

reducing the risk of flooding



A guide to our
flood defence schemes in York

We are the Environment Agency. It's our job to look after your environment and make it **a better place** – for you, and for future generations.

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February 2009

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Flooding is a natural occurrence. we can't always stop flooding but we can help to prevent it.

We aim to reduce the risk of flooding by managing land, rivers, coastal systems and flood defences.

While we do everything we can to reduce the chance of flooding, it is a natural process and can never be completely eliminated.

reducing the risk

During a flood, we issue flood warnings. We also control our systems such as flood gates and barriers and we clear obstructions that may cause hazards.

We use the latest technology to monitor river levels, rainfall, tides and sea conditions, 24 hours a day, 365 days a year. We regularly check our flood defences to make sure:

- that they are in good order
- the river channels have adequate capacity and pumping stations, flood control gates and tidal barriers are fully operational if a flood happens.

What is the ‘normal’ level of water in York?

The normal water level (sometimes called the normal summer water level) in York is established at 5 metres Above Ordinance Datum (AOD). Ordinance Datum is the internationally recognised standard value for sea level.

There is a famous gauge board at Ouse Bridge that shows the height that recent major floods have reached. It is calibrated in feet and inches, with zero set at normal water level.



York's historic legacy

The first settlement was probably established on this site due to its ideal position on the River Ouse, between the upstream tidal limit and the furthest downstream fordable point. In other words, the best place both to cross and navigate the river.

York sits on the confluence of the River Ouse and its tributary, the River Foss. The interaction of the two rivers, with the significant amount of rainfall the catchment attracts, combined with the melting of accumulated hill snow from the Pennines, makes the city particularly susceptible to flooding.

Historical research has shown that the force of the rivers overflowing has been a serious concern to the citizens of York for many centuries.

Historical records:

1263 – Flood water rampages down North Street as far as the junction of Bridge Street and Ouse Bridge.

1316 – Floods hold York Castle to siege, washing away essential earthworks.

1564 – An ice jam, caused by huge chunks of thawing ice borne upon flooding waters, smashing away parts of the Ouse Bridge.

1625 and 1638 – Highest flood in York ever to be recorded.

More recently there was serious flooding in 1947, 1978, 1991 and 1995. However, 2000 saw the worst flood on record for that century. The River Ouse rose to an astonishing 5.50 metres above its normal level, flooded 540 properties and put a further 320 seriously at risk. 18,700 hectares of agricultural land around York was also affected. For the next three days, the commercial and industrial life of the city was virtually brought to a standstill. When the waters subsided, the damage at that time was estimated at well over £2 million.



a unique York

Due to the complex geography of the area, York is at risk from a variety of sources. This has called for a coordinated and innovative approach to controlling floods.

Following the flood of 1978, a series of flood defence improvements were initiated and since 1979, work on defending York from the destructive force of flooding has continued. A number of separate, yet coordinated schemes in the city have now been implemented at a cost of around £10 million.

The flood defences for York include a number of local flood barriers to help prevent direct flooding from the Ouse and Foss. These are combined with arrangements to pump internal flows from sewage systems and internal watercourses, to prevent pollution.

Work has also been carried out to improve and use the upstream storage washlands, such as Clifton Ings in order to reduce the frequency and extent of flooding in the city. Steps have also been taken to protect fresh water treatment plants.



the River Foss

The River Foss is a large tributary which flows through York, joining the River Ouse just downstream from Clifford's Tower.

Because of the delicate relationship between these two rivers, rising water in the Ouse can often result in a dangerous reaction in the Foss. A rapid increase in the volume of water in the Ouse would force the Foss back on itself, causing it to overtop its banks and flood surrounding properties. It was this dramatic effect that contributed to the severity of the floods in 1947, 1978 and 1982. A solution for the Foss had to be found.



the solution

Many conventional flood control systems, such as channel improvements or bypass channels were inappropriate because of the nature of the flooding on the Foss. A more inventive method of defence was needed.

This came in the form of a moveable barrier system - a large 'turn and lift gate' which when in place, effectively isolates the Foss from the Ouse, stopping water from surging back upstream. Because this would also prevent water naturally flowing from the Foss into the Ouse, a system of high volume pumps were installed. When the barrier is lowered, the optimum level of water in the Foss is maintained by pumping water around the barrier, directly into the Ouse.

A flood wall was also built between the pumping station and the higher ground at Skeldergate Bridge, helping to keep the Foss and the Ouse separate and protecting the access road that leads to the pumping station.

Another important factor was that the site is close to the city centre and this needed to be taken into consideration. Consequently, special attention was paid to the visual impact of the structure. Natural materials such as sandstone were combined with glass to allow the barrier to blend into its surroundings.

The design of the barrier and adjacent flood walls replicate the architecture of the city's famous buildings and walls.

The scheme has received several awards by organisations including the Institute of Civil Engineers and the Brick Development Association. In 1986/7, the total cost of the barrier and associated defences was £3.34 million.

Foss Barrier

How does it work?

The barrier is a turnover lift gate weighing 16.5 tonnes. It is held horizontally above the river when not in use. This allows boats and barges to pass underneath and enables regular and efficient maintenance.

When the River Ouse reaches 7.4 metres Above Ordinance Datum (AOD), the duty officer for the barrier is alerted.

As soon as the River Ouse reaches 7.8 metres AOD, the barrier is lowered. Highly visible and audible alarms are activated to warn any boats. We run the pumps for a few minutes to clear any rubbish and silt from the riverbed so that the barrier is a watertight fit. The electrically driven barrier is then lowered, which takes about four minutes.

Once the barrier is in place, the flow from the River Foss is transferred around the barrier and into the Ouse by up to eight pumps. These pumps automatically maintain the water level of the Foss at around 6.5 metres AOD and are capable of pumping 30 tonnes of water per second.

When the flood subsides and the level of the Ouse drops to 6.5 metres AOD, the levels on either side are equalised. We send out another warning before the gate is opened and shut the pumps down.



variety of solutions

Not every flood defence in York is as prominent as the Foss Barrier, but they all follow the same basic principles - to provide effective flood protection in keeping with the local surroundings.

1 North Street

The North Street area contains many shops and a number of commercial properties. An increase in the water level of the River Ouse can be extreme, flooding homes and businesses.

In 1992/3 a series of flood gates and walls were constructed to protect this important area. Also included in the scheme is a main trunk sewer which can be isolated and pumped. In keeping with the surrounding area, the defence has been cleverly minimised by the architectural landscaping of the pumping station and its location in a secluded corner of the gardens. Flood walls have been placed alongside the road leaving the riverside views unaffected.

2 Lower Ebor Street

This area of the nineteenth century housing was badly flooded in 1978. Work had already begun to protect the area when it flooded again in 1982. Since then, a combination of concrete flood walls with steel trench sheeting have been constructed, as well as earth embankments. Valves have been installed to isolate the sewage system incorporating a small pump to evacuate sewage when river levels are too high.

3 Holgate Beck

In order to prevent flooding in the Acomb area of the city, and near the racecourse, upstream tributaries of Holgate Beck were diverted to discharge flow directly into the Ouse downstream of York. Upstream of York, where Holgate Beck joins the Ouse, a two pump station was built to control water levels.

4 Lower Bootham

Regular flooding from the River Ouse and the resulting overflowing sewers had caused some concern in this residential area. The flood of 1982 caused £1.2 million worth of damage to 134 properties here.

The flood alleviation scheme was initiated in Lower Bootham in 1983. It comprises a 650 metre earth floodbank, combined with a 280 metre reinforced concrete wall, providing a defence 460 millimetres higher than the highest floodwaters of 1982.

In addition, the local sewage network has been modified and isolated at three key points, allowing sewage to be pumped during times of high water levels.

This scheme received an award from the Institute of Civil Engineers for its outstanding excellence in concept, design and execution.

5 Acomb Landing

Based here is the water treatment works that supplies fresh drinking water to York. It is vital to the city that this site remains free from flood contamination and avoids structural damage.

After the 1982 flood, a reinforced retaining wall was added to the existing embankments, significantly raising the level of protection.

6 Clifton Ings

This is a natural flood plain upstream of York which can store 2.3 million cubic metres of water, lowering the peak flood level in the city by 150 millimetres.

In 1982, at a cost of £1.25 million, the existing flood banks were raised and new embankments constructed to provide greater storage. Sluice controls for letting flood water in and out of Clifton Ings were put into operation.

This system is extremely effective for medium order floods of up to 4.27 metres AOD. For higher order flooding, the site is designed to let the banks overtop allowing the full capacity of the site to be used.



YORK CITY CENTRE



7 Leeman Road

The Leeman Road area of York consists primarily of nineteenth century ex-railway workers' houses. It was extremely prone to flooding from both the River Ouse and the adjacent Holgate Beck. In 1978, 225 houses were seriously flooded.

In 1980 a flood bank was constructed in front of the houses to protect them from flood water. The sewage system was also improved drastically, allowing sewage to be pumped when the river levels were high.

During the 1982 flood, high winds blowing over Clifton Ings generated large waves which overtopped the Leeman Road defences. The flood bank was raised in response to this effect.



If you would like to know more about the Foss Barrier please contact the Foss Barrier on **01904 642264**

If you would like to know more about flooding please visit **www.environment-agency.gov.uk/flood**

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