

River Trent Catchment Flood Management Plan

Summary Report December 2010

managing flood risk



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Published by:

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December 2010

Introduction



I am pleased to introduce our summary of the River Trent Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the River Trent catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.

The River Trent CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and ground water is however limited due to a lack of available information.

The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to Flood Risk Management. As we all work together to achieve our objectives, we must monitor and listen to each other's progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

The River Trent catchment area has a long history of river, tidal and surface water flooding. At present it is estimated that there are approximately 22,851


properties (both residential and commercial) and 45,473 people at risk in the catchment in a 1% flood event. However, it is expected that both of these figures could rise quite significantly within the next 50 to 100 years by which point some 62,027 properties and 134,206 people could be affected by flooding in a 1% event.

We cannot reduce flood risk on our own, we will therefore work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to manage flood risk in the future. Amongst others, Local Authorities, Natural England, the Forestry Commission, the National Farmers Union (NFU), the National Park Authority, and a number of Internal Drainage Boards (IDBs) have been involved in the formulation of this plan.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing enquiries@environment-agency.gov.uk alternatively paper copies can be viewed at any of our offices in Midlands.

A handwritten signature in blue ink, appearing to read 'Mark Sitton-Kent', enclosed in a circular scribble.

Mark Sitton-Kent
Director - Midlands



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The purpose of a CFMP in managing flood risk

CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

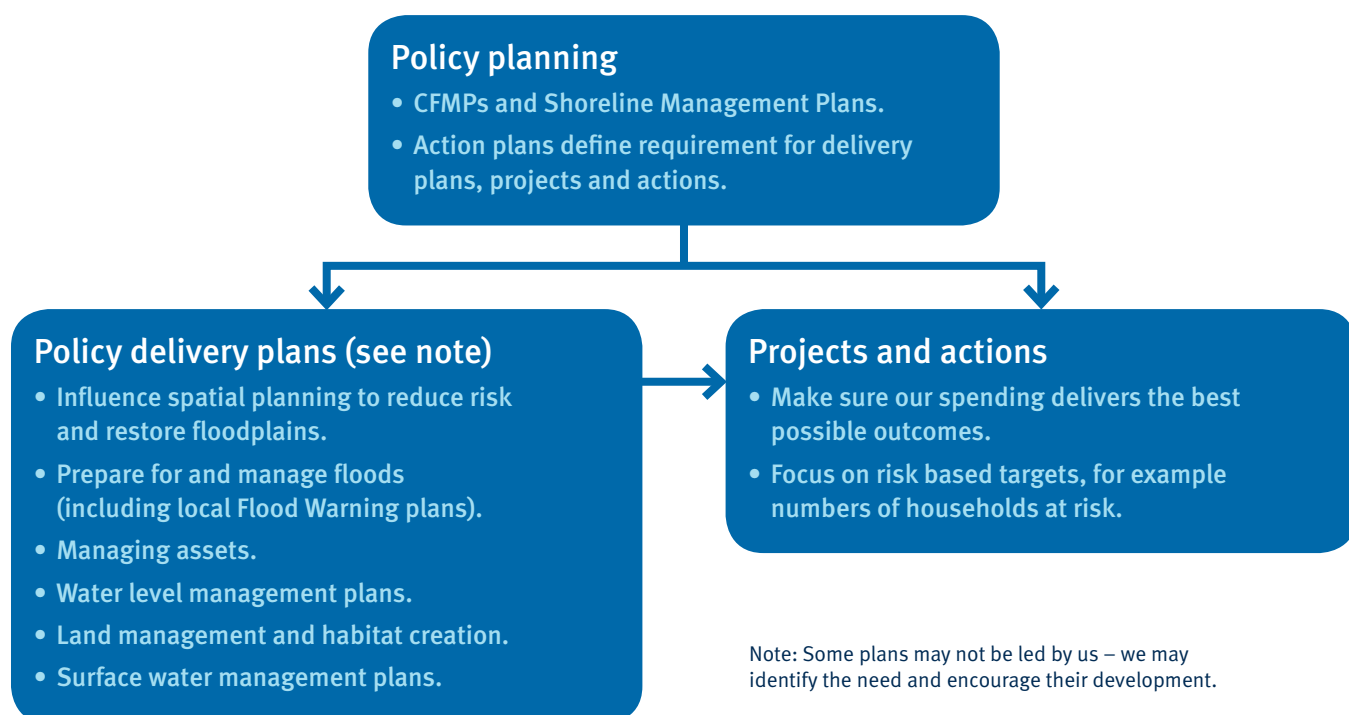
- The Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions;
- Local authorities who can use the plan to inform spatial planning activities and emergency planning;

- IDBs, water companies and other utilities to help plan their activities in the wider context of the catchment;
- Transportation planners;
- Land owners, farmers and land managers that manage and operate land for agriculture, conservation and amenity purposes;
- The public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in figure 1.

Figure 1: The relationship between CFMPs, delivery plans, projects and actions



Catchment overview

The River Trent CFMP covers the entire River Trent Catchment from its source above Stoke-on-Trent down to Keadby Bridge. Beyond this the River Trent flows into the Humber Estuary. The CFMP area includes all of the River Trent's tributaries, covering an area of 10,452km². Major tributaries join the Trent from three main areas:

- The Peak District (Dove, Derwent and Erewash).
- Central Midlands (Sow, Tame and Soar).
- Lower catchment (Torne and Idle).

Although 70% of the land use within the River Trent CFMP area is agricultural, it is home to around six million people, containing much of the metropolitan area of Birmingham, which is the second largest city in the UK. The other main urban areas of the catchment include the West Midlands

conurbation, Stoke-on-Trent, Derby, Leicester and Nottingham.

The physical characteristics of the catchment vary significantly, including both low lying ground, such as the broad flat flood plains of the Tame and Trent, and steep dramatic landscape, such as that in the Peak District National Park in the northwest of the CFMP area. We also find that the geology, soil types and land use changes considerably throughout the catchment. Impervious upland areas with thin, less productive soils change into flatter, lowland mudstones with loamy soils. Here agriculture is an important industry. As a result, the response to rainfall and mechanisms of flooding vary immensely. It is important to understand this variation when assessing flood risk, and in determining appropriate means of managing the flood risk.

The CFMP area also has national and international significance for nature conservation with rivers and other habitats of high ecological importance. Designations in the catchment include 316 Sites of Special Scientific Interest (SSSI), 17 of which fall within the 1% flood outline, including entire watercourses such as the River Blythe and the River Eye SSSIs and extensive wetland areas, such as the River Idle Washlands, and the Humberhead Peatlands SSSIs. Two Special Protection Areas (SPA), 15 Special Areas of Conservation (SAC), and one Ramsar site (Cop Mere – part of the Midlands Meres & Mosses) also fall within the current 1% flood outline. The landscape in the catchment is also designated for its importance. There are two statutory landscape designations in the CFMP area, Cannock Chase Area of Outstanding Natural Beauty, and the Peak District National Park of which less than 2.5% fall within the current 1% flood outline.



↑ River Churnet, near Leek

Current and future flood risk

Overview of the current flood risk

Flood risk has two components: the chance (probability) of a particular flood and the impact (or consequence) that the flood would have if it happened. The probability of a flood relates to the likelihood of a flood of that size occurring within a one year period, it is expressed as a percentage. For example, a 1% flood has a 1% chance or 0.01 probability of occurring in any one year, and a 0.5% flood has a 0.5% chance or 0.005 probability of occurring in any one year. The flood risks quoted in this report are those that take account of flood defences already in place.

The River Trent CFMP area has a long history of river, tidal and surface water flooding with earliest reports dating back to 530 A.D. The most significant river flooding on record occurred in February 1795, on the River Trent at Burton, in Nottingham and Newark. Tidal flooding breached embankments at Morton and Spalford, with flooding extending to Lincoln. The flooding covered an area of more than 8,000ha to a depth of more than 3.0m in places. In March 1947, approximately 2,000 properties were affected in Gainsborough, however flood levels dropped when the flood bank at Morton was breached, inundating 50,000 acres. In December 1965, flooding was widespread, and in places such as Matlock, was over 2m deep. In the winter of 2000, 19 properties

were flooded in Girton alone.

The most severe tidal flooding took place in October/November 1954 as a result of a series of tidal surges, breaching defences on the tidal River Trent.

What is at risk?

Using a broadscale hydraulic model we estimate that there are approximately 45,473 people and 22,851 residential and commercial properties at risk in the catchment from a 1% annual probability river flood.

It is difficult to assess the current impact of flooding to environmental features. The catchment has a number of designated sites which are at risk of flooding. However, many of these sites contain habitats for which floods are a natural and important occurrence which can be beneficial. There are also 51 Scheduled Monuments which may also be at risk of flooding.

Where is the risk?

Due to the large size of the Trent catchment and its varied characteristics, it is very unlikely that a single storm event would cause flooding throughout the entire catchment. In the upper, urbanised reaches of the catchment flooding usually results from short intensive storms. Whilst in the lower reaches, prolonged or continuous rainfall, significant snowmelt, tidal surges or most likely a combination of factors are required before water levels will rise significantly.

The distribution of flood risk from a 1% annual probability river flood, is illustrated in Map 2. Table 1 summarises where there is flood risk to more than 100 properties. We recognise that there is also a potential risk from surface water and groundwater flooding. Surface water flooding is most associated with the steeper upland areas such as at Buxton, Stoke-on-Trent and Ashbourne. It also occurs in low-lying urban areas within Birmingham, Leicester, Nuneaton and Loughborough, whilst a combination of heavy rainfall and high tides can cause flooding around the lower tidal Trent, such as at Gainsborough and Scunthorpe. Furthermore, in rural areas of Charnwood, parts of Leicestershire and Cannock Chase, agricultural practices can result in surface water flooding through high run-off rates from the land.

Groundwater flooding associated with spring emergence or high discharge rates into springs is not widespread in the catchment, though could occur within the sandstones of Sherwood Forest and Cannock Chase. Flooding could also occur in the main Trent valley where aggregate extraction is undertaken, due to water being transmitted through subsurface layers to other locations.

However, further studies following on from the CFMP are needed by us and our partners to quantify these potential risks.

How we currently manage risk

Over the years, a number of engineering schemes have been implemented throughout the catchment with the intention of reducing the probability of flooding. This activity includes:

- The construction of new flood defences.
- Maintaining and improving existing flood defences and structures.
- Maintaining river channels.
- Maintenance of drainage networks by Internal Drainage Boards (IDBs) and landowners.
- Maintenance of road drainage and sewers.

In addition to these engineering schemes, other flood risk management activities are carried out in the catchment. These include activities which help to reduce the probability of flooding and those that address the consequences of flooding such as:

- Understanding where flooding is likely by using flood risk mapping.
- Providing flood forecasting and warning services.
- Working with Local Authorities to influence the location, layout and design of new and redeveloped property and ensuring that

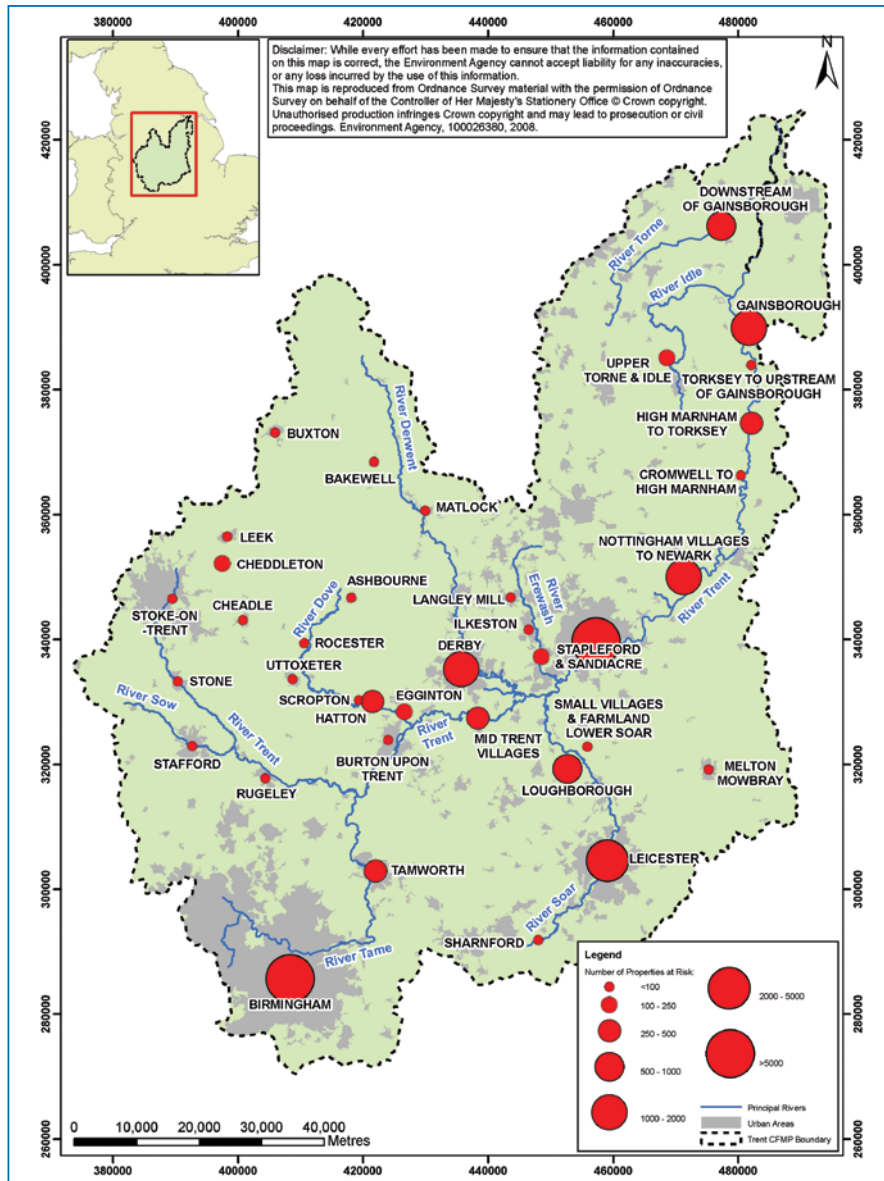
Table 1: Locations of towns and villages with 100 or more properties at risk in a 1% annual probability river flood

Number of properties at risk	Locations
>5,000	Birmingham, Nottingham
2,000 to 5,000	Derby, Leicester, villages and towns within Idle catchment (including Worksop, Mansfield and Retford)
1,000 to 2,000	Gainsborough, downstream of Gainsborough, Nottinghamshire villages down to Newark
500 to 1,000	Loughborough
250 to 500	Mid Trent villages, Tamworth, High Marnham to Torksey
100 to 250	Burton-on-Trent, Cheddleton, Stapleford and Sandiacre, Hatton, Egginton

Table 2: Critical infrastructure at risk

15 Chemical/sewage treatment works,	31 Sewage/water treatment plants
54 Schools	4 Sites with radioactive substances
32 Caravan parks/hotels	2 Telephone exchanges
13 Care homes	48 Waste management sites
26 Emergency response centres	43.9km of A-road
39 Hospital and health centres	111.1km of Railway
15 IPPC registered sites	
230 Power (sub-stations) and gas	
7 Railway stations	

Map 2: Flood risk to property in a 1% annual probability river flood



Low level embankments are in place in the lower River Trent, protecting farmland from small frequent floods, whilst set back from the river, larger embankments protect urban areas from less frequent, but more severe flood events.

Flood storage areas in place include an on line storage reservoir at Kings Bromley on the River Trent, and the River Wreake at Melton Mowbray. Off-line storage reservoirs have been implemented on the River Tame, upstream of Birmingham, where flood risk is high.

Flood alleviation schemes include a flood relief channel at Cannock; the flood storage scheme above Melton Mowbray; the tidal flood storage scheme at Alkborough Flats, and the raised flood banks around Burton-upon-Trent; Gainsborough; Matlock; Nottingham (Queens Drive, West Bridgford and Bee Bank) and Stafford. In Axholme, land drainage pumps and drain network (owned and operated by the IDBs) provide some protection against flooding of low lying farm land and property, with the standard of protection estimated at approximately a 5% AEP flood event.

Our Asset System Management teams carry out improvements on our structures to manage flood risk, including repairs and larger capital schemes.

only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS 25).

- Promoting awareness of flooding so that organizations, communities and individuals are aware of the risk and are prepared in case they need to take action in time of flood.
- Promoting resilience and resistance measures for those properties already in the floodplain.

In Midlands Central Area we currently maintain approximately 1,000km of main rivers and 62km of raised defences along the Rivers Trent, Dove, Tame and major tributaries in the Trent Catchment. This provides protection for about 32,000 people. In Midlands East Area we maintain over 1,100km of main rivers and 550km of flood defences along the Rivers Trent, Derwent, Soar and major tributaries. This provides protection up to a 1% AEP flood event for approximately 18,000 properties.

The impact of climate change and future flood risk

In the future, flooding will be influenced by climate change (including sea level rise), urban development and changes in the way that the land is used and managed. In the River Trent CFMP area, climate change will have the greatest impact on flood risk. The following future scenario for climate change was used in the River Trent CFMP:

- 20% increase in peak flow in all watercourses. This will increase the probability of large-scale flood events.
- a total sea level rise of 1,000 mm by the year 2100. This will increase the probability of tidal flooding downstream of Gainsborough from the River Trent.

Using river models we estimate that within the next 50 to 100 years, the number of properties (both residential and commercial) at risk of flooding during a 1% flood event will rise from 22,851 to over 45,473. Furthermore the number of people at risk of flooding during a 1% flood event will also rise from 62,027 to 134,206.

Figure 2 shows the difference between current and future flood risks from a 1% annual probability river flood at key locations in the catchment. Following on from the CFMP, organisations need to work together to investigate flood risk from other sources (e.g. surface water and groundwater flooding) in more detail.

Figure 2: Current and future (2100) flood risk to property from a 1% annual probability river flood.

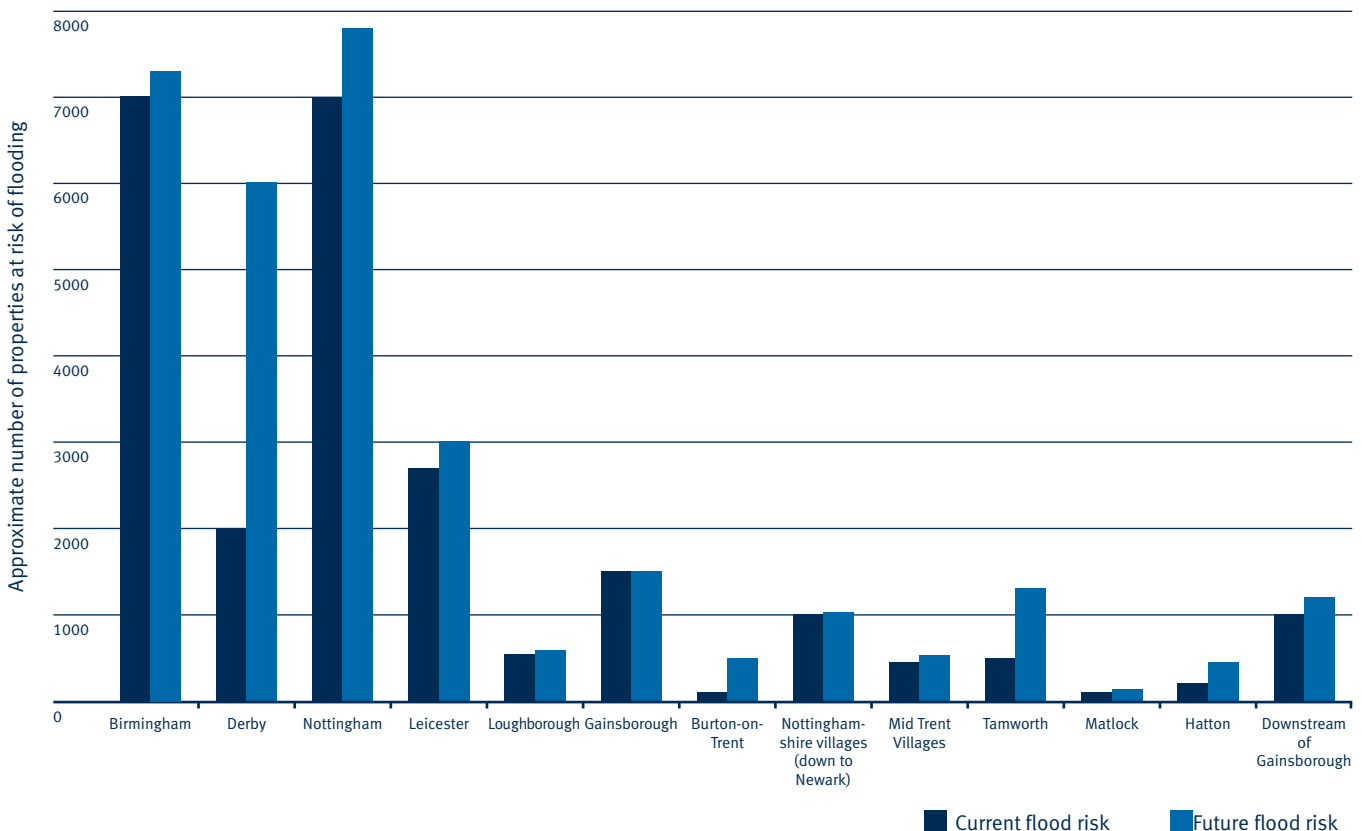


Table 3: Policy options

† Policy 1

Areas of little or no flood risk where we will continue to monitor and advise

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

† Policy 2

Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

† Policy 3

Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

† Policy 4

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

† Policy 5

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

† Policy 6

Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Axholme and NW Lincolnshire

Our Key Partners:

Local Authorities

Landowners

Internal Drainage Boards

Natural England

Utility Companies

NFU

The issues in this sub area

This sub area is predominantly low-lying and rural with smaller settlements, villages and towns. It contains extensive areas of artificially drained fenland with some considerable freshwater wetland sites.

Flood risk is identified in this location as low to medium with approximately 50 properties at risk in a 1% flood event. However, there is an extensive risk to agricultural land on both sides of the River Trent. Flooding from the Rivers Idle and Torne and their tributaries is responsible for a third of the flooding in a 1% event.

There are several environmental sites such as Hatfield Moors, Epworth Turbary and Haxey Turbary SSSIs which are at risk of flooding in a 1% event. However, regular freshwater flooding can actually benefit these sites.

Essential infrastructure at risk includes the M180 and Keadby Power Station. However, these would only be affected in an extreme event (0.1%).

It is expected that the levels of flood risk throughout this sub area will increase significantly in the future, predominantly as a consequence of climate change. Rising sea levels will lead to more frequent overtopping of tidal River Trent defences, potentially causing them to fail. If this was the case then it is estimated that in the next 50 to 100 years 25,000 properties would be at risk during a 1% flood event.

The vision and preferred policy

Policy Option 4 – Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further action to keep pace with climate change.

We have selected this policy because although flood risk is currently managed appropriately, it is expected to rise significantly in the long term. In these circumstances, we need to do more in the future to reduce the expected increase in risks.

The key messages

- Flood risk management activities will be targeted on mitigating the impacts of climate change, with a focus on opportunities to use more sustainable and / or effective methods.
- Flooding can not be entirely eliminated and so residents, owners and businesses need to manage some risks themselves. For example, registering for our Floodline Warnings Direct (FWD) service and flood warden schemes, being aware of emergency plans, and adapting vulnerable buildings.
- We will sustain and improve the status of environmentally designated areas particularly within the low lying fens around the Isle of Axholme through appropriate frequency, extent and duration of flooding.
- Where appropriate, we will return watercourses to a more natural state, increasing biodiversity specifically on the Rivers Torne and Idle.

Proposed actions to implement the preferred policy

- Complete the Isle of Axholme Flood Risk Management Strategy.
- We will review our approach to managing flood defences and other flood risk assets, to ensure that we are managing them efficiently and taking the best approach to managing flood risk in the longer term.
- Investigate options for increasing biodiversity and habitat creation via water level management on pumped watercourses.
- Review implications on designated sites to ensure the current status is improved or maintained where appropriate.
- Draw on our understanding of the Tidal Trent Strategy and the Humber Strategy in any future approaches for the sub area.
- Strengthen relationships and work with IDBs in the area.



↑ Isle of Axholme

Sherwood

Our key partners:

Local Authorities

Landowners

Natural England

Internal Drainage Boards

Country Landowners Association

The issues in this sub area

This sub area has low valleys and well-defined floodplains in the east and low lying hills to the west. Raised areas tend to be forested and there are pockets of high grade agricultural land. The Rivers Idle and Torne rise from the Sherwood Sandstone near the surface where wells provide public water supply. The sub area consists of many areas of artificially drained fenland with some extensive freshwater wetland sites.

Flood risk in this sub area is generally low but slightly higher in some urban areas. The risk is mainly from the upper parts of the Rivers Idle and Torne and its tributaries the Rivers Maun and Meden. People and property in Mansfield, Worksop and East Retford are susceptible to flooding and there are currently

136 properties at risk in a 1% flood event. There are no major flood defences within this sub area and there is no major essential infrastructure at risk of flooding.

River flooding tends to be due to insufficient channel capacity and overland flow combined with surface water ponding. There is also urban drainage flooding, mainly due to blocked drains.

SSSIs susceptible to flooding in the area are the River Idle Washlands, Sutton and Lound Gravel Pits.

Flood risk is currently assessed as low, and is not expected to rise significantly within this policy unit.

The vision and preferred policy

Policy Option 3 – Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

We have selected this policy because the risks are currently managed appropriately and the risk of flooding is not expected to increase significantly in the long term. This policy may mean reviewing the current flood warning services and/or how we manage the defences that are already in place.

The key messages

- The overall input into flood risk activities will remain the same, with a focus on opportunities to use more sustainable and/or effective methods.
- We plan to reduce unsustainable long-term dependence on raised flood defences, by taking opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains.
- We seek to minimise the increase in the cost of flood damage in Mansfield, Retford and Worksop, taking into account future climate change and urban growth.
- Sustain and improve the status of environmentally designated areas such as the River Idle Washlands, Sutton and Lound Gravel Pits SSSI through appropriate frequency, extent and duration of flooding.
- Where appropriate, we will return watercourses to a more natural state, increasing biodiversity and opening up green river corridors through urban areas such as Mansfield, Worksop and Retford.
- Sustain existing and increase the amount of Biodiversity Action Plan (BAP) habitat.
- We will support and encourage land management that will protect and improve water quality by reducing diffuse pollution from agricultural run-off.

Proposed actions to implement the preferred policy

- Investigate locations, ways and funding sources to return the river channel to a more natural state, particularly through Retford, Mansfield, Worksop, and the middle Idle.
- Identify opportunities to maximise the use and benefits of sustainable drainage systems (SuDS), particularly in areas where the sandstone geology will support extensive use, and where a strategy for retro-fitting SuDS may be developed.
- Work with the IDBs within the area to develop the appropriate approaches to drainage activities.
- Encourage rural and urban best-practices in land-use and in land-management to restore more sustainable natural floodplains and to reduce run-off. Identify areas where efficiencies can be achieved, such as reduced channel maintenance and the removal of flood risk management structures.
- Identify potential sites for BAP habitat creation and sustain existing sites.



↑ Flood defences, River Ryton, Worksop

Peaks and Moorlands

Our key partners:

Local Authorities

Landowners

Natural England

Internal Drainage Boards

Country Landowners Association

Water Companies

NFU

National Park Authority

Forestry Commission

near rivers. Rapid run-off from the Peak District and Staffordshire moors results in the rapid onset of flooding in downstream towns and villages. Bridges and other constrictions along the watercourses tend to make the flooding within the towns and villages worse. Locations which have people and properties that are exposed to relatively frequent flooding from deep, fast flowing water include Buxton, Bakewell, Matlock, Ashbourne, Leek and Cheddleton. There are approximately 320 properties currently at risk of flooding in a 1% flood event.

The area has a number of notable environmental features including the Churnet Valley SSSI comprising the steep sided main valley of the Churnet and a number of tributaries. The valleys contain semi natural woodland, scrub, acid grassland, mire, marsh and carr. Flooding at the site has been historically important and will be beneficial to the fen land area developing. The Peak District National Park is a major designated landscape and attracts many visitors. The South West Peak and North Peak are designated Environmentally Sensitive Areas (ESAs).

Throughout this sub area flood risk is currently assessed as low, and is not expected to rise significantly in the future. However, there are also a small number of locations within

this sub area with high flood risk which are expected to see more frequent flooding as a result of climate change. In the next 50 to 100 years up to 445 properties will be at risk in a 1% flood event.

The vision and preferred policy

Policy Option 6 – Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

Our long term vision for this sub area is to set a framework to deliver a sustainable approach to flood risk management that considers the natural function of the river and reduces long term dependence on raised flood defences. This includes identifying opportunities to better utilise areas of natural floodplain to store floodwaters and to attenuate rainwater that will reduce flood risk within this sub area and downstream.

The issues in this sub area

This sub area is characterised by steep gradients and peaks in the Peak District before levelling out in the low lands. Soils tend to be very peaty in the upland areas where rainfall is high. Farming in the upland White Peak District area is characterised by well-drained soils, promoting its use as improved grassland. In contrast, the surrounding Dark Peak soils are acidic and generally covered by scrubland and raised bogs. The area is also notable for its underlying carboniferous limestone geology. The area is well populated by small towns such as Buxton, Bakewell, Ashbourne, Leek, Matlock and Cheddleton.

The narrow valleys mean that settlements tend to be concentrated

The key messages

- We plan to reduce unsustainable long-term dependence on raised flood defences, by taking opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains.
- Reduce the number of people at risk from deep and fast flowing waters or fast onset of flooding through the towns of Buxton, Bakewell, Matlock, Ashbourne and Leek.
- We plan to sustain and improve the status of environmentally designated areas through appropriate frequency, extent and duration of flooding, including using existing and future flood storage areas and floodplains more to benefit nature conservation.
- Support and encourage land management and land use in the River Derwent and River Dove catchments that will reduce run-off rates from upland areas.
- Identify potential sites for BAP habitat creation and sustain existing sites.

Proposed actions to implement the preferred policy

- Investigate opportunities for storage or reduced conveyance upstream of urban areas.
- Identify requirements for existing and future flood protection measures within the policy unit to maintain an acceptable level of flood risk.
- Study the options and feasibility of using water supply reservoirs within the Derwent Valley and upper reaches of the River Churnet to provide some support to flood risk management.
- Implement a project to improve the standard of protection for Ashbourne, potentially carrying out improvements to existing balancing areas and creating further storage areas upstream of the town.
- Identify locations where flood attenuation ponds or wetland areas could be developed with associated habitat improvement.
- Investigate the water level management requirements of the Churnet Valley SSSI, determining the appropriate depth, duration timing and frequency of flooding.
- Progress land use changes which will provide flood risk management benefits and develop a land use management plan for the policy unit.



↑ River Churnet by-pass channel and balancing pond, Leek

Shelford to Gainsborough

Our key partners are:

Local Authorities

Landowners

Natural England

Internal Drainage Boards

Highways Authority

Aggregate Companies

Minerals and Waste
Regulation Authorities

English Heritage

The issues in this sub area

This sub area is characterised by flat gradients where the slope of the River Trent gradually falls from approximately 30 metres AOD to less than 5 metres AOD over a distance of 70 km to the lower tidal reaches. The main towns in the area are Gainsborough and Newark, with many smaller villages across the area. The soil cover is generally loamy with some eastern areas having sandy soils. The underlying geology is mainly Triassic mudstone. There are areas in this unit that have high value agricultural land. The Trent becomes tidally influenced below the Cromwell Weir near Newark.

Flooding normally occurs as a result of overtopping of flood defence embankments on either side of

the River Trent. Gainsborough and Newark are the main urban areas at risk of flooding but there are also many villages at risk. Throughout this sub area it is estimated that there are 2,970 properties at risk in a 1% flood event.

Major embankments protect the larger towns and were designed to provide protection up to a 1% event, whilst minor embankments protect farmland from frequent flooding up to a 10% event. The A46 Lincoln by-pass embankment prevents flooding from the Trent that could travel eastwards towards Lincoln.

Flooding also occurs behind defences when high flows and/or tidal effects prevent the free outflow of water from tributaries and drainage channels. The interaction of tides and river flows can cause combined flooding with saline or brackish water. This is a particular concern for high value agricultural land that can take years to recover from such inundation.

Infrastructure at risk includes the A46 and the A631 crossings over the Trent in Gainsborough which can result in significant disruption locally.

Environmental sites in the sub area include three SSSIs, Lea Marsh, Allington Meadows and Besthorpe Meadows.

Whilst flood risk is currently assessed as medium, this could become high as a result of climate

change and urbanisation. As a result it is estimated that within the next 50 to 100 years the number of properties at risk in this sub area during a 1 % flood event could rise to 3,875.

The vision and preferred policy

Policy Option 4 – Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

We have selected this policy because although the risk is currently managed appropriately, it is expected to rise significantly in the long term. In these circumstances, we need to do more in the future to reduce the expected increase in risks.

The key messages

- Minimise disruption to people, communities and commerce caused by flooding, taking into account future pressure resulting from climate change.
- We will sustain and protect the historical environment and social heritage in the catchment, including the Scheduled Ancient Monuments (SAMs) within the River Trent floodplain throughout this policy unit.

- Reduce the disruption caused by any of the five River Trent road crossing points which lie within the policy unit.
- We aim to minimise the increase in the cost of flood damage, taking into account future pressures from climate change, which may increase flood risk.
- Sustain and improve the status of environmentally designated areas of Allington Meadows and Besthorpe Meadows through appropriate frequency, extent and duration of flooding.
- Sustain and increase the amount of BAP habitat along the main Trent corridor and also within the many small tributary streams.
- Focus on maximising flood risk benefits from disused aggregate workings.

Proposed actions to implement the preferred policy

- Draw on our understanding of the Tidal Trent Strategy and the Humber Strategy in any future approach for the sub area.
- Complete the implementation of an appropriate flood alleviation scheme for Gainsborough and Newark.
- Work with the IDBs within the area to develop appropriate approaches to drainage activities.
- Achieve the right balance between flood risk management and habitat creation within Beckingham Marshes.
- Investigate options for removing, abandoning or breaching sections of embankments where they provide little or no flood risk management benefit, to allow more targeted effort where it is needed. By investigating options for managed realignment, it will be possible to counter the effects of climate change and help to prevent an increase in overall flood risk.
- Investigate options for creating and restoring existing wash lands to accommodate climate change.
- Complete a study to investigate improved resilience or alternative strategic options for transport in the area during flood events.



↑ Flood defences, Gainsborough

Burton, Derby and Nottingham

Our key partners:

Local Authorities

Landowners

Aggregate Companies

Natural England

Utility Companies

Severn Trent Water

Internal Drainage Boards

The issues in this sub area

This sub area contains the main urban centres of Nottingham, Derby and Burton-on-Trent. There are also smaller towns such as Egginton, Langley Mill, Stapleford, Sandiacre and Ilkeston. There are mainly loamy soils, with sandy soils to the east, although the valley floor has large sand and gravel deposits. The geology in the sub area is mainly Triassic mudstone.

Flood risk in this sub area is generally high, with particular risks associated with the more densely populated urban areas. There are significant flood defence structures protecting towns and cities that need to be maintained.

Flooding tends to occur due to heavy rainfall that overwhelms channel capacity, surface water and urban drainage. Flood levels in urban areas can be elevated by structures that restrict flows. It is estimated that nearly 9,915 people are at risk from flooding and this could rise to as much as 15,777 in the next 50 to 100 years as a result of climate change and urbanisation. There are numerous key infrastructure sites and facilities at risk due to the density of urban areas.

The vision and preferred policy

Policy Option 5 – Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

This policy is about reducing the risk where the existing flood risk is too high. We need to take action in the short term to reduce this level of risk.

The key messages

- We aim to reduce the number of people at risk from deep and fast flowing waters or fast onset of flooding within Nottingham, Derby or Burton.
- Reduce the disruption caused by flooding to transport and infrastructure.
- Reduce the cost of flood damage particularly where it is high and may be economically viable.
- Return watercourses to a more natural state, increasing biodiversity and opening up green river corridors through Derby and the towns of Langley Mill, Ilkeston, Sandiacre and Long Eaton.
- Sustain and increase the amount of BAP habitat in the catchment by opening up green spaces within the built environment.
- Support and encourage land and drainage management that will protect and improve water quality.

Proposed actions to implement the preferred policy

- Provide a more accurate and community focused flood warning service.
- Identify locations and opportunities where we can work with aggregate extraction companies to improve planning for and restoration of gravel workings, particularly in relation to flood risk management.
- Increase green corridors through urban areas, particularly on the River Erewash through building partnerships with local authorities and by applying appropriate development control.
- Complete Derby (Lower Derwent) strategy and implement findings.
- Implement the findings of the Nottingham strategy.
- Investigate flood resilience of electricity and gas stations that are at risk from the more frequent 10% flood event.
- Identify locations within the urban areas where BAP habitats may be created, expanded or improved through links with other flood risk management schemes or initiatives.
- Identify problems associated with local mine water flooding and resulting pollution.
- Produce an Integrated Urban Drainage (IUD) strategy for main urban areas, and support this to reduce the incidence of surface water and foul water flooding.



↑ Flood defence scheme, West Bridgford

Mid Staffs and Lower Tame

Our key partners:

Local Authorities

Natural England

NFU

National Park Authority

Forestry Commission

Landowners

Aggregate Companies

Mineral and Waste Regulation Authorities

Relevant Mining Company or Authority

The issues in this sub area

This sub area contains predominantly pastureland, with open arable areas in the lowland area of the upper Trent. There are wooded heights above the shallow central valley and more industrial areas based around former Warwickshire coalfields. The area is dominated by the lower broad flat floodplains of the River Tame and River Trent confluence. The soils are loamy with small areas of sandy soils underlain by mainly Triassic sandstones.

Flood risk is generally low across the area, but recognised as medium around Tamworth due to the high number of properties behind existing flood defences. At present it is estimated that throughout this sub area there are 1,010 properties at risk during a 1% flood event.

The River Tame channel has been heavily modified over the centuries, including widening and straightening to improve flow capacity. Elsewhere the watercourses are relatively natural with few flood defences. Flooding occurs as a result of overtopping of river banks or embankments.

Flood risk is currently assessed as low, and is not expected to rise significantly within this policy unit. As a result of climate change the number of properties at risk within the catchment in a 1% flood event could rise in the next 50 to 100 years to 1,920.

The vision and preferred policy

Policy Option 6 – Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

Our long term vision for this sub area is to set a framework to deliver a sustainable approach to flood risk management that considers the natural function of the river and reduces long term dependence on raised flood defences. This includes identifying opportunities to better utilise areas of natural floodplain to store floodwaters and to attenuate rainwater that will reduce flood risk within this sub area and downstream.

The key messages

- We aim to minimise disruption to people and communities caused by flooding in Tamworth and other smaller settlements along the Trent corridor, taking into account future climate change and development pressure.
- We will work with others to reduce the disruption caused by flooding to transport and infrastructure.
- We will work with others to sustain and improve the status of environmentally designated areas through appropriately managing the frequency, extent and duration of flooding.
- Reduce soil erosion resulting from rapid surface water run-off,

particularly where there has been significant ground disturbance caused by mining (Staffordshire) and where sandy soils are prone to erosion such as Cannock Chase.

- Where appropriate, return watercourses to a more natural state, increasing biodiversity and opening up green river corridors through urban areas.
- Sustain and increase the amount of BAP habitat in the catchment.
- We will support and encourage land management and drainage practices that will protect and improve water quality.

Proposed actions to implement the preferred policy

- Provide a more accurate and community focused flood warning service.
- Complete strategy for the River Tame, focusing on opportunities to naturalise the river in rural areas and to reduce flood risk in Tamworth (accepting that this will probably require some local increase in defences). This strategy must include a wide-ranging technical assessment of flood attenuation options.
- Carry out a feasibility study to identify and assess locations for river restoration or improvements.
- Identify locations where flood attenuation ponds or wetland areas could be developed with associated habitat improvement or creation.
- Work with aggregate companies and the mineral and waste authorities to prepare a plan identifying current and future opportunities to create restoration that benefits both wildlife and flood risk management.
- Identify problem coal mining sites within Staffordshire where discharge during flood events causes pollution and damages habitat/species in receiving watercourses.



↑ Flood defences, River Sow, Stafford

West Staffs

Our key partners:

Local Authorities

Landowners

Internal Drainage Boards

NFU

Staffordshire Wildlife Trust

Severn Trent Water

Developers

taking account of the defences in place in this policy unit, is considered low with 110 properties at risk during a 1% flood event.

A number of environmental sites are liable to be affected by flooding such as the Cannock Extension Canal (SAC), Doxey and Tillington Marshes (SSSI) and Mottey Meadows (NNR).

Flood risk is not expected to increase considerably in the future as a result of climate change and urban growth.

The key messages

- We aim to minimise disruption to people and communities caused by flooding, taking into account the potential pressures associated with future climate change and urban growth.
- We aim to minimise the increase in the cost of flood damage, taking into account extensive future urban growth in the policy unit.
- We will work with others to return watercourses to a more natural state, increasing biodiversity and opening up green river corridors, for example through Stoke-on-Trent and other urban areas, where feasible.

The issues in this sub area

This sub area has a varied landscape with a significant rural element. The geology of the area is predominantly Triassic sandstones and harder millstone grit in the upper reaches on the edge of the Peak District.

In this sub area, there is a fast response to rainfall in watercourses due to the steep nature of the upper catchment areas. There is disruption to people and communities caused by flooding in areas such as Stoke-on-Trent, Stone, Stafford and Cannock, although recent flood defence works, particularly in Cannock and Stafford, have significantly reduced flood risk. The overall current flood risk,

The vision and preferred policy

Policy Option 4 – Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

We have selected this policy because although the risk is currently managed appropriately, it is expected to rise significantly in the long term. In these circumstances, we need to do more in the future to reduce the expected increase in risks.

Proposed actions to implement the preferred policy

- Provide a more accurate and community focused flood warning service.
- Review current land drainage, flood defence and water level management practices in the Sow and Penk catchments.
- Investigate opportunities to manage flood risk in Stoke-on-Trent, and assess improving the river by de-culverting and opening up a green corridor through the city.
- Work with the '*Farming Floodplains for the Future*' project to influence and share findings and policies that support flood risk management.
- Produce and implement an Integrated Urban Drainage Strategy through Stoke-on-Trent and Stafford.
- Encourage close liaison with planners and developers to ensure future urban growth is appropriate and helps manage flood risk.
- Investigate the opportunities for and the feasibility of broad scale SuDS and encourage them to be implemented, where practical.



↑ Flood balancing pond, Mill Green, Cannock

Rural Leicestershire

Our key partners:

Local Authorities

Landowners

CLA

NFU

Natural England

National Park Authority

Forestry Commission

Overall current flood risk in this area is low with only 30 properties at risk during a 1% flood event. It is anticipated that there will be no significant increase in the future. Flooding generally impacts farmland and isolated properties causing disruption to people and agriculture.

A number of environmental sites are liable to be affected by flooding such as the River Eye (SSSI) and Frisby Marsh (SSSI).

The key messages

- Assess long-term opportunities to move development away from the floodplain and create green river corridors through parts of Leicester.
- We aim to minimise the increase in the cost of flood damage, which may occur as a result of future climate change.
- Sustain and improve the status of environmentally designated areas through appropriate frequency, extent and duration of flooding, including using rivers and floodplains to benefit nature conservation.
- Work with land managers and farmers to reduce soil erosion from intensively farmed land.
- Support and encourage land management and land use that will reduce run-off rates from upland areas.
- Sustain and increase the amount of BAP habitat in the catchment.

The issues in this sub area

This sub area has a varied landscape with a significant rural element. The area in the northeast consists of ridges used for arable farming and pasture with more steep sided valleys in the east. There are washlands in the Trent Valley to the north that support a variety of farming. To the northwest of Leicester runoff from the land generates a fast response to rainfall that drains into both the River Soar and River Tame.

There are no formal flood defences in this sub area, although Melton Mowbray is protected from flooding from the River Wreake by an upstream flood storage area which reduces the likelihood of flooding.

The vision and preferred policy

Policy Option 6 – Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

Our long term vision for this sub area is to set a framework to deliver a sustainable approach to flood risk management that considers the natural function of the river and reduces long term dependence on raised flood defences. This includes identifying opportunities to better utilise areas of natural floodplain to store floodwaters and to attenuate rainwater that will reduce flood risk within this sub area and downstream.

Proposed actions to implement the preferred policy

- Investigate locations and opportunities to provide water storage from all tributaries of the River Soar and assess if it is feasible.
- Investigate land use changes which will reduce run-off rates and lessen soil erosion from intensively farmed land in Leicestershire.
- Identify locations where flood attenuation ponds or wetland areas could be developed with associated habitat improvement.
- Identify potential sites for BAP habitat creation.



↑ River Soar at Birstall

Upper Soar and Upper Anker

Our key partners:

Local Authorities

Natural England

NFU

Internal Drainage Boards

Severn Trent Water

Highways Authority

Network Rail

The issues in this sub area

Leicester is the main city in the sub area and there are smaller towns such as Nuneaton and Loughborough. The area is characterised by the distinctive Soar river valley with its floodplains and terraces. The geology is generally Keuper Marl combined with beds of Triassic Sandstone. Soils are often loamy clay which impedes drainage and results in significant amounts of rainfall becoming surface water run-off.

Flooding results from lack of capacity in the river channels and the floodplains becoming inundated. Leicester and Nuneaton are near the headwaters of their respective catchments and are

therefore at risk from rapid runoff. Leicester is also susceptible to surface water flooding when the capacity of urban drainage systems is exceeded.

Overall, there is a medium risk of flooding in this area, although parts of Leicester are considered to be at high risk. Throughout this sub area there are approximately 3,310 properties at risk during a 1% flood event.

It is anticipated that flood risk is likely to increase in future due to further urban growth with the number of properties at risk of flooding during a 1% flood event rising to 3,690.

The vision and preferred policy

Policy Option 4 – Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

We have selected this policy because although the risk is currently managed appropriately, it is expected to rise significantly in the long term. In these circumstances, we need to do more in the future to reduce the expected increase in risks.

The key messages

- Assess long-term opportunities to move development away from the floodplain and create green river corridors through parts of Leicester.
- We will work with others to minimise disruption to people and communities caused by flooding, taking into account future climate change and urban growth.
- We will work with others to reduce the disruption caused by flooding to transport, particularly the A50 and A47, and several 'B' roads around Leicester.
- Work to minimise the cost of flood damage in Nuneaton, Leicester and Loughborough, taking into account future climate change and urban growth.
- Return watercourses to a more natural state, increasing biodiversity and opening up green river corridors through urban areas of Leicester.
- Sustain and increase the amount of BAP habitat in the catchment.

Proposed actions to implement the preferred policy

- Provide a more accurate and community focused flood warning service.
- Investigate upstream storage for 'at risk' urban centres, including the six small watercourses running through Leicester.
- Support the production and implementation of an integrated drainage strategy for urban areas, to reduce the incidence of surface water and foul water flooding by working with Severn Trent Water Ltd in flood risk management.
- Investigate opportunities for creating green corridors along watercourses through urban centres. Identify mechanisms for achieving this and implement, by working with planners and building partnerships with local authorities.
- Investigate flood resilience for infrastructure such as roads (for example the A50 and A47, and several 'B' roads around Leicester).



↑ River Anker culvert, Nuneaton

Birmingham and Black Country

Our key partners:

Local Authorities

Severn Trent Water

Internal Drainage Boards

Highways Authority

Network Rail

Utility Companies

Landowners

The issues in this sub area

This is the most urbanised and populated sub area within the River Trent catchment. Land use is dominated by urbanisation and suburban areas. The River Tame is the main watercourse, rising south of Walsall before flowing through Birmingham and out to the broader floodplains and its confluence with the River Trent. The main geology of the Tame catchment is Keuper Marl combined with beds of Triassic Sandstone. Soil drainage is impeded by the loamy clay soil and therefore a high percentage of the rainfall that falls on the catchment runs off.

Flood risk in this area is high with flooding occurring from a wide range of sources including the River Tame and its tributaries,

surface water runoff, storm water drainage and sewer overflow. In urban areas there is insufficient channel capacity in some locations creating a risk of flooding to historic floodplains and undefended locations. There is a risk that urban drainage systems can be overwhelmed by heavy rainfall and rapid run-off from hard surfaces. The ability of some drainage systems to flow into the River Tame can be reduced by high water levels.

A number of environmental sites are liable to be affected by flooding such as the Checkhill Bogs and Sutton Park (SSSI) and the Fens Pools (SAC).

Throughout the catchment there are approximately 5,000 properties at risk of flooding during a 1% flood event. In the next 50 to 100 years however, it is estimated that this figure could rise to 11,000 as a result of climate change.

The vision and preferred policy

Policy Option 5 – Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

This policy is about reducing the risk where the existing flood risk is too high. We need to take action in the short term to reduce this level of risk.

The key messages

- Work with others to minimise disruption to people and communities caused by flooding, taking into account future climate change, and urban growth in the policy unit area.
- Reduce the disruption caused by flooding to transport and infrastructure.
- Reduce the cost of flood damage within the policy unit, particularly where it is high and may be economically viable, within Birmingham and the Black Country.
- Promote and encourage urban drainage systems that will protect and improve water quality within the surrounding watercourses.
- Sustain and increase the amount of BAP habitat in the catchment.
- Return watercourses to a more natural state, increasing biodiversity and opening up green river corridors throughout the policy unit, particularly through city centre regeneration projects.

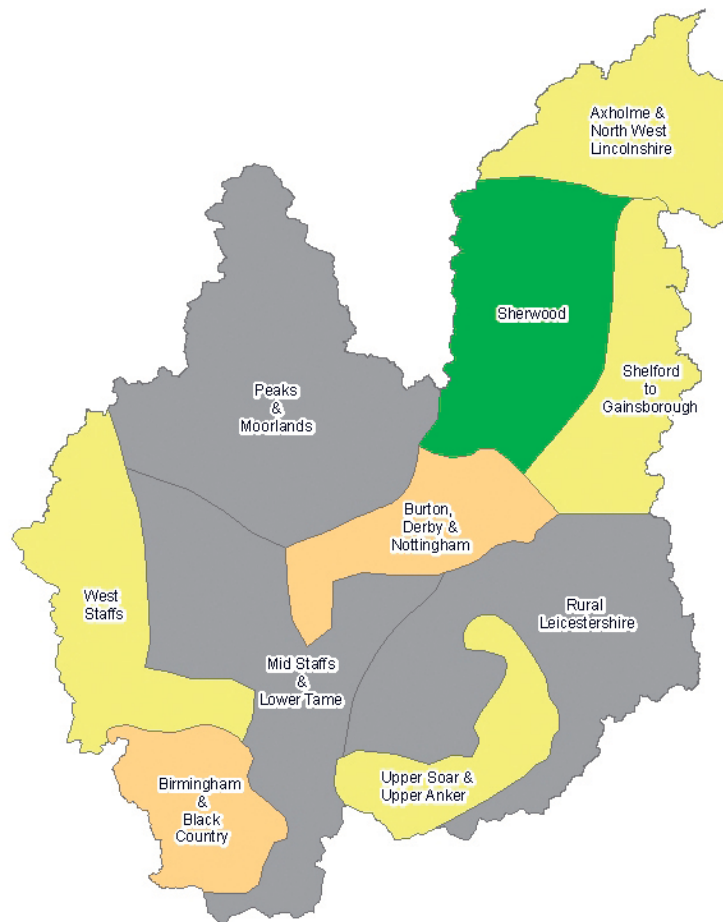
Proposed actions to implement the preferred policy

- Provide a more accurate and community focused flood warning service.
- Conclude River Tame flood risk management strategy.
- Reduce the incidence of foul water flooding by involving Severn Trent Water Ltd more in flood risk management.
- Investigate and promote opportunities to create green corridors along watercourses through Birmingham and the Black Country.
- Produce and implement an integrated urban drainage strategy.
- Investigate flood resilience for infrastructure, including roads, rail, electricity, gas, oil, water and telecommunications at risk of flooding within the city of Birmingham.
- Identify locations where flood storage ponds or wetland areas could be developed within the urban areas, with associated habitat creation.
- Produce an integrated flood defence asset management strategy.



↑ River Tame and balancing pond, Tipton

Map of CFMP policies



Policy 1: No active intervention (including Flood Warning and Maintenance). Continue to monitor and advise.

Policy 2: Reduce existing flood risk management actions (accepting that flood risk will increase over time).

Policy 3: Continue with existing or alternative actions to manage flood risk at the current level.

Policy 4: Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).

Policy 5: Take further action to reduce flood risk.

Policy 6: Take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.



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