

WATER RESOURCES

WATER RESOURCES IN THE BRITISH ISLES

- **A dam** is a structure that holds back water
- **A reservoir** is a body of water behind a dam wall.
- **Hydroelectric power** is releasing water stored behind a dam to turn a turbine to generate electricity.

There is **no national grid system** for water supply in the UK as it is often **managed locally**. Britain has plenty of water overall and yet there may still be droughts, hosepipe bans and sometimes flooding, sometimes at the same time but in different parts of the country.

The **North and West of the UK** tend to have a **higher rainfall**. Areas such as Ireland, the southwest, Scotland, Wales, The Isle of Man and the Midlands have a **water supply dominated** by the abstraction **from rivers or storage in surface reservoirs**.

The rocks in this area are **older and impermeable**; many being **metamorphic or igneous**. **Less than 10%** of water supply relies on abstraction from **groundwater sources**.

SURFACE WATER SUPPLY

Advantages

1. **Easy to abstract** from rivers, lakes or reservoirs by direct pumping (no boreholes required nor lengthy tubing).
2. Water can be **returned to rivers** when demand is low (after treatment).
3. Dams and reservoirs can be used for **hydroelectric power generation**.
4. Reservoirs can be used **for recreation** purposes.

Disadvantages

1. **Requires treatment** (more vulnerable to exposure to contaminants).
2. **Seasonal supply**, (volume of water in rivers varies & water loss through evaporation).
3. Requires the **construction of expensive and environmentally damaging dams**.
4. Requires the **flooding of land for reservoirs**.
5. Requires **dredging to remove silt** build up
6. Construction of dams **and reservoirs may trigger earthquakes**. (Large volumes of water being held on the land could induce earthquakes OR **earthquakes could rupture the dam**)
7. Requires **sufficient rainfall** and **large enough river catchments** – there is no backup in **drought** conditions. **Unreliable**, especially in the face of climate change.

GROUND WATER SUPPLY

Advantages

1. **Rocks act as a natural filter** purifying the groundwater
2. There is **much less loss of water through evaporation**
3. No requirement for expensive environmentally damaging dams (**lower setup costs**)
4. Artesian basins are self-pumping - have **lower pumping costs**
5. Higher **reliability**, groundwater is **abstracted on demand**

Disadvantages

1. **Requires a suitable aquifer site** (porous and permeable sedimentary rock in vicinity of water table)
2. Problems of **surface subsidence**, especially when water over abstracted.
3. **Pollutants have a long residence time** – aquifers are **highly susceptible to pollution**.
4. **Pumping costs** as the **water has to be raised vertically**, even in the case of an artesian well where it is above the water table.
5. **Not all groundwater is potable** - usually due to the presence of dissolved salts making it brackish.

SUSTAINABILITY OF WATER RESOURCES

Two very important terms

- **A renewable resource** is one that is replenished by natural processes on a human timescale at a rate equal to or exceeding its rate of use. Therefore, it can be theoretically managed such that supply is always available.
- **A sustainable resource** is one that is used in such a way that it can continue into the future. It can be exploited both at today's levels and to ensure future demands are met.

We are making increasingly greater demands on our water resources. **Most of the water is used for agriculture**. The need to ensure a reliable public water supply is a pressing issue, particularly in the light of our concerns about **global warming and climate change**.

- ✚ Groundwater from **live aquifers** is **a renewable resource**.

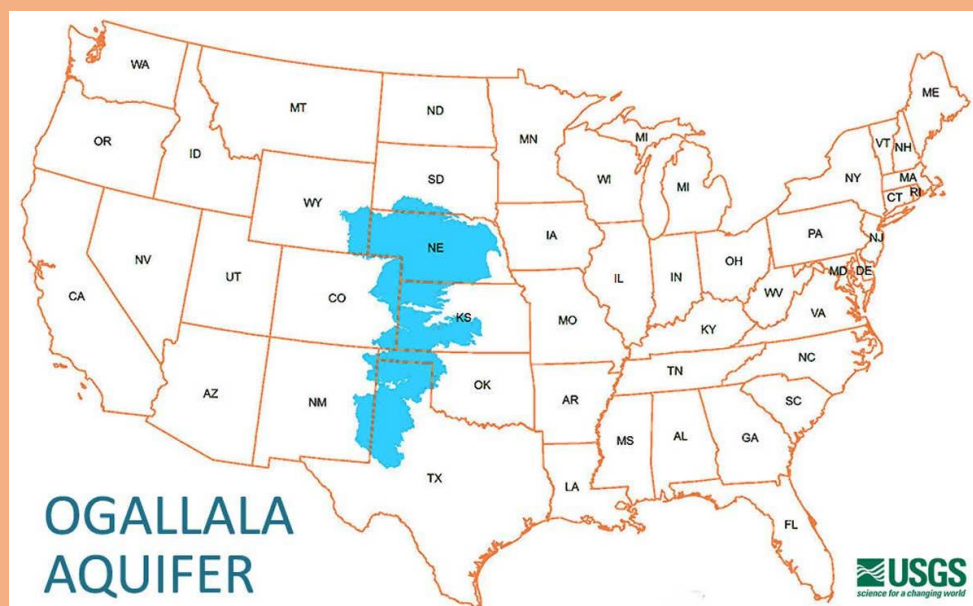
As part of the water cycle, groundwater is replenished by **rainwater infiltrating into the soil** and **then percolating downwards through rocks** to reach the **water table**. This is a **natural process** of replenishment.

- ✚ Groundwater resources are **only sustainable if** the rate of extraction **does not exceed** the rate of replenishment.

- ✚ In addition, groundwater supplies are only classed as being **sustainable if the natural system of filtration** through rocks **can clean the water fast enough** and the water **remains free from pollutants**.

Fossil aquifers, such as the **Ogallala aquifer of the central USA** and the **Great Artesian Basin of eastern Australia**, are non-renewable resources and are ultimately unsustainable.

Water extraction from parts of the Ogallala aquifer is **more than 100 times the recharge rate**.



RECENT INITIATIVES IN WATER RESOURCE MANAGEMENT ***LEARN THIS CASE STUDY WELL***

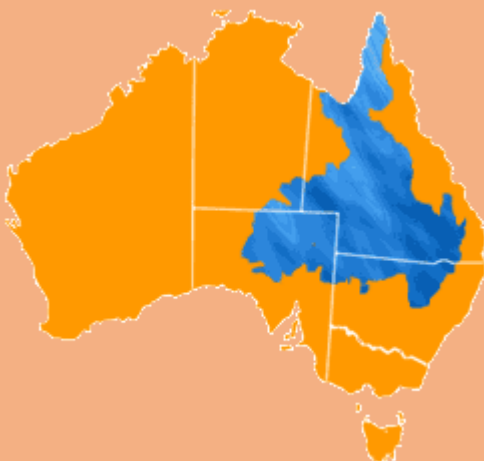
As components of the water cycle, there is an intimate relationship between surface water and groundwater.

The natural **replenishment** of an aquifer **can be supplemented by artificial recharge**. Water may be **pumped into the ground through boreholes** or by using **controlled flooding** to spread water over a large area so that it can **infiltrate the ground**. The idea is to **store surplus water in aquifers for future** use. Parts of the London Basin are **recharged with treated river water during the Winter** months. But at present, artificial recharge is only really used to a limited extent in the British Isles.

Of greater importance is the use of **groundwater to maintain river flow during dry periods**. Several major schemes in England, including the **Shropshire Groundwater Scheme**, have been designed to **pump groundwater into rivers** to ensure continuous public water supply during the summer months to **protect the river environment**.

CASE STUDY: THE GREAT ARTESIAN BASIN OF EASTERN AUSTRALIA

- The **Great Artesian Basin of eastern Australia** is the only 'reliable' water source for much of **inland Australia**.
- The basin is fortunately the **largest and deepest artesian basin** in the world.
- It **underlies 23% of the continent** and is estimated to contain ~ 64,900 km³ groundwater
- **2/3 of the extracted water is wasted** (by **evaporation** from free **flowing artesian boreholes**)
- This could be prevented by capping boreholes
- In January 2007, the Australian Government implemented the **National Plan for Water Security** over fears of shortages during droughts.
- **Costing \$10 billion**, it aims to reduce over abstraction across Australia and **increase water efficiency** (promoting sustainability).





During summer months, the **River Severn's level may insufficient** for the demands of the West Midlands communities.

The **Shropshire Groundwater scheme** began in 1984 – designed to increase the River Severn's flow using groundwater and releases from reservoirs in Wales.

The scheme has pumping stations and boreholes that **abstract groundwater from the underlying Permo-Triassic sandstone aquifer**.

Groundwater is discharged into the river system through weirs and sand traps to ensure the water is suitably oxygenated and sediment free.

A cenote is a natural pit, or sinkhole that results from the collapse of limestone bedrock that exposes groundwater beneath it.

Cenotes are natural swimming holes formed by the collapse of porous limestone bedrock, which has revealed a secret subterranean world of groundwater pools. Most cave cenotes have fresh water that has been meticulously filtered by the earth, making them so clear and pure that you can see straight through to small fish frolicking in the plant life below. Open-air cenotes also have clear water, and often are home to vitamin- and mineral-rich algae that nourish and protect your skin. Underwater photographers will be thrilled with the clear waters, which allow for aquatic-playground shots in high-definition clarity.

