

Peterborough Flood Risk Management Strategy (FMS)



Peterborough Flood Risk Management Strategy

Flood Risk Management Strategy Production

This document has been prepared by Peterborough City Council (the Lead Local Flood Authority) with input from the Environment Agency, Anglian Water, North Level District Internal Drainage Board, Middle Level Commissioners, Welland and Deeping Internal Drainage Board, Highway England and the Local Resilience Forum.



middle level
commissioners



This document has been prepared by collecting information over the last four years about flood risk in Peterborough and about the needs to build resilience against flooding. The following table sets out some of the major events that have contributed to the development of this strategy and the remaining stages required for finalisation and adoption.

Stage	Event	Date
Evidence gathering - significant community engagement	Continuous involvement of Flood and Water Management Partnership	2010 - 2014
	City Centre Flood Awareness Fair	September 2011
	Letters sent to all parish councils to invite them to nominate flood wardens	September 2011
	Issued community newsletter	Spring 2012
	Development of Flood and Water website for residents and developers	April 2012
	Thorpe Gate Residents meeting	April 2012
	Flood Awareness Fair – West Ward	February 2013
	Preparation of Flood and Water Management Supplementary Planning Document	December 2012 – December 2013
	Presentation to Scrutiny Commission for Rural Communities	March 2013
	Cambridgeshire Community Resilience Event	April 2013
	Peterborough Community Resilience Event	June 2013

	Association of Drainage Authorities Woking Demonstration Fair	July 2013
	Engagement as part of response to Main River flood incidents	November – December 2013, February 2014
	Engagement as part of response to surface water flooding incidents	August 2011, April - August 2012, Winter 2013/14, June 2014
Development	Consultation draft being developed	2014
Consultation draft published	Public consultation on the draft Flood Risk Management Strategy	November – December 2014
Revision	Comments assessed and incorporated wherever appropriate	January 2015 - June 2015
Partnership review	Involvement in significant changes as document is updated	February 2015
Adoption	Peterborough Flood Risk Management Strategy proposed for adoption by Peterborough City Council	July - October 2015
Implementation and monitoring		2015 – 2020
First review		2020

Associated documents

1. *FMS Action Plan*
2. *FMS Public Summary*
3. *Equality Impact Assessment*
4. *Strategic Environment Assessment of the Peterborough Flood Risk Management Strategy, Peterborough City Council*

Closely related documents

1. *Anglian River Basin Management Plan, Environment Agency:*

Further information

For all general queries about flood risk and water management visit the website at www.peterborough.gov.uk/water

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1. Introduction

1.1. Aims

1.1.1. The aims of the Peterborough Flood Risk Management Strategy are:

- a) To confirm and raise awareness of the risk and management of flooding in Peterborough
- b) To set out a clear plan of actions to tackle local issues and opportunities that is updated each year.
- c) To take a holistic and cross-partner approach to flood risk management, considering other elements of water and environmental management that are affected or can be improved.
- d) To co-ordinate partner actions to ensure projects and schemes are as efficient as possible and that joint funding opportunities are sought.

1.1. Requirement, review procedures and Peterborough's approach

Requirement

1.1.1. The Flood and Water Management Act 2010 (FWMA 2010) set out a significant change to responsibilities with regards to how flood risk is managed in England and Wales. Under the FWMA 2010, Peterborough City Council is a Lead Local Flood Authority (LLFA) with a responsibility for co-ordinating 'local flood risk' management. With this comes several other new duties and powers. Each of these is explained further in chapter 3.

1.1.2. Section 9 of the Act sets out the requirement for LLFAs to develop, maintain, apply and monitor a 'local flood risk management strategy'. The strategy must specify:

- a) The flood risk in its area
- b) The risk management authorities
- c) The management functions carried out
- d) Objectives for managing the risk
- e) The actions to achieve the objectives
- f) The costs of those actions and how they are to be paid for
- g) The benefits of the actions
- h) How and when the strategy will be reviewed
- i) How the strategy contributes to the achievement of wider environmental objectives

1.1.3. The local flood risk management strategy for Peterborough is entitled the Peterborough Flood Risk Management Strategy and given the acronym FMS.

1.1.4. The Act requires the FMS to be consistent with the National Flood and Coastal Erosion Risk Management Strategy. Further details can be found in sections 3.3 and 3.4.

‘Local’ flood risk

1.1.5. In setting out the city council’s statutory requirement for a local flood risk management strategy, the term ‘local’ is specifically defined in paragraph 9, section (2) of the FWMA 2010 as including the sources of flood risk listed below.:

- a) ordinary watercourses
- b) groundwater, and
- c) surface runoff

1.1.6. These sources of risk are then explained in paragraph 1, section 6 of the FWMA 2010 as:

<p>(3) “Ordinary watercourse” means a watercourse that does not form part of a main river.</p> <p>(4) “Groundwater” means all water which is below the surface of the ground and in direct contact with the ground or subsoil.</p> <p>(5) “Surface runoff” means rainwater (including snow and other precipitation) which –</p> <ul style="list-style-type: none"> (a) is on the surface of the ground (whether or not it is moving), and (b) has not entered a watercourse, drainage system or public sewer. <p>(6) In subsection (5)(b) –</p> <ul style="list-style-type: none"> (a) the reference to a watercourse includes a reference to a lake, pond or other area of water which flows into a watercourse, and (b) “drainage system” has the meaning given by paragraph 1 of Schedule 3.

Figure 1-1: Extract from section 6 of the FWMA 2010

Peterborough City Council must co-ordinate management of flooding from:		
		
Surface runoff (often referred to as surface water)	Ordinary watercourses	Groundwater

Figure 1-2: Illustration of the sources of flood risk for which an LLFA has responsibilities

1.1.7. To clarify figure 1-1, responsibility for Main Rivers is not included in the city council’s powers. A Main River is a watercourse shown on the statutory Main River map held by the Environment Agency and the Department of Environment, Food and Rural Affairs. This can include any structure or appliance for controlling or regulating the flow of water into, in or out of the channel. The Environment Agency has permissive powers to carry out works of maintenance and improvement on these rivers.

Peterborough's approach

- 1.1.8. To meet the regulations and Peterborough City Council's legal responsibilities, it would be acceptable if the FMS only dealt with this 'local' risk. However it is more appropriate for the FMS to be inclusive of all types of flood risk management. Seventeen of the watercourses in urban and rural areas of Peterborough are classified as Main River and present a notable risk to both homes and businesses. These would otherwise be excluded from the FMS. Flood risk from surface runoff, groundwater and ordinary watercourses may also interact with other sources of flooding including sewers and Main Rivers to worsen the impacts. It is important to consider the interaction of flooding from all sources to correctly assess the actual flood risk to a location. For example, since many ordinary watercourses and surface water sewers (taking rainwater) in the city ultimately flow into a Main River, when river water levels are very high, water will not be able to discharge and will instead overflow from the ordinary watercourses and the sewers.
- 1.1.9. Responsibility for different sources of flood risk sits with different organisations as discussed in chapter 6. However through working together with all of the water management organisations operating in Peterborough, the city council has produced a strategy that co-ordinates flood risk management, and which residents and businesses can use to find answers to the questions they wish to ask.
- 1.1.10. The Government's National Flood and Coastal Erosion Risk Management Strategy sets out certain visions and aims for the FMS (section 3.3.3) which have been followed in the preparation of the FMS, as required by the FWMA 2010. Taking these as a starting point, the FMS aims to be more holistic than requirements set out. We have instead discussed all sources of flood risk relevant to Peterborough and set out how other water and environmental management issues and pieces of legislation affect flood risk management and taken these into consideration in the plan of action that the city council and its partners wishes to take forward.
- 1.1.11. It is inevitable that there will be competing demands across the Peterborough area as the differing landscapes and characteristics mean that the needs of each area will differ. The aim of the FMS is to bring all these flood risk management needs together and try to ascertain the overall priorities on which the city council and its partners will invest resources over the coming years.

Completing and reviewing the FMS

- 1.1.12. There is no statutory deadline for producing a local flood risk management strategy, nor is there a prescribed format or scope beyond the legislative requirements contained in the Act. Guidance notes have however been developed by the Local Government Association and Peterborough City Council has considered these in the production of the FMS.
- 1.1.13. Since the city council's role and expertise as an LLFA is still developing, it is likely that the FMS will need to be updated as new information comes forward. It is intended that the FMS will be formally updated every 5 years. It is hoped that future reviews will align with updates to a related but separate document, produced by the Environment Agency (EA), called the Anglian Flood Risk Management Plan.

Status in the planning system

- 1.1.14. As with any document, the FMS can be used as a material consideration in planning. In order to ensure that flood risk development policies have the required

weight in the planning system a separate Supplementary Planning Document (SPD) has been prepared that is part of the Peterborough planning policy framework. The Flood and Water Management SPD specifically covers elements of flood risk and drainage which are relevant to new development and is discussed briefly in section 3.5.5 and in more detail in section 10.6.

2. Peterborough Background

- 2.1.1. Peterborough is a unitary authority located in the East of England, approximately 125 kilometres (80 miles) north of London. It comprises a large urban area and 25 villages set in countryside extending over an area of approximately 344 square kilometres (see figure 2-1). The area borders the other Lead Local Flood Authorities of Rutland, Lincolnshire, Cambridgeshire and Northamptonshire County Councils. The total population of Peterborough is estimated as 183,631 (2011 Census).
- 2.1.2. Today Peterborough is an important modern regional centre, providing employment, shopping, health, education and leisure facilities for people across a wide catchment area. The city, however, has a long history of settlement with evidence of Bronze Age remains at Flag Fen, the nearby Roman town of Durobrivae and the Saxon settlement of Medehamstede. A Norman Cathedral still stands at the heart of Peterborough; a city which expanded in Victorian and Edwardian times as Peterborough developed as a significant railway town, and then experienced further rapid growth from 1967 under the New Towns programme. The legacy is a rich historic environment including designated and non-designated heritage assets. In terms of nationally designated assets Peterborough has 933 listed buildings, 29 conservation areas, 4 registered parks and gardens and 72 scheduled monuments. It is of particular relevance that many of Peterborough's scheduled monuments include, or are adjacent to, drainage assets. Sections of Car Dyke, a Romano-British canal, are scheduled monuments in their own right.
- 2.1.3. Peterborough is surrounded by contrasting countryside. This is illustrated in [Appendix A](#) by the national landscape area classifications that feature in Peterborough. To the west and north, the shallow river valleys of the Nene and Welland give way to an undulating limestone plateau, with a denser pattern of attractive stone villages. To the east of the City, the fen landscape is flat and open, with the villages of Eye and Thorney on islands of higher ground and a settlement pattern of dispersed hamlets and farms. This eastern area was originally marshy fen subject to periodic flooding. In the 17th century the Fens were drained to create a new landscape with rich soils well suited to agriculture and horticulture. Water levels in this landscape are now continually managed to reduce flood risk and to support strong economic communities of agriculture and horticulture, as well as to allow navigation and encourage important nature and tourism opportunities. [Appendix B](#) provides more detail about the wider Fens landscape and about the objectives for managing it.
- 2.1.4. Two different river catchments cover the majority of Peterborough; the Welland and the Nene. The Welland flows through Peterborough from its source in Hothorpe Hills, Northamptonshire to its mouth in the Wash. The River Welland itself forms the northern boundary of Peterborough but its catchment extends further south and includes the villages of Barnack, Ufford, Etton, Marholm, Glinton and Peakirk as well the northern part of Peterborough's urban area. The rivers making up the Peterborough Brooks form notable tributaries to the Welland. The greater part of Peterborough is within the River Nene catchment which includes tributaries such as Thorpe Meadows, Orton Dyke and Stanground Lode. The River Nene which is formed from three sources (the principal one being Arbury Hill in western Northamptonshire) and ultimately flows out to the Wash, divides Peterborough city centre in half as it passes through. For this reason the Nene historically provided a principal transport route for trade and for building materials such as those used to

construct the Cathedral and more recently the railways. The Nene and Welland Rivers have had their courses and floodplains altered significantly over time to aid such uses. Both are now managed for flood risk and navigation purposes by the Environment Agency. A small area in the southwest of Peterborough drains via the Whittlesey and District Internal Drainage Board District to the Old Bedford including Middle Level catchment. This area includes part of Stanground and the agricultural land to the east of the urban boundary. All three catchments are shown in figure 2-2.

- 2.1.5. Both the landscape and water environments of Peterborough contain rich biological diversity. Peterborough has three internationally designated sites; Barnack Hills and Holes Special Area of Conservation (SAC), Orton Pit SAC and the Nene Washes SAC (which covers sections of the River Nene and Morton's Leam). The whole of the Nene Washes is also a Special Protection Area (SPA), a Ramsar site and a Site of Special Scientific Interest (SSSI). In total there are 17 SSSIs, of which three are designated National Nature Reserves (Castor Hanglands, Bedford Purlieus and Barnack Hills & Holes); 107 County Wildlife Sites of value and five Local Nature Reserves. Twenty-nine areas of Peterborough have also been recorded as Conservation Areas, some in the city centre and some in outlying villages. The majority of these villages are located in the west and north-west of Peterborough. There are two country parks, a number of parklands and a 'Green Grid' of walking and cycling routes across the authority.
- 2.1.6. Peterborough has experienced and will continue to experience rapid growth requiring new housing, infrastructure and commercial/industrial development. Local planning policy makes provision for a net increase of at least 25,000 new homes and 20,000 new jobs between 2009 and 2026. As of 1st April 2014 there was an outstanding requirement of 21,309 homes. The spatial strategy provides for housing growth at a wide variety of places across the local authority area, but with a distinct emphasis on locations within and adjoining the urban area.
- 2.1.7. The city centre is a key area of focus for the city council to ensure that Peterborough remains to be a regional service centre. The city centre presents a wide range of constraints and opportunities linked to flood risk, but also linked to other elements such as the presence of a rich historic environment and the ecological diversity of many brownfield sites. Prime redevelopment opportunities exist along the Nene which would help improve the connection between the existing centre around Cathedral Square, the River itself and the communities south of the Nene. The River is an asset which would benefit from revitalisation, additional presence and environmental improvements. Housing growth, a clear route for ensuring investment in this area, comes with its own water related constraints to overcome, not least land contamination, flood risk from the river and the existence in many areas of combined sewers which can limit capacity for wastewater discharge.
- 2.1.8. It is against this background that the risks, challenges and opportunities related to local flooding have been considered and presented in the FMS.

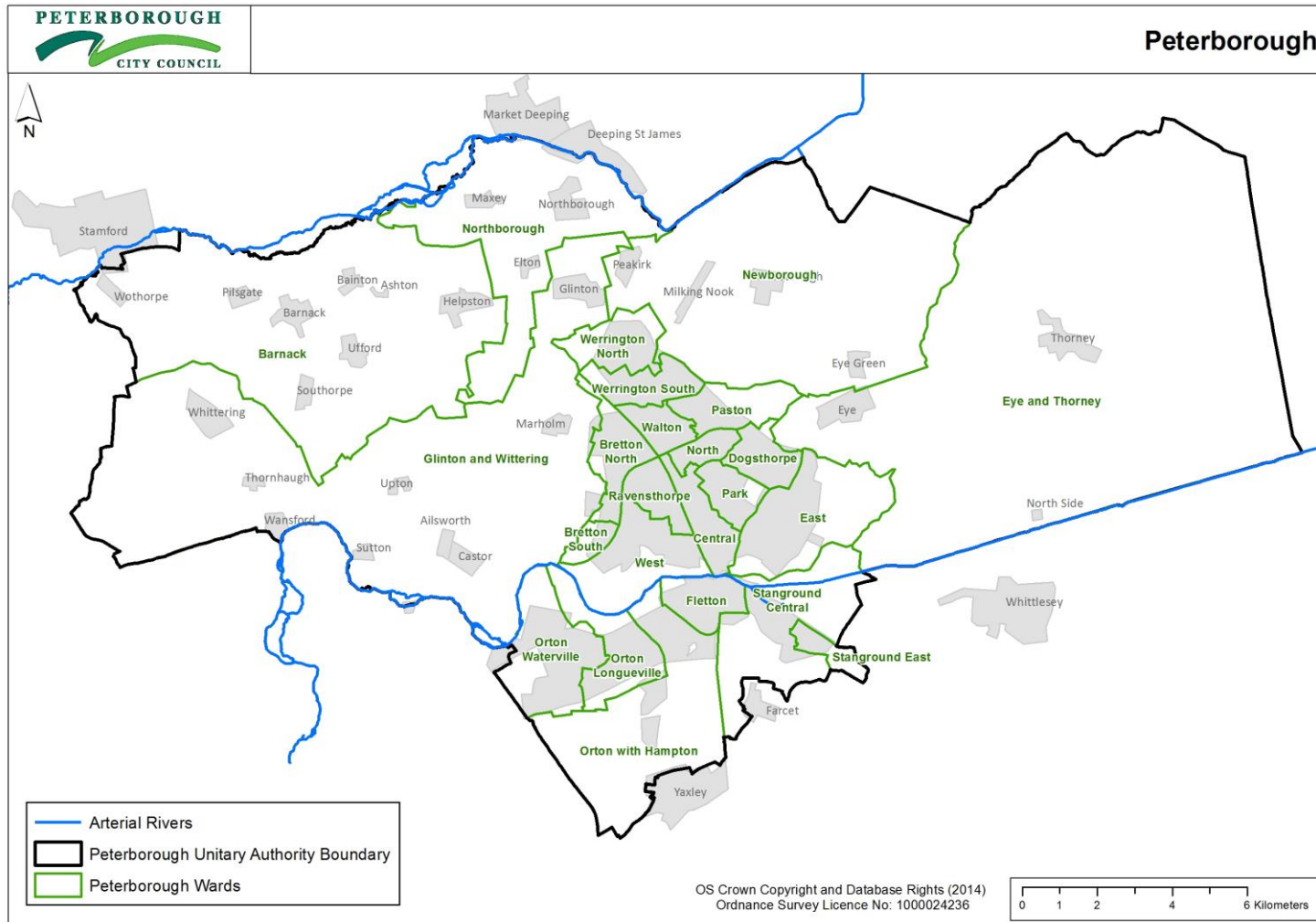


Figure 2-1: The area of Peterborough City Council (a unitary authority) with village and ward labels

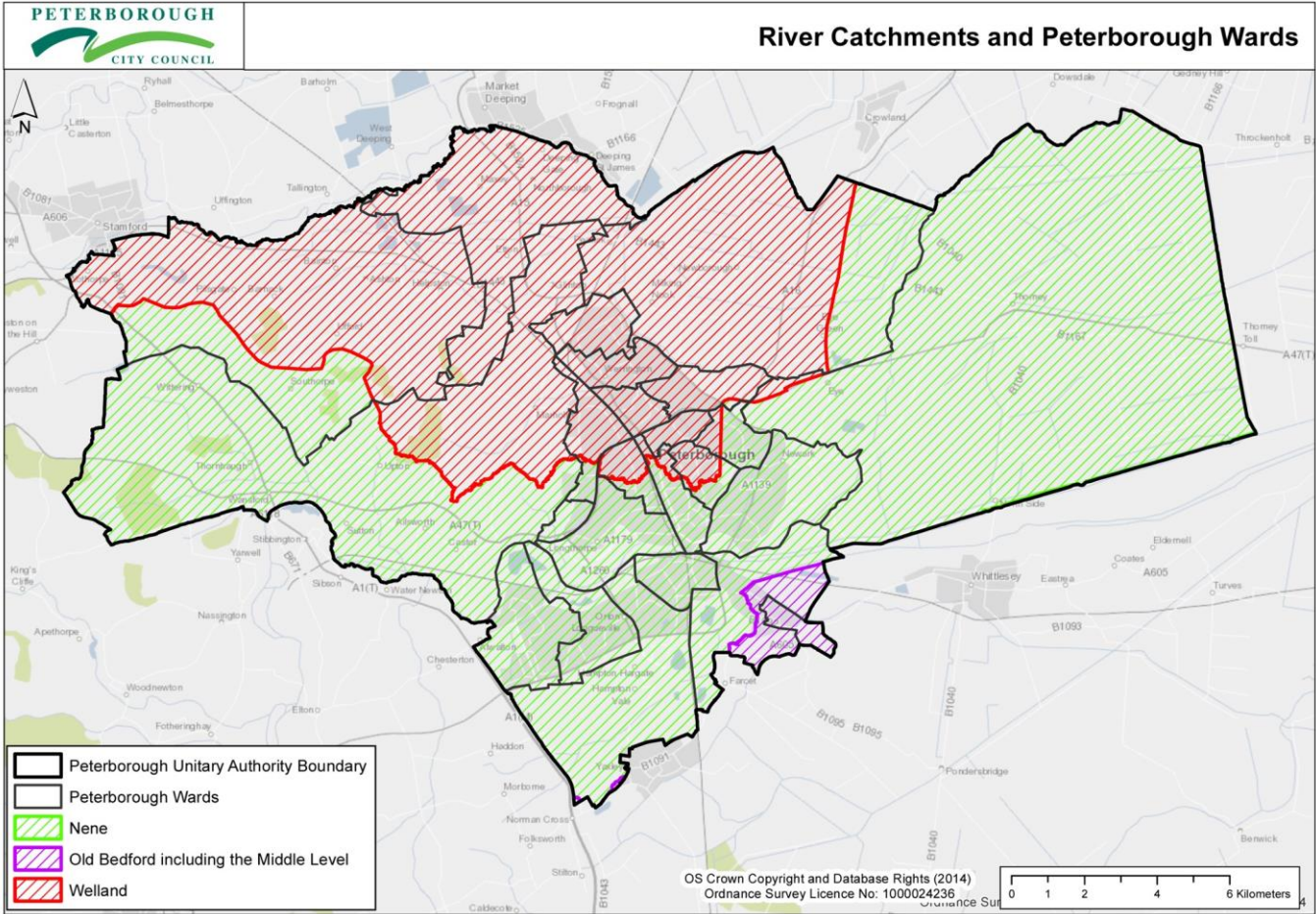


Figure 2.2: The river catchments and electoral wards in Peterborough

3. Policy, Legislation and Guidance

3.1. Links between legislation and guidance documents

- 3.1.1. Flood and water management in Peterborough is influenced by European, national and local policy and legislation as well as technical studies and local knowledge. Figure 3-1 below attempts to summarise the main different types of contributing document.
- 3.1.2. The key drivers for the production of the FMS are the FWMA 2010, the National Strategy, the Flood Risk Regulations 2009 and the Water Framework Directive. These are explained below alongside related policies and documents.

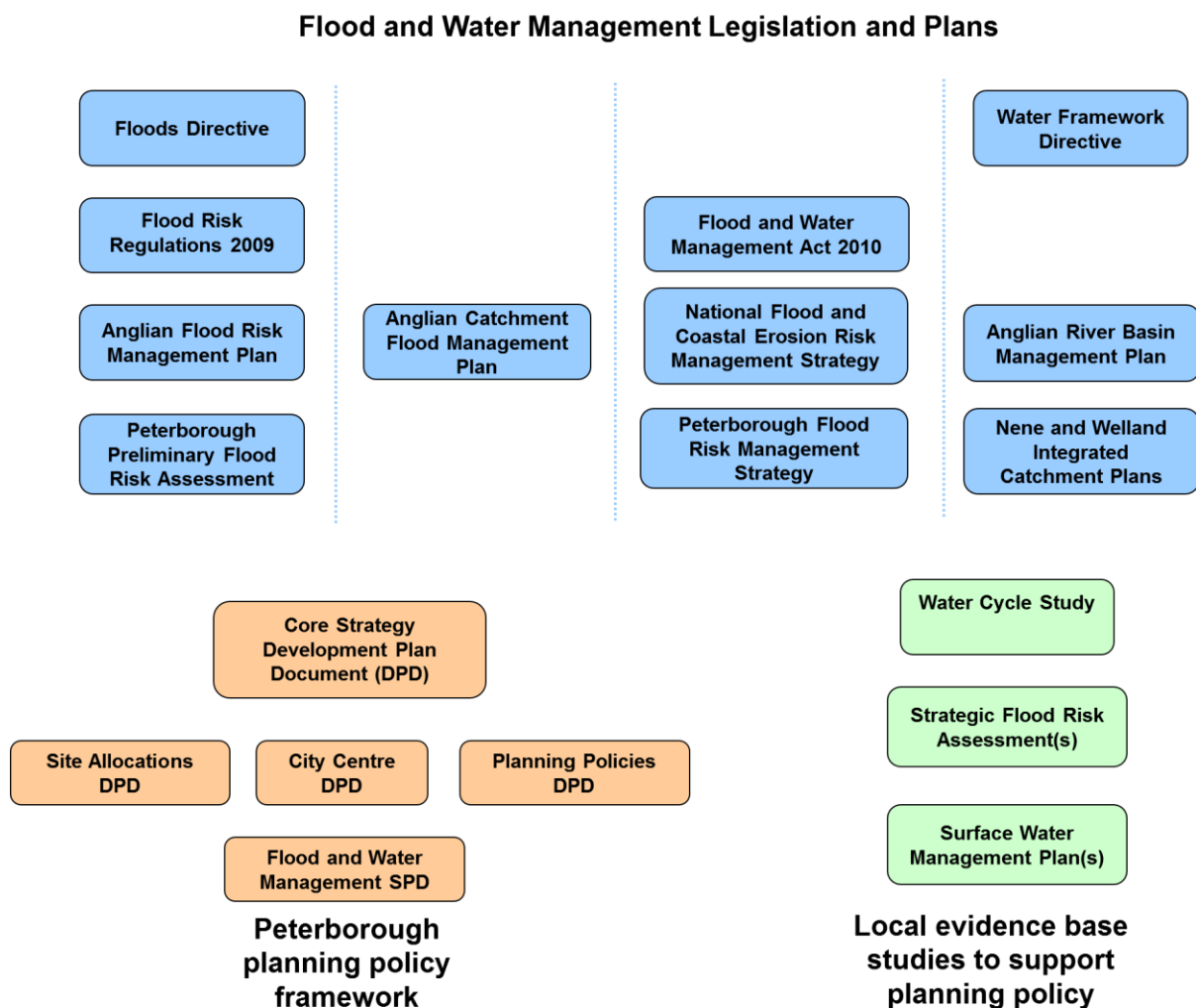


Figure 3-1: Legislation, strategies, policies and plans affecting flood risk management

3.2. European context

The Floods Directive

- 3.2.1. The EU Floods Directive - 2007/60/EC came into force due to a need for European Union countries (member states) to better understand and gather accurate data about the risks from surface water flooding. In the UK the Directive came into force via the Flood Risk Regulations 2009 which in turn sets the requirement for Preliminary Flood Risk Assessments (PFRA) and Flood Risk Management Plans to be produced. The Peterborough PFRA and the Anglian Flood Risk Management Plan are discussed below under the heading on local background.

The Water Framework Directive

- 3.2.2. The Water Framework Directive – 2000/60/EC (WFD) is a piece of EU legislation that came into force in December 2000 and was enacted into UK law in December 2003. The legislation requires member states to make plans to protect and improve the water environment. It applies to all surface freshwater bodies, including lakes, streams, rivers and canals as well as estuaries; groundwater; and coastal waters out to one mile from low water. There are four main aims of the WFD which are to:

- a) improve and protect inland and coastal waters
- b) promote sustainable use of water as a natural resource
- c) create better habitats for wildlife that lives in and around water
- d) create a better quality of life for everyone

- 3.2.3. The Directive requires European Union member states to:

- a) prevent deterioration in the status of aquatic ecosystems, protect them and improve the condition of water for ecology
- b) protect deterioration in the status of aquatic ecosystems, protect them and improve the condition of waters for ecology
- c) aim to achieve a defined standard termed 'good ecological status' for all water bodies by 2015. If a water body has good ecological status it means that it has biological, chemical and structural characteristics similar to those expected under natural conditions. Where it is not possible to achieve this by 2015, and subject to criteria set out in the Directive, the aim is to achieve good ecological status by 2021 or 2027;
- d) promote sustainable use of water as a natural resource;
- e) conserve habitats and species that depend directly on water;
- f) progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- g) progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants;
- h) contribute to mitigating the effects of floods or droughts.
- i) meet the requirements of the Water Framework Directive Protected Areas.

- 3.2.4. River Basin Management Plans produced by the Environment Agency (see section 3.4.6) detail the pressures facing the water environment and what actions need to be taken in order for the WFD to be met in each area.

3.3. National context

Flood and Water Management Act 2010

- 3.3.1. The FWMA 2010 takes forward some of the proposals in three water strategy documents previously published by the UK Government: Future Water, 2008; Making space for water, 2005 and the UK Government’s response to Sir Michael Pitt’s Review of the Summer 2007 Floods, 2008.
- 3.3.2. The FWMA 2010 makes many changes to the way that flood risk is managed in the UK. Some of the most significant changes are set out below:
- i. Development of a national flood and coastal risk erosion management strategy and the need to act consistently with it.
 - ii. Giving the responsibility for co-ordinating management of flooding from surface runoff, ordinary watercourses and groundwater to lead local flood authorities (unitary and county councils)
 - iii. Development of local flood risk management strategies and the need to act consistently with these.
 - iv. The ability for risk management authorities to designate structures and features that affect flooding.
 - v. A strengthening of the need for landowners to gain consent to carry out works on or near a watercourse.
 - vi. New arrangements for reservoir safety based on risk rather than size of the reservoir.
 - vii. Updates to the Regional Flood Defence Committee to make them Regional Flood and Coastal Committees.
 - viii. A duty for authorities to co-operate and provide information.
 - ix. A requirement for authorities to contribute towards sustainable development when exercising their flood risk management functions.
- 3.3.3. The FWMA also contains an intention to establish a sustainable drainage systems approval body (SAB) to approve and adopt proposed sustainable drainage systems (SuDS) in new and re-developments. However this is now not expected to be brought into force. The Government have instead strengthened national planning policy to make more of the requirements for sustainable drainage systems to be used in developments (see section 3.3.10). This became applicable from April 2015.

Other Legislation

- 3.3.4. Table 3-1 below lists some of the other key legislation that drives water and flood risk management actions and the roles and responsibilities of different organisations:

Table 3-1: Other water related legislation

Acts	Subject Matter
Environment Act 1995	Establishment of the Environment Agency and transfer of powers from the National Rivers Authority (predecessor to the Agency)
Land Drainage Act 1991	The powers and responsibilities of local authorities, Internal Drainage Boards (IDBs) and riverside

	landowners.
Water Industry Act 1991	Supply of water and sewerage services
Water Resources Act 1991	The powers and responsibilities of the National River Authority
Water Act 1989	Establishment of water companies and of the National Rivers Authority (predecessor to the Environment Agency)
Highways Act 1980	Management and operation of the road network (including surface water drainage)

National Flood and Coastal Erosion Risk Management Strategy

3.3.5. Local flood risk management strategies must be consistent with the National Flood and Coastal Erosion Risk Management Strategy for England (the National Strategy) which was approved in July 2011 by Parliament. The National Strategy aims to ensure the risk of flooding and coastal erosion is properly managed by using the full range of options in a co-ordinated way. In order to deliver this it sets three objectives for communities, individual, voluntary groups and private and public sector organisations, and five objectives for Government to deliver. The former, which the FMS should deliver are set out below.

- i. Manage the risk to people and their property.
- ii. Facilitate decision-making and action at the appropriate level whether this is individual, community, local authority, river catchment, coastal cell or national.
- iii. Achieve environmental, social and economic benefits, consistent with the principles of sustainable development.

3.3.6. The National Strategy highlights that flood management may mean that difficult decisions have to be taken on where risk management activities can and cannot be carried out at both national and local levels. These decisions and the processes by which they are taken should be based on a clear set of high-level guiding principles:

- a) Community focus and partnership working
- b) A catchment and coastal 'cell' based approach
- c) Sustainability
- d) Proportionate, risk-based approaches
- e) Multiple benefits
- f) Beneficiaries should be encouraged to invest in risk management

National Planning Policy Framework – flood risk

3.3.7. Section 10 of the National Planning Policy Framework (NPPF) sets out the government's intention that planning should proactively help mitigation of, and adaptation to, climate change including management of water and flood risk.

3.3.8. The NPPF aims to *"ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall."*

- 3.3.9. The NPPF states that both Local Plans and planning applications decisions should ensure that flood risk is not increased and that development should only be considered appropriate in flood risk areas where it can be demonstrated that:
- a) a site specific flood risk assessment has been undertaken which follows the Sequential Test, and if required, the Exception Test; and
 - b) within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and
 - c) development is appropriately flood resilient and resistant, including safe access and escape routes where required; and
 - d) that any residual risk can be safely managed, including by emergency planning; and
 - e) the site gives priority to the use of sustainable drainage systems
- 3.3.10. Government has produced technical guidance to the NPPF which covers flood risk. This is a web-based resource titled *Planning Practice Guidance – Flood Risk and Coastal Change* which discusses how to select sites for development and the type of information that needs to be submitted with a planning application.¹
- 3.3.11. Paragraphs 051 and 079-086 of the guide (updated March and April 2015 respectively) specifically explain the requirement for use of sustainable drainage systems (SuDS) in new and re-developments. The associated technical standards published by Defra set out the minimum requirements in terms of what is deemed to be reasonably practical.² To aid interpretation of the guidance and help developers to achieve the standards the Local Authority SuDS Officer Organisation (LASOO) has also developed a best practise guide.³

National Planning Policy Framework – other

- 3.3.12. The NPPF contains policy on many other factors other than flood risk that can affect the way that flood risk management is carried out. Examples which are very relevant to Peterborough's landscape are biodiversity and heritage policies. Section 11 (paragraphs 109 to 125) address the need to conserve and enhance the natural environment while section 12 (paragraphs 126 to 140) addresses the historic environment. The city council has more detailed policies in its Local Plan and while these are not detailed in this document, they will need to be considered for projects coming forward.

3.4. River basin and catchment focused flood risk and water management

- 3.4.1. Water doesn't flow according to political boundaries. Each river and its tributaries form a catchment area in which water is expected to ultimately flow into the named river. Understanding the management of flood risk across catchments is essential to ensure that flood risk is managed effectively without the creation of unintended downstream impacts. When larger catchments are grouped together this is known as a river basin. Peterborough is part of the Anglian River Basin District.

¹ Planning Practise Guide – Flood Risk and Coastal Change
<http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/> (2015)

² Non-statutory technical standards for sustainable drainage systems
<https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards> (2015)

³ Non-statutory technical standards for sustainable drainage systems – Best Practise Guidance (To be published during 2015)

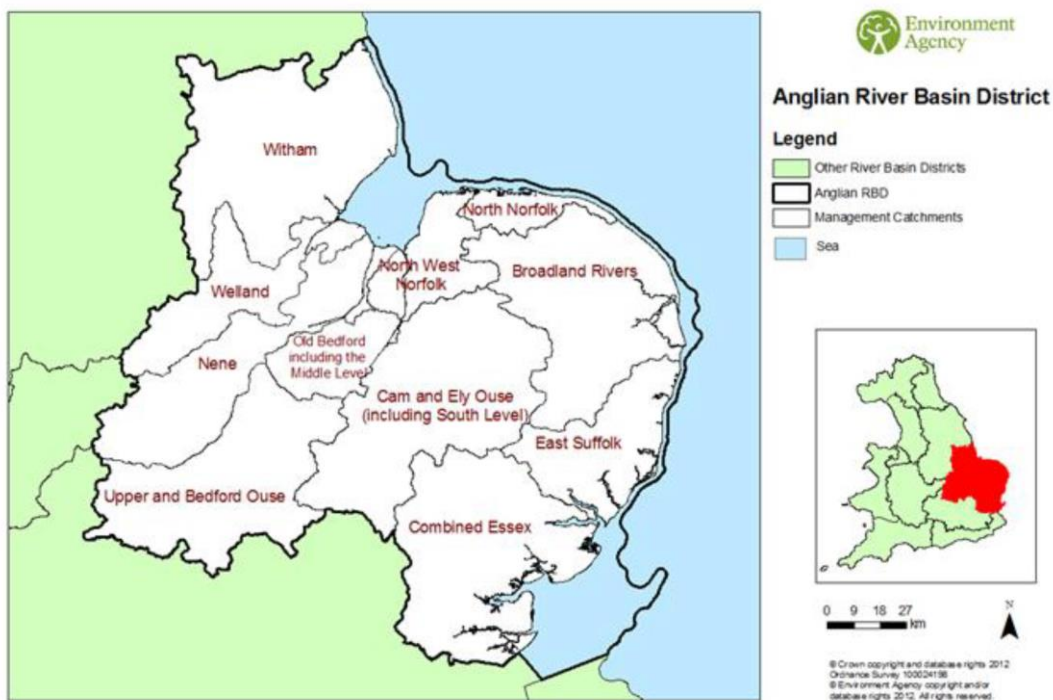


Figure 3-2: The Anglian River Basin District and its river catchments

Nene, Welland and Great Ouse Catchment Flood Risk Management Plans

- 3.4.2. In 2009 the Environment Agency completed Catchment Flood Management Plans (CFMPs) for each of Peterborough’s river catchments. Within each river catchment areas were broken down for management’s sake into policy units, where each unit represents similar types of flood risk in terms of the mechanisms of flooding, the level of risk and the type of receptor (people, environment etc). Each unit was assigned a policy to guide management in the area. The same policy covered all parts of Peterborough within the Nene, Welland and Great Ouse catchments:

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

- 3.4.3. Since preparation of the CFMPs the Great Ouse Catchment has been split down into smaller catchments for easier management. These are known as Upper and Bedford Ouse, Cam and Ely Ouse (including the South Level), North West Norfolk, and Old Bedford (including the Middle Level). South east Peterborough falls into the latter of these named catchments.

Anglian Flood Risk Management Plan

- 3.4.4. The Flood Risk Regulations implement the Floods Directive, and require the preparation and publication of Flood Risk Management Plans (FRMPs) by December 2015. The Environment Agency must prepare FRMPs covering flooding from Main Rivers, the sea and reservoirs.⁴ These will draw on the relevant CFMPs

⁴ LLFAs in identified Flood Risk Areas must also prepare FRMPs but covering only ‘local’ sources of flooding. Peterborough is not part of a Flood Risk Area, so does not need to prepare a FRMP under

covering Peterborough, to develop the FRMP. The Anglian Flood Risk Management Plan will be a river basin district level plan which highlights flood risk across the district and identifies the types of measures which need to be undertaken. The plan will enable effective co-ordination across catchments and better co-ordination with river basin management planning in support of Defra's Catchment Based Approach⁵. The Environment Agency will use FRMPs to inform investment in flood risk management.

- 3.4.5. The Anglian FRMP is being prepared on very similar timescales to the FMS and hence the two are being written in alignment. The Anglian FRMP will include local flood risk management, on a voluntary basis, while the FMS will also include flooding from Main Rivers, the sea and reservoirs. The FMS will complement the Anglian FRMP and provide a more local context to flood risk management.

Anglian River Basin Management Plan

- 3.4.6. The Environment Agency also produces plans for each river basin district to cover other elements of water management, such as water resources and protection of the water environment. The Anglian River Basin Management Plan (Anglian RBMP) is being updated on the same timescales as the Anglian Flood Risk Management Plan.
- 3.4.7. One of the aims of the Anglian RBMP is to deliver the improvements required by the European Water Framework Directive (section 3.2.2). This Directive applies to all water bodies. Ensuring that flood risk management abides by the requirements is a key part of delivering the third objective of England's National Flood and Coastal Erosion Risk Management Strategy.

the Flood Risk Regulations. However it still needs to prepare a local flood risk management strategy under the FWMA 2010.

⁵ <https://www.gov.uk/government/publications/catchment-based-approach-improving-the-quality-of-our-water-environment>

Nene and Welland integrated catchment management plans

- 3.4.8. Integrated catchment management plans have been developed for the non-tidal stretches of the Welland and the Nene to provide more detail on how the actions from the Anglian RBMP and Water Framework Directive can be delivered. These actions are joined by equally important actions to improve the watercourse and our enjoyment of it in a wider sense. For example this could be by improving amenity value for visitors, facilities for boaters and fisherman and bringing communities together to encourage them to help protect and maintain their local water environment.
- 3.4.9. The plan for the Welland, known as the Welland Improvement Plan was finalised in 2013 by the Welland Valley Partnership (see section 6.11) and brings together the work and aspirations of many people and organisations, setting an agenda for the actions needed to enhance the River. Delivery of the projects from the plan is underway and ones linked to Peterborough are referenced in Chapter 10 and the [Action Plan](#).
- 3.4.10. The River Nene Regional Partnership (see section 6.12) co-ordinated the development of an integrated catchment management plan for the Nene which contains a significant number of Peterborough-based projects. Not all of these will be discussed in the FMS due to some being more about green infrastructure and less about flood risk. Projects identified in the River Nene plan aim to bring about as many different benefits as possible across the full scope of water management work. The Nene Catchment Partnership, hosted by the RNRP, will now look to co-ordinate delivery of the opportunities identified in the Nene Integrated Catchment Management Plan.

3.5. Local context

Peterborough Water Cycle Study (2010)

- 3.5.1. The detailed Water Cycle Study for Peterborough (2010) sets out a range of recommendations for growing Peterborough in a way that ensures the right water infrastructure can be in place to support development.

Peterborough Strategic Flood Risk Assessment(s)

- 3.5.2. A Strategic Flood Risk Assessment (SFRA) provides the essential information on flood risk, allowing local planning authorities to understand the risk across the authority area. SFRAs produced for Peterborough are available online on the city council's web library of water management documents⁶. The SFRA Level 2 provides breach and hazard mapping information for Peterborough that may be useful to developers in undertaking site specific flood risk assessments (FRAs).

Peterborough Preliminary Flood Risk Assessment (2011)

- 3.5.3. The Peterborough Preliminary Flood Risk Assessment (PFRA) is a statutory document completed under the European Floods Directive. The PFRA process is aimed at providing a high level overview of flood risk from local flood sources, including surface runoff, groundwater, ordinary watercourses and public sewers. It is not concerned with flooding from Main Rivers or the sea. The Peterborough PFRA report of June 2011 confirms (based on the evidence collected) that there is

⁶ <http://www.peterborough.gov.uk/waterdocuments>

no 'Flood Risk Area' of national significance within Peterborough's administrative area. However, the PFRA recognises that there are areas of flood risk with local significance that need further exploration.

Peterborough Green Grid Strategy

3.5.4. The Green Grid Strategy draws up a framework and action plan for green space provision throughout the Peterborough area. The work was undertaken by a partnership formed from a number of environmental organisations alongside Peterborough City Council and Cambridgeshire County Council. The aim of the strategy is to ensure that Peterborough's growth goes hand in hand with the protection and provision of quality green infrastructure. The strategy's objectives relate to improving the quality of life within the region; contributing to sustainable water management, enhancing opportunities for visitors and tourism and delivering high quality sustainable development. A large number of the schemes put forward in the action plan relate to river corridor improvements which would benefit the water environment as well as the surrounding landscapes.

Local planning policy

3.5.5. The city council's local planning policy includes those documents listed in table 3-2. Relevant flood and water management policies are listed alongside.

Table 3-2: Peterborough planning policy documents

Policy document	Adoption date	Role	Flood and water management policies
Core Strategy Development Plan Document	2011	Sets the type and amount of development that will be accommodated in Peterborough up until 2026	CS12 – Infrastructure CS22 – Flood risk
Site Allocations Development Plan Document	2011	Identifies sites for development to meet the vision of the Core Strategy.	-
Planning Policies Development Plan Document	2012	Provides detailed policy to assist in the determination of planning applications.	PP16 – Landscaping and biodiversity implications of development PP20 – Development on land affected by contamination
City Centre Development Plan Document	Expected late 2014	Identifies sites for development and regeneration specifically within the city centre area.	Section 4.9
Flood and Water Management Supplementary Planning Document	2012	Provides detailed guidance about flood risk, drainage and how development can affect the water environment	Whole document

4. Delivering Wider Benefits

4.1. Introduction

- 4.1.1. The National Strategy requires the FMS to deliver environmental, social and economic benefits through taking an approach that is sustainable, uses community and partnership working, is catchment based and that delivers multiple benefits. This chapter explains why this is important and how we will ensure that this happens.
- 4.1.2. Delivering multiple benefits means that when a flood risk management scheme is designed, for example to protect homes, it should also bring forward other improvements. This could include, for example the creation of new green infrastructure such as riverside paths or recreational facilities, improved habitat for biodiversity or improvements in water quality. As well as improving social aspects and local facilities for Peterborough's communities, tourism can also be increased by the creation of new amenities or the protection of heritage assets such as historic buildings or monuments. Flood risk schemes can also bring very significant economic benefits in the form of enabling development in areas where it would not previously have been possible.
- 4.1.3. Another reason for delivering multiple benefits is the ability to attract different funding streams. Some funding streams will only fund projects that deliver environmental benefits and others want to see benefits in the form of new homes and businesses being built. Chapter 9 of this report explains the different funding streams used to finance projects.



Figure 4-1: Pond dipping education at Ferry Meadows, Peterborough.

Figure 4-2: Boating and cycle opportunities, Peterborough

Images courtesy of Chris Porsz and Nene Park Trust.

4.2. Benefits of improved green space and water environments

- 4.2.1. The provision of green space (green infrastructure) in and around urban areas is now widely recognised as being an important factor in creating places where people want to live and work. Green infrastructure, including integrated water environments, provides benefits to our physical and mental health, our quality of life, recreation and tourism, economic regeneration and house prices, flood risk and water quality management, and our ability to adapt to climate change and the

impacts of severe weather. Natural England provides a useful reference guide explaining and promoting green infrastructure and its benefits.⁷

River and canals and their banks are included within the definition of green infrastructure as well as many other forms of green spaces such as parks, gardens, play areas, allotments, cycle routes, woodland and churchyards.

- 4.2.2. The provision of green infrastructure is also directly related to flood risk because land that is not developed and has a permeable surface can act to both store water and allow it to infiltrate naturally into the ground. Since plants and permeable ground also filter water as it passes through them green infrastructure also provides significant water quality benefits. These elements form part of the intentions of sustainable drainage systems which are discussed in section (4.3).
- 4.2.3. Having an understanding of the benefits that green infrastructure and our environment as a whole can provide helps to ensure that any projects deliver as many benefits as possible for the local community. In Peterborough the Green Grid Strategy (discussed in section 3.5.4) sets out projects that the city would like to achieve. These projects have been compared with those in the FMS [Action Plan](#) and where projects overlap or are located near to each other, work will be undertaken to either bring the projects together or try to ensure that each helps to deliver the other's objectives

The Forestry Commission and Natural England have both carried out studies to calculate the quantitative benefits of green space⁷⁸. An example from Natural England's 2014 report is provided below:

A single large tree can transpire 450 litres of water per day, making urban trees an effective way of reducing temperatures. Street trees and green roofs can reduce runoff by 50% in the immediate area.

4.3. Sustainable drainage systems (SuDS)

- 4.3.1. One method by which the city council encourages the achievement of multiple environmental benefits is through the use of sustainable drainage systems. These are a collection of techniques and components that manage surface water by taking into account water quantity (flooding), water quality (pollution) and amenity and biodiversity issues.
- 4.3.2. SuDS mimic nature and typically manage rainfall close to where it falls. The benefits of SuDS over traditional drainage methods are:
- i. Management of runoff volumes and flow rates from hard surfaces, reducing the impact of urbanisation on flooding
 - ii. Reduction of pollution in the runoff and hence protection or enhancement of water quality
 - iii. Protection of natural flow regimes in watercourses
 - iv. Provision of habitat for wildlife

⁷ Natural England. (2009). *Green Infrastructure Guidance*.

⁸ Forestry Commission. (2012). *Research Report: Economic Benefits of Greenspace*

⁹ Natural England. (2014). *Microeconomic Evidence for the Benefits of Investment in the Environment*.

- v. Opportunities for evapotranspiration from vegetation and the surface (reduction in quantity of surface water)
 - vi. They can be designed to be sympathetic to the environment and the needs of the local community
 - vii. Good SuDS create better places to live, work and play through safer and more aesthetically pleasing communities with better access to green infrastructure provision.
- 4.3.3. Further information is available about the different types of SuDS components and what they can do from the city council's SuDS website¹⁰.
- 4.3.4. Figure 4-3 illustrate an example of a swale being used for enjoyment by school children as part of wider use of open spaces (green infrastructure). A swale is a planted shallow SuDS feature which conveys water and also allows infiltration.



Figure 4-3: "Dancing in the swale – Red Hill School Worcester (Bob Bray, 2011)"

4.4. The need for a catchment based approach

- 4.4.1. The water environment is affected by every activity that takes place on land as well as through our actions of abstracting, using and returning water to rivers, the sea and the ground. River catchments are the natural scale to consider this aspect of the environment as within this area activities will have interlinked impacts. Coordinated action is desirable not only when managing flood risk but also when trying to address the significant pressures placed on the water environment e.g. by diffuse pollution from agricultural and urban sources or the widespread, historical alteration of channel form.
- 4.4.2. The Government promotes a catchment based approach, encouraging community involvement and partnership working to deliver river improvement schemes. The Department for Food, the Environment and Rural Affairs (Defra) has set out its objectives for a catchment based approach as:
- i. To deliver positive and sustained outcomes for the water environment by promoting a better understanding of the environment at a local level; and
 - ii. To encourage local collaboration and more transparent decision-making when both planning and delivering activities to improve the water environment.

¹⁰ www.peterborough-suds.org.uk

- 4.4.3. Peterborough will endeavour to use this approach wherever possible when delivering flood risk schemes in order to create as many other benefits from the schemes as possible. Wherever appropriate, delivery of projects will be in partnership with or co-ordinated with the Welland Valley Partnership or River Nene Regional Park and their relevant catchment management plans (sections 3.4.8, 6.11 and 6.12).

4.5. Assessing and mitigating environmental impacts

As well as considering extra benefits that can be delivered it is crucial to consider what impacts or negative effects schemes could have and how these could be mitigated. In Peterborough the scope for flood risk management actions to impact on the environment is significant. The proposed actions in the **Action Plan** are intended to bring about improvements to and increased protection for Peterborough's landscapes and aquatic environments. However, with the requirements of the Water Framework Directive and the existence of a number of nationally and internationally designated biodiversity sites and a wide range of nationally significant heritage assets in the area, it is prudent to undertake thorough environmental assessment of any actions suggested. An example of a relevant consideration in Peterborough could be how a flood risk scheme or development affects the wider hydrology, especially if it is to take place in an area where heritage assets are currently preserved in a waterlogged and water dependent environment.

- 4.5.1. Therefore for the FMS, the Strategic Environmental Assessment (SEA) process is being followed in line with the requirements of the European Union Directive 2001/42/EC (SEA Directive). Assessment of whether the strategy and its actions meets the requirements of the Water Framework Directive assessment and the Habitats Regulations Assessment is also being undertaken and will be incorporated into the SEA.
- 4.5.2. The Environment Agency have also carried out SEA for the Anglian Flood Risk Management Plan (FRMP). This will consider cumulative impacts but will be undertaken at a high level with any very preliminary measures and actions (i.e. those recommending further study) scoped out. It has been agreed with the Environment Agency that the SEA for the FMS will not assess new Environment Agency-led schemes as these will be picked up by the FRMP SEA. The FMS SEA will however need to consider cumulative impacts with schemes that are already published in the Environment Agency's Medium Term Plan, such as those that were proposed in the CFMPs.

5. Objectives

- 5.1.1. The objectives of Peterborough's FMS are set out in table 5-1. The objectives were developed from a workshop with the Peterborough Flood and Water Management Partnership (section 6.8) where each organisation was asked what themes and outcomes they wanted to see delivered by the FMS. These objectives shape the content and intentions of the FMS.
- 5.1.2. The FMS is required to be consistent with the National Strategy. The alignment between the FMS objectives and the National Strategy objectives (section 3.3.3) and guiding principles (section 3.3.4) is therefore shown in table 5-1.

Table 5-1: Objectives and their consistency with the National Strategy.

FMS Objectives		Consistency with National Strategy objectives	To be delivered using National Strategy guiding principles
1	Improve awareness and understanding of flood risk and its management to ensure that the city council, partner organisations, stakeholders, residents, communities and businesses can make informed decisions and can take their own action to become more resilient to risk.	(i) Manage risk (ii) Facilitate decision-making and action at the appropriate level (iii) Environmental, social and economic benefits	a) Community and partnerships f) Beneficiaries encouraged to invest
2	Establish efficient co-ordinated partnership approaches to flood and water management and response and recovery, including sharing and seeking new resources together.	(i) Manage risk (ii) Facilitate decision-making and action at the appropriate level (iii) Environmental, social and economic benefits	a) Community and partnerships b) Catchment based approach c) Sustainability e) Multiple benefits
3	Reduce flood risk to prioritised areas and strategic infrastructure, ensuring that standards of protection elsewhere are maintained.	(i) Manage risk	c) Sustainability d) Proportionate and risk-based e) Beneficiaries encouraged to invest
4	Improving the wider sustainability of Peterborough; ensuring an integrated catchment approach and proper consideration of the water environment and its benefits in new and existing urban and rural landscapes.	(iii) Environmental, social and economic benefits	a) Community and partnerships b) Catchment based approach c) Sustainability d) Proportionate and risk-based e) Multiple benefits f) Beneficiaries encouraged to invest

- 5.1.3. In later chapters proposed actions and management approaches are related back to the FMS objectives to show how these will be met.

6. Roles and Responsibilities

6.1. Organisations involved in flood risk management

6.1.1. There are a number of different organisations, authorities and individuals involved in flood risk management in Peterborough. At the end of the chapter figure 6-1 provides a quick reference guide for some of the main flood related issues that may be experienced. The principal management organisations are also discussed in this chapter, setting out what their roles and responsibilities are. A brief paragraph is also included on where the organisation’s funding comes from. Funding for flood risk management schemes in Peterborough is dealt with in more detail in Chapter 9.

6.1.2. The organisations discussed in sections 6.2 to 6.6 are defined by the FWMA 2010 as ‘risk management authorities’ (RMAs) with responsibilities relating to the FMS. These are set out in table 6-1. All RMAs must also act in a manner which is consistent with the National Strategy and guidance. The other organisations discussed in this chapter have no formal duty in these respects.

Table 6-1: Risk management authorities as defined by the FWMA 2010 and the legislation under which they carry out their flood risk management functions

Organisation	Defined as an RMA (FWMA 2010 section 6)	Legislation under which flood risk management functions may be exercised (FWMA 2010, section 4)	Duty relating to the FMS (FMW Act 2010 sections 9,11)
Peterborough City Council (as LLFA and a highways authority)	Yes	<ul style="list-style-type: none"> FWMA 2010 Flood Risk Regulations 2009 Land Drainage Act 1991 Highways Act 1980 	<ul style="list-style-type: none"> Develop, maintain, apply and monitor Consult the other RMAs Act in a manner consistent with the FMS and related guidance
The Environment Agency	Yes	<ul style="list-style-type: none"> FWMA 2010 Flood Risk Regulations 2009 Water Resources Act 1991 Land Drainage Act 1991 	<ul style="list-style-type: none"> Act in a manner consistent with the FMS and related guidance¹¹
Internal Drainage Boards	Yes	<ul style="list-style-type: none"> FWMA 2010 Land Drainage Act 1991 	
Highways England (as a highway authority)	Yes	<ul style="list-style-type: none"> FWMA 2010 Highways Act 1980 	
Anglian Water (as water company)	Yes	<ul style="list-style-type: none"> FWMA 2010 Water Resources Act 1991 Water Industry Act 1991 	<ul style="list-style-type: none"> Have regard to the FMS and guidance

¹¹ When delivering their flood risk management functions as defined by section 4 (2) of the FWMA 2010.

6.2. Peterborough City Council

As a Drainage Authority

6.2.1. Peterborough City Council has been a drainage authority for many years under the Land Drainage Act 1991. This gives the city council various powers relating to flood prevention, maintaining flows in watercourses and the making of byelaws¹². In many cases the powers and duties given to the city council have now been superseded by the FWMA 2010.

As a Lead Local Flood Authority

6.2.2. Under the FWMA 2010 Peterborough City Council, along with other unitary and county councils, became a LLFA with responsibility for co-ordinating the management of flood risk from surface runoff, ordinary watercourses and groundwater. Under this Act the city council also has the following new responsibilities, as set out in table 6-2.

Table 6-2: The powers and duties given to LLFAs by the FWMA 2010

Change	Notes	Power or duty?	Paragraph of Act
Local Flood Risk Management Strategy	LLFAs are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area.	Duty	9
Duty to co-operate	All relevant authorities must co-operate with other relevant authorities in the exercise of their flood and coastal risk erosion management functions.	Duty	13 and 14 (4)
Power to delegate	A RMA may arrange for another flood risk management function, except for delivery of the local flood risk management strategy, to be exercised on its behalf by another RMA or a navigation authority.	Power	13 (4)
Power to request information	An LLFA and the EA may request information in connection with their flood risk management functions	Power	14
Investigating flood incidents	LLFAs have a duty to investigate flooding incidents within their area, to the extent that the LLFA considers it necessary or appropriate	Duty	19
Asset Register	LLFAs have a duty to maintain a register of structures or features which are considered to have a significant effect on flood risk and records of details about those structures, including ownership and condition as a minimum. The register must be	Duty	21

¹² Peterborough City Council's byelaws are available at: <https://www.peterborough.gov.uk/council/planning-and-development/flood-and-water-management/works-near-a-watercourse/>

	available for inspection.		
Contribution towards sustainable development	In exercising a flood risk management function LLFAs, IDBs and Highways England must aim to make a contribution towards the achievement of sustainable development.	Duty	27
Designation powers	LLFAs, as well as the Environment Agency and Internal Drainage Boards, have powers to designate structures and features that affect flooding or coastal erosion in order to safeguard assets that are relied upon for flood or coastal erosion risk management.	Power	30 and Schedule 1
Works powers	LLFAs have powers to undertake works to manage flood risk from surface runoff, groundwater or ordinary watercourse.	Power	31 and Schedule 2, section 29. Amends Land Drainage Act 1991 section 14.
Consents for works to ordinary watercourses	Consent is required from the LLFA before works can be carried out on a watercourse that is not a Main River.	Duty	31 and Schedule 2, section 32 Amends Land Drainage Act 1991 section 23.
Overview and Scrutiny	Include arrangements to review and scrutinise the exercise by risk management authorities of flood risk management functions which affect the LLFAs area.	Duty	31 and Schedule 2, section 54. Amends section 21 of the Local Government Act 2000
Incidental flooding	LLFAs and IDBs can carry out works that cause incidental flooding or increases in the amount of water below the ground if the works satisfy four conditions. Condition 1 – work in interest of nature conservation, cultural heritage or people’s enjoyment of the environment. 2 – Benefits outweigh harmful consequences. 3 – The EA have been consulted and if applicable agreed. 4 - Other local authorities affected and	Power	39

	owners and occupiers of land have been consulted.		
SuDS Approving Body (SAB)	This section of the Act, specifying that LLFAs would approve, adopt and maintain any new drainage systems, was not brought in to force. Table 6-3 details the Government’s preferred alternative approach.	N/A	32 and Schedule 3

6.2.3. In April 2015 an amendment was made to the Town and Country Planning Act 1990 to bring in a planning related duty for LLFAs. This was done through issuing the Town and Country Planning (Development Management Procedure) (England) Order 2015.

Table 6-3: The duty given to LLFAs under changes to the Town and Country Planning Act

Change	Notes	Power or duty?	Paragraph of Act (as amended)
Statutory consultee for major development¹³ applications	LLFAs are to be consulted, by planning authorities, on the management of surface water on major development sites (those of 10 dwellings or more; or equivalent non-residential or mixed development)	Duty	18 and Schedule 4

As a Planning Authority

6.2.4. Under the Town and Country Planning Act 1990 the city council, as a local planning authority (LPA) has a responsibility to ensure new developments are designed in a way that protects them from flooding and to ensure that the developments do not increase flooding downstream.

6.2.5. For the management of surface water the city council is specifically expected to ensure that sustainable drainage systems are put in place in major developments, be satisfied that proposed minimum standards are met and ensure that there are clear arrangements in place for ongoing maintenance over the lifetime of the development. This should be carried out through the use of local planning policies and decisions on planning applications.

6.2.6. Since the city council is also a Lead Local Flood Authority, and has been a Drainage Authority for some years, it has a drainage and flood risk team that can fulfil the new planning related requirements for LPAs and LLFAs.

As an Emergency Responder

6.2.7. Under the Civil Contingencies Act 2004 Peterborough City Council is a Category One Emergency Responder. The city council's role is principally about recovery after an event but the following actions are undertaken:

¹³ Major development is development of 10 dwellings or more; equivalent non-residential or mixed development, as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010.

- i. Informing and warning activities
- ii. Co-operating with other emergency responders
- iii. Providing rest centres
- iv. Helping to rehabilitate people after an incident

As a Highways Authority

- 6.2.8. Under the Highways Act 1980 Peterborough City Council is classed as a Highway Authority and is responsible for the management of highways including drainage. The city council adopts and manages the majority of Peterborough's highways and footpaths although it is not technically the landowner for them. Some highways are privately owned and managed, and others (the A1 and A47) are managed by Highways England as part of the national network.
- 6.2.9. Highway drainage systems are for the primary purpose of accepting surface water runoff from roads and carriageways and the authority's duties include the need to minimise flooding to roads that could in turn lead to a breakdown of the network. Ensuring that the network can function as a whole is the priority; small scale flooding in specific locations may be less of an issue if there are alternative routes that traffic can take.
- 6.2.10. The design of highways and their drainage is now adapting to better fit with the drive for more sustainable drainage systems. When the city council adopts highways under S38 of the Highways Act 1990, it will now seek to also adopt SuDS to drain the highway.

Funding

- 6.2.11. Peterborough City Council's funding comes from a variety of places. Government provides the most significant input in terms of grants. Unlike in the past these funds are often now not ring-fenced for any specific purpose and have to be allocated according to need. The city council also collects a percentage of its income from Council Tax. Aside from these the city council can borrow funds, generate income from selling assets or submit project specific bids to Government agencies or other funding bodies.

6.3. Highways England

Formerly an executive agency of the Department of Transport, known as the Highways Agency, Highways England became a government-owned company on 1st April 2015. Highways England is responsible for operating, maintaining and improving the strategic road network in England on behalf of the Secretary of State. The network itself is owned by central government, is some 4,300 miles long and is made up of motorways and trunk roads (the most significant 'A' roads). In Peterborough Highways England manages the A1, A1M and A47, including some but not all slip roads.

- 6.3.1. Part of Highway England's role in managing the roads is a responsibility for managing the quality and quantity of road runoff that is collected within their network. Flood risk must not be increased by new road projects and discharges of water from the highway must not cause pollution to receiving water bodies. In line with this aim a Memorandum of Understanding with the Environment Agency has been developed to support the two organisations working together. More information about Highway England's approach is available on their website.

Funding

- 6.3.2. Highways England's funding continues to come from the Department for Transport but is now based on a 5 year business plan, thus providing greater flexibility than in previous years and going some way to addressing the restrictions of the previous yearly plan. This should lead to improvements in the way they work and, although there are no plans to do so at present, in the future there may be potential to attract outside funding.

6.4. Environment Agency

- 6.4.1. The Environment Agency is a non-departmental public body and has responsibilities for protecting and enhancing the environment as a whole (air, land and water), and contributing to the government's aim of achieving sustainable development in England and Wales.
- 6.4.2. Following the FMWA, the Environment Agency was given the strategic overview role for all types of flooding. This involves advising Government, supporting LLFAs with data and guidance and managing the allocation process for capital funding. In addition to this the Agency retains its existing responsibility for the management of flood risk from Main Rivers (see section 1.1.7 for full definition), the sea and reservoirs. This includes providing advice to planning authorities on development in areas of high flood risk. The Agency does not provide advice on other sources of flood risk as this is the responsibility of the Local Planning Authority.
- 6.4.3. For designated Main Rivers and any associated designated assets, the Environment Agency has permissive powers to carry out maintenance, improvement and flood defence works. User of the powers is determined on a risk based approach. This includes being responsible, through the flood defence consenting process, for controlling works by others which could affect Main Rivers or flood defences (section 10.6.15). The Environment Agency do not, however, generally own Main Rivers and the overall responsibility for maintenance of Main Rivers (as with any other watercourse) does lie with the landowner (see section 6.13 on riparian owners).
- 6.4.4. The Environment Agency is the lead organisation responsible for coastal flood risk management and erosion, including tidal flooding and also the enforcement authority for reservoirs in England and Wales that are designated high risk and hold more than 25,000 cubic metres of water. While the safety of reservoirs is the responsibility of the owner, the Environment Agency has responsibility for enforcing safety, maintaining a register of reservoirs and ensuring that flood plans are put in place.
- 6.4.5. Alongside Local Authorities and the Emergency Services the Environment Agency is a Category One Emergency Responder under the Civil Contingencies Act 2004. Their role includes providing coastal and river flood warnings and supporting other emergency responders in the event of flooding.

Funding

- 6.4.6. The Environment Agency is a national organisation with an annual operational budget of over a £1 billion. Its funding is split across many different areas of environmental work, but approximately half is spent on flood risk management. This includes the construction of new flood defences, the maintenance of the river system and existing flood defences together with the operation of a flood warnings

system and the management of the risk of coastal erosion. The vast majority of the funding for flood defence comes directly from the Department for the Environment, Food and Rural Affairs (Defra).

6.5. Internal Drainage Boards

- 6.5.1. Over forty percent of Peterborough's land area is classified as being part of the national Fens character area. This is an artificially drained landscape and is part of the wider area of the Fens which overlaps with the local authority boundaries of Lincolnshire County Council, Norfolk County Council, Cambridgeshire County Council and Suffolk County Council. See [Appendix B](#) for further information. Land drainage authorities called IDBs were established within the Fens because of the special water level and drainage management needs existing within the area. These land drainage authorities are autonomous public bodies.
- 6.5.2. Peterborough has four land drainage authorities of this type operating within its fenland area, three classified as independent IDBs and one classified as a Commissioners. Throughout the FMS the term Internal Drainage Board (IDB) is used to refer to all four of these organisations. [Appendix C](#) provides a map of the management area of each IDB within Peterborough's boundaries.

North Level District Internal Drainage Board (NLD IDB)

- 6.5.3. NLD IDB is a land drainage authority responsible for the drainage and evacuation of surplus water from 33,000 hectares of land. The NLD IDB Board is responsible for the improvement and maintenance of some 613 kilometres of drains within the area and for the operation of 12 pumping stations.

Welland and Deepings Internal Drainage Board (W&D IDB)

- 6.5.4. Welland and Deepings IDB is responsible for supervision over all aspects of land drainage within their district (other than Main River). They have regulatory powers in and adjacent to drainage systems and undertake improvements, maintenance and operation of their flood management assets. Their area extends to some 32,400 hectares and stretches from just north of Peterborough to south of Kirton near Boston.

Whittlesey and District Internal Drainage Board

- 6.5.5. This IDB is responsible for the drainage and evacuation of surplus water from over 8,300 hectares of land. The Board is managed by the Whittlesey Consortium of IDBs. Strategic functions such as responses to planning applications and liaison with local flood risk management strategies is carried out on behalf of Whittlesey and District IDB by the Middle Level Commissioners.

Middle Level Commissioners (MLC)

- 6.5.6. The Middle Level Commissioners are a statutory body with powers and duties under general and local legislation relating to flood risk management and navigation. The Commissioners maintain an arterial system of watercourses and associated apparatus. The Commissioners act as consultants for the Whittlesey and District IDB.

Funding

- 6.5.7. Each of the aforementioned drainage authorities is funded by rates paid by the landowners in their area. This can be broken down into Drainage Rates and Special Levies. Drainage rates are paid by agricultural landowners direct to the IDB based on the area of their property. Where land in the IDB's district is not in agricultural use, the owner instead pays their levy to Peterborough City Council as part of their Council Tax. The relevant amount is then separated out from the Council Tax and paid to each IDB. This is known as a Special Levy.

6.6. Anglian Water Services Ltd

- 6.6.1. Anglian Water (AW) is the water and sewerage undertaker for the Peterborough area and has a statutory obligation to supply water and wastewater services to its customers. AW currently has the responsibility to effectually drain their area and maintain their foul, surface and combined public sewers.

Funding

- 6.6.2. Funding for water companies comes principally from water bills that residents and businesses pay. Larger investment can also come from shareholders and investors. Ofwat (the Water Services Regulation Authority) agrees the cost of water bills for each water company as part of a regular five year review process called the Periodic Review process. Periodic Review 2014 is currently underway to set the management plan for water companies for the period 2015 to 2020, also known as Asset Management Plan period 6.

6.7. Local Resilience Forum

- 6.7.1. The Cambridgeshire and Peterborough Local Resilience Forum (CPLRF) is responsible for developing multi-agency emergency management arrangements in accordance with the Civil Contingency Act, 2004 within the County of Cambridgeshire. The CPLRF covers an area of over 2000 square miles and serves a combined population of approximately 805,000 people. Membership consists of five district councils, one unitary authority (Peterborough) and Cambridgeshire County Council.
- 6.7.2. The CPLRF have identified a number of risks with Cambridgeshire which they publish within the CPLRF Risk Register. The top risks for the county include severe weather, flooding events and pandemic influenza.

6.8. Peterborough Flood and Water Management Partnership

- 6.8.1. The primary partnership arrangement covering the Peterborough area is the Peterborough Flood and Water Management Partnership (the FloW Partnership). This was originally established in 2009 under the name Peterborough Flood Risk Partnership. Its members include the organisations in sections 6.2 to 6.7. The objectives of the FloW Partnership are:
- a) Steer the production of the FMS, ensuring a holistic approach to all sources of flood risk, the different roles and aims of partners, local resilience management and the water environment.

- b) Implement in partnership the action plan of the FMS to ensure we manage the risk of flooding, improve our sub catchment data and understanding, and enable our communities to be more resilient.
- c) Enable and support delivery of projects within the Nene and Welland Integrated Catchment Plans.
- d) Influence planning policy and guidance for developments on all water management issues including reviewing and support the development of local contributing reports and plans such as Strategic Flood Risk Assessments. This includes identification and exchange of appropriate data sets in support of any activity.
- e) Support the implementation of sustainable development through the establishment and workings of the Sustainable Drainage Systems Approving Body.
- f) Coordinate high-level management and maintenance of flood risk assets, features and structures to ensure effective flood risk management.
- g) Promote the dissemination of information about flood risk, water efficiency or other relevant water topics to householders, businesses and other organisations.
- h) Take advantage of partnership funding and financing opportunities including Section 106 agreements and Community Infrastructure Levy (when introduced), preparing bids to external sources, and making the most of match and in-kind funding;
- i) Explore opportunities for collaborative research
- j) Liaise with and support the preparation of emergency plans by the Local Resilience Forum to ensure that management of incidents such as drought and flooding can be handled appropriately

6.9. Anglian Northern Regional Flood and Coastal Committee

6.9.1. Section 23 of the FWMA 2010 required that previously existing Regional Flood Defence Committee were updated and re-launched as Regional Flood and Coastal Committees (RFCCs). The purpose of the RFCCs is to bring together members appointed by LLFAs and independent members with relevant experience to:

- a) ensure there are coherent plans for identifying, communicating managing flood risk across catchments and shorelines;
- b) promote the funding of schemes that benefit local communities and represents value for money
- c) represent the whole of the Northern are regardless of local authority boundaries
- d) provide a link between the Environment Agency, LLFAs, other risk management authorities and other relevant bodies
- e) engage constructively with and offer advice to the Agency having developed its own view as to the flood and coastal risk erosion management needs within its region informed by local knowledge, contacts with other risk management authorities and engagement with risk management planning. This includes providing consent for the Agency's regional programme and agreeing changes to Local Levy rates.

6.10. Parish Councils and Volunteer Flood Wardens

6.10.1. Some parish councils and residents associations engage actively in flood risk management, appointing a local flood warden to be a main point of contact between the residents of their area, the city council and the Environment Agency. The extent

of their role is decided by the groups/individuals but often includes staying up to date with local flood risk management news; helping to gather a picture of flood risk in their area; raising awareness among their neighbours of risk and of what to do during an emergency and being the principal emergency contact during flood events.

Flood Warden case study

“As a Flood Warden I take on the responsibility of providing flood risk information to the local residents in my community. To keep up-to-date I attend meetings, events or training sessions with Peterborough City Council and the Environment Agency several times a year. I also monitor the river levels using both local measuring equipment that I helped to implement and the Agency’s River Levels Online Service. I have used this knowledge to prepare a flood plan for the whole community so that we can be prepared before, during and after a flooding event. As the primary contact for our community, the city council send me regular updates during potential flood events and the Environment Agency has provided me with an emergency kit including supplies like a torch, fleece and blanket.

In 2013 I enjoyed organising a community ‘Flood Awareness Fair’ with a number of Peterborough’s flood risk management organisations. This included arranging for property level protection companies to show their products and giving a presentation about local flood risk issues.

The greatest achievement during my time as a Flood Warden has been to get most of the properties in my community surveyed to determine their height in relation to the river level. This allowed us to calculate what level of risk the homes (rather than the gardens) were subject to. Doing this has made a real difference to the residents as we now have a Surveyor’s Certificate which can be sent to insurance companies to try and get cheaper and more realistic household insurance quotations.

All of this has been made possible by the strong working relationship that I have with our local residents group, the city council and Environment Agency.”

Tony Lambert, August 2014

6.11. Welland Valley Partnership

- 6.11.1. The Welland Valley Partnership was formed in 2011 in response to the Government’s desire to set up 10 ‘pilot catchments’ to work in partnership to improve rivers and bring about wider environmental and social benefits. The pilots were intended to *“provide a clear understanding of the issues in the catchment, involve local communities in decision making by sharing evidence, listening to their ideas, working out the priorities for action and seeking to deliver integrated actions that address local issues in a cost effective way and protect local resources”* (Richard Benyon MP, the then Minister for Natural Environment and Fisheries). Since the pilot completed, the partnership, which includes local authorities, businesses, charities and interest groups based around the River Welland catchment, has continued to attract new members and implement improvement schemes.

6.12. River Nene Regional Partnership

6.12.1. The River Nene Regional Partnership (RNRP) was originally established in 2004 to co-ordinate green infrastructure activities (planning, economic development, regeneration and leisure) in Northamptonshire and along the Nene. It is now an independent Community Interest Company which develops, enables and implement green infrastructure projects at a sub-regional level. The RNRP has produced the Nene Catchment Plan, an integrated management plan for the River Nene from its source to its tidal limit. This was also one of the Government's original ten catchment pilots.

6.13. Riverside landowners

6.13.1. A landowner with a water body (e.g. a lake or river) running through or alongside their property is known as a 'riparian owner' as they will own all or part of the water body in the absence of anything in their conveyancing documents to state otherwise. If a watercourse is the boundary to the land then a riparian owner will normally own, and therefore have maintenance responsibilities, up to the centre line of the watercourse.

6.13.2. Riparian owners' rights are modified by other duties to the community and to the environment, but in general riparian owners have rights to:

- a) protect their property from flooding
- b) protect their banks from erosion

6.13.3. In many cases consent is required from a relevant drainage authority (see section 10.6.15) for any works other than routine maintenance and cleansing (section 23 of the Land Drainage Act 1991) and from the Environment Agency for abstraction.

6.13.4. Riparian owner responsibilities include:

- a) a duty to their upstream and downstream neighbours;
- b) accepting water from an upstream neighbour and allowing it to transfer to a downstream neighbour;
- c) not causing or perpetuating a nuisance, such as causing obstruction to the flow of water. It is important that access is preserved to the banks for maintenance and safety purposes through controlling vegetation and considering appropriate locations for fencing and access tracks;
- d) ultimate responsibility in perpetuity for the water body.

6.13.5. The Environment Agency, Internal Drainage Boards and the Lead Local Flood Authority share certain powers under the Land Drainage Act 1991, for enforcing riparian responsibilities.

6.13.6. The comprehensive guidance document *Living on the Edge* has been prepared by the Environment Agency for riparian owners and can be found on the websites of both the Environment Agency and Peterborough City Council. Landowners with queries are encouraged to contact the Environment Agency, their local Internal Drainage Board or the city council.

Who to Contact Quick Reference Guide

If you notice flooding please report it as per this guide



* Responsibility can vary between several partners so if you are unclear start by contacting Peterborough City Council.

#	Structure or feature where problem is arising	Responsible organisation
1	Utilities	Your gas, electricity or sewerage supplier
2	Surface water runoff and groundwater flooding	Peterborough City Council * or on major roads Highways England
3	Rural or farmland runoff, or overtopping from smaller watercourses	Peterborough City Council *, Internal Drainage Boards
4 & 5	Main River flooding and/or obstructions	Environment Agency
6	Sandbags	Builders merchant
7	Household protection	Property owner's responsibility but the Environment Agency and/or Peterborough City Council can provide advice.
8	Flood damage cover and claims	Your insurance company
9	Internal wastewater flooding	Anglian Water
10a	Ordinary watercourses in fenland areas	Internal Drainage Boards
10b	Ordinary watercourses not in fenland areas	Peterborough City Council

Figure 6-1 and Table 6-4: A quick reference guide, not necessarily to who might be responsible for managing the flooding, but to which organisation is most likely to be able to help with flood related queries on specific subjects

7. The Risk to Peterborough

7.1. Introduction

- 7.1.1. This chapter looks at each type of flood risk that Peterborough is susceptible to and explains how the types of flooding differ, the broad distribution and level of risk in Peterborough and how to find out more. This chapter is predominantly concerned with flooding caused when the received rainfall or river flows exceeds the design capacity of the drainage and flood risk management systems.
- 7.1.2. As well as natural flood risk from weather systems flooding can happen anywhere due to operational issues such as blockages, bursting of pipes or failures of defences. It is harder to predict the likelihood, location and impacts of flooding caused by operational issues and these can only be prevented by appropriate maintenance of assets. Maintenance is discussed in chapter 10. It is important to note that flooding resulting from breaches or bursting of pipes can have a more significant impact than the gradual overtopping of watercourses or surcharging of sewers because the impacts can occur very suddenly, creating a flow of water at speed.

7.2. What is risk?

- 7.2.1. In order to understand flood risk the meaning of 'risk' needs to be clear. Risk is the likelihood of a hazard occurring multiplied by the impact of the hazard when it occurs.

$$\text{Risk} = \text{Likelihood} \times \text{Impact}$$

- 7.2.2. With flooding it is normally the likelihood of it occurring which is discussed. This likelihood is stated in terms of **annual probability**. The most commonly discussed probabilities are shown in table 7-1 below:

Table 7-1: Common flood related probabilities

Annual probability	Annual probability as a fraction	Example
3.3%	1 / 30	The largest rainfall event for which surface water sewers are designed not to flood
1%	1 / 100	A common design standard for Main Rivers defences
0.5%	1 / 200	The largest flood event for which defences on the tidal Nene are designed to defend against
0.1%	1 / 1000	The largest flood event that the banks of the Whittlesey Washes Flood Storage Reservoir are designed to contain.

- 7.2.3. In the past the likelihood of flooding has been described using the term 'return period'. This is, however, no longer standard practise as it implied that a '1 in 100' flood event would only happen once every 100 years. The probability is actually a 1 in 100 chance of the event happening every year. It could happen twice in a year, or more often.

7.3. Standards of protection for defences

- 7.3.1. In this chapter you will also find mention of standards of protection of various flood defences. The standard of protection (SoP) of a drainage system or flood defence is the level up to which it is expected to provide protection against a flood event. For example, a flood defence could be designed and built to have an SoP of 1 in 100 (1%). This means that it would provide protection against flood events that have an annual occurrence of up to 1 in 100 (1%). If larger and lower probably flood events occur, these could overtop these defences.

7.4. Differing probabilities for river flood events and heavy rainfall events

- 7.4.1. A rainfall event of annual probability 1 in 100 (1%) will not necessarily cause a river flood event of annual probability 1 in 100 (1%). The complexity of different river catchments and landscapes means that the probabilities of rainfall events and river flooding are not comparable. For example rainfall landing in a catchment can flow overland into sewers or rivers or filter through the ground to join groundwater supplies.

7.5. Rating the different types of flood risk for Peterborough

- 7.5.1. The types of flooding described in this chapter are laid out in order of the organisations responsible for co-ordinating the management.
- 7.5.2. The risk from different types of flooding varies significantly across Peterborough depending on the landscape, the proximity to watercourses, the style of local drainage system and what would be impacted by the flooding. In order to give flood and water management organisations an overall perspective of flood risk in Peterborough, each type of flooding has been rated according to the likelihood of an event occurring in Peterborough and the expected impacts. This exercise was carried out with Peterborough's water management partners using a risk matrix calculation and professional judgement to identify the economic, environmental and social impacts. The results are set out in table 7-2.
- 7.5.3. [Appendix D](#) show the categories for likelihood, impact and risk that were used for this calculation. The likelihood categories have been developed based on the Environment Agency's classification bands for flood risk. The likelihood does take flood defences into consideration. Where the annual probability of flooding from a source spans more than one band, the highest likelihood band has been represented. With the impact score this was derived based on the highest scoring impact from the impact categories.
- 7.5.4. The following risk table and this chapter do not include flooding caused by operational issues such as breaching, bursting pipes or damaged defences.
- 7.5.5. The risk from foul-only sewers is also not included in the table below. This is because the likelihood of properties in Peterborough having foul capacity issues is very low and water companies treat the resolution of these issues as high priority.

Table 7-2: Risk matrix for Peterborough

FLOOD SOURCE & DETAILS	SOURCE OF FLOODING	Sea (coastal)	Reservoir	Main river - tidal waters (Nene only)	Main river – non tidal	Combined Nene Event (during Nene tide lock with Washes full)	IDB drainage catchments	Ordinary watercourses (not in IDB areas)	Ground water	Surface runoff (including overflow from gullies and surface water sewers)	Combined sewers (foul and surface water)	Two or more sources e.g. Main River and surface water runoff
	PAGE	39	39	40	42	55	49	50	53	51	54	55
	RESPONSIBLE AUTHORITY	EA	EA	EA	EA	EA, IDB	IDB	PCC	PCC	PCC and AW	AW, PCC	EA, PCC, AW, IDB
WARDS WHERE NOTABLE AREA OF RISK EXISTS FOR THE FLOODING SOURCE	Barnack		✓				✓	✓	✓	✓		✓
	Bretton North				✓			✓	✓	✓		✓
	Bretton South							✓		✓		✓
	Central		✓		✓	✓		✓	✓	✓	✓	✓
	Dogsthorpe							✓	✓	✓		✓
	East			✓	✓	✓		✓	✓	✓		✓
	Eye & Thorney		✓	✓	✓		✓		✓	✓		✓
	Fletton & Woodston		✓		✓			✓	✓	✓	✓	✓
	Glington & Wittering		✓		✓	✓	✓	✓	✓	✓		✓
	Newborough		✓		✓		✓		✓	✓		✓
	North				✓				✓	✓		✓
	Northborough		✓		✓		✓		✓	✓		✓
	Orton Longueville		✓		✓	✓		✓	✓	✓		✓
	Orton Waterville		✓		✓	✓		✓	✓	✓		✓
	Orton with Hampton				✓			✓	✓	✓		✓
	Park							✓	✓	✓	✓	✓
	Paston				✓				✓	✓	✓	✓
	Ravensthorpe								✓	✓	✓	✓
	Stanground Central		✓		✓	✓		✓	✓	✓	✓	✓
	Stanground East							✓		✓		✓
Walton				✓			✓	✓	✓		✓	
Werrington North				✓			✓	✓	✓		✓	
Werrington South				✓			✓	✓	✓		✓	
West				✓	✓	✓	✓	✓	✓	✓	✓	

FLOOD SOURCE & DETAILS	SOURCE OF FLOODING	Sea (coastal)	Reservoir	Main River - tidal waters (Nene only)	Main River - non tidal	Combined Nene event (during Nene tide lock with Washes full)	IDB drainage catchments	Ordinary watercourse	Ground water	Surface runoff (including overflow from gullies and surface water sewers)	Combined sewers (foul and surface water)	Two or more sources e.g. Main River and surface water runoff
	PAGE	39	39	40	42	55	49	50	53	51	54	55
	RESPONSIBLE AUTHORITY	EA	EA	EA	EA	EA, IDB	IDB	PCC	PCC	PCC and AW	AW, PCC	EA, PCC, AW, IDB
PETERBOROUGH-WIDE RISK MATRIX	LIKELIHOOD OF EVENT OCCURRING	0	1	1	4	2	4	4	3	5	5	4
	IMPACT OF EVENT	N/A	5	2	3	5	1	1	2	1	2	3
	RISK	No risk (0)	Low (5)	Low (2)	High (12)	High (10)	Low (4)	Low (4)	Medium (6)	Low (5)	High (10)	High (12)

7.6. Coastal flooding

7.6.1. In the Anglian Region coastal flooding occurs particularly when storms in the North Sea coincide with spring tides, causing the overtopping of coastal sea defences. This occurred in 1953 in East Anglia as well as in 2013. While all of Peterborough’s risk management authorities would give assistance during these events, Peterborough itself is not at risk from the coastal flooding.

7.7. Reservoir flooding

7.7.1. The likelihood of Peterborough flooding from large raised reservoirs (ones that hold over 25,000 cubic metres of water – equivalent to approximately ten Olympic sized swimming pools) is very low. Flooding would need to happen either from the reservoirs either being overtopped (gradual) or failing (catastrophic). The former is unlikely because the water level of large reservoirs is carefully managed and water can be transferred in and out through pipe and Main Rivers systems. The latter is unlikely because the Reservoirs Act requires that, regardless of the level at which a large reservoir might overtop, there must be no risk of catastrophic breach from in an event with an annual probability of occurrence of less than 1 in 10,000 (0.01%). All large reservoirs must be inspected and supervised by reservoir panel engineers. There has been no loss of life in the UK from reservoir flooding since 1925.

7.7.2. While flooding is very unlikely, if a reservoir dam did fail, a large volume of water would escape at once with little or no warning. Therefore to ensure that this can be planned for by emergency responders and those living near reservoirs, the Environment Agency produces a map show the extent of flooding that could occur if a reservoir failed. This map can be found on their website. The large reservoirs in and around Peterborough are listed in table 7-3:

7.7.3. There are other smaller reservoirs in Peterborough that are privately owned e.g. by farmers and landowners to provide water supply for irrigation. These are not subject to as stringent legislation.

Table 7-3: Large reservoirs in and around Peterborough

Reservoir	Type of reservoir	Bank name if relevant	Standard of Protection (SoP) against overtopping	Standard of protection against catastrophic breach
Whittlesey Washes / Nene Washes ¹⁴	Flood storage	South Barrier Bank	Mainly 1 in 1000 (0.1 %) 1 in 10,000 (0.01%) near Eldernell	1 in 10,000 (0.01%)
Rutland Water	Water supply	-	1 in 10,000 (0.01 %)	1 in 10,000 (0.01%)
Burghley House Lake	Amenity	-	1 in 1000 (0.1 %)	1 in 10,000 (0.01%)
Eyebrook	Built to supply Corby steel works though	-	1 in 1000 (0.1 %)	1 in 10,000 (0.01%)

¹⁴ This area of land is registered for its RAMSAR, SSSI and SPA environmental designations under the name ‘Nene Washes’ and hence the area is often referred to in Peterborough by this name. However the Environment Agency specifically refer to the flood storage reservoir as the Whittlesey Washes. This is to reduce confusion with the Nene Washlands in Northampton which also provides flood storage to the River Nene. The term Whittlesey Washes will be used throughout the FMS to enable consistency with the Agency’s terminology.

Reservoir	Type of reservoir	Bank name if relevant	Standard of Protection (SoP) against overtopping	Standard of protection against catastrophic breach
	demand is now much reduced. Now trout fishery and nature reserve.			
Crowlands Cowbit Washes	Flood storage	-	1 in 1000 (0.1 %)	1 in 10,000 (0.01%)
Deene Lake	Private lake	-	1 in 1000 (0.1 %)	1 in 10,000 (0.01%)
Pitsford	Water supply	-	1 in 10,000 (0.01 %)	1 in 10,000 (0.01%)



Figure 7-1: Man fishing at Rutland Water reservoir. Source: Anglian Water.

7.8. Tidal Main River flooding

- 7.8.1. Peterborough is at risk from tidal flooding on the Nene. There are however measures in place to manage and minimise this risk. The Dog-in-a-Doublet sluice, shown in figures 7-2 and 7-3, provides a tidal limit, with the gates being closed at high tides to prevent water from entering Peterborough city centre from the downstream end of the Nene. East of the sluice either side of the tidal stretch of the River Nene the flood defences also have a standard of protection of 0.5% which means they protect against a flood event that has a probability of occurring of 1/200 in any one year.
- 7.8.2. The tidal limit on the River Welland is at Fulney Lock and the Marsh Road Sluice, downstream of Spalding. In Peterborough there is no risk of tidal flooding from the Welland.



*Figure 7-2: Dog in the Doublet sluice during a very high tide.
Source: Peterborough City Council*



*Figure 7-3: Dog in the Doublet sluice when the tide is not so high.
Source: Environment Agency.*

1947 Case Study

Source: Eye Peterborough, 2014 and Dr Mark Saunders, 1998.

The winter of 1947 was extremely cold with strong gales and heavy snowstorms. When temperatures rose in March the snow thawed quickly. The ground was still frozen so the snow melt could not infiltrate and instead ran towards streams and rivers. This coincided with the peak of a spring tide and the high water levels combined with very strong winds pounded flood defences. On 19th March 1947 the water level in the River Nene is reported as having been 2.4 metres above average at Town Bridge in Peterborough. At Wansford data from the Environment Agency and the Institute of Hydrology indicates that the flood flow peak was approximately 255 cubic metres per second.

A breach in the flood defences of Cowbit Washes north of Crowland occurred on 21st March. Water inundated the northern areas of Peterborough, reaching land north of Thorney and Eye Green.



Figures 7-4 (left): It looks like the photographer was standing on a causeway in the middle of a large lake but the view is actually looking south along Crowland Road. The road was previously under water. Credit: John Kemmery.

Figure 7-5 (right): The right-hand image is the same view in 2013. Credit: www.eyepeterborough.co.uk

Flooding occurred in many areas across Peterborough. Flood Zone 2, illustrated in the Environment Agency's Flood Map for Planning, is generally understood to closely follow the outline of flooding in Peterborough in 1947.

Since 1947 significant work has been carried out to upgrade defences in the Fens including the installation of more powerful pumps.

7.9. Main River flooding (non-tidal)

- 7.9.1. Certain watercourses in England have been historically designated by the Secretary of State for Environment, Food and Rural Affairs as 'Main Rivers'. This enmainment process is now carried out by the Environment Agency. A Main River is defined as a watercourse marked on a statutory Main River map held by the Department of Environment, Food and Rural Affairs and the Environment Agency. This can include any structure or appliance for controlling or regulating the flow of water into, in or out of the channel. En-mainment is carried out based on the flood risk importance of a river. The larger arterial watercourses are therefore normally designated but some smaller watercourses have also been included.

- 7.9.2. The Environment Agency does not own Main Rivers but has permissive powers to maintain and improve these rivers to manage flood risk. It is important to note that the ultimate responsibility for maintenance of any river sits with the landowner (see sections 6.4 and 6.13).
- 7.9.3. Peterborough has 17 Main Rivers, listed below by river catchment and illustrated in figure 7-6.

Welland Catchment

- i. Brook Drain
- ii. Car Dyke
- iii. Folly River
- iv. Marholm Brook (downstream of Belham Wood only)
- v. Maxey Cut
- vi. Paston Brook
- vii. River Welland
- viii. Werrington Brook

Nene Catchment

- ix. Billing Brook
- x. Castor Splash
- xi. Fletton Spring
- xii. Mortons Leam
- xiii. Orton Dyke
- xiv. Padholme Drain
- xv. River Nene (Non-tidal from Northamptonshire into Peterborough up to the Dog-in-a-Doublet sluice. Tidal downstream from the sluice gate.)
- xvi. Stanground Lode
- xvii. Thorpe Meadows

- 7.9.4. Figures 7-7 and 7-8 provide Nene and Welland catchment-wide summaries of the risk to property from a Main River flood event with an annual probability of 1 in 100 (1%).

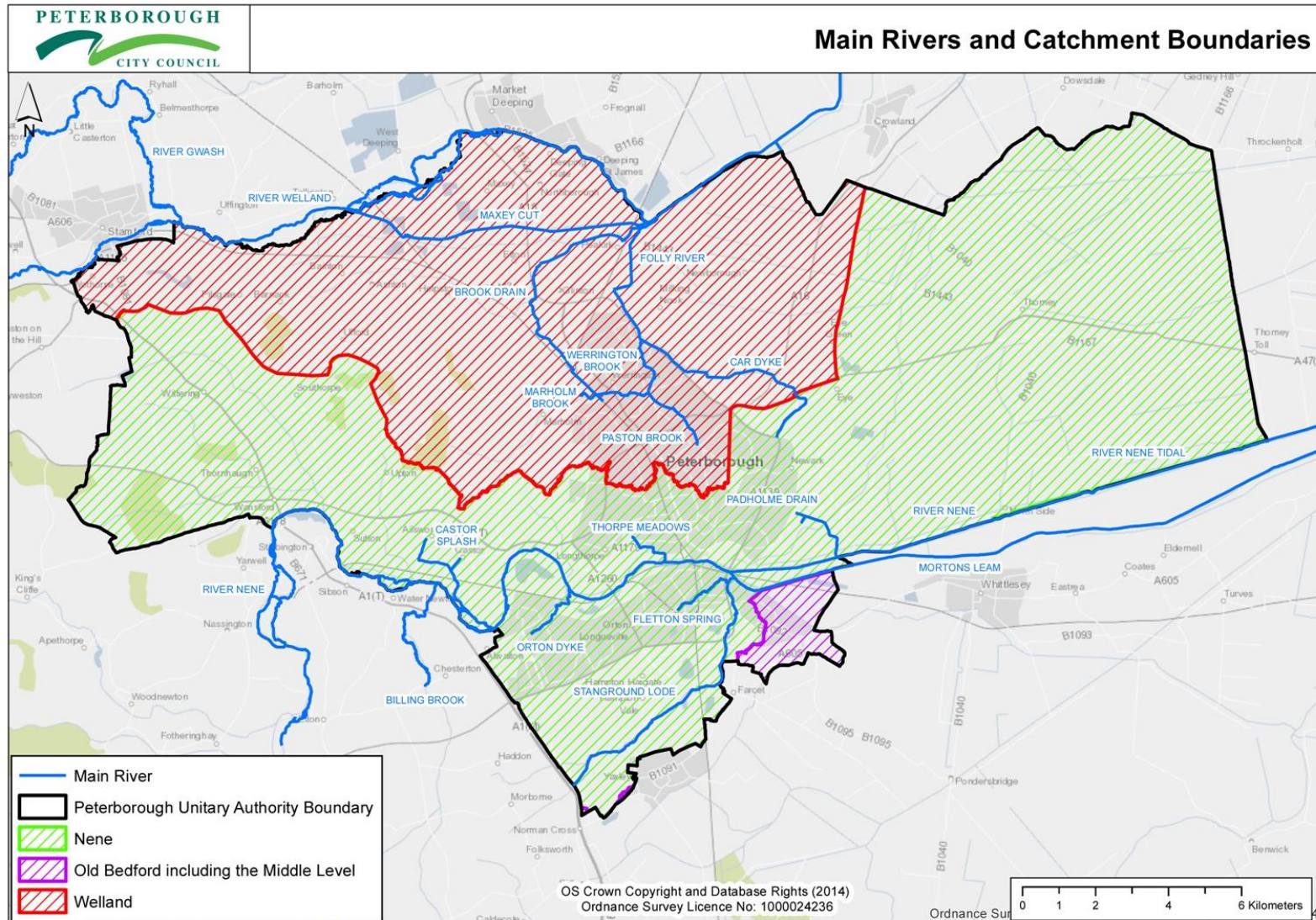


Figure 7-6: Main Rivers and catchment boundaries

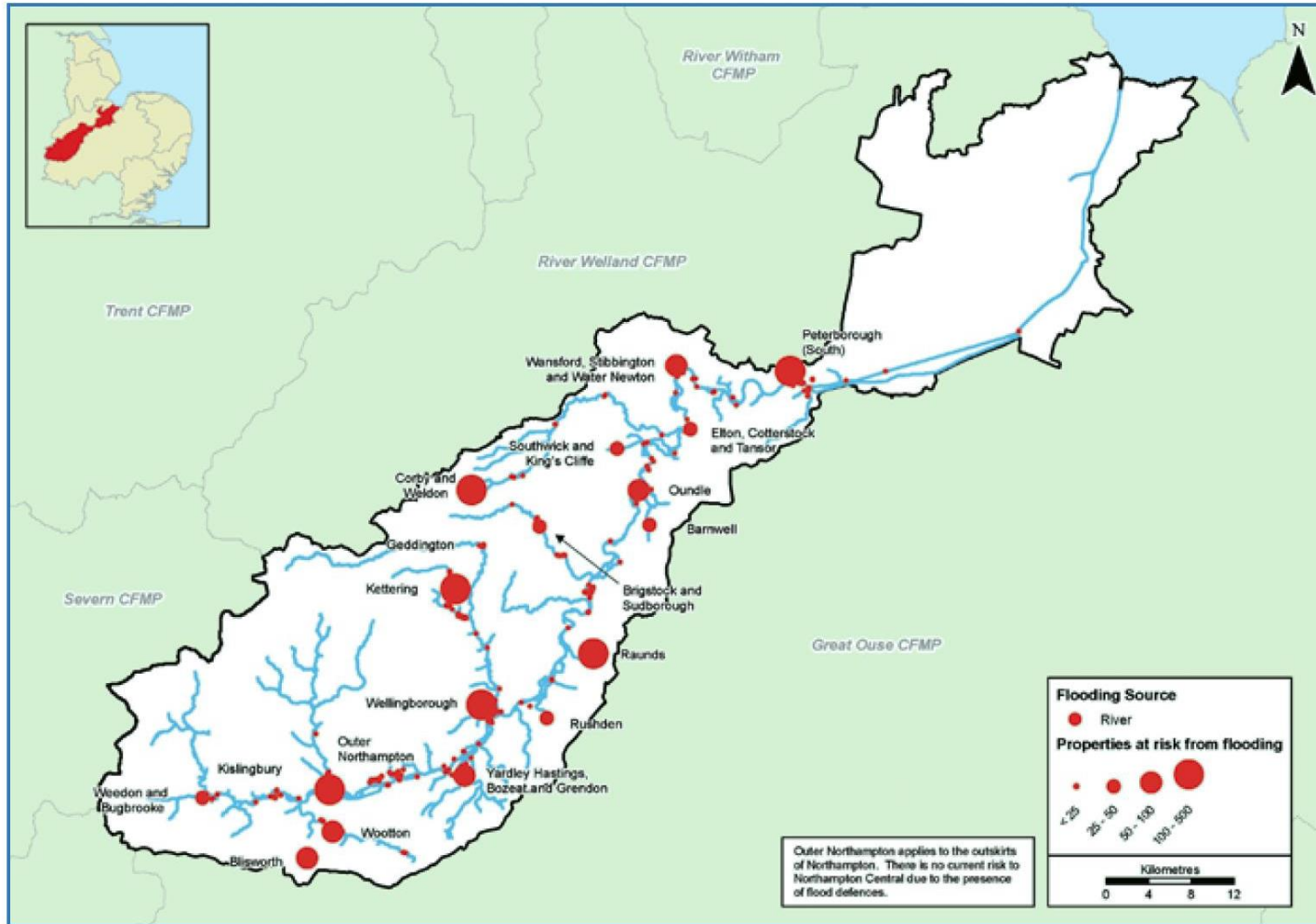


Figure 7-7: Map showing the extent and location of the Nene and, taking into account current flood defences, the areas with properties at risk of Main River flooding from a 1% probability river flood.

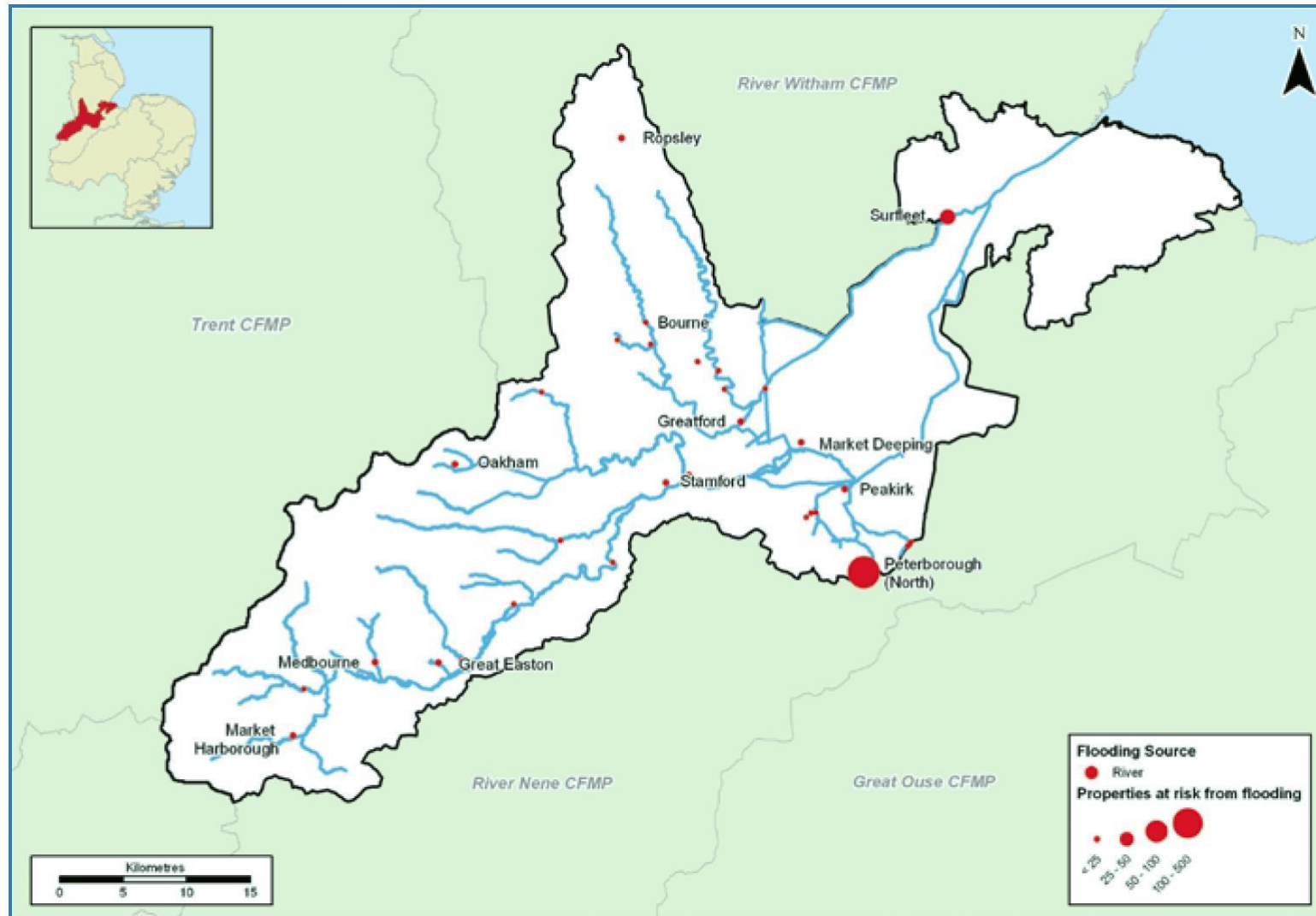


Figure 7-8: Map showing the extent and location of the Welland and, taking into account current flood defences, the areas with properties at risk of Main River flooding from a 1% probability river flood.

- 7.9.5. Areas at risk of flooding from Main Rivers are usually those within a certain distance from the river, with risk reducing further from the channel. The area immediately next to a river where the river is expected to flood, or where it would flood if there were not defences, is called floodplain. The size of the floodplain depends on the size and flow of the river and the surrounding landscape.
- 7.9.6. For many of the watercourses in Peterborough the standard of protection they provide is given by the size and shape of the river, its banks and the level of maintenance undertaken. However some Main Rivers also benefit from formal flood defence structures. For example, alongside the Whittlesey Washes the River Nene has a design standard of protection (SoP) of 1 in 200 (0.5%) created by the formal flood defence embankments on either side of the river channel. Tables 7-4 and 7-5 below give the standard of protection for formal flood defences in Peterborough within the Nene and Welland catchments. This is based on information held within the National Flood and Coastal Defence Database.

Table 7-4: SoP for formal Main River defences within the Nene Catchment

Defence type	Watercourse	Standard of Protection (SoP)
Raised (man-made) river embankments	River Nene north bank: Fitzwilliam Bridge to Dog in a Doublet	1 in 100 (0.1%)
Raised (man-made) river embankments	River Nene Cradge Bank (southern bank): Fitzwilliam Bridge to Dog in a Doublet	1 in 100 (0.1%)
Sea defence (man-made) tidal embankments	River Nene both banks: Dog in a Doublet to Halls Farm	1 in 150 (0.67%)
Raised (man-made) embankment - designated reservoir embankment serving the Whittlesey Washes reservoir	South Barrier Bank	1 in 1000 (0.1 %)

Table 7-5: SoP for formal Main River defences within the Welland Catchment

Defence type	Watercourse (alphabetical order)	Standard of Protection (SoP)
Raised (man-made) river embankments	Car Dyke western bank: Werrington Bridge Road to opposite Hawkshead Way	1 in 50 (2%)
Raised (man-made) river embankments	Car Dyke eastern bank: Werrington Bridge Road to Whitepost Road	1 in 50 (2%)
Raised (man-made) river embankments	Folly River both banks: Peakirk Bridge to Peakirk pumping station	1 in 100 (1%)
Raised (man-made) river embankments	Maxey Cut north bank: Loham Sluice to confluence with River Welland	1 in 100 (1%)
Raised (man-made) river embankments	Maxey Cut south bank: Loham Sluice to Peakirk Viaduct	1 in 100 (1%)

- 7.9.7. In Peterborough when river levels in the Nene are high and exceed the discharge capacity of the Dog in a Doublet sluice, the Whittlesey Washes will begin to fill up.

This is possible even in low tide conditions (i.e. when the sluice gate is open). The Washes therefore provide Peterborough with flood protection from Main River flooding. Further information about the role of the Washes during high tides is available in section 7.16.

Find out about the risk of flooding in your area from Main Rivers

- 7.9.8. The Environment Agency produces two different maps that can be used when looking at flood risk from rivers and the sea. These maps include the risk of flooding from tidal events (section 7.8), Main Rivers and other watercourses with a catchment greater than 3km².

Flood Maps

To view the maps described below and the risk for your area please visit:
<http://maps.environment-agency.gov.uk/>

- 7.9.9. **Risk of Flooding from Rivers and the Sea map**- This map shows the actual risk of flooding on a scale of very low, low, medium and high as well as the flood extents. The map takes flood defences and management actions into account. However please note that flood defences can be overtopped or fail (e.g. conditions greater than the risk that the defence was designed for or if the defences are in poor condition). Therefore some areas behind defences are still shown as having a level of risk. The map uses the following risk bands:
- i. High – each year there is a chance of flooding of greater than 1 in 30 (3.3%).
 - ii. Medium – each year there is a chance of flooding of between 1 in 30 (3.3% and 1 in 100 (1%)
 - iii. Low – each year there is a chance of flooding of between 1 in 100 (1%) and 1 in 1000 (0.1%)
 - iv. Very low – each year there is a chance of flooding less than 1 in 1000 (0.1%)
- 7.9.10. **Flood Map for Planning (Rivers and the Sea)** - This map is designed for use in the planning system when allocating development to appropriate sites and when assessing submitted applications. The map does not show the presence of defences because of the risk that these can fail or be overtopped and the need for development to consider lower risk areas where minimal flood risk management works are needed before considering higher risk development sites. The Flood Map for Planning shows the flood extents possible from a flood event of annual probability:
- i. of up to a 1 in 100 (1%). This is often referred to as Flood Zone 3.
 - ii. of up to 1 in 1000 (0.1%). This is often referred to as Flood Zone 2.
 - iii. less than 1 in 1000 (0.1%). This is often referred to as Flood Zone 1 and is considered to be the area of lowest and minimal risk.

1998 Case Study

Source: Met Office, October 2012

At the start of Easter 1998 (8-10th April) a stationary band of heavy rain led to saturated ground and excessive surface water runoff. On Good Friday levels in the Nene were very high, with the flood flow peak at Wansford being approximately 200 cubic metres per second. 18 homes were flooded from the Nene in a variety of locations and many roads across Peterborough were flooded from surface water. Two days later on Easter Sunday 100 homes flooded from the Thorpe Meadows watercourse, a smaller Main River. This was due to the effect of significant local rainfall and surface water entering the watercourse from the Longthorpe catchment of Peterborough, and the watercourse not being able to discharge out into the River Nene. Since this event a flood defence wall has been installed to protect properties from overtopping of Thorpe Meadows watercourse.

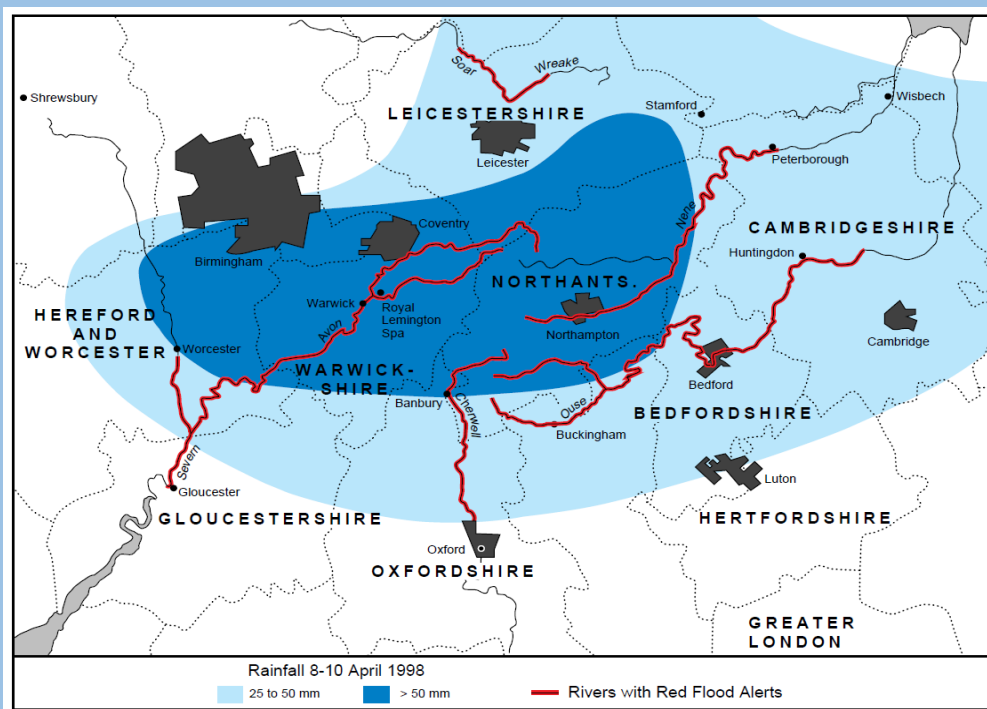


Figure 7-9: Map showing the contours of the heaviest rainfall for the three day period 8-10 April 1998, together with the rivers put on Red Flood Alert by the UK Environment Agency.. (Credit: Saunders, 1998).

7.10. The Fens and Internal Drainage Board watercourses

7.10.1. The Fens is a wide expanse of flat prime agricultural land, much of which is below sea level. In order to drain the land, water from Peterborough’s fens is generally pumped via a large grid-like network of open watercourses (classed as ordinary watercourses) into the downstream tidal sections of the Nene and Welland, and from there out to sea. In most areas the gradient across the land to the watercourses is only 6 inches to 1 mile (1 centimetre to 106 metres) and hence water has to be pumped by large diesel and electric pumps within the network. These pumps are housed in pumping stations as shown within figures 7-10 and 7-11.

- 7.10.2. In drier months the role of an IDB can be more about managing water levels in the channels for irrigation or navigation, than about draining the land.



Figures 7-10 and 7-11: Cross Guns Pumping Station inside (left) and outside (right).
Source: North Level District IDB

- 7.10.3. More detailed information about the wider area of the Fens covering Lincolnshire, Cambridgeshire Norfolk and Suffolk is included in [Appendix B](#).
- 7.10.4. Protection for the Fens is effectively provided on three different levels; primary coastal defences (remembering that IDB districts extend much further towards the Wash than the boundary of Peterborough City Council); Main River defences and flood risk management assets e.g. on the Welland and Nene; and the network of IDB watercourses, pumping stations and other associated water level management structures. Therefore Peterborough's Fens effectively have three different levels of risk. In order of likelihood of occurrence these are:
- a) the risk of individual ordinary watercourses overtopping. *Probability < 1 in 50 (2%) - event is not severe.*
 - b) the risk of Main River defences being locally overtopped. *Probability < 1 in 100 (1%);*
 - c) the risk of complete system failure due to an 'combined high tide and river flow event', where a spring tide in the North Sea coincides with intense rainfall in Peterborough and high river levels from upstream. *Probability < 1 in 200 (0.5%) - event is more severe.* This third type of flood risk event is discussed in section 7.16.
- 7.10.5. The standard of protection of the IDB systems, including the ordinary watercourses and related infrastructure is known to be at least 1 in 50 (2%) i.e. the watercourses are not expected to overtop in an event of lower probability than this. However given investment in the network in previous years it is believed that these systems actually has a higher standard of protection of approximately 1 in 75 (1.33%). Drainage district modelling is planned in order to confirm this.
- 7.10.6. The intensity of rainfall is more of a problem for IDB watercourses than the length of the rainfall period. For example in January 2014 Peterborough experienced four times the average expected monthly rainfall but this total was distributed over the whole month and the IDB pumps could continue to pump the water away. This increases the cost of the water level management (more pumps need to be used for longer) but is well within the capacity of the system. During a very heavy rainfall event all of the IDB pumps would need to be operating and if the intensity was greater than that of a 1 in 100 (1%) probability rain event the watercourses could be overtopped in some locations. This would cause localised flooding in some parts of

the district but is unlikely to cause a complete failure of the system as intense rainfall tends to be localised.

- 7.10.7. It should be noted that risk to power supplies is an important factor in protecting our fen areas as IDB systems depend on this. To increase their resilience they have both electric and diesel pumps and these are serviced regularly.
- 7.10.8. Due to the close linkages between Main River and ordinary watercourse flooding in the Fens, flood risk from IDB ordinary watercourses is included in the Environment Agency's Flood Maps for Rivers and the Sea described on page 45.
- 7.10.9. As mentioned in section 7.9 the Main Rivers protecting Peterborough's IDB districts have a 1 in 200 (0.5%) standard of protection.

7.11. Ordinary watercourse flooding

- 7.11.1. Ordinary watercourses include every river, stream, ditch, drain, cut, dike/dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a Main River. Ordinary watercourse flooding can be caused when intense or long duration rainfall drains to the channel and results in water levels overtopping of the banks of the channel on to surrounding land.
- 7.11.2. In Peterborough there are three types of ordinary watercourse:
 - i. Those owned by principally agricultural landowners in the Fens and managed as part of the IDB network.
 - ii. Those owned and managed by private landowners. The exact number of these drains present is not recorded. This is in part due to the broad definition of what a watercourse can be.
 - iii. Those where maintenance is undertaken by Peterborough City Council. This could be either because the city council is the landowner (these watercourses are known as CRA Dykes¹⁵) or where there is a private landowner but due to the associated flood risk, the city council historically agreed to take on management (these watercourses are known as Parish Dykes). In total the city council has 55 ordinary watercourses under its management.
- 7.11.3. Flood risk from IDB ordinary watercourses in the Fens is covered in the previous section (section 7.10).
- 7.11.4. No extensive detailed modelling of the risk level from ordinary watercourse types ii-iii has been undertaken. It is noted above that complete maps of type ii so not exist. As a first step the action plan includes an action to do further mapping of ordinary watercourses and this is also discussed further within chapter 10.
- 7.11.5. The city council has no records of flooding of properties caused by ordinary watercourses on its own land. Flooding from Parish Dykes has occurred, for example from Racecourse Drain in Fengate. In the past flooding has occurred from watercourses that were classed at the time as ordinary watercourse. These watercourses were then referred to as critical ordinary watercourses and in 2004/5

¹⁵ CRA Dykes are drainage ditches within Community Related Asset (CRA) land. CRA land refers to tranches of land transferred from the Development Corporation, when it closed, to Peterborough City Council. The majority of CRA land forms verges between the highway and other land uses.

were enained due to the level of risk. This applies to Brook Drain, Marholm Brook and Thorpe Meadows.

7.12. Surface runoff / surface water

7.12.1. Peterborough is susceptible to flooding from surface water runoff. This generally results from very intense rainfall exceeding the capacity of local drainage networks (whether sewers, ordinary watercourses or other drainage features such as lakes) and therefore flowing across the ground. Peterborough has also experienced flooding in these two opposing situations:

- i. Sudden or high volumes of melting snow cause surface runoff which exceeds the capacity of the local drainage system. If the ground is frozen then minimal water can infiltrate naturally in these conditions which can make surface water flooding worse.
- ii. The ground is very hard and dry from lack of rainfall (e.g. in drought periods). This also makes the ground solid and reduces the ability of rainwater to infiltrate, creating more runoff.

The term **surface water** is normally used in relation to surface runoff, particularly with regards to the naming of **surface water sewers** that take rainwater from roofs and highways.

These sewers (also sometimes called storm water sewers) do not take water to be treated, but to local watercourses. It is therefore important that contaminants that need treating are not put down drains in the highway or drains at the bottom of household or commercial downpipes.

7.12.2. Flooding from surface runoff tends to be localised due to the fact that the most intense rainfall within a storm is often itself localised. The existence on the ground of structures or land heights that may channel water into certain locations also adds to this. Whatever the source, surface runoff will tend to flow towards low spots where it collects. Flooding can occur both to land or property which lies in the flow path of the water or to property situated in the low spot where the water finally collects. While flooding tends to be localised the actual risk is fairly well spread across Peterborough indicating that surface water flooding can happen almost anywhere.

7.12.3. In practise if heavy rainfall is particularly intense or occurs for long periods of time it can be difficult to differentiate it from other sources of flooding. Heavy rainfall can quite quickly cause flooding from surface water sewers, from ordinary watercourse flooding or from groundwater if the groundwater in the catchment is quick to respond. Ultimately full surface water sewers and ordinary watercourses can lead to increased levels in the Main Rivers and flooding from this source.

7.12.4. It is quite common for parts of Peterborough to experience small scale flooding of highways, footpaths and private gardens from surface runoff, as surface water sewers (sometimes called storm water sewers) are only designed with a standard of protection of 1 in 30 (3.3%). The number of homes that have flooded from surface runoff in the past is relatively low but we know from recent events that the risk exists and both new development and existing maintenance practises need to take this risk into consideration.

7.12.5. Figure 7-12 illustrates how the existing highway drainage system in Peterborough functions. Highway gullies owned by Peterborough City Council feed into surface water sewers currently owned by Anglian Water. As the increased future impacts of heavier rainfall and severe weather are better understood, the use of sustainable drainage systems (introduced in chapter 4) needs to become more common to make Peterborough more resilient.

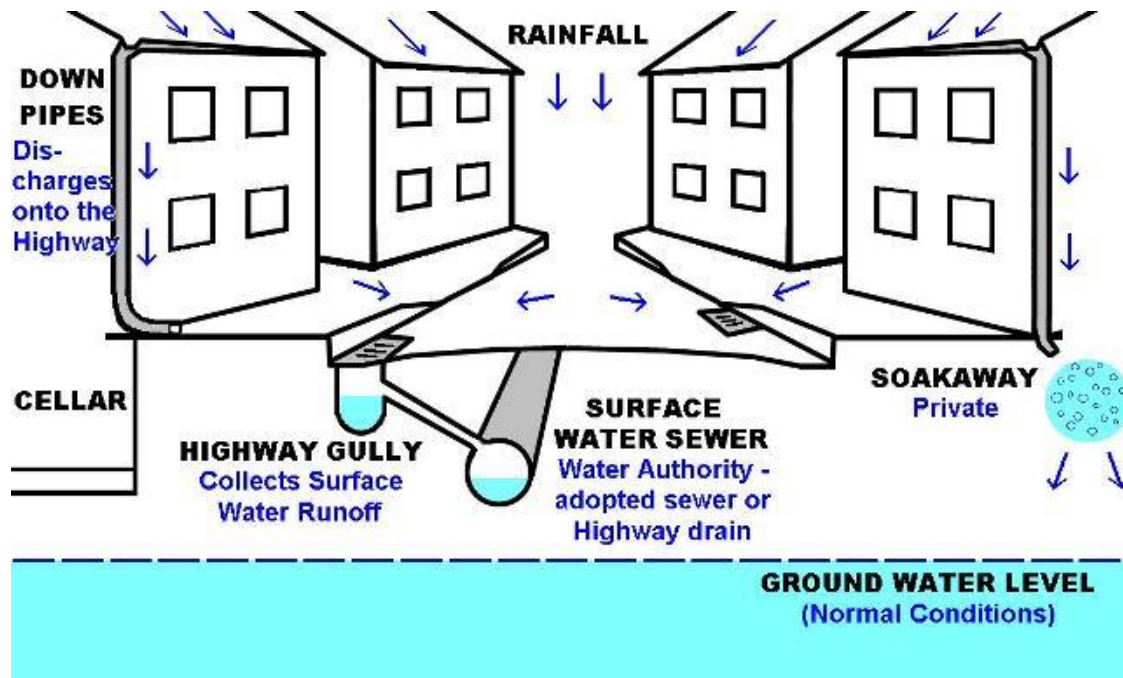


Figure 7-12: Illustration of how the highway drainage and surface water networks function.

7.12.6. Approaches to manage surface water that take account of water quantity (flooding), water quality (pollution) and amenity issues are collectively referred to as sustainable drainage systems (SuDS). SuDS mimic nature and typically manage rainfall close to where it falls. They are technically regarded as a sequence of management practises, control structures and designs to efficiently and sustainably drain surface water.

7.12.7. Peterborough City Council's SuDS website is available at www.peterborough-suds.org.uk. This site aims to provide comprehensive information for developers and others needing to consider site drainage in Peterborough. Supplementary information is also available from the website of susdrain, the community for sustainable drainage.¹⁶

7.12.8. The localised nature of thunderstorms with intense downpours makes it very difficult to accurately forecast and provide warnings for surface water flooding. Rain totals experienced even in neighbouring wards can vary significantly. Since water follows flow routes based on land heights and runs towards low spots, properties in one part of a street may well be affected while those further along the street may be fine. The city council recommends that communities and businesses check their risk level online and keep abreast of weather forecasts and weather warnings issued by

¹⁶ www.susdrain.org.

the Met Office to give them as much notice as possible. To find out about the surface water risk in your area see box below.

Flood Maps

To view these maps and the risk for your area please go to:
<http://maps.environment-agency.gov.uk/wiyby>

7.12.9. The FWM Act 2010 defines flooding from surface runoff as that generated from rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not yet entered a watercourse, drainage system or public sewer. This coincides with the type of flooding shown by the Environment Agency’s Risk of Flooding from Surface Water maps.

7.12.10. **Risk of Flooding from Surface Water map**- This map shows the risk of surface water flooding and includes information on depth and velocity of water. The map does not take thresholds heights of individual properties into account and therefore cannot be used to identify properties that will flood from surface water. It can only give an indication of the broad areas at risk.

7.12.11. The map uses the following risk bands:

- i. High – each year there is a chance of flooding of greater than 1 in 30 (3.3%).
- ii. Medium – each year there is a chance of flooding of between 1 in 30 (3.3% and 1 in 100 (1%)
- iii. Low – each year there is a chance of flooding of between 1 in 100 (1%) and 1 in 1000 (0.1%)
- iv. Very low – each year there is a chance of flooding less than 1 in 1000 (0.1%)

7.12.12. Table 7-6 below shows other ways to explain the main risk categories used for the mapping:

Table 7-6: Understanding the main risk categories shown on the Risk of Flooding from Surface Water map

Level of risk	Chance of flooding in any given year (1 year)	Chance of flooding in a typical mortgage (30 years)	Chance of flooding in a lifetime (80 years)
High	Greater than 1 in 30 (3.3%)	Greater than 2 in 3 (64%)	Greater than 14 in 15 (94%)
Medium	Between 1 in 30 (3.3%) and 1 in 100 (1%)	Between 2 in 3 (64%) and 1 in 4 (26%)	Between 14 in 15 (94%) and 1 in 2 (55%)
Low	Between 1 in 100 (1%) and 1 in 1000 (0.1%)	Between 1 in 4 (26%) and 1 in 34 (3%)	Between 1 in 2 (55%) and 1 in 13 (8%)
Very Low	Less than 1 in 1000 (0.1%)	Less than 1 in 34 (3%)	Less than 1 in 13 (8%)

7.13. Groundwater flooding

- 7.13.1. Groundwater flooding tends to occur after long periods of sustained rainfall where infiltration into the ground raises the level of the water table and/or cause springs to have greater flow. Low-lying areas, where the water table is more likely to be at shallow depth, can be most at risk. Groundwater flooding is particularly associated with limestone and chalk soils which contain layers of water-bearing rock, clay or sand as these tend to contain major aquifers. To the west of Peterborough, the Nassaburgh limestone contains a number of aquifers and related springs.
- 7.13.2. Flooding from groundwater can also result from rivers being in flood over land that is very permeable as groundwater levels have a natural tendency to balance out other water levels across the area. The floodplains of the Nene and Welland contain permeable alluvial deposits of sand and gravels and hence this can be applicable here.
- 7.13.3. Groundwater flooding relates to the movement of water through the soils and bedrock and is different to land being waterlogged. Clay, for example, can become easily waterlogged after long periods of rain. The water is held in the soil which becomes boggy and new rainfall is unable to drain away and instead becomes surface water runoff as discussed in section 5.7. A large area of Peterborough has clay-based soil. However, in chalk, sands and gravels water can actually move through the soils due to the gaps between soil particles. This means that water can flow under the surface of the ground and hence springs and/or flooding can occur in areas not directly next to a river or a distance from where the heaviest rainfall has fallen.
- 7.13.4. The city council has allocated a proposed action in the action plan to understanding more about groundwater risk in Peterborough. With there being no publically available flood maps, local historical groundwater flood information being limited, and the city council only gaining a responsibility for managing this type of risk in 2010, it is an area where the city council would benefit from greater knowledge.

7.14. Sewer Flooding

- 7.14.1. Peterborough has three different types of sewers: surface water sewers, foul sewers and combined sewers. Surface water runoff caused by surface water sewers reaching their capacity is dealt with in section 7.12. This section discusses the risk from foul sewers which carry wastewater from homes and businesses (e.g. from washing machines and toilets) and the risk from combined sewers which carry both foul water and rainwater.

Combined sewer flooding

- 7.14.2. Combined sewers are generally associated with having the greatest risk of flooding within the wastewater network; during intense rainfall events large quantities of rainwater can take up the capacity in the sewers. This can cause foul water to back up from manholes or inside homes e.g. from toilets. Much of Peterborough's existing city centre, the old hospital and station quarter and Central Ward contain combined sewers and this risk should be borne in mind when opportunities arise to make these areas more resilient for the future.

Foul flooding

- 7.14.3. There are not many locations in Peterborough which are classified as being at risk from foul flooding due to a lack of capacity in the network. This is because resolving foul flooding is a key priority for water and sewerage companies. Anglian Water is obliged to report to Ofwat where there are properties at risk of internal flooding due to hydraulic incapacity in the system. This is known as the DG5 register. The location of properties in Peterborough on the DG5 register is not discussed within the FMS due to very localised nature of this flooding; the implications for the property itself and because the register changes regularly as issues are resolved or in some cases as new problem areas are discovered. Foul flooding is therefore not covered by the risk matrix in table 7-2.
- 7.14.4. Peterborough has also experienced foul flooding due to operational issues. Since these events can happen anywhere no specific levels of risk are formally associated with different parts of Peterborough. There are two main operational issues that the area suffers from:
- a) Blockages in the network which prevent pumping stations from working and hence can create significant risk to properties on the same network as the blockage. Blockages are often caused by fats, oils and greases which are put down the drains at home and at work. The sewer system is not designed to be able to cope with these materials which act to clog up the pipes and removal is generally expensive.
 - b) Surface water infiltrating into the foul system (for which it is not designed) and caused capacity issues and surcharging. Most foul systems are not vacuum sealed and hence rainwater can get into them through structures like manholes. However it is when very large volumes appear in the network that this causes flood risk and investigation is needed into how the water is getting there.

Notes about the foul network

Foul water sewers carry used water from sinks, baths, showers, toilets, dishwashers and washing machines.

These sewers take water to be treated at sewage treatment works. Discharge containing chemicals should go into the foul network and not into surface water sewers as described in section 7.12. Detergents from car washes or oil leaks from cars are two examples of contaminants that often end up going into surface water sewers (and therefore untreated into rivers) when they would ideally go into the foul network.

The 'waste' from sewage treatment works is very often recycled into products for use in industrial and agricultural processes. For this reason you may hear Anglian Water refer to sewage treatment works as *water recycling plants*.

7.15. Impacts of Main Rivers water levels on other sources of flooding

- 7.15.1. Water levels in Main Rivers can easily impact upon flooding from other sources. Most ordinary watercourses, smaller Main Rivers and sewers flow or outfall into

another river. If the larger river is full then the smaller watercourse or sewer will not be able to discharge freely and may back up. This is often called flood locking and can cause flooding higher up the network potentially quite far from a Main River.

7.16. Combined high tides and river flows

- 7.16.1. As described in section, when high tides occur in Peterborough the Dog-in-a-Doublet sluice is closed to prevent tidal waters flooding homes, businesses and land. When a high tide occurs at the same time as a high river flow on the River Nene the closure of the sluice gates means that water from the Nene cannot escape out to sea. For this reason water from the Nene is channelled into the Whittlesey Washes flood storage reservoir via Stanground Sluice. When the tide begins to go out and river levels have reduced the stored water is released back into the Nene downstream at Rings End. This is demonstrated in figure 7-13 below.
- 7.16.2. The original design capacity of the Washes is 1 in 200 (0.5%) as shown in figure 7-14. The existence of the North Bank embankment and the South Barrier Bank means that flood water would not be expected to overtop onto surrounding land north or south of the Washes until around a 1 in 1000 (0.1%) probability flood water level was reached. Overtopping would only occur if the wind creates waves on the Washes, rather than because the water level in the Washes is higher than the bank. It is important to note, however that by the time this happened large areas of Peterborough, both along the Nene, around Stanground sluice and else, would already be flooded.
- 7.16.3. In theory there could also be a risk of breach from the South Barrier Bank from flood events of annual probability between 0.5% and 0.1%. Breaches can take place when defences are weakened e.g. by continued severe weather or by the actions of humans (insufficient maintenance) or animals (burrowing). Significant works are currently being led by the Environment Agency along this bank to ensure that the probability and impact of such a breach is minimised.
- 7.16.4. The worst case situation for Peterborough is one where very intense local rainfall, coincides with maximum flow in the Nene for several days and a North Sea spring tidal surge occurs meaning that the Dog in a Doublet has to be closed often. This is because the chances of the Washes reaching its design capacity (0.5%) is increased and once this happens there is an increased risk that water will start to overtop the Nene in various places through Peterborough.
- 7.16.5. Significant local rainfall amounts would also mean that ordinary watercourses and sewers are likely to be unable to discharge into Main Rivers and hence surface water flooding will occur around low points, manholes, and where ordinary watercourses overtop.

Whittlesey (Nene) Washes

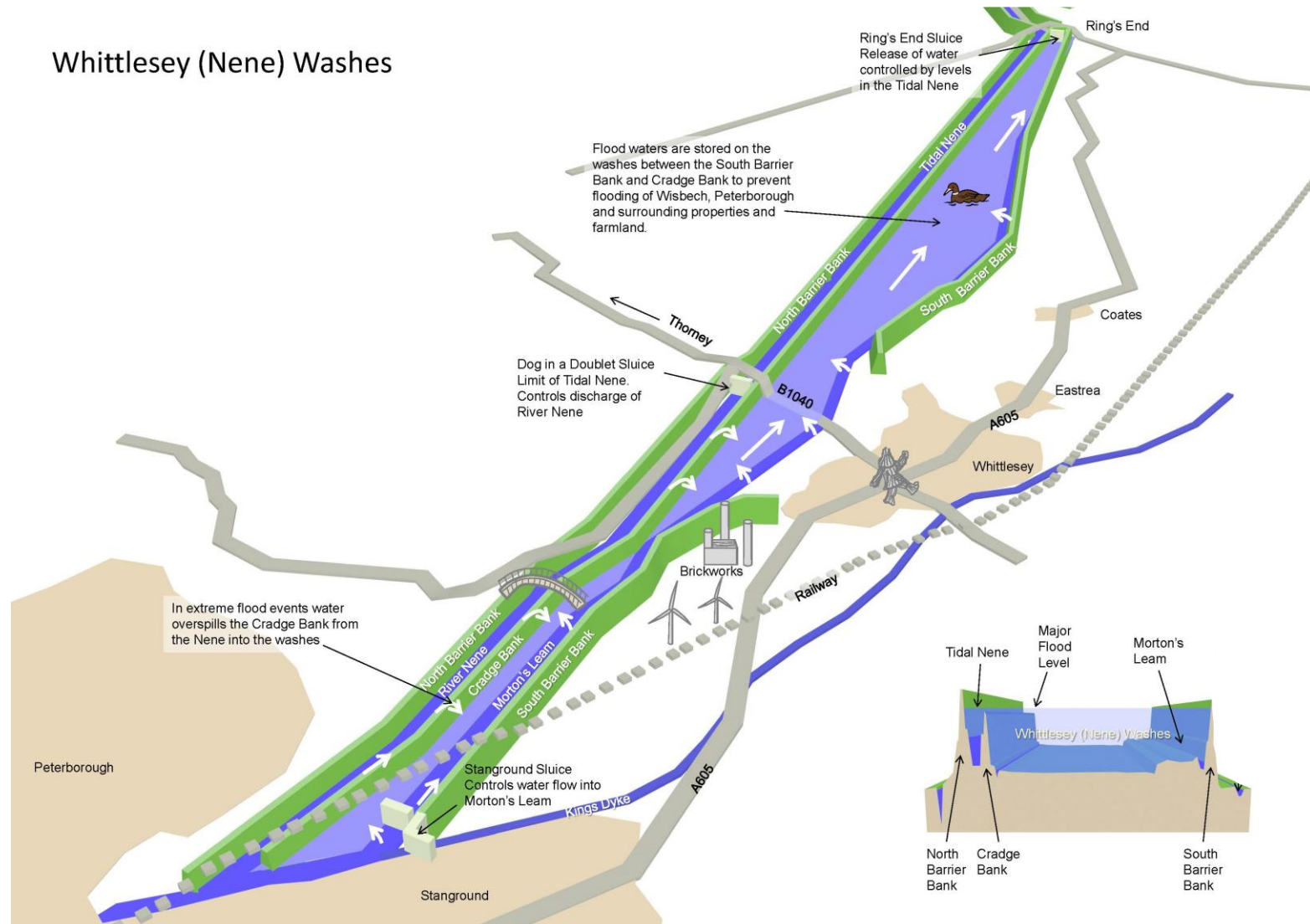


Figure 7-13: Diagram of the operation of the Washes. Formally water enters the Washes at Stanground Sluice via Morton's Leam and leaves at Rings End Sluice. When water levels in the Nene are very high water can also overtop the Cradge Bank into the Washes.

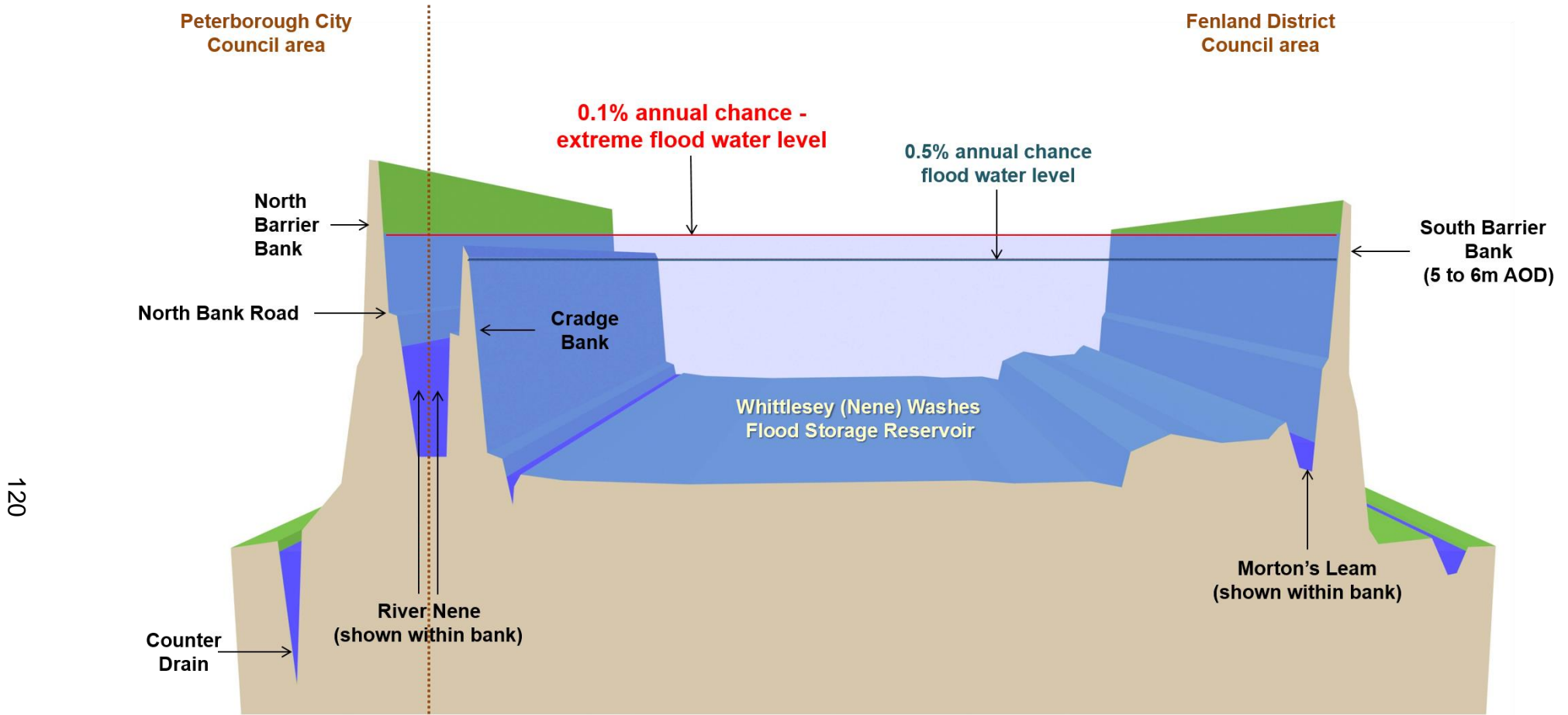


Figure 7-14: Diagram explaining the Whittlesey (Nene) Washes

Worst case impact on IDB systems

- 7.16.6. IDB systems are a secondary defence. While section 7-10 discusses the local risks of flooding from IDB systems, the large scale failure of an IDB system depends on the overtopping or failure of its primary defences; the Main Rivers defences of the Nene or Welland. The situation on the Nene discussed in section 7.16 is that which could lead to the overwhelming of IDB systems. Intense local rainfall puts pressure on IDB systems and combined with overtopping from Main Rivers this could weaken an otherwise robust system. IDBs have several pumps they can use depending on demand and in such an event all pumps would be in use trying to remove water from the land as quickly as possible. In effect a circular motion could be created where water spills onto their land as quickly as they can pump it off.
- 7.16.7. It is this kind of event, potentially combined with the power outages that can occur during flooding, that would cause the large scale failure of the IDB systems and result in the widespread flood extents that are shown on the Environment Agency's Flood Map for Planning. This map shows the extent of flooding without considering defences and hence returns the Fens to an area of periodic flooding as would have been the case prior to the formal drainage of them in the 17th Century.

7.17. Flooding related to operational issues

- 7.17.1. Although flooding is usually caused by heavy or long duration rainfall, it can be easily made much worse by the presence of operational issues. The following are counted as operational issues:
- c) Flytipping – large waste items e.g. tyres, sofas etc.
 - d) Littering – smaller items.
 - e) Plant and tree roots growing into piped systems and reducing the capacity.
 - f) Damaged pipes from wear and tear, vandalism, or movement of the ground.
 - g) Collapse of banks of a watercourse e.g. gradually over time (lack of maintenance) or suddenly due to ground instability or movement.
- 7.17.2. Since it can never be known exactly when such issues may occur, flooding from a watercourse could be caused after less rainfall than would be expected for a more natural flood event. The FMS cannot provide details of the risk of operational issues occurring, but it does give details of the approach which is taken to minimise this type of event in Peterborough e.g. regular maintenance. Maintenance is covered in chapter 10.

7.18. Summary

- 7.18.1. Peterborough is at risk from many different types of flooding. Main river, the larger combined tidal and river events and flooding from combined sewers are the types that present the greatest risk on average across the City. However, surface water, groundwater and sewer flooding can still have devastating effects within localised areas. Further efforts to promote an understanding of surface water flood risk are included with the action plan and discussed in chapter 10. Flood risk from groundwater and ordinary watercourses are the least well understood types and are areas proposed for further investigation in future. The likelihood of flooding from reservoirs is so low that even with widespread consequences the overall risk remains small. Peterborough's fenland areas are carefully managed. Very localised waterlogging and surface water flooding is possible over short time frames but with minimal impacts. However large scale failure of the drainage board systems is of

considerably lower probability and would have to coincide with significant flooding elsewhere in Peterborough and the region. Flooding from operational issues in any part of Peterborough's watercourse or sewer network is impossible to model and map, but remains a risk for Peterborough and is identified as an area of work for Peterborough's water management authorities.

7.19. In the future

- 7.19.1. It is expected that, without significant national scale intervention, flood risk from all sources will increase in the future. This is due to factors such as urban creep and climate change.

Urban creep

- 7.19.2. Over time the following noticeable development-related trends have an impact on flood risk. Where site runoff has not been controlled these can cause an increase in surface water flooding:

- a) an increase of hard paving being laid over grassed areas
- b) in-fill developments and extensions being added to existing buildings

8. Climate Change Implications for Flood Risk

8.1. Context

- 8.1.1. Flood risk management projects, like many other projects relating to the built environment and future risk, need to consider the resilience of the chosen measures over the long term. Any projects applying for Government flood defence funding must therefore incorporate the impacts of changing risk and adaptation methods.¹⁷ This includes adapting to a changing climate and using advice based on clear scientific evidence about the scale and impacts of global climate change.
- 8.1.2. Over the past century around the United Kingdom we have seen sea level rise and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts have only changed a little in the last 50 years. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.
- 8.1.3. Greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.
- 8.1.4. Figure 8-1 below shows the expected temperature changes related to three different future scenarios for greenhouse gas emissions as set out by the Intergovernmental Panel on Climate Change (IPCC) and the United Kingdom climate projections.

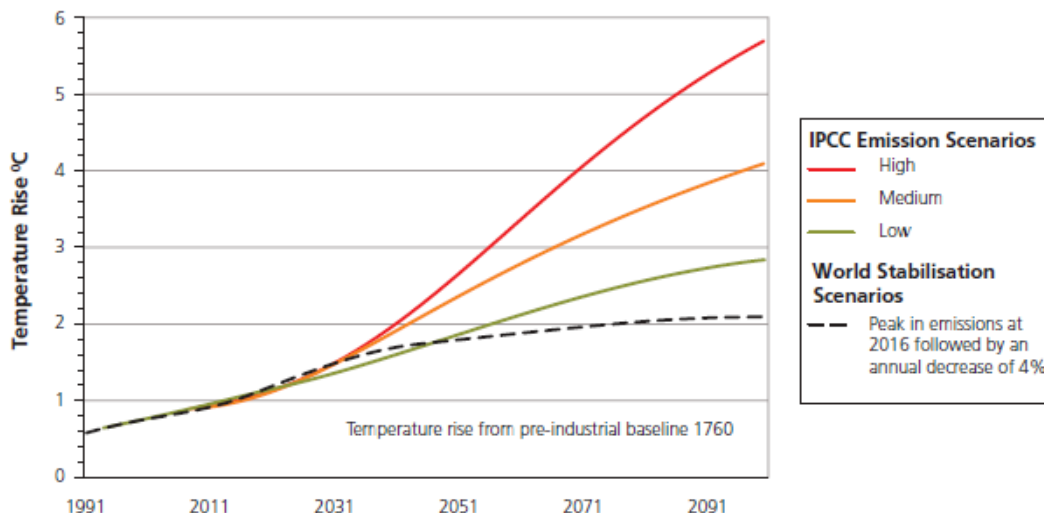


Figure 8-1: Temperature rise expected based on different emissions scenarios.

- 8.1.5. There is enough confidence in large scale climate models to say that Peterborough must plan for the implications of climate change. There is more uncertainty at a

¹⁷ Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities, Environment Agency

local scale but model results can still help us plan to adapt. For example rain storms are likely to become more intense, even if it isn't known exactly where or when. By the 2080s, the latest United Kingdom climate projections¹⁸ are that there could be around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

- 8.1.6. Between 1961 and 2006 UKCIP reports that the Anglian Region experienced:
 - i. An annual daily mean temperature increase of 1.4-1.8C
 - ii. An average increase in annual precipitation of 9%

8.2. Key projections for the Anglian River Basin District

- 8.2.1. The Environment Agency's Flood Risk Standing Advice on climate change allowances for planners sets out allowances that must be applied to flood risk assessments to account for climate change. The recommended allowances for net sea level rise since 1990, peak rainfall intensity and peak river flow are set out below in table 8-1.

Table 8-1: Allowances and sensitivities to be applied for climate change (Environment Agency, 2013)

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Sea level rise for the East of England (mm per year) ¹⁹	4.0	8.5	12.0	15
National peak rainfall intensity ²⁰	+5%	+10%	+20%	+30%
National peak river flow	+10%	+20%		

8.3. Implications for flood risk

- 8.3.1. Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.
 - a) *River and groundwater flooding* - Wetter winters and more rain falling overall during wet spells may increase river levels and also ensure that groundwater levels are kept high.
 - b) *Surface water flooding* – Increased intensity of rainfall may cause more surface runoff and more areas of ponding water. In turn the excess of water

¹⁸ UK Climate Projections 2009 (UKCP09) tool is a climate analysis tool, which funded by Defra, features the most comprehensive climate projections this country has. It provides information designed to help those needing to plan how they will adapt to a changing climate.

¹⁹ You can derive sea level rise up to 2025 by applying the 4mm per year back to the 1990 level. You can derive sea level rise from 2026 to 2055 by adding the number of years on from 2025 to 2055.

²⁰ You can derive peak rainfall by multiplying the rainfall measurement (in mm per hour) by the relevant percentage so if there is a 10mm per hour rain event for the 2025 to 2055 period this would be 11mm per hour and for the 2055 to 2085 period this would be 12 mm per hour.

would put pressure on small watercourses, highway drains and on surface water, combined and even foul sewers. Summer storm intensify with increasing temperatures in generally hotter and drier summers, so we need to be prepared for the unexpected.

- c) *Combined sources* - Rising sea or river levels may also increase local flood risk inland and away from major rivers because of the interactions upstream with drains, sewers, ordinary watercourses (including IDB drains) and groundwater.
- d) *Tidal flooding* - Even small rises in sea level could add to very high tides so as to affect places a long way inland. Significant future increases in both river levels and high tides could start to cause an impact on Peterborough's IDB systems (see section 7-11)

8.3.2. Flood and coastal erosion risk management guidance issued on adapting to climate change provides estimates for how river flood flows will change within the Anglian River Basin District. These are shown in table 8-2.

Table 8-2: Climate Change predictions for the Anglian Region (Environment Agency, Unknown)

Anglian Region	Total potential change anticipated for 2010 - 2039	Total potential change anticipated for 2040 - 2069	Total potential change anticipated for 2070 - 2099
Upper end estimate	30%	40%	70%
Change factor	10%	15%	25%
Lower end estimate	-15%	-10%	-5%

8.4. Local sensitivity to climate change


8.4.1. The impacts of climate change in Peterborough can only be understood fully from carrying out local studies. In 2012, Peterborough City Council therefore completed a Local Climate Impacts Profile to look at how changing weather patterns affect council services. The city council is also keen to have a wider understanding of Peterborough's sensitivity to climate change, but undertaking new modelling of the extent and scale of flood risk with climate change is beyond the scope of the FMS. A simple analysis has therefore been undertaken using existing data and tools to support existing plans and assessments.

8.4.2. Using maps showing different annual probabilities of flooding, the extent of flooding on a wide range of receptors around the city was recorded. Receptors include homes, hospitals, schools, nature reserves, listed buildings, roads and wastewater treatment works. The change in impact on the receptors across the different annual probability flood events can be used as a proxy to climate change. The risk of flooding from rivers shown in flood zone 3 was compared with that in flood zone 2 and the risk of flooding from surface water for a 1 in 30 annual probability event was compared with that of a 1 in 1000 annual probability event. The wards showing the greatest difference are those most likely to be sensitive to heavier storms and increased river flows as a result of climate change. A method statement is available in [Appendix E](#).

The impact of flood risk and the sensitivity to climate change of a ward is a factor not only of the changing extent of flood risk but also of the types of receptors existing within that ward and the significance of those receptors being flooded.

- 8.4.3. Using this method, the scale of changing risk in Peterborough, based purely on flood risk impacts, does not appear to be as significant as might be expected from other climate change predictions. This could be because there are many other factors that can contribute to how susceptible an area is to climate change. For example other weather and temperature patterns, the types of construction processes used and the cost of adaptation are other relevant factors. The way that the results are presented gives a relative susceptibility to help the city council prioritise areas to work on. The intention here is that the outputs in table 8-3 below will be investigated further and the city council will work with its partner organisations to find more about how susceptible the different receptors are and what can be done in future years to ensure their protection or adaptation. This work will be linked to the adaptation plan (action 50-P) proposed in the [Action Plan](#).
- 8.4.4. The wards expected to have medium to high sensitivity to climate change are listed in table 8-3 below. Note that the wards scoring highly are those expecting the biggest *change* in future years. A ward with a consistently high risk of flooding regardless of the probability/strength of the flood or rainfall events will not score as having a high sensitivity to climate change.

Table 8-3: Wards that are expected to be most susceptible to the flood risk implications of climate change

Source of flood risk	Ward	Rating	Flood risk expected to have greater impacts on
River flooding	Werrington South	Medium - high	-Health facilities -Infrastructure such as schools, roads, emergency services, power
	West		-Homes within the national 40% most deprived bracket -Infrastructure
Surface water flooding	Ravensthorpe	Higher 	-Health facilities -Infrastructure -Homes
	Werrington North		-Health facilities infrastructure -Homes
	East		-Health facilities
	Eye and Thorney		-Infrastructure -Homes with the national 40% most deprived bracket
	Werrington South		-Environmental and archaeological designations -Infrastructure

- 8.4.5. This means, for example that Ravensthorpe and Werrington North have, relative to other areas in Peterborough, a higher sensitivity to future changes in surface water flood risk. The data behind this conclusions shows that both wards have health facilities and other infrastructure that are very important to the lives of residents both in these wards and in other parts of Peterborough. Infrastructure includes

roads, rail, schools, power and emergency services for example). The predicted future increase in flood risk to some of these sensitive facilities or pieces of infrastructure is of note.

8.5. Adapting to change

- 8.5.1. Past emissions mean some level of climate change is inevitable. It is essential we respond by planning ahead. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building in the capacity to adapt (referred to as a 'managed adaptive approach' by Government²¹). Regular review of flood risk management strategies and plans is key to achieving long-term, sustainable benefits. Although the broad climate change picture is clear, flood risk management organisations often need to make decisions against a more uncertain local picture. A range of different measures therefore need to be considered, each with flexibility to be adapted in future. This approach, embodied within national flood risk appraisal guidance, would help to ensure that our vulnerability to flooding is not increased.
- 8.5.2. For the city council specifically, it is important that business continuity plans consider how city council services can adapt to changing weather and become more resilient. Suggested adaptation measures for severe weather and flood risk include:
- a) Detailed recording of the impact on city council resources and services of severe weather events to improve our understanding;
 - b) Developing a specific adaptation plan for city council services;
 - c) Appropriate management and maintenance of existing flood risk assets;
 - d) Ensuring development is sustainable with appropriate drainage systems and flood resilience measures;
 - e) Improving the resilience of city infrastructure (pumping stations, sewage treatment works, powers stations, railway lines etc) against flooding;
 - f) Improving the resilience of our highway network against droughts (can cause road subsidence and cracking in Fen areas), flooding and ice (blockage of drainage systems and potholes);
 - g) Increasing summer and winter water storage to be used for periods of flooding and drought;
 - h) Increasing tree cover across Peterborough to reduce urban heat island effect and slow down the movement of water;
 - i) Having strong working relationships and flexible contracts with health care delivery, emergency response and community recovery organisations to account for times of greater demand.

²¹Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities, Environment Agency

9. Partnership Funding

9.1. Introduction

- 9.1.1. This chapter provides background on the different types of funding which may contribute towards a flood management action or a water environment action proposed in Peterborough. National funding is explained in the most detail as this system has changed in recent years and often attracts questions. The sections following that are laid out in terms of how they are referred to in national funding guidelines and examples are given of average expenditure of Peterborough's flood risk management organisations.
- 9.1.2. Expenditure for all flood risk and water management schemes is split down into capital works (that create, purchase, significantly improve or replace new assets) and revenue works (operational maintenance). Maintenance is often funded by the owner of, or the organisation responsible for, a certain type of watercourse or management asset. Capital funding often requires more levels of approval. Capital budgets are not allocated as routine by organisations so money often has to be bid for in competition with other projects.

9.2. Grant in Aid - national funding

Flood risk funding

- 9.2.1. The way that flood risk management projects are managed and funded has recently changed in the UK. Since April 2012 the new government policy *Flood and Coastal Resilience Partnership Funding* has controlled how money is allocated to capital projects. In theory under the new approach every project providing a certain level of benefits has the potential to be supported by support from national funding over time. The amount of national funding, known as Grant in Aid (GiA) available to any capital project will directly relate to the outcomes the project delivers. GiA for flood risk management projects is called Flood Defence Grant in Aid (FDGiA). The outcomes measures for capital flood risk management schemes have been set by Defra and are as below:
- Outcome Measure (OM) 1 – Economic benefits
 - OM 2 – Households at risk
 - OM 2b – Households at very significant and significant risk
 - OM2c – Deprived households at very significant and significant risk
 - OM3 – Households at risk from coastal erosion
 - OM3b – Households at risk from coastal erosion in 20 years
 - OM3c – Deprived households at risk from coastal erosion in 20 years
 - OM4a – Hectares of water dependent habitat created or improved
 - OM4b – Hectares of intertidal habitat created
 - OM4c – Kilometres of rivers protected under the EU Habitats/Birds Directive
- 9.2.2. Each outcomes measure has a payment rate associated with it. Households better protected against flood risk or coastal erosion in the 20% most deprived areas of the country have the greatest payment rate; in this case OM2c and OM3c have a payment rate of 45p per £1 of the scheme cost. This clearly highlights the need for additional non-Government funding to enable any scheme to be delivered.

- 9.2.3. Defra have produced a spreadsheet calculator which allows flood risk management authorities to calculate what percentage of costs might be covered by central government through GiA funding and what other contributions they will need to raise locally. It is intended that beneficiaries to the scheme will contribute in some way, whether they be LLFAs, IDBs, parish councils, communities, or private companies. As well as direct financial contributions, agreements to carry out maintenance or other in-kind contributions that a cost could be put against may also be considered. Any contribution put towards the scheme improves the overall Partnership Funding score of the scheme. Every scheme must score a minimum of 100% to be eligible for GiA.
- 9.2.4. Schemes requesting FDGiA need to be submitted to the Environment Agency's / RFCC's Medium Term Plan (MTP). The MTP sets out a six-year programme of works that the RFCC would like to deliver subject to funding, further development of business cases and final scheme approvals. This is similar to the idea of the Peterborough FMS [Action Plan](#), but for the Anglian region. Projects to be delivered in Peterborough that require FDGiA need to be in both the FMS and the MTP.
- 9.2.5. There is a limited pot of central government funding so FDGiA payments to approved projects will be subject to availability of funds. Each year competing projects will be prioritised by RFCCs to ensure projects provide good value for money and to achieve national and regional targets. As of 2014/15 there are several very large capital projects in the UK that already have expenditure in future years committed to them. This reduces the amount of money available to new schemes. Therefore the Partnership Funding score needed is very high, almost 250%. This may change in future years and so it is encouraged that projects are still submitted to the Medium Term Plan even for the future even if they cannot yet reach a suitable score to enable delivery.
- 9.2.6. It is expected that through the need to work in partnership all schemes proposed will now consider management of flood risk in an area from all sources, proposing joint solutions that reduce the overall flood risk to a community or area.
- 9.2.7. The inclusion of amenity benefits for local communities is one way of attracting wider support for schemes from local communities and helps to draw in local contributions.
- 9.2.8. All schemes are also encouraged financially to include the delivery of multiple benefits related to other themes of water management other than flood risk. Outcome measures 4a to 4c specifically encourage habitat benefits.

Water Environment funding

- 9.2.9. For schemes where the main driver is environmental improvement, the source of Government funding is instead Water Framework Directive Grant in Aid (WDGiA). These schemes may include work to improve habitats, increase biodiversity, remove obstacles to fish and eel migration, and improve water quality. Ultimately the schemes should bring about an improvement to, or help to prevent a deterioration in the status of a watercourse under the Water Framework Directive.
- 9.2.10. The investment plan in which all such schemes needs to be entered is called the Integrated Environment Programme (IEP). This is the equivalent of the flood risk management MTP. The process for submitting projects is largely similar to that for

flood risk management and schemes will need to demonstrate how they meet the IEP's outcome measures in order to attract funding.

- 9.2.11. If schemes deliver significant benefits to flood risk and to the water environment they can be entered into the MTP and the IEP and apply to use both FDGiA and WFDGiA.

9.3. Public contributions

Environment Agency funding

- 9.3.1. As discussed in section 6.4, the majority of the Environment Agency's funding for flood and coastal risk management comes directly from the Department for the Environment, Food and Rural Affairs (Defra). This is the same for water environment works to meet the Water Framework Directive. For new capital schemes, the Environment Agency need to put their projects on the MTP and IEP and submit project bids to Defra for GiA in the same way that LLFAs and IDBs can. Therefore there is no additional source of Environment Agency funding that could be added to a bid, e.g. as a local contribution, in order to raise the partnership funding score.

Regional Flood and Coastal Committee

Section 6.9 explains the role of the Anglian Northern Regional Flood and Coastal Committee. Part of this role is to oversee the MTP work programme of flood risk management schemes in the region. Within the region of the Anglian Northern Regional Flood and Coastal Committee the gross expenditure of the Environment Agency was £33,119,000 in 2013/14 and is £44,679,000 for 2014/15. These values include money collected from Local Levy, General Drainage Charges and IDB Precepts as shown in table 9-1.

Table 9-1: RFCC income

Income source	Income in 2014/15 (£k)
Government FDGiA	37,988
IDB precepts	2,167
General Drainage Charges	1,420
Local Levy payments from LLFAs	1,681
Movement in balances	1,423
Total Income	44,679

- 9.3.2. The RFCC collects and allocates IDB Precepts, General Drainage Charge and Local Levy funding which can be used as match funding for capital schemes requiring FDGiA or to support delivery of the revenue maintenance programme. For very small schemes that are deemed locally significant, it is sometimes possible for these to be funded directly from these sources. Therefore any schemes hoping for regional contributions need to be submitted to the MTP.

Local Levy

- 9.3.3. Under the FWMA 2010 and the Environment Agency (Levies) (England and Wales) Regulations 2011, local levy is collected annually from all Lead Local Floods Authorities in the area of the RFCC. The levy is agreed annually in January and are

often based on an average increase of between 0% and 5%. The total levy payment is shared between all contributing bodies in the committee area on the basis of the number of Council Tax Band D equivalents that each has. The table below illustrates the total value of the Local Levy collected by the RFCC and the contribution from PCC for the last few years.

Table 9-2: Local Levy paid by Peterborough City Council

Budget	Amount 2012/13	Amount 2013/14	Amount 2014/15
Average voted change from previous year*	0%	+ 5%	+ 3.5%
Actual Peterborough Local Levy contribution (£k)	147	154.5	161.4
Total Levy collected by Anglian Northern RFCC (£k)	1,547	1,624	1,681

General drainage charges

- 9.3.4. General Drainage Charges are charged directly to agricultural landowners who are not in an IDB area. The charge is deemed to be a contribution towards the management of water and flood risk for those landowners. It is calculated on a rate per hectare basis using the Council Tax Base of Band D equivalent properties.

IDB precepts

- 9.3.5. Precepts are paid by IDBs to the Environment Agency for works done by the Environment Agency on channels or defences that affect or are in an IDBs area. The works are normally maintenance based. The formula for calculating the precept is complex but is approximately based on the number of hectares of land protected. The value of precepts has not been raised for a few years.

Lead Local Flood Authority funding

- 9.3.6. Money spent by the city council on flood and water related actions comes from un-ringfenced Government flood risk grants, from allocating a share of the corporate budget to this area or from ringfenced commuted sums relating to specific development schemes. Since becoming an LLFA, the city council has had an average total budget of approximately £600k for all drainage, flood risk management and water management activities. This expenditure goes on:
- highway drainage maintenance, schemes and reactive works (gullies and watercourses);
 - maintenance of adopted drainage systems on specific development sites;
 - relevant staff salaries and on-costs;
 - asset surveys;
 - flood awareness community events

- f) delivery of required flood risk reports or policies e.g. for developing the
- g) training and software; and
- h) flood and water management projects.

9.3.7. The sum in section 9.3.6 excludes the drainage and flood risk sums collected through Council Tax each year which are then:

- i. paid as a Local Levy contribution to the Environment Agency for management by the RFCC; or
- ii. transferred to the IDBs as a Special Levy.

As of 2013/14 information is included in Peterborough’s Council Tax booklet about these levies.

9.3.8. To obtain corporate capital funding to deliver significant capital schemes, officers would need to submit a separate bid for funding as part of the annual budget setting process.

9.4. Internal Drainage Board funding

9.4.1. As discussed in section 6.5 drainage boards are funded by rates paid by the landowners in their area. This can be broken down into Drainage Rates and Special Levies. Drainage rates are paid by agricultural landowners direct to the IDB based on the area of their property. Where land in the IDB’s district is not in agricultural use, the owner instead pays their levy to Peterborough City Council as part of their Council Tax. The relevant amount is then separated out from the Council Tax and paid to each IDB. This is known as a Special Levy.

9.4.2. The total expenditure for Peterborough’s two largest IDBs for the year 2014/15 is shown in table 9-3. The area of Peterborough that falls within the Middle Level and with the Whittlesey and District IDB is small and hence the details of these organisations is omitted below. It is important to note that the IDBs’ funding is for maintenance and capital works across their whole areas, not just in Peterborough.

Table 9-3: IDB Expenditure

Internal Drainage Board	Total Expenditure for 2014/15
North Level District IDB	£1,514,778
Welland and Deepings IDB	£2,100,367

9.5. Use of public sector co-operation agreements

9.5.1. The use of public sector co-operation agreements can enable organisations such as councils, the IDBs and the Environment Agency to work in partnership to deliver services in a very efficient and more cost effective way. The agreements can be used for example, to cover maintenance and emergency response work, where the following criteria is met by the agreement:

- a) it must be a genuine co-operation between the participating contracting authorities, aimed at jointly carrying out their public service tasks (different in character to a contract for services);
- b) involves co-operation only between public entities;

- c) is non-commercial in character (no profit is generated and only reimbursement of actual costs), and
- d) is governed solely by considerations and requirements in the public interest and is of little interest to a private sector supplier.

9.5.2. The Environment Agency have such an agreement in place with some IDBs²² in Peterborough, and it is hoped that in future the city council may also have agreements in place with some of its flood risk partners. See section 10.2.32 and [Action Plan](#).

9.6. Private contributions (community and commercial)

9.6.1. Partnership funding guidance intends that those benefitting from the proposed flood management scheme contribute towards its costs. This could be local residents, a parish council or a local business, for example. Securing contributions from private sources is not easy, especially as it is a relatively new system, and therefore Peterborough City Council will endeavour to engage with all beneficiaries as early as possible in the process of developing new schemes. If there is an expectation that others will contribute then it is important that they are involved in designing the scheme.

Anglian Water

9.6.2. Contributions from water companies count as private contributions. In order to secure funding from Anglian Water, projects need to be part of the company's five yearly Asset Management Plan (AMP) which is agreed by Ofwat, the water company regulator. The upcoming AMP period is called AMP 6 and covers 2015 to 2020. Prices are set by Ofwat at the beginning of each AMP period, following submissions from the water company about what it will cost to deliver their business plan.

9.7. Impact of local funding contributions

9.7.1. In order to demonstrate the importance of local funding being available to contribute to schemes applying for FDGiA, the following figures have been calculated by the RFCC:

Figure 9-1: Example of the multiplying benefit of Local Levy

For a Levy contribution of	= £1000
Actual cost to the Local Authority	= £667
Expected funding levered in from GiA	= £3,000 to £15,000
Actual benefit to the local community	= £20,000 to £120,000

²² http://www.ada.org.uk/news_detail.php?id=483

10. Management and Action Plan

10.1. Introduction

- 10.1.1. This chapter provides the context to and the benefits of the different management procedures, policies and actions of Peterborough's flood and water management organisations. The chapter is intended to be read alongside the proposed **Action Plan** and the Completed Action Table in **Appendix F**.
- 10.1.2. Since the introduction of the FWMA 2010 the organisations managing flood risk in Peterborough have come a long way in terms of working together to understand and manage risk. The Flood and Water Management Partnership, as described in section 9, has been established and many actions have been delivered in partnership. There has been a significant increase in communication and awareness raising activities and in the consideration of surface runoff and groundwater flooding. **Appendix F** has been put together to illustrate the actions delivered since the FWMA 2010 was enacted.



Figure 10-1: Completed action to create a new ditch near Eye Green to reduce flooding

- 10.1.3. A major role of the FMS is to set out measures or actions for the future that are proposed in order to meet the objectives set in chapter 5. These measures can be found in the **Action Plan**. The tasks and projects listed have been identified based on input from a wide range of stakeholders and an understanding of the need. In order for the proposed measures to become deliverable actions, each item on the action plan will need to be worked up in more detail and tested for deliverability and viability through the business case process. The key dependencies and risks affecting the actions are discussed in the box overleaf and sections 10.1.4 – 10.1.8 set out how to interpret the **Action Plan**.

Dependencies and risks

All of the schemes proposed in the strategy will require individual business cases to be developed by the lead partner. They will not be able to progress beyond the proposal stage unless approval is obtained from all stakeholders and funding partners. The benefits and impacts of the actions will be assessed. The following dependencies and risk affect the actions listed in the [Action Plan](#):

Funding

Appropriate funding needs to be secured from a range of different sources to meet Partnership Funding requirements (see chapter 9). This may result in some schemes being delayed until these requirements are met.

Timescale and priority changes

Priorities may need to change, for example, as a result of updated information about the flood risk in an area (i.e. from modelling), the specific risks associated with delivering the project, and /or the availability of resources to deliver the schemes.

Land ownership and maintenance agreements

If third party land is required for a scheme, the landowner's approval will need to be sought. It is also essential that an agreement is put in place about the long-term maintenance of any structure or feature being constructed.

Flood defence or ordinary watercourse land drainage consent

Changes to watercourses require consent under the Land Drainage Act 1991. Consent requires the project to demonstrate that there will be no negative impacts on flood risk elsewhere, on the watercourse or on elements of the habitat and water quality that are governed by the Water Framework Directive.

Planning related consents and assessments

Some projects may require planning permission, environmental impact assessment, scheduled monument or listed building consents or be affected by other constraints like Tree Preservation Orders.

Traffic regulation orders

Works taking place near roads or on highway drainage may require a traffic regulation order to be put in place.

10.1.4. The [Action Plan](#) includes the following information about individual projects:

- i. Name
- ii. Action number and code e.g. 1-A, 51-P
- iii. Ward
- iv. Management area
- v. Description of the action
- vi. Lead partner
- vii. Other partners
- viii. Time frame
- ix. Funding source
- x. Cost
- xi. Objectives and benefits

- xii. Priority of the action
- xiii. Progress

- 10.1.5. A more comprehensive action plan is available on request that also contains information about the: catchment, the source of flood risk being addressed, the objective that the action meets, project risks, legislation or policy drivers, and action plan review dates.
- 10.1.6. Some actions apply fairly consistently across Peterborough. These actions are listed as having a Peterborough-wide management area and are discussed next. Some actions are specific to different areas of Peterborough due to local characteristics (e.g. landscape type) dictating the need for different approaches. For the purpose of discussing these latter actions, Peterborough has been divided into three management areas: Urban, Fens (Rural North and East) and Rural West as shown in figure 10-2.

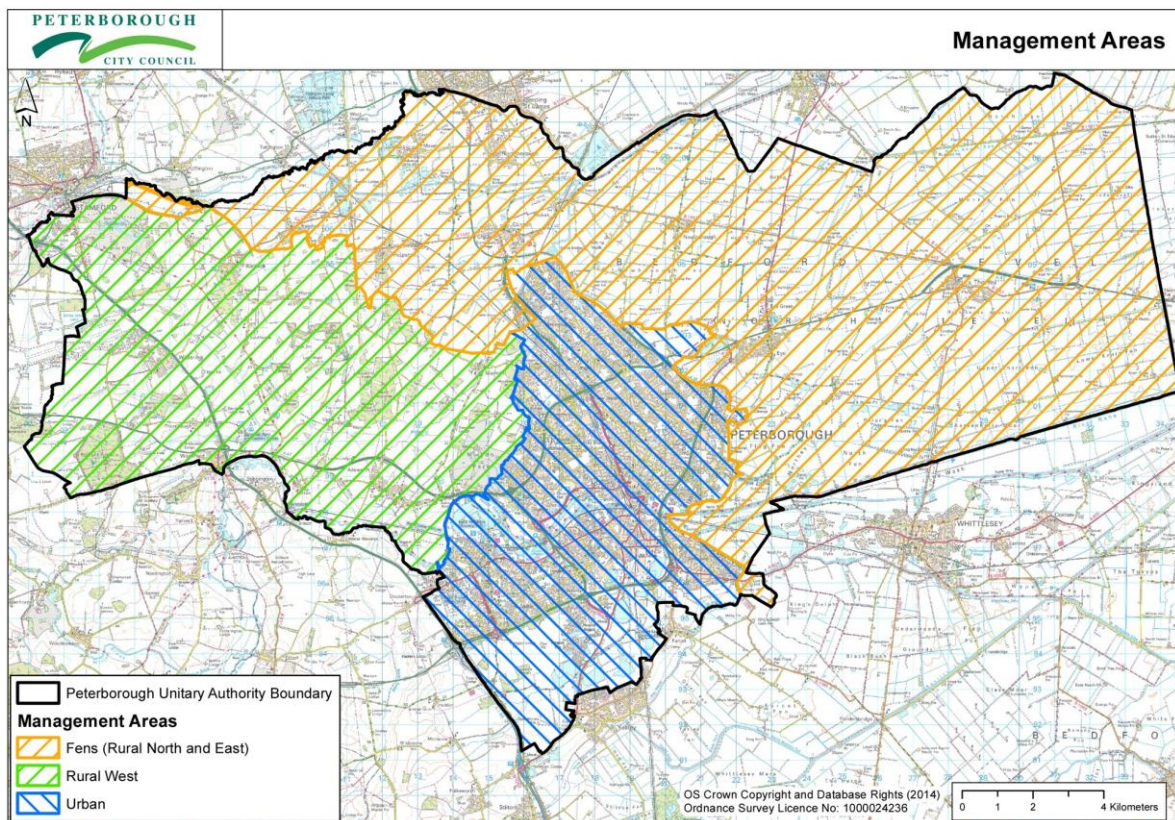


Figure 10-2: Management areas into which Peterborough has been divided for the purpose of the Action Plan

- 10.1.7. Against each action listed in the action plan it is noted which objectives the action meets and what type of benefits the action has. The meeting of FMS objectives allows the achievement of the objectives in the National Flood and Coastal Risk Erosion Management Strategy as set out in 3.3. Below is a reminder of the FMS objectives:

Objective 1 – Improve awareness and understanding of flood risk and its management, to ensure that everyone can make informed decisions and take their own action to become more resilient to risk.

Objective 2 – Establish efficient co-ordinated cross-partner approaches to flood and water management, response and recovery, sharing and seeking new resources together.

Objective 3 - Reduce flood risk to prioritised areas and strategic infrastructure, ensuring that standards of protection elsewhere are maintained.

Objective 4 – Improve the wider sustainability of Peterborough, ensuring an integrated catchment approach and proper consideration of the water environment and its benefits, in new and existing environments.

- 10.1.8. Some schemes have direct benefits to a numbers of home and businesses, some to infrastructure or the natural environment and some actions are more about improving the efficiency of management processes and expanding flood risk knowledge. The latter category will still have benefits to homes and businesses but they may be indirect. Once schemes are worked up in more detail in terms of development of the detailed business cases, it will be possible to provide further information about the exact benefits achieved. A list is provided below of the benefit categories used for the actions:

Benefit category code	The action has benefits for:
Agr	Agriculture
Bus	Businesses
Com	Community amenities and public services
Dev	New development (all types)
Eff	Efficiency of management
Env	Natural environment
Hom	Homes
Inf	Infrastructure
Kno	Better local knowledge and understanding

10.2. Management - Peterborough-wide

- 10.2.1. This section gives an overview of the different types of management taking place now and in the future that are not specific to one particular area of Peterborough. This section should be read alongside the section which specifically relates to your area of interest to give a full picture of flood risk management in your area.

Watercourse maintenance

<i>Action</i>	<i>Benefits to</i>
1-A	Agr, Bus, Com, Hom, Inf
2-A	Agr, Bus, Com, Hom, Inf

- 10.2.2. Each water management organisation undertakes a variety of maintenance activities to look after their infrastructure. Details are provided in table 10-1 below.

Table 10-1: Maintenance activities undertaken in Peterborough

Organisation	Location of activity	Maintenance activity	Average frequency
PCC (Drainage and Highways Functions)	Higher risk watercourses (classes 1-3)	Vegetation management	Annually
		Rubbish removal and headwall and screen clearance	As required
		De-silting	Every 30 years, plus localised high silt levels
	Lower risk watercourses (class 4)	Vegetation management, litter removal and desilting	As required
	Highway gullies	Carriageway and footway gully cleaning	Routinely as well as on a reactive basis
Environment Agency	Nene	Vegetation maintenance	As required
		De-silting	Annually at Popley's Gull where silt collects
	Welland	Vegetation maintenance	As required
		De-silting	Not applicable
	Higher risk Main Rivers (excluding Nene and Welland)	Vegetation maintenance	As required
	Lower risk Main Rivers	Vegetation maintenance	As required
	All raised defences	Vermin control of raised defences	As required

10.2.3. Some watercourses have much higher or lower risk associated with them and therefore the maintenance required will vary according to the risk profile. For example Peterborough City Council uses the following classification for its watercourses as shown in table 10-2:

Table 10-2: Watercourse classification

Class	PCC Classification
1	Critical
2	Non critical – high risk
3	Non critical – medium risk
4	Non critical – low risk
5	No routine maintenance

10.2.4. The maintenance works carried out by IDBs is covered in section 10.5 as this is specific to the Fens (Rural North and East).

10.2.5. Each organisation also undertakes upgrade schemes in specific locations depending on the areas of greatest need and the funding available. The schemes proposed for the upcoming years are included in the Action Plan.

Emergency planning

Action Benefits to

27-C	Bus, Com, Hom, Kno
36-C	Bus, Hom
38-P	Bus, Eff, Hom, Inf, Kno
59-P	Bus, Com, Hom, Inf

- 10.2.6. Under the Civil Contingency Act 2004, Peterborough City Council and many of the other flood management organisations are also emergency responders. There are two categories of emergency responder:
- i. Category 1 – the core responders. Includes the ‘blue-light’ services (Police, Fire and Rescue, Ambulance Service), the NHS, local authorities and the Environment Agency.
 - ii. Category 2 – co-operating responders that act in support of the category 1 responders. Includes utility companies such as Anglian Water and UK Power Networks, and transport organisations such as Highway’s England.
- 10.2.7. In planning for flooding the following different roles exist under this legislation:
- a) Warning and informing people – all
 - b) Putting joint response plans in place - all
 - c) Response actions – blue light services
 - d) Recovery – Local authorities i.e. Peterborough City Council
- 10.2.8. All local authorities will have an emergency flood plan. Peterborough’s Flood Guidance Document was last reviewed in 2011 and there are currently separate plans for Peterborough and Cambridgeshire. It is intended now to create one plan covering both local authority areas as this would then align with the area over which the Emergency Services operate, making response more efficient. The plan would be used by all emergency responders and is therefore to be called a Multi-Agency Flood Plan. The Environment Agency will also be involved in the development of both this plan and others from surrounding areas to ensure full coverage of the Nene and Welland catchments.
- 10.2.9. One of the most controversial elements of the November/December 2012 flood events was the issues of sandbags. The need for clarity over the policy of the city council and its partner organisations is very important. Some local authorities do provide sandbags, knowing that the presence and actions of council and emergency services officers on site helping local people is important. However many other councils do not provide sandbags. This is because while they can slow floodwater, they do not stop it; they provide no protection if the flooding is due to rising groundwater; and after the floods the disposal of large numbers of contaminated sandbags can be very difficult and expensive. Efforts can sometimes be better focused on investing in other, better and reusable defence measures. At any time you will be able to find the sandbag policy of Peterborough City Council online at <http://ask.peterborough.gov.uk/help/council/environment/sandbags/> A proposed future action is for PCC to investigate the benefits of procuring any longer lasting ‘temporary’ defences. While a storage location for these would need to be found, the defences could be used to help protect city council property, such as the Key Theatre, as well as other key infrastructure.
- 10.2.10. As part of their role in managing flood risk from Main Rivers, the Environment Agency provide a Main River forecasting and flood warning service. It is their intention to continue this service, to work with local communities and other risk

management authorities to promote awareness of flood risk and the warning service.

10.2.11. Activities are included in the Action Plan to help us better plan for and improve resilience against surface water flooding. Surface water flooding is very hard to predict due both to the nature of heavy rain showers being localised and changes in land levels having a very significant effect on where the runoff ends up. To try and improve our understanding and management of surface water the following actions are being considered:

- a) Raising awareness through our website and targeted communications of the risk of surface water flooding, of weather warnings and of what people can do and who they can contact.
- b) Continue to follow the current national and European research (such as the RAINGAIN programme²³) on the development of surface water flooding warning systems. Incorporate learning and actions into our plans whenever possible.

Resilience of critical infrastructure

<i>Action</i>	<i>Benefits to</i>
37-C	Inf

10.2.12. Peterborough’s critical infrastructure (electricity substations, water treatment plants, care homes, schools etc) are often owned by a range of different organisations, many of them not part of the FloW Partnership. Peterborough City Council and the FloW Partnership have highlighted an action to work with the owners of critical infrastructure wherever possible to ensure that flood risk to the infrastructure is minimised.

Flood risk communication and awareness

<i>Action</i>	<i>Benefits to</i>
25-C	Com, Eff, Kno
26-C	Eff
27-C	Bus, Com, Hom, Kno
28-C	Bus, Com, Eff, Env, Hom, Kno
29-C	Bus, Hom, Eff, Inf
30-C	Hom, Inf
34-C	Hom, Inf

10.2.13. Communication about flood risk with residents and businesses is very important. The principal areas of communication which are required are:

- a) Warning people of imminent flooding.
- b) Making people aware of flood risk in their area (outside of flood events) and ensuring they know where to look and who to contact for further information.
- c) Encouraging people to prepare themselves mentally and physically for flooding and make their homes more resilient.
- d) Encouraging and supporting communities and parish councils to prepare their own emergency plans.

²³ <http://www.raingain.eu>

- e) Helping people to understand what organisations and processes are currently in place to manage flood risk in their area and who to contact.
- f) Being clear about things that residents, businesses, developers can do to make sure that they do not increase flood risk such as not paving over gardens with impermeable materials or putting fats, oils, greases and other ‘unflushables’ such as baby wipes down the sink, drains or toilets.
- g) An awareness raising campaign about the responsibilities of riparian owners (those owning land which is alongside or which contains a watercourse) and the flood risks that are caused when appropriate maintenance is not carried out. Many residents and organisations in Peterborough, including the city council, the Environment Agency and Anglian Water, are riparian owners. If we can ensure that watercourses do not get forgotten about and receive an appropriate level of maintenance this will reducing the changes of flood risk being caused by blockages or a lack of care. In Peterborough, tree clippings, rubble and flytipping have all been dumped in watercourses from time to time. Each time this happens these will significantly increase the risk of flooding for those living alongside that watercourse.

10.2.14. All of these elements are included in the Flood and Water Management Partnership’s intended actions (see [Action Plan](#)). The communication messages will be delivered through a range of mediums such as website updates, flood warden training sessions and larger scale public events.

Integrated landscape and water management

<i>Action</i>	<i>Benefits to</i>
41-P	Bus, Com, Dev, Eff, Env, Hom, In
44-P	Bus, Eff, Home
45-P	Bus, Dev, In
51-P	Hom
53-P	Agr, Env, Inf
54-P	Bus, Hom
55-P	Agr, Bus, Dev, Hom, Inf
56-P	Bus, Eff, Home, Inf

10.2.15. When flood management schemes are being proposed, consideration will be given to other water and green infrastructure management actions in the same catchment or sub-catchment that could be combined to create a larger joint scheme. This could deliver a wider range of benefits as discussed in chapter 4, increase the number of outcomes measures for Partnership Funding (section 9) and therefore increase the chance of a scheme going ahead. Actions from the Green Grid Strategy and the Nene and Welland integrated catchment management plans are included in the Action Plan for the FMS where these seeks to deliver notable benefits to flood risk.

Flood investigations and thresholds

<i>Action</i>	<i>Benefits to</i>
3-A	Agr, Bus, Hom, Inf

10.2.16. Section 19 of the FWMA 2010 sets out that LLFAs have a duty to investigate flooding incidents within their area, to the extent that the LLFA considers necessary or appropriate. The investigation must set out:

- a) *which risk management authorities have relevant flood risk management functions, and*
- b) *whether each of those risk management authorities have exercised, or is proposed to exercise, those functions in response to the flood.*

10.2.17. Where an authority carries out an investigation:

- a) *it must publish the results of its investigation, and*
- b) *notify any relevant risk management authorities.*

For the city council to undertake formal investigation it must be made aware of the flooding, whether from officers, contractors, other risk management authorities or members of the public. An incident notification form exists for this purpose and is in [Appendix G](#). People are encouraged to send in photographs with the form to aid the investigation.

10.2.18. In order to determine situations where formal investigation is necessary, Peterborough City Council has established thresholds. Flooding must meet the criteria set out below for a section 19 investigation to take place:

Thresholds for FWMA 2010 section 19 flood investigations

- a) Internal flooding to any one dwelling
- b) Internal flooding to more than one business premises
- c) Flooding to any critical infrastructure or critical services
- d) Flooding that causes significant disruption to a transport link for a defined period*

10.2.19. In d) above the definition of 'defined' period is dependent on the transport link affected. The following thresholds have been derived for each of the highway categories set out in the UKRLG Code of Practice for Highway Maintenance:

Table 10-3: Thresholds for the city council to carry out and publish flood investigations

Category	Name	Description	Example	Duration of significant disruption to network
1	Motorway	Motorway	A1(M)	Over 1 hour
2	Strategic Route	Trunk roads and some principal 'A' roads	A15 Glington Bypass, A1139 Fletton Parkway, A1260 Nene Parkway	Over 1 hour
3a	Main Distributor	Main urban network and inter-primary links	A605 Oundle Road, A15 Bourges Boulevard, A15 London Road	Over 4 hours
3b	Secondary distributor	Classified road: B and C class	B1443 Helpston, B1091 Peterborough Road Stanground, B1081 Old Great North Road Wothorpe, Taveners Road (C60), Eastfield Road (C51), Gresley Way (C299)	Over 4 hours
4a	Link Road	Roads linking the Main Distributor network to the secondary Distributor	Stamford Road Marholm (C40), Deeping Road Peakirk (C6), Oakdale Avenue Stanground, Hartwell Way Ravensthorpe, Werrington Bridge Road (C47)	Over 24 hours
4b	Local Access Road	Roads serving limited numbers of properties carrying only access traffic	Any small cul-de-sac or similar residential estate road	Over 24 hours

10.2.20. The city council commits to starting the investigation within 30 days of the flood event. The investigation will be shared with the other risk management organisations and the results of the investigation will be published on PCC's website within six months of the date of the incident. No personal information will be included in the reports. Photographs supplied will not be included in the final report without the owners' permission.

Measuring the impacts of severe weather

Action	Benefits to
39-P	Eff, Kno

10.2.21. In 2012 Peterborough City Council prepared a Local Climate Impacts Profile (LCLIP) which illustrates the effects that severe weather has had on city council services over the years. The report set out that:

- a) Between 2000 and 2012 a total of 220 media stories reported extreme weather events in Peterborough, with more than 500 consequences to city services and the wider community.
- b) These consequences include impacts on transport systems, health and social systems and service provision.
- c) Excessive rainfall/flooding and ice/snow are the most common events impacting city services, although hot weather and wind are also significant.
- d) Severe weather events affect services both directly and indirectly and these events normally have cost implications, whether through direct action or lost opportunity costs. While some costs can be ascertained, the majority are not recorded in an accessible manner, or are hidden costs.
- e) The financial impact of severe weather differs according to the services and weather types in question. Loss of income and increased costs are the most commonly associated with these events, in particular snow/ice, ground movement and excessive rainfall/flooding.
- f) Existing budgets may not be able to cope with the expected increase in severe weather events and the resulting reactive works required. This makes the case for changing the way Peterborough approaches its work to make the City more resilient, rather than just focusing on post-event recovery and repair.

10.2.22. In order to be able to know how much to invest in more adaptable designs it is important to know what the costs of the severe weather impacts are. Therefore it is proposed that the city council adopts a severe weather recording system. One called SWIMS (Severe Weather Information and Monitoring System) has already been used by Kent County Council and all their emergency response partners. It has been very successful and now allows the organisations to collectively assess the costs of flooding, for example on staff resources and contractor availability, lost working hours, costs of repair and insurance claims.

Adapting to changes in climate and natural resource availability

<i>Action</i>	<i>Benefits to</i>
33-C	Bus, Env, Hom, Kno
49-P	Agr, Bus, Com, Dev, Eff, Env, Hom, Inf, Kno
58-P	Eff, Env

10.2.23. The city council and its Environment Capital partners would like to plan for change by developing an Adaptation Action Plan. The plan would need to look at both internal (e.g. changes to organisations’ own processes) and external (e.g. Peterborough-wide building design and construction) so that companies, residents and public services can better cope with changing environmental and weather conditions. This would be made easier once better impact data has been collected through the implementation of a recording system as discussed in the previous paragraph. The LCLIP also noted that measures to adapt to and minimise the impacts of severe weather events require cross service collaboration. This demonstrates the need for a Peterborough-wide Adaptation Action Plan rather than just a city council-based one, for example.

Asset register

<i>Action</i>	<i>Benefits to</i>
7-A	Eff, Kno
8-A	Eff, Kno
9-A	Eff, Kno
10-A	Eff, Kno
11-A	Kno
13-A	Agr, Inf

10.2.24. Section 21 of the FWMA 2010 requires the city council to maintain a register of flood risk related structures. The legislation is provided below.

<p>21 Lead local authorities: duty to maintain a register</p> <p>(1) A lead local flood authority must establish and maintain—</p> <p>(a) a register of structures or features which, in the opinion of the authority, are likely to have a significant effect on a flood risk in its area, and</p> <p>(b) a record of information about each of those structures or features, including information about ownership and state of repair.</p> <p>(2) The Minister may by regulations make provision about the content of the register and record.</p> <p>(3) The lead local flood authority must arrange for the register to be available for inspection at all reasonable times.</p>
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Figure 10-3: Extract from the FWMA 2010

10.2.25. The asset register provides a useful tool for:

- a) ensuring that members of the Flow Partnership are aware of important assets belonging to other partners e.g. in case it would be useful to link the maintenance or operation of them;
- b) the Flow Partnership to identify areas where joint actions may need to be planned and funding sought
- c) providing a list of significant assets in certain locations so that if and when flood events occur the city council can quickly identify what partner organisations it needs to consult and which partners may need to be part of any investigation undertaken (section 10.2.24)

10.2.26. It is intended that the asset register will be reviewed annually by the Flow Partnership to ensure it is both useful and up-to-date.

10.2.27. Several actions are included in the action plan with regards to gradually increasing the data held about assets in Peterborough. This will continue to improve the understanding of the level of flood risk and the condition of the assets being used to manage this risk.

Designation of features or structures

<i>Action</i>	<i>Benefits to</i>
12-A	Bus, Hom, Inf

10.2.28. Under Section 30 and Schedule 1 of the FWMA 2010 a designating authority (the Environment Agency, an LLFA or an IDB) can designate a “*structure or natural or man-made feature of the environment*” whose existence or location influences flood risk. Once designated the feature or structure may then not be altered, removed or replaced without the consent of the designating authority. A designation becomes a local land charge, showing up on house searches.

10.2.29. This new power exists to prevent structures that are not formal flood defences but that are protecting locations from flooding, from being removed. Example might be a garden wall or potentially even an areas of trees. The designation does not place a requirement on a landowner to upgrade or spend money on maintaining the feature, but it does seek to prevent any work taking place that would cause the structure to be weakened or removed. Enforcement action will be taken by the city council if a designated structure is changed, damaged or removed.

10.2.30. Figure 10-4 below sets out the steps involved in designating a feature. The designation assessment involves considering what type and level of protection the structure provides, its vulnerability, the consequences of removal and the current management of the structure. Consultation with the land/property owner is a very important part of the full process.

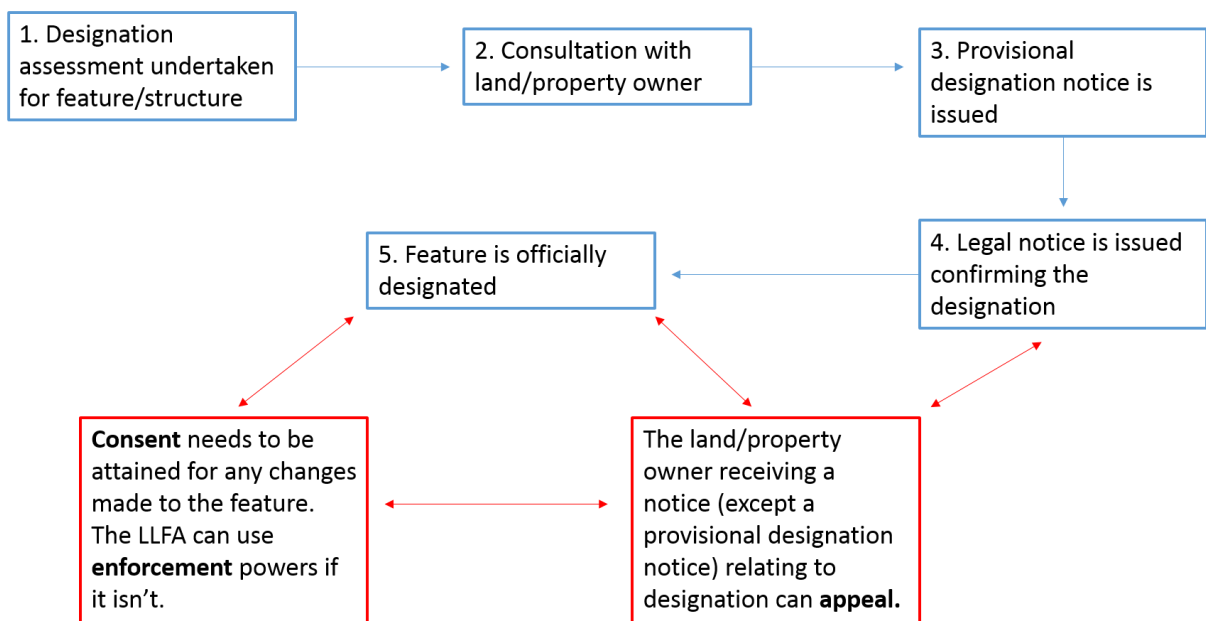


Figure 10-4 Designation process

10.2.31. If you would like to suggest to the city council that a particular structure or feature is assessed for designation then please email watermanagement@peterborough.gov.uk.

Sharing services

Action	Benefits to
17-A	Eff

10.2.32. Section 13(4) of the FWMA 2010 allows a risk management authority to arrange for a flood risk management function to be exercised on its behalf by another risk

management authority. The proposal is that the city council develops Public Service Co-operation Agreements, where appropriate, with one or more relevant partner organisations. This should help to increase the efficiency of flood risk management in Peterborough and reduce the costs. Chapter 9 provides more details about how these agreements could work for functions like emergency response, regular maintenance and asset inspection.

10.3. Management – Urban Peterborough

- 10.3.1. The soils underlying the urban area (and future urban extension area) of Peterborough are heavy clay and have been characterised by Natural England as Bedfordshire and Cambridgeshire Claylands. The clay soils along with impermeable urban surfaces have so far acted to limit infiltration potential and increase surface runoff after heavy rain. The urban area of Peterborough also has many Main Rivers running through it. In and near to the floodplain the soil type is more consistent with sand and gravels and hence can also be susceptible to groundwater flooding. The varying sources of risk and the high number of sensitive receptors (homes, roads and other infrastructure) make it a key area for investment in flood risk management.

Comprehensive flood alleviation and water environment schemes

<i>Action</i>	<i>Benefits to</i>
44-P	Bus, Com, Dev, Env, Hom
45-P	Bus, Dev, Env, Inf
46-P	Env, Hom, Inf
51-P	Com, Env, Hom

- 10.3.2. In Bretton North, Werrington North and Werrington South, a comprehensive water environment management project is underway which seeks to bring flood risk improvements as part of a wider scheme seeking improvements in the water quality, habitat, biodiversity and amenity value of water bodies. The project is focused on the Main Rivers of Brook Drain, Marholm Brook, Werrington Brook and Paston Brook, on Cuckoos Hollow Lake and on the ordinary watercourses that are part of this sub catchment of the River Welland. This project has many themes including physical in-channel improvements, improving the quality of discharges into the river by working with residents, industry and farmers, and trying to change long-term behaviours and attitudes towards the river environment. The project is already a fantastic example of using a catchment based approach to maximise the deliverability of projects and multiple benefits. The involvement of many different organisations and community members in this project is what has made it a success so far.
- 10.3.3. At Brook Drain in North Bretton and at Paston Brook in North Ward, the Environment Agency intend to undertake specific projects to review Main River assets and how these are managed. These projects had already been identified by the Agency in the Welland CFMP but will also form part of the catchment based approach of the project described in the previous paragraph. At North Bretton changes proposed to the river by Network Rail will also drive a review of the Dukesmead Penstock and significant environmental improvements, while at Paston Brook the A47 culvert is being considered for improvement. The latter may have benefits for surface water flood risk as well as Main River risk due to nature of the catchment.

- 10.3.4. In Dogsthorpe Ward a scheme is proposed to reduce the risk of surface water flooding to residential properties by increasing storage within the surface water network. The intention is to consider the retrofit of sustainable drainage systems, diverting and providing attenuation for excess flows that would otherwise put pressure on the surface water sewers. It is hoped to also provide a public amenity feature(s) and habitat as part of these works.

Understanding the risk and developing appropriate management

<i>Action</i>	<i>Benefits to</i>
40-P	Bus, Hom
42-P	Hom
43-P	Bus, Hom
47-P	Bus, Hom, Eff
48-P	Bus
57-P	Hom, Kno

- 10.3.5. A variety of projects have been proposed in the following urban wards in order to improve our understanding of the current and future risks: Fletton and Woodston, Orton Longueville, Orton Waterville, Ravensthorpe, Stanground Central and West Ward. These projects are about better understanding the risk, promoting awareness and resilience in the community and about investigating what other solutions might be deliverable to assist communities with protecting their properties. These areas do not rate as high flood risk areas in national assessments and hence will attract minimal Government funding. Working in partnership to identify alternative funding mechanisms for proposed solutions will be integral to these projects.

Understanding surface water flooding

<i>Action</i>	<i>Benefits to</i>
28-C	Bus, Com, Eff, Env, Hom, Kno
29-C	Bus, Eff, Hom, Inf
30-C	Hom, Inf
34-C	Hom, Inf
39-P	Eff, Kno

- 10.3.6. Surface water flooding can occur anywhere and is often localised. In order to try and improve our understanding and management of surface water Peterborough would benefit from increased data about rainfall both during and after the storms occur. The Fens and rural areas of Peterborough are home to several rain gauges managed by the Environment Agency and North Level District Drainage Board. However, the urban area has a lack of rain gauges. It is therefore proposed to install gauges on five to ten sites within Peterborough (mainly schools) to improve coverage. These will serve two main functions, firstly real-time data to allow the city council and its contractors to respond quickly, and secondly a bank of data that can be used to compare different locations and impacts. The data would be available for use (alongside other weather and air pollution data) in school science and research projects to encourage children to take a close interest in their environment.
- 10.3.7. Engagement campaigns are proposed to promote awareness around issues that can increase the risk of surface water flooding. These issues are not unique to the urban area but they do cause a greater severity of problems here and hence it is proposed to focus this activity in the urban area initially to ensure best use of resources. Communications will cover:

- a) the paving of front gardens;
- b) looking after your sewers and spotting misconconnections;
- c) minimising flood risk from watercourses by keeping them maintained and clear of debris.

10.4. Management - Rural West

10.4.1. The Natural England National Character Area assessment of landscape types characterises this area as Rockingham Forest and Northamptonshire Vales (see [Appendix A](#)). Tree cover and large areas of woodland are a significant feature of the Rockingham Forest landscape but the Northamptonshire Vale area contains less in the way of the woodland cover which can bring valuable water quality and flood risk benefits by slowing down water. Pastoral and arable farming and water supply abstraction also shape the landscape of the Vales. Soil compaction and erosion contributes to rural runoff in some places and along with nutrient and pesticide loss into watercourses these factors can affect water quality. Soils vary from clay to more permeable limestone, the latter being more prone to groundwater movement. The Northamptonshire Vales contain the river valleys of the Nene and Welland and are important areas of habitat which need further protection. Most ordinary watercourses in the rural west are privately owned and hence riparian maintenance is very important. The city council has taken on maintenance of the higher risk watercourses in this area, known as Parish Dykes.

Comprehensive flood alleviation and water environment schemes

<i>Action</i>	<i>Benefits to</i>
54-P	Bus, Hom

10.4.2. A project has been proposed in the Environment Agency’s Flood Risk Management Plan to develop a flood management scheme for Wansford. This will include a comprehensive review of the risk and existing management assets and investigation of appropriate solutions. Funding needs to be sought for this scheme.

Riparian owner engagement

<i>Action</i>	<i>Benefits to</i>
28-C	Bus, Com, Eff, Env, Hom, Kno

10.4.3. The FloW Partnership would like to work more closely with riparian owners in this area to share knowledge and experience, see if we can support each other and gain a better understanding of the different ordinary watercourses and private reservoirs that are present in Peterborough. Ensuring that water bodies are maintained to prevent flooding is crucial.

10.4.4. There are also other water management schemes that landowners in this area may have already been engaged in which bring a wide range of other benefits to Peterborough. Farm stewardship schemes encouraged by Natural England and Nene Park Trust seek to reduce soil erosion into nearby water bodies and therefore improve water quality. Anglian Water is also increasing the scale of its catchment advisory scheme which aims to help reduce the impacts of chemical fertilisers and pesticides in our water supply. It is important that any proposed new schemes with riparian owners are complimentary and do not create a burden for agricultural landowners or detract from these existing beneficial schemes.

10.4.5. Section 6.13 discussed the rights and duties of riparian owners. Ultimately the city council, the Environment Agency and IDBs have powers under the Land Drainage Act 1991 that they can use where appropriate to require certain essential works to be carried out and to enforce prohibitions on obstructions being placed in watercourses. Legislation related to flytipping may also be used where this is appropriate. Any obstructions to the flow of watercourses could increase local flood risk.

10.5. Management - Fens

10.5.1. Peterborough’s rural north and east are part of the wider Fens landscape area as described in **Appendix B**. The Fens is an intensively managed environment created in the 17th century from large scale drainage of the fertile peat soils. IDBs (IDBs) undertake specialist water management to maintain these areas. Their areas are split up into several pumped catchments, which are referred to as drainage districts. The actions listed in this section are specific to the area managed by Peterborough’s IDBs.

Maintenance of Fen watercourses and structures

<i>Action</i>	<i>Benefits to</i>
1-A	Agr, Bus, Com, Hom, Inf
2-A	Agr, Bus, Com, Hom, Inf

10.5.2. Table 10-4 below illustrates the maintenance undertaken regularly by Peterborough’s IDBs.

Table 10-4: Maintenance activities undertaken in IDB areas

Organisation	Location of activity	Maintenance activity	Average frequency
Internal Drainage Boards	Arterial ordinary watercourses within district	Vegetation management	Annually (More often for some watercourses that serve urban areas)
		De-silting	5-10 year rotation depending on watercourse
		Fallen trees and obstructions removed	As necessary
		Servicing of pumping stations by an engineer or pumping station attendant	Annually
		Test on pumping stations and defects noted and dealt with	Daily/weekly by a station attendant. Monthly by a Board engineer.
		Inspection of control structures by Board engineer	As required
	Landowner watercourses	Ratepayers and board members must notify IDB of any defects in assets	As soon as they are discovered

Works and asset upgrades

<i>Action</i>	<i>Benefits to</i>
52-P	Bus, Com, Hom
13-A	Agr, Inf

- 10.5.3. Improvements are being proposed to Stewards House Drain in Thorney which drains surface water from an area of approximately 300 houses within the villages and from agricultural land. The Drain has been running at full capacity in recent years, overtopping into adjoining gardens and hence improvements are proposed to raise the standard of protection to prevent more significant flooding. This is a partnership scheme that has been submitted to the Medium Term Plan for Grant in Aid funding. Contributions are also coming from the city council, the parish council and the local school.
- 10.5.4. North Level Drainage Board and Peterborough City Council have also identified several culverts within the North Level area that are in need of upgrade or improvement works. Partnership work is needed to first of all identify the ownership of the culverts. After this condition assessments are required and agreement is needed as to who will carry out the maintenance or upgrades required. This work will consider use the FWMA 2010 section 13 arrangement discussed in section 10.2.28 of the FMS.

Drainage district modelling

<i>Action</i>	<i>Benefits to</i>
16-A	Kno

- 10.5.5. Welland and Deepings IDB and North Level District IDB have begun modelling their drainage districts in order to find out what the district wide standard of protection now is. Over the years the systems will have changed significantly with regular improvements being made. Therefore the SoP is hoped to be greater than the previously noted 1 in 50 (2%). The Action Plan includes an action to continue with this work, spread out over the next few years.

Counter Drain

<i>Action</i>	<i>Benefits to</i>
53-P	Agr, Env, Inf

- 10.5.6. There has been a desire for many years among partners to improve the resilience of the Counter Drain. This channel carries a small amount of surface water from the urban area but its principal use is to carry the treated water discharged from Flag Fen Water Recycling Centre. The Drain is in a poor state with slipped banks in some places and trees and weed growth causing obstacles in other areas. The flow in the drain is pumped and the water flows eventually into the Nene at the Dog in a Doublet sluice downstream of Peterborough city centre. A study has been carried out which demonstrates that when the pumps are working, despite the current condition of the drain, most of the time it does have capacity for the flows which it receives now and increased flows which may result from new development. However when the pumps fail in power cuts or due to their own flooding issues, water flows from the drain onto adjacent agricultural land. This has happened on

several occasions and results in a measurable loss of potato crops for the landowner(s). Ideally the drain should be improved in partnership by all its riparian owners to prevent further decline and measures needs to be put in place to improve the resilience of the system with regards to pump failure There are however many obstacles to this work being carried out. These are outlined below and discussed in more detail in the Counter Drain Study:

- d) The impacts of this flooding on agricultural land are not deemed significant enough by Partnership Funding guidelines for Peterborough to be able to secure GiA funding from Government.
- a) Landownership (riparian ownership) is spread across several different partners including the Environment Agency, Peterborough City Council, businesses, Anglian Water and agricultural landowners.
- b) The watercourse is not a Main River and so does not feature on the Environment Agency’s regular maintenance schedule.
- c) The watercourse is not designated as a public sewer and therefore is also not recognised by Ofwat, the Water Company regulator, as an asset which Anglian Water can significantly invest in.
- d) The priorities for this watercourse are very different for each stakeholder.

10.6. Management - New Development

10.6.1. Although this section includes discussion of newly proposed actions that are Peterborough-wide, it has been separated out from the rest of the management chapters to make it easier to locate information relating to new development. It aims to give a brief overview of some of the current priorities for new development with regards to flood and water management. Before proposed actions are discussed the status of funding with regards to new development is confirmed.

Note about funding flood risk management schemes for new development

10.6.2. The Partnership Funding process described in section 8.2 will not fund flood risk management works to ‘new’ development. This is defined as any development built since 1st January 2009. This is because the appropriateness, design and safety of all new developments with regards to all sources of flood risk should have been fully considered as part of the planning process. If funding is required for schemes that relate to new development or redevelopment it will be sought through the Community Infrastructure Levy, Section 106 agreements, the Local Enterprise Partnership²⁴ or from organisations with an interest in the land or improved infrastructure. The potential for funding from CIL and S106 is explained further in the Peterborough Planning Obligations SPD (to be replaced by the Developer Contributions SPD in early 2015) available from the city council’s website.

10.6.3. The following schemes might be eligible to apply for use of Community Infrastructure Levy due to the delivery of reductions in flood risk to sites available for growth and regeneration in Peterborough: 41-P, 44-P, 45-P, 46-P, 52-P, 53-P, 56-P)

Strategic Flood Risk Assessment

<i>Action</i>	<i>Benefits to</i>
20-D	Dev

²⁴ Greater Cambridge Greater Peterborough Enterprise Partnership <http://www.gcgp.co.uk/>

- 10.6.4. An update to our SFRA is included in the FMS action plan. SFRA should be updated regularly to ensure continued relevance with regards to changing flood zones and new flood risk data. Since the production of the Peterborough SFRA Levels 1 and 2 several new and/or updated data sets are available for use when planning new developments:
- a) Publically available data about areas at risk of surface water flooding
 - b) Privately developed groundwater maps available for purchase
 - c) Information about the impacts of climate change on development sites particularly in the city centre.
 - d) Critical Drainage Areas/Areas of Notable Drainage Interest
- 10.6.5. **Critical Drainage Areas** are recognised as areas that are in Flood Zone 1 but that have special drainage requirements. These can include:
- a) existing flood records
 - b) capacity issues which, with extra flows, would create increased surface water flood risk.
 - c) sensitive receiving environments
 - d) the potential for development to significantly change drainage patterns
- 10.6.6. The formal definition in the Town and Country Planning (General Development Procedure Amendment 2, England) Order 2006 for these is: *“an area within Flood Zone 1 which has critical drainage problems and which has been notified [to] the local planning authority by the Environment Agency”*.
- 10.6.7. However with the introduction of the FWMA 2010, LLFAs are now the principal authority managing surface water flood risk and so it is more likely that LLFAs would need to identify important surface water risk areas. Until any changes are made in the national definition, when the city council needs to update the formally identified critical drainage areas in Peterborough, it will use the term **Areas of Notable Drainage Interest**. Each time the city council updates its Strategic Flood Risk Assessment these areas will be displayed in the new document.
- 10.6.8. A review of the existing Critical Drainage Areas identified in the *SFRA Level 2 (2010)* has been undertaken and a map of the newly proposed areas is included in **Appendix H**. Areas of Notable Drainage Interest have therefore been identified in the following wards and locations:
- a) Central (2)
 - b) Dogsthorpe
 - c) East (2)
 - d) Fletton and Woodston
 - e) Newborough
 - f) North Bretton (2)
 - g) North
 - h) Orton Waterville
 - i) Ravensthorpe
 - j) Stanground Central
 - k) West

Resilient development

<i>Action</i>	<i>Benefits to</i>
19-D	Dev
20-D	Dev

10.6.9. As development in low risk areas continues and the impacts of climate change on flood risk increases, land for development that is low risk will eventually be in short supply. Planning ahead for the future, it is important that the city council and other risk management authorities agree what resilient development looks like in Peterborough. This will involve considering what makes appropriate access and egress routes for sites that are at risk of flooding, what emergency plans should consist of and the consideration of alternative designs that may be appropriate. This work will also link in with the development of an adaptation plan for Peterborough.

Flood and Water Management Supplementary Planning Document

<i>Action</i>	<i>Benefits to</i>
21-D	D

10.6.10. This SPD is a formally adopted part of Peterborough’s suite of planning policy documents. One of the principal actions set out in the FMS is to ensure that the SPD is used, understood and followed by planners working on new development. The SPD provides planning guidance on:

- a) How to assess whether or not a site is suitable for development based on flood risk grounds.
- b) The use of different sustainable drainage measures within Peterborough.
- c) The protection of aquatic environments and how development can contribute positively to the Water Framework Directive.

Sustainable Drainage Systems

<i>Action reference</i>	<i>Benefits to</i>
22-D	Dev

10.6.11. Peterborough City Council requires sustainable drainage in all new developments. Strengthened planning guidance plus the city council’s in-house expertise will be used to help developers design drainage strategies and systems that reduce flood risk while also delivering the other benefits of SuDS such as water quality, amenity and biodiversity improvements (see section 4). As a unitary authority which is a Local Planning Authority, a Lead Local Flood Authority and a Highways Authority, the city council is confident it can provide an efficient process which will aid our development and regeneration sites to implement a solution that works for the residents, the developers and the environment. Peterborough’s flood risk management organisations will continue to work closely with developers to this aim. For detailed guidance on SuDS, planners and developers are referred to the Flood

and Water Management SPD, the Peterborough SuDS website²⁵ and the Government's technical standards.²⁶

Works to watercourses – byelaws, consents and culverts

- 10.6.12. If it is proposed to undertake construction within the locality of, including over, under and within, a watercourse a specific consent is needed from one of Peterborough's flood and water management organisations. This consent is not included within planning permissions but may be sought at the same time. The type of consent required and the distance from the watercourse for which it is needed depends on what area of Peterborough the site is in and the classification of the watercourse. The requirements are set out clearly in chapter 8 of the Flood and Water Management SPD.
- 10.6.13. It is the Flow Partnership's intention to ensure that such works have clearly included consideration of the environmental impacts in terms of biodiversity, habitat and water quality. Therefore example assessments that may be required in order for Land Drainage Consent to be granted for works to an ordinary watercourse, would be a water vole survey or a Water Framework Directive assessment.
- 10.6.14. The city council seeks to avoid culverting and its consent (see section 10.6.17) will not normally be granted except where there is a clearly demonstrated need to enable access. Further to this where the Flow Partnership progresses projects in areas where culverts already exist, alternative options for the culverts will be considered as part of the development of these schemes. If there is an appropriate option to enable the culvert to be daylighted (removed) then this will rate as a high priority.

10.7. Summary

- 10.7.1. Across all of the partner organisations the Action Plan proposes a significant number of actions for the future. Delivery of these may be challenging given the constraints involved in working up deliverable schemes (discussed in section 10.1.4), the current economic climate and pressure from other factors such as urban creep and climate change.
- 10.7.2. Each of the proposed actions delivers different types of benefits. Some seek to reduce the likelihood of flooding, some to reduce the impacts (e.g. by raising awareness so that property owners can act in time) and some to improve the efficiency of management. Delivery of the actions would bring improvements to flood risk management in the local area of the proposed schemes or projects. While there is no guarantee of being able to deliver the full action plan the FloW Partnership will work together closely to further develop the actions, seek funding and resources, and deliver as many actions as is possible in the plan period.

²⁵ www.peterborough-suds.org.uk

²⁶ Defra. (2015). Non-statutory technical standards for sustainable drainage systems <https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards>

11. Monitoring and Review

- 11.1.1. The FloW Partnership meetings will provide a method for monitoring the progress on activities listed with the FMS's action plan. Actions will be rated as:
- i. Completed (in which case they will be moved to the other spreadsheet) - blue
 - ii. On target – dark green
 - iii. Progress - light green
 - iv. Some obstacles - yellow
 - v. At risk – red
 - vi. Not started - white
- 11.1.2. The Partnership will then be able to work together to try and progress past any arising barriers to ensure that schemes can be delivered. Part of the process will also be about ensuring that the actions do deliver the FMS objectives.
- 11.1.3. The FMS should be updated every 5-6 years. The FloW Partnership may wish this to be done to best co-ordinate with updates to the Environment Agency's Flood Risk Management Plans. Some of the background sections may change very little but updates may be needed to the risk, climate change and management chapters.
- 11.1.4. It is intended that the Action Plan will be reviewed every year at a FloW Partnership meeting alongside monitoring progress on the existing actions.

12. Glossary and References

12.1. Glossary

Term	Explanation
Annual flood probability	The estimated probability of a flood of given magnitude occurring or being exceeded in any year, expressed as, for example, a 1 in 100 or 1% chance.
Area of Notable Drainage Interest	An area where the existing drainage design or risk level means that measures used to address site drainage need careful consideration to ensure they comply with relevant drainage strategies and policies and that risk will not be exacerbated.
Asset Management Period (AMP)	The five year business planning period for UK water companies as set by the regulator, OfWAT. AMP 5 is 2010-2015, AMP 6 is 2015-2020 and AMP 7 is 2020-2025.
Aquifer	Layer of water-bearing permeable rock, sand, or gravel which is capable of providing significant amounts of water
Climate change	A change of average global climate caused by an alteration of the composition of the atmosphere that is due directly or indirectly to human activity and is in addition to natural climate variability.
Combined sewer overflow	Overflow that might be needed to prevent internal flooding of foul water. During intense rainstorms, when combined sewerage system can reach capacity diluted but untreated wastewater can be discharged from these overflows into a watercourse.
Combined sewer system	Sewer system that carries both foul water and rainwater
Community Infrastructure Levy	The Community Infrastructure Levy (CIL) is a new levy that local authorities in England and Wales can choose to charge new developments in their area to help pay for infrastructure which is needed to support those developments. CIL can be used to fund a wide variety of infrastructure including transport schemes, flood defences, schools, hospitals, parks, leisure centres etc.
Community Related Asset (CRA) land and dykes	Tranches of land transferred from the Development Corporation, when it closed, to Peterborough City Council. The majority of CRA land forms verges between the highway and other land uses and therefore often contains drainage ditches known as CRA dykes. Some of the land is subject to clawback agreements with the Homes and Communities

	Agency in the event of a change of land use.
Critical ordinary watercourse	A watercourse that passes through an area of land which is either an intensively developed urban area at risk from flooding or a less extensive urban area with some high grade agricultural land and/or environmental assets of international importance requiring protection. The watercourse is only designated as critical for the length passing through these areas of land.
DG5 register	Register of properties at risk of internal sewer flooding. Register maintained by the sewerage undertaker at the requirement of their regulator, Ofwat.
Flood risk	An expression of the combination of a flood probability and the magnitude of the potential consequences of a flood event.
Floodplain	Area of land that borders a watercourse over which water flows in time of flood, or would flow but for the presence of defences.
Flood Zones	Flood Zones are defined in Government's National Planning Policy Framework. They indicate land at risk by referring to the probability of flooding from river and the sea, ignoring the presence of defences.
Highway authority	An organisation with responsibility for maintenance and drainage of highways
Infiltration	The passage of surface water through the surface of the ground
Lead Local Flood Authority	A term given to a unitary or county council under the Flood and Water Management Act 2010.
Local Levy	A sum collected annually by the Regional Flood and Coastal Committee from all Lead Local Flood Authorities in the region under the FWMA 2010 and the Environment Agency (Levies) (England and Wales) Regulations 2011.
Main River	Watercourse shown on the statutory Main River maps held by the Environment Agency and the Department of Environment, Food and Rural Affairs, and can include any structure or appliance for controlling or regulating the flow of water into, in or out of the channel.
Ordinary watercourse	Any watercourse which is not a Main River
Regional Flood and Coastal Committee	A committee established by the Environment Agency under the Flood and Water Management Act 2010 that brings together the Agency, members from Lead Local Flood Authorities and independent members with relevant experience.
Scheduled Monuments	Archaeological sites or historic buildings considered to be of national importance.
Stakeholders	Individuals and organizations that are actively involved in a project, or whose interests may be affected as a result of the project execution.
Sustainable Drainage Systems	Concept of surface water drainage which takes into account the quantity and quality of runoff, and the

	amenity value of surface water in the urban environment. The main focus is on source control and the mimicking of natural processes.
Unitary Authority	A local authority that is one-tier and has no separate county council.
Watercourse	A natural or artificial channel that conveys surface water

12.2. Acronym glossary

AMP	Asset Management Period
Anglian RMBP	Anglian River Basin Management Plan
AW	Anglian Water
CCC	Cambridgeshire County Council
CCTV	Closed Circuit Television
CFMP	Catchment Flood Management Plan
CIL	Community Infrastructure Levy
CPLRF	The Cambridgeshire and Peterborough Local Resilience Forum
CRA dyke	Dyke within Community Related Asset land
Defra	Department for Environment, Food and Rural Affairs
DPD	Development Plan Document
EA	Environment Agency
EU	European Union
FloW Partnership	Peterborough Flood and Water Management Partnership
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FMS	Peterborough Flood Risk Management Strategy
FWMA 2010	Flood & Water Management Act 2010
GHG	Greenhouse Gas
GiA	Grant in Aid
IDB	Internal Drainage Board
IPCC	Intergovernmental Panel on Climate Change
LCLIP	Local Climate Impacts Profile
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
MLC	Middle Level Commissioners
NCC	Northamptonshire County Council
NLD IDB	North Level District Internal Drainage Board
NPPF	National Planning Policy Framework
OfWAT	Water Services Regulation Authority (was the Office of Water Services and the previous acronym has remained)
OM	Outcome Measure
PCC	Peterborough City Council
PFRA	Preliminary Flood Risk Assessment
RFCC	Regional Flood and Coastal Committee

RMA	Risk Management Authority
RNRP	River Nene Regional Partnership
SAB	SuDS Approving Body
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SoP	Standard of Protection
SPA	Special Protection Area
SPD	Supplementary Planning Document
SSSI	Sites of Special Scientific Interest
SWIMS	Severe Weather Information and Monitoring System
SWMP	Surface Water Management Plan
UKCIP	United Kingdom Climate Impact Profile
UKCP09	United Kingdom Climate Projections 2009
UKRLG	United Kingdom Roads Liaison Group
uFMfSW	Updated Flood Map for Surface Water
WFDGiA	Water Framework Directive Grant in Aid
WFD	Water Framework Directive
W&D IDB	Welland and Deepings Internal Drainage Board
WVP	Welland Valley Partnership

12.3. References

Portrayed as footnotes throughout the report with web address where possible.

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- xvii. Peterborough City Council (2012). *Local Climate Impacts Profile.*
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13. List of Associated Documents and Appendices

13.1. Appendices to the FMS

Appendix A – Natural England’s National Landscape Character Areas

Appendix B – The Fens

Appendix C – Map of Internal Drainage Boards

Appendix D – Risk Matrix Method

Appendix E – Summary Method Statement for Climate Change Sensitivity Exercise

Appendix F – Plan of completed actions

Appendix G – Flood Incident Notification Form

Appendix H – Critical Drainage Areas

13.2. Associated documents

Action Plan – Plan showing the identified actions proposed for future delivery

Strategic Environmental Assessment – Assessment of the environmental impacts of the proposed actions