

THE LEIGH BARRIER

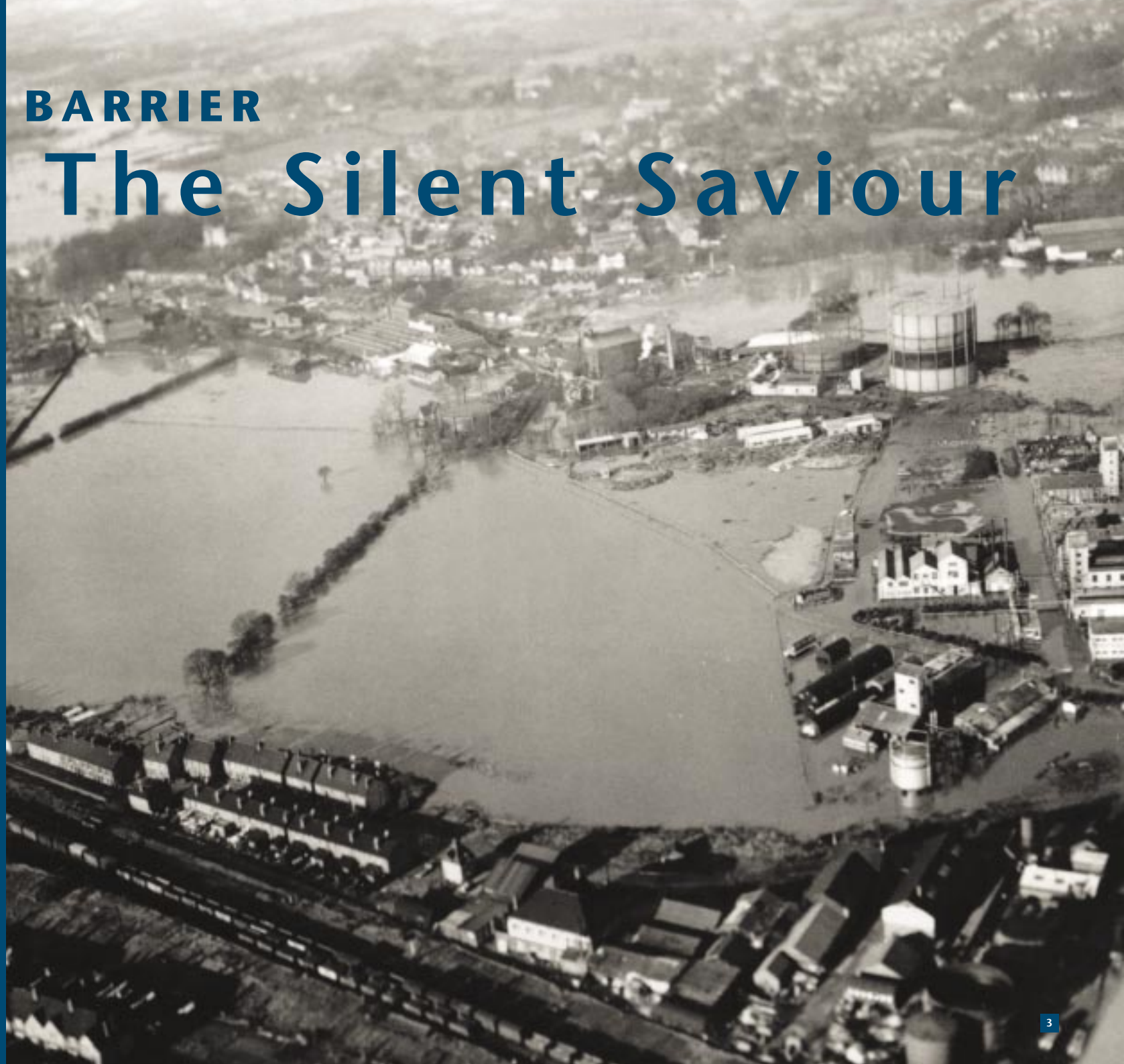
The Leigh Barrier has successfully reduced the water levels and averted flooding from the River Medway an average of twice a year since its construction in 1981.

The four million pound scheme to build the 1.3km dam wall and control gates has given a record breaking on-line storage capacity of 5,580,000 cubic metres (1,230 million gallons) is so effective in taming the floods that it often goes unnoticed. The silent saviour often holds back surplus water from the Medway Valley after heavy rain and stores it on the natural floodplain until the danger has passed.

The volume of water has only been so phenomenal as to reach the storage reservoir's capacity three times in its twenty year history, but the barrier faced its stiffest challenge ever in October 2000. The flow on the Medway at Leigh on an average autumn day is an impressive 20 cubic metres per second (the equivalent of about eighty bathfulls of water passing every second), but during the peak of the October event the flow was more than thirteen times that amount.

This booklet outlines the history and vital statistics of the structure and the way it handled its biggest challenge to date.

The Silent Saviour



History

The Leigh Barrier was built in 1981 to address a historical flooding problem on the Medway and Eden that threatened towns and villages on their course, such as Tonbridge, Hadlow and East Peckham. The worst flood in recent history hit in 1968 when people's belongings were seen floating down the streets of Tonbridge and the famous Hever Castle was under several feet of muddy water.

In 1974 a Mott MacDonald report recommended that a flood storage reservoir should be constructed immediately downstream of the point where the Rivers Eden and Medway meet. There was a very good justification for the cost as large numbers of properties in Tonbridge would otherwise be regularly damaged. In order to obtain the necessary powers to proceed with the construction, a Private Bill was promoted which resulted in the River



Medway (Flood Relief) Act 1976. This was a unique opportunity as there was an unpopulated valley upstream from Tonbridge where landowners were prepared to allow their land to flood periodically.

The River Medway is one of England's great rivers, flowing more than 100 kilometres from its source in Ashdown Forest, East Sussex to its mouth at Sheerness in Kent. Its name is derived from the Celtic Medu meaning mead or sweet water and its power was used in Roman times for forges to create iron from the deposits in the clays.

As the Medway flows eastwards across the Vale of Kent, the gradient reduces and collects tributaries (feeder streams) that rise in other parts of the High Weald including the rivers Eden, Bourne and Teise. The largest tributary, the Beult, rises near Ashford and joins the Medway at Yalding. The Wealden rivers respond rapidly to rainfall and are subject to extremes of flow between summer and winter.

The clay soils of the area drain rapidly and the spread of urban development has added to the river's 'flashy' nature. Historically the area has suffered from flooding of both property and agricultural land.

Left: The old sluice gates at Leigh
Right: Hever Castle under water



The Scheme



The principle of 'on line' flood storage is to use a sluice (large moveable gates) in an embankment across the valley of the river to throttle flows to an acceptable maximum downstream. This reduces flooding downstream and holds floodwater in six kilometres of the valley which is unoccupied.

The site selected for the storage reservoir was at Leigh about 3km (1.86 miles) upriver from Tonbridge and necessitated an embankment which was up to 5.7m (over 18 feet) high and a storage area of 278 hectares (1.1 square miles). The embankment is 1,300m long (0.8 of a mile) and crosses a number of awkward features including the Powder Mill Stream, the railway embankment, the Tonbridge Bypass Embankment, Redlands gravel plants, two silt lagoons and Hayesden Lake.

The sluice itself is of heavy reinforced concrete with the base slabs being 2m (6'6") thick in places and the external walls taper upwards from similar base dimensions. The overall size of the structure is approximately 30m x 40m (97'6" x 130') and included some 8,000 cubic metres of clay and other natural material, 3,500 cubic metres of concrete and 300 tonnes of reinforcement.

Above: The River Medway was diverted during the summer months while the gates were under construction

The gates of the sluice are unusual as they were designed to both lift and lower electrically due to the fact that there had been many reported problems with the more common type where the positive control is in just one direction. The gates are operated by a large screw on either side, measuring 80mm (3.25 inches) wide, each driven by a 3.0Kw motor fitted to operating platforms on the structure. There is a back up diesel generator and the gates can also be operated by hand as a last resort.

Under normal river conditions the gates do not impede the flow of the Medway in any way, but following heavy rain the river levels are monitored and if they reach a height that threatens flooding downstream then the barrier can control the flow. It does this by keeping water behind the barrier (impounding) and only allowing a proportion to continue its natural course towards Tonbridge. The water builds up behind the barrier depending on how much is entering the reservoir from the natural river flow and when the peak of the floodwater has passed the contained water is released in a controlled manner.

The river levels are monitored 24 hours a day electronically and can be remotely interrogated at fifteen minute intervals and compared to different events in order to predict the way that the river will behave and the way the barrier can help. Control calculations based on river levels and inflow data are carried in a computer in the control building on site and optimise the potential benefits of operation.

The barrier has been operated 40 times up until the end of the year 2000 and there have only been three floods that needed the maximum reduction that the scheme offers.

MAINTENANCE

The barrier has an annual maintenance programme costing in the region of £150,000 and is regularly inspected by an independent engineer where any recommended works are carried out at his or her behest. This ensures that the barrier is kept in excellent condition and ready for operation at any time and fully complies with the Reservoir Act 1975 that stipulates a high standard of maintenance for dam structures in the UK.

The independent engineer also visits following any event where the barrier is called into action.

Right: After - The Leigh Barrier in action



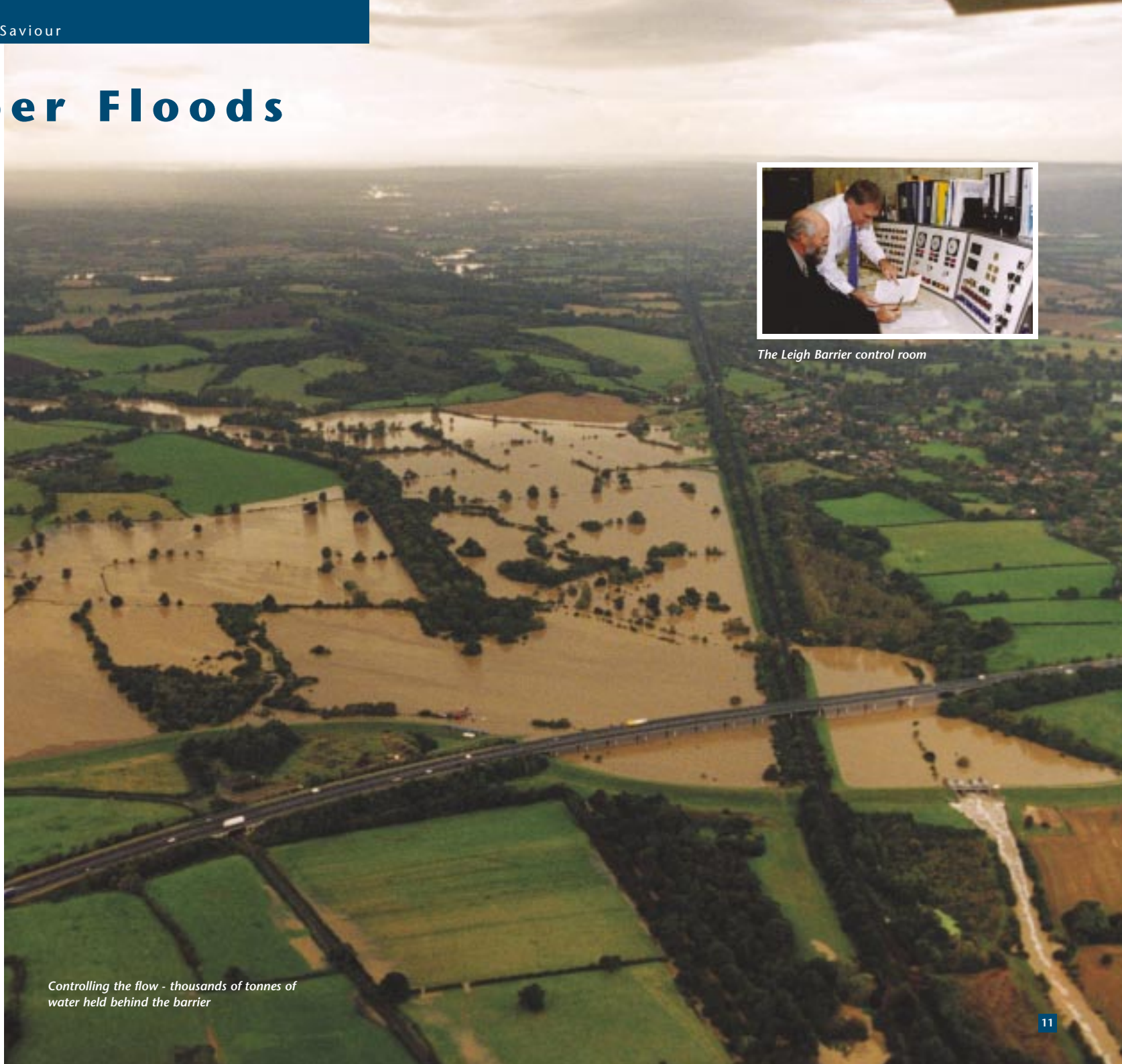
The October Floods

In October, 2000 torrential rain lashed the South of England, causing widespread flooding across Hampshire, Isle of Wight, Sussex and Kent. Towns such as Lewes in Sussex flooded for the first time in many decades due to the sheer volume of water and the Leigh Barrier faced its toughest challenge to date.

Between October 9 and October 12, up to 15cm (six inches) of rain fell in Kent and the barrier started to impound (take a percentage of the water from the swollen river) at 10.30 on the morning of October 12. Such was the flow of the Medway that the reservoir was nearing its full capacity by mid-afternoon while allowing the maximum safe amount of water to continue its course.

The reservoir is designed to ensure that if full design capacity is reached there is one metre of freeboard remaining between the highest water level and the top of the embankment.

In the flood of 1968 the maximum flow measured on the river was 225 cubic metres per second, but the effects of the torrential rainfall of October 2000 saw flows of over 260 rushing into the storage area. Over a sustained period of time the levels were rising by an amazing 3cm (1.2 inches) per minute on an area of 278 hectares (over a square mile).



The Leigh Barrier control room

Controlling the flow - thousands of tonnes of water held behind the barrier

The Agency engineers were faced with a very delicate balancing act of making sure that the volume of water allowed to pass through the gates did not overtop the defences in the town. If all the storage space behind the barrier was used up Tonbridge would have flooded. If too much water had been allowed through, Tonbridge would have flooded.

Precision in the control of flow protected over two hundred properties and businesses from possible ruin on the evening of Thursday October 12.

Prior to the event on October 12, the highest ever flow to reach the barrier was 144 cumecs (cubic metres per second) back in December 1982.

Rainfall figures in autumn 2000 were way above the long term average in Kent. September saw 90mm (3.5 inches) of rainfall when the average is 75mm (2.95 inches), October 250mm (9.75 inches) instead of 80mm (3.1 inches) and November 200mm (7.8 inches) instead of 84mm (3.3 inches). As a result of this the ground became so saturated that the rivers began to react very quickly to rainfall as water that

would have normally soaked into the ground ran off the land and into the watercourse.

The table below shows the rate of the river flows and how the barrier helped to control the water passing down the river towards Tonbridge. This benefited communities downstream along the whole of the Medway until it combines with two large fast flowing rivers – the Beult and the Teise near Yalding.

THE FUTURE

Following the floods of 2000 the full potential of the barrier to limit flooding in extreme conditions has been appreciated and will inform future operation. The structure worked extremely well and Agency defences downstream held fast in atrocious conditions, but it is recognised that whilst floods can be reduced they can never be prevented.

All the data and information gathered from the October storms will be explored by the Agency along with the best possible ways to protect communities in all of England and Wales from rivers and the sea.

Date of event	Peak flow at Leigh	Peak flow at Tonbridge
Oct 12-15	260 cumecs	150 cumecs
Halloween	190 cumecs	110 cumecs
Nov 5-7	200 cumecs	105 cumecs

NB – a cumec is a cubic metre of water is the equivalent of four bathfulls and weighs one tonne



October 2000 Tonbridge stays dry – a stark contrast to the devastation of 1968 (See page 2/3)

TECHNICAL DATA

Length of main embankment	1,300 metres
Maximum height of main embankment	5.7 metres
Volume of fill material	125,000 cubic metres
Volume of water at full capacity	5,580,000 cubic metres
Surface area of storage when full	278 hectares (686 acres)
Control structure type	Reinforced concrete structure with three screw driven radial gates and St Anthony Fall's type spillway. Structure founded on gravel with sheet pile cut-off walls.
Size of control structure	40m long x 44m wide x 14m deep
Size of radial gates	2 x 7m radius x 6.6m wide 1 x 7m radius x 9.1m wide
Weight of radial gates	2 x 12 tonnes, 1 x 17 tonnes
Bridge details	30m pre-stressed road bridge over Control structure 27m pre-stressed footbridge over river
Length of railway embankment protected	1,400m
Volume of fill in railway berms	82,000 cubic metres
Capacity of Leigh pumping station	1.43 cubic metres per second
Cost	£.3.6 million (1980 prices).

USEFUL NUMBERS

FLOODLINE 0845 988 1188

Quickdial numbers

River Medway and tributaries 01264
Rivers Teise and Beult 01265

e-mail so-floodwarning@environment-agency.gov.uk
Website www.environment-agency.gov.uk/flood



The flood warning system consists of the following codes, with the following meanings:



Flooding possible

Be aware!
Be prepared!
Watch out!



Flooding expected

affecting homes, businesses and main roads. Act now!



Severe flooding expected

Imminent danger to life and property. Act now!



All Clear

There are no **Flood Watches** or **Warnings** in force. Water levels receding. Check all is safe to return. Seek advice

Information You Can Act On

What you need to do during a flood will depend on local conditions but, here is some general advice to bear in mind when warnings are issued

Flood Watch

Flooding is possible, and the situation could worsen, so:

- Watch water levels
- Stay tuned to local radio or TV
- Ring Floodline on 0845 988 1188
- Make sure you have what you need to put your flood plan into action
- Alert your neighbours, particularly the elderly
- Check pets and livestock
- Reconsider travel plans

Flood Warning

Flooding is now expected, so put your floodplan into action: As with Flood Watch plus:

- Move pets, vehicles, food, valuables and other items to safety
- Put sandbags or floorboards in place
- Be prepared to turn off gas and electricity
- Be prepared to evacuate your home
- Protect yourself, your family and others that need your help

Severe Flood Warning

Severe flooding is now expected: As with Flood Warning plus:

- Be prepared to lose power supplies - gas, electricity, water, telephone
- Try to remain calm, and to reassure others - especially children
- Co-operate with emergency services and local authorities - you may be evacuated

SOUTHERN REGION ADDRESSES

REGIONAL OFFICE

Environment Agency
Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD
Tel: 01903 832 000
Fax: 01903 821 832

KENT AREA OFFICE

Environment Agency
Orchard House
Endeavour Park
London Road
Addington
West Malling
Kent ME19 5SH
Tel: 01732 875 587
Fax: 01732 875 057

SUSSEX AREA OFFICE

Environment Agency
Saxon House
Little High Street
Worthing
West Sussex
BN11 1DH
Tel: 01903 215 835
Fax: 01903 215 884

HAMPSHIRE AND ISLE OF WIGHT AREA OFFICE

Environment Agency
Wessex Business Park
Wessex Way
Colden Common
Winchester
Hampshire SO21 1WP
Tel: 01962 713 267
Fax: 01962 841 573

ISLE OF WIGHT

Tel: 01983 822 986
Fax: 01983 822 985



- Area Administrative Boundaries
- Regional Boundary
- Area Office
- ▲ Regional Headquarters

www.environment-agency.gov.uk

ENVIRONMENT AGENCY
GENERAL ENQUIRY LINE

0845 933 3111

ENVIRONMENT AGENCY
FLOODLINE

0845 988 1188

ENVIRONMENT AGENCY
EMERGENCY HOTLINE

0800 80 70 60



ENVIRONMENT
AGENCY



ENVIRONMENT
AGENCY

THE LEIGH BARRIER The Silent Saviour

THE LEIGH BARRIER

The Silent Saviour