

**KEY LEARNING**

- Embankments
- The benefits and costs of embankments
- Flood relief channels
- The benefits and costs of a flood relief channel

## River management: more hard engineering

Two other methods of hard engineering are **embankments** and **flood relief channels**.

### What are embankments?

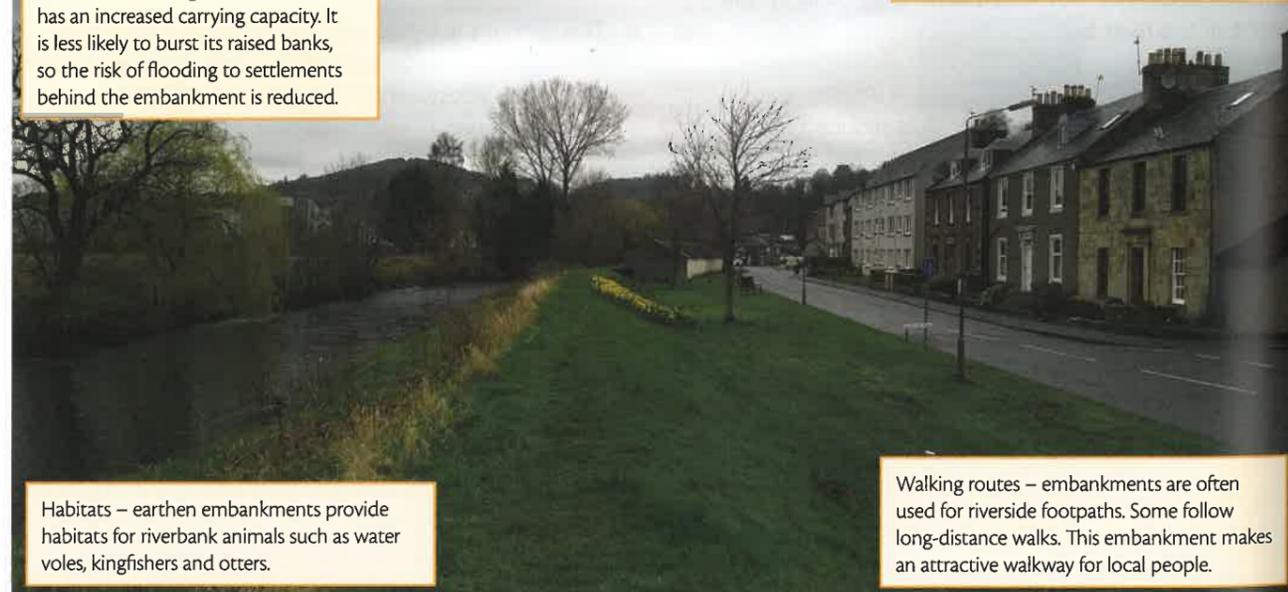
An embankment is an artificially raised river bank. In raising the banks, more water is contained in the channel. This reduces the flood risk. In Figure 11.47 the embankment at Bridge of Allan in Stirling, Scotland, is protecting the houses on the right that have a high flood risk. An embankment is made by bulldozers moving huge mounds of impermeable soil on to the river banks to build up their height. Some embankments are reinforced by gabions (wire cages filled with stones) or lined with concrete.

### What are the benefits and costs of embankments?

#### Benefits

Safer from flooding – the channel now has an increased carrying capacity. It is less likely to burst its raised banks, so the risk of flooding to settlements behind the embankment is reduced.

Cheap – compared to other methods of hard engineering, the cost of building embankments is quite low.



Habitats – earthen embankments provide habitats for riverbank animals such as water voles, kingfishers and otters.

Walking routes – embankments are often used for riverside footpaths. Some follow long-distance walks. This embankment makes an attractive walkway for local people.

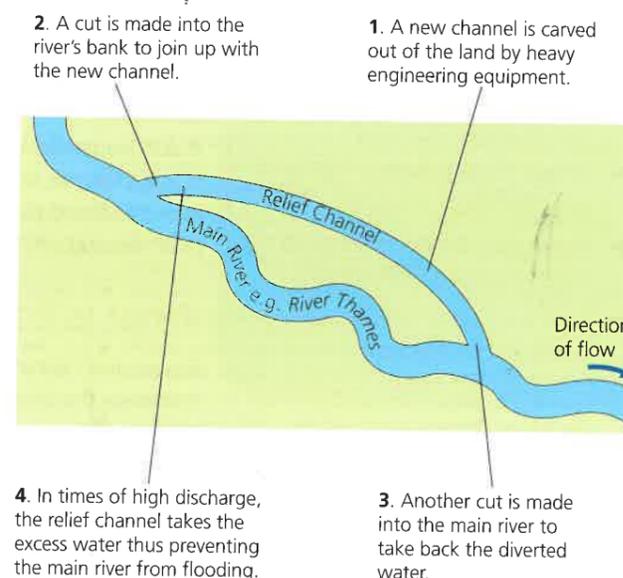
▲ Figure 11.47 The embankment protects houses in Bridge of Allan, Scotland

#### Costs

Social	Economic	Environmental
Embankments deprive people of easy access to the river for fishing and boating. Although they reduce the risk of flooding, embankments are not as reliable as other types of hard engineering. Their presence gives people a false sense of security, which means they may not be prepared for floods.	Embankments have higher maintenance costs than other hard engineering methods, as they need constant monitoring and repair. Earthen embankments are prone to erosion and this increases sedimentation downstream, which will incur a dredging cost if flooding is to be avoided.	If the embankment is breached, water lies on the land for a long time, as it has a restricted overland route back to the river. Gabions and concrete linings displace riverbank animals from their habitats. These reinforced sections are unattractive and, if they break, wire mesh or huge slabs of concrete litter the river bed.

### What is a flood-relief channel?

A flood-relief channel is an artificially made channel that is designed as a backup channel for a river that frequently floods. It works like a bypass. The newly engineered channel runs roughly parallel to the main river (as seen with the Thames in Figure 11.48). The River Exe at Exeter has three relief channels, which were constructed at a cost of £8 million following devastating floods in 1960. The largest of these channels is the Exwick spillway. A gate has been built across the River Exe which automatically closes off the river in times of high discharge and diverts water along the Exwick spillway, thus reducing the risk of the River Exe flooding.



▲ Figure 11.48 How a flood-relief channel works

#### Benefits

<b>Social</b>	A relief channel removes the risk of flooding from a designated area. Exeter's relief channels protect around 3,000 properties. Footpaths and cycle tracks are built along a new channel. Calm water provides areas for model boating and canoeing. Where reed beds have been included, birdwatching and nature reserves may be set up.
<b>Economic</b>	Insurance costs are lower in the vicinity. The value of homes increases and houses are easier to sell. There is a more secure environment for setting up business ventures.
<b>Environmental</b>	Some relief channels include artificial reed beds and grass-covered concrete sides. These provide new habitats. When full of water, they produce a tranquil setting.

#### Costs

<b>Social</b>	People living in the path of a relief channel have to be moved, causing disruption. Settlements downstream of a relief channel suffer from increased flooding, as the merging of water from the relief channel swells this part of the river. This raises the question of the ethics of protecting some settlements to the detriment of others.
<b>Economic</b>	Flood-relief channels are expensive. Sometimes, as in the case of the Jubilee River (see Section 11.15), they run out of funds. They also need to be maintained and repaired. The schemes take a long time to come into effect; Exeter's relief channels took twelve years to build.
<b>Environmental</b>	In the construction of relief channels, habitats are disturbed. The level of water in a relief channel varies considerably. This provides an unreliable habitat. Relief channels look unattractive in times of low flow, when vast expanses of concrete and gabions are exposed.

#### → Activities

- 1 Study Figure 11.47.
  - a) List the social, economic and environmental benefits of embankments.
  - b) Consider the social, economic and environmental benefits and costs of embankments. In each case, do you think the cost or the benefit is greater?
- 2 Imagine you live in an area prone to flooding and the council is considering two proposals. One is to embank the river. The other is to build a relief channel.
  - a) What four questions would you raise at the council meeting?
  - b) Which proposal are you more likely to favour, and why?