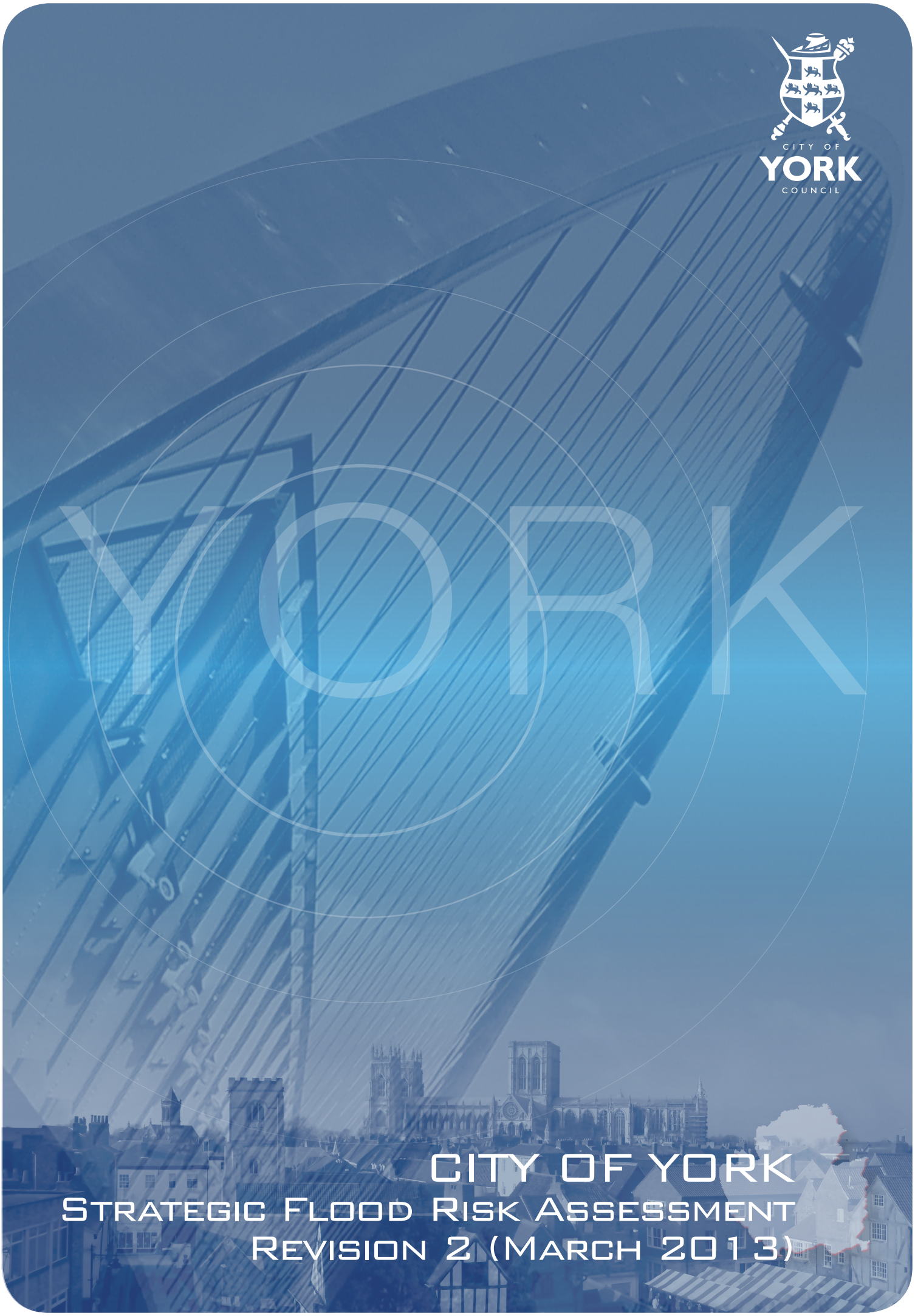

CITY OF YORK
STRATEGIC FLOOD RISK ASSESSMENT
REVISION 2 (MARCH 2013)

City of York Council

Strategic Flood Risk Assessment

Revision 2: March 2013

Contents

Figures

(Please see accompanying map booklet)

Tables

Glossary

Attenuation	Reduction of peak flows and increased duration of a flow event.
Breach	Flood defence failure, usually caused by water seepage through cracks in the structure during flood events. Over time, the water pressure widens the cracks until part of the defence structure collapses and water flows freely through the defence. Earth defences are particularly vulnerable to this type of failure, as the breach can be widened significantly by fast flowing water.
Brownfield Land	Land, which is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure (PPS3 Annex B).
Design Flood Event	Flood event that has a given probability of occurrence, (e.g.1 in 100-year (1%)), used for designing flood defences and production of Environment Agency Flood Zone Maps.
Enmainment	Adoption of Critical Ordinary watercourses by the Environment Agency
Flood Defences	Various fixed man-made structures, such as earth embankments, floodwalls, sluice gates, storage lagoons, designed to prevent flooding of areas behind the defences.
Flooding Direction	A Direction made under the Town and County Planning (Flooding) (England) Direction 2006 whereby a local planning authority must refer a planning application through the Government Office to determine whether it should be called-in for a decision by the Secretary of State where it is proposed to grant planning permission in the face of a sustained objection by the Environment Agency.
Flood Resilience	Built-in measures carried out on properties situated on the floodplain, to increase their resistance to flood damage. These either prevent the penetration of floodwater by barriers or seals, or ensure that if water were to enter the property, less damage would be caused e.g. raised plug sockets, rendered walls.
Floodplain	The area on the sides of a stream, river, or watercourse that is subject to periodic flooding. The extent of the floodplain is dependent on soil type, topography, and water flow characteristics.
Freeboard	The difference between the flood defence level and the design flood level.
Greenfield Land	Land that has not been previously developed.
Head above Crest Level	Depth of water above level of defence or breach.
Hydraulic	Related to the flow of water.
Hydrograph	Diagram showing flow rates varying over time.
Inundation	The rising of a body of water and its overflowing onto normally dry land.
Local Plan	The emergent development plan for the City of York authority area (replaces Local Development Framework).

Major development	A major development is a) where the number of dwellings to be provided is ten or more, or the site area is 0.5 ha or more or b). Non-residential development, where the floor space to be provided is 1,000m² or more, or the site area is 1 ha or more.
Onset of Flooding	Like 'standard of protection', this defines the probability of a flood event. However, in this case, it is when a defence is likely to be at risk of overtopping and some flooding is likely to occur. For this reason, the water level that causes the onset of flooding has a lower probability (i.e. it is less likely to occur) than the water level used to calculate standard of protection.
Overtopping	Flow of floodwater over the top of flood defences.
Rapid Inundation Zone	The area near to flood defences, where a breach or the source of flooding could create a significant flood hazard i.e. risk to life due to high velocity floodwaters and significant depth.
Risk Based Approach	This takes into account all factors relevant to flooding, the nature and expected lifetime of the development proposed, and the extent to which it is designed to deal with flood risk.
Sequential Test	The sequential test is the process by which local planning authorities, in drawing up or revising policies in development plans, or in considering planning applications, give priority in allocating and permitting sites for development in order of acceptability. In the case of flooding, this means giving priority to those sites in flood zones representing little or no risk and only considering higher risk options if it can be demonstrated that there are no suitable alternative sites in a lower risk category.
Standard of Protection	This is the probability of the flood event that the defence was designed to protect against. However, an event that results in a higher water level than the design flood event level would not necessarily overtop the defence. This is because the height of a defence includes an allowance for additional factors such as wave action, modeling uncertainties and global warming.
Sustainable Drainage Systems (SUDS)	A sequence of management practices and control structures, often referred to as SUDS, designed to drain water in a more sustainable manner than some conventional techniques. Typically these are used to attenuate run-off from development sites.
Windfall sites	Sites, which become available for development unexpectedly and are therefore not included as allocated land in a planning authority's development plan.

Abbreviations

ABI	Association of British Insurers
BRE	Building Research Establishment
CIRIA	Construction Industry Research and Information Association
CFMP	Catchment Flood Management Plan
CYC	City of York Council
DEFRA	Department for the Environment, Food and Rural Affairs
EA	Environment Agency
FRA	Flood Risk Assessment
LDF	Local Development Framework
AOD	Above Ordnance Datum
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Urban Drainage Systems
IDB	Internal Drainage Board
DCLG	Department of the Communities and Local Government
NPPF	National Planning Policy Framework
TG	Technical Guidance to the National Planning Policy Framework

Executive Summary

Purpose of the Assessment

The Strategic Flood Risk Assessment (SFRA) assesses the different levels of flood risk in the York Unitary Authority area and maps these to assist with statutory land use planning. It provides concise information on flood risk issues, which will assist planning officers in the preparation of the City of York's emergent new Local Plan (ultimately supporting the Local Plan) and in the assessment of future planning applications. It is also intended that this document may be used by the general public and those wishing to propose developments as a guide to the approach that Local Planning Authorities will follow in order to take flood risk issues into account in a sustainable manner.

The SFRA has also been produced in response to Government policy on planning for flood risk. Initially this was set-out in Planning Policy Statement 25 (PPS25) "Development and Flood Risk". This has since been replaced by the 'National Planning Policy Framework' (NPPF), which states that 'Local Plans should be supported by Strategic Flood Risk Assessment.' Additional guidance to NPPF is provided in 'Technical Guidance to the National Planning Policy Framework' (TG), which retains key elements of PPS25.

Outputs

The Key outputs of this study include:

- An overview of flood risk issues in the York area
- Maps of the flood risk zones within the York area.
- A summary of the sequential flood risk test and exception test within the planning system and gives more detail of these tests for a York perspective.
- Recommended policies for forward planning
- Recommended guidance for development management
- General drainage guidance

Comment is also given with regards to the Council's management of development and flood risk in line with NPPF and the TG, which sets out the following three key requirements: -

- The need to adopt a risk-based approach to proposals for development in or affecting flood risk areas.
- The requirement to apply this risk-based approach to the preparation of development plans and development management decisions through a sequential test.
- The need for all development plans to consider flood risk areas and for the Environment Agency to provide advice on flood risk and flood defences.

Following the identification and mapping of flood risk issues within the York Area, guidance has been developed to assist planners with the application of NPPF and TG. Tables 2 and 3 , of the TG are particularly relevant sections for potential developers and landowners. These are replicated in Tables ES1 and ES2 at the end of this summary.

Policy Recommendations for Forward Planning

As part of the preparation of the Local Plan, site allocations must be made to identify areas where major developments are expected. When making site allocations, planners are required to consider a variety of material planning considerations, including flood risk. Certain types of development are more vulnerable than others to the potential impacts of flooding, and as such the type of acceptable development varies with the degree of flood risk. In order to assist planners within the York area, a series of policy recommendations have been developed to provide advice on the practical application of the guidance contained within NPPF. These policy recommendations include guidance on the type of development which may be appropriate for each flood risk zone and the mitigation measures that may need to be considered in developments in this area to manage flood risk issues. This guidance, together with the flood risk maps, can be used to assist in the site allocation process.

Guidance for Development Management

Flood risk is a material planning consideration, which should be taken into account when making a determination for planning permission. In order to assist both planners and developers with the York area, guidance has been developed as part of the SFRA to provide advice on the practical application of NPPF when considering a particular development site. This guidance, together with the flood maps and the Flood Risk Assessment prepared by the developer, can be used to assist in the development management process.

NPPF and its associated technical guidance (TG) can be viewed or downloaded from http://www.communities.gov.uk/planningandbuilding/planningsystem/planningpolicy/nppfrelatedpublications/)

The York area is drained by three Main Rivers fed by a number of various sized minor tributaries. This river network is shown on **Figure 1**, and the SFRA is broken down into separate areas covering the following catchment boundaries, as shown on **Figure 6**: -

- River Ouse
- River Foss
- River Derwent

This document has been prepared by City of York Council's Flood Risk Management section using local knowledge and data, aided by numerous studies for the local catchment carried by the following consultants on behalf of the council, Internal Drainage Boards and the Environment Agency (North East - Yorkshire Area): -

Arup

Atkins

Babtie Group Ltd

Bullens Consultants

JBA Consulting

Table ES1: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes), which have to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, Ambulance stations, Fire stations, Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "Essential Infrastructure")
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, **subject to a specific warning and evacuation plan**.
Less Vulnerable	• Police, ambulance and fire stations, which are **not** required to be operational during flooding. • Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants which do **not** need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan**.

Notes to table:

a) This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2) and also on the need of some uses to keep functioning during flooding.

b) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.
c) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

Table ES2: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see also Table 2.1)	**Zone 1** Flood risk probability less than 1 in 1000-year (<0.1%).	✓	✓	✓	✓	✓
	Zone 2 Flood risk probability between 1 in 100-year (1%) and 1 in 1000-year (0.1%)	✓	✓	Exception Test required	✓	✓
	Zone 3a Flood risk probability between 1 in 100-year (1%) and 1 in 25-year (4%).	Exception Test required	✓	×	Exception Test required	✓
	Zone 3a(i) Annual probability of flooding up to 1 in 25-year (4%) or greater. Existing development	Exception Test required	✓	×	×	Exception Test required
	Zone 3b'Functional Floodplain' Annual flood risk probability up to 1 in 25-year (4%) or greater.	Exception Test required	✓	×	×	×

✓ Development **is appropriate***
× Development **should not be permitted**

Notes to table:
This table does not show:
a) The application of the Sequential Test, which guides development to Flood Zone 1 first, then Zone 2 and then Zone 3;
b) Flood risk assessment requirements; or
c) The policy aims for each flood zone

Future Reviews to SFRA

Reviews of national or local policy, the occurrence of further significant flood events or the publication of other flood plans / risk assessments may have the effect of changing guidance in the SFRA. These shall be taken into account as and when they become available and read in conjunction with the SFRA.

1 Introduction

1.1 Background

1.1.1 York sits astride the confluence of the River Ouse and the River Foss, and the River Derwent forms its eastern boundary with East Riding of Yorkshire Council, as shown on **Figure 1**. These rivers drain three catchments, the Yorkshire Dales, the Howardian Hills and the North York Moors respectively. The interaction of the rivers, with the significant amount of rainfall the catchments attract, along with snowmelt in winter, makes the city particularly susceptible to flooding. Historically, the major flood events followed rapid snowmelt in the hills. The 1982 flood, following which significant defences were built to protect vulnerable areas of the city, was calculated to have a return period of 1 in 100-years (1%).

1.1.2 The flood in 2000 was a result of rainfall alone, following a very wet autumn. It flooded 353 properties and threatened a further 3,500. Subsequent modelling calculated this flood to have a return period of 1 in 80-years (1.1%), and the maximum flood level was 300mm above the 1982 event. There were no fatalities despite the severity of the flood.

1.1.3 This provides convincing evidence that climatic conditions are changing and that the probability of severe flooding is increasing. **Figure 5** shows graphically that the trend of maximum flood event levels is rising, due to factors such as increased development, improved agricultural drainage and climatic change.

1.1.4 The Environment Agency's report (March 2001), entitled "Lessons Learned: Autumn 2000 Floods" stated the following: -

> "Autumn 2000 was the wettest experienced in the UK in over 270 years. Unprecedented rainfall levels caused widespread flooding in some 700 locations across England and Wales and demonstrated the serious consequences which flooding can have for people and their property. In all some 10,000 properties were damaged with a further 37,000 properties in another 17 locations saved by sandbags alone[i]. The total bill to insurers, including the associated storm damage, was £1.3 billion (£860m domestic property and £440m for commercial property). The Deputy Prime Minister John Prescott said at the time that these events should serve as a "wake-up call".
>
> "The Department for Environment, Food and Rural Affairs (Defra) estimates that 10% of the land area of the UK is in danger of flooding. Up to 2 million homes and 185,000 businesses are at risk from flooding".

1.1.5 The cost of the 2000 flood to the Council was £1.32m, with internal flooding to approximately 353 homes and many businesses. Transport links were severed at Poppleton, the A19 at Rawcliffe, Tower Street, Skeldergate, Knavesmire Road, the A19 at Fulford (including Fordland's Road), Bishopthorpe, Naburn, Acaster Malbis and Elvington. Under the direction of Silver Command the combined forces of the Army, the EA and the Council were required to prevent further devastation and to clear up once floodwaters had receded. In addition to the three emergency services assistance was also provided by Parish Councils and the British Civil Defence Force.

1.1.6 Flooding in June 2007 badly affected many areas throughout the country. This once again demonstrated that severe flood events could happen at any time of the year, and affect different areas depending on the nature of the rainfall. This flooding resulted from very intense, relatively short rainfall causing rapid rises in watercourses. The flooded areas tended to be different from those affected by longer duration and less intense rainfall, which is the type of event that causes river flooding in York. However, while summer flooding from the River Ouse does occur, the 2007 summer storms that

were experienced in York caused localised flash flooding away from the rivers which were generally as a result of a lack of capacity in drainage systems.

1.1 Purpose of the Assessment

1.2.1 One of the primary purposes of the Council's Strategic Flood Risk Assessment (SFRA) is to provide a strategic assessment of flood risk issues within the York district. This will support a risk-based approach to the allocation of sustainable development sites within Local Development Framework (LDF), and will assist planners in the assessment of future planning applications.

1.2.2 The Strategic Flood Risk Assessment has also been produced in response to NPPF which sets out the government policy on planning for flood risk and recommends that Local Planning Authorities prepare a SFRA.

1.2 Contents

1.3.1 **Section 2: Background.** This provides an overview of York's river network and identifies its broad physical characteristics. Comment is made on the key causes of flooding, along with the effects of climate change and its influence on development and flood risk. It also details the key European, National and Local policies and guidance.

1.3.2 **Section 3: Flood Risk in York.** This presents the analysis of the available information, describing the features and uses of the river network in York. It identifies the areas at risk of flooding, the existing flood defences, and highlights the key issues relating to each area.

1.3.3 **Section 4: Approach to Flood Risk.** This section makes detailed policy recommendations for Forward Planning and guidance for Development Management, in order to provide a future policy approach for the York area.

1.3.4 **Section 5: Sequential Test and Exception Test.** This section provides detailed information on the Sequential Test and the Exception Test for the York Unitary Authority Area. The guidance is split down into Forward Planning and Development Management.

Copies of this document are available from the Council's website:

http://www.york.gov.uk/info/200406/ldf_evidence_base_documents/465/ldf_evidence_base_documents/2

Further information is available from the Integrated Strategy Unit:

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2 Background

2.0.1 This section provides an overview of the river network in and around York and identifies its broad physical characteristics. Comment is also made on climate change and its influence on development and flood risk. The final part of this section details key European, National and Local policies/guidance. The information in this section will be used to help inform York's overall policy and guidance approach set out in Section 4.

2.1 River Network

2.1.1 The York area is drained by three main rivers, all running generally in a southwards direction, fed by a number of various sized tributaries. This river network is shown on **Figure 1**, and the SFRA is broken down into separate areas covering the following catchment boundaries, as shown on **Figure 6**: -

2.1.2 **River Ouse -** the largest river within York drains the Yorkshire Dales catchment and is formed from the rivers Swale, Ure and Nidd upstream of York. The river downstream of Naburn weir is tidal and the river Wharfe joins the Ouse at Kelfield just south of the York boundary. The peak measured flow in the Ouse during the autumn 2000 flood was 583 cubic metres per second (m^3/s), which is over 11 times the average summer flow of 50 m^3/s. This level of flow in the river resulted in a rise of 5.4m above normal summer level. The Ouse has the following main tributaries within the York boundary: -

- Blue Beck – drains relatively flat areas of residential and commercial development in Rawcliffe, Clifton Without and Clifton Moor north west of the city.
- Holgate Beck – drains relatively flat areas of residential development in Woodthorpe, Acomb and Holgate west of the city.
- Burdyke – drains relatively flat areas of residential and commercial development in Clifton and Clifton Without north of the city.
- River Foss – drains relatively flat areas of residential development in Strensall, Haxby, Wigginton, and New Earswick along with large, flat areas of agricultural land in the upper catchment north of the city.
- Germany Beck – drains relatively flat areas of residential development in parts of Heslington and Fulford including the existing university campus, along with flat areas of agricultural land east of the city.

2.1.3 **River Foss -** the third largest river within York, with a peak flow of 31 m^3/s and a normal summer flow of 1 m^3/s. It has the following main tributaries: -

- Westfield Beck – drains relatively flat areas of residential development in Haxby, Wigginton and New Earswick north of the city.
- South Beck – drains Monk's Cross Retail Park and relatively flat areas of residential development in Huntington north east of the city.
- Tang Hall Beck – drains relatively flat areas of residential development in Tang Hall and flat areas of agricultural land in the upper catchment around Stockton-on-the-Forest north east of the city.
- Osbaldwick Beck – drains relatively flat areas of suburban residential development in Osbaldwick and flat areas of agricultural land in the upper catchment around Holtby and Murton east of the city. The southern boundary of the catchment is a ridge south of the A1079 of which the highest point is Kimberlow Hill.

2.1.4 **River Derwent -** the second largest river within York, with a peak flow of 199 m^3/s and a normal summer flow of 15 m^3/s. The following main tributaries drain into the river upstream of York: -

- River Rye, River Riccall, Hodge Beck, River Dove, River Seven, Costa Beck, Pickering Beck, Thornton Beck and River Hertford. Characterised by: -
  - Upper Derwent – relatively steep upland areas of the North York Moors, predominantly heather/grass moorland and commercial woodland.
  - Lower Derwent – gentler sloping area in the Vale of Pickering and Vale of York, mainly agricultural use with natural washlands subject to frequent flooding.

2.1.5 Within the York boundary, Elvington Beck at Elvington drains into the Derwent. This drains relatively flat areas of residential development and also flat areas of agricultural land to the west of the village of Elvington, including part of the former airfield which is now in commercial and leisure use.

2.2 Broad Physical Characteristics

2.2.1 York and its surrounding areas have a diverse character consisting of urban, industrial and agricultural land-uses. The Vale of York consists mainly of valuable agricultural land, with the urban and residential areas centered on the two largest settlements of York and Selby.

2.3 Topography, Geology, Soils and Hydrogeology

2.3.1 *Topography:* The Vale of York is a low-lying mainly flat landscape, though minor ridges and glacial moraines provide subtle local variations in topography. The area lies between the Pennines to the west and the North York Moors and the Wolds to the east. South of York, much of the land is less than 20m above sea level.

2.3.2 *Geology*: British Geological Survey maps show the bedrock in the area to consist of the Sherwood Sandstone group, a thick soft sandstone of Triassic age that forms the centre of the Vale of York. The superficial deposits, which overlay the sandstone, consist predominantly of sands and gravels, with some clay and till. Bands of alluvium deposits can be seen to intersect the City of York along the path of the River Ouse and River Foss.

2.3.3 *Soils*: Soil types are often a reflection of the underlying solid geology and similarly, land use is often associated with the soil. The river valleys are dominated by soils formed from glacial till, sands and gravels that are generally fertile and suitable for agriculture. A band of groundwater clay soils, which are seasonally waterlogged and affected by shallow fluctuating groundwater table, extends south easterly from Thirsk, around York to Selby.

2.3.4 *Hydrogeology:* The hydrogeology of an area is directly influenced by the characteristics of the local drift and solid geology. Different rock types may either hold or transmit water or may act as a barrier to groundwater flow. Aquifers are important for several reasons; they act as a source of good quality water for water supply and provide base flow to rivers. The underlying bedrock for the whole flood risk area is Sherwood Sandstone, a formation always classified as a Major Aquifer. The drift deposits overlying the Sherwood Sandstone are classified as a Minor Aquifer, where the drift is relatively permeable, and a Non-Aquifer, where the drift deposits are fairly thick and have low permeability.

2.4 Existing Flood Defences

2.4.1 York's flood defences were mainly constructed alongside vulnerable sections of the River Ouse, between Rawcliffe Ings and Rowntree Park, to protect property in areas where major flooding has occurred in the past. These existing defences, built between 1979 and 1993, are shown on **Figure 7**. They are a mixture of earth embankments, brick or stone clad concrete walls and floodgates. Most of the defences also have flood-pump stations, to deal with sewerage and watercourse flows.

2.4.2 Of particular importance is the Foss Barrier, which effectively isolates the Foss from the Ouse, stopping water from surging back upstream in times of high Ouse levels. Water levels in the Foss are managed by a number of high volume pumps that discharge around the barrier, directly into the Ouse. None of the Ouse defences currently offer 1 in 100-years (1%) flood protection.

2.4.3 Elvington flood defence was completed in 2008, consisting of an earth bank and flood-pump station to prevent backflow into Elvington from the River Derwent. This defence provides the only 1 in 100-years (1%) flood protection in York.

2.5 Climatic Change Influences on Flooding

2.5.1 It is becoming increasingly accepted that Global Climate Change is one of the principal challenges facing us in the 21st Century. It is also considered that the major contributory cause to global climate change is the man-made emissions of greenhouse gases, of which Carbon Dioxide (CO_2) associated with the burning of fossil fuels is by far the largest single contributor.

2.5.2 Climate change will increase flood risks in York for two reasons. Firstly, because more intense rainfall, especially in winter, will increase peak river flows, and secondly, because soils will tend to be wetter on average in winter.

2.5.3 The following paragraphs regarding climate change are taken from the EA's website:-

Current estimates are that peak river flows in Britain could be 20 percent higher by 2080. This could have important implications for the flood zones of rivers - in a review of flood defences last year, the Environment Agency found that a tenth of the population in England and Wales now lives on flood plains.

Information posted on the Meteorological Office website reports that autumn 2000 (September to November) was the wettest autumn in England and Wales since records began in 1766. In addition the period October to December 2000 ranks as the second wettest three-month sequence for England and Wales in the last 200 years.

"The Foresight Future Flooding report was released on 22 April 2004 by the Department of Trade and Industry (DTI)… The report is the most wide-ranging analysis of flood risk in the UK. It predicts that climate change will be an important factor in increasing flood risk, and that both the number of people in danger from flooding and the costs of damage from floods will significantly rise.

It uses scenarios of potential social and economic changes, as well as information on climate change to help us understand the risks of flooding in future, and inform both public and Government bodies on what will need to be done to meet these risks."

Using a series of scenarios that take into account potential social and economic changes, as well as information on climate change, the main findings of the Foresight Future Flooding report are as follows:

! Climate change is an important factor in increasing flood risk, particularly through the impacts of rising sea levels and more stormy weather.

! Other important factors include the way we use land, increased urban development and the effects of increased wealth and higher standards of living.

! Figures for annual damage from flooding could rise from the present level of £1 billion to about £25 billion in the worst-case scenario.

! The number of people at a high risk from flooding could rise from 1.5 million to 3.7 million.

! More effective land management will help reduce the risks in most scenarios. However, in the worst-case scenario these are of little benefit and greater use of flood defences and coastal re-alignment will be required.

As a result of these findings, Foresight concludes that:

! We must all play a part in reducing the amount of carbon we are burning, and so help to slow down the rate of climate change.

! We must spend more on flood and coastal defence to protect against the impacts of climate change.

! To avoid creating a huge problem for the future, we need tougher restrictions against building on floodplains now.

! We must make any new developments resilient against flooding.

2.6 Policy Background

2.6.1 A wide range of policies at the European, National and Local levels have a significant influence on development and flood risk in the York area. This section identifies the key influencing policy factors.

2.7 European Context

2.7.1 European Spatial Development Perspective (ESDP)

European Union (EU) Ministers for Spatial Planning adopted the European Spatial Development Perspective (ESDP) at the Potsdam Council in May 1999. The ESDP represents agreement on common objectives and concepts for the future development of the EU and emphasises that the aim of spatial development policies is to work towards a balanced and sustainable development of EU territory.

The ESDP emphasises the importance of achieving goals, equally in all regions of the EU. A fundamental goal of European policy relating to flooding is:

- the conservation and management of natural resources, including the management of surface and groundwater, flooding and drought.

This European Directive places a significant emphasis on integrating the environment into decision-making processes and on the effective management of water systems.

2.7.2 The Water Framework Directive

The Water Framework Directive was adopted by the European Parliament and the Council of the European Union in December 2000. Its objective is to establish a Community Framework for the protection of inland surface waters, transitional waters, coastal waters and ground water, in order to prevent and reduce pollution, promote sustainable water use, protect the aquatic environment, improve the status of aquatic ecosystems and mitigate the effects of floods and droughts.

2.7.3 Strategic Environmental Assessment Directive

The Strategic Environmental Assessment Directive (SEA) was adopted by European Parliament in May 2001 and by the Council of the European Union in June 2001. However, the SEA did not come into force in British law / legislation until July 2004. The purpose of the SEA Directive is to ensure that environmental consequences of certain strategic plans and programmes can be identified and assessed during their preparation and before their adoption. This will contribute to more transparent planning and help achieve the goal of sustainable development. The updated version can be viewed on the communities.gov.uk website.

2.8 National Context

2.8.1 Government Policy on meeting the challenge of climate change, flooding and coastal change, including planning for flood risk is set out in paragraphs 93 to 108 of the National Planning Policy Framework (NPPF), supported by Technical Guidance on the National Planning Policy Framework (TG). Both of these documents were published in March 2012 (available to view or download from http://www.communities.gov.uk/planningandbuilding/planningsystem/planningpolicy/nppfrelatedpublications/) replacing previous Government policy set out in Planning Policy Statement 25 (PPS25). More specifically, in relation to planning for flood risk, NPPF, which retains many of the key elements of its predecessor, aims to avoid the inappropriate development of areas that are at risk of flooding. It does not categorically preclude development in these areas, and where development is necessary in areas at risk of flood it seeks to make such development safe without increasing the risk of flood elsewhere.

2.8.2 To help inform the preparation of Local Plans, NPPF states that:

Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.

2.9 Risk-Based Approach

2.9.1 Historically, development has taken place in river floodplains. The advantages of flat, fertile land, which is easily developed and managed and close to transportation links have outweighed the disadvantages of intermittent flooding. Defences have also been constructed to protect against flooding. However, whilst flood defence works can reduce the risk of flooding it cannot eliminate it, and so the long-term sustainability of this method has been brought into question. Soft engineering techniques and avoiding development in the first place in the floodplain, form key aspects of the government's approach to flood risk.

2.9.2 Potential damage from flooding is both uncertain and unpredictable. Because of this, the government considers that the objectives of sustainable development and meeting the challenge of climate change requires action to be taken through the planning system, to manage development and flood risk. More precisely, NPPF expects that:

Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:

- *applying the Sequential Test;*
- *if necessary, applying the Exception Test;*
- *safeguarding land from development that is required for current and future flood management;*

- *using opportunities offered by new development to reduce the causes and impacts of flooding; and*
- *where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations.*

2.10 The Sequential Test

2.10.1 A sequential risk-based approach to determining the suitability of land for development in flood risk areas is central to applying the requirements of NPPF, and it should be applied at all levels of the planning process.

2.10.2 The aim of the sequential test is to steer new development to areas at the lowest probability of flooding (Zone 1). This indicates that priority should be given to allocating sites for development in descending order to the 'Flood Zones' set out in the TG. These are set out in **Table 2.1.**

2.11 Exception Test

2.11.1 If, following the application of the Sequential Test, is not possible, consistent with wider sustainability objectives, for the development to be located in zones of lower probability of flooding, the Exception Test can be applied. The Test provides a method of managing flood risk while still allowing necessary development to occur.

2.11.2 For the Exception Test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA, where one has been prepared; and

- a site specific flood risk assessment (FRA) must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The requirements for a FRA can be found on the EA's website. and further guidance is available in BS 8533:2011 : Assessing And Managing Flood Risk In Development – Code Of Practice.

2.11.3 The Exception Test should be applied by decision-makers only after the Sequential Test has been applied and in circumstance shown in **Table 2.1.** Only where there are no reasonably available sites in Flood Zones 1 and 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of the land uses and applying the Exception Test if required. However, it should not, in the absence of evidence to show that reasonably available sites are not available in Flood Zones 1 and 2, be used to justify locating development at higher levels of vulnerability in Flood Zones 3a and 3b.

Table 2.1: Technical Guidance on the National Planning Policy Framework (TG) Flood Zones and the Sequential Test

Flood Zone	Definition	Appropriate Use	Flood Risk Assessment (FRA) Requirements	Policy Aims
Zone 1 : Low Probability	This zone comprises land assessed as having less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%)	All uses of land are appropriate in this zone	For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the affect of new development on surface water runoff, should be incorporated in a FRA. This need only be brief unless the factors above require particular attention.	In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems..
Zone 2: Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1%-0. 1%) or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5%-0. 1%) in any year.	Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses as set out in Table ES1 are appropriate in this zone. The highly vulnerable uses in Table ES1 are only appropriate in this zone if the Exception Test is passed.	All development proposals in this zone should be accompanied by a FRA.	In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.
Zone 3a: High Probability	This zone comprises land assessed as having between a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (0.5%) in any year.	The water-compatible and less vulnerable uses of land in Table ES1 are appropriate in this zone. The highly vulnerable uses in Table ES1 should not be permitted in this zone. The more vulnerable and essential infrastructure uses in Table ES1 should only be	All development proposals in this zone should be accompanied by a FRA.	In this zone, developers and local authorities should seek opportunities to: • Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems; • Relocate existing development to land in zones with a lower probability of flooding; and

Flood Zone	Definition	Appropriate Use	Flood Risk Assessment (FRA) Requirements	Policy Aims
		permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designated and constructed to remain operational and safe for users in time of flood.		• Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, locating and safeguarding open space for flood storage.
Zone 3b: The Functional Floodplain	This zone comprises land where water **has** to flow or be stored in times of flood. Local authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.	Only the water-compatible uses and the essential infrastructure (listed in Table ES1) that has to be there should be permitted in this zone. It should be designed and constructed to: • remain operational and safe for users in time of flood • result in no net loss of floodplain storage; • not impede water flows; and • not increase flood risk elsewhere. Essential infrastructure in this zone should pass the Exception Test.	All development proposals in this zone should be accompanied by a FRA.	In this zone, developers and local authorities should seek opportunities to: • Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems; and • Relocate existing development to land with a lower probability of flooding.

2.12 Taking climate change into account

2.12.1 The UK Climate Change Projections (UKCP09) report is a set of projections released by Defra, looking at temperature, rainfall, sea level rise and other variables to the end of this century for the whole of the UK. The projections are based on three emissions scenarios (low, medium, high) and give us information about the likelihood of different levels of climate change. For this reason the projections are being called 'probabilistic scenarios'.

2.12.2 Generally the report advises that there are likely to be hotter, drier summers and warmer wetter winters, with more extreme events such as floods, drought and sea level rise

2.12.3 In making an assessment of the impacts of climate change on flooding from the land, rivers and sea as part of a flood risk assessment, the sensitivity ranges in Table 2.2 may provide an appropriate precautionary response to the uncertainty about climate change impacts on rainfall intensities, river flow, wave height and wind speed.

Table 2.2: Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights

Parameter	1990 to 2025	2025 to 2055	1990 to 2025	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		

Notes to table

a) Refer to Department for Environment, Food and Rural Affairs FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006, for details of the derivation of this table.
b) For deriving peak rainfall, for example, between 2025 and 2055 multiply the rainfall measurement (in mm per hour) by 10 per cent and between 2055 and 2085 multiply the rainfall measurement by 20 per cent. So, if there is a 10mm per hour event, for the 2025 to 2055 period this would equate to 11mm per hour; and for the 2055 to 2085 period, this would equate to 12mm per hour. Other parameters in table 5 are treated similarly

2.13 Strategic and Local Planning Context

2.13.1 A specific flooding policy has been included in the "**City of York Draft Local Plan Incorporating the Fourth Set of Changes – Development Control Local Plan Approved April 2005"**. Policy GP15a 'Development and Flood Risk' seeks to clarify and amplify the management of flood risk when determining planning applications. This is shown in Appendix 3.

2.13.2 The City of York Draft Local Plan is an interim document, and will be replaced by a new Development Plan.

2.13.3 Planning law, through Section 38(6) of the Planning and Compulsory Purchase Act 2004 and section 70(2) of the Town and Country Planning Act 1990, requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise. In September 2004, the Planning and Compulsory Purchase Act introduced major changes to the

planning system. The **Local Development Framework (LDF)** is a 'portfolio' of planning policy documents produced by Local Planning Authorities, to replace the Local Plan. This was subsequently replaced by the NPPF in March 2012, which reintroduced the terminology 'Local Plan' (which can also encompass LDFs, depending on the progress made in adopting LDF documents).

2.13.4 As previously mentioned in Paragraph 2.8.2, NPPF states that:

Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.

2.14 EA Development and Flood Risk Report

2.14.1 The EA aims to reduce much of the misery, loss and damage seen in recent floods, by encouraging the correct design and location of all developments to reduce the risk of damage from flooding.

2.14.2 The EA's annual Development and Flood Risk Report is a principal national source of information for monitoring and reviewing the impact of the EA's technical advice on flood risk on planning decisions made by Local Planning Authorities (LPAs). The report is produced jointly with local government for the Department for Environment, Food and Rural Affairs (Defra) and the Department for Communities and Local Government.

2.14.3 Key indicators from the Development and Flood Risk Report are:

- The number of planning applications permitted by LPAs, where the outcome is known, against a sustained objection from the Environment Agency on flood risk grounds, as a percentage of the total number of applications to which the Environment Agency sustained an objection on flood risk grounds;
- The number of planning applications for major development permitted by LPAs, where the outcome is known, against a sustained objection from the Environment Agency on flood risk grounds, as a percentage of the total number of planning applications permitted against sustained Environment Agency advice on flood risk;
- The lack of a FRA or an inadequate FRA cited as the reason for an Environment Agency objection to planning applications, as a percentage of the total number of its objections on flood risk grounds; and
- The number of decision notices received from LPAs by the Environment Agency as a percentage of the number of objections the Environment Agency made to planning applications on flood risk grounds.

2.14.4 LPAs should request FRAs in accordance with the NPPF Technical Guidance paragraph 6, and they should work closely with the Environment Agency on resolving objections to development proposals and contribute positively to providing information to assist the effective monitoring of flood risk.

2.14.5 The EA is consulted by Local Planning Authorities (LPAs) on proposals for major development in the floodplain, in accordance with their guidance and responds by giving technical advice. Sometimes they recommend that planning consent should be refused outright on flooding grounds, or they may recommend that it should be refused until the implications for flooding have been properly assessed.

2.14.6 Major development is defined in The Town and Country Planning (Flooding) (England) Direction 2007 as:

- In respect of residential development, a development where the number of dwellings to be provided is 10 or more, or the site area is 0.5 hectares or more; or
- In respect of non-residential development, a development where the new floor-space to be provided is 1,000 square metres or more, or the site area is 1 hectare or more;

2.15 EA Standing Advice: Development & Flood Risk (England)

2.15.1 The Environment Agency's Standing Advice on development and flood risk can be accessed on their website:
http://www.environment-agency.gov.uk/research/planning/82584.aspx

2.16 Current Environment Agency Flood Policy

2.16.1 The Defra initiative 'Making Space for Water' provides future policy initiatives in order to provide a more sustainable approach to flood risk management and land management on a catchment wide basis. The EA have embraced this concept within their strategy, as many of the long-term strategic options require national policy changes, which will influence people and businesses in the area. 'Making space for water' provides the mechanism for whole scale land-use changes, in order to provide a more sustainable approach to flood risk management. There is a need to build flexibility into any plan to allow for future changes, including climate change, particularly since the effects of these changes are not fully understood. The EA also recognises the need to work with natural processes rather than resist them, and this accord aligns with the EU Water Framework Directive and other policy initiatives. Finally, the EA highlighted the need to ensure that they took an integrated approach to flood risk management and environmental strategies in neighbouring catchments.

2.17 City of York Council Duties as Lead Local Flood Authority

2.17.1 Following the enactment of the Flood Risk Regulations 2009 and the Flood and Water Management Act 2010, the Council became a Lead Local Flood Authority (LLFA). It has a duty to lead the co-ordination of flood risk management and to develop, maintain, apply and monitor a strategy for local flood risk management in its area.

2.17.2 Flood Risk Assessments and Management Plans developed by the Council as LLFA will be used in conjunction with the SFRA to guide development with respect to Flood Risk.

3 Flood Risk in York – Key Issues

3.1 The River and Watercourse Network

3.1.1 To enable the assessment of flood risk in York, along with the effects on present and future development, the York Unitary Authority has been divided into three areas. These areas are based upon the catchments of the major rivers passing through the City:

- The River Ouse
- The River Foss
- The River Derwent

3.1.2 **Figures 2 and 3, at the end of this report,** show the location of these rivers passing through the City boundary, along with the extent of the upstream catchments. The areas in the Ouse and Foss catchments upstream of Naburn Lock are classed as fluvial (non-tidal), as are the areas in the Derwent catchment upstream of Barmby Barrage. Therefore, this report concentrates on the Fluvial Floodplain within York.

3.1.3 **Figure 4** shows the boundaries of the four Internal Drainage Boards (IDBs) within the City Boundary, along with the areas administered by the Council as a drainage authority. The IDBs are long established bodies operating predominantly under the Land Drainage Act 1991 and have permissive powers to undertake work to secure drainage and water level management of their districts, and undertake flood risk management works on ordinary watercourses within their districts (i.e. watercourses other than 'main river'). The Council can exercise broadly the same powers within its drainage district. The IDB and Council Drainage District boundaries define smaller catchment areas within which flood risk can be assessed.

3.1.4 The City of York's drainage area has a total of 5.65km of ordinary watercourses, as detailed below: -

Watercourse	Length of open watercourse (km)[1]	Length of culverted watercourse (km)
Tang Hall Beck	1.57	0.86
Osbaldwick Beck	1.20	0.37
South Beck	0.15	0.16
Burdyke	Nil	1.34

3.1.5 Other ordinary watercourses within the City Council boundary are the responsibility of the four IDBs listed below: -

Internal Drainage Board	Area (Ha) *	Total Length of maintained watercourses (km)*
Ainsty (2008)	16,337	286.43
Foss (2008)	12,495	215.48
Kyle and Upper Ouse	11,753	252
Ouse and Derwent	19,801	264

* These are the total areas and lengths for the Internal Drainage Boards, all of which extend beyond the Council boundary. Therefore only a small proportion of the adopted drain lengths are in the CYC area.

3.1.6 All of the Council's watercourses, with the exception of South Beck, have been transferred to the EA. Additionally, Holgate Beck in the Ainsty (2008) IDB area, and Blue Beck and the upstream length of Burdyke in the Kyle and Upper Ouse IDB have been transferred. As a result, the EA is now responsible for the management and maintenance of these watercourses and associated structures and pumping stations. However, Yorkshire Water Services (YWS) own and manage Rawcliffe Lake, which provides attenuation storage for flows from Clifton Moor and Clifton Without. Controlled flows from the lake discharge to Blue Beck which flows to the River Ouse.

3.1.7 The River Foss, upstream of the old City boundary beyond Yearsley Weir, is the responsibility of the Foss (2008) IDB. The River Foss downstream to its confluence with the River Ouse, the River Derwent and the River Ouse are designated as Main River and thus the responsibility of the EA.

3.2 Flood Risk Zones

3.2.1 **Figure 8** shows the Flood Risk Zones for York, as defined by the EA, indicating the following three zone types: -

(Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences.

Flood Zone 1: Little or no risk (not coloured)
Annual probability of flooding: <0.1% (less than 1 in 1000-year risk of flooding)

Flood Zone 2: Low to medium risk (light blue)
Annual probability of flooding: 0.1-1.0% (between 1 in 100-year and 1 in 1000-year risk of flooding)

Flood Zone 3: High risk (dark blue)
Annual probability of flooding, with defences where they exist:
1.0% or greater (greater than 1 in 100-year risk of flooding)

3.2.2 The SFRA Flood Zones are a refinement of the EA Flood Zones based on local knowledge. The EA Flood Zone maps show areas within Flood Zone 3 benefiting from defences, but due to those in York providing varying levels of protection less than 1 in 100 (1%), and the location of existing development within Flood Zone 3, it has been necessary to further divide Flood Zone 3 as follows:

- Flood Zone 3a: Areas between 1 in 100 and 1 in 25 annual probability of flooding in any year (1% to 4%) **shown blue on figures 10, 10a, 10b and 10c.**

This is further divided into;

- Flood Zone 3a: Defended up to 1 in 50, flood risk between 1 in 50 and in 100 (2% to 1%) **shown blue with orange stripes on figures 10, 10a, 10b and 10c.**
- Flood Zone 3a: Defended up to 1 in 100 (1%) **shown blue with orange dots on figures 10, 10a, 10b and 10c.**
- Flood Zone 3a(i): Developed areas with up to a 1 in 25 or greater annual probability of flooding in any year (4%) **shown green on figures 10, 10a, 10b and 10c.**
- Flood Zone 3b: Areas with up to a 1 in 20 or greater annual probability of flooding in any year (5%) **shown pink on figures 10, 10a, 10b and 10c.**

Zone 3a High risk

3.2.3 In considering development in any area in Zone 3 the following statement, retained from PPS25, remains relevant in the context of the varying standards of defence and development in York:

> Following application of the Sequential Test and Exception Test development should not normally be permitted where flood defences, properly maintained and in combination with agreed warning and evacuation arrangements, would not provide an acceptable standard of safety taking into account climate change. Low-lying tidal and coastal areas are particularly vulnerable, due to the residual risk of defences being overtopped or breached, resulting in fast flowing and deep water flooding. Planning authorities should take these hazards fully into account when drafting Local Development Documents (LDDs) and considering planning applications, recognising that the Environment Agency is not obliged to maintain defences. Risks will be greatest close to such defences, and local planning authorities should seek opportunities to set back developments. Planning authorities should take into account the need for access to maintain defences when considering planning applications in areas close to them.

3.2.4 Thus when considering potential development sites within Zone 3a or any of its sub divisions, the Sequential and Exception Tests must be passed, as explained in Section 5. For major developments the EA expect to see evidence of this.

3.2.5 In considering development within Zone 3a, the EA also states that preference should be given to those sites that are already protected by a 1 in 100-year (1%) standard of flood defence. The November 2000 flood (1 in 80-year event (1.1%)) highlighted the fact that the only flood defences in York that currently has a 1 in 100-year (1%) standard of protection is at Elvington village, which was completed in 2008. The areas benefiting from these defences are shown on Figures 10, 10a, 10b and 10c.

3.2.6 Reference should also be made to section 3.4, where some areas within Zone 3 have been identified as being at additional risk of rapid inundation of floodwater in the event of a failure in flood defences.

Zone 3b Functional Floodplain

3.2.7 Zone 3b areas, functional floodplains, are defined in TG as “land where water has to flow or be stored in times of flood”. Although the TG states that the identification of the functional floodplain should take into account local circumstances and not solely be defined on rigid probability factors, it can typically be defined as:

- Land which would flood with annual probability of 1 in 20 (5%) or greater in any year.
- Land which provides a function of flood conveyance (i.e. free flow) or flood storage, either through natural processes or by design (e.g. washlands and flood storage areas)
- Land where the flow of flood water is not prevented by flood defences or by permanent buildings or other solid barriers during times of flood

3.2.8 Discussions with the EA have confirmed that, due to the obstructions to overland flow paths posed by existing development within flood affected areas, existing buildings (that are considered impermeable to floodwater) should *not* be considered as falling within the functional floodplain. For this reason, these areas have been delineated as Zone 3a(i) for planning purposes. Recommended planning responses have been established accordingly. It is important to highlight that the land surrounding existing

buildings form important flow paths and flood storage areas and, therefore, must be protected.

3.2.9 It is important to recognise that all areas within Zone 3a(i) are subject to relatively frequent flooding, with a 1 in 25 chance of flooding in any given year. There are clear safety, sustainability and insurance implications associated with future development within these areas, and informed planning decisions must be taken with particular care.

3.3 City of York Council's Emergency Planning – Flood Risk

3.3.1 The provision of flood warning systems is primarily the responsibility of the Environment Agency. Their flood warning dissemination plan assesses the predicted risks to the City from rising river levels. Appropriate warnings are issued, including individual warnings to high-risk properties.

3.3.2 The Council recognises its related and important role in emergency planning and response, and therefore:

- Ensures that its emergency response plans include appropriate arrangements for flooding emergencies and reviews the plan, in consultation with the Environment Agency, Internal Drainage Boards, all statutory undertakers and the emergency services annually;

- Maintains an awareness of the Environment Agency's flood warning dissemination plan for its area and contributes to its implementation as necessary; and

- Plays an agreed role in any flood warning emergency exercises organised by the Environment Agency covering its area.

3.3.3 The Council has included plans for responding to river flooding in its Emergency Planning Procedures and has arrangements for cascading warnings received from the Environment Agency to relevant Council services.

3.3.4 As part of the Exceptions Test, developers intending to build within Flood Risk Zones 2 or 3 should consult the Council's emergency planning officers at an early stage. Information regarding existing emergency procedures can be provided and advice given on the suitability of any proposed additions/amendments.

3.4 Rapid Inundation Zones (RIZ)

3.4.1 The response of the River Ouse to heavy rainfall is relatively slow, taking a day to a day and a half to reach York from the upper catchment depending on upstream conditions. However, protected areas in Zone 3a are at risk from rapid inundation of floodwater if a failure in the defences were to occur.

3.4.2 Where detailed flood levels and topographic data were available, depth of flooding likely from the 1 in 100-year (1%) event has been shown. This provides an indication of the flood risk within Zone 3, and allows for the calculation of rapid inundation zones where the combination of depth and velocity could lead to a potential loss of life.

3.4.3 The RIZ were identified by carrying out an analysis within each protected flood cell, assessing an area approximately 500m behind the defences. Where the current ground elevation was within 300mm of the peak 1 in 100-year (1%) defence design water level, this was removed from the rapid inundation zone, as it is likely that simple mitigation measures would reduce the risk to an appropriate level.

3.4.4 In addition, areas of low-lying topography where breach water would flow and flood the area to a significant depth (greater than 0.6 m) were included in the screening of the high flood risk in Zone 3.

3.4.5 The following graphics from Report FD2320/TR2 (R&D OUTPUTS: FRA GUIDANCE FOR NEW DEVELOPMENT: PHASE 2) by HR Wallingford (2005), further illustrate the hazards in a Rapid Inundation Zone during breach scenarios.

Table 3.1: Relationship between Flood Hazard and Distance Away from a Flood Defence assuming a Defence Breach (HR Wallingford, 2005)

Distance from defence (m)	Head above crest level (m)			
	0.5	1	2	3
100				
250				
500				
1000				
1500				
2000				
2500				
3000				
3500				
4000				
4500				
5000				

Danger for some

Danger for most

Danger for all

- This table has been generated for a breach of 100 metres wide, breaching onto a flat floodplain. There may be greater spatial variation for different sized breaches, and uncertainty is expected to be relatively large. A breach smaller than 100m wide could also lead to serious problems.
- Hazard to people increases as the head of water against the defence increases.
- For small defences (say 2m high or less) the zone of high hazard only extends for the first few hundred metres if the defence is breached.

Table 3.2: Danger to People – relationship between Flood Depth and Flood Velocity assuming a Defence Breach (HR Walling ford, 2005)

Velocity (m/s)	Depth of flooding (m)											
	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.00												
0.10												
0.25												
0.50												
1.00												
1.50												
2.00												
2.50												
3.00												
3.50												
4.00												
4.50												
5.00												

Key

Danger for some

Danger for most

Danger for all

3.4.6 The following provides a very simplified guide as to the groups of people that should be considered as falling into these danger classifications:

- Danger for some – includes children, the elderly and the infirm (yellow).
- Danger for most – includes the general public (orange)
- Danger for all – includes emergency services (red)

3.4.7 The outputs of the Flood Risk to People project indicate that flood depths below 0.25m and velocities below 0.5 m/s are generally considered low hazard. When designing safe access and exit routes, the combinations of depth and velocity on the routes should correspond to the white boxes in the above diagram. As flood depth and/or velocity increase, the hazard to people increases. Combinations of depths and velocities in the white boxes (below the 'danger for some' class) are 'very low hazard', but a hazard does remain. A debris factor is also taken into consideration in the calculations to produce the above table.

Figure 11: Plan view of Danger to People from Breach Scenario

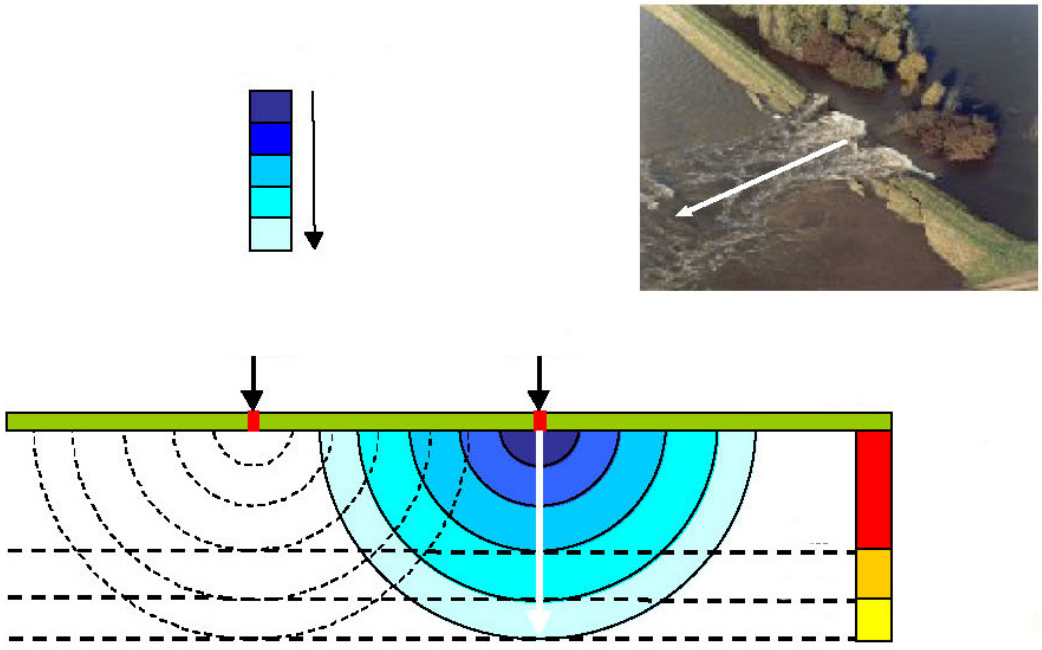
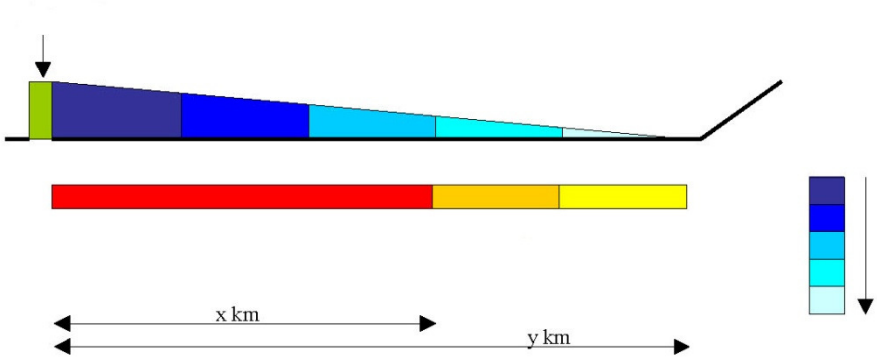


Figure 12: Section View of Danger to People from Breach Scenario



Notes on use of Flood Depth Mapping and Rapid Inundation Zones:

3.4.8 Using this simple approach from the Wallingford report, it can be seen that the danger to people decreases as the distance from the defence increases. A more detailed analysis would identify areas where the hazard would be lower or higher, for example due to localized high or low ground respectively.

3.4.9 These “danger to people” classifications should be considered as fairly subjective and should not be used as the decision-making mechanism to refuse development, especially as measures identified in a FRA to mitigate residual risk could reduce risk to acceptable levels. The classifications are most suitably applied to the identification of the least risk areas within the area being considered in order to apply a sequential approach to allocating land for development and for determining suitable types of development.

3.4.10 In summary, the risk from rapid inundation can be categorized as follows: -

- **High Risk –** land within 500m of existing flood defences and at least 600mm below the 1 in 100-year (1%) predicted flood level, posing a threat to human life, or land which lies beyond 500m from the existing flood defences and which is more than 1000mm below the predicted 1 in 100-year (1%) flood level.

- **Medium Risk** - Land in Zone 3, which is within 500m of the existing flood defences and which is less than 600mm below the 1 in 100-year (1%) predicted flood level. In the event of a breach, flood depth and flow velocities would be comparatively low;

- The land within Zone 3, which lies beyond 500m from the existing flood defences and which is less than 1000mm below the predicted 1 in 100-year (1%) flood level, where flooding would not pose a threat to human life, i.e. the higher ground, unlikely to be in the rapid inundation zone;

3.4.11 In general, this suggests that development should be avoided within the first few hundred metres of the defence because there is a risk to all people exposed to floodwater. The distance depends on the head of water above the floodplain. In addition, the velocities in this zone will be relatively high and therefore there is a clear risk of damage to property.

3.5 Flood Depth Mapping

The River Ouse

3.5.1 Extensive historic flooding records exist for the River Ouse in York, dating back to 1263 A.D. The most recent and biggest flood in autumn 2000 was assessed by the EA using computer modelling as having a 1 in 80-year return period. This is approximately only 100mm lower than the predicted 1 in 100-year (1%) flood. The aerial photographic records taken within hours of this flood peak, supplemented by subsequent levelling surveys, allows Zone 3 (1 in 100-year (1%)) to be predicted with a high degree of confidence, this is an assumption made from hydraulic modelling.

The River Foss

3.5.2 The River Foss did not flood in 2000 to the same level as the River Ouse, due to the operation of the Foss Barrier. However, the extent of River Foss flooding in 1982 is well documented, with aerial photographs providing reasonable calibration of the 1 in 100-year (1%) flood prediction carried out by the EA in 2009.

The River Derwent

3.5.3 River Derwent predictions are a little less certain, as historic records are not quite as extensive, and the worst flood to date (November 2000) has a calculated return period of 1 in 50-years (2%). However, the extent of flooding in 2000 is well documented, with aerial photographic records providing reasonable calibration of the 1 in 100-year (1%) flood prediction.

Other supporting information

3.5.4 The EA has carried out flood risk studies under Section 105(2) of the Water Resources Act 1991 & 1995 of some watercourses to improve understanding of flood risk. The outline (Phase One) studies quantify the flood risks and make recommendations on whether further investigation is necessary. If this is the case, detailed (Phase Two) studies are carried out, including hydraulic modelling. Those covered to date are: -

River Ouse catchment

- **Burdyke (Phase 2: Detailed), Atkins-2003,** from 120m upstream of the Sutton Way culvert to the Burdyke Pumping Station at the confluence with the River Ouse.
- **Holgate Beck / Chaloners Whin (Phase 2: Detailed), Faber Maunsell 2008,** lengths formally classed as Critical Ordinary Watercourses**.**
- **Blue Beck (Phase 1: Outline), Atkins-2001**

River Foss catchment

- **River Foss (Phase 2: Detailed), JBA-2003,** from Lock House Weir, Earswick to the confluence with the River Ouse.
- **Westfield Beck, Haxby (Phase 2: Detailed), JBA-2009**
- **Tang Hall Beck (Phase 2: Detailed), JBA-2004,** from Cow Moor Bridge (Stockton Lane) to the confluence with the River Foss.
- **Osbaldwick Beck (Phase 2: Detailed), JBA-2004,** from the A64 road bridge to the confluence with Tang Hall Beck.

River Derwent catchment

- **Elvington Beck (Phase 1: Outline), JBA-2000,** from the beck head to its confluence with the River Derwent.

Other studies

- Arup carried out a further flood study, commissioned by the Kyle and Upper Ouse IDBin 2001, to investigate the November 2000 flood event that affected the Blue Beck Catchment, Rawcliffe.
- Arup carried out a study, commissioned by CYC, into the capacity of Burdyke pumping station following operational and reliability problems during the 2000 flood.

3.5.5 Apart from Westfield Beck and Elvington Beck, it can be seen that these are all watercourses that have been enmained and responsibility for their management and maintenance has now been transferred to the EA.

3.6 Climatic Change Influences on Flooding

3.6.1 Defra has adopted a precautionary approach to increased flood risk due to climate change. They recommend that sensitivity analysis of river flood alleviation schemes should take account of potential increases of up to 20% in peak flows over the next 50 years (see also Table 2.2). For some larger rivers, the impact of such an increase in flow will change the frequency of what is currently a 1 in 1000-year (0.1%) event to possibly 1 in 100-years (1%), depending on the slope of the relevant flood frequency curve(s).

3.6.2. Flood frequency curves are derived from observed historical flood records. Peak flow magnitudes, and how often they occur, are graphically plotted against each other to produce a curve of best fit through this data. Locations with shallow flood frequency curves would indicate that a change from a 1 in 100-year (1%) event to a 1 in 1000-year (0.1%) event would have a greater effect on peak flow magnitudes than locations with steeper curves. Such areas are characterized as flat land adjacent to floodplains, where increases in depth of flooding can spread more easily than steep sided valleys.

3.6.3 The sensitivity analysis would establish whether the proposed scheme could be effective against the effects of climate change and maintain the desired protection against flooding for the design period. The effect of climate change is likely to vary between catchments and the sensitivity analysis would take into account how the physical characteristics affect its reaction to different flood flows.

3.7 Freeboard Allowance

3.7.1 Freeboard is generally understood as being the difference in level between the built crest of a flood defence and the design flood level. This is incorporated to allow for uncertainties in the design, construction and operation procedures. **"R&D Technical Report W187: Fluvial Freeboard Guidance Note",** produced by the EA in 2000, provides a consistent technical approach to the calculation of freeboard allowances using risk analysis, which is complex and will vary at different locations. Factors taken into account include:

- Climate change, wave action, defence settlement / erosion, modeling and frequency analysis uncertainty, consequences of overtopping

3.7.2 Previous "rules of thumb", for 1 in 100-year (1%) protection, added allowances of 450mm to flood defences and 600mm to property thresholds. The Environment Agency continues to recommend that finished floor levels of habitable buildings should be a minimum of 600mm above the 1 in 100-year (1%) level in Zone 3, and 300mm above in Zone 2.

3.8 River Ouse

General

- The Yorkshire Dales and eastern slopes of Pennines form the Ouse catchment upstream of York, a total of 3,500 square kilometres, as shown on **Figure 2**. The River Ouse is fed mainly by the rivers Swale, Ure, Nidd and Foss. The catchment is predominantly rural, with population and industry concentrated in the built-up areas of Richmond, Northallerton, Thirsk, Ripon, Harrogate and York. Heavy, persistent rainfall and/or rapid snowmelt on the high ground results in rises in river level in York, and in 2000 it rose to 5.4m above the normal summer level of 5.0 m above ordnance datum. River Ouse levels are recorded at the Viking Recorder, North Street and all Ouse flood warnings quote the level at this location.
- As detailed in Section 2, the main tributaries within York (starting upstream) are:
    - Blue Beck.
    - Holgate Beck
    - Burdyke.
    - River Foss, with the following tributaries (see Foss Zone for further description)
        - Westfield Beck
        - South Beck
        - Tang Hall Beck
        - Osbaldwick Beck
    - Germany Beck.

  In addition to these there are minor watercourses draining Poppleton, Acomb, Bishopthorpe and Acaster Malbis.

- The River Ouse level is controlled at Naburn Lock and weir, downstream of which it becomes tidal.
- The long-term average annual rainfall over the River Ouse catchment is 899mm.
- The mean summer river level is 5.00m Above Ordnance Datum (AOD) measured at North Street.
- The normal summer flow is 50 m^3/s.
- Large parts of the City Centre and surrounding area, straddling the River Ouse, are designated as Areas of Archaeological Importance, as shown on **Figure 9: Local Plan Map Extracts.**

Environmental Features

- The River Ouse is an important water resource, having many uses including, but not limited to, public water supply, irrigation, industry, angling and other recreation activities. Some water is exported from the catchment to West and South Yorkshire for public water supply. In York, recreation dramatically increases, with mooring points for motorised pleasure craft, marinas, and a number of rowing and canoeing clubs. Small, hired motorboats also use the river through York, along with a number of passenger cruise lines.
- The Ouse Navigation Authority is British Waterways.
- The River Ouse supports large numbers of coarse fish of many different species and also provides the corridor for salmon entering the catchment, making it popular with anglers. Water quality improvements have been made over the years and these have encouraged the presence of UK Biodiversity Action Plan species such as lampreys and salmon. The biological water quality of the non-tidal River Ouse in 2000 was classified as excellent to good. The invertebrate community is characterized by a diverse range of caddis flies and molluscs, such as river snails, swan mussels and populations of depressed river mussels.

- There are numerous important sites of environmental interest along the Ouse and its tributaries, including Sites of Special Scientific Interest (SSSI) at:
    - Acaster South Ings, Askham Bog, Church Ings, Fulford Ings, Heslington Tilmire and Naburn Marsh. Askham Bog has been identified as being of national importance; see **Figure 9: Local Plan Map Extracts**.
- Water vole, otters and bats are present within the catchment and the only confirmed British population of the rare Tansy Beetle (downstream of Rowntree Park and on Rawcliffe Meadow). Clifton Ings, while not a SSSI, is noted as a special grassland area.

Floodplain Characteristics - Past Flood Events

- Severe floods occurred in 1947, 1978, 1982, 2000 and 2012.
- Records of flooding in York go as far back as 1263 A.D.
- A maximum flow of 583 m^3/s was recorded in 2000, over 11 times the normal average summer flow.
- A maximum flood level in November 2000 of 10.40m AOD was recorded at the Viking Recorder, North Street. All Ouse flood warnings quote the level at this location.
- The 2000 flood left the A19 at Fulford impassable for 9 days and affected many other major and minor roads. 353 properties were affected by flooding and a further 3,500 threatened.

- The 2000 flood peaked at just 50mm below the crest level of the defences.

Flood Defences

3.8.1 Large sections of York are protected by numerous River Ouse flood defence schemes. These were originally designed to give a 1 in 100-year Standard of Protection, but subsequent high flood events have reduced this level significantly.

3.8.2 The defence levels, above ordnance datum, vary through the city, due to the natural gradient of the river, which is compounded by the backing-up effect caused by the narrower river channel and constrictions to flow at the numerous bridges through the city. The nominal flood defence level at North Street (Viking Recorder) is 10.48m AOD. **Figure 7** shows the Flood Defences and their protection levels through the city.

3.8.3 These existing defences, built between 1979 and 1993, are at Clifton / Rawcliffe Ings, Acomb Landing, Holgate Beck, Leeman Road, Lower Bootham (Phases 1 & 2), North Street, Foss Barrier and Lower Ebor Street. The defences are a mixture of earth embankments, brick or stone clad concrete walls and gates. All defences, apart from Clifton Ings, have flood pump stations associated with them, to deal with foul and surface water flows from the 'dry-side' of the catchments. Flood defences help to reduce the risk of flooding. However, they do not provide complete protection. Flooding can occur when an event is large enough to generate water levels higher than the defences or if the defence fails during a flood. The degree to which existing walls and embankments protect areas from flooding is known as the 'standard of protection'.

3.8.4 '**Standard of protection**' is the probability of the flood event that the defence was designed to protect against. However, an event that results in a higher water level than the design flood event level would not necessarily overtop the defence. This is because the height of a defence includes an allowance (freeboard) for additional factors such as wave action, modeling uncertainties and global warming.

3.8.5 A further term used to describe the level of service a defence provides is **'Onset of flooding'**. Like 'standard of protection', this defines the probability of a flood event. However, in this case, it is when a defence is likely to be at risk of overtopping and some flooding is likely to occur. For this reason, the water level that causes the onset of flooding has a lower probability (i.e. it is less likely to occur) than the water level used to calculate standard of protection. Although properties may be defended they are still at risk of flooding, as the defences may, for example, breach.

3.8.6 Clifton Ings is a natural floodplain upstream of York. In 1982, the existing embankments were raised and new ones constructed to increase the volume of storage to 2.3 million m^3. Sluice gates, which control the flow of floodwaters in and out of the Ings, were also constructed. Clifton Ings can reduce levels in York by approximately 100mm for flows of 400 m^3/s (equivalent to something greater than a 25% (1 in 4-year flood event). However, its effect reduces as flows increase, with the washlands having no significant effect on levels in York for flows greater than approximately 550 m^3/s (a 2.5% or 1 in 40-year flood event). For comparison, the peak flow during the November 2000 event was 583 m^3/s, and in 1982 it was 541 m^3/s.

3.8.7 None of the Ouse defences offer protection against a 1 in 100-year (1%) River Ouse flood event. The Rawcliffe defences were upgraded by the EA following the 2000 flood, by extending an embankment to reduce the risk of outflanking (flow of floodwater through low spots at the ends of defences). However, the review of the November 2000 flood by Arup concluded that significant flooding could still result from the backing-up of floodwater derived from within the Blue Beck catchment itself, due to the limited capacity of local storage behind the flood defence.

3.8.8 Additionally, the EA's model of the upper Ouse catchment suggests that if peak runoff increases by 20 percent, an approximately corresponding increase would be passed down the catchment to the study area. For example, a 20 percent increase in peak flows at Skelton Gauging Station, which is just upstream of York, would increase peak levels in York by between 400 to 560mm. This increase may drastically affect the standard of protection provided by some of the existing defences.

Flood Risk Areas

3.8.9 **Figure 8,** the **EA Flood Zone Map**, shows the areas that are at greatest risk of property flooding from 1 in 100-year (1%) and 1 in 1000-year (0.1%) events in the River Ouse catchment, along with flooding from its main tributaries. The areas affected by flood risk are discussed in detail below. This is regularly updated by the EA and can be viewed on their website.

Holgate Beck

3.8.10 Flooding occurred in this sub-catchment in 1947, 1978 and 1982 as a result of backflow from the River Ouse. The 1947 flood saw 217 houses in the Hamilton Drive area, located 2km from the river Ouse, affected by floodwaters.

3.8.11 Following the 1982 flood, Holgate Pumping Station was constructed by the Marston Moor IDB, which along with the associated flood bank, has kept the area free from flooding to date. The November 2000 flood came within 50mm of overtopping the City's defences, but there was no flooding directly linked to Holgate Beck. However, there is a high risk of flooding if the pumping station fails or the Water End / Leeman Road Embankments are over-topped / breached, with resultant rapid inundation from the river. The flood defences do not give 1 in 100-year (1%) protection. Landing Lane it is at a lower point than the flood embankment around Leeman Road and in the past sand bagging has been required to protect Salisbury Road.

3.8.12 Following enmainment in April 2006, the pumping station is now the responsibility of the EA. A Section 105 (Phase 2: Detailed) study was carried out by the EA in 2008, providing a more detailed assessment of flood risk issues and revised the modelled flood outlines.

Section 4 details the constraints that should be placed on future development in this area.

Blue Beck - Rawcliffe

3.8.13 Flows from Clifton Moor Industrial Estate and housing area are managed by Rawcliffe Lake, a flow balancing lake maintained by YWS, as shown on **Figure 13a**. Regulated flows discharge from the lake, to join flows from the rest of the catchment, which then normally flows unrestricted under Rawcliffe flood bank to discharge into the Ouse. During high River Ouse floods, backflow into Rawcliffe is prevented by the closure of a penstock in the earth flood-bank. From this point onwards, Blue Beck has no outfall and Rawcliffe Storage Lagoon located immediately behind the flood bank comes into operation. The combination of the two storage structures was designed to balance and store the flows from the catchment, but as a precautionary measure the EA positions temporary pumps on the embankment to ensure that sufficient capacity is maintained in the storage lagoon to accommodate flows from the beck catchment.

3.8.14 November 2000 saw 120 properties in Rawcliffe affected by flooding as a result of outflanking of the flood defences by the River Ouse. i.e. the floodwater inundated the area via a low point in the defences. The review of the flood in 2001, by Arup on behalf of the Kyle and Upper Ouse IDB, concluded that significant flooding would still occur in Rawcliffe due to backing-up of floodwater derived from within the Blue Beck

catchment itself. The system was assessed to only give protection against a 1 in 25-year (4%) flood event.

3.8.15 Following the investigation in 2001, the Rawcliffe defences were subsequently upgraded by the EA as follows with additional funding from Rawcliffe Parish Council and the Kyle and Upper Ouse IDB funding an emergency track-way to enable temporary pumping to be deployed.

- A new section of flood bank was constructed to prevent outflanking of the defences.
- Telemetry was installed to monitor water levels.
- The flood response procedure was amended.

3.8.16 However, since the problem of insufficient storage persists, future development should be constrained as detailed in Section 4.

Bur Dyke

3.8.17 Flooding occurred in this sub-catchment in 1947, 1978 and 1982 as a result of backflow from the River Ouse, the area affected being centred on Clifton Green, approximately 1km from the River Ouse. The roundabout and area behind Canon Lee School (Lilbourne Drive) is also affected by surface water flooding due to infrastructure failure. Following the 1982 flood, Bur Dyke Pumping Station was constructed by York City Council which, along with the associated earth flood-bank built as part of the Lower Bootham Phase 1 defences, has kept the area relatively free from flooding to date, with no property flooding recorded. However, during the November 2000 flood, the flood pump failed and fire engines and other pumps were brought in to carry out emergency pumping. The flood bank also came close to being overtopped. An amount of flooding occurred behind the flood-bank due to the pump failure, but no properties were affected.

3.8.18 A Section 105 (Phase 2: Detailed) study of Bur Dyke was carried out by Atkins in 2003, prior to enmainment by the EA in April 2006. The report concluded that, although the culvert itself is not under-capacity, the flood pump should be upgraded at some time in the future. The station has no standby pump in case of failure.

3.8.19 Also following the 2000 flood, CYC commissioned a report from Arup to look into the feasibility of improving the pumping station. This did not result in an upgrade, as the scheme did not qualify for Defra grant aid. The pumping station is now the responsibility of the EA.

3.8.20 The flood defences do not give 1 in 100-year (1%) protection and there remains a moderate risk of flooding if the pumping station fails or the earth flood-banks are over-topped / breached, which could affect 543 properties in the Clifton Green / Water Lane / Longfield Terrace areas.

Consequently, future development in this area should be constrained, as detailed in Section 4.

Marygate Area and North Street

3.8.21 These areas suffered direct flooding from the River Ouse in 1947, 1978 and 1982.

Following the 1982 flood, the Marygate area was protected by the construction of the Lower Bootham Phase 2 flood defences. These consist of brick-clad concrete walls, floodgates and a sewage pumping station.

3.8.22 The North Street area was protected by the construction of the North Street flood defence scheme in 1993, again with brick-clad concrete walls, floodgates and a sewage pumping station.

3.8.23 However, the November 2000 flood came within 50mm of overtopping both defences and a high risk of flooding remains, should the floodwalls fail. A low point has been identified in the grounds of the sorting office on Leeman Road. Neither defence provides 1 in 100-year (1%) protection and are classed as high-risk, rapid inundation zones, with significant flood depth exceeding 0.6m. Consequently, future development in these areas should be constrained, as detailed in Section 4.

Skeldergate and Queens Staith, Kings Staith and South Esplanade and New Walk and areas south of the centre, i.e. Clementhorpe, Bishopthorpe, Acaster Malbis, Fulford and Naburn.

3.8.24 These areas suffered direct flooding from the River Ouse during the major floods in 1947, 1978, 1982 and 2000. Limited local defences currently exist for some of these areas to varying standards, none of which are to 1 in 100-year standard. Consequently, numerous properties suffer from flooding when river levels exceed 8.2m AOD (3.2m depth of flood). Any re-development should consider recommendation in Section 4.

Future EA Flood Defence Strategy – River Ouse

3.8.25 The Ouse Catchment Flood Management Plan (CFMP) (July 2010) gives the following high-level comment on the future flood defence strategy.

"Future direction for flood risk management

Approaches in each sub-area

Flood risk is not the same in all of the catchment. We have divided the Ouse catchment into ten sub-areas which have similar physical characteristics, sources of flooding and level of risk. We have identified the most appropriate approach to managing flood risk for each of the sub-areas and allocated one of six generic flood risk management policies, shown in Table 3.

To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

Map 3. Catchment sub-areas

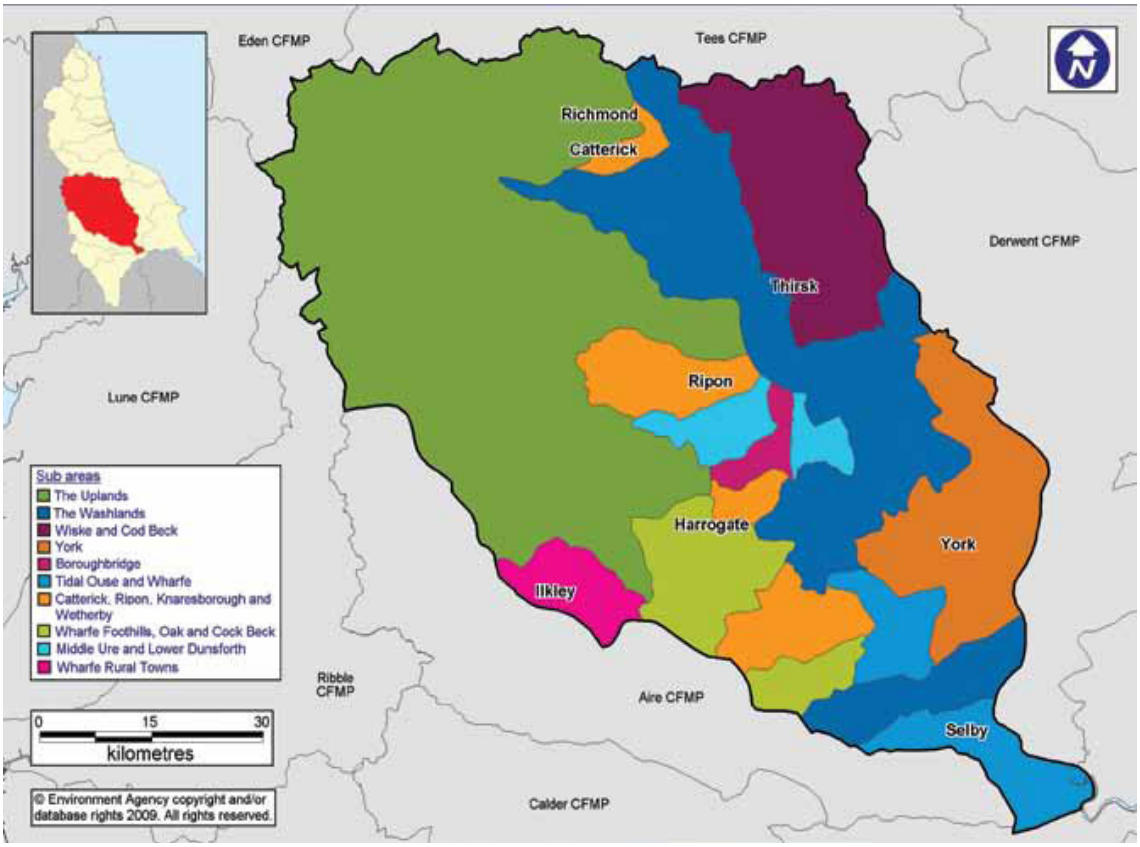

Eden CFMP
Tees CFMP
Richmond
Catterick
Derwent CFMP
Thirsk
Ripon
Lune CFMP
Harrogate
York
Ilkley
Ribble CFMP
Aire CFMP
Selby
Calder CFMP
Sub areas
The Uplands
The Washlands
Wiske and Cod Beck
York
Boroughbridge
Tidal Ouse and Wharfe
Catterick, Ripon, Knaresborough and Wetherby
Wharfe Foothills, Oak and Cock Beck
Middle Ure and Lower Dunsforth
Wharfe Rural Towns
0
15
30
kilometres
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Table 3: Policy options

➜Policy 1: Areas of little or no flood risk where we will continue to monitor and advise

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

➜ Policy 2: Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

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

➜ Policy 3: Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

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

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

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

➜ Policy 5: Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

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

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

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

(Note by CYC: The EA's policies for the sub-catchments upstream of York have a major bearing on flooding, as this is where the majority of river flow is generated, especially in the Upland Area and Washlands. Selected details of these two areas are given below, followed by the comments for York)

THE UPLANDS (Sub-area 1, Dark Green on Map 3)

The Uplands sub-area includes a large area to the north and west of the catchment. The steep topography of the sub-area and the higher than average annual rainfall results in frequent instances of rapid rainfall runoff, resulting a rise in river levels. The steep gradients of the rivers mean that flood waters flow rapidly through the sub-area.

Policy Option 6 has been chosen for the Uplands sub-area. Flooding can be generated quickly by rapid runoff from these upland areas and flood risk is dispersed throughout the area. Our vision is that we will take action to reduce the risk by working with land owners to implement changes to the way land is managed such as blocking grips, gill planting and other measures that will reduce the rate of run-off from the upland areas.

We will also seek opportunities to provide environmentally sensitive flood storage areas although the topography of the sub-area will mean that these are likely to be small scale in nature. Implementing this policy will offer benefits to communities locally and downstream that suffer from flash flooding.

Actions to implement the policy

- Produce a system asset management plan to determine the requirements for maintaining existing FCRM infrastructure whilst increasing channel roughness elsewhere in the policy unit to hold back water.

- Work with landowners and other organisations to change the way land is managed and slow the rate at which floods are generated. Reducing runoff, soil erosion and increasing channel roughness on the upland headwaters of the Ure, Swale, Nidd and Wharfe could reduce flood risk locally and immediately downstream.

- Carry out a flood warning feasibility study to address the potential to extend our flood warning service coverage for Gilling West, Masham and Hambleton Beck.

- Investigate creating flood storage areas to manage flood risk. Sites that should be investigated further include Cover Valley, Bishopdale and historic mineral workings.

- Carry out a washland optimisation study to identify the operational and maintenance requirements and identify the optimum level of storage.

- Work in partnership with the LLFA to reduce the risk of flooding from surface water in areas such as Patelely Bridge and Ramsgill.

- Investigate the potential of increasing storage in reservoirs to reduce flows downstream.

THE WASHLANDS (Sub-area 2, royal blue on Map 3)

This sub-area covers a large part of the mid catchment. It covers the large areas of strategic washlands throughout the catchment which play a vital role in regulating flood flows and reducing flood risk.

Policy Option 6 has been selected for this sub-area. The risk of flooding is low and property affected is dispersed throughout the area. Our vision is that by reducing peak flows in the rivers we will reduce flood risk downstream and locally. We will carry out a wash-land optimisation study in order to ensure the existing washlands are operating for maximum flood risk reduction benefit. We will seek further opportunities to store flood waters on all the rivers but in particular on the Bishops Dyke. Old gravel extraction sites within the sub-area may present an opportunity for flood storage. We will also promote land management changes which may help to reduce run off in the sub-area to further reduce flood peaks in the rivers.

Actions to implement the policy

- Produce a system asset management plan to determine the requirements for maintaining existing defences and optimising flood storage.
- Determine in greater detail the risk of flooding to the A1(M) and A19. If required, ensure alternative emergency routes are reviewed.
- Investigate the potential for creating flood storage areas to manage flood risk both locally and downstream.
- Work with landowners and other organisations to change the way land is managed and slow the rate at which floods are generated on Bedale, Scorton and Birdforth Becks, as well as Bishop's Dyke.
- Carry out a wash-land optimisation study. This should: identify the operational and maintenance requirements for the successful operation of sites; identify the optimum level of storage to reduce the risk of flooding.

YORK (Sub-area 4, orange on Map 3)

The issues in this sub-area

This sub-area covers the River Ouse from just upstream of York to Kelfield downstream. The sub area has a long history of regular flooding with a large number of properties at risk of flooding. There are a number of defences through the area, but there is still a high risk with 4201 properties at risk during the one per cent annual probability flood, this could rise to 6159 in the future. This estimate does not take account of the Foss Barrier though so it may overstate the risk. There is also a record of surface water flooding within the sub-area. Flooding from the Ouse is the result of prolonged rain in the upper Ouse catchment and takes a long time to develop. However, the smaller urban watercourses through York are susceptible to rapid flooding. The washlands upstream are important in reducing risk and our flood warning service is vital in reducing the consequences of flooding.

The vision and policy

Policy Option 5 has been selected for this sub-area, as our vision is to reduce existing flood risk. Several areas have been identified through the Ouse Strategy Study where

improvements could be justifiable. We will continue to explore the best way to reduce risk in the area and also promote our flood warnings service to encourage sign up. A flood risk mapping study for Stillingfleet Beck is being carried out and will determine if it is possible to improve the defences in that location. Surface water flooding also represents a risk within the urban centres of the sub- area. We will promote the development of a surface water management plan which will identify the scale of the risk and recommend improvements which will be promoted and implemented where feasible.

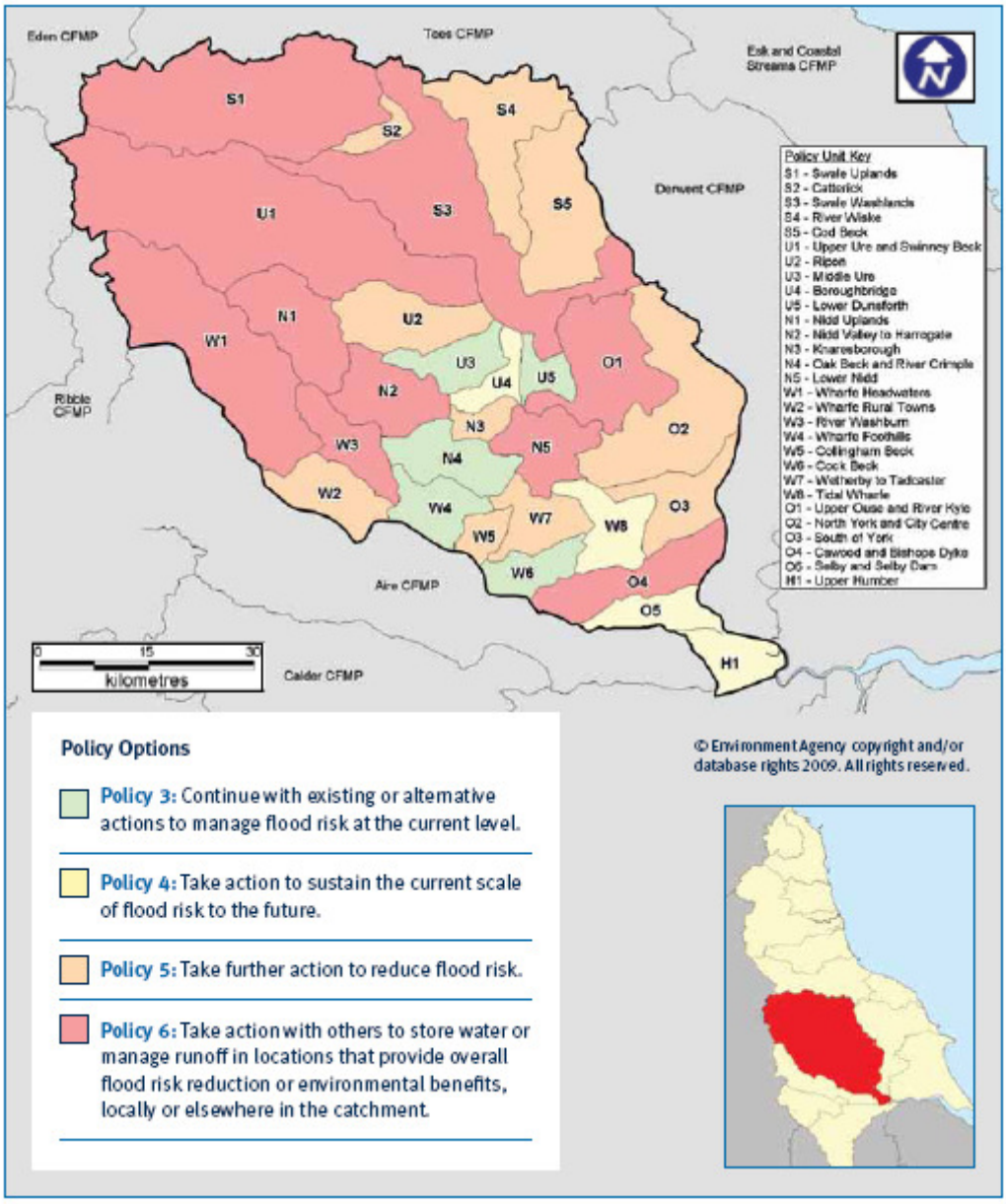
The key messages

- Washlands to the south of York play a role in managing the risk in downstream areas such as Selby.
- Surface water flooding and flooding from smaller watercourses such as Burdyke, Tang Hall Beck and Blue Beck is common.
- Washlands upstream play a crucial role in managing the risk in York.

Actions to implement the policy

- Work in partnership to identify the requirements for improving the standard of protection at key locations.
- Produce a system asset management plan to determine the most sustainable approach to managing existing assets to ensure that the risk of flooding is still reduced.
- Work in partnership with City of York Council to reduce the risk of flooding from surface water.
- Establish and maintain a register of structures or features which are likely to have a significant effect on flood risk in their area together with information about them.
- Ensure that the reviews/updates undertaken by the City of York Council of their internal and multiagency flood emergency plans take adequate account of changes in flood risk.
- Carry out a flood warning feasibility study to address the potential to extend our flood warning service.
- With English Heritage identify flood risk to Scheduled Ancient Monuments and the proposed World Heritage Site.
- Work with landowners and other organisations to change the way land is managed on the River Foss and slow the rate at which floods are generated.
- Review the current pumping regime for pumping stations at Holgate Beck and Burdyke.

Map of CFMP policies



(End of Ouse CFMP (July 2010) extracts)"

3.9 River Foss

General

- The watercourse is known as the River Foss along its whole length, and is designated as Main River from just upstream of Yearsley Bridge (OS NGR SE 6097 5393) to its downstream extent at the confluence with the River Ouse, a distance of approximately 3km. The total length of the River Foss from its source in the Howardian Hills to the confluence with the River Ouse is approximately 36km.
- The river drains a catchment area of approximately 172km², rising on Yearsley Moor in the Howardian Hills (NGR SE5776 7497). The source is approximately 27km upstream of York and the highest point in the catchment lies at approximately 170mAOD.
- The Foss was canalised between 1793 and 1806, between its confluence with the River Ouse and Sheriff Hutton Bridge, a distance of eleven and a half miles. A small reservoir (Oulston Reservoir), owned by the Council, is located in the upper part of the catchment, less than a kilometre downstream of the source of the river. The reservoir is on-line and drains a very small part of the total catchment (approximately 1.5km²). The reservoir was constructed to top up flow during dry summer periods when the river was being used by river traffic, to compensate for loss of water during lock usage.
- The Foss Navigation fell into decline with the building of the railways from 1845 onwards. All of the locks are now dismantled apart from Castle Mills Lock. The Navigation now ends shortly upstream of the Sustrans Iron Bridge over Huntington Road, a distance of 2.86km. CYC is the Navigation Authority.
- The mean summer river level is 7.6m AOD at Castle Mills Lock.
- Normal summer flow is 1.0 m^3/s
- The soils within the upper and lower sections of the Foss catchment consist of slowly permeable, seasonally waterlogged, fine loamy and clayey soils. The soils of the central part of the catchment are permeable fine sandy soils.
- The solid geology of the Vale of York consists of Permo-Triassic rocks cutting across Carboniferous rocks of the Yorkshire Dales. The Permian sequence of Magnesium Limestone and Marl forms a north south ridge of higher land on the west of the Vale of York, and is overlain on the eastern side by Sherwood Sandstone. This is overlain by Mercian Mudstone and Jurassic Lias to the east of the Vale of York. The downstream part of the River Foss catchment is located within the Sherwood Sandstone, and the northern section in the Mercian Mudstone and Jurassic Lias.

The long-term average annual rainfall over the River Foss catchment is 637mm.

Main Tributaries within York:

- **Westfield Beck** – drains relatively flat areas of residential development in Wigginton, Haxby and New Earswick north of the city. It discharges by gravity, via 1.0m dia. culvert, to Old River Foss. Storm flows (approximately 0.5 m^3/s) are pumped by a YWS owned pumping station to main River Foss approximately 1km upstream of the gravity discharge.
- **South Beck** – drains an area of 2.6km² north of the city, consisting of relatively flat areas of arable land and Monk's Cross Shopping development at the top of the catchment, along with residential areas at the bottom.

- **Tang Hall Beck** - draining an area to the north east of the city, it flows through the suburbs of Tang Hall and Layerthorpe before flowing into the River Foss at the edge of the city centre. The lower 3.7km of the watercourse is main river.
- **Osbaldwick Beck** - drains an area to the east of the city, it flows through the village of Osbaldwick and the suburb of Tang Hall before joining Tang Hall Beck in a culvert under St Nicholas Fields. The lower 3.9km of the watercourse is main river.
- Th**e** total catchment of Tang Hall and Osbaldwick Becks drains an area approximately 47km² in size, and contributes a significant amount of flow to the River Foss, via two outfalls, a low-flow and a high-level culvert. The low-flow system, known as Tang Hall Culvert, was constructed in the 18th and 19th centuries and discharges into the River Foss immediately downstream of the Foss Barrier at Browney Dyke. When the barrier is closed, a penstock on the Tang Beck culvert, immediately downstream of the barrier, is closed and diverted upstream of the barrier. The inlet of this culvert is only 150mm above the normal summer level of the river Ouse, and as a consequence its capacity is very limited, with a maximum of 2 m^3/s in the most favourable conditions.
- The Foss Islands High Level Culvert connects Tang Hall Beck more directly to the River Foss at a location approximately 200m downstream of Layerthorpe Bridge on Foss Islands Road, approximately 1km upstream from Castle Mills Sluice. This culvert comprises a 2.1m by 2.1m twin concrete box system, which is regulated by a sluice gate that is controlled and maintained by the Environment Agency. It is operated only when the level in Tang Hall beck exceeds the level in the River Foss.
- The River Foss is controlled to a normal level, equal to 7.6m AOD, by a lock and sluice-gated bypass channel at Castle Mills Bridge. Thus, the most frequently occurring floods in the River Ouse, which do not exceed 7.6m AOD, have no effect on the levels in River Foss. However, once this level is exceeded, floodwater from the River Ouse backs up the River Foss and eventually overtops its banks and floods surrounding properties. The Foss Barrier (para 3.8.3) was constructed to prevent this in 1987. A similar problem occurs with Tang Hall Beck and Osbaldwick Beck, with subsequent back-flow from the River Foss. It was this dramatic effect that contributed to the severity of the floods in 1947, 1978 and 1982.

Environmental Features

3.9.1 The Foss catchment is predominantly rural in the upper reaches, consisting of agricultural land and dispersed settlements. An area of heathland known as Strensall Common (579ha) is designated as a SSSI due to it being one of only two areas of open heathland remaining in the Vale of York, and has been identified as being of national importance, being designated as a Special Area of Conservation. This is shown on **Figure 9**. In the lower reaches, as the river enters the vicinity of York, the catchment becomes increasingly urbanised, passing through several large villages such as Strensall, Haxby and Huntington before entering the city of York.

Floodplain Characteristics - Past Flood Events

- Severe floods March 1947, January 1982 and November 2000
- Maximum flood level (1982) = 9.95m AOD at Castle Mills Lock, which provides the basis for the current flood zone 3 outline.
- Maximum 1 in 100-year (1%) flow of 31.8 m^3/s.
- Prior to the building of the Foss Barrier, 70 ha flooded in January 1982, 78 domestic properties and 64 commercial properties flooded for 2-3 days.

- Examination of the available historical flooding information has enabled the flood events on the Foss to be ranked and given an estimated return period using the Gringorten formula. Using this formula, **the November 2000 flood had an estimated return of 1 in 80 years (1.1%)** (Based on data over the last 50 years).

Flood Defences

- The Foss Barrier (including associated pumping station and flood walls) was built in 1986/7 at a cost of £3.34 million. It consists of a moveable barrier system (a large 'turn and lift gate') which when in place, effectively isolates the Foss from the Ouse, stopping water from surging back upstream. Because this prevents water naturally flowing from the Foss into the Ouse, a system of eight high volume pumps was installed (pumping capacity of 30.4 m^3/s). In short, when the barrier is lowered, the optimum level of water in the Foss is maintained by pumping water around the barrier, directly into the Ouse, thus maintaining a steady water level in the River Foss.

- The flood protection of the north eastern part of York in the Foss catchment is highly dependent on the operation of the Foss Barrier. In November 2000, when York was threatened with flooding, the pumps at the Foss Barrier failed to operate for 3-4 hours owing to a power failure and as a result the water levels in the River Foss increased rapidly. Flooding in the River Foss catchment was only narrowly avoided. The Foss Barrier pumps were refurbished following the 2000 flood to restore the capacity to the original design and improve reliability. The loss of a flood control system due to circumstances such as this is a real possibility and as such the EA should be specifically consulted for development in this area.

3.9.2 In short, the EA flood mapping study of 2004 has shown that the greatest risk of flooding from the River Foss to the city of York is a direct result of the capacity of the pumps at the Foss barrier being exceeded (flow in excess of 30.4 m^3/s) and Tang Hall Beck overtopping at James Street Link Road, adjacent to the Travelers' site. This latter source of flooding occurs during events greater than 1 in 10-year return period.

3.9.3 During 1 in 100-year (1%) events affecting both the Ouse and Foss catchments, the capacity of the pumps is predicted to be exceeded when flows from the River Foss catchment reach the Foss Barrier, this is a scenario based on modelling by the EA. Approximately 5 hours later, the River Ouse is predicted to flood into the River Foss via overland flooding at Tower Street. At this point the combined floodwaters at Browney Dyke would continue to exceed the capacity of the pumps for approximately 19 hours. The water levels on the Foss, upstream of the barrier, increase once the capacity of the pumps is exceeded and continue to do so until the incoming flow is less than the capacity. The maximum predicted water levels occur coincidental with the peak from the River Ouse via Tower Street.

Flood Risk Areas

3.9.4 **Figure 8,** the EA's Flood Zone Map, shows the areas that are at greatest risk of property flooding from 1 in 100-year (1%) and 1 in 1000-year (0.1%) events in the River Foss catchment, along with flooding from its main tributaries. These flood risk areas are discussed in detail below.

River Foss

3.9.5 The Castle Mills Sluice gate, at Tower Street, controls water levels in the River Foss upstream of Castle Mills against events less than or equal to the 1 in 50-year (2%) return. For events greater than 1 in 50-year (2%) return, the Foss Barrier and pumping station control water levels in the River Foss.

3.9.6 The flood zone maps assume failure of the Foss Barrier Defences, with inundation from the River Ouse affecting the area up to Yearsley Weir (near to Yearsley Swimming Baths). Historically, the worst property flooding occurred during the 1982 floods, when no defences were in place. Consequently, 1 in 100-year (1%) flood levels will be over 400mm deeper than has ever been experienced in the past.

3.9.7 The total number of properties at risk of flooding from a 1 in 100-year (1%) return period flood event in the River Foss reaches is estimated to be 558 for the barrier and pumps operating as per design. The majority of these properties are clustered in the densely urbanised parts of the catchment, particularly in the city centre and along Huntington Road in the Groves between the disused railway bridge and Monk Bridge and opposite King George's Field.

3.9.8 When the Foss Barrier is closed and all 8 pumps fail to operate the number of properties at risk increases to 840.

Tang Hall and Osbaldwick Beck

3.9.9 Serious flooding from Tang Hall Beck and Osbaldwick Beck occurred in March 1947, January 1982 and November 2000.

3.9.10 The critical sections of Tang Hall and Osbaldwick Becks are within the urban paved areas within the outer ring road. November 2000 saw high water levels, out of bank flow and flooding in the following areas: -

Osbaldwick Beck

- Metcalfe Lane, Appletree Village
- Osbaldwick Link Road

Tang Hall Beck

- Applecroft Road
- James Street Traveler's Site

3.9.11 Since November 2000, the James Street Traveler's Site has flooded due to problems with balancing the flood flows between Tang Hall Beck and the River Foss. This risk is now reduced as the Environment Agency has now installed telemetry monitoring in the area and the site is protected by defences constructed in 2010 which are reliant on the closure of a penstock and over pumping of locally generated surface water from the site to Tang Hall Beck.

South Beck

3.9.12 November 2000 saw flooding of part of the Monk's Cross Development at the northern extent of South Beck. The Asda car park and the adjacent roundabout were affected by floodwaters, due to the operation (lack of capacity / failure of the pumps) of the attenuation ponds immediately downstream. However, numerous problems have occurred in the past with the pumping arrangements for the pond, such that additional temporary pumping was required to prevent overflow of the ponds. Large areas of developable land still exist at Monks Cross, which will require detailed assessment of flood risk to prevent exacerbating the situation. This is addressed in Section 4.

Westfield Beck

3.9.13 Numerous areas in Haxby and Wigginton suffered surface water flooding problems during the June 2007 rainfall event. However, investigations have shown that these were mostly as a result of localised maintenance problems, some of which have since been rectified. More recent EA modelling has reduced the extent of predicted flooding at Haxby and Wigginton from Westfield Beck, but the watercourse is considered to be at capacity and reliant on the operation of Westfield Beck Pumping Station, which is owned by YWS.

Foss Valley Area

3.9.14 It can be seen from the foregoing description of the Foss Valley area that, due to the presence of minor watercourses and sub-catchments and the flood protection measures both within the catchment and associated with the River Ouse, flooding mechanisms are exceedingly complex. While modelling has provided guidance on this, a pragmatic view has to be adopted in dealing with this area based on local knowledge, in order that development is not unreasonably restricted.

3.9.15 The extent of the modelled functional floodplain is affected by the presence of the defences and, taking this into account, the mapping shows the lower catchment protected to the same standard as the areas benefiting from the Ouse defences. The protected area appears to end abruptly the end of Hallfield Road, but this reflects the topography of that area and the raising of the ground for that development. Although some areas are shown to be development in the functional floodplain (3a(i), this is not entirely clear from the available information and any proposed development in these areas will require a more detailed analysis.

Future EA Flood Defence Strategy – River Foss

3.9.16 The River Ouse CFMP in 3.8.25 makes the following general comment:-

- The EA will work with landowners and other organisations to change the way land is managed on the River Foss and slow the rate at which floods are generated

3.10 River Derwent

General

- This zone is bounded to the north by the Hambleton Hills, Cleveland Hills and the North York Moors, by the Wolds and the coast to the east, the Vale of York to the west and the Humber Estuary to the south. The upland areas have maximum elevations of around 400m AOD. **Figure 3** shows the extent of the catchment and its relationship to York. Total length of main river of the Derwent and its tributaries is approximately 275km. This includes the length of the River Derwent outside of the Council authority boundary.
- The Upper Derwent passes through areas of Corallian Limestone and Kimmeridge Clay, flowing into the Lower Derwent within Mercian Mudstone, Jurassic Lias and Sherwood Sandstone.
- A large proportion of the catchment upstream of York is forested. Management of felling and planting schemes will have a noticeable effect on runoff and sedimentation of the Derwent.
- Barmby Barrage, constructed in the 1970s to maintain the fresh-water quality of the river, controls the Derwent's outfall to the tidal section of River Ouse.

- The Derwent is navigable downstream of Stamford Bridge. However, navigation above Sutton Lock, Elvington is only by permission from the EA, as water is extracted by YWS from the Derwent above this point.
- On the upper Derwent, the majority of flood flows from the eastern part of the North York Moors are diverted into the Sea Cut, a 19th century man-made channel discharging to the North Sea at Scalby. However, during a 1 in 100-year (1%) event, significant flows (over 95%) are contributed to the Lower Derwent by the following tributaries: -
    - River Rye, River Riccall, Hodge Beck, River Dove, River Seven, Costa Beck, Pickering Beck, Thornton Beck and River Hertford.
    - The catchment is predominantly rural, extending over 2100 km², one tenth of Yorkshire. Geographically it is split into two areas: -
    - Upper Derwent – relatively steep upland areas, predominantly heather/grass moorland and commercial woodland, accounting for two-thirds of the total catchment and the majority of the flow. Characterised by steep sided valleys.
    - Lower Derwent – gentler sloping area in the Vale of Pickering and Vale of York, mainly agricultural use with natural washlands subject to frequent flooding.
- Mean summer river level of 5.45m AOD (upstream of Elvington sluices).
- Mean summer river level of 2.67m AOD (downstream of Elvington sluices).
- Normal summer flow of 15 m^3/s.
- The long-term average annual rainfall over the River Derwent catchment ranges from 600mm near Barmby to 1100mm on the North York Moors, with an overall average of 763mm.

Environmental Features

- The Lower Derwent valley is internationally recognised for its conservation importance, with good biodiversity. The River Derwent and Derwent Ings are SSSIs, and Derwent Ings has been identified as being of national importance. River Derwent and Wheldrake Ings have designation as Special Areas of Conservation. Wheldrake Ings has an additional classification as a Special Protection Area under the Birds Directive (Council Directive 79/409/EEC on the conservation of wild birds) and is a wetland area of international importance designated under the Ramsar Convention.
- River quality of the River Derwent at Elvington is classed as “good” upstream of Elvington sluice, and “fair” downstream of the sluice.

Floodplain Characteristics

Past Flood Events

- Maximum 1 in 100-year (1%) flow of 221 m^3/s at Elvington.
- Severe floods in March 1999 and November 2000, affecting large areas of agricultural land. The only residential area of York affected by River Derwent flooding is Elvington village.
- Flash flooding of Elvington Main Street can occur due to summer storms. This is due to the lack of capacity in Elvington Beck, and can occur independently of high river levels in the Derwent.

- Flooding of the road was witnessed in 2002 at the Dalby Lane / Main Street junction at Elvington, away from the effects of backing-up from the River Derwent, although no properties were flooded at this location.
- Maximum flood level of 7.06m AOD (@ Elvington - 2000), with 13 properties flooded over a period of 19 days. The return period for this event was assessed to be 1 in 50- years (2%)[l], with peak flows of approximately 199 m^3/s.

Flood Defences

3.10.1 Flood defences, primarily in the form of earth embankments, are present from Elvington down to the Barmby Barrage, at the confluence of the River Derwent and the tidal River Ouse. However, during the 2000 flood, extensive flooding of agricultural floodplain took place throughout the catchment and all the washlands were filled to capacity. The main York-Scarborough rail line at Malton was flooded, as were many road links, including the B1228 through Elvington.

3.10.2 A flood defence was built by the Environment Agency at Elvington in 2007, which protects the village from the effects of River Derwent floods to 1 in 100-year (1%) standard. Maintenance of the new defence is shared between the Environment Agency (floodbank) and the Ouse and Derwent IDB (pumping station).

Future EA Flood Defence Strategy – River Derwent

3.10.3 The EA's Derwent Catchment Flood Management Plan (July 2010) gives the following high-level comment on the future flood defence strategy.

Executive Summary

"The majority of the flood risk management work envisaged in the catchment will be focused on maintaining existing flood defences and flood warning services to protect vulnerable areas from flooding such as Malton / Norton and Stamford Bridge. However, further work is required to fully understand the role of the flood storage areas in the Vale of Pickering in order to optimise their use for flood risk management as well as taking opportunities to improve or create habitat.

Our vision for the majority of the upland headwaters that arise on the North York Moors and the Costa Beck catchment is to manage run-off or store water in locations that provide an overall flood risk reduction or environmental benefit."

Lower Derwent Policy

"The **vision** for the Lower Derwent policy unit is that flood risk will remain low as the implication of climate change is limited and confined to isolated communities. This risk of flooding will be managed through the continued maintenance of Barmby Barrage and local defences.

We believe that a change to the current arrangement of flood banks along the river network may provide a more sustainable strategic approach to long-term flood risk management. However at present we are not in a position to know where we would like to see flood banks removed, maintained or strengthened. The current role of defences within the downstream end of the policy unit are vital in reducing flood risk to the local area when the River Derwent backs up following closure of the Barrage. We need to find the optimum balance between the flood risk to properties in the policy unit, in the downstream units and to the agricultural land in the unit.

As we need to carry out further investigations into the role of raised man made defences within the policy unit we shall continue with the current arrangement of flood defences whilst we undertake a detailed strategic study into the Derwent flood banks

system. This policy of continuing with the current actions will be short term and will be reviewed upon the completion of a detailed study which will model the river and the effects of the banks in much greater detail than is appropriate or possible through a high level strategic study which this CFMP is."

Lower Derwent Actions

The following actions were proposed by the EA:-

- Produce and implement a System Asset Management Plan (SAMP) for the Lower Derwent policy unit to determine the most sustainable approach to managing assets to ensure that the standard of protection is maximised under current levels of investment.

- Continue to maintain Barmby Barrage to ensure that flood risk does not increase from lack of maintenance.

- Improve modelling and understanding of flood risk in the Lower Derwent to determine a sustainable long-term approach to managing flood banks and assets throughout the area. As part of this work evaluate the benefit of defences within the Lower Derwent policy unit as well as the role of Barmby Barrage in reducing flood risk to Selby from the tidal influence of the Humber Estuary.

- Implement the River Derwent River Restoration Plan in order to recover the SSSI section of the river to an 'unfavourable recovering' or 'favourable' condition in partnership with Natural England and others.

- Following the improved understanding of defences within the Wolds and Derwent policy unit, reassess the long term strategic CFMP policy to ensure that the most sustainable approach to managing flood risk has been adopted.

4 Approach to Flood Risk

4.0.1 Section 3 of this SFRA assessed the flood risks for the Ouse, Foss and Derwent river areas and outlined the key issues for each catchment. This section makes detailed recommendations for a future policy approach for the York area in each of the flood risk zones, including information on location and appropriateness of types of development.

4.0.2 There are two aspects of flood risk that need to be assessed: -

- Is the site itself at risk of flooding?
- Will development of the site cause flooding to adjacent sites and elsewhere in the catchment?

4.0.3 It is likely that, apart from those sites within flood zones 2 and 3 (which are at risk of flooding themselves), the second factor will be the most important to consider in an assessment.

4.1 Policy Recommendations and Development Management Guidance

4.1.1 This has been split into two main sections:

- **Section 4.1.a:** Forward Planning Policy Recommendations, providing advice on the application of NPPF.
- **Section 4.1.b:** Development Management Guidance for the Consideration of Planning Applications.

Section 4.1.c provides additional General Surface Water Drainage Guidance for developers and Development Management Officers.

4.1.a Policy Recommendations for Forward Planning

4.1.2 The York Local Plan will identify areas where major developments are to be situated, taking into account a number of NPPF considerations, including those covering flood risk. A balanced, flexible approach allows all material planning factors to be considered in site allocations.

4.1.3 In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development, based on past trends.

4.1.4 Flood risk within each Flood Zone will vary according to the vulnerability of different types of development. As shown below, **Table 4.1** lists the Flood Risk Vulnerability and **Table 4.2** lists the relevant Flood Zone Compatibility. Further information relating to the Sequential Test and the Exception Test refer to Section 5.

Table 4.1: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes), which have to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, Ambulance stations, Fire stations, Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "Essential Infrastructure")
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, **subject to a specific warning and evacuation plan**.
Less Vulnerable	• Police, ambulance and fire stations, which are **not** required to be operational during flooding. • Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants, which do **not** need to remain operational during times of flood. • Sewage treatment plants (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan**.

Notes to table:

a) This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2) and also on the need of some uses to keep functioning during flooding.

b) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

c) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

Table 4.2: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	**Zone 1** Flood risk probability less than 1 in 1000-year (<0.1%).	✓	✓	✓	✓	✓
	Zone 2 Flood risk probability between 1 in 100-year (1%) and 1 in 1000-year (0.1%)	✓	✓	Exception Test required	✓	✓
	Zone 3a Flood risk probability between 1 in 100-year (1%) and 1 in 25-year (4%).	Exception Test required	✓	×	Exception Test required	✓
	Zone 3a(i) Annual probability of flooding up to 1 in 25-year (4%) or greater. Existing development	Exception Test required	✓	×	×	Exception Test required
	Zone 3b'Functional Floodplain' Annual flood risk probability up to 1 in 25-year (4%) or greater.	Exception Test required	✓	×	×	×

✓ Development **is appropriate**

× Development **should not be permitted**

Notes to table:

This table does not show:

a) The application of the Sequential Test, which guides development to Flood Zone 1 first, then Zone 2 and then Zone 3;
b) flood risk assessment requirements; or
c) the policy aims for each flood zone.

4.1.1 Forward Planning (FP) Policy Recommendations have been prepared for development within the following flood risk zones:

- FP Policy Recommendation: Flood Zone 1 – Little or no risk, flood risk probability less than 1 in 1000-year (<0.1%).
- FP Policy Recommendation: Flood Zone 2 – Low to medium risk, flood risk probability between 1 in 100-year (1%) and 1 in 1000-year (0.1%).
- FP Policy Recommendation: Flood Zone 3a – Non-functional floodplain at high risk of flooding, flood risk probability between 1 in 100-year (1%) and 1 in 25-year.
- FP Policy Recommendation: Flood Zone 3a(i) – Developed areas at high risk of flooding, flood risk probability up to a 1 in 25-year (4%) or greater.
- FP Policy Recommendation: Flood Zone 3b - Functional floodplain at high risk of flooding, flood risk probability up to a 1 in 20-year (5%) or greater.

FP Policy Recommendation: Flood Zone 1 (little or no risk of flooding) flood risk probability less than 1 in 1000-year (<0.1%).

4.1.6 This Zone comprises land with an annual probability of flooding of less than 1 in 1000-year (<0.1%), and as such there are no constraints on the allocation of sites due to river flooding.

4.1.7 However, all development sites should be considered with respect to other potential types of flooding such as: -

- Sewer flooding – proposed sites should have no surface flooding during a 1 in 30-year (3.3%) storm event, and should retain any sewer flooding from a 1 in 100-year (1%) storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year (1%) storm. Allocations near to pre-1930's terraced housing or inner-city areas need careful consideration, due to the possibility of sewer flooding during summer storms from the existing combined sewerage systems.
- Groundwater
- Overland flow from adjacent sites
- Flooding to adjacent sites and elsewhere in the catchment from the site (the most important aspect to consider with land allocations in this zone)

4.1.8 The majority of the watercourses in York have no additional capacity. Consequently, 1 in 100-year (1%) surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -

- Existing runoff rates (if a previously developed site), based on 140 l/s/ha, in accordance with The Building Regulations 2007, Part H.3, with a reduction of 30% in runoff. This is based on the predicted increased intensity in rainfall to 2115, in accordance with the NPPF. It covers the 100 year equivalent and standard lifetime for development.
- Unless otherwise calculated, agricultural runoff rates (if the site has no previous development) will be based on 1.4 l/s/ha. To achieve this, additional run off volume will require balancing.

4.1.9 The use of sustainable drainage systems must be considered, where practicable, to enable this target to be met. Site allocations on larger sites, exceeding 1Ha, should include a suitable allowance for public open spaces, for the location of any SuDS.

4.1.10 Development will also have the potential to increase flood risk elsewhere, through the addition of hard surfaces, and the effect of the new development on surface water run-off must be incorporated in a FRA.

4.1.11. The EA should be consulted for all sites over 1ha. The EA's Flood Risk Matrix (ref paragraph 2.15), which contains appropriate standard responses, should be consulted for other types of site.

YWS should be consulted at an early stage for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB should be consulted on all proposed development (refer to **Figure 4**).

The Council's Flood Risk Management Section should be consulted on all proposed development.

FP Policy Recommendation: Flood Zone 2 (low to medium risk of flooding) flood risk probability between 1 in 100-year (1%) and 1 in 1000-year (0.1%).

4.1.12 This Zone comprises land with an annual probability of flooding of between 1 in 100-year (1%) and 1 in 1000–year (0.1%).

4.1.13 This zone **Figure 10**, is generally suitable for most developments, apart from highly vulnerable uses listed in **Table 4.1**, e.g. basement dwellings, which should be subject to the exceptions test. However, note that Table 4.2 does not show the application of the Sequential Test which guides development to Flood Zone 1 first, then Flood Zone 2, and then Flood Zone 3. Proposed allocation for essential civil infrastructure should remain accessible and operational during a 1 in 1000-year (0.1%) flood.

4.1.14 As part of the Exceptions Test, developers intending to build within Flood Risk Zone 2 should consult the Council's emergency planning officers at an early stage. Information regarding existing emergency procedures can be provided and advice given on the suitability of any proposed additions/amendments.

4.1.15 The EA's flood zone mapping for the 1 in 100-year (1%) event in York is considered to have a high degree of confidence, due to the collation and interpretation of past historical data. However, the 1 in 1000-year (0.1%) flood outline is less certain in some areas outside the old city boundary. Consequently, all development sites in Zone 2 (regardless of size) will require a site-specific FRA to prove their viability, which must also assess the sensitivity of the site to climate change. FRAs should contain the level of detail requested in the EA's planning matrix, which will vary with the size of the proposed development.

4.1.16 Sites that are less sensitive to climate change should be given preference when considering site allocation.

4.1.17 All development sites in Zone 2 should also be considered with respect to other potential sources of flooding such as: -

- Sewer flooding – sites should have no surface flooding during a 1 in 30-year (3.3%) storm event, and should retain any sewer flooding from a 1 in 100-year (1%) storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year (1%) storm. Allocations near to pre-1930's terraced housing or inner-city areas need careful consideration, due to the possibility of sewer flooding during summer storms from the existing combined sewerage systems.
- Groundwater
- Overland flow from adjacent sites
- Flooding to adjacent sites and elsewhere in the catchment from the site (the most important aspect to consider with land allocations in this zone)

4.1.18 The majority of the watercourses in York have no additional capacity. Consequently, 1 in 100-year (1%) surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -

- Existing runoff rates (if a previously developed site), based on 140 l/s/ha, in accordance with The Building Regulations 2007, Part H.3, with a reduction of 30% in runoff where practicable (as agreed with the EA) or,
- Unless otherwise calculated, agricultural runoff rates (if the site has no previous development) will be based on 1.4 l/s/ha. To achieve this, additional run off volume will require balancing.

4.1.19 The use of sustainable drainage systems must be considered, where practicable, to enable this target to be met. Site allocations on larger sites, exceeding 1Ha, should include a suitable allowance for public open spaces, for the location of any SuDS.

4.1.20 Development will also have the potential to increase flood risk elsewhere, through the addition of hard surfaces, and the effect of the new development on surface water run-off must be incorporated into the required FRA.

4.1.21 The EA should be consulted for all sites over 1ha. The EA's Flood Risk Matrix, (ref paragraph 2.15) which contains appropriate standard responses, should be consulted for other types of site. The EA must also be consulted regarding all development within Flood Zone 2, except domestic extensions and commercial extensions of less than 250m².

4.1.22 YWS should be consulted for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB should be consulted on all proposed development (refer to **Figure 4**).

The Council's Flood Risk Management Section should be consulted on all proposed development.

FP Policy Recommendation: - Flood Zone 3a: Non-functional floodplain at high risk of flooding – general comments applicable to 3a.

4.1.23 This Zone **Figure 10**, comprises land with an annual probability of river flooding between 1 in 100-year (1%) and 1 in 25-year (4%).

The water-compatible and less vulnerable uses of land in **Table 4.1** are appropriate in this zone. However, please note that less vulnerable uses, although appropriate, will need to show that the sequential test has been carried out.

The highly vulnerable uses in **Table 4.1** should not be permitted in this zone.

4.1.24 The more vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in time of flood.

- When considering potential **development sites within Zone 3a, the Sequential and Exception Tests must be passed** as explained in Section 5, NPPF and its TG.

4.1.25 In some instances this detailed FRA work may show that the specific site is not in the higher risk area as a result of more accurate site level data and assessment of overland flow routes.

4.1.26 In order to assess which of the Zone 3 areas could be suitable for development (with mitigating measures), land use was used to delineate zones 3a (non-functional floodplain) and 3b (functional floodplain) within the high-risk zone. Recommendations are given for each sub-zone in the following sections.

Proposed development should avoid the Rapid Inundation Zones described in section 3.4.

The appropriate IDB should be consulted on all proposed development (refer to **Figure 4**).

The Council's Flood Risk Management Section should be consulted on all proposed development.

The EA must be consulted regarding all development within Flood Zone 3, except domestic extensions and commercial extensions of less than 250m².

4.1.27 The majority of the watercourses in York have no additional capacity. Consequently, 1 in 100-year (1%) surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -

- Existing runoff rates (if a previously developed site), based on 140 l/s/ha, in accordance with The Building Regulations 2007, Part H.3, with a reduction of 30% in runoff where practicable (as agreed with the EA) or,
- Unless otherwise calculated, agricultural runoff rates (if the site has no previous development) will be based on1.4 l/s/ha. To achieve this, additional run off volume will require balancing.

FP Policy Recommendation: - Flood Zone 3a: Non-functional floodplain at high risk of flooding, flood risk probability between 1 in 100-year and 1 in 25-year. Including areas benefiting from flood defence protection level of up to 1 in 100-year (1%).

4.1.28 The following section is in addition to the general comments (4.1.23 to 4.1.27):

As detailed in Section 3, the only part of York's flood defences currently providing 1 in 100-year (1%) standard of protection is at Elvington.

4.1.29 As part of the Exception Test, developers intending to build within Flood Risk Zone 3 should consult the Council's emergency planning officers at an early stage. Information regarding existing emergency procedures can be provided and advice given on the suitability of any proposed additions/amendments.

4.1.30 In some instances this detailed FRA work may show that the specific site is not in the higher risk area, as a result of more accurate site level data and assessment of overland flow routes.

4.1.31 All development sites in Zone 3a should also be considered with respect to other potential sources of flooding such as: -

- Sewer flooding – sites should have no surface flooding during a 1 in 30-year (3.3%) storm event, and should retain any sewer flooding from a 1 in 100-year (1%) storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year (1%) storm. Allocations near to pre-1930's terraced housing or inner-city areas need careful consideration, due to the possibility of sewer flooding during summer storms from the existing combined sewerage systems.
- Groundwater
- Overland flow from adjacent sites
- Flooding to adjacent sites and elsewhere in the catchment from the site

4.1.32 Proposed development should avoid the Rapid Inundation Zones described in section 3.4. Rapid inundation of areas behind flood defences, following breach or overtopping, has the potential to lead to structural damage, injury or death. A sequential approach to the allocation of sites within Rapid Inundation Zones should therefore be followed, with preference being given to sites where the lowest consequences of flood defence failure are anticipated.

4.1.33 The use of sustainable drainage systems must be considered, where practicable, to enable this target to be met. Site allocations on larger sites, exceeding 1Ha, should include a suitable allowance for public open spaces, for the location of any SuDS.

4.1.34 Sites exceeding 1 Ha will also have the potential to increase flood risk elsewhere, through the addition of hard surfaces, and the effect of the new development on surface water run-off must be incorporated into the required FRA.

4.1.35 Flood risk within this zone is already high. The impacts of climate change may increase the frequency and/or magnitude of flood events, and must be taken into account when planning all new developments.

4.1.36 YWS should be consulted for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB should be consulted on all proposed development (refer to **Figure 4**).

The Council's Flood Risk Management Section should be consulted on all proposed development.

The EA must be consulted regarding all development within Flood Zone 3, except domestic extensions and commercial extensions of less than 250m².

FP Policy Recommendation: - Flood Zone 3a: Non-functional floodplain at high risk of flooding, flood risk probability between 1 in 50-year (2%) and 1 in 100-year (1%). Including areas benefiting from flood defence protection level up to 1 in 50-year (2%).

4.1.37 The following section is in addition to the general comments (4.1.23 to 4.1.27):

The River Foss Catchment

4.1.38 This area is the only one in York that has the benefit of a large pumping station, at the Foss Barrier, to deal with high flood flows. Preference will be given to development in this zone over other areas in Zone 3a.

Other areas behind existing flood defences

4.1.39 The remaining flood defences generally have only walls / embankments for protection. Although offering 1 in 50-year (2%) protection, the EA has stated that development will be less preferential in these areas than in the Foss zone.

4.1.40 As part of the Exception Test, developers intending to build within Flood Risk Zone 3 should consult the Council's emergency planning officers at an early stage. Information regarding existing emergency procedures can be provided and advice given on the suitability of any proposed additions/amendments.

4.1.41 In some instances this detailed FRA work may show that the specific site is not in the higher risk area as a result of more accurate site level data and assessment of overland flow routes.

4.1.42 All development sites in Zone 3a should also be considered with respect to other potential sources of flooding such as: -

- Sewer flooding – sites should have no surface flooding during a 1 in 30-year (3.3%) storm event, and should retain any sewer flooding from a 1 in 100-year (1%) storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year (1%) storm. Allocations near to pre-1930's terraced housing or inner-city areas need careful consideration, due to the possibility of sewer flooding during summer storms from the existing combined sewerage systems.
- Groundwater
- Overland flow from adjacent sites
- Flooding to adjacent sites and elsewhere in the catchment from the site (the most important aspect to consider with land allocations in this zone)

4.1.43 Proposed development should avoid the Rapid Inundation Zones described in section 3.4. Rapid inundation of areas behind flood defences, following breach or overtopping, has the potential to lead to structural damage, injury or death. A sequential approach to the allocation of sites within Rapid Inundation Zones should therefore be followed, with preference being given to sites where the lowest consequences of flood defence failure are anticipated.

4.1.44 The use of sustainable drainage systems must be considered, where practicable, to enable this target to be met. Site allocations on larger sites, exceeding 1Ha, should include a suitable allowance for public open spaces, for the location of any SuDS.

4.1.45 Development will also have the potential to increase flood risk elsewhere, through the addition of hard surfaces, and the effect of the new development on surface water run-off must be incorporated into the required FRA.

4.1.46 Flood risk within this zone is already high. The impacts of climate change may increase the frequency and/or magnitude of flood events, and must be taken into account when planning all new developments.

4.1.47 YWS should be consulted for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB and should be consulted on all proposed development (refer to **Figure 4**).

The Council's Flood Risk Management Section should be consulted on all proposed development.

The EA must be consulted regarding all development within Flood Zone 3, except domestic extensions and commercial extensions of less than 250m².

FP Policy Recommendation: Flood Zone 3a(i) – Developed areas at high risk of flooding, flood risk probability up to a 1 in 25-year (4%) or greater.

4.1.48 This Zone, shown on **Figure 10**, comprises land within the 1 in 25-year (4%) flood envelope with existing development.

The water-compatible uses of land in **Table 4.1** are appropriate in this zone.

The more vulnerable and highly vulnerable uses in **Table 4**.1 should not be permitted in this zone.

4.1.49 The less vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designated and constructed to remain operational and safe for users in time of flood.

4.1.50 Early contact with the EA is required to establish the viability of sites in this zone, as they have placed constraints on development in these high-risk areas within the historic flood outline to control any increase in the number of people introduced into the floodplain and put at risk of flooding.

4.1.51 When considering potential development sites within Zone 3a(i), the Sequential and Exception Tests must be passed, as explained in Section 5, NPPF and its TG. .

4.1.52 As part of the Exception Test, developers intending to build within Flood Risk Zone 3 should consult the Council's emergency planning officers at an early stage. Information regarding existing emergency procedures can be provided and advice given on the suitability of any proposed additions/amendments.

4.1.53 All development sites in Zone 3a(i) should also be considered with respect to other potential sources of flooding such as: -

- Sewer flooding – sites should have no surface flooding during a 1 in 30-year (3.3%) storm event, and should retain any sewer flooding from a 1 in 100-year (1%) storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year (1%) storm. Allocations near to pre-1930's terraced housing or inner-city areas need careful consideration, due to the possibility of sewer flooding during summer storms from the existing combined sewerage systems.

- Groundwater

- Overland flow from adjacent sites

- Flooding to adjacent sites and elsewhere in the catchment from the site (the most important aspect to consider with land allocations in this zone)

4.1.54 The majority of the watercourses in York have no additional capacity. Consequently, 1 in 100-year (1%) surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -

- Existing runoff rates (if a previously developed site), based on 140 l/s/ha, in accordance with The Building Regulations 2007, Part H.3, with a reduction of 30% in runoff where practicable (as agreed with the EA) or,

- Unless otherwise calculated, agricultural runoff rates (if the site has no previous development) will be based on 1.4 l/s/ha. To achieve this, additional run off volume will require balancing.

4.1.55 The use of sustainable drainage systems must be considered, where practicable, to enable this target to be met. Site allocations on larger sites, exceeding 1Ha, should include a suitable allowance for public open spaces, for the location of any SuDS.

4.1.56 Sites exceeding 1 Ha will also have the potential to increase flood risk elsewhere, through the addition of hard surfaces, and the effect of the new development on surface water run-off must be incorporated into the required FRA.

4.1.57 Flood risk within this zone is already high. The impacts of climate change may increase the frequency and/or magnitude of flood events, and must be taken into account when planning all new developments.

4.1.58 YWS should be consulted for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB and should be consulted on all proposed development (refer to **Figure 4**).

The Council's Flood Risk Management Section should be consulted on all proposed development.

The EA must be consulted regarding all development within Flood Zone 3, except domestic extensions and commercial extensions of less than 250m².

FP Policy Recommendation: Flood Zone 3b – Functional Floodplain, flood risk probability up to a 1 in 20-year (5%) or greater.

4.1.59 This zone comprises land where water has to flow or be stored in times of flood and is within the functional floodplain. Flood risk probability up to a 1 in 25-year (4%) or greater.

4.1.60 The water-compatible uses of land in Table 4.1 are appropriate in this zone. Essential infrastructure listed in **Table 4.1,** which have to be there, should also be permitted in this zone. It should be designed and constructed to: -

- Have emergency procedures in place during flood events
- Result in no net loss of floodplain storage
- Not impede water flows
- Not increase flood risk elsewhere
- Adequately defended against 1 in 100-year (1%) flooding without increasing the degree of flood risk to any third party
- Provide flood resilience of buildings to minimise the damage if a flood exceeding the 1 in 100-year (1%) event occurs

4.1.61 Essential infrastructure in this zone **must** pass the Exception Test, as explained in Section 5, NPPF and its TG.**.**

4.1.62 As part of the Exception Test, developers intending to build within Flood Risk Zone 3 should consult the Council's emergency planning officers at an early stage. Information regarding existing emergency procedures can be provided and advice given on the suitability of any proposed additions/amendments.

A FRA should accompany all development proposals in this zone.

4.1.63 Flood risk within this zone is already high. The impacts of climate change may increase the frequency and/or magnitude of flood events, and must be taken into account when planning all new developments.

The Council's Flood Risk Management Section should be consulted with all proposed development.

The EA must be consulted regarding all development within Flood Zone 3b.

4.1.b Guidance for Development Management and the Consideration of Planning Applications

4.1.64 This Section outlines recommended policies for Planning and Development Management purposes, assisting both planners and developers in the practical application of the policies contained within NPPF and its TG. It must be stressed that flood risk is a material planning consideration that must be taken into account when making a determination for planning permission.

4.1.65 Developers must assess whether any proposed development is likely to be affected by flooding and whether it will increase flood risk elsewhere in the catchment. Where flood risk is present, developers must satisfy the local planning authority that any flood risk will be successfully managed and provide details of proposed mitigation measures.

4.1.66 A Flood Risk Assessment must be submitted with any planning application where flood risk is an issue, regardless of its location within the Flood Zones. Additionally, all proposed development within Flood Zones 2 and 3 will require a FRA, regardless of size. The level of detail provided within a FRA will depend on the scale of the development and flood risks posed. The EA's Flood Risk Matrix (ref paragraph 2.15) gives Standing Advice on the scope and extent of Flood Risk Assessments and further guidance is available in BS 8533:2011: Assessing and Managing Flood Risk In Development – Code Of Practice.

4.1.67 Development Management (DM) guidance has been prepared for development within the following flood risk zones, based on the EA's advice contained on their website: -

- DM Guidance: Flood Zone 1 – Little or no risk, flood risk probability less than 1 in 1000-year (<0.1%).
- DM Guidance: Flood Zone 2 – Low to medium risk, flood risk probability between 1 in 100-year (1%) and 1 in 1000-year (0.1%).
- DM Guidance: Flood Zone 3a – Non-functional floodplain at high risk of flooding, flood risk probability between 1 in 100-year (1%) and 1 in 25-year.
- DM Guidance: Flood Zone 3a(i) – Developed areas at high risk of flooding, flood risk probability up to a 1 in 25-year (4%) or greater.
- DM Guidance: Flood Zone 3b - Functional floodplain at high risk of flooding, flood risk probability up to a 1 in 20-year (5%) or greater.

DM Guidance: Flood Zone 1 (little or no risk of flooding) Flood risk probability less than 1 in 1000-year (<0.1%).

4.1.68 Zone 1 is defined as having an annual probability of flooding of less than 1 in 1000-year (<0.1%). The aim of NPPF is to steer new development to Flood Zone 1.

4.1.69 Planning applications for major development proposals of 1 hectare or greater in Flood Zone 1 must be accompanied by a FRA. The FRA should identify opportunities to reduce the probability and consequences of flooding.

4.1.70 A FRA will also be required where the proposed development or change of use to a more vulnerable class may be subject to other sources of flooding or where the Council, EA, IDB and/or other bodies have indicated that there may be drainage problems.

4.1.71 The FRA will be required to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed, taking the potential impacts of climate change into account, giving details of proposed mitigation measures. The EA provides advice on its website outlining the level of detail required, which should reflect the scale and potential significance of the development.

If the FRA does not sufficiently address flood risk, the planning application will be unacceptable.

4.1.72 The EA will need to be consulted as part of the planning process if any of the following apply: -

- Proposed development is an operational development greater than 1 ha.
- The development lies within 8m of the bank top of a Main River
- The development lies within 8m of the foot of a raised flood defence bank
- Any temporary or permanent works which will restrict flows within an ordinary watercourse
- Proposed culverting works of an ordinary watercourse.

The appropriate IDB must also be consulted with regard to any proposed development within their respective areas (see **Figure 4**).

The Council's Flood Risk Management Section must be consulted on all applications.

DM Guidance: Flood Zone 2 (low to medium risk of flooding), flood risk probability between 1 in 100-year (1%) and 1 in 1,000 year (0.1%).

4.1.73 Zone 2 is defined as having an annual probability of flooding of between 1 in 100-year (1%) and 1 in 1000-year (0.1%).

4.1.74 This zone, **Figure 10**, is generally suitable for most developments, apart from highly vulnerable uses listed in **Table 4.1,** e.g. basements, which should be subject to the exceptions test. However, note that Table 4.2 does not show the application of the Sequential Test which guides development to Flood Zone 1 first, then Flood Zone 2, and then Flood Zone 3. Essential civil infrastructure within this zone should remain accessible and operational during a 1 in 1000-year (0.1%) flood.

4.1.75 All planning applications in Flood Zone 2 must be accompanied by a FRA, which should identify opportunities to reduce the probability and consequences of flooding.

4.1.76 The FRA will be required to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed, taking the potential impacts of climate change into account, giving details of proposed mitigation measures. The EA provides advice on its website outlining the level of detail required, which should reflect the scale and potential significance of the development.

If the FRA does not sufficiently address flood risk, the planning application will be unacceptable.

4.1.77 The EA must be consulted as part of the planning process if any of the following apply: -

- Proposed development is an operational development greater than 1 ha.
- The development lies within 8m of the bank top of a Main River
- The development lies within 8m of the foot of a raised flood defence bank
- Any temporary or permanent works which will restrict flows within an ordinary watercourse
- Culverting works of an ordinary watercourse are proposed.
- The site lies within a documented historic flooding area.

The appropriate IDB must also be consulted with regard to any proposed development within their respective areas (see **Figure 4**).

The Council's Flood Risk Management Section must be consulted on all applications.

4.1.78 Specific points to consider for Zone 2: -

- Habitable floor levels to be 300mm above the 1 in 100-year (1%) flood level
- The development will be adequately defended against 1 in 100-year (1%) flooding without increasing the degree of flood risk to any third party
- Ultimate depth of water following breach or inundation– level of ground in relation to water level
- Flood resilience of buildings to minimise the damage if a flood exceeding the 1 in 100-year (1%) event occurs. Please refer to the Communities and Local Government Guidance 'Improving the Flood Performance of New Buildings – Flood Resilient Construction' for further information.

DM Guidance: Flood Zone 3a Non-functional floodplain at high risk of flooding, flood risk probability between 1 in 100-year (1%) and 1 in 25 (4%). Including areas benefiting from flood defence protection level of up to 1 in 100-year (1%).

4.1.79 As detailed in Section 3, only Elvington has the benefit of flood defences currently providing 1 in 100-year (1%) standard of protection.

The water-compatible and less vulnerable uses of land in **Table 4.1** are appropriate in this zone. However, please note that less vulnerable uses, although appropriate, will need to show that the sequential test has been carried out.

The highly vulnerable uses in **Table 4.1** should not be permitted in this zone.

4.1.80 The more vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed. Essential infrastructure, permitted in this zone, should be designed and constructed to remain operational and safe for users in time of flood.

4.1.81 When considering potential development sites within Zone 3a, the Sequential and Exception Tests must be passed, as explained in Section 5, NPPF and its TG.

4.1.82 All planning applications in Flood Zone 3 must be accompanied by a FRA. The FRA should identify opportunities to reduce the probability and consequences of flooding.

4.1.83 The FRA will be required to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed, taking the potential impacts of climate change into account, giving details of proposed mitigation measures. The EA's Standing Advice outlines the level of detail required, which should reflect the scale and potential significance of the development.

If the FRA does not sufficiently address flood risk, the planning application will be unacceptable.

4.1.84 The EA must be consulted as part of the planning process for all proposed developments, the only exception being for extension less than 250m², where the following applies: -

- The development lies within 8m of the bank top of a Main River
- The development lies within 8m of the foot of a raised flood defence bank
- Any temporary or permanent works which will restrict flows within an ordinary watercourse
- Culverting works of an ordinary watercourse are proposed.
- The site lies within a documented historic flooding area.

The appropriate IDB must also be consulted with regard to any proposed development within their respective areas (see **Figure 4**).

The Council's Flood Risk Management Section must be consulted on all applications.

4.1.85 Specific points to consider:-

- The development will be adequately defended against 1 in 100-year (1%) flooding without increasing the degree of flood risk to any third part
- Ultimate depth of floodwater following breach or inundation.
- Finished floor levels should be raised a minimum of 600mm above the modelled 1 in 100-year flood level.

- Flood resilience of buildings to minimise the damage if a flood exceeding the 1 in 100-year (1%) event occurs. Please refer to the Communities and Local Government Guidance 'Improving the Flood Performance of New Buildings – Flood Resilient Construction' for further information.

DM Guidance: Flood Zone 3a Non-functional floodplain at high risk of flooding, flood risk probability between 1 in 50-year (2%) and 1 in 100-year (1%). Including areas benefiting from flood defence protection level up to 1 in 50-year (2%).

The River Foss Catchment

4.1.86 This area is the only one in York that has the benefit of a large pumping station, at the Foss Barrier, to deal with high flood flows. Preference will be given to development in this zone over other areas in Zone 3a.

The water-compatible and less vulnerable uses of land in **Table 4.1** are appropriate in this zone.

4.1.87 The more vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designated and constructed to remain operational and safe for users in time of flood

The highly vulnerable uses in **Table 4.1** should not be permitted in this zone.

Other areas behind existing flood defences

4.1.88 The remaining flood defences generally have only walls / embankments for protection. Although offering 1 in 50-year (2%) protection, the EA has stated that development will be less preferential in these areas than in the Foss zone.

Appropriate uses are as in 4.1.91

4.1.89 When considering potential development sites within this zone, the Sequential and Exception Tests must be passed, as explained in Section 5, NPPF and its TG.

4.1.90 All planning applications Flood Zone 3 must be accompanied by a FRA. The FRA should identify opportunities to reduce the probability and consequences of flooding.

4.1.91 The FRA will be required to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed, taking the potential impacts of climate change into account, giving details of proposed mitigation measures. The EA's Standing Advice outlines the level of detail required, which should reflect the scale and potential significance of the development.

If the FRA does not sufficiently address flood risk, the planning application will be unacceptable.

4.1.92 The EA must be consulted as part of the planning process for all proposed developments, the only exception being for extension less than 250m², where the following applies: -

- The development lies within 8m of the bank top of a Main River
- The development lies within 8m of the foot of a raised flood defence bank
- Any temporary or permanent works which will restrict flows within an ordinary watercourse
- Culverting works of an ordinary watercourse are proposed.
- The site lies within a documented historic flooding area.

The appropriate IDB must also be consulted with regard to any proposed development within their respective areas (see **Figure 4**).

The Council's Flood Risk Management Section must be consulted on all applications.

4.1.93 Specific points to consider:-

- The development will be adequately defended against 1 in 100-year (1%) flooding without increasing the degree of flood risk to any third party
- Ultimate depth of floodwater following breach or rapid inundation
- Finished floor levels should be raised a minimum of 600mm above the modelled 1 in 100-year flood level or ground level, whichever is higher.
- Flood resilience of buildings to minimise the damage if a flood exceeding the 1 in 100-year (1%) event occurs. Please refer to the Communities and Local Government Guidance 'Improving the Flood Performance of New Buildings – Flood Resilient Construction' for further information.

DM Guidance: Flood Zone 3a(i) Developed areas at high risk of flooding, flood risk probability up to 1 in 25-year (4%) or greater.

4.1.94 This Zone, shown on **Figure 10**, comprises land with an annual probability of river flooding up to 1 in 25-year (4%) or greater. There is a high risk of flooding and most are known to have flooded in the past.

The water-compatible uses of land in **Table 4.1** are appropriate in this zone.

The more vulnerable and highly vulnerable uses in **Table 4.1** should not be permitted in this zone.

4.1.95 The less vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designated and constructed to remain operational and safe for users in time of flood.

4.1.96 When considering potential development sites within Zone 3a(i), the Sequential and Exception Tests must be passed, as explained in Section 5, NPPF and its TG.

4.1.97 Early contact with the EA is required to establish the viability of sites in this zone, as they have placed constraints on development in these high-risk areas within the historic flood outline to control any increase in the number of people introduced into the floodplain and put at risk of flooding.

4.1.98 All planning applications Flood Zone 3 must be accompanied by a FRA. The FRA should identify opportunities to reduce the probability and consequences of flooding.

4.1.99 The FRA will be required to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed, taking the potential impacts of climate change into account, giving details of proposed mitigation measures. The EA's Standing Advice outlines the level of detail required, which should reflect the scale and potential significance of the development.

If the FRA does not sufficiently address flood risk, the planning application will be unacceptable.

4.1.100 The EA must be consulted as part of the planning process for all proposed developments, the only exception being for extension less than 250m², where the following applies: -

- The development lies within 8m of the bank top of a Main River
- The development lies within 8m of the foot of a raised flood defence bank
- Any temporary or permanent works which will restrict flows within an ordinary watercourse
- Culverting works of an ordinary watercourse are proposed.
- The site lies within a documented historic flooding area.

The appropriate IDB must also be consulted with regard to any proposed development within their respective areas (see Figure 4).

The Council's Flood Risk Management Section must be consulted on all applications.

4.1.101 Specific points to consider for Zone 3a(i): -

- The development will be adequately defended against 1 in 100-year (1%) flooding without increasing the degree of flood risk to any third party

- Ultimate depth of water following breach or inundation
- Finished floor levels should be raised a minimum of 600mm above the modelled 1 in 100 year flood level
- Flood resilience of buildings to minimise the damage if a flood exceeding the 1 in 100-year (1%) event occurs. Please refer to the Communities and Local Government Guidance 'Improving the Flood Performance of New Buildings – Flood Resilient Construction' for further information.

DM Guidance: Flood Zone 3b – Functional Floodplain, flood risk probability up to 1 in 20-year (5%) or greater.

4.1.102 This zone, shown on **Figure 10**, comprises land where water has to flow or be stored in times of flood and is within the functional floodplain. Flood risk probability is up to 1 in 25-year (4%) or greater.

4.1.103 The water-compatible uses of land in Table 4.1 are appropriate in this zone. Essential infrastructure listed in Table 4.1, that have to be there, should also be permitted in this zone. It should be designed and constructed to:

- Have emergency procedures in place during flood events
- Result in no net loss of floodplain storage
- Not impede water flows
- Not increase flood risk elsewhere
- Adequately defended against 1 in 100-year (1%) flooding without increasing the degree of flood risk to any third party
- Provide flood resilience of buildings to minimise the damage if a flood exceeding the 1 in 100-year (1%) event occurs

4.1.104 Essential infrastructure in this zone must pass the Exception Test, as explained in Section 5, NPPF and its TG. .

A FRA should accompany all development proposals in this zone. If the FRA does not sufficiently address flood risk, the planning application will be unacceptable.

4.1.105 Flood risk within this zone is already high. The impacts of climate change may increase the frequency and/or magnitude of flood events, and must be taken into account when planning all new developments.

4.1.106 The EA's Standing Advice outlines the level of detail required, which should reflect the scale and potential significance of the development. The EA must be consulted as part of the planning process for all proposed developments, the only exception being for extension less than 250m², where the following applies: -

- The development lies within 8m of the bank top of a Main River
- The development lies within 8m of the foot of a raised flood defence bank
- Any temporary or permanent works which will restrict flows within an ordinary watercourse
- Culverting works of an ordinary watercourse are proposed.
- The site lies within a documented historic flooding area.

4.1.107 The appropriate IDB must also be consulted with regard to any proposed development within their respective areas (see **Figure 4**).

The Council's Flood Risk Management Section must be consulted on all applications.

4.1.c General Surface Water Drainage Guidance

4.1.108 The 2000 flood saw all the major Becks and rivers flowing at full capacity, in each of the three river zones. Flooding affected 365 properties and threatened a further 5000. Consequently, the following policy should apply to all new development / re-development, irrespective of which flood zone it lays in: -

1 Surface water flows from all sites should, where practicable, be restricted to 70% of the existing runoff rate i.e. 30% reduction This is based on the predicted increased intensity in rainfall to 2115, in accordance with the NPPF. It covers the 100 year equivalent and standard lifetime for development. Existing runoff rates are calculated as follows:

a. Brownfield (i.e. previously developed) site = 140 l/s/ha (in accordance with The Building Regulations 2007, Part H.3) or

b. Undeveloped sites = 1.4 l/s/ha (agricultural runoff rates).

Storage volume calculations, using computer modelling, must accommodate a 1 in 30-year storm with no surface flooding, along with no internal flooding of buildings or surface run-off from the site in a 1 in 100-year storm. Proposed areas within the model must also include an additional 20% allowance for climate change. The modelling must use a range of storm durations, with both summer and winter profiles, to find the worst-case volume required.

If no connected impermeable areas (if the site has no previous development i.e. Greenfield) then an Agricultural runoff rate of 1.4 l/s/ha shall be used.

Notes:

In some instances, there may be no flow from the site that discharges to a watercourse and the land may be waterlogged. Development of such a site will require the compensatory attenuation of flow elsewhere to maintain the status quo.

Agricultural runoff rate of 1.4 l/s/ha is currently quoted to developers. However, it is recognised that this empirical figure may not be appropriate for all soil types and modeling carried out as part of the flood risk assessment specific to a particular development site may establish a different existing runoff from the site on which a design can be based and agreed.

2 Surface water from developments shall not connect to combined drains or sewers, if a suitable surface water sewer is available and unless expressly authorised by Yorkshire Water.

Note: This is to prevent overloading of the sewerage system and prevent unnecessary treatment of surface water. Some areas are wholly combined systems of drainage (e.g. city centre).

3 All full planning applications shall have complete drainage details (including Flood Risk Assessments when applicable) to include calculations and invert levels (to AOD) of both the existing and proposed drainage system included with the submission, to enable the assessment of the impact of flows on the catchment and downstream watercourse to be made. Existing and proposed surfacing shall be specified.

Note: This should be confirmed at plans processing stage and the application rejected when insufficient detail is provided, thus preventing the promotion of inappropriate development. This will also reduce the need for conditions related to drainage and provide clarity for enforcement purposes.

4. **Sustainable Urban Drainage System (SUDS) methods of source control and water quality improvement should be utilised wherever possible for all new developments in the catchment.**

   Note: In accordance with Approved Document Part H of the Building Regulations 2000, the first option for surface water disposal should be the use of sustainable drainage methods (SUDS) which limit flows through infiltration e.g. soakaways or infiltration trenches, subject to establishing that these are feasible, can be adopted and properly maintained and would not lead to any other environmental problems. For example, using soakaways or other infiltration methods on contaminated land carries groundwater pollution risks and may not work in areas with a high water table.

5. **Where the intention is to dispose to soakaway, these should be shown to work through an appropriate assessment carried out under BRE Digest 365, (if possible carried out in winter) - to prove that the ground has sufficient capacity to accept surface water discharge, and to prevent flooding of the surrounding land and the site itself.**

   Where permeable paving is proposed the same BRE Digest 365 assessment should be carried out to prove that the ground has sufficient capacity to accept surface water discharge, and to prevent flooding of the surrounding land and the paving itself.

   The Council's Flood Risk Management Section should witness the BRE Digest 365 test.

   Notes:

   The suitability of the use of soakaways and swales within York will be limited, due to the unsuitable clay ground encountered throughout most of the city. There should be a presumption that these will be unsuitable unless proven otherwise.

   Should follow on with other options, if infiltration does not work, i.e. on site retention, sewers, watercourses as per Building Regulations - Part H (Drainage & Waste Disposal) 2002 Edition

6. **Ground water / land drainage from proposed developments shall not be connected to public sewers and existing land-drainage systems should be maintained.**

   Note: YWS will not allow the connection of ground water to public sewers, to prevent hydraulic over-loading of the sewerage system and problems associated with siltation.

7. **Applications for smaller scale developments in relation to surface water drainage, which are part of larger sites that already have outline permission, must comply with any conditions that were applied to the larger site.**

Note: This is to prevent a 'piecemeal' approach to SUD/drainage schemes. This will apply to both large-scale housing and industrial developments, where the drainage system should be designed "as a whole".

8. **Proposed development near to existing areas served by combined sewerage systems (typically pre-1930 terraced housing and inner-city) will need careful consideration with regards to additional hydraulic loading**

   Note: YWS should be consulted at an early stage for all developments over 10 dwellings or sites exceeding 0.5ha, as new connections to sewers suffering from under-capacity may result in exacerbation of any existing problems. The proposed site may also flood itself due to surcharge during intense summer storms.

4.2 Specific Comments on Development in High Risk Flood Zone 3 Areas

River Ouse Catchment

Holgate Beck

4.2.1 Due to the risk of failure of the Water End / Leeman Road Embankment, with resultant rapid inundation from the river, no further development should be permitted in this area unless it passes the Exception Test, including a specific Flood Risk Assessment in line with EA requirements.

Blue Beck

4.2.2 Blue Beck has 1 in 80-year (1.1%) protection from the River Ouse, but has the potential to flood behind the defences due to insufficient flood storage, which persists within the catchment. No further development should be permitted in this area unless it passes the Exception Test, including a specific Flood Risk Assessment, in line with EA requirements.

Bur Dyke

4.2.3 Breach of the flood embankment could affect 543 properties in the Clifton Green / Water Lane / Longfield Terrace areas, with resultant rapid inundation from the River Ouse. No further development is being permitted in this area unless it passes the Exception Test, including a specific Flood Risk Assessment, in line with EA requirements.

Marygate and North Street

4.2.4 Although classed as a “Brownfield site” (i.e. previously developed), any re-development in these areas must pass the Exception Test, including a robust FRA, as it is in a high-risk rapid inundation zone.

Skeldergate and Queens Staith, Kings Staith South Esplanade and New Walk

4.2.5 No flood defences currently exists for these areas. As these areas are fully developed any re-development should consider flood resilience.

River Foss Catchment

4.2.6 This area is the only one in York that has the benefit of a large pumping station, at the Foss Barrier, to deal with high flood flows.

4.2.7 Any proposed developments must pass the Exception Test, including the provision of full Flood Risk Assessments, which should consider flood risk not only to development sites, but also to adjacent sites and elsewhere in the catchment.

4.2.8 The 2000 floods saw all the major becks flowing at full capacity, especially Tang Hall Beck and Osbaldwick Beck. The Foss Barrier was also running at full capacity.

4.2.9 Historically, the worst property flooding occurred during the 1982 floods, when no defences were in place. Consequently, 1 in 100-year (1%) flood levels will be over 400mm deeper than has ever been experienced in the past.

4.2.10 In summary, the flows from all new development in the Foss catchment should be restricted to the existing flow from the site less 30% (if a Brownfield site) or agricultural runoff rate if the site has no previous development.

River Derwent Catchment

4.2.11 The 2000 floods saw all the major becks flowing at full capacity, especially Elvington Beck, which severely affected the village for nearly 3 weeks.

4.2.12 To prevent future flooding problems, all flows from all new development should be restricted to the existing flow from the site (if a previously developed site) or agricultural runoff rate if the site has no previous development, especially flows to Elvington Beck.

Elvington village has 1 in 100-year (1%) flood protection following the completion of flood defence works in 2007/8.

5 The Sequential Test and Exception Test

5.0.1 This section provides detailed information on the Sequential Test and the Exception Test for the York Unitary Authority Area. This is considered below for both a Forward Planning and Development Management viewpoint.

5.1 The Sequential Test and Exception Test for Forward Planning

5.1.1 The following section gives detailed information relating to directing the location of future development including the allocation of sites in the York area, as regards the Sequential Test, the Exception Test, and the associated flood risk zones set out in **Table 4.2.**

The Sequential Test

5.1.2 The Sequential approach is a decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. This is set out in Section 2.10 of this SFRA and paragraph 102 of NPPF. In considering the allocation of sites in the Key Allocations DPD and Area Action Plans, the Council will use the Sequential Test so that suitable land with a lower probability of flooding will be developed first.

The Exception Test

5.1.3 As highlighted in Section 2.11 of this SFRA and paragraph 103 of NPPF, if, following the application of the Sequential Test, it is not possible or desirable for a development to be located in a zone with a lower probability of flooding, the Exception Test can be applied in some cases, as highlighted in **Table 4.2.** The Exception Test makes provision for sites that can be balanced against wider sustainability considerations and is designed to ensure that the flood risk posed to such sites is controlled and mitigated to an acceptable level. It should be noted that if the Exception Test cannot be satisfied then the site would not be permitted as part of the Key Allocations DPD and therefore not included in the LDF.

5.1.4 When undertaking an Exception Test, the evaluation and consideration of the views from the EA are vital.

5.1.5 An Exception Test must consider an assessment of the criteria a-c below:

a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk. NPPF has a presumption in favour of sustainable development. The objectives in **Table 5.1a** set out the local sustainability considerations, which must be taken into account. These have been taken from the Council's existing Core Strategy Sustainability Appraisal Scoping Report and will be the basis for the application of the Exception Test until the publication of the Local Plan.

Table 5.1a: Exception Test Sustainability Considerations – Forward Planning

Headline Sustainability Objective
H1. To reduce City of York's Ecological Footprint
Environmental
EN1. Land use efficiency that maximises the use of brownfield land
EN2. Maintain and improve a quality built environment and the cultural heritage of York and preserve the character and setting of the historic city of York
EN3. Conserve and enhance a bio-diverse, attractive and accessible natural environment
EN4. Minimise greenhouse gas emissions and develop a managed response to the effects of climate change
EN5. Improve Air Quality in York
EN6. The prudent and efficient use of energy, water and other natural resources
EN7. Reduce pollution and waste generation and increase levels of reuse and recycling
EN8 Maintain and improve water quality
EN9 Reduce the impact of flooding to people and property in York
Social
S1. Enhance access to York's urban and rural landscapes, public open space/recreational areas and leisure facilities for all
S2. Maintain or reduce York's existing noise levels
S3. Improve the health and well-being of the York population
S4. Safety and security for people and property
S5. Vibrant communities that participate in decision-making
S6. Reduce the need to travel by private car
S7. Developments which provide good access to and encourage use of public transport, walking and cycling
S8. A transport network that integrates all modes for effective non car based movements
S9. Quality affordable housing available for all
S10. Social inclusion and equity across all sectors
Economic
EC1. Good quality employment opportunities available for all
EC2. Good education and training opportunities for all which build skills and capacity of the population
EC3. Conditions for business success, stable economic growth and investment
EC4. Local food, health care, education/training needs and employment opportunities met locally

b) Any new development should be located on previously developed land (Brownfield land). If this is not possible, it must be proved that there are no alternative sites on previously developed land.

c) A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The requirements for a FRA can be found on the EA's website. . A site specific FRA will need to be undertaken before sites are included as allocations within the LDF. The level at which this FRA will be carried out will relate to the DPD under production fully reflecting the views of the Environment Agency.

5.2 The Sequential Test and Exception Test for Development Management

5.2.1 The following section gives detailed information for Development Management decisions in the York area, as regards the Sequential Test, the Exception Test, and the associated flood risk zones set out in **Table 4.2.**

The Sequential Test

5.2.2 The Sequential approach is a decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. This is set out in Section 2.10 of this SFRA and paragraph 102 of NPPF. Development Management decisions are subject to the Sequential Test and, if necessary the Exceptions Tests at the planning application stage. **Table 5.2** below sets out the approach to apply these two tests, and **Table 5.3** is the checklist which is used by the Environment Agency to provide a framework for transparent demonstration of the application of the Sequential Test to planning applications.

The Exception Test

5.2.3 As highlighted in Section 2.11 of this SFRA and paragraph 103 of NPPF, if, following the application of the Sequential Test, it is not possible or desirable for a development to be located in a zone with a lower probability of flooding, the Exception Test can be applied in some cases, as highlighted in **Table 4.2**. The Exception Test makes provision for sites that can be balanced against wider sustainability considerations and is designed to ensure that the flood risk posed to such sites is controlled and mitigated to an acceptable level. It should be noted that if the Exception Test cannot be satisfied, then the planning application should be refused.

5.2.4 When undertaking an Exception Test the evaluation and consideration of the views from the Environment Agency are vital in respect of Part 'C', the Flood Risk Assessment.

5.2.5 An Exception Test must consider and assess of the criteria a-c below:

a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk. NPPF has a presumption in favour of sustainable development. The objectives in **Table 5.1b** set out the local sustainability considerations, which must be taken into account. These have been taken from the Council's existing Core Strategy Sustainability Appraisal Scoping Report and will be the basis for the application of the Exception Test until the publication of the Local Plan.

Table 5.1b: Exception Test Sustainability Considerations – Development Management

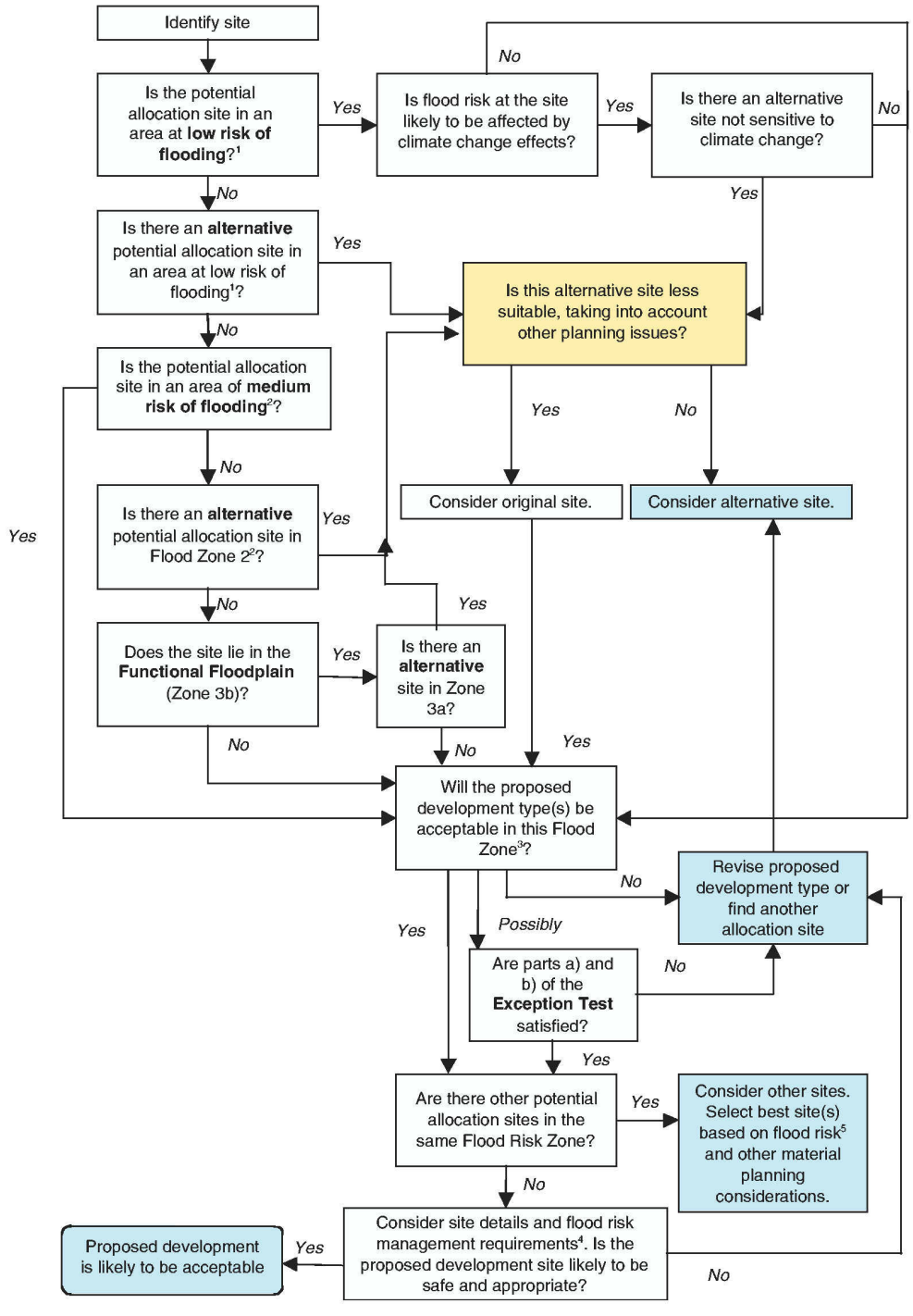
Headline Sustainability Objective
H1. To reduce City of York's Ecological Footprint
Environmental
EN1. Land use efficiency that maximises the use of brownfield land
EN2. Maintain and improve a quality built environment and the cultural heritage of York and preserve the character and setting of the historic city of York
EN3. Conserve and enhance a bio-diverse, attractive and accessible natural environment
EN4. Minimise greenhouse gas emissions and develop a managed response to the effects of climate change
EN5. Improve Air Quality in York
EN6. The prudent and efficient use of energy, water and other natural resources
EN7. Reduce pollution and waste generation and increase levels of reuse and recycling
EN8 Maintain and improve water quality
EN9 Reduce the impact of flooding to people and property in York
Social
S1. Enhance access to York's urban and rural landscapes, public open space/recreational areas and leisure facilities for all
S2. Maintain or reduce York's existing noise levels
S3. Improve the health and well-being of the York population
S4. Safety and security for people and property
S5. Vibrant communities that participate in decision-making
S6. Reduce the need to travel by private car
S7. Developments which provide good access to and encourage use of public transport, walking and cycling
S8. A transport network that integrates all modes for effective non car based movements
S9. Quality affordable housing available for all
S10. Social inclusion and equity across all sectors
Economic
EC1. Good quality employment opportunities available for all
EC2. Good education and training opportunities for all which build skills and capacity of the population
EC3. Conditions for business success, stable economic growth and investment
EC4. Local food, health care, education/training needs and employment opportunities met locally

b) Any new development should be located on previously developed land (Brownfield land) if this is not possible it must be proved that there are no alternative sites on previously developed land.

c) A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The requirements for a FRA can be found on the EA's website.

Table 5.2: Application of the Sequential Test

Figure 3.1 Application of the Sequential Test



Notes

1 Flood Zone 1 for fluvial and tidal flooding and with a low risk of flooding from other sources.
2 Flood Zone 2 for fluvial and tidal flooding and with a medium risk of flooding from other sources.
3 As defined by the Sequential Test.
4 Development to be safe and to not increase flood risk elsewhere. Required to pass part c) of the Exception Test, where applicable.
5 Including susceptibility to future climate change and residual flood risk.

Table 5.3: Environment Agency checklist to provide a framework for transparent demonstration of the application of the Sequential Test to planning applications

Table 1.3 Environment Agency checklist to provide a framework for transparent demonstration of the application of the Sequential Test to planning applications

Question	Answer Yes/No	Sequential Test – passed or failed?
1. Is this application consistent in scale, development type and location, with a site allocation that has already been sequentially tested and included in the Local Development Document (LDD)?	If yes, state which allocation and the location in the development plan. **If the answer is 'No' go to Question 2.**	If the answer is Yes the Sequential Test has been passed – FINISH HERE
2. Does the application site fall within an area identified for 'windfall' development that has been agreed as part of the LDD in association with a Strategic Flood Risk Assessment (SFRA)?	If yes, state the location in the LDD. **If the answer is 'No' or there are no such areas identified in the LDD, go to Question 3.**	If the answer is Yes the Sequential Test has been passed – FINISH HERE
3. Does the LDD or background documents contain reasonably available, alternative site allocations that are situated in a lower flood risk zone?	If yes, state which allocation(s) and the location in the development plan. **If the answer is 'No' go to Question 4**	If the answer is Yes the Sequential Test has been failed – FINISH HERE
4. Does the development plan or background documents contain reasonably available, alternative site allocations that are within the same Flood Zone and subject to a lower probability of flooding *from all sources* as detailed by the SFRA?	If yes, state which allocation(s) and the location in the development plan.	**If the answer is No to Questions 3 *and* 4 the Sequential Test has been passed.** **If the answer is Yes to Question 4, the Sequential Test has been failed – FINISH HERE**

Note:
Refer to Environment Agency standing advice at environment-agency.gov.uk/planning for the full version of this table.

APPENDICES

Appendix 1: Sources of Information

General Sources

River Flood Emergency Plan – City of York Council

Flood Scrutiny Panel Report, 2004

River Ouse Catchment

Burdyke (Phase 2: Detailed) - 2003, Atkins

Holgate Beck / Chaloners Whin (Phase 2: Detailed) - 2008, Atkins

Blue Beck (Phase 1: Outline) - 2001, Atkins

Ouse Model Update – September 2009

Foss Model Update – May 2009

River Ouse Catchment Flood Management Plan – July 2010, Environment Agency

River Foss Catchment

River Foss Flood Alleviation Study – June 1983, YWA Rivers Division

Foss Navigation and the Effects on its Hinterland – 2000, Tessa Mitchell

The River Foss, Its History and Natural History – 1973, Michael Fife

Tang Hall Beck and Osbaldwick Beck Floodplain Mapping Study (Phase 2) – March 2004, JBA Consulting for EA

River Foss Floodplain Mapping Study (Phase 2) – March 2004, JBA Consulting for EA

River Foss (Phase 2: Detailed) - 2003, JBA

Westfield Beck (Phase 2: Detailed) - 2001, JBA

Tang Hall Beck (Phase 2: Detailed) 2004, JBA

Osbaldwick Beck (Phase 1: Detailed) - 2004, JBA

River Derwent Catchment

Derwent Catchment Flood Management Plan – July 2010, Environment Agency

River Derwent Catchment Flood Defence Improvement Strategy – May 2001, Babtie Group

Elvington Beck (Phase 1: Outline), 2001, JBA

Appendix 2: Consultees

External Consultees

Environment Agency

Ainsty (2008) Internal Drainage Board

Foss (2008) Internal Drainage Board

Kyle and Upper Ouse Internal Drainage Board

Ouse and Derwent Internal Drainage Board

Parish Councils

Appendix 3: City of York draft local plan incorporating the 4th set of changes – Development control local plan: approved April 2005.

Policy GP15A: Development and Flood Risk

There will be a presumption against built development (except for essential infrastructure) within the functional floodplain outside existing settlement limits.

Proposals for new built development on previously undeveloped land outside defined settlement limits will only be granted where it can be demonstrated that the development will not result in the net loss of floodplain storage capacity, not impede water flows and not increase flood risk elsewhere.

All applications in the low to medium risk (2) or high-risk (3) areas should submit a Flood Risk Assessment (FRA) providing an assessment of additional risk arising from the proposal and the measures proposed to deal with these effects. Developers must satisfy the Local Planning Authority that any flood risk will be successfully managed with the minimum environmental effect and ensure that the site can be developed, serviced and occupied safely.

The use of sustainable drainage systems to mimic natural drainage will be encouraged in all new developments in order to reduce surface water runoff.

Discharges from new development should not exceed the capacity of existing and proposed receiving sewers and watercourses and long-term runoff from development sites should be less than the level of pre development rainfall runoff.

Where required the provision and future maintenance of flood mitigation and defence measures will be sought from the developer.

(1) Low risk areas are defined as having an annual probability of flooding (river) less than 0.1% (1 in 1000 years)

(2) Low to medium areas of flood risk are defined as having an annual probability of flooding (river) 0.1-1.0% (1 in 100 to 1 in 1000 years)

(3) High risk areas of flood risk are defined as having an annual probability of flooding (river) greater that 1.0% (1 in 100-year).

2.42 Flooding is an important land use planning consideration for the City of York, and work has been undertaken in recent years to achieve flood protection in an environmentally friendly manner. Given that the Rivers Ouse and Foss both run through the centre of York it will continue to be important to balance the pressure for new development with the alleviation of potential flooding. There is also a need for the beneficial effects of flooding on the natural environment to be effectively managed.

2.43 Unless carefully sited and designed, new development or redevelopment adjacent to rivers can exacerbate the risk and problems of flooding, erosion and pollution downstream by increasing surface water run off from impermeable surfaces or by reducing flood plain capacity. Accordingly, the Environment Agency, British Waterways and the relevant Internal Drainage Board will be consulted before planning applications, which might increase the risk of flooding, are determined.

2.44 If development is allowed in a location liable to flood, proposals will be expected to take this potential into account when designing the development (e.g. locating parking areas and access points in such a way that allow buildings to continue to be used during a flood). Important considerations will be:

* the capacity of the floodplain;
* flood heights;
* the contribution of existing or proposed alleviation measures;
* access for emergency services.

Appendix 4: City of York Council Local Development Framework Core Strategy Draft Submission (March 2011).

Section 19: Flood Risk

Strategic Objective

The Local Development Framework (LDF) will ensure that new development is not subject to flooding, does not contribute to flooding and is designed in a way that takes account of both existing and future flood risk.

Targets

Progress towards meeting the strategic objectives will be measured against the following targets:

- No planning permissions granted contrary to the advice of the Environment Agency on flood risk and water quality grounds.
- All brownfield development, where technically feasible and viable, to achieve a 30% reduction in run-off rates.
- All greenfield development, where technically feasible and viable, to achieve no worsening of run-off rates.
- The production of a Supplementary Planning Document (SPD) relating to Sustainable Design and Construction and all development meeting the requirements set out in this document.

Policy CS22: Flood Risk

The LDF will ensure that new development is not subject to flood risk, incorporates sustainable drainage and is designed and constructed in a way that mitigates against current and future flood events.

Flood Risk

In considering the suitability of any proposed development site, either through the Allocations Development Plan Document process or when determining planning applications, the Council will use the 'Flood Risk Vulnerability Classification' and 'Flood Risk Vulnerability and Flood Zone Compatibility Classification' tables from the *Strategic Flood Risk Assessment* (2011) and any subsequent updates.

In addition, a site-specific Flood Risk Assessment, which takes account of future climate change must be carried out:

- when allocating sites through the LDF process; and
- for all planning applications of 1 hectare or greater in Flood Zone 1 and for all applications in Flood Zones 2, 3a, 3a(i) and 3b.

Sustainable Drainage

All new development will be required to include the implementation of Sustainable Drainage Systems (SUDS) unless it can be demonstrated that it is not technically feasible or viable.

More specifically:

- all brownfield development in York will be required to demonstrate that there will be a reduction of at least 30% in existing runoff rates; and
- all greenfield development must demonstrate no alteration of runoff rates following completion of development. Any additional volume of runoff following development of a greenfield site must be taken into account by providing long-term storage.

Retrofitting for flood prevention and SUDS within the existing built environment must be explored where it would not damage environmental assets.

Design and Construction
The LDF will ensure that the design and construction of new development takes account of existing and future flood risk particularly given the implications of climate change. Further advice on this issue will be provided through the production and adoption of a Supplementary Planning Document (SPD) relating to Sustainable Design and Construction.

Explanation

19.1 Flood risk is a particularly important issue for York. The City has a history of flooding and the management of flood risk continues to be essential, particularly following the numerous major flooding events witnessed in the City in recent years. It is the characteristics of the York river catchment, in addition to the significant amount of rainfall it receives that makes York particularly susceptible to flooding. It is anticipated that the flooding threat will increase as a result of climate change, due to more intense rainfall and increased peak river flows. Development in inappropriate locations such as floodplains will exacerbate the problems associated with climate change.

19.2 The approach taken in *Planning Policy Statement 25 (2010)* aims to reduce the risks from flooding to people and both the natural and built environment. It provides national planning principles for the location of new development in relation to flood risk, directing development to the lowest areas of flood risk, advocating a risk-based 'Sequential Test' approach. However national policy also recognises that exceptions may be necessary in certain circumstances where there are no suitable lower risk sites, this requires the application of the 'Exception Test'.

19.3 Only after the Sequential Test has been applied can the Exception Test be undertaken. The Exception Test approach recognises the need to balance wider sustainability issues with flood risk. This test involves the consideration of whether the proposed development contributes to sustainable development in its wider sense, is located on brownfield land and whether a detailed site specific flood risk assessment indicates that the development will be safe and will not increase flood risk elsewhere. The Exception Test essentially allows a balance to be struck in some instances between flood risk and wider sustainability objectives, for example where a highly accessible brownfield development site lies within a high flood risk zone, which is likely to apply to some parts of York's existing built up areas.

19.4 The City of York Council have completed an updated *Strategic Flood Risk Assessment (2011)* (SFRA) which assesses the different levels of flood risk in the York area and provides advice on what development is appropriate in each flood risk zone. Together with the Sequential and Exception Tests the *SFRA (2011)* will assist in identifying sites for development through the LDF and when determining planning applications. The high flood risk zones (3a, 3a(i) and 3b) taken from York's SFRA maps have also helped inform the Spatial Strategy and are illustrated at Figure 3.6 within Section 3 'Spatial Strategy'.

19.5 The majority of watercourses in York are up to maximum capacity. This is recognised in the policy above. Where technically feasible and financially viable, run-off rates for development will be restricted to:

- existing runoff rates (if a brownfield site), based on 140 litres/second/hectare, in accordance with *The Building Regulations Part H Drainage and Waste Disposal (2000 amended 2010)*, with a reduction of 30% in runoff where practicable; or
- unless otherwise calculated, agricultural runoff rates (if the site has no previous development) will be based on 1.4 litres/second/hectare. To achieve this additional run off volumes will require balancing.

19.6 The use of SUDS must be considered, to enable the run-off targets to be met. SUDS provide a method of discharging surface water in a sustainable way to reduce the risks of flooding and pollution and should be employed where technically feasible and viable. They are built to manage surface runoff and may take different forms depending on the nature of the development and the area. They can include green roofs, filter strips and swales, infiltration devices and basins or ponds with some offering opportunities for environmental and landscaping enhancement improving biodiversity and local amenity. The LDF will promote SUDS through a Sustainable Design and Construction SPD, which will address issues of flood resilience and resistance along with SUDS adoption.

Figure 2: River Ouse and Foss Catchment Boundaries

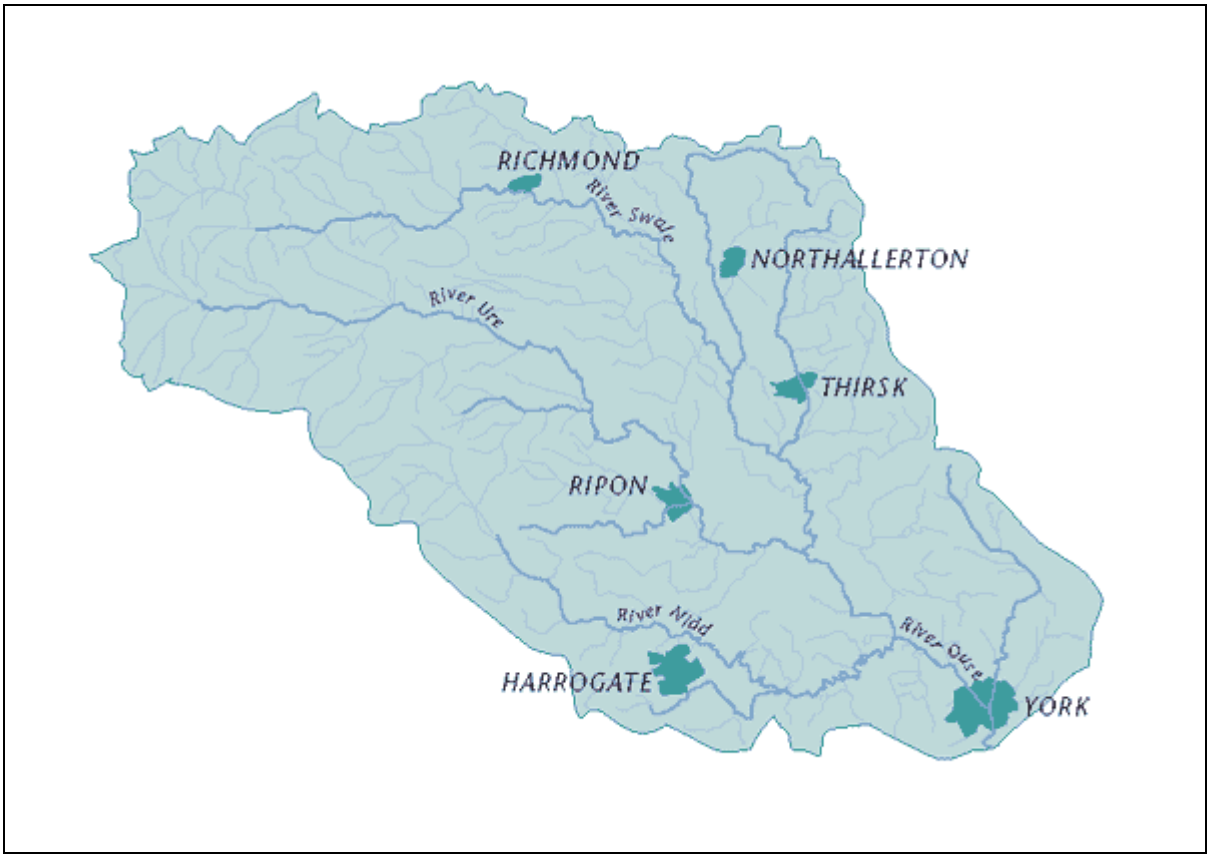
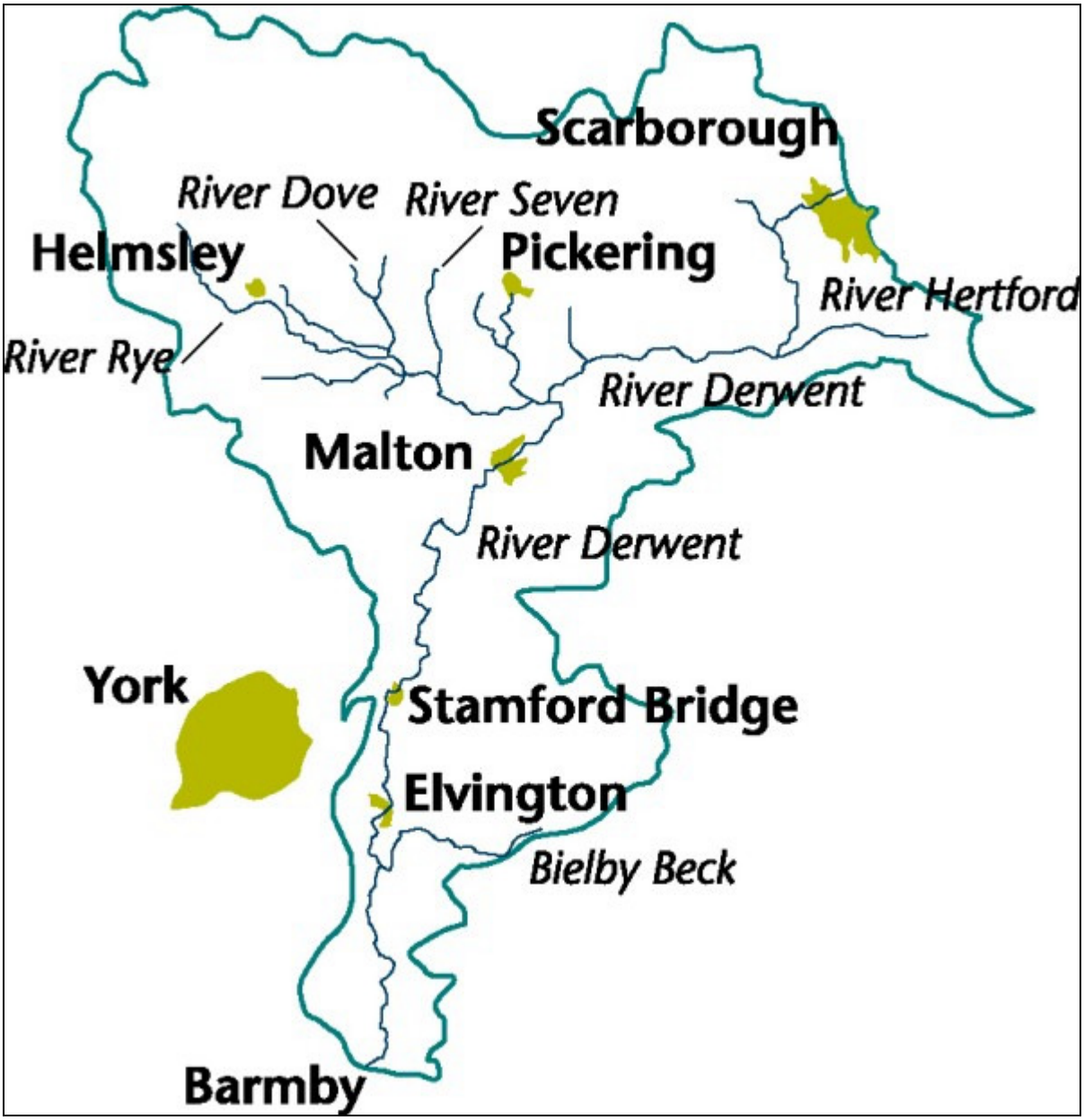


Figure 3: River Derwent Catchment Boundary



Future Reviews to the SFRA

Reviews of national or local policy, the occurrence of further significant flood events or the publication of other flood plans / risk assessments may have the effect of changing guidance in the SFRA. These shall be taken into account as and when they become available and read in conjunction with the SFRA.