

## 1 Temporary Flood Barriers

### What are they?

These are lightweight barriers that can be moved to areas to prevent flooding.



### How do they work?

They physically stop the flood water flowing into an area as they raise the level of the surrounding river bank.

### What are the advantages?

- They can be moved to where there is most risk of flooding.
- They are simple to use.
- Very effective at stopping properties being flooded in the short term.
- Easy to install.
- Very little impact on the environment.

### What are the disadvantages?

- The flood warning systems need to be monitored constantly so the barriers can be deployed in time.
- Barriers need to be transported to where they are needed and then assembled.
- A pump run on diesel may be needed to move water away.
- When not in use the barriers need to be stored somewhere.
- The water may come over the top if the flood is too high.
- The steel parts of the barriers can be re-used, but the plastic parts of the barriers are only used once.
- Not a long-term flood management system.

### How much will they cost?

£500 each barrier, a barrier is 3m in length and 1.5m high.



## 2 Permanent flood barriers

### What is it?

Building of permanent concrete/steel/brick structures in the town centre to prevent water flooding homes and businesses when the river levels get high.

### How does it work?

These walls prevent water from the river going into people's homes and business properties. Often with these structures pumps are also needed to remove water from the property side of the barrier.



### What are the advantages?

- Very effective at protecting property from flooding.

### What are the disadvantages?

- Very expensive.
- Environmentally damaging. The natural environment along the river bank is built on, so habitats are lost and wildlife is negatively impacted.
- Unattractive and block people's view of the river.
- Need to be maintained.
- Takes many months, even years to plan and build.

### How much will they cost?

£8 million per 500m of river bank.



### 3 Create inland flood storage areas in fields

#### What is it?

These are large areas of open-fields, alongside rivers, upstream of the town. These are called floodplains and are naturally low-lying areas of land.



#### How does it work?

When the river levels are high, water spills out over the river banks and into the flood storage area next to the river. Embankments, usually made of clay are built around the edge of the area, so that water can be stored on the land. Some embankments may be made of steel or concrete. There is a gate in the embankment that can be opened to release the water back into the river once the river water level has dropped.

#### What are the advantages?

- Large impact on reducing the flooding in a town downstream.
- Improves water quality.
- Once built, more habitats will be available for wildlife.
- A nature based solution.

#### What are the disadvantages?

- Farmers might lose money if they use the land to grow crops or graze animals.
- Requires large areas of land.
- Diggers which need fuel will be needed to build the flood storage area.
- Takes many months to plan and create the flood storage areas.

#### How much will they cost?

£500,000 per field, there are 14 fields surrounding Stemville.



## 4 Dredging the rivers

### What is it?

A machine digs out any extra sand and silt that has collected in the bottom of the river.

### How does it work?

It removes extra silt and sand which makes the river deeper, so it can hold more water. This means that the river will be less likely to flood the surrounding area.



### What are the advantages?

- In the right circumstances can be very effective at reducing flooding.

### What are the disadvantages?

- Damages the environment, particularly habitats and wildlife in the river.
- This method does not work for most rivers because the sand and silt removed would quickly be replaced so it does not solve the flooding problem in the long term.
- Heavy machinery is required which needs fuel to be operated.
- Has a negative affect on the water quality as the silt gets mixed with the river water.
- This is not a sustainable long-term solution as the machines will be needed to re-dredge the river in the future.

### How much will they cost?

£500,000 per river. There are 3 rivers surrounding Stemville, but only the river Leawell is suitable for dredging.



## 5 Property level protection including flood resistant front doors for houses and businesses

### What is it?

A metal flood barrier that is put on the outside of house and business doors.



### How does it work?

It works like a moveable barrier, it physically stops the water from entering the property.

### What are the advantages?

- Easy to install
- Once the town is flooded it helps to stop the water getting into buildings and causing damage.
- Has no impact on the environment.

### What are the disadvantages?

- Although these are effective at stopping water entering a property they are not attractive to look at.
- Prevents a property from being damaged but does not stop a town flooding.
- Relies on property owners to put the measures in place when needed.

### How much will they cost?

£1,000 per building. There are 6,000 buildings in Stemville, but only 1,000 have been flooded in the last 5 years.



## 6 Install permeable pavements

### What is it?

These are special pavement and road surfaces with gaps in.



### How does it work?

When it rains or floods, the water can soak through the surface of the pavement or road and into the ground, whereas water on normal roads and pavements will collect on the surface so it is more likely to flood.

### What are the advantages?

- Recycled materials are used to make permeable pavements, which is good for the environment.
- As the water seeps through, ice does not form as easily on them in winter.
- Reduces the problems of surface water flooding in heavy rain.

### What are the disadvantages?

- It is expensive to install.
- Does not last as long as normal road surfaces.
- Need regular maintenance.
- It will not stop a river flooding, but it does reduce surface water flooding after heavy rain.

### How much will they cost?

£3 million to replace all the pavements Stemville.



## 7 Beaver Reintroduction Scheme

### What is it?

A family of beavers are re-introduced to one of the local rivers.



### How does it work?

A family of beavers is introduced to the local river, in a fenced off area. Beavers burrow, fell trees and create dams which helps store, spread and slow the flow of water. This can reduce flooding downstream.

### What are the advantages?

- Reduces flooding
- An eco-tourist attraction which may bring money into the local economy.
- Creates more wetland habitat that benefits other wildlife such as birds.
- Improves the quality of the water as the dams remove sediment.
- A nature-based solution.
- This is a sustainable solution because once the beavers are in place few resources will be needed for maintenance.

### What are the disadvantages?

- A lot of open space is needed around the beavers to allow the river to change.
- Can only be introduced away from the town.
- Can only be introduced in streams, not large rivers.
- One beaver colony does not have a big impact on reducing the amount of flooding on its own. Needs to be used with other measures.
- Many months of planning and preparation needs to take place before beavers can be introduced to an area. It takes a few years of beaver activity before a reduction in flooding is seen downstream.

### How much will they cost?

£0.5 million, for the reintroduction scheme. Only streams that feed into the river Crane are suitable habitats for beavers.



## 8 Planting trees on the steep slopes on the west side of the town

### What is it?

Planting of trees on the steep hills on the west side of the town.



### How does it work?

Trees planted on a slope will slow the flow of water down a hill and into a town when it rains.

### What are the advantages?

- After several years, flooding in the town will be reduced.
- Improves habitat for wildlife.
- Creates a better place for local people and visitors to enjoy.
- Once planted not much maintenance is needed.
- A nature-based, sustainable solution which is environmentally friendly.

### What are the disadvantages?

- Trees take a long time to grow.
- Young trees need to be protected by plastic covers which are unattractive and not environmentally friendly.

### How much will they cost?

£6000 per acre (a measure of land), the hill by the town is 2000 acres in size.

