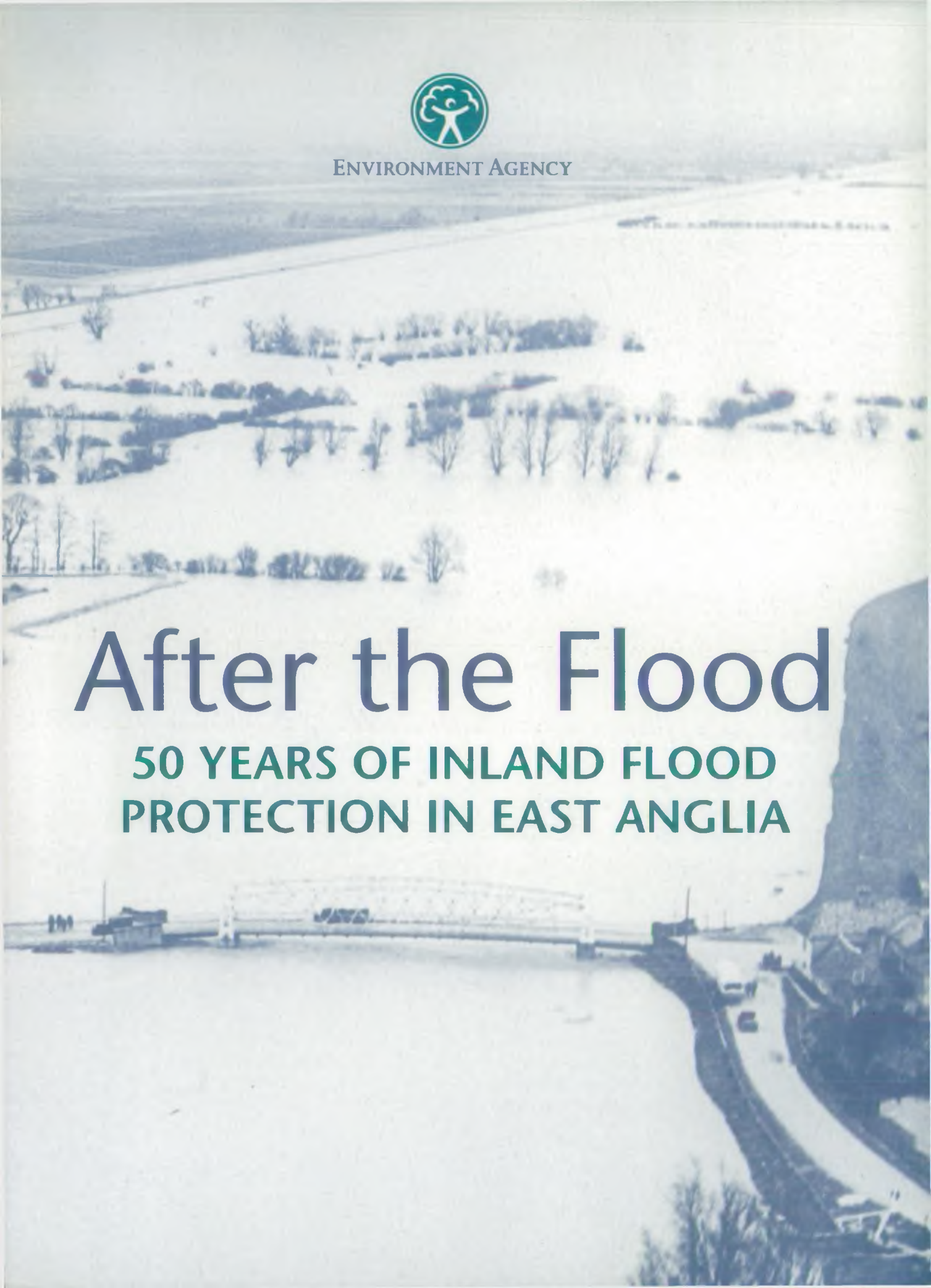

ENVIRONMENT AGENCY

After the Flood

50 YEARS OF INLAND FLOOD PROTECTION IN EAST ANGLIA

Marooned - supplies arrive by boat for a trapped smallholder

INTRODUCTION

Today the threat of flooding from the region's rivers is a constant reminder of the vulnerable nature of large areas of the eastern counties of England. Huge tracts of rich agricultural land lie below the level of local rivers and drainage channels; scattered farms and small riverside towns and communities nestle alongside numerous waterways. All of them rely on an extensive network of flood protection schemes and the constant vigilance of river engineers to remain safe and dry.

Over 50 years ago the banks which form the main defence against flooding were battered by some of the most savage weather conditions ever seen in the eastern counties. By early March 1947 rivers throughout the area from the Humber to the Thames were full to the brim, running higher than ever before. Despite the massive amount of

Front Cover: Earith Suspension Bridge and 100 Foot Washes, March 1947

THE FLOOD

It began towards the middle of March with the ending of the coldest, hardest, wettest and worst winter in living memory and resulted from an unusual combination of weather conditions.

For about six weeks there had been severe penetrating frost and frequent heavy snow. The ground was frozen to a depth of half a metre and snow had drifted more than two metres deep. The harsh weather meant the snow was unable to melt slowly into the ground and feed away into the rivers.

Destruction - a house is demolished by floodwater

water most of the banks withstood the onslaught, held the floodwater at bay and ensured that it flowed into the sea without causing any serious damage on the way.

But in the lowlands of the Great Ouse, Welland and Nene the pressure proved too much. Water flowed over the top of the banks, tore huge breaches in them and drowned nearly 250 square kilometres of the Fens under as much as two metres of water. Hundreds of families were made homeless, property was damaged and thousands of sheep, cattle, pigs and poultry were swept away. Miraculously no one was killed.

It was the worst freshwater flooding to hit the area in over 100 years. For more than two weeks there was a constant battle, by day and by night, to protect lives, land and homes from the swirling waters that kept tugging mercilessly at the defences.

Above: Gone - a roadway torn away

Main picture: Soldiers close Over breach with Neptunes and bags of clay

A sudden rapid thaw set in on 10 March and the following day heavy rain swept the area. The combination of melting snow and rain amounted to four and a half inches of rain - the equivalent of a heavy thunderstorm continuing unabated for 24 hours! The water ran off the frozen ground, pouring into the rivers which rose at a ferocious rate.

By Friday 14 March flood patrols were on full alert and work was well underway to sandbag points where the water was beginning to attack the tops of river banks. The following day floods engulfed 500 homes, shops and offices in Bedford and the Ouse Valley. Downstream in the Fens more and more gangs of men worked feverishly to bolster vulnerable banks.

The water continued to rise and was soon running up to two metres above normal. It lapped over the river banks, scoured across flood plains and rose relentlessly as it left the higher ground inland for the bowl of the Fens. Throughout Saturday - 15 March - the situation deteriorated rapidly. Reports of flooding and threats of imminent breaching of banks were pouring in. The battle was on.

Repair attempts were hampered by the height of the water. Tugs and barges carrying clay to reinforce the banks were unable to get under the numerous bridges. Some barges were ballasted so low in the water they foundered and sank. By the end of the flood up to 18 barges and three steam dredgers were lost.

Waves of water (foreground) smash against the remaining defences

Top: Structures could not cope with the amount of water

Above: Emergency bank repairs went on throughout the bleak, cold nights

Sunday 16 March heralded the arrival of hurricane force winds. They built up throughout the day making the foul working conditions even more horrendous. By the early evening the wind, blowing at 70 mph and gusting up to 98 mph, was so violent it brought operations to a standstill. Driving rain and bitter cold tore into the men toiling on the banks, the savage gale whipping up huge waves of water, lashing them into the banks and sending icy spray more than 10 metres in the air. The men, sliding around in a sea of mud and clay, were blown off their feet and the rescue operation was plunged into darkness as hurricane lamps could not be kept alight. Sandbags being used to seal the breaches were snatched away by the force of the raging water and wind. It was too dangerous to continue.

Throughout the fens trees were uprooted and flung across roads, smashing down telegraph poles and hampering the transport of men and materials. Communications collapsed into chaos as telephone lines were broken and more than 30 telephone exchanges were put out of action by flood and gale.

In their low lying homes people gathered up their belongings and either moved upstairs or headed to higher ground. Wherever the flood posed a serious threat, evacuation was organised.

In the teeth of the howling wind the most serious breach of the floods occurred - at Over near Cambridge. The banks 'blew' and the torrent burst into the fen, deepening and spreading devastation as far as the eye could see.

The following day - Monday 17 March - the gale continued to harry the defences and the repair work. In a growing number of places water overtopped the banks undermining the strengthening and repair work which had been carried out by the 1,000 river men, volunteers and German prisoners of war. Reports of sunken barges, of others swept through breaches on to the fen and missing tugs heightened anxieties for the safety of workers and concerns over delays in getting repair materials. The arrival of the first detachments of troops coincided with news of further serious breaches and deepening flooding.

Above: Flooding hit many towns and villages near rivers but most escaped the full fury

Below: The road to nowhere - numerous roads were impassable for days

Bottom: Ready to be sunk - redundant Neptunes prepare for their last 'action'

With the frost loosening its grip on the earth banks and the massive weight of water in the rivers and channels, some sections of banks began to lose their stability. Small leaks grew larger and where water overflowed it began attacking the banks from the rear, undermining them. Working conditions were atrocious and many of the men were physically and mentally exhausted from the back breaking work. The soldiers provided renewed spirit and efficiency and, with the engineers, superintendents and foremen, set about tackling the worst incidents.

Vast quantities of water continued to pour through the breached banks into the flooded fens most of which were now under more than two metres of water. This lowered the levels in some rivers, but not all, and the threat continued unabated.

Desperate efforts were being made to prevent a major breach at Southery but at the end of the week- Saturday 22 March - in a vicious gale the defences were blown. To compound the misery, the breach at Over was still haemorrhaging millions of litres of water.

The battle of the banks continued day and night without respite. Mobile canteens ferried up to 1,000 meals a day to workers and food was taken by boat to the more inaccessible sites where gangs were working in cruel weather conditions and isolation.

On Monday 24 March the Over breach was 'plugged' with a string of Neptunes - 18 ton amphibious load carriers which had been discovered parked and redundant in railway sidings at Bluntisham, awaiting disposal as war surplus. These were driven into the 50 metre gap, surrounded with tank track panels and covered with tarpaulins and sandbags. The task of pumping out and reclaiming 12,000 hectares of flooded land could begin.

It took another 10 days - until Thursday 4 April - to staunch the breach at Southery with a huge brushwood and willow mattress and tons of clay. Throughout the whole of this period severe gales, rain and sleet showers hampered operations and kept increasing the threat of further breaks in the banks. But the constant repair efforts were paying off. Banks held, breaches were repaired and flood waters contained.

On 9 April the gale force winds began to decrease, the flood waters started to subside and the danger passed.

FLOOD STATISTICS

During the rescue and repair operation 126 barges were used to transport materials, mainly 11,000 tonnes of loose and bagged clay. They were towed to the sites by a fleet of six tugs. About 700 lorries - mostly three ton tipper vehicles - were involved in the operation, some of which had to be commandeered from as far afield as Ipswich, Norwich and Chelmsford. They carried over 4,000 tonnes of clay.

About 550,000 sandbags were used in addition to those provided by the Army. The largest quantity - 100,000 - was issued on Tuesday 18 March. One Catchment Board stores also issued 430 lanterns, nearly 500 shovels and 800 tarpaulins during the main flood period.

More than 200 large pumps - including 17 brought from Holland - were used to pump out the flooded areas.

COULD IT HAPPEN AGAIN?

Although a combination of freak weather conditions - frozen ground, heavy snow, rapid thaw, torrential rain and hurricane force winds - was the prime cause of the floods there were four other contributing factors:

Frozen structures - the water at river and channel structures, locks and sluices froze so hard that it was impossible to operate them to regulate the flow of water.

Blocked structures - when the rapid thaw occurred massive amounts of debris were sucked into the river structures. Straw, trees, vegetation, and silt packed the locks and sluices reducing the flow and causing the water to ' back up' and break out of the banks.

Channel capacity - the most serious problem was the lack of adequate capacity in the rivers. This was a legacy of the drainage policy which had been adopted for many years of trying to get flood water off agricultural land and into the rivers and away as quickly as possible. With efforts focused on speeding the run off, insufficient attention had been paid to making sure the rivers, channels and structures were able to cope with volume and rapid build up of the water. Because the rivers were relatively shallow they were unable to handle the massive onslaught in 1947 when flows were more than twice those of any flood recorded previously or since.

Main pic: Many waterside properties were severely damaged

Inset Below Left: Floodwater flows passed a frozen lock

Inset Below Right: To the rescue - wading to safety with a few belongings

Under investment - during the war years the banks, pumping stations, sluices and gates had done their job of conveying water safely from the productive farm land to the sea. Now, however, there was a desperate need for new investment to stop banks leaking, to repair worn out pumps and to replace diesel engines and hand gears with reliable diesel/electric automated systems.

Although the whole of the eastern counties and much of England suffered from similar under investment and weather in 1947, it was in the Fens that the water found the weak spots in the banks and defences. Elsewhere rivers managed to cope - but only just - with minor isolated flooding in many towns and villages and in cities such as Lincoln and Norwich. Ipswich was the only area in the region outside the Fens to suffer any significant flooding with over one hundred homes and properties affected.

Above: Huge pumps sucked away the floodwaters reclaiming the drowned fields

Below: Major dredging and bank regrading took place on rivers throughout the region

AFTER THE FLOODS

Once the rescue and recovery operation was completed the flood fighters turned their attention to deciding on the ways in which they could try to stop it happening again.

The answer involved radical rethinking of the policies which had existed for the earlier part of the century. The emphasis moved from simply getting the water off the land and into the sea to more comprehensive and structured programmes of flood protection and flood alleviation schemes.

To increase the carrying capacity of the rivers and channels substantial dredging was undertaken together with an extensive programme of refurbishing and rebuilding the gates, sluices and banks. This was later followed by a major investment in electrical pumps to replace diesels and automatically controlled electric motors to replace hand operated sluices. High technology monitoring systems were installed to give improved and speedier information about river conditions.

The Environment Agency (formerly the National Rivers Authority) is responsible for providing flood protection, building and maintaining flood defences. In the intervening years three massive schemes dominated extensive programmes to improve inland flood protection throughout the region:

- **the £10.5 million Great Ouse Flood Protection Scheme, the largest post-war drainage project to be undertaken in Britain, which would cost about £100 million today. Taking 15 years to complete it involved excavating about 10 million cubic metres of earth to build an 18 kilometres relief channel from Denver in Norfolk to the tidal river at King's Lynn; widening and deepening the Ten Mile or Ely Ouse River; and providing a major relief channel running 48 kilometres from Denver to Barton Mills in Suffolk;**

- **a 10 year improvement scheme on the River Welland which involved wide ranging improvements throughout the length of the river from the outfall to Stamford, and later as far as Market Harborough, including widening, regrading and raising floodbanks; the building of the Coronation Channel to divert main flows away from the flood bottleneck of Spalding and the creation of large new channels to ease flows in key areas;**

Top: New channels and cuts were dug to better handle flows

Above: New control structures are key features of many flood alleviation schemes

Below: Huge construction projects help to strengthen flood barrier banks

- **a £20 million project to heighten, strengthen and improve more than 60 kilometres of flood barrier banks along the Ouse Washes, a vital 'safety valve' of washlands and one of the leading wetland habitats in Europe.**

These multi-million pound projects have been augmented by substantial investment in new or refurbished flood defences for many other inland towns and cities in the eastern counties such as:

Lincoln; Norwich; Buckingham: Leighton Buzzard; Bury St Edmunds; Northampton; Ipswich; Bedford; Newport Pagnell; St Ives; Stamford; Market Harborough; Wellingborough; Kettering; Colchester; Stowmarket.

Such capital schemes are supported by extensive annual maintenance programmes. Over 1355 kilometres of tidal, estuary and sea defences, 848 sluices and locks and 44 pumping stations have to be regularly maintained and monitored to make sure water flows safely to the sea. Computers, the electronic monitoring of river levels and the automatic operation of gates and sluices play an increasingly important role in this aspect of the operation.

Within the Region the Environment Agency works closely with 120 Internal Drainage Boards which cover 60 square kilometres of the lowest lying land. The Boards are collectively responsible for the operation of 380 pumping stations and maintenance of over 10,000 kilometres of channels which drain into the Agency's major rivers.

THE CONSTANT THREAT

The task of the Environment Agency, through the five local flood defence committees in the region, is to reduce the risk to people, property and the natural environment of flooding by rivers and the sea. This is a major priority in a region where nearly 20 per cent of the area is below high tide level and slow moving rivers flow through hundreds of thousands of hectares of low lying land.

Fifty years after the 1947 Floods, the threat remains. Despite the substantial improvements which have been made to inland flood defences, a repeat of the same weather conditions could result in flooding on a similar or worse scale. Indeed flood forecasters say the devastation could be far more serious because of the amount of housing, commercial and industrial development which has taken place in the intervening years in areas prone to flooding.

To try to reduce the risk the Agency constantly promotes the need for concerted action to curb any development in floodplains - land immediately adjoining a river which acts as a natural overspill and storage area in times of flood. Since the 1960s pressure for development land in the fastest growing area of Britain has resulted in numerous homes, factories and offices being built in these vulnerable areas. The Agency has published its revised Policy and Practice for the Protection of Floodplains to coincide with the 50th anniversary of the 1947 floods. Copies are available from Agency offices.

Top: Massive investment in new and upgraded structures

Above: New for old - replacement of lock gates

Below: Essential control where river flows meet tidal waters

By working closely with local councils, responsible for planning and development matters, the Agency ensures that the flood protection implications of development plans and planning applications are fully considered. Councils are also urged to safeguard floodplains by protecting their natural role in allowing for the storage and free flow of flood water and by resisting any development which would jeopardise this.

For people who have to live with the threat of flooding the Agency takes the lead in issuing flood warnings. Predecessor organisations, with the police, rescue services and local authorities, have developed contingency plans for handling major flood emergencies. These plans are constantly updated and new technology provides sophisticated monitoring of weather conditions, rainfall and river flows. The Agency provides a 24 hour emergency flood warning and protection service in flood risk areas. One method of issuing warnings using up-to-date communications in some of the most vulnerable areas is direct telephone contact. Through this and other warning initiatives the Agency works to reduce the initial disruption caused by major flooding.

The threat of flooding means there is an on going need for improved public awareness and support for maintaining and improving defences. Work to heighten, strengthen and improve banks; to dredge and maintain channels; to upkeep, repair and where necessary, rebuild river structures, costs the region over £50 million a year.

The annual future cost for new and improved flood defences for inland protection from river flooding in the Anglian Region is estimated at about £15 million a year. In addition about £22 million is needed for protecting the coastal area of the region from sea and tidal flooding.

During the next 10 years [to the year 2007] nearly 150 inland flood protection projects are planned including:

Canvey Island and Tilbury in Essex; Houghton, St Ives, Offord in Cambridgshire; Market Rasen, Lincoln, Lower Witham and River Glen in Lincolnshire; Broadland, and Denver Sluice in Norfolk; the Ely/Ouse, the Ouse Washes, River Great Ouse and the River Nene.

Maintaining the system and providing flood warning is expected to cost another £13 million a year.

Possible global warming and climate change are expected to impact on the risk of flooding in the east of England. The nature and extent of any change has not been fully established but the indications are that any changes will increase the need for money to provide improved defences and more pumping plant to protect areas at risk.

Today the "battle of the banks" is still being fought, both physically and financially. A robust system of inland flood defence and the investment to make it happen are crucial to protecting life and property, alongside the need to curb development in floodplains. Without this many areas will continue to run the risk of a flood similar to 1947.

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FLOODING INFORMATION
Dial and listen for information and advice on flooding in your area

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For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

ENVIRONMENT AGENCY
GENERAL ENQUIRY LINE

0645 333 111

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

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0800 80 70 60

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