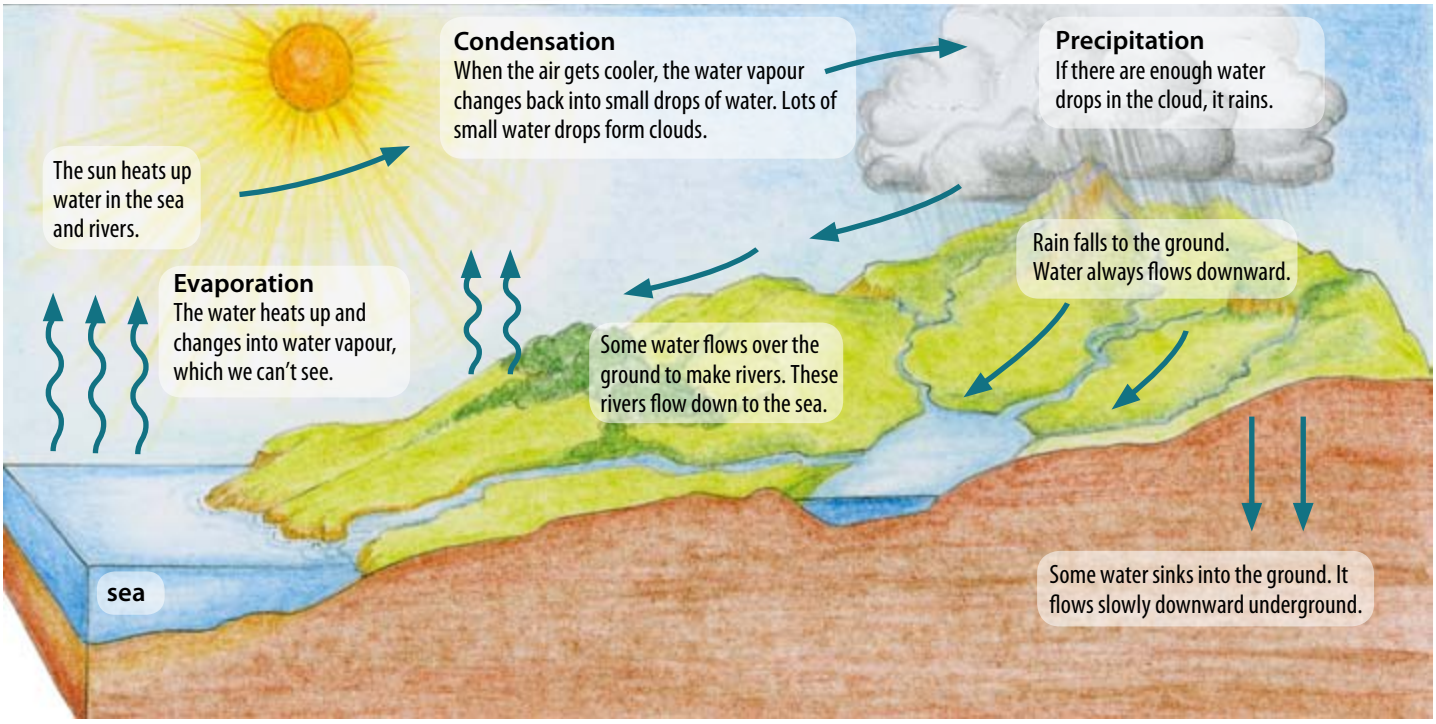
A basin in your house is something that collects and drains water. A river basin is an area of land that drains all the water in that area.

ACTIVITY

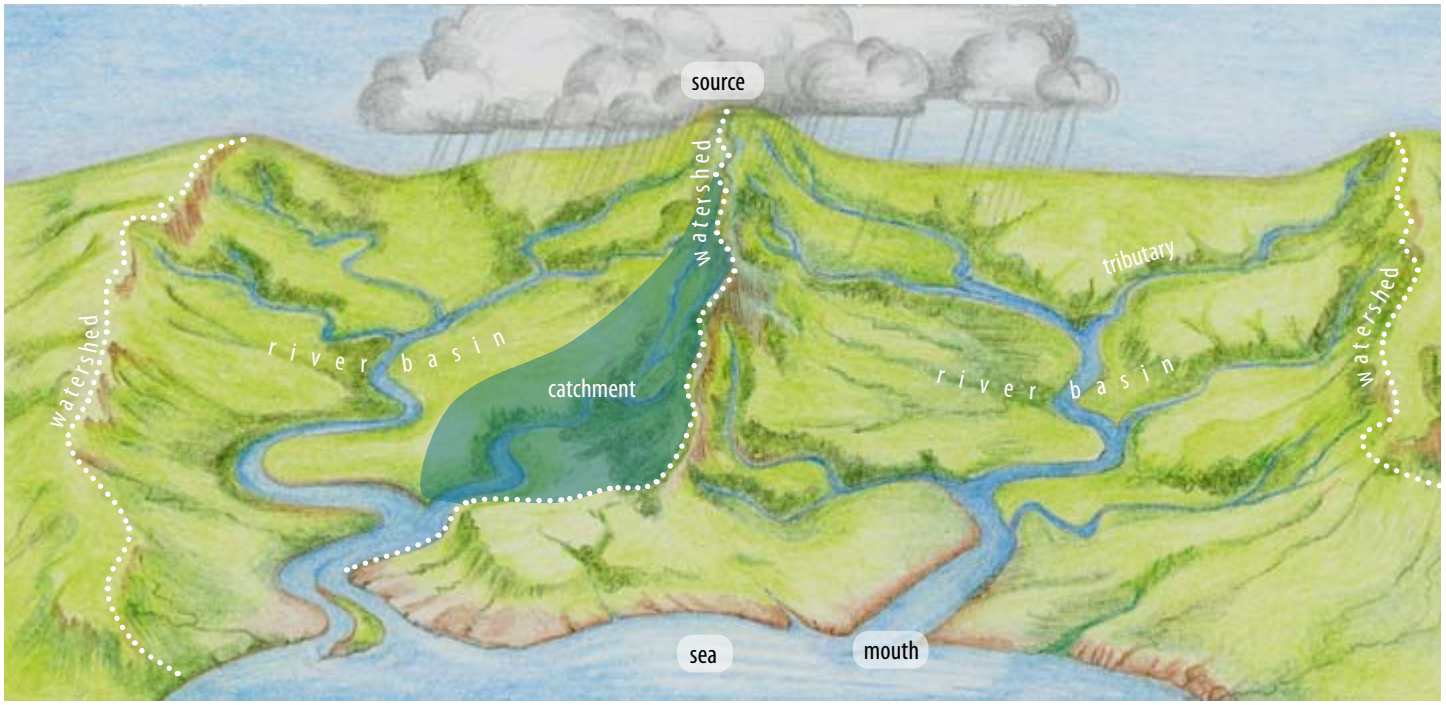
Make a model river basin!

1. Crumple up a large sheet of newspaper.
2. Slowly pour water from above onto the newspaper. This is like the rain. Can you see how:

- the water flows over the paper to form rivers?
- some of the water makes tributaries?
- the higher areas of the paper are like mountains, separating the river basins?



The water cycle



FACT BOX

River words

mouth: the place where a river enters the sea

river: water that flows downwards over the ground

river basin: an area of land that is drained by one river and its tributaries

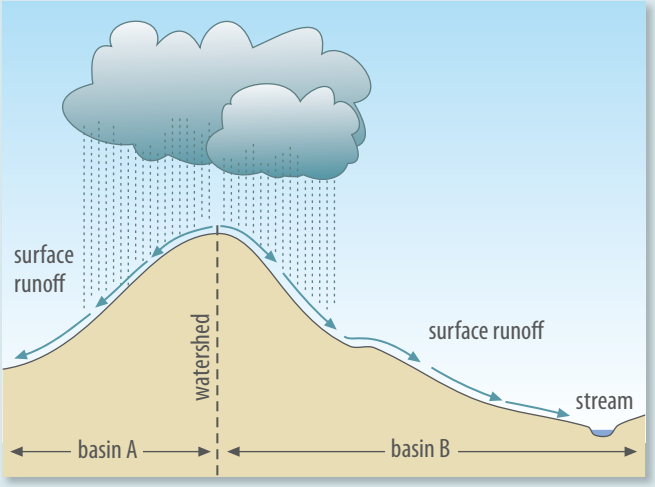
source: the start of a river

tributaries: smaller rivers that join a bigger river as it flows downwards towards the sea

watershed: a high area of land separating river basins

FACT BOX

Water always flows downwards, so it can't flow up over higher areas like mountains or hills. This means that a mountain or a hill separates river basins. These higher areas that separate river basins are called watersheds.



Getting ready

4 December

I didn't know that getting ready to travel was such hard work! We're travelling through four countries, so I have to make sure I have a passport.

Then I need to pack for different kinds of weather. In southern Africa most rain falls in summer. Lesotho gets a lot of rain but as we travel towards the western half of the river basin, it will become drier until the river ends up flowing through desert.

Lebo said that in winter, Lesotho has snow and the temperatures are below freezing! In summer, Namibia often has temperatures higher than 40 degrees celcius. I'm glad we are travelling in April because it is between summer and winter.

I'm excited that I will get to see places that are very different. Lesotho has the highest mountains in southern Africa. Large parts of Botswana and Namibia are hot deserts. We will visit Johannesburg – the biggest city in southern Africa, but we will also stay in small villages, sleep in huts and even under the stars.

I love facts, so I did some research about where we're going. Some of the things I found out are on these two pages.

The Orange River flows through the desert when it gets near its mouth.

The high mountains of Lesotho

FACT BOX

Country	Number of people	Size of the country (in km²)	Percentage of the Orange–Senqu River basin	Capital city
Lesotho	2 074 000	30 355	3,5%	Maseru
South Africa	52 981 991	1 221 037	64%	Pretoria
Botswana	2 024 904	582 000	8%	Gaborone
Namibia	2 113 077	824 268	24,5%	Windhoek

The average amount of rain every year

ACTIVITY

Are you good at finding out facts? Use the information on pages 2 to 9 to help you answer these questions. *Check your answers on page 50 to find out if you are a good fact detective!*

1. Which countries are away from the sea?
2. Which country has the most people?
3. Which country makes up most of the Orange–Senqu River basin?
4. In which country is the source of the Orange River?
5. Which countries are at the mouth of the Orange River?
6. Which part of the Orange–Senqu River basin gets the most rainfall – near the mouth or near the source?

Lesotho

10 December

I don't think I'll sleep tonight. It's so exciting to be here. Wow! My first trip outside South Africa! Our home in Bloemfontein seems so far away.

I'm writing by candlelight because there's no electricity here. We are high up in a small village near Mount Moorosi, which is in the Maloti Mountains of Lesotho. It's cold and wet outside. Lebo told me that in winter these mountains are covered in snow.

Lesotho is mainly mountains and we climbed higher and higher to get here – so high my ears kept popping. The dirt road was covered in mud from all the rain so Lebo drove really slowly up the steep passes. I was scared that we would topple over into the rivers below us.

This village is right above the Senqu River, which becomes the Orange River when it flows into South Africa. When it rains, the rainwater collects in small streams and these streams run into bigger rivers like the Orange-Senqu River. Lebo said that even though Lesotho covers such a small area, nearly half the water in the Orange-Senqu River comes from here. Millions of people depend on the water from this river basin.

There's a LOT of water around here but in this village it still has to be carried and stored in buckets.

People walk or get around on small ponies.

ACTIVITY

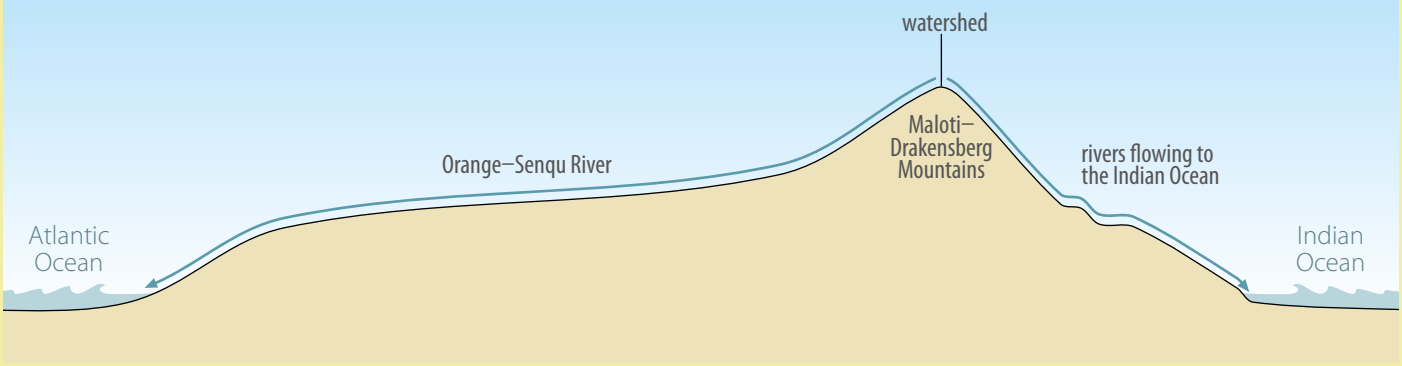
What is the nearest river to your home? Try to find it on the map on pages 4 and 5.

Mamasoko and her daughter, Bohlokoa

The family we're staying with, inside their hut

FACT BOX

Rivers always flow down to the sea. Even though the Indian Ocean is only a short distance (a few hundred kilometres) from where the Senqu River starts, it does not flow into the Indian Ocean. This is because there is a high mountain range in between the river and the sea. (These mountains are called the Maloti Mountains in Lesotho and Drakensberg Mountains in South Africa.) So instead, the Orange–Senqu River has to flow west right the way across southern Africa for over 2 000 kilometres to reach the Atlantic Ocean.



The village on the mountain slope above the river

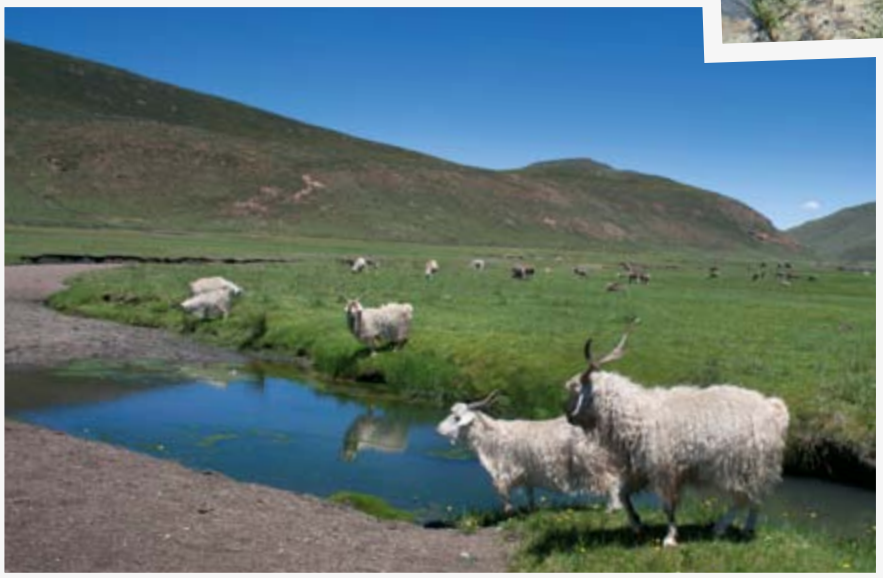
11 December

We woke up at sunrise. The cattle were mooing and, thanks to them, I had a mug of fresh warm milk.

Lebo explained over breakfast that the people in this village need their sheep and cows to live. They also get food from farming small plots of land near the river. But there are more people living here than before. This means that there are more animals than before grazing on the land, but the amount of land for farming and grazing isn't getting bigger.

When too many animals graze in an area, they eat all the grass. So the soil is left bare. Then, when it rains, there is no grass to slow down the flow of the rainwater. The soil is just washed away and so nothing can grow there. This is called soil erosion. Eroded land cannot be used for grazing or farming.

In the afternoon we went to see what's being done about the problem. Lebo told me about a project that helps people find ways of getting food and making a living other than keeping sheep or cattle. This project also tries to get the grass growing again. We met Mamasoko Lesotsa. She works three days a week on the project. She builds stone walls and replants the grass to stop the soil from washing away.



The animals have eaten all the grass near the river. When it rains, soil is washed into the river.

A stone wall that has been built to stop the soil washing away

People are planting grasses that have strong roots. The grass can also be used for sheep and cattle to eat.

Mamasoko in her vegetable garden. She is also breeding chickens – they ran out of the photograph!

12 December

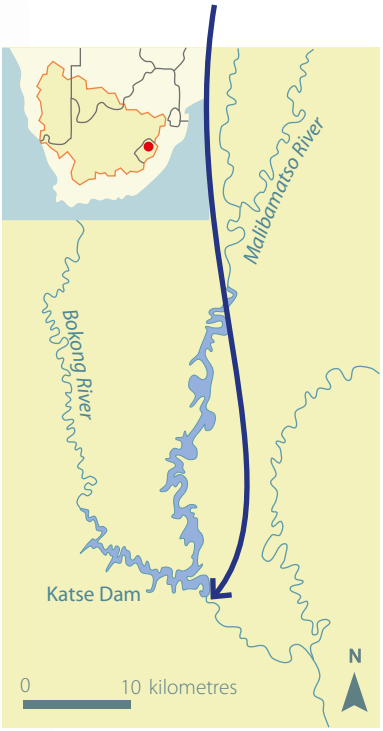
Today we visited the Katse and Mohale dams, which are high up in the mountains. Both dams are part of a project called the Lesotho Highlands Water Project, or LHWP.

The LHWP is meant to help Lesotho get more electricity and money. Lesotho sells the water collected in its dams to South Africa, because South Africa needs more water than it has. The dams store the water and then pipes carry it to faraway places in South Africa where there are big cities, lots of factories and mines, and farming areas.

Lebo explained how we get electricity from flowing water. The power of the flowing water is so strong that it turns big wheels called 'turbines'. The spinning turbines turn a machine called a 'generator'. The generator makes electricity, which is taken by power lines to where it's needed.

Most dams in Lesotho are built by building a wall that stops the river flowing. All the river water collects behind the dam wall. The LHWP and dam building has been good for Lesotho in some ways, but when the dam walls were built, the valleys and villages behind them were flooded by the dammed water. I would hate it if someone decided to build a dam that flooded our house!

I was here at the dam wall.



This is a map of the Katse Dam. It shows how the dam stores water in two deep valleys. The wall was built where the two big rivers meet. The river water stores up behind the wall.

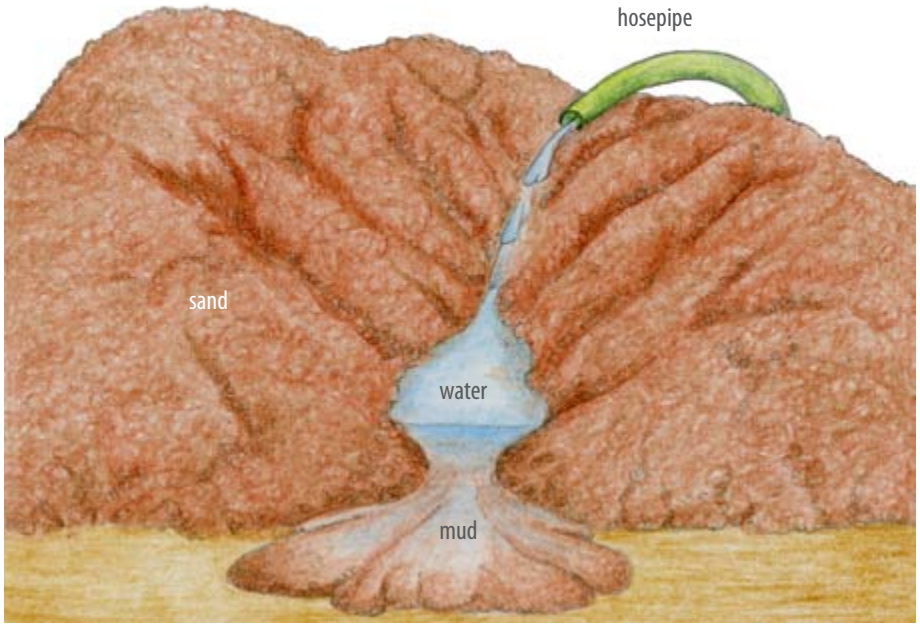
The Katse Dam wall is huge and is made from cement. At the bottom it is more than 60 metres thick. It has to be this thick to hold back the large amount of water behind it.

Build a dam

ACTIVITY

It's not easy building a dam wall strong enough to stop a river, and to hold back the weight of millions of litres of water. Try building your own dam.

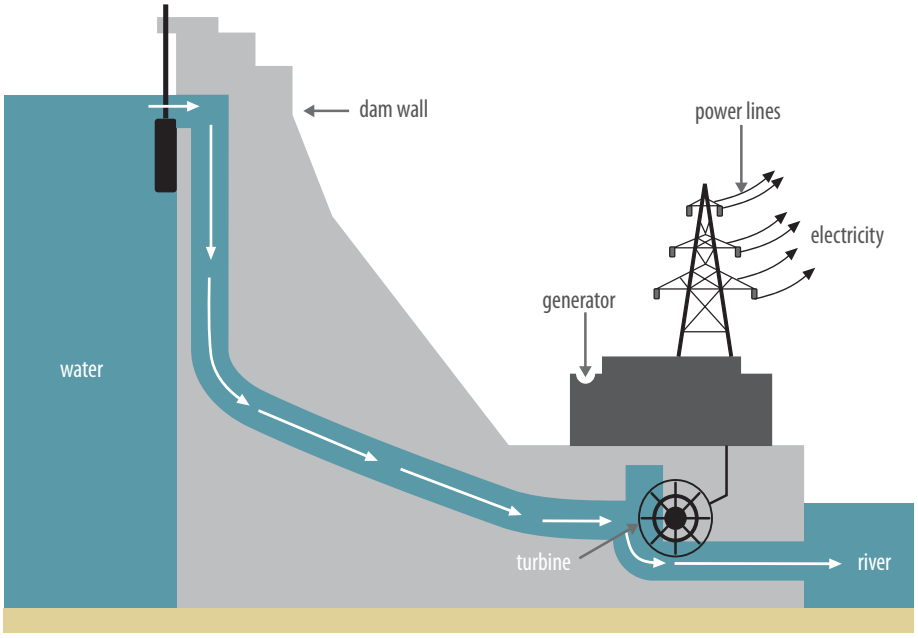
- Use soil to build up a mountain 'valley' with two high areas and a lower channel in between.
- Use a hosepipe to let water run slowly through the channel from one end of the 'valley'. This is your river.
- Now try to dam the river using sticks, stones, mud or anything else you can find. How well does your dam store water?



FACT BOX

Water from the Katse Dam flows over 80 kilometres in a tunnel underground all the way into a river in South Africa. From there, the river flows into the Vaal Dam. Pipes and tunnels carry the Vaal Dam water to the nearby cities, like Johannesburg.

Hydroelectric Power



Hydroelectric power: how we get electricity from water

12 December

After visiting the dams, we travelled to a town called Maputsoe. It feels strange to be back where there are tarred roads and electricity.

Many people in Lesotho try to find work in the cities or in other countries, like South Africa.

Lebo reminded me that our grandparents grew up and lived in Lesotho before moving to South Africa.

We visited a huge factory where they make clothing. The clothes get sold to other countries. It's strange to think that people in faraway places like Australia might be wearing jeans made in Lesotho.

I couldn't understand why we were visiting a factory. Lebo explained that making things in factories uses a lot of water. The way things are made can also pollute the water in rivers. The factory manager told us that one of the rivers near a jeans factory is called the 'Blue River' because the leftover blue dye from the jeans used to be dumped into the river. Imagine a whole river being so polluted that it changes colour!

The manager said that there is often not enough water at the factory for making things, drinking and the toilets. I didn't understand this at first, because Lesotho gets a lot of rain. But Lesotho doesn't have enough pipes to carry all the water to where it is needed, so some places do not have enough water.

It is important that we do not waste water. Can you think of five ways you could save water each day?

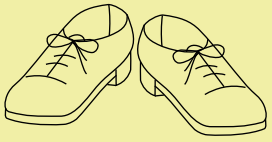
Inside the factory we visited. There are over 900 people making clothes here!

FACT BOX

Did you know that to make one plastic bottle takes twice as much water as is inside the bottle?

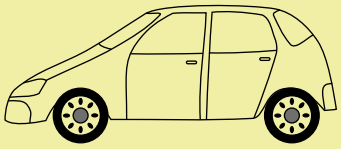
1 litre 2 litres

This is how much water it takes to make:

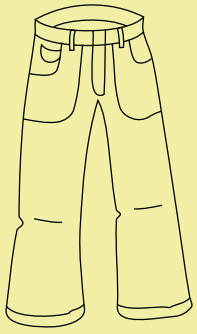


leather shoes: 8 000 litres

cotton shirt: 4 000 litres



new car with tyres: 145 000 litres



jeans: 3 500 litres

12 December

We crossed the border from Lesotho to South Africa. We saw farms stretching everywhere. So much of our land is used for farming. Many millions of people in southern Africa depend on farming to make a living. Not all farmers can get water from dams for their crops. Instead they have to depend on the rain. So they have to farm in a way that makes the best use of water that's in the soil.

We visited a project called the MD Foundation cooperative in Ficksburg. In this project, the farmers work together and help each other to grow wheat.

These are some of the MD Foundation Cooperative farmers we met. They farm in a way that is good for the soil.

They depend on only the rain to water their crops, but there is very little rain in the Ficksburg area, so they don't plough because ploughing dries out the soil and takes out the leftover plant material. Instead of ploughing, these farmers do something called 'minimum tillage', which disturbs the soil as little as possible so it doesn't dry out as much. They also rely on things like leftover plant material, worms and small creatures to protect the soil and break it into smaller pieces. The farmers also use as few chemicals as possible. (Using chemicals on the land can pollute the groundwater and rivers.)

FACT BOX

How does wheat grow?

Wheat is planted in the autumn months and harvested in November and December. Once it has been harvested, wheat farmers usually plough their fields. This means they turn over the soil. Ploughing removes weeds and breaks up the soil into smaller pieces. It uses a lot of expensive fuel and needs big tractors.

This photograph shows the big machines that are used to harvest the wheat.

ACTIVITY

The MD Foundation Cooperative farmers keep the soil covered with dead plant material to stop it from drying out. Try this experiment to see how plant material can help to keep moisture in the soil.

You will need:

- two handcloths or facecloths (these represents the soil)
- water
- pieces of cut grass or leaves.

Soak both cloths in some water. Then spread them out in the sun. Cover one cloth with the grass or leaves. Which cloth do you think will dry first? Why?

Test your results after a few hours. Can you explain what happened?

13 December

I'm in Jozi! There are over 12 million people living in Johannesburg and in the areas around it. We seem so far away from any big rivers.

Johannesburg has the more people living in it than any other area in southern Africa. So there are lots of people living in a small area and they all need water for drinking, washing and cooking. The Johannesburg area also has the most factories and mines in southern Africa. They also use water. Lebo said that this area uses over 20% of all the water used in the Orange-Senqu Basin. That's a lot of water!

So, the problem is that Johannesburg needs lots of water but there are very few big rivers in the area. It doesn't help that South Africa is one of the driest countries in the world. Even when it does rain, it doesn't help a lot. In Johannesburg the rain falls in the hot summer season and so a lot of that water just evaporates back into the air.

Water is brought into Johannesburg by pipes, tunnels and canals. Water from the Lesotho Highlands Water Project (LHWP) and from other rivers further away, is added to the water in the dams to try to get the amount of water that is needed.

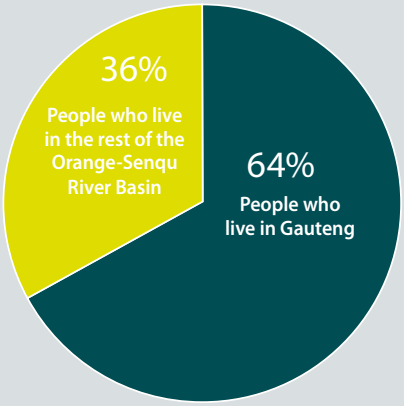
Lebo said that having enough water for people to use in their homes and for the factories and mines to use is only one of the problems to do with water in this area. The other problems all have to do with what people do.

FACT BOX

Did you know that most large cities in the world are next to big rivers? Johannesburg is one of the few large cities that is not next to a big river.

FACT BOX

Did you know that there are over 14 million people living in the Orange–Senqu River basin? Nine million of these people live in the Gauteng area, which is where Johannesburg is.



ACTIVITY

Do you know how much water household activities use? Choose the correct amount of water each of these everyday activities uses from the box.
You can check your answers on page 50.

- flushing the toilet
- having a bath
- showering
- washing a load of washing in a washing machine
- running a tap to brush your teeth
- watering the garden

11 litres

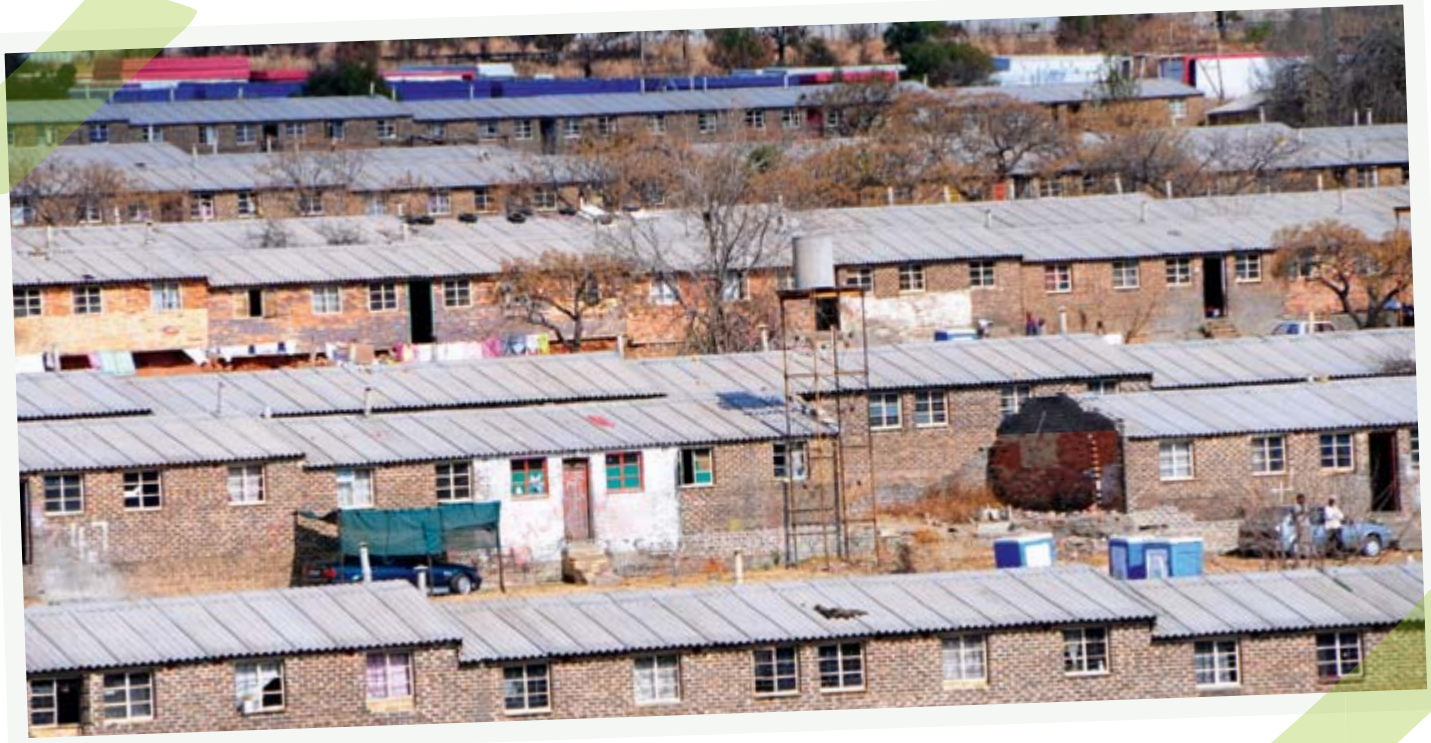
90 litres

136 litres

4 litres a minute

7.5 litres a minute

26 litres a minute



Look at how close together people live in Gauteng. There are lots of people!

Vaal

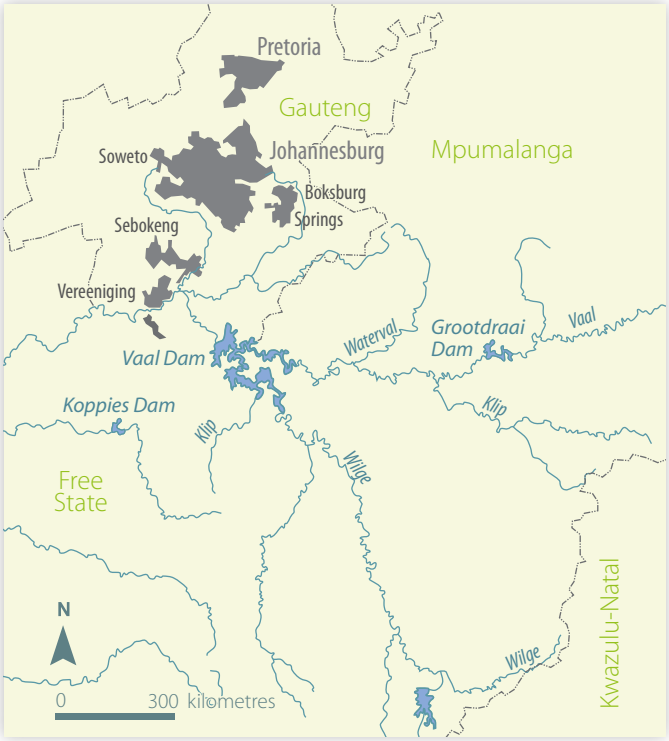
This is a photo of the Vaal Dam. This dam was built in 1938. Since then the dam wall has been raised twice to allow more water to be stored in the dam.

FACT BOX

Water from the Vaal River, Wilge River and Klip River flows into the Vaal Dam.

The water is taken from the dam and cleaned at purification stations before it is used in the Johannesburg area.

Why do you think the river water needs to be cleaned? *Find out on pages 23 to 29.*



14 December

I learnt about something called 'groundwater' today. Lebo explained that groundwater is actually just water that is in the ground we walk on. After it has rained, water seeps into the ground. Some of this water flows downwards into cracks and crevices in the rocks and spaces between the sand. In some places it collects in large underground lakes.

People living in cities need to have water taken to them through pipes which are also underground. So there's lots of water that we don't actually see. It's strange to think of all that water under our feet – flowing through pipes, in underground lakes and in the ground.

15 December

We have visited lots of different places in and around Johannesburg. I have learnt so much about how people affect the water in a river system. Now I also understand how all the water in a river system is connected. What happens in one place along a river affects what happens in another place.

Today we visited Bekkersdal near Johannesburg. Lots of the people here have come to live in Bekkersdal to try find work in the area. Many of them live in shacks they built themselves. They also have to share taps to get water. They keep water in buckets and plastic drums in their homes. This drinking water can easily get dirty and people can become sick from drinking it.

In places like this there is no rubbish removal. The sewage systems are often broken and leaking. So the pollution seeps into the ground and makes the groundwater unsafe to use.

Yesterday we went to Soweto where there are so many people from all over Southern Africa. Lebo told me that the cities in Southern Africa are changing all the time, and getting bigger. People come to the cities to try find work, but they need places to live – and water! It wasn't always that way.

From about 40 000 years ago, there were a few San hunter-gatherers in the area where Johannesburg is now. As long as 2 500 years ago, the Khoi farmed cattle, sheep and goats in the area. Then from about 700 years ago, people started settling in villages. They farmed cattle and sorghum. During all of these times, there were very few people in the area so there was enough water for everyone.

This changed when gold was discovered in 1886. Thousands of people came to find work on the mines. Then other industries and businesses started developing. More and more people came to the area to find work.

The mining of gold, platinum and coal, and manufacturing (making products) are still very important. The mines and factories provide work for people, which is a good thing. But, they also cause water shortages and a lot of water pollution, like acid rain and acid mine drainage. Although it's easy to see some types of pollution, Lebo says the biggest problems are the ones we can't see easily – in the air and under the ground. Scary!

I took lots of photos wherever we went so my photos really tell the story.

Many people have to share taps to get their water.

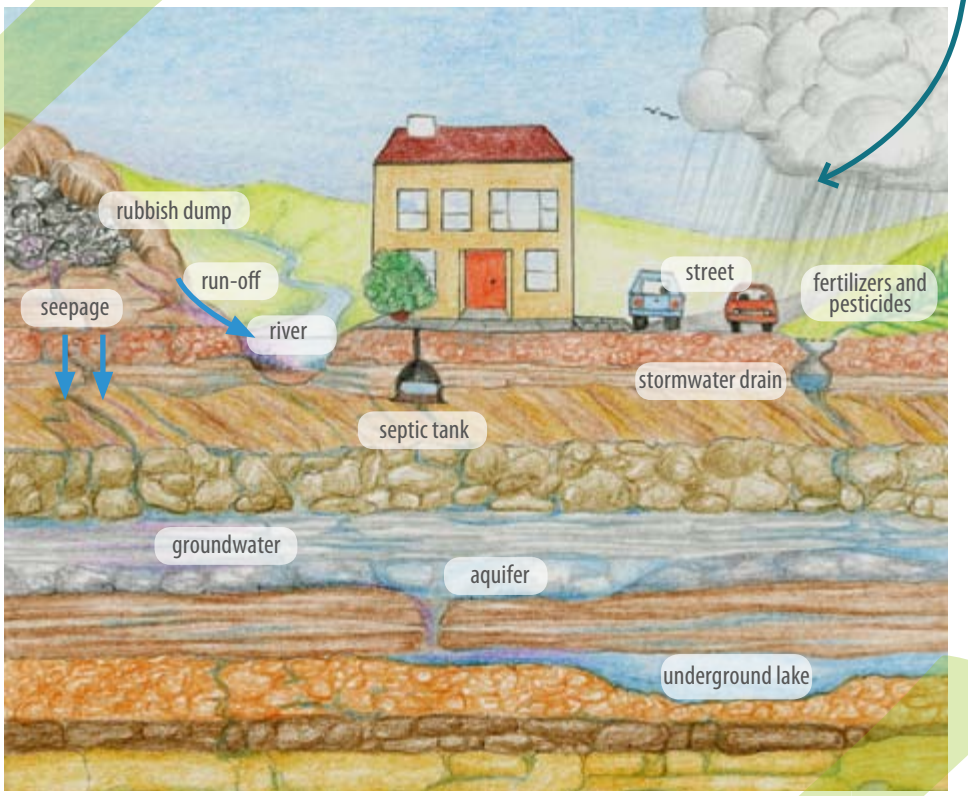
ACTIVITY

A caption describes what is shown in a photograph or drawing. Look at the photograph on the right. Can you think of your own caption for the photograph?

Like lots of people, this girl's family does not have taps in their home or nearby. She spends nearly two hours before school every day collecting and carrying water.

There is a problem with rubbish removal in this area. Also, many people live in shacks that do not have piped sewage. So, a lot of waste from the area flows into the river system.

I found this picture. It shows how pollution moves underground and into a river.



In cities, water runs off the streets and out of containers like septic tanks into underground drains. This water is polluted with waste matter and chemicals. The stormwater drain pipes often have leaks, and the polluted water gets into the groundwater. The polluted groundwater eventually flows back into the river system where it pollutes the river. And then, when this water flows into the dam, it pollutes the dam too. That's how the groundwater, dam and river water get too dirty to be used by people.

In places where there are no drains, pollution seeps into the ground. This is how it gets into the groundwater and eventually flows into rivers.

FACT BOX

At 1 drip per second, a leaking tap can leak
11 000 litres per year!

This is a wastewater treatment plant on the Klip River. It cleans wastewater and sewage before allowing it to flow back into the river.

ACTIVITY

Try this experiment to see for yourself how easy it is for pollution in our stormwater drains to get into the groundwater. Here's a list of what you will need for the experiment, and what these things represent in real life:

You will need:	What they represent in real life:
a glass bowl (or a clear plastic box)	the ground under the surface
a cardboard box with a small hole in it	the stormwater drain
food colouring	chemicals (like those in cleaning products and fertiliser)
sunflower oil	motor oil
soil and sand or pebbles	the soil and rocks in the ground
bits of grass and leaves	natural vegetation
small bits of plastic	plastic pollution like plastic bags
a watering can filled with water	rain

Put everything except the bowl and watering can into the cardboard box. Hold the box above the bowl. Pour water from the watering can into the box. Look carefully at what drains through the box and into the bowl. This is like what passes through a stormwater drain deep into the ground.

The groundwater near this big steel manufacturing plant is poisoned with dangerous chemicals that cause diseases. A woman living here told Lebo that her tea even foams when milk is added - that's how polluted the water is!

FACT BOX

Acid mine drainage is the pollution of ground water from mining. It is one of the biggest water problems in the Gauteng and Vaal areas of the Orange–Senqu River basin.

During mining, the groundwater is pumped continuously out of the mine tunnels.

When mining is finished the mine tunnels are empty. Groundwater usually flows into these empty tunnels.

The water comes into contact with the mined rocks and forms acid and dissolves metals like lead, copper and uranium.

The polluted acid water moves around underground and pollutes nearby groundwater, underground lakes and rivers.

There are many abandoned mines in the Orange–Senqu River basin, especially in Gauteng. Each day, several million litres of acid water flow into the groundwater and can spill into the rivers and dams. Soon the water that the area depends on could be badly polluted by acid mine drainage.

A Groundwater seeps into the mine.

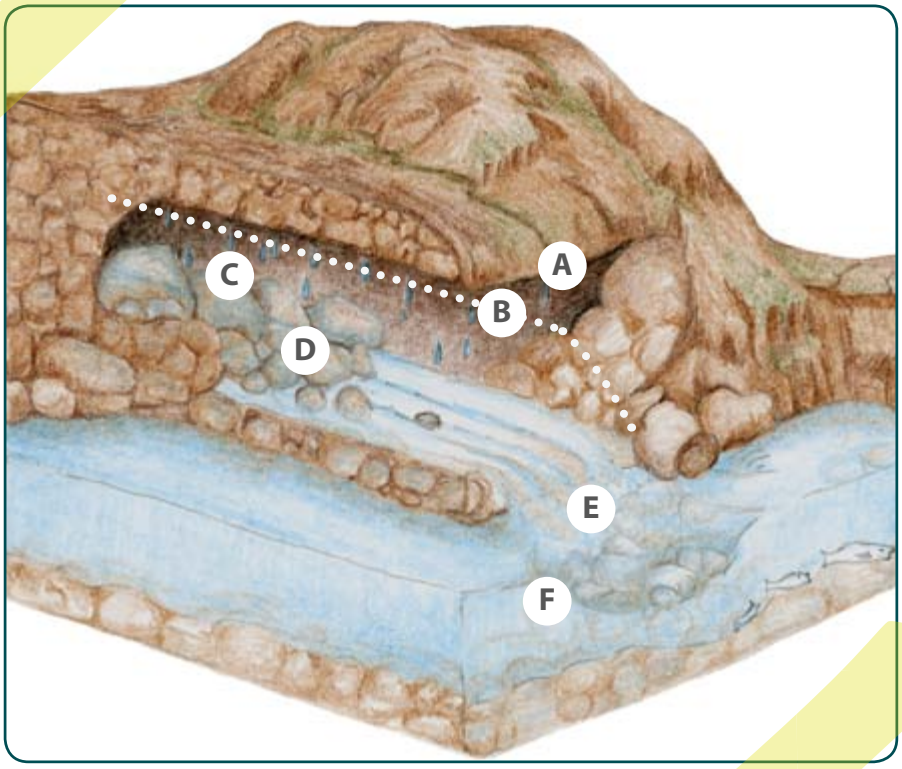
B Groundwater level rises.

C Rocks and metals.

D Water runs over the rocks and and forms acid and dissolves metals. The groundwater level rises, polluting water in wells and boreholes.

E Polluted water also drains back to lakes and rivers on the surface.

F Animals and plants that live in the river are poisoned.



During mining, groundwater is pumped out of the mine tunnels.

ACTIVITY

In the rural areas, people can usually get water from rivers or boreholes. But in the cities, people need water supplied to them. More and more people are moving to the cities every day. This is a big problem for areas where there isn't a lot of water. What water there is, is often polluted by people at home and by factories and mines.

If you were interviewed by a TV reporter, how would you answer these questions?

- Why does water in the Vaal area need to be piped from other areas?
- How do people living in cities get their water?
- What are some of the ways that people pollute water close to where they live?
- How do factories pollute our water?
- How does mining pollute our water?
- Why is water pollution a problem for people?
- What do you think should be done about water pollution?

16 December

For the next part of her research, Lebo had to find out more about farming and water. I've never really thought about where the food I eat comes from – like the potatoes I love and my pap in the morning. So much of the food I eat comes from the Orange-Senqu River basin.

I didn't realise that farming needs such a lot of water. In southern Africa, it often doesn't rain for a very long time. Lebo told me there have been such bad droughts that sometimes the Orange River and Vaal River have stopped flowing.

When there are droughts, farmers can't plant their crops. This means that less food is grown and so the food that there is costs more in the shops. People who work on the farms might also lose their jobs. It is very important for plants to get enough water in the Orange-Senqu River basin.

One way of making sure there is enough water for the crops is to pump the water from dams or rivers to where the crops are. This is called 'irrigation farming'. A lot of the water used for irrigation farming in the Orange-Senqu River basin comes from the Vanderkloof Dam, which is one of the largest dams in southern Africa.

Canals are like rivers, but they are made by people. They carry the water from the dam or river to where it is needed which is often many kilometres away.

FACT BOX

'Gariep' means 'Great Water' in the San language. The Orange River was first called the Gariep River. In some areas, it is still called by this name today.

FACT BOX

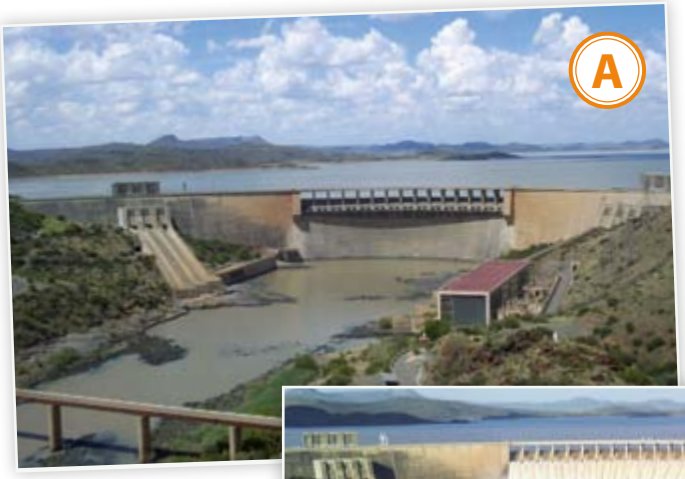
The Vaalharts Irrigation Scheme has over 1 176 kilometres of canals. That's more than half the length of the whole of the Orange–Senqu River. Over 1 000 farmers get water from these canals, which are supplied from the Vaal and Harts rivers.

We met Mr Ipeleng Morgan Bonmamye, a farmer who grows maize and barley on his small farm in Taung. He said he wouldn't be able to farm without the water that he gets from the Vaalharts Irrigation Scheme.

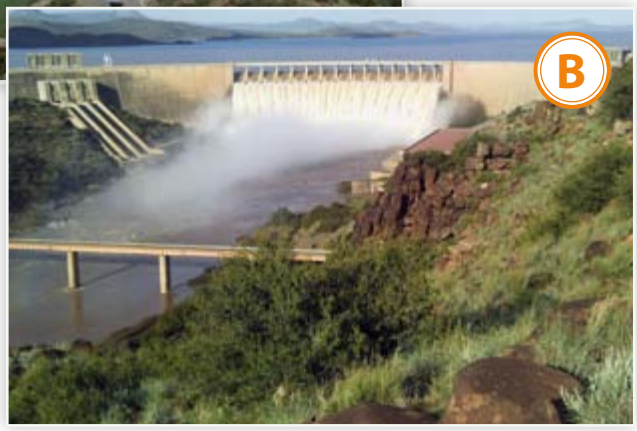
ACTIVITY

Look at these photos. Can you answer these questions about them?

- What differences do you notice?
- Why do you think so much water is being let out of the dam in photo B?
- How do you think letting out so much water will affect people who live further down the river?



The Gariep Dam during a dry period



Think of your own caption for photo B.

17 December

Not long ago, we were high in the cool mountains of Lesotho with its many flowing rivers. Now we are in the Kalahari Desert! It is very flat, with a few red sand dunes, grass and trees for as far as we can see. At first the desert looked quite boring. It looked as if nothing ever happens here, but I've learnt that the desert sand dunes are moving all the time!

Khawa is a very small village in the middle of the Kalahari Desert. Life is tough here. There are not a lot of jobs. Most people in the village depend on the land around them to survive. Families farm a few cattle, gather wild fruit, do wood carving and make things from leather.

Just like in Lesotho, people have too many animals for the number of plants that can grow in the area. The cattle ate up all the plants before new ones could grow. Cattle have big feet. As they walk along, their feet trample and dig up small plants. This happened especially around the waterholes. Because wild animals were killing the cattle, they were kept in smaller areas near the waterholes. This made the problem of overgrazing even worse.

The sand of the dunes used to be held in place by the plants. So many plants have been eaten and trampled, there is nothing to hold the sand in place. So, the wind blows the sand around. It blows the dunes slowly towards Khawa. When the sand comes into the village, it takes over the buildings, paths and waterholes. Lebo is finding out more about a project that is trying to help the people of Khawa deal with these problems.

This is a cheetah. It is a wild animal found in the Kgalagadi Transfrontier Park, one of the world's largest conservation areas. This national park is near Khawa. Sometimes wild animals move out of the park and attack cattle.

Some of the sand dunes are really big.

These are cisterns for harvesting water in the rainy season. The fences protect animals from falling in and drowning.

FACT BOX

Overgrazing is when the grass is eaten by so many cattle, sheep or goats that it cannot grow back. The land becomes bare and the soil can easily wash away or blow away.

18 December

Last night, we stayed in Vaalhoek, which is a small village in Botswana. It's near the Molopo River. This river last flowed in 1988 – that was long before I was born! This part of Botswana is very, very dry.

The two biggest rivers in the basin in Botswana are the Molopo and Nossob rivers. They only flow above the ground when there is a lot of rain – which means hardly ever! So, these rivers are mostly just dry riverbeds. When it does rain, most of the water evaporates because it is so hot or the water seeps through the sand and becomes groundwater.

But, there is groundwater under the dry riverbed. Long ago, the Nama people who settled in this area dug into the ground to get water for themselves and their livestock. As more and more people settled here, they dug more wells. So, the groundwater was used up faster. Lebo explained that it's like sipping water from a glass through a straw. As you sip the water, the level of the drink gets lower and you have to push the straw down lower into the glass. Well, as more groundwater was used up, the groundwater level got lower and lower. This meant that the wells had to be dug deeper and deeper. We met Mr Bok, who told us that long ago the water from the wells was the nicest to drink. It was sweet and cold. Now it's so salty that often you can't drink it.

We also met the Kamboer-Vissagie family. Like other people living in Vaalhoek, this family uses plastic bottles, pipes and large drums to try and collect any rainwater that might fall.

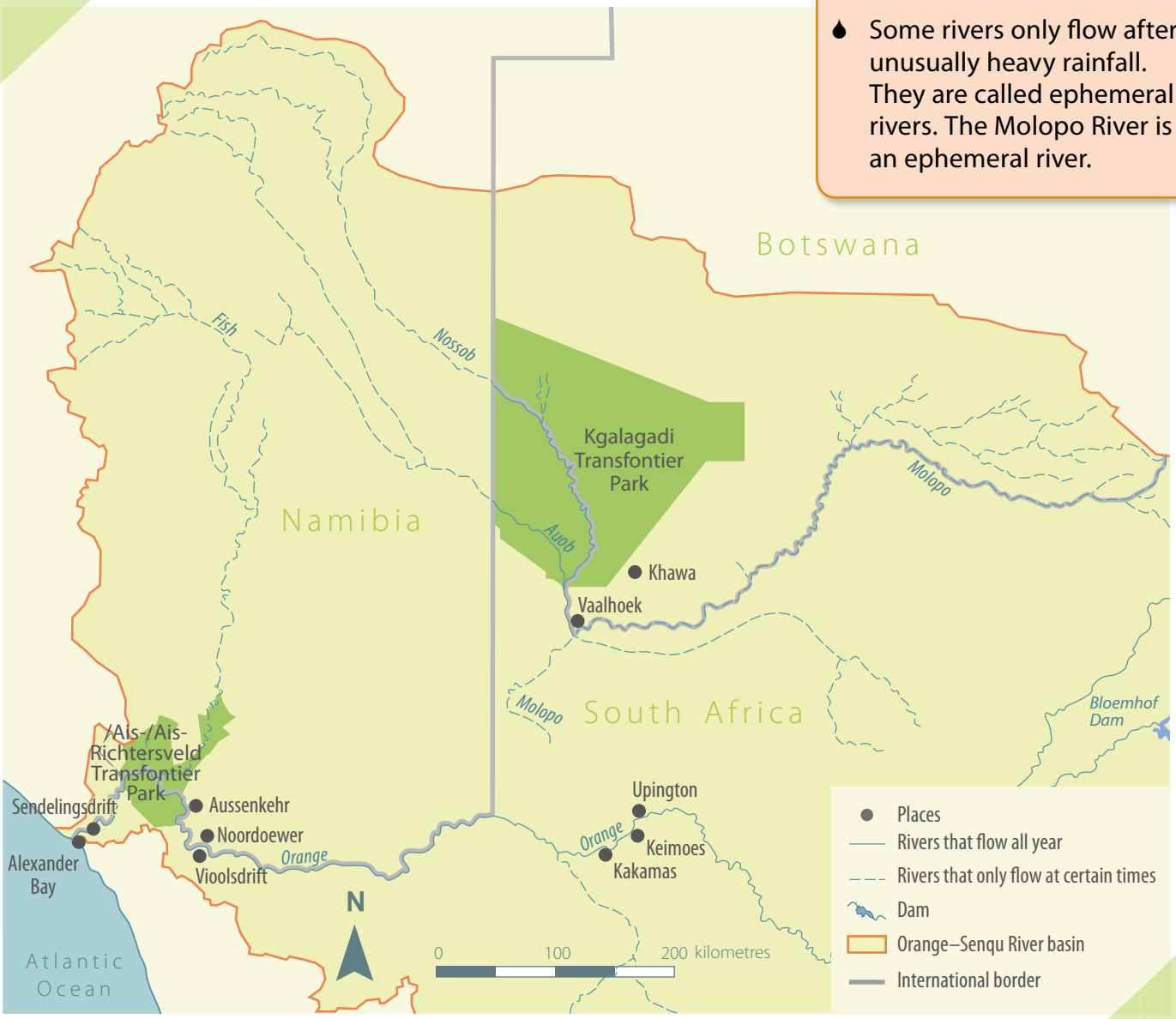
The green area what the Molopo riverbed looks like today. It's hard to believe that in 1852 there were hippos in the deep Molopo River.

This is the map that Lebo found to show me where the Nossob River and Molopo River disappear into the sand of the Kalahari Desert. She said that scientists believe the two rivers haven't flowed into the Orange River for over a thousand years.

FACT BOX

There are three kinds of rivers.

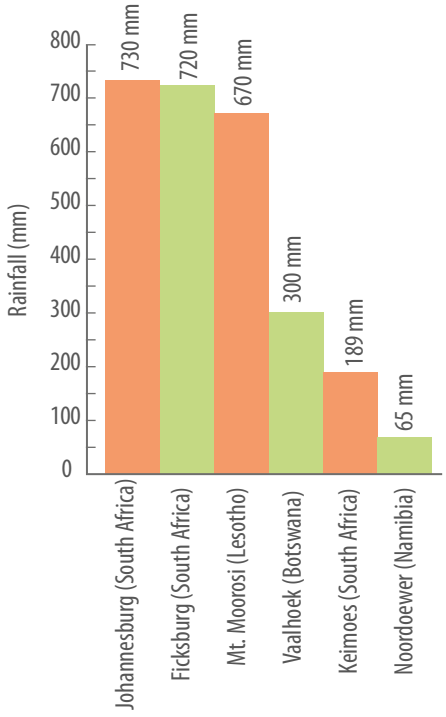
- Some rivers flow all year round. They are called perennial rivers. The Orange–Senqu River is a perennial river.
- Some rivers only flow for part of the year in the rainy season. These are called seasonal rivers.
- Some rivers only flow after unusually heavy rainfall. They are called ephemeral rivers. The Molopo River is an ephemeral river.



Most people living here have to carry all their water from an outside tap that they share. Some people sleep outside because it is so hot, even at night.

This is the pump that Mr Bok uses to pump groundwater out from his deep well.

ACTIVITY

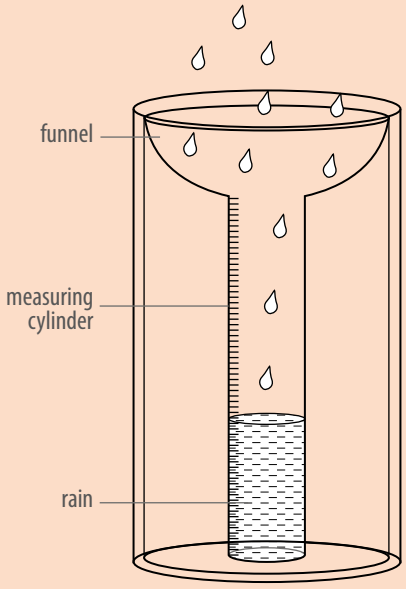


Can you find the places named on the graph below on the map on pages 6 and 7? Now use the graph to help you answer the questions.

1. Does the amount of annual rainfall get more or less as you move down the Orange–Senqu River from Lesotho and the Vaal area towards the sea?
2. How much more rain does Mount Moorosi get than Noordoewer: two times, five times or ten times more?
3. Find out the annual rainfall of where you live. You can look on the Internet. (Ask your teacher or another adult to help you.) Is it more or less than Mount Moorosi? Is it more or less than Vaalhoek?

FACT BOX

The usual or average amount of rain that falls every year is called 'average annual rainfall'. Rainfall is measured in millimetres. The Vaalhoek area only gets 300 millimetres annual rainfall, on average.



A rain gauge

Children from the Vaalhoek settlement in the Kalahari Desert carry firewood they have gathered to their homes. There is no electricity in many parts of the Kalahari Desert. People depend on firewood for heat and cooking.

ACTIVITY

Below are some of the problems facing the people living in the Kalahari Desert part of the Orange–Senqu River basin. The project in Khawa helps people to do different things to stop the overgrazing and the sand dunes shifting around. Can you match the problems in the table with a solution?

Problems

1. Unreliable rainfall and salty groundwater
2. Moving sand dunes
3. Cattle being hunted and eaten by wild animals
4. Destruction of plants by animals near the waterholes
5. Overgrazing
6. Poverty, and too few ways to earn a living

You can find the answers on page 50.

Solutions

A. Farmers move the cattle around to graze so they don't use all the waterholes at the same time. This means the plants at some waterholes are given a chance to recover and grow.

B. Cattle are kept in kraals at night so they can't wander around and destroy the plants. They are also starting to farm sheep, which cause less damage to plants.

C. People build fences which helps to stop the sand blowing freely. They plant trees and shrubs, which holds the sand in place.

D. To protect cattle their cattle from cheetah and hyena, people use guard dogs, and at night, kraals.

E. People collect and store rainwater in tanks and cisterns. They are digging more boreholes and wells.

F. People are increasing tourism in the area by developing campsites and traditional crafts such as woodcarving.

19 December

I'm really getting around South Africa! We've travelled in cars, buses, and I even got to fly for the first time when we flew over Vioolsdrift to look at the channels in the river!

We visited the small towns of Keimoes and Kakamas. It's very hot here. They have to do all the farm work very early before the sun rises because it gets so hot. The Orange River is very different here to where it begins in Lesotho. In some places the river is a few kilometres wide and has lots of islands in the middle. We had a lot of fun swimming in the river. Then we went all the way to a part of the Orange River where the river forms the border between South Africa and Namibia. There is a small town on the Namibian side of the river called Noordoewer and on the South African side of the river there is a town called Vioolsdrift.

This area is very dry desert and that makes farming difficult. There are a lot of irrigation canals here taking water from the river to the areas further away from the river. The few farms there provide work and a living for a number of families in the area.

A channel

We swam in the Orange River near Keimoes.

I helped Sannette pick grapes on a farm in Keimoes.

South Africa is on the other side

The bridge goes over the Orange River

Namibia is on this side

The border post at Vioolsdrift

ACTIVITY

This photo was taken from an aeroplane flying over the Orange River near Vioolsdrift. Can you find these things?

- the Orange River
- islands in the river
- channels in the river
- green vegetation on the banks of the river
- dry desert areas on each side of the river.

20 December

The Northern Cape and Namibia are very hot and dry. Many years ago when people settled here, they needed trees that would grow quickly and easily so that they had shade and wood for building, and food for their cattle, sheep and goats. They decided to plant a tree that comes from America called prosopis. It seemed like it was the perfect solution because prosopis grows quickly and produces lots of seedpods. The seedpods made good food for their animals and also meant that new trees grew everywhere very quickly.

Over time prosopis has grown TOO well. Prosopis has roots that are able to reach deeper than the roots of the trees that have always grown in the area.

Prosopis also spreads so easily because its natural enemies – like bugs – are not found in Southern Africa. This means that trees do not die off naturally. So, because of this and prosopis' deep roots, there is less groundwater in the area and other trees are finding it hard to grow.

Lebo told me about a man north of here who has a clever way of dealing with the prosopis problem and has turned it into a good business. He employs people to remove the trees and cut them up to make timber for building with. So, he gives people jobs, gets rid of the trees and makes something useful from them.

Prosopis is a very thick and very thorny tree that grows in and along dry riverbeds. When it rains and the river flows again it uses up this water. Prosopis roots can be as long as 300 metres so it also uses up a lot of the groundwater.

Wood from prosopis trees being cut into planks to use for building.

21 December

Next we visited a huge farming area called Aussenkehr. This is on the banks of the Orange River. It stretches for 15 kilometres along the river bank. All the water the crops need to grow comes from the Orange River.

About 1 300 people work there all through the year. During the harvest season which is six months long, about 5 000 extra workers come from all over Namibia to work on the farm. They often bring their families with them so there can be up to 30 000 people living on the farm during harvest time.

Lebo told me that life here is very hard for the workers. Although there is some clean, piped water, it can be very far away from the place where the workers live in Aussenkehr, and there is no piped sewage. This means that human waste can be washed into the Orange River when it rains, and that the workers often use unpurified water from open reservoirs in the area.

Aussenkehr farm

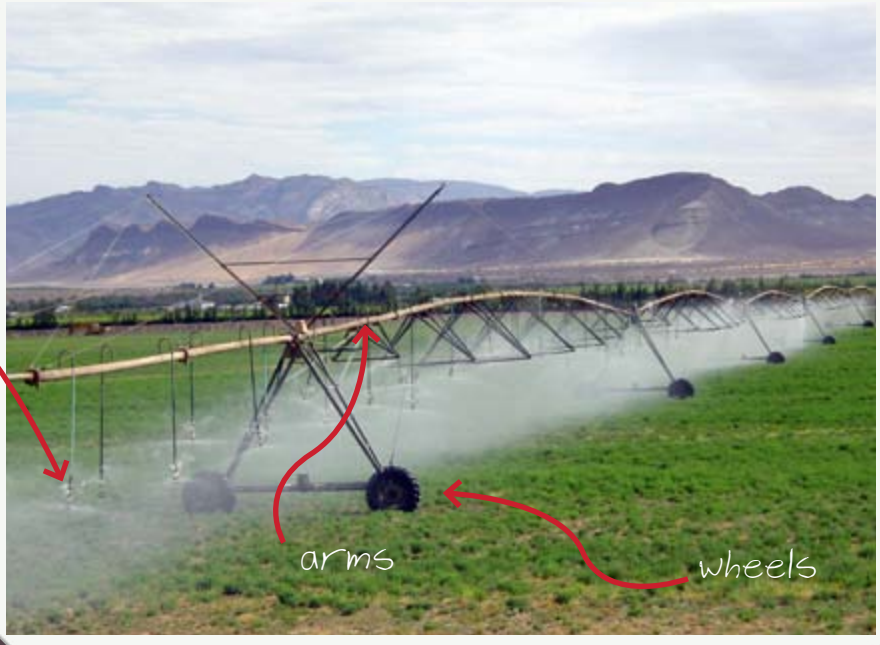
21 December

I think I'm becoming an expert on rainfall – or maybe even farming! Namibia is one of the driest countries in the world. In some places the rainfall is less than 50 mm a year. Even though it is so dry, farming is important in Namibia. It provides food and jobs for people.

Everyone knows that plants need sunshine, soil and water to grow, right? In this part of the Orange-Senqu River basin, the soil is often sandy and doesn't have many nutrients in it. Although Namibia has lots of sunshine, it doesn't have much water. So all the crops have to be watered. Another word for 'watered' is 'irrigated'.

Some ways of irrigating, like drip irrigation and centre-pivot irrigation, use less water than other ways of watering that people have used for a long time.

The governments of South African and Namibia are working together on projects on both sides of the river. They measure things like the amount of water in the soil, the quality of water in the area and the amount of water that is sometimes wasted. They share this information with the farmers. It helps the farmers make good decisions about what farming methods and equipment to use. I didn't know that there was so much science and planning needed for farming!



We saw a large field of crops being watered using centre-pivot irrigation. The long pipes carrying the water look like 'arms'. They turn slowly around a centre point. Water flows from the centre point, along the arms, and through the sprinklers onto the ground below.

A field that is watered using drip irrigation

FACT BOX

Drip irrigation is a way of watering plants by providing the exact amount of water the plants need to allow them to grow healthily. Pipes are laid along the ground or underground. The pipes have little holes in them at or near to the plants roots. A small amount of water – a 'drip' – flows out of the pipe into the soil, to water the plant. It goes straight to the plants' roots underground so water is not lost through evaporation. Drip irrigation doesn't waste any water.

Another way of irrigating is to let water from the river flow into canals, and then into the fields where the crops are growing. This is called flood irrigation.

ACTIVITY

Make your own drip irrigation system to save water while you water plants

You will need:

- a 2-litre plastic bottle with its lid
- a sharp knife or pair of scissors
- water

1. Make two small holes in the side of the bottle.
2. Make another two small holes in the bottom of the bottle.
3. Fill the bottle with water and screw the lid back on.
4. Bury the bottle in the ground between your plants.

22 December

Phew, we are in such a hot place! Yesterday, we crossed the Orange River again to get back into South Africa. We used a sort of floating bridge called a 'pont' at Sendelingsdrift to get here, to a place called the Richtersveld. Lebo told me it can get as hot as 50 degrees celcius here in the summer.

I thought that nothing would be able to grow in this heat and in the rocky mountains, but I was wrong! There are over 650 different kinds of plants here. All the animals and plants in this area have adapted to the desert. 'Adapted' means that the animals and plants look and behave in certain ways so that they can live in the heat and without much water.

People, called the Khoikhoi, have lived here for thousands of years – keeping sheep and goats. Because there is so little grass or bushes for grazing, the farmers have to move around a lot to find new grazing areas. They never move too far from the Orange River.

We met Joseph Obies who is a shepherd. His job is to look after someone else's goats. He lives in a shelter made of plastic, sticks and cloth. It's amazing to me how little he needs to survive here. Because he has to walk with the goats, he can't carry a heavy load. He just has a few belongings like a pot, cups, water bottles and a wood saw. He gets his firewood from the few trees in the area and collects his water from the river. He lives alone in this huge, open area with just the goats and his dogs. I asked him if he ever feels lonely. Joseph told me that every weekend the goats' owner comes to look after them and then Joseph can go home to his family in a village near here.

Joseph Obies' camp and the goats he looks after

FACT BOX

A World Heritage Site is a place that is very special and is protected. The place might be chosen because of its history, or because it has things that you can't find anywhere else in the world. In one small part of the Richtersveld World Heritage Site there are 33 types of plant that you can only find there and nowhere else in the world.

A plant growing in a crack in the Richtersveld rocks

ACTIVITY

Study the photograph of Joseph Obies' camp. Then try these things!

1. Find the following in the photograph:

- the shelter
- the goats
- the Orange River

2. Write down words to describe the ground.
3. What can you tell about the climate from the photograph? (For example, do you think it gets a lot of rain or just a little? Do you think it is cold or hot in the daytime?)
4. Think of a reason why trees are only near the river.

23 December

We are finally at Alexander Bay! It's hard to believe we have followed the Orange-Senqu River all the way from its source to here, where it enters the sea. I was so excited to actually stand on the beach, where the muddy river joins the Atlantic Ocean.

I always think of beaches as being warm and sunny, but there was a strange mist on the beach. It was so thick that it was hard to see Lebo! Lebo explained that the mist forms when the cool air from above the cold sea water and the warmer air from above the hot desert sand mix together.

For many years, Alexander Bay was famous for the diamonds that were mined in the sand and at the mouth of the river. Divers even used to go into the cold, dark ocean to vacuum them up off the seabed. I kept looking down at where I walked, hoping to see the sparkle of a diamond, but Lebo told me that nearly all the diamonds have already been found.

We walked over the dunes to a large area of shallow water, dunes and marshes. This is a protected area because of its special birds, animals and plants. Many of the birds fly here from far away. Some of them fly here from as far away as Europe and the Arctic to escape the cold winters there.

Seeing the birds was a good way to end our trip. I thought we had come far! Some of these birds fly over 10 000 kilometres to get to Namibia and then another 10 000 kilometres to get home again. That's five times the length of our mighty Orange-Senqu River!

I had fun playing with these children at Alexander Bay.

This is the place where the saltwater from the Atlantic Ocean mixes with the river water. These beautiful birds, called flamingoes, love it here.

We saw this diamond mine at Alexander Bay. It is near the mouth of the Orange River.

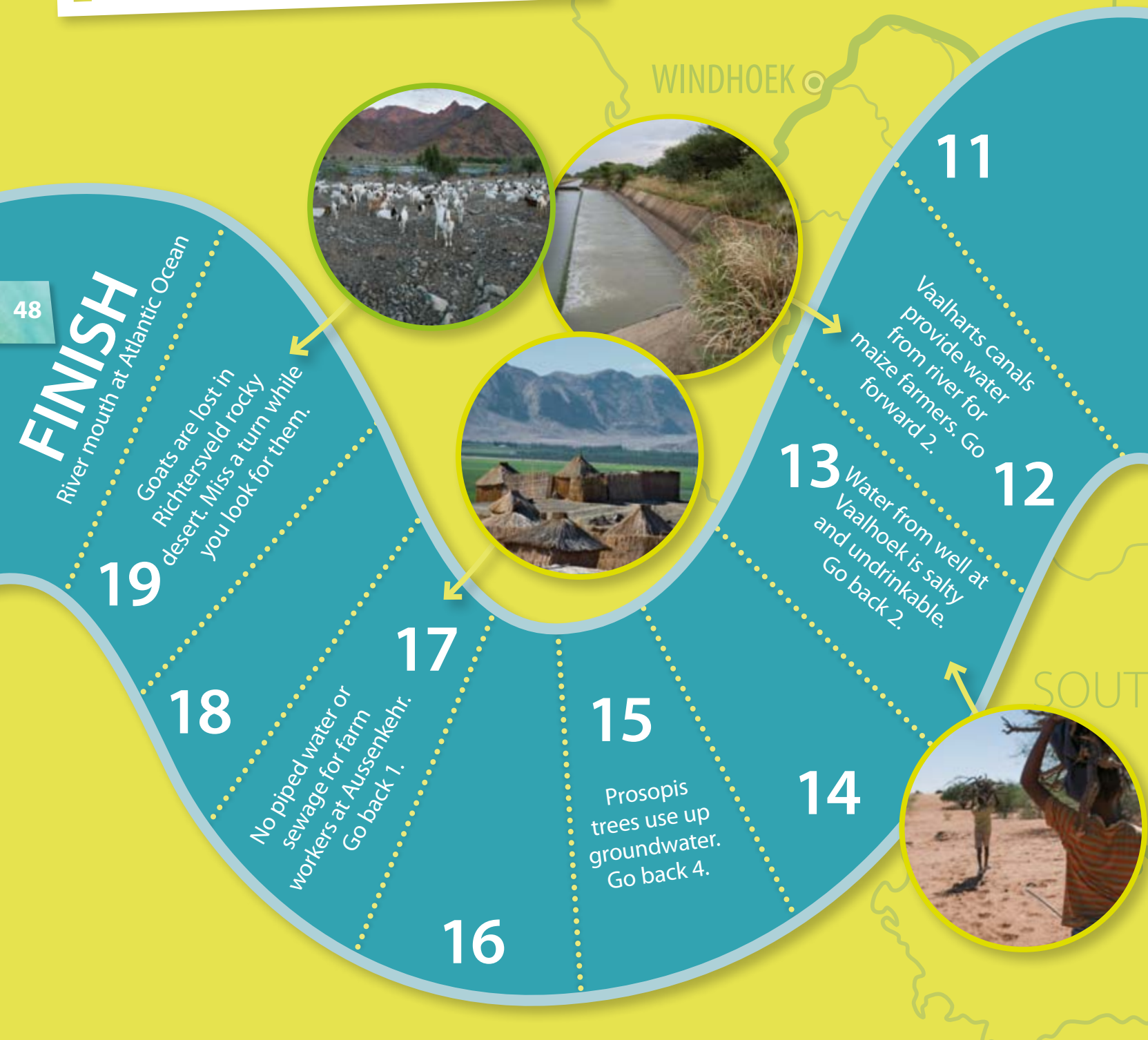
We saw this diamond mine at Alexander Bay. It is near the mouth of the Orange River.

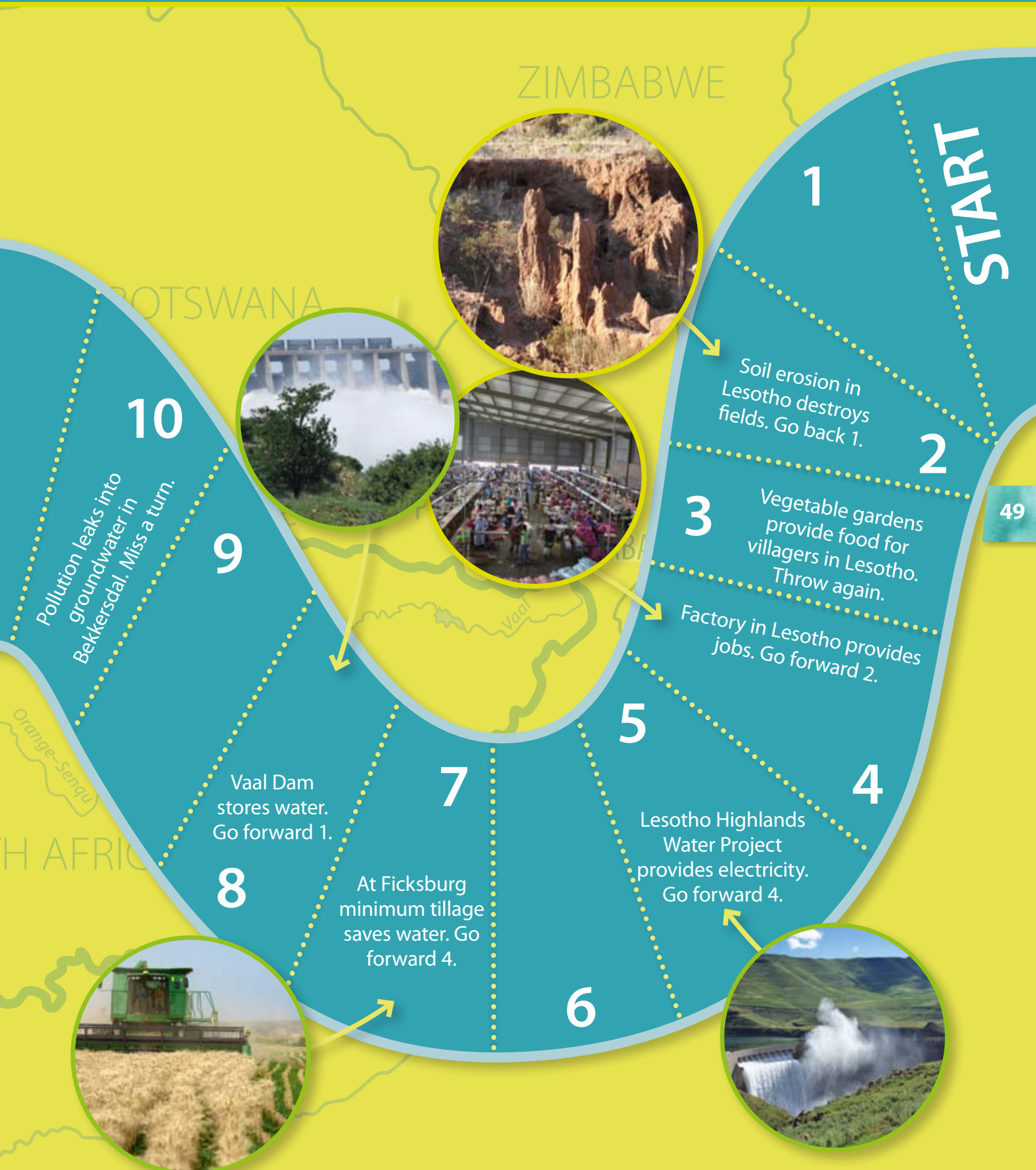
FACT BOX

When it is winter in the northern half of the world, it is summer in the southern half of the world. And when it is winter in the southern half, then it's summer in the northern half. Many birds need to escape the cold of winter. So they fly between the northern and southern halves of the world – living in a permanent summer. This is called 'migration'.

Play this game about life in the Orange-Senqu River Basin with a friend!

- You will need a dice and two counters or small stones.
- Start at the source of the river. The first player to reach the Atlantic Ocean is the winner.
- Take turns throwing the dice. Move your marker according to the number you throw.




ZIMBABWE
START
1
Soil erosion in Lesotho destroys fields. Go back 1.
2
3
Vegetable gardens provide food for villagers in Lesotho. Throw again.
Factory in Lesotho provides jobs. Go forward 2.
4
Lesotho Highlands Water Project provides electricity. Go forward 4.
5
6
7
At Ficksburg minimum tillage saves water. Go forward 4.
8
Vaal Dam stores water. Go forward 1.
9
10
Pollution leaks into groundwater in Bekkersdal. Miss a turn.
Vaal
Orange-Senqu

Looking back

27 December

What an amazing trip! I can't wait to tell my friends about how I've travelled all the way along southern Africa's greatest river. I'm going to show them my photos!

When I got home last night, I wanted a long bath. Then I remembered how much water bathing uses and how precious our water is. I don't think I'll ever be able to use water again in the same way as before this trip.

Here are ten things I learnt during our trip:

1. Water is everywhere! It moves in the air as water vapour, clouds and rain. It is found on land in rivers, lakes, dams, tunnels, pipes and canals. Under the ground there is groundwater.
2. The Orange–Senqu River starts in Lesotho and then flows over 2 000 kilometres across southern Africa where it flows into the Atlantic Ocean
3. The Orange–Senqu River basin spreads across parts of four countries: Lesotho, South Africa, Botswana and Namibia.
4. All the water in the Orange–Senqu River basin, including the smaller rivers (tributaries) and groundwater, is connected. So what happens in one place can affect the water far away.
5. Over 14 million people live in the Orange–Senqu River basin. We need it for drinking, washing, growing the food we eat and for making the clothes we wear.
6. Most of southern Africa has low rainfall and is very sunny. So, a lot of the water in rivers and on the ground, evaporates back into the air. This makes water scarce.
7. We can control and manage the water supply by building dams, canals, boreholes, wells and pipes. The water we use sometimes comes from far away.
8. Many of the things we do pollute our water, which means there is even less clean water for drinking. Polluted water can make people very sick.
9. Water pollution travels from one river to another. It can even travel under the ground into groundwater, and from under the ground to the surface.
10. One of the biggest problems in the future of the Orange–Senqu River basin is that there are more and more people that will need water from this river.

Answers

Page 9:

1. Lesotho and Botswana; 2. South Africa; 3. South Africa; 4. Lesotho; 5. Namibia and South Africa; 6. the source

Page 21:

flushing the toilet = 11 litres, having a bath = 136 litres, showering = 7.5 litres a minute, washing a load of washing in the washing machine = 90 litres, running a tap for teeth brushing= 4 litres a minute, watering the garden = 26 litres a minute.

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1 - E; 2 - C; 3 - D; 4 - A and B; 5 - A and B; 6 - F

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Seals swimming at Alexander Bay

ABOUT ORASECOM

The Orange–Senqu River Commission (ORASECOM) was established in 2000 by the governments of Botswana, Lesotho, Namibia and South Africa, which share the water resources of the Orange–Senqu River basin. The Commission provides a forum for consultation, sharing information and cooperation between the countries. For more information on ORASECOM, visit http://www.orasecom.org/.

ABOUT THE ORANGE–SENQU STRATEGIC ACTION PROGRAMME

The Orange–Senqu Strategic Action Programme is a four-year project working in close collaboration with ORASECOM. It assists the basin states in identifying threats to the water resources of the Orange–Senqu and in developing a basin-wide plan to address these. The objective of implementing such initiatives contributes towards ORASECOM's programmes and the long-term goal of sustainable development of the Orange–Senqu River basin. The project is implementing a transboundary diagnostic analysis and strategic action programme process to meet this objective, while concurrently implementing a number of projects and activities to help strengthen ORASECOM, fill knowledge gaps, and raise awareness and encourage participation of the public.

The project is funded by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP) and is executed by the United Nations Office for Project Services (UNOPS). For more information on the project, visit http://undp.orasecom.org/.

gef

ORANGE–SENQU RIVER COMMISSION
BOTSWANA LESOTHO NAMIBIA SOUTH AFRICA
ORASECOM

UNDP
Empowered lives.
Resilient nations.

ABOUT THIS BOOK

The Orange–Senqu River basin is one of the largest in southern Africa. From the Orange–Senqu's headwaters in the highlands of Lesotho the river is joined by numerous tributaries on its westward journey, draining significant areas of Botswana, Namibia and South Africa. More temperate in the east, the climate of the basin becomes increasingly arid towards the west. Rainfall is variable, subjecting the basin to droughts and floods. Nevertheless, the Orange–Senqu provides the water required to drive the most economically active region in southern Africa, supports large-scale irrigation and meets the domestic needs of several million inhabitants.

Water supply required to meet the various demands has been assured through the construction of numerous dams and a series of transfer schemes that store and move water to areas and at times when it would otherwise not be available. In western areas, much of the rural and urban water requirements are met by tapping the basin's groundwater resources.

Whilst important for economic development, this remarkable operation of the basin's water resources comes at a price. Extensive water abstraction for has significantly altered the natural flow of the river system. The frequency, size and duration of floods are also affected. These changes adversely affect the health of the river, the resources and ecosystems it supports and the services they provide. To maintain these important ecological functions and secure resources in the long term, it is essential that the Orange–Senqu is managed effectively, efficiently and sustainably. ORASECOM promotes such an integrated approach to water management.

To help the four basin nations plan on how to manage the river basin sustainably and equitably, we require a thorough understanding of the priority problems, their underlying causes and the impacts they have. Such an analytical study was recently carried out by the Orange–Senqu Strategic Action Programme, through the assistance of our international cooperating partners, UNDP–GEF. The study – or transboundary diagnostic analysis, as it is known – provides the technical and analytical basis on which strategic plans have been developed to address the problems.

Based on findings of the Orange–Senqu Transboundary Diagnostic Analysis, this children's book highlights the characteristics of the river basin – its resources, the people and economies it supports, and its problems – in a way that is accessible to a younger audience. Designed for the future custodians of this river basin and the resources it provides, this book gives an insight into the diversity of the basin and the importance of a common understanding of pertinent management challenges to the nations that share the river basin and which collaborate to address them.