

KEY LEARNING

- Dams and reservoirs
- The benefits and costs of dams and reservoirs
- Channel straightening
- The benefits and costs of channel straightening

River management: hard engineering

Hard engineering uses heavy machinery to build artificial structures which work against nature to reduce the risk of flooding. **Dams and reservoirs** and **channel straightening** are two methods of hard engineering.

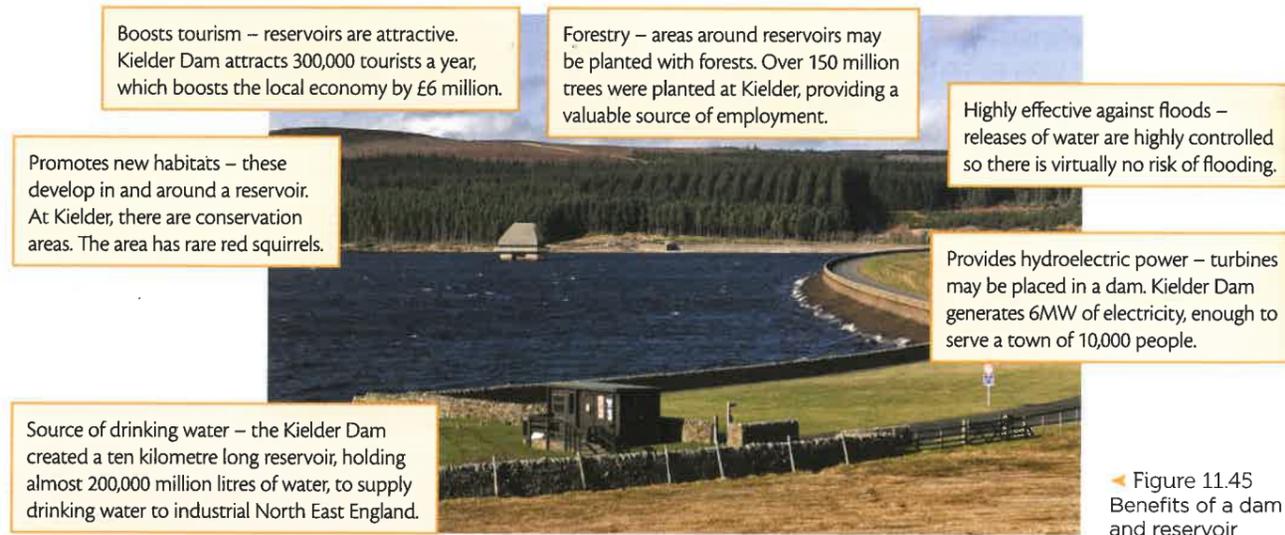
What are dams and reservoirs?

A dam is a large concrete barrier built across a river to impede its flow. This causes the valley behind the dam to flood, forming an artificial lake called a reservoir. This restricts the supply of water downstream. Water is released in a controlled manner through sluice gates in the dam. If water releases are carefully controlled and monitored, there should be no risk of flooding downstream.

What are the costs and benefits of dams and reservoirs?

Benefits

The benefits of the Kielder Dam and Reservoir in Northumberland, completed in 1981 can be seen in Figure 11.45.



◀ Figure 11.45 Benefits of a dam and reservoir

Costs

Social	Economic	Environmental
The flooding of a valley displaces people, usually farmers from their homes. At Kielder 58 families were displaced. This causes distress and breaks up communities.	Dams are expensive. Kielder Dam cost £167 million and may have been a waste of money. Loss of industry in North East England meant the demand for water and HEP was less than expected. Additionally, soils downstream can become less fertile through lack of sediment from floods, which reduces crop yields.	A concrete dam interferes with the path of migrating fish. Sediment is trapped behind the dam and this interferes with fish spawning grounds. Algae often collects behind a dam which deoxygenates the water. If there should be a sudden release of water through the sluice gates, this can cause river bank erosion downstream. The building of a dam may trigger an earthquake. Landslides often occur on the sides of a reservoir; this increases sediment and create shock waves which damage buildings. Reservoirs often flood areas of outstanding natural beauty. At Kielder, 1.5 million trees were lost along with 2,700 acres of farmland. This had a negative effect on habitats. New plantings are confined to Sitka Spruce.

What is channel straightening?

Channel straightening is when a meandering section of a river is engineered to create a widened, straightened and deepened course. This more efficient course improves navigation and reduces flood risk. In the nineteenth century, a new course was cut across a large meander loop on the River Tees to improve navigation. Centuries of straightening have also taken place on the River Parrett, to reduce flood risk in the low-lying Somerset Levels.

What are the benefits and costs of channel straightening?

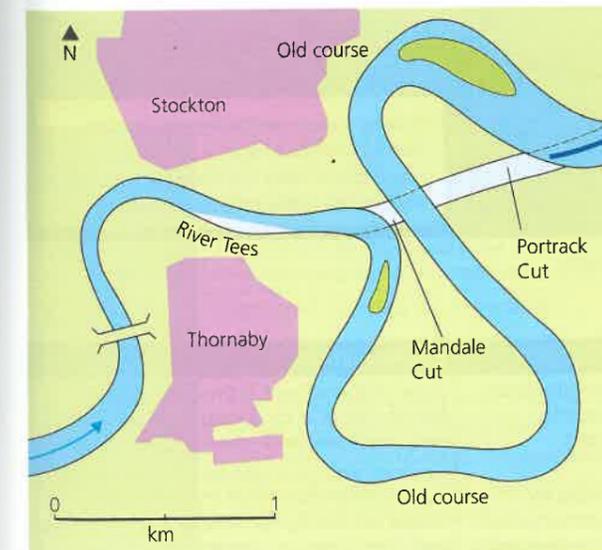
Benefits

Social:

A straightened river reduces flood risk by moving water out of the area more quickly, as there is less friction with the bed and banks. The faster-flowing water also removes sediment that would otherwise build up the height of the river bed.

Economic:

- The historic cuts on the River Tees reduced the length of the river by 4.4 kilometres. This straightened course improved navigation considerably and increased trade at Stockton's port.
- Home owners gain confidence to invest in their property as they no longer expect to be flooded. Insurance costs also go down due to the lower flood risk.



▲ Figure 11.46 Straightening the River Tees

Costs

Social:

Water flows through a straightened section quickly, but when it meets a meandering section downstream, such as at Burrowbridge in the Somerset Levels (2014), velocity is reduced. This causes sedimentation of the channel, so the river is more likely to flood, causing problems in another area.

Economic:

River straightening is expensive. Dredging a river to remove silt accumulation downstream is also expensive. After the 2014 flood damage, the EU authorised the £5.8 million dredging of a five-mile section of the Rivers Parrett and Tome near Burrowbridge. In some cases the impact of a straightened section downstream has been so severe that the river is restored to its original course. At Lewisham, London, £1.1 million was spent putting meanders back in the River Quaggy.

Environmental:

- The changes in hydrology and flooding downstream that can occur endanger animals and destroy habitats. The river's ecosystem is changed.
- A straightened river may have a concrete lining. This is visually unattractive and it deprives burrowing river bank animals of their habitat.
- In straightened sections, there is some evidence of increased pollution on the land from agro-chemicals, as runoff cannot drain into the river so easily.

→ Activities

- 1 Use information from Figure 11.45 to assess the social, economic and environmental benefits of dams and reservoirs.
- 2 Roleplay in a group of four. Take on the roles of an environmentalist, a local forestry worker, an elderly farmer living in the area to be flooded and a member of the local tourist board. Engage in a discussion about the proposal to dam the valley to make a reservoir.
- 3 Imagine you live in the valley that is to be flooded. Write a diary entry describing your thoughts on hearing of the proposal.
- 4 Draw an annotated diagram to explain how straightening a river reduces flood risk in an area.