East Midlands Councils

Climate east midlands

Met Office

The Changing Nature of Flooding in the East Midlands

February 2015

East Midlands Councils

The Changing Nature of Flooding in the East Midlands
February 2015

Foreword

Whatever your views on the causes of climate change, the fact is our climate is changing. Sea levels are rising and we are experiencing extreme weather conditions more regularly. The evidence suggests these trends are likely to continue. Increased flooding is the most visible result of our changing climate. Even minor events can have significant impacts on people and businesses. At its worst flooding can be life threatening.

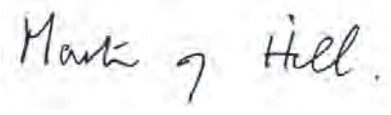
The East Midlands has large areas of land and property at risk of flooding from the coast, rivers, surface water and groundwater. Our councils and communities have worked hard to understand and manage existing levels of flood risk. But as the Met Office literature review indicates, the East Midlands is vulnerable to quite small changes in future climate conditions. As a result, much more will need to be done to prepare for the challenges of the future. Clear national leadership and investment from both Government and the Environment Agency will become increasingly important.

This report sets out the key challenges facing the East Midlands over the next decades. It highlights some of our existing good practice, but also those areas where an enhanced response will be required – at both local and national levels.

The East Midlands has a long and successful history of managing water to meet the needs of people and the environment, and a huge amount of insight and experience as a result. We expect this report to be used positively to inform policy and practice at all levels of Government and within the business community.

Cllr Jon Collins
Chairman - EMC

Cllr Neil Clarke MBE
Vice Chairman - EMC



Cllr Martin Hill OBE
Vice Chairman - EMC

Executive Summary & Recommendations

The East Midlands has a significant area of land at risk of flooding: 20% of the region is within Flood Zone 2[1] for fluvial and coastal flooding, with over 200,000 properties and over 400,000 people living in flood risk areas[2].

An independent review by the Met Office has concluded that, based on the proportion of people at risk, the East Midlands region has the highest exposure to increases in flood risk due to climate change in England. The region's vulnerability has also been highlighted in the Environment Agency's National Flood Risk Assessment and by the Government's independent advisors, the Committee on Climate Change.

The East Midlands is highly vulnerable to coastal flooding, due to large areas of low lying land along the Lincolnshire coastline, river flooding and surface water flooding. A 10% increase in peak flow in the East Midland's rivers would potentially double the number of residential properties at 'significant risk'[3] of flooding from around 30,000 to 60,000 properties.

To address current and future risks of flooding in the East Midlands the following challenges will need to be tackled:

- **Development of an improved evidence base on the causes and local impacts of flooding to monitor trends more effectively and to determine the best adaptation measures;**
- **A national cross party agreement on a long term approach to flood risk management and the funding and maintenance of flood defences which reflects both climate change and local economic conditions;**
- **Building resilience in local communities, businesses, the public and voluntary sectors - in particular in those new areas which are at risk due to climate change impacts but which have no recent history of flooding;**
- **Ensuring that local and national partnerships are strengthened and continue to work effectively before, during and after extreme weather events when flooding results.**

The report goes on to make a number of recommendations for Government, councils and business organisations.

[1] Government Planning Practice Guidance defines Flood Zone 2 as: Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
[2] East Midlands Flood Risk Appraisal, 2009, Aecom (for East Midlands Regional Assembly)
[3] Significant risk refers to properties in the 1 in 75 year flood map, which is a significant threshold for insurance purposes

Recommendations for Government

- **The Government should use the six year capital funding process to ensure that defences are sufficient to at least maintain current levels of risk in the face of climate change, and look to develop a similar long term approach for maintaining existing assets with revenue support.**

- **The Government should undertake a further review of the partnership funding model introduced in 2011 to ensure that it is not undermining defences in agricultural areas and in places with low land values or limited development potential, or placing an unreasonable administrative burden on local partners where the national contribution is a minor element of the total funding package.**

- **The Government should monitor and keep under review the SuDS approval arrangements to be introduced in April 2015 to ensure that the necessary rapid deployment of SuDS is delivered on the ground, and is not undermined by viability or other considerations.**

- **The Government and the Association of British Insurers (ABI) need to keep the accessibility of flood insurance under review for businesses in areas at risk of flooding and give consideration for making specific provision if necessary.**

- **The Government needs to ensure that the second round of the Adaptation Reporting Power is effective, given that it is now voluntary for organisations to report.**

- **The Government should ensure that Emergency Planning is supplemented by a clearer focus on community resilience and recovery.**

- **The Government should ensure that water companies continue to deliver on their commitments to managing flood risk.**

Recommendations for Councils

- **Local Resilience Fora in the East Midlands should make consistent use of the Severe Weather Impacts Monitoring System (SWIMS) tool to monitor extreme weather events and their local impacts.**
- **Lead Local Flood Authorities in the East Midlands should look to establish one or more additional posts charged with securing third party contributions to deliver priority flood risk management schemes.**
- **To inform and support local decision making, local authorities in the East Midlands should use locally determined indicators, based on the Adaptation Sub-Committee's (ASC) analysis, to help determine whether areas are becoming more or less resilient to the future climate, particularly flood risk.**
- **Local authorities and their partners are recommended to use the 'Climate Just' tool to examine the causes of flood disadvantage in their local area and identify the most appropriate responses. www.climatejust.org.uk**
- **Local politicians should work to raise awareness in communities at most risk of flooding as part of their community leadership role, and ensure that the work of local authorities is properly joined up between different services.**

Recommendations for LEPs, business organisations, and businesses

- **Representative business bodies in the East Midlands, including the CBI, IoD, FSB and local Chambers should promote business continuity planning with their memberships, including active flood risk management.**
- **Individual businesses should make use of the free, online Business Resilience Health Check tool. http://www.businessresiliencehealthcheck.co.uk**
- **LEPs should facilitate dialogue with businesses and infrastructure or service providers to identify and explore pinch points and potential weak spots in high priority vulnerable sites.**
- **LEPs can support growth in the climate change adaptation and resilience sector through the goods and services they buy and by developing skills programmes to embed adaptation skills.**

Section 1: Summary of Met Office literature review into climate change and flood risk in the East Midlands

This report has been informed by an independent review of the research and other literature looking at the impacts of climate change on flood risk undertaken by the Met Office, which is published in full online: www.emcouncils.gov.uk/flooding. The Met Office review focuses on new evidence from more recent climate modelling published since 2009, and highlights a number of 'risk multipliers' that are important for the East Midlands.

1.1 Increased flood risk is the greatest threat to the UK from climate change. Historical emissions and global warming are likely to have already increased the potential for flooding in England. (The Government's Adaptation Sub-Committee, 2014)

1.2 The potential impacts of Climate Change on the East Midlands were described in an East Midlands Development Agency report (2010) and highlighted in a regional Climate Change Risk Assessment (CCRA) summary document published by Climate UK in 2012.

1.3 The landscape of the East Midlands varies considerably from the upland areas of Derbyshire (which include a large part of the Peak District National Park in the north) to the large expanses of Lincolnshire and the coast to the east, and densely populated urban areas. The region is at risk from river flooding (from the Trent, Derwent and Soar), coastal flooding (65 miles of North Sea coastline are located in Lincolnshire), groundwater flooding, surface (pluvial) water flooding and sewer flooding.

1.4 When flood risk is overlaid with demographic data the East Midlands is shown to be particularly vulnerable, with high proportions of elderly residents and deprived communities exposed to coastal flooding and large areas of high quality agricultural land located in floodplains.

1.5 The Met Office review highlights that flood risk in the East Midlands is highly sensitive to changes in peak river flow due to climate change. For instance, a 10% increase in peak flow in the East Midland's rivers would double the number of residential properties at 'significant risk'[4] from around 30,000 to 60,000 properties.

East Midlands Flood Zones

Environment Agency

© Crown copyright and database rights 2015 Ordnance Survey 100024198
© Environment Agency copyright and/or database rights 2015. All rights reserved.

[4] Significant risk refers to properties in the 1 in 75 year flood map, which is a significant threshold for insurance purposes.

1.6 **Based on the proportion of people at risk, the East Midlands region has the highest exposure to increases in flood risk due to climate change in the UK.**

1.7 Future flood risk depends on the impacts of climate change, socio-economic change and the level of adaptation, particularly the level of investment in and effectiveness of coastal erosion risk management. There is new evidence on climate change and flooding in the research literature that has been published since the UK Climate Change Projections in 2009 (UKCP09) and the Climate Change Risk Assessment in 2012, including:

- Improvements to the understanding of convection currents and the impact on summer rainfall events, which indicates that heavy summer rainfall events may increase in frequency more than indicated in the UKCP09 projections;
- Improvements in understanding the inter-relationships between the ocean, atmosphere and land and the impacts on flooding, which support previous findings on increased winter flood risk;
- Early attribution and detection studies are linking floods, such as the events in autumn 2000 and the winter of 2013/14, to climate change and suggest that there has already been an increase in flood risk.

1.8 The Met Office review highlights a number of climate change 'risk multipliers' that are likely to increase the frequency of flooding in the East Midlands. These include:

- A two-fold increase by the end of the century in the frequency of the atmospheric conditions that influence winter flooding in the UK and a similar increase in the frequency of heavy daily rainfall in winter by the end of the century under a 'medium' carbon emissions scenario;
- Potential for four-fold increases of heavy rainfall events in summer by the end of the century under a high emissions scenario (although further work is needed to understand the uncertainty around these preliminary results);
- Up to a three-fold increase in the frequency of very high river flows in Anglian Region river basin and up to eight-fold increase in the Humber Region by the end of the century;
- A significant increase in average winter groundwater levels at sites in the Lincolnshire Limestone by the 2050s under a medium carbon emissions scenario with implications of an increased frequency of groundwater flooding; and
- Increased mean and extreme sea levels with significant impacts on coastal flooding.

1.9 **The Met Office Review concludes that the East Midlands is already highly vulnerable to flooding from all sources and that the frequency of flooding in the region is likely to increase due to the impact of a number of 'climate risk multipliers'. As a result, early action is required to develop flood risk management schemes that can reduce current vulnerability and future risk.**

Car park closed © Climate East Midlands

Case Study: SWIMS tool

Local evidence of the impacts of severe weather is generally not recorded, particularly the financial impacts. This has meant that getting an accurate picture of how severe weather impacts on the council estate and service delivery is often not possible. Without evidence it is difficult to understand the local impacts of trends, or make the case for adaptation measures.

To address this lack of information, Kent County Council led the development of the Severe Weather Impacts Monitoring System (SWIMS). SWIMS is a decision support tool for risk management and planning across Kent partners. The data collected help to build the business case for action to increase resilience to severe weather.

After about 2 years of use in Kent, SWIMS has over 100 users, spread over 85 services and 32 organisations, including:

- Police
- Fire and Rescue
- NHS
- Environment Agency
- District and Borough Councils
- Met Office
- Utilities (rail, highways, water, power networks)

Kent County Council have used SWIMS to:

- **Capture data on how severe weather affects individual services:** SWIMS is intended as a decision-support tool. By using SWIMS, services can record how they are impacted by severe weather and how they are responding to severe weather to build up a clear picture of their vulnerability to these events.

- **Build a robust evidence base (including financial costs):** SWIMS captures costs and clean data (not story telling). This allows teams to build up a clear and robust evidence base to inform risk management and develop effective business cases to demonstrate where services or funding may be needed into the future, as events become more commonplace.

- **Generate severe weather summary reports:** Users can also benefit by getting a lot more information than they put in to SWIMS. Users can produce a report for their whole organisation on how it has been impacted by and responded to severe weather, highlighting areas of good practice and any common barriers to allow teams to learn from each other's experiences and co-ordinate efforts to address vulnerability in partnership and make longer-term cost savings.

SWIMS is now freely available to all councils and several in the East Midlands are in the early stages of using it. SWIMS is hosted by Climate UK: **http://climateuk.net/resource/severe-weather-impacts-monitoring-system-swims**

Recommendation 1

Local Resilience Fora in the East Midlands should make consistent use of the Severe Weather Impacts Monitoring System (SWIMS) tool to monitor extreme weather events and their local impacts.

Section 2: Managing Increasing Flood Risk in the East Midlands

2.1 Flood Risk Management Funding

Summary

Defending people and properties from flooding is a high priority for Government. The Environment Agency has acknowledged that national spending on flood defences will have to increase above inflation to keep pace with the impacts of climate change. However, the National Audit Office (NAO) has concluded[5] that, excluding emergency aid, capital and revenue funding on flood risk management has fallen by 10% in real terms since 2010.

The Government has recently committed to developing a 6 year capital programme for improving flood defences to provide greater certainty and confidence, although revenue funding for maintaining existing defences is still only allocated on an annual basis. The Government has also encouraged the use of third party 'partnership' funding to supplement national investment, including for maintenance and refurbishment schemes. Experience from the East Midlands suggest this approach is more viable when flood risk management schemes are directly linked to the delivery of new development and local partners should take a more strategic approach to securing such investment. But partnership funding is much harder to secure when improvements protect agricultural land or areas with low land values or little development potential.

Historical flood levels under Trent Bridge, Nottingham © Climate East Midlands

Capital Funding

2.1.1 The Government's 2012 Climate Change Risk Assessment reported that climate change will significantly increase flood risk in the UK and place greater pressure on flood defence assets as a result. The Environment Agency's Long Term Investment Scenarios (2009) indicated that funding would need to increase by an average of £20 million every year, plus inflation, until 2035, if the current overall level of protection is to be maintained.

2.1.2 The National Audit Office (NAO) has reported (2014) that capital funding for improved flood defences reached a peak of £365 million in 2010/11, fell back to £261 million in 2011/12 and then recovered to £344 million in 2014/15. Following the recent winter floods, the Government allocated an extra £167million over 2013-14 and 2014-15 to restore the condition of damaged flood defence assets. Whilst this emergency funding was very welcome, the NAO concludes that investment in improving defences has decreased in both cash and real terms over recent years, despite the increased and increasing levels of risk.

2.1.3 The NAO also concluded that the Environment Agency's approach to prioritising capital investment was robust and that investments have a high benefit to cost ratio, typically over 9 to 1.

[5] National Audit Office, 2014, Strategic Flood Risk Management http://www.nao.org.uk/report/strategic-flood-risk-management-2/

Case Study: Trent Left Bank Flood Alleviation

Nottingham has a long history of flooding, going back as far as 1683. The initial flood defence was built in 1947 after flooding affected 28 miles of road, 3,000 properties and 86 factories in the city centre. After the flood events in 2000 the Environment Agency worked with partner organisations to study the flood risk over the entire length of the River Trent and its main tributaries. Based on this work the Nottingham Left Bank flood scheme was developed.

The £45 million scheme reduces the risk of flooding to 16,000 homes and businesses along a 27 kilometre stretch of the River Trent, from Sawley to Colwick. It also provides additional protection to key infrastructure at the heart of the communities along the Trent. The new scheme reduces the risk of flooding to one per cent (1 in 100 chance) in any given year. The scheme is the biggest individual inland flood defence ever built in terms of properties protected[6] and one of the last to be fully funded by the Environment Agency before the partnership funding model was introduced.

Key contact: **paul.lockhart@environment-agency.gov.uk**

2.1.4 The Government has committed to developing a longer term (6 year) investment strategy for capital investment in flood risk management (similar to the processes for rail and strategic road investment) to provide greater certainty and confidence. Whilst this is very welcome, the Government will need to demonstrate that the investment strategy is capable of managing increasing levels of risk over the coming years.

Partnership Funding

2.1.5 Since May 2011 the Government has taken steps to broaden the funding basis for capital expenditure through the introduction of the partnership funding model. Instead of meeting the full costs of a limited number of flood defence schemes, the new approach is intended to make Government funding available to a larger number of schemes on a part funded basis, with other public or private contributions making up the difference. Since April 2011, Government estimates that over £140 million has been generated from external sources – more than was originally anticipated. However 75% of this has come from local authorities and only 25% from the private sector[7].

2.1.6 There are opportunities for partnership funding to be used in the East Midlands, particularly where improvements in defences can allow new housing or employment development to be delivered to support regeneration objectives. To make the most of such opportunities, Lead Local Flood Authorities in the East Midlands should consider establishing one or more dedicated posts to secure third party contributions to priority schemes. Experience from elsewhere (including the Humber Region) indicates that such investment will repay many times over. Where partnership funding comprises the majority of funding for a scheme, the Environment Agency should have the freedom to apply a more flexible approach to financial project management to prevent an unreasonable administrative burden on local partners.

[6] Defra press release 13/9/2012, Nation's biggest inland flood defence opened in Nottingham https://www.gov.uk/government/news/nation-s-biggest-inland-flood-defence-opened-in-nottingham
[7] National Audit Office, 2014, Strategic Flood Risk Management http://www.nao.org.uk/report/strategic-flood-risk-management-2/

Case Study: 'Our City, Our River', Derby

A '1 in 100' year flood event could have devastating effect in the Lower Derwent Valley, with 3,600 properties at risk of flooding[1]. In Derby itself, rising waters during a severe flooding event would spill over existing flood defences along the Derwent, impacting on residential communities, businesses, local energy and transport infrastructure, and the Derwent Valley Mills World Heritage Site. At the same time the area around the river in Derby is a priority for regeneration, with a number of key sites identified for housing and employment development.

A scheme to improve the standard of defences and allow much needed regeneration to take place has been developed by the City Council and the Environment Agency, but will cost £85 million to fully implement[9]. The Environment Agency is only able to contribute around £29 million[10] leaving local partners to find the rest. The City Council has secured contributions from the European Regional Development Fund and the UK Single Growth Fund, and is looking at a wide range of other funding options. Securing contributions from private developers through the planning system, that will enable individual sites to be developed on a phased basis, will form a key part of the implementation strategy.

Key Contacts: **ocor@derby.gov.uk** and **paul.lockhart@environment-agency.gov.uk**

Overwhelmed drain in Melton Mowbray 2012 © Climate East Midlands

2.1.7 Where a scheme is needed but is unlikely to unlock new development (such as in areas where agriculture is the dominant land use or where there is limited development potential for other reasons), or where land values are too low to secure sufficient private sector contributions (as in parts of the Lincolnshire Coast), then partnership funding can be much harder to secure. This is especially a problem in coastal areas, where the costs of schemes are higher because their scale is greater. In such areas, the Government should consider applying a more flexible approach that allows high priority schemes to be delivered.

[8] Our City, Our River website, Derby City Council and the Environment Agency http://www.ourcityourriver.co.uk/
[9] Environment Agency & Derby City Council, 12/10/2013, Our City, Our River: Gateway 1: Business case for FSoD approval http://bit.ly/15BSF0q
[10] Defra press release 2/12/2014, £162 million spend on flood defences in East and Central Midlands https://www.gov.uk/government/news/162-million-spend-on-flood-defences-in-east-and-central-midlands

The significance of Lincolnshire's agricultural production and its flood risk

Lincolnshire's extensive high quality farmland produces significant quantities of produce for the country[1], as illustrated in the following table. However flood risk to high quality agricultural land is identified in the UK Climate Change Risk Assessment and described as 'high consequences (negative) and high confidence by the 2080s[12]'.

Land Use (hectares 000's)

	Lincolnshire	England	% of national use
All Horticulture	32	148	22
- bulbs & flowers	2	5	38
- peas & beans	12	38	32
- other veg & salad	18	68	26
Sugar beet	21	130	16
Linseed	5	32	16
Potatoes	13	105	13
Wheat	184	1709	11
Oilseed rape	50	463	11

Figures are shown rounded to the nearest 1,000 hectares. From Defra Agricultural Census, 2006.

Revenue (Maintenance) Funding

2.1.8 The allocation of an additional £35 million for 2014-15 and 2015-16 has in cash terms restored maintenance funding to 2010-11 levels. However, the NAO has concluded that this still represents a real terms decrease of 6%[13].

2.1.9 To meet funding constraints, around 50% of all flood defence assets (those with a lower economic value) are now only maintained to a 'minimum level'. This means that defences will become vulnerable more quickly, which will have an impact on requirements for future capital investment. The NAO have highlighted the risk that:

'…some geographical areas will be disproportionally affected by the funding reductions...'

2.1.10 The Environment Agency has estimated that an increase in maintenance spend of £4.9 million would reduce flood damage by £46.7 million, and that investment in preventative maintenance gives a benefit to cost ratio of 7:1. Although the Government is moving towards a multi-year strategy for capital investment in flood defences, revenue funding for maintenance is still determined annually. The Government should consider measures to better align capital and revenue funding on a multi-year basis to ensure the life of existing assets is maximised and the requirement for future capital investment managed down as a result.

[11] The Value of Food and Farming in Lincolnshire. Lincolnshire Research Observatory, 2007 http://www.research-lincs.org.uk/UI/Documents/full%20final%20report.pdf
[12] CCRA Agriculture Summary, Defra, 2012 http://randd.defra.gov.uk/Document.aspx?Document=CCRASummaryAgriculture.pdf
[13] National Audit Office, 2014, Strategic Flood Risk Management http://www.nao.org.uk/report/strategic-flood-risk-management-2/

Recommendation 2

The Government should use the six year capital funding process to ensure that defences are sufficient to at least maintain current levels of risk in the face of climate change, and look to develop a similar long term approach for maintaining existing assets with revenue support. Maintaining existing assets is particularly important when funds are limited due to austerity.

Recommendation 3

Lead Local Flood Authorities in the East Midlands should look to establish one or more additional posts charged with securing third party contributions to deliver priority flood risk management schemes.

Recommendation 4

The Government should undertake a further review of the partnership funding model introduced in 2011 to ensure that it is not undermining defences in agricultural areas and in places with low land values or limited development potential, or placing an unreasonable administrative burden on local partners where the national contribution is a minor element of the total funding package.

2.2 Adapting to More Water

Summary

As the Met Office literature review makes clear, the risk of flooding of all kinds is projected to increase, both as a result of changing patterns of rainfall and from other factors. Despite some uncertainties about the degree and timescale of changes to summer and winter precipitation and sea level rise, the East Midlands needs to adapt to a future with more water.

This will not be the case all the time, as hotter, drier summers are also projected to increase in frequency and severity, so heat-waves, droughts and problems with water quality will also be part of that same future. More integrated solutions will become increasingly important like increased winter water storage, but that is outside the scope of this report.

At times it will be much wetter, as has been seen in some of the recent weather events described earlier, and hence the challenge is for communities in the East Midlands to adapt.

Recent trends

2.2.1 The Government's independent advisors, the Adaptation Sub Committee (ASC) has conducted recent work to develop indicators of the UK's resilience to climate change which are particularly relevant here. Whilst it may not be possible to be precise about the future levels of flood risk, there are some metrics that can be used to help determine trends and indicate whether as a society we are becoming more or less resilient to the future climate. The diagram below illustrates the subset of (national) indicators that were developed in 2012 to measure progress on reducing flood risk. In only two out of six indicators is the level of risk decreasing (green). For the other four, the risk is either static or increasing.

2.2.2 The ASC's research into flooding for its 2012 progress report ("Is the UK preparing for flooding and water scarcity?") found that over the period 2001 – 2011, some 19% of new development in the floodplain was exposed to a significant chance of flooding. Across the country this equates to 40,000 homes and within the East Midlands, the figure is 4,486.

Flooding indicators

Name	Direction of trend	Implication of trend
Development in the floodplain	↑	
Development in areas at significant flood risk (unprotected or poorly protected)	↑	
Planning applications approved by local authorities despite Environment Agency flood objection	↓	
Paved-over surfaces in urban areas	↑	
Investment in flood defences	→	
Uptake of measures to reduce flood risk (property-level flood protection, sustainable drainage systems, Environment Agency flood warning)	↑	

Note on arrows: the direction of the arrow depicts the trend in that indicator (increasing, decreasing or no significant trend). The colour of the column assesses the implication for the level of risk (red = increasing risk; green = dcreasing risk; yellow = risk is neither increasing or decreasing).
Further information is available in the Chapter 2 of the Adaptation Sub-Committee 2012 report.

2.2.3 This reveals a concerning (national) trend, that progress is going backwards, as the risk to these homes will increase over time, and potentially the cost of protecting them. The ASC draws a number of conclusions about how local planning authorities should use their flood risk appraisals to better inform decisions about future land use and challenges the assumption that the benefits of development in the floodplain always outweigh the cost.

2.2.4 On the positive side, the numbers of planning applications approved against the advice of the Environment Agency is going down, and the uptake of 'property-level flood protection' measures is going up. However the rate needs to increase dramatically in order to keep pace with the increasing risk of flooding.

2.2.5 One of the demographic changes in the East Midlands is the continuing increase in the numbers of older people, which means an increase in social vulnerability. This is particularly noticeable in Lincolnshire, where the trend towards an ageing population profile will continue, with the proportion of people over 75 years of age predicted to increase by 101% between 2012 and 2037[14]. The Lincolnshire coast is a draw for older people and accordingly has a higher than average age profile[15]. This combination of social vulnerability and exposure to hazard (coastal flooding) shows up as acute flood disadvantage in section 2.4 on Community Resilience.

2.2.6 The good news, in terms of flood protection to the region's largest and potentially vulnerable populations in the East Midlands three largest cities is that major fluvial (river) flood alleviation schemes have either been completed or are in planning. The Nottingham flood alleviation scheme was completed in 2012 and funding was confirmed for schemes in Derby and Leicester in December 2014[16]. The bad news is that the risk of pluvial (surface water) flooding is projected to increase, particularly in urban areas, where there are large areas of impermeable surfaces and where future development is likely to be concentrated.

2.2.7 Although a lot of progress has been made in modelling surface water flood risk, with Environment Agency maps[17] now available online since December 2013, the modelling is at a much earlier stage than for river and coastal flood risk. Surface water flooding is much more difficult to predict and manage because it depends where intense rain falls and for how long, not just the topography of the area.

Managing flood risk in new development

2.2.8 Part of the difficult balance for councils to manage is to help meet the need for challenging housing targets whilst encouraging new thinking and practice about drainage in order to minimise future flood risks. This involves a combination of:

- Encouraging highways and public realm sustainable drainage instead of traditional piped drainage
- Storing water in open space and encouraging the public to view it positively
- Mapping and designating flood storage areas so that the public appreciate its function
- Learning to identify mutual benefit and gain buy-in at an early stage
- Improving understanding about the risks from groundwater and how they can be managed especially in areas of mine water rebound and acid mine drainage.

Sustainable drainage incorporated into a new development at Upton, Northampton © Climate East Midlands

[14] Lincolnshire Research Observatory, 2013, Population Trends Lincolnshire 2013 http://www.research-lincs.org.uk/UI/Documents/population-trends-in-lincolnshire-2013.pdf
[15] Lincolnshire Research Laboratory, 2007, Population Patterns in Lincolnshire http://www.research-lincs.org.uk/ui/documents/population%20patterns%20in%20lincolnshire.pdf
[16] Defra press release 2/12/2014, £162 million spend on flood defences in East and Central Midlands https://www.gov.uk/government/news/162-million-spend-on-flood-defences-in-east-and-central-midlands
[17] Environment Agency flood maps http://maps.environment-agency.gov.uk/

Sustainable Drainage Schemes (SuDS)

2.2.9 SuDS is one of the most important mechanisms in reducing flood risk from new developments - the incorporation of sustainable drainage to deal with run-off water on site, rather than routinely connecting to the sewerage system and potentially increasing flood risk elsewhere. The Pitt Review following the 2007 floods recommended that the automatic right to connect new development to the public sewer was withdrawn and that the Government should resolve which organisations are responsible for the ownership and maintenance of sustainable drainage systems (SuDS), but neither of these have yet been implemented.

2.2.10 The Flood and Water Management Act 2010 made provision for Lead Local Flood Authorities to establish SuDS Approval Bodies to ensure long term maintenance arrangements for all new schemes are agreed but this has still not been resolved. Government has now proposed a different model whereby new SuDS would be assessed and approved as part of the planning system by the local planning authority.

2.2.11 This will place additional technical and resource pressures on most councils. There is also concern that SuDS could be dropped from new developments if it can be demonstrated that they compromise the viability of the development.

2.2.12 This concern is echoed by the Adaptation Sub-Committee which suggests that developers will continue to favour traditional piped systems of drainage because of the extra land needed in some SuDS designs, unless SuDS are made the default option (a Pitt Review recommendation).

2.2.13 There are some good examples of SuDS across the East Midlands although this is still an emerging area of practice and there is wide variation in the quality and effectiveness of different schemes. A well designed SuDS can considerably enhance new developments through multiple benefits, including amenity, wildlife and creating a sense of place, in addition to their role in managing run-off.

Case Study: Rain Garden retrofit project, Nottingham

Part of the solution to reducing flood risk in urban areas is through retrofitting sustainable drainage into the existing built environment. The Environment Agency, Nottingham City Council and Groundwork Greater Nottingham worked together on such a scheme to create a series of small 'rain gardens' in a suburban street where surface water flooding occurred.

This involved removing sections of kerb stones and grass verge and installing water storage, over planted with drought and flood tolerant plants. This has improved highway drainage and also reduced the level of pollutants entering the nearby Day Brook, as the rain gardens help to trap contaminants in surface water runoff from the road surface.

The scheme is maintained with some minor adjustments to the usual street cleaning regime, with each rain garden entry point regularly swept to clear leaves and annual management of the vegetation.

Key Contact: **fay.bull@nottinghamcity.gov.uk**

Daybrook rain gardens © Climate East Midlands

Green Infrastructure and wider land management

2.2.14 The concept of Green Infrastructure (GI) is not a new one and there has been considerable work done on planning for GI within the East Midlands over recent years. Given projected increases in flood risk, an increase in the quantity, quality and interconnectivity of GI, particularly in urban areas (in the context of the trend of the 'paved over surfaces in urban areas' indicator on page 14), is an appropriate response. GI features consistently in training and guidance for planners, was part of the East Midlands Climate Change Skills Programme and has featured most recently in new guidance from the Environment Agency's Climate Ready service and Climate UK[18].

2.2.15 Wider landscape scale and river catchment scale interventions are also a part of an integrated response to reducing flood risk, by capturing rain water more effectively on higher ground before it has the chance to run into rivers. A good illustration of this is the work of the Moors for the Future partnership which is working to restore peat moorlands including in the Peak District National Park[19]. Healthy peat is a natural sponge and can store far more water when in a healthy than in a degraded state.

2.2.16 How agricultural land is managed also makes a difference to the amount of run-off from farms entering water courses. Climate East Midlands, working with the Farming Advice Service and Environment Agency started in 2013 to provide soil management workshops for farmers in the East Midlands to discuss how to look after soils and water in a changing climate[20].

2.2.17 Some commentators[21] have started to question why EU farming subsidies are encouraging the clearance of vegetation in upland areas in order to provide grazing for sheep, as maintaining more woodland and woody vegetation helps to retain more water higher in the course of rivers.

2.2.18 Capturing rainfall within the wider landscape and reducing the volume and flow of water through flood risk areas further downstream will become increasingly important as the level of risk continues to rise over time, suggesting an increasingly important role for land owners and managers.

Mainstreaming flood risk management

2.2.19 All the Lead Local Flood Authorities in the East Midlands are making good progress on their statutory duty to develop local flood management strategies. However the long term success of these strategies and the benefits they will bring for local people will only be secured if they are fully implemented, and flood risk management is 'mainstreamed' across relevant local government functions.

2.2.20 Water companies also have an important role in helping to manage the increasing risks from flooding. For example, Severn Trent Water's Climate Change Risk Assessment in 2011 identified its key business risks for waste water as:

- Increased frequency of overflows from sewers arising from severe storms (summer and winter).
- Inundation of treatment works and pumping stations.

In its 2011 Climate Change Adaptation Report, Anglian Water had identified its assets that are vulnerable to a 0.4m increase in sea level rise.

Recommendation 5

To inform and support local decision making, local authorities in the East Midlands should use locally determined indicators, based on the ASC's analysis, to help determine whether areas are becoming more or less resilient to the future climate, particularly flood risk.

Recommendation 6

The Government should monitor and keep under review the SuDS approval arrangements to be introduced in April 2015 to ensure that the necessary rapid deployment of SuDS is delivered on the ground, and is not undermined by viability or other considerations.

Recommendation 7

The Government should ensure that water companies continue to deliver on their commitments to managing flood risk.

[18] Environment Agency and Climate UK, 2014, Building a resilient environment (sector tools and resources) http://climateuk.net/resource/building-resilient-environment-%E2%80%93-sector-tools-and-resources
[19] Moors for the Future website, Repairing bare peat http://www.moorsforthefuture.org.uk/repairing-bare-peat
[20] Climate East Midlands website, Land management business resilience project http://www.climate-em.org.uk/projects/land-management-business-resilience/
[21] Monbiot G., 22/5/2013, Why Britain's barren uplands have farming subsidies to blame, The Guardian, http://www.theguardian.com/environment/georgemonbiot/2013/may/22/britain-uplands-farming-subsidies

2.3 Economic Resilience

Summary

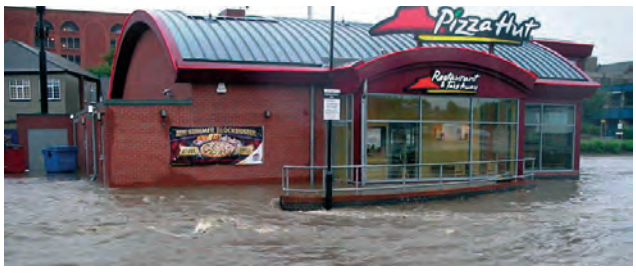
Increasing flood risk will bring a mix of threats and opportunities for businesses. Proactive adaptation can bring many benefits such as avoiding disruption and costs. The OECD has estimated that, across Europe, £1 spent adapting now will save £4 in damages later.[22]

Some risks will be specific to the locality, e.g. if a business is located in an area of high flood risk. Other businesses may be affected indirectly by flooding, through interdependencies. Their supply chains may be affected, as may the transport and energy infrastructure they depend upon.

For individual companies, opportunity can be found in raising themselves above the competition and winning contracts due to their robust resilience plans. Cleone Foods, a Birmingham-based company, won a major food contract, beating similar competitors, thanks to its resilience plan. The contract resulted in an 11% increase in sales.[23] For some companies, the nature of their business can enable them to help others in the event of a flood, if they themselves are resilient (see Plantool case study, below). There is a growing market for adaptation goods and services, such as flood resilience products. Over the past few years the sector has grown at a faster rate than general growth in the UK economy.[24]

Following the recent information note on "Delivering Resilient Growth", published by Climate UK and the Environment Agency's Climate Ready service, this section focuses on three areas:

- Organisational resilience
- Resilient infrastructure
- Business opportunities



Flooded Pizza Hut in Chesterfield, June 2007 © DNCC

Organisational resilience

2.3.1 Severe weather, including flooding, represents a significant threat to businesses. The Chartered Management Institute (CMI) Business Continuity Management Survey (2013) found that extreme weather was the biggest source of disruption for the 4th year in a row, for the organisations surveyed. This contrasts with their measure of managers' perceptions of threats facing their organisation, where severe weather was only rated 9th.[25] This potentially indicates a lack of awareness of the risks associated with severe weather, including heavy rain and flooding, and almost certainly a lack of awareness of how these risks are likely to increase with climate change.

2.3.2 When a business does get flooded, the amount of time it takes to get the business up and running again, if there are no contingency plans in place, can come as a surprise. The average length of business interruption by flooding increased from 8 months in 1996 to 14 months in 2005.[26]

2.3.3 Business Continuity Management arrangements vary depending on the size of the organisation. It is often the case that smaller businesses don't have the capacity to systematically consider their risks and develop business continuity plans.[27] A recent survey conducted by the Federation of Small Businesses found that 59% of the small businesses questioned, did not have a plan in place to deal with extreme weather conditions such as floods.[28] This is despite the fact that two thirds of small businesses have been negatively impacted by extreme weather, including flooding, over the last three years.[29] Smaller businesses are unlikely to have the funds to relocate out of a flood risk area, and may be more reliant than large companies on local connections for business.[30]

[22] Climate UK and Climate Ready (2014) Delivering Resilient Growth. http://climateuk.net/news/delivering-resilient-growth
[23] Sustainability West Midlands, Cleone Foods case study. http://www.sustainabilitywestmidlands.org.uk/resources/cleone-foods-winner-of-the-bitc-business-resilience-award-2013
[24] Adaptation Sub-Committee (2014) Managing Climate Risks to Wellbeing and the Economy: ASC Progress Report. http://www.theccc.org.uk/wp-content/uploads/2014/07/Final_ASC-2014_web-version-4.pdf
[25] Chartered Management Institute (2013) Business Continuity Management Survey. http://www.managers.org.uk/sites/default/files/Weathering_the_storm_CMI_BCM2013_1.pdf
[26] AXA (2006) Climate change and its effects on small businesses in the UK. http://nationalfloodforum.org.uk/wp-content/uploads/AXA-Climate-Change-and-its-effects-on-small-businesses-in-the-UK.pdf
[27] CMI (2013) Business Continuity Management Survey. http://www.managers.org.uk/sites/default/files/Weathering_the_storm_CMI_BCM2013_1.pdf
[28] Federation of Small Businesses (2014) Press Release: FSB warning as more than half of small firms without flood plan. http://www.fsb.org.uk/News.aspx?loc=pressroom&rec=8855
[29] Federation of Small Businesses (2014) Press Release: FSB warning as more than half of small firms without flood plan. http://www.fsb.org.uk/News.aspx?loc=pressroom&rec=8855
[30] Frontier Economics (2014) Flood and Coastal Erosion Risk Management and the Wider Economy. A report for Defra and the Environment Agency. http://evidence.environment-agency.gov.uk/FCERM/en/Default/FCRM/Project.aspx?ProjectID=76cf10b6-9280-4ae2-8a08-713eb35ccc2b&PageID=9719662d-81e9-4a8f-b46f-72675770cdce

Small business case study: Plantool Ltd, Kettering, Northamptonshire

A tool hire depot operated by Plantool Ltd in Kettering was badly affected by flooding in June 2007. Turnover fell by 70% overnight and it took 13 months before the depot was back up and running fully, and over 2 years after that before trade was back to where it had been before the flood.

To increase its resilience, Plantool Ltd now has a company-wide Business Continuity Plan, and a Flood Plan adapted for the Kettering depot. The depot is now signed up to receive Flood Warnings from the Environment Agency, and staff are trained in "what to do next". They have also made physical changes to the depot by moving stock up off the floor, raising electric sockets, and locking away or tying up equipment so that it wouldn't float away in the event of another flood. A resilient tool hire centre is well placed to help others recover from a flood, e.g. by hiring out pumps and dehumidifiers. In this sense, a flood represents a business opportunity, as long as the hire centre can continue to trade.

The full case study is available on the Climate East Midlands website: **http://www.climate-em.org.uk/resources/item/business-resilience-case-studies**

2.3.4 In the East Midlands, the Building Business Resilience project[31] is currently in its fourth year and is a collaboration between Climate East Midlands and the Environment Agency. The project supports businesses to increase their resilience to severe weather and climate change, through guidance, including a guide for SMEs called "Weathering the Storm"[32], good practice case studies[33], workshops and the use of tools. One of these tools, the Business Resilience Health Check[34] was used by over 2,000 UK businesses in 2014, according to monitoring by Climate UK.

2.3.5 Large businesses, as well as medium-sized businesses where risks are dealt with day-to-day (e.g. in regulated industries), are more likely to be able to adapt[35] to increased risk of flooding, as they will have greater capacity to investigate the risks and undertake action to reduce the risks. However, evidence indicates that large businesses tend to have a large fixed asset base that makes moving out of a flood risk area to a new site particularly costly.[36]

The great flood in Lincolnshire 1953 © Environment Agency

[31] Climate East Midlands, Business Resilience Project http://www.climate-em.org.uk/projects/building-business-resilience
[32] Climate East Midlands (2012) Weathering the Storm: Saving and Making Money in a Changing Climate http://www.climate-em.org.uk/resources/item/weathering-the-storm-a-business-guide-to-climate-change-adaptation
[33] Climate East Midlands, business resilience case studies. http://www.climate-em.org.uk/resources/item/business-resilience-case-studies
[34] Climate UK, Business Resilience Health Check. Online tool. http://www.businessresiliencehealthcheck.co.uk
[35] Frontier Economics (2014) Flood and Coastal Erosion Risk Management and the Wider Economy. A report for Defra and the Environment Agency. http://evidence.environment-agency.gov.uk/FCERM/en/Default/FCRM/Project.aspx?ProjectID=76cf10b6-9280-4ae2-8a08-713eb35ccc2b&PageID=9719662d-81e9-4a8f-b46f-72675770cdce
[36] Frontier Economics (2014) Flood and Coastal Erosion Risk Management and the Wider Economy. A report for Defra and the Environment Agency. http://evidence.environment-agency.gov.uk/FCERM/en/Default/FCRM/Project.aspx?ProjectID=76cf10b6-9280-4ae2-8a08-713eb35ccc2b&PageID=9719662d-81e9-4a8f-b46f-72675770cdce

Large business case study: Boots UK (HQ based in Nottingham)

Boots UK uses Business Continuity Planning to prepare for severe weather events, and to enable a swift recovery. Their priority is to provide continuity of service for customers, particularly the pharmacy service.

When Boots stores experience flash flooding, such as during summer 2012, they are usually able to keep trading, or in some cases stop trading briefly (for less than 24 hours). The way that the stores are fitted out, with tiled floors, allows water to be mopped up easily.

When more serious flooding occurs, such as in Cockermouth in 2009 when the town centre was under 8 feet of water, the Boots store had to close for a few weeks, but they kept the pharmacy service operating in the meantime. Boots UK has plans in place to use other local pharmacies in the event that one is out of action. Boots pharmacists dispensed medicines at another pharmacy and then brought the medicines back into Cockermouth to give to their customers. When the water levels receded, Boots set up a temporary pharmacy in a portakabin on the high street within a few days. Drying out and refurbishing the original store took a few weeks.

The full case study is available on the Climate East Midlands website: **http://www.climate-em.org.uk/resources/item/business-resilience-case-studies**

2.3.6 There are examples in the East Midlands of where businesses of various sizes are working together with their neighbours to increase their resilience. For example, business estates in Northamptonshire have developed estate-wide business continuity plans, supported by Northamptonshire Enterprise Partnership and Northamptonshire County Council.

Supply chain resilience

2.3.7 Businesses also need to understand how resilient their supply chains are. Their supply chains may extend nationally and internationally. The greatest risk of disruption is often further 'up-stream' in supply chains, yet businesses often only consider risks to their immediate suppliers.[37] The flooding in Thailand in 2011 disrupted supplies for thousands of companies.[38]

2.3.8 The Institute of Environmental Management and Assessment (IEMA) guidance on Building the Business Case for Climate Change Adaptation contains several anonymised examples from practitioners as to how different companies have gone about managing risks in their supply chains:[39]

- A medium-sized company decided to own and manage its delivery logistics in order to better ensure continuity of service to customers. The company also ensured sufficient 'held stock' for a continuity of supply out to its critical and valued clients. This approach is seen by the company as providing an advantage over competitors who operate a 'just in time' system for outward deliveries and internal supplies.

- A large corporate with international production and sales secured resilience and continuity by diversifying suppliers and building in contingency.

- A further large corporate addressed risks through significantly localising its supply chain where its suppliers effectively guarantee delivery, i.e. responsibility is put on the supplier.

The Environment Agency's Climate Ready service has published guidance: "Assessing and Managing Climate Change Risks in Supply Chains."[40]

Insurance

2.3.9 The Flood Re scheme, due to start in summer 2015, is the result of lengthy negotiations between the Government and the insurance industry. It is designed to ensure that domestic properties in the UK at the highest risk of flooding can receive affordable cover for the flood element of their household property insurance.[41] However, Flood Re has been criticised by the Adaptation Sub-Committee (ASC) as it does not incentivise the uptake of household flood protection measures, making it a missed opportunity. As a result, the ASC foresees that Flood Re costs will be higher than they need to be.[42]

[37] Adaptation Sub-Committee (2014) Managing Climate Risks to Wellbeing and the Economy: ASC Progress Report. http://www.theccc.org.uk/wp-content/uploads/2014/07/Final_ASC-2014_web-version-4.pdf
[38] Climate UK and Climate Ready (2014) Delivering Resilient Growth. http://climateuk.net/news/delivering-resilient-growth
[39] IEMA (2013) Climate Change Adaptation: Building the Business Case. http://www.iema.net/readingroom/articles/cca-business-case-guidance
[40] Climate Ready (2013) Assessing and Managing Climate Change Risks in Supply Chains. http://climateuk.net/resource/supply-chains-adaptation-guidance
[41] ABI website, Flood Re Explained. https://www.abi.org.uk/Insurance-and-savings/Topics-and-issues/Flooding/Government-and-insurance-industry-flood-agreement/Flood-Re-explained
[42] Adaptation Sub-Committee (2013) Letter from Lord Krebs to the Environment Secretary: Advice on designing flood insurance proposals to encourage flood risk reduction. http://www.theccc.org.uk/publication/letter-advice-on-designing-flood-re-to-encourage-flood-risk-reduction

2.3.10 Flood Re does not include business premises. According to the ABI:

"The individual nature and assessment of business and commercial property risks means that available and affordable flood insurance is less of an issue than for homes. While some individual firms may experience problems in accessing flood insurance, these can usually be resolved by using (as most do) an insurance broker. Flood Re will establish clear rules for 'borderline' cases such as 'Bed and Breakfast' properties."[43]

2.3.11 However, the British Insurance Brokers Association (BIBA) has compiled evidence of rocketing flood insurance premiums experienced by private landlords, owners of recently built flats or leasehold properties, and owners of small business premises, none of whom are included in Flood Re. BIBA presented the evidence to Defra Ministers, but the dossier has not been made public.[44] This suggests that accessible flood insurance for businesses may be more of a challenge than the ABI suggests, and the Government and the insurance industry should keep this situation under review.

Resilient infrastructure

2.3.12 Even if a business has taken significant steps to increase its own resilience, it is still reliant on infrastructure. If transport, energy or other infrastructures are disrupted, this can have knock-on impacts on businesses.

2.3.13 The Adaptation Sub-Committee asserts that resilient national infrastructure is a key attribute of economic competitiveness, and that acting now to increase resilience makes economic sense, especially in the context of a changing climate. Nationally, natural hazards account for between 10-35% of all delays or service interruptions to electricity, road and rail customers every year. Floods in particular can have long-lasting impacts on infrastructure networks and cause widespread disruption.[45]

2.3.14 In 2010, the Government used the Adaptation Reporting Power in the Climate Change Act 2008 to require a range of infrastructure providers to assess their climate risks and report publicly on the results and on their plans to manage the risks. The Highways Agency, utilities, Network Rail, airports and others reported accordingly and the increased risks from flooding featured in many of these reports. Disruption on the roads, railways and airports has become a regular feature of extreme weather events. Whilst infrastructure providers cannot prevent disruption altogether that arises from severe weather events and floods, they will need to do progressively more over time to manage the risks.

Transport infrastructure

Highways

2.3.15 The national Climate Change Risk Assessment (2012) did not consider climate risks for local highways, which constitute 98% of the roads in the country, so in 2013 Climate UK was commissioned to organise a national conversation with local highway authorities to ensure all had an opportunity to engage in the issue. This was part of a joint project with Department for Transport, the Association of Directors of Environment, Economy, Planning and Transport (ADEPT), the Chartered Institution of Highways and Transportation (CIHT) and the Institution of Civil Engineers (ICE), the Environment Agency's Climate Ready service and Climate UK. The presentations and write up of the East Midlands event can be found on the Climate East Midlands website.[46] Similar events were held around the country and subsequently guidance was published on "Creating and Managing Resilient Local Highways".[47]

2.3.16 One of the case studies provided in the "Creating and Managing Resilient Local Highways" document is about the 3 Counties Alliance Partnership's (Nottinghamshire, Derbyshire and Leicestershire County Councils) 2009 project to understand and address the effects of climate change on the local authorities' highway network.[48] The project produced a list of practical adaptation actions, but implementation has been hampered by budget cuts in more recent years.

2.3.17 One of the areas that the Adaptation Sub-Committee's (ASC) 2014 progress report to Government focused on, was the resilience of national infrastructure.

[43] ABI website, The Future of Flood Insurance https://www.abi.org.uk/Insurance-and-savings/Topics-and-issues/Flooding/Government-and-insurance-industry-flood-agreement/The-future-of-flood-insurance
[44] The Telegraph (2014) Government Flood Insurance Scheme 'Failing'. http://www.telegraph.co.uk/finance/personalfinance/insurance/10930445/Government-flood-insurance-scheme-failing.html
[45] Adaptation Sub-Committee (2014) Managing Climate Risks to Wellbeing and the Economy: ASC Progress Report. http://www.theccc.org.uk/wp-content/uploads/2014/07/Final_ASC-2014_web-version-4.pdf
[46] Climate East Midlands (2013) Resilient Highways workshop materials. http://www.climate-em.org.uk/resources/item/resilient-highways-workshop-materials
[47] Climate UK et al. (2013) Creating and Managing Resilient Local Highways. http://climateuk.net/localhighways
[48] Scott Wilson (2009) The Effect of Climate Change on 3CAP's Highway Network Policies and Standards. http://www.leics.gov.uk/climate_change_adaptations.pdf

Case study of a collaborative project to reduce flood risk: British Gypsum, East Leake, Nottinghamshire

British Gypsum's headquarters are near the village of East Leake, Nottinghamshire. Flooding from the brook that runs through the village was causing disruption and distress for local residents and businesses. Erosion of the banks of the brook was threatening the main road through the village. When the road flooded, vehicles would have to take a long diversion and the roads became heavily congested. A large proportion of the staff at British Gypsum's headquarters live locally, so flooded roads had the potential to make it difficult for them to get into work.

The project partners included East Leake Parish Council and Nottinghamshire County Council. British Gypsum provided staff volunteers to help clear vegetation from the brook to prepare the way for the engineering work to take place, to shore up the banks of the brook.

As a result of the project flood risk has been reduced, protecting homes and reducing the risk of disruption for local businesses. British Gypsum won the East Midlands Business Resilience Award in 2013.

The full case study is available on the Climate East Midlands website: **http://www.climate-em.org.uk/resources/item/business-resilience-case-studies**

Volunteers from British Gypsum at work in East Leake

The following summary is taken from the Adaptation Sub-Committee's 2014 Progress Report:[49]

Rail

The rail sector has a legacy of ageing assets, some of which were severely damaged by the winter 2013/14 storms. Network Rail is increasingly taking a whole-life approach to managing its assets and assessing the resilience of its major routes to climate change, although it could go further to embed adaptation into its design specifications. Expenditure on the renewal of the most vulnerable structures, such as earthworks and sea walls, is set to increase in the coming years, and Network Rail reports annually on the progress being made.

Energy infrastructure

Electricity transmission and distribution assets were severely disrupted during the 2007 floods. Since then, coordinated steps have been taken with the economic regulator Ofgem to assess current and future flood risk, establish standards of protection and deliver a programme of resilience measures. Once implemented, nearly 90% of customers currently reliant on substations at high risk will have been protected by the 2020s, even after accounting for projected increases in the likelihood of flooding with climate change.

Water infrastructure

Water companies have complex networks of assets including treatment works, pumping stations, pipes and sewers. These networks are exposed to flood risk and ground subsidence in particular. National-level data on the current impacts of these hazards is not collected. There is no consistent assessment of risks across the sector, and any steps taken by companies to reduce risks are not routinely reported.

Ports and airports

Ports and airports are privately operated so motivated by competition to ensure reasonable continuity of service. However, operators do not bear the full costs of impacts to the economy from service disruptions, which can be substantial at the largest airports and most specialised ports. The first round of the Adaptation Reporting Power ensured some reporting of the steps being taken to manage climate risk.

ICT

The ICT sector has extensive built-in redundancy and private operators compete on the basis of service reliability. However, weather-related risks to ICT networks are not systematically covered by resilience policies. It is unclear whether the sector considers projected climate change in its risk assessments.

[49] Adaptation Sub-Committee (2014) Managing Climate Risks to Wellbeing and the Economy: ASC Progress Report. http://www.theccc.org.uk/wp-content/uploads/2014/07/Final_ASC-2014_web-version-4.pdf

Business opportunities

2.3.18 Globally the value of the climate change adaptation and resilience sector is estimated at £68.7bn. In the UK the market is worth £2.1bn, mainly in construction and retrofit, and transport resilience. The market is growing well above trend at around 5% in the UK, and is predicted to increase globally to more than 7% by 2015/16.[50]

2.3.19 UK companies provide key adaptation goods and services such as flood protection and resilience measures, professional services including architecture and engineering, and finance and insurance products and services.[51]

Examples

- Nottingham Flood Defence Scheme: Nottingham is one of the fastest growing cities in the UK. The flood defences on the left bank of the River Trent through Nottingham are designed to provide protection to properties with a 1% annual probability of flooding. This benefits both small and large businesses. Small businesses account for a large proportion of the economic activity in the flood plain. The flood defence scheme has facilitated the development of the Boots Enterprise Zone within the flood plain. The zone is solely owned by Alliance Boots, and plans to provide up to 200,000 square metres of additional business space.[52]

- Lower Dove, Derbyshire: The Environment Agency worked with local stakeholders and a major employer, Nestle, to raise and extend existing flood defences along the River Dove. The £9.33m scheme, including a partnership contribution from Nestle, safeguarded 400 local jobs and created an additional 400 jobs.[53]

- Water Management for Growth, GLLEP: The Greater Lincolnshire Local Enterprise Partnership supported the creation of 5,440 jobs through 11 water management and flood resilience projects funded by £20.5m of Growth Funds.[54]

- UK Flood Barriers: Based in Worcestershire, UK Flood Barriers is one of the fastest growing companies in the UK over the last 4 years. A local business owner was flooded, developed an innovative flood barrier technology, and is now exporting around the world, from Thailand to the United States.[55]

[50] Climate UK and Climate Ready (2014) Delivering Resilient Growth. http://climateuk.net/news/delivering-resilient-growth
[51] Adaptation Sub-Committee (2014) Managing Climate Risks to Wellbeing and the Economy: ASC Progress Report. http://www.theccc.org.uk/wp-content/uploads/2014/07/Final_ASC-2014_web-version-4.pdf
[52] Frontier Economics (2014) Flood and Coastal Erosion Risk Management and the Wider Economy. A report for Defra and the Environment Agency. http://evidence.environment-agency.gov.uk/FCERM/en/Default/FCRM/Project.aspx?ProjectID=76cf10b6-9280-4ae2-8a08-713eb35ccc2b&PageID=9719662d-81e9-4a8f-b46f-72675770cdce
[53] Climate UK and Climate Ready (2014) Delivering Resilient Growth. http://climateuk.net/news/delivering-resilient-growth
[54] Climate UK and Climate Ready (2014) Delivering Resilient Growth. http://climateuk.net/news/delivering-resilient-growth
[55] Climate UK and Climate Ready (2014) Delivering Resilient Growth. http://climateuk.net/news/delivering-resilient-growth

Recommendation 8

Representative business bodies in the East Midlands, including the CBI, IoD, FSB and local Chambers should promote business continuity planning with their memberships, including active flood risk management.

Recommendation 9

The Government needs to ensure that the second round of the Adaptation Reporting Power is effective, given that it is now voluntary for organisations to report.

Recommendation 10

Individual businesses should make use of the free, online Business Resilience Health Check tool. **http://www.businessresiliencehealthcheck.co.uk**

Recommendation 11

The Government and the ABI need to keep the accessibility of flood insurance under review, for businesses in areas at risk of flooding, and give consideration for making specific provision if necessary.

Recommendation 12

LEPs should facilitate dialogue with businesses and infrastructure or service providers to identify and explore pinch points and potential weak spots in high priority vulnerable sites.

Recommendation 13

LEPs can support growth in the climate change adaptation and resilience sector through the goods and services they buy and by developing skills programmes to embed adaptation skills.

Building Business Resilience workshop in Derby, 2013 © Climate East Midlands

2.4 Community Resilience

Summary

A number of major flood events have occurred around the country over the last ten years and affected a range of different locations and communities across the East Midlands. This is well illustrated in the recent example on page 26 from Lincolnshire, which highlights some of the issues involved in trying to build community resilience, so that people are better prepared beforehand, can take action during an event and can recover more quickly afterwards once the blue lights have gone.

This section details some of the challenges involved and describes some of the work underway in different parts of the East Midlands in building community resilience. It also includes insights from new independent research into climate impacts like flooding and social vulnerability which has found that groups like older people, those in poor health and tenants are more adversely affected by floods than other social groups.

2.4.1 Improving community resilience to extreme weather events like floods is an explicit objective in Government policy, in the National Adaptation Programme 2013 and in the work of the Cabinet Office whose role includes *'building a resilient society to ensure businesses and communities are better prepared for, and able to recover from, emergencies'.*

2.4.2 Whilst many areas have made good progress in building community resilience, through the establishment of initiatives like flood action groups, volunteer flood wardens, running flood fairs to promote relevant products or services, etc. it can be difficult to engage people in the issue if an area has not suffered a recent flooding event or is not perceived locally to be at risk of flooding. Yet a feature of many flooding events is a lack of preparation, awareness and knowledge amongst those affected about what to do and an expectation that the councils will turn up and sort things out.

2.4.3 Research carried out for the Joseph Rowntree Foundation has found: *'extreme weather events can affect anyone, but some people have the potential to be more affected than others. How badly a person or group will be affected will depend not just on their exposure to the event, but on their social vulnerability – that is, how well they are able to cope with and respond to events like floods and heatwaves. People and communities experiencing multiple causes of vulnerability are the most extremely socially vulnerable.'*[56]

2.4.4 The process of building resilience therefore needs to take account of the differential impacts upon different groups – it isn't just about reducing exposure to a hazard but includes tackling the underlying issues that make people socially vulnerable in the first place. The Met Office Review highlights the point that economic growth and prosperity promotes adaptive capacity.

[56] Climate Just website 2015, www.climatejust.org.uk

Boston Stump undergoing renovation following the tidal surge in December 2013 © Climate East Midlands

Case Study: Flooding on the Lincolnshire coast, 5th December 2013

Sixty years on from the 'Great Storm' of 1953 which saw widespread devastation and loss of life down the East coast of England and in the Netherlands, coastal flooding occurred on the night of 5th December 2013 when high tides, strong winds and low pressure combined. The resulting storm surge at 5.2m was the largest for over 60 years and 70cm higher than the 1953 event. Between 18-20 km of sea defences were overtopped and there were four breaches in the defences. 720 homes and businesses were flooded (mainly in Boston), including the iconic St Botolph's Church (known as Boston Stump) and 1,700 hectares of agricultural land were inundated. Lincolnshire's valuable coastal environment was damaged, including the nature reserve and visitor centre at Gibraltar Point. There was £8.1m worth of damage to infrastructure.

A major emergency response was initiated by the authorities as the surge moved south down the East coast, with reports that the surge was higher than predicted. Vulnerable people were moved in advance, but only those known about as the area is home to many houses in multiple occupation and migrant workers. Over 200 received assistance to evacuate and 44 were rescued. An unknown number ignored warnings and stayed in their homes whilst others exposed themselves to high risk at the flood walls.

Some of the conclusions of the emergency responders were that in comparison to 1953, Lincolnshire was:

- **Better protected** (by and large the defences and drainage system did their job)
- **Better prepared** (responders got ahead of the surge and responded well to a late developing threat)
- **Better informed** (households, businesses and key partners benefited from accurate forecasting and flood warnings)

Many lessons were learned from the event, which tested the capacity and resilience of partners to the limit. Some of the responders involved consider that they were lucky, as although the storm surge was the biggest since 1953, other weather conditions were favourable, and believe it could have been far worse if this had not been the case.

Other, later impacts included 350 tonnes of flood contaminated waste having to be disposed of and the local Household Waste site being flood damaged.

After the event, it was a long haul to recover from the damage, particularly as only 50% of the houses affected were insured. A community response 'Get Boston back on its feet' was established via social media to help raise funds and offer grants to those affected. £320,000 was made available by the Government in February and offered as flood recovery grants to businesses or households of up to £5,000.

The development of the 'Boston Barrage' (for which Government funding has now been confirmed) will help to reduce the likelihood of similar events in the future.

Case Study: Community Resilience Pathfinder in Northamptonshire

Northamptonshire County Council was one of a small number of councils to secure £300,000 Defra funding in 2013 to carry out a two year Pathfinder project to help communities to help themselves in tackling the risk of flooding. Fifteen communities were identified and were offered a range of tools, including resources for use in schools, property level protection surveys and community rain gauge warning systems. An online toolkit is also being developed which helps to facilitate community-led improvements in resilience and preparedness.

Some of the lessons learnt so far are:

- Each community is different and people are generally not interested unless they are directly affected by flooding
- There is a general lack of understanding of the different types of flood risk
- A single point of contact for each community is needed, in the form of a Flood Warden or Community Flood Forum
- There is a low level of take up for property level flood protection surveys – people want to know what the catches are
- Educating children helps ensure that important messages get taken home

Case Study: Community Resilience in Nottinghamshire

Community resilience stores have been established in high risk areas by district councils (Newark & Sherwood, Bassetlaw and Gedling). Stores have been provided for the relevant parish council and typically contain a mix of Personal Protective Equipment (PPE) (wellingtons, waders, gloves, etc.), road signs, torches, sandbag trolleys, shovels, sandbags (including alternatives such as 'aqua-sacs'), sand, polythene sheeting and wheelbarrows. Such equipment can be deployed quickly by the parish council / flood wardens and will usually form the first operational response to flooding. Each parish council has ownership of their store and is responsible for its maintenance. The equipment within belongs to the parish council; it is their responsibility to decide how the resources should be distributed during an incident.

Nottinghamshire County Council has a Community Flood Signage Scheme policy which enables identified Flood Wardens to set up warning signs on particular roads and locations when flood warning alerts have been issued. Flood Wardens have to be trained in order to use the signs and alert the County Council (the Local Highways Authority) accordingly when they are about to be used.

Case Study: Lincolnshire Coastal Pathfinder

Lincolnshire County Council worked with the Environment Agency, District Councils, Internal Drainage Boards and local communities on the east coast and round the Wash on a Defra funded Coastal Change Adaptation Pathfinder from 2009 which included a project to improve information and communication with communities at risk of coastal flooding[57]. The resulting coastal awareness campaign continues annually, recently modified to take account of the 2013 surge event. The capacity of response authorities during the December 2013 surge was in part informed by detailed research undertaken through the coastal pathfinder to understand better the diverse nature of coastal communities and the most effective ways of establishing and maintaining dialogue with them.

[57] Climate East Midlands case study, 2012, We're prepared for coastal flooding – are you? http://www.climate-em.org.uk/images/uploads/CEM-Lincolnshire-67-A4.pdf

Climate Just

2.4.5 A new online tool is being developed by JRF, in association with the Environment Agency, University of Manchester and Climate UK, to help local authorities and other public service providers better understand who is most vulnerable in their communities to extreme weather events and why. It includes a comprehensive mapping tool to help identify where vulnerable people are located and provides suggestions for actions that can be taken by councils and others in response. **www.climatejust.org.uk**

2.4.6 Maps illustrating areas of the East Midlands with 'river and coastal flood disadvantage' are shown on page 29. Flood disadvantage is a combination of exposure to a flooding hazard and social vulnerability. Social vulnerability can be a combination of many different factors (including ability to prepare, to respond and to recover from an extreme weather event) and the Climate Just tool enables users to examine the underlying factors and indicators separately to help determine the nature of the risk and inform the most appropriate response.

2.4.7 The areas showing acute levels of flood disadvantage include large stretches of the Lincolnshire coast north of Mablethorpe and Skegness to Boston, part of Derby and along the Trent Valley near Long Eaton, parts of Leicester and Loughborough and an area to the west of Northampton. The tool also maps surface water disadvantage and the areas at high risk are generally in larger urban areas.

2.4.8 The increasing risks from flooding to those communities most affected and the potential (and differential) impacts need to be understood by a range of public service providers, not just those directly responsible for flood risk and emergency response, but also those concerned with services to vulnerable people, spatial planning, housing, public health, health and wellbeing. A coordinated and combined response will help to build local community resilience, and this is where the role of elected members will be particularly helpful.

After the 'blue lights' have gone

2.4.9 The experience of recent flooding events suggests that the planning and preparation by local authorities, the Environment Agency and the emergency services has much improved in recent years, along with the capacity to provide more accurate and tailored warnings to those at risk. However the area where communities need more support is in the recovery phase after a flooding event. Local authorities, particularly at district level, have very limited capacity to be able to provide hands on support to individual households and businesses. The recovery period can often take weeks, months or longer to deal with insurance claims, repairs to property damage and getting back to normal. This is often a very stressful period for the people concerned.

Recommendation 14

Local authorities and their partners are recommended to use the Climate Just tool to examine the causes of flood disadvantage in their local area and identify the most appropriate responses. **www.climatejust.org.uk**

Recommendation 15

Emergency Planning should be supplemented by a clearer focus on community resilience and recovery.

Recommendation 16

Local politicians should work to raise awareness in communities at most risk of flooding as part of their community leadership role, and ensure that the work of local authorities is properly joined up between different services.

Flood disadvantage maps from the Climate Just map tool

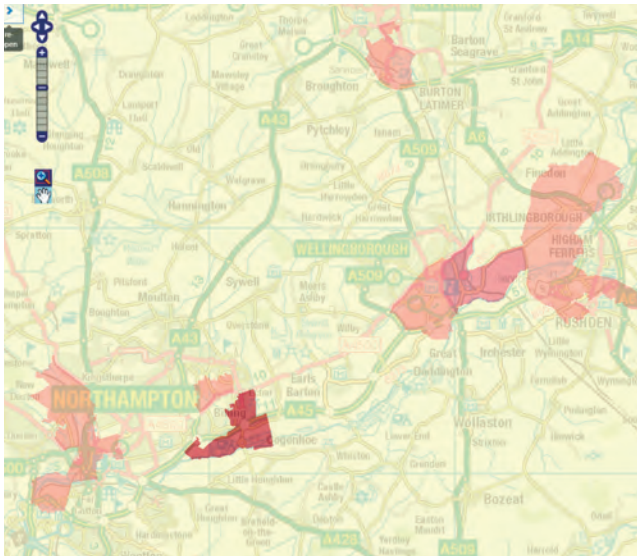
River and coastal flood disadvantage

The maps of river and coastal flood disadvantage show how flood-related social vulnerability combines with the potential for exposure to flooding from rivers and the sea. It accounts for both the likelihood of coming into contact with a flood and also the severity of negative impacts on the health and wellbeing of local communities that could occur as a result of that contact. The map shows the result of an equally-weighted combination of neighbourhood-level scores for:

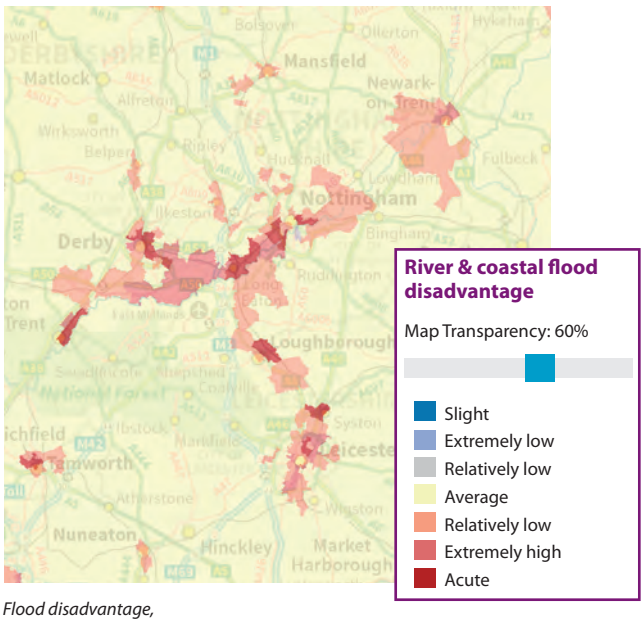
- Socio-spatial flood vulnerability – a map of where negative social impacts are more likely
- Flood hazard-exposure – a map of where river and coastal flooding is more likely

Neighbourhood mapping uses Middle Super Output Areas (MSOAs) from the UK Census, 2011. More information is available in the Climate Just user guide and list of limitations. This area-based representation could be improved with finer scale data and local data holdings.

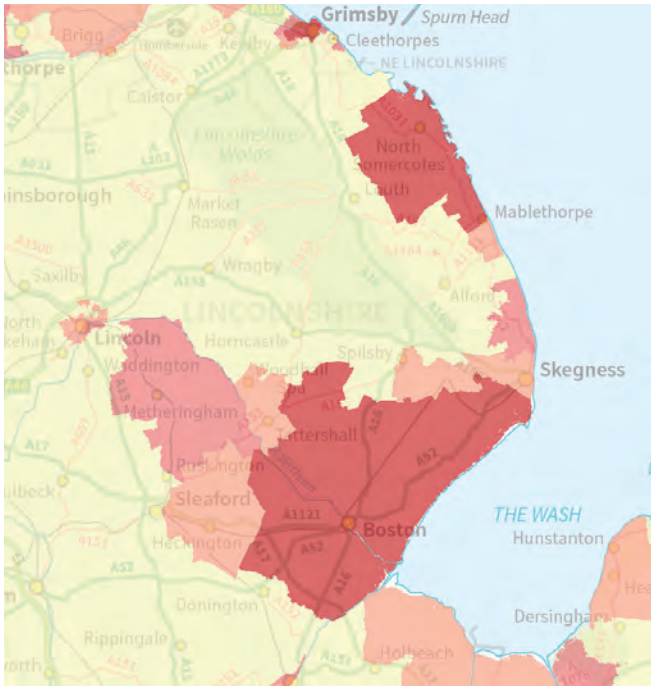
Acknowledgements: See indicator information on the Climate Just website **www.climatejust.org.uk** for relevant data acknowledgements for the inputs to this dataset. Mapping is based on Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: **http://census.edina.ac.uk/**



Flood disadvantage, Northamptonshire



Flood disadvantage, Derbyshire/Nottinghamshire/Leicestershire



Flood disadvantage, Lincolnshire

East Midlands Councils

The Changing Nature of Flooding in the East Midlands
February 2015

East Midlands Councils

East Midlands Councils
T: 01664 502 620
E: info@emcouncils.gov.uk
W: www.emcouncils.gov.uk
@EMCouncils

East Midlands Councils
Pera Business Park
Nottingham Road, Melton Mowbray
Leicestershire, LE13 0PB

For more information please call **01664 502 620** or e-mail: **info@emcouncils.gov.uk**

This document has been printed on recycled paper.

Published February 2015.