



Pipe networks

Resource sheet 1

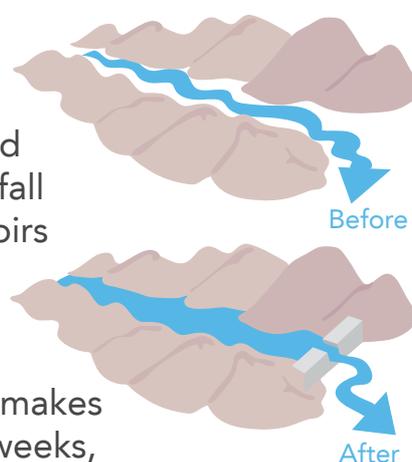
How is water collected for us to use?

1 It is easy to turn on the tap to get clean water, but a lot of things have to happen to allow us to do that.

First of all, water has to be taken away from its natural cycle.

Most of the water used today is collected and stored in man-made or natural lochs called reservoirs. Rainfall is highest in hilly areas, so this is where most reservoirs are.

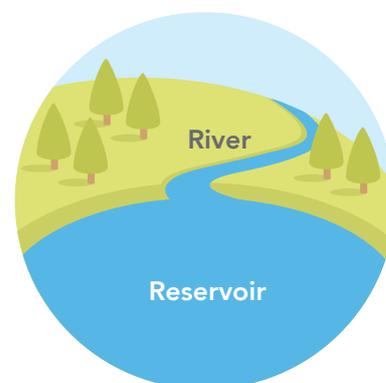
Reservoirs are made by building a dam across the upper part of the river. The water then collects and makes a huge loch. So, even if it does not rain for several weeks, there will still be water available.



2 The dam has to be made of very strong, thick concrete to hold back the huge amount of water behind it. The amount of water flowing through the dam is controlled by opening and closing valves.

The Scottish Environment Protection Agency (SEPA) set minimum compensation flow rates from the dam to protect the environment such as fish, wildlife and plants downstream.

The water in the reservoir needs to be cleaned before it is ready for us to drink. The river has carried lots of bits of grit and dirt down with the water. Some of this grit and dirt will sink to the bottom of the reservoir as silt. This happens because the water in the reservoir is deep and still. The rest is removed at the water treatment works which makes the water clean and safe to drink.





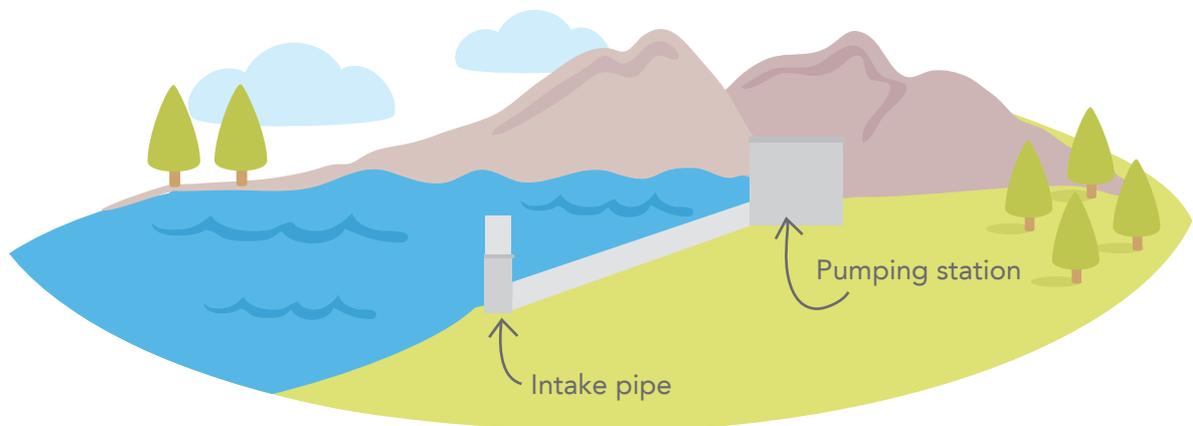
Pipe networks

Resource sheet 2

How is water collected for us to use?

1

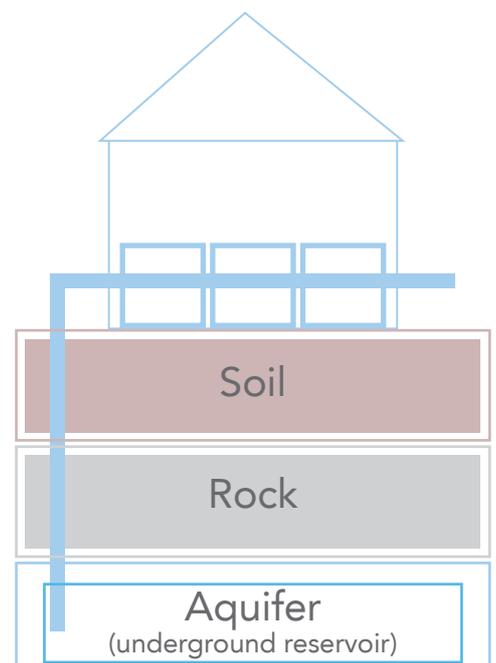
Sometimes we take water from natural lochs like Loch Lomond.



Sometimes a reservoir forms naturally underground. Rainwater soaks into the ground and through the rock below. It happens where there are rocks like chalk and limestone. They soak up a lot of water. They are a bit like underground sponges. The water then collects in a space between layers of rock. We call this an aquifer.

2

We collect water from the aquifer by drilling boreholes in the rock. The water is then pumped out. Wherever we get it from, all water must go to the water treatment works to be made safe and clean before it is piped to our taps. When clean water leaves the water treatment works it travels through large pipes called water mains which are buried underground. There is a water main under the road near your house and the water in your tap comes through a water supply pipe from that water main.





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Resource sheet 3

The water pipe network

- 1 Water is delivered to homes through the **water mains** network by pressure.
- 2 Scottish Water get this pressure either by using gravity or pumping the water through the network. Scottish Water normally put their large storage tanks at high level so the water can flow downhill. This saves energy and keeps the cost of delivering the water through the network of pipes to the taps in your home down.
- 3 Drinking water enters your home through a pipe called the **water supply pipe**. This pipe is controlled with a **stop cock** and **water meter** (if you have one) which is found at the end of the **communication pipe**.
- 4 The **water main** is laid below ground to make sure that it is not damaged by frost.
- 5 The **communication pipe** takes the water from the **main pipe** to your home.
- 6 Where the **water supply pipe** enters your home, usually in the kitchen, it is fitted with a **stop valve** which controls the water coming in from the **water main**.

The diagram below shows which of the pipes around a home Scottish Water and the homeowner are responsible for.



Water and waste pipes	Responsibility
① — The water supply pipe	Homeowner
② × Stop valve	Homeowner
③ — Private drain	Homeowner
④ ● Sopcock/meter	Scottish Water
⑤ — The communication pipe	Scottish Water
⑥ — The water main	Scottish Water
⑦ — Sewer	Scottish Water



Pipe networks

Resource sheet 4

The waste water pipe network

Waste water is anything which flows through a sewer including bath water, industrial waste and toilet waste. Rain water from the roads, roofs and gardens is known as surface water.

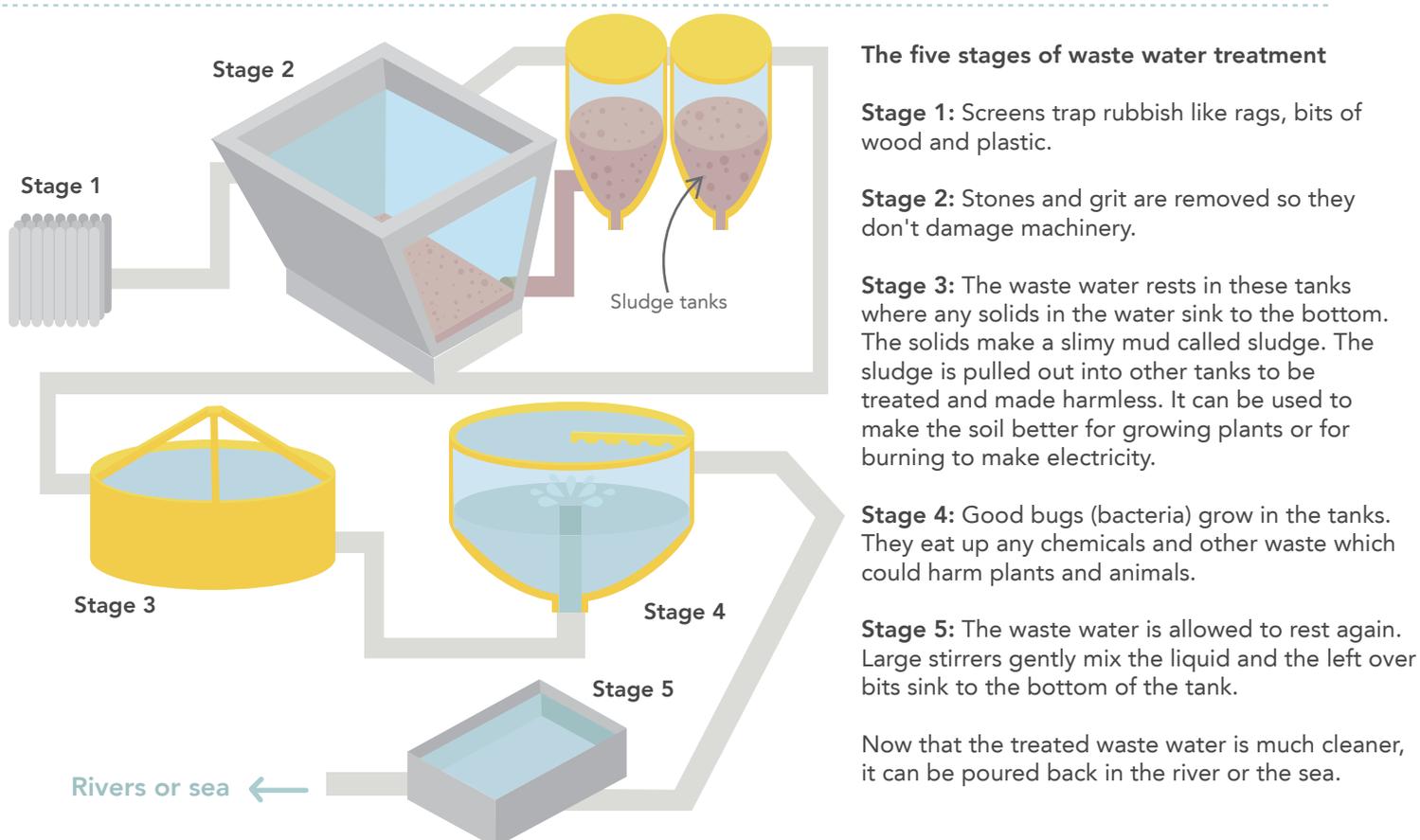
The more clean water we use, the more dirty water we produce.

So that the natural environment can be protected and to control the possible spread of waterborne diseases, waste water is treated by Scottish Water before it is returned to the environment.

From your home, the dirty water flushed down the toilet, wash hand basin and kitchen sink all goes into the private drain.

This private drain carries the water through to the public sewer which takes it to the waste water treatment works.

Underneath every road and street there is a network of sewers, pipes and pumps that carry waste water to where it can be treated and returned to the environment. Sewers vary in diameter.





Pipe networks

Resource sheet 5

Pipe networks quiz

- 1 Which areas have the highest rainfall in Britain?
- 2 What are the natural or man-made lochs called, that collect and store our water?
- 3 What is silt?
- 4 Some kinds of rock can soak up a lot of water. Name two of them.
- 5 What is an aquifer?
- 6 What does a water treatment works do?
- 7 Why are large storage tanks at a high level?
- 8 Why is the communication pipe buried underground?
- 9 Pipes coming into a house usually divide into two. One goes to the kitchen sink. Where does the other one go?
- 10 What is waste water made up of?
- 11 What diameter are sewers?
- 12 Why does Scottish Water treat waste water before it is returned to the environment?



Pipe networks

Resource sheet 6

Building a pipe network

Before providing a new pipe network to extend the water supply an environmental impact assessment will take place. For example, cutting down woodland to lay pipes can destroy the land's natural defence against flooding and digging up environmentally important areas like marshes can destroy the homes of birds and animals.



The environmental impact assessment is very important and must be carried out before permission will be given to build the pipe network.

- Step 1** Scottish Water will think very carefully about the route of any pipe network and try to choose the best route that will cause least harm to the environment.
- Step 2** The proposed route will be mapped out and the impact on the environment described.
- Step 3** Discussions take place with a number of public bodies for example, Scottish Natural Heritage (SNH) and the Scottish Environment Protection Agency (SEPA). Local communities affected by the development are also part of the discussions.
- Step 4** All the information collected is put into a document called an Environmental Statement which becomes part of the planning application. This Environmental Statement includes details of any steps that will be taken to reduce the impact of the building of the pipe network on the environment. Sometimes it is impossible to prevent environmental damage but it may be possible to reduce it or create alternative habitats for wildlife and birds.
- Step 5** The design of the pipe network is discussed by the Local Authority who have the final decision whether to allow it to be built on the proposed site.



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Resource sheet 7

Island map



Key



Houses



Loch



Roads



Pipes



Sea



Woods



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Resource sheet 8

The pipe networks challenge

An environmental impact assessment

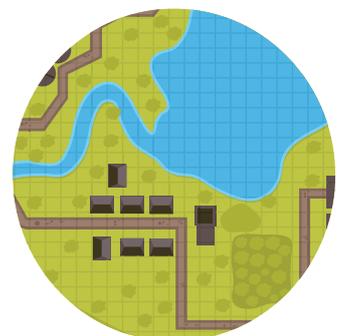
The villagers on the island need a steady supply of fresh water from a clean water pipe network to use for example for drinking, cooking, washing-up and washing clothes. They also need a good waste water pipe network to carry waste water from their homes, schools and workplaces to the waste water treatment works where the waste water can be treated to make it safe before it is released back into a river or the sea.

Before the pipe networks can be built, an environmental impact assessment will have to be carried out.

- 1 Look at the map of the island and decide the following:
 - The location of the water treatment works.
 - The location of the waste water treatment works.
 - The route that the water pipe network and the waste water pipe network will take.

- 2 Carry out and produce an Environmental Impact Assessment of your plan. This should include:
 - The proposed design of the pipe networks.
 - Why you have selected that route.
 - The impact that your chosen route will have on the environment.
 - Any actions that you are prepared to take to reduce the impact on the environment.

- 3 You will be asked to present your ideas and assessment to the class who will be in the role of the island community. You will have 10 minutes to present your plan. Following this presentation and discussion you may make any amendments before it is given to a panel of pupils who will be acting as the Local Authority. They will have the final decision as to whether you can build the pipe networks as you have planned.



Good luck!



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Resource sheet 9

Local residents' questions



I run a fish factory, so I use lots of water. I'm really in favour of a better water supply.



What about the tourists? They'll be put off by all these great big diggers all over the place!



The pipes will be going right through my fields. I want compensation for that!



I run a bed and breakfast house. I hope some of the workers come and stay at my place whilst they're here.



I'm worried in case the water and waste water treatment works look really ugly and spoil our beautiful countryside.



I'm a mum with three small children. I'm worried in case they wander off and fall into these deep holes, or get knocked over by the construction vehicles.



Will any permanent jobs be created at the water and waste water treatment works?



I'm a farmer, so I'd be very pleased if the waste water treatment works could produce some cheap fertilizer for my crops. Is that possible?



We've had droughts here recently. Will the new works mean that we are less likely to have a hosepipe ban in future?



Will your new pipes have to go under a road? If so, how will you keep disruption to a minimum? I'm concerned in case my customers can't get to my shop every day.



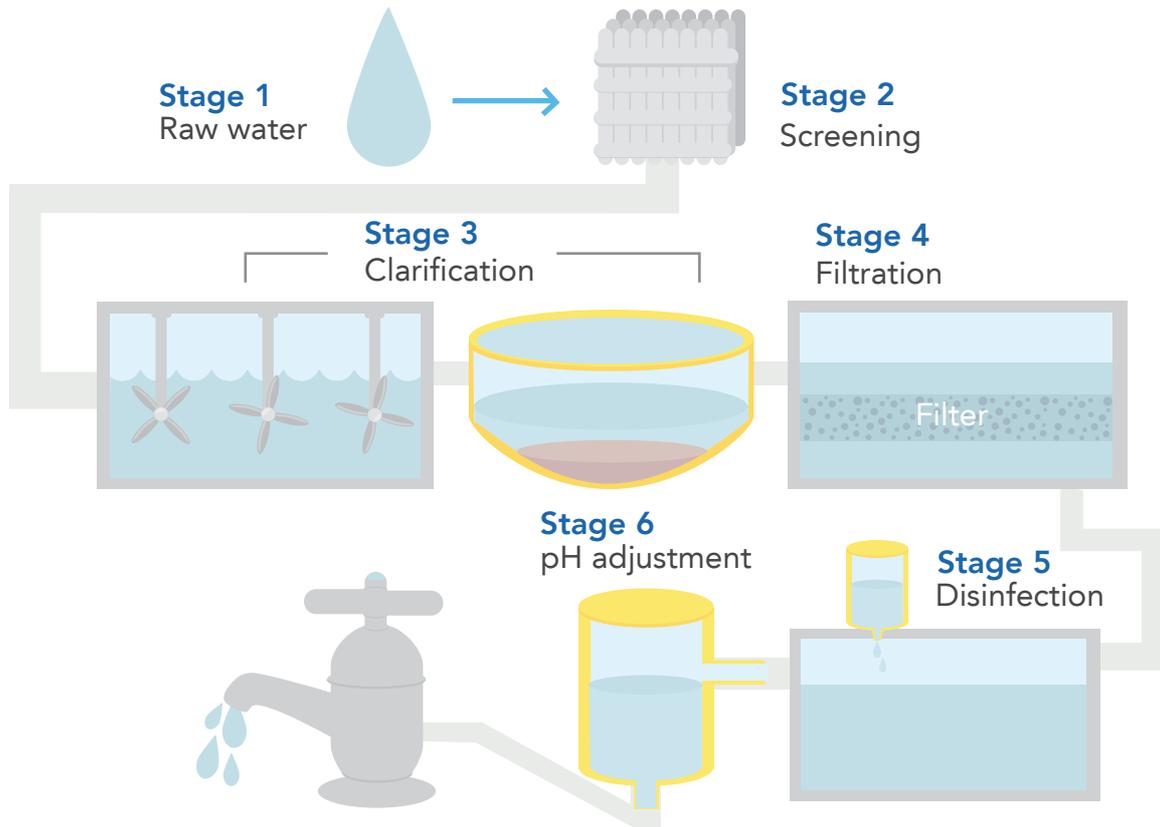
I work at the local hospital. Can you guarantee that the new water supply will be absolutely fresh and clean?



Pipe networks

Resource sheet 10

Typical example of the water treatment process



Stage 1: Surface water is stored in reservoirs to provide a continuous supply to meet demand throughout the year.

Stage 2: Water is passed through mesh screens to remove debris, such as leaves, weeds and sticks.

Stage 3: Impurities in the water are removed.

Clarification includes:

- coagulation and flocculation
- sedimentation

Stage 4: Any impurities still left from the clarification stage are removed through filtration.

Stage 5: Disinfection is vital to ensure that water-borne diseases are eliminated, and that the drinking water that we supply to you meets the water supply regulations.

Stage 6: pH is a scientific term used to describe the acidity or alkalinity of a substance. We need to control the pH level of drinking water. If water is too acidic it may corrode metal pipes, and if it is too alkaline it may cause deposits to form inside the pipes.

The water is now safe to drink and use in our homes, schools and businesses.



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Resource sheet 11

Water treatment process

Screening

Clarification

Filtration

Disinfection

pH Correction