City of York Council

Strategic Flood Risk Assessment

Level 1 Report

August 2022

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Quality information

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Executive Summary

City of York Council is currently working towards a new Local Plan that is fully compliant with the National Planning Policy Framework (NPPF) and other relevant statutes. The new Local Plan will set strategic priorities for the City of York and forms the basis for future planning decisions, as well as detailed policies to guide development. In 2016 City of York Council undertook a Local Plan Preferred Sites Consultation to set out the revised housing and employment demand, as well as the supply of sites they identified to meet this need. The portfolio of sites was subsequently confirmed through the Local Plan Publication Draft (2018) submitted for Examination in Public on 25 May 2018. As at August 2022, the Examination of the Local Plan is ongoing.

Since 2013 when the existing City of York Strategic Flood Risk Assessment (SFRA) was completed, the NPPF and its supporting guidance has been developed, climate change guidance has evolved, updated flood modelling (York Detailed Model) was finalised in 2016 for the River Ouse and River Foss within the City of York administrative area and the York Flood Alleviation Scheme has been progressed.

The NPPF and associated Planning Practice Guidance (PPG) for Flood Risk and Coastal Change emphasise the active role Local Planning Authorities (LPAs) should take to ensure that flood risk is assessed, avoided, and managed effectively and sustainably throughout all stages of the planning process.

Recent updates in flood risk and drainage guidance have prompted the requirement for the City of York Council to update their existing SFRA. This document provides an update to guidance and recommendations relating to flood risk and drainage requirements for use by developers and other partner organisations.

Level 2 Strategic Flood Risk Assessment

Following the update of the evidence base for the Level 1 SFRA it has been determined that there are currently no strategic development sites within high flood risk areas and it is not intended to progress to a Level 2 Strategic Flood Risk Assessment at this time. This will be further reviewed as any updated information is made available.

Living Document

The Level 1 SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the study area. The Environment Agency may in the future revise the hydraulic modelling for the Rivers Ouse, Foss, Derwent and associated tributaries, which will improve the current knowledge of flood risk, and may marginally alter predicted flood extents within parts of the study area in the future.

New information may influence future development control decisions within these areas. Therefore, it is important that the SFRA is adopted as a ‘living’ document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk within City of York Council’s administrative area.

This document is supported by a separate drainage design guide, City of York Council’s Sustainable Drainage Systems Guidance for Developers which should be consulted to further inform resilient design of developments.

1. Introduction and Background

1.1 Terms of Reference

AECOM has been commissioned to review and revise the Level 1 and Level 2 (where necessary) Strategic Flood Risk Assessments (SFRA) for its administrative area. This report comprises the updated Level 1 SFRA.

1.2 Project Background

The National Planning Policy Framework[1] (NPPF) and associated Planning Practice Guidance for Flood Risk and Coastal Change (PPG)[2] emphasise the active role Local Planning Authorities (LPAs) should take to ensure that flood risk is understood and managed effectively and sustainably throughout all stages of the planning process. The NPPF outlines that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and LPAs should use the findings to inform strategic land use planning.

In 2013 City of York Council's Flood Risk Management Team finalised the existing Strategic Flood Risk Assessment[3] for the City of York. Since the preparation of that report, there have been a number of further changes in legislation and guidance relating to planning and flood risk such as the introduction of the NPPF and updated climate change guidance. The introduction of the NPPF, has replaced Planning Policy Statements (PPS), which covered all aspects of national planning policy. The accompanying technical guidance document relating to flood risk, originally derived from the PPS documents has also been recently replaced by the PPG.

The Flood and Water Management Act (FWMA) attained royal assent in 2010, with the intention of enabling the provision of more effective flood management. As such, City of York Council is designated a Lead Local Flood Authority (LLFA) and has significant duties and powers in relation to flooding from local sources, specifically surface water, groundwater and ordinary watercourses. The Environment Agency retains responsibility for leading and coordinating the management of flood risk associated with main rivers and the sea.

As well as legislative and planning policy changes, a number of new and revised datasets have been made available since the release of the previous SFRA in 2013. The Environment Agency has undertaken revised modelling of the River Ouse and River Foss for City of York Council's administrative area which was finalised in 2016). In addition, Environment Agency national surface water flood risk mapping, the Risk of Flooding from Surface Water Map (RoFSW) has been released by the Environment Agency for use by LPAs in SFRAs. City of York Council also have a new Local Flood Risk Management Strategy[4] (LFRMS) (2015) document which has been used to inform this revised SFRA. City of York Council have also published a Local Flood Risk Management Strategy (LFRMS) (2015) document which has been used to inform this revised SFRA, an updated LFRMS will be published later in 2022, the revisions will further support this review and have been considered in it's preparation.

The purpose of the revised Level 1 SFRA is to collate and analyse the most up to date readily available flood risk information for all sources of flooding, to provide an overview of flood risk issues across the study area. This will be used by City of York Council to inform the application of the Sequential Test for future site allocations.

The NPPF sets stringent tests to protect people and property from flooding which all LPAs are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed. The main steps to be followed can be summarised as **Assess**, **Avoid** and **Manage and Mitigate** flood risk. These steps are set out below and are designed to ensure that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.

[1] Department for Communities and Local Government. 2021. *National Planning Policy Framework*. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[2] Department for Communities and Local Government.(2021) . *Planning Practice Guidance: Flood Risk and Coastal Change.* Available at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
[3] City of York Council (2013) City of York Strategic Flood Risk Assessment Revision 2 (March 2013)
[4] City of York Council. *Local Flood Risk Management Strategy.* Available at: https://www.york.gov.uk/downloads/file/3120/local_flood_risk_management_strategypdf

Assess Flood Risk	As the LPA, City of York Council should undertake a **SFRA** to fully understand the flood risk in the area to inform Local Plan preparation. For sites in areas at risk of flooding, or with an area of 1 hectare or greater, developers must undertake a **site-specific Flood Risk Assessment** (FRA) to accompany planning applications (or prior approval for certain types of permitted development).
Avoid Flood Risk	City of York Council should apply the **sequential approach** to site selection so that development is, as far as reasonably possible, located where the risk of flooding from all sources is lowest, taking account of climate change and the vulnerability of future users to flood risk. In **plan-making this involves applying the Sequential Test**, and where necessary the **Exception Test** to Local Plans, as described in Figure 1. In **decision-taking this involves applying the Sequential Test** and if necessary, the **Exception Test** for specific development proposals.
Manage and Mitigate	Where alternative sites in areas at lower risk of flooding are not available, it may be necessary to locate development in areas at risk of flooding. In these cases, City of York Council and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development and will not increase flood risk overall. City of York Council and developers should seek flood risk management opportunities (e.g. safeguarding land), and to reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems).

1.3 SFRA Deliverables

The Level 1 SFRA Report has been is structured as follows:

- Section 1: Description of Study Area and Partner Organisations
- Section 2: Legislative and Planning Policy Context;
- Section 3: Level 1 SFRA Assessment Methodology;
- Section 4: Level 1 Assessment of Flood Risk;
- Section 5: Avoiding Flood Risk – Applying the Sequential Approach;
- Section 6: Flood Risk Management Measures;
- Section 7: Guidance for Preparing Site Specific FRAs;
- Section 8: Next Steps;
- Appendix A: Data Register;
- Appendix B: Level 1 SFRA Flood Risk Mapping Figures; and
- Appendix C: Flood Risk Management Policy Recommendations.

Section 4 provides a strategic assessment of flood risk from all sources across City of York Council's administrative area. The figures included within Appendix B should be referred to when reading this Section.

Section 5 provides guidance on the application of the Sequential Test by City of York Council when allocating future development sites as part of the plan-making process, as well as by developers promoting development on windfall sites. The strategic assessment of flood risk presented in Section 4 will inform the Sequential Test carried out by City of York Council. The datasets presented in Section 4 have been used to prepare a site assessment database for City of York Council, detailing the flood risk at each of their potential development sites to enable comparison of sites throughout the application of the Sequential Test.

Section 6 provides guidance on the Flood Risk Measures that can be used after the Sequential Test to mitigate flood risk where alternative sites in areas at lower risk of flooding are not available and it is necessary to locate development in areas at risk of flooding. In these cases, City of York Council and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development and will not increase flood risk overall.

Section 7 provides guidance for prospective developers and City of York Council on the contents of a site-specific FRA. It should be noted that this document is strategic in nature and only provides an overview of flood risk within City of York Council's administrative area. This document should be used as a starting point for developers and City of York Council Development Management Officers and read alongside City of York Council's Sustainable Drainage Systems Guidance for Developers to gain an understanding of flood risk across the City. City of York Council should ensure that each planning application is supported by an appropriate site-specific FRA, where required by the NPPF, PPG and this Level 1 SFRA.

Section 8 presents the next steps for City of York Council following completion of the Level 1 SFRA.

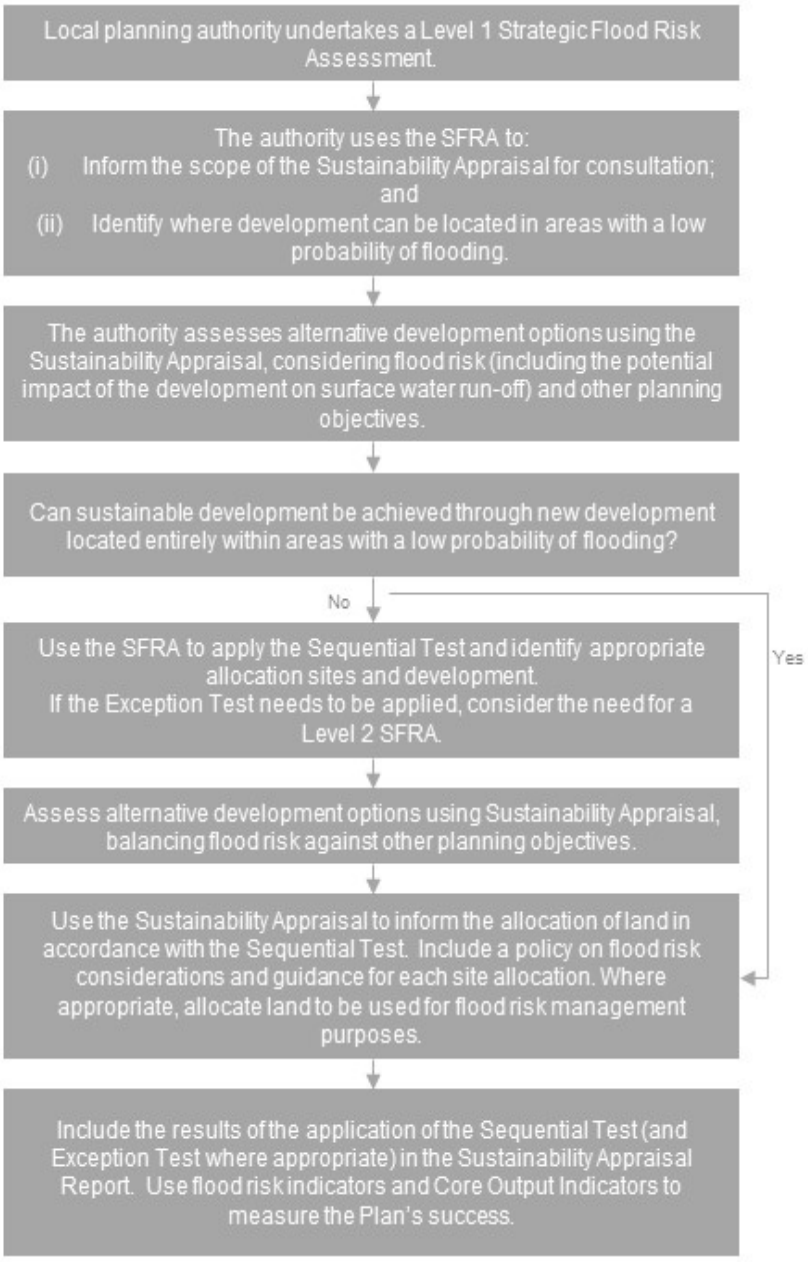


Figure 1. Taking flood risk into account in the preparation of a Local Plan (PPG, p6)

1.4 Partner Organisations

There are several organisations involved in development and flood risk management across the study area. These are identified below:

City of York Council is the LPA for the study area and is a statutory consultee in the planning system in England and Wales. The role of local councils in the planning process covers an array of responsibilities, which include:

- influencing decisions and policies;
- developing city/town/parish plans;
- identifying potential sites for affordable housing; and
- leading community engagement in implementation projects.

All councils have a statutory duty to produce a Local Plan. A Local Plan sets strategic priorities for the whole city, forms the basis for planning decisions and must be reviewed at regular intervals to keep it up to date. City of York Council's Local Plan is currently under Examination following submission for independent Examination on 25 May 2018. This was prepared to be NPPF 2012 compliant and is currently being examined under transitional arrangements[5] (against NPPF 2012). In advance of adoption, decision-making can afford weight to policies in the emerging plan in accordance with paragraph 48 of the NPPF (2021).

Adopting a Local Plan is important to provide a spatial strategy for growth to ensure the economic, social and environmental requirements over the plan period are delivered. To meet identified need, the Local Plan sets out overarching strategic policies as well as detailed policies against which applications will be judged. Additionally, the plan aims to deliver 600 jobs per annum and 867 homes per annum over the plan period 2017-2033, and beyond. To meet this requirement the plan identifies approximately 480 hectares of land for housing and 57 hectares of land for employment across strategic allocations (over 5 hectares) and general housing and employment allocations (under 5 ha).

As the designated LLFA under the FWMA, City of York Council has a duty to lead and coordinate the management of local flood risk, which includes flood risk from surface water, groundwater and ordinary watercourses. Main River and coastal flooding remain the responsibility of the Environment Agency.

City of York Council is also a statutory consultee for surface water drainage in its capacity as the LLFA and is required to assess applications for the provision of surface water drainage for all major developments. LPAs should ensure Sustainable Drainage Systems (SuDS) are incorporated, unless there is clear evidence that this would be inappropriate, and that through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

In addition, under the Civil Contingencies Act, City of York Council has emergency planning functions during flood events as a Category 1 responder.

The **Environment Agency** is a statutory and non-statutory consultee in the planning system in England and Wales. As an advisor to government, the Environment Agency influences and informs planning legislation and planning policy.

Further to this, as an advisor and consultee to regional and local planning authorities, the Environment Agency promotes sustainable development by providing environmental evidence advising on:

- draft strategies;
- development plans and other strategic frameworks;
- environmental assessments;
- monitoring planning applications; and
- reporting on environmental performance.

On the individual development level, the Environment Agency is a statutory consultee for all developments in Flood Zones 2 and 3, unless covered by Environment Agency Standing Advice. The Environment Agency is consulted for expert technical advice on around 50 higher-risk planning applications and pre-planning enquiries in York per

[5] See Para 214 - Department for Communities and Local Government. 2019. *National Planning Policy Framework*. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2

annum, and any developer wishing to develop a site in Flood Zones 2 or 3 should contact the Environment Agency to determine the precise requirements of a FRA.

Within City of York Council, the Environment Agency has operational responsibility for managing flood risk associated with Main Rivers and reservoirs and is a statutory consultee for any development, other than minor development, proposed within Flood Zone 2 or 3, works in the bed of or within 8m of a bank of Main River. The Environment Agency is continually improving and updating their flood map for main rivers[6] and has permissive powers to carry out flood defence works, maintenance and operational activities for these main rivers under the Water Resources Act. However, overall responsibility for maintenance lies with the riparian owner. Further information outlining the rights and responsibilities of riparian landownership is provided in the Environment Agency's 'Owning a watercourse'[7] guidance.

As part of taking a strategic overview for all sources of flooding the Environment Agency are involved in strategic flood risk mapping projects, such as the national mapping of surface water flood risk. The Environment Agency also has a key role in allocation of funding for flood and coastal erosion risk management projects.

Yorkshire Water Services Ltd has a duty as a statutory undertaker to provide clean and wastewater services across the City and is responsible for the management, maintenance and operation of flood control structures associated with their operational sources. Water Companies are defined as a Risk Management Authority (RMA) within the FWMA and are responsible for flood risk management functions in accordance with the Water Resources Act 1991 and the Land Drainage Act 1991. As part of this role they are required to make sure their systems have the appropriate level of resilience to flooding, maintain and manage their water supply and sewerage systems to manage the impact and reduce the risk of flooding and provide advice to LLFAs on how water and sewerage company assets impact on local flood risk.

Yorkshire Water Services Ltd is responsible for surface water drainage from development via adopted sewers and for maintaining trunk sewers into which many of the highway drainage assets in the study area connect.

Internal Drainage Boards are independent public bodies responsible for managing water levels and reducing the risk from flooding within their districts. Each Internal Drainage Board (IDB) operates within a defined area, known as a Drainage District. They are made up of elected members who represent land occupiers, and others nominated by local authorities who represent the public and other interest groups. Under the Land Drainage Act 1991, each IDB exercises a general power of supervision over all matters relating to water level management within its district. IDBs also have a series of bylaws relating to the management of watercourses and can designate features and structures within their district which relate to managing flood risk.[8]

IDBs are not statutory consultees in the Planning Application process undertaken by the Local Planning Authority. However, IDBs will endeavor to make comment on Planning Applications in relation to Land Drainage Act 1991 Section 23 and Section 66 (byelaws) related consent requirements.

The following IDBs are located within City of York Council's administrative area:

- **Kyle and Upper Ouse IDB** - covering the north west of York extending into the Hambleton District Council area with the River Ouse as its western boundary. It includes Burdyke and Blue Beck upstream of the lengths designated as Main River;
- **Ainsty (2008) IDB** - covering the west and south west of York, extending into the Harrogate Borough and Selby District Council areas, with the River Ouse as its eastern boundary. It includes Holgate Beck upstream of the length designated as Main River;
- **Ouse and Derwent IDB** - covering an area south and east of York extending into the Selby District Council area with the River Ouse forming its western boundary and the River Derwent its eastern boundary. It includes non-main river watercourses Elvington Beck, Germany Beck and Tunnel Drain; and
- **Foss (2008) IDB** - covering an area centred on the River Foss north of York extending into the East Riding of Yorkshire area. It includes Tang Hall and Osbaldwick Becks upstream of the lengths designated as Main River, and also non-Main River watercourses Westfield Beck and part of South Beck.

[6] Environment Agency Flood Map for Planning. Available at Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)
[7] Environment Agency (2018) Owning a watercourse. Available at https://www.gov.uk/guidance/owning-a-watercourse

[8] ADA. 2016. *Internal Drainage Boards.* Available at: http://www.ada.org.uk/about_idbs.html

Highways Authorities have a responsibility under the Highways Act 1980 for the effectual drainage of surface water from adopted roads and along major roads insofar as ensuring that drains, including kerbs, road gullies and ditches and the pipe network which connect to the sewers, are maintained.

1.5 Study Area

The study area, as shown in Figure 2, covers an area of approximately 275 km^2 and is defined by the administrative boundary of City of York Council, which is bordered to the north, west and south by North Yorkshire County Council. The River Derwent forms the eastern boundary with the East Riding of Yorkshire Council.

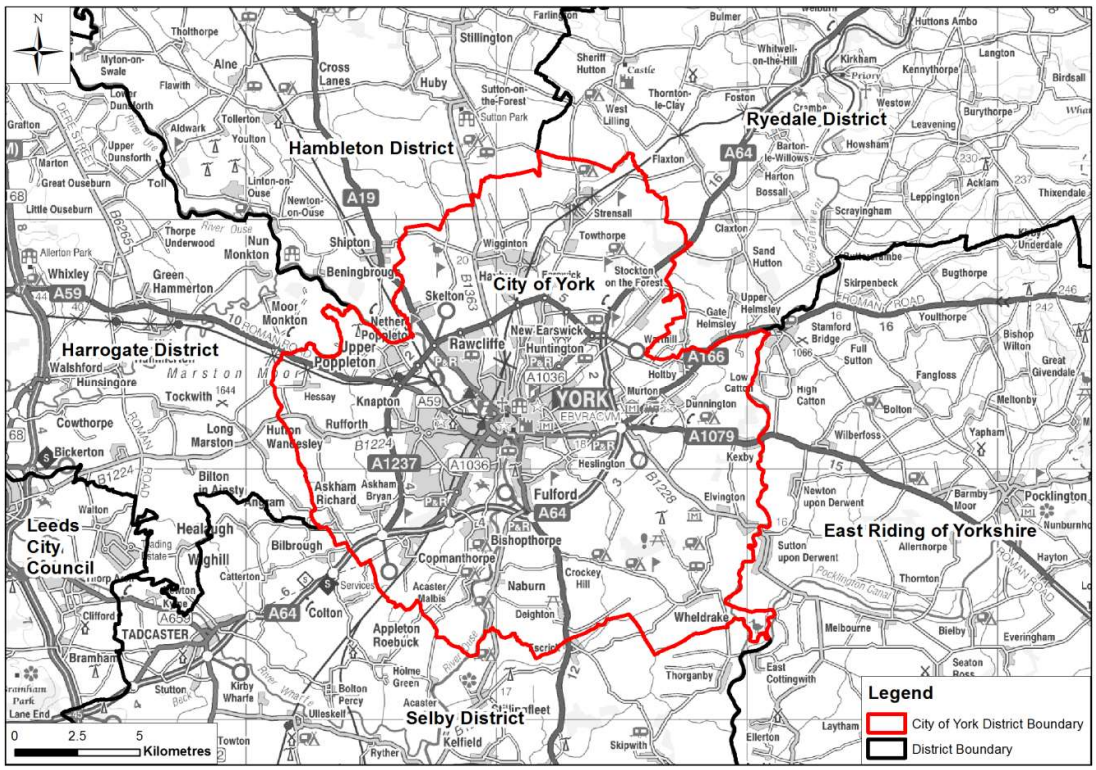


Figure 2. City of York Council Study Area

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 centred on the two largest settlements of York and Selby.

1.6 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. Topographic data for City of York Council's administrative area is presented in Appendix B, Figure 1.

1.7 Geology and Hydrogeology

British Geological Survey maps show the bedrock in the study 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.

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.

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.

1.8 Watercourses

The City of York sits astride the confluence of the River Ouse and the River Foss, and the River Derwent forms the eastern boundary of City of York Council's administrative area with East Riding of Yorkshire Council, as shown on Figure 2. These rivers drain three catchments, the Yorkshire Dales, the Howardian Hills and the North York Moors respectively. A more detailed illustration of the Main River and Ordinary Watercourses network is presented in Appendix B, Figure 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. Water levels in the River Ouse are controlled at Naburn Lock and weir, downstream of which the watercourse is tidal. The River Wharfe joins the Ouse at Kelfield just south of the York boundary. The catchment extends across the majority of the City of York boundary, covering approximately 243.8 km^2 (90%) of the study area. The Ouse has the following main tributaries within the York boundary:

- **Blue Beck** - draining residential and commercial development in Rawcliffe and Clifton Moor north west of the city, the responsibility of Kyle and Upper Ouse IDB to Rawcliffe Lake. The lake is the responsibility of Yorkshire Water and its level is controlled by them. Downstream of this to the Ouse Blue Beck is Main River;
- **Holgate Beck** - draining residential development in Woodthorpe, Acomb and Holgate west of the city to the north of Hob Moor, the responsibility of Ainsty (2008) IDB. Downstream of this point to the Ouse is main river including Holgate Beck pumping station;
- **Burdyke** - draining residential and commercial development in Clifton north of the city, to the south of Bootham Stray, the responsibility of Kyle and Upper Ouse IDB. Downstream of this point to the Ouse is main river, including Burdyke pumping station; and
- **Germany Beck** - draining residential development in parts of Heslington and Fulford including the existing and new university campuses, along with agricultural land east of the city to the River Ouse south of Fulford. The entire length is the responsibility of Ouse and Derwent IDB.

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

River Foss – Known as the River Foss along its whole length, the watercourse is designated as Main River from just upstream of Yearsley Bridge (OS NGR 6097 5393) to its downstream extent at the confluence with the River Ouse, a distance of approximately 3 km, above this point the river is in the area managed by the Foss IDB. The watercourse is the third largest river within York and has the following main tributaries:

- **Westfield Beck** - drains relatively flat areas of residential development in Haxby, Wigginton and New Earswick north of the city to join the Foss south of New Earswick. This is the responsibility of Foss (2008) IDB. Westfield Beck pumping station, owned by YWS, diverts excess flows from the Haxby and Wigginton catchments to the river Foss to protect the downstream village of New Earswick from flooding;
- **South Beck** – draining Monk's Cross Retail Park and residential development in Huntington north east of the city. The upstream of length is the responsibility of Foss (2008) IDB and final 350 m to the Foss is the responsibility of City of York Council;
- **Tang Hall Beck** - draining residential development in Tang Hall and agricultural land in the upper catchment around Stockton on Forest north east of the city, the responsibility of Foss (2008) IDB to the outskirts of Heworth. Downstream is Main River; and
- **Osbaldwick Beck** - draining residential development in Osbaldwick and agricultural land in the upper catchment around Holtby and Murton east of the city, the responsibility of Foss (2008) IDB to the outskirts of Tang Hall. Downstream is Main River.

The River Derwent – the second largest river within York covers an area of 27.2km^2 (10%) of the study area. The River Derwent acts as the eastern boundary of the City of York LLFA. Within the York boundary, **Elvington Beck** at Elvington drains into the Derwent. This drains relatively flat areas of residential development and agricultural land to the west of the village of Elvington, including part of the former airfield which is now in commercial and leisure use. The entire length is in the area managed by the Ouse and Derwent IDB including the pumping station at the confluence of the beck and the River Derwent.

2. Legislative and Planning Policy Context

2.1 Introduction

This Section provides an overview of the legislative and planning policy context specific to the updated Level 1 SFRA for the City of York. The information presented in the SFRA should be used by City of York Council to establish robust policies in relation to flood risk as part of their emerging Local Plan and used to guide responses to applications for development within areas of flood risk.

2.2 Flood and Water Management Act 2010

In response to the severe flooding across large parts of England and Wales in summer 2007, the Government commissioned Sir Michael Pitt to undertake a review of current flood risk management practices. The Pitt Review – Learning Lessons from the 2007 Floods[9], and subsequent progress reviews outlined the need for changes in the way the UK is adapting to the increased risk of flooding and the role different organisations have to deliver this function.

The FWMA enacted by Government in response to The Pitt Review in 2010 designated Councils and Unitary Authorities such as City of York Council as LLFAs. As a LLFA, City of York Council has responsibilities to lead and co-ordinate local flood risk management. Local flood risk is defined as the risk of flooding from surface water runoff, groundwater and ditches and watercourses (collectively known as ordinary watercourses).

The FWMA also formalises the flood risk management roles and responsibilities of other organisations including the Environment Agency, water companies and highways authorities establishing them as RMAs. The responsibility to lead and co-ordinate the management of tidal and fluvial flood risk remains that of the Environment Agency.

2.2.1 National Flood and Coastal Erosion Risk Management Strategy for England

In accordance with the FWMA, the Environment Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England[10]. Whilst this strategy has been developed by the Environment Agency, it provides a framework for the work of all flood and coastal erosion risk management authorities. The first strategy was published in 2011, the strategy was updated in 2020.

It sets the context for, and informs the production of, local flood risk management strategies by LLFAs, which will in turn provide the framework to deliver local improvements needed to help communities manage local flood risk. It also builds on Governments 25 Year Environment Plan by incorporating a stronger approach to making nature part of the solution and to support an integrated approach to land management to better support flood risk management needs. It has 3 long-term ambitions:

- climate resilient places: working with partners to bolster resilience to flooding and coastal change across the nation, both now and in the face of climate change
- today's growth and infrastructure resilient in tomorrow's climate: making the right investment and planning decisions to secure sustainable growth and environmental improvements, as well as infrastructure resilient to flooding and coastal change
- a nation ready to respond and adapt to flooding and coastal change: ensuring local people understand their risk to flooding and coastal change, and know their responsibilities and how to take action

[9] The Cabinet Office. 2008. *The Pitt Review: Learning Lessons from the 2007 Floods.* Available at: http://webarchive.nationalarchives.gov.uk/20100807034701/http:/archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf

[10] Environment Agency (2020). National Flood and Coastal Erosion Risk Management Strategy for England. Available at: https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england--2

The Environment Agency's 'Flood and coastal risk projects, schemes and strategies: climate change allowances' guidance[11] was published in July 2020. The 2020 version of the guidance reflects an assessment completed by the Environment Agency using the UK Climate Projections (UKCP) data to produce more representative climate change allowances for river flood flows and extreme rainfall for each of the river basin districts in England. It is essential that land use planning decisions consider the impact of a changing climate where appropriate both now and into the future. Further information is presented in Section 4.2.9.

2.2.2 Local Flood Risk Management Strategy (LFRMS)

City of York Council's Local Flood Risk Management Strategy[12] was created in partnership with the Environment Agency and other risk management authorities and through consultation with residents. The strategy is a legal document which provides a framework for addressing flood risk and links to existing key information in six guidance documents. The development, maintenance and implementation of the strategy for the management of local flood risk is a statutory duty of City of York Council, as a LLFA under the FWMA.

The LFRMS defines how City of York Council, in partnership with other organisations who also have statutory roles, will seek to manage flood risk across their area. The strategy focuses on flood risk from all sources, rivers, surface runoff, ordinary and groundwater. The strategy aims to understand flood risk from all sources in the city, reduce its likelihood and impact on residents and visitors and take the opportunity to improve the city environment. It is a living document which will provide an ongoing comprehensive framework for managing York's flood risk. The strategy has drawn on existing plans and knowledge to form an understanding of the various flood risks, what management is already in place and where risk remains a concern.

2.2.3 Surface Water Management Plan

A Surface Water Management Plan (SWMP) was prepared for City of York Council in December 2012[13]. A SWMP is a plan which outlines the preferred surface water management strategy in a given location. In this context surface water flooding describes flooding from sewers, drains, groundwater, and runoff from land, small water courses and ditches that occurs as a result of heavy rainfall.

The objectives of the SWMP are to:

- Achieve a clear understanding of the causes of flooding at each location investigated.
- Gain a record of the infrastructure serving the location and its condition and ownership.
- Provide a validation of the EA Flood Map for Surface Water.
- Provide recommendations for future maintenance to prevent a repetition of the problem.
- Achieve an understanding of how representative the findings are of the situation citywide.
- Provide recommendations for further investigation.
- Provide recommendations for further work.
- Provide advice and information to local authority planners.

Where appropriate, the findings of the SWMP have been referred to within this Level 1 SFRA.

2.2.4 Yorkshire Regional Flood and Coastal Committee (RFCC)

City of York Council falls within the Yorkshire Regional Flood and Coastal Committee (RFCC) area. The RFCC is a committee established by the Environment Agency under the FWMA 2010 that brings together members appointed by LLFAs (such as City of York Council) and independent members with relevant experience for 3 purposes:

- To ensure there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines;
- To encourage efficient, targeted and risk-based investment in flood and coastal erosion risk management that represents value for money and benefits local communities; and,

[11] Environment Agency. 2020. *Flood and coastal risk projects, schemes and strategies.* Available at: https://www.gov.uk/guidance/flood-and-coastal-risk-projects-schemes-and-strategies-climate-change-allowances
[12] City of York Council. *Local Flood Risk Management Strategy*. Available at: https://www.york.gov.uk/downloads/file/3120/local_flood_risk_management_strategypdf
[13] City of York Council. *Surface Water Management Plan*. Available at: http://democracy.york.gov.uk/documents/s77948/SWMP%20final.pdf

- To provide a link between the Environment Agency, LLFAs, other risk management authorities, and other relevant bodies to build understanding of flood and coastal erosion risks in its area.

2.3 Flood Risk Regulations 2009

As well as the duties under the FWMA to prepare LFRMS, LLFAs have legal obligations under the EU Floods Directive,[14] which was transposed into UK Law through the Flood Risk Regulations 2009[15] ('the Regulations').

2.3.1 Preliminary Flood Risk Assessment

Under the Regulations, all LLFAs were required to prepare a Preliminary Flood Risk Assessment (PFRA) report in 2011, which will be subsequently due for renewal on a 6-yearly cycle, see below. The PFRA is a high-level screening exercise to identify areas of significant risk as 'Indicative Flood Risk Areas' across England where 30,000 people or more are at risk from flooding for reporting to Europe.

A PFRA was prepared for City of York Council in July 2011[16]. The PFRA seeks to provide a high-level overview of flood risk from local flood sources and includes flooding from surface water, groundwater, ordinary watercourses, and canals. It excludes flood risk from Main Rivers, the sea and reservoirs, as these are assessed nationally by the Environment Agency. The PFRA report looks at past flooding and where future flooding might occur across the area and the consequences it might have to people, properties and the environment. The report provides a useful baseline in the preparation of this revised Level 1 SFRA.

In 2017 the 2011 PFRA was reviewed by the Environment Agency to revisit if there had been significant updates to flood risk understanding within the York LLFA area. The understanding of flood risk within York LLFA area was determined not to have changed and therefore the PFRA written in 2011 still applies.

2.3.2 Humber River Basin District Flood Risk Management Plan 2015 – 2021

Under the Regulations, the Environment Agency is required to prepare FRMPs for all of England covering flooding from main rivers, the sea and reservoirs. As such, the Humber FRMP[17] has been published by the Environment Agency and sets out the proposed measures to manage flood risk in the Humber River Basin District (RBD) from 2015 to 2021 and beyond. The Humber FRMP for 2021 to 2027 is anticipated in Autumn 2022.

FRMPs explain the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs. FRMPs set out how risk management authorities will work with communities to manage flood and coastal risk over the period 2015-2021. Risk management authorities include the Environment Agency, local councils, internal drainage boards, Highways England and LLFAs.

Each river basin district also has a river basin management plan, which looks at how to protect and improve water quality and use water in a sustainable way. FRMPs and river basin management plans work to a 6-year planning cycle. The current cycle is from 2015 to 2021, work is currently underway to revise the plans and all supporting assessments. The Humber FRMP has been developed alongside the Humber River Basin Management Plan (RBMP). Both flood risk management and river basin planning form an important part of a collaborative and integrated approach to catchment planning for water. The Humber RBD FRMP draws on existing policies and actions within reports and plans which have been prepared in the past such as the Ouse and Derwent Catchment Flood Management Plans (CFMP).

2.3.3 Catchment Flood Management Plans

A CFMP is a high-level strategic planning document that provides an overview of the main sources of flood risk and how these can be managed in a sustainable framework for the next 50 to 100 years. The Environment Agency engages stakeholders within the catchment to produce policies in terms of sustainable flood management solutions whilst also considering local land use changes and effects of climate change. Whilst not entirely superseded by the FRMP, CFMPs complement the later FRMPs and RBMPs prepared for the District and region respectively.

[14] Flood risk management - Water - Environment - European Commission (europa.eu)
[13] Environment Agency. 2009. *Flood Risk Regulations*. Available at: The Flood Risk Regulations 2009 (legislation.gov.uk)e
[16]City of York Council, 2011. *Preliminary Flood Risk Assessment*. Available at: http://democracy.york.gov.uk/documents/s50981/Annex%201%20Preliminary%20Flood%20Risk%20Assessment.pdf
[17] Environment Agency. 2016. *Humber River Basin District Flood Risk Management Plan 2015 to 2021*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500465/Humber_RBD_Part_1_river_basin_management_plan.pdf

City of York Council falls within the Environment Agency's CFMP area for the River Ouse[18] and the River Derwent[19], where the visions and preferred policy for these areas are:

- Ouse Catchment Sub Areas 4, Policy Option 5: "Areas of moderate to high flood risk where further action can be taken to reduce flood risk"; and
- Derwent Catchment Sub Area 6, Policy Option 3: "Areas of low to moderate flood risk where existing flood risk is generally managing effectively".

2.4 National Planning Policy Framework

The NPPF[1] is a framework within which councils and local people can produce local and neighbourhood plans that reflect the needs and priorities of their communities. The applicable paragraphs of the NPPF (2021) state:

"161 All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

a) applying the sequential test and then, if necessary, the exception test as set out below;

b) safeguarding land from development that is required, or likely to be required, for current or future flood management;

c) using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management); and

d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

162 The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding

The NPPF (2021) goes on to confirm

163 If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.

164. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. To pass the exception test it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

165. Both elements of the exception test should be satisfied for development to be allocated or permitted."

Further detail regarding the Sequential and Exception Tests is included in Section 5 of this report.

[18] Environment Agency. 2010. *River Ouse Catchment Flood Management Plan.* Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/289228/River_Ouse_Catchment_Flood_Management_Plan.pdf
[19] Environment Agency. 2010. *River Derwent Catchment Flood Management Plan.* Available at: River Derwent: Catchment flood management plan - GOV.UK (www.gov.uk)

2.4.1 Planning Practice Guidance

The NPPF[1] is supported by a series of Planning Practice Documents referred to as the PPG. The PPG: Flood Risk and Coastal change guidance[2] outlines how LPAs should develop and use SFRAs, (as follows):

- Determine the variations in risk from all sources of flooding across an area, and also risks to and from surrounding areas in the same flood catchment, both in the present day, and in the future. The impacts of climate change should be considered when assessing future flood risk;
- Inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparations of plan policies, including policies for flood risk management to ensure that flood risk is not increased;
- Apply the Sequential Test and, where necessary, the Exception Test when determining land use allocations;
- Identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river and sea flooding;
- Determine the acceptability of flood risk in relation to emergency planning capability;
- Consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water.

SFRAs should be prepared in consultation with the Environment Agency, lead local flood authorities, local planning authorities' own functions of emergency response and drainage authority under the Land Drainage Act 1991 – and where appropriate , internal drainage boards.

2.4.2 NPPF Guidance SuDS Policy (April 2015)

SuDS are an approach to managing direct rainwater and surface water that replicates natural drainage, the key objectives being to manage flow rate and volume of runoff to reduce risk of flooding and water pollution. LPAs such as City of York Council should ensure Sustainable Drainage Systems (SuDS) are incorporated (unless there is clear evidence that this would be inappropriate) for all major developments, and that through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

As a LLFA, City of York Council is also a statutory consultee for SuDS applications and will need to be consulted on the drainage elements of planning applications for major development to ensure they conform to necessary national and local SuDS standards. The legislation also encourages the use of SuDS in minor developments. City of York Council produced a sustainable drainage systems guidance document[20] in 2018 which provides advice to developers on how SuDS should be delivered. This guidance should be referred to as part of consulting with City of York Council whilst considering drainage elements during planning applications.

2.5 Summary

Figure 3 provides a summary of the key documents that are reviewed within this section. The figure demonstrates that the main driver for the SFRA is the NPPF and highlights the multi partnership approach to flood risk management across City of York Council's administrative area. Documents and plans prepared by both the Environment Agency and City of York Council under the requirements of the FWMA and the Flood Risk Regulations provide key inputs to inform the preparation of the revised SFRA and City of York Council's new Local Plan.

[20] City of York Council. 2018. *Sustainable Drainage Systems Guidance for Developers,* Available at: https://www.york.gov.uk/downloads/file/2724/sustainable-drainage-systems-guidance-for-developers

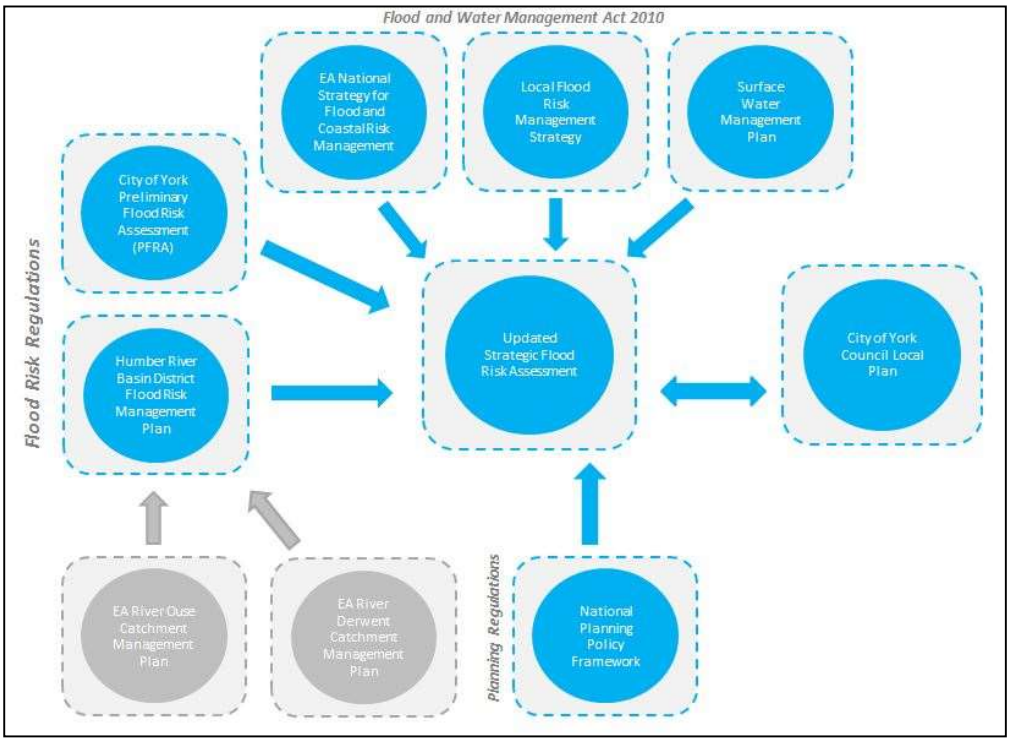


Figure 3. Summary of Legislative and Planning Landscape

3. Level 1 SFRA Methodology

The Level 1 SFRA is a desk-based study, using readily available existing information and datasets to enable the application of the Sequential Test and to identify where the Exception Test may be required. The main tasks in preparing the Level 1 SFRA are described below.

3.1.1 Establishing relationships and understanding the planning context

An inception meeting was held to facilitate relationships between the project team, City of York Council and the Environment Agency to aid collaborative working and enable the free exchange of available information and datasets. City of York Council provided an overview of the current planning context with respect to the preparation of the new Local Plan and the main flood risk issues in the area were identified and discussed.

3.1.2 Gathering data and analysing it for suitability

Under Section 14 of the NPPF[1], the risk of flooding from all sources must be considered as part of a Level 1 SFRA, including flooding from tidal sources, rivers (fluvial), land (overland flow and surface water), groundwater, sewers and artificial sources.

In order to provide this assessment of all sources of flooding in the study area, an extensive set of datasets was requested from a number of organisations, including City of York Council, the Environment Agency and Yorkshire Water.

Datasets and information gathered as part of the preparation of the first iteration of the SFRA have been retained where appropriate. In preparation of this assessment, a number of stakeholder datasets were obtained and collated prior to a quality review and gap analysis. This information was then used to establish the most recent and technically robust datasets. Further details relating to this exercise can be found within Appendix A.

3.1.3 Producing strategic flood risk maps, GIS deliverables and a technical report

A series of GIS maps have been produced based using the data gathered during the study. The mapping deliverables are summarised in Table 1 (and presented in Appendix B) and should be referred to when reading Chapter 4 ‘Level 1 Assessment of Flood Risk’ which provides an overview of flood risk across the study area.

Table 1. Strategic Flood Risk Assessment Maps

Figure No.	Figures Title and Content
Figure 1	Elevation *(Administrative Boundaries, LiDAR topography, Main River)*
Figure 2	Catchment Flood Management Area *(Catchments, watercourses, waterbodies)*
Figure 3	Bedrock Geology
Figure 4	Aquifer Designation - Bedrock
Figure 5	Superficial Geology
Figure 6	Aquifer Designation – Superficial Geology
Figure 7A-7J	Environment Agency Recorded Flood Outlines
Figure 8A – 8J	Environment Agency Flood Map For Planning *(Watercourses, Flood Zones, flood defences, flood storage areas)*
Figure 9A- 9J	Climate Change (Proxy) - Undefended Scenario
Figure 10A-10J	Climate Change (Proxy) - Defended Scenario
Figure 11A- 11J	Environment Agency Risk of Flooding from Surface Water *(RoFSW, watercourses)*
Figure 12	Areas Susceptible to Groundwater Flooding *(Potential groundwater flooding areas, groundwater flood records)*
Figure 13	Risk of Flooding from Reservoirs
Figure 14A-14J	Environment Agency Flood Warning and Flood Alert Areas *(Flood Warning and Flood Alert Areas)*

4. Level 1 Assessment of Flood Risk

4.1 Introduction

This Section provides the strategic assessment of flood risk across the City from each of the sources of flooding outlined in the NPPF[1]. For each source of flooding, the datasets used for the assessment are described, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This section should be read in conjunction with the figures provided in Appendix B.

Tidal Flooding

York has a long history of flooding, with written records of floods stretching back as far as the 13th-century. Before Naburn Lock was built there was some tidal effect seen in the city, but this was relatively small, and the predominant flood risk has always been fluvial as a consequence of high flows coming down the River Ouse through the study area.

4.2 Flooding from Main Rivers

4.2.1 Sources

To enable the assessment of flood risk in York, along with the effects on present and future development. The Main Rivers passing through the study area are as follows:

- The River Ouse;
- The River Foss;
- The River Derwent;
- The Blue Beck;
- The Burdyke;
- The Tang Hall Beck;
- The Osbaldwick Beck;
- The Holgate Beck;
- The Beck; and
- The Fleet.

Appendix B Figure 2 shows the location of these rivers passing through City of York Council's boundary. Further information for each watercourse is summarised in Section 1.8.

4.2.2 NPPF Flood Zones

The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 2.

The 'Flood Map for Planning (Rivers and Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain. The 'Flood Map for Planning (Rivers and Sea)' dataset is available on the Environment Agency website[21] and is the main reference for planning as it contains Flood Zones 1, 2 and 3a which are referred to in the NPPF and presented in Table 2.

[21] Environment Agency Flood Map for Planning (Rivers and Sea) http://apps.environment-agency.gov.uk/wiyby/37837.aspx

Table 2. Fluvial Flood Zone Definitions (extracted from the PPG, 2021)

Flood Zone	Fluvial Flood Zone Definition	Probability of Flooding
Flood Zone 1	Land having a less than a 0.1% Annual Exceedance Probability (AEP) (1 in 1,000 chance of flooding in any one year). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1% AEP (1 in 100 chance of flooding in any one year) and 0.1% AEP (1 in 1,000 chance of flooding in any one year). ***In addition, Flood Zone 2 typically includes the extent of historic flood events that have been verified by the Environment Agency, and displayed on the Recorded Flood Outline dataset.***	Medium
Flood Zone 3a	Land having a 1% AEP or greater (1 in 100 chance of flooding in any given year).	High
Flood Zone 3b	Land where water has to flow or be stored in times of flood. LPAs should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. ***Flood Zone 3b is not separately distinguished from Flood Zone 3a on the Flood Map for Planning.***	Functional Floodplain

The 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling (JFLOW). It is routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys, hydrological and/or hydraulic modelling (as described in Table 3) as well as previous flood events.

4.2.3 Functional Floodplain (Flood Zone 3b)

The Functional Floodplain is defined in the NPPF as 'land where water has to flow or be stored in times of flood'. The Functional Floodplain (also referred to as 'Flood Zone 3b'), is not separately distinguished from Flood Zone 3a on the Flood Map for Planning (Rivers and Sea). The extent of the Functional Floodplain should be defined within the SFRA by City of York Council as the LPA and LLFA in discussion with the Environment Agency.

The PPG states that the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood during a 5% AEP or greater event or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% AEP) event should provide a starting point for consideration and discussions to identify the functional floodplain. The PPG does not provide any additional guidance on how to define the functional floodplain.

The PPG states that '*areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be defined as functional floodplain*'. There may be opportunities to reinstate areas which can operate as functional floodplain through the use of previously developed land adjacent to watercourses to provide space for flood water to reduce the risk to new and existing development.

The PPG recognises the importance of pragmatic planning solutions that will not unnecessarily blight areas of existing urban development. It may not be practical to refuse all future development within existing urban areas falling within land which would flood during a 5% AEP (1 in 20 year) event, therefore careful consideration must be given to future sustainability. The Sequential and Exception Tests must be applied to ensure development type is appropriate and the risks posed to and from the development are fully understood and mitigated.

For City of York Council's study area, the flood extent for the 5% AEP (1 in 20 year) flood event has been used as a starting point to delineate the Functional Floodplain where modelling is available. The following rivers[22] were included to define Flood Zone 3b:

[22] It is worth noting that this list includes rivers which are not classified as Environment Agency Main Rivers. All of these rivers were included and modelled in the strategic hydraulic models which cover the City of York administrative area.

- River Ouse;
- River Foss;
- Tang Hall Beck;
- Osbaldwick Beck;
- Westfield Beck;
- South Beck;
- Hurns Gutter;
- Germany Beck[23]

Where modelling data is not available, no Functional Floodplain extent is shown.

4.2.4 Hydraulic Modelling Studies

As discussed above, Table 3 provides a summary of the hydraulic modelling studies that have been undertaken within City of York Council's administrative area and have been used to inform the current 'Flood Map for Planning (Rivers and Sea)'. The hydraulic modelling is often completed to assess risks to specific communities or to develop flood mitigation options. As such the extent of the modelled areas and the scenarios covered (defended, undefended and return period) can differ between the studies.

Table 3. Summary of Hydraulic Modelling Studies completed across the City of York area

Watercourse	Modelling Study	Year
Ouse and Wharfe Washlands	An evaluation of the Ouse and Wharfe washlands was completed in 2018 by Mott MacDonald.	2018
River Ouse	Complete updated modelling for the River Ouse was finalised in 2016; this has been recalibrated following the Boxing Day flood event.	2016
River Foss	Complete updated modelling for the River Foss was finalised in 2016; this has been recalibrated following the Boxing Day flood event This model also includes the Westfield, Tang Hall and Osbaldwick Becks.	2016
Holgate Beck	Holgate Beck / Chaloners Whin, updated in 2016 by JBA.	2016
Ure and Tributaries	Hydraulic study of the River Ure and Tributaries from Westwick Weir to Skelton was completed in 2010 by Halcrow.	2010
Germany Beck	Detailed study of the Germany Beck watercourse was completed in 2006 by Halcrow.	2006
Burdyke	Burdyke (Detailed), from 120m upstream of the Sutton Way culvert to the Burdyke Pumping Station at the confluence with the River Ouse - Atkins.	2003

4.2.5 River Ouse

4.2.5.1 Historic Records

The City of York has numerous accounts of historical flooding associated with the rivers outlined above and historic flooding records exist for the River Ouse in York, dating back to 1263 AD. Figure 7 in Appendix B illustrates the flood extents as held by the Environment Agency 'Recorded Flood Outline Map'. Table 4 summarises details of recent historic flood events for the Ouse gathered through a review of flood studies and the Environment Agency Recorded Flood Outline Map. It should be noted that not all flooding events would have been recorded therefore this should not be considered a complete dataset.

Table 4. Recent Historic Fluvial Flooding along the River Ouse and Tributaries

Date	Description of flooding
1947	Flooding along the River Ouse in March 1947 due to channel capacity being exceeded. Flooding was caused primarily by the melting of a large volume of snow that had fallen across a prolonged cold spell in January and February that year.

[23] The flood extents associated with a 4% AEP undefended scenario was used on Germany Beck in the absence of 5% AEP model results

Date	Description of flooding
1968	Flooding along the River Ouse in March 1968 due to channel capacity being exceeded.
1978	Flooding along River Ouse in 1978 due to the overtopping of flood defences along the watercourse.
1982	Flooding along the River Ouse in January 1982 due to the overtopping of flood defences along the watercourses. Flooding was caused by a prolonged period of rain over the few weeks leading up to the flood event.
1991	Flooding along the River Ouse in February 1991 due to the overtopping of flood defences along the watercourses.
1995	Flooding along the River Ouse in January and February 1995.
2000	Flooding along the River Ouse in the Autumn of 2000 due to the overtopping of flood defences along the watercourses. Highest water level ever recorded on the River Ouse and there was widespread flooding of the river's major tributaries. This flood followed a period of extreme rainfall; the autumn of 2000 was the wettest since rainfall records began in 1766. Flood defences protected many areas, but there was flooding of 540 properties in York and a further 3,500 threatened. The A19 at Fulford was impassable for 9 days and affected many other major and minor roads.
2012	Flooding along the River Ouse in September 2012 due to channel capacity being exceeded. The River Ouse rose to a level of over 5 metres above normal, and the city's flood defences successfully protected more than 1,000 properties. There were however over 200 properties directly affected by flood water including residential properties at Leeman Road, Lower Ebor Street, Alma Terrace, Fulford and Naburn.
2015	Heavy rainfall through December 2015 (Storm Desmond at the start of December was followed by Storm Eva which in turn was followed by the average monthly rainfall for December falling within a 48 hour period) led to flooding in a number of communities, but the most severe and widespread flooding was seen between Boxing Day and New Year in York. Levels on the River Ouse rose above 5 metres, but there was also very heavy local rainfall over the Foss catchment. Over 600 properties were flooded during the event.
2019	Heavy rainfall in March 2019 led to flooding in York. The River Ouse peaked at 3.8m at the Viking Recorder in York City Centre.
2020	Storm Ciara and Storm Dennis in February 2020 caused flooding along the River Ouse.
2020	Hurricane Epsilon in October 2020 caused flooding along the River Ouse.
2021	Storm Christoph in January 2021 caused flooding along the River Ouse.
2022	Storm Franklin in February 2022 caused flooding along the River Ouse.

4.2.5.2 Flood Defences

Appendix B, Figure 8 details the locations of the existing flood defence assets protecting the people and property within City of York Council's administrative area from flooding.

York's flood defences are mainly located alongside vulnerable sections of the River Ouse, between Rawcliffe Ings and Rowntree Park, to protect property in areas where major flooding has occurred in the past. These flood defences include a variety of assets including earth embankments, brick or stone clad concrete flood walls and flood gates. Most of the defences also have flood-pump stations associated with them, to deal with surface water flows from the 'dry-side' of the defences. Existing flood defences are listed below from upstream to downstream:

- *Clifton Ings* - a formal washland located upstream of York, Clifton Ings, was created in 1982 from the natural floodplain by raising the existing embankments and new ones constructed to increase the volume of storage to 2.3 million cubic metres ($m^{3)}$. The Ings are controlled by sluice gates, and can reduce levels downstream in the centre of York by approximately 100mm for the 25% AEP event;
- *Lower Bootham Flood Alleviation Scheme* - implemented following the 1982 floods, it comprises a series of flood embankments and floodwalls from north of Burdyke Beck to Museum Gardens, a pumping station prevents the Burdyke Beck backing up and flooding when free discharge into the Ouse is not possible;
- *Water End Flood Alleviation Scheme* - constructed in 2013, the scheme comprises a floodwall running along the western side of Water End from the junction with Landing Lane to opposite properties on Forth Street, and a flood embankment runs south from Water End, to St. Barnabas Church of England Primary School. Holgate Beck Pumping Station prevents the River Ouse backing-up Holgate Beck;

- *North Street Flood Alleviation Scheme* - provides a line of defence from Lendal Bridge to Ouse Bridge. At Lendal Bridge a flood gate forms a seal across an opening in the bridge from which a floodwall extends south tying into property walls further downstream;
- *Lower Ebor Street* – a floodwall completed in protects Lower Ebor Street from flooding; and
- *Middlethorpe Ings* - like Clifton Ings, Middlethorpe Ings, located on the west bank of the River Ouse opposite Fulford, is a modified floodplain designed to store flood water and lower water levels in York.

Other infrastructure and assets such as: culverts, trash screens, penstocks, flap valves, “de facto” defences, etc. exist throughout York however; due to their small scale these existing assets have not been included on Appendix B, Figure 8.

Appendix B Figure 8 also outlines the Areas Benefitting from the Flood Defences described above. None of the Ouse defences offer protection against a 1% AEP flood event (1% AEP) however; large reaches of flood defences along the River Ouse can be seen to benefit York City Centre, Clifton and large areas of agricultural land to the south of Naburn. An extensive programme of defence improvements is currently underway, the Areas Benefitting from Flood Defences mapping will be updated on completion and Appendix B will be revised accordingly.

4.2.5.3 Historic Records

Figure 7 in Appendix B illustrates the flood extents as held by the Environment Agency ‘Recorded Flood Outline Map’. Table 5 summarises details of historic flood events for the Foss gathered through a review of flood studies and the Environment Agency Recorded Flood Outline Map. It should be noted that not all flooding events would have been recorded therefore this should not be considered a complete dataset.

Table 5. Historic Fluvial Flooding for the River Foss

Date	Description of flooding
1947	Flooding along the River Foss in March 1947 due to channel capacity being exceeded. Flooding was caused primarily by the melting of a large volume of snow that had fallen across a prolonged cold spell in January and February that year.
1968	Flooding along the Foss in March 1968 due to channel capacity being exceeded.
1982	Flooding along the Foss in January 1982 due to the overtopping of the watercourse. Flooding was caused by a prolonged period of rain over the few weeks leading up to the flood event. An area of 70 ha flooded including 78 domestic and 64 commercial properties.
1995	Flooding along the River Foss in January and February 1995 due to the overtopping.
2000	Flooding along the River Foss in the Autumn of 2000 due to the overtopping of flood defences along the watercourses. This flood followed a period of unprecedented rainfall; the autumn of 2000 was the wettest since rainfall records began in 1766. The flood event had an estimated return period of 1 in 80 years (1.1% AEP).
2015	Heavy rainfall through December 2015 led to flooding in a number of communities, but the most severe and widespread flooding was seen between Boxing Day and New Year in York. The River Foss at Huntington recorded the highest ever level at 3.58m. Working at full capacity, the Foss Barrier was unable to cope with the level of flow in the River Foss and was at risk of being overwhelmed and rendered inoperable. As a result, the decision was made to raise the barrier gate. This slowed the rate of rise on the Foss and reduced the maximum level of the flooding, providing more time for emergency services to respond and reducing the overall damage done by the flooding.
2021	During Storm Christoph in January 2021 the River Foss peaked at 2.73m above normal summer levels following heavy rainfall that quickly entered the river upstream of the Foss Barrie, which continued to function as planned. Flooding affected Huntingdon Road.

4.2.5.4 Flood Defences

Appendix B, Figure 8 details the locations of the existing flood defence assets protecting the people and property within City of York Council’s administrative area from flooding. From the figure it can be seen the majority of the flood defences to be located along the River Ouse, the ‘main river’ reach of the River Foss and along the reaches of their tributaries that flow through urban areas.

One of the most notable flood defences in the catchment is the Foss Barrier which was built in 1986/7. The barrier 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 when water levels in the River Ouse are high. When the barrier is lowered, the optimum level of water in the Foss is maintained by pumping water around the barrier, directly into the Ouse, thus maintaining a steady water level in the River Foss. The flood protection of the north eastern part of York in the Foss catchment is highly dependent on the operation of the Foss Barrier.

In response to the Boxing Day 2015 flooding, the pump capacity at the barrier has since been upgraded providing increased capacity to maintain a steady water level in the River Foss in the future. In conjunction with the barrier and pumps, there is a floodwall around St George's Field Carpark preventing the River Ouse bypassing the Barrier.

Appendix B Figure 8 also outlines the Areas Benefitting from the Flood Defences described above.

4.2.6 River Derwent

4.2.6.1 Historic Records

Figure 7 in Appendix B illustrates the flood extents as held by the Environment Agency 'Recorded Flood Outline Map'. Table 6 summarises details of historic flood events for the Derwent gathered through a review of flood studies and the Environment Agency Recorded Flood Outline Map. It should be noted that not all flooding events would have been recorded therefore this should not be considered a complete dataset.

Table 6. Historic Fluvial Flooding for the River Derwent

Date	Description of flooding
1978	Flooding within the wider Derwent catchment in December 1978 due to channel capacity being exceeded.
1982	Flooding within the wider Derwent catchment in March 1982 due to channel capacity being exceeded.
1991	Flooding within the wider Derwent catchment in February 1991 due to channel capacity being exceeded.
1999	High water levels in the Derwent lead to flooding of large areas of agricultural land and Elvington village.
2000	This flood followed a period of unprecedented rainfall; the autumn of 2000 was the wettest since rainfall records began in 1766. Extensive flooding of agricultural floodplain took place throughout the catchment and all washlands were filled to capacity. High water levels in the Derwent lead to flooding at Elvington village.

4.2.6.2 Flood Defences

Appendix B, Figure 8 details the locations of the existing flood defence assets protecting the people and property within City of York Council's administrative area from flooding.

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.

A further flood defence was completed by the Environment Agency at Elvington in 2008, consisting of an earth embankment and a flood-pump station to prevent backflow into Elvington from the River Derwent. This defence protects the village from the effects of River Derwent floods to a 1% AEP (1 in 100) standard. Maintenance of the flood defence is shared between the Environment Agency (flood bank) and the Ouse and Derwent IDB (pumping station).

4.2.7 York Flood Alleviation Scheme

The York Flood Alleviation Scheme (FAS) is funded by the UK Government with the aim of reducing the risk of flooding to homes and businesses in York. Situated on low-lying land where the River Foss joins the River Ouse, the City of York has always been prone to flooding. In recent years, however, the onset of climate change along with changes in the way land is managed upstream have caused these floods to become more severe. Following the December 2015 floods, the government allocated an additional £45 million to the Environment Agency to better protect 2,000 homes from flooding within the City's administrative boundary. This funding is in addition to the £38 million investment made to refurbish and upgrade the Foss Barrier.

Existing flood defences for York have been built over many years and no longer provide the level of protection needed to deal with increased volumes of water. With this additional funding, the York FAS will make improvements to reduce the risk of flooding for many residents and businesses in York. However, it should be noted that flooding is a natural phenomenon that cannot always be prevented, and the funding granted to the Environment Agency will not stop flooding in all parts of the City. It is not feasible to continue building ever higher walls to keep the water out, instead water should be managed better by building flood defences where they are most effective and finding ways to alleviate the impact of flooding where it is not possible to build these 'hard' defences. The river catchment (the area from which a river draws its water supply) will be looked at as a whole by the Environment Agency to find new ways to store water upstream, lowering peak flows during flood events and so reducing the impact of flooding on the City. The York FAS seeks to achieve this.

The Environment Agency are carrying out work in 18 flood cells (a flood cell is defined as an area where the flood risk can be addressed independently of the areas up and downstream). Each flood cell has its own characteristics and complexities; there are often many factors to consider that influence or constrain the choice of solution. Further detail on the works in each cell can be found on the York FAS Information Page. Once the York FAS is completed additional assessment will be required to understand the flood risk to the area.

In the interim period whilst the York FAS is being implemented, any assessment of residual risk will not take into account planned defences in the area. Instead residual risk will only be calculated using existing flood defences.

4.2.8 Current Fluvial Flood Risk

The current fluvial flood risk is summarised below and illustrated in Figure 8 of Appendix B. The following summary of fluvial flood risk has been determined from predictive and historic flood information:

- The urban reaches of the River Ouse, River Foss and their tributaries can be seen to have a fairly confined Flood Zone 3 extent which is very similar to that of Flood Zone 2. This is primarily due to the confined nature of the river corridor and constrictions that the numerous bridges pose to the watercourses through the urban settlements. Any developments within Flood Zone 2 or 3 will need to consider the risk from more frequent events. Where hydraulic modelling has not been completed, this may require additional assessment.
- Flood Zone 3 can be seen to affect a fairly large urban area between Layerthorpe to Fishergate which surrounds the confluence of the Rivers Ouse and Foss and the River Foss and Tang Hall Beck.
- Downstream of Fulford, to the south of York City Council's boundary, Flood Zone 2 and 3 can be seen to extend further from the River Ouse, with the Flood Zone 2 extent covering the area between the A64 and the A19, across Clementhorpe, Bishopthorpe, Acaster Malbis, Fulford and Naburn. The large number of small dykes and agricultural drains, including the Howden Dyke, South Fields Dike and Wood Dike, combined with the low-lying nature of the agricultural land, increases the risk of flooding in this area.
- The areas of Rawcliffe and Clifton can be seen to lie within Flood Zone 2 from Blue Beck. During flood conditions the River Ouse historically has triggered backflow up Blue Beck, causing the flow within the Beck to exceed channel capacity and flow through the surrounding streets.
- The land surrounding the central urban region of York is predominantly characterised by low lying agricultural land. To the North of City of York Council's boundary this low lying land allows for wider, relatively flat floodplains along the upper reaches of the River Foss, Tang Hall Beck and Osbaldwick Beck increasing the Flood Zone 2 and 3 extents in this area, which can be seen to potentially affect thoroughfares such as the A64 and the A1237.

4.2.9 Climate Change

In May 2022 the Environment Agency published revised guidance on climate change allowances[24]. This updated guidance reflects an assessment completed by the Environment Agency using UKCP19 data, to produce more representative climate change allowances for river basin districts across England. Due to the complexity of projecting climate change, there are uncertainties attributed to climate change allowances. As a result, the guidance presents a range of possibilities to reflect the potential variation in climate change impacts over three periods or 'epochs'.

The allowances for the Humber RBD are of relevance to the City of York study area and are set out in Table 7 below.). It is envisaged that the '2070-2115' epoch will be appropriate for most developments.

Table 7. Peak River Flow Allowances by Management Catchment

River Basin District	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Swale, Ure, Nidd and Upper Ouse	Upper end	25%	34%	53%
	Higher central	15%	20%	33%
	Central	11%	15%	25%
Wharfe and Lower Ouse	Upper end	23%	31%	48%
	Higher central	13%	18%	29%
	Central	11%	14%	22%
Derwent	Upper end	33%	35%	54%
	Higher central	22%	22%	33%
	Central	18%	17%	24%

The allowance category to be used is based on the vulnerability classification of the proposed development and the flood zones within which it is to be located, as set out below.

Flood Zone 2

Vulnerability Classification	Central	Higher Central	Upper End
Essential infrastructure		✓	✓
Highly Vulnerable		✓	✓
More Vulnerable	✓	✓	
Less Vulnerable	✓		
Water compatible		None	

Flood Zone 3a

Vulnerability Classification	Central	Higher Central	Upper End
Essential infrastructure			✓
Highly Vulnerable		Development not permitted	
More Vulnerable		✓	✓
Less Vulnerable	✓	✓	
Water compatible	✓		

[24] Environment Agency, Flood Risk Assessments: climate change allowances. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Flood Zone 3b

Vulnerability Classification	Central	Higher Central	Upper End
Essential infrastructure			✓
Highly Vulnerable		Development not permitted	
More Vulnerable		Development not permitted	
Less Vulnerable		Development not permitted	
Water compatible	✓		

The impact of climate change on flood risk will not be the same everywhere as local differences in the scale of change may be governed by geographic conditions. For very flat floodplains, where flood extents can increase significantly for a small increase in flood peak magnitudes, locations currently within lower risk zones (e.g. Flood Zone 2) could in future be re-classified as lying within a higher risk zone (e.g. Flood Zone 3a) as a result of climate change. In more well-defined floodplains, increased flows will primarily result in increased flood depths rather than an increase in flood extent. This in turn could have implications for the type of development that is appropriate according to its vulnerability to flooding.

It is essential that developers consider the possible change in flood risk over the lifetime of the development as a result of climate change. For planning purposes, the SFRA assumes that the 'lifetime of development' equates to 100 years for residential development, and 75 years for commercial development.

As part of the hydraulic modelling study for City of York river catchments, simulations have been run for the 1% AEP event, including a 20%, 30% and 50% increase in river flow for both the undefended i.e. the removal of raised flood defences, and defended scenarios to account for the implications of climate change based on the Environment Agency climate change guidance. However, climate change allowances have changed since these models were simulated and the 20%, 30% and 50% increases have been used as a proxy before these models are re-simulated with the latest climate change allowances (refer to Table 7). Please refer to Appendix B Figure 9 and Figure 10 for a comparison of the impact of climate change on Flood Zone 3 for the full range of potential allowance factors.

When assessing climate change as part of a site-specific FRA, current guidance available at the time of writing should always be applied to any planning application. It is anticipated that future studies will take account of the new allowances, however in the interim period there will be greater emphasis on site specific FRAs to include for additional modelling scenarios to determine the future risk with respect to climate change. See Section 7.6 for further details.

4.3 Flooding from Ordinary Watercourses

4.3.1 Sources

An Ordinary Watercourse is a watercourse that does not form part of a Main River and 'includes all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows' in accordance with Section 72(1) of the Land Drainage Act 1991. Main Rivers are the responsibility of the Environment Agency; all other watercourses are classified as Ordinary Watercourses and fall under the remit of City of York Council as the LLFA or the IDBs, as outlined in Section 1.4 and Section 1.8.

Appendix B Figures 2, 5A-5D and 8A-8D identify the ordinary watercourses in the study area. This information is provided from the Environment Agency Detailed River Network (DRN) dataset.

The following significant ordinary watercourses are present in the study area:

- Holgate Beck upstream of the length designated as main river;
- Tang Hall and Osbaldwick Becks upstream of the lengths designated as main river;
- Westfield Beck and part of South Beck;
- Burdyke and Blue Beck, upstream of the lengths designated as main river;
- Elvington Beck;

- Germany Beck; and
- Tunnel Drain.

4.3.2 Historic Records

There is no evidence of historic flooding from the ordinary watercourses in the outlying rural areas covered by the four IDBs.

- To the west and south east of the central urban region there are a large number of small dykes and agricultural drains, when combined with the low-lying nature of the agricultural land, increase the risk of flooding in these areas. Development in any of these areas will need to consider the risk from more frequent events.

In the suburban areas:

- Westfield Beck west of Haxby reached a level in June 2007 high enough to flood gardens and roads. There were concerns that this was exacerbated by problems with Westfield Beck pumping station and the operating regime was reviewed by City of York Council, YWS, EA and the Foss IDB.
- Elvington Beck has also caused surface water flooding of roads due to intense rainfall, unconnected with levels in the Derwent. Subsequent investigations revealed the cause was lack of maintenance and restricted capacity which have been addressed in response to each investigation.

4.3.3 Assessment of Ordinary Watercourse Flooding from Surface Water Mapping

River modelling studies undertaken by the Environment Agency as part of their national programme of coastal and river modelling typically focus on flooding associated with main rivers, and therefore ordinary watercourses that form tributaries to the main rivers may not always be included in the models. In the absence of modelled flood extents for these watercourses, the Risk of Flooding from Surface Water Map (RoFSW) provides a useful indication of flood risk associated with these watercourses, particularly where they are flowing at surface level. The RoFSW mapping is provided in Appendix B Figures 8A-8D. Full details regarding the RoFSW dataset is provided in Section 4.5.3.

The RoFSW considers three design rainfall events. The most extreme of these (0.1% AEP) can be used to provide an indication of the impact of climate change on the extent of flooding associated with ordinary watercourses.

4.4 Flooding from Surface Water

Surface water flooding, also known as pluvial flooding, occurs when high intensity rainfall generates runoff which flows over the surface of the ground and accumulates in low lying areas. The presence of impermeable surfaces, saturated soils, and insufficient capacity within the drainage network can further exacerbate surface water flooding. The PPG states that an SFRA should identify areas at risk from surface water flooding and drainage issues, taking account of the surface water flood risk mapping published by the Environment Agency as well as other available information.

Appendix B, Figure 11 shows the spatial distribution of surface water flood risk across the city of York.

4.4.1 Historic Records

City of York Council has records of surface water flooding at various locations across its area, mainly resulting from rainfall since 2007. The most comprehensive records relate to the consequences of intense rainfall in June 2007 when areas in Haxby, Wigginton, Rufforth, Strensall, Clifton, Rawcliffe, Acomb and Holgate were affected by very localised rainfall events ranging from 14.3% AEP (1 in 7 to 1% AEP (1 in 100) return period. These records show that 138 locations reported flood related problems, of which 7 were believed to be habitable properties suffering from internal flooding. The flooding mostly affected roads where the rainfall exceeded the drainage infrastructure design capacity of 1 in 30 years. Similar impacts were experienced following significant city-wide rainfall in August 2018.

4.4.2 City of York Surface Water Management Plan

At the time of commencing the SWMP there was little evidence in the form of reported incidents available pointing to widespread, frequent or persistent surface water flood risk at any location within the study area.

As part of the SWMP for City of York Council, direct rainfall modelling was undertaken, and the results used to identify flooding hotspots where surface water flooding poses risk to properties, businesses and infrastructure. The surface water flooding hotspots identified for City of York Council are identified in Table 8.

Table 8. Surface Water Flooding Hotspots

Hotspot Name	Location
Strensall	York Road
Wiggington/ Haxby	The Village
Rawcliffe	Howard Drive, Rawcliffe Croft
Clifton Without	St Phillip's Grove
Clifton	Shipton St Field View
Heworth	Straylands Grove, Elm Park Way, Elmfield Avenue
Acomb	Junction of Carr Lane and Boroughbridge Road, Ouse Acres
Westfield	Huntsman Walk

The SWMP identified potential high-level options to manage and mitigate the flooding at each of the hotspots as well as broader ranging actions for City of York Council to meet the requirements of the FWMA in their role as the LLFA.

4.4.3 Risk of Flooding from Surface Water Map

The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying those areas at risk of surface water flooding during three annual probability events: 3.33% AEP (1 in 30), 1% AEP (1 in 100) and 0.1% AEP (1 in 1000). The latest version of mapping is referred to as the 'Risk of Flooding from Surface Water' (RoFSW) and the extents have been made available to City of York Council as GIS layers. This dataset is also presented on the Environment Agency website.

The RoFSW provides all relevant stakeholders, such as the Environment Agency, City of York Council and the public access to information on surface water flood risk which is consistent across England and Wales[25]. The modelling helps the Environment Agency take a strategic overview of flooding and assists City of York Council (as the LLFA) in their duties relating to management of surface water flood risk. For the purpose of this SFRA, the mapping allows an improved understanding of areas which may have a surface water flood risk.

The modelling represents an improvement on previous national scale mapping, namely the surface water flood maps, for example:

- Increased model resolution to 2m grid;
- Representation of buildings and flow routes along roads and manual editing of the model for structural features such as flyovers;
- Use of range of storm scenarios; and,
- Incorporation of appropriate local mapping, knowledge and flood incident records.

However, it should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas;
- It does not show the susceptibility of individual properties to surface water flood records; and,
- As with all models, the RoFSW is affected by a lack of, or inaccuracies in available data.

The datasets provide a picture of surface water flooding across the study area and identify that areas of susceptibility to surface water flooding are widespread across most parts of the City of York. Through an assessment of the dataset, it can be seen that surface water flood risk can typically be associated with the following, although this list is by no means exhaustive:

[25] Environment Agency, 2013. *'What is the updated Flood Map for Surface Water?'*

- **Fluvial Corridors**: The risk of surface water flooding tends to coincide with the fluvial floodplains of Main Rivers and Ordinary Watercourses, which, due to their low-lying nature, allow flows to be accumulated and passed downstream. In these areas, there is significant interaction between fluvial and surface water flows. Within areas of urban development, any surface water drainage networks which discharge to watercourses may be restricted by flood locked outfalls.
- **Land Drains**: Within City of York Council's administrative area, there is an extensive network of land drainage systems and Ordinary Watercourses, which act as conveyance routes for surface water. Although these features tend to occur in primarily rural, undeveloped areas, there is the potential that new sites, particularly minerals and waste allocations, may coincide with these features. The risk of flooding as a result of these flow routes, will need to be examined as part of any development, even if the current risk appears to be minimal.
- **Urban Areas**: Surface water flooding frequently occurs in urban areas as a direct result of topographic features, such as buildings and roads, which restrict infiltration, deflect flows into sewer systems with limited capacity and encourage localised ponding. This can be seen within the majority of the urban areas in City of York Council's administrative area.
- **Railway and Road Embankments**: The presence of raised embankments, such as those usually associated with highway and rail networks, can have a significant impact on surface water flow routes, which restrict flows leading to localised areas of deep ponding. This is evident across to the south west of the City and increases flood risk to those communities which align with this infrastructure.
- **Roads**: Roads, highways and railway lines can act as conveyance routes for surface water whilst flooding can also affect the operational potential of this infrastructure. The risk to these receptors should be considered as part of any future development application, ensuring safe access and egress to sites during times of flood.
- **Underpasses**: Where underpasses are present, the lower elevation allows for the increased risk of surface water flooding. In these areas, although the extent may be minimal, the depth of flooding experienced may be significant.

4.4.4 Climate Change

The RoFSW does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However, a range of three annual probability events have been undertaken, 3.3% AEP, 1% AEP and 0.1% AEP and therefore it is considered appropriate to use the 0.1% AEP event as a substitute dataset to provide a worst-case scenario and an indication of the implications of climate change.

4.5 Flooding from Groundwater

Groundwater flooding usually occurs in areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth.

4.5.1 Sources

Appendix B Figure 12 illustrates the Environment Agency's Areas Susceptible to Groundwater Flooding (AStGWF) map for City of York Council's administrative area. The mapping shows the susceptibility to coincide with the distribution and thickness of lacustrine clay (typically Boulder Clay) within the superficial geology (Appendix B Figure 4). As such, the greatest susceptibility to groundwater occurs to the north east and south west of the City of York area and along the river corridors where Till cover is typically thin or absent.

4.5.2 Historic Records

Although the AStGWF map suggests a potential for groundwater flooding, the Council has no record of areas where groundwater emergence is known to be a cause of significant flooding. It has therefore been ruled out as a potential cause of flooding in this assessment.

4.6 Flooding from Sewers

4.6.1 Sources

Rainwater falling on impermeable surfaces in developed areas drains into either surface water or combined sewers (which convey both surface water and sewage). Until approximately eighty years ago the use of combined sewers was standard practice, with excess flow in times of storm discharged through combined sewer overflows to an

adjacent watercourse. A large part of the central core of the City of York is drained in this way. Post 1930s development is largely drained by separate sewerage systems with surface water sewers ultimately discharging to local watercourses.

During heavy rainfall, flooding from the sewer system may occur if:

(1) The rainfall event exceeds the capacity of the sewer drainage system:

The majority of modern 'adoptable surface water' sewer systems are designed to accommodate rainfall events with a 3.3% AEP or less. Therefore, rainfall with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While Yorkshire Water, as the sewerage undertaker for City of York Council's administrative area, is concerned about the frequency of extreme rainfall events, it is not economically viable to build sewers that could cope with every extreme rainfall event.

(2) The system becomes blocked by debris or sediment

Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris (e.g. litter). Reduced hydraulic capacity from siltation is a particular problem in York due to the flatness of the area and the difficulty in designing sewerage systems that are self-cleansing i.e. provides sewer flow velocities sufficient to pick up and disperse solids. This is also the case with piped and open systems in other ownerships and has been highlighted in the SWMP.

(3) The system becomes blocked by waste products

Sewer blockages may be caused by fats, oils, grease and un-flushable or sanitary items which are largely derived from domestic or commercial waste systems.

(4) The system surcharges due to high water levels in receiving watercourses

Within the study area there is potential for surface water outlets to become submerged due to high river levels. When this happens, water is unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will begin to overflow into streets and potentially into houses. Where the local area is served by 'combined' sewers i.e. containing both foul and storm water, if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will contain dilute untreated sewage.

4.6.2 Historic Records

Overall the sewerage system has remained largely unchanged over the years, but at some locations schemes have been implemented to address local flooding issues. An example of this is the storage tank at Union Terrace where a number of properties have experienced flooding from the combined sewer network during times of extreme rainfall. A 15-metre diameter storage tank has been built between 83 and 93 Union Terrace to store flows which is pumped back into the sewerage system when there is sufficient capacity.

Further problems can occur where sewerage systems are isolated behind flood defences in times of raised river levels. Systems are in place to manage these occurrences (pumping stations or sluices) but they can be compromised and present risks to areas that are defended – i.e. Leeman Road in 2012.

Yorkshire Water has provided an extract from their DG5 Flood Register for the study area. The DG5 is a water company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years. Due to data protection requirements the data has not been provided at individual property level; rather, the register comprises the number of properties within 4 digit postcode areas that have experienced flooding either internally or externally within the last 10 years.

The DG5 records indicate hydraulic flooding within the City of York occurs predominantly in the larger urban areas around the outskirts of York city centre, including Rawcliffe, Acomb, Holgate and Tang Hall. There are fewer isolated incidents of sewer flooding at village level across the administrative area.

It should be noted that records only appear on the DG5 register where they have been reported to Yorkshire Water, and as such they may not include all instances of sewer flooding. Furthermore, given that Yorkshire Water target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding in the future.

4.6.3 Climate Change

Climate change is anticipated to increase the potential risk from sewer flooding as summer storms become more intense and winter storms more prolonged. This combination is likely to increase the pressure on the existing efficiency of sewer systems, thereby reducing their design standard and leading to more frequent localised flooding incidents.

Yorkshire Water will monitor the risk of sewer flooding and put plans in place to manage this, as required, based on their business plan and priorities. City of York Council will work with Yorkshire Water to identify flooding hotspots and locations of known sewer capacity issues where risk could be exacerbated.

Yorkshire Water will prioritise investment for potential flood alleviation schemes depending on the severity and frequency of flooding, but this can only be identified where affected property owners report the incident to the water company.

4.7 Flooding from Artificial Sources

4.7.1 Risk of Flooding from Reservoirs Mapping

A reservoir can be defined as a natural or artificial waterbody where water is collected and stored until needed. Under the FWMA (2010), the Environment Agency is responsible for managing flood risk from large raised reservoirs. Large raised reservoirs are defined in the FWMA (2010) as:

- A large[26], raised structure[27] designed or used for collecting and storing water; or
- A large, raised lake or other area capable of storing water which was created or enlarged by artificial means.

The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The PPG encourages LPAs to identify any impounded reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment it is located within, and / or whether emergency draw-down of the reservoir will add to the extent of flooding.

Reservoir flooding is extremely unlikely to happen; there has been no loss of life from reservoir flooding in the UK since 1925. All large reservoirs are regularly inspected and supervised by reservoir engineers under the enforcement authority for the Reservoirs Act 1975 in England. If a reservoir were to breach, a large volume of water would come cascading down the surrounding valleys with very little warning. People living and working in these areas would be at great danger; therefore, it is necessary to plan in advance an emergency strategy should such an event occur.

The Environment Agency 'Flooding from Reservoirs' mapping[28] available online and mapped within Appendix B Figure 13 shows the potential flood risk if reservoirs were breached. The model outputs are for emergency planning purposes and are not intended to reflect the most detailed flood extents. As such, these data show the absolute maximum flood where there is likely to be an impact.

There is only one reservoir (Clifton Ings) located within City of York Council's administrative area used for storage and recreational purposes. A further 32 reservoirs are located within the Ouse catchment upstream of the City. Approximately 6000 people are at risk from flooding resulting from a failure of a reservoir in the upstream catchment, and the greatest areas of risk are upstream of York. Although there is some risk to riverside properties in York, the distance between the reservoirs and the city means that a large amount of water will have dissipated across the floodplain before reaching the city.

From Appendix B Figure 13 there are several additional reservoirs and structures that, if breached, have the potential to affect property and infrastructure in the administrative area. These include the following:

- Angram Reservoir is located along the River Nidd in Upper Nidderdale and is the first of a series of three reservoirs along this section of the Nidd. If a breach were to occur from the reservoir the River Nidd would flood and result in flooding of the River Ouse throughout its length in City of York. Flooding from this breach could

[26] A raised structure or area is "large" if it is capable of holding 10,000$m^3$of water or more, above the natural level of any part of the surrounding land. A review into reducing the capacity to which a reservoir will be regulated from 25,000 m^3 to 10,000 $m^3$is expected to be phased in to improve the safety legislation and regulation of reservoirs[26]. These changes to the safety legislations of reservoirs have yet to come into effect under the Environment Agency.

[27] A structure or area is "raised" if it is capable of holding water above the natural level of any part of the surrounding land.

[28] Environment Agency Check long term flood risk for an area in England. Available at: https://www.gov.uk/check-long-term-flood-risk

potentially flood riverside extents of villages and properties in Nether Poppleton, York City Centre, Fulford, Naburn and Acaster Mabis;

- Scar House Reservoir is the second in the series of three reservoirs along the River Nidd in Nidderdale. If a breach were to occur from the reservoir the River Nidd would flood, consequently causing the River Ouse to flood south of York City Centre. Flooding from this breach would be limited to the floodplain and flood storage areas along the River Ouse;
- Gouthwaite Reservoir is located in Nidderdale and is the final reservoir in the series of three located along the upper course of the River Nidd. If a breach were to occur from the reservoir the River Nidd would flood at the confluence with the River Ouse causing flooding along the River Ouse to Nether Poppleton. Flooding from this breach would be limited to the floodplain and flood storage areas along the River Ouse;
- Siwards How is a surface water feature located by the University of York. If Siwards How were to flooding would potentially affect property and infrastructure in the University Campus, Heslington and Osbaldwick before flood waters reach Osbaldwick Beck;
- Thruscross Reservoir located west of Harrogate, and Fewston Reservoir, located north of Otley and west of Harrogate form a series of reservoirs along the upper course of the River Walsburn. If a breach were to occur from either reservoir the River Walsburn and River Wharfe would flood, and, at the confluence with the River Ouse, flood waters would cause flooding upstream within the southern boundary of City Of York. Flooding would be contained within the floodplain of the River Ouse;
- Grimworth Reservoir is located in the south east extent of the Yorkshire Dales National Park in the upstream catchment of the River Wharfe. If a breach were to occur from this reservoir the River Wharfe would flood, and at the confluence with the River Ouse flood waters would cause minor flooding upstream within the southern boundary of City of York. Flooding would be contained within the floodplain of the River Ouse;
- Linton Ings is a flood storage area located on the floodplain of the River Ouse, immediately south of Linton-on-Ouse. If a breach of this flood storage area were to occur flood waters inside the administrative boundary would be confined to the River Ouse floodplains and channel;
- Bishopthorpe Lagoon is a small surface water attenuation feature located in Bishopthorpe, south of York city centre and is maintained by Yorkshire Water. If a breach were to occur, the River Ouse would likely flood. Flooding from this breach could potentially affect properties in the north of Bishopthorpe, highway infrastructure and greenfield land;
- Rawcliffe Lake, located on Clifton Moor, is a shallow local surface water feature located in the centre of Rawcliffe, and is maintained by Yorkshire Water. If a breach were to occur flooding would be localised to residential properties and local infrastructure to the north, east and west of the lake; and
- Elvington Wastewater Treatment Works (WwTW) is located along the banks of the River Derwent, north east of the village of Elvington and is operated by Yorkshire Water. There are three artificial surface water features associated with the processes at the WwTW. If a breach of these surface water features were to occur the River Derwent would likely flood both upstream and downstream of this location. Flooding from this breach could potentially affect properties in Elvington, the B1228 and surrounding agricultural land.

It should be noted that although the consequences of reservoir flooding are high, the probability of reservoir failure is very low.

Any site-specific FRA should identify any reservoir, including those with a smaller area, and determine the risk of flooding from these features.

4.8 Emergency Planning

4.8.1 Flood Warning Areas

The Environment Agency provides a free Flood Warning Service[29] for many areas at risk of flooding from rivers and the sea. The Environment Agency has provided a GIS layer of Flood Warning Areas in the study area which

[29] Environment Agency Flood Warning Service. Available at: https://www.gov.uk/sign-up-for-flood-warnings

are presented in Appendix B Figure 14. The Environment Agency Flood Warning Areas across City of York Council's study area, at the time of publication, are identified in Table 9.

Table 9. Flood Warning Areas in the City of York

Flood Warning Area	Watercourse
River Derwent at Elvington	River Derwent
River Ouse at York - riverside properties	River Ouse
River Ouse at York - St George's Field and Queen's Staith	River Ouse
River Foss at York - Huntington Road and Foss Island	River Foss
Tang Hall Beck at York - Beckside Properties	Tang Hall Beck, River Foss
River Ouse at York - Skeldergate and Tower Street	River Ouse
Osbaldwick Beck at York - Beckside Properties	Osbaldwick Beck, River Foss
River Ouse at York - River Street	River Ouse
River Ouse at York - Peckitt Street	River Ouse
River Ouse at York - Fulford and Fordlands Road	River Ouse
River Ouse at Naburn Lock	River Ouse
River Ouse at Naburn and Acaster Malbis	River Ouse
River Ouse at Acaster Malbis	River Ouse
River Ouse at York - Clifton	River Ouse
River Ouse at York - Marygate	River Ouse
River Ouse at York - Leeman Road	River Ouse
Holgate Beck at York	River Ouse, Holgate Beck
River Ouse at York - Clementhorpe, Lower Ebor Street and South Bank	River Ouse
River Ouse at York - Skeldergate	River Ouse
River Foss at York - Huntington and York	River Foss
Tang Hall Beck at York - Tang Hall	Tang Hall Beck, River Foss
Osbaldwick Beck at York - Osbaldwick and Tang Hall	Osbaldwick Beck, River Foss
River Ouse at York - Fulford Road	River Ouse
River Ouse at York - North Street	River Ouse
River Ouse at York - Rawcliffe	River Ouse, Blue Beck
River Ouse at York - City Centre	River Ouse

Note that the areas presented in Table 9 are illustrative of the range of flood warnings within the City of York Council area and up to date details should be obtained from the Environment Agency to inform a site-specific FRA.

The Environment Agency also issue flood alerts when flooding to low lying land and roads is expected. Flood alerts cover larger areas than flood warnings and are issued more frequently. Flood warnings and flood alerts are signed up to separately, however when signing up for flood warnings homes and businesses must agree to receive flood alerts.

4.8.2 Emergency Planning

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.

City of York Council, working closely with the North Yorkshire Local Resilience Forum, plays an important role in emergency planning and response, and therefore :

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

- Maintains an awareness of the Environment Agency's flood warning dissemination plan for its area and contributes to its implementation as necessary; and
- Plays an agreed role in any flood warning emergency exercises organised by the Environment Agency covering its area.

City of York Council has produced an Emergency Plan[30] for responding to river flooding in its Emergency Planning Procedures and has arrangements for cascading warnings received from the Environment Agency to relevant Council services. The Emergency Plan:

- outlines the procedures for responding to Environment Agency flood warning notices; and
- details matters such as health and safety considerations, resource prioritisation, vulnerable community identification and appropriate evacuation procedures.

[30] City of York Council York Flood Plan

5. Avoiding Flood Risk - Applying the Sequential Test

5.1 Sequential Approach

This Section guides the application of the Sequential Test and Exception Test in the Plan-making and planning application processes. Not all development will be required to undergo these tests, as described below, but may still be required to undertake a site-specific FRA. Guidance is included in Section 7.

The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to sites at higher risk. This will help avoid the development of sites that are inappropriate on flood risk grounds and to minimise the extent of development in areas at risk of flooding. The subsequent application of the Exception Test, where required, will ensure that new developments in areas of particular flood risk will only occur where flood risk is clearly outweighed by other sustainability drivers and where development can be made safe from flooding and will not increase the risk of flooding elsewhere.

All opportunities to locate new developments (except Water Compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

5.2 Applying the Sequential Test – Plan- Making

As the LPA, City of York Council must demonstrate that, throughout the site allocation process and related Sustainability Appraisal process, a range of possible sites have been considered in conjunction with the flood risk and vulnerability information set out in the SFRA, and that the Sequential Test, and where necessary the Exception Test, has been applied.

The Sequential Test, as set out in the NPPF, is principally based on the definition of Flood Zones associated with tidal and fluvial flood risk, and the PPG provides guidance on the application of the Sequential Test with reference to tidal and fluvial flood risk. However, the NPPF acknowledges that some areas will be at risk of flooding from sources other than tidal or fluvial. All sources of flood risk must be considered when planning for new development including flooding from land or surface water runoff; groundwater; sewers; and artificial sources. If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

In order to ensure that the Sequential Test takes account of flood risk from all sources, Table 10 provides a suggested flood risk classification based on available datasets in the SFRA that could be employed by City of York Council to apply the Sequential Test.

Table 10. Flood Risk Classifications for the Sequential Test

Risk	Source of Flooding				
	Fluvial/Tidal	Surface Water	Groundwater	Sewer	Reservoir
Low	Flood Zone 1	RoFSW Very Low	Not within a Potential Groundwater Flooding Zone OR Limited potential for groundwater flooding to occur	Yorkshire Water to assess the sewer network for each site.	Use Environment Agency Flooding from Reservoirs map
Medium	Flood Zone 2	RoFSW Low to Medium	Potential Groundwater Flooding Zone – Potential for groundwater flooding of property situated below ground level.		N/A
High	Flood Zone 3a	RoFSW High OR Within Critical Drainage Area	Potential Groundwater Flooding Zone Potential for groundwater flooding at surface. – and/or Historic records of groundwater flooding.		N/A
Very High	Flood Zone 3b	N/A	N/A		N/A

As well as an understanding of flood risk across the study area, the Sequential Test requires an understanding of the vulnerability classification of the proposed developments. Flood risk vulnerability classifications, as defined in the PPG are presented in Table 11.

Table11. Flood Risk Vulnerability Classification (PPG, 2021)

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations, energy storage facilities; and water treatment works that need to remain operational in times of flood. • Wind turbines. • Solar farms.
Highly Vulnerable	• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”).
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in “more vulnerable”, and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • 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.

Table 12 is reproduced from the NPPF PPG and indicates the compatibility of different development types with each of the Flood Zones.

Table 12. Flood Risk Vulnerability and Flood Zone 'Compatibility' (PPG, 2021)

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test Required	✓	✓
	3a	Exception Test Required	✓	×	Exception Test Required	✓
	3b	Exception Test Required	✓	×	×	×

Key:

✓ - Development is appropriate

× - Development should not be permitted

† - In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* - In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, 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.

Figure 4 illustrates the approach for applying the Sequential Test that City of York Council should adopt in the preparation of the Local Plan. The approach is also described in the steps below. The Sequential Test should be undertaken by City of York Council and accurately documented to ensure decision processes are consistent and transparent.

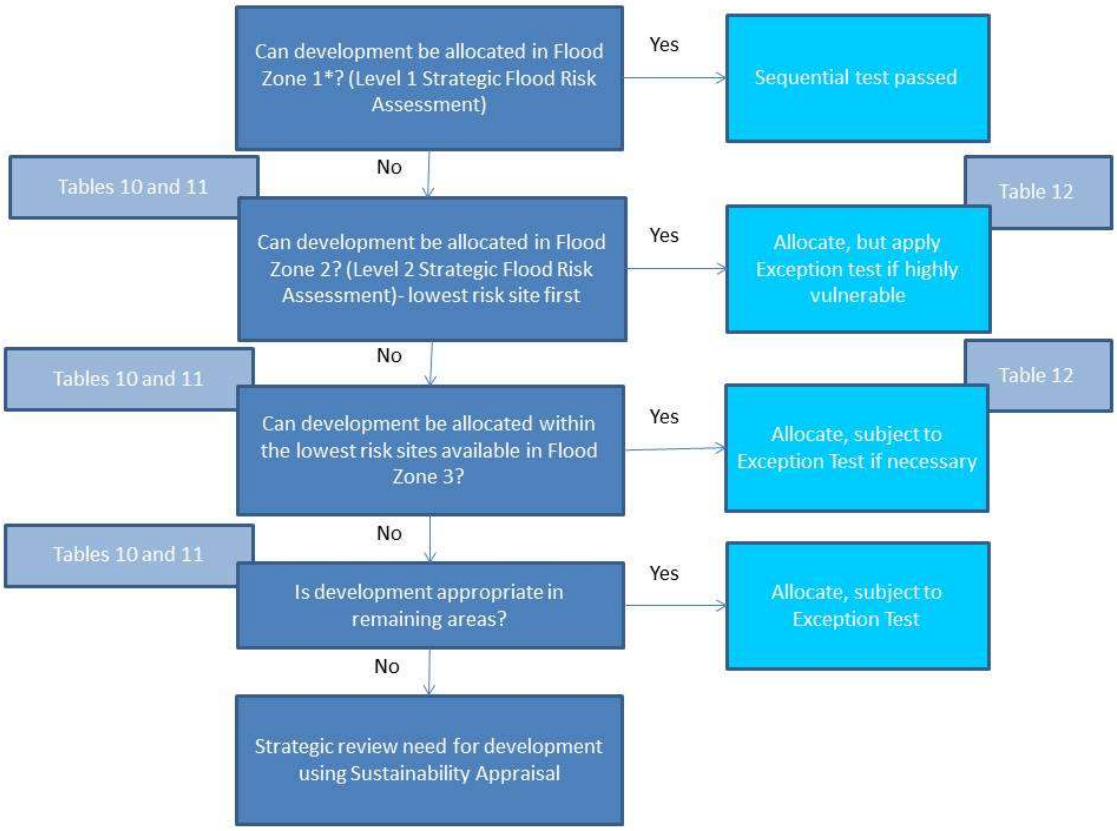


Figure 4. Application of the Sequential Test for Local Plan Preparation

5.2.1 Stages for LPA application of the Sequential Test in Plan-Making

The information required to address many of these steps is provided in the accompanying maps in Appendix B and site assessment database held by City of York Council.

a. Assign potential developments with a vulnerability classification (Table 8). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.

b. The location and identification of potential development should be recorded.

c. The Flood Zone classification of potential development sites should be determined based on a review of the Flood Map for Planning (Rivers and Sea). Where these span more than one Flood Zone, all zones should be noted.

d. The risk of flooding from other sources should also be identified, based on readily available datasets and local information as set out in Section 4 of this Report and the figures in Appendix B.

e. Identify existing flood defences serving the potential development sites. (However, it should be noted that for the purposes of the Sequential Test, Flood Zones ignoring defences should be used).

f. The design life of the development should be considered with respect to climate change:

- 100 years – up to 2125 for residential developments; and
- Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.

g. Highly Vulnerable developments to be accommodated within the LPA area should be located in those sites identified as being within Flood Zone 1 and at low risk of flooding from other sources. If these cannot be located in areas of low flood risk, because the identified sites are unsuitable or there are insufficient sites in areas of low risk, sites in Flood Zone 2 can then be considered. Highly Vulnerable developments in Flood Zone 2 will require application of the Exception Test. If sites in Flood Zone 2 are inadequate, then the LPA may have to identify additional sites in Flood Zones 1 or 2 to accommodate development or seek opportunities to locate the development outside their administrative area. Within each Flood Zone Highly Vulnerable development should be directed, where possible, to the areas at lowest risk from all sources of

flooding. It should be noted that Highly Vulnerable development is not appropriate in Flood Zones 3a and 3b.

h. Once all Highly Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as More Vulnerable. In the first instance, More Vulnerable development should be located in any unallocated sites in Flood Zone 1 and at low risk of flooding from other sources. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate More Vulnerable development, sites in Flood Zone 3a can be considered. More Vulnerable developments in Flood Zone 3a will require application of the Exception Test. As with Highly Vulnerable development, within each Flood Zone, More Vulnerable development should be directed to areas at lowest risk from all sources of flooding. It should be noted that More Vulnerable development is not appropriate in Flood Zone 3b.

i. Once all More Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located in any remaining unallocated sites in Flood Zone 1 and at low risk of flooding from other sources, continuing sequentially with Flood Zone 2, then Flood Zone 3a. Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.

j. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied.

k. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however, it is appreciated that Water Compatible development by its nature often relies on access and proximity to water bodies.

l. Where the development type is Highly Vulnerable, More Vulnerable, Less Vulnerable or Essential Infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test.

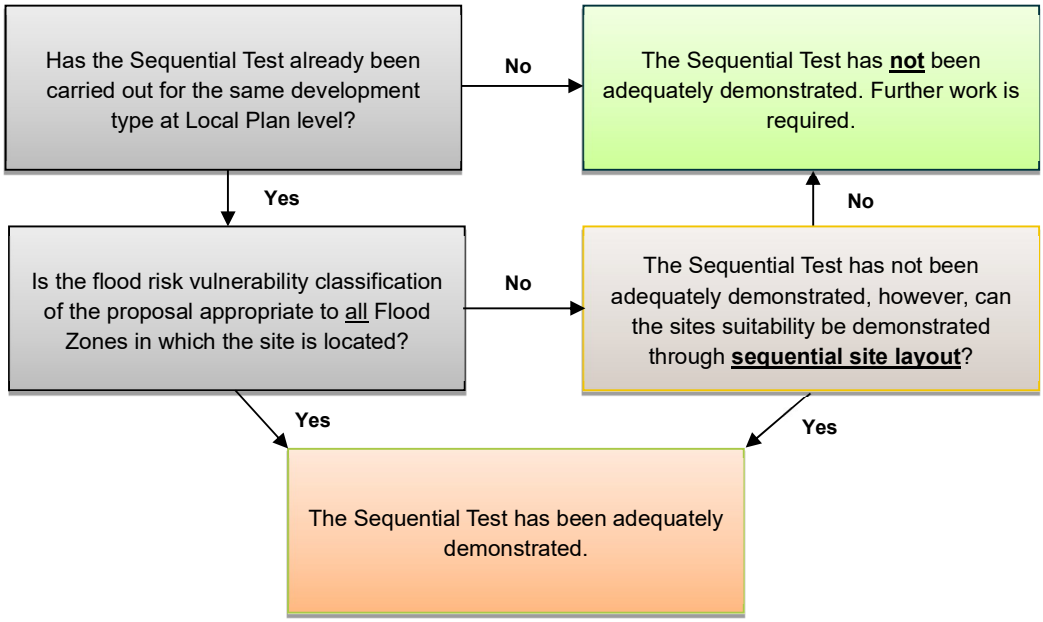
5.2.2 Windfall Sites

Windfall sites are those which have not been specifically identified through the Local Plan process. They comprise sites that have become available and/or could not reasonably have been identified through the site selection process. 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 and expected future trends. It is recommended that the acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms.

5.3 Applying the Sequential Test – Individual Applications

As illustrated in Figure 5 the flood risk Sequential Test can be considered adequately demonstrated if (1) the Sequential Test has already been carried out for the site for the same development type at the Local Plan level and (2) the development vulnerability is appropriate to the Flood Zone.

Figure 5. Determining when the Sequential Test is required for Planning Applications



If the answer to the first criteria is 'yes', but is 'no' for the second, it may be possible to make the site suitable for the proposed use by applying a sequential approach to the development site layout. Further guidance on how to apply a sequential approach is provided in Section 5.3.2.

If the answer to either of these two criteria is 'no', then it is necessary to undertake a Sequential Test for the site. The Environment Agency publication 'Demonstrating the Flood Risk Sequential Test for Planning Applications[31] sets out the procedure as follows:

- Identify the geographical area of search over which the test is to be applied; this could be the District area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area identified for regeneration in Local Plan policies);
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan;
- State the method used for comparing flood risk between sites; for example, the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources;
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s);
- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed;
- Where necessary, as indicated by Table 9, apply an Exception Test;
- Apply the sequential approach to locating development within the site.

It should be noted that it is for LPAs, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence to the LPA what area of search has been used when making the application. Ultimately City of York Council needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere.

[31] Environment Agency (February 2017) Flood risk assessment: the sequential test for applicants. Available at: https://www.gov.uk/guidance/flood-risk-assessment-the-sequential-test-for-applicants

5.3.1 Sequential Test Exemptions

It should be noted that the Sequential Test does not need to be applied in the following circumstances:

- Individual developments proposed on sites which have been allocated in development plans through the Sequential Test.
- Minor development, which is defined in the NPPF as:
  - Minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250 m^2;
  - Alterations: development that does not increase the size of buildings e.g. alterations to external appearance; and
  - Householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats;
- Change of Use applications, unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site or a change in use to a more vulnerable class where they could be affected by any source of flooding;
- Development proposals in Flood Zone 1 (land with a low probability of flooding from all sources) unless the SFRA, or other more recent information, indicates there may be flooding issues now or in the future (for example, through the impact of climate change);
- Redevelopment of existing properties (e.g. replacement dwellings), provided they;
  - Will not be placed at an unacceptable level of flood risk, irrespective of the risk posed to the existing dwelling;
  - Do not increase the number of dwellings in an area of flood risk (i.e. replacing a single dwelling with an apartment block); and
  - Do not increase the net footprint of the building(s) unless accompanied by adequate floodplain compensation or suitable under floor voids.
- Redevelopment, for example replacement dwellings, will be expected to meet current Flood Risk Management best practice standards. Where this is not feasible due to conflicting planning reasons, designs should be as close to best practice as possible. Under no circumstances will a worsening of flood risk compared to the existing case be accepted.

5.3.2 Sequential Approach to Site Layout

This Section provides some guidance on allowances that could be made by identifying those portions of proposed development sites located within these flood zones.

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas. Development should be sequentially allocated within the site boundary to areas firstly within Flood Zone 1 (Low Probability) and then Flood Zone 2 (Medium Probability) where ‘less vulnerable’ development uses would be more appropriate. Residential developments (‘more vulnerable’) should be restricted to areas at low probability of flooding and the following types of ‘water compatible’ development can be placed on lower ground with a higher probability of flooding (Flood Zones 3a and 3b):

- Car parks;
- Green Infrastructure (i.e. open spaces, proposed landscaped areas, nature conservation);
- Outdoor sports and recreation;
- Flood control infrastructure; and
- Water and sewerage transmission infrastructure.

Should development pressure create a need to develop in areas within Flood Zone 3 (plus an allowance for climate change) appropriate minimum floor levels to adopt in agreement with the Environment Agency should be determined.

It is required that any flood volume displaced as a result of development within the entire Flood Zone 3 plus an allowance for climate change envelope (encapsulating Flood Zones 3a (High Probability) and 3b (Functional Floodplain) be compensated for elsewhere within the site boundary on a 'level for level' and 'volume for volume' basis. Any proposed layout and location for such compensation should take into account the flow routing to ensure adequate conveyance.

Appropriate mitigation measures should be incorporated, such that the risk of flooding to surrounding areas is not increased, and where opportunity exists reduction is sought.

In addition to mitigating the impact of any fluvial flows displaced as described above, consideration should be given to the impact of any development on pluvial flow routes and areas susceptible to ponding (see Appendix B Figure 9) informed by a review of the local topography, geology and any structures that may influence the movement of water over the surface. Following the sequential approach to the layout of buildings the provision of SuDS (as outlined in the City of York Sustainable Drainage Guidance for Developers document) will assist in mitigating any increase in risk from surface water to surrounding areas.

5.4 Exception Test

The Exception Test, as set out in paragraph 159 of the NPPF, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

Figure 6 illustrates the approach for applying the Exception Test that City of York Council should adopt in the preparation of the Local Plan.

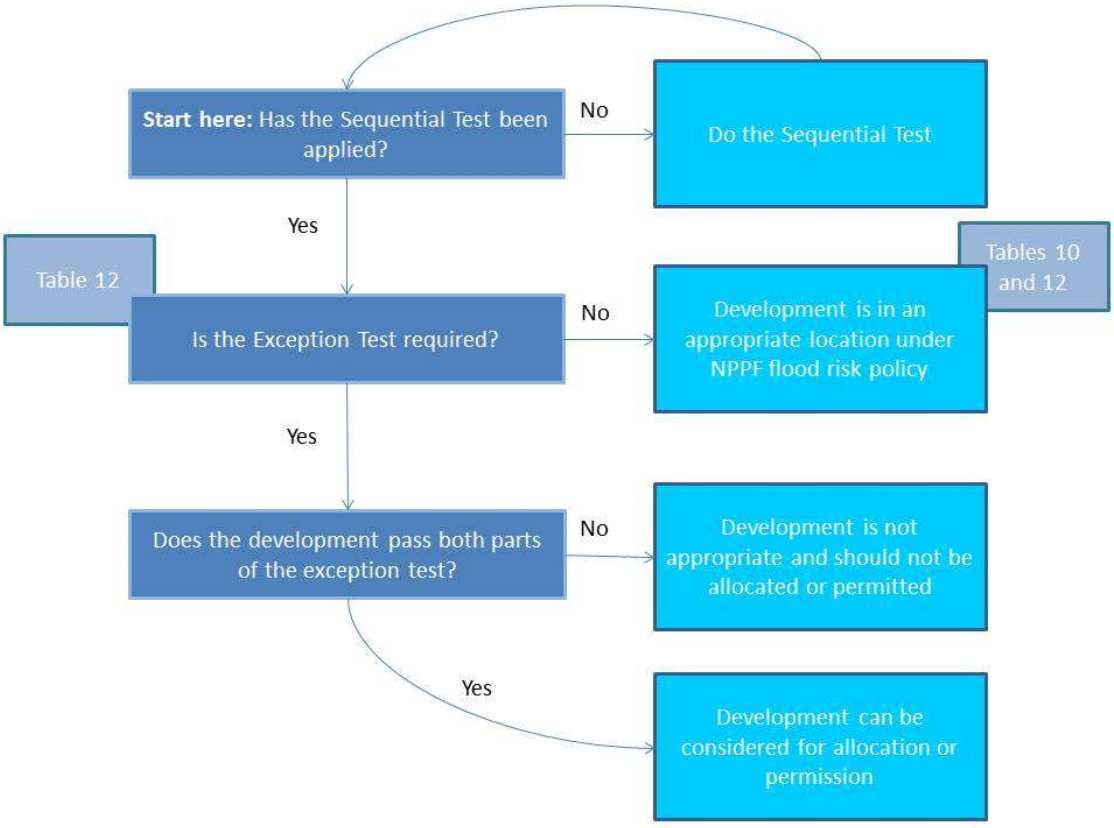


Figure 6. Application of the Exception Test to Local Plan preparation

The purpose of an Exception Test is to ensure that where it may be necessary to locate development in areas at risk of flooding, new development is only permitted in Flood Zone 2 and Flood Zone 3 where the flood risk is clearly outweighed by other sustainability factors and where the development will be safe during its lifetime, considering climate change.

The NPPF states that for the Exception Test to be passed:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted.

In order to determine Part 1) of the Exception Test, applicants should assess their scheme against the objectives set out in the Local Plan Sustainability Appraisal (2018)[32] and reproduced in Table 13. In order to demonstrate satisfaction of Part 2) of the Exception Test, relevant flood risk management and mitigation measures should be applied and demonstrated within a site-specific FRA as detailed in Section 7.

Table 13. City of York Council's Sustainability Appraisal Objectives

	Sustainability Objectives
1	To meet the diverse housing needs of the population in a sustainable way.
2	Improve the health and wellbeing of York's population.
3	Improve education, skills, development and training for an effective workforce.
4	Create jobs and deliver growth of a sustainable, low carbon and inclusive economy.
5	Help deliver equality and access to all.
6	Reduce the need to travel and deliver a sustainable integrated transport network.
7	To minimise greenhouse gases that cause climate change and deliver a managed response to its effects.
8	Conserve and enhance green infrastructure, biodiversity, geodiversity, flora and fauna for accessible high quality and connected natural environment.
9	Use land resources efficiently and safeguard their quality.
10	Improve water efficiency and quality.
11	Reduce waste generation and increase level of reuse and recycling.
12	Improve air quality.
13	Minimise flood risk and reduce the impact of flooding to people and property in York.
14	Conserve and enhance York's historic environment, cultural heritage, character and setting.
15	Protect and enhance York's natural and built landscape.

5.4.1 Exemptions

It is noted that applications for minor development and of use change (except where changed to a more vulnerable class where they could be affected by any source of flooding) are exempt from an Exception Test (see Notes to the Flood Risk Vulnerability and Flood Zone 'Compatibility' table (PPG, 2014) however site-specific FRAs are still required, as detailed in Section 7.

[32] City of York Council & Amec Foster Wheeler, (2018) Sustainability Appraisal of the Local Plan Publication Draft [Examination Library references: CD008 and CD009]

6. Flood Risk Management Measures

Where alternative sites in areas at lower risk of flooding are not available, it may be necessary to locate development in areas at risk of flooding. In these cases, City of York Council and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development and will not increase flood risk overall.

6.1 Sequential Approach within Development Sites

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development and to ensure flood risk is not increased elsewhere.

Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas e.g. residential developments (classified as More Vulnerable Development) should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas (classified as Water Compatible or Less Vulnerable Development) can be placed on lower ground with a higher probability of flooding.

Whilst traditionally applied to the risk of river flooding, this approach should also be implemented when considering the risk of other sources of flooding (i.e. surface water flooding, groundwater flooding etc.) across a site.

6.2 Finished Floor Levels

Where developing in fluvial or tidal flood risk areas is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) land uses, is to ensure internal floor levels are raised 600mm above the known or modelled 1% AEP flood level for rivers or 0.5% AEP flood level for tidal sources, including a suitable allowance for climate change (see Environment Agency Standing Advice). Floor levels may not need to be raised for other types of development where buildings can be designed to be floodable e.g. Less Vulnerable development.

<table>
<tr><th>Development Type</th><th>Flood Zone 3</th><th>Flood Zone 2</th></tr>
<tr><td>Minor residential development</td><td>Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development should be incorporated
OR,
Floor levels within the extension will be set 300mm above the known or modelled 1 in 100 year (1% AEP) flood level including climate change for fluvial flood risk and the 1 in 200 year (0.5% AEP) event including climate change for tidal flood risk.</td><td>Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development should be incorporated.</td></tr>
<tr><td>Other development - residential</td><td colspan="2">Where appropriate, subject to there being no other planning constraints (e.g. restrictions on building heights), finished floor levels should be set at whichever level is higher:
600mm above existing ground level of the site plus 300mm of flood proof / resilient construction.
600mm above the highest recorded flood level plus 300mm of flood proof / resilient construction.
300mm above the known or modelled 1:100 (1% AEP) flood level including the appropriate climate change allowance for fluvial flood risk and the 1:200 (0.5% AEP) flood level including climate change for tidal flood risk.
For defended fluvial floodplain, flood levels in the event of a breach should be derived for the 1% AEP undefended event plus climate change and for defended tidal floodplain, flood levels should be derived for the (0.5% AEP undefended event plus climate change.

For a habitable use to be acceptable there must be no more than 300mm depth of internal flooding. If internal flood depths are greater than 300mm development cannot be considered to have safe internal access or egress, and so would not be appropriate for habitable use. Where ground floor levels cannot be set above the estimated river or tidal level, sleeping accommodation should be restricted to the first floor or above to offer the required ‘safe place’. Internal ground floors below this level could however be occupied by either Less Vulnerable commercial premises, garages or non-sleeping residential rooms (e.g. kitchen, study, lounge) (i.e. applying a sequential approach within a building).</td></tr>
<tr><td>Other development – non residential</td><td colspan="2">Finished floor levels may not need to be raised. For example, Less Vulnerable developments can be designed for water entry instead of raising floor levels, and this may be beneficial to help minimise the impact of the development on the displacement of floodwater and the risk of flooding to the surrounding area.

However, it is strongly recommended that internal access is provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. Such refuges will have to be permanent and accessible to all occupants and users of the site and a Flood Warning and Evacuation Plan should be prepared to document the actions to take in the event of a flood.

Other flood resilience and resistance measures may also be required.</td></tr>
<tr><td>Basement dwellings</td><td>Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units are not permitted in Flood Zone 3b. Self-contained residential basements and bedrooms at basement level are not permitted in Flood Zone 3a. Internal access to a higher floor situated 300mm above the 1% AEP flood level including climate change must be provided for all other basements, basement extensions and conversions.</td><td>All basements, basement extensions and conversions must have internal access basement higher floor situated 300mm above the 1% AEP flood level including climate change.</td></tr>
</table>

In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. The Environment Agency has provided Standing Advice on extensions and floor levels.

Where an area benefits from the presence of flood defences, the fluvial and/or tidal risk is considered to be residual.

The Environment Agency has prepared updated guidance on the methodology used to assess record and address the residual uncertainties associated with finished floor levels and freeboard allowances[33].

6.2.1 Basement Dwellings

Basement dwellings are classified as Highly Vulnerable under the NPPF and as such the following should be adhered to within the FRA:

- Basements dwellings are discouraged within areas at risk of fluvial, surface water or groundwater flooding risk;
- Basement dwellings are not permitted within Flood Zone 3a and Flood Zone 3b;
- For Flood Zone 2, basement dwellings must pass the Sequential and Exception Tests;
- Where basement dwellings are constructed, access must be situated 300mm above the design flood level, and developers are required to install protection to prevent surcharge from the public sewer network into the property. This is often achieved by the installation of a positively pumped system in the basement;
- Waterproof construction techniques should be employed to avoid seepage during flood events;
- An assessment of ground conditions is required to inform the structural integrity of the basement construction. This should include consideration of groundwater conditions, as well as flow paths and the potential for excessive surface water to pond at the side of buildings with the potential to infiltrate and compromise structural integrity;
- Surface water flow paths should be assessed to inform the strategic location of SuDS and techniques to route flows around the edge of buildings.

6.3 Flood Resistant and Resilient Design, including Property Flood Resilience

Flood resistant measures aim to keep water out and give occupants time to relocate ground floor contents. Passive flood resilience measures aim to prevent/reduce damage of flood water and this includes raising of electrics and wipeable furnishings. Flood resistant and resilient design should be undertaken in line with the Department for Communities and Local Government Guidance: Improving the Flood Performance of New Buildings, Flood Resilient Construction[34]. This provides specific advice on how to improve the resilience of new properties in low or residual flood risk areas and suitable materials and construction techniques for floors, walls, doors and windows and fittings. These passive and resistant flood measures should be used where appropriate. Figure 7 provides a summary of different design strategies depending on the depth of floodwater that could be experienced.

[33] Environment Agency (2021) Accounting for residual uncertainty: updating the fluvial freeboard guide. Available at: https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/accounting-for-residual-uncertainty-an-update-to-the-fluvial-freeboard-guide
[34] Ministry of Housing, Communities & Local Government (2007). Improving the flood performance of new buildings: flood resilient construction. Available at: https://www.gov.uk/government/publications/flood-resilient-construction-of-new-buildings

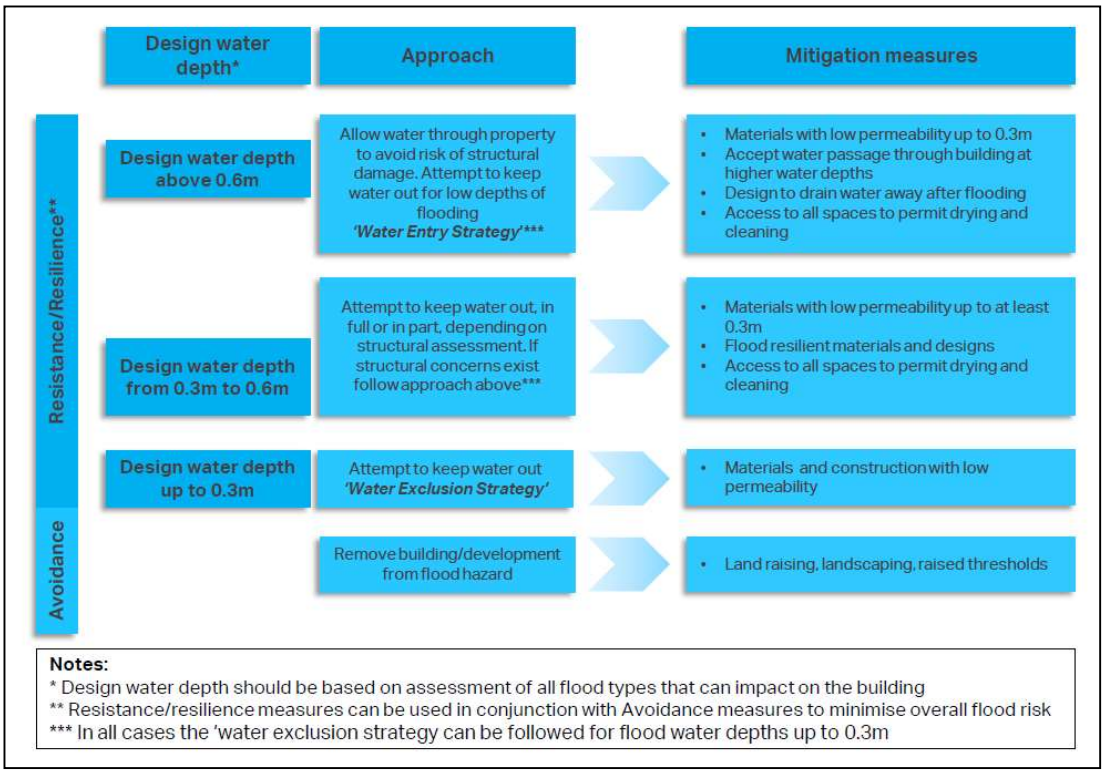


Figure 7. Rationale for Flood Resilient Design Strategies, Improving Flood Performance, (Figure 4.1 from CLG 2007)

Materials can be used which allow the passage of water whilst retaining their structural integrity and they should also have good drying and cleaning properties. Alternatively, sacrificial materials can be included for internal and external finishes; for example, the use of gypsum plasterboard which can be removed and replaced following a flood event. Flood resilient fittings should be used to at least 0.1m above the design flood level. Resilience measures are either an integral part of the building fabric or are features inside a building that will limit the damage caused by floodwaters.

Property flood resilience measures are affordable flood resistant and resilience measures that homeowners can deploy to help prevent and limit the damage caused by flood water. Information on property level protection can be found on the National Flood Forum website, the Environment Agency website and The University of Manchester and Manchester Metropolitan University's Six Steps to Property Level Flood Resilience[35].

6.4 Development adjacent to Existing Defences

Flood defences are an essential means of protecting low-lying areas from flooding. Where development directly adjacent to the defences is permitted, the Environment Agency and City of York Council may wish to use this opportunity to extend public access to the waterside and protect and enhance existing ecological features.

Development should take into account the need to raise these defences and otherwise accommodate increased river levels in the future and must be sufficiently set back from them to allow for their inspection, maintenance and renewal. Horizontal set-back distances should be calculated relative to the landward extent of the defences, in order to allow for a range of engineering options for future works. Development should aim to be 8m behind a fluvial flood wall. Site specific constraints may affect the amount of setback that can be achieved, in these instances; a smaller set back may be acceptable following discussion and agreement from the Environment Agency / LPA.

The EA are a statutory consultee for planning applications where development is within 20m of a main river (http://www.legislation.gov.uk/uksi/2015/595/schedule/4/made). Permission is required for any work activity within 8m of a flood defence or culvert on a main river, or within16m of a tidal river or tidal defence (https://www.gov.uk/guidance/flood-risk-activities-environmental-permits).

[35] Six Steps to Property Level Flood Resilience. Available at: http://www.smartfloodprotection.com/

City of York Council, as the LLFA, is responsible for consenting of works in ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010).

In addition, IDBs are responsible for consenting of works in watercourses within their Drainage Districts (for any work activity within 9m of an IDB watercourse) under Section 23 of the Land Drainage Act 1991 (as amended), and the Drainage Byelaws, created under Section 66 of the Land Drainage Act.

6.5 Construction of flood defences and land raising in a new development

The construction of flood walls to protect a development are not generally considered to be an appropriate strategic option for City of York Council as residual risk of flooding will still remain. If linear defences are used to protect a development then a residual risk of a breach in defences remains. It is best practice to sequentially position development away from areas of higher flood risk to areas of low flood risk, wherever possible. It is acknowledged that in some cases development may need to be considered in areas at risk of flooding. The construction of flood defences, including walls, could be considered but early discussions with the City of York Council and the Environment Agency should be engaged as early as possible to confirm if flood walls would be acceptable in principle.

If a development is to include the construction of flood defences, designs should include details of access for pedestrians and vehicular access to the elevation of the development, impacts on the streetscape and challenges of perceived isolation, land-take for the use of access routes and embankments and challenges to site drainage and surface water runoff.

Land raising can ensure that development is located above the design flood level. However, land raising can increase risk to neighbouring communities, reduce community place-making and can require high land-take. Where land raising is proposed within flood risk areas, compensatory storage should be provided on a level for level/volume for volume basis.

Developers should engage as early as possible with City of York Council and the Environment Agency to confirm whether new defences and/or land raising would be acceptable in principle. This reduces the potential for abortive work, delays in relevant planning permissions and completion of development.

When considering development proposing to raise land, City of York Council will consider the following potential impacts:

- Changes to the topography of the area following a redevelopment could lead to an increase in water level to other parts of the area during a flood event following a defence breach;
- For the Exception Test to be passed to allow development in a flood risk zone it must be demonstrated that the development will not increase flood risk elsewhere;
- Wider scale use of land raising or secondary defences across City of York Council could require detailed breach modelling and potentially compensatory flood storage, which is unlikely to be suited to the densely urbanised area.

6.5.1 Floodplain Compensation Storage

Where a proposed development results in a change in building footprint, the developer must ensure that it does not impact on the ability of the floodplain to store water, and in areas of higher risk e.g. Flood Zone 3b, should seek opportunities to provide betterment.

Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage must be provided to ensure that the total volume of the floodplain storage is not reduced in areas that lie outside the extent of the design flood event.

Compensation works can be divided into 'direct' and 'indirect' methods. These terms are used in CIRIA report 624 'Development and flood risk - guidance for the construction industry' (CIRIA, 2004[36]). Direct or 'level for level' methods re-grade land at the same level as that taken up by the development, hence providing a direct replacement for the lost storage. Indirect methods rely on water entering a storage area, which then releases the water back at a controlled rate, in a manner similar to surface water attenuation schemes. Indirect schemes are complex to design

[36] CIRCA (2022). C738A: Managing Urban Flooding from Heavy Rainfall Guidance. Available at: https://www.ciria.org/Resources/Free_publications/c738.aspx

and construct, and require a much more intensive maintenance regime, which needs to be carried out in perpetuity, so are generally less favourable.

Compensatory volume must be provided at the same level as the lost storage for it to be 'level for level'. An equal volume of flood plain must be created to that taken up by the development. This equal volume must apply at all levels between the lowest point on the site and the design flood level (the 1% AEP floodwater level with an allowance for the potential impacts of climate change).

The height between the lowest point of the development and the floodwater design levels is split into a series of bands (commonly at 0.2 metre intervals). The volume of lost floodplain storage space as a result of the development is then calculated individually for each of these bands. Elsewhere on-site, existing ground levels are then lowered at the same band levels, such that, for each band level, the lowered areas equate to at least the volume lost.

The compensation areas provided should be able to freely fill and drain.

Unacceptable options for compensatory flood storage:

- Excavation of a hole in the ground, as this will become full before the time in the flood event when the compensation is needed.
- Providing a compensation area within a landlocked location, that is connected by a narrow access or a culvert. These links are more prone to blockages and maintenance can be an issue.
- Works that will damage sensitive habitats or the heritage of the site.
- Works that may place surrounding properties at risk. For example, lowering the ground level close to 'at risk' properties, thereby increasing their flood risk further by creating new flow routes.

6.6 Designing for Exceedance and Flood Routing

Design for exceedance approaches should be considered by using urban areas and infrastructure to help manage local flooding. This can include temporarily using roads to channel water, open spaces such as car parks to store water and erect temporary barriers to make homes and businesses flood resilient and resistant. Further information on designing for exceedance is available in the CIRIA (C738a) Managing Urban Flooding from Heavy Rainfall Guidance[33].

Careful consideration should be given to the use of fences and landscaping walls so as to prevent causing obstruction to flow routes and increasing the risk of flooding to the site or neighbouring areas.

6.7 Riverside Development

The Environment Agency require an 8m wide undeveloped buffer strip alongside main rivers (fluvial) and 16m alongside main rivers (tidal) or flood defences. Under the Land Drainage Act 1991 and associated regional byelaws, any works within this buffer area requires an Environment Agency Flood Risk Activity Environmental Permit depending on the specific activity proposed. In addition, the Environment Agency would also ask developers to explore opportunities for river restoration as part of any development proposals.

City of York Council, as the LLFA, is responsible for consenting of works in ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010). City of York Council are recommended to be consented regarding any activities occurring that could impact flood defences on ordinary watercourses. However, primarily in order to ensure access to ordinary watercourses is maintained, consultation with City of York Council is recommended for any work within 9m of an ordinary watercourse so that advice can be provided.

Under Section 23 of the Land Drainage Act 1991 (as amended) and the Drainage Byelaws created under Section 66 of the Land Drainage Act IDBs are responsible for consenting of works in watercourses within their Drainage Districts. Consent for any work activity within 9m of an IDB watercourse should therefore be obtained from the appropriate IDB.

The Environment Agency and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT) have produced some joint guidance[37] on flood risk emergency plans for new development. This guidance provides a Framework for the LLFA to appraise emergency plans in the absence of any local arrangements. and

[37] ADEPT and Environment Agency. 2019. *Flood risk emergency plans for new development,* Available at: ADEPT/EA Flood Risk Emergency Plans for New Development | ADEPT (adeptnet.org.uk)

aims to support robust consideration of whether proposed development will be safe. It also provides guidance to developers and consultants to produce suitable plans and ensure that relevant stakeholders are involved appropriately.

6.8 Safe Access and Egress

Safe access and egress is required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood risk management authorities and responders to carry out any necessary duties during periods of flood.

A safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g. within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances. This is of particular importance when contemplating development on sites within Flood Zone 1, but the surrounding area is within Flood Zone 2 or 3.

Guidance prepared by the Environment Agency[38] uses a calculation of flood hazard to determine safety in relation to flood risk. Flood hazard is a function of the flood depth and flow velocity at a particular point in the floodplain along with a suitable debris factor to account for the hazard posed by any material entrained by the floodwater, (refer to Table 14). The derivation of flood hazard is based on the methodology in Flood Risks to People FD2320, the use of which for the purpose of planning and development control is clarified in the above-mentioned publication. Flood hazard mapping should be undertaken as part of a site-specific FRA, if required, when looking at potential access and egress routes.

Table 14. Hazard to People Rating (HR=d x (v +0.5) + DF) (Table 13.1 FD2320/TR2)

Flood Hazard (HR)	Description
Less than 0.75	Very low hazard – Caution
0.75 to 1.25	Dangerous for some – includes children, the elderly and the infirm
1.25 to 2.0	Dangerous for most – includes the general public
More than 2.0	**Dangerous for all – includes the emergency services**

For developments located in areas at risk of tidal fluvial flooding safe access and egress must be provided for new development as follows in order of preference:

- Safe dry route for people and vehicles.
- Safe dry route for people.
- If a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause risk to people.
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles. However, the public should not drive vehicles in floodwater.

For fluvial flooding, a 'dry' access/egress is a route located above the 1% annual probability flood level (1% AEP) including an allowance for climate change.

6.9 Safe Refuge

In exceptional circumstances, dry access above the 1% AEP flood level including climate change associated with fluvial flooding may not be achievable. In these circumstances the LLFA and the Environment Agency should be consulted to ensure that the safety of the site occupants can be satisfactorily managed. This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed egress route. For example, this may entail the designation of a safe place of refuge on an upper floor of a building, from which the occupants can be rescued by emergency services. It should be noted that sole reliance on a safe

[38] Environment Agency, 2021. Flood risk assessment guidance for new development. Available at: Flood risk assessment guidance for new development - GOV.UK (www.gov.uk)

place of refuge is a last resort, and all other possible means to evacuate the site should be considered first. Provision of a safe place of refuge will not guarantee that an application will be granted.

6.10 Green Infrastructure and Urban Blue Corridors

Urban Blue Corridors present the opportunity to link into existing networks of Green Infrastructure to provide dynamic hydraulic and ecological corridors in the urban environment and provide multifunctional use. This can be done in tandem with delivering environmental, social and economic benefits.

Green Infrastructure is defined as "a network of multi-functional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities."

Definitions for Green Infrastructure vary in the degree to which they refer to 'Blue' infrastructure elements. The Natural England Green Infrastructure Guidance[39] recognises rivers and streams within a Green Infrastructure typology, whereas other definitions make specific reference to water resources forming part of the Green Infrastructure network. Green Infrastructure elements or assets include individual sites or broader features such as urban squares, city parks, nature reserves, brown/green roofs, private gardens, railway corridors and woodland. Most assets can contribute to surface water management, however, whilst Green Infrastructure takes into account flood risk management, it does not, at present, include overland flow paths.

By linking with Green Corridors and Infrastructure, Urban Blue Corridors offer the opportunity to help align with national environmental aspirations. For example, Natural England, in their Position Statement on Urban Areas, states that:

- The natural environment in towns and cities is fundamental to sustaining urban life and should be integral to the way in which urban areas are planned and managed;
- The distinctive fabric of the natural environment in towns and cities makes a major contribution to urban landscape and sense of place and should be valued, conserved and enhanced;
- The natural environment in towns and cities should underpin their adaptation to a rapidly changing climate and provide environmental security for communities; and
- People should have opportunities to readily access high quality natural environment in urban areas in order to enjoy the broad range of environmental and social benefits it offers.

Where proposed sites contain a Main River or Ordinary Watercourse, conservation and restoration of the river corridor should be incorporated into the site layout, and if necessary, a fluvial management strategy developed. Where possible, the post development situation should be better in terms of flood risk compared to the existing situation, by providing space for water to include an allowance for climate change, as well as improve ecology, water quality and amenity. In these instances, it may not be necessary to undertake a Sequential Test for the site, if all development can be shown to be within Flood Zone 1.

6.11 Car Parks

Where car parks are specified as areas for the temporary storage of floodwaters, flood depths should not exceed 300mm given that vehicles may be moved by water of greater depths. Where greater depths are expected, car parks should be designed to prevent the vehicles from floating out of the car park. Signs should be in place to notify drivers of the susceptibility of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary.

The Environment Agency recommends that in areas where under croft parking is provided, occupants should also sign up to flood alerts. Due to the nature of flood warnings, it is possible that under croft parking areas may have flooded before a flood warning has been issued.

[39] Natural England. 2009.Natural England's Green Infrastructure Guidance (NE176). Available at: http://publications.naturalengland.org.uk/publication/35033

7. Guidance for Preparing Site-Specific FRAs

7.1 Overview

This Level 1 SFRA provides a high-level assessment of the flood risk posed to the City of York. However, this document has a strategic scope and therefore a site-specific Flood Risk Assessment (FRA) may need to be undertaken for a proposed development, in accordance with the requirements of the NPPF and supporting PPG.

A FRA should assess the risk of flooding to the development from all sources, and detail any measures required to mitigate the risk of flooding to the development, site users and surrounding area.

This chapter sets out when a FRA is required, what it should contain, and guidance on a range of mitigation measures that are typically applied to development in areas of flood risk, including residual flood risk.

7.2 Pre-Application Consultation

Pre-Application discussions are recommended to be undertaken with City of York Council. Early discussions may result in improved flood risk management for the site and surrounding area to ensure the required and correct documentation is prepared and submitted.

As recommended within the NPPF and supporting PPG, discussions between City of York Council, as the local planning authority and LLFA; the Environment Agency, IDB, if required, and Yorkshire Water, as the water and sewerage company, from the outset are advised. This will enable water supply and quality issues and the need for new water and wastewater infrastructure to be identified, both on and off-site. Specifically, developers should engage with Yorkshire Water at the earliest convenience if they wish to connect surface water to the Yorkshire Water sewer network. The City of York Council Sustainable Drainage Guidance for Developers document considers this further.

7.3 When is a Flood Risk Assessment required?

In accordance with the NPPF, a site-specific FRA must be produced to support applications for development proposed in flood risk areas or where a proposed development may increase flood risk to third parties.

The NPPF states that a site-specific FRA is required to accompany a planning application for a site:

- where the site lies within Flood Zone 1 and is greater than 1 hectare in area; or
- in an area within Flood Zone 1 which is greater than 1ha or has critical drainage problems (as notified to the LPA by the Environment Agency[40]); and,
- All proposals for new development (including minor development[41] and change of use) in Flood Zones 2 and 3; or
- where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

The Environment Agency Guidance Note[42] for FRAs in Flood Zone 1 should be consulted for advice on the approach and content of a site-specific FRA.

7.4 What are the objectives of a Flood Risk Assessment?

The objectives of a site-specific FRA are to:

- Assess the risks for all sources of flooding to and from development.

[40] A critical drainage area in this context is defined under the Town and Country Planning Order 2006 as an area within Flood Zone 1 which has critical drainage problems and has been notified to the Local Planning Authority (LPA) by the Environment Agency. This is separate to critical drainage areas (CDAs) that may be highlighted in Surface Water Management Plans (SWMP) which are defined by a local authority when there is a cluster of surface water flood hotspots

[41] According to the PPG, minor development means:
minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m^2.
alterations: development that does not increase the size of buildings e.g. alterations to external appearance.
householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

[42] https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zone-1-and-critical-drainage-areas

- Provide evidence (where required in the PPG) to apply the Sequential Test[43] to individual developments and demonstrate to the LPA that this has been applied (based on specific guidance from the LPA).
- Show that the development is safe and passes the Exception Test[44] (if applicable) as required by the NPPF.
- Demonstrate that flood risk to the development can be managed now and over the lifetime of the development, taking climate change into account, and;
- Demonstrate that the development does not increase the risk of flooding to third parties from all sources.

The Planning Practice Guidance Section 10 on flood risk and coastal change provides detail on the requirements of a site-specific flood risk assessment, and the application of the sequential and exception tests:

- Planning Practice Guidance section 10: http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment/

It additionally includes the considerations that need to be made to meet the wider sustainability benefits to the community and the safety of the development if it is to satisfy the exceptions test.

The Environment Agency provides guidance on the requirements of, and how to complete, an FRA as part of a planning application:

- Environment Agency Planning Application Advice: https://www.gov.uk/planning-applications-assessing-flood-risk
- Alternatively for planning application advise, the Yorkshire Sustainable Places team inbox can be contacted using the following email address sp-yorkshire@environment-agency.gov.uk

This also includes information on when an FRA is required and advice on the contents of FRAs for different development types in Flood Zones 1, 2 and 3. Applicants for planning permission within City of York Council's area should follow both the PPG and EA advice when preparing a site-specific FRA.

General Flood Risk Standing Advice can also be useful to consult as it is this guidance which City of York Council will use in combination with the PPG to assess your application: https://www.gov.uk/flood-risk-standing-advice-frsa-for-local-planning-authorities

Additionally, the Environment Agency can provide pre-application advice to developers, at a cost. Further information is available here:

- Pre-planning application advice: https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion
- Detailed planning advice: https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions

7.5 What should a Flood Risk Assessment address?

Site-specific FRAs should be **proportionate to the degree of flood risk and appropriate to the scale, nature and location of the development**. The report should make optimum use of readily available guidance and information, including the PPG, Environment Agency Standing Advice and the mapping presented within the City of York SFRA, City of York SWMP and available through the Environment Agency website.

[43] The Sequential Test ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. Further information is provided in the NPPF and the PPG – Sequential Test

[44] The Exception Test is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available. Further information is provided in the NPPF and the PPG – Exception Test

FRAs should also be **appropriate to the scale, nature and location of the development**. For example, City of York Council would generally need a less detailed assessment to be able to reach an informed decision on the planning application where the development is an extension to an existing house (for which planning permission is required), as this is unlikely to significantly increase the number of people in an area at risk of flooding. For a new development comprising a greater number of houses in a similar location, or one where the flood risk is greater, City of York Council would require a more detailed assessment.

7.6 FRA Specific Requirements Checklist

The PPG contains a model FRA checklist which has been used as a basis for a City of York Council FRA checklist outlined below. Where appropriate, additional flood risk issues requiring attention and relating specifically to York have been added.

It should be noted that organisations listed within the following tables may be able to provide sources of data to support the FRA but will not undertake the investigations for developers.

The information below is based on the checklist for site specific FRAs provided in the PPG. Where appropriate, references have been added to determine where the information can be found to support each required item. Further guidance to inform the development of a site specific Flood Risk Assessment can be found in the City of York Sustainable Drainage Guidance for Developers document Report jj 2017-03-14 (york.gov.uk).

7.6.1 Development Description and Location

Requirements		Notes
a.	What type of development is proposed, and where will it be located?	Site information; it is important at this stage to ensure that sufficient plans are provided showing the site boundary, features including ground levels, watercourses and other bodies of water as well as any structures which may influence the flow of flood water. A site survey will be necessary to ensure all such structures are identified. If the application is for a basement development, refer to Section 6.2
b.	What is the proposed developments flood risk vulnerability classification?	The FRA should identify the vulnerability classification of the proposed development, as set out in Section 5 of this report and Table 2 of the PPG. Where proposed developments comprise a range of developments with differing vulnerabilities (e.g. a mixed used development), the highest vulnerability should be used in the assessment.
c.	Does the proposed development comply with City of York Local Plan policies and follow supplementary planning guidance?	City of York Local Plan (currently in development) provides the strategic planning policy framework for the City.
d.	What evidence can be provided that the Sequential Test and where necessary the Exception Test has/have been applied in the selection of this site for this development type?	Consult City of York Council to determine if the site has been included in the Sequential Test once this has been carried out. If not, refer to Section 5.3 for guidance on undertaking the Sequential Test for individual development sites and to determine whether the Exception Test is required.
e.	Will the proposal increase overall the number of occupants and/or users of the building/land, or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people?	Particularly relevant to minor developments (alterations and extensions), and changes of use, including multi occupancy use.

7.6.2 Identifying Flood Sources

Requirements		Notes
a.	What sources of flooding could affect the site? Assess all potential sources of flooding.	Refer to Section 4
b.	For each source identified in section a above, describe how flooding would occur, with reference to any historic records where these are available.	Refer to Section 4.
c.	What are the existing surface water drainage arrangements for the site?	Developers must be able to demonstrate that there would be no increased risk of surface water flooding either on or off site as a result of the proposed development. Where an increased risk exists, developers need to provide a Drainage Strategy to demonstrate how they intend to address this, by what methods, over what timeframe and how maintenance of such works would be funded over its lifetime. Further guidance can be found in City of York Council's Sustainable Drainage Systems Guidance for Developers document.

7.6.3 Probability

Requirements		Notes
a.	Which Flood Zone (or zones) is the site within?	Refer to the Flood Map for Planning and the Long Term Flood Risk Assessment Search on the Environment Agency's website
b	If there is a Strategic Flood Risk Assessment (SFRA) covering this site, what does it show?	City of York Council SFRA & SWMP
c.	What is the probability of the site flooding?	Environment Agency online flood risk mapping. Where the quality and/or quantity of information for any of the flood sources affecting a site is insufficient to enable a robust assessment of the flood risks, further investigation may be required. For example, where hydraulic modelling is not available for small watercourses, City of York Council and the Environment Agency should be contacted for pre application advice to see if the scope of the site specific FRA needs to be increased to include modelling to ensure details of flooding mechanisms are fully understood and that the proposed development incorporates appropriate mitigation measures. If further modelling is required then please allow additional time in your programme for the model to be reviewed and signed off by the EA.

Requirements		Notes
d.	What are the existing rates and volumes of surface water run-off generated by the site? Assess the sequence of flooding across the site, rate of rise of water level, flow velocities, depths and the duration of flood (existing and post-development).	Rates and volumes of runoff for a range of storm events up to and including the 1% AEP event (including an allowance for climate change) should be calculated. Where the scale of development as advised by City of York Council requires calculation of rates and volumes of runoff this can be supported using industry-standard software, such as WinDes, and the outputs from these submitted with the FRA. City of York Council's Sustainable Drainage Systems Guidance for Developers document should be used to inform the drainage design/ surface water management elements. For fluvial flood risk, detailed information on rate of onset of flooding, velocities, depths and duration of flooding may be informed by hydraulic modelling carried out by the Environment Agency. Where such information is currently unavailable, the Environment Agency will advise on the requirement for further investigation. For groundwater flood risk, Potential Groundwater Flooding Zone mapping within the SFRA should be consulted for potential areas of groundwater flooding. It may be necessary to carry out groundwater monitoring on-site to confirm groundwater levels. Yorkshire Water should be contacted regarding flood risk from sewers.
e.	Is the site at residual risk of flooding, e.g. in the event of a failure of the fluvial or tidal flood defences? What level of flood risk could be experienced on the site during such an event? Consider the benefit afforded to the site from any existing flood alleviation measures.	Where a suitable location has not been modelled, a developer may have to conduct their own assessment of the residual risk, in a manner that is proportionate to the scale and nature of development proposed.

7.6.4 Climate Change

Sites located in lower risk areas (Flood Zone 2) could in future be located in higher risk areas (Flood Zone 3a) when the impacts of climate change are taken into account. This predicted greater risk needs to be addressed within a FRA demonstrating that the proposal is safe, does not increase the risk of flooding or impede flows over the lifetime of the development. The Environment Agency has provided detailed online guidance[45] on the use of these allowances for flood risk assessment and it is recommended that reference is made to this source for the most up to date guidance.

To help developers decide which allowances to use to inform the flood levels that the FRA will be based on for a proposed development, the following should be considered:

- likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s). It is envisaged that the '2070-2125' epoch will be appropriate for most developments (Table 7);
- vulnerability of the proposed development types or land use allocations to flooding;
- 'built in' resilience measures used, for example, raised floor levels; and

[45] Climate change allowances for Flood Risk Assessment https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

- capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

The latter point acknowledges that there may be instances where some flood risk management measures are not necessary now but may be in the future. For example, this 'managed adaptive' approach may include setting a development away from a river so it is easier to improve flood defences in the future.

Requirements		Notes
a.	How is flood risk at the site likely to be affected by climate change?	Use available datasets to assess the potential impacts of climate change including: City of York Council SFRA (for all sources see Section 4) and Appendix B Figure 9 and Figure 10. Environment Agency's 'Climate Change allowances for planners' guidance NPPF & PPG

7.6.5 Detailed Development Proposals

Requirements		Notes
a.	Demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding (include details of the development layout).	Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas e.g. residential developments should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on land with a higher probability of flooding. Refer to Section 7.1 regarding the use of the sequential approach within development sites

7.6.6 Flood Risk Management Measures

Mitigation measures should be seen as a last resort to address flood risk issues to new development. However, where development takes place in an area at risk of flooding, it must be demonstrated, through the production of a FRA that it is:

- Safe for its lifetime;
- Does not increase the risk of flooding elsewhere; and
- Where possible reduced flood risk overall.

Requirements		Notes
a.	How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime?	Developers constructing new developments in lower flood risk areas are required to manage the flood risk by conforming to NPPF and the PPG and considering the design and construction in line with: • Improving the Flood Performance of New Buildings - Flood Resilient Construction Guidance hierarchy: Flood Avoidance, Flood Resistance and Flood Resilience (DCLG/Environment Agency's 2007) and, • Property flood resilience measures (see Section 6.2 and Section 6.3).
		Development should ensure that surface water run-off is managed in line with City of York Council's surface water management requirements, as set out in City of York Council's Sustainable Drainage Systems Guidance for Developers document.
		The design life of the proposed development should be considered with respect to climate change as: • 75 years – up to 2090 for commercial / industrial developments; and • 100 years – up to 2115 for residential developments
		Consideration should be given to the following (further detail is provided below): • Finished floor levels, in particular for habitable rooms of more vulnerable uses • Uses of buildings • Flood resistance and resilience design • Existing flood defences.
b.	Where new or modified structural measures are proposed, an assessment of their behaviour in extreme events greater than those for which they are designed should be provided.	The use of raised floor levels and, in particular, raised bedrooms, can minimise the impact of internal flooding in the event of a breach of defences. It is recommended that if these measures are used, that the building design should be resilient to flooding from a breach event in the 1.0% AEP, considering climate change. Structural strengthening of buildings should be considered, where this could reduce risk to life. This should incorporate building design that is resistant to flooding up to 0.6m.

7.6.7 Off Site Impacts

Developers should be able to demonstrate that proposed developments will not increase flood risk off-site and/or downstream. Where possible, developments should seek to reduce overall flood risk both on and off site.

Requirements		Notes
a.	Assess the change in flooding conditions progressively away from the site boundary (both upstream and downstream), including volume of displaced water as well as flood levels.	Where proposed development results in an increase in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water and or floodwater flow conveyance.
b.	How will it be ensured that the proposed development and the measures to protect the site from flooding will not increase flood risk elsewhere?	Consider measures such as: **Floodplain Compensation Storage** - where ground levels are elevated to raise the development out of the floodplain or there is a loss of storage from additional structures and buildings, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced (refer to Appendix C). **Flood Routing** - development in the floodplain will need to prove that flood routing is not adversely affected by the development, for example giving rise to backwater affects or diverting floodwaters onto other properties. **Riverside Development** - development in or adjacent to a watercourse has the potential to impact flow conveyance and increase flood risk elsewhere. All works within or adjacent to a watercourse require consent.
c.	How will run-off from the completed development be prevented from causing an impact elsewhere?	Consider measures such as: **SuDS –** runoff from the site can be managed using SuDS to reduce the impact of urbanisation on flooding. Further guidance can be found in City of York Council's Sustainable Drainage Systems Guidance for Developers document.
d.	Are there any opportunities offered by the development to reduce flood risk elsewhere?	Discussions should be undertaken with City of York Council. Opportunities for delivering wider environmental benefits, including water quality, Water Framework Directive and pollution reduction should also be considered.

7.6.8 Residual Risk

Requirements		Notes
a.	What flood-related risks will remain after the necessary mitigation measures to protect the site from flooding have been implemented?	Residual risks should be identified. These could be associated with a number of potential risk factors including (but not limited to): • a flooding event that exceeds that for which the flood risk management measures have been designed e.g. flood levels above the designed finished floor levels, • the structural deterioration over time or breach of flood defence structures (including informal structures acting as a flood defence), • the implementation of new flood defences such as the York FAS and/or • general uncertainties inherent in the prediction of flooding.
b.	How, and by whom, will these risks be managed over the lifetime of the development?	Steps should be taken to manage the residual risks over the lifetime of the development such as through the use of flood warning and evacuation procedures.
c.	If the development is in an area protected by flood defences, but has a high residual risk classification, the following must be provided: • Details of indicative breach flood water levels, • Ground levels, • Ground, first and second floor levels in metres AOD and the floor level for bedrooms, • Safe refuges, providing justification for the options chosen, and • A Flood Warning and Evacuation Plan.	Guidance on the requirements for Flood Warning and Evacuation Plans is provided in Section 6.3 of this document. 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.

7.6.9 Plans and Cross-Sections

In addition to the below requirements for plans and cross-sections, all plans should explicitly indicate the extent of the floodplain on the site for the design event and reference all levels and flood levels to Ordnance Datum.

Requirements	
a.	A site location plan, including geographical features, street names and all water bodies.
b.	Topographical plans of both the existing site and the site post-development.
c.	A plan identifying the location of existing defences or other flood alleviation measures, with reference to standards of protection and condition.
d.	A plan of any structures that may influence hydraulic conditions at the site or the surrounding area, with reference to maintenance and operation.

Requirements	
e.	A plan of available historic flood information, such as recorded levels, flood extent, dates, photos, etc. Any changes to the site since the last event should be identified.
f.	A plan identifying safe access and exit routes.
g.	Cross-sections of post-development finished floor and road levels relative to flood levels.
h.	A plan showing drainage proposals and arrangements
i.	A plan showing flow paths and flood receptors both within and surrounding the development site, incorporating receptors identified as being impacted by flow paths from / to the development site.

Note: All plans should relate to levels in metres above ordnance datum (mAOD)

Further details to inform Requirement h above are available in City of York Council's Sustainable Drainage Systems Guidance for Developers document.

8. Next Steps

8.1 Overview

This Level 1 SFRA provides a strategic overview of the flood risk in City of York Council's administrative area from all sources of flooding based on readily available datasets, local knowledge and historic information supplied by stakeholders.

8.2 The Sequential Test

The information, mapping and site assessment database included in this report should be used by City of York Council to apply the Sequential Test and identify any sites where the Exception Test may be required. The guidance presented in Section 5 should be used to facilitate the application of the Sequential Test and the process should be carefully documented by City of York Council.

8.3 Level 2 Strategic Flood Risk Assessment

Following the update of the evidence base for the Level 1 Strategic Flood Risk Assessment it has been determined that there are currently no strategic development sites within high flood risk areas, and it is not intended to progress to a Level 2 Strategic Flood Risk Assessment at this time. This will be further reviewed as any updated information is made available.

8.4 Living Document

This SFRA has been updated building heavily upon existing knowledge with respect to flood risk across City of York Council's administrative area. The Environment Agency review and publish updates to the Flood Map for Planning on a quarterly basis and update catchment strategic models on a five-yearly basis. Future new modelling of watercourses in the area will improve the current knowledge of flood risk within the City.

New information may influence future development management decisions within these areas. Therefore, it is important that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk across the City.

City of York Council could look to improve their understanding of flood risk to include detailed mapping of their ordinary watercourses and working closely with Yorkshire Water to understand local sewer capacity issues.

Appendix A Data Register

Dataset	Source	Format	Description
City of York Council	CYC	ArcGIS .shp file	Boundary
OS VML Background Mapping	CYC	TIFF Image	Detailed background mapping provided by CYC via an OS Licence
LiDAR	Data.Gov	TIFF Image	Topographic Data
Watercourse Catchments	FEH CD ROM	ArcGIS .shp file	Catchment outlines for the River Ouse and River Derwent
Flood Zone 3	Data.Gov	ArcGIS .shp file	Flood Zone 3 extent
Flood Zone 2	Data.Gov	ArcGIS .shp file	Flood Zone 2 extent
Flood Storage Areas	Data.Gov	ArcGIS .shp file	Areas classified as Flood Storage Areas (FSA)
Areas Benefitting from Flood Defences	Data.Gov	ArcGIS .shp file	Areas classified as benefitting from the presence of flood defences
Spatial Flood Defences	Data.Gov	ArcGIS .shp file	Details of flood defences including attributes
Flood Warning Areas	Data.Gov	ArcGIS .shp file	Areas that receive flood warnings of fluvial or tidal flooding from the EA
Flood Alert Areas	Data.Gov	ArcGIS .shp file	Areas that receive flood alerts of fluvial or tidal flooding from the EA
Recorded Flood Outlines	Data.Gov	ArcGIS .shp file	Reported and recorded historic flood outlines
Detailed River Network	EA Geostore (via CYC)	ArcGIS .shp file	Main River and ordinary watercourse lines
Main Rivers	EA Geostore (via CYC)	ArcGIS .shp file	Statutory Main Rivers
Risk of Flooding from Surface Water (RoFSW)	EA Geostore (via CYC)	ArcGIS .shp file	Low, medium and high risk of flooding from surface water extents
Aquifer Designation-Bedrock Geology	EA Geostore (via CYC)	ArcGIS .shp file	Designated Aquifers within the bedrock geology
Aquifer Designation-Superficial Geology	EA Geostore (via CYC)	ArcGIS .shp file	Designated Aquifers within the superficial geology
Areas Susceptible to Groundwater Flooding (AStGWF)	EA Geostore (via CYC)	ArcGIS .shp file	Database outlining the susceptibility to groundwater flooding over 1 km^2 grid.
BGS 600k Bedrock Geology	British Geological Survey	ArcGIS .shp file	Bedrock Geology of the UK
BGS 600k Superficial Geology	British Geological Survey	ArcGIS .shp file	Superficial Geology of the UK
YW DG5- Sewer Flooding Locations	Yorkshire Water Limited	Excel Spreadsheet	Details of internal and external flooding recorded within each drainage area

Risk of Flooding from Reservoirs	Environment Agency	ArcGIS .shp file	Flood risk from reservoir extent
EA Flood Model Extents for Climate Change Scenarios	Environment Agency	ArcGIS .shp file	Reports and GIS outputs for the 'York Detailed Modelling Study' completed in October 2016, including climate change scenario extents for both undefended and defended scenarios. For the purposes of the Level 1 SFRA, this data has also been used to derive Flood Zone 3b where applicable.

Appendix B Level 1 SFRA Mapping Figures

Figure 1	Elevation *(Administrative Boundaries, LiDAR topography, Main River)*
Figure 2	Surface Waterbodies *(Watercourses, waterbodies)*
Figure 3	Bedrock Geology
Figure 4	Aquifer Designation - Bedrock
Figure 5	Superficial Geology
Figure 6	Aquifer Designation – Superficial Geology
Figure 7A-7J	Environment Agency Recorded Flood Outlines
Figure 8A – 8J	Environment Agency Flood Map For Planning *(Watercourses, Flood Zones, flood defences, flood storage areas)*
Figure 9A- 9J	Climate Change (Proxy) - Undefended Scenario
Figure 10A-10J	Climate Change (Proxy) - Defended Scenario
Figure 11A- 11J	Environment Agency Risk of Flooding from Surface Water *(RoFSW, watercourses)*
Figure 12	Areas Susceptible to Groundwater Flooding *(Potential groundwater flooding areas, groundwater flood records)*
Figure 13	Risk of Flooding from Reservoirs
Figure 14A-14J	Environment Agency Flood Warning and Flood Alert Areas *(Flood Warning and Flood Alert Areas)*

Appendix C Flood Risk Management Policy Recommendations

Overview

To ensure developments promoted under the NPPF achieve the aims of the PPG for Flood Risk and Coastal Change, a number of recommendations have been made in light of the information generated within this Level 1 SFRA. The aim of these recommendations is to support City of York Council in the development of their Local Plan and provide advice over the type and nature of policies contained within.

Policy Considerations

In order to help the development of Local Plan policy related to flood risk, a series of recommendations for how flood risk can be managed or minimised through the plan making process and through the development control process has been provided. These recommendations also seek to provide general improvement to the water environment as well as flood risk management and should be taken into account by City of York Council during the policy making process. Guidance on how these objectives can be met throughout the development control process for individual development sites will be set out in Section 7.

Seeking Flood Risk Reduction through Spatial Planning and Site Design

The primary aim of the PPG is to "steer new development to areas with the lowest probability of flooding". To achieve this aim the following policies are recommended:

- The Sequential approach within development sites should be used to inform site layout by locating the most vulnerable elements of a development in the lowest risk areas. For example, the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide an effective means of flood risk management as well as providing connected green spaces with consequent social and environmental benefits;
- Avoid development immediately downstream of flood storage reservoirs which will be at high hazard areas in the event of failure;
- As the variation in flood extents can be negligible between the return periods, consideration should be given to how the proposed site would be affected by this and developers should be confident in their assessment of flood levels. Especially taking into account the range of climate change allowances;
- Seek opportunities for new development to achieve reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features;
- Identify long-term opportunities to remove development from the floodplain through land swapping, whereby existing development is removed from the floodplain and the site returned to provide its original flood storage function;
- Build resilience into a site's design (e.g. flood resistant or resilient design, raised floor levels); and
- Ensure development is 'safe'. For residential developments to be classed as 'safe', dry pedestrian egress out of the floodplain and emergency vehicular access should be possible. Dry pedestrian access/egress should be possible for the 1% AEP return period event including an allowance for climate change associated with fluvial flooding.

Reducing Surface Water Runoff from New Developments

The risk of surface water flooding is less predictable than fluvial flooding and whilst there are clear trends for surface water to accumulate within the river corridors and specific topographic and urban features (embankment etc.), the risk of surface water can be much more localised and harder to predict. Where possible, City of York Council should ensure that all sites located in areas of surface water flood risk (based on the mapping and historic incidences) are supported by a site-specific FRA. The FRA should also consider the impacts of climate change on future surface water flood risk.

- All sites require the following:
  - Use of SuDS (where possible use of strategic SuDS should be made);
  - Discharge rates should be restricted to Greenfield runoff rates;

  - 1% AEP attenuation of surface water, including an allowance for climate change.

- Space should be specifically set aside for SuDS and used to inform the overall layout of development sites;
- Surface water drainage proposals should have a clear plan for the long-term maintenance and adoption of the systems, prior to approval of any planning permission in line with national planning policy.
- Large potential development areas should be planned with a holistic approach to the provision of SuDS. This will need to be on an integrated and strategic scale and where necessary will require the collaboration of all developers involved in implementing a specific expansion area or site.
- Careful assessment of the potential impact of surface water drainage from new developments will be necessary in areas with constrained drainage networks, particularly those networks that are dependent upon sewers, culverted watercourses and pumping stations with limited or a finite capacity.
- Surface water drainage proposals should follow the SuDS guidance provided in City of York Council's Sustainable Drainage Guidance for Developers document

Enhancing and Restoring the River Corridor

- Those proposing development in proximity to watercourses should look for opportunities to undertake river restoration and enhancement as part of a development to make space for water. Enhancement opportunities should be sought when renewing assets (e.g. daylighting (the removal of culverts to return river to natural conditions), the use of bio-engineered river walls, raising bridge soffits to take into account climate change).
- Further culverting and building over culverts is not preferred and should be avoided. Where practical, all new developments with culverts running through their site should seek to daylight rivers for flood risk management and conservation benefit. Any culverting or works requires the prior written consent of either the Environment Agency for main rivers, or City of York Council for ordinary watercourses affecting the flow of that watercourse, under the terms of the Environmental Permitting Regulations 2010 and the Flood and Water Management Act 2010. These regulatory bodies seek to avoid culverting, and their consent for such works will not normally be granted except as a means of access, but it cannot be guaranteed that they will be acceptable.
- Set development back from rivers, seeking an 8-metre-wide undeveloped buffer strip for development by all watercourses including those where the Flood Zone does not exist. For tidal main rivers this buffer should be 16 metres wide.

Protecting and Promoting Areas for Future Flood Alleviation Schemes

- Protect Greenfield functional floodplain from future development (our greatest flood risk management asset) and where possible reinstate areas of functional floodplain which have been developed (e.g. reduce building footprints or relocate to lower flood risk zones).
- Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

Improving Flood Awareness and Emergency Planning

Where flooding affects only a limited number of properties, it is unlikely that measures to improve flood defences will attract priority funding. Instead, it may be necessary to place greater reliance on making properties that are at risk more resilient to flooding. Similarly, steps should be made to improve the resilience of properties and infrastructure that is at risk of surface water flooding, through:

- Seeking to improve the emergency planning process using the outputs from the SFRA.
- For areas at risk of fluvial flooding, encouraging all those within existing Flood Zone 3a and 3b (residential and commercial occupiers) to sign up to Flood Warning Service operated by the Environment Agency.
- Ensuring robust emergency (evacuation) plans are implemented for new developments.
- Considering locations where flood resistant and resilient measures, can be retrofitted to properties at risk of surface water or fluvial flooding.

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