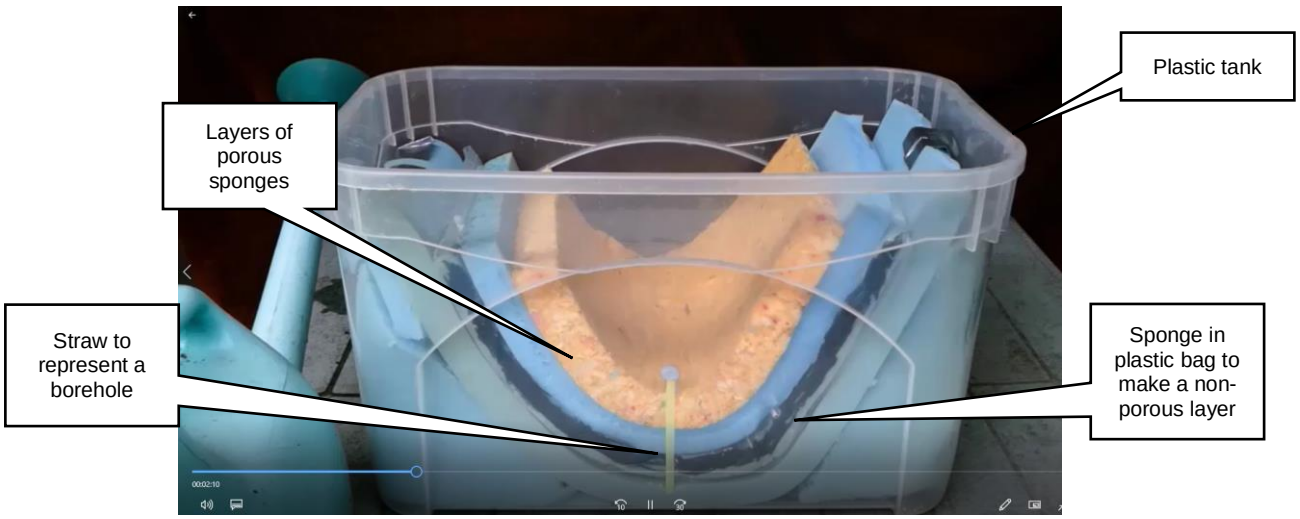
Make your own aquifer – 2 The London Basin
Model the aquifers in the London Basin with sponges

Some books show groundwater only in caves or underground rivers. However, most groundwater is stored in the small spaces or pores between the grains in sedimentary rocks, or in the fractures of other rocks. A rock which stores water in this way is called an **aquifer.**
The principle of aquifers is explained in the activity and video "Make your own aquifer – 1 with sponges".
"Make your own aquifer – 2 the London Basin" uses foam sponges to model the aquifers lying beneath the London Basin.

Fill a transparent tank with several foam sponges, as in the photo. Point out that one sponge is wrapped in a plastic bag to produce a non-porous, impermeable layer. The sponges are arranged to form a syncline (downfold) to replicate the structure of the London Basin in the U.K. The sponges should fit the container as much as possible to avoid leakage down the sides. There is also a video of the activity which would save building up the model. See Useful links below.



Ask the pupils:

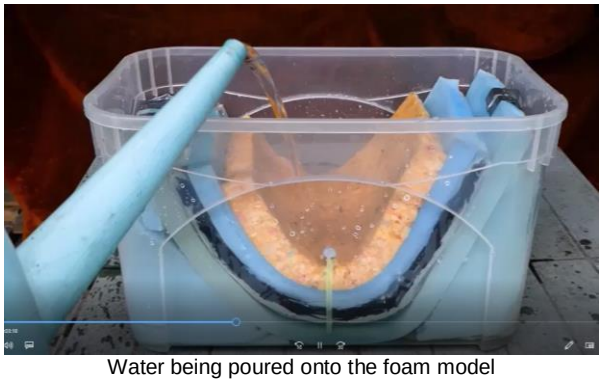
- to imagine that the foam layers represent layers of sedimentary rock lying beneath London (in the middle of the model) and to describe the structure of the foam layers; *The layers form a downfold, known as a syncline.*
- what will happen if some coloured water is added? Ensure that water is poured over <u>all</u> the sponges where they reach the surface; *The water will gradually fill the pore spaces in the sponges.*
- how can we ensure that water can reach the layers lying <u>below</u> the impermeable sponge, wrapped in plastic? *It must be poured on the exposed edges of the lower layers where they reach the surface.*
- what will happen if a pipe, or well, is inserted into the sponges in the centre of the downfold? *Probably* n*othing will happen unless you suck on the pipe, or, in the real world, pump the water out.*
- to watch carefully as you gently suck on the pipe; *The water will flow towards the base of the pipe making a cone shape.*

Pupils may have noticed that the lower levels of the foam become saturated with water, and that this can be seen through the sides of the tank. The top level of this saturated zone is known as the **water table**, and this was marked by a black dotted line at one stage during the video (see the last two photos).

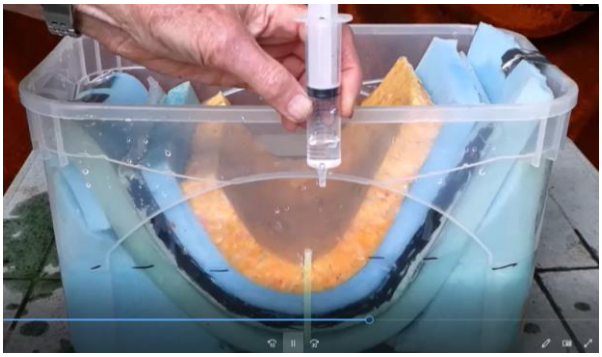
Ask the pupils what might happen at the well if the water table in the 'oldest' layer of foam is higher than the top of the well; *Water would flow out of the well without pumping, as it would be driven by the 'head' of water above it.*

It is difficult to achieve this in the model, because of leakage around the sides, but it did happen in the London Basin when wells were first drilled into the lower aquifers. The diagram below shows that the water table in the Chalk aquifer was at a higher level than the wells in London. However, as more and more water was taken out, the water table dropped and so the wells do not flow naturally now, but need pumping.

The term **artesian basin** is applied to such a feature, where rain falls on the exposed parts of porous, permeable rocks and then flows through the rocks to become trapped below the area where the water is needed.

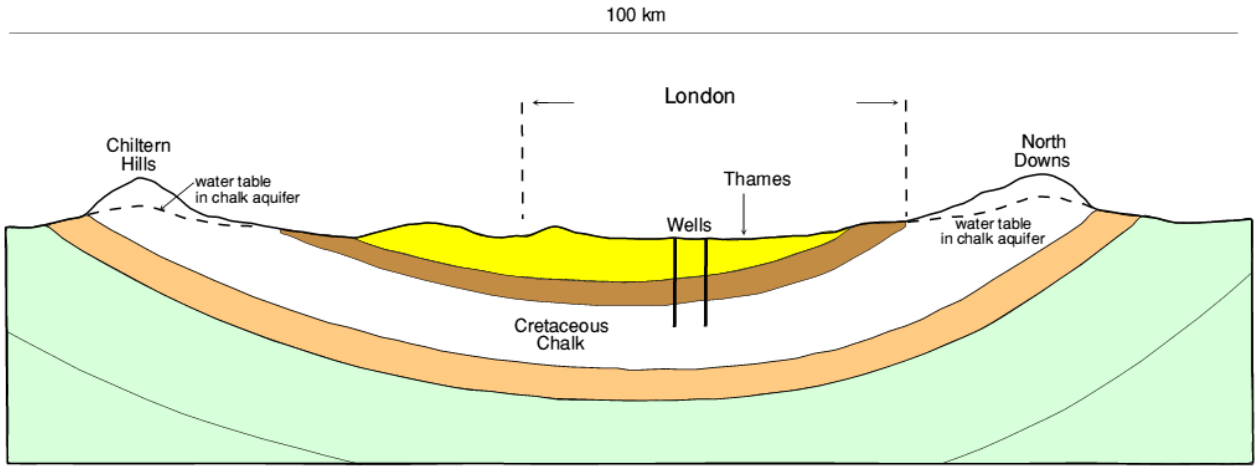


Water being poured onto the foam model



Success!

Water being drawn up from a “borehole”



Sketch section of the London Basin

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The back-up

Title: Make your own aquifer – 2 The London Basin

Sub-title: Model the aquifers in the London Basin with sponges

Topic: This activity uses sponges to demonstrate water in pore spaces in sedimentary rocks.

Age range of pupils: 11 years upwards

Time needed to complete activity: up to 30 minutes, once the model has been constructed

Pupil learning outcomes:
Pupils can:

- state that some sedimentary rocks have spaces or pores between the grains and are porous;
- show that sponges can be used to simulate these porous sedimentary rocks;
- state that a porous, permeable rock which holds water is called an aquifer;
- show that water can be extracted from aquifers;
- show that an aquifer can form, even though it lies below an impermeable layer;
- show that a syncline where an aquifer is trapped beneath an impermeable layer may become an artesian basin.

Context:
This activity may be used in science and geography lessons when studying the water cycle or water management.

Following up the activity:
- Investigate situations where salt water has infiltrated aquifers, so polluting the water supply.
- Draw a map of the aquifers in use in your area for water supply.
- Investigate artesian basins.

Underlying principles:
- Sedimentary rocks which have spaces or pores between the grains are porous.
- Rocks which allow water to flow through them are termed permeable.
- Aquifers are porous, permeable rocks which hold water.
- Water can be extracted from aquifers via wells.
- A cone of depletion occurs at the base of the well as water is pumped out at the surface.
- An aquifer can occur beneath an impermeable layer when the permeable layers are exposed to rainfall beyond the area where the water is being abstracted.
- A well drilled into such an aquifer is termed an artesian well.
- Artesian wells may produce water at the land surface without pumping if the water table in the surrounding hills is higher than the site of the well.
- Most artesian basins are synclinal structures.

Thinking skill development:
Answering and discussing the questions as the activity is demonstrated involves construction and metacognition. Introducing the sponge in a plastic bag involves cognitive conflict and relating the activity to the real world is bridging.

Resource list:
- water supply
- colouring agent
- transparent container
- sponges
- container to pour the water
- transparent plastic bag
- pipe/straw
- syringe

Useful links:
For a video of this activity see:
https://www.earthlearningidea.com/Video/418_Aquifer2.html
For an introductory model of aquifers see:
https://www.earthlearningidea.com/PDF/417_Aquifer1.pdf

Source:
Adapted by The ELI Team from an original idea of Dr. Marta Ferrater of the Prof. Institut Manuel de Cabanyes, Spain
Photographs by P. Kennett