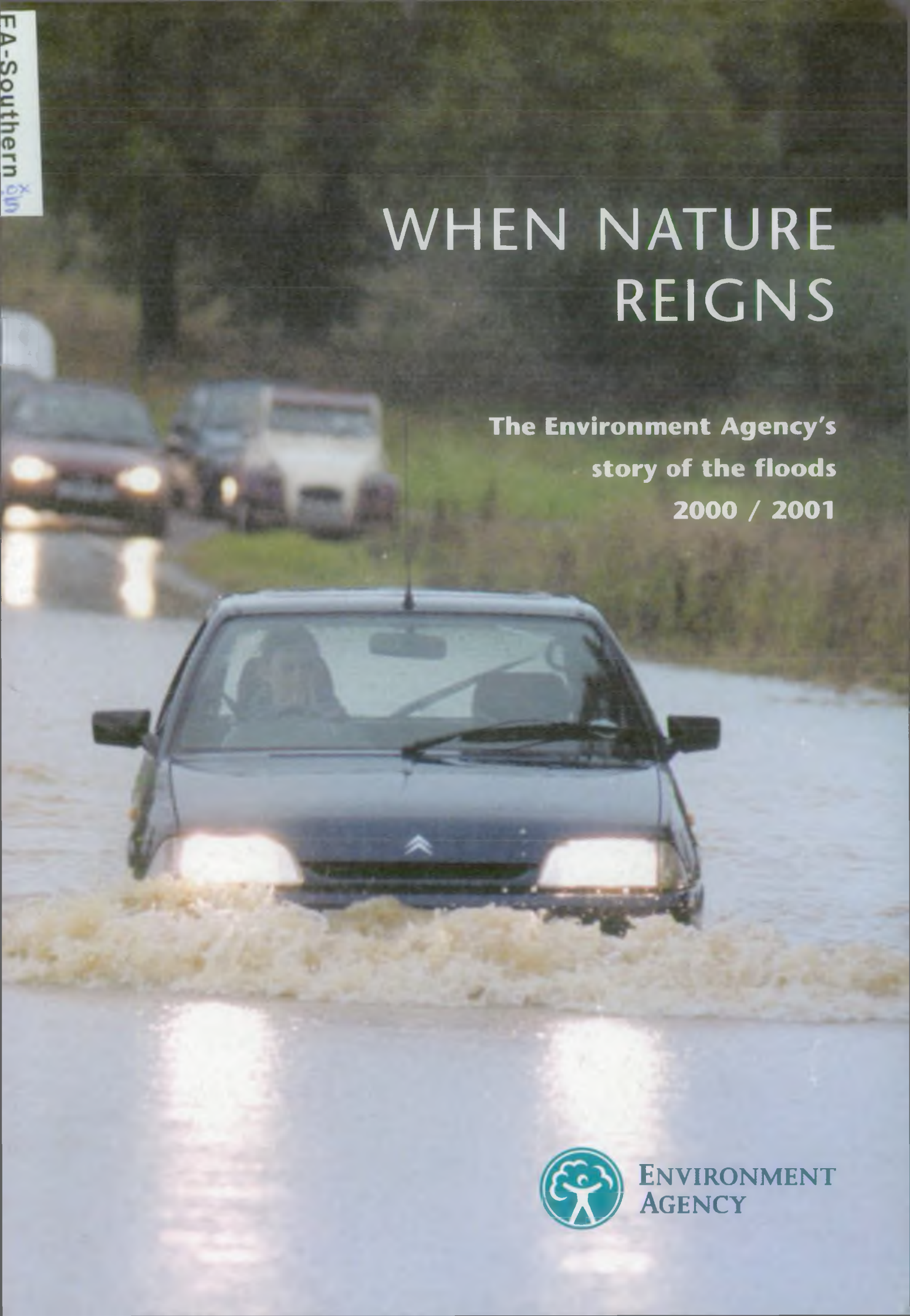


WHEN NATURE REIGNS

The Environment Agency's story of the floods 2000 / 2001

ENVIRONMENT AGENCY

David Jordan (centre) explains the situation to John Prescott.

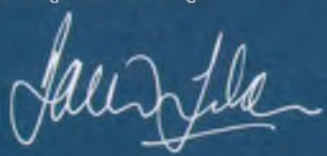
WELCOME

Welcome to the Environment Agency's perspective on the devastating flooding of 2000/2001. **When Nature Reigns** aims to explain through words and pictures the challenges facing the Agency while tackling one of the worst winters on record.

As Regional Director, I not only witnessed the damage that the floods inflicted on families and businesses across the South East, but also the way in which Environment Agency staff pulled together to minimise the impact of that relentless weather. Thanks to the expertise of the Flood Defence teams, not one of the structures we manage failed - but the sheer volume of water was too much for several of our river systems and banks were overtopped.

Since the introduction of the telemetry system that provides up to the minute information on river levels across Hampshire, Isle of Wight, Sussex and Kent, our Flood Warnings have become increasingly effective. Thousands of people received warnings directly to their homes and businesses, allowing them to take precautions as early as possible. Foundation work with our professional partners helped develop an understanding that was crucial in a crisis where every minute counts and I would like to acknowledge the professional work the emergency services did under pressure.

I hope that the pages of this book will reflect the magnitude of what happened and highlight the need for continued investment and vigilance. The Agency will certainly continue to evolve and face the challenges of sea level rise and other aspects of climate change and strive to provide us all with the right standard of defence against flooding.



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Written by Jo Warburton who handled over a thousand media calls during the floods, keeping the information flowing as the situation unfolded. She gave dozens of radio interviews - some in the middle of the night - in a bid to give the public as much warning as possible through the media route.

Designed by GSB Associates

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EA - Southern

FOREWORD

The wettest autumn and winter on record wreaked havoc on humanity and the environment alike in 2000/2001, saturating every inch of exposed soil in the south east and turning tranquil streams and rivers into raging torrents.

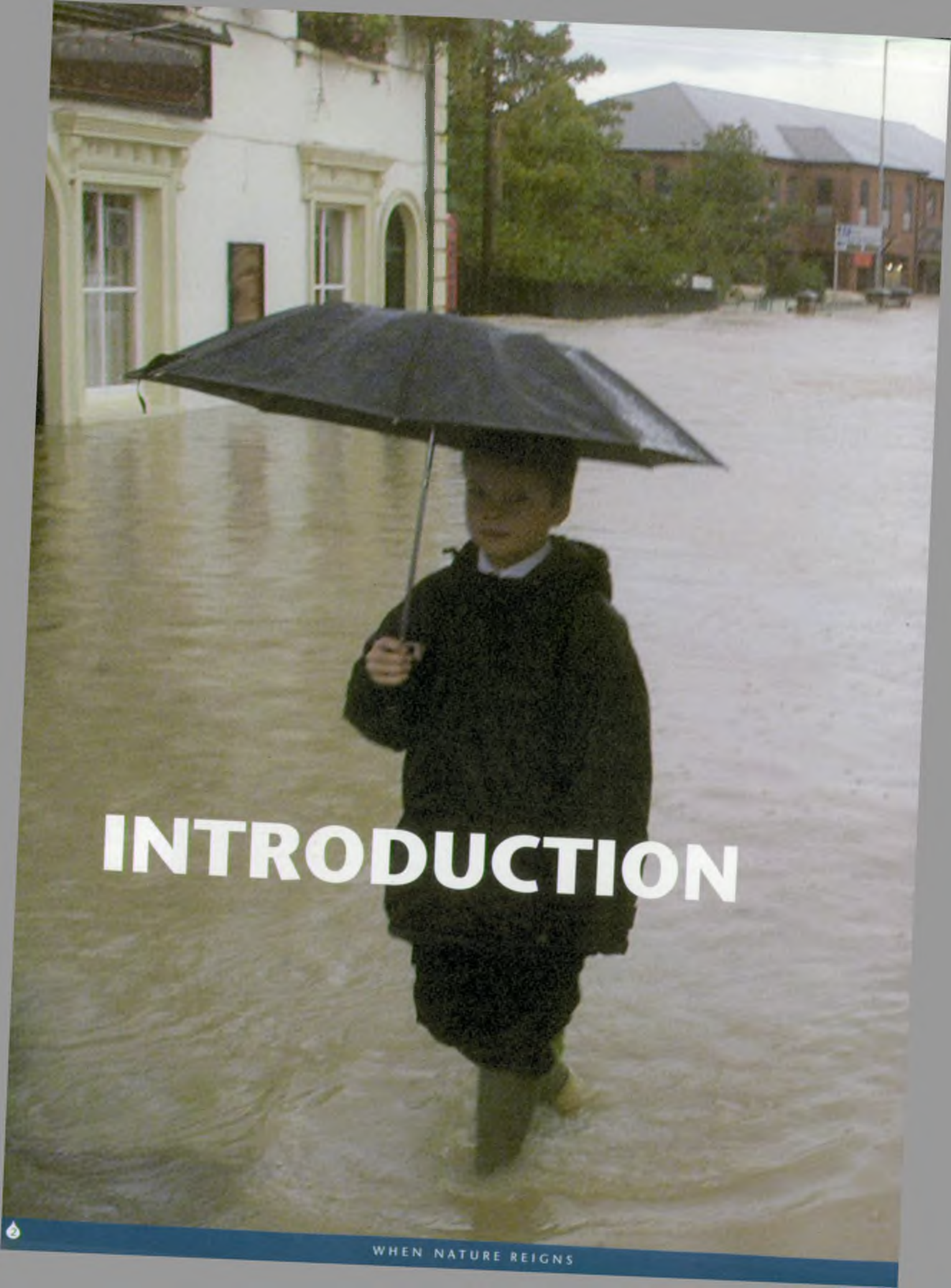
While no one could predict the extent to which nature would throw her incredible forces at the south coast of our country over six months of seemingly interminable rainfall, in hindsight, the year started as it meant to go on. The final Christmas of the millennium will be remembered for all the wrong reasons by hundreds of people in Hampshire, the Isle of Wight, Sussex and Kent as storms lashed the coastline combining gale force winds with unusually high tides until December 27.

Floodwater was an unwelcome and uninvited guest into many homes over the holiday period, wrecking property and industry in its wake and stealing the magic of Christmas from scores of children living in areas vulnerable to rivers or the sea. The trauma suffered by groups such as youngsters and the elderly has been highlighted in the Environment Agency's report into the Autumn flooding as parents have told how their children now become distressed at the merest hint of rain.

The next news of serious flooding came not from England, but from Mozambique's Limpopo Valley in February, 2000 when Sofia Pedro gave birth to her daughter in a tree where she was trapped for hour after hour by deep fast flowing floodwater. Extreme weather was being reported from all corners of the globe, including floods in Argentina driving 120,000 people from their homes in March, the Philippines, eastern India and Bangladesh and Japan all suffering from severe flooding in consecutive months and disruption hitting the UK once more in May.

Heavy rainfall on the eighth saw dozens of vulnerable properties and businesses across the whole of the South East suffer, and among the victims of this unseasonal flooding were Lamberhurst and Robertsbridge. In July isolated heavy thunder storms caused mayhem just minutes away from blue skies. One of the worst hit places was Worthing in West Sussex where a summer day was punctuated by torrential rainfall that was simply too much for the drainage system and in as little as ten minutes water was inside the shops and supermarkets of the seaside town.

Whilst there were no more notable events throughout the summer months of 2000, the rainfall was still higher than would be expected from year to year, helping to lower the environment's defences against what nature was about to throw at it. The following document is the Environment Agency's part in the epic battle of man against the elements and how ordinary people were confronted by extraordinary conditions.



INTRODUCTION

The network of streams and rivers and the chalk aquifers (natural underground reservoirs) are vital for domestic and business use throughout the year and the Environment Agency controls the use of this precious resource through the issue of licences to Water Companies, agriculture and industry. In the South East 70% of our drinking water comes from the underground sources trapped in the sponge like structure of the chalk in The Downs. Water companies drill into the chalk and pump the water out and farmers can use the same method or take directly from the river to feed crops or livestock and industry uses water either for irrigation or to cool down their processes.

During the summer there has to be enough water to serve all these needs and still have a healthy flow to support the fish and wildlife, and in winter when the levels rise there are a number of structures and river walls that aim to keep the river water out of homes and businesses. Most of the defences on what is described as 'main river' are maintained by the Environment Agency, but the legal responsibility for the banks lie with the riparian owner – the person or business that owns the land. They are obliged, amongst other things, to maintain the bank and ensure the safe passage of water down the river.

Smaller streams and ditches are described as 'ordinary' watercourses and can fall under riparian ownership or local authority powers. The Agency has a duty to warn people of flooding on main river, but ordinary watercourses are currently covered by the wider 'Catchment Flood Watch' issued on the forecast of bad weather or rising levels of main rivers.

Usually nature finds a balance between the extremes of summer and winter where the rivers continue to flow at a reduced rate during the hotter months and the river water makes its way safely to the sea where the floodplains are still accessible during the wetter months.

Sadly, in recent years the land that has flooded in wintertime for many centuries past has been built upon, thereby drastically increasing the number of properties and businesses at risk across the country.

Tougher guidelines have been introduced by government as a result of the autumn flooding, but for those already living or working on land rightfully belonging to rivers or the sea, the threat of flooding is always there.

The autumn of 2000 was the wettest since records began 234 years before in 1766,

Lewes October 12 2000

with an incredible three times the normal monthly rainfall soaking the South East on three consecutive months between September 15 and November 15. This period of heavy rain contained four downpours of such intensity that widespread flooding was suffered by an estimated total of 2,700 properties and businesses across Hampshire, Isle of Wight, Sussex and Kent. As winter finally gave way to spring in 2001, many of the residents of the worst affected towns and villages across the south were still in temporary accommodation while homes devastated by muddy river water, often contaminated by sewage, were put back in order.

The emotional cost of these events both for the people who were directly affected by the flooding and for those who worked long hours, often in dreadful physical conditions in the battle against the elements, is tremendous. Several months on further cases of depression and stress are still being reported as a direct consequence of the long, wet winter. The financial cost can be estimated through insurance claims and the emergency expenditure of professional bodies such as the Agency, the fire service and local authorities and runs into many millions of pounds. The full cost of damage to the flood defences ran into hundreds of thousands of pounds. Other problems for individuals or businesses were also difficult to estimate where there was no insurance or the insurance did not include flooding – for example hundreds of cars were washed away or inundated and 'third party fire and theft' is inadequate to cover this.

In a year where a 100 foot sluice gate in Kent that is expected to be used an average of twice a year has been called into action 26 times, a year that saw a month's rain fall in a matter of hours and the highest tide since the disastrous one of 1953 on the North Kent Coast, there was not a single structural failure of an Environment Agency defence in Southern Region. Mercifully, there was no loss of human life unlike the tragic floods of 1953 and 1998.

This can be attributed in part to the early and clear flood warning system implemented by the Environment Agency, the co-operation and professionalism of the emergency services and the expertise of Agency flood defence staff.

The vast majority of the flooding was caused by an overwhelming of the drainage systems, complete saturation of the ground and sheer volume of water flowing over the river banks.

AND WHERE?

WHO DOES WHAT

The Environment Agency is made up of eight regions across England and Wales, with Southern Region based in Worthing, West Sussex and covering Hampshire and the Isle of Wight, Sussex and Kent. Each of these areas has a base in its county with depots and smaller offices strategically placed where needed.

pollution events, fish kills or the unlikely event of problems at the region's power station or heavy industry. The centre also has access to an electronic system that spans about 450 rain gauges and all the main rivers in the south and gives details of rain fall and river levels, flow rates and triggers alarms at certain danger levels.

way or give an equal amount of warning, with the lead time of the peak of the flow making its way to the sea ranging from a very flashy 2-3 hours for the Uck in East Sussex, to a hefty 24-30 hour warning for the Medway and towns such as Maidstone.

In the autumn of 2000, fifty Severe Flood

'Debris' washed into a sluicegate by the floodwaters

There is a flood defence and a flood warning team in each area who have a good local knowledge of their patch and the way that different rivers respond to rain and the level of flood warning needed. The Agency also has an emergency workforce that carries out routine maintenance throughout the year such as reed cutting, clearing screens and sluices and shoring up sea defences. During the flood events of autumn and winter these workers were on the ground twenty-four hours a day doing everything within their power to reduce the effects of the floodwaters on the local residents and businesses.

Such was the demand, equipment and plant had to be hired to supplement the Agency's own and contract agencies were brought in for tree felling and removal and to help distribute 35,000 sandbags to the riverbanks.

At the regional headquarters in Worthing there is a control room that operates around the clock all year long, taking emergency calls such as reports of serious

The Agency has its own forecasting officers but is dependent on early and accurate data from the Met. Office in order to predict flooding at the earliest opportunity. If a severe weather warning is received by the Agency forecasting enough rain or a high enough tide to cause flooding concerns, then the flood defence staff can make the decision to issue a 'Flood Watch' well in advance. This means flooding is possible, be aware, be prepared – watch out!

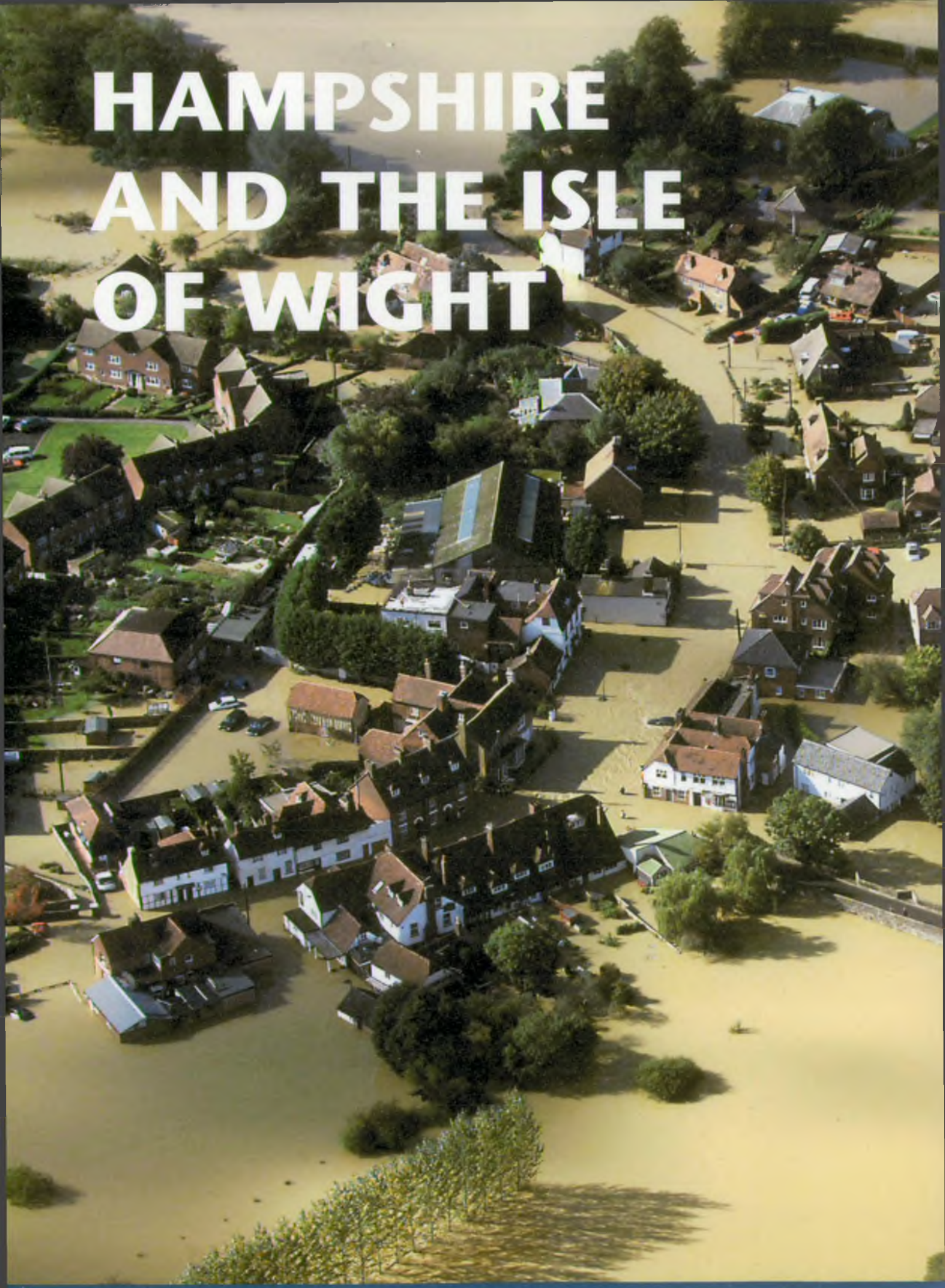
Each Agency office has an AVM (automated voice messaging) machine which rings directly to the home, business or pager of anyone who is registered on the system. If they have decided to have this first stage of warning because they are in a particularly vulnerable area or need longer to enact their flood action plan, they will be the first to know about the danger. Over 200,000 calls were made by the AVM in the autumn of 2000.

When the actual rainfall starts the Agency is able to monitor how the rivers are reacting and warnings are upgraded as necessary. Not all rivers behave the same

Warnings were issued in Southern Region alone. This level of warning is not issued lightly as it triggers an emergency plan involving other professional bodies such as the local authorities, the police and the fire service. The final decision both to evacuate homes and close coastal or riverside roads lies with the police who act on advice from other bodies, including the Environment Agency.

The Agency deals with flooding from 'main rivers' and the sea, however flooding can occur from a number of other sources including surface water run off – when drainage systems are overwhelmed and water that would have normally soaked away is unable to do so. This can fall under the jurisdiction of the local authority, the water company or the Highways Agency and due to the localised and unpredictable nature cannot be covered by the Agency's four stage flood warning system. However, the Catchment Flood Watch and general state of the river environment can act as a guide to when properties prone to this sort of flooding are in danger.

HAMPSHIRE AND THE ISLE OF WIGHT



Hampshire and the Isle of Wight were the worst affected by the first of the four severe weather events in September, 2000 but escaped the full impact of the October flooding as the heaviest rain fell in East Sussex and Kent.

Overall, September was the wettest on record for nearly twenty years and exceeded the average monthly rainfall of 75mm (3") in Hampshire, reaching up to 124mm (5") across the county. However, most of the damage was done September 15 when almost half of that tremendous rainfall amount hit in the space of four hours. Flood experts calculated that it was a 1:100 year event, meaning that the odds against it happening in any one year were very long – about a 1% chance.

The heavy rainfall warning was received by the Agency on Thursday September 14, advising that around 25mm (1") of rain was expected during the latter part of the day and evening. Actual rainfall of 1-4mm (less than a fifth of an inch) appeared and Met Office forecasters explained that the front was moving slower than they anticipated and was now not expected to reach Hampshire until the following morning.

Portsmouth

On Friday the intensity of the rain was such that the drainage system in Southsea was overwhelmed. The Sewage Undertaker, Southern Water, has a pumping station at Eastney that deals with the domestic waste water of Portsmouth. This is known as a combined sewer, meaning that as well as sewage and household wastewater travelling through the system, rainwater drains from the streets into the gullies and joins the network of pipes under the city. In normal circumstances this helps with dilution of the sewage and is discharged harmlessly to sea, however, there was nothing normal about September 15 and the hundreds of tonnes of water entering the system proved to be far too much for the station.

The pumping station failed when it became inundated and stormwater combined with raw sewage backed up from it, flooding the streets of Southsea and entering up to 700 properties, some of which took many months to get back to their original state.

The Agency published a detailed report on the incident, but after several interviews under caution with the water company and a thorough investigation into the performance of the pumping station, the Agency was advised by legal council that it could not prosecute under current legislation.

Milford-on-sea

The flood defence scheme at Milford has been called into action four times this autumn and winter, saving the town from certain flooding on each occasion. Historically the centre of the town had suffered from flooding on numerous occasions, with some of the most serious documented in 1965, 1974, 1982 and 1983, but a flood relief scheme implemented back in 1985 to protect the properties in the High Street has, so far, done just that. Improvements costing over half a million pounds were made to the scheme in 1998 following a feasibility study four years before which identified the main cause of flooding to be inadequate capacity of the Danes Stream.

A flood holding area was created by building an embankment up to 5m (16.4 feet) high across the valley of the Danes Stream, protecting the High Street by diverting floodwaters to a location where they do the least damage. This is achieved by temporarily flooding pastures and woodland upstream of the flood embankment and holding a percentage of the water there during the highest river flows. Once the danger has passed, the stored water is slowly released back into the Danes Stream by a motorised flood gate.

The volume of water stored by the scheme during the largest conceivable flood could reach 500,000 cubic metres – the equivalent of 2,000 Olympic size swimming pools – and would cover an area of some 21 hectares (52 acres). This was designed to cope with the biggest storm of the average lifetime, but as an emergency measure water can spill safely out to sea through the low point in the cliffs at Taddiford Gap.

Erosion of these cliffs was a consideration when the scheme was being built, so a low embankment was made from rock filled wire baskets (gabion mattresses) to limit the damage – this emergency spillway is believed to be a unique feature in Britain.

If the scheme had not been built, Milford would have certainly flooded.

Devastation at Southsea (courtesy of The News)

Flow gauging in Hampshire

Ryde

Over the last hundred years problems have been experienced in the town of Ryde through flooding from the Monktonmead Brook with serious incidents recorded in 1936, 1965, 1993, 1999 and 2000. In September 2000, several properties were flooded by surface water run off, but in October a combination of high water levels in the brook and a high tide meeting at the same time, up to 70 properties were flooded. This number was made up of houses affected by water from the brook alone (a reported nineteen) and the remainder from surface water that could not be drained away and sewage from a combined system similar to the one at Portsmouth.

In the early 18th century Ryde existed as two fishing hamlets with 1km (0.6 miles) of marshy land between Dover Street and Appley. It was defended from the sea by a small embankment on the site of The Strand before becoming a popular seaside resort between 1800 and 1830. This was the beginning of much of the development that we see in the town today, with the castle being built in 1840 and The Strand constructed fourteen years later.

A sea wall was built from the pier to Cornwall Street slipway, forming the Esplanade and claiming the land that was formally marshes from the sea. With this new structure keeping the saltwater at bay, roads, businesses and homes were built and people settled there.

Groundwater flooding in Hampshire

Between 1871 and 1880 the railway was built and the Monktonmead Brook was straightened and its feeder streams were filled in. The Brook was made to go through culverts (tunnels and channels) for a distance of 180m (590.5 feet) between the sea wall and the recreation ground and tidal flaps and a pumping station were put into the culvert. This was to prevent the saltwater from going up the Brook during high tides and to allow any floodwaters to flow from the watercourse at low water. Since 1968, some 50-60 sites have been developed in Ryde which means that more and more properties have become at risk, some of which are converted basements and therefore below ground level.

In an attempt to alleviate the problem and reduce the risk of flooding happening in this low lying and vulnerable area, the Environment Agency looked at various options of a flood defence scheme. This involved a combination of works on the existing sea outfall and the pumping station at a cost in the region of three quarters of a million pounds.

Due to the natural movement of the sand through the action of the waves, the outfall that was built all those years ago became ineffective as it was partially blocked by a build up of sand. It could not be cleared due to its design and sand would only take around a week to fill it up again. The new scheme saw the building of a much longer outfall that would not be affected by the beach movement and the construction of a higher capacity pumping station. The sewage problems were also addressed by the water company, thereby affording a better level of protection for the people of Ryde.

Havant

In the 1960's improvements were made to the river banks of the Hermitage Stream and the Havant Lavant. Recent works on the Hermitage Stream combined with those of forty years ago prevented flooding of extensive housing areas. A flood board can be installed at Crosslands Drive in Havant to divert the flows from the Lavant Stream to the Hermitage Stream through a pipe link and this also helped to restrict the flooding in the area.

An Agency official who was out measuring the flows on the swollen River Wallington in October put his own life at risk in order to save a teenage boy from drowning. Alan Smith saw the teenager clinging to a branch in the middle of the river as the dinghy that he had been sailing in with two friends had capsized. The other two boys had managed to scramble to the bank, but the third had not been so lucky and was only seconds away from being taken by the raging current when the Water Resources Officer managed to pull him to safety.

Due to an unusually dry January and March, the year 2000 as a whole did not break the records for rainfall in Hampshire until the very last day. Measurements taken at the Portsmouth Water borehole in Havant saw the record set in 1960 finally broken on December 31 when a 23.5mm (approx. 1") downpour took the annual total to 1,175.1mm (almost four feet) – the highest since records began there in 1886.

Alan with the rescued youngster

EAST AND WEST SUSSEX

Environment Agency measures the flow in Uckfield

In terms of properties flooded, Lewes in East Sussex was the worst affected town in the whole of the country. Uckfield was the first town to suffer serious flooding in the UK in those terrible floods of October 2000 and seven months after the initial devastation, many families were still out of their homes in both towns and many businesses were forced to close their doors for good.

The flooding of October 12 was preceded by three days of storms and heavy rain across the whole of East Sussex. The ground became increasingly waterlogged and several properties in the area suffered flooding from surface water that simply had nowhere else to go. The rivers were responding to the intense rainfall and the Environment Agency Sussex area office issued Flood Watches and Flood Warnings to areas at risk from the swollen watercourses.

'The Aftermath'

Red dotted line shows height of floodwater

Chaos in Uckfield

The River Uck is a relatively small watercourse, around nine metres across at the point that it passes through Uckfield, but on the morning of the twelfth the volume of water was such that the channel was inundated and the effect on the town was devastating. It was five o' clock in the morning when Uckfield flooded dramatically, with river levels rising to a peak between 9 and 10am. During this peak floodwaters were flowing through the centre of the town to a depth of up to 2m (6.6 feet) leaving damage and heartache in their wake.

By mid-afternoon the levels began to drop as quickly as they had risen and the river was back in its banks by late afternoon, revealing the extent of the clean up needed from authorities and householders alike in order to brings things to some semblance of normality.

As the floodwaters drained from Uckfield, the peak of the River Uck joined forces with the peak of flow from the middle Ouse and continued to build towards Lewes, inundating the natural floodplain between Barcombe and the county town. False rumours that the gates at Barcombe had been operated incorrectly and worsened the flooding were dismissed in an independent Consultant's report. With the flows that were measured at that point being a hundred times faster than normal, the operation of those gates would be 'like a cat flap in the Thames' according to a senior Agency flood defence engineer.

Barcombe Weir three days before the flood of October 2000

Robertsbridge

Harvey's Brewery in the height of the floods

The river was flowing so fast that the water rushing past those gates was a staggering 200 tonnes every single second.

Concerns for Lewes were rising as the unfortunate coincidence of high tides meeting the floodwaters that were trying to escape to sea was making the event of 'tidelocking' a real possibility. As a simple description of the effect of tidelocking, imagine that you are in the bath and make a wave by pushing the water towards the tap end. The wave, like the flood peak, travels the way it is forced, but as it hits the end of the tub the wave reverses direction or backs up. At low tide the force of the river water is towards the sea and it discharges there, but a high spring tide pushes water up the river in the opposite direction to the floodwater and blocks its progress to the Channel, acting in the same way as the end of the bath tub. Widespread flooding hit Lewes just after lunchtime when the rising river backed up behind the Cliffe Bridge as the flow was too much for the structure and the water overtopped (spilled over) the flood defences at a number of locations. Within as little as an hour the defences were overwhelmed and the town centre rapidly filled with floodwater. Hundreds of people were stranded and had to be rescued by the emergency services in boats and by the peak of the floodwaters at around 9.30 that evening, parts of Lewes were under an incredible 3.6m (11.8 feet) of water.

The rescuers rescued - brave lifeboat men struggle to safety after their boat is sucked under the waterlogged bridge!

Lewes railway station after the floods!

The waters were slow to recede in the town as some were trapped behind the defences and took longer to drain, and it was not until two days later on the Saturday that people were able to return to their devastated homes and businesses. It was quickly apparent that the flooding in Uckfield and Lewes was the worst in living memory.

It is believed that downstream of the Lewes bypass, the River Ouse stayed in its banks all the way to Newhaven, although the Rodmell Brooks flooded via an underpass beneath the A27 embankment..

Robertsbridge

Intense rainfall over the area feeding the River Rother resulted in the worst flooding in this village near the East Sussex/Kent border in living memory. River flows at Udiam, downstream of Robertsbridge were up to six times as fast as would be expected at that time of year.

Over seventy homes in the village were flooded, some up to nine times in the last two years.

The possible impact of the flood culverts through the embankment carrying the diverted A21 London to Hastings Road were investigated as these cross the floodplain. Several public meetings were attended by Agency officers along with other organisations to seek a long term solution.

Robertsbridge

Pumping at Church Farm Pit

Chichester

The River Lavant is a groundwater fed chalk stream that runs through the county town of West Sussex, usually at a sedate rate between the months of March and June when the winter's rain has had time to filter through the South Downs.

Winter flows in 2000 exceeded eight cubic metres per second at its worst point over 15% more than the flows that devastated the town six years before.

A massive multi-million pound, multi-agency operation was launched from November 2000 in order to keep the city dry, with the Environment Agency's flood defence experts incorporating lessons learnt from the flood that hit Chichester at Christmas and New Year of 1993/94.

Supporting the culvert wall as the water levels rise

Some of the pipes snaking through the city

The incredible speed of the invading water caught some by surprise

The epic battle against nature in the exceptional autumn of 2000 and the following winter had many twists and turns and could have been lost on several occasions, but the expertise of the Environment Agency staff and the grit and determination of the fire service tipped the balance in favour of the emergency group, co-ordinated by West Sussex County Council.

The root of the problem in Chichester goes back many centuries when the Romans paid West Sussex an extended visit. They were probably the ones who diverted the River Lavant from its natural path to the sea, taking it east around where almost half of the city now lies when it actually wants to go south. The Victorians built a number of culverts (tunnels and channels) for the water to go through and although the integrity of these structures were sound, the capacity or amount of water they can cope with is limited and their collapse or blockage would have had catastrophic effects on the east of the city.

Nice weather for ducks! - some shopkeepers show their sense of humour in difficult times

The depth of the water table is measured at several points north of the city at Agency controlled monitoring boreholes. These are holes drilled into the chalk at a carefully selected place where the water levels are not interfered with in any way by human activity and can therefore give a good overall picture of what is happening underground in the larger area. The borehole at Chilgrove hit a trigger level set by the emergency group to indicate a risk of flooding in October 2000. Heavy rainfall on Sunday November 5 saw the River Lavant Springs in West Sussex to rise by 60% in 24 hours and a Flood Warning was issued – at this time of year the River would normally be dry.

An unprecedented pumping operation – believed to be the biggest in Europe – saw 13 miles of pipes snaking around the city, some of it having to be brought in from Italy such was the demand. The theory was much simpler than the practice with pumps installed north of the city to catch the water before it entered the vulnerable Victorian culverts and put it back into the river to the south of the city. This relieved the pressure by about one cubic metre per second (the equivalent of around four bathfuls of water each and every second - almost 2.5 million bathfuls a week), but even this looked as though it would not be enough as levels rose relentlessly.

The threat of flooding was not only casting a shadow over the festive period for those living and working in the danger area (the south east of the city), but the whole of Chichester was losing trade in what should have been their busiest time despite being at no risk of flooding at all. Extreme circumstances call for extreme measures and the Agency on behalf of the emergency group built a relief channel that was effective in less than two weeks, an achievement that few would have thought possible due to the complexities.

Following the flooding of 93/94 the Environment Agency designed a permanent flood relief scheme, but this was not yet in place due to the normal timeframe of these things where consulting, raising funds, buying land where necessary, hiring in specialist equipment and gaining planning permission are just a few of the obstacles to negotiate. The scheme was due to be installed the following year, funding permitting, which was still faster than the average timescale of ten years, so when the emergency powers to put some of the scheme into place were granted the Agency was ready to spring into action.

The complex works included a new culvert (tunnel) built under the A27, new pipes under the railway line, extended or new culverts under the A259 and B2066 and almost 3km(nearly two miles) of new channel.

If the work had not been done the south east of Chichester would have flooded more severely than it did in 93/94.

The last of the pipes were finally removed from the city in April 2001.

Sussex area manager, Peter Midgley became a familiar face in the local and national media during the Autumn and Winter months, but his work behind the scenes was tireless. He was awarded an MBE in the New Year's Honours List for his lifetime services to the environment.

He visited Buckingham Palace on Tuesday May 1, 2001 to collect the award for his services to environmental protection. Halifax born Mr Midgley has been a high-profile figure in the Agency's fight to protect Sussex against the floods and storms of the past months. His responsibilities extend across the whole of East and West Sussex, covering both coastal and river flood protection.

Mr Midgley joined the former Southern Water Authority as a hydrologist in Worthing in 1976. He moved to the National Rivers Authority as Hampshire district resources officer in 1989 and was appointed NRA Sussex area manager in 1993. In 1996 he was appointed to his present post with the Environment Agency.

Prime Minister, Tony Blair visits the city

KENT

The control gates at the Leigh Barrier

The Leigh Barrier was built in 1981 to address a historical flooding problem on the Medway 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.

The River Medway is one of England's great rivers, flowing more than 100km from its source in Ashdown Forest, East Sussex to its mouth in Sheerness in Kent. Its power was used in Roman times for forges to create iron from the deposits in the clays.

The Leigh Barrier has successfully reduced the water levels and averted flooding from the River Medway an average of twice a year over the last twenty years. 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). It is so effective at taming the floods that it often goes unnoticed. This 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 bathfuls of water passing every second), but during the peak of the October event the flow was more than thirteen times that amount.

Between October 9 and 12, up to 21cm (eight inches) of rain fell in Kent and the barrier started to impound (hold back a percentage of the water from the swollen rivers) at 10.30 on the morning of the twelfth. 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.

In the flood 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 reservoir filled in just five hours – the fastest previous time was 24 hours.

The man in charge of operating the barrier, Richard Francis had to pull on every ounce of his engineering skill and experience in order to protect the hundreds of properties depending on the barrier in these dreadful conditions. He and his team faced a very difficult balancing act of making sure that the volume of water allowed to pass through the gates did not overtop the defences in Tonbridge. If all the storage space behind the barrier was used up and overtopping of the dam had occurred, the town would have flooded, but if too much water had been allowed through the gates, it would have suffered the same fate.

Precision in the control of flow and the integrity of this impressive flood defence structure saved over eight hundred properties and businesses from possible ruin on the evening of Thursday, October 12. Engineer, Richard Francis was recognised in the Birthday Honours List in 2001 with an MBE for his work during the floods.

Richard is the Team Leader of North West Kent's Operations, based at Tonbridge and has played a pivotal role in providing flood defence for the communities in Kent for 22 years having joined the Agency, then part of Southern Water, in 1974.

He led his team during very long and anti-social hours to ensure the flood defence – and the safety – of those living and working in Kent towns and villages. The water level in Tonbridge was 90cm (3 feet) lower then during the flood of 1968, despite the flows in 2000 being more intense. Richard's operation of the Leigh Barrier not only saved Tonbridge from the worst flooding in recent memory, but also offered maximum relief that the scheme could provide to other communities beyond the barrier.

The Leigh Barrier holds back millions of gallons of water

Yalding

The village of Yalding was one of the worst-hit places in terms of frequency of flooding. Despite the fact that the flows were being held back on the river Medway by up to 50% by the Leigh Barrier, the swollen rivers of the Medway, Teise and Beult converged on Yalding leading to extreme flooding. The village became the focus of much media attention as flooding continued after each period of intense rainfall. The village is situated in a natural saucer meaning that it is on low lying land and its position at the junction of three very powerful rivers makes providing any defences for the village extremely complicated without passing the problem on elsewhere.

The normal winter river levels at Yalding are between 8.5m and 9m above sea level, but during the autumn levels exceeded this average by more than two metres resulting in damage to around forty family homes, a caravan park and a number of boats. The Anchor sluice at the north of the village which is used to maintain river levels in summer was submerged by the floodwaters by over two metres and the heavy metals gates had to be lifted clear from the water so that they did not impede the flow.

The misery of those who had to endure floodwater in their homes on several occasions during this horrendous six month period was compounded by false rumours that the Leigh Barrier had somehow made the flooding worse for them. Impossible suggestions such as whether the barrier was going to send a tidal wave down the Medway or that Yalding was being sacrificed for Tonbridge were asked by media and public alike through a misunderstanding of how the structure works. At no time was the flow leaving the barrier greater than the peak of the flood levels arriving at it – in fact at some points only half of the thousands of tonnes of water were able to pass the barrier. The rumours that Yalding were sacrificed for Tonbridge were also unfounded as both communities are on the same side of the barrier and therefore if large amounts of water leave Leigh, they pass through Tonbridge first.

The floods highlighted a need for the Agency to make information available to the people of Kent on the barrier and to help them realise that this twenty year old structure and the engineers who operate it have helped and not hindered in the fight against flooding. A leaflet has been produced called 'Silent Saviour' and is available from the Leigh and Addington offices of the Environment Agency or can be viewed on the website at: www.environment-agency.gov.uk.

Ashford

The town of Ashford and the East Stour Valley are protected by the Aldington and Hothfield flood storage reservoirs.

Ashford lies at the junction of the Great Stour and the East Stour rivers which also collect water from a number of feeder streams. Plans to build a flood defence system in the 1980's was prompted by extensive flooding the decade before and by 1991 the Ashford Flood Alleviation Scheme was in operation.

Since the scheme was built, the town and surrounding areas have expanded significantly and have become host to the Channel Tunnel Rail Link.

The Aldington flood storage reservoir is situated on the Great Stour, not far from the M20 and has 6m (19.7 feet) banks and a storage capacity of 1.3 million cubic metres or over 290 million gallons.

In simple terms the flood storage area is like a huge bowl that usually lies empty while the river flows through its southern curve. When the river levels rise following very heavy rain, the storage area begins to take in water (impound) in order to reduce the impact on Ashford. On most occasions the reservoir does not fill completely, due to the sheer volume of water that it can store and the water levels in the river hardly change at all. When the main danger or peak of flow passes the water is allowed to take its natural course.

When the scheme was designed, the engineers were fully aware that it was only a matter of time before a storm or prolonged period of very wet weather would be too much for the reservoirs to take. They planned to keep one small step ahead of nature in case of this happening.

If the banks were all of equal height and angle then there would be no control over where exactly the water spilled over, but the banks are not level and have an area that is lipped. The water takes this easy route and is guided at a controlled rate down a gentle slope (the spillway) made of textured concrete 300m (1,000 feet) long. As the land at the bottom of the spillway is farmed, the Agency has made sure that drainage of the area is as effective as possible, thereby exercising the Agency's bought right to flood the land to protect homes while keeping the disruption to the farmer to a minimum.

This was the first time in its ten year history that the area was holding back its full capacity - water from a storm so extreme that the odds against it happening in any one year are 100:1. The engineers were pleased that the structure worked exactly as they designed it and water ran down the spillway.

The Hothfield flood storage reservoir on the Great Stour worked to its full 1.8 million cubic metre (396,000 million gallons) capacity during the heavy rain in October and November of last year, but never required the use of its spillway. Aldington, however, handled flows over ten times the average that would be expected at that time of year and started to spill onto the concrete bank on November 6, 2000 for a period of 28 hours. During this time the reservoir reduced the flow by 74% and there was limited flooding to the East Stour Valley mainly affecting farmland. Sadly a few properties in Mersham flooded, but there were historical problems suffered there annually before the scheme was installed.

Without the two flood storage reservoirs there would have been devastation in the area with acres more farmland and localised properties under feet of water. The older parts of Ashford town, over a hundred properties and the railway station would have been flooded out, leaving a trail of destruction behind thousands of tonnes of this muddy, fast-flowing water.

Construction of the reservoir

The Dartford Creek Barrier

The Dartford Creek Barrier forms part of the Thames Tidal Flood Defences and is situated where the rivers Darent and Cray meet, near to where they feed into the Thames. It was designed to protect North Kent from surge tides following the disastrous floods of 1953 which claimed hundreds of lives in Essex and East Anglia and many more in Holland.

The barrier ready for action

The barrier in use

Since being completed in 1981, the £11.2 million pound structure has been called into action on average six times a year, but in the Autumn and Winter of 2000/01, it was needed 26 times – the equivalent of four year's worth of use in just under six months.

As the flooding problems being experienced around the country were from rivers, drainage systems and groundwater, it went relatively unnoticed that the highest tide since the fateful surge of 1953 came and went on the evening of February 12. The water was lapping just a metre (three feet) from the top of the boards at the barrier, but due to the structure, there was no flooding from this monster tide – it is hard to imagine what would have happened before the barrier was built had that tide appeared.

The east side of the barrier is in the Kent Borough of Dartford, the west side is in the London Borough of Bexley and the Thames tidal defences protect a strip of land up to 3km wide extended from Greenhythe downstream of Dartford Creek up to Erith. It was designed to withstand a tide so huge that the odds against it happening in any one year are a thousand to one, but with the threat of climate change and sea level rise the odds look like shortening.

The one thousand year water level was calculated using studies of past tides, weather patterns and astronomical tide data, then confirmed by computerised model testing at the Hydraulics Research, Wallingford.

To defend against this scale of event needs something a bit special and the Dartford Creek Barrier certainly lives up to this, being over sixty metres (two hundred feet high) and thirty metres (100 feet) across. There are two gates each weighing about 160 tonnes and measuring 30 metres across by 5.2 metres (17 feet) high that have to be lowered exactly level to prevent them getting wedged in the metal grooves in either side of the river. The gates fit, one on top of the other, into a metal cill which was inserted in the river bed at the time the barrier was built. They were built in Teeside and transported in eight large sections by road.

The need to keep these hefty gates exactly level during lifting and lowering presented a challenge to the engineers and was overcome using two 300 feet long chains – much like giant bicycle chains – and huge water filled containers to act as counterbalances. Each tank weighs about 16 tonnes empty and 70 tonnes when full of water. Instead of the usual links on a bike that measure around 2.5cm (an inch) in length and less than a centimetre wide, these chains that are made by Italian bicycle chain manufacturers, are 165mm (over 6") across and twice as long.

The chains and counterweights are housed in the towers that straddle the river bank. The foundations were built by John Howard and Company in 1979 and were well below the water level. The first big landmark in the construction programme was when a plug was placed in one of the under water steel piling box – this plug contained around 4,500 tonnes of concrete and was poured in one weekend in November. The plug on the western side of the river bank was not placed until some three months later.

The barrier is not constantly manned, but an operating team goes to the Barrier whenever the Met Office predicts that a tide is going to be above a level that would pose danger of flooding. An early warning of these conditions is usually received by the Agency about 12 hours in advance, but the decision to close the Barrier is not usually taken until about four hours before high water. This is because a more accurate prediction of the level to be expected can be made from actual conditions along the East Coast of England.

The Weakest Link

Despite the rigorous maintenance programme and the excellent design of the barrier, the excessive use over the winter months started to take its toll and one of the links of the giant chain was weakened.

The team had painstakingly greased every single one of the hundreds of hefty links, but they were disappointed to see that each time the 250 foot chain did its loop it was struggled to bend over the cog in the top engine room. This indicated that there was the same problem occurring at all the cogs not visible to the operators and the grating and creaking sound when the barrier was in action was a sign of remarkable strain on the drive engines and chains.

Mending the chain was not going to be a simple feat – this one link would mean building a 50 foot tower of scaffolding in one of the concrete towers, the hire of heavy duty lifting equipment due to the weight of the chain and the import of the parts from a sole supplier.

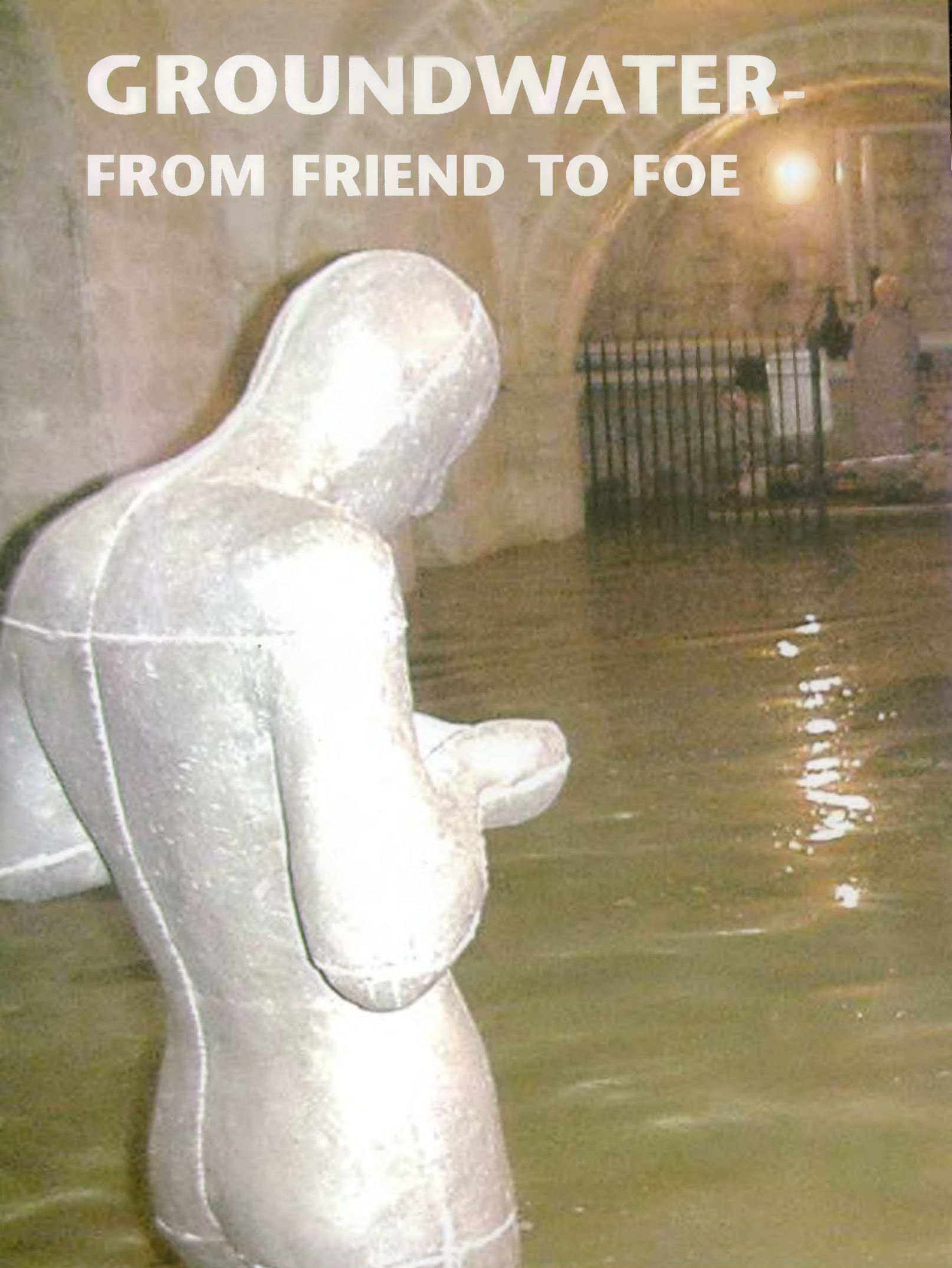
It was going to take time and there was no guarantee that the barrier would not be needed. One gate was available, however, and the engineers knew that in case of emergency it would be necessary to lower the untroubled gate at the critical moment.

This reduced the flow of tidal water up Dartford Creek and eased flood levels upstream of the barrier.

Thankfully when the big tide arrived on the twelfth of February all the repairs were completed and both gates could be used.

Inundation of the Medway Valley

GROUNDWATER-
FROM FRIEND TO FOE



Groundwater is of vital importance in the South East as it supplies us with the vast majority of our drinking water and water for agriculture and industry. There are teams across the region whose sole aim is to protect this precious resource against pollution with the full legal backing of the Groundwater Regulations, 1998 and the Water Resources Act, 1991. If pollution does occur, clean up is very expensive and time consuming – costs can run into millions and water quality can be adversely affected for dozens of years.

Groundwater should be just that – water that stays in the ground, but with the intensity of the rainfall in autumn 2000 and the following winter, it began to make an appearance above the surface. This manifested itself in three main ways in Hampshire, in the emergence of new springs which had either never been seen or had not flowed for hundreds of years, the increased flow of spring fed chalk streams and the filling of cellars and basement flats in some areas.

The flooding from groundwater has become a serious issue in Hampshire, and levels higher than the last similar event of 1994/95 have been exceeded during the winter months of 2000/01. Villages such as Hatherden, Upton, Vernham Dean and Hursley have experienced the flooding of cellars and the main road through Appleshaw was under water for many weeks.

An additional problem brought by groundwater flooding is a loss of water pressure in the home which meant that the toilet could not be flushed in some houses across the county. Some villages had to install temporary outdoor conveniences for shared use, proving particularly difficult for young children or the elderly who needed to use them on the cold, wet winter nights of the worst six months on record.

A complication that groundwater flooding has over river problems is that there is no way to stop or divert the flow, nor is there any way to know exactly where the springs will appear or how long they will continue to flow. Pumping water from cellars is not something that the Agency advises as the pressure from the surrounding water on an empty space can be enough to cause structural damage. Pumping to prevent it from entering the house is also flawed as the groundwater is unrelenting and there is nowhere to put the pumped water without passing the problem on to someone else.

In a bid to monitor the groundwater levels in Winchester the Agency drilled a borehole in a car park in the centre of town and regular readings were taken during the following months.

Groundwater weeps through a wall

The rivers Test and Itchen are fed by groundwater trickling through the Downs and properties in the floodplain of these rivers were known to be at risk from flooding. The Agency wrote to homes and businesses to warn them of the dangers which were not expected to subside until late summer.

In **KENT** groundwater levels were responsible for the Nailbourne Stream, a winterbourne that usually only flows on average once every seven years, to pose a serious threat to properties in the vicinity.

The Nailbourne Stream is rarely seen since it only flows when the water table reaches ground level. However a wet spring last year, followed by a mild summer and the heavy rainfall of the autumn led to the highest groundwater levels for 60 years.

The flow of the Little Stour, which is present all year, is directly affected by the levels in the Nailbourne Stream which drains into it meaning that groundwater flooding became an issue affecting all communities along the whole of the valley. Homes in the villages of Patrixbourne and Littlebourne were flooded by the invasive groundwater.

Groundwater levels usually begin to recede by spring, however the extreme weather of the autumn and winter months saw levels remain high throughout the valley for some months.

Some fifty properties in the town of Bridge were protected from the River Nailbourne by a scheme that was built in 1999. Widespread flooding occurred in the 1940's, 1960's and 1988 as a result of heavy rainfall but improvements to channels in the High Street and the installation of a 12.5m embankment has drastically reduced the risk.

In **SUSSEX** not only was the rise of the Lavant due to the rapidly rising groundwater, but springs started appearing across East and West Sussex that had never been seen before.

The city of Brighton was plagued by a new 'river' in Patcham at the intersection of the A27 and A23 and the council had to undertake a massive pumping operation in order to alleviate the flooding as much as possible. The water was several feet deep and flowed over a main road and busy petrol station and was unrelenting over the winter months.

The Agency has no remit over this kind of flooding as it is not from a river or the sea, and there is no way of stopping the water from filtering through the Downs making the pumping option the closest thing to a solution. The Agency offered what technical advice it could to the City Council as they battled with millions of gallons of water leaking from the hillside, but the nature of this flooding was very different to river management.

Penton Grafton

THE FORGOTTEN THREAT

Selsey

The flooding of October 2000 and the ensuing months was concentrated around the rivers and estuaries of Hampshire, Isle of Wight, Sussex and Kent – but the main threat in the South East is from the sea.

Large communities live in close proximity to the coast and 93,537 properties and businesses have been identified as being at risk from the enormous body of water. This compares to 35,946 at risk from rivers and almost 30,000 who are at risk from both.

The power of the sea is not to be underestimated as big waves in storm conditions are strong enough to demolish buildings. Each cubic metre of sea water weighs around a tonne, which combined with the force of the wave action makes it like a demolition ball hitting the defences every few seconds.

Felpham

The Agency works throughout summer and winter to improve and maintain sea defences around the south coast and the north Kent coast, and staged flood warnings are offered to those at risk. While the height and peak times of the tide can be known years in advance, the key factors that turn a high tide into a dangerous tide can only be predicted hours before. Atmospheric pressure has a significant effect on the levels as high pressure effectively pushes the water down, whereas low pressure found in storm conditions allows the water to expand, creating a surge. Wind direction is critical as well because there is more chance of flooding with a gale blowing the waves towards the shore and the strength of the wind can also affect the height of the waves hitting the defences.

Millions of pounds are spent every year on coastal defences, but further investment is still needed if we are to cope with the rising sea levels and sinking land in the south. There is no way that flooding can be completely prevented as a storm as big as the one that hit France in 1999 would overwhelm a large percentage of the coastal defences.

Few people realise that the killer storm that went on to destroy millions of trees and hundreds of historic buildings in northern France was only hours away from hitting the south east. A dramatic change of wind direction on that fateful Christmas Eve saved us from definite disaster.

CONCLUSION

Flooding from the Aldingbourne Rife, Bognor Regis

The number of communities rocked by the dreadful flooding of Autumn 2000 and Winter 2001 across Hampshire, the Isle of Wight, Sussex and Kent is staggering and only a selection can be shown in the pages of this booklet. An estimated 2,500 homes and businesses were invaded by floodwater and tens of thousands of families lost a basic right that is the fabric of British society – to feel safe in their own homes. After years of living near rivers and the sea the sense of security that they have nurtured has been shattered in six months of dark skies.

An estimated additional16,000 properties would have flooded in the absence or failure of Environment Agency defences. Every report of flooding has its own human tragedy behind it, from the couples who had spent tremendous amounts of time and money turning houses into homes only to see them devastated by water and sewage to the elderly people who helplessly watched a life's worth of memories washed away. There is a lot of anger in some communities that this sort of thing was allowed to happen in a civilised country, but despite all advances we cannot accurately and scientifically predict the weather never mind control it.

Flood defence schemes are very costly and for some vulnerable areas there are simply no practical long-term solutions, making the risk of flooding a fact of life for some communities. The tug on the public purse

Flow gauging!

comes from many directions including education and National Health, so like any large organisation the Agency has to prioritise its flood alleviation work while maintaining what it already has. The way that this is funded is through a levy system where the Agency outlines its annual needs to the Local Flood Defence Committees (LFDC) which comprise Council members, organisations such as English Nature and local land owners.

The whole committee (one for Hampshire and Isle of Wight; Sussex and the third in Kent) looks at the work that the Agency proposes to do and votes as to whether everything is in order. Once this has been discussed the Council representatives vote on what percentage of the levy they will give the Environment Agency, a sum that they can later claim back from government.

When the levy is set at the meeting this determines how much the Agency will have to spend on flood defences and emergency works as the government gives funds in multiples of the levy. It is essential that the Agency is supported to enable it to carry out its work. In general the Agency does receive the support it needs, but Sussex has been under funded by its committee five years running.

The human battle with the elements is as old as humanity itself and water, like fire, is powerful as both friend and foe. Our very survival relies on the availability of this precious resource for drinking, growing our crops and keeping our industries going, yet the expanding population and need for thousands upon thousands of new houses in the south east puts increasing pressure on natural supplies.

Climate change is a real threat for the future and will cause many changes over a relatively short period of time. It is predicted that the annual quantities of rain will remain about the same, but it is expected that following the dry summers there will be intense downpours that will increase the number of times that vulnerable properties are flooded.

Currently almost 160,000 homes and businesses across Hampshire, Isle of Wight, Sussex and Kent are at risk of flooding, the sea level is rising and the south coast is sinking 6mm every year and although we can all do our bit to slow down the process and protect the environment, we sometimes have to accept that nature reigns.

Most churches are built on higher ground - this one just escaped the flooding

WHAT YOU CAN DO

Flooding. You can't prevent it. You can prepare for it.

That's our message to anybody living or working in areas at risk of flooding. We are working hard to reduce the risk but it's up to individuals to take action to minimise the effects of flooding on their homes or businesses.

We offer free advice and information via our Floodline service on **0845 988 1188** and on our website at **www.environment-agency.gov.uk.** It also lists a wide range of flood protection products and services and how supplies them. It includes information on sandbags, domestic flood protection barriers, flood alarms and domestic dehumidifiers.

The following pages provide information about Floodline, our flood warning codes, how to contact us, our website and floodplain maps, flooding advice and a list of fact sheets.

Floodline
If you need to know what to do about flooding or whether floods are likely in your area, you can call our **Floodline on 0845 988 1188.**

This 24-hour service offers four options:

1. Pre-recorded information on flood warnings.
2. Links to our emergency and incident rooms to report flooding.
3. An ordering service for information packs.
4. Talk to a Floodline operator for general information and advice between 8am to 11pm weekdays and from 10am to 4pm at weekends and Bank Holidays.

Floodline helps you find out what to do before, during and after a flood and recorded information tells you about warnings in force, 24 hours a day.

ENVIRONMENT AGENCY

Floodline

0845 988 1188

Where to contact us
How to contact the Environment Agency:

You can **phone** us at local rates on **0845 933 3111** and you will be put through to your nearest Agency area office.

Our **website** is at **www.environment-agency.gov.uk**

You can **email** us at **enquiries@environment-agency.gov.uk**

Our 24-hour freephone **incident hotline** for reporting all environmental incidents (pollution, flooding, illegal fishing) is **0800 80 70 60.**

Our **Floodline** number is **0845 988 1188.**

Fact sheets
You can get a range of fact sheets on flooding from the Agency - call our floodline 0845 988 1188. They are available in other languages as well as English and include:

- Are you prepared for flooding?
- What to do when you hear a flood warning
- What to do when the flooding starts
- How do you cope after a flood?
- Make a flood plan
- How flood warnings are issued

Our advice
Our advice to people at risk of flooding is:

- prepare a flood kit in advance - torch, blankets, waterproof clothes, wellingtons, portable radio, first aid kit, rubber gloves and key personal documents including details of your household insurance;
- think how you can stop water entering your property - flood boards or sandbags to block doorways, covers for airbricks;
- listen to TV and radio news and weather reports;
- call Floodline 0845 988 1188 for information and flood warnings;
- when a warning is issued for your area, move people, pets and valuables upstairs or to higher ground;
- move your car to higher ground - just 600mm of fast-flowing water can wash a car away;
- check on neighbours particularly elderly ones;
- switch off gas and electricity at the mains if you have time;
- try not to come into contact with floodwater; it may be contaminated with sewage;
- do no cross a flood by car or on foot. Walking in floodwater above knee level is dangerous - it can easily sweep you off your feet and hazards may be hidden under water.

PROTECT YOUR PROPERTY

You can do a lot to help protect your home or business against flooding. Here are some suggestions but remember that every property and situation is different. The Agency cannot accept liability for loss or damage caused using this information.

A 'good practice' flood-proofing guide is available on our website at **www.environment-agency.gov.uk**

Lay sandbags
Sandbags can divert water away from property or be a front line of defence at a garden wall. They are not ideal for protecting doorways because they are permeable and difficult to fit into doorways.

It is essential to fill and lay sandbags correctly. Put a plastic sheet around the doorway first to from an impermeable layer then lay sandbags. They must be no more then half to 3/4 full.

Build up the layers like brickwork with the bottom row butted up tight to each other, end to end and well stamped down before laying the second row on top. If the wall is more than two sandbags high, there should be double line of bottom sandbags, followed by a second double line, then a single line on top.

If you can't get ready-made sandbags, make your own using compost bags, carrier bags or pillowcases filled with sand or earth.

Install flood boards
Fix plywood or metal sheet in front of door to seal doorway. Compressible material needs to be bonded to board to act as gasket, e.g. carpet underlay or pipe lagging. Various firms manufacture flood boards but they are easily made and can be bolted on or dropped into slots fixed to door frame.

Seal air bricks
All possible water entry points should be examined and sealed, including airbricks, air vents, and openings for electricity, gas, and water. To seal air bricks and vents, use the same technique as flood boards for doorways. If you seal gas vents remember to switch off the gas supply first to prevent the build-up of carbon monoxide gas in your home.

Prevent water backing up through drains
Fit a flap valve or non-return valve to drain.

Stop seepage
Water may flow through pipe bedding, or through the soil into floors and walls. Seal pipes and ducts going through walls. Seepage may be stopped with a waterproof coating to walls and solid floors.

Prevent water reaching your property
Use existing walls or raise ground levels to protect property or channel surface water away.

GUIDE TO THE FLOOD WARNING CODES

ENVIRONMENT AGENCY

Floodline

0845 988 1188

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

Information You Can Act On

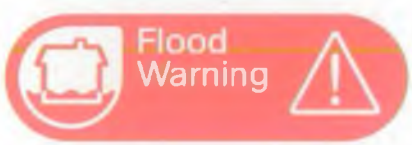
What you need to do during a flood will depend on local conditions, but here is some general advice to bear in mind when warnings are issued.

Flooding possible
Be aware!
Be prepared!
Watch out!

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



Flooding expected
affecting homes, businesses and main roads. Act now!

Flood Warning

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

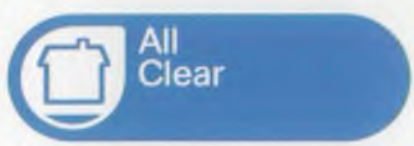
- Move pets, vehicles, food, valuables and other items to safety
- Put sandbags or floodboards in place
- Prepare to turn off gas and electricity
- Be prepared to evacuate your home
- Protect yourself, your family and others that need your help

Severe flooding expected
Imminent danger to life and property.
Act now!

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 keep calm, and to reassure others - especially children
- Co-operate with emergency services and local authorities - you may be evacuated



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

PICTURE REFERENCE

Cover Flooded roads - courtesy of John Connor Press Associates

Inside cover Regional Director David Jordan with Deputy Prime Minister, John Prescott - Environment Agency picture

Pg 1 Boy enjoys a paddle on flooded country lane - courtesy of John Connor Press Associates

Pg 2 Boy with umbrella - courtesy of John Connor Press Associates

Pg 3 Lewes under water - Environment Agency picture

Pg 4 Forced upstairs by the rising floods - lady looks on in disbelief - courtesy of John Connor Press Associates

Pg 5 Debris collects in a sluice gate - Environment Agency picture

Pg 6 Muddy waters engulf large areas of Hampshire and the Isle of Wight

Pg 7 Devastation at Southsea - photo courtesy of The News.

Pg 8 Hampshire water resources gauge the flow - Environment Agency picture

Pg 8 Emergency Services in action - courtesy of John Connor Press Associates

Pg 9 Man with boy - picture courtesy of the News

Pg 9 Flooded road - Environment Agency picture

Pg 10 The emergency services rescue by boat - courtesy of John Connor Press Associates

Pg 11 In the centre of Uckfield - Environment Agency picture

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Pg 12 Barcombe Weir - Environment Agency picture

Pg 12 Robertsbridge - Environment Agency picture

Pg 13 Harvey's brewery and the rescuers rescued - courtesy of John Connor Press Associates

Pg 14 Lewes train station - courtesy of John Connor Press Associates

Pg 14 Robertsbridge - Environment Agency picture

Pg 15 Pumping at Church Farm Pit, Chichester and the pipes - Environment Agency pictures

Pg 16 An ambulance caught in floodwaters at Lewes - courtesy of John Connor Press Associates

Pg 17 Scenes at Chichester - Environment Agency picture

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Pg 19 Aerial photo of the Leigh Barrier

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Pg 21 The reservoir under construction

Pg 22 The Dartford Creek Barrier

Pg 23 Firefighter with little boy - courtesy of John Connor Press Associates

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Pg 26 Boy watches the waves - photo by Ray Kemp of the Environment Agency

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Pg 31 Inundation of the floodplain - Environment Agency picture

Pg 32 The Cuckmere Valley - Environment Agency picture

Pg 34 The horror of the floods - courtesy of John Connor Press Associates

A guide to National Centres and National Services

National Centres and Services Summary

National Flood Warning Centre	Centre/Service:	Centre

MANAGEMENT

Head/contact:	Jim Haywood	Contact number:	7-25-2180
Location:	Frimley, Surrey	Budget 2001/02	1,000k
Line Manager:	Chris Birks, RD Thames	Directorate:	Water Mgmnt

CUSTOMER BOARD

Chairman:	Bryan Utteridge, Head of Water Resources
Directorate representatives:	
Chief Exec:	
EP:	
Water Mgmnt:	David Rooke
ES:	
Ops:	Chris Birks, Edward Evans
Finance:	
Personnel:	
Corp Affairs:	
Legal:	
Other:	Prof. Dennis Parker (FHRC Middlesex), Roy Ward (RFDC Chair), Reg Purnell (MAFF), David Ramsbottom

Comments:

ROLE

To provide the focal point for internal and external flood warning expertise in order to broaden and deepen the Agency's skills and knowledge base in flood warning. The NFWC aims to establish and help implement best practice, enabling the Agency to deliver a seamless and integrated service of flood forecasting, warning and response. The centre also aims to ensure the Agency is a "learning" organisation and seeks to continuously improve its flood warning capabilities to match future needs.

The aims are:

- To identify and review current best flood warning practice(in use of available)
- To support and guide consistent application of current best practice across the Agency
- To assess weakness in application and identify opportunities to improve
- To facilitate improvements through focused R&D programme and learning process
- To support the take up and application of new and emerging best practice

National Flood Warning Centre will achieve these aims by:

- Delivering improvements and greater national consistency
- Develop effective public awareness campaigns and education material to improve understanding by the public of flood

- risks and what actions they must take
- Co-ordination of response from public services to help those in need
- Provide practicable, realistic advice and guidance to flood warning practitioners

The work of the Centre will address the key aspects of the flood warning process:

- Detection of precursor events which may lead to flooding (e.g. heavy or prolonged rainfall etc.)
- Transmission and receipt of related data (e.g. gauging and telemetry etc.)
- Flood forecasting (e.g. use of models, interpretation of data, etc.)
- Warning dissemination (e.g. issue of warnings, broadcasts and focussed transmittal)
- Response to warnings (e.g. action by at-risk public, emergency services etc.)

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Information contributed by: James Knapman (Business Efficiency, HO) Last modified: 17 September 2001

SOUTHERN REGION ADDRESSES

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

HAMPSHIRE AND ISLE OF WIGHT AREA OFFICE
Environment Agency
Colvedene Court
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

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

SUSSEX AREA OFFICE
Environment Agency
Saxon House
Little High Street
Worthing
West Sussex
BN11 1DH
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Fax: 01903 215 884

— Area Administrative Boundaries

— Regional Boundary

● Area Office

▲ Regional Headquarters

www.environment-agency.gov.uk

ENVIRONMENT AGENCY

ENVIRONMENT AGENCY
GENERAL ENQUIRY LINE
0845 933 3111

ENVIRONMENT AGENCY
FLOODLINE
0845 988 1188

ENVIRONMENT AGENCY
EMERGENCY HOTLINE
0800 80 70 60

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