

GIRO FLOOD RISKS WORKING PARTY

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Headlines:

Over a million people in the UK are at a “significant” (greater than 1 in 75 chance) risk of flooding and this number is likely to increase. 10% of all properties in England are located on floodplains and more than a million new homes are due to be built on floodplains by 2020 – including areas in Tewkesbury that were flooded in 2007 (!!).

Climate change and man-made developments (if you can separate the two) are likely to increase the frequency, severity and cost of extreme weather events such as the 2007 floods. Despite the considerable and increasing risk of floods:

- the legislation regarding flood risks is confusing, particularly with regards the responsibilities of different bodies for surface water flooding.
- there is very little publicity about making homes more flood resilient.
- the new Home Information Packs do not include flood risk.
- there's no real consensus on the best way to dry out and repair flooded homes.
- data on flood defences is difficult to acquire and, in places, of dubious quality.

Insurers and the public find it hard to get reliable information on flood risk. Many observers have little confidence in the Environment Agency's (“EA”) assessment of flood risk. In their last three assessments of flood risk (in 2004/05/06), only 40% of UK properties stayed in the same risk category (low, moderate or significant) across each release; more than 10% of homes were in a different risk category in each release; more than a million homes had their risk category increased between one review and the next.

(Some) insurers are wimps!! Or at least may be ill-informed about the “true” flood risk assessment (possibly linked to the instability in EA data referred to above) of properties they insure. Our review of household premiums found that it's still possible to get very competitive insurance quotes in almost all areas of “significant” flood risk. Insurers may be making lots of noise about the need to increase premiums but collectively the market is still charging a far from realistic price in many high risk flood areas. Insurers could also do a lot more to collect flood information in a usable format (water depth and construction of buildings, for example) and would serve the public better if they co-operated after flood events (co-ordinating repairs in the same street, for example).

We've been finalising this paper just as the Pitt Review and the review of the ABI's Statement of (flood) Principles were concluded. The Pitt Review contains many sensible suggestions; to be effective there needs to be clear responsibility for some concrete actions, with real money spent. The ABI also needs to make sure that everyone is clear what its stance is on new properties built in high flood risk areas: whether they will be insured and how the level of risk will be assessed.

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1. INTRODUCTION

1.1 Overview of the paper

We start the paper with a quick reminder of what happened in 2007, how the events of summer 2007 sit in an historical context and what the likely trends for such flood events might be going forwards (section 2). We then tackle the subject of floods from two perspectives - the insurance (section 3) and non-insurance (section 4) aspects. Inevitably there's a bit of overlap between sections 3 and 4. Our insurance section includes a survey of the UK's main insurers, reviewing their allowance for floods and their use of flood models.

We've stuck to just considering UK floods, although we've allowed ourselves a brief diversion (section 3.10) to consider a number of alternative models for flood insurance from overseas. We finish with a number of observations on the state of the world (section 5), covering our views on some of the shortcomings in the UK flood environment, be it legislative, the quality of public information or the behaviour of insurers.

We've included a lengthy bibliography and précised a number of papers that we feel might be particularly relevant for insurance practitioners (Appendix I). If you're flummoxed by the countless acronyms used in relation to floods, we have also included a handy glossary (Appendix II) just for you.

1.2 Thanks

A number of people have helped the working party produce this paper for which many thanks. These include: Ivo Banovsky (Intermap), Richard Norreys (EQECAT), Milan Simic (AIR), Claire Souch (RMS), Manuel Chirouze (Guy Carpenter), Peter Stirling (the Actuarial Profession), Krunal Sheth and the Chairman's indefatigable PA, Jenny Page.

1.3 What the paper is not

We haven't dwelt at length on the impact of climate change on UK floods. The excellent 2007 GIRO paper "The impact of climate change on non-life insurance" covers much of the meteorological arguments, as does a vast body of research that is only a quick click away for the interested reader. Its fair to say our working assumption is that climate change is likely to increase the propensity and cost of floods in the UK.

1.4 Some definitions

We might as well get these over with at the start

Fluvial flooding is flooding from rivers and streams, usually caused by prolonged intense rainfall. A less formal term is just “river flooding”.

Coastal flooding occurs, would you believe it, along coastal areas. It is usually caused by high tides and extreme weather conditions (which can include earthquakes and volcanoes). Such floods may be referred to as sea, or storm, surges.

Ground water flooding arises from increased ground water levels caused by prolonged periods of rainfall. They arise particularly where developments are built on permeable soils or rocks such as chalk, limestone and sandstone. This type of flooding can take place in areas outside floodplains.

Surface water flooding occurs when the ground is unable to absorb rainwater, which causes the rain to flow across the ground. This can occur either because the ground is too hard and dry, so water runs off it rather than replenishing soil moisture or ground water levels, or because the soil is saturated and unable to absorb any more water. This sort of flood is sometimes known as “flash flooding”.

Intra-urban flooding arises when heavy rainfall exceeds the capacity of artificial drainage systems (pipes, land drains and sewers), or when such drainage systems become blocked. This type of flooding may also be known as surface water flooding. In urban areas paving and tarmac behave like saturated soil. Here, if there is very heavy rain, gullies and drains cannot always cope. Excess water fills low-lying areas and can quickly lead to localised flooding.

There are other causes of floods such as infrastructure failure, for example the failure of a dam or pumping station, a burst water main, or the breaching of an embankment or levee. Floods may also be caused by snow or ice melt.

You'll have to look up what riparian means yourself.

2. BACKGROUND

2.1 Why are we here ?

You may have noticed that the UK had some floods last summer.... Section 2.2 provides a reminder of what happened in summer 2007. Whilst the floods were undoubtedly a prompt to produce this paper (and a considerable number of other flood publications in the last 12 months), as noted in the Headlines section, over a million people in the UK are at a “significant” (greater than 1 in 75 chance) risk of flooding, with 10% of all properties in England located on floodplains and more than 10% of new homes built this century having been built in flood hazard areas. So had GIRO papers been produced according to some sort of risk assessment of relevant topics for the profession to consider, perhaps the GI actuarial profession would have been putting finger to keyboard to produce this paper a few years earlier

A look further back than summer 2007 (in section 2.3) also provides a backdrop as to why we are here. The UK has experienced a series of major flood events over recent millenia. Whilst the summer 2007 floods were “exceptional”, they were preceded by a series of major flood events at fairly regular intervals over the last couple of thousand years. So the 2007 floods were not so exceptional that we shouldn't expect there to be similar events in future. In an average year, the UK can expect floods costing over £3,000m (roughly half from river / coastal flooding, the rest from flash flooding / drainage-related issues). In fact, as we touch on in section 2.4, climate change and other man-made interference are likely to increase the frequency, severity and cost of floods, so flood risk will be of increasing significance.

Flood risk is, for now, generally more of a concern for insurers than reinsurers, as likely flood costs are below the deductibles of most insurers' reinsurance programmes. To the extent that reinsurers are concerned about flood risk, it is more likely to be in connection with coastal flooding and the possibility of a repeat of the 1953 floods.

2.2 So what happened in summer 2007?

The total rainfall for England and Wales in May, June and July 2007 was well over twice the usual level for that period. This was the wettest May-July period since records began in 1766. Hundreds of thousands of people were affected in what was the most serious inland flood since 1947. The Fire and Rescue Service launched “the biggest rescue effort in peacetime Britain”.

The primary reason for the floods was the position of the Jet Stream. The Jet Stream contributes significantly to the UK's weather, both generating and steering weather systems in from the Atlantic. The Jet Stream moves with the seasons, tending to be further north in summer, restricting storms to the North Atlantic and the Greenland Sea, and further south in winter. During the summer of 2007 the Jet Stream was several hundred miles further south than usual. This led to more rain bearing depressions crossing southern and central parts of the UK.

A second contributory factor to the quantity of rainfall was the fact that sea temperatures were warmer than average. This led to the formation of more rain clouds, which consequently led to higher rainfall.

Summer rainfall can often be heavy, but usually only lasts for a short length of time. In 2007 there was sustained heavy rainfall occurring from May and continuing through the summer. Dry ground absorbed the rainfall in May and early June. However, by mid-June the ground was saturated and low sunshine levels meant that there was little evaporation. This meant that further heavy rainfall could easily lead to localised flooding. If rainfall was sustained then widespread river flooding was inevitable. Reservoirs that normally absorb rainwater run-off were filled by the May and early June rainfall.

On the 24-25 June a slow-moving area of low pressure resulted in a prolonged period of heavy rainfall, stretching from Yorkshire and Humberside down to Wales. Many places in Yorkshire had over a month's rainfall in 24 hours. Since the soil in the North-East was already saturated the rainwater had nowhere to go and as a result there was major flooding.

The major impacts of the June rainfall were:

- severe surface water flooding in Hull. This led to widespread disruption and damage to more than 7,000 homes and 1,300 businesses.
- the river Don burst its banks, flooding Sheffield and Doncaster.
- there was flooding in Derbyshire, Lincolnshire and Worcestershire.
- there were fears that the dam wall at the Ulley Reservoir near Rotherham would burst. This could have led to flooding of the M1 as well as many homes and businesses.

Around three weeks after the floods in June a further slow-moving, low-pressure system moved northwards across the UK. Rainfall was at its heaviest across the South Midlands. Already high river levels were swelled by the rainwater and run-off. In the following days the Severn, Avon and Thames over-topped (went over) their flood defences and significant fluvial flooding occurred. At their highest, river levels were up to 6m above normal (!!). Thousands of properties in these areas were flooded, and many residents were forced to evacuate as the rivers burst their banks.

2.3 What happened before summer 2007?

Given the headlines last summer, you might be forgiven for thinking that the floods of 2007 were the worst floods in history. However, this thought reflects the fact that no matter how often we are told that the weather is the coldest or wettest for X years, the truth is that history is usually only repeating itself. Significant, or catastrophic, floods have occurred since the dawn of time, before records began. The usual aftermath is to “be prepared” for the next one, but when the interval is a long one, memories fade and optimism replaces knowledge of the facts, which are that whilst the damage from “ordinary” floods can be limited, catastrophic floods are, and always will be, virtually uncontrollable.

Earliest floods

The earliest recorded flood on the River Thames was in AD 9. Elsewhere in AD 14 the West Midlands suffered “inundations of the Severn with great damage”. A river flood along the Dee caused much damage at Chester in AD 33. In AD 37 another flood extended over four counties and records refer to 10,000 people drowned. So floods have been happening in the UK for a while....

Reliable meteorological data does not really become available until the seventeenth century. However there are references, some of them more legendary than meteorological, before then including:

AD 218: the overflowing of the River Trent for 20 miles on either side

AD 353: the drowning of an estimated 5,000 people in Cheshire

AD 479: a flood “10 miles above and 10 miles below” the Thames

AD 575: an East Anglian deluge

AD 738: 400 families were drowned at Glasgow

AD 942: much of Clonmacnoise (next to the River Shannon) destroyed

1086, the year in which the Domesday Book was completed, was noted for “...so great unpropitiousness in weather as no one can easily think”. Heavy summer rainfall in 1233 in Waverley was caused by “... a terrible tempest, violent beyond precedent.... there was flooding in several places to a height of 8 feet....”. In 1400 the old bridge at Durham was swept away by a raging flood. Incessant rain in June and July (sounds familiar?) of 1527 caused widespread crop failure and an extensive famine

Significant floods since the seventeenth century include:

1607

The flood occurred in January 1607. A number of historical documents exist that describe the event and its aftermath. An area from Barnstaple in North Devon, up the Bristol channel and Severn estuary to Gloucester, then along the South Wales coast around to Cardigan were affected - some 570 km of coastline. The coastal population was devastated with at least 2,000 fatalities.

1774

This was the greatest flood for a century. During this flood, Henley Bridge was washed away. It is estimated that at Mapledurham lock the flood level in 1774 was at least 600mm (2 feet) above the level recorded in 1894. There were also significant floods in 1848, 1852 and 1875.

1894

One of the worst floods on the non-tidal Thames in recent history occurred in 1894. This event was due to exceptionally heavy rainfall. During the 26 days prior to its peak, over 200 mm (8 inches) of rain fell which was equal to one third of the total annual rainfall for the area.

1947

Snow, storms and rain combined to cause widespread flooding in March 1947 - the worst since 1894. The river below Chertsey was 3 miles wide and Wraysbury, Datchet and Runnymede were isolated. In Reading a thousand people had to leave their homes and in Maidenhead the floods were over 1.8m (6 feet) deep. More than 100,000 properties were damaged - at least twice 2007's toll. The floods left immediate damage estimated at £12m (£300m at current values).

1952

On 15 August, thirty-four people perished, and sixty properties were lost when the river at Lynmouth was transformed into a raging torrent that devastated the village. The event is recognised as Britain's worst river flood disaster.

1953

On 31 January and 1 February 1953 the greatest North Sea storm surge on record occurred. The surge height reached 2.74m at Southend, 2.97m at King's Lynn and 3.36m in the Netherlands. Across South-East England 300 people drowned, 24,000 homes were damaged and 180,000 acres were flooded. This disaster prompted the construction of the Thames Barrier at Woolwich (at a cost of around £500m) which became operational in October 1982. It was officially opened by Her Majesty The Queen on 9 May 1984.

1994

December 1994 saw the most severe flooding in west central Scotland in recent times. Three people died and there was major disruption, including the closure of 80 roads across Glasgow, Kilmarnock and Kirkintilloch. The clear-up cost an estimated £100m.

2000

Thousands of people were moved out of their homes in October 2000 after floods in many towns and villages in South East England were engulfed by rising waters. Over 1,000 people were affected and the total estimated damage was over £5b.

2003

In December 2002, the Thames catchment experienced more than twice the seasonal average rainfall, causing extensive flooding in the Thames basin during the first week of January 2003. Some 550 houses were flooded. At Mapledurham Lock the water was only 300mm (12 inches) lower than in 1947 and 600mm (2 feet) lower than in 1894.

2004

The Boscastle flood of 2004 occurred on 16 August 2004 in the two villages of Boscastle and Crackington. The villages suffered extensive damage after a flash flood caused by an exceptional amount of rain that fell over the course of that afternoon. The floods were the worst in local memory. A study commissioned by the EA concluded that it was among the most extreme ever experienced in Britain. The annual chance of this (or a greater) flood in any one year is about 1 in 400.

2005

Saturday 8 January 2005 saw the worst floods the city of Carlisle had ever seen after a month's rain fell within 24 hours. An estimated 4,500 homes, schools and businesses were deluged and round 10,000 people found themselves homeless.

And the moral of this historical recap is

History shows us that the floods of 2007 were not a "one off". The UK has seen many events of a similar nature many times before. The only thing we can be sure of is that one day history will repeat itself – we're just not quite sure when....

A brief history of Severn

Floods in the Severn valley pop up at regular intervals in any summary of UK floods. The nursery rhyme about Dr Foster and Gloucester wasn't constructed by accident.... Because the Severn features so regularly, we thought it could have a section of its own.

The Severn valley and the Bristol channel are unique geological features when it comes to understanding floods. The tidal differences in the channel are among the greatest in the world. The Severn (and Avon) regularly flood. Along the Somerset coast we have low lying ground. South Westerly gales blow directly up the Channel to the mouth of the river. The river is tidal as far north as Tewkesbury, where the Avon and Severn join up. There is historical evidence of storm surges, tsunami and many good old-fashioned river floods. There is even the famous Severn bore which surfers recently rode to beat the world record. So the area is therefore important if we need to understand flooding in a UK context.

There are regular small floods not connected to the main rivers, as there are many small streams such as the Carrant. Most of these floods arise from the drainage systems being blocked either deliberately or by debris. The source of the damage to Tewkesbury recently was not the Severn. The course of the Severn has changed over millennium (as witnessed by ancient gravel beds), and the new rivers (for example the Carrant) now take the water away. This is important as these rivers are often small streams but become raging torrents after a significant storm. Many of the recent flooding events elsewhere in the Severn valley are due to small streams becoming far bigger.

The other factor that encourages flooding is the rising water table. In the early 1990's, if you dug a hole 6 feet deep near Tewkesbury, then it would remain dry. At the turn of the millennium that had changed significantly. Ancient Tudor fishing ponds, long since gone and only identifiable by winter rain, retained water well into the summer. Thus if you have a basement, then there was a possibility of flooding due to the rising water table.

A further factor helping to contribute to floods in the area is the inadequacy of flood defences. This was highlighted by the Good Friday storm of 1998. The builders were opening show homes in the Wheatpiece Estate (Tewkesbury) the same day with a view to selling the newly built properties. However the subsequent brochure failed to mention the lake which appeared as a consequence of the storm, and that no one came to view the properties on the opening day as the access roads were all flooded. It took a number of days for the water to subside, with many people in the surrounding area trapped in their homes.

So, many parts of the Severn valley have all the ingredients for regular flooding:

- inadequate drainage and flood defences.
- rising water table.
- flooding from sources other than the main rivers.
- increased rainfall.

Whilst a number of these features have been worsening in recent years, the Severn valley has always been prone to floods. As noted previously, records before the seventeenth century are a bit hazy. Precise dates are also sometimes stymied by the change from Julian to Gregorian calendars. Severn floods might not be given the prominence they might attract elsewhere because they happen so often.... Some of the earliest recorded floods along the Severn include floods in AD 14, AD 115 and AD 218. Slightly more recent floods include:

1484

There was a flood known as The Duke of Buckingham's Water which helped towards his defeat and death in his rebellion against Richard III. Many people were drowned in their beds. The same century saw 8ft of water in the friary at Shrewsbury. In the early records Shrewsbury was an important town (it is, of course, jolly important now if you live there....) and there are numerous records of flooding. When the Earl of Warwick was buried in his parish church at Worcester, the locals stated that he would be drowned, not buried.

1606

1606 saw the famous storm surge or tsunami. Modern historians tend to support the notion that it was a tsunami not a storm surge. Many hundreds of men, women and children perished during this great flood, which was between Gloucester and the estuary.

1672, 1770 and 1795

Flood marks for these years are to be found on the walls near Worcester cathedral. During February 1795 a significant flood occurred which is reputed to be the deepest and most damaging on record. The flood followed a rapid thaw after two months of frost and snow (which happened all over England and Wales). Many Severn bridges were swept away.

1947

The great flood which saw one of the highest recorded floods on the Severn.

A major flood of the Severn has happened on average every 200 years. 1947 was the last one, but smaller, major floods have also occurred in 1960, 1965, 1968, 1981, 1989, 1990 and of course 2007.

We can, perhaps, learn something from our forebears. The Abbey at Tewkesbury (built in 1140) rarely gets flooded – it's on raised ground. Tewkesbury is a mediaeval town with three main streets. Houses are built along alleys which enable any excess water to flow from the main streets. More recently houses have been built on part of the floodplain (the Wheatpieces estate), this included water defences but as we know (and as the inhabitants found out....), water defences can only do so much to protect properties.

More recent Severn floods include:

Easter 1998

This event occurred on the Avon only and was caused by a slow moving front over Warwickshire, Northamptonshire and Oxfordshire. There was extensive flooding at Leamington, Stratford, Evesham, Worcester and Shipston on Stour. This event was estimated with a return period of 30-50 years

October 1998

This was the largest flood event in the Severn Uplands region for 30 years. Communities affected included Shrewsbury, Ironbridge, Bridgnorth, Bewdley and Worcester.

October/November 2000

Autumn 2000 was the wettest autumn on record (270 years): in Wales the rainfall was considered a 1 in 100 year event.

February 2002

In February 2002 flooding occurred along the Severn caused by consecutive bands of very heavy rainfall concentrated over the Welsh mountains. Again this was viewed as an “exceptional” event with return periods ranging from 10 years to 30 years.

In summary, floods along the Severn are probably not going to go away.... They certainly didn't go away in summer 2007, as described overleaf.

Summer 2007 floods

Following the summer 2007 rain, river levels were the highest ever recorded in many locations - probably close to 1 in 200 year event. The Avon at Evesham had levels around a third of a metre higher than previous record flood of Easter 1998. The Severn at Tewkesbury was over 10cm higher than previous recorded in 1947. The Severn at Gloucester was only 1cm lower than highest level recorded in 1947.

The consequences in the Severn valley were dramatic. There were mass evacuations and extreme travel disruption with the West Side of Gloucestershire (the Forest of Dean) becoming effectively an island. The M5, M50 and M40 were closed. There was severe rail disruption, and access to towns and cities was severely restricted. Electricity supplies to 500,000 properties were only protected following emergency work involving the EA, emergency services and the military. The Mythe water treatment works broke down leaving 140,000 homes without water supplies.

2.4 What will happen?

The UK's climate has historically been fairly moderate, not too hot, cold, wet or dry. Climate change means that this will no longer necessarily be the case. As sea temperatures rise cyclones, which pick up energy over warm water, will increase in intensity. Cyclones reaching the UK will have higher wind speeds and will deposit more rainwater than current storms. This increase in extreme weather events, as well as a rise in the mean sea level, will increase the amount of all types of flooding.

Most coastal defences will be largely ineffective

The Intergovernmental Panel on Climate Change ("IPCC") has stated that the global sea level has risen between 10 and 25cm in the past 100 years. They believe that much of the rise may be related to the increase in global mean temperature. Thermal expansion of the oceans and the melting of glaciers and ice-sheets mean that the average sea level is projected to rise by a further 50 to 95cm by 2100. Even if we have managed to stabilise concentrations of greenhouse gases by this time it is likely that sea levels will continue to rise at the same rate beyond 2100.

A serious North Sea surge, like that experienced in 1953, can be brought about by a combination of a high tide, heavy rain, low barometric pressure and a sustained northerly gale. The risk of storm surge damage could increase as the south-east of England is sinking at the rate of about 1mm per year. In fact this tectonic sinkage means that if the same conditions arose today as in 1953, the sea surge level could be as much as two and a half metres higher than was recorded. With global warming experts suggesting that barometric pressure could be lower in the future and wind speeds higher and sustained for longer, the risk of a serious sea surge is increased.

It is believed that most current sea defences will also be ineffective against the increase in the size of storm surges expected. Communities currently living behind good flood defences that provide protection against 1 in 100 year events could, by the end of the century, only have protection as low as 1 in 5 each year, if defences are not improved.

Surface water and intra-urban flooding to increase

An increase in extreme weather also means that rain is more likely to be falling on ground that has been hardened by a long hot, dry period. The ground is then unable to absorb the rainwater, which causes flash flooding, rather than replenishing soil moisture or ground water levels.

Increased hard landscaping in Britain's cities exacerbates this effect by reducing the number of places where rainwater can be absorbed into ground water and forcing the water into drains. An area 22 times the size of Hyde Park has been at least partially paved over in London as a result of gardens being turned from grass to concrete in recent years. Many drains around the country were not built to withstand the level of rainwater run-off they are now being exposed to (see section 4.2). This can lead to heavy downpours overwhelming drains.

There are currently 200,000 properties at risk from intra-urban flooding. This could increase to between 700,000 and 800,000 by the 2080s.

Ground water flooding increasing too....

It is estimated that ground water flooding affects a few hundred thousand properties in the UK. Ground water flooding occurs as a result of water rising up from the underlying rocks or from water flowing from abnormal springs. This tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Ground water tends to flow from areas where the ground level is high, to areas where the ground level is low (who'd have thought....). In low lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional ground water flowing towards these areas, the water table can rise up to the surface causing groundwater flooding. Ground water flooding takes longer to dissipate because ground water moves much more slowly than surface water and will take time to flow away underground.

The level of ground water in Central London is rising and increasing the risk of sub-surface infrastructure flooding (that is basements, cellars and tunnels) and settlement of deeply founded structures (for example tall buildings and underground escalators). The reason for this rise in groundwater is a fall in the level of ground water extraction for industrial and commercial purposes. It has been commented that there are less breweries in London now, due to a reduced demand for their beers, and these breweries had been a significant contributor to groundwater pumping. Ground water had also previously been used to supply the public with water, but after the Second World War public supplies were largely sourced from rivers.

Increasing number of people at risk from flooding

In June 2001 the EA Sustainable Development Unit said “Major floods that have only happened before say, every 100 years on average, may now start to happen every 10 or 20 years. The flood season may become longer and there will be flooding in places where there never has been any before.”

The number of people at high risk from river and coastal flooding could increase from 1.6 million today, to between 2.3 and 3.6 million by the 2080s. It is possible that parts of cities will be demolished to make room for flood reservoirs or green corridors to take water away.

Whilst the number of people at risk of flooding is likely to rise, simply due to climatic changes, this will be exacerbated by increasing numbers of people living on floodplains. Planning applications on floodplains in Britain have been going up every year for the last five years. Around 5 million people, in 2 million homes in the UK are at risk of coastal or inland flooding, with over a million people having a greater than 1 in 75 year risk of flood. Despite the EA providing advice to planners on applications to build on floodplains, councils are not obliged to take the advice. In the year from April 2006 to March 2007 councils gave planning permission to 13 major developments, against EA advice. The Association of British Insurers (“ABI”) has called for tougher planning controls if flood insurance is to remain widely available for new homes. They have estimated that of the 3 million new homes the Government plan to build by 2020, a third will be on a floodplain.

Thames Estuary 2100 project (“TE2100”)

London and the Thames Estuary are currently protected to a high standard of flood defence by the Thames Barrier. Since it was opened in 1982, the number of times each year that the Thames Barrier has been closed has been steadily increasing.

However, rising sea level, changes in fluvial flows due to climate change, increasing development in the floodplain (the Thames Gateway Regeneration Project will involve building approximately 120,000 homes this century, as well as hospitals, schools, transport, businesses and retail premises) and decaying defence performance arising from asset ageing or shrinking maintenance budgets mean that flood risk is increasing. By the year 2030, improved protection will be required.

The increasing flood risk needs to be managed to an acceptable level and what is considered acceptable will need to be agreed by national government and comply with EU legislation. The steadily increasing flood risk may mean that existing developments become uninsurable. The ABI says that the Thames Gateway developments will not be insurable unless special measures are taken to reduce the flood threat. The premiums would either be so high that people could not afford to pay them (especially the low income groups) or the industry might think the risk was unacceptable at any premium.

The EA's TE2100 project is developing a flood risk management plan for London and the Thames Estuary for the next 100 years and is exploring a range of options for an integrated flood risk management approach. As part of this approach, there is increasing emphasis on the use non-structural responses ("NSRs") which could supplement or reduce the need for structural measures. Taking a NSR route to flood risk management will rely on a more community-centred approach that recognises the particular circumstances of community and social groups. However, the effectiveness of many NSR measures is reliant on the community responding appropriately and is currently severely limited by low risk perception and lack of flood experience. Hence, in reality, and as a result of the heavily defended nature of the Thames Estuary, flood risk in London and the Estuary will be managed by a combination of structural and NSR responses.

Current Government policy ensures that flood risk is, or should be, taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding. This is outlined in Planning Policy Statement 25 ("PPS25"), published in December 2006 (see section 4.5). The process that must be followed directs development away from areas at highest risk. On occasion there can be a strong case for developing in an area that is at risk of flooding. In those exceptional circumstances, the policy aims to make it safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall. Independent research by the ABI shows that implementing PPS25 effectively for new housing developments in the Thames Gateway could reduce potential flood risk losses by over half. However, the Strategic Flood Management Plan will not be completed until 2008/09 but by then many development plans in the Thames Gateway will be approved.....

It is hoped that a focus on the following innovative risk reduction measures, recommended by both the ABI (2004) and the Greater London Authority (2002) as part of the overall development strategy, may go some way to compensate for the lack of integrated flood risk management at an earlier stage, namely:

- effective development control carried out according to PPS25 to potentially prevent inappropriate development.
- the use of flood-resistant building design.
- creation of areas of flood-compatible land use adjacent to rivers that can act as occasional flood storage.
- improved emergency preparedness.

However, about 50% of new “affordable” homes in the Thames Gateway will be developed using modern methods of construction which are largely untested in relation to their resilience to flooding.....

3. INSURANCE ASPECTS OF FLOODS

3.1 Rating and underwriting issues

Insurers have a number of options when it comes to providing flood cover. The following list is not exhaustive and some are (deliberately) simplistic.

Refuse to cover high risk properties

Insurers could refuse to insure high risk properties. At present risk is classified by reference to river and coastal flooding. Such an approach would blight over half a million properties and would risk government and public backlash. However, a “get tough” attitude might galvanise the government into a step change in funding and defence activity.

Remove flood cover altogether

The UK is almost alone in offering flood cover as part of standard home/commercial insurance packages. A radical and heavy handed approach would be to remove flood cover altogether, irrespective of potential flood risk. Such a move would reduce volatility of financial results caused by major events but has major PR issues both in terms of government and public backlash. However, removing cover altogether would also galvanise the government into doing something about the underlying problem.

An alternative to the blanket removal of flood cover would be to decline cover where developments have been challenged by the EA on flood grounds. Cases such as the new development in Longford, just outside Tewkesbury (see section 5) would be a classic case where insurers could consider not offering flood cover to a new development knowingly built in a flood-prone area.

Introduce a levy for flood protection

One of, if not the, major constraints to enhanced flood protection, be it by river/coastal defences or improved drainage infrastructure, is funding. The government, like most GIRO attendees, has a finite purse. To generate a step change in funding and ensure visibility of those funds a levy (via insurance) could be introduced specifically for flood-related enhancements. It could be called a levee levy perhaps?

There are pro's and con's associated with a levy. The general population could pay for additional flood funding via additional direct taxes – however this is not usually a vote winner. Alternatives include a levy on some or all insurance premiums. This would, of course, be just another “stealth” tax but an increase in IPT, for example, would only have to be modest (say 0.5%-1.0%) to generate circa £500-1,000m per year.

Charge economically justified premiums

That would be a first wouldn't it? However, charging economically justified premiums is not as simple as it sounds. No really. Most flood models are probabilistic as such they determine the likelihood of a flood occurring, rather than the risk premium which requires a view of the quantum of damage expected. Irrespective of the weakness of such models most if not all companies have shied away from reflecting the full extent of any increased risk in premium rates.

Insurers could adopt a risk based approach and increase premiums for the higher risk cases. In some instances the flood element of the premium could increase by an order of magnitude. Again, this approach risks a PR backlash – essentially the industry being the fall guy for the government. Significant premium increases could also provide more momentum for the government to implement additional flood defences and protect their voters.

Insurers would run the risk that charging economically justifiable premiums (that is probably significantly higher in high risk areas) actually reduces their total premium income. This could arise because in a fiercely competitive market other insurers still charge uneconomic rates, or people simply do not take out insurance.

Demand all new developments utilise flood resilient measures

The industry could go public and state they won't offer insurance for new developments without resilient measures. This is a stronger message than declining cover for new developments in flood risk areas. In practice this would be fraught with difficulties as it would be very hard for insurers to know whether a given house was "new" or not (many houses may have the same postcode as "old" houses next door, for example), let alone whether it had suitable flood resilient measures.

Apply policy terms and conditions more rigorously

Strictly speaking the amount of money paid out in compensation for flood claims should often be reduced because the claimant is under-insured. This isn't a recipe for great PR for a given insurer or the insurance industry, but off the back of major weather events insurers could do more to remind people about the importance of keeping their Sum Insured up to date.

Other policy terms and conditions could also be applied better. Strictly speaking ground water flooding is often not covered by household insurance, yet benign, or possibly inefficient, insurers regularly pay claims for such floods. Policyholders have a duty to do as much as possible to protect their property from damage. Again, it would be a harsh insurer who refused, or reduced, payment because of this but there is scope for insurers to argue that their insureds should have done more, either to protect their property or to move valuable items to positions of safety.

Revise excesses or conditions of insurance

Rather than increase premiums or remove cover, insurers could introduce economically justifiable excesses. At present standard excesses for individual properties range between zero and a few hundred pounds. Flood excesses exist, often related to the sum insured and previous claim experience and are typically a few thousand pounds. For high risk, high sum insured properties an excess of £10,000+ may well be justified. Higher excesses still leave the insurer with a hefty bill however, particularly when average flood claims can run into many tens of thousands of pounds. Insurers can also run into problems: what if the insured simply doesn't have a spare £10,000 to pay the first £10,000 of any claim?

Another alternative might be to require insureds to take resilient and resistant measures to protect the property and hence reduce the risk – see section 4.4

Demand better information

The previous insurer options relate to specific insureds (albeit all of them in the case of removing flood cover completely). There are more general things that insurers could and should be doing to better enable it to underwrite flood risks. Assessing risk is all about having accurate and appropriate information – better quality information generates greater confidence. Whilst a number of the larger insurers have invested significant sums developing their own flood models, public data available through the EA, NaFRA or SEPA has a number of limitations. Fundamentally, none of the government backed data sets were created for insurance purposes. As such they should not be used as an insurer's sole source when assessing flood risk.

Putting aside the appropriateness or otherwise of public data to assess risk, the industry could make public the extent to which the government's risk assessment of individual properties, or even significant geographical areas, changes from one year to the next. This can mean an individual property/area can be classified as high risk one year, low risk the next and a medium risk the year after that. If the government want insurers to provide flood cover, government agencies need to provide fit for purpose data that generates confidence not confusion. Sharing the confusion and inconsistencies of the current data sets with the voting public might be a way of generating political momentum..... Whilst the government bodies concerned are making significant progress enhancing their river and coastal models, more needs to be done. At present models assessing drainage/flash flood risks are unavailable from government sources.

Further, there needs to be clarity and visibility around planned and completed defence work. Through the ABI Statement of Principles ("SoP", see section 3.7) insurers agree to cover properties that benefit from adequate defences (or those where such defences are planned). Should defences not materialise the industry could/should remove cover.

An extension to demanding better information is to make public all (government) information related to risk assessment - this should not be seen as scare mongering but rather helping the individual/company assess their level of risk.

Lobby for one agency to be responsible for all water related issues

At present ownership of water-related issues is at best confused and at worst chaotic: the EA, Local Authorities, water companies and landowners all have some responsibility. Where responsibility starts and stops is rarely clear.

Irrespective of responsibility a complete understanding of flood risk (river, coastal, groundwater, surface water, dam break and drainage) is essential to assess risk. Such a complete view is unavailable under the current regime and will only be viable if the EA, Local Authorities and the water companies can share information without fear of recrimination – sharing known weak spots in existing infrastructure is fraught with risk. Realistically, this is only likely if responsibility sits under one agency.

To support the creation of a complete view of flood risk the industry should actively lobby for one agency to be responsible for all things water related (as proposed in the Pitt Review).

Use available data more effectively

There is much data available to insurers, though insurers would have to pay to use some of it and have the capability of using it for rating or underwriting. The types of data available for the main types of flood are summarised below:

For fluvial floods data includes:

- EA NaFRA – covers England and Wales at 100m x 100m level – based on the NEXTMap DTM (Digital Terrain Model); 1m accuracy, made available to insurers for a nominal fee. It uses the existing flood zones and data from NFCDD to give a view of defended risks. Only data available covering England and Wales.
- NFCDD (National Flood coastal and defence database) – is a list of defences (not private defences).
- SEPA have data for Scotland - based on a NEXTMap DTM; this is not currently made available to insurers although the data is available on-line. They will supply it for £2 a click. They do make defence data available.
- OPW (Office of Public Works) Northern Ireland has no mapping available at present but has just commissioned a height map.
- defended and undefended maps of the largest 79 urban areas are available from JBA (approx 70% of all properties) – based on LiDAR – 0.15m accuracy.

For coastal floods NaFRA includes coastal risk on the same basis as river – but only at the 1 in 200 level.

For surface water floods data includes:

- 124 cities have been modelled by JBA in LiDAR and full England & Wales coverage will be available shortly.
- RMS is promising a model by summer but not intended for use at property level.

For ground water floods data includes:

- BGS/Experian have just launched a ground water map – shows areas affected without any measure of probability.
- JBA ground water maps give an event likelihood as well as extent.

For dam breaks data includes:

- national database of dams held by EA but not generally available because of the fear of terrorist attack, though this is likely to change following the Pitt Review.
- JBA has dam break maps for over 1,500 dams likely to affect urban areas.

Rating in practice

Analysis was carried out to assess the availability and affordability of home insurance in flood areas in England and Wales. To do this, a sample of 1,000 domestic postcode units were selected from each NaFRA 2006 risk category – low, moderate and significant risk of flooding. In addition, 1,000 postcodes deemed by NaFRA not to be on floodplains were selected.

To reduce the potential for results to be distorted by other perils, the postcode samples were selected in such a way that the spread of the expected claims cost arising from causes other than flood were distributed evenly between samples. A standard home policy was created, with both buildings and contents cover required. This policy was attached to each of the selected postcodes to produce a set of 4,000 risks which were identical in all ways other than the postcode.

These risks were run through ISL's Broker WhatIf package (in February 2008) to generate a range of quotes available from 24 different insurers.

Headline results for the mean of the postcodes in each category are included in the following table:

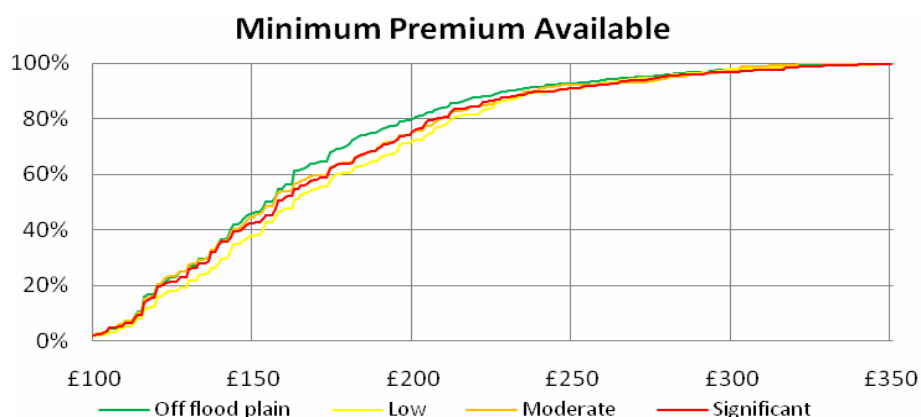
	Off Flood Plain	Low	Moderate	Significant
Number of postcodes	1000	1000	1000	1000
Number of companies quoting	22.51	20.87	20.55	18.92
Mean price	£268.35	£307.90	£306.03	£319.88
Median price	£256.40	£273.13	£267.83	£270.93
Cheapest price	£164.23	£173.80	£168.35	£169.89
Standard deviation of available prices	£67.44	£127.89	£134.46	£157.97

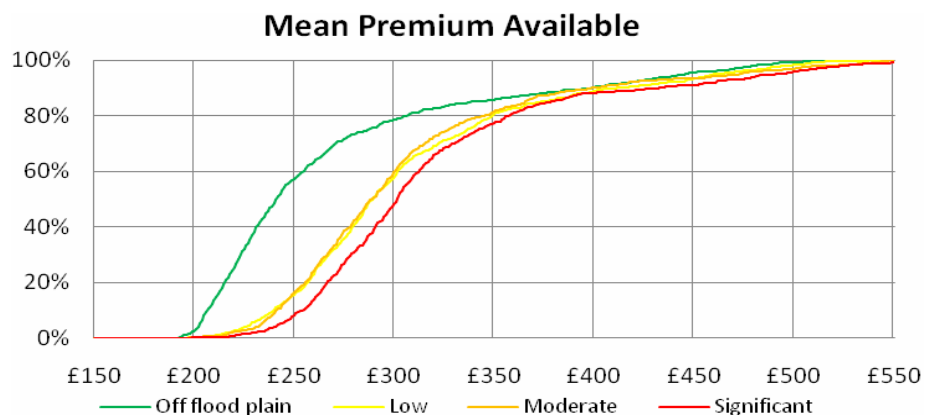
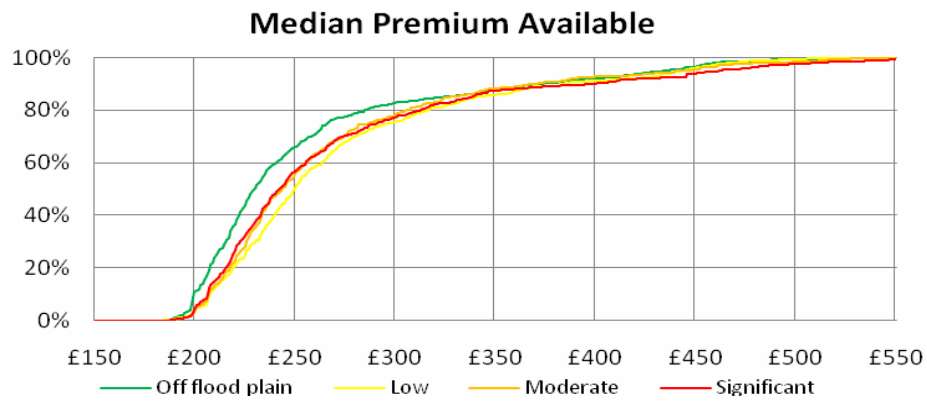
Based on this analysis, it seems that even in a significant risk flood area a homeowner prepared to shop around would have little difficulty in insuring their home. On average 19 of the 24 insurers would insure a property at significant risk of flood, and for every postcode selected at least 11 companies provided a quotation.

The additional premium required to insure property in a flood area does not appear to be prohibitive. The mean premium charged in a significant risk flood plain in £320, compared to £268 in off flood plain postcodes. The best price available for those prepared to shop around shows a very low additional premium, with the average cheapest quote available in significant risk flood plains being just £170, compared with £164 off flood plains.

The range of available prices is much higher in higher risk flood areas. This suggests that a minority of insurers are charging substantially higher prices on flood plains, but that many are not.

The following graphs show the distribution of the minimum, mean and median premium available for the thousand risks in each category.





In the graphs of minimum and median premium, the distribution of quotes for low, moderate and significant risk flood areas are very similar, and are typically a few pounds more expensive than the equivalent percentile available off floodplains.

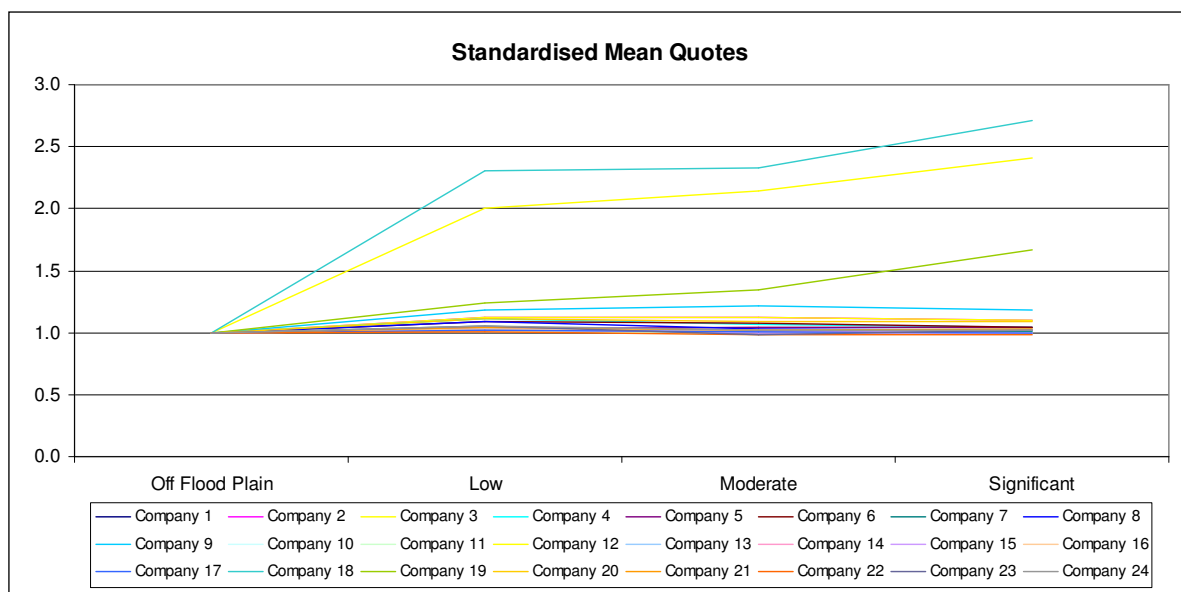
The graph of mean premiums available exhibits a different pattern, with premiums in significant risk flood areas typically a few pounds greater than in low and moderate risk areas, and premiums in flood plains being typically around £50 greater than the equivalent percentile off flood plains.

The following table contains details of how many risks and at what average price each company quoted for:

	Significant		Moderate		Low		Off Flood Plain	
	Number of Quotes	Average Quote	Number of Quotes	Average Quote	Number of Quotes	Average Quote	Number of Quotes	Average Quote
Company 1	0	-	988	254.13	985	260.46	993	250.62
Company 2	364	354.61	700	362.18	818	361.97	958	322.38
Company 3	364	265.40	700	270.67	818	270.82	958	241.26
Company 4	455	260.74	464	265.39	507	278.27	812	249.29
Company 5	623	365.71	653	368.14	626	361.83	865	351.51
Company 6	653	221.77	596	227.17	626	231.65	763	211.82
Company 7	663	267.49	712	266.19	739	269.15	947	264.38
Company 8	730	268.33	675	270.51	699	285.49	802	262.87
Company 9	753	403.59	876	414.15	935	403.34	997	342.01
Company 10	816	273.35	796	275.89	795	287.71	803	274.02
Company 11	856	318.36	788	313.66	803	325.75	967	318.17
Company 12	902	696.01	898	618.04	913	577.58	969	288.80
Company 13	939	223.02	929	220.67	919	223.87	910	216.16
Company 14	940	270.33	942	268.64	918	272.02	919	266.51
Company 15	952	264.36	941	265.36	931	276.06	928	265.19
Company 16	953	263.69	938	265.27	899	267.92	993	260.03
Company 17	955	224.25	959	225.96	944	229.27	943	224.61
Company 18	1000	594.09	1000	510.37	1000	506.48	998	219.48
Company 19	1000	411.36	1000	329.18	1000	305.56	999	245.92
Company 20	1000	356.73	996	355.42	998	363.53	997	325.98
Company 21	1000	272.85	1000	271.55	1000	275.92	999	265.39
Company 22	1000	231.86	1000	231.14	1000	235.70	999	234.46
Company 23	1000	203.86	998	197.35	999	210.62	996	200.22
Company 24	1000	203.42	1000	203.38	1000	208.35	999	198.57

From this, it seems that a little over half of the companies underwrite on flood risk in some way (companies 1 to 9, 11, 12 and perhaps 16), although only company 1 has taken the extreme view and excluded all significant risk NaFRA postcodes.

The following graph has been produced to show the extent to which each companies' pricing correlates with NaFRA flood areas. To ease analysis, average prices are expressed as a proportion of the average price off flood plains:



From this, it seems that only two insurers on the ISL panel has prices which vary dramatically with flood risk – companies 12 and 18. Of the others, there is some evidence that companies 19 and 9 charge higher premiums in flood plains, but in all other cases average premiums for each segment are no more than 12% higher than off flood plains.

Conclusions which can be drawn from this analysis are:

- insurance is generally available on NaFRA floodplains, with industry underwriting being not much more restrictive than in other areas.
- most insurers do not charge significantly higher premiums on NaFRA floodplains than in other areas. These insurers either have a view of flood risk which is substantially different to the NaFRA view of flood risk, or they do not have flood risk as a significant part of their underwriting or rating structure.
- a minority of insurers do price substantially higher on NaFRA floodplains than off them. These insurers increase the average quote available in the market, but these can usually be avoided if the customer chooses to shop around.

This analysis was been conducted based on ISL's Broker WhatIf package, and as such is representative only of that part of the market represented on their panel. In particular, no attempt has been made to assess direct insurance channels.

How do insurers arrive at flood loadings?

Arriving at a sensible flood loading to include as part of an insurer's risk premium is as much art as science..... Certainly there is no “right” or “wrong” way to arrive at flood loadings. The main components of any flood loading will typically be an allowance for attritional claims plus a large / Cat loading for larger events.

The allowance for attritional claims might be averaged over a “medium” timescale. It's a matter of judgement, and sometimes the availability of reliable data, as to how long a period one might take an average over. Most insurers change their claims systems at regular intervals and may change their protocols for how they record claims. It's important to understand how claims systems and methods of recording claims have changed so that one has a consistent definition of claims cost over time from which to base an attritional loading. It's a matter of judgement where attritional claims stop and large / Cat claims begin.

Most insurers have, or have access to, Cat models used as part of their reinsurance purchasing process and ICAs. These Cat models would usually form the basis of any large / Cat allowance. For both large / Cat claims and attritional claims it may well be considered appropriate to include an increasing factor to allow for the effects of climate change. Our practitioner survey (section 3.9) asked the main UK insurers for some details of: how they arrive at flood loadings; what they typically are; how their loadings changed following the summer 2007 floods. We'll be presenting the results of this survey at the September GIRO conference.

3.2 Flood models

Three basic types of model exist to assist insurance companies with assessment of flood risk. We've described these from the perspective of an insurance user. So, for example, when insurers talk about return periods for floods they're talking about, and only really interested in, the return period of the river flooding, rather than reaching a certain depth, say. We've also used the term “probabilistic or stochastic models” which is how insurers would describe the models below; a more scientifically correct term might be “event set models”. The types of model are:

- Rating models, which define areas in which any individual point can be expected to flood with a given frequency. Typically each area, or floodplain boundary, is related to the expected return period of flooding, for example 1 in 100 years, and so on. These models do not assess the extent of individual events.
- Deterministic models, which aim to describe as accurately as possible the extent of an individual event, for example, a repeated historic flood, a historic flood given upgraded defences, or a “worst case scenario” for a particular area. These models do not assess how often a particular location might expect to experience flooding.
- Probabilistic or stochastic models, which provide an event set which aims to mimic the entire possible spectrum of possible events in the area modelled. Each event is associated with a frequency of occurrence (relative to other events in the event set) and is described in terms of the area inundated and/or severity at locations within the affected area. Hence these are the only types of model to assess both frequency of flooding and flood extent.

What probabilistic flood models are available for the UK?

The availability of rating models is dealt with in the rating and underwriting issues section, 3.1. From a reinsurance perspective, it is the probabilistic models that are of most relevant, since this is the only type to enable output of the loss exceedance curve used for pricing of reinsurance cover. The table below summarises the availability of probabilistic modelling solutions for the UK:

Source	Peril covered	Geographic Coverage	Input	Output
AIR	Sea surge	S&E coasts of England	Insurance portfolio; not designed for individual risks.	Loss exceedance curve. Results aggregated to postcode unit level and above. Results mapping at postcode sector level.
	River flood*	Great Britain	Insurance portfolio. Can accept risks at address level	Loss exceedance curve. Designed to provide output at postcode unit level. Results mapping at postcode unit level.
EQECAT	Sea surge (in conjunction with EU Wind model)	Coastline of England and Wales (E, S & W)	Principally insurance portfolio information at postcode sector but will accommodate site (lat/long) information.	Loss exceedance curve and results aggregated to postcode sector level and above
RMS	Inland flood**	England, Wales & Scotland	Insurance portfolio and individual risks	Loss exceedance curve. Results at variable resolution grid (minimum 50m) and aggregated to postcode sector level and cresta. Derivative products suitable for risk rating at street postcode unit level. Flood risk assessment maps for major and minor rivers will be available shortly after the release of the main model.
	Sea surge (in conjunction with windstorm)	S&E coasts of England	Insurance portfolio and individual risks	Loss exceedance curve. Results at VRG (Minimum 50m) and aggregated to postcode unit and above. Derivative products suitable for risk rating at street and postcode unit level.

* Model is due for release in October 2008

** Model first released 2001, with upgrade due for release in Summer 2008

For river floods, reinsurers tend to run the model currently available to the market but often do not use the output numbers for any specific analysis. This is partly due to the model assumptions, and therefore the high loss numbers associated with the high return period events which reinsurance, by its nature, is often looking at. The version of the RMS UK river flood model currently serving the industry contains very broad assumptions that make the tail risk look extreme in many cases. The driver of these large, stepped results are the defence assumptions built into the model. These assumptions are based on defence failure and when and where these failures occur. Without detailed defence failure data for the defences that operate in the UK, RMS applied failure rates according to the population density surrounding the water course in question. At high return periods this meant most of the defences were assumed to be breached and the output was a high gradient step in the Exceedance Probability (“EP”) curve.

However, partly due to the summer 2007 floods, and partly due the new model releases in 2008, the reinsurance industry are starting to increase their use of UK flood specific models. Both AIR and RMS have obtained detailed defence data from the EA and have used that within their models. The increase of computer power has also made it possibly for the models to contain more detail without compromising run time by a significant amount. Interest in these models within the industry is significant but how much the outputs will be relied upon remains to be seen.

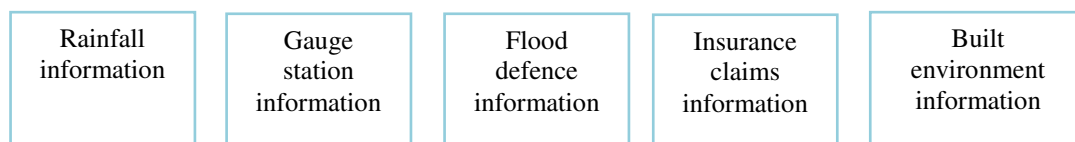
Our survey (see section 3.9) asked the UK's main insurers about their use of Cat models: which models they use; how they use them; what information they can feed into the models; and what they feel the limitations of the models are. We'll be presenting the results of this survey at the September GIRO conference.

Components and limitations of probabilistic flood models

As with any model, the least accurate component is the one that will limit the overall accuracy of the modelled output and, in the case of probabilistic flood modelling for insurers, the accuracy of reinsurance pricing so obtained. This section reviews the data inputs and components to probabilistic flood models and examines the limitations and quality of each component to provide a better understanding of the limitations of such models and identify areas of focus for those wishing to improve the accuracy of model output.

Data inputs

The main data inputs and components to a probabilistic flood model are:



Digital terrain model

The quality of DTMs available for the UK is extremely high, there being solutions available at an accuracy of 15cm. These solutions are extremely expensive, however, and additionally, if later modelling is carried out at this resolution, run-time problems can result for the user of the model. Hence very low resolution data is rarely incorporated into Cat models, and more aggregate solutions are generally used. 10m solutions are reasonably priced and adequate for nationwide flood modelling, especially if enhanced by 1m data in areas of high exposure.

Rainfall information and gauge station information

Good quality historic precipitation and gauge station information is available for the UK. Although not available for free as would be the case in the USA, this information is available at reasonable cost to the modelling companies. The main limitation on such information is the length of the historical data record, which is generally 100 years or less at gauging stations in the UK.

Flood defence information

River flood defence information for the UK is held by the EA in its National Flood and Coastal Defence Database (“NFCDD”). These data have only been made available to insurers in the past year; hence models released prior to 2008 could not include this information. Getting hold of the information in the NFCDD remains a complex, with different levels of success reported by different companies seeking the information, and a licence for the data at country level is costly.

Several concerns exist in relation to the quality of the NFCDD data, as expressed in the 2007 National Audit Office report “Building and maintaining river and coastal defences in England” (see a precis in Appendix I.2). This report found that the NFCDD “records are not yet complete” and refers to difficulties encountered obtaining information regarding existing defence structures. Notwithstanding such comments, the availability of the NFCDD, to those companies who obtain access, has greatly improved the information available regarding river flood defence locations and their design standards in the UK. Information relating to construction type is also recorded, but unfortunately details such as state of repair and age of the defence are not available. The modelling companies face further challenges if they wish to obtain information regarding sea defence, which is held in a different database, or in relation to drainage and sewer systems, which is available not from the EA but rather from various local drainage organisations. In summary, flood defence data appears to be one of the weakest inputs to today’s Cat models, being expensive, difficult to acquire and, in places, of dubious quality.

Claims information

Claims information are critical for calibration and validation of the probabilistic Cat models. The availability of such information has increased in the last year as a result of the 2007 flooding. How much of this information is passed on to the modelling companies to enable them to improve their models is a matter for individual insurers to decide. Generally speaking, the more information companies provide, the better the model should be expected to perform, and from the point of view of an individual company, provision of such data provides the reassurance that the model has been calibrated against their individual experience. It may additionally be possible to calibrate a customised version of a model to the experience of an individual company.

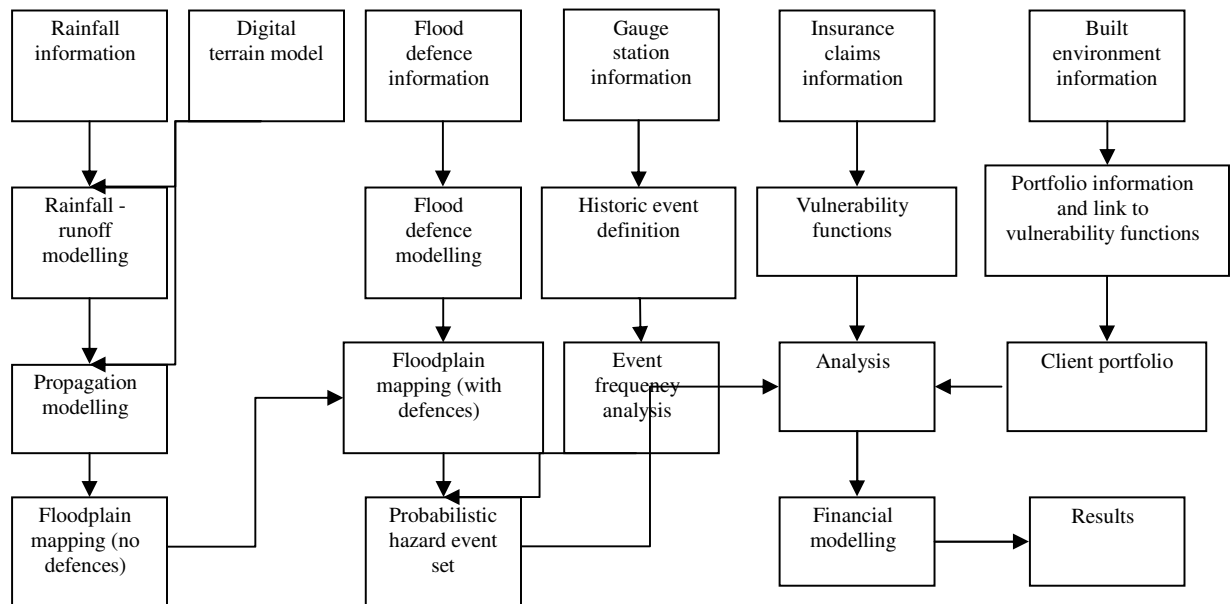
Ideally, claims information will include the original exposure information, value of the paid claim, and information on the hazard intensity (typically water depth) recorded at the building. The exposure information will ideally include details regarding building height, construction material, occupancy and presence or absence of a cellar. Although most claims data available in the UK lacks all of these components, the claims information available from the 2007 event is generally better than has been previously available and show a marked improvement relative to data recorded in 2000. Information regarding water heights at buildings and details relating to the building type may only be available via reference to the original loss adjuster's notes, however. Should insurers wish to play their part in the improvement of model quality, therefore, there remains a need for continued improvement of the quality of exposure and claims data provided in insurance portfolios.

Built environment information

Built environment information, providing data on the number and type (for example height, construction, occupancy, and so on) in a particular region is available from a number of sources, including census data and commercially available databases. Although of variable quality and cost, overall, sufficient data are available to the modelling companies.

Modelling process

The main component of a probabilistic flood model is the hazard event set. The development of this event set uses much of the information listed above and a number of modelling stages, as illustrated:



In addition to the constraints resulting from accuracy and availability of the raw data components, the following comments relate to the quality possible for each of the modelling components:

Propagation modelling and floodplain mapping (no defences)

The science of propagation modelling and resulting floodplain map output is also a well-developed science and may be viewed as one of the better quality components of today's probabilistic flood models. In general, the quality of this component is governed by the quality of the DTM used. Some differences do exist between solutions that carry out physical modelling of water flow (that is those which take hydraulic factors into account) and those that use a purely GIS-based approach to estimate how far water may flow, the former being the more accurate.

Development of probabilistic hazard event set (including historic event definition and event frequency analysis)

Information on the extent of historic flood events may be more sparse, since only recently could events be captured by modern imaging techniques. Likewise, the quality of any event-frequency analysis is limited by the length of the historical data record, which is generally 100 years or less at gauging stations in the UK. The gauge station data may be supplemented by historic records relating to very large events, which are more likely to be recorded by newspapers. Although statistical methods do exist to estimate extreme event severities from a limited historical record, the more data available, the more accurate the analysis, and which of many techniques available is the most suitable for estimating severities of a particular peril in a given location is also open to scientific opinion and judgement, and the approach used will vary from model to model, causing variation in the results. Since the historical record is one component that cannot be improved, the availability of historical information is one of the major factors limiting the accuracy of probabilistic models. The user should be aware that the historical event set for calibration of losses at all return periods is limited to an approximately 100 year data record (or less in some cases).

An aspect of flood modelling that will be given more thought following the summer 2007 floods is independence of events. As we saw in summer 2007, the conditions that lead to one flood may remain for a period after the first event (saturated land, inconveniently placed Jet Stream, see section 2.2). So the chance of having a second flood was in fact greater immediately following the June floods. The cost of the 2007 floods was below most insurers' reinsurance retentions, however the combined cost (of the June and July events) may well have been above the retention level. The assumption of independence of events may well be a weakness in many insurers' and reinsurers' flood models.

Defence failure modelling

The modelling of flood defence failure in probabilistic models is a further area of severe limitation on the accuracy of flood model results, for several reasons:

- constraints on the availability and quality of data from the NFCDD, as outlined above.
- the NFCDD does not aim to contain the information that is directly needed by the developer of a probabilistic model, who must assess the probability of a particular defence failing for a given scenario in the model's event set, which may typically be quantified according to the level of water at the defence structure. Rather this probability must be derived from information provided by the database regarding height and construction type of the defence.
- typically, the height/construction information is used by the model to link each defence to a defence failure probability curve. These curves may be derived from first principles by the modelling company, or obtained from existing information available in scientific literature. In fact, there is little historic data available worldwide relating to defence failures, and hence little validation of these curves has been carried out.

Portfolio information and link to vulnerability functions

The information contained in the portfolio provided for analysis, per risk, is the risk location, sum insured, risk type and coverage, policy information, insurance terms and conditions (applied at either risk or policy level) and information on building construction and occupancy that can be used to relate the risk to the relevant vulnerability function in the model. Although the information in insurance portfolios has improved over the last few years, much information remains missing from portfolios provided for analysis relative to the "ideal" case. This problem not only limits the accuracy of results that may be obtained, but also can limit the performance of the model due to the need to implement many assumptions to make up for missing data. Broadly speaking the "ideal" case information includes:

- risk location for flood analysis should be provided at least at full postcode level, but this is not always the case. Specifically, there remain problems for many multi-risk policies where the location of individual sites is either not known or not properly recorded. In the case of address level information, a further common problem may be the provision of adequate information for accurate geocoding.

- sum insured, risk type, coverage and information relating to risk/policy level terms and conditions of good quality. Problems exist in relation to many BI policies, in which the value of BI coverage entered may be inaccurate or not correspond to the requirements of the model.
- information on building type and construction, especially in relation to information that's relevant for flood (for example building height, presence of cellar, and so on), is very commonly inadequate, forcing the modeller to make assumptions when linking the building to vulnerability functions.

In the case where building occupancy and construction information are not adequate, flood models will generally provide a module that gives a proxy for this information, that is the model will incorporate information on building types per region and use the risk location and type to determine the most likely building construction type and accuracy. Although good information regarding building construction type is available from various sources, any assumptions will limit results accuracy. Thus lack of adequate information in insurance portfolios may be considered one of the limiting factors on results accuracy; this is even more the case for those risks for which adequate locator information is not known.

Vulnerability functions

There are several approaches for assessing the likely damage to a property or group of properties in the event of flooding. The approach used by today's Cat models is the "depth-damage" approach, in which damage is related primarily to the water depth predicted to occur at the property. A wealth of information exists on "depth-damage" curves in the scientific literature relating to UK flood. There are some limitations to this approach, however, which include:

- the level of damage to a particular building depends not only on water depth, but also on other factors such as water velocity, sedimentation, impacts of debris with the building structure, duration of flooding, whether the water is fresh, salty or polluted, and whether or not the property was protected by its owners prior to the flood, for example using sandbags or other protection measures. These other factors cannot easily be taken into account by a simple "depth-damage" curve. Although in some cases the depth-damage curve may be adjusted for selected risks where specific circumstances apply, for example, risks that are expected to flood for a longer duration due to their location, for the most part, variation in damage value due to factors not related to water depth are considered to form part of the uncertainty on the vulnerability function.
- analysis of claims information show that the uncertainty associated with a depth-damage curve is extremely large. Yet although standard deviation is often reported by the Cat models, this information is rarely taken into account by the users.

- depth-damage curves are extremely difficult to validate, and as far as insurance claims values is concerned, little validation has been carried out. Claims data are not normally provided with associated with water depth information, and the few studies that have been carried out to assess flood depths at damaged properties after an event have normally focussed on economic damage rather than providing a link to the value of the eventual insurance claim paid.

Vulnerability functions are one part of a probabilistic Cat model that have a very direct impact on the results of the model. Put simply, if a vulnerability function overestimates damage by approximately 50%, the results of the model will be overestimated by approximately 50%. Hence any deficiencies in this area should be considered extremely seriously. The floods in 2007 have generated a new set of flood claims information which has the ability to improve the accuracy of vulnerability functions in the UK river flood models going forwards. The extent to which such an improvement will be seen in the models will depend upon the willingness of insurance companies to make their claims information available to the modelling companies. Some aspects of flood claims are unmodellable – such as toxic waste leading to contamination problems. Information provided to AIR and RMS is expected to be used in the development of vulnerability curves for the new river flood models to be released later this year.

Financial terms and conditions

Financial terms and conditions, and reinsurance treaty structures are modelled by Cat models worldwide, can be done so with good accuracy, and in general do not specifically relate to flood risk. Hence they are not discussed further here, except to mention one issue that is specifically a problem for flood modelling, namely the hours clause (see section 3.5).

Flood mapping and risk rating in relation to probabilistic models

At present there is a lack of flood model solutions that incorporate both a floodplain mapping aspect and a probabilistic model. Floodplain mapping solutions are provided by organisations such as the EA and SEPA (see the “Use available data” section in 3.1) but these maps are not consistent with the probabilistic models used to price reinsurance. From an insurer’s perspective, the lack of integration between probabilistic and floodplain mapping solutions can cause inconsistencies in the approach used for underwriting and reinsurance pricing, for example:

- disparity between the treatment of flood defences in probabilistic and floodplain mapping solutions can mean that either (a) some postcodes analysed in the probabilistic model show high levels of exposure at low return periods whereas the floodplain map indicates a good level of defence against floods of this scale; or (b) assumptions made by the probabilistic model relating to population density imply that a postcode is well-protected whereas the zonation model reveals that no defence is present.

- disparity between the areas considered to flood once in n years between the probabilistic and floodplain mapping solutions due to differences in propagation modelling between the two models can lead to the inability to properly reflect underwriting practices when assessing a portfolio's exposure to flood. For example if the insurer chooses to apply different deductibles according to whether a risk lies in or out of the 100 year return period flood zone as defined by the floodplain mapping solution, it is not possible to define in the reinsurance assessment that "all risks in the 100 year flood zone should have a higher deductible applied" – rather the information must be stored at risk level (not always the case with some portfolios).
- a floodplain mapping solution will typically only examine one "type" of flooding, for example, river or sea surge, but may not consider exposure to the less easily-mapped ground water or surface water flooding. This problem was illustrated in the 2007 floods in England, where surface water flooding of many properties outside of "flood zones" as defined in the various floodplain boundary maps available caught many insurers unawares.

As the last of these examples illustrates, there are also limitations to the use of traditional floodplain maps when underwriting flood risk. An alternative approach is to use information derived from a probabilistic model that incorporates all flood types, using (for example) the average annual loss ratio or 100 year loss to a unit value in each postcode area (or other area geographic of interest) to determine the terms and conditions that should be applied to an individual risk. To date, this has been a rarely-used application of probabilistic models.

Conclusions and recommendations in relation to probabilistic flood modelling

Several commercial probabilistic models are available to insurers to enable assessment of their exposure for reinsurance purposes. The output of these models (although rarely used in this way) is additionally suitable for rating of postcode areas for flood. These models have improved in recent years due to increased processing power, improved exposure information and the availability of data from the EA's NFCDD database.

The weakest components of these models may be regarded as:

- flood defence information and subsequent modelling.
- modelling of vulnerability functions.
- for some companies, provision of inadequately detailed portfolio data for analysis.

Some suggested ways in which insurers can improve the results they obtain from probabilistic models are:

- as an industry, continue to encourage the provision of more coherent and accessible information on defence structures, preferably from a single source for all defence types (for example river, sea, sewer).
- continue to improve the quality and detail of exposure data used for analysis.
- continue to improve claims data and its availability to the modelling companies, including internal systems that enable claims information to be attached to exposure data and loss adjuster information such as water depth recorded at a building and details regarding use and structure of the building.
- improve understanding of the models and their capability, in particular in relation to the different “types” of flood hazard. Consider using output from probabilistic models that encompass all types of flood risk for risk rating, rather than relying on river flood maps, which ignore other (non-river) sources of flooding and provide risk areas for only a limited number of return periods.

3.3 Mitigation before and after floods

Before the event

Steps can be taken in advance of floods in order to reduce the impacts on customers, and the costs to insurers. Section 4.4 concentrates on what property owners can do, this section concentrates more on what insurers can do.

One of the simplest steps is to ensure that home owners (or businesses) are given as much warning as possible of expected floods. Currently, home owners can elect to be provided with flood alerts, but responsibility for these alerts is confused, and often the information provided is too technical for home owners to understand. There is a case for providing flood alerts as a matter of course unless specific home owners have elected to “opt out”.

The Pitt Review (see sections 3.8 and 4.9) into the summer 2007 floods concluded that planning authorities need to toughen their approach to development control, and the building regulations need major amendment. It also recommended that the government show more of a lead on decisions about land use, especially given the flood threat to critical infrastructure.

Defra's recent review concluded that development on the floodplain is likely to continue, and that an outright ban on development in the floodplain is not the most viable step forward. Rather, any “new buildings in the floodplain are properly flood resilient and resistant.”

The ABI has been reviewing the Statement of Principles (“SoP”) on the provision of flood insurance, see section 3.7. The new SoP excludes all new developments built after 1 January 2009. This may have some impact in ensuring that appropriate building regulations for flood area developments are adhered to. It is unlikely however to prevent all developments in floodplains.

Where new developments are planned the ABI wishes to ensure that these do not increase flood risk elsewhere, are built to a specified minimum standard of protection, and utilise sustainable urban drainage systems (“SUDS”), with clear responsibilities for their future maintenance. They would not want planning permission to be given unless sewerage systems can cope with the increased capacity or fully funded plans in place to upgrade them.

Insurers can offer customers incentives to contribute to flood resilient repairs. Such customers will have experienced the emotional cost of flooding, and may be more open to consider measures to prevent or limit any repeat. It is reasonably common for customers who have had sizeable flood claims to have high excesses applied for future flood claims, and insurers can consider waiving the higher excesses if the customer agrees to resilient repairs. So far though, there has been little evidence that customers are prepared to fund the considerable costs involved (see section 4.4 for further details).

Research undertaken after the 2007 floods indicated that almost no customers seriously considered flood resilience measures. A study after the summer flooding showed that 83% of people living in Gloucester, Tewkesbury, Hull, Sheffield and Rotherham believe there is nothing they can do to protect their home from flooding. Consequently 95% have not taken any measures that could help prevent or significantly reduce the stress and emotional trauma of a future event. Nationally 79% of people mistakenly think there is nothing that can be done to protect homes from flooding other than moving furniture or using sand bags. This figure rises to 83% in flood hit areas

During the event !!

Insurers must also decide how to deal with new business enquiries during floods. There were examples during the summer 2007 floods of customers buying cover immediately after they were flooded, and successfully claiming (!!). The July 2007 floods were perhaps unusual in that after extensive flooding in the Gloucester / Cheltenham area, there were several days warning of flood waters heading for Oxford. This offered customers the potential to purchase cover, with a high probability that they would make a claim within the first few days. This practice goes against the principles of insurance and should be discouraged. Ideally insurers will have the capability to restrict or delay coverage in specific postcodes. In other areas of the country, media coverage of flooding can be a powerful encouragement to uninsured families to buy themselves some cover and is therefore an opportunity to write some new business.

After the event

In the aftermath of a major flood event there is the potential for the insurance industry to generate either significant goodwill, or very bad PR. It is likely that there will be media interest in such a human interest story, either locally or nationally. An early, visible presence by insurers and/or loss adjusters can be a very reassuring presence in affected areas, giving confidence that the insurance industry has the best interests of its customers at heart, and providing immediate assistance and information.

However, once the immediate emergency is over, a reassuring presence is not sufficient, and customers want to see action. One of the key learnings from the flood events of summer 2007 was the need to communicate clearly to affected customers about what the repair process entails and how long it is likely to take (see section 3.6). This is also one of the Pitt Review recommendations (see section 3.8).

It is also important to explain to customers the importance of doing the repairs properly. Sometimes local builders can appear to offer a quicker solution than an insurer's repairers, but if properties are not properly dried out then subsequent problems are likely to emerge. The use of local builders who may not all have relevant experience can often lead to inconsistent standards of repair. Unfortunately, areas affected by widespread flooding can also be an attractive target for cowboy builders. Many customers will be unaware that if they choose to use their own builders, their insurer is unlikely to guarantee the work in the same way that they would for a builder from their own network.

After large floods, there are often problems with saturation (no pun intended) of suppliers. This will affect not only the flood repairs, but can also have a knock on effect on other perils. A shortage of specialist equipment such as dehumidifiers can slow the rate of claim settlement. There may be advantages in insurers working together to co-ordinate repairs – for example, tackling repairs on a street by street basis. This can help reduce complaints from customers as neighbours will be repaired at the same time, and is also good practice for certain types of housing such as terraces where it is important that adjacent properties are thoroughly dried too before internal redecoration takes place.

The two major flood events of 2007 did lead to saturation of suppliers. The industry might well have coped adequately had there been only one major event, but two such large events in quick succession caused problems. There was a shortage of specialist equipment, and some basic construction materials were in short supply in the following months. Whilst some action can be taken to mitigate the impacts (for example by importing equipment and materials from overseas), realistically there is little that insurers can do in a cost efficient manner to guarantee adequate supplies in all circumstances.

There are a number of improvements that the industry could make to how it deals with the aftermath of floods. The first is in communications with its customers. Providing more information about the repair process up front would be very valuable, and insurers could also put customers in contact with organisations which offer support to flood victims, including local flood groups.

For example, the National Flood Forum (“NFF”) is a charity set up to look after the interests of people who have been flooded, or are at risk of flooding. Its aims are:

- to advise and support communities and individuals that flood or are at flood risk.
- to raise awareness of the plight of flood victims that experience flooding.
- to encourage the establishment of community led groups for mutual support and action to mitigate their future risk of flooding.
- to instigate multi agency collaboration and mediation between those that flood and those that manage flood risk.
- to organise "flood fairs" to provide public information and advice from the NFF, government agencies and self help protection firms.
- to work to secure effective and appropriate action by working with:
Government, insurance companies, EA, Local Authorities and water companies.

Each insurer will have their own approach to under-insurance. However, in general, most insurers will tolerate some degree of under-insurance, but will reduce claims where there is a significant shortfall in cover. The increasing use of blanket sums insured in household insurance has reduced this problem to some degree, but this can be more of an issue with commercial insurance, and brokers have a big role to play in ensuring that this problem does not arise.

It became apparent during the repair process that there's no clear consensus as to how best to dry out properties after floods. Insurers could usefully work with the building trade to undertake research as to how best to dry out properties after floods.

Insurers could usefully take steps to educate claimants about the practical steps they can take to mitigate against future flooding. The industry does not have a strong track record of undertaking flood resilient repairs, and some can be undertaken at little or no additional cost (for example raising the height of power sockets). In addition, by working with customers, insurers may be able to agree to share the costs of further improvements which would significantly improve the outcome in future floods. Unfortunately, many of the better preventative measures are very expensive (see section 4.4).

3.4 Producing estimates of flood costs

An important activity for insurers immediately after a flood is arriving at an estimate of the likely ultimate cost. Most company actuaries will be familiar with the phone call or e-mail from the Finance Director a few hours after (or quite possibly during....) a flood asking “How much will this have cost us then?”. In this section we review methods used by the insurers to estimate the cost of a flood shortly after the event, highlighting the strengths and weaknesses of each approach.

Why produce estimates?

For many years the insurance industry have been actively campaigning to raise awareness of flood risk among the public and Government. At the same time there has been a growing public awareness of climate change and the associated potential for more extreme weather events. Consequently when extreme events occur there is a strong demand for information on the event, including comment from the insurance industry on the expected event costs. Typically the media expect insurance companies to be able to estimate the cost of floods before the rain has even stopped !

However insurers also need to provide early estimates of event costs to meet both external and internal reporting requirements. External pressure to quantify the costs of extreme events comes from:

- Stock Exchange requirement to inform shareholders of changes in profit expectations.
- rating agencies interest in affect upon financial strength.
- regulators interested in impact upon solvency.

There are also internal requirements to estimate the event costs in order to:

- direct appropriate levels of resource to those affected.
- determine the impact on reinsurance cover.

In summary there is more interest than ever in extreme weather events and industry estimates of event costs provide useful information for both internal and external stakeholders.

Historical context - past events

Section 2.3 provides a general historical backdrop to the summer 2007 floods but did not focus particularly on the insured costs. To provide some historical context to the summer 2007 floods the table below summarises the insured costs of the main UK flood events occurring over the last 10 years:

Year	Area Affected	Description	Initial Loss Estimate
1998	Central England	6 April – 16 April. Two months rainfall in two days over central England lead to widespread flooding. The towns of Evesham and Royal Leamington Spa experienced severe flooding. Considered at the time to be the most severe flood event since 1947.	£500m - £700m
2000	England & North Wales	31 October – 16 November Windstorms resulted in two weeks of widespread and severe flooding across North Wales and England. Considered at the time most severe flood event since 1947.	£1b
2004	Boscastle, Cornwall	18 August One month's rainfall fell in two hours resulting in flash floods that devastated the Cornish town of Boscastle.	£50m
2005	Carlisle, Cumbria	8 January Severe rainstorm resulted in localised flooding of homes and business's in the city of Carlisle.	£230m - £250m
2007	Summer floods	June , July Two separate periods of prolonged rainfall resulted in widespread flooding in Humberside and Yorkshire during June and Southern England during July.	£2.5 - £3b

It's apparent from the above table that events can vary widely in geographic spread, rainfall intensity, event duration and, not least, cost.

The difficulty is not in providing estimates shortly after, but in providing accurate estimates. As no two events are the same it is difficult to accurately quantify the cost of any one event using knowledge of past events.

Overview of Methodologies

For the purpose of this paper we have summarised the methods for producing event cost estimates into two types: a development factor approach and an exposure based approach. Common to both approaches is the principle that the event cost can be estimated by multiplying the expected number of claims by an expected average cost:

$$\text{Event Cost} = \text{number of claims} * \text{average claim cost}$$

The difference in approaches comes down to how the estimates of the ultimate number of claims and average costs are calculated.

Development factor based approaches will be familiar to reserving actuaries. In such methods reported claim numbers are grossed up to estimate the ultimate number of claims. Exposure based approaches will be familiar to pricing actuaries. In these methods the number of claims is determined by applying knowledge of areas affected by the floods to the insurers known exposure profile.

Before considering each method in more detail the next section reviews the published flood cost estimates produced following the summer 2007 floods.

Summer 2007 flood published event costs

The following table summarises the ABI's estimates of the summer 2007 flood costs. The information has been gathered from press releases made at the time.

Date	Estimated Houses flooded	Estimated Commercial Properties flooded	Estimated event cost
<u>June event</u>			
29/06/2007	27,000	5,000	£1b
06/07/2007	27,500	7,000	£1.5b
<u>July event</u>			
27/07/07	12,000	3,500	£1b

As at the 27 July the ABI estimated that the total cost of both June and July events was £2.5b, though recognised the estimate of the July costs was still rising.

The table below shows a selection of insurance company estimates of the summer 2007 flood costs. The information has been extracted company accounts and typically costs are shown net of reinsurance:

Insurer	2007 Half Year accounts	2007 Full Year accounts
Aviva	£400m *	£475m
RBS Insurance	£125m	£274m
HBOS	£60m	£135m
RSA	£55m	£120m
Lloyds TSB	£45m	£101m
Zurich FS	£250m *	£250m
Axa	£87m	£182m
Legal & General	£40m	£76m
* includes estimate of July event costs		

At the time of publishing half-year results the July flood event had taken place but the majority of insurers avoided commenting upon the July event costs and estimated the cost of the June event only. By the time the 2007 year end results were published event costs were well understood. Unfortunately it is not possible to determine whether the insurers had revised the view of the June event costs from the published full year figures.

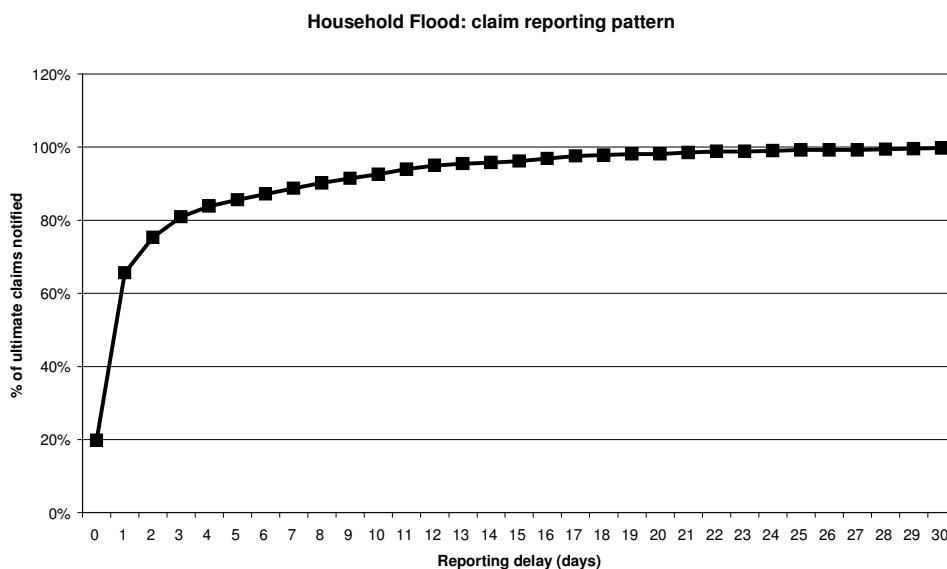
Development factor based methodology

The principles behind the development factor methodology will be familiar to reserving actuaries. As noted above, the event cost is estimated by multiplying the ultimate number of claims by an ultimate average cost.

The ultimate number of claims and ultimate average costs are determined by grossing up reported claim numbers and costs to ultimate using assumptions about the development pattern of claim numbers and costs. Development pattern assumptions would normally be determined from past flood events, such as those identified above.

In practice, claims are reported quickly. It is not uncommon for 50% of household claims to be reported within 3 days of an event and nearer 80% to be reported within a week. It can take longer if claims are reported via a broker or through a “scheme”. In contrast the cost of claims will take much longer to be known with any accuracy. From the date of the event it can take weeks for loss adjustors to visit properties and months for the repairs to be made and claims to be paid. In the initial days following an event there will be very little actual cost data upon which to apply development factors in order to estimate the ultimate average claim cost. Consequently it is common practice to use a benchmark average cost per claim when deriving an early estimate of the event cost.

The chart below illustrates a typical claim-reporting pattern for Household flood claims following an event of one-day duration. In this example 20% of claims are reported on the same day as the flood event, and three days after the event just over 80% of claims are reported:



So if 100 claims had been reported on the day of a flood event lasting one day, using this development pattern the estimated ultimate number of claims would be 500 ($= 100 / 20\%$). If, three days after the event day, the number of reported claims had risen to 360, the estimated ultimate number of claims would be 450 ($= 360 / 80\%$).

Flood events often take place over a number of days. In such circumstances this methodology needs a slight adaptation. The number of claims notified for each incident day need to be identified and separately grossed up in order to estimate the ultimate number of claims.

To illustrate this, suppose 3 days after the start of a flood event lasting 2 days 360 claims had been reported from event day 1 and 150 had been reported from event day 2. From the development chart above let's assume that we would expect reported claims to be 80% of ultimate 3 days after an event and 75% 2 days after.

Our estimate of the ultimate number of claims would then be 450 ($= 360 / 80\%$) for event day 1 and 200 ($= 150 / 75\%$) for event day 2 giving a total of 650 claims.

An exercise to compare reporting patterns amongst some of the UK's major insurers towards the end of 2007 showed that, on average, about 94% of June event household flood claims had been reported by the end of July and 97% by the end of August.

Having estimated the ultimate number of claims an estimate of the average cost per claim is required to calculate the overall event cost. Typical average claim costs for Household flood events range between £15,000 to £30,000. The ultimate figure will depend upon many factors including; but not limited to:

- the nature of the flood for example fluvial, coastal, surface water.
- the severity of the event, for example depth of water, time submerged and force of flow.
- the vulnerability of the property to flood damage, for example the type of construction, existence of basements and cellars.

Typically the deeper the flood water and the longer flood water remains in the property the greater the damage and resultant claim cost. With the limited information that is available immediately after an event at best subjective adjustments for these factors can be made to benchmark average costs.

When selecting a benchmark average cost also we need to take account of inflation since past events, and especially the inflationary effect of increased demand of building services following the event. A suitable proxy for flood peril inflation would be the observed inflation in Escape of Water claims. With many insurers reporting Escape of Water inflation in excess of 10% per year the adjustment of past event costs for inflation will have a material impact on the estimated event cost.

These same techniques can be applied to Commercial Property accounts. The diverse nature of Commercial Property risks makes it more difficult to select an accurate benchmark average cost. Claims from complex commercial risks can easily exceed £1m once business interruption costs are included. Consequently while an initial benchmark of £100,000 is not uncommon, ultimate average costs can be quite different from this initial estimate. It is always preferable to estimate Commercial Property average costs on the basis of individual claim estimates.

Development factor methods have the advantage of being simple, requiring only summarised information on reported claim numbers by incident day, which is readily available. A firm estimate of the number of claims can be made relatively quickly so that the uncertainty in the overall event cost quickly becomes a function of the average claim cost.

The disadvantage of development factor methods relates to the suitability of the assumed claim-reporting pattern. The nature and timing of the event can have a significant effect on the number of claims reported in the first few days following the event. When events fall on weekends it is common, despite insurers operating 24 hour / 7 day a week claim lines, for people to wait until the following Monday to report their claim. Without suitable consideration of and adjustment for such issues early estimates could be significantly different from the true cost.

Exposure based methodology

The principle behind the exposure based methodology will be familiar to pricing actuaries. As noted above, the number of claims is determined by applying knowledge of areas affected by the floods to individual companies known policy exposures.

This approach is adapted from the risk pricing approach where:

$$\text{Risk} = \text{Sum over all exposure (Hazard * Vulnerability)}$$

In the context of this paper the hazard is the flood peril including river flood, coastal flood, surface water floods and so on. Vulnerability is the cost of a flood claim, which will be a function of the flood depth and other property characteristics.

Following a flood event the hazard, in this case the extent of flooding, is to some extent known. How accurately the hazard is known is a function of elapsed time following the event. The table below gives illustrates how accurately the extent of a flood may be known:

<u>Area accuracy</u>	<u>Example (property resolution)</u>	<u>Timescale</u>
Postcode Area	PO (225,000)	Immediate
Postcode	PO1 (9,300)	Hours post event
District		
Postcode	PO1 3 (2,800)	Day post event
Sector		
Postcode Unit	PO1 3AX (15)	Week post event
Address level	#4 PO1 3AX (1)	Month post event

So we could reasonably expect to know the postcode area affected immediately as the floods take place, given the flood warnings issued by the EA and news reports from the media. However knowing the postcode area will not provide very accurate information on the number of properties affected as the average postcode area will contain 225,000 properties of which only a small proportion will hopefully have been flooded. Quite often though the media are able to indicate the number of properties in an area that have flooded.

Armed with this information it is possible for an insurer to estimate the cost of an event to their portfolio. For example suppose in post area PO it has been reported that 2,250 properties have been flooded. Further assume that from the Post Office address files we know that PO contains 225,000 properties. The insurer knows that in post area PO they insure 36,000 properties. On the basis of this information the insurer would estimate that they will receive 360 claims ($36,000 * 2,250 / 225,000$).

This is equivalent to saying that the number of claims received will be in line with the market share in the affected areas. As knowledge of the affected areas becomes more refined the estimates will become more accurate as they move from being on a blanket countrywide market share basis to reflecting the different levels of market share in each affected area.

When it comes to estimating average claim costs, information about the insurer's risks can be used directly to adjust the benchmark average cost. The insurer will know which properties are at risk, the rating characteristics of those properties and how this compares to the characteristics of their whole portfolio. This information can be used to estimate how the average claim cost in the flood affected areas will vary from the benchmark due to property characteristics. Further adjustment of the benchmark will still need to be made to take account of the nature and severity of the event.

Of course if flood depth information is known then a more sophisticated adjustment could be made taking into account vulnerability functions linked to flood depths. In practice this information is unlikely to be known and there is unlikely to be sufficient time to warrant such additional complexity of calculations.

For Commercial Property exposure based approaches can bring significant improvements to the accuracy of average claim cost estimates by taking into account the EML (Estimated Maximum Loss) of the at risk or affected properties. Suppose that past events have shown that actual costs were 10% of EMLs. Then applying 10% to current EMLs would be a sensible starting point for an event cost estimate, prior to adjustment for event duration and severity.

Exposure based methods have the advantage of incorporating specific knowledge of the insured risks into the event cost calculation. This should help improve the accuracy of average claim cost estimates which we have noted earlier are the main cause of uncertainty in the development factor based calculations. In theory exposure based methods can produce estimates of the event cost before any claims are notified, which can be of additional benefit when planning the response to major events.

The obvious disadvantage of exposure based methods is in the additional data requirement and specific knowledge of policy risk details that is required when determining cost estimates. Some of the data requirements rely on third parties and there is little guarantee that such information will always be available in appropriate timescales and to a required level of accuracy. For Commercial Property these additional data requirements are probably outweighed by the potential improvements in accuracy.

Summary

To summarise, we have discussed the benefit of providing industry estimates in both raising awareness of weather events among the general public and informing stakeholders in insurance companies. We have looked at the cost of the 2007 summer floods in the context of events over the last 10 years, highlighting the varied nature of flood events. Turning to methods used to estimate flood event costs we have identified development factor and exposure based methods. Both methods will at best only be capable of giving indicative estimates of event costs shortly after an event. However we have seen that development factor approaches are simple to apply and well suited to household claims, but that for Commercial Property there is merit in using exposure based approaches in order to take account of the potentially varied risks within a portfolio.

3.5 Reinsurance and capital issues

In the paper so far we've concentrated on the perspective of the insurer. In this section we describe some of the issues that arise in connection with reinsurance and say a little bit about ICAs and flood models.

Hours clause in flood models

Current UK river flood models do not allow for the hours clause, an essential definition for any UK flood policy. The hours clause is a period of time, for example 168 hours, written into a flood insurance policy specifying the maximum time period a reinsured can define as “an event”, and therefore the period a claim on their reinsurance policy for a given flood scenario can be made. Each portfolio of business covered by a reinsurance policy will respond differently in the light of a claim, meaning there is the potential for separate event definitions to occur. This makes it very difficult to restrict an event to, say, urban areas within a loss model. One proposed solution for this problem is to allow the Cat modeller to define certain events within an event set to see the affect on their portfolio, and is something being tackled within some of the latest model releases due this year.

The usual four letter word

Data. Another question facing the reinsurance industry is data quality. Future flood models will have the ability to model at a much higher resolution than only postcode. If, however, the data collected is only at postcode level, which it often is in the UK, the model output will not be as detailed and informative as it could be. Many initiatives have been implemented to increase the data quality, and one such initiative is currently being drawn. The ACORD data standards are an industry wide enterprise aiming to secure the highest quality of data. As a direct result of these standards the quality of model outputs will be far better. Flood modelling is a great example of this. Without precise location data, the model has to use assumptions to fill in the gaps and the results obtained will therefore have a larger margin of error.

The new models being released to the market, and the increased demand for good quality data, will encourage the market to use the models. To what extent these models will be utilised is not clear but if flooding in the UK continues the likelihood is that it will sizably increase.

Common or conflicting understanding of flood?

The UK lacks a “common” flood model, there being multiple floodplain mapping solutions available to insurers in addition to the probabilistic solutions provided by the three commercial catastrophe modelling companies (see section 3.2). The advantage to the presence of multiple opinions is that for a householder in a flood-prone area, different insurers using different models may have different opinions as to the level of risk; hence the home owner may be able to find cover with some insurers whose view of the risk is lower. Likewise for the insurers assessing seeking reinsurance, different technical pricing will result from the different models and hence can lead to the availability of different pricing from different reinsurers. In an open market, the presence of multiple flood modelling solutions, therefore, may be regarded as an advantage, or even necessity, since use of a single modelling solution could highlight the “uninsurability” of certain risks (note that nonetheless, market competition may result in the availability of insurance cover from some providers).

Despite these advantages, there remain some disadvantages to the use of multiple modelling solutions. From a purely scientific point of view, the funding available for flood model development is spread over the development of many models, and much of the development work is repeated by various organisations. From the point of view of the home owner, insurer or reinsurer, the conflicting information and results provided by the different solutions can be confusing. Additionally, the presence of multiple solutions removes the ability for there to be a common understanding of flood hazard between property owners, the insurance market and government organisations. If Defra uses a different flood models to assess the greatest needs for flood defence modelling to the ones that insurers use to judge which properties are “insurable” against flood, there will inevitably be areas in which Defra view defences to be adequate but insurers refuse to provide protection, and other areas in which Defra improve defences to protect areas that already enjoy full flood insurance coverage.

However, there are also practical difficulties to the development of a single modelling solution.... The organisation of funding and management of development of a market-wide model is no simple task, requiring the agreement of a large portion of market players. As has been recently demonstrated in Poland, where attempts to develop such a solution recently met with failure, obtaining market-wide agreement and initiating such a project is no easy task. From a theoretical point of view, there are also several considerations. How can one model be judged to be “correct” and a second “incorrect”? Heavy reliance on a single model solution leaves insurers at the mercy of its errors whereas use of a second can demonstrate areas in which there is greater uncertainty in the model (for example, whether or not a given defence will breach in a flood scenario).

In an open market situation, therefore, it is unlikely to be possible to steer all players towards use of a single modelling solution. Reinsurers and insurers are likely to take the view that use and/or development of a “better” solution than their competitors can be advantageous to their business, and the Cat modelling companies view the development of proprietary competing models as their core business, rather than being inclined to work together. The use of a single solution may in fact be disadvantageous, since the presence of varying results from the different models can lead to a greater variety of insurance pricing in the market.

Possible reinsurance “solutions” for UK flood insurance

Although the question of reinsurance is at first glance a step removed from the needs of individuals seeking adequate flood insurance, there can be no doubt that the means by which reinsurance is provided to insurance companies can influence the cover they in turn provide to their clients, and any “solution” for UK flood insurance must consider the resulting reinsurance needs of the primary companies. Additionally, as demonstrated in France, the provision of a state-backed scheme in which flood insurance is mandatory can be used to ensure that adequate insurance protection is provided to all individuals.

Traditional or non-traditional “solutions” ?

Alternative reinsurance solutions are becoming more popular as insurers try to find innovative ways to transfer their risk. Amongst the various solutions in the market place are catastrophe bonds (Cat bonds) which allow non-reinsurance companies to take on risk through the issuance of bonds. This form of investment is often attractive due to the high return on investment, and is often uncorrelated with other investment opportunities and market cycles. One such Cat bond is Blue Wings which includes a UK flood component (see below). The UK flood component of this deal is triggered parametrically, and as such models are involved with assessing the risk to a portfolio and calculating whether trigger levels have been met. The increased interest in this type of deal and their reliance on catastrophe models suggests the increased use and dependence on model outputs.

Cat bonds, although offering a different approach to risk, are not replacing the traditional covers being bought by existing UK insurers. Since the UK experienced devastating floods in 2007 there has been a presumption that UK residential household insurance premiums have increased. In fact, in most cases the opposite is true. Rates are continuing to fall, albeit at a lesser rate than before the floods and apart from the policyholders who incurred large losses, rates have not increased.

Blue Wings Cat bond

Cat bonds are an alternative to reinsurance that take the form of securities sold into the capital markets, usually through a private placement. The bonds offer insurers the ability to transfer risks that they do not want to hold themselves, including exposure to low-frequency/ high severity perils such as earthquakes and hurricanes.

In 2007, the first Cat bond covering flood risk was issued: the \$150m Blue Wings Cat bond allowed German insurer Allianz to transfer potential river flood losses in the UK, as well as earthquake damage in Canada and the US excluding California, to the capital markets.

The Blue Wings transaction was structured using a parametric trigger, meaning that the potential for Allianz to claim on the bond is linked to a predetermined set of parameters that reference flood depths at over 50 locations in the UK, with various weightings used to calculate an overall index.

The use of parametric triggers is common in Cat bonds because it allows potential investors to quantify the risk without insurer-specific considerations and the lack of transparency and timeliness that is sometimes associated with the claims settlement process in reinsurance. The drawback of parametric triggers, however, is that they represent basis risk for the insurer; in other words, the payback offered by the bond if an event occurs might not equal the insurer's Ultimate Net Loss. For large diversified insurers, and when the parametric triggers have been defined in such a way as to closely mirror the insurers' exposure, this basis risk can be partly mitigated.

Should reinsurance be state-backed or private market?

There are two basic extremes to the way in which flood insurance and reinsurance is provided:

- an open market solution in which insurers and reinsurers are free to provide and price for risks as they see fit according to their business model, with minimal intervention from the government; and
- a solution in which laws are implemented to make flood insurance mandatory for all property owners, and pricing of flood insurance and reinsurance is in some way pre-set or pre-agreed.

Consideration of other countries worldwide illustrates that either of these solutions may be considered to be a viable way forwards, each with its own advantages and disadvantages. A number of different ways of providing flood insurance are considered in a bit more detail in section 3.10. In France and other countries including Norway and Switzerland, a state-backed insurance scheme has been used to ensure that all householders can obtain flood insurance no matter even if their property is located in an area considered by insurers to be "uninsurable". From the perspective of a home owner in a flood-prone area, the advantages of such a scheme are clear; for the home owner in an area considered to be relatively safe from flooding, such a scheme would be less welcome since it would likely imply the increase in flood insurance costs, and in some cases enforce insurance cover that the home owner viewed to be unnecessary. For this reason, such schemes are commonly multi-peril, encompassing multiple peril types in the mandatory cover.

From a Government perspective, such a solution may at first glance appear to be advantageous; but in the absence of adequate planning restrictions, ready availability of flood insurance may lead to increased development in flood-prone areas. Depending on how the reinsurance of such a scheme is set up, the resulting increase in flood damage would be paid for either by the Government, or by reinsurance companies, and the latter are unlikely to be willing to finance a scheme that could lead to increasing exposure. Hence the Government must be willing to either accept a greater proportion of the financial risk of flood events or generate a scheme which is attractive to insurers and reinsurers alike. There is doubtless also an impact on voting patterns if implementation of a scheme causes a rise in insurance costs to the majority of the population; and the number of people who live in floodplain areas, whilst very significant, is not a majority of voters.

From the perspective of the insurer, state-backed schemes have two sides. On one side such a scheme removes some of the ability to compete openly against competitors (for example by better risk pricing/selection). However, the UK insurance industry currently faces issues relating to defence standards, which are seen to be poor enough in several areas that insurance is not a viable financial proposition. The ABI's SoP (see section 3.7) does not provide the industry with a great deal of leverage over the government and its policies in relation to, and spending on, flood defences. Were a state-backed insurance scheme in which the government took some of the financial responsibility for flood damage to be implemented, the industry would have a substantial amount more leverage, since those (reinsurance) companies backing the scheme would be in a position to provide backing only in return for improved expenditure on defences and/or require that damage in areas where defences of inadequate design and maintenance standards were breached would become the responsibility of the government to pay.

Hence, although the start up of any nationwide flood insurance (and reinsurance) scheme would require a Government-led initiative, if the ongoing debate over defence standards and insurability does conclude that something needs to be changed, rather than continuing provision of cover in an open market, there is an opening for the industry as a whole to propose alternative damage-financing schemes to the government that are of benefit to all players. Were such an initiative to go ahead, then substantial input would be required from the industry in order to suggest how such a scheme would operate and could be financed.

Individual Capital Assessments and flood

An insurer or reinsurer with contracts covering flood events needs to make allowance within their Individual Capital Assessment (“ICA”) for potential future losses arising from flood events. An ICA can be calculated using two general approaches: a fully probabilistic approach or a stress and scenario approach. Scenario tests must be shown to be both relevant and adequate to a 1 in 200 level.

Historically UK floods haven’t affected the UK reinsurance market to a large degree as it has been either below or only slightly larger than retention levels. Reinsurers are far more concerned with, and interested in, storm events. The same applies to some extent to ICAs. At the 1 in 200 level storms are far more significant than floods, though as we've seen in section 2.4, that situation may change over time in future. Nevertheless, at the 1 in 200 level, insurers should be considering potential flood events amongst their stress and scenario tests. And although storms dominate floods at the 1 in 200 level, floods are a major contributor to the volatility of net profits (or rather losses...), so are an important part of any financial model.

One of the main issues for ICAs in relation to flood risks is data capture. In order to accurately assess flood exposure it is necessary to obtain detailed individual risk locations and attributes so to increase the accuracy of this data a set of standards are being implemented throughout the industry. These ACORD data standards were pioneered in 2003 but were not generally adopted by the market. A renewed push to implement a new set of standards has begun which aims not only to assist with ICAs but with all aspects of underwriting procedure from pricing to reinsurance purchasing.

Certain flood models have been updated/built and due for release mid-2008 (see section 3.2). The new versions of the models are expected to contain more events within the event sets, with more extreme scenarios calculated using EA defence data and high resolution elevation models to calculate the flood footprint. These models are expected to contain more detailed vulnerability curves and be able to use claims data from many events to calculate losses. These new, more comprehensive models will help the insurance sector with their flood ICA, depending on the quality of the original location data. From an ICA perspective the return from a scenario test must return a figure relevant for a 1 in 200 level although more extreme events should be looked at within this framework and variance around a modelled loss considered.

3.6 Claims handling / loss adjuster issues

Perhaps not surprisingly, the most serious inland flood since 1947, with four years' worth of flood claims in four weeks caused insurance company claims teams and loss adjusters some problems..... The general consensus however is that the insurance industry coped with the floods pretty well. The Pitt Review (see sections 3.8 and 4.9) concluded that the UK's insurance arrangements were largely effective. The insurance industry did, after all, pay a significant part of the overall cost of the floods and were involved in repairing the vast majority of damaged properties. Whilst the Pitt Review noted that "... of those who had insurance, many were very pleased with the service they received." the Review also heard accounts of some poor experiences with insurers, mainly relating to the difficulty and time taken to get information and the time taken to perform repairs.

Different insurance and loss adjusting companies will have had different issues and concerns about how they coped during and after the floods. There were some "internal" lessons learnt and a number of issues about how insurers dealt with customers. Some observations on the lessons learnt are as follows

Communication, communication, communication

Many of the customer problems arose from confusing or inadequate communication by insurers. Difficulty in getting information was one of the main complaints from a survey carried out as part of the Pitt Review (see section 3.8). Some insurers proactively made calls to their customers in affected postcode areas to see if they wanted assistance; others set up mobile advice units at the scene in the hardest hit areas; some set up dedicated flood teams in their call centres to deal with the influx of claims and extended their opening hours. However, some customers struggled to contact their claims handler or loss adjuster, repeatedly calling mobiles or call centre numbers and getting no answer; others felt that the insurance company made them feel like a criminal for making a claim. In places contradictory advice was given to neighbours in the same street. All this highlights the need to be able to draft experienced staff in to man the phones – ideally staff with a basic training in handling flood claims as a first point of contact.

Time, time, time

Whilst many customers were satisfied with the service they received from their insurer, of those who weren't satisfied the time taken to get information and the time taken for their home to be repaired were two of the biggest gripes.

Happiness can be defined as the difference between your expectations and your experience. Some of the reason that some customers weren't happy is that they probably had unrealistic expectations of the speed at which repairs might progress. Spelling out the likely timescales from the out-set would have helped align expectations with reality.

Some customers might have been vexed by delays in making repairs by using insurer-approved builders, possibly from a national supply chain, rather than local builder Fred from the down the road who could start straight away. There may be good reasons for not using Fred however. For example Fred might not be fully trained in making flood resilient repairs, or the correct standard to dry out properties before repairs commence; insurers often guarantee repairs made by their own builders, whereas no such guarantee would apply for any repairs by Fred. Again, explaining the reasons for decisions and processes can help alleviate the natural frustrations that customers are likely to experience if they feel repairs to their properties aren't happening as quickly as they would like.

Most customers only experience of making an insurance claim was in respect of a motor policy, for which the customer is often lead through the process. By contrast, household claims can involve a confusing number of different parties: claims handlers, loss adjusters, contractors from drying companies, building companies and so on. Again, insurers could have done more to spell out to customers the roles and responsibilities of all the different parties.

Information about timescales and the different parties involved would be included in a “claims plan”. The Pitt Review found that less than a third of customers received such a claims plan. One Pitt Review recommendations is that:

“The insurance industry should develop and implement industry guidance for flooding events, covering reasonable expectations of insurers and reasonable actions of customers.”

Opportunity

Even in the middle of a flood event there are opportunities for insurers.... Claims are the acid test of insurance, and a good experience when making a claim can help retain a customer for a lifetime just as a bad one can drive them away. The good reports outlined in the Pitt Review demonstrate that at least some insurers are taking this on board – several went as far as to give Christmas gifts or hampers to customers out of their homes over the festive period. The cost of these is small in comparison to the cost of the claim, but in conjunction with competent and customer-focussed claims handling they can build reputations.

“Internal” issues

Floods typically hit hard and fast, so a well-prepared catastrophe plan is essential to ensure that processes run smoothly in those vital early hours. This includes having contact numbers for key personnel or their deputies, allocating additional staff to handle claims volumes, prioritising between flood claims and business as usual activities, communicating with colleagues, customers, suppliers and even telephone companies to ensure systems don't crash, and having pre-defined policies on everything from overtime for call centre staff to restricted underwriting in affected areas.

Another important issue for insurers in the immediate aftermath of a flood is coming up with an assessment of the likely cost of a major event (see section 3.4). Some insurers found that guidelines for setting case estimates were unclear, or were not adhered to, hindering attempts to arrive at reliable estimates shortly after the floods.

A lot of information was collected by claims handlers and loss adjustors, but not all of it was recorded in a way that it was easily extractable. For example information on the depth of flood water, or the type of building construction would help insurers (and their reinsurers) assess the likely cost of future floods under different scenarios (see section 3.2), however much of this information was simply hard-coded in “text” fields, so cannot be readily accessed

In normal circumstances, insurers often have well defined processes for contacting claimants at regular intervals. However under the extreme strain of major weather events such as the floods, the regular process of customer liaison sometimes went out of the window. This meant that sometimes the customers who shouted loudest and most regularly got attention, rather than the most needy or deserving customer. Having a clear set of priorities for which customer to deal with, when, and sticking to it might have helped.

Finally, insurers could have cooperated more. Loss adjustors, builders and restorers were often working for a number of different insurers on the same street. Coordination of visits might have saved time for all concerned and avoided feelings of dissatisfaction as one claimant saw their neighbours claim progressing faster than their own. Often repairs need to be carried out in tandem - for example drying out properties in a row of terraced houses. So a common approach to the time scales of repairs could have helped all the residents.

3.7 ABI Statement of Principles

Overview

The ABI introduced its SoP (on the provision of flood insurance) with effect from 1 January 2003, following the 2000 floods. It only applies to the provision of flood insurance in England. The SoP was reviewed and revised with effect from 1 January 2006. Following the summer 2007 floods a further review was launched by the ABI and the Government (through the EA, NaFRA and Defra) in preparation for a revised proposal to be presented to parliament before the summer recess. The Government and the ABI announced a revised agreement on 11 July 2008 which takes effect from 1 August 2008. It does not apply to any new property built after 1 January 2009. The ABI will be publishing guidance on insurance for new developments in Autumn 2008.

The results of the latest review of the SoP were only just becoming available as the working party finished writing this paper. So we haven't been able to describe the results in as much detail as we'd like. We'll give a further update at the

September 2008 GIRO conference once further details of the SoP, and the approach to insurance for new developments, have become a little clearer.

Conclusions of the latest review

The objective of the SoP is to prevent the problems that would be caused if existing householders could not access insurance and the subsequent implications for house values and mortgages. To prevent this problem arising, insurers are committing through the SoP to continue to insure existing customers in existing housing stock providing a minimum risk level (properties are protected to at least a 1 in 75 level) is achieved, or planned to be achieved within an agreed time period.

The ABI and the government have committed through the new SoP to:

- improve the understanding of flood risk.
- put in place a long-term strategy to reduce flood risk setting out short/medium and long-term strategic flood aims.
- ensure that the planning system prevents inappropriate development in flood risk areas.
- raising awareness of flood risk and encourage flood mitigation.
- promote access to insurance for low-income households.

The Government will be publishing a Draft Floods and Water Bill in spring 2009 and preparing a detailed response to the Pitt Review in autumn 2008.

SoP review process

The latest SoP review was organised through a steering group and five working groups. The working groups covered:

- Risk Assessment: to ensure comprehensive information about flood risk from all sources is freely available to inform the Government's flood management strategy, to measure the success of Government strategy, and to inform underwriters.
- Strategy for Reducing Flood Risk: to agree targets for reducing risk levels for flooding from all sources, and a long-term strategy for achieving this.
- Limiting high risk new development: to ensure that flood risk for new developments does not compromise their insurability nor increase availability / affordability of insurance concerns for existing properties.
- Preparing for and responding to floods: to ensure all parties are prepared for and manage the response to future flooding as effectively as possible.
- Understanding impact on the market: to understand the impact of the SOP on the market and consider any changes needed to maximise the beneficial effect and minimise unintended adverse consequences.

Risk Assessment working group

This group considered, amongst other things, flood risk data, and charging / licensing for the provision of flood risk information.

EA flood risk data at present considers risk from fluvial and coastal floods. Insurers would like data to extend to other forms of flood such as surface water and intra-urban flooding (though of generally less significance than fluvial and coastal flooding) but recognise this will not happen until one body, as recommended by the Pitt Review, is responsible for all water related issues. The proposed Floods and Water Bill may lead to this data becoming available but realistically this may not happen until 2010.

As noted in our Headlines section, insurers have been more than a little vexed at the lack of stability in EA flood risk data. In their last three assessments of flood risk (in 2004/05/06), only 40% of UK properties stayed in the same risk category (low, moderate or significant) across each release; more than 10% of homes were in a different risk category in each release. These vexations are, to some extent, a bit tough on the EA. The flood risk data they provide was never intended to be used to help set insurance premium rates or to be accurate at postcode level. However more than a million homes had their risk category increased between one review and the next, which points to rather more issues with the data than minor reclassifications.... The data is not going to significantly improve in the short-term but should see some major improvements from 2009. As part of the SoP review the Government has committed that the EA will provide more accurate data by January 2009 and undertake an annual review thereafter.

One of the positive outcomes of the working group is an agreement for the EA and ABI members to work together much more closely in the future. To that end the group, or a subset thereof, will continue to meet once the SoP review has finished. There is a strong desire to share details of the EA models and introduce a feedback mechanism for insurers. Such an open approach should generate buy-in for the data rather than the frustrations and lack of clarity that exist at the moment when the risk classification changes for large areas from one release to the next.

The insurers and government recognise that NaFRA was not established to meet the needs of insurance companies rather it was the best government data available given time and cost constraints. NaFRA data continues to improve but its purpose and design are driven by government/planning demands rather than generating risk assessment for individual properties as required for insurance.

A number of local authorities have higher quality more detailed data than NaFRA currently utilises. Notwithstanding the fundamental differences in the models, the EA has agreed to investigate how it might better incorporate the local information in the national model.

Insurers expect data to be delivered free to underpin the SoP, or for charges to be limited to the administrative cost associated solely with the provision of the data to insurers. Where the data is enhanced (by Government), it is reasonable for additional costs to be charged. The existing charging and licensing process is confusing with the ABI (through a levy on insurers) and individual insurers paying for licences and data elements. Any revised structure in terms of data delivery, type and format, needs to address the needs of both large and small insurers. There should be a cap limiting the total expenditure for any one insurer.

Licensing is a bit of vexed subject too. Using the EA data involves cutting through a fair amount of civil service red tape..... The usual license for flood data prevents the data being used for pricing/underwriting purposes. Insurers aren't likely to want to use the data for much else!! Work continues to clarify what insurers are allowed to do with EA flood data. Any insurer using the data for any other purpose would still need to reach a separate agreement with the EA.

Strategy for reducing flood risk working group

The introduction of a long term investment strategy (“LTIS”) by the Government is the main strategic initiative at the moment – but there is very little clarity around what will be delivered at present. The LTIS working group expects to report to government in the first quarter of 2009. At present commitments tend to be vague rather than concrete with a small reduction in the number of homes at “significant risk” within the next 3 years. Insurers are keen that any targets include commercial properties.

Limiting high risk new development working group

The new SoP does not apply to any property built after 1 January 2009. This places much greater emphasis on planners and developers to build properties that are flood resistant and resilient.

The latest guidance on allowing for flood risk is contained in Planning Policy Statement 25 (“PPS25”), see section 4.5, The general consensus is, we believe, that PPS25 is beginning to bite. This statement introduced tighter guidelines for planning and in particular ensures any development of more than 10 properties exposed to a high flood risk is referred to the EA. However, even if new developments are referred to the EA, local authorities can still proceed and allow developments in high flood risk areas So there is a risk that PPS25 sounds good in theory but in practice nobody pays any attention.... One of the other problems the summer 2007 floods highlighted as the over-loading of drainage systems. One of the Pitt Review recommendations is a change in legislation which limits the right to simply “plug” (no pun intended) new developments into the existing drainage network.

The working group has proposed a New Build Flood Certificate to confirm new buildings are well defended and resilient but the Government response has to date been lukewarm. Alternative options included insisting on a New Build Certificate confirming an agreed standard for any buildings built after 2008, in the floodplain or in an area of critical drainage, before providing insurance. Such an approach would need a question when applying for insurance and for insurers to be able to collect and use data on when a property was built.

Insurers would like the EA to set up a register of areas where objections to developments are raised on the grounds of flooding and to only remove areas from this register if they receive positive confirmation that problems have been overcome from planning authorities. At present the EA is only advised of the outcome for major developments.

Preparing for and responding to floods working group

As noted in section 3.8 on the Pitt Review, most customer concerns were in relation to the quality of communication. Most people's experience of insurance claims are in relation to Motor accidents, where much more tends to be “done” for the claimant. For household claims, many customers don't understand the role and responsibilities of the various parties in the claims process, such as claims handler, loss adjustor, builders and so on. Clear explanations of each party's role would be helpful.

Disparity in drying out times causes issues especially between neighbours who see the repairs to their homes progressing at different rates. Insurers need to give more advice on timescales and factors that influence drying-out times. Advice should be structured – essentials on day 1, then a clear plan of action between a week and a month after the claim.

Understanding the impact on the market working group

This was largely discussed by the steering group and focused on the ultimate goal of establishing a free-market for flood risks rather than the imperfect one a SoP creates.

Devolved administrations

The SoP only applies in England. Scottish, Welsh and Northern Irish stakeholders have been engaged. Government structures in each of these areas differ from England, for example in Northern Ireland local authorities do not have input into flood risk and developments tend not to be on floodplains.

3.8 Pitt and Insurance

Background to the Review

Sir Michael Pitt was asked by the government to conduct an independent review of the flooding that took place in June and July 2007. He produced an interim review in December 2007 and a final review (“the Review”) published on 25 June 2008.

The exercise involved a three month consultation period, conferences and public meetings throughout the country (attended by over 1,000 professionals in various relevant fields) and over one thousand written submissions from the public. Sir Michael described the review as “one of the widest ranging policy reviews of our time”.

The final report is over 400 pages long and boasts a 30+ page Executive Summary. It's accompanied by a 50 page “Implementation and delivery guide”, setting out timescales and cost-benefit indications for delivery of the Review's recommendations. The review also updated the Foresight Future Flooding 2004 qualitative risk analysis. The update was carried out to assist the Review and reassess the drivers and responses to flood risk from the original Foresight 2004 review.

The majority of the Review's observations and recommendations are described in section 4.9. In the following section we limit ourselves to summarizing the observations from the Review with respect to insurance.

The Pitt Review's overall verdict on insurance companies

The Review noted that the insurance industry played a major role in helping the country recover from the summer 2007 floods. In total there were at least 180,000 claims costing more than £3,000m – the largest flood event since flood became a standard policy feature (in 1961). The Review noted that the UK is in the somewhat unusual position that flood risk is typically covered as standard as part of business and household insurance – unlike many other countries, where the local government often becomes the insurer of last resort (alternative insurance regimes are described in section 3.10). Overall the Review concluded that the private insurance system in the UK, under-pinned by the ABI's Statement of Principles (see section 3.7) “appears generally effective”. There's gratitude for stumping up £3,000m The Review doesn't believe there's any need to change the current system of insurance provisions and supports the ABI's Statement of Principles, noting that both parties (government and the insurance industry) need to play their part in meeting their obligations under the agreement.

Members of the public raised concerns with the Review about potential difficulties getting insurance following the floods. However the ABI had reassured the Review that very, very few policy renewals have been refused (literally a handful) and no existing cover withdrawn, although, of course, premium levels may rise. Note that according to the review the GIRO working party did of insurance premiums (see section 3.1), it still appears possible to get very reasonably priced insurance in pretty much all high risk areas.

Specific recommendations in relation to insurance

One of the main observations in relation to insurance was that many of those affected by the floods did not have insurance. In some of the areas affected by the floods, barely a quarter of households had any contents insurance (compared to the national average of 78%). Many of those who do have insurance are often under-insured. The Review also cited a survey highlighting that 90% of small businesses were under-insured and that 40% of them had no business continuity / loss of earnings insurance. One of the recommendations of the Review is that:

“The Government and the insurance industry should work together to deliver a public education programme setting out the benefits of insurance in the context of flooding.”

It's not just home owners and businesses that are potentially under-insured. The Audit Commission report “Staying afloat” noted the considerable disparity in different local authorities use of insurance: only 30% of the financial cost to local Government from the summer 2007 floods was insured.

The Government launched a financial inclusion strategy in 2004 which had no emphasis on taking out insurance. However in a revised action plan, published in December 2007, the government has included some additional focus on home contents insurance, allocating the DWP £12m to establish “financial inclusion champions” which will include twenty two-person teams to assist in the uptake of home contents insurance and affordable credit products.

The Review noted that there are a variety of low-cost insurance schemes for social housing tenants, either insurance-with-rent schemes or arms-length affinity schemes. For example the Northern Housing Consortium runs a scheme called SIMPLE (Simple Insurance Making Peoples Lives Easier), provided by Marsh / RSA (which has 170 similar schemes). However, a survey as part of the Review revealed that less than half of the UK's housing organisations had any sort of insurance scheme. A further recommendation of the Review is that:

“The Government should review and update the guidance 'Insurance for all: a good practice guide' for providers of social housing and disseminate it effectively to support the creation of insurance with rent schemes for low income households.”

Another area that the Review produced a recommendation for insurers was in the area of public education. The Review noted that:

“In flood risk areas, insurance notices should include information on flood risk and the simple steps that can be taken to mitigate the effects.”

Some insurers had questioned how worthwhile this would be because of issues of cost and effectiveness. The final Review shied away from a proposal in the interim review to make signing up for Flood Warning Direct a condition of insurance (after a mixed response to this suggestion – some observers noting that it might have the unintended effect of invalidating insurance agreements for people who did not sign up).

The Review had some less positive comments on the personal experience of those making a claim, citing a study that noted:

“The stress of dealing with insurance companies and having to go through a cumbersome system of approval adds to people's discomfort and anxiety at a time when they are already in a very distressed condition.”

The Review described how many of the problems people experienced with insurance companies and loss adjusters arose from confused communication and expectations of how long the process would take. Whilst insurers didn't get glowing praise for their communication skills, they were rated 3.26 out of 5 in a telephone survey in November 2007, compared to 3.13 for the Environment Agency and 2.64 for national Government. In an update as at June 2008, the ABI had risen to 3.5/5 and the Government had fallen to 2.5/5. So insurers can at least claim to be not as unpopular as the Government

Whilst the majority (72%) of claimants were very or fairly satisfied with how their insurance claim had been dealt with, 22% were very or fairly dissatisfied. The main grumbles amongst the dissatisfied were:

- time taken for home to be repaired (66%).
- difficulty in getting information (66%).
- time taken to get information / advice (42%).

The Review recommended that:

“The insurance industry should develop and implement industry guidance for flooding events, covering reasonable expectations of the performance of insurers and reasonable actions of customers.”

3.9 Our survey says

As part of the process of producing this paper we conducted a survey of actuaries in most of the UK's main insurance companies. Appendix III includes details of the survey questions (and accompanying letter).

There are two main types of question in the survey. The first is about insurer's loadings for flood claims risk in their premiums, the second is about their use of Cat models.

For the questions about flood loadings we've asked how much of a typical premium relates to flood risk, did the events of summer 2007 cause insurers to change their allowance for flood risk and for some details of how flood risk premiums were arrived at.

On Cat models we asked which models insurers used, whether these models were used to model flood risk and if so how, whether insurers made any use of the standard deviation figures so lovingly included in the models and what insurers felt were the main limitations of the models.

We don't want to steal the thunder from our GIRO conference presentation so haven't described the survey responses here. This also reflects the fact that we struggled to get responses from all the insurers by the deadline for completing this paper!!! So we'll give a full update at GIRO, rather than a partial update based on half the responses, in this paper.

3.10 Lessons from overseas ?

There exist many different methods for dealing with flood insurance worldwide. Three countries are selected here as examples.

Czech Republic

As in the UK, the Czech insurance market is private, and both life and non-life companies are represented by the Czech Insurance Association (Ceska Asociace Pojistoven – CAP). CAP membership comprises 26 full members and 3 associate, which account for over 99% of non-life premiums. CAP is very active in many areas of activity, including leadership of the market's initiative to mitigate flood losses following a major event in 1997.

Flood is the main natural hazard to threaten the Czech Republic. The most recent large event occurred in 2002, when insured losses totalled around USD 1.3bn, representing around 50% of the total economic loss for the country. 97% of the insured loss was covered by the reinsurance market (Source: AXCO). Insured losses in this event were mitigated by the strict controls over flood coverage which are employed by the market following earlier flood events, notably in 1997.

Following the 1997 event, CAP initiated a unified approach of the individual insurance companies to mitigation of flood losses. Detailed flood risk modelling played a major role in this approach. Due to the existence of an addresses database at the Ministry of Social Affairs it was possible to geo-code all addresses stored in insurers' property portfolios. All insurance companies in the Association agreed on a single consistent approach to flood modelling, using one set of flood maps that was prepared by MultiMedia Computer (Intermap Technologies). The first flood maps and geo-data were delivered to all the Czech Insurers in MaGIS tool (2001) and later in FRAT (2003), with additional support for industrialization of the underwriting process being provided for certain companies in the Aquarius.NET system in 2003. This software provides insurers with the ability to geocode risks in their portfolio and subsequently locate them relative to floodplain boundary mapping for five different annual probability bands, hence providing the annual flood probability and rating information for every address and property location that is geo-coded. Risk-level information for other perils including windstorm, hailstorm and theft and information on the availability of fire brigade and rescue services is also available.

Flood is generally covered automatically by the majority of household insurers, but is often sub-limited. The flood model has enabled Czech insurers to employ sophisticated flood risk management practices, including limitations to the availability of flood coverage. The measures taken vary per company but some examples include:

- refusal or limitation of cover to residential and commercial risks located in zones with a probability of flooding >0.05 per annum.
- losses are not indemnified for flood events which have a probability of >0.05 per annum.
- sub-limits are applied to commercial and industrial risks, for example maximum coverage per risk for industrial risks is normally CZK 100 Mio, although this can be increased through coinsurance.

Following the 2002 floods, there has been a huge growth in premium, following a radical re-rating of the property account. Retention levels have risen sharply, and the cancellation of small business quota shares and increases in excess of loss priorities mean that in a future large flood event, the domestic market would be expected to have a 10% share of insured losses.

France

In France, flood risk forms part of the state-backed “Catastrophes Naturelles” (CatNat) insurance scheme. As part of this scheme, the state provides insurance cover for perils considered “uninsurable”, including among others earthquake, flood, landslide, subsidence and cyclone (but excluding windstorm). A compulsory insurance guarantee against these perils is attached to every property damage insurance policy, covering direct material damage and loss of profit. Motor vehicles are also covered by the scheme. A compulsory deductible is applied on a sliding scale related to peril and loss prevention measures so as to encourage the insured to protect themselves where possible. In the case of an event, a decree of natural disaster must be declared by the local prefect, and thereafter, policies suffering damage which shows a causal link to the declared catastrophe and are within the geographical extent of the decree can be indemnified under the CatNat scheme.

The CatNat scheme is administered by CCR, who provides two-fold reinsurance:

- 50% quota share treaty with no reinsurance commission.
- stop loss unlimited in excess of at least 200% on the retention.

This protection is not obligatory, but is widely used, since the amount of cover offered is unlimited.

The unlimited protection provided by CCR has reduced the demand for development of detailed insurance flood modelling solutions, since companies do not need to quantify their exposure above the start of the stop loss cover provided by CCR. Consequently, there is no market-wide probabilistic solution available at present. Flood mapping models do exist, but have been developed outside of the insurance industry and come from a number of de-centralised sources.

USA

In the USA, the Federal Emergency Management Agency (“FEMA”), manages the National Flood Insurance Program (“NFIP”). There are three components of the NFIP, namely:

- flood insurance.
- floodplain management.
- flood hazard mapping.

To be part of the NFIP communities across the United States must participate in the NFIP by adopting and enforcing floodplain management practice as described by FEMA (FEMA estimate that 20,000 communities within the US are now part of the programme). In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary.

Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. FEMA estimate that flood damage is reduced by nearly \$1 billion a year through communities implementing sound floodplain management requirements and property owners purchasing of flood insurance.

Flood resilient measures are a key focus and FEMA estimate that buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance.

In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps all the US's floodplains – through a process known as map modernization.

4. NON-INSURANCE ASPECTS OF FLOODS

4.1 The human impact of floods

Being flooded is a traumatic experience. For most victims of flood the financial cost is small, with insurance companies funding repair and replacement. The stress and anxiety of the clean up operation as well as the loss of sentimental items are the impacts that many flood victims find it hardest to come to terms with.

Dundee University carried out research into the personal impacts of floods. The following are quotes from focus groups run as part of this research. They serve to highlight that financial loss is just one small impact of flooding.

"Panic. It's all panic... you think, 'I'm going out the house, what do I need if I'm going out? I need medicines, so I get my medicines' - my wife's diabetic - 'I need toiletries, I need towel, I need a change of underwear, I need clothing'. So you've got to pack a bag and packing a bag in 10 minutes to go out, you don't know how long you're gonna be out for, is impossible. You don't think, 'Oh my photos' because you're just full of... fear. Fear sets in. Medication - that's the kind of things you think of."

"I think you've a fear factor initially of adrenaline that helps to carry you through it ... I think in a lot of cases, panic sets in and actually gets you through whatever it may be and then after that's finished, then it sets in. Then it's the desperation to get alternative accommodation or whatever and then after that it's getting the loss adjuster to come and look. You walk back through your house again and it's covered in sewage. That's a devastating moment".

"My life was in two skips, things which you cannot replace, wedding photographs, birth certificates. I was in the RAF during the war and my flying log was all ruined. I had a couple of wings off my uniform, gone. These are things that you cannot replace ... not by an insurance company or anybody else".

There can be a long term economic cost to the homeowner too following a flood. Property prices can fall, especially if an area that wasn't previously considered by the community as at risk of flood is flooded. In extreme situations properties can be impossible to sell and there are the inevitable concerns over whether affordable insurance cover will be available.

Empty properties awaiting repair following a flood are easy targets for burglars. Homeowners return to their property to find that their remaining possessions that weren't damaged by the flooding are stolen. This leads to further upset and anxiety, as well as further stress of dealing with insurance claims.

People who live in areas that flood regularly can live in fear of the next flood. They may find it difficult to sleep when it's raining, for fear that the house will flood overnight. Small changes to property can make a huge difference to these people. A case study by Norwich Union highlighted the positive benefits that fitting flood resilient measures can bring to those living in flood risk areas. The property in question was one of 20 in an area that had been flooded on a number of occasions over the last few years.

"I have grown used to water coming right up to my front door, but since my home was refitted I definitely have a greater peace of mind.

"Before, when we had a flood warning, we would have had to move all our belongings upstairs and empty all the kitchen units. You couldn't go to bed at night for the fear a flood would happen while you were asleep. But the last time this area was seriously flooded I just had a trickle of water that came through the flood guard on the front door, so it was a mop and bucket job, everything else was dry and safe. Some of my neighbours weren't so lucky they were left with soaking wet carpets and furnishings.

"If I ever am seriously flooded again I know I should be able to move back home pretty quickly and hopefully it will just be a matter of wiping down the walls and maybe a bit of decorating instead of waiting weeks for everything to dry out."

Further research on the human impact of floods was done by a group of people from Wolverhampton university: "Exploring the experience of UK homeowners in flood disasters" by Victor Samwinga, David Proverbs and Jacqueline Homan (in September 2004). They classified the impact of floods into five categories: economic, emotional, service-related, social and physical. Again, they included some verbatim quotes that illustrate the emotional impact of floods, not just the bricks and mortar implications:

"Emotionally it really affected me..... Even now when it rains I panic. Is it going to happen again?"

"It did affect us severely; we lost things that had been in the family over 100 years."

The authors argue that a greater understanding of the "human" side of flood disasters would be beneficial to all stakeholders. Certainly the reports and studies illustrate that there's far more to floods than simply getting your house repaired. They also show that there's far more than just the monetary price to bear in mind when considering making flood resilient repairs. You can't put a price on peace of mind.

4.2 All you ever wanted to know about sewers (but were too scared to ask)

Public sewers

Public sewers are owned by water companies (“Sewerage Undertakers”, known affectionately as the “Undertakers”), who inherited them from various other bodies following the 1974 Local Government re-organisation and subsequent privatisation of the water industry. A public sewer is any sewer shown as being a public sewer on the Water Companies’ maps, and can include some culverted watercourses. Local Authorities generally no longer act as agents for the water companies, and therefore they normally have no role in the construction or maintenance of the public sewerage system. Sewers serving a small number of houses are generally in private ownership, with the landowners being responsible for their upkeep.

Separate systems

Sewer systems can be separate or combined. Many of the older systems are combined, with both surface water and foul water being conveyed in the same conduits. However, this can lead, in times of heavy rainfall, to overloading of sewers and sewage treatment works, and discharge of contaminated effluent into watercourses via combined sewer overflows. New developments are usually served by separate systems (that is a foul sewer and a surface water sewer). A separate surface water sewer will normally discharge to a watercourse.

Public sewer design standards

Public surface water sewers are normally laid by the water companies (or historically by their predecessors), or have been laid by developers and adopted by a water company. The design standards which must be applied to sewers offered for adoption are contained within “Sewers For Adoption” (currently 6th Edition), published by the Water Research Council. This document stipulates that surface water sewers must be designed to cope with a 30 year return period storm without flooding – the water companies are unwilling to take on responsibility for assets designed to any higher standard, due to the cost of maintenance and, more especially, the future cost of replacement. This means that a system designed to current standards would be expected to be surcharged by any storm event more extreme than this standard, leading to overflows from manholes and overland flow. Many older systems have been designed to other standards, such as a rate of rainfall, and may therefore have less capacity than the current standard. Furthermore, siltation and the gradual deterioration of systems will inevitably lead to a reduction in capacity. Given the variety of design standards historically applied, and the variation in the level of maintenance, it is not possible to define the distribution of standards which now apply nationwide, but the 30 year standard of service is a reasonable assumption. As extreme events become more likely, sewerage systems currently adequate to a 1 in 30 year level will, of course, fall beneath that standard unless the quality of the sewers is improved.

Rights of connection to public sewers

All existing properties, and proposed developments having a valid planning consent, have a right of connection into the public sewerage system. However, land drainage and groundwater may not be discharged into the public sewer. Flooding of basements and cellars by groundwater, therefore, cannot be rectified by discharging the water into public sewers. Only impermeable surfaces (for example roofs and driveways) within a building curtilage are allowed to be drained into the public system.

Highway drainage

Highway drainage in urban areas (for example road gullies) normally connects into the public sewerage system. However, in more remote areas (for instance along major trunk roads and motorways) a dedicated highway drainage system is provided, normally discharging into a natural watercourse. Modern systems typically include attenuation ponds which restrict the rate of discharge into the watercourse.

New developments

Drainage from new developments may be allowed to be connected into the public system, subject to a valid planning consent. However, the water company would normally be consulted on the planning application and would comment on the available spare capacity (or lack of it) in the system. It may be the case, where capacity is restricted, that the developer will be required to pay for an upgrade to the system capacity (under the sewer requisition procedure), where this is insufficient to accommodate runoff from the development. Unrestricted new discharges to, say, a combined system can result in an increase in flood risk and pollution due to more frequent and greater discharges into watercourses from combined sewer overflows. A developer may requisition, from the water company, a new offsite public sewer crossing third party land, in order to allow a remote development to connect into the public system. This offsite sewer would normally be installed by the water company, but funded by the developer.

Responsibility for drainage systems

Some drainage systems discharge direct into watercourses managed either by Local Authorities (ordinary watercourses), the EA (main rivers) or Internal Drainage Boards (drainage ditches, and so on). For new developments, these bodies normally require that discharge rates are regulated to the existing runoff rate in order that flood risk associated with the watercourses is not increased. In the case of Internal Drainage Board drains, many of these are designed for a greenfield runoff rate of 1.4 litres/second/hectare. Restriction of discharge rates normally leads to the requirement for on-site attenuation storage (for example ponds, underground tanks and oversized pipes). Landowners abutting a watercourse (riparian owners) are generally responsible for the watercourse. One of the conclusions of the Pitt Review, and an observation of this working party, is that responsibility for drainage systems can be very unclear – which is a recipe for inaction and inadequately maintained drains, as some parts of Hull discovered.

Sustainable Drainage Systems (“SUDS”)

Recent guidance given in building regulations, and other official documents, stipulates that sustainable drainage systems must now be used wherever possible, and the preferred hierarchy for discharge of surface water should be:

- infiltration drainage to ground (soakaways, and so on).
- to a watercourse.
- to a public sewer.

4.3 Let's talk about dams

Introduction

There are approximately 5,000 reservoirs of varying size in England and Wales. Of these, approximately 2,000 retain more than 25,000m³ of water at a level above the local ground level; this volume is the condition that determines whether the reservoir falls under UK reservoir safety legislation or not. However, the average age of this stock of dams and reservoirs is 110 years, with many being constructed during the Victorian era and some considerably earlier. A high percentage of these dams are earth embankment dams with clay cores.

Current legislation for reservoir safety is determined by the Water Act, 2003. Requirements from this act are likely to be enforced, following direction from the Secretary of State, in Spring 2009. Additional requirements from the European Floods Directive, which came into force in December 2007 (see the précis in Appendix I.2), will most likely also affect the way in which flood risk from reservoirs is assessed and managed.

A brief history of dams

In comparison to many countries, the UK has a relatively good history of reservoir safety. However, the Dale Dyke Dam failure in 1864 resulted in a flood wave destroying mills, warehouse and homes in Sheffield killing around 250 people. This is recorded as one the worst man made disasters in England and a noted event in reservoir safety. However, it still required three dam failures in 1925 before legislation was introduced. In 1925 the failure of two dams in North Wales resulted in the death of 16 people at Dolgarrog and led to The Reservoirs (Safety Provisions) Act, 1930 being passed.

Since 1975, reservoir safety has been driven by the Reservoirs Act 1975. This required owners of reservoirs storing 25,000m³ or more to comply with a number of requirements, including the appointment of qualified Supervising and Inspecting Engineers. The Act requires that the reservoir must be inspected at minimum every ten years by an independent, qualified civil engineer (Inspecting Engineer).

Past dam failures are not routinely recorded and investigated. However many individual organisations and experts maintain records. The most easily referenced is ICOLD (International Commission of Large Dams) bulletin 111.

Current legislation and enforcement

The Water Act 2003 supersedes the Reservoirs Act 1975 and introduces some significant changes in enforcement and requirements for the owners. Responsibility for enforcement of reservoir safety activities in England and Wales has transferred from the Local Authorities to the Environment Agency. Significantly, owners are now required to produce flood plans to support emergency planning.

The role of the EA in safety enforcement includes:

- maintaining a register of reservoirs and making it available to the public.
- making sure that Undertakers have their reservoirs regularly inspected by inspecting engineers.
- making sure that Undertakers appoint a supervising engineer for each of their “in operation” and “abandoned” reservoirs.
- making sure that Undertakers carry out necessary repairs required by inspecting engineers.
- enforcing the Act by making sure that undertakers fully comply; warning and ultimately prosecuting those that don’t.
- in the extreme event that Undertakers fail to comply, commissioning engineering services and necessary repairs and recharging the Undertaker.
- reporting to Defra and the Welsh Assembly Government.
- acting in an emergency if the Undertaker is not available.

A specific requirement of the Act is also that Undertakers produce flood plans for selected reservoirs. These flood plans are likely to require on-site and off-site plans for emergency actions, as well as analyses of potential downstream impacts arising from dambreak, including the production of inundation maps. Guidance on specific requirements for these plans is currently being developed.

The European Floods Directive came into force in December 2007. This requires flood risk from all sources to be considered and inundation plans for a range of events to be produced. Whilst not directly referring to flood risk from reservoirs, there is no specific exemption (as, for example, with urban drainage) hence it is thought likely that requirements of the Directive will also apply to reservoir flood risk. This is unlikely to change the need for analyses including inundation plans and impact assessment, as proposed under the Water Act, 2003 but the scheduling and frequency of review and update will need to be meshed with forthcoming guidance.

R&D Supporting Reservoir Safety

There have been a number of R&D projects in recent years which aimed to provide guidance for flood risk and emergency planning activities for dams and reservoirs. These include:

- CIRIA Report C542 – Risk management for UK reservoirs.
- Interim Guide to Quantitative Risk Assessment for UK Reservoirs.
- Draft Guide to Emergency Planning for UK Reservoirs.

In particular, the latter two propose methods for dam break, impact assessment and emergency action plan development.

Current issues and likely direction

An initiative that has arisen from a combination of EA, Pitt and the flood plans project team is the proposed national mapping of potential inundation from reservoirs in England and Wales. Currently, the specification for this mapping work is being developed through trial application to a selection of reservoirs in the EA North West region. Subsequently, the methodology will be rolled out to cover all regions in England and Wales. A critical aspect of this work is to ensure that resolution and accuracy of base and predicted data supports the range of potential end uses that this mapping might ultimately be used for. Equally, that models and methods adopted are appropriate for the extreme hydraulic conditions that typically arise during a dambreak scenario. End uses of the indicative mapping include:

- broad scale indicative inundation mapping for potential flooding from reservoirs.
- identification and risk to/from critical national infrastructure.
- risk categorisation of reservoirs.
- emergency planning and evacuation planning.
- spatial planning.

As noted in section 3.1, some firms such as JBA can provide dam break maps for over 1,500 dams likely to affect urban areas.

4.4 Flood mitigation

Widespread flooding in parts of the UK in recent years have raised the profile of flooding as an issue with which we should all be concerned. The types of damage from floods (which depends on the nature and the duration of the flood, and on the type of construction) includes:

- water entering around closed doors and through airbricks.
- seepage through brickwork and other external claddings.
- overloaded sewers discharging into ground floor rooms.
- water seeping through the ground and into basements or up through the ground floor.
- entry of water around cable services through external walls.

The flood water is unlikely to be clean and will normally contain contaminants such as sewage and fuel. If flood water rises beyond about 1m, then it is increasingly likely that buildings will suffer structural damage due to the hydrostatic pressure. Physical damage may also occur as the result of floating debris and larger objects, including trees and vehicles, colliding with the building.

The effects of flooding are not normally limited to the homes – it is likely that the infrastructure around the home will also be affected. For example, roads will be unusable, preventing access to the homes and may also suffer damage.

There are different types of mitigating action a home owner can take, depending on the likely type of flood and the sort of damage one wants to mitigate against. In this section we're interested in the actions the home owner can take to protect their property, rather than the actions insurers can take to minimize their exposure to floods, which are described in section 3.3.

There are three basic ways of reducing the effects of flooding.

1. Don't build homes in areas susceptible to flooding

This is the safest option and manages risk in the most positive way. Section 4.5 describes the planning environment and the responsibilities of those concerned. Sometimes building on a floodplain is deemed the only, or the least worst, alternative, in which case the other two main types of flood mitigation apply.

2. Build “flood-proof” (aka flood resistant) homes

Although it is possible to build homes that are flood-proof, their specification has to be very different from standard housing. They probably need to be constructed with a ground floor and walls designed as a water-retaining concrete structure. External doors would need to be “submarine” doors, capable of withstanding hydrostatic pressure and non-return valves would need to be provided to drainage connections. A satisfactory flood-proof specification would be prohibitively expensive for ordinary housing.

Building “on stilts” does not provide a generally acceptable solution as homes would still be susceptible to impact damage from floating objects and there is a concern that lower levels built “open” and intended for use as car parking would later be filled in to provide extra habitable rooms. There would also be a conflict with the requirements to provide access for the disabled. Building on stilts may be more appropriate for flats than for houses.

3. Build homes “resilient to flooding”

Homes at risk of occasional flooding could be built using flood-resilient construction so that they are little damaged and could be repaired quickly and cheaply in the event of a flood. Clearly it would be better if resilience measures were fitted in homes when they were built – it is considerably cheaper than retrofitting. Internal resilience measures are many and varied but could be introduced over a number of years. They include:

- concrete floors with ceramic tiling (instead of carpet).
- plastic skirting boards.
- sealed flood boards and air brick covers.
- limelight plaster on lower half of walls.
- raising white goods approximately 45cms.
- concrete bottom step.
- solid wood or metal kitchen units (rather than chipboard ones).
- raising electricity sockets above 1m.
- non-return valves on drains and toilets.

On a more engineering basis, and therefore more costly:

- sump and pumps – only useful in certain circumstances.
- flood skirts – expensive and reliant on someone to erect it.
- barrier systems (more appropriate for a group of buildings/small village).
- landscaping (to deflect water away from a property – onto somebody else's!).

There is, however, no current consensus as to which forms of construction are flood-resilient. For instance, a house with masonry walls and a concrete floor may be undamaged by flooding but is likely to take a long time to dry out. On the other hand, a timber frame house with a timber ground floor may need to have the wall linings, insulation and floor decking removed following flooding but would then dry out quickly and could be reinstated and reoccupied within a few weeks.

The ABI document “Flood Resilient Homes” (see Appendix I.2) details some of the main flood protection measures of and compares the costs of flood protection measures, showing the cost saving for deep (up to 1m) or shallow (up to 5cm) floods. Some illustrative costs of some of the flood mitigation measures we've described are as follows:

Replace timber floor with concrete in a 3 bedroom semi detached house

Cost of measure	£6,150
Cost of restoration without measure	£3,100
Cost saving each deep flood event	£2,350
Cost saving each shallow flood event	£2,350

So money is “saved” after two flood events

Mount heating boiler on wall

Cost of measure	£150
Cost of restoration without measure	£850
Cost saving each deep flood event	£700
Cost saving each shallow flood event	£700

So money is “saved” after one flood event. Typical costs of other potential flood mitigation strategies include:

Flood boards

To be at all effective flood boards need to be combined with airbrick covers. Also all pipes would need to be sealed – not an easy job. These measures will offer some protection against low level short term flooding. If water levels are high or prolonged, water will get into property through the bricks. The cost is approximately £1,000.

Non-return valves on drains/toilets

To stop water rising from the drains non-return valves must be fitted. If the drain is shared it can make damage to the other property worse. There is an amount of maintenance required for these devices that is rarely done and over time renders them a liability. The only successful schemes would involve maintenance contracts too. The cost is approximately £400.

Landscaping

Severn Trent have used landscaping as a way to deflect water away from the property – they add flood proof gates and contour ground to reduce water ingress – for many properties the most efficient addition is a well sealed entrance porch. This is a more effective solution against flash flood than river flooding which tends to be longer lasting. The cost is approximately £5,000.

Why don't people invest in flood mitigation measures ?

Individuals will probably have short term time horizons and will want to recoup their “investment” over a short time horizon, so would probably want to see “benefits” (that is cost savings after floods) in the near future: clearly not something that can be guaranteed unless a property floods at very regular intervals.

Budget constraints place flood protection as low priority and not an immediate need and can be thought of as a luxury purchase. Is flood protection likely to add value to their home? The measures that can be undertaken are not likely to make a home more attractive from an aesthetic viewpoint. A new bathroom is likely to be perceived as better value than flood mitigation measures in the short term.

If insurance is in place this means that the insured is at the extremes likely only to be responsible for a small proportion of the losses caused by flood and so taking their own actions seems of relatively small value. If insurance returns your property to its previous condition, then why go the extent of a larger outlay? Of course the counter-argument is the emotional distress and turmoil of having a house flooded (see section 4.1) but home owners usually think more in pounds and pennies.

The assessment of risk of their property being damaged by flood is hard for the general householder to grasp, the main reference point being “when did it last flood” rather than any view forecasting this risk into the future (see section 4.7). Flood is seen as a rare event, the definition of rare is of course a judgemental one.

Also if the insured believes (even if implicitly) that “the authorities” will provide aid to them in the event of a flood event, then why would they bother to undertake it for themselves.....

What more can householders do if flooding is imminent?

If the worst happens, or is about to happen, the EA website provides a list of advice covering a number of things householders can do. This includes:

Gas, electricity and water

- put plugs into sinks and weigh them down with something heavy.
- turn off gas, electricity and water supplies at the mains.
- unplug all electrical items and store upstairs or as high up as possible.

Reduce flood water getting into your home

- silicone sealant around doors and windows.
- cover doors, windows and airbricks with plywood, sandbags or metal sheeting.

Furniture and appliances

- move as much furniture and electrical items as you can upstairs (or raise them up on bricks or blocks).
- move furniture away from walls (helps when drying your property).
- roll up carpets and rugs and put them upstairs.
- remove curtains or hang them up over the rail so they are kept above flood water.
- leave internal doors open or remove them and store them upstairs.

Other common sense advice includes:

- move personal / sentimental items upstairs.
- keep important personal documents in a sealed bag in a safe location.
- move anything not fixed down into a safer location (for example dustbins, garden chemicals, car oil and so on).
- move your car to higher ground to avoid damage.
- weigh down manhole covers outside the house to prevent them floating away.

Strictly speaking, insureds are legally obliged to do all they can to mitigate insurance losses. Many of the suggestions above are “free” and for most people just require a bit of time (and elbow grease). In situations where insureds have several days notice, an insurer could refuse to pay claims, or reduce the amount paid, if basic mitigation measures had not been taken.... A more reasonable alternative would be for insurers to make sure insureds had such a list of sensible mitigating actions; they could also e-mail or text guidance to their insureds if there was sufficient notice before a potential flood to warrant doing so.

4.5 Roles and responsibilities of different interested parties

There are many different parties with an interest in the management and mitigation of flood risk in the UK. Whilst the main focus here is on England, in many cases there are similar bodies, systems, processes and requirements in Wales, Scotland and Northern Ireland. In this section we aim to outline the roles and responsibilities of a number of the main interested parties, though the list is by no means exhaustive.

To put the responsibilities into context, we start with a brief overview of building regulations and the planning process.

Building regulations

Building regulations set standards for the design and construction of buildings, mainly to ensure the safety and health of people in or around those buildings, but also for energy conservation and access to and around buildings. As well as covering things like fire safety and ventilation they also include resistance to moisture, drainage and waste disposal. The Department of Communities and Local Government (“DCLG”) publishes guidance on meeting the requirements of building regulations in what are known as “Approved Documents”. Building regulations are different from planning permission and for many types of building work separate permission will be required under both regimes.

Planning process

Planning policies and procedures across the UK are the mechanism by which development and the use of land is regulated, with the aim of promoting sustainable development. The national planning policy for England in relation to management of flood risk is set out in Planning Policy Statement 25 (“PPS25”) published in 2006 (and replacing Planning Policy Guidance Note 25, PPG25, issued in 2001). PPS25 requires that Local Planning Authorities (“LPA's”) should adopt a risk-based approach to proposals for development in or affecting flood-risk areas. Flood risk is an important factor to be considered by planning authorities when preparing development plans and, where relevant, it is a “material consideration” to be taken into account by LPAs when determining planning applications.

The planning process requires an assessment to be made of any flood risks related to proposed developments. This primarily involves two key issues:

- whether the development itself would be at risk of being flooded.
- whether the development would increase the risk of flooding elsewhere.

The effective management of flood risk through the planning process requires contributions from a range of parties. In relation to proposals for construction or development, the primary parties typically include:

- developers and others involved (for example architects and builders).
- LPAs.
- Flood Defence Agencies (“FDA”). For most development proposals within England and Wales the principal agency will be the EA. However, in certain circumstances internal drainage boards and LPAs can also act as the FDA, and may also be consulted.
- sewerage undertakers (see section 4.2) and canal operators.

Key responsibilities relating to flood risk in the planning process are:

Organisation	Key responsibilities
Developers and others involved in development	Provision of flood risk assessment and planning application, as required by the LPA
LPAs	Preparing development plans. Development control. Administration of building regulations.
FDAs	Consultees during the preparation of development plans. Consultees advising LPAs on flood risk in relation to planning applications. Some FDAs have their own regulatory powers under the Land Drainage Acts and bye-laws under which consents must be obtained from the FDA. The procedure is quite separate from the planning process.
Sewerage undertakers	Public sewerage systems. Development drainage where this is via adopted sewers.
Highways authorities	Highway and road drainage.
Canal operators (in many cases the canal operator will be British Waterways)	Canals and some navigable sections of watercourses.
Other consultees	Advice on other factors, for example environmental issues.

Against this backdrop of building regulations and the planning process, we've listed below the main interested parties who have a role to play in considering flood risks in the UK.

Government

The form of government may be local – LPAs, or central – the DCLG. First and foremost, Government is responsible for ensuring that appropriate priority and sufficient funding is given to ensuring that flood risks are well managed in the UK. This will take the form of ensuring that there is a coherent, well funded and deliverable flood defence strategy in place, in addition to ensuring that appropriate legislation and regulations are in place giving relevant bodies the authority and ability to implement the required strategy.

In terms of planning, whilst DCLG sets national planning policy, LPAs have a central role in the operation of the planning system, preparing development plans and determining planning applications. In the context of flood risk management, the primary role of the LPA is to guide, regulate and control development. Currently, at the strategic level, county councils and unitary authorities produce “Structure Plans” and “Unitary Development Plans” (“UDPs”) respectively (though this is under review). LPAs produce local plans which set out, within the general context of the Structure Plan, detailed policies and specific proposals for the development and use of land. However, national administrations retain powers to intervene in the development plan preparation process.

The selection of areas for development proposed in local plans should take account of flood risk using the risk-based method and the relevant national planning policies. The assessment of flood risk during the preparation of development plans is usually based on national flood mapping programmes (such as the indicative flood maps produced by the EA) or on strategic flood risk assessments commissioned by the LPA. However, the scale of these assessments means that the mapping of flood plains may be of limited accuracy and not all relevant flood risk issues may be covered for all sites.

Recent changes to planning regulations mean that should a LPA decide to go ahead with a development in a high risk flood area against the advice of the EA, the matter must be referred to the Secretary of State for final approval.

Developers

When developers are planning and designing a development it is important that flood risk issues be considered in terms of the risk and consequences of the site itself being flooded and in relation to flood risk elsewhere being affected by the development.

Those proposing specific developments are responsible for:

- providing an assessment of whether the proposed development is likely to be affected by flooding and whether it will affect flood risk elsewhere.
- satisfying the LPA that any flood risk to the development, or additional flood risk elsewhere arising from the proposal, will be successfully managed with minimum environmental effect, to ensure the site can be developed and used safely.

FDA's and other Bodies

During determination of a planning application for a site where flood risk is a potential concern, the LPA will usually consult with the FDA, and any other relevant bodies, to assess the appropriateness of the proposed development. If the application contains sufficient information to indicate that flood risk issues are not significant, the LPA may rely on standing advice from the FDA, and may decide that specific consultation is unnecessary. Other bodies that may be consulted by the LPA, especially in relation to run-off issues, include sewerage undertakers, local authorities and British Waterways.

EA (Environment Agency)

The principal aim of the EA, as stated in the Environment Act 1995 and summarised in PPS25, is to contribute towards the achievement of sustainable development. Within its wide-ranging responsibilities, the EA has a duty to exercise a general supervision over all matters relating to flood defence in England and Wales. Under Section 105 of the Water Resources Act 1991, the EA was required to carry out surveys relating to flood defence, and the resulting documents are generally referred to as "Section 105 Surveys". The EA has also produced indicative flood plain maps. While these surveys and maps are to be updated "from time to time", the EA has a continual programme of recording and archiving hydrometric data, including river levels and flows, groundwater levels and water quality information. Following the Pitt Review, the Government has committed that the EA will review its data annually. The EA is developing a range of management plans covering its flood defence, water resources, pollution control and fisheries functions and environmental duties. These surveys, records and plans can provide valuable information for use in flood risk assessments.

The EA has permissive powers to maintain and improve watercourses and flood defence works and to construct new works. However, except where the powers are to be used for defence against the sea or tidal water, the use of these powers is restricted to lengths of watercourse designated “main river”. If a river is not designated a “main river” by Defra it's known as an “ordinary watercourse”. The EA's powers are permissive not mandatory, and improvement works are programmed on a priority basis. In particular, the EA does not promote, at public expense, schemes to protect new development from flooding unless this is incidental to the reduction of flood risk to existing properties. The EA has certain rights to enter land, and to deposit dredged material on land next to a watercourse.

The EA operates flood forecasting and warning procedures for many areas at risk of flooding throughout England and Wales. The related documentation can be an additional source of information.

The EA is a statutory consultee when Structure Plans and some (“Part 1”) UDPs are being prepared and will also contribute to the preparation of Local Plans and other sorts (“Part 2”) of UDPs. The EA will normally be consulted by an LPA regarding any application for planning permission where flood risk is likely to be a material consideration. A recent amendment to planning legislation means that if LPA's want to approve development against the advice of the EA, then the application will be referred to the Secretary of State.

Internal drainage boards

Certain areas of England and Wales are designated internal drainage districts (“IDDs”). For each such district, an internal drainage board (“IDB”) has permissive flood defence powers and duties in relation to ordinary watercourses within the district. On request, the LPA or the EA will be able to indicate whether the site of a proposed development is in an IDD. If this is the case, the IDB should be consulted in addition to the EA as they often have detailed local information regarding flood risk. An IDB's powers to maintain and improve ordinary watercourses and related flood defence works, and to construct new works, are generally the equivalent of the EA's powers in relation to main river. The policy of IDBs regarding the protection of proposed development from flooding is similar to that of the EA.

Local authorities

Local authorities have some permissive flood defence powers in relation to ordinary watercourses outside IDs. However, their powers to maintain and improve watercourses and flood defence works, and to construct new works at public expense, are limited to work which may be necessary for the purpose of preventing flooding or mitigating any damage caused by flooding. Also, a local authority shall not carry out or maintain any drainage works except with the consent of, and in accordance with any reasonable conditions imposed by, the EA.

With all the IDD, IDBs, FDAs, UDPs, EAs and Defras around, it's not surprising that one of the Pitt Review recommendations (see section 4.9) was for some clarification of the responsibilities of the main parties involved in managing flood risk. Certainly the working party was struck by the confusing environment of the many and varied bodies who have some responsibility for flood risks.

Water Boards and general utility services (for example gas, electricity & telecom)

These organisations are responsible for providing essential services in a reliable manner. Following the summer 2007 floods, when power was nearly lost to 500,000 homes and water supplies were cut off for more than 100,000 people, these organisations are no doubt reviewing their flood contingency plans rather more thoroughly than they had in the past....

Emergency services (including the NHS, RNLI, armed forces)

These organisations perform a key role in providing emergency assistance in the event of flood disasters. They are responsible for defending, rescuing and providing emergency medical assistance to the public should the need arise.

Home owners

In light of the publicity given to recent and historical flood events and related risks of recurrence, it would be a naïve and foolish potential home buyer that fails to investigate the risks of flood relating to any home they intend to purchase. Whilst many other interested parties have their own roles and responsibilities, potential home owners must take some responsibility for their own actions. This will include seeking advice regarding the risk of flooding relating to homes they intend to purchase and seeking advice from insurance companies regarding the insurability of these homes against the risks of flooding.

For home owners already in-situ, each has a responsibility to manage their risk to the extent possible in light of the latest flood risk information available. Section 4.4 details a number of flood resilience measures that can be taken, from the “no cost”, move valuable items upstairs (unless you're in a bungalow....), to the rather more comprehensive installation of flood barriers.

Charitable organisations (such National Flood Forum, Citizens Advice Bureau)

The role of these organisations in terms of flood risk are to help advise how best to manage the risks in advance of flood events and assist in any issues following flooding. This might include dealing with insurance companies.

4.6 Information about potential flood risk for the public

There are a few sources of information on properties at risk from flood available to the public.

On www.environment-agency.gov.uk you can look up your postcode (providing you don't have a new house because their address file is out of date!) for free and get an indication of your flood risk from river or coastal flooding and also an indication that there are flood defences in the area which may protect your property. If your insurance company needs more detail, for a fee (£25), the EA will supply a report for your property – but past examples of these reports have been confusing, putting a property in several flood risk categories for example.

Property Search companies such as Landmark, Groundsure and Hometrack use/interpret commercially available data, historic flood maps and other data to give you a view of flood risk for your property. Their main focus is the conveyancing market, supplying solicitors during the home buying process. These reports retail around the £30 - £60 mark.

If a property looks to be at risk from flooding the next step is a full assessment of the actual risk. This would require a flood risk assessment from an engineering consultancy firm costing from £750. This assessment would be house specific, much more accurate and could include suggested mitigation measures.

Surprisingly Home Information Packs do not contain a flood risk assessment. One of the recommendations in the Pitt Review is that flood risk does become a mandatory part of HIPs, so that at least on purchasing a property the level of flood risk is known.

4.7 Flood and the perception of risk

Actuaries may not like it, but there's more to dealing with flood risks than allocating a probability to a certain scenario and making a clear-cut decision as a result.....

A low probability / high consequence event might have the same “expected value” as a high probability / low consequence event but the two different outcomes are often viewed very differently by society. Coach crashes, acts of terrorism, or other “shock” events usually attract far more attention than everyday road accidents, even if the monthly fatalities of the latter are far greater than the former. A catastrophic, significant coastal flood, or widespread fluvial flooding, similarly attracts far more attention than regular, low level, moderately inconvenient flooding (even if sometimes the latter, over time, is of more financial consequence than the former).

The perception of risk also depends on ones ability to control or influence it. Most people probably under-estimate the risk of driving to work because they are aware of what fantastic drivers they are. When it comes to things like floods, the public needs to put its faith in others, “the authorities”, in whom there may be an inherent distrust which colours the view of risk.

Ones view of risk is also affected by the financial consequences. Although no one would want to be flooded (as section 4.1 makes clear), if one is “happy” that insurers will pick up the pieces (or you believe that “the authorities” will do something to help), then the risk has less consequence than if, say, insurance was not available – in which case flood would be a considerably more important risk in the eyes of most people.

There's a difference between societies collective view of risk and that of the individual. It may make sense for society collectively to allow some coastal areas to be flooded rather than pay many millions of pounds to erect sea defences. For the individual living on the edge of a cliff, the cost / benefit case looks rather different. The various conflicting views of risk are described in the excellent HR Wallingford report “Risk, performance and uncertainty in flood and coastal defence: a review” (see Appendix I).

Leaving aside the subtleties of risk assessment above, many members of the public (and indeed a number of senior members of insurance companies!) don't have a basic grasp of statistics / probability. The classic case being the relief that now we've had a 1 in 100 year event, we should be safe for another 99 years until the next one....

So in all the considerations of flood risk, there are many different factors to be taken into account. The underlying “scientific” views of risk are themselves inherently very uncertain, more so because of the impact of climate change. But there is a further layer of uncertainty due to the different issues described above.

4.8 Flood and climate change

Climate change is definitely happening, however, the consequences are very uncertain. We haven't set out to dwell at length on the whys and wherefores of climate change in this paper – there's more than enough literature in the public domain on that subject already. We'd refer the interested reader to the 2007 GIRO working party paper “The impact of climate change on non-life insurance” (see a précis in Appendix I.2).

There's a danger that almost every extreme weather event is explained by climate change.... The recent low levels in reservoirs were put down to climate change as were the recent floods!! Of course no one “event” is conclusive proof one way or the other of climate change or its effects. Strictly speaking, the general scientific consensus is that the summer 2007 floods were not a “climate change event” but rather were a consequence of a combination of unusual (but normal) events, for example the position of the Jet Stream (as described in section 2.2). The weather was worsened by higher than average sea temperatures which could, however, be linked to climate change.

If climate change is not taken into account the rainfall of summer 2007 can be considered broadly a 1 in 200 year event. As such it should have been part of the risk management assessment of most insurance companies (as noted in section 3.5). Local authorities can be forgiven for not considering such an event in their disaster planning as a 1 in 100 year test is the norm for such purposes.

A broad consequence of global warming is more rain (as a consequence of more evaporation) and more storms (as a consequence of a more dynamic atmosphere). If we do increasingly see new weather patterns as a consequence of climate change, then this will put a new perspective on the above (1 in 200) statistics. John Prescott described the floods of 2000 as a “wake up call” to climate change. We run the risk of still dozing.... The EA have indicated that what was previously a 1 in 100 year flood may become 1 in 10 to 1 in 20 year events and that coastal defences currently adequate to a 1 in 100 level of protection may only offer protection to a level as low as 1 in 5.

Should floods of the magnitude seen in summer 2007 become anywhere near a 1 in 10 year event, let alone coastal defences only offering protection to a 1 in 5 year level, insurers will certainly have to consider the adequacy of their flood loadings (section 3.1). Reinsurers would need to pay rather more attention to flood risks too (section 3.5). And members of the public might find a 10% chance of being flooded a rather more compelling reason to invest in some flood mitigation measures than a 1% chance (sections 4.1 and 4.4).

4.9 Pitt and non-insurance

The background to the Pitt Review is described in section 3.8 which also covers the insurance aspects of his recommendations. In total the Review makes 92 recommendations. In this section we give an overview of the main, non-insurance, recommendations.

The recommendations follow four underlying principles:

- to deal with the needs of individuals and communities who have suffered from flooding or who are at risk.
- strong and more effective leadership is needed to ensure that the needed changes will happen.
- clarification of who does what.
- the need to work together and share information.

Scientific analysis was commissioned which indicated that climate change has the potential to cause more extreme scenarios than previously envisaged and Pitt also draws on the Stern report.

Pitt identified that no one organisation was responsible for overseeing and planning for surface water flooding (as opposed to river flooding) and that responsibility for drains was unclear. Edited highlights from the rest of the recommendations are:

R1-2

The first two recommendations are that the Government should prioritise the climate change programme with the EA overseeing all flood risks.

R3-6

The next four recommendations relate to the EA and the Met office working together to improve forecasting and prediction models.

R7-13

These deal with building and planning matters (see section 4.5). In particular recommendations were made that householders should no longer be able to lay impermeable surfaces as of right and that there should be no automatic right to connect surface water drainage of new developments to the existing sewerage system. The Review also recommended that building regulations should be revised to ensure that all new or refurbished buildings in high risk flood areas are flood resistant or flood resilient.

R14-22

These include a number of recommendations for local management to be responsible for local flooding, but that the Government needs to resolve the issue of who is responsible for the ownership and maintenance of sustainable drainage systems. Defra, Ofwat and the water industry are to explore how appropriate risk-based standards for public sewerage systems can be achieved

R23-28

These deal with the Government's long-term strategic plans, the guidance provided to local authorities and that the forthcoming flood legislation should be a single unifying Act that addresses all sources of flooding, clarifies responsibilities and facilitates flood risk management.

Remaining sections include:

- a fully funded national capability for flood rescue.
- in respect of dams, local Government should provide local Flood Resilience Forums with the inundation maps for both large and small reservoirs to enable them to assess risks and plan.
- for contingency, warning and evacuation and the outline maps be made available to the public online as part of wider flood risk information.
- the Government should implement a public information campaign drawing on a single definitive set of flood prevention and mitigation advice for householders and businesses, which can be used by media and the authorities locally and nationally.
- flood risk should be made part of the mandatory search requirements when people buy property (in HIPS).
- the public should make up a flood kit which includes personal documents, insurance policy, emergency contact numbers (including local council, emergency services and Floodline), torch, battery or wind-up radio, mobile phone, rubber gloves, wet wipes or antibacterial hand gel, first aid kit and blankets.

The recommendations are wide ranging and sweeping. As noted in our Headlines section, to be effective responsibilities for implementing them must be clearly allocated and where necessary additional funding made available.

5. SUMMARY

5.1 So what ?

The authors of this paper didn't start with a remit to “report to Body X”, or “make recommendations to Group Y”. Rather we're a group of people, largely actuaries, with an interest in flood risks who thought it would be useful to review and summarise UK flood issues primarily for the benefit of GIRO attendees and the GI actuarial / insurance community. A number of facts and shortcomings regarding UK floods have struck us in the process of pulling this paper together, which are summarised below.

Our main observations and recommendations are:

- a large and increasing number of people are at risk of flooding.
- many new homes will be uninsurable – but it's unclear which ones. The ABI needs to clarify its stance on insuring new properties and how. insurers will decide which properties are “high risk”.
- responsibility for surface water is particularly unclear.
- there needs to be more publicity about how to make homes flood resilient.
- there needs to be some guidance on how best to dry out properties.
- the public and insurers need better data on flood risk.
- it's still easy to get reasonably priced insurance in high risk areas.
- insurers should collect flood information more effectively.
- insurers should co-operate with each other more after flood events.
- there are a number of enhancements that can be made to flood models.
- the Pitt Review needs to lead to clear accountabilities for flood issues and real money to be spent.

A large and increasing number of people are at risk of flooding

The number of people (over a million) in the UK at a significant (greater than 1 in 75 chance) risk of flooding is, we suspect, rather more than most observers imagine. As too is the fact that 10% of all properties in England are built on floodplains.

But in fact the situation is worse than that..... The “at risk” figure above doesn't include surface water and ground water floods, both of which affect several hundred thousand people in the UK. Nor does it include the risk of infrastructure failure, such as dams breaking. And for all types of flood the clear consensus is that the risk of flooding is increasing. The increasing risk is particularly acute for coastal flooding: many coastal properties that are currently protected to a 1 in 100 year level of protection will only be “protected” to a 1 in 5 level by the end of the century unless significant action is taken.

Despite the significant and increasing risk, many new homes are still being built on floodplains. Planning regulations mean that local authorities have to refer to the EA and consider flood risk – but ultimately can still go ahead and allow properties to be built on floodplains and in high risk flood areas. An example of this is the decision to allow 600 homes to be built in flood-prone Longford, just to the east of Tewkesbury – an area that experienced significant flooding in the summer 2007 floods.

Life is not so simple that one can simply say “don't build homes in flood-prone areas”..... New homes have to be built somewhere; in this case the site achieved the joint highest “score” in an assessment of where developments should be allowed and will only be built if sustainable drainage systems are installed. However, local councillors have described the decision as “disgusting”, Tewkesbury's MP said “It's unbelievably stupid” and locals have described it as “... bad news for the future of Longford.”

Many new homes will be uninsurable – but it's unclear which ones

As noted in section 2.4, parts of Thames Gateway development may be uninsurable. As noted above and elsewhere, local authorities can, and do, approve developments in flood-prone areas. The recently revised SoP regarding the availability of flood insurance does not apply to new homes built after 1 January 2009. So there will potentially be many new homes in England for which insurers are not prepared to provide cover.

Our survey of household premiums (see section 3.1) shows that it is still possible to get very competitive premiums even in high risk flood areas. It will be interesting to see if competitive pressures mean that some insurers are still happy to “chance it” by offering insurance in high risk flood areas, or perhaps don't have the wherewithal to differentiate between new properties and long established properties and do so inadvertently.

There are various conflicting views of what the real level of flood risk is. As noted in section 3.7, the EA data on flood risks has rapidly and repeatedly changed from one risk category to another. In future, if such changes mean the difference between having insurance or not, the EA data will need to be far more robust.... Some insurers have a more sophisticated view of some flood risks than the EA. It's not clear whose view of flood risk will determine whether insurers can reasonably refuse to offer flood cover. There's much to be done to flesh out exactly how the details of the SoP for new homes will work in practice and insurers need to make sure they have the information necessary to apply the SoP to new homes fairly.

Responsibility for surface water is unclear

The summer 2007 floods dramatically highlighted the problem of surface water and intra-urban flooding. The sewerage and drainage system cannot, and is not built to, cope with extreme events, so when there is an extreme amount of rain excess water runs across the ground. There are ways of mitigating this risk but responsibility for ensuring sustainable drainage systems is hazy, straddling local authorities and the water companies. Like the Pitt Review, this struck us as an obvious area where responsibility for owning and maintaining sustainable drainage systems needs to be resolved.

There needs to be more publicity about how to make homes flood resilient

Many people believe there is nothing they can do to prevent their homes from being flooded – even those whose properties have been affected by the summer 2007 floods. Whilst insurers will pay to repair the structural damage to properties, a flood victim still suffers considerable trauma and inconvenience. For the sake of a few thousand pounds such trauma can be considerably reduced or avoided (section 4.4 describes a range of measures available to the public to protect their properties). More should be done to publicise these measures, particularly in flood-prone areas, by insurers and local authorities alike. Ideally some sort of funding assistance (in the same way as insulation measures are encouraged for some groups of people) would help.

There needs to be some guidance on how best to dry out properties

It became apparent during the repair process that there are different views on how best to dry out properties. The construction and insurance industry could usefully promote research and debate on the best techniques to dry out flooded properties.

The public and insurers need better data on flood risk

In the last three assessments of flood risk (in 2004/05/06) by the EA, only 40% of UK properties stayed in the same risk category (low, moderate or significant) across each release; more than 10% of homes were in a different risk category in each release. These means the public can get mixed messages about their level of flood risk and if EA data alone is used as a basis for insurance premiums, premiums can change considerably from one year to the next.

The EA flood risk data was never intended to be used to help set insurance premium rates or to be accurate at postcode level. However, as it is increasingly being relied on by various parties its reliability clearly needs to be improved. We were pleased to see, and echo, the recommendation in the Pitt Review that EA data is improved (from 1 January 2009) and is regularly reviewed thereafter.

The Pitt Review also recommends correcting another glaring omission. Home Information Packs do not need to include any information on flood risk – so property buyers can happily buy a house with no idea that they are in a high risk flood area. For such information in HIPs to be useful, a stable definition of flood risk is needed, lest HIPs show properties as low risk one year, then bump up the property to high risk the next (as happened to more than a million homes between each of the last three EA updates).

It's still easy to get reasonably priced insurance in high risk areas

Our review of household premiums (in section 3.1) found that it's still possible to get very competitive insurance quotes in almost all areas of “significant” flood risk. Insurers may be making lots of noise about the need to increase premiums but collectively the market is still charging a far from realistic price in many high risk flood areas....

Insurers should collect flood information more effectively

Insurers could also do a lot more to collect flood information in a usable format. We note in section 3.2 that insurers and reinsurers (and other interested parties) would have a much better understanding of flood risks if information on, for example, water depth and construction of buildings, was recorded systematically as part of the claims process.

Insurers should co-operate with each other more after flood events

In section 3.6 we note that insurers could save themselves and their customers time and money by coordinating visits by loss-adjustors and planning repairs on properties in the same street together. This would avoid the frustrations of some flood victims seeing neighbouring properties being dealt with far quicker than others, or repairs in a row of terraced houses being delayed because one of the properties has not been adequately dried out.

There are a number of enhancements that can be made to flood models

Section 3.2 describes a number of enhancements that can be made to current flood models. These include:

- better information on flood defences.
- better modelling of vulnerability functions.
- better claims / exposure data for analysis.
- insurers to collect more flood data (see above).
- consider non-river floods and the whole spectrum of return periods.
- consider the independence of flood events.

The Pitt Review needs to lead to some action !!

One of the main stumbling blocks that will need to be resolved is to ensure clear accountabilities for all the recommendations in the Review. Some simple, clear, measurable targets would help provide some focus to all concerned: for example the number of properties in the UK at significant risk of flooding and the number of new properties built in floodplains or high risk areas.

To be effective, as well as being clear about accountabilities and targets, some real money will need to be found to bolster flood defences or to improve flood resilience measures and the availability of information about floods.

APPENDIX I

BIBLIOGRAPHY, PRÉCISES AND USEFUL WEBSITES

This appendix is split into the following sections:

- I.1 Publications reviewed by the working party
- I.2 Précises of some of the papers
- I.3 Useful web site references

Interested readers are welcome to contact the Chairman for copies, or web references, of any of the papers we have reviewed (copyright permitting) at: jul1anandcar0l@ntlw0rld.c0m (replacing 1's with i's and 0's with o's as appropriate).

APPENDIX I.1

PUBLICATIONS REVIEWED BY THE WORKING PARTY

The following publications have been reviewed by the Working Party as part of the process of writing this paper. Details of nearly all these papers are either included in the body of the text, or précises are given later in Appendix I.2.

“After a flood”, Environment Agency

“Assessment of the cost and effect on future claims of installing flood resilient measures”, ABI, (May 2003)

“Building and maintaining river and coastal defences in England”, Report by the National Audit Office HC 528 Session 2006-2007 (June 2007)

“Change in the weather: weather extremes and the British climate”, Philip Eden (2005)

“Crises as catalysts for adaptation: human response to major floods”, Flood Hazard Research Centre: C. Johnson, S. Tunstall, E. Pennin-Rowsell (2004)

“Development and flood risk – guidance for the construction industry”, CIRIA (2004)

“During a flood”, Environment Agency

“EC Directive on the assessment and management of flood risks”, European Parliament (October 2007)

“Exploring the experience of UK homeowners in flood disasters”, Victor Samwinga, David Proverbs and Jacqueline Homan (September 2004)

“Extreme Floods – a history in a changing climate”, Robert Doe (2006)

“Flood resilient homes”, ABI

“Flooding”, Environment, Food and Rural Affairs Committee (May 2008)

“Handbook on good practices for flood mapping in Europe”, EXCIMAP (November 2007)

“Historic storms of the North Sea, British Isles and Northwest Europe”, Lamb (1991)

“Impacts of Climate Change on Financial Institution's Medium to Long Term Assets and Liabilities”, L. Peroy, Staple Inn Actuarial Society (June 2005)

“Learning lessons from the 2007 floods”, Interim report by Sir Michael Pitt (December 2007)

“Preparing for floods”, Office of the Deputy Prime Minister (October 2003)

“Preparing for a flood”, Environment Agency (February 2002)

“Review of Summer 2007 floods”, Environment Agency (December 2007)

“Ranking port cities with high exposure and vulnerability to climate extremes”, OECD (2007)

“Scrutiny inquiry into the summer emergency 2007”, Gloucestershire County Council (November 2007)

“Staying Afloat”, the Audit Commission (December 2007)

“Summer floods 2007; learning the lessons”, ABI (November 2007)

“The impact of climate change on non-life insurance”, GIRO Climate Change Working Party (October 2007)

“The June 2007 floods in Hull”, Interim / Final reports by the Independent Review Body (August / November 2007)

“The July 2007 floods in England and Wales – a preliminary appraisal”, Centre for Ecology and Hydrology (July 2007)

“The rough guide to Climate Change”, Robert Henson (2006)

“The summer 2007 floods in England and Wales – a hydrological appraisal”, Centre for Ecology and Hydrology: T.J. Marsh and J. Hannaford (2007)

“The use of historical data in flood frequency estimation”, Centre for Ecology and Hydrology, AC Bayliss and D W Reed (report to MAFF) (March 2001)

“Wrong type of rain: impact and implications of 2007 UK floods”, Guy Carpenter (December 2007)

PRÉCISES OF SOME OF THE PAPERS

Summaries of most of the papers referred to in Appendix I.1 are given below:

“After a flood”, Environment Agency

A useful 12 page guide that covers what to do after the flood has subsided. The most important point it makes is make sure it's safe to return to your property – flooding may cause structural damage. Inform your insurer as soon as possible and find out who is responsible for cleaning up your property. As much flooding involves contaminated water, always wear protective clothing if you are clearing up. Make sure you have your own records of the damage – photograph as much as possible – and keep records of all correspondence, phone conversations and visits. It also discusses resilient repairs to protect against future events and discusses temporary housing.

“Building and maintaining river and coastal flood defences in England”, National Audit Office (June 2007)

Printed in June 2007, this report summarises the level of property exposure to flood in the UK and examines the role of the EA in managing flood defence systems since its increase in responsibilities in this area in 2001. Several improvements with regard to flood defence management are noted to have occurred since 2001 namely: a greater oversight of flood risks at national level; improved management of major construction projects; protection of greater numbers of people; and the establishment of a more rigorous system for classifying, recording and monitoring the condition of flood defences.

Several areas requiring improvement are also highlighted namely: inconsistencies in the management of defence assets across the country; the absence of reliable data on the lifespans of assets whilst research is ongoing; the lack of a clear management policy for dealing with assets owned and managed by third parties; the need for further changes to work practice; the lack of benefit for small rural communities of the current focus on the construction of new flood defences to protect large numbers of households and meet targets; the need to increase spending on the development of proposals; and weaknesses in data recording systems. A number of recommendations are made regarding how the EA could improve flood defence management.

“Crises as catalysts for adaptation: human response to major floods”, Flood Hazard Research Centre (2004)

This is an EPSRC-funded project being carried out by researchers at Middlesex University’s Flood Hazard Research Centre. The project examines changes in human behaviour and public policy following four UK flood crises, namely the 1947, 1953, 1998 and 2000 flood events. Early findings point to the fact that following a crisis event, there is a time period in which human behaviour and policies have an increased tendency to change rapidly in a way that would have been unlikely without the occurrence of the crisis. Many policy changes are driven by coalitions of players who share similar beliefs and values which become translated into core policy objectives and policy instruments. When complete, a summary of the final results of the study will be available at www.fhrc.mdx.ac.uk.

“Development and flood risk – guidance for the construction industry”, CIRIA (2004)

This book provides guidance to developers and the construction industry on the implementation of good practice in the assessment and management of flood risk as part of the development process, and is intended to promote development that is sustainable in terms of flood risk.

This guidance describes the mechanisms and impacts of flooding, covering a wide range of causes of flooding including rivers, the sea, estuaries, groundwater, overland flow, artificial drainage systems and infrastructure failure. National planning policy guidance for development and flood risk in the United Kingdom is also included.

This is practical guidance with the aim of achieving a consistent approach to the implementation of planning guidance in relation to flood risk. Such an approach should allow developments to be planned and designed more efficiently.

This guide is intended for the construction industry, in particular developers, builders, designers and planners, but it is also intended to provide background information for other parties involved in the development process, including insurers, mortgage lenders and the owners and occupiers of developments.

The book contains the following sections / appendices:

- Flooding – causes and mechanisms.
- Developments and flooding.
- Flood risk assessment within the planning process.
- Flood risk assessment.
- Flood risk assessment toolkit.
- National arrangements for the control of development and flood risk.
- Technical guidance on flood risk assessment.
- Mitigation measures for flood risk management.

“During a flood”, Environment Agency

This guide is about staying safe in a flood – people before property. It gives the flood warning codes and details of what to do in an emergency. It discusses protecting what you can by moving it upstairs, moving your car and pets and to evacuate when told. It gives guidance on a flood plan and again space to list useful numbers.

“EC Directive on the assessment and management of flood risks”, European Parliament (October 2007)

Between 1998 and 2004, Europe suffered over 100 major damaging floods, including the catastrophic floods along the Danube and Elbe rivers in summer 2002. Severe floods in 2005 further reinforced the need for concerted action. Since 1998 floods in Europe have caused some 700 deaths, the displacement of about half a million people and at least €25 billion in insured economic losses.

In response to this, Directive 2007/60/EC was proposed by the European Commission on 18 January 2006 and was finally published in the Official Journal on 6 November 2007. Its aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU. The Directive also requires all assessments, maps and plans prepared to be made available to the public.

“Flood resilient homes”, ABI

This is an eleven page fact sheet outlining steps that home owners can take to minimise the cost of flooding to their property either after a flood event or during the normal course of renovation.

The fact sheet provides tables summarising the costs and benefits of installing flood resilient measures to each of five typical properties ranging from a two bedroom ground floor flat to a four bedroom detached house. In so doing, it highlights measures that will generally pay for themselves after a single flood such as replacing timber floors with concrete and chipboard kitchen units with plastic equivalents.

In addition, the fact sheet provides information on actions to limit the amount of water entering a property and options available to pay for the installation of flood resilient measures.

The fact sheet is aimed directly home owners. Readers looking for a more detailed technical assessment of the resilience measures would be advised to read: “Assessment of the cost and effect on future claims of installing flood resilient measures”, also produced by the ABI.

“Flooding”, Environment, Food and Rural Affairs Committee (May 2008)

In July 2007, an inquiry was held into the 2007 floods and the Government’s response to them. The enquiry was intended to contribute to the recently-announced Pitt Review. The publication details the committee’s findings.

The committee recommends that the Government implements the findings of the Pitt Review in a robust and transparent manner. The Government announced an increase in expenditure on flood risk management from £600 million in 2007–08 to £800 million by 2010–11. Analysis of the figures shows that the amounts stated are not adequate.

The committee rejected the proposal of a dedicated Flood Agency, but welcomed the Government and the Environment Agency’s work to develop long-term investment strategies for flood risk management.

The enquiry found that surface water flooding was the cause of much of the 2007 floods. The current infrastructure was not able to cope with the unexpectedly heavy rainfall. To prevent further flooding of this type the committee recommends that the UK adopt a European model of local authority responsibility for surface water drainage as this has the advantage of local accountability.

The committee supports the Government’s Water Strategy policies as these ease the pressure on public drainage and sewerage systems.

Sustainable drainage systems (SUDs) should be owned and maintained by local authorities because they already hold a number of roles relating to SUDs. This would ensure that there is no ambiguity over who is responsible for them.

Local authorities should insist that developers install SUDs where possible, thus increasing their use. An opinion favouring SUDs should be included in the Planning Bill, to add weight to Planning Policy Statement 25.

The committee believes that specific duties be placed on utility companies to ensure that their critical assets are protected from floods.

“Handbook on Good Practices for Flood Mapping in Europe”, EXCIMAP (November 2007)

EXCIMAP is the European exchange circle on flood mapping. This publication is targeted at flood management authorities in EU member states and aims to describe best practice techniques for the creation of flood maps for use in flood risk assessment, management and mitigation. It focuses particularly on mapping designed to comply with the European flood directive, and contains examples of practices in various European countries.

The requirements for the content, complexity and scale of flood maps depends on their intended use. Uses include prevention and mitigation of flood risk, land use planning, emergency planning and public awareness issues, as well as being a useful tool for private sector companies such as insurers.

Flood hazard maps detail areas with low, medium and high probability of floods occurring. The most common type of maps are flood extent maps, which detail areas which are affected by floods with different return periods, with some distinguishing between river and coastal flooding and some detailing flood defences. Some countries have flood depth maps for each of the return periods, which can be derived from flow models for river flooding. The European flood directive asks for maps which represent flow velocity, where appropriate, although this is difficult to do. Other types of flood maps include flood danger maps and event maps. European examples, uses and standard content of each of these types of flood map are detailed.

Flood risk maps combine the probability of flood events with the potential adverse consequences to human health, the environment, and economic activity. These maps need to define a risk measure, and require content relating to human and economic aspects and potential causes of pollution in addition to the extent and severity of flooding. European examples, uses and standard content of each of these types of flood map are detailed.

Associated with maps of flood plains are emergency maps, which are used for crisis management and rescue services, and detail things such as evacuation routes, shelter areas and hospitals.

There are many different issues to consider when creating a flood map. These include the collection and storage of data; the type of flood map to be built; the types of flood to be modelled; the presentation of the maps; organisation of the mapping project; documentation of process; and flood map dissemination.

The handbook also contains two annexes. The first contains summarised responses to a flood mapping questionnaire sent to European administrations, and the second is an Atlas of European flood maps.

“Impacts of climate change on financial institution's medium to long-term assets and liabilities”, Perroy, Louis, SIAS (June 2005)

This paper focuses on the impacts of climate change on the Asset Liability management (“ALM”) of financial institutions. It recognises the potential for worsened insurance claims (reinsurance, property, business interruption, motor, travel, health, life, and so on) and also the impacts of climate change on the asset side of the balance sheet.

Whilst countries may try to mitigate or adapt to climate change, such measures themselves may also impact on assets and liabilities. The paper focuses on how ALM might need to be amended to incorporate climate change and climate change mitigation into the projections.

“Preparing for a flood”, Environment Agency (February 2002)

A practical 12 page guide with advice on what you can do to reduce the effects of flooding on you and your property. It outlines what a flood plan should incorporate, covering insurance, services, an essentials kit and a contact plan. It gives information on flood warning codes, simple measures to keep water out and longer term changes that would make your property more resilient if flooded. It also has a useful page of contacts, storage for useful numbers and further sources of information.

“Preparing for Floods”, Office of the Deputy Prime Minister (October 2003)

This is a 100 page guide bringing together information on measures that can be taken to reduce the impact of flooding on properties and small businesses. It reviews preparing a flood plan, keeping water out of the building and improving internal resistance if water were to get in. It concludes that a combination of these measures is most effective. It's a practical guide with useful case studies and covers both new builds and existing property. There is a useful list of further reading and contacts together with notes on preparing for a flood and what to do during and after a flood.

“Ranking port cities with high exposure and vulnerability to climate extremes”,
OECD (2007)

This working paper (and accompanying spreadsheet) gives a worldwide ranking of the vulnerability of port cities to extremes of climate. The ranking is given in two ways, firstly in the size of population exposed, and secondly in the value of assets exposed. The report relates to 2005 (but before Katrina) and with a projection out to 2070.

The report gives twenty cities with the highest population exposure today, which are mainly in Asia and developing countries. When assets are considered, the exposure switches to the more developed countries, as the wealth of the cities becomes important. The report indicates that the total value of assets exposed in 2005 is estimated to be US\$3,000 billion; this corresponds to around 5% of global GDP in 2005 (both measured in international US\$). The top ten cities in this ranking are Miami, Greater New York, New Orleans, Osaka-Kobe, Tokyo, Amsterdam, Rotterdam, Nagoya, Tampa-St Petersburg and Virginia Beach. These cities contain 60% of the total exposure, but are from only three (wealthy) countries: USA, Japan and the Netherlands. By 2070 the amounts are projected to be 9% of projected GDP

There are only two UK cities in the survey, namely London and Glasgow. Only the former gets a mention to the extent that London is protected to a “1 in 1000” standard, whereas New York is only to a “1 in 100” standard. London is fourteenth in the current ranking

Although a full reading of the report is necessary to understand the methodology and assumptions, the report indicates that London has 300,000 people exposed and \$60bn assets exposed (in 2005). Based on a 1 in 1,000 year time frame this gives an annual exposure of \$0.06bn. Under a future scenario this rises to \$0.23bn, but the worldwide ranking goes down from 14th to 28th.

A great deal of caution is needed over interpretation of the report but the key cities to avoid from an insurance (and some would say several other...) context are Miami and New York.

"Risk Performance and Uncertainty in Flood and Coastal Defence: A Review",
HR Wallingford Report for the Environment Agency, SR587 (2002)

This report offers a review of the principles of flood risk, performance and uncertainty and identifies how these can be used in decision-making practice. The report includes a review of tools and techniques that can be used in flood risk analysis and, in many ways, sets the scene for the present day flood risk analysis models. An interesting perspective on how risk is perceived is conveyed. Although a risk can have the same monetary value, the combination of probability and damage that determine the risk can also be important. High probability/low consequence events are often perceived in different ways to low probability high consequence events. The reasons for this can relate to the "shock factor" and graphical media coverage associated with the low probability events, such as the recent Asian Tsunami.

"The June 2007 floods in Hull", Interim / Final reports by the Independent Review
Body (August / November 2007)

The interim report into the June 2007 floods in Hull was issued by the Independent Review Body in August 2007. The Report outlined the physical nature of the floods, the amount of rainfall that occurred, the areas that flooded and looked at some of the unique factors affecting Hull. It highlighted that the flooding occurred because the drainage system was overwhelmed by the levels of rainfall experienced. It then went on to review how the main agencies operated during the flooding, noting that there was inadequate consultation, co-operation and unity. Interim recommendations included the need to review the adequacy of designing drainage systems to a 1 in 30 year storm event (given climate change), the need to tackle how multiple agencies operate and some specific Hull recommendations.

The Final Report of the Independent Review Body into the June 2007 floods in Hull focuses on the impact of the floods on the population of Hull, and how the impacts could be reduced and relief efforts improved for future events. It highlights that schools were particularly badly affected (only 8 out of 99 schools unaffected), forcing parents to take time off work, lose earnings and in some cases jobs. It highlights serious issues with the Hull drainage system, and the lack of action by Yorkshire Water to known failings with its infrastructure. It notes that many properties were only flooded by a few centimetres, and many could have been saved if earlier drainage recommendations had been implemented.

It's recommendations include mandatory standards for drainage systems, and enhanced regulatory power for Ofwat over such systems, the government to consider underwriting flood risk, or seek alternatives to the ABI SoP, building regulations should be changed to improve flood resilience in flood risk areas and extra protection should be provided for key social infrastructure such as schools. In addition there are recommendations for how agencies can operate better in flood emergencies.

“The July 2007 floods in England and Wales – a preliminary appraisal”, Centre for Ecology and Hydrology (July 2007)

This preliminary appraisal gives a brief summary of some of the key features relating to the July 2007 floods, a few of which are outlined below.

Weather conditions experienced across much of the UK throughout the summer of 2007 were truly exceptional. The Jet Stream followed an abnormally southerly track and the extension of the Azores high pressure cell across the UK failed to become established. Correspondingly, a sustained sequence of rain-bearing low pressure systems produced outstanding 12-week rainfall totals, and a series of flood events culminating in widespread severe flooding in late July.

The combined May and June rainfall total was the highest on record for the UK by a considerable margin and the May-July period was expected to be the wettest for England and Wales. The volatile July weather patterns culminated in an extremely wet episode on the 20th. On the basis of historical data they would be expected to occur, on average, only once in several hundred years.

Generally, groundwater levels decline over the May to September period, due to an absence of natural replenishment (recharge). In the 19th century, significant summer recharge was recorded in a number of years (for example 1860 and 1879) but examples of significant and widespread summer recharge in the 20th century are very rare.

By their nature, individual extreme flood events cannot be linked directly to climate change. If they form part of a developing pattern or emerging trend, then a causative association becomes more plausible. In England and Wales, evidence for long term increases in fluvial flood magnitude is elusive.

“The summer 2007 floods in England and Wales – a hydrological appraisal”, Centre for Ecology and Hydrology: T.J. Marsh and J. Hannaford (2007)

This report brings together both flood and meteorological data and systematically breaks down the series of events leading to extensive river flooding, which had no close modern parallel for the June-August period across the UK and confirms that the floods were a very singular event and does not support the idea that the exceptional river flooding was linked to climate change.

The report recognises that the 2007 flooding was remarkable in its extent and severity and truly outstanding for a summer event. River flows in many areas exceeded the design limits of many flood alleviation schemes. Rainfall amounts and intensities led to urban drainage systems being overwhelmed in a number of areas. This underlines the UK’s continuing vulnerability to climatic extremes, but long-term rainfall and river flow records confirm the exceptional rarity of the hydrological conditions experienced in 2007.

“Scrutiny inquiry into the summer emergency 2007”, Gloucestershire County Council (November 2007)

This is a significant report with 148 pages of main report and 242 pages of appendices. Although the report is indicated as final, it clearly indicates that there is still outstanding work. The report was intended to supplement the various national reports and ensure that the views of Gloucestershire are fully represented.

The broad conclusions are that the agencies did cope, power supplies were maintained and people did get drinking water. The main events identified were that the initial heavy rainfall caused minor rivers to burst their banks and overwhelmed many urban drainage systems producing localised and severe flash flooding. The Rivers Avon, Severn, and Churn flooded in days following the heavy rain, causing some properties to be flooded twice in a short time, initially from flash flooding and then later from rising river levels. In total approximately 4,000 homes, and over 500 businesses, were flooded in July.

Further events included: the Mythe water treatment works in Tewkesbury, operated by Severn Trent Water which was flooded, leaving 350,000 people in Gloucestershire without water; the Castlemeads electricity sub-station, operated by Central Networks, was shut down due to surge water, leaving 42,000 without power. The sub-station was not fully restored until 24 hours later; in addition the Walham electricity sub-station was also at high-risk of flooding, which would have left the whole of Gloucestershire, and part of Wales and Herefordshire without power. Only a concerted effort involving the Fire and Rescue Service, the Military, the Environment Agency, and National Grid prevented the loss of this sub-station.

The report gives a thorough review of the events and actions and makes 83 recommendations to the various agencies involved, from Central governments and Defra through to the local police force. One of the more interesting recommendations is that:

“This Inquiry believes that there should be a single agency with overall responsibility for ensuring the maintenance of watercourses, as the current system is not effective, and therefore recommends legislative change to create a single agency with overall responsibility for ensuring the maintenance of watercourses. The new system must include clear signposting for members of the public on how to report problems and on who is responsible for addressing those problems.”

The report mentions insurance in a number of cases, in particular fears over insurance costs, difficulties in dealing with insurance companies (there is a recommendation to increase Citizen Advice Bureau support), and that different insurance companies were showing different levels of support to policyholders:

“For example one resident recounted how it had taken them 27 days of daily phone calls and emails just to get her insurance company to call her back “

“The Impact of Climate Change on Non-Life Insurance” GIRO working party (2007)

This paper covers a wide range of topics relating to climate change, split roughly evenly between the implications of climate change for non-life insurers and the science behind the headlines.

The insurance topics covered include the impact of climate change on the liabilities, assets, capital requirements and reputation of insurers, the role of actuaries in assessing and quantifying the impact of climate change, and the strategies, opportunities, threats and possible mitigating actions available to insurers in the context of climate change.

The scientific overview provides a brief summary of what climate change is, the reasons for sceptical viewpoints being expressed in the media and the flaws in some of those views, and an update on the latest science as at the publication date.

There is also a wiki for the working party at <http://climatechange.pbwiki.com>.

“Wrong type of rain: impact and implications of 2007 UK floods”, Guy Carpenter (December 2007)

This publication provides an overview of the summer flood events in 2007, and possible implications for the insurance industry. It is written for an audience interested in the peril of flood and the resulting economic impacts. Section one covers the events themselves, giving an in-depth explanation on the cause of the floods and maps indicating precise locations affected. Section two discusses the insurance industry and its relationship with flooding events in the UK. This section explores the role of both the insurance industry and the Government for future flood mitigation and how insurers can reduce their exposure to this peril by investing in alternative risk transfer solutions. Section three explains the different types of flooding that can lead to a loss, and how the frequency of flooding events on the scale seen in 2007 could increase.

USEFUL WEB SITE REFERENCES

ABI/Flood resilient homes:

http://www.abi.org.uk/Display/File/Child/553/Flood_Resilient_Homes.pdf

ABI/Overview of flood risk in the UK:

<http://www.abi.org.uk/flooding>

ABI/Q&A on flood issues from the insureds viewpoint:

<http://www.abi.org.uk/floodinfo>

ABI/Summer floods 2007: learning the lessons:

<http://www.abi.org.uk/BookShop/ResearchReports/Flooding%20in%20the%20UK%20Full.pdf>

ABI/Assessment of the cost and effect on future claims of installing flood resilient measures:

http://www.abi.org.uk/Display/File/78/Flood_Resistance_report.pdf

The Pitt Review interim report:

<http://www.cabinetoffice.gov.uk/thepittreview>

The Pitt Review Final report:

http://www.cabinetoffice.gov.uk/thepittreview/final_report.aspx

Environment Agency – Preparing for a Flood:

<http://publications.environment-agency.gov.uk/pdf/FLHO1007BNET-e-e.pdf>

Environment Agency – Review of summer 2007 floods:

<http://publications.environment-agency.gov.uk/pdf/GEHO1107BNMI-e-e.pdf>

Scrutiny inquiry into the summer emergency 2007 (Gloucestershire County Council):

<http://www.gloucestershire.gov.uk/index.cfm?articleid=17502>

The June 2007 floods in Hull / Interim report by Independent Review Body:

http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/24_08_07_hull_floods.pdf

The June 2007 floods in Hull / Final report by Independent Review Body:

<http://www.coulthard.org.uk/downloads/floodsinhull3.pdf>

APPENDIX II

GLOSSARY

ABI	Association of British Insurers
AIR	Applied Insurance Research
ACORD	Association for Cooperative Operations Research and Development
DCLG	Department of Communities and Local Government
Defra	Department for Environment Food and Rural Affairs
DTM	Digital Terrain Model
EP	Exceedance Probability
FDA	Flood Defence Agencies
FEMA	Federal Emergency Management Agency (US term)
ICOLD	International Commission of Large Dams
IDB	Internal Drainage Board
IDD	Internal Drainage District
IPCC	Intergovernmental Panel on Climate Change
LiDAR	Light Detection And Ranging
LPA	Local Planning Authority

NaFRA	National Flood Risk Assessment
NFCDD	National Flood and Coast Defence Database
NFF	National Flood Forum
NFIP	National Flood Insurance Programme (US term)
NSR	Non-structural response (to flood risk)
PPS25	Planning Policy Statement 25
RMS	Risk Management Services
SEPA	Scottish Environment Protection Agency
SoP	Statement of Principles
SUDS	Sustainable Drainage Systems
TE2100	Thames Estuary 2100 project
UDP	Unitary Development Plan

APPENDIX III

COPY OF SURVEY: ACCOMPANYING LETTER

BACKGROUND

The GIRO Flood Working Party would appreciate 30 minutes of your time to complete the attached Flood survey.

The survey aims to understand what methods insurers use to price for flood risk and understand the reliance upon commercial flood models.

It is hoped that the anonymous results of this survey will be summarised and included in the working party's forthcoming paper.

Can I wholeheartedly encourage you to find time to complete as much of the survey as possible. The greater the response rate, the better the subsequent Working Party analysis will be.

INSTRUCTIONS

Please return the completed survey to Peter Sterling, at the Institute Of Actuaries, who will collate the returns, ensuring that responses remain anonymous to the working party members.

Can you also e-mail myself and Julian Lowe to confirm your completion of the survey.

With the information at hand the survey should take no more than 30 minutes to complete, and we request that responses are sent via e-mail to Peter by Weds 16th July.

CONTACT DETAILS

Peter Sterling: Email: peter.stirling@actuarles.org.uk, Tel: +44 (0)20 7632 2177

Nigel Carpenter - Email: nigel.carpenter@uk.rsagroup.com, Tel: 01403 231164

Julian Lowe – Email: julianandcarol@ntlworld.com ,Tel: 01603 683004

(replace l's with i's in e-mail addresses above)

Thank you in anticipation of your support for this survey.

Nigel Carpenter
On behalf of GIRO Flood working party.

COPY OF SURVEY: QUESTIONS ASKED

Survey Questions

Q. 1a	For your Personal and Commercial Property portfolios what percentage of the premium payable by the policyholder relates to the flood claims risk.	
<u>Product</u> <i>Example answer</i> Personal Property Commercial Property	<u>Percentage</u> 2.5%	

Q. 1b	How has your view of this changed following the events of Summer 2007.	
<u>Product</u> <i>Example answer</i> Personal Property Commercial Property	Decreased / Unchanged / Increased <i>Increased from 2.2%</i>	

Q. 2	What method(s) do you use to determine the flood risk premium. Give indication of whether these differ for attritional, large and catastrophe events?
<i>Example Answer</i> <i>Attritional events: aggregate risk premium, trending last 10 years loss experience</i> <i>Large events – aggregate risk premium, trending last 20 years loss experience</i> <i>Cat events – aggregate risk premium using Annual Aggregate Losses from an external CAT model</i>	
Answer	

Q. 3	Please indicate which of the following probabilistic commercial catastrophe models you licence in relation to UK Flood (river or sea surge)?	
	<u>Model</u>	<u>Licenced ?(Yes / No)</u>
a)	AIR – Sea Surge	
b)	AIR – River Flood	
c)	EQECAT – sea surge	
d)	RMS – Inland Flood	
e)	RMS – Sea Surge	
f)	Other: Please provide details	
g)	None: Please provide reasoning	

Q. 4	Do you use the CAT model for assessing your exposure to flood for reinsurance purposes? If so do you provide the results of your analysis to reinsurers to assist in the pricing or structuring of reinsurance, or does a broker carry out this work on your behalf?
<i>Example Answer</i> <i>Yes modelling output is used to determine appropriate amount of Reinsurance to purchase. Analysis is performed by Reinsurance brokers using exposure data provided to them.</i> <u>Answer</u>	

Q. 5	<p>Do you adjust the results of the CAT model in any way, and if so, how and why?</p> <p>Do you think the results of the model can be used directly for underwriting or Pricing individual risks?</p>
<p><i>Example Answer</i></p> <p><i>Yes output is adjusted where there is evidence to suggest this is appropriate. Eg Cat model output at low return periods is compared to past experience and this is then used to calibrate Cat Model outputs at higher return periods.</i></p> <p><i>CAT model outputs are one of many inputs used in the pricing of individual risks.</i></p> <p><u>Answer</u></p>	

Q. 6	<p>What geographic area and flood types are covered by the model you use?</p> <p>How do you account for regions and types of flood that are not included?</p>
<p><i>Example Answer</i></p> <p><i>CAT Inland flood model covers all of UK. CAT Storm surge model covers East Coast only. Deterministic internal model is used estimate costs for remainder of UK.</i></p> <p><u>Answer</u></p>	

Q. 7	<p>Commercial CAT models provide a standard deviation as well as a mean figure in their results. How do you deal with the standard deviation?</p> <p>If you were to run your entire portfolio, what value of standard deviation would you expect the model to provide, as a percentage of the mean?</p>
<p><u>Answer</u></p>	

Q. 8	What construction/property type information are you able to provide for risks analysed? Are you satisfied with the detail and quality of information you are able to provide for flood analysis?
<u>Answer</u>	

Q. 9	What in your view are the main limitations on accuracy of results you get from the model?
<u>Answer</u>	

Q. 10	Overall, are you satisfied with the probabilistic cat model(s) you licence iro UK Flood? How do you rate their value for money?
<u>Answer</u>	