

Evidence Base

City of York

LDF

Local
Development
Framework

Strategic Flood Risk Assessment

June 2007



City of York Council

Strategic Flood Risk Assessment

York Consultancy

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Glossary

Attenuation	Reduction of peak flow 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), used for designing flood defences and production of Environment Agency Flood Zone Maps.
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.
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 Development Framework	The Local Development Framework (LDF) is at the heart of the new planning system introduced by the Planning and Compulsory Purchase Act 2004. It is a 'portfolio' of policy documents produced by Local Planning Authorities, to replace the Local Plan.

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 floorspace to be provided is 1,000m ² 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
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
RSS	Regional Spatial Strategy
SFRA	Strategic Flood Risk Assessment
SUDS	Sustainable Urban Drainage Systems
IDB	Internal Drainage Board

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 planners in the preparation of their Local Development Framework (LDF) 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 Planning Policy Statement 25 (PPS25) "Development and Flood Risk", which sets out the government policy on planning for flood risk and recommends that Local Planning Authorities prepare a SFRA.

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 control
- General drainage guidance

Comment is also given with regards to City of York Council's management of development and flood risk in line with PPS25, 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 control 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 implementation of PPS25. Section 4, which incorporates **Tables 4.1, 4.2** and policy guidance, are particularly relevant sections for potential developers and landowners. **Tables 4.1, 4.2** and the Environment Agency's Flood Risk Matrix (**Table 1.1**) can also be found at the end of this summary.

Policy Recommendations for Forward Planning

As part of the preparation of the Local Development Framework, 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 implementations of the guidance contained within PPS25. These policy recommendations include guidance on the type of development, which maybe 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 Control

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 implementation of PPS25 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 control process.

A web-based consultation paper, '**Development and Flood Risk: A Practice Guide Companion to PPS25 – Living Draft**', was published by the ODPM in February 2007 to provide advice on practical implementation of PPS25 policy (this can be viewed at www.communities.gov.uk/index.asp?id=1504639). The consultation period for this draft closes on 20 August 2007, and the comments will then be assessed to ensure the final version is clear, succinct, comprehensive and workable.

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 Engineering Consultancy, 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 - Dales Area): -

Arup
Atkins
Babtie Group Ltd
Bullens Consultants
JBA Consulting

Table 4.1: Flood Risk Vulnerability Classification

Essential Infrastructure	<ul style="list-style-type: none"> Essential transport infrastructure (including mass evacuation routes) that has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	<ul style="list-style-type: none"> 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.
More Vulnerable	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	<ul style="list-style-type: none"> 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:

- 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.
- 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.
- 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	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a(i) (100-year protection)	Exception Test required	✓	x	Exception Test required	✓
	Zone 3a(ii) (50 to 100-year protection)	Exception Test required	✓	x	Exception Test required	Exception Test required
	Zone 3a(iii) (less than 50-year protection)	Exception Test required	✓	x	Exception Test required #	Exception Test required #
	Zone 3b ‘Functional Floodplain’	Exception Test required	✓	x	x	x

- ✓ Development is appropriate
- x Development should not be permitted
- # Redevelopment only – not applicable to new build

Table 1.1: Environment Agency Flood Risk Standing Advice for England (PPS25) Version 1.0 – May 2007 (Flood Risk Matrix)

Development category	Development (including boundary walls etc.) within 20 metres of the top of a bank of a Main River	Includes culverting or control of flow of any river or stream	Within Flood Zone 3	Within Flood Zone 2	Within Flood Zone 1
Householder development and alterations	Consult EA	Consult EA with FRA showing design details of any culvert or flow control structure proposed	No consultation - see standard comment	No consultation - see standard comment	No consultation - No EA Advice
Non-residential extensions with a footprint of less than 250m ²	Consult EA	Consult EA with FRA showing design details of any culvert or flow control structure proposed	No consultation - see standard comment	No consultation - see standard comment	No consultation - No EA Advice
Change of use FROM Water Compatible TO 'Less Vulnerable' development	Only consult EA if site also falls within Flood Zone 3. FRA Required	No consultation - No EA Advice	Consult EA with FRA	No consultation - no EA advice	No consultation - No EA Advice
Change of use RESULTING IN 'Highly Vulnerable' or 'More Vulnerable' development	Only consult EA if site also falls within Flood Zone 3. FRA Required	No consultation - no EA advice	Consult EA with FRA	Consult EA with FRA	No consultation - No EA Advice
Operational development less than 1 hectare	Consult EA	Consult EA with FRA showing design details of any culvert or flow control structure proposed	Consult EA with FRA and Sequential Test Evidence (and where required confirm Exception Test has been applied)	Consult EA with FRA and Sequential Test Evidence (and where required confirm Exception Test has been applied)	No consultation - see standard comment
Operational development of 1 hectare or greater	Consult EA	Consult EA with FRA showing design details of any culvert or flow control structure proposed	Consult EA with FRA and Sequential Test Evidence (and where required confirm Exception Test has been applied)	Consult EA with FRA and Sequential Test Evidence (and where required confirm Exception Test has been applied)	Consult EA with FRA

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.

- 1.1.2 The flood in 2000 was a result of rainfall alone following a very wet autumn. It flooded 365 properties and threatened a further 5000. Subsequent modelling calculated this flood to have a return period of 1 in 80-years, and the maximum flood level was 300mm above the 1982 event.
- 1.1.3 This provides irrefutable 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 alone¹. 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 City of York Council was £1.32m, with internal flooding to approximately 400 homes and 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. The combined forces of the Army, the Environment Agency and City of York Council were required to prevent further devastation and to clear up once floodwaters had receded.

1.2 Purpose of the Assessment

- 1.2.1 One of the primary purposes of City of York 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 PPS25 “Development and Flood Risk” which sets out the government policy on planning for flood risk and recommends that Local Planning Authorities prepare a SFRA.

1.3 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, Regional 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 Control, 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 Control.

Copies of this document and further information are available from:

Anna Woodall

Assistant Development Officer

City Strategy

City Development

City of York Council

9 St. Leonard’s Place

York YO1 7ET

Tel: 01904 551491

Fax: 01904 551392

Email: anna.woodall@york.gov.uk

Martin Grainger

Principal Development Officer - Forward Planning

City Strategy

City Development

City of York Council

9 St. Leonard’s Place

York YO1 7ET

Tel: 01904 551317

Fax: 01904 551392

Email: martin.grainger@york.gov.uk

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, Regional 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 (cumecs), which is over 11 times the average summer flow of 50 cumecs. 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 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 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 cumecs and a normal summer flow of 1 cumec. 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 Forest north east of the city.
- Osbalwick Beck – drains relatively flat areas of residential development in Osbalwick and flat areas of agricultural land in the upper catchment around Holtby east of the city.

2.1.4 **River Derwent** - the second largest river within York, with a peak flow of 199 cumecs and a normal summer flow of 15 cumecs. 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.

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 all constructed alongside vulnerable sections of the River Ouse, between Clifton Bridge 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.

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 (CO₂) 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 rains, 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 web site:-

"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 web site 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, Regional 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 on 10 and 11 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, including use, 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 Strategic Environmental Assessment Directive

The Strategic Environmental Assessment Directive (SEA) was adopted by European Parliament on 31st May 2001 and by the Council of the European Union on 5th 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.

2.7.3 The Water Framework Directive

The Water Framework Directive was adopted by the European Parliament and the Council of the European Union on 22nd 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.

2.8 National Context

2.8.1 **Planning Policy Statement 25 (PPS25) 'Development and Flood Risk'** was published in December 2006. It sets out Government Policy on planning for flood risk. This aims to reduce the risks from flooding to people, and both the built and natural environment. A web-based consultation paper, '**Development and Flood Risk: A Practice Guide Companion to PPS25 – Living Draft**', was published by the ODPM in February 2007 to provide advice on practical implementation of PPS25 policy (this can be viewed at www.communities.gov.uk/index.asp?id=1504639). The consultation period for this draft closes on 20 August 2007, and the comments will then be assessed to ensure the final version is clear, succinct, comprehensive and workable.

2.8.2 PPS25 sets out three key requirements that influence how Local Planning Authorities should deal with development and flood risk: -

- 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 control 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**.

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 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 require that action through the planning system, to manage development and flood risk, should be based on the precautionary principle. The precautionary principle stated in the Rio Declaration in 1992, is particularly relevant to dealing with the hazard of flooding. It states "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation".

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 PPS25, and it should be applied at all levels of the planning process.

2.10.2 Paragraph 16 of PPS25 recommends that Local Planning Authorities allocating land in Local Development Documents (LDD's) should apply the Sequential Test. Its aim 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 PPS25. These are set out in **Table 2.1**.

2.11 Exception Test

2.11.1 If the application of the Sequential Test is not possible, 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:

- a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA. If the Development Plan Document (DPD) has reached the 'submission' stage – see Figure 4 of PPS12: Local Development Frameworks – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;
- b) the development should be on developable, previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and
- 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 in Appendix 7.

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** when 'more vulnerable' development and 'essential infrastructure' cannot be located in Zones 1 or 2 and 'highly vulnerable' development cannot be located in Zone 1. It should not be used to justify 'highly vulnerable' development in Flood Zone 3a, or 'less vulnerable'; 'more vulnerable'; and 'highly vulnerable' development in Flood Zone 3b.

2.12 Brownfield Development

2.12.1 PPS25 attempts to reconcile the emphasis which Government places on development of previously developed (brownfield land) for housing, with the understanding that much of this land is located alongside rivers and vulnerable to flooding. Paragraph D14: (*PPS25: The Exception Test*) states: -

“Criterion b) of para. D9 reflects the Government’s commitment to making the most efficient and effective use of land in line with the principles of sustainable development. Reflecting this, Planning Policy Statement 3 (PPS3): Housing sets out the Government’s objectives for a flexible, responsive supply of land for housing which gives priority to the use of previously-developed land for development. However, flood risk should be taken into account in determining the suitability of the land for development.

2.12.2 This clearly affects several large sites in York, and the implications of this are addressed in Section 4.

Table 2.1: PPS25 Flood Zones - 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 1000 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 run off, 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 techniques.
Zone 2: Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year.	The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table 4.1 are appropriate in this zone. Subject to the Sequential Test being applied, the highly vulnerable uses in Table 4.1 are only appropriate in this zone if the Exception Test is passed.	All development proposals in this zone should be accompanied by a FRA. See Annex E in PPS25 for minimum requirements.	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 techniques.
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	The water-compatible and less vulnerable uses of land in Table 4.1 are appropriate in this zone. The highly vulnerable uses in Table 4.1 should not be permitted in this zone. The more	All development proposals in this zone should be accompanied by a FRA.	In this zone, developers and local authorities should seek opportunities to: i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable

Flood Zone	Definition	Appropriate Use	Flood Risk Assessment (FRA) Requirements	Policy Aims
	flooding from the sea (0.5%) in any year.	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.		drainage techniques; ii. relocate existing development to land in zones with a lower probability of flooding; and iii. create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating 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. SFRAs should identify this Flood Zone (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, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).	Only the water-compatible uses and the essential infrastructure (listed in Table 4.1) 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 times 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: i. 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 techniques; and ii. relocate existing development to land with a lower probability of flooding.

2.13 Regional Context

- 2.13.1 Under planning legislation, the new **Regional Spatial Strategy for Yorkshire and the Humber to 2016 based on the Selective Review of RPG12 (December 2004)** has statutory force. It highlights the need for the regional spatial pattern of development to minimise the risk of new buildings being subject to flooding, and ensure that development does not increase the likelihood of flooding.
- 2.13.2 **Policy R2 ‘Development and Flood Risk’** reinforces the guidance set out in PPS25 stating that development plans should adopt a sequential risk-based approach to development and flooding. A coordinated approach is also encouraged between Local Planning Authorities, The Environment Agency and other Local Planning Authorities in river catchment areas.
- 2.13.3 Under the Planning and Compulsory Purchase Act, new planning legislation has also been proposed for regional guidance. Therefore, the Regional Spatial Strategy for Yorkshire and the Humber to 2016, based on the Selective Review of RPG12 (December 2004), will feed into the new document called the Regional Spatial Strategy (RSS).
- 2.13.4 The Yorkshire and Humber Assembly have now produced the **Regional Spatial Strategy (RSS) – The Yorkshire and Humber Plan, Draft for Public Consultation (December 2005)** the comments received from this consultation will then inform the final RSS which is expected to be adopted in late 2007.
- 2.13.5 **Policy ENV1 ‘Floods and Flood Risk’** which is included in the RSS Consultation Draft (December 2005) states that the purpose of the policy is to inform development on the basis of strategic flood risk assessments and ensure flood management reflects regional spatial and economic priorities, as well as environmental objectives, thereby helping to maintain of the major conurbations and valuable communities alike.
- 2.13.6 The weight of undertaking a SFRA is therefore expected to increase under the new RSS policy. It is therefore very important for City of York Council to undertake a SFRA, so that we have complied with current regional policy, and with the new more stringent guidance that is expected to come into force.

Yorkshire and the Humber Regional Sustainable Development Framework

- 2.13.7 **The Regional Sustainable Development Framework (RSDF)** is the region’s strategy for sustainable development and seeks to ensure that sustainable development is an integral part of policy and decision making at regional, sub-regional and local levels throughout the Yorkshire and Humber region.
- 2.13.8 The RSDF has 15 aims and these have been used to develop a sustainability appraisal process. This is a tool to make sure that sustainability, and in particular this region’s vision for sustainability, is embedded within other strategies and action plans. These include a managed response to climate change and a bio-diverse and attractive natural environment.

A Strategic Flood Risk Assessment Regional Handbook

- 2.13.9 In spring 2004, the Yorkshire and Humber Assembly and the Environment Agency jointly produced a handbook called “**At Risk? Planning for Flood Risk in Yorkshire and Humber**”. The purpose of this document is to provide best practice / guidance for Local Planning Authorities in Yorkshire and Humber in relation to development and flood risk, and in particular to help them undertake SFRA’s. This handbook therefore supplements the guidance on the flood risk assessments given in Planning Policy Statement 25.

2.14 Strategic and Local Planning Context

- 2.14.1 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 5.
- 2.14.2 The City of York Draft Local Plan is an interim document, and will be replaced by a document known as the Local Development Framework.
- 2.14.3 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.
- 2.14.4 **'Planning Policy Statement 12 (PPS12): Local Development Frameworks'** is one of the new planning policies set out by the government. On pages 32-33 of PPS12, under the section Pre Production – Development of the Evidence Base, it is suggested that Flood Risk Assessments should be produced as part of the Evidence Base and the Core Strategy, to be included as part of the three year project plan known as the Local Development Scheme (LDS). It goes on to explain that Local Authorities should gather evidence about their area and should include a policy on areas at risk of flooding.

"At the earliest stage in the preparation of a development plan document, and particularly for preparation of the core strategy, the local planning authority should gather evidence about their area. This might include studies to be undertaken or commissioned on for example areas at risk of flooding".

2.15 EA High Level Target 5 (HLT5)

- 2.15.1 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.
- 2.15.2 The EA's HLT5 annual 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 (LPA's). 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.
- 2.15.3 Key indicators from the HLT5 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.

2.15.4 LPAs should request FRAs in accordance with Annex E in PPS 25, 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.

2.15.5 The EA is consulted by local Planning Authorities (LPAs) on proposals for major development in the floodplain, in accordance with the guidance given in their matrix shown in **Table 1.1, Appendix 7**, and responds by giving technical advice and sometimes by recommending 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.

2.15.5 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;

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

2.16.1 Appendix 7 details the Environment Agency's Standing Advice on development and flood risk and the technical advice can be accessed on the web with the following link:

www.pipernetworking.com/floodrisk/

The appendix also contains the EA's flood risk matrix, giving development advice in all flood risk areas.

2.17 Current Environment Agency Flood Policy

2.17.1 The Environment Agency's latest (November 2005) recommendations on flooding policy were published in the Ouse Flood Risk Management Strategy, which is summarised below.

Development control

2.17.2 The EA see development control as an important aspect in the management of future flood risk, and have made the following policy recommendations:

- They will continue to develop their floodplain mapping to improve the advice given to planning authorities;
- The guidance contained in Planning Policy Statement 25 (PPS25) should be adhered to by the planning authorities, where the "precautionary principle" should be followed;
- All new developments with appropriate flood risk assessments within flood risk areas should incorporate flood resilience measures;

- Homeowners and businesses should consider fitting flood resilience measures to existing properties in flood risk areas;
- All new developments, whether in flood risk areas or not, should not increase the flood risk elsewhere. This may be through the use of Sustainable Drainage Systems (SuDS) or compensatory storage;
- Any new river crossings should not increase the flood risk. If, for example, new bridges include approach embankments or spans, provision should be made to maintain flows in the floodplain.

2.17.3 Comment was also made by the EA that “Refurbishment and redevelopment of older industrial areas brings both opportunities and constraints since many are located in areas of high flood risk. Site-specific Flood Risk Assessment is vital to the success of creating sustainable development solutions for such areas in order to maximise the social and economic benefits not at the expense of environmental concerns.

2.17.4 Local Plans for York, Selby, Hambleton, Harrogate and Boothferry all contain policies relevant to flood risk. They generally state that proposals for development within floodplains or other areas liable to flood will only be permitted where the proposal will not be at risk from flooding and/or significantly increase the risk of flooding elsewhere. Exceptionally, essential transport or utilities infrastructure, which cannot be located in a lower risk area, and which is designed to remain operational even in times of flood, will be permitted within functional floodplains.”

- Normally, discharge of surface water to the watercourses should be limited to the existing green-field runoff, and currently a maximum runoff rate of 1.4 l/s/ha is 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.

2.17.5 In addition Sustainable Urban Drainage (SUDS) methods of source control and water quality improvement should be adopted and made a standard planning condition on all new developments in the catchment. It should be noted that increase flow due to climate change should be accounted for with regards to development control issues.

National policy recommendations

Broad principles

2.17.6 The new Defra initiative ‘Making Space for Water’ is looking to provide 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.

2.18 City of York Council Policy Statement on Flood and Coastal Defence

2.18.1 In 1993, the Government published a policy aim and three objectives for flood and coastal defence^[1], as shown below: -

Government's policy aim: To reduce the risk to people and the developed and natural environment from flooding and coastal erosion by encouraging the provision of technically, environmentally and economically sound and sustainable defence measures.

Objective (a): To encourage the provision of adequate and cost effective flood warning systems.

Objective (b): To encourage the provision of adequate, economically, technically and environmentally sound and sustainable flood and coastal defence measures.

Objective (c): To discourage inappropriate development in areas at risk from flooding and coastal erosion.

2.18.2 To ensure a more certain delivery of the aim and objectives by the individual operating authorities, the Government published a series of high-level targets^[2]. The first target requires each operating authority to publish a policy statement setting out their plans for delivering the Government's policy aim and objectives in their area. This was to include their assessment of flooding and erosion risk in their area, and the plans for managing that risk.

2.18.3 City of York Council prepared this policy statement in 2001, to fulfill these Governmental requirements. The full policy statement is shown in Appendix 4. This policy is due to be reviewed in 2006, following take-over of the Critical Ordinary Watercourses (COW's) by the EA. Similar policies have been produced by each of the IDB's for their areas.

[1] Strategy for Flood and Coastal Defence in England and Wales MAFF and Welsh Office, September 1993.

[2] High Level Targets for Flood and Coastal Defence Operating Authorities and Elaboration of the Environment Agency's Flood Defence Supervisory Duty MAFF, November 1999.

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** shows 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 six Internal Drainage Boards (IDB's) within the City Boundary, along with the areas administered by City of York Council as a drainage authority. The IDB's 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 Internal Drainage Board 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)	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 six Internal Drainage Boards listed below: -

Internal Drainage Board	Area (Ha) *	Total Length of adopted drains (km)*
Acaster	1,340	24
Appleton Roebuck and Copmanthorpe	1,884	31
Foss	9,085	163
Kyle and Upper Ouse	11,753	252
Marston Moor	9,708	150
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 not all of the adopted drain lengths are in the CYC area.

- 3.1.6 On 1st April 2006, some watercourses were transferred to the Environment Agency, as they were categorised as Critical Ordinary Watercourses (COWs). COWs are defined as: -

“watercourses that are not classified as “main river” but which the Environment Agency and other operating authorities agree are critical because they have the potential to put at risk from flooding large numbers of people and property”

- 3.1.7 All of the Council's watercourses, with the exception of South Beck, have been transferred to the Environment Agency. Additionally Holgate Beck in the Marston Moor IDB area, and Blue Beck and the upstream length of Burdyke in the Kyle and Upper Ouse IDB has been transferred. As a result the Environment Agency is now responsible for the management and maintenance of these watercourses and associated structures and pumping stations.
- 3.1.8 The River Foss upstream of Yearsley Weir is the responsibility of the Foss Internal Drainage Board. The River Ouse, River Derwent and the River Foss between Yearsley Weir and its confluence with the River Ouse are designated as Main River and thus the responsibility of the Environment Agency. The total length of Main River in the authority's area is 45.1km plus the newly transferred COWs.

3.2 Flood Risk Zones

- 3.2.1 **Figure 9** shows the Flood Risk Zones for York, as defined by the Environment Agency, indicating the following 3 zones 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 Environment Agency Flood Zone Maps do not identify the sub-division of Zone 3 into Flood Zones 3a, and 3b, although they do show areas with defences affording a 1 in 100-year flood protection level. All currently developed sites in York within Flood Zone 3 are defined as Zone 3a.

Zone 3a High risk

- 3.2.3 Annex G in PPS25 states the following regarding the Management of Residual Flood Risk: -

“Following application of the Sequential Test and Exception Test (see Annex D, PPS25), 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.”

- The EA also stated in November 2006, that when considering potential **development sites within Zone 3a, the Sequential and Exception Tests must be passed**, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

3.2.4 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 standard of flood defence. The November 2000 flood (1 in 80-year event) highlighted the fact that the only flood defences in York that currently has a 1 in 100-year standard of protection is part of flood cell B10 (Blue Beck sub-catchment – Rawcliffe), as detailed in section 3.8.1. However, this protection is only against River Ouse flooding and significant flooding could still occur in Rawcliffe due to backing-up of floodwater derived from within the Blue Beck catchment itself. Hence, **no area in York currently has a 1 in 100-year standard of flood defence**. Elvington village will have 1 in 100-year flood protection by Autumn 2007, following the completion of flood defence works.

This SFRA has identified the three sub-zones of Zone 3a on **Figure 11**, defined as follows:-

- Zone 3a(i): areas at high risk of flooding which are **currently defended** to the appropriate minimum standard as defined by PPS25 (**1 in 100-year protection**).
- Zone 3a(ii): areas at high risk of flooding which are **currently defended** to the appropriate minimum standard for existing development as defined by Defra (**50-year protection**), but are **not defended** to the appropriate minimum standard for new development as defined by PPS25 (**1 in 100-year protection**).
- Zone 3a(iii): areas at high risk of flooding which are **not currently defended** to the appropriate minimum standard as defined by Defra (**50-year protection**).

3.2.5 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

3.2.6 Zone 3b areas, functional floodplains, are defined in PPS25 as “..land where water has to flow or be stored in times of flood”. Specifically, this land:

- Would flood with annual probability of 1 in 25 (4%) or greater in any year, or:
- Is designed to flood in an extreme 1 in 100 year flood,

3.2.7 Whilst developed areas are not normally considered to in Functional Floodplains, some areas may still provide important designed flood storage or be flow routes, such as riverside car parks associated with commercial developments, which have been designed to flood.

- 3.2.8 All areas in Zone 3 are considered as Zone 3b (Functional Floodplain) unless shown to be in Zone 3a (High Probability) by this SFRA or a site specific FRA. Built development in Zone 3b areas would be wholly exceptional.

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 City of York Council recognises its related and important role in emergency planning and response, and will therefore:
- Ensure that its emergency response plans include appropriate arrangements for flooding emergencies and that such plans are reviewed, in consultation with the Environment Agency, at least every two years;
 - Maintain an awareness of the Environment Agency's flood warning dissemination plan for its area and contribute to its implementation as necessary; and
 - Play an agreed role in any flood warning emergency exercises organised by the Environment Agency covering its area.
- 3.3.3 City of York Council has included plans for responding to both major and minor 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. Zone 3(iii) areas (not defended to 1 in 50) are therefore not at risk from flash flooding. However, protected areas in Zone 3(i) and Zone 3(ii) 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 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 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: Relation ship 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	Yellow	Red	Red	Red
250	Yellow	Red	Red	Red
500	Yellow	Yellow	Red	Red
1000	Yellow	Yellow	Red	Red
1500	Yellow	Yellow	Yellow	Red
2000	Yellow	Yellow	Yellow	Yellow
2500		Yellow	Yellow	Yellow
3000		Yellow	Yellow	Yellow
3500		Yellow	Yellow	Yellow
4000		Yellow	Yellow	Yellow
4500			Yellow	Yellow
5000				Yellow



- 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.
- 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												

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.
- Danger for most – includes the general public
- Danger for all – includes emergency services

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.

Figure 12: Plan view of Danger to People from Breach Scenario

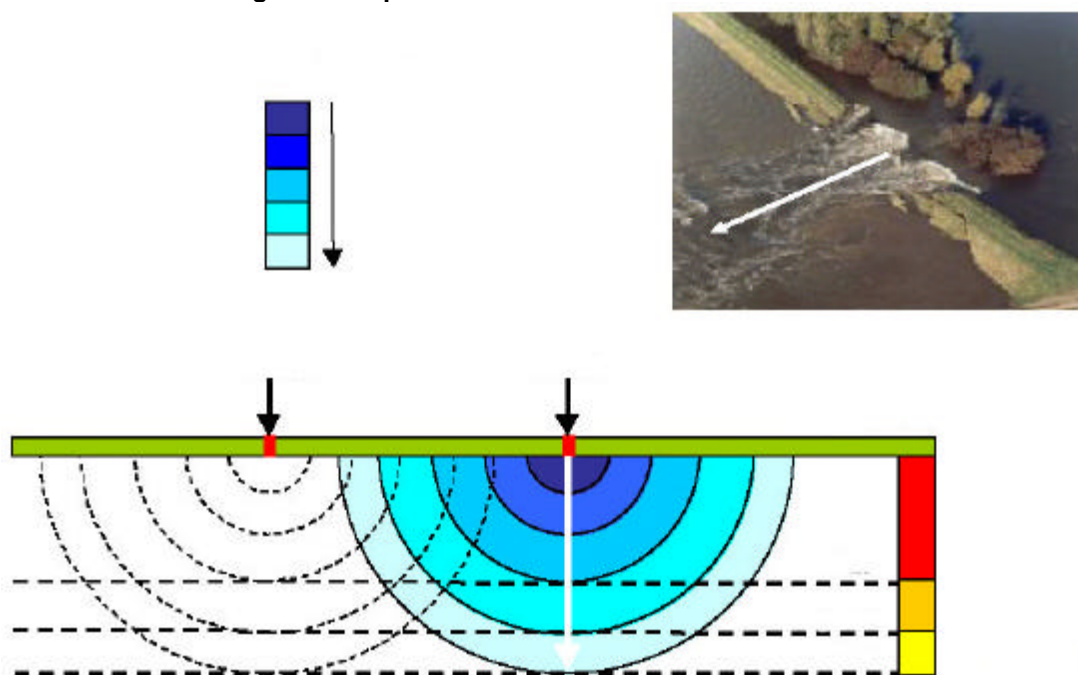
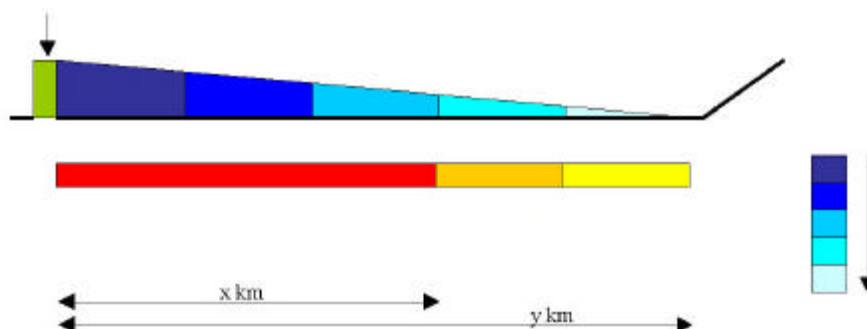


Figure 13: Section View of Danger to People from Breach Scenario



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, for example due to localised high ground.
- 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 categorised 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, over 742 years. The most recent and biggest flood in autumn 2000 was assessed by the EA using computer modelling as having an 80-year return period. This is approximately only 100mm lower than the predicted 1 in 100-year flood. The aerial photographic records taken within hours of this flood peak, supplemented by subsequent levelling surveys, allows Zone 3 (1 in 100-year) to be predicted with a high degree of confidence.

The River Foss

- 3.5.2 Because the river Foss did not flood in 2000, the best guidance for the Zone 3 outline is the 1982 flood. Council records are good for this within the old city council boundary. However, lack of flooding records in some of the former Ryedale District areas north of Bell Farm has led to large areas being covered by modelled predictions of Zone 2 and 3 flooding. The Environment Agency acknowledge this modelling to be indicative and continue to review their flood risk mapping using more sophisticated modelling with the aim of refining the zone boundaries. To date this has been achieved for the Huntington, New Earswick, Earswick and Strensall areas, but is still outstanding for Haxby and Wigginton.

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 50-years. However, the extent of flooding in 2000 is well documented, with aerial photographic records taken within hours of the flood peak, providing reasonable calibration of the 1 in 100-year flood prediction.

Other supporting information

- 3.5.4 The Environment Agency 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 / Chaloner's Whin (Phase 1: Outline), Atkins-2003**, lengths 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.
- **Haxby Beck (Phase 1: Outline), JBA-2003**

- **Tang Hall Beck (Phase 1: Outline), JBA-2003**, from Cow Moor Bridge (Stockton Lane) to the confluence with the River Foss.
- **Osbaldwick Beck (Phase 1: Outline), JBA-2003**, 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 Environment Agency in 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 It can be seen that these are all watercourses that have been designated as COWs and responsibility for their management and maintenance has now been transferred to the Environment Agency.

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. For some larger rivers the impact of such an increase might involve a shift from a 1 in 100-year event to a 1000-year event, 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 event to a 1 in 1000-year 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 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 level.

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. Rain and snowmelt on the high ground results in rises in river level in York and in 2000 it rose to 5.4m above normal.
- 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.
- 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 cumecs.
- Large parts of the City Centre and surrounding area, straddling the River Ouse, are designated as Areas of Archaeological Importance, as shown on **Figure 10: 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 in the past five 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 10: 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).

Floodplain Characteristics - Past Flood Events

- Severe floods occurred in 1947, 1978, 1982 and 2000.
- Records of flooding in York go as far back as 1263 A.D.
- A maximum flow of 583 cumecs 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. 400 properties were affected by flooding and a further 5000 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 which offer the standards of protection detailed in **Table 3.3: York Flood Defences – Standards of Protection**.
- 3.8.2 These defence levels vary through the city, due to the natural gradient of the river 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 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 we think 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. **Table 3.6** from the EA's Strategy Report summarises the current standard of protection and onset of flooding for the existing defences. **Table 3.6** also shows those properties that are at risk of flooding from a 1 percent (1 in 100-year) event. Although properties may be defended to this standard or higher, 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 m³. Sluice gates, which allow floodwaters in and out of the Ings, were also constructed. Clifton Ings reduces levels in York by approximately 100mm for flows of 400 cumecs (equivalent to something greater than a 25% (1 in 4-year flood event)). However, its effect reduces as flows increase, with the washland having no significant effect on levels in York for flows greater than approximately 550 cumecs (a 2.5% or 1 in 40-year flood event). For comparison, the peak flow during the November 2000 event was 583 cumecs, and in 1982 it was 541 cumecs.
- 3.8.7 Of all the areas within Zone 3 in York, only part of flood cell B10 (Blue Beck sub-catchment - Rawcliffe) is shown on the EA's maps to be defended against a 1 in 100-year 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's concluded that significant flooding would still occur due to backing-up of floodwater derived from within the Blue Beck catchment itself.
- 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 in 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. **Table 3.3** shows how such an increase may drastically affect the standard of protection provided by some of the existing defences.

Flood Risk Areas

- 3.8.9 **Figure 9, the Environment Agency Flood Zone Map**, shows the areas that are at greatest risk of property flooding from 1 in 100-year and 1 in 1000-year events in the River Ouse catchment, along with flooding from its main tributaries. The areas affected by flood risk are discussed in detail below.

3.8.1 Holgate Beck

- 3.8.1.1 Flooding occurred in this sub-catchment (ref. B3 and B6) 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.

3.8.1.2 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 West 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 protection.

3.8.1.3 Following enmainment as a COW in April 2006, the pumping station is now the responsibility of the EA. A Section 105 (Phase 2: Detailed) study is to be carried out by the Environment Agency to provide a more detailed assessment of flood risk issues.

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

3.8.2 Blue Beck - Rawcliffe

3.8.2.1 Flows from Clifton Industrial Estate and housing area are managed by Rawcliffe Lake, a flow balancing lake maintained by Yorkshire Water, as shown on **Figure 14a** Restricted 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.

3.8.2.2 November 2000 saw 120 properties in Rawcliffe (ref B10) affected by flooding, primarily 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 EA, 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 25-year flood event.

3.8.2.3 Following the investigation in 2001, the Rawcliffe defences were subsequently upgraded by the EA to give 1 in 100-year protection against River Ouse flooding, consisting of the following: -

- A new section of flood bank was constructed to prevent outflanking of the defences.
- Low spots in the defences were raised.
- An emergency trackway was laid to enable temporary pumping to be brought deployed.
- Telemetry was installed to monitor water levels.
- The flood procedure was amended.

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

3.8.3 Bur Dyke

- 3.8.3.1 Flooding occurred in this sub-catchment (ref. B11) in 1947, 1978 and 1982 as a result of backflow from the River Ouse, the area affected being centred on Clifton Green, some 1km from the river Ouse. 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.
- 3.8.3.2 A Section 105 (Phase 2: Detailed) study of Bur Dyke was carried out by Atkins in 2003, prior to enmainment by the Environment Agency in April 2006. The report concluded that, although the culvert itself it not under-capacity, the flood pump is should be upgraded at some time in the future. The station has no standby pump in case of failure.
- 3.8.3.3 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.
- 3.8.3.4 The flood defences do not give 1 in 100-year protection and there remains a moderate risk of flooding if the pumping station fails or the earth flood-banks are overtopped / 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.

3.8.4 Marygate Area (B12) and North Street (B4)

- 3.8.4.1 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 pumping station.
- 3.8.4.2 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 pumping station.
- 3.8.4.3 However, the November 2000 flood came within 50mm of overtopping both sets of defences and a high risk of flooding remains, should the floodwalls fail. Both sets of flood defences do not give 1 in 100-year 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.

3.8.5 Skeldergate and Queens Staith (B7), Kings Staith and South Esplanade (B15) and New Walk (B16)

- 3.8.5.1 These areas suffered direct flooding from the River Ouse during the major floods in 1947, 1978, 1982 and 2000. No flood defences currently exists for these areas. 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.

Table 3.3 York Flood Defences – Standards of protection

Defence Location	Nominal Defence Level (mAOD)	Onset of Flooding	Current standard of protection	Estimated standard of protection with 20% increase in peak flows
Rawcliffe Ings / Clifton Park	11.10	2% (1 in 50)	4% (1 in 25)	20% (1 in 5)
Leeman Road	10.94	2% (1 in 50)	4% (1 in 25)	20% (1 in 5)
Lower Bootham Phase 1: (Queen Anne School)	10.62	4% (1 in 25)	10% (1 in 10)	>20 % (<1 in 5)
Lower Bootham Phase 2: (Almery Terrace)	10.62	4% (1 in 25)	4% (1 in 25)	>20 % (<1 in 5)
Lower Bootham Phase 2: (Marygate)	10.61	2% (1 in 25)	4% (1 in 25)	20 % (1 in 5)
Museum Gardens	10.39	2% (1 in 25)	4% (1 in 25)	20 % (1 in 5)
North Street	10.48	2% (1 in 50)	4% (1 in 25)	20% (1 in 5)
Foss Barrier	10.30	1% (1 in 100)	2% (1 in 50)	10 % (1 in 10)
Lower Ebor Street	10.20	4% (1 in 25)	10% (1 in 10)	>20% (< 1 in 5)

3.8.6 Environment Agency Policy on Future Development behind Flood Defences in York

3.8.6.1 In 2003, the Environment Agency commented that: -

1) "PPG25 (now PPS25) states the appropriate standard of a defence for new development should provide protection against a 1 in 100-year flood for the lifetime of the development: the defences in the York area no longer offer this level of protection".

2) "With this in mind, the Agency is likely to object to development proposals behind the defences and within the historic flood outline, as we do not wish to see an increase in the number of people introduced into the floodplain and put at risk of flooding. In accordance with PPG25 (now PPS25), all development proposals require an assessment of flood risk to be carried out. If having, carried out the sequential approach, your council support further development in these areas, all applications for new development must be supported by a Flood Risk Assessment confirming that the minimum appropriate standard of protection will be met and how this will be achieved."

3.8.6.2 The Ouse Flood Risk Management Strategy Report (2006) detailed below reinforces this, and maintains that the "precautionary principle" in PPS25 should be followed. However, redevelopment of older industrial areas (brownfield) within Zone 3 will only be allowable if they pass both the Sequential and Exception Tests as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

3.8.6 EA's Future Flood Defence Strategy

Introduction

3.8.7.1 The Ouse Flood Risk Management Strategy report was published by the EA in November 2005, following a lengthy period of consultation with interested parties. The Strategy sets out their plan for the sustainable management of flood risk to people, property and the environment over the next 100 years. The study area examined the full length of the River Ouse catchment, from Linton Lock to Boothferry Bridge. The following sections summarise selected parts of the report, relative to the City of York Council's area. For the purposes of identifying and assessing flood risk, the study area was divided into eight separate sections or 'reaches'. These take into account such things as land use and natural boundaries. The reaches are listed in **Table 3.4**, together with a brief description of the characteristics that define them. The reaches are further sub-divided into distinct flood cells as shown on **Figure 8**.

Options

3.8.7.2 In developing this strategy, the EA assessed a large number of generic flood risk management options, taking into account the existing environmental and technical constraints. A short-list of options was considered in more detail, including both strategic options, as well as more local improvements. Each option was assessed against the following criteria:

- **Technical feasibility:** Mathematical models of the River Ouse and its main tributaries allowed an assessment of how effective an option would be at reducing flood risk. Construction difficulties/techniques and the identification of any wider impacts were assessed during site visits;
- **Environmental impact:** A Strategic Environmental Assessment of the options was carried out, allowing for the identification of their potential environmental effects, constraints and opportunities for environmental improvement;

- **Economic viability:** The benefit-cost ratio of each option was analysed to allow identification of options that were economically viable.

3.8.7.3 Having carried out the above assessment, each viable option's DEFRA priority score was calculated, which determined the likelihood of a scheme being promoted.

The study indicated that there were a number of economically viable options that could provide a uniform standard of protection to the whole study area; these are listed below:

- new on-line storage, upstream of the study area;
- improve off-line storage at Clifton Ings;
- optimise off-line storage / out of channel flow at Cawood-Wistow Lordship and Kelfield Ings;
- raise/provide new defences throughout the study area.

3.8.7.4 The first three would require defences in some locations, to provide a consistent standard throughout. However, all the options had low priority scores and were unlikely to be promoted within the next five years. There is also a need to study the storage options in more detail to confirm their viability. A number of stand-alone improvements to the defences are cost beneficial. Some of these have high priority scores, whereas others are unlikely to be promoted. These are highlighted in the EA's preferred plan below.

Preferred plan

Flood risk management measures short and long term

3.8.7.5 The following flood risk management measures are detailed within the EA's action plan, for implementation within the first five years of the strategy. Prior to implementation, a full detailed appraisal of these options will be required, as the strategy only provides a broad-brush assessment.

Existing flood risk management measures

3.8.7.6 The EA are to continue with existing measures where justifiable, maintaining the existing defences to protect homes and businesses and continuing to operate pumping stations and floodgates and will carry on with flood forecasting activities and provide flood warnings.

Local defences – short term (York)

3.8.7.7 There was one area in York where the priority scores were high and it would be possible to increase the existing standard of protection (currently 10% or 1 in 10-year) in the next five years. This was the **Water End / Leeman Road** area, where the following is proposed: –

- 205m of new embankment along Water End;
- Installing a 90m long sheet pile cut-off wall to prevent seepage under Water End;
- Replacing (rather than raising) the existing Leeman Road embankment, due to its current poor condition.

Local defences – long term (York)

3.8.7.8 Improvements may be viable in the following areas, although their priority scores are low and would not receive funding until after 2010:

- The War Memorial Gardens / North Street
- Clementhorpe (Lower Ebor Street)
- Foss flooding from the Ouse including South Esplanade
- Fulford.

3.8.7.9 Several others local schemes have positive benefit/cost ratios but very low priority scores. There is a possibility that some of the following schemes could be promoted in the longer term (2015 onwards), although this is unlikely:

- Knavesmire
- Queen Anne School (Lower Bootham Phase 2)
- Marygate and Museum Gardens (Lower Bootham Phase 1)
- New Walk

Improvements in other areas are unlikely to be economically viable.

Further studies into long-term strategic options

3.8.7.10 The implementation of the long-term strategic options is dependant on further studies, as much of the information required to justify them does not exist at present. However, these options are the solutions that will provide a long-term sustainable solution to the reduction of flood risk within the catchment. In addition, these options could provide opportunities for significant environmental and recreational enhancements of the catchment. Although these options are not planned for implementation on the ground within the next five years, the EA have included costs for undertaking further studies within the first five years of the strategy.

3.8.7.11 The following long-term strategic studies affecting York were recommended by the EA for future consideration:

- Modifications to Clifton Ings;
- Managed realignment of the defences in the Upper Swale;
- Operation of existing reservoirs, which we will discuss with water companies;
- More detailed study of the minor watercourses, including the River Foss (and its tributaries) and Holgate Beck (which is linked to proposed improvements to the defences);
- Changes in land management;
- Assessment of flood and river bank protection requirements.

Action Plan

3.8.7.12 The effects of the elements of the EA's preferred plan on flood risk are identified in **Table 3.5**.

Strategy review

3.8.7.13 The findings of the EA's strategy will be reviewed every five years to take account of changes in flood risk, national policy, funding mechanisms and environmental issues.

Environment Agency Policy on Future Development behind Flood Defences in York

3.8.7.14 In 2003, the Environment Agency commented that: -

“PPG25 (now PPS25) states the appropriate standard of a defence for new development should provide protection against a 1 in 100 year flood for the lifetime of the development: the defences in the York area no longer offer this level of protection”.

3.8.7.15 Consequently, the EA have placed constraints on development in high-risk Zone 3 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. These are detailed in Section 4.

Table 3.4: Ouse Study Reaches (EA Strategy Report)

Table 2.1 – Study reaches		
Reach	Limits	Characteristics
A	River Ouse between Linton Weir and the A1237 York northern ring road	<ul style="list-style-type: none"> Primarily agricultural land (grade 3) Area has a number of designated environmental constraints including SAMs, replanted historic woodland and a historic park (Beningbrough)
B	River Ouse from the A1237 York northern ring road to the A64 York bypass, including the Foss	<ul style="list-style-type: none"> Urban area of York High number of environmental constraints, primarily heritage and archaeological Complex infrastructure, including regional and national rail links River is mainly channelled, non-tidal Areas of biodiversity interest include Clifton Ings (a controlled washland) and Fulford Ings (a SSSI)
C	River Ouse from the A64 York bypass to Naburn Weir	<ul style="list-style-type: none"> Non-tidal Mixed land use, including agricultural land (grades 2 and 3), small towns and villages The main areas of designated environmental interest are SSSIs at Naburn Marsh and Church Ings
D	River Ouse from Naburn Weir to Ouse/Wharfe confluence	<ul style="list-style-type: none"> Tidal reach passes through predominantly agricultural land (grades 2 and 3) SSSI at Acaster South Ings

**Table 3.5: Table S2 – How will the Ouse Flood Risk Management Strategy affect me?
(EA Strategy Report)**

Table S2 – How will the Ouse Flood Risk Management Strategy affect me?											
Reach	Flood cell	Existing defence Y/ N?	Flood Risk			Effects of Flood Risk Management Options					
			Flood risk today	Flood risk with climate change	Future local defences?	Modifications to storage areas		Managed realignment		Upstream storage (on-line)	Land Management
						Modification of Cawood and Kelfield Ings	Modification of Clifton Ings	Lower Wharfe	D/s of Selby		
Linton to York	A1 – Linton on Ouse	N	Moderate	Significant	No	No impact	Marginally raised water levels during flood events – local defences may be required	No impact	No impact	Raised water levels upstream of storage area. Reduced levels downstream	
	A2 – Newton on Ouse	N	Low	Moderate	No						
	A3 – Nun Monkton	N	Moderate	Significant	No						
	A4 – Beningbrough	N	Moderate	Significant	No						
	A5 – Poppleton	N	Moderate	Significant	No						
York	B1 – Millfield Industrial Estate	N	Significant	Significant	No	Reduced water levels during flood events, with increasing benefits as you go downstream	Reduced water levels during flood events	No impact	No impact	Reduced water levels during flood events	Reduced water levels during flood
	B2 – York Waterworks	Y	Moderate	Significant	No						
	B3 – Water End (Leeman Road)	Y	Moderate	Significant	Scheme viable possible funding in first five years						
	B4 – War Memorial Gardens and North Street	Part	Moderate	Significant	Scheme viable, possible funding after 2010						
	B5 – Knavesmire	N	Low	Moderate	Scheme viable, but funding only possible in long-term						
	B6 – Hob Moor	N	Moderate	Significant	No						
	B7 – Queens Staith and Skeldergate	N	Significant	Significant	No						
	B8 – Clementhorpe (Lower Ebor Street)	Part	Moderate / Significant	Significant	Scheme viable, possible funding after 2010						
	B9 – Clementhorpe (Rowntree Park and Bishopthorpe Road)	N	Moderate	Significant	No						
	B10 – Rawcliffe and Clifton Park	Y	Moderate	Significant	No						
	B11 – Queen Anne School (Lower Bootham Phase 1)	Y	Moderate	Significant	Scheme viable, but funding only possible in long-term						

Reach	Flood cell	Existing defence Y/ N?	Flood Risk		Future local defences?	Effects of Flood Risk Management			
			Flood risk today	Flood risk with climate change		Modifications to storage areas		Managed realignment	
						Modification of Cawood and Kelfield lngs	Modification of Clifton lngs	Lower Wharfe	D/s of Selby
B York	B12 – Marygate and Museum Gardens (Lower Bootham Phase 2)	Y	Moderate	Significant	Scheme viable, funding only possible in long-term	Reduced water levels during flood events, with increasing benefits as you go downstream	Reduced water levels during flood events	No impact	No impact
	B13 – Lendal Bridge – Ouse Bridge left bank	N	Low	Moderate	No				
	B14 – Foss	Part	Moderate	Significant	Scheme viable, possible funding after 2010				
	B15 – King's Staith and South Esplanade	N	Significant	Significant	Scheme viable, possible funding after 2010				
	B16 – New Walk	N	Moderate	Significant	Scheme viable, funding only possible in long-term				
	B17 – Middlethorpe	N	Moderate	Significant	No				
	B18 – Fulford	N	Moderate	Significant	Scheme viable, possible funding after 2010				
C York to Naburn	C1 – Bishopthorpe	Y	Low	Moderate	No	Reduced water levels during flood events, with increasing benefits as you go downstream	Reduced water levels during flood events	No impact	No impact
	C2 – Acaster Malbis	N	Significant	Significant	No				
	C3 – Naburn	N	Significant	Significant	No				
	C4 – Naburn STW	N	Moderate	Significant	No				

Key

Local defences

Flood risk	Meaning
Low	The chance of flooding in any year is 0.5 percent (1 in 200) or less
Moderate	The chance of flooding in any year is 1.3 percent (1 in 75) or less, but greater than 0.5 percent (1 in 200)
Significant	The chance of flooding in any year is greater than 1.3 percent (1 in 75)

Community-wide options

Cell colour

Table 3.6: Current Standards of Service and Defence Provision

Table 3.3 – Current standards of service and defence condition					
Reach	Flood cell ⁶	Existing defences?	Flood event annual probability: ⁷		
			Properties at risk from 1% flood	Onset of flooding	Slip
A Linton to York	A1 – Linton on Ouse	N	0	<1%	
	A2 – Newton on Ouse	N	1 – 2	2%	
	A3 – Nun Monkton	N	0	<1%	
	A4 – Beningbrough	N	0	<1%	
	A5 – Poppleton	N	1	~1%	
	B1 – Millfield Industrial Estate	N	0	0.5%	
	B2 – York Waterworks	Y	1	1%	
	B3 – Water End/Leeman Road	Y	570	2%	
	B4 – War Memorial Gardens and North Street	Part	421	2%	
	B5 – Knavesmire	N	209	>20%	
B York	B6 – Hob Moor	N	153	2%	
	B7 – Queens Staith and Skeldergate	N	88	>20%	
	B8 – Clementhorpe (Lower Ebor Street)	Part	201	4%	
	B9 – Clementhorpe (Rowntree Park and Bishopthorpe Road)	N	7	4%	
	B10 – Rawcliffe and Clifton Park	Y	138	2%	
	B11 – Queen Anne School (Lower Bootham Phase 1)	Y	543	4%	
	B12 – Marygate and Museum Gardens (Lower Bootham Phase 2)	Y	82	2%	
	B13 – Lendal Bridge – Ouse Bridge left bank	N	3	10%	
	B14 – Foss	Part	492	1%	
	B15 – King’s Staith and South Esplanade	N	59	>20%	
C York to Naburn	B16 – New Walk	N	87	>20%	
	B17 – Middlethorpe	N	3	>20%	
	B18 – Fulford	N	61	>20%	
	C1 – Bishopthorpe	Y	160	>20%	
D Naburn to Wharfe	C2 – Acaster Malbis	N	35	>20%	
	C3 – Naburn	N	121	>20%	
	C4 – Naburn STW	N	0	-	
	D1 – Stub Wood (Acaster Marshes)	Y	0	1.0%	
E Wharfe	D2 – Acaster Selby	Part	8	>20%	
	D3 – Stillingfleet (including Escrick)	Y	258	4%	
	D4 – Stillingfleet House	N	0	0.5%	
	D5 – Bell Hall	N	3	>20%	
E Wharfe	E1 – Stutton	N	0	0.5%	
	E2 – Kirkby Wharfe	N	13	>20%	
	E3 – Ulleskelf West	Y	11	20%	

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 City of York 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. The Navigation Authority is City of York Council.
- The mean summer river level is 7.6m AOD at Castle Mills Lock
- Normal summer flow is 1.0 cumecs
- 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 Magnesian 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 Mercia 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 Mercia 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 cumecs) 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** -drains 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. Classed as Critical Ordinary Watercourse (COW) for bottom 3.7km.

- **Osbalwick Beck** - drains an area to the east of the city, it flows through the village of Osbalwick and the suburb of Tang Hall before joining Tang Hall Beck in a culvert under St Nicholas Fields. Classed as COW for bottom 3.9km.
- The total catchment of Tang Hall and Osbalwick 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 cumecs 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 50m south of Office World 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 3.8.5) was constructed to prevent this in 1987. A similar problem occurs with Tang Hall Beck and Osbalwick 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 10**. 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 flow of 31.8 cumecs.
- 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 90 years** (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 cumecs). 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 York along the Foss is highly dependant 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 flood zone maps are prepared not only when the barrier and pumps operate as per design, but also for various 'failure' scenarios at the Foss Barrier and pumping station for an event with a 1 in 100-year return period. These scenarios are as follows:
 - Barrier fails to close during a 'typical' flooding event;
 - Barrier closed with all 8 pumps failing to operate; and
 - Barrier closed with 4 pumps out of the 8 failing to operate.

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 cumecs) and Tang Hall Beck overtopping the Foss Islands disused railway line at James Street Traveler's site. This latter source of flooding occurs during events greater than 10-year return period.

3.9.3 During 1 in 100-year 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. 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 9**, the EA's Flood Zone Map, shows the areas that are at greatest risk of property flooding from 1 in 100-year and 1 in 1000-year 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 return. For events greater than 1 in 50-year 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 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 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. James Street Traveler's site is severely affected.
- 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.
- 3.9.9 However, lack of flooding records in some of the former Ryedale District areas north of Bell Farm has led to large areas being covered by modelled predictions of Zone 2 and 3 flooding, where little or no historic flooding is known to have occurred. The Environment Agency acknowledge this modelling to be indicative and continue to review their flood risk mapping using more sophisticated modelling, with the aim of refining the zone boundaries. To date this has been achieved for the Strensall area, but is still outstanding for Huntington, New Earswick, Earswick, Haxby and Wigginton.

Tang Hall and Osbaldwick Beck

- 3.9.10 Serious flooding from Tang Hall Beck and Osbaldwick Beck occurred in March 1947, January 1982 and November 2000.
- 3.9.11 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
- Tang Hall Beck
- William Birch's Plant Yard,
 - Applecroft Road
 - James Street Traveler's Site
- 3.9.12 Since November 2000, the James Street Traveler's Site has flooded on two further occasions due to problems with balancing the flood flows between Tang Hall Beck and the River Foss. This risk should be reduced after April 2006, when the Environment Agency are to link the telemetry monitoring high flood levels on both the Foss and Tang Hall Beck.

South Beck

- 3.9.13 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 is in place 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

- 3.9.14 Extensive flooding is predicted at Haxby and Wigginton from Westfield Beck. Ascot Road and Mill lane are known to have flooded in the past, but this may have been as a result of the late or non-operation of Westfield Beck Pumping Station. At the time, responsibility for the pumping station was in dispute but Yorkshire Water has since formally adopted this pumping station. It is therefore anticipated that maintenance issues should not be a problem in future.

Future Flood Defence Strategy

- 3.9.15 The current standard of protection against flooding from the River Ouse provided by the Foss Barrier and its defences is 2% (1 in 50). The standard for the onset of flooding is 1% (1 in 100). However, these defences could be outflanked by a 4% (1 in 25) flood event around Tower Street.
- 3.9.16 To provide a 2% (1 in 50) standard of protection against outflanking of the Foss Barrier, the following works may be required: -
- Raise wall from Skeldergate Bridge around St. George's Field park area, and
 - Raise Tower Street in the vicinity of the roundabout / traffic lights at the end of Skeldergate Bridge.
- 3.9.17 However, the above works will only address flood risk from the River Ouse. Further modeling work was recommended in the Ouse Strategy Report, to better understand the risk of flooding from the River Foss itself, and from its tributaries, notably Tang Hall Beck and Osbaldwick Beck.

Development in Flood Zone 3a

- When considering potential **development sites within Zone 3a, the Sequential and Exception Tests must be passed**, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.
- 3.9.18 **The River Foss Zone is the only zone in York that currently has the benefit of a large pumping station, at the Foss Barrier, to deal with flood flows. The EA stated in November 2006, that overtopping of Ouse defences into the Foss Zone would have much less serious consequences than in any other areas, which have only walls / embankments for protection.**

3.10 River Derwent

General

- This zone is bounded to 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.
- The Upper Derwent passes through areas of Corallian Limestone and Kimmeridge Clay, flowing into the Lower Derwent within Mercia 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 affect on runoff and sedimentation of the Derwent, which will be addressed in the Derwent Catchment Flood Management Plan, due for publishing in early 2006.
- Barmby Barrage, constructed in the 1970's 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 by permission from the EA, as water is extracted by Yorkshire Water 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 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 cumecs
- 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 SSSI's, 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 flow of 221 cumecs 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 independent 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^[5], with peak flows of approximately 199 cumecs^[5].

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 new flood defence is to be built by the Environment Agency at Elvington in 2007, which will protect the village from the effects of River Derwent floods. Maintenance of the new defence will be shared between the Environment Agency (floodbank) and the Ouse and Derwent IDB (pumping station), as Elvington Beck is not designated as a critical ordinary watercourse.

Future Flood Defence Strategy

- 3.10.3 The Derwent Catchment Flood Management Plan was at consultation stage when this SFRA was published. When completed, it will give high-level comment on the future flood defence strategy.

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 Flood risk needs to be assessed from 2 different angles: -

- 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 this study.

4.1 Policy Recommendations and Guidance

4.1.1 The following policy recommendations have been split into two sections. Section 4.1.a outlines Policy Recommendations for Forward Planning, providing advice on the application of PPS25. Section 4.1.b outlines recommended Guidance for Development Control and the Consideration of Planning Applications. Section 4.1.c gives General Drainage Guidance.

4.1.a Policy Recommendations for Forward Planning

4.1.2 The York LDF will identify areas where major developments are to be situated, taking into account a number of PPS considerations, including PPS25 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	<ul style="list-style-type: none"> Essential transport infrastructure (including mass evacuation routes) that has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	<ul style="list-style-type: none"> 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.
More Vulnerable	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	<ul style="list-style-type: none"> 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:

- 1) 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.
- 2) 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.
- 3) 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	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a(i) (100-year protection)	Exception Test required	✓	x	Exception Test required	✓
	Zone 3a(ii) (50 to 100-year protection)	Exception Test required	✓	x	Exception Test required	Exception Test required
	Zone 3a(iii) (less than 50-year protection)	Exception Test required	✓	x	Exception Test required #	Exception Test required #
	Zone 3b‘Functional Floodplain’	Exception Test required	✓	x	x	x

- ✓ Development is appropriate **is appropriate**
- x Development should not be permitted **Development should not be permitted**
- # Redevelopment only – not applicable to new build

4.1.5 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)
- FP Policy Recommendation: Flood Zone 2 - (low to medium risk)
- FP Policy Recommendation: Flood Zone 3a(i) – (Non-functional floodplain at high risk of flooding, with 1 in 100-year standard of flood defence)
- FP Policy Recommendation: Flood Zone 3a(ii) - (Non-functional floodplain at high risk of flooding, with 1 in 50-year standard of flood defence)
- FP Policy Recommendation: Flood Zone 3a(iii) – (Non-functional floodplain at high risk of flooding, without an appropriate standard of flood defence)
- FP Policy Recommendation: Flood Zone 3b - (Functional floodplain at high risk of flooding)

FP Policy Recommendation: Flood Zone 1 (little or no risk of flooding)

4.1.6 This Zone comprises land with an annual probability of flooding of less than 1 in 1000-year, 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 30-year storm event, and should retain any sewer flooding from a 1-100-year storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year 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 are up to maximum capacity. Consequently, 1 in 100-year surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -

- Existing runoff rates (if a brownfield site), with preferably a reduction in runoff if possible or,
- Agricultural runoff rates (if the site has no previous development).

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 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 in a FRA.

4.1.11 The Environment Agency should be consulted for all sites over 1ha. The EA's Flood Risk Matrix (**Table 1.1, Appendix 7**) should be consulted for other types of site, which contains appropriate standard responses.

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

The appropriate IDB and City of York Council's Drainage Section should be consulted on all proposed development (refer to **Figure 4**).

FP Policy Recommendation: Flood Zone 2 (low to medium risk of flooding)

- 4.1.12 This Zone comprises land with an annual probability of flooding of between 1 in 1000-year and 1 in 100-year.
- 4.1.13 This zone is generally suitable for most developments, apart from highly vulnerable uses listed in **Table 4.1**, e.g. basement dwellings and essential civil infrastructure (fire/ police/ambulance stations). Proposed allocation for essential civil infrastructure within this zone must pass the Exception Test, and should remain accessible and operational during a 1 in 1000-year 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 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 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 30-year storm event, and should retain any sewer flooding from a 1 in 100-year storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year 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 are up to maximum capacity. Consequently, 1 in 100-year surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -
- Existing runoff rates (if a brownfield site), with preferably a reduction in runoff if possible or,
 - Agricultural runoff rates (if the site has no previous development).
- 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 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.
- 4.1.21 The Environment Agency should be consulted for all sites over 1ha and all civil emergency infrastructures. The EA's Flood Risk Matrix (**Table 1.1, Appendix 7**) should be consulted for other types of site, which contains appropriate standard responses.
- 4.1.22 Yorkshire Water should be consulted for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB and City of York Council's Drainage Section should be consulted on all proposed development (refer to **Figure 4**).

FP Policy Recommendation:- Flood Zone 3a: Non-functional floodplain at high risk of flooding - general

- 4.1.23 This Zone comprises land with an annual probability of river flooding greater than 1 in 100-years.

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

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 designated 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 and in PPS25 - Appendix 6, Section D9.

- 4.1.25 In some instances this detailed FRA work may show that the specific site is not in the higher risk area, which is usually 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. Zone 3a was further split, as described in Section 3.2.4 and shown on **Figure 11**. 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 Environment Agency must be consulted regarding all development within Flood Zone 3.

FP Policy Recommendation:- Flood Zone 3a(i): Non-functional floodplain at high risk of flooding which are currently defended to the minimum standard as defined by PPS25 (1 in 100-year protection).

- 4.1.27 As detailed in Section 3, no part of **York's flood defences currently provide 1 in 100-year standard of protection.**

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

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

- 4.1.28 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.

- 4.1.29 When considering potential **development sites within Zone 3a, the Sequential and Exception Tests must be passed**, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

- 4.1.30 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.

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

- 4.1.32 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 30-year storm event, and should retain any sewer flooding from a 1 in 100-year storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year 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

- 4.1.33 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.

- 4.1.34 The majority of the watercourses in York are up to maximum capacity. Consequently, 1 in 100-year surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -

- Existing runoff rates (if a brownfield site), with preferably a reduction in runoff if possible or,

- Agricultural runoff rates (if the site has no previous development).

4.1.35 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.

4.1.36 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.

4.1.37 Yorkshire Water should be consulted for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB and City of York Council's Drainage Section should be consulted on all proposed development (refer to **Figure 4**).

4.1.38 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.

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

The Environment Agency must be consulted regarding all development within Flood Zone 3.

FP Policy Recommendation:- Flood Zone 3a(ii): Non-functional floodplain at high risk of flooding, with an appropriate standard of flood defence for existing development as defined by Defra (1 in 50-year protection), but not defended to the appropriate minimum standard for new development as defined by PPS25 (1 in 100-year protection).

The River Foss Zone

- 4.1.39 **Flood cell B14 (refer to Figure 8) is the only zone in York that has the benefit of a large pumping station, at the Foss Barrier, to deal with high flood flows.** The EA stated in November 2006, that overtopping of Ouse defences into the Foss Zone would have much less serious consequences than in any other areas in Zone 3.

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

- 4.1.40 The more vulnerable, 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

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

Other areas behind existing flood defences

- 4.1.41 The remaining flood defences generally have only walls / embankments for protection. Although offering 1 in 50-year protection, the EA has stated that areas behind these defences have the following suitability: -

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

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

- 4.1.42 The more vulnerable, less vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed, **which will be more restrictive than in Flood Cell B14.** The 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.

- 4.1.43 When considering potential **development sites within Zone 3a(ii), the Sequential and Exception Tests must be passed**, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

- 4.1.44 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.

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

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

- Sewer flooding – sites should have no surface flooding during a 30-year storm event, and should retain any sewer flooding from a 1 in 100-year storm within the confines of the site. No property flooding should occur as a result

of a 1 in 100-year 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)

4.1.47 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.

4.1.48 The majority of the watercourses in York are up to maximum capacity. Consequently, 1 in 100-year surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -

- Existing runoff rates (if a brownfield site), with preferably a reduction in runoff if possible or,
- Agricultural runoff rates (if the site has no previous development).

4.1.49 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.

4.1.50 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.

4.1.51 Yorkshire Water should be consulted for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB and City of York Council's Drainage Section should be consulted on all proposed development (refer to **Figure 4**).

4.1.52 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.

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

The Environment Agency must be consulted regarding all development within Flood Zone 3.

FP Policy Recommendation:- Flood Zone 3a(iii): Non-functional floodplain at high risk of flooding, without an appropriate standard of flood defence

4.1.53 This Zone, shown on **Figure 11**, comprises land with an annual probability of river flooding greater than 1 in 100-years. There is a high risk of flooding, as these areas have no flood defences and most are **known to have flooded in the past**. The current flood defences shown on Figure 7 all offer at least the appropriate minimum standard as defined by Defra (1 in 50-year protection) and are in Zones 3a(i) or 3a(ii).

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

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

4.1.54 The more vulnerable, less vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed. The more vulnerable and less vulnerable uses should be restricted to redevelopment sites only, and does not apply to new build. Essential infrastructure—permitted in this zone should be designated and constructed to remain operational and safe for users in time of flood.

4.1.55 Early contact with the Environment Agency 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.

4.1.56 When considering potential **development sites within Zone 3a(iii), the Sequential and Exception Tests must be passed**, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

4.1.57 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.

4.1.58 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 30-year storm event, and should retain any sewer flooding from a 1 in 100-year storm within the confines of the site. No property flooding should occur as a result of a 1 in 100-year 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)

4.1.59 The majority of the watercourses in York are up to maximum capacity. Consequently, 1 in 100-year surface water runoff rates for developments in this zone should be, where practicable, restricted to either: -

- Existing runoff rates (if a brownfield site), with preferably a reduction in runoff if possible or,
- Agricultural runoff rates (if the site has no previous development).

4.1.60 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.

4.1.61 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.

4.1.62 Yorkshire Water should be consulted for all developments over 10 dwellings or sites exceeding 0.5ha.

The appropriate IDB and City of York Council's Drainage Section should be consulted on all proposed development (refer to **Figure 4**).

1.1.63 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.

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

The Environment Agency must be consulted regarding all development within Flood Zone 3.

FP Policy Recommendation: Flood Zone 3b – Functional Floodplain

- 4.1.64 This zone comprises **land where water has to flow or be stored in times of flood**, either during floods with an annual probability of 1 in 20-years or where land is designed to flood in an extreme 1 in 100-year flood.
- 4.1.65 Only the water-compatible uses and the essential infrastructure listed in **Table 4.1**, which have to be there, should be permitted in this zone. It should be designed and constructed to: -
- remain operational and safe for users in times of flood;
 - result in no net loss of floodplain storage;
 - not impede water flows; and
 - not increase flood risk elsewhere
- 4.1.66 Essential infrastructure in this zone **must** pass the Exception Test as explained in Section 5 and in **PPS25** (Appendix 6, Section D9).
- 4.1.67 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.

- 4.1.68 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 Environment Agency must be consulted regarding all development within Flood Zone 3.

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

- 4.1.69 This Section outlines recommended policies for Planning and Development Control purposes, assisting both planners and developers in the practical implementation of the policies contained within PPS25. 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.
- 4.1.70 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.
- 4.1.71 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 Environment Agency's Flood Risk Matrix (**Table 1.1, Appendix 7**), gives Standing Advice on the scope and extent of Flood Risk Assessments.
- 4.1.72 Development Control (DC) guidance has been prepared for development within the following flood risk zones, based on the EA's advice in **Table 1.1**: -
- DC Guidance: Flood Zone 1- (little or no risk)
 - DC Guidance: Flood Zone 2 - (low to medium risk)
 - DC Guidance: Flood Zone 3a(i) – (Non-functional floodplain at high risk of flooding, with 1 in 100-year standard of flood defence)
 - DC Guidance: Flood Zone 3a(ii) - (Non-functional floodplain at high risk of flooding, with 1 in 50-year standard of flood defence)
 - DC Guidance: Flood Zone 3a(iii) – (Non-functional floodplain at high risk of flooding, without an appropriate standard of flood defence)
 - DC Guidance: Flood Zone 3b- (Functional floodplain at high risk of flooding)

DC Guidance: Flood Zone 1 (little or no risk of flooding)

- 4.1.73 Zone 1 is defined as having an annual probability of flooding of less than 1 in 1000-year. PPS25 recommends that there are no constraints on development due to river flooding.
- 4.1.74 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.
- 4.1.75 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 Environment Agency, Internal Drainage Board and/or other bodies have indicated that there may be drainage problems.
- 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 Environment Agency's Standing Advice (FRA1/FRA2) 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 should be refused.

- 4.1.77 As detailed in Appendix 7, the Environment Agency 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 8 m 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 respective Internal Drainage Board must also be consulted with regard to any proposed development within their respective areas (see Figure 4). City of York Council's Drainage Section must be consulted on all applications.

DC Guidance: Flood Zone 2 (low to medium risk of flooding)

- 4.1.78 Zone 2 is defined as having an annual probability of flooding of between 1 in 100-year and 1 in 1000-year.
- 4.1.79 This zone is generally suitable for most developments, apart from highly vulnerable uses listed in **Table 4.1**, e.g. basement dwellings and essential civil infrastructure (fire/ police/ambulance stations). Proposed allocation for essential civil infrastructure within this zone must pass the Exception Test as explained in Section 5 and in PPS25, and should remain accessible and operational during a 1 in 1000-year flood.
- 4.1.80 **All planning applications in Flood Zone 2 must be accompanied by a FRA.** The FRA should identify opportunities to reduce the probability and consequences of flooding.
- 4.1.81 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 Environment Agency's Standing Advice (FRA1-3) 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 should be refused.

- 4.1.82 As detailed in **Appendix 7**, the Environment Agency 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 8 m 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 respective Internal Drainage Board must also be consulted with regard to any proposed development within their respective areas (see Figure 4). City of York Council's Drainage Section must be consulted on all applications.

- 4.1.83 Specific points to consider for Zone 2: -
- Habitable floor levels to be 600mm above the 1 in 100-year flood level
 - The development will be adequately defended against 1 in 100-year 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 event occurs.

DC Guidance: Flood Zone 3a(i) developed areas at high risk of flooding which are currently defended to the minimum standard as defined by PPS25 (1 in 100-year protection).

4.1.84 As detailed in Section 3, **none of York's flood defences currently provide 1 in 100-year standard of protection.** Elvington will have 1 in 100-year protection by the autumn of 2007.

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

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

4.1.85 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.

4.1.86 When considering potential **development sites within Zone 3a(i), the Sequential and Exception Tests must be passed**, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

4.1.87 **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.

4.1.88 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 Environment Agency's Standing Advice (FRA1-3) 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 should be refused.

4.1.89 **As detailed in Appendix 7, the Environment Agency must be consulted as part of the planning process for all proposed developments**, the only exception being for extension less than 250m², unless the following applies: -

- the development lies within 8m of the bank top of a Main River
- the development lies within 8 m 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 respective Internal Drainage Board must also be consulted with regard to any proposed development within their respective areas (see Figure 4). City of York Council's Drainage Section must be consulted on all applications.

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

- The development will be adequately defended against 1 in 100-year 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 event occurs.

DC Guidance: Flood Zone 3a(ii) Non-functional floodplain at high risk of flooding, - developed areas at high risk of flooding which are currently defended to the minimum standard for existing development as defined by Defra (50-year protection), but are not defended to the minimum standard for new development as defined by PPS25 (1 in 100-year protection).

The River Foss Zone

4.1.91 Flood cell B14 (refer to Figure 8) is the only zone in York that has the benefit of a large pumping station, at the Foss Barrier, to deal with high flood flows. The EA stated in November 2006, that overtopping of Ouse defences into the Foss Zone would have much less serious consequences than in any other areas in Zone 3.

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

4.1.91 The more vulnerable, 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

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

Other areas behind existing flood defences

4.1.92 The remaining flood defences generally have only walls / embankments for protection. Although offering 1 in 50-year protection, the EA has stated that areas behind these defences have the following suitability: -

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

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

4.1.93 The more vulnerable, less vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed, **which will be more restrictive than in Flood Cell B14.** The 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.

4.1.94 When considering potential **development sites within Zone 3a(ii), the Sequential and Exception Tests must be passed**, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

4.1.95 **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.

4.1.96 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 Environment Agency's Standing Advice (FRA1-3) 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 should be refused.

4.1.97 **As detailed in Appendix 7, the Environment Agency must be consulted as part of the planning process for all proposed developments**, the only exception being for extension less than 250m², unless the following applies: -

- the development lies within 8m of the bank top of a Main River
- the development lies within 8 m 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 respective Internal Drainage Board must also be consulted with regard to any proposed development within their respective areas (see Figure 4). City of York Council's Drainage Section must be consulted on all applications.

4.1.98 Specific points to consider for Zone 3a(ii): -

- The development will be adequately defended against 1 in 100-year flooding without increasing the degree of flood risk to any third party
- Ultimate depth of water following breach or rapid 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 event occurs.

DC Guidance: Flood Zone 3a(iii) - Non-functional floodplain at high risk of flooding, without an appropriate standard of flood defence

4.1.99 This Zone, shown on **Figure 11**, comprises land with an annual probability of river flooding greater than 1 in 100-years. There is a high risk of flooding, as these areas have no flood defences and most are **known to have flooded in the past**. The current flood defences shown on **Figure 7** all offer at least the appropriate minimum standard as defined by Defra (1 in 50-year protection) and are in Zones 3a(i) or 3a(ii).

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

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

4.1.100 The more vulnerable, less vulnerable and essential infrastructure uses in **Table 4.1** should only be permitted in this zone if the Exception Test is passed. The more vulnerable and less vulnerable uses should be restricted to redevelopment sites only, and does not apply to new build. Essential infrastructure—permitted in this zone should be designated and constructed to remain operational and safe for users in time of flood.

4.1.101 When considering potential **development sites within Zone 3a(iii), the Sequential and Exception Tests must be passed**, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

4.1.102 Early contact with the Environment Agency 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.

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

4.1.103 **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.

4.1.104 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 Environment Agency's Standing Advice (FRA1-3) 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 should be refused.

4.1.105 **As detailed in Appendix 7, the Environment Agency must be consulted as part of the planning process for all proposed developments**, the only exception being for extension less than 250m², unless the following applies: -

- the development lies within 8m of the bank top of a Main River
- the development lies within 8 m 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 respective Internal Drainage Board must also be consulted with regard to any proposed development within their respective areas (see Figure 4). City of York Council's Drainage Section must be consulted on all applications.

4.1.106 Specific points to consider for Zone 3a(iii): -

- The development will be adequately defended against 1 in 100-year 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 event occurs.

DC Guidance: Flood Zone 3b – Functional Floodplain

4.1.107 This zone comprises **land where water has to flow or be stored in times of flood**, either during floods with an annual probability of 1 in 20-years or where land is designed to flood in an extreme 1 in 100-year flood.

4.1.108 **Only the water-compatible uses and the essential infrastructure listed in Table 4.1, that have to be there, should 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 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 event occurs

4.1.108 Essential infrastructure in this zone should pass the Exception Test, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.

A FRA should accompany all development proposals in this zone.

4.1.109 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.

4.1.110 The Environment Agency's Standing Advice (FRA1-3) 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 should be refused.

4.1.111 **As detailed in Appendix 7, the Environment Agency must be consulted as part of the planning process for all proposed developments**, the only exception being for extension less than 250m², unless the following applies: -

- the development lies within 8m of the bank top of a Main River
- the development lies within 8 m 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.

4.1.112 **The respective Internal Drainage Board must also be consulted with regard to any proposed development within their respective areas (see Figure 4). City of York Council's Drainage Section must be consulted on all applications.**

The Environment Agency must be consulted regarding all development within Flood Zone 3.

4.1.c General Drainage Guidance

4.1.113 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 the existing runoff rates (if a brownfield site) or agricultural runoff rates (if the site has no previous development).**

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.

A maximum 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.

Flow attenuation from new development is only practicable when surface water discharges exceed 4 l/s, as this is the minimum figure that flow-control devices such as Hydrobrakes can operate at, without increasing the possibility of blockages due to small orifice sizes. This flow can be produced for developments with impermeable areas exceeding 500m². Consequently, it is unworkable to limit runoff from development below this level.

- 2. Surface water from developments shall not connect to combined drains or sewers, 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) included with the submission, to enable the assessment of the impact of flows on the catchment to be made.**

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

Notes: 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. Where the intention is to dispose to soakaway, these should be shown to work through an appropriate assessment carried out under BRE Digest 365, carried out in

winter if possible - 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.

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 Part H

- 5. Proposed flow balancing of storm water runoff shall be capable of storing a 1 in 100-year rainfall event, with no run-off into adjacent sites.**

Note: This is a requirement of Yorkshire Water for adoptable sewerage systems.

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

Note: Yorkshire Water 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: Yorkshire Water 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 Proposed Development within Zone 3

- 4.2.1 The High Risk Zone 3 is divided into 'non-functional floodplain' (3a), and 'functional floodplains' (3b), defined in PPS25 as "... land where water has to flow or be stored in times of flood ", as shown on **Figure 11**.
- 4.2.2 As detailed in Section 3, **none of York's flood defences currently provide 1 in 100-year standard of protection.**
- 4.2.3 Consequently, these "protected" Zone 3 areas are not generally suitable for new residential, commercial or industrial development, unless they pass the Exception Test, as explained in Section 5 and in PPS25 - Appendix 6, Section D9.
- 4.2.3 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 and 3b within the high-risk zone. Zone 3a was further sub-divided, as described in Section 3.2.4.
- 4.2.4 **Figure 11** gives an indication of the scale of the residual risk, and identify where a more detailed site-specific study will be necessary when looking at a particular development allocation or application. In these high-risk areas, inundation-mapping tools should be used to fully explore the degree of the residual risk, and where appropriate used to test mitigation schemes. In some instances this detailed work may show that the specific site is not in the higher risk area, but demonstrates the precautionary approach taken in the SFRA.

Specific Comments on Development in High Risk Zone 3 Areas

River Ouse Zone

Holgate Beck

- 4.2.5 Due to the risk of failure of the West 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 Environment Agency requirements. Environment Agency proposals to rebuild / refurbish these defences by 2010 will restore the 1 in 100-year flood defence standard, removing this restriction.

Blue Beck

- 4.2.6 Blue Beck has 1 in 100-year protection from the River Ouse, but can 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 Environment Agency requirements.

Bur Dyke

- 4.2.7 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 Environment Agency requirements.

Marygate and North Street

- 4.2.8 Although classed as a “brownfield site”, 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 (B7), Kings Staith and South Esplanade (B15) and New Walk (B16)

- 4.2.9 No flood defences currently exists for these areas. As these areas are fully developed any re-development should consider flood resilience. The Environment Agency could provide new defences for this area by 2010, which would restore the 1 in 100-year flood defence standard, removing this restriction.

Environment Agency Policy on Future Development behind Flood Defences in York

- 4.2.10 “PPS25 now states that the appropriate standard of a defence for new development should provide protection against a 1 in 100 year flood for the lifetime of the development: the defences in the York area no longer offer this level of protection”.

2) “With this in mind, the Agency is likely to object to development proposals behind the defences and within the historic flood outline, as we do not wish to see an increase in the number of people introduced into the floodplain and put at risk of flooding. In accordance with PPS25, all development proposals require an assessment of flood risk to be carried out. If having, carried out the sequential approach, your council support further development in these areas, all applications for new development must be supported by a Flood Risk Assessment confirming that the minimum appropriate standard of protection will be met, and how this will be achieved.”

- 4.2.11 The Ouse Flood Risk Management Strategy Report (2006) reinforces this, and maintains that the “precautionary principle” in PPS25 should be followed. However, redevelopment of older industrial areas (brownfield) within Zone 3 will only be allowable if it passes the Exception Test, including appropriate flood risk assessments and the incorporation of flood resilience measures to protect against a 1 in 100-year flood.

River Foss Zone

- 4.2.12 **Flood cell B14 (refer to Figure 8) is the only zone in York that currently has the benefit of a large pumping station, at the Foss Barrier, to deal with high flood flows.** The EA stated in November 2006, that overtopping of Ouse defences into the Foss Zone would have much less serious consequences than in any other areas in Zone 3.
- 4.2.13 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.
- 4.2.14 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. The James Street Traveller’s site is particularly susceptible to flooding (3 times since November 2000).
- 4.2.15 Historically, the worst property flooding occurred during the 1982 floods, when no defences were in place. Consequently, 1 in 100-year flood levels will be over 400mm deeper than has ever been experienced in the past.

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

River Derwent Zone

- 4.2.17 The 2000 floods saw all the major becks flowing at full capacity, especially Elvington Beck, which severely affected the village for nearly 3 weeks.
- 4.2.18 To prevent future flooding problems, all flows from all new development should be restricted to the existing flow from the site (if a Brownfield site) or agricultural runoff rate if the site has no previous development, especially flows to Elvington Beck.

Elvington village will have 1 in 100-year flood protection by Autumn 2007, following the completion of flood defence works.

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 Control 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 paragraphs 2.10 of this SFRA and 16-17 of PPS25. In considering the allocation of sites in the Key Allocations DPD, the City of York 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 paragraphs 2.11 of this SFRA and 18-20 of PPS25, 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 Environment Agency are vital.

5.1.5 An Exception Test would comprise the following:

- The consideration and 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. PPS25 states the benefits of the development should contribute to the Core Strategies Sustainability Appraisal. The objectives in **Table 5.1** set out the sustainability considerations which must be taken into account. These have been taken from the City of York Councils Core Strategy Sustainability Appraisal Scoping Report.

Table 5.1: Exception Test Sustainability Considerations

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
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
Supplementary Objective (requires an additional objective)
EN5. Improve Air Quality in York
Social
S1. Preserve and enhance York's urban and rural landscapes and public open space
S3. Improve the health and well-being of the York population
S6. Accessibility to public recreational areas and leisure facilities for all
S7. Reduce the need to travel by private car
S8. Good access to and encourage use of public transport, walking and cycling
S9. A transport network that integrates all modes for effective non car based movements
S10. Quality affordable housing available for all
Supplementary Objective (requires an additional objective)
S4. Safety and security for people and property
S11. Social inclusion and equity across all sectors
Economic
EC1. Good quality employment opportunities available for all
EC2. Good Education and training opportunities which build skills and capacity of the population
EC3. Conditions for business success, stable economic growth and investment
Supplementary Objective (requires an additional objective)
EC4. Local needs met locally

b) the development should be on developable, previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and

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 in Appendix 7. 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 Control

- 5.2.1 The following section gives detailed information for Development Control 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 paragraphs 2.10 of this SFRA and 16-17 of PPS25. Development control 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 paragraphs 2.11 of this SFRA and 18-20 of PPS25, 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.
- 5.2.5 An Exception Test would comprise the following:

- The consideration and 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. PPS25 states the benefits of the development should contribute to the Core Strategies Sustainability Appraisal. The objectives in **Table 5.1** set out the sustainability considerations which must be taken into account. These have been taken from the City of York Councils Core Strategy Sustainability Appraisal Scoping Report.

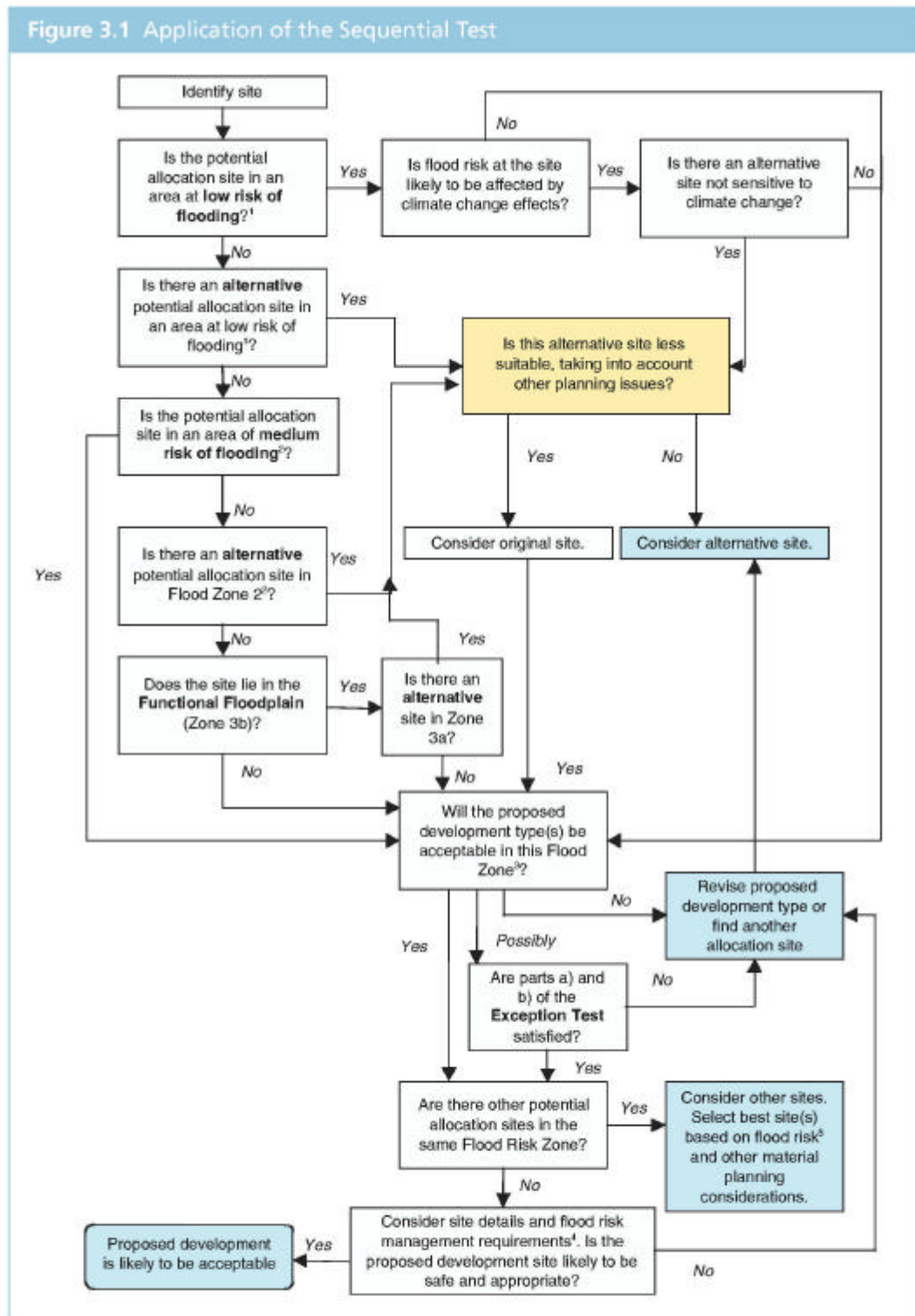
Table 5.1: Exception Test Sustainability Considerations

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
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
Supplementary Objective (requires an additional objective)
EN5. Improve Air Quality in York
Social
S1. Preserve and enhance York's urban and rural landscapes and public open space
S3. Improve the health and well-being of the York population
S6. Accessibility to public recreational areas and leisure facilities for all
S7. Reduce the need to travel by private car
S8. Good access to and encourage use of public transport, walking and cycling
S9. A transport network that integrates all modes for effective non car based movements
S10. Quality affordable housing available for all
Supplementary Objective (requires an additional objective)
S4. Safety and security for people and property
S11. Social inclusion and equity across all sectors
Economic
EC1. Good quality employment opportunities available for all
EC2. Good Education and training opportunities which build skills and capacity of the population
EC3. Conditions for business success, stable economic growth and investment
Supplementary Objective (requires an additional objective)
EC4. Local needs met locally

b) the development should be on developable, previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and

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 in Appendix 7.

Table 5.2: 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.

(Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft')

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.

(Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft')



City Development
City of York Council
9 St Leonards Place
York
YO1 7ET
Tel (01904) 551491
Email: citydevelopment@york.gov.uk

