South Norfolk Council Level 1 Strategic Flood Risk Assessment

Final Report

June 2024

Prepared for:
South Norfolk Council

www.jbaconsulting.com

Document Status

Issue date	7 June 2024
Issued to	South Norfolk Council
BIM reference	HHH-JBAU-XX-XX-RP-HM-0022
Revision	A1-C02
Prepared by	William Addison-Atkinson BSc MSc Analyst Hannah Booth BSc (Hons) Analyst Rebecca Lee BSc MSc Analyst
Reviewed by	Thomasin Shorrock BA (Hons) MCIWEM C.WEM Principal Analyst Sarah Hambling BSc MSc Analyst

Carbon Footprint

JBA is committed to championing sustainability and has made The Ten Principles of the UN Global Compact part of its culture and operations. We have a Group-wide objective to be a Net Zero carbon emissions business.

The format of this report is optimised for reading digitally in pdf format; duplex printing in B&W on 100% post-consumer recycled A4 will result in a carbon footprint of 503g CO_2e. This will increase to 640g CO_2e if primary-source paper is used. Please consider the environment before printing.

Contract

JBA Project Manager	Thomasin Shorrock
Address	1 Broughton Park, Old Lane North, Broughton, Skipton, North Yorkshire, BD23 3FD
JBA Project Code	2021s1664

This report describes work commissioned by South Norfolk Council by an instruction dated 26 July 2023. The Client's representatives for the contract were Simon Marjoram and Kate Fisher of South Norfolk Council. William Addison - Atkinson, Hannah Booth, Rebecca Lee, Sarah Hambling, and Thomasin Shorrock of JBA Consulting carried out this work.

Purpose and Disclaimer

Jeremy Benn Associates Limited ("JBA") has prepared this Report for the sole use of South Norfolk Council and its appointed agents in accordance with the Agreement under which our services were performed.

JBA has no liability for any use that is made of this Report except to South Norfolk Council for the purposes for which it was originally commissioned and prepared.

No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by JBA. This Report cannot be relied upon by any other party without the prior and express written agreement of JBA.

Acknowledgements

We would like to acknowledge the assistance of South Norfolk Council, the Environment Agency, Norfolk County Council, Anglian Water, and planners at the neighbouring authorities.

Contents

Appendices

List of Figures

List of Tables

Abbreviations

ACP.....Area with Critical Drainage Problems
AEP ..... Annual Exceedance Probability
AStGWf ..... Areas Susceptible to Groundwater flooding
CC ..... Climate Change
CFMP ..... Catchment Flood Management Plan
CIRIA..... Construction Industry Research and Information Association
Defra ..... Department for Environment, Food and Rural Affairs
EA ..... Environment Agency
EU ..... European Union
FAA ..... Flood Alert Area
FCERM ..... Flood and Coastal Erosion Risk Management
FFL..... Finished Floor Level
FRA..... Flood Risk Assessment
FRMP ..... Flood Risk Management Plan
FWA ..... Flood Warning Area
FWMA ..... Flood and Water Management Act
FWS ..... Flood Warning System
GSPZ ..... Groundwater Source Protection Zone
IDB ..... Internal Drainage Board
JBA..... Jeremy Benn Associates
LFRMS ..... Local Flood Risk Management Strategy
LiDAR..... Light Detection and Ranging
LLFA..... Lead Local Flood Authority
LPA ..... Local Planning Authority
LPU ..... Local Plan Update
mAOD ..... metres Above Ordnance Datum
NFM ..... Natural Flood Management
NCC ..... Norfolk County Council
NPPF..... National Planning Policy Framework
NRD ..... National Receptor Database
NVZs ..... Nitrate Vulnerable Zones
PFRA..... Preliminary Flood Risk Assessment
PPG..... Planning Practice Guidance

RBD..... River Basin District
RBMP..... River Basin Management Plan
RMAs ..... Risk Management Authorities
RoFSW..... Risk of Flooding from Surface Water
SFRA..... Strategic Flood Risk Assessment
SoP ..... Standard of Protection
SSSI..... Site of Special Scientific Interest
SuDS..... Sustainable Drainage Systems
SWMP..... Surface Water Management Plan
SNC..... South Norfolk Council
WFD..... Water Framework Directive

Definitions

1D model: one-dimensional hydraulic model

2D model: two-dimensional hydraulic model

Annual Exceedance Probability: the probability (expressed as a percentage) of a flood event occurring in any given year.

Brownfield: previously developed parcel of land

Climate Change: long term variations in global temperature and weather patterns caused by natural and human actions.

Catchment Flood Management Plan: a high-level planning strategy through which the EA works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.

Cumecs: the cumec is a measure of flow rate. One cumec is shorthand for cubic metre per second (m^3/s).

Design flood: This is a flood event of a given annual flood probability, which is generally taken as: fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or tidal flooding with a 0.5% annual probability (1 in 200 chance each year), or surface water flooding likely to occur with a 1% annual probability (a 1 in 100 change each year), plus an appropriate allowance for climate change, against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.

Exception test: Set out in the National Planning Policy Framework (NPPF), the exception test is a method used to demonstrate that flood risk to people and property will be managed appropriately, where alternative sites at a lower flood risk are not available. The exception test is applied following the sequential test.

Flood defence: Infrastructure used to protect an area against floods such as floodwalls and embankments; they are designed to a specific standard of protection (design standard).

Flood Map for Planning: The EA Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.

Flood Risk Area: An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).

Flood Risk Regulations: Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically

address flood risk by prescribing a common framework for its measurement and management.

Floods and Water Management Act: Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.

Fluvial Flooding: Flooding resulting from water levels exceeding the bank level of a river (main river or ordinary watercourse).

Flood Risk Assessment: a site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.

Green Infrastructure: a network of multi-functional green and blue spaces and other natural features, urban and rural, which is capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity (NPPF, December 2023).

Greenfield: undeveloped parcel of land

Indicative Flood Risk Area: nationally identified flood risk areas based on the definition of 'significant' flood risk described by Defra and WAG.

Lead Local Flood Authority: the unitary authority for the area or if there is no unitary authority, the county council for the area.

Main river: a watercourse shown as such on the statutory main river map held by the Environment Agency. They are usually the larger rivers and streams. The Environment Agency has permissive powers (not duties) to carry out maintenance and improvement works on main rivers).

Major development: defined in the NPPF (2023) as a housing development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more, or as a non-residential development with additional floorspace of 1,000m² or more, or a site of 1 hectare or more, or as otherwise provide in the Town and Country Planning (Development Management Procedure) (England) Order 2015 available here.

Ordinary watercourse: any river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows but which does not form part of a main river. The local authority or internal drainage board has permissive powers (not duties) on ordinary watercourses.

Pitt Review: Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.

Pluvial flooding: see surface water flooding.

Resilience measures: Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.

Resistance measures: Measures designed to keep flood water out of properties and businesses; could include flood guards for example.

Return period: Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.

Riparian owner: A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.

Risk: In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.

Risk Management Authority: The Environment Agency; a lead local flood authority; a district council in an area where there is no unitary authority; an internal drainage board; a water company and a highway authority.

Sequential test: Set out in the NPPF, the sequential test is a method used to steer new development to areas with the lowest probability of flooding.

Sewer flooding: Flooding caused by a blockage or overflowing in a sewer or urban drainage system.

Standard of Protection: Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1% AEP (1 in 100 year) standard of protection.

Stakeholder: A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.

Surface water flooding: Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.

Sustainable Drainage Systems: SuDS are methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques, such as grates, gullies and channels.

Surface Water Management Plan: The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study. There are three key partners who must be involved and engaged in the SWMP study

process: the Local Authority, the Environment Agency and the relevant Water and Sewerage Companies.

Water Framework Directive: Under the WFD, all waterbodies have a target to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP) by a set deadline. River Basin Management Plans (RBMPs) set out the ecological objectives for each water body and give deadlines by when objectives need to be met.

Windfall site: a site which becomes available for development unexpectedly and therefore not included as allocated land in a planning authority's local plan.

Executive Summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the review and update of the South Norfolk Council's planning policies. The review process is known as the Local Plan Update (LPU).

This report uses the best available information, including input from key stakeholders. This Level 1 Strategic Flood Risk Assessment (SFRA) for South Norfolk Council (SNC) was prepared to replace and update the previous combined Level 1 SFRA produced by JBA in 2017 for the Greater Norwich Area. This SFRA applies the latest national planning policy and guidance, including the National Planning Policy Framework (NPPF), which was revised in July 2021 and further updated in December 2023, the updated August 2022 Planning Practice Guidance (PPG), and the updates to the EA climate change guidance in July 2021 and May 2022.

Introduction

To support the review and update of the Local Plan for SNC, the key objectives of the assessment are:

- To collate and analyse the latest available information and data for current and future (i.e., climate change) flood risk from all sources, and how these may be managed for development.
- To inform decisions in the emerging LPU, including the selection of development sites and planning policies.
- To provide evidence to support the application of the sequential test for the allocation of new development sites, to support SNC in the preparation of the LPU.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the update to the Local Plan.
- To help decide when a Flood Risk Assessment (FRA) will be required for individual planning applications.
- To provide advice for applicants carrying out site-specific Flood Risk Assessments (FRAs) and outline specific measures or objectives that are required to manage flood risk.
- To provide the basis for applying the sequential test on planning applications, including by identifying sources of flooding other than those in 'Flood Zones' and those at risk of flooding in the future.
- To identify opportunities to reduce the causes and impacts of flooding and gather information on the land that is likely to be required for flood risk management structures.

Summary of flood risk in South Norfolk District:

- **Fluvial**: The primary fluvial flood risk to the north of the District is from the River Wensum and River Yare, which flow west to east along the northern border;

similarly, the River Waveney flows south to north-east along the south-eastern border. Their confluence at Burgh Flats is at particular flood risk due to the low-lying marshland. Tributaries of the River Yare, including the River Tiffey, Dyke Beck, River Tas, and Well Beck, also pose risk to the north of the District; while tributaries of the River Waveney, including Broome Beck, Starston Beck, and the Frenze Beck, pose fluvial flood risk to the south of the District. *Fluvial flood risk is discussed in Section 4.3 and Appendix E and the flood extents are shown in the GeoPDFs in Appendix A.*

- **Surface water**: The Risk of Flooding from Surface Water (RoFSW) map shows a number of prominent overland flow routes that are largely channelled by the topography of surrounding watercourses. This includes the River Tiffey, River Tas, River Chet, and Frenze Beck in particular. There are also areas with additional flow paths and surface water ponding; for example, where water is impounded at road or rail embankments and in low-lying areas. There are also considerable flow routes along highways in major urban centres such as Wymondham, Poringland, Long Stratton, and Diss. *Surface water flood risk is discussed in Section 4.4 and Appendix E and the flood extents are shown in the GeoPDFs in Appendix A.*
- **Climate change**: Areas at risk of flooding today are likely to become at increased risk in the future and the frequency of flooding will also increase in such areas, because of climate change. Flood extents will increase; in some locations, this may be minimal, but flood depth, velocity and hazard may have more of an impact due to climate change. *The approach to climate change is discussed in Section 5 and the flood extents are also shown in the GeoPDFs in Appendix A*.
  It is recommended that SNC work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development when developing climate change plans and strategies for South Norfolk District.
- **Sewer**: Anglian Water provides water services and sewerage services across the entirety of the District. Anglian Water have provided details of historic sewer flooding across the District. *Sewer flood risk is discussed in Section 4.6.*
- **Groundwater**: The Areas Susceptible to Groundwater Flooding (AStGWF) map shows that in general, areas with greater than 50% susceptibility to groundwater flooding are located along the main fluvial flow routes. This includes the River Wensum and River Yare along the northern border of the District, and the River Waveney along the southern and eastern borders. Furthermore, the floodplains of the River Tiffey and River Tas in the north, and Frenze Beck and Dickleburgh Stream in the south, also have a greater than 50% susceptibility to groundwater flooding. The JBA Groundwater Emergence Map emulates this, with similar areas experiencing groundwater levels within 0.5m of the surface, with the addition of the east of the District due to its lower elevation. The EA's RoFSW map suggests that any groundwater emerging in these areas is likely to be

channelled by the low-lying topography of the River Tiffey and River Tas in the north-west, the River Chet and Broome Beck in the east, and the Frenze Beck and Dickleburgh Stream in the south.
Groundwater flood risk is discussed in Section □ and Appendix E, and the AStGWF map and JBA emergence map are shown in the GeoPDFs in Appendix A.

- **Reservoirs**: There are two reservoirs located within the study area, and a further two located outside the study area where the 'wet day' or 'dry day' scenarios encroach into the District. There is a potential risk of flooding from reservoirs both within the District and those outside. The main risk is along the northern and south-eastern borders of the District. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific FRAs (where relevant) in accordance with the PPG. *Reservoir flood risk is discussed in Section 4.8 and Appendix E. The 'Dry Day' and 'Wet Day' flood extents are shown in the GeoPDFs in Appendix A.*

Defences

The EA AIMS dataset provides information on flood defence assets across the District. The primary defence type across the study area is 'Natural High Ground', located along both banks of main watercourses such as the River Wensum and River Yare, River Tiffey, River Tas, Frenze Beck, and Dickleburgh Stream. Additional engineered defences, including a wall, embankments, and demountable defences, also line parts of the River Yare, River Waveney, and Broome Beck. The condition of these defences varies from poor to good, with the Standard of Protection (SoP) varying between the defences. *Further information on defences across the study area is available in Section 6.4 and shown in the GeoPDFs in Appendix A.*

Development and flood risk

The sequential and exception test procedures for both Local Plans and FRAs have been documented, along with guidance for planners and developers. Links have been provided for relevant guidance documents and policies published by other Flood RMAs such as the Lead Local Flood Authority (LLFA) and the Environment Agency (EA).

The risk of flooding should be reviewed as early as possible in the development process to ensure that opportunities are taken to reduce the risk of flooding on and off the site. Where necessary, development and redevelopment within South Norfolk District will require an FRA appropriate to the scale of the development and to the scope as agreed with the LLFA and/or EA. FRAs should consider flood risk from all

sources including residual risk, along with promotion of Sustainable Drainage Systems (SuDS) to create a conceptual drainage strategy and safe access/egress at the development in the event of a flood. Latest climate change guidance (last updated in May 2022) should also be taken into account, for the lifetime of developments. Planners and developers must check that modelling in line with the most up to date EA climate change guidance has been run.

How to use this report

Planners

The SFRA provides recommendations regarding all sources of flood risk in South Norfolk District, which can be used to inform policy on flood risk within the emerging LPU. This includes how the cumulative impact of development should be considered.

It provides the latest flood risk data and guidance to inform the sequential test and provides guidance on how to apply the exception test. The Council can use this information to apply the sequential test to strategic allocations and identify where the exception test will also be needed.

The SFRA provides guidance for developers, which can be used by development management staff to assess whether site-specific FRAs meet the required quality standard.

Developers

For sites that are not strategic allocations, developers will need to use this SFRA to help apply the sequential test. For both strategic allocations and windfall sites, developers will need to apply the exception test in the following cases:

- Highly vulnerable development in Flood Zone 2
- Essential infrastructure in Flood Zone 3a or 3b
- More vulnerable development in Flood Zone 3a
- Proposed development in locations affected by surface water flood risk

A site-specific FRA should be used to inform the exception test at the planning application stage.

This SFRA is a strategic assessment and does not replace the need for site-specific FRAs where a development is either within Flood Zones 2 or 3, greater than a hectare in Flood Zone 1, is less than a hectare and located in an area affected by sources of flooding other than rivers and the sea, or is in an area within Flood Zone 1 which has critical drainage problems as notified by the EA. In addition, a sustainable surface water drainage strategy will be needed for development requiring an FRA, or in any other case for major category development in to satisfy Norfolk County Council (NCC), the LLFA. Further assessments may also be required at this stage to manage the risk

from sewer flooding to a site, and developers should contact Anglian Water for further advice.

Developers can use the information in this SFRA, alongside site-specific research to help scope out what additional work will be needed in a detailed FRA. To do this, they should refer to Section 4, Appendix A (Interactive PDF mapping) and Appendix B (Data sources used in the SFRA). At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances, last updated in May 2022), inform masterplanning and demonstrate, if required, that the exception test is satisfied. As part of the EA's updated guidance on climate change, which must be considered for all new developments and planning applications, developers will need to undertake a detailed assessment of the impact of climate change on flood risk to the site as part of the planning application process when preparing FRAs.

Developers need to check that new development does not increase surface water runoff rates and volumes from a site or contribute to cumulative effects at sensitive locations, see Section 7 and Appendix F (Cumulative Impact Assessment (CIA)). Section 9 provides information on the surface water drainage requirements of the LLFA. SuDS should be considered at the earliest stages that a site is developed which will help to minimise costs and overcome any site-specific constraints.

Site-specific FRAs will need to identify how flood risk will be mitigated so development is safe from flooding for its lifetime and does not have an adverse effect on third parties or other areas. In high-risk areas the FRA will also need to consider emergency arrangements, including how there will be safe access and egress from the site.

Any developments located within an area protected by flood defences and where the Standard of Protection (SoP) is not of the required standard (either now or in the future) should be identified and the use of developer contributions considered to fund improvements to the defences.

Neighbourhood plans

Neighbourhood planning groups can use the information in this SFRA to assess the risk of flooding to sites within their community, using Section 4, the sources of flooding in South Norfolk District and the flood mapping in Appendix A. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas. Similarly, all known available recorded historical flood events for South Norfolk District are listed in Section 4.1. This can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned by SNC are outlined in Section 6 and Section 8.3 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

Mapping

The SFRA mapping highlights on a strategic scale flood risk from fluvial, surface water and reservoirs sources, and where groundwater emergence may occur; as well as where the effects of climate change are most likely. The maps are useful to provide a community level view of flood risk but may not identify if an individual property is at risk of flooding or depict small scale changes in flood risk. Local knowledge of flood mechanisms will need to be included to complement this mapping. Similarly, all known available recorded historical flood events for South Norfolk District are listed in Section 4.1. This can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned by SNC are outlined in Section 6.4 and Section 8.3 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area. The mapping data should always be supplemented by direct consultation with the relevant wastewater company to ascertain if there is any site-specific risk from a public sewer. This is because sewer flood risk information is not publicly available and would need to be considered on a site-specific basis.

Cumulative Impact Assessment (CIA)

Under the NPPF, strategic policies and their supporting SFRAs, are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (Paragraph 166). A Cumulative Impact Assessment (CIA) has identified which catchments in South Norfolk District are more sensitive to the cumulative impact of development and where more stringent policy regarding flood risk is recommended. Any development in these areas should seek to contribute to work that reduces wider flood risk in those catchments.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

“Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the EA and other relevant flood RMAs, such as lead local flood authorities and internal drainage boards.”. (NPPF, Paragraph 166).

The previous Level 1 SFRA for South Norfolk District was conducted by JBA in 2017, as part of the Greater Norwich Area SFRA. This was followed by a Level 2 SFRA for Greater Norwich in 2020 and then an addendum to this Level 2 SFRA for South Norfolk District in 2021 to support the South Norfolk Village Clusters Housing Allocations Plan (VCHAP). However, since the publication of the previous Level 1 SFRA report there have been considerable changes to guidance, including updates to the EA's climate change guidance, as well as changes to the NPPF and PPG.

Following the updates to the PPG in August 2022, SNC commissioned a fully updated Level 1 SFRA. This study provides a comprehensive and robust evidence base to support the local plan. This SFRA replaces the previous joint Level 1 SFRA report for the Greater Norwich Area (2017) for South Norfolk. This study only covers South Norfolk District.

This 2024 SFRA will be used to inform decisions on the location of future development and the preparation of land use planning policies for the long-term management of flood risk, reflecting the implications of the August 2022 changes to the PPG.

As the data available for SFRAs and the relevant legislation is continually changing, a SFRA should be a live document and updated to reflect changes where applicable and practicable.

1.2 Local Plan

SNC worked with Norwich City Council and Norfolk County Council to prepare the Greater Norwich Local Plan (GNLP). The GNLP was adopted by SNC on the 25 March 2024 and includes strategic policies to guide future development and plans to protect the environment.

SNC are also carrying out a Village Clusters Housing Allocations Plan (VCHAP), which is a Local Plan document which, once adopted, will become part of the Development plan for South Norfolk and identify sites to be delivered in the district's village clusters by 2038.

1.3 Levels of SFRA

The PPG identifies the following two levels of SFRA:

- All LPAs are required to undertake a Level 1 assessment. Where potential site allocations are not at major flood risk and where development pressures are low a Level 1 assessment is likely to be sufficient, without the LPA progressing to a Level 2 assessment. The Level 1 assessment should be of sufficient detail to enable application of the sequential test, to inform the allocation of development to areas of lower flood risk.
- A Level 2 assessment is required where land outside flood risk areas cannot appropriately accommodate all necessary development, creating the need to apply the NPPF's exception test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This is a Level 1 SFRA assessment. If all the development proposed is not located outside areas of flood risk, a Level 2 assessment may be required. The PPG can be accessed on the Government's website here.

1.4 SFRA Outputs

This SFRA aims to provide the following outputs:

- Identification of existing national and local policy and technical updates.
- Identification of any strategic flooding issues or cumulative effects which may have cross boundary implications.
- Appraisal of all potential sources of flooding, including main river, ordinary watercourse, surface water, sewers, groundwater, and reservoirs.
- Review of historic flooding incidents.
- Reporting on the SoP provided by existing flood risk management infrastructure.
- Mapping showing distribution of flood risk across all Flood Zones from all sources of flooding including climate change allowances.
- Mapping defining the extent of Flood Zone 3b (the functional floodplain).
- Assessment of the potential increase in flood risk due to climate change.
- FRA guidance for developers.
- Assessment of surface water management issues, how these can be addressed through development management policies and the application of SuDS.
- Recommendations of the criteria that should be used to assess future development proposals and the development of a sequential test and sequential approach to flood risk.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.

1.5 SFRA Study Area

SNC is a local government district in Norfolk, in the east of England.

The main urban area in South Norfolk District is the town of Wymondham. Other urban centres include Diss, Harleston, Hingham, Loddon, Long Stratton, Dickleburgh, Hethersett, Cringleford, and Poringland.

The District is bounded by six neighbouring authority areas:

- Norwich
- Broadland
- Great Yarmouth
- East Suffolk
- Mid Suffolk
- Breckland

An overview of the study area showing the neighbouring authorities is shown in Figure 1-1.

There are six key watercourses within South Norfolk District. The River Yare flows west to east along the northern border of the study area. The River Tud bisects the north west tip of the study area, flowing west to east between Hollingham and Hellesdon. The River Tiffey flows north through the District from Wymondham, before discharging into the River Yare east of Barford. Similarly, the River Tas flows north from Aslacton, discharging into the River Yare at Breydon Water. The River Chet flows east from Poringland to the eastern border of the District, discharging into the River Yare at Hadley Cross. Finally, the River Waveney flows along the southern and eastern border of the District, until its confluence with the River Yare at Burgh Flats at the eastern tip of the study area.

A number of tributaries of the River Waveney, including Broome Beck, Frenze River, and several smaller tributaries flow through the south and east of the District to join the River Waveney. Watercourses across the remainder of the District eventually drain into the River Yare.

Along the River Yare in South Norfolk, there are several large water bodies including flooded sand pits at Colney, the University of East Anglia Broad, Whitlingham Broad, Surlingham Broad, and Rockland Broads. Along the eastern side of the District there are marshland areas adjoining the River Yare around Surlingham and Rockland Broads. Downstream of these broads the river is embanked, and the adjacent land has been drained for agricultural use. River water levels there are above the surrounding topography and pumping stations are required to raise surface water runoff into the embanked watercourses. The main watercourses are shown in Figure 1-2.

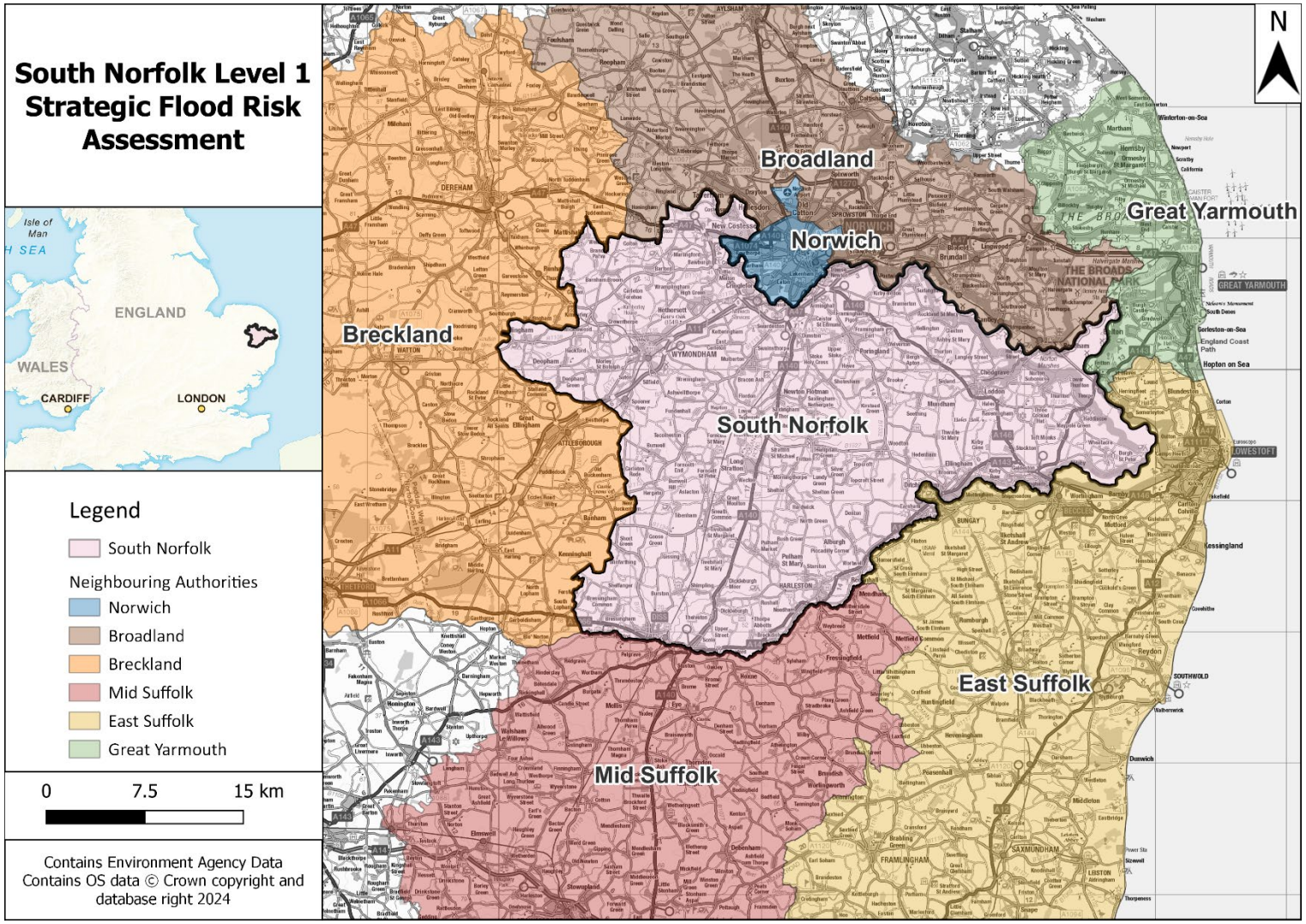


Figure 1-1: Neighbouring authorities to South Norfolk District.

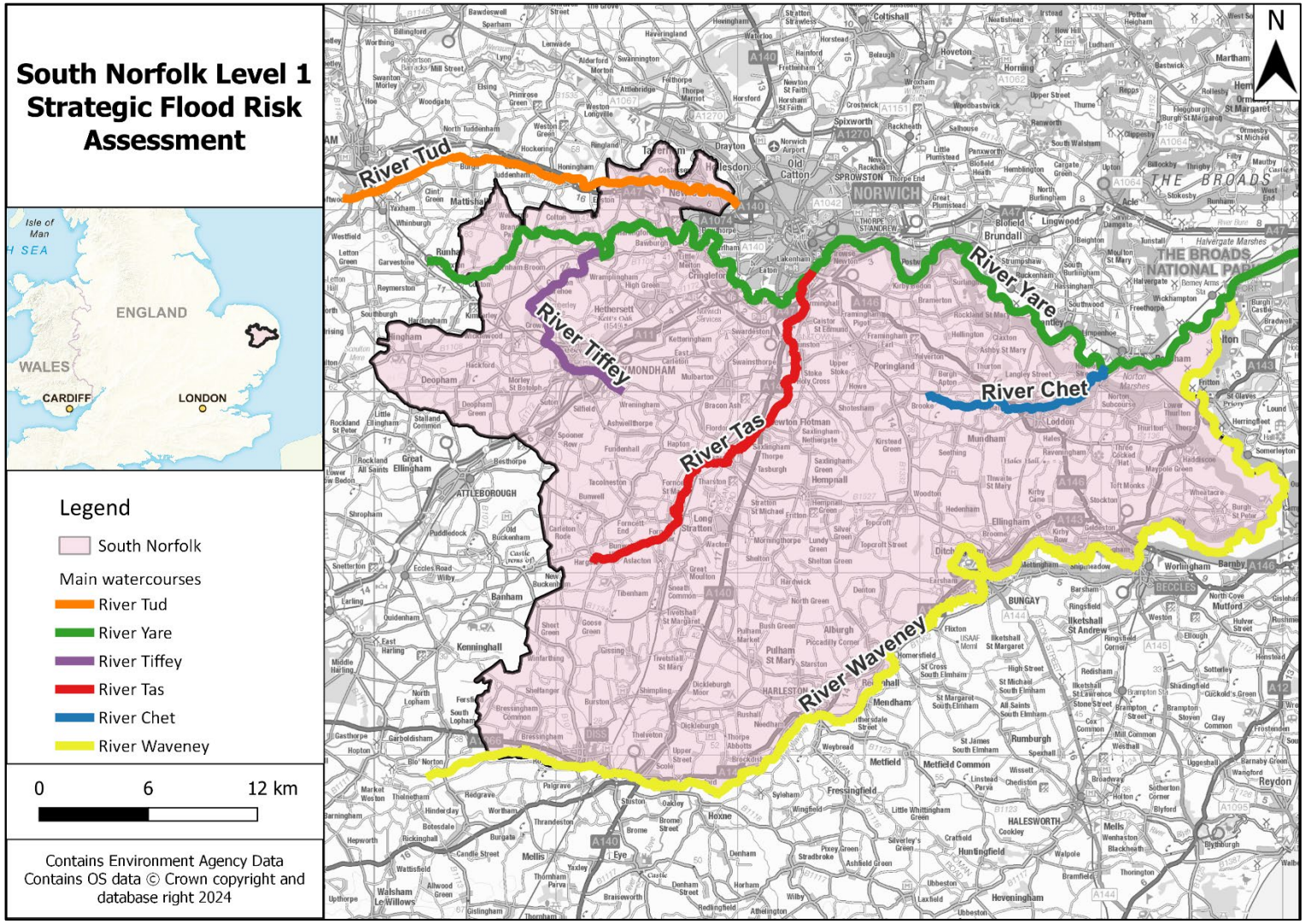


Figure 1-2: Key watercourses in South Norfolk District.

1.6 Consultation

SFRAs should be prepared in consultation with other RMAs. In addition to the SNC Place Shaping Team, the following parties have been consulted during the preparation of this version of the SFRA either through data requests or draft report reviews:

- Norfolk County Council (as LLFA)
- EA
- Anglian Water
- Water Management Alliance
- Data from neighbouring authorities to inform cross-boundary development implications.

1.7 Use of SFRA data

Level 1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. The primary purpose is to provide an evidence base to inform the preparation of Local Plans and any future flood risk policies.

Developers will still be required to undertake site-specific FRAs, where required, to support Planning Applications. Developers will be able to use the information in the SFRA to scope out the sources of flood risk that will need to be explored in more detail at site level.

Appendix C presents a SFRA User Guide, further explaining how this SFRA data should be used, including reference to relevant sections of the SFRA, how to consider different sources of flood risk and recommendations and advice for sequential and exception tests.

On the date of publication, this SFRA contains the latest available flood risk information. Over time, new information will become available to inform planning decisions, such as updated hydraulic models (which then update the Flood Map for Planning), updated information on other sources of flood risk or evidence showing future flood risks, new flood event information, new defence schemes and updates to policy, legislation, and guidance. The EA are currently undertaking new nationalised modelling (NaFRA2) which is due to go live in August 2024, although these timescales are subject to change due to the complexities of this project. Developers should check the online Flood Map for Planning in the first instance to identify any major changes to the Flood Zones and the long-term flood risk mapping portal for any changes to flood risk from surface water or inundation from reservoirs.

1.8 Structure of this report

Table 1-1 sets out the contents of the report and how to use each section

Table 1-1 Report contents

Section	Contents	How to use
Executive summary	This section focuses on how the SFRA can be used by planners, developers, and neighbourhood planners.	Users should refer to this section for a summary of the Level 1 findings and recommendations.
1. Introduction	This section provides a background to the study, the Local Plan stage the SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA. It also provides a short introduction to how flood risk is assessed and the importance of considering all sources.	Users should refer to this section for general information and context.
2. Flood risk policy and strategy	This section sets out the relevant legislation, policy, and strategy for flood risk management at a national, regional, and local level.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	This section provides an overview of both national and existing Local Plan policy on flood risk management. This includes the Flood Zones, application of the Sequential Approach and sequential/exception test process. It provides guidance for SNC and Developers on the application of the sequential and exception test for both allocations and windfall sites, at allocation and planning application stages.	Users should use this section to understand and follow the steps required for the sequential and exception tests.
4. Understanding flood risk in South Norfolk District	This section provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding incidents, flood risk from all sources and flood warning arrangements.	This section should be used to understand all sources of flood risk in the District including where has flooded historically. This section may also help identify any data gaps,

Section	Contents	How to use
		in conjunction with Appendix B.
5. Impact of climate change	This section outlines the latest climate change guidance published by the EA and how this was applied to the SFRA. It also sets out how developers should apply the guidance to inform site-specific FRAs.	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
6. Flood alleviation schemes and assets	This section provides a summary of current flood defences and asset management and future planned schemes. It also introduces actual and residual flood risk.	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site specific stage.
7. Cumulative impact of development and strategic solutions	This section introduces the Cumulative Impact Assessment (CIA), which is included as Appendix F.	Planners should use this section to help develop policy recommendations for the cumulative impact of development, in conjunction with Appendix F.
8. Flood risk management for developers	This section contains guidance for developers on FRAs, considering flood risk from all sources.	Developers should use this section to understand requirements for FRAs and what conditions/guidance documents should be followed, as well as mitigation options.
9. Surface water Systems	This section provides an overview specific local standards and guidance for SuDS from the LLFA.	Developers should use this section to understand what national, regional, and local SuDS standards are applicable. Hyperlinks are provided.
10. Summary and recommendations	This section summarises sources of flood risk in the study area and outlines planning policy	Developers and planners should use this as a summary of

Section	Contents	How to use
	recommendations. It also sets out the next steps.	the SFRA. Developers should refer to the Level 1 SFRA recommendations when considering site specific assessments.
Appendices	Appendix A: Interactive flood risk maps Appendix B: Data sources used in the SFRA Appendix C: SFRA User Guide Appendix D: Flood Alert and Flood Warning Areas Appendix E: Summary of flood risk across South Norfolk Appendix F: Cumulative Impact Assessment (CIA)	Planners should use these appendices to understand what data has been used in the SFRA, to inform the application of the sequential and exception tests, as relevant, and to use these maps and tabulated summaries of flood risk to understand the nature and location of flood risk.

1.9 Understanding flood risk

The following content provides useful background information on how flooding arises and how flood risk is determined.

1.9.1 Sources of flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land, and environmental and cultural heritage. Flooding can occur from many different and combined sources and in many ways. Major sources of flooding include:

- Fluvial (rivers) - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- Surface water - direct run-off from adjacent land.
- Sewer flooding - surcharging of piped drainage systems (public sewers, highway drains, etc.).

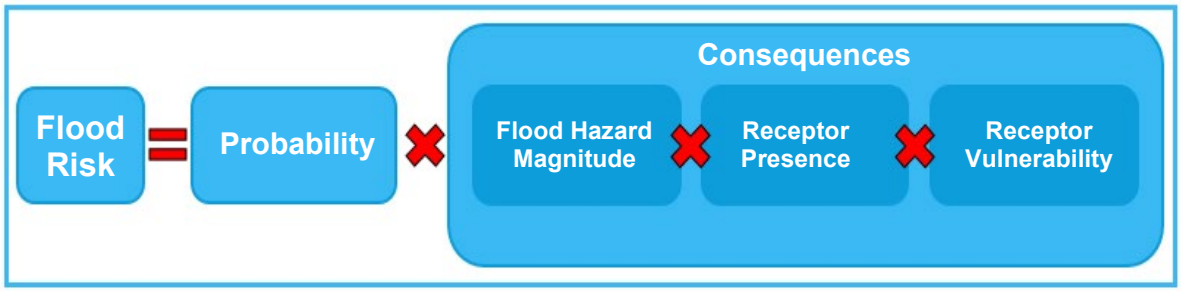
- Groundwater - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- Infrastructure failure - reservoirs; industrial processes; burst water mains; blocked sewers or failed pumping stations.
- Other sources of flooding including breaching of flood defences, overwhelmed canals, lakes, and other artificial sources.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth, and duration of flooding, can vary greatly. With climate change, the frequency, pattern, and severity of flooding are expected to change and become more damaging.

1.9.2 Defining flood risk

Section 3 (subsection 1) of the Flood and Water Management Act (FWMA) defines the risk of a potentially harmful event (such as flooding) as 'a risk in respect of an occurrence is assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences.'

Thus, it is possible to summarise flood risk as:



1.9.2.1 Source-Pathway-Receptor model

Flood risk can be assessed using the Source-Pathway-Receptor model where:

- the source is the origin of the floodwater, principally rainfall
- a pathway is a route or means by which a receptor can be affected by flooding, which includes rivers, drains, sewers, and overland flow, and,
- a receptor is something that can be adversely affected by flooding, which includes people, their property, and the environment.

This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. All these elements must be present for flood risk to arise. Having applied the Source-Pathway-Receptor model it is possible to mitigate the flood risk by addressing the source (often very difficult),

blocking or altering the pathway, or removing the receptor, e.g. steer development away.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk to apply this guidance in a consistent manner.

1.9.2.2 Probability

The probability of flooding is expressed as a percentage based on the average frequency measured or extrapolated from records over many years. A 1% probability indicates the flood level that is expected to be reached on average once in a hundred years, i.e., it has a 1% chance of occurring in any one year, not that it will occur at least once every hundred years.

Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 26% (1 in 4) chance of occurring at least once in a 30-year period - the period of a typical residential mortgage
- And a 49% (1 in 2) chance of occurring in a 70-year period - a typical human lifetime

1.9.2.3 Consequences

The consequences of flooding include fatalities, property damage, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality), the receptors that are present and the vulnerability of these receptors (type of development, nature, e.g. age-structure, of the population, presence, and reliability of mitigation measures etc).

2 Flood risk policy and strategy

This section sets out the flood risk management roles and responsibilities for different organisations and relevant legislation, policy, and strategy.

2.1 Roles and responsibilities for Flood Risk Management in South Norfolk District

There are different organisations in and around South Norfolk District that have responsibilities for flood risk management, known as RMAs. These are listed in Table 2-1, with a summary of their responsibilities.

Further information on the roles and responsibilities of the EA is available in Annex A of the National Flood and Coastal Erosion Risk Management Strategy (FCERM) for England, available from the Government website here.

The Local Government Association also provide further information on the roles and responsibilities for managing flood risk on their website here.

Table 2-1: Roles and responsibilities for RMAs

Risk Management Authority	Strategic Level	Operational Level	Planning role
EA	Strategic overview for all sources of flooding, National Strategy, reporting and general supervision	Main River (e.g. the River Yare) and reservoirs (Flood Risk Activity Permits (FRAPs), enforcement, and works)	Statutory consultee for certain development in Flood Zones 2 and 3 and all works within 20 metres of a main river. Advice on when to consult the EA is available on the Government website here.
Norfolk County Council (NCC) as LLFA	Coordination of Local Flood Risk Management and maintaining a Local Flood Risk Management Strategy (LFRMS)	Surface water, groundwater, and ordinary watercourses (consenting, enforcement, and works)	Statutory consultee for major developments
Anglian Water	Asset Management Plans, supported by Periodic	Public sewers	Non-statutory consultee

	Reviews (business cases), develop drainage and wastewater management plans		
Highways Authorities - National Highways for motorways and trunk roads and NCC for non-trunk roads	Highway drainage policy and planning	Highway drainage	Statutory consultee regarding highways design standards and adoptions
Norfolk Rivers and Waveney, Lower Yare an Lothingland Internal Drainage Board's (IDBs)	Water level/flood risk management within their Internal Drainage District	Permissive powers to undertake works to provide water level/flood risk management	Statutory consultee for developments within IDB areas

2.1.1 Riparian ownership

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties, called Riparian Owners. Riparian Owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species, and allowing the flow of water to pass without obstruction. More information can be found on the Government website in the EA publication 'Owning a watercourse' (2018), available from the Government website here.

When it comes to undertaking works to reduce flood risk, the EA, and Norfolk County Council (NCC) as LLFA do have permissive powers, but limited resources must be prioritised and targeted to where they can have the greatest effect. Permissive powers mean that RMAs are permitted to undertake works on watercourses but are not obliged.

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in South Norfolk. Hyperlinks are provided to external documents:

- Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991), Environment Act (1995), which set out the regulations for development on land in England and Wales.
- Flood and Water Management Act (2010) – as amended and implanted via secondary legislation. These set out the roles and responsibilities for organisations that have a role in Flood Risk Management.
- The Land Drainage Act (1991, as amended) and Environmental Permitting Regulations (2018) also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an ordinary watercourse or main river.
- The Water Environment Regulations (2017) – these transpose the European Water Framework Directive (WFD) (2000) into law and require the EA to produce River Basin Management Plans (RBMPs). These aim to improve/maintain the water quality of aquatic ecosystems, riparian ecosystems and wetlands so that they reach 'good' status.
- The Environment Act 2021 requires developers to provide Biodiversity Net Gain (BNG) and for LPAs to develop Local Nature Recovery Strategies (LNRS). Strategic site allocations in Local Plans which present opportunities for BNG or areas for habitat improvement/creation identified by the LNRS could have parallel opportunities to contribute to reduced flood risk from a range of sources.
- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014), and Strategic Environmental Assessment Directive (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.
- Flood Risk Regulations (2009) - these transpose the European Floods Directive (2000) into law and require the EA and LLFAs to produce PFRAs and identify nationally significant Flood Risk Areas (FRAs).

2.3 Key national, regional, and local policy documents and strategies

Table 2-2 summarises relevant national, regional, and local flood risk policy and strategy documents and how these apply to development and flood risk. Hyperlinks are provided to external documents. These documents may:

- Provide useful and specific local information to inform FRAs within the local area.
- Set the strategic policy and direction for flood risk management and drainage – they may contain policies and action plans that set out what future flood mitigation and climate change adaptation plans may affect a development site. A developer should seek to contribute in all instances to the strategic vision for flood risk management and drainage in South Norfolk.
- Provide guidance and/or standards that inform how a developer should assess flood risk and/or design flood mitigation and SuDS.

The following sections provide further details on some of these documents and strategies.

Please note that the links to these documents may change over time and any requests for these documents should be directed toward the author.

Table 2-2: National, regional, and local flood risk policy and strategy documents

Policy level	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
National	Flood and Coastal Management Strategy (EA) 2020	No	Yes	No	2026
National	National Planning Policy Framework updated in December 2023	No	Yes	Yes	-
National	Planning Practice Guidance (PPG) updated in August 2022	No	No	Yes	-
National	Building Regulations Part H (MHCLG) 2010	No	No	Yes	-
Regional	Broadland Rivers Catchment Flood Management Plan (EA) 2009	No	Yes	No	-
Regional	Anglian River Basin District Flood Risk Management Plan (EA) 2022	No	Yes	No	2027
Regional	River Basin Management Plan for the Anglian River Basin District (EA) 2022	No	Yes	No	2027
Regional	Anglian draft Water Resources Management Plan 2024	Yes	No	No	2029
Regional	Anglian Water Drainage and Wastewater Management Plan	Yes	No	No	2028
Regional	Climate change guidance for development and flood risk (EA) last updated May 2022	No	No	Yes	-
Local	Norfolk Preliminary Flood Risk Assessment (NCC) 2011	Yes	No	No	-
Local	Norfolk Local Flood Risk Management Strategy (NCC) 2015 and LFRMS Policy Review 2021	No	Yes	No	-
Local	Greater Norwich Water Cycle Study	Yes	No	No	-

2.3.1 The National Flood and Coastal Erosion Risk Management Strategy for England (2020)

The National Flood and Coastal Erosion Risk Management (FCERM) Strategy for England provides the overarching framework for future action by all RMAs to tackle flooding and coastal erosion in England. The EA brought together a wide range of stakeholders to develop the strategy collaboratively. The Strategy looks ahead to 2100 and the actions needed to address the challenge of climate change.

The Strategy has been split into three high level ambitions:

- Climate resilient places
- Today's growth and infrastructure resilient in tomorrow's climate
- A nation ready to respond and adapt to flooding and coastal change.

Measures within the Strategy include:

- Updating the national river, coastal, and surface water flood risk mapping and producing a new set of long-term investment scenarios to improve understanding of future risk and investment needs.
- Trialling new and innovative funding models to contribute to the investment needs for flood and coastal resilience.
- Flood resilience pilot studies.
- Developing an adaptive approach to the impacts of climate change by seeking nature-based solutions towards flooding and erosion issues, integrating Natural Flood Management (NFM) into the new Environmental Land Management scheme, and considering long term adaptive approaches in Local Plans.
- Maximising the opportunities for flood and coastal resilience as part of contributing to environmental net gain for development proposals, investing in flood risk infrastructure that supports sustainable growth, and developing world leading ways of reducing the carbon and environmental impact from the construction and operation of flood and coastal defences.
- Aligning long term strategic planning cycles for flood and coastal work between stakeholders.
- Consistent approaches to asset management and record keeping.
- Updating guidance on managing high risk reservoirs considering climate change.
- Development of digital tools to communicate flood risk, transforming the flood warning service, supporting communities to plan for flood events, increasing flood response and recovery support, and mainstreaming property flood resilience measures and 'building back better' after flooding.

The Strategy was laid before parliament in July 2020 for formal adoption and published alongside a New National Policy Statement for Flood and Coastal Erosion Risk Management, which can be accessed from the Government website. The

statement sets out five key commitments which will accelerate progress to better protect and better prepare the country for the coming years:

1. Upgrading and expanding flood defences and infrastructure across the country,
2. Managing the flow of water to both reduce flood risk and manage drought,
3. Harnessing the power of nature to not only reduce flood risk, but deliver benefits for the environment, nature, and communities,
4. Better preparing communities for when flooding and erosion does occur, and
5. Ensuring every area of England has a comprehensive local plan for dealing with flooding and coastal erosion.

It can be expected that the implementation of the National Strategy will lead to the publication of new guidance and practice that is focused on resilience and adaptation over the coming years. It will be important to adjust the content of the SFRA so that changes in approach are captured in the delivery of the Local Plan.

For further information, the Government has published the full National Flood and Coastal Erosion Risk Management Strategy (FCERM).

2.3.2 Flood Risk Regulations (2009)

The Flood Risk Regulations (FRRs) (2009) translate the European Union (EU) Floods Directive into UK law, which is at the time of writing retained in UK law post-Brexit, and can be accessed on the Government website. The EU requires Member States to complete an assessment of flood risk (known as a PFRA) and then use this information to identify areas where there is a significant risk of flooding. For these Flood Risk Areas, States must then undertake Flood Risk and Hazard Mapping and produce Flood Risk Management Plans (FRMPs). This cycle is repeated on a six-yearly basis.

The FRRs direct the EA to do this work for river, sea, and reservoir flooding. LLFAs must do this work for surface water, ordinary watercourse, and groundwater flooding.

The first cycle of planning ran from 2009 until 2015. Within this time LLFAs published their first PFRAs. The first FRMPs were also published.

The second cycle of planning commenced in 2016. Within this cycle, LLFAs published addendums to their existing PFRAs, the EA published their PFRA, and the second cycle FRMPs were published in December 2022, with actions to manage flood risk across England for the period 2021 to 2027.

The EA PFRA (2018) for river, sea and reservoir flooding identifies nationally significant Flood Risk Areas for these sources. This PFRA identified 18 FRAs within the Anglian River Basin District (RBD), one of which affects South Norfolk. The Norwich Flood Risk Area covers a small part of the northern boundary of the South Norfolk District. The full PFRA can be found on the Government website.

The NCC PFRA, published in 2011, is a high-level screening exercise which provides an assessment of past flood risk based on historical data from NCC, the EA, Anglian Water, and local Parish Councils, Town Councils, and Residents Associations. No nationally significant FRAs were identified in Norfolk in the initial 2011 PFRA however the following 2017 addendum identified one FRA, the Norwich Urban Area, which affects the northernmost part of South Norfolk. The 2011 PFRA is available on the NCC website, here, and the 2017 addendum is available on the Government website, here.

South Norfolk District lies within the Anglian RBD FRMP area. The second cycle FRMP is a plan to manage significant flood risk in the FRAs identified within the Anglian RBD within the EA PFRA. The Anglian FRMP identified one FRA which partially lies within South Norfolk:

- The Norwich Surface Water FRA

Measures identified within this FRA include:

- Continuing to offer grants to property owners who suffer surface water flooding.
- Continuing to prioritise consultation responses to major planning applications, while seeking opportunities for flood risk betterment, in Critical Drainage Catchments and working with LPAs.
- Engaging with Parish Councils, community groups and other organisations.
- Reviewing the level of protection provided by major drainage assets constructed as part of new development.
- Reviewing the local flood risk in all sub-catchments within the Norwich urban area and re-assigning Critical Drainage Catchments if appropriate.
- Seek funding and opportunities.
- Trialling the use of gully sensors.

More information on measures for this FRA alongside strategic and national scale measures is available on the EA's online interactive mapping.

It is also recognised that there are areas at flood risk outside of these FRAs. The plan has therefore been expanded to show what is happening across the RBD and in locally important areas referred to as 'Strategic Areas' which were put forward by the EA providing they were not already designated FRAs. The Anglian RBD FRMP is available on the government website here.

As of 1 January 2024, the Retained EU Law (Reform and Revocation) Bill automatically repealed any retained EU law (REUL) not otherwise preserved or replaced in UK law before the end of 2023, including the Flood Risk Regulations 2009 which transposed the EU Floods Directive into legislation. This is because much of the FRRs is duplicated in existing domestic legislation, namely the Flood and Water Management Act 2010. The EA and LLFAs in England will therefore no longer be required to comply with the third cycle of planning, however the government expects to see continued implementation of the FRMPs 2021-2027.

2.3.3 Flood and Water Management Act (2010)

The FWMA was passed in April 2010 following the recommendations made within the Pitt Review (2009) following the flooding in 2007. It aims to improve both flood risk management and the way water resources are managed.

The FWMA (2010) has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for Local Authorities, as LLFAs, designed to manage local flood risk (from surface water, ground water and ordinary watercourses) and to provide a strategic overview role of all flood risk for the EA.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by Local Authorities and other key partners. The integration and synergy of strategies and plans at national, regional, and local scales, is increasingly important to protect vulnerable communities and deliver sustainable regeneration and growth.

2.3.3.1 Schedule 3 enactment

In January 2023 the government's decision to implement Schedule 3 of the Flood and Water Management Act (2010) was announced. The implementation will follow a consultation period expected in 2024. This legislation introduces an approval body for the consideration of sustainable drainage through new development. This will be supported by the introduction of a SuDS Approval Body (SAB), which will be a role taken on by the local authority.

This will change the way SuDS are constructed, adopted, and maintained. The Non-Statutory Technical Standards for Sustainable Drainage in England were reviewed in 2021. Recommendations for updating these standards have been published and will form the basis for statutory standards once Schedule 3 is implemented.

2.3.4 The Water Framework Directive and Water Environment Regulations and River Basin Management Plans

The purpose of the WFD, which was transposed into English Law by the Water Environment Regulations (2003), is to deliver improvements across Europe in the management of water quality and water resources through a series of plans called RBMPs.

The WFD requires the production of RBMPs for each River Basin District. RBMPs support the government’s framework for the 25-year environment plan and allow local communities to find more cost-effective ways to further improve our water environments. Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques.

The EA manages the RBMPs and must review and update them every six years. The first cycle of RBMPs were published in 2009 and were most recently updated in 2022.

South Norfolk District lies within the Anglian RBD. The updated Anglian RBD RBMP for 2022 can be accessed on the Government website.

2.3.5 Updated Strategic Flood Risk Assessment guidance

There was an update to the 'How to prepare a Strategic Flood Risk Assessment guidance' in March 2022, which requires further adjustment to the approaches to both Level 1 and Level 2 assessments. The Level 1 assessment is undertaken in accordance with the latest guidance. The latest guidance can be accessed on the Government website.

2.3.6 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are high-level strategic plans providing an overview of flood risk across each river catchment. The EA use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management.

South Norfolk District lies within the Anglian CFMP region, which sets out policies relating to flooding from rivers, surface water, and groundwater within the Anglian catchment area.

2.3.7 Norfolk County Council Local Flood Risk Management Strategy (LFRMS) 2015

NCC is responsible for developing, maintaining, applying, and monitoring a LFRMS. The most recent Strategy was published in April 2015 and is used as a means by which the LLFA co-ordinates Flood Risk Management on a day-to-day basis. A policy review was conducted in 2021 and can be downloaded from the NCC website.

The LFRMS aims to set out how flood risk will be reduced and managed in the District, with seven objectives developed:

1. Determine and communicate Local Flood Risk Undertake projects to determine and understand the risk of flooding from surface run-off, ordinary watercourses and groundwater. Increase public awareness through the publication of clear and consistent information about local flood risk.
2. Partnership Working Work with all Risk Management Authorities (RMAs) and other stakeholders to coordinate flood risk management roles, responsibilities and activities. Share best practice; raise the profile of Risk Management Authorities working within Norfolk and assist organisations in ensuring their plans and projects take proper account of all flood risk.

3. Partnership Programmes and Projects Identify, secure and optimise resources to develop and deliver measures to manage flood risk. Assist organisations to establish and update long-term plans to manage flood risk.
4. Riparian Responsibilities Work with Risk Management Authorities to encourage and where necessary enforce the management and maintenance of privately owned flood management structures and ordinary watercourses and minimise unnecessary constrictions and obstructions within local drainage networks.
5. Flood Risk and Development Ensure that planning authorities are properly informed about local flood risk, that there is a consistent approach to the consideration of flood risk management in new development and that new developments seek to reduce existing flood risk and contribute to the achievement of sustainable development. Ensure flood risk management techniques adopted will conserve and enhance the historic environment, heritage assets and their settings.
6. Water Framework Directive Support the implementation of the 'Water Framework Directive' by ensuring that watercourse morphology, water quality and ecological status are not harmed by activities that are controlled by, or undertaken by, owners, occupiers and managers of Flood and Coastal Erosion Risk Management infrastructure. Facilitate measures to improve morphology, water quality and ecological status whenever it is practicable and necessary to do so.
7. Support Water and Sewerage Company infrastructure Work closely with water and sewerage companies to minimise flood risk associated with their infrastructure and promote the development and management of sustainable water resources.

2.3.8 Local policy and guidance for SuDS

The 2023 NPPF states that: 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Paragraph 175) and 'development should only be allowed in areas at risk of flooding where… it can be demonstrated that… c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate' (Paragraph 173). When considering planning applications, local planning authorities (LPAs) should consult the relevant LLFA on the management of surface water to satisfy that:

- The proposed minimum standards of operation are appropriate.
- Using planning conditions or planning obligations there are clear arrangements for on-going maintenance over the development's lifetime.

At the time of writing this SFRA, the following documents and policies are relevant to SuDS and surface water in South Norfolk. Hyperlinks are provided to external documents:

- Norfolk (NCC) SuDS Strategy, 2019
- SuDS Manual (C753), published in 2007 and updated in 2015
- Defra Non-statutory technical standards for sustainable drainage systems, 2015
- Defra National Standards for sustainable drainage systems Designing, constructing (including LASOO best practice guidance), operating and maintaining drainage for surface runoff, 2011
- Building Regulations Part H (MHCLG), 2010

The 2023 NPPF states that flood risk should be managed “using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding" (Paragraph 167). NCC set out in their SuDS strategy that they expect SuDS to be incorporated when planning all major developments, from the Strategic Development Location scale through to a ten-dwelling development.

2.3.9 Water Cycle Studies

Water Cycle Studies assist local authorities to select and develop growth proposals that minimise impacts on the environment, water quality, water resources, infrastructure, and flood risk and help to identify ways of mitigating such impacts.

AECOM were commissioned in 2021 to undertake an Outline Water Cycle Study for the Greater Norwich area (including Broadland District Council, Norwich City Council and South Norfolk District Council). This study provides an assessment of the impact of planned future development throughout the study area with regards to water supply capacity, wastewater capacity and associated environmental capacity. Any water quality issues and water infrastructure upgrades were also identified.

This study found the following conclusions:

- It is recommended that Major Development sites assessed by Anglian Water Services as part of the WCS as Amber or Red for wastewater network constraints should be subject to a pre-development enquiry.
- Upgrades to several wastewater catchments is needed to increase treatment capacity.
- It is recommended that communication with neighbouring local authorities, as part of the duty to co-operate, should continue to be pursued, to ensure that future Water Cycle Study assessments closely represent the future growth scenarios at Water Recycling Centres which discharge into the Waveney, Bure, Yare and Wensum (and their tributaries).
- Discharges of surface water to watercourses should provide pollution prevention control measures prior to discharge. The use of SuDS should be encouraged to provide water quality improvements.
- The surface water and combined sewer systems in the study area are generally at capacity and it is therefore necessary for developers to implement SuDS

systems to reduce runoff rates to as close to greenfield runoff as possible and achieve greenfield rates for all undeveloped sites.

This Water Cycle Study is available to download from the Council website.

It should be noted that Water Cycle Studies are based on information available at the time, and subsequent changes, including issues such as nutrient neutrality and subsequent legislative requirements for treatment upgrades to specific water recycling centres will present additional challenges for future growth.

SNC are currently preparing an update to the Outline Water Cycle Study to support the publication of their 2024 Regulation 19.

2.3.10 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning, and future developments.

In September 2016, Stage 1 of the South Norfolk SWMP was complete. Following completion of the Stage 1 SWMP, the LLFA focused on individual settlements with high flood risk and/or flooding such as Diss, Wymondham, Long Stratton and Kenninghall. Projects were not progressed in Diss and Wymondham, however, schemes are being progressed in Long Stratton.

2.3.11 Water Resources Management Plans (WRMPs)

Under the duties set out in sections 37A to 37D of the Water Industry Act 1991, all water companies across England and Wales must prepare and maintain a WRMP. This must be prepared at least every five years and reviewed annually.

WRMPs should set out how a water company intends to achieve a secure supply of water for their customers and a protected and enhanced environment.

Anglian Water have recently published their draft 2024 WRMP, available on their website here. This sets out how they intend to provide a secure and sustainable water supply over the next 50 years, looking ahead to 2050.

2.3.12 Drainage and Wastewater Management Plans

Water and sewerage companies have a statutory duty under the Environment Act to produce Drainage and Wastewater Management Plans (DWMPs). The first plans were published in 2023. DWMPs must cover a minimum period of 25 years, looking at

current and future capacity, pressures, and risks to their networks, such as climate change and population growth.

DWMPs should detail how the companies will manage these pressures and risks through their business plans and how they will work with other RMAs or drainage asset owners.

Anglian Water published their first DWMP in May 2023, which covers the period from 2025 to 2050. As part of the DWMP, Anglian Water set out ten goals, which include:

- Promote the use of nature-based solutions, especially for surface water removal.
- Show what's needed to protect their assets and customers from the impacts of heavy rainfall due to climate change.

The DWMP can be downloaded from the Anglian Water website, here.

3 Planning policy for flood risk management

This section summarises national planning policy for development and flood risk.

3.1 National Planning Policy Framework and Guidance

The revised NPPF was published in July 2021, and was most recently updated in December 2023. The NPPF sets out Government's planning policies for England and is available on the Government website here. It must be considered in the preparation of local plans and is a material consideration in planning decisions. The NPPF advises on how flood risk should be considered to guide the location of future development and FRA requirements. The NPPF states that:

“Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards” (Paragraph 166).

The PPG on flood risk and coastal change was published in March 2014 and sets out how the policy should be implemented. Diagram 1 in the PPG sets out how flood risk should be considered in the preparation of Local Plans. It was most recently updated on the 25 August 2022. The most up-to-date guidance is available on the Government website.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas. Since July 2021 the approach has adjusted the requirement for the sequential test (as defined in Paragraph 167 of the NPPF) so that all sources of flood risk are included in the consideration. The requirement for the revised sequential test has been addressed by adopting the following approach:

- The test will no longer be purely based on the use of the Zones describing river and sea flood risk, and instead be based on whether development can be located in the lowest risk areas (high-medium-low) of flood risk both now and in the future. The test now applies to all sources of flood risk – whereas previously the test was only performed for present day flood risk for the “Flood Zones” i.e. river and sea flood risk.
- Understanding flood risk to sites based on their vulnerability and incompatibility as opposed to whether development is appropriate.
- In addition to the flood risk mapping describing river and sea flood risk, there is mapping available to describe surface water flood risk. Although, this is not

conceptually similar to the flood risk mapping for rivers and sea due to the differing nature of flooding.

- As there is no available competent risk mapping for other sources of risk it is not considered appropriate to use such mapping in a strict process that involves comparison of differing levels of flood risk. Reservoir, groundwater and sewer flood risk are addressed through the SFRA using a variety of datasets to analyse and describe the risk to areas across the South Norfolk District.
- A more formal assessment of these sources is undertaken in a Level 2 SFRA and involves a more detailed assessment of the implications of reservoir, sewer, and groundwater flood risk to establish that more appropriate locations at lower risk are not available.
- Consideration is given to all sources of flood risk using the available data to complete the sequential test so decisions on the selection of preferred sites for allocation address the potential implications of groundwater, reservoir, and sewer flooding. Also, where necessary it identifies sites where consideration should be given to satisfying the requirements of the exception test.

3.2.1 Flood Zones - Fluvial Risk

The definition of the Flood Zones is provided below. The Flood Zones do not consider defences, except when considering the functional floodplain. This is important for planning long term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

The Flood Zones are:

- Flood Zone 1: Low risk: less than a 0.1% chance of river and sea flooding in any given year.
- Flood Zone 2: Medium risk: between a 1% and 0.1% chance of river and sea flooding in any given year.
- Flood Zone 3a: High risk: between a 3.3% and 1% chance of river and sea flooding in any given year.
- Flood Zone 3b: Functional Floodplain: land where water has to flow or be stored in times of flood (greater than 3.3% AEP). SFRAs identify this Flood Zone in discussion with the LPA and the EA. The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. Information on flood risk vulnerability classification is available online in Annex 3 of the NPPF, here. It may be required to consider climate change on the functional floodplain; this would need hydraulic modelling to confirm extents and therefore it is recommended that this is considered in an FRA and a suitable approach is agreed with the EA.
    - FZ3b is based on the best available model data:

        - 3.3% Annual Exceedance Probability (AEP) where available
        - 1% AEP where the 3.3% is not available.
    - Where model data is not available, FZ3a (1% AEP) is used as a conservative proxy.

Flood Zones 2 and 3a consider undefended fluvial or tidal risk whilst Flood Zone 3b considers defended fluvial or tidal risk. The Flood Zones do not risk mapping for surface water, sewer, groundwater flooding or the impacts of reservoir failure or climate change. Hence, there could still be a risk of flooding from other sources and that the level of flood risk will change over the lifetime of a development. In addition to the Flood Zones, areas at future flood risk need to be considered within the sequential test. The approach to consideration of climate change within this SFRA and the available data are set out in Section 5 and Appendix C: User Guide details the approach for assessing future flood risk within the SFRA.

Important note on Flood Zone information in this SFRA

We have used the best available data to inform this SFRA. For some watercourses, additional modelling was available (shown on the Appendix A Mapping as Modelled Flood Zones) in addition to the existing Flood Map for Planning Flood Zones 2 and 3a. These areas are as follows:

- Fluvial models:
    - River Tiffey
    - River Waveney
    - Bungay Tin
- 2D Strategic models:
    - Gillingham - fluvial and tidal outputs

It is important to note that the strategic model at Gillingham was developed by JBA in 2020 to inform the sequential site-based planning according to flood risk to for the Level 2 assessment. This model is informed by high-level data i.e., LiDAR, rather than a topographic survey. A strategic model may not be sufficient to inform a site-specific Flood Risk Assessment and therefore further detailed modelling may be required.

JBA were informed of a topographic survey that had been undertaken for the purposes of a FRA supporting a development application for the area of Gillingham, dated June 2023. Following consultation with the EA, the general schematisation of the 2D Gillingham model is comparable to the topographic survey from the FRA documentation, therefore it is deemed appropriate for strategic purposes and carrying out sequential site-based planning. However, new data from the topographic survey should inform a site-specific FRA.

The EA Flood Zones do not cover all catchments or ordinary watercourses with areas <3km². As a result, whilst the EA Flood Zones may show an area is in Flood Zone 1, there may be a flood risk from a smaller watercourse(s) not shown in the Flood Zones.

Functional floodplain (Flood Zone 3b) is identified as land which allows water to flow in times of flood with an AEP of 3.3% (1 in 30 years). As this extent is not shown on the Flood Map for Planning, this can only be identified where detailed hydraulic modelling exists. 3.3% AEP extents were available for the following models:

- River Waveney
- River Yare
- Upper Wensum and Wensum Norwich
- River Tud
- Broome Beck
- Bungay Tin
- Frenze Beck

For the River Tiffey, the 2% AEP output was used as a proxy for Flood Zone 3b.

For the Gillingham Strategic model, no 3.3% or 2% AEP output was available, so the 1% AEP output should be used as a proxy for Flood Zone 3b.

The site screening process is described in more detail in Section 10.2.

For areas outside of the detailed model coverage, Flood Zone 3a (1% AEP) has been used as a conservative indication. Further work should be undertaken as part of a detailed site-specific FRA to define the extent of Flood Zone 3b where no detailed modelling exists. Caution should also be applied where the conservative Flood Zone 3b extent encompasses existing urban areas which would not otherwise be "designed to flood".

3.2.2 Flood Zones - surface water risk

To address the requirement that flood risk from all sources is included in the sequential test in addition to the fluvial Flood Zones, a further set of surface water zones have also been defined.

The surface water zones define locations at either lower or higher risk of surface water flooding based on the extent of the 1% AEP plus 40% climate change allowance surface water event, the modelled uplift applied to the Environment Agency's RoFSW of which has been rerun as part of the SFRA. This is the upper end allowance for the 2070s epoch which the EA climate change guidance recommends is assessed within SFRAs.

- Zone A – lower risk of surface water flooding (lies outside the 1% AEP plus 40% climate change surface water extent)
- Zone B – higher risk of surface water flooding (lies within the 1% AEP plus 40% climate change surface water extent)

Surface water mapping does not strictly describe the same conceptual risk zone as is defined for river and sea flooding (even though it is notionally associated with the same probability) as the mapping is based on different assumptions. However, it does

create a product that can accommodate sequential testing, as it can facilitate strategic decisions that direct development to land in a “lower risk surface water flood zone”. These Zones have been defined as part of the SFRA to allow for application of the Sequential Test, and are not defined or used in the NPPF or existing SWMPs.

Surface water flood risk can be of much shallower depth and is not normally experienced for such extensive durations as river flooding. However, the safety implications of placing proposed development at locations where there is surface water flood risk together with the potential effects on third parties is a material consideration and thus if it is proposed to place development in a Zone of high surface water flood risk then consideration should be given to the demonstrating that part “b” of the Exception Test (outlined in section 3.2.5) can be satisfied (with the presumption that part “a” was satisfied if the land was allocated in the Local Plan).

3.2.3 Flood Zones - other sources of flooding

Other sources of flooding also need to be considered as part of the sequential test. This includes reservoir and groundwater flooding.

One source of flooding is from reservoirs, which provide water storage facilities. It is recommended that reservoir flooding is not included in the sequential test. The latest available mapping now shows “wet day” and “dry day” reservoir inundation extents. The “wet day” being a reservoir breach at the same time as a 0.1% AEP river flood (as this is a likely time when a reservoir might fail) and the dry day shows the failure just from the water retained by the dam. However, neither set of mapping describes a risk-based scenario, as they do not indicate the relative risk to land based on the probability of dam failure but are intended to show a “worst credible case”.

By comparing the extent of Fluvial Flood Zone 2 with the Reservoir Flood Map Wet Day Extent two zones can be defined:

1. Where reservoir flooding is predicted to make fluvial flooding worse.
2. Where reservoir flooding is not predicted to make fluvial flooding worse.

The mapping could be used to direct proposed new development away from locations that could potentially be affected by reservoir flood risk. However, it is different to the risk pertaining to river and sea flooding and further assessment would be required to understand the magnitude of the potential hazard. This mapping will also identify locations where proposed development could result in a change to the risk designation of a reservoir. If proposed sites are located in a zone at reservoir risk, it will be necessary to include a more detailed assessment in a Level 2 SFRA.

For the purposes of this SFRA it is not possible to prepare zone maps for sewer flood risk, or groundwater flood risk as the appropriate analyses and data are not available. The existing datasets on sewer flooding, and groundwater are used to inform the sequential approach to development at a site in accordance with Paragraph 167 of the NPPF (which could in some instances result in alternative sites being considered).

3.2.4 The sequential test

Paragraphs 023 - 030 of the PPG provide guidance on the application of the sequential test and should be referred to in in conjunction with the SFRA.

Firstly, land at the lowest risk of flooding from all sources should be considered for development. A test is applied called the 'sequential test' to do this.

This section sets out the sequential test for the local plan process. The sequential test for developers is outlined in Section 3.3.1.

Figure 3-1 summarises the sequential test.

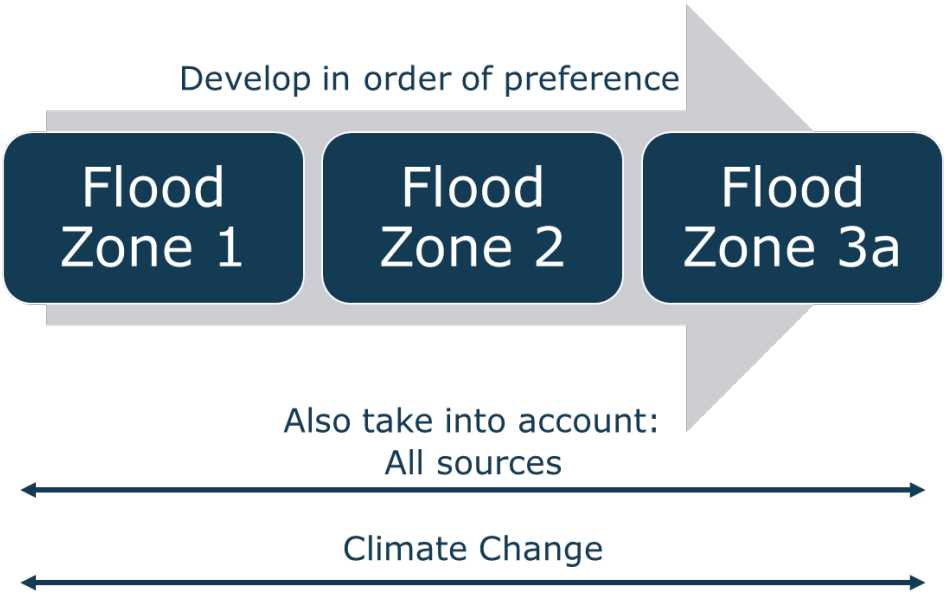


Figure 3-1: A summary of the sequential test

The sequential approach steers development away from areas of flood risk and where the sequential and exception test have been applied (where required) and have not been met, development should not be permitted. It is advised that this approach should be considered early in the design process.

The sequential test should be applied to all relevant planning applications, as set out below. Developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test.

A sequential test should be carried out if the development is:

- Within Flood Zones 2, 3a, or 3b
- Within Flood Zone 1 where:
- This SFRA shows it to be at risk of flooding from rivers or sea in the future; or
- It is at risk of flooding from other sources
    - Surface water (identified as Zone B in this SFRA)

- Groundwater, reservoirs, and sewer (see Section 3.2.3 which refers to the limitations with data currently available to assess flood risk these sources)

Exceptions to this requirement are for changes of use (except for changes of use to a caravan, camping or chalet site, or to a mobile home or park site, where the sequential and exception tests should be applied as appropriate), householder development, and non-residential extensions with a footprint less than 250 square metres.

The LPA should work with colleagues involved with local flood risk to define a suitable search area for the consideration of alternative sites in the sequential test.

The sequential test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land or Employment Land Availability Assessments.

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone it is proposed for. Table 2 of the PPG defines the flood risk vulnerability and flood zone 'incompatibility' of different development types to flooding which can be found on the Government website here.

Figure 3-2 illustrates the sequential and exception tests as a process flow diagram (Diagram 2 of the PPG) using the information contained in this SFRA to assess potential development sites against the EA's Flood Map for Planning flood zones and development vulnerability compatibilities.

This is a stepwise process, but a complex one, as several of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded. In addition, the risk of flooding from other sources and the impact of climate change must be considered when considering which sites are suitable to allocate. The SFRA User Guide in Appendix C shows where the sequential and exception test may be required for the datasets assessed in the SFRA, and how to interpret different sources of flood risk, including recommending what proposed development sites should be assessed at Level 2.

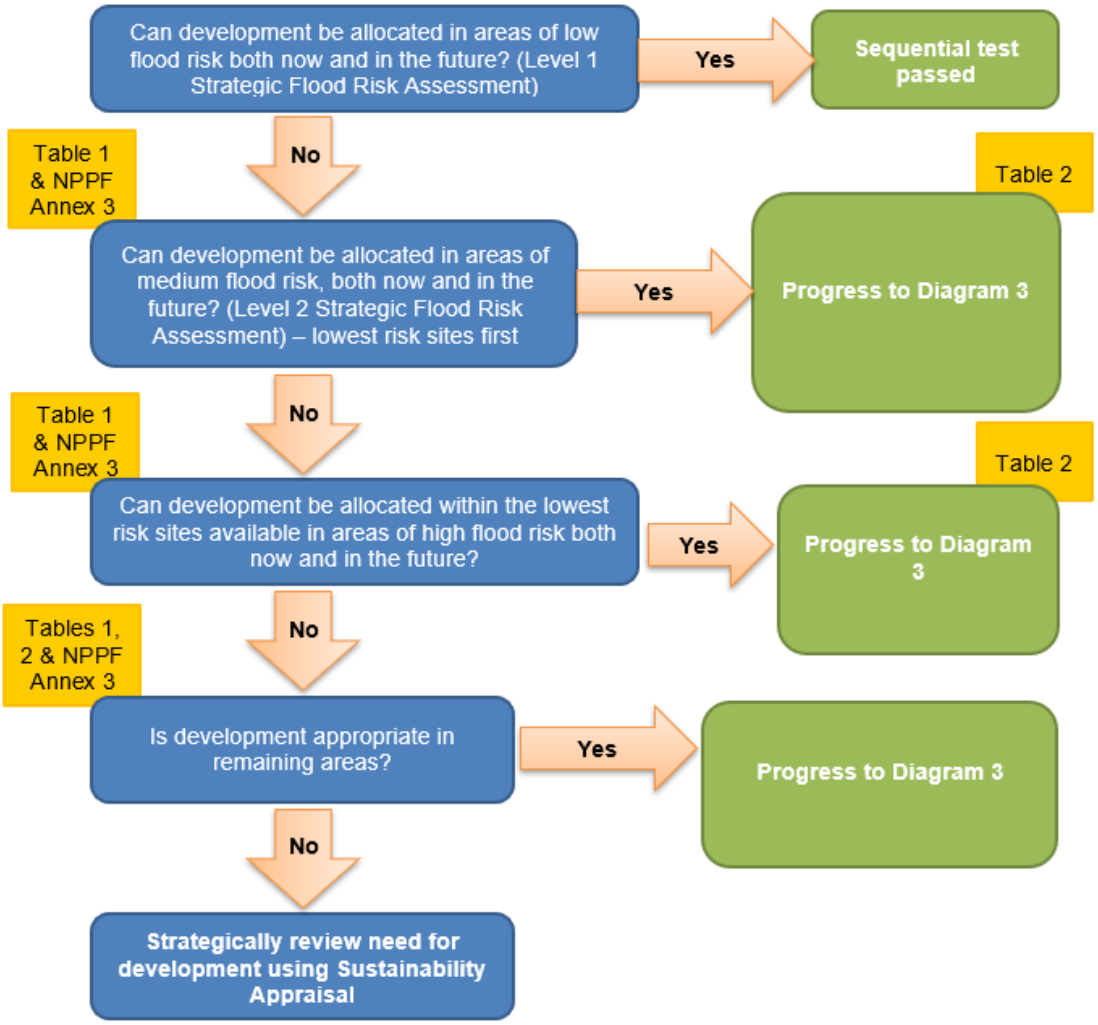


Figure 3-2: Local Plan sequential approach to site allocation

3.2.5 The exception test

Paragraphs 031 - 037 of the PPG provide guidance on the application of the exception test and should be referred to in in conjunction with the SFRA.

It will not always be possible for all new development to be located on land that is not at risk from flooding. To further inform whether land should be allocated, or Planning Permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the exception test will be required.

The exception test should only be applied following the application of the sequential test. It applies in the following instances:

- 'More vulnerable' development in Flood Zone 3a
- 'Essential infrastructure' in Flood Zone 3a or 3b
- 'Highly vulnerable' development in Flood Zone 2

- Any development where a higher risk of surface water has been identified (surface water Zone B) and the site does not clearly show that development can be achieved away from the flood risk.

'Highly vulnerable' development should not be permitted within Flood Zone 3a or Flood Zone 3b. 'More vulnerable' and 'Less vulnerable' development should not be permitted within Flood Zone 3b.

While current guidance in Table 2 of the PPG only applies to the EA's Flood Map for Planning, which displays risk of flooding from rivers and the sea, updated PPG (August 2022) now requires all sources of flood risk to be assessed within the sequential test and therefore it follows that, where sufficient datasets are available, the exception test should also take into account all sources of flood risk.

Figure 3-3 summarises the exception test.

For sites proposed for allocation within the Local Plan, the LPA should use the information in this SFRA to inform the exception test. At the planning application stage, the developer must design the site such that it is appropriately flood resistant and resilient in line with the recommendations in national and local planning policy and supporting guidance and those set out in this SFRA. This should demonstrate that the site will still pass the flood risk element of the exception test based on the detailed site level analysis.

For developments that have not been allocated in the Local Plan, developers must undertake the exception test and present this information to the LPA for approval. The Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should investigate in more detail to inform the exception test for windfall sites.

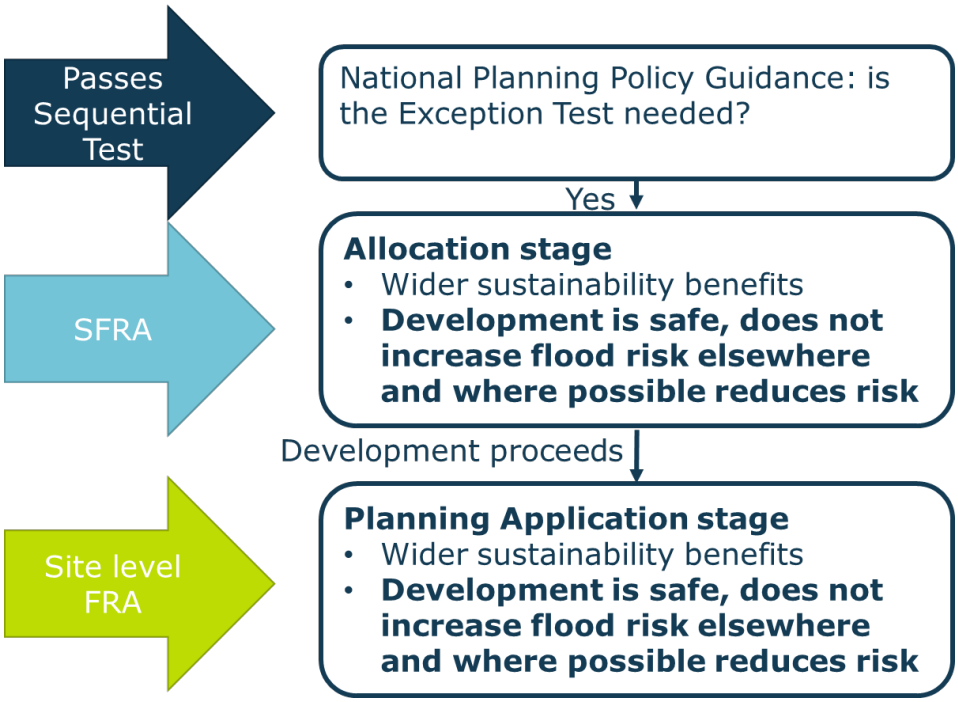


Figure 3-3: The exception test

There are two parts to demonstrating a development passes the exception test:

1. Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.

LPAs will need to set out the criteria used to assess the exception test and provide clear advice to developers on the information required. If this information is not provided, the LPA should consider whether the use of planning conditions and / or planning obligations could allow it to pass the exception test. If this is not possible, this part of the exception test has failed, and planning permission should be refused.

At the stage of allocating development sites, LPAs should consider wider sustainability objectives, such as those set out in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

The LPA should consider the sustainability issues the development will address and how far doing so will outweigh the flood risk concerns for the site, e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

2. Demonstrating that 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.

In circumstances where the potential effects of proposed development are material a Level 2 SFRA is likely to be needed to inform the exception test for strategic allocations to provide evidence that the principle of development can be supported. At the planning application stage, a site-specific FRA will be needed. Both will need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

3.2.6 Making a site safe from flood risk over its lifetime

LPAs will need to consider the actual and residual risk of flooding and how this will be managed over the lifetime of the development:

- Actual risk is the risk to the site considering existing flood mitigation measures.
- The PPG refers to the 'design flood' against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed.
    - The 'design flood' is defined as the 1% AEP fluvial event or 1% AEP surface water event, plus an appropriate allowance for climate change. Allowances for climate change can be found on the EA website here.
- Safe access and egress should be available during the design flood event. Firstly, the design of the development should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.
- Residual risk is the risk that remains after the effects of flood defences have been taken into account and/ or from a more severe flood event than the design event. The residual risk can be:
    - The effects of an extreme 0.1% annual probability flood event. This could lead to the overtopping of flood defences, which may lead to erosion and/or failure, and/ or
    - Structural failure of any flood defences, such as breaches in embankments or walls.

Flood resistance and resilience measures should be considered to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage caused, should water enter a property. Emergency plans should also account for residual risk, e.g. through the provision of flood warnings and a flood evacuation plans where appropriate. Further details can be found in Section 8.5.

In line with the NPPF, the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk. Climate change is discussed further in Section 5.

Section 8.2.5 discusses requirements for finished floor levels.

3.3 Applying the sequential test and exception test to individual planning applications

3.3.1 Applying the sequential test

SNC, with advice from the EA, are responsible for considering the extent to which sequential test considerations have been satisfied.

Developers are required to apply the sequential test to all development sites, unless the site is:

- A strategic allocation and the test has already been carried out by the LPA as part of preparing the local plan, or
- A change of use (except to a caravan, camping or chalet site, or to a mobile home or park home site), or
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m²), or
- A development in fluvial Flood Zone 1 unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).

The SFRA contains information on all sources of flooding and takes into account the impact of climate change. This should be considered when a developer undertakes the sequential test, including the consideration of reasonably available sites at lower flood risk.

Local circumstances must be used to define geographical scope of the sequential test (within which it is appropriate to identify reasonably available alternatives). To determine the appropriate search area criteria, include the catchment area for the type of development being proposed. For some sites this may be clear, e.g. school catchments, in other cases it may be identified by other Local Plan policies. For some sites, e.g. regional distribution sites, it may be suitable to widen the search area beyond LPA administrative boundaries.

The sources of information on reasonably available sites may include:

- Site allocations in Local Plans
- Sites with Planning Permission but not yet built out
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/ five-year land supply/ annual monitoring reports
- Locally listed sites for sale

It may be that a number of smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood risk.

Ownership or landowner agreement in itself is not acceptable as a reason not to consider alternatives.

3.3.2 Applying the exception test

If, following application of the sequential test, it is not possible for the development to be located in areas with a lower probability of flooding the exception test must then be applied (as set out in Table 2 of the PPG).

Where a development proposal is in accordance with an allocation made in a Local Plan following the application of the sequential and exception tests, the exception test will only be required to be repeated if:

- Elements of the development that were key to it satisfying the exception test at the plan-making stage (such as wider sustainability benefits to the community or measures to reduce flood risk overall) have changed or are not included in the proposed development; or
- The understanding of current or future flood risk has changed significantly.

The applicant will need to provide information that the application can pass both parts of the exception test:

1. Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.
    - Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These often consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.
    - Applicants should assess the sustainability issues the development will address and how doing it will outweigh the flood risk concerns for the site, e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.
2. Demonstrating that 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.
    - The site-specific FRA should demonstrate that the site will be safe, and the residents/occupiers will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:
        - the design of any flood defence infrastructure,
        - access and egress,
        - operation and maintenance,
        - design of the development to manage and reduce flood risk wherever possible,
        - resident awareness,
        - flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event, and

        - any funding arrangements required for implementing measures.
    - Further guidance on FRAs for new developments can be downloaded from the government website here.

4 Understanding flood risk in South Norfolk District

This section explores the key sources of flooding in South Norfolk District and the factors that affect flooding including topography, soils, and geology. The main sources of flooding affecting the district are from watercourses, surface water, and sewers, as detailed in information provided by SNC, the EA, and Anglian Water.

This is a strategic summary of the risk in South Norfolk District. Developers should use this section to scope out the flood risk issues they need to consider in greater detail in a site-specific FRA to support a Planning Application.

Appendix B contains a list of the sources of data used in the SFRA and the approach to using hydraulic model data to inform the mapping.

4.1 Historical flooding

4.1.1 Historical flood records

Historic flooding data to inform this SFRA was provided by NCC in the form of Section 19 Flood Investigation reports and a GIS database of recorded flood incidences.

Under the FWMA (2010), the LLFA has a duty to investigate flood incidences, where considered necessary or appropriate, and produce a report known as a Section 19 Flood Investigation report.

The South Norfolk, Wymondham Section 19 report was published in 2014 and covered a series of flood events from 2012 to 2014. It was reported that flooding occurred on Station Road, Wymondham on the 4 April 2012. The highway, which is a primary gritting route and the main access point for local residents and emergency services, was flooded under the railway bridge and rendered inaccessible. Four other flooding events were recorded in 2012, three in 2013, and two in 2014 on Station Road, Wymondham.

Flooding occurred in various locations across Norfolk on 2 June 2018. The rainfall event on this date generated 60 reports of flooding, 47 of which were located in the South Norfolk and Breckland Districts, this in turn led to the identification of 24 properties that had suffered internal flooding within these Districts. The properties affected were predominantly located to the South of Wymondham with a further two individual properties located to the Southeast of the town.

There was also a major flood event in South Norfolk on the 23 and 24 December 2020 due to heavy rainfall (1117.7mm total rainfall, 204% of the long-term average) with 205 incidences of internal flooding recorded by NCC spread across the district. Based

on reports from neighbouring properties and other RMA reports, considerably more properties than this are believed to have been affected.

Section 19 reports relevant to South Norfolk can be downloaded from the NCC website.

Table 4-1 details the major flood events contained within the GIS records provided by NCC. Table 4-2 details the flood events shown within the EA Recorded Flood Outlines dataset. The watercourses and areas affected by these events are detailed further in Appendix E.

Table 4-1: Historic flooding incidents provided by NCC.

Flood date	Flood source	Flood cause	Receptors
14th February 2013	Surface Water	Partial obstructions within the drainage system	Flooding to Highway in Little Melton
9th March 2013	Surface Water	Partial obstructions within the drainage system	Flooded roads in Long Stratton
2012 - 2014	Surface Water	Partial obstructions within the highways surface water drainage systems	A variety of dates from 2012-2014 on Station Road in Wymondham. Flooding of the highway under the rail bridge blocked the road and trapped cars as they tried to drive through the water.
29th June 2014	Surface water	Partial obstructions within the highways surface water drainage systems	2 properties flooded internally on Station Road, Ditchingham.
23rd June 2016	Surface water	Loss of drainage features	The rainfall event on this date generated 19 reports of flooding that led to the identification of 8 properties that had suffered internal flooding in Cringleford.
2nd June 2018	Surface water	Loss of drainage features	The rainfall event on this date generated 60 reports of flooding, 47 of which were located in the South North and Breckland Districts.

Flood date	Flood source	Flood cause	Receptors
23rd and 24th December 2020	Surface water/ground water	Surface water	205 incidences of internal flooding on this date. It was noted that significantly more properties were flooded internally.
9th December 2021	River/surface water	Obstruction to watercourse/surface water	Property was internally flooded on Flaxlands, Carleton Rode.
8th July 2021	Surface water	Local drainage/surface water	The flood impacted the north of the district. No additional information was provided regarding the receptors affected during this flood.

Table 4-2: Historic flooding incidents shown in the EA Recorded Flood Outlines dataset. These are also shown in Figure 4-1.

Flood date	Flood source	Flood cause	Areas affected
September 1953	Coastal	Channel capacity exceeded (no raised defences)	Widespread flooding across the northwest of the district, particularly along the River Yare and its tributaries, and the River Waveney.
September 1968	Main river	Channel capacity exceeded (no raised defences)	Areas of flooding along the River Yare from the western part of Barnham Brook to Cringleford, and along the length of the River Tas.
November 1993	Main river	Channel capacity exceeded (no raised defences)	River flooding occurred on the River Tud in Taverham and Costessey
December 2020	Main river	Channel capacity exceeded (no raised defences)	A section of the River Waveney flooded south of Bressingham in the south west part of the District.

In addition, the EA's Historic Flood Map (HFM) shows areas of land that have been previously subject to fluvial and coastal flooding in the area. This includes flooding from rivers and the sea but excludes surface water. The HFM outline for South Norfolk District is shown in the interactive mapping in Appendix A. Please note some of the historic extents may refer to older historic flood events, prior to flood defence improvements.

Information on sewer flooding across the District is included in Section 4.5 and a list of historic flooding incidences provided by Anglian Water is available in Table 4-4.

Anglian Water have further indicated that the winter of October 2023 to March 2024 was one of the wettest winters on record with the impact of increased surface water and groundwater flooding being reflected in increased sewer flooding incidents in South Norfolk including: Hethersett, Long Stratton, Wacton, Aslacton, Great Moulton and Tivetshall.

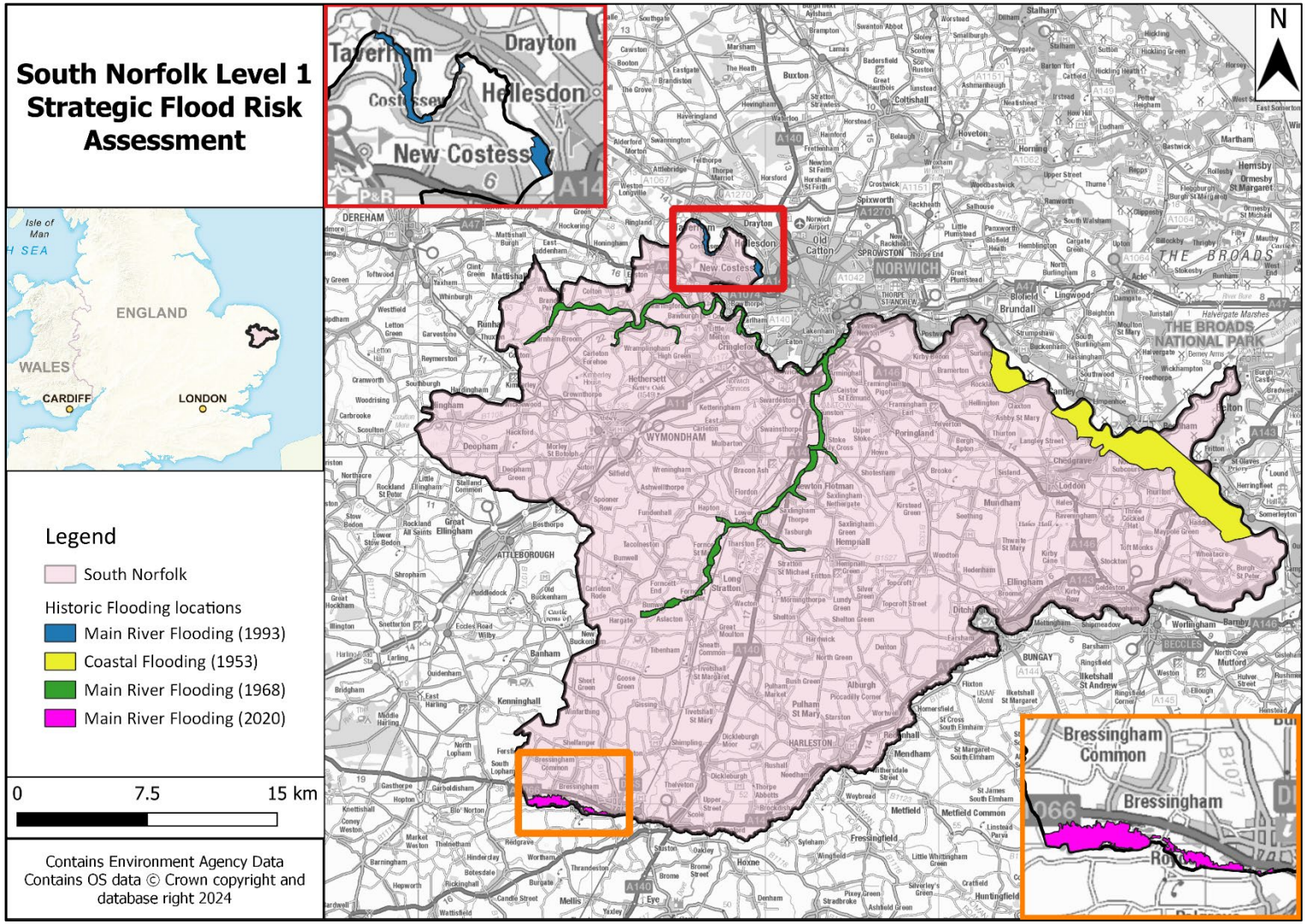


Figure 4-1: Historic flooding extents across South Norfolk District.

4.2 Topography, geology, soils, and hydrology

The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of run-off reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface runoff, whereas more permeable rock such as limestone and sandstone may result in a more subdued response.

4.2.1 Topography

EA 1m LiDAR has been used to assess the topography across the District, which is shown in Figure 4-2.

The topography across South Norfolk is relatively flat and low-lying. The highest areas of the borough are generally in the western half of the borough, sloping gently downhill across the borough towards the north-eastern and eastern border, where elevations are lowest. Along this the north-eastern boundary, shared with Waverley and Great Yarmouth, the land is below 0mAOD. An area just north of Burgh St Peter measures -2mAOD. The area with the highest elevations is Poringland in the north of the District at 75mAOD and Welbourne in the northwest at 62mAOD.

4.2.2 Geology

Information on the bedrock and superficial geology in the District can be viewed online in the British Geology Society Geology Viewer.

In the north, west, and south of the District, bedrock geology is primarily made up of Lewes Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formation. In the east of the District, bedrock geology is primarily made up of Crag Formations consisting of sands and gravels.

The EA also provides mapping of different types of aquifer, the underground layers of water-bearing permeable rock from which groundwater can be extracted. Aquifers are designated as either principal or secondary aquifers. Principal aquifers are designated by the EA as strategically important rock units that have high permeability and water storage capacity. The bedrock underlaying the entire South Norfolk area is classified as a principal aquifer. The superficial deposits are predominantly classified as a secondary aquifer or unproductive. Superficial deposits along the river corridors in the South Norfolk area are classified as Secondary A aquifers.

4.2.3 Soils

Soils along the southern and southeastern boundary of South Norfolk, along the floodplain of the River Waveney, are mainly a combination of fen peat soils and lime-rich loamy and clayey soils with impeded drainage, with some areas of freely draining

slightly acid sandy soils, particularly around Scole and Earsham. Soils across the southern area of South Norfolk are slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils, meaning drainage can be impeded. Areas further to the north, particularly across the lower lying land surrounding the key watercourses, are also loamy and clayey with slightly impeded drainage. In the east of the District, soils are loamy and clayey soils of coastal flats with naturally high groundwater. These soils are naturally wet.

Information on soil characteristics across South Norfolk can be viewed online on the BGS website.

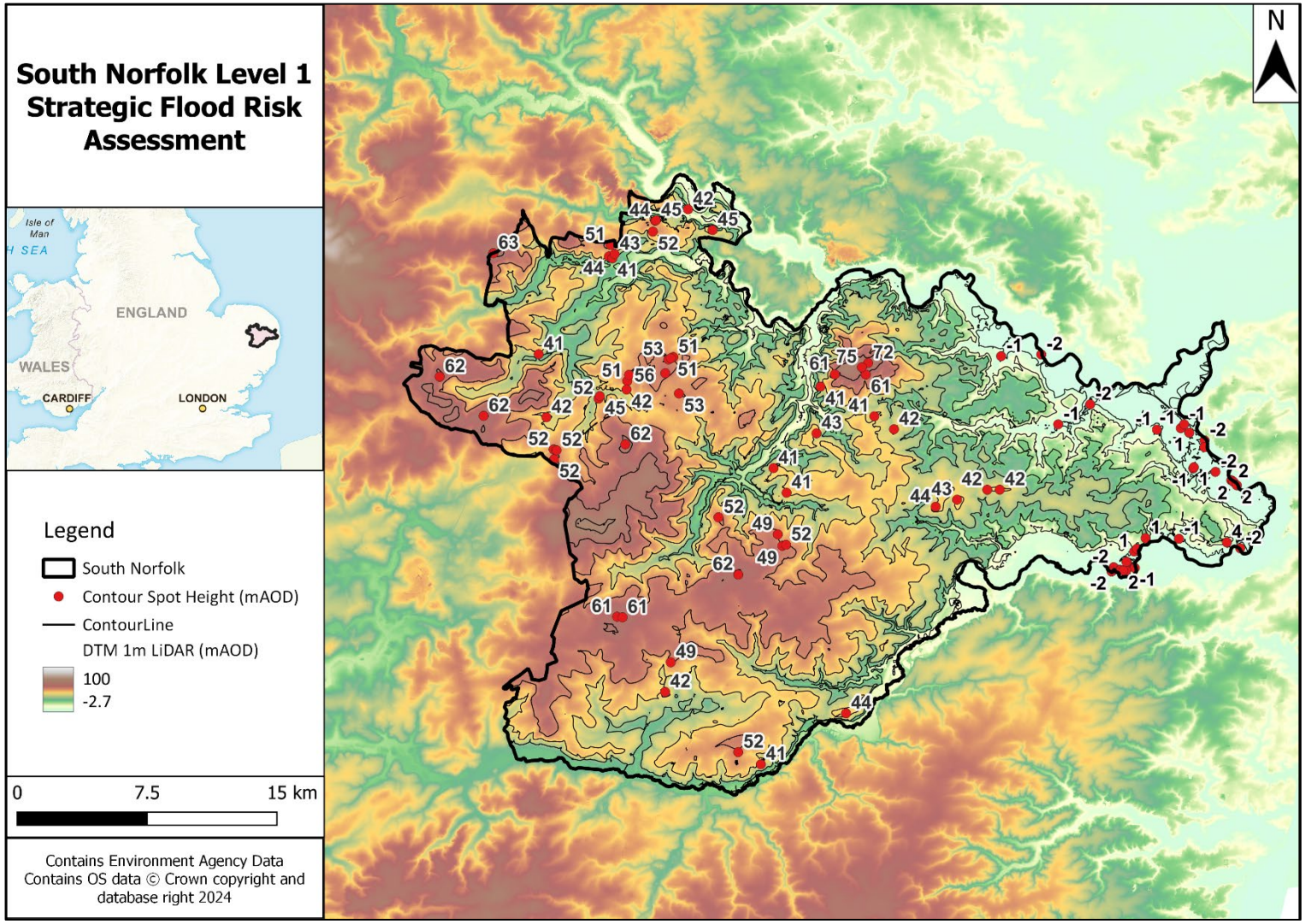


Figure 4-2: LiDAR Topographic data from the Environment Agency (1m resolution) with contour lines and spot heights (only the highest and lowest points) across South Norfolk District.

4.3 Hydrology and fluvial flood risk

The key watercourses flowing through the South Norfolk District are:

- The River Yare, and its tributaries the River Tiffey, River Tas, and River Chet.
- The River Waveney and its tributaries, including Broome Beck and Frenze River.

Tributaries of these watercourses include smaller ordinary watercourses and numerous unnamed drains. Along the River Yare in South Norfolk, there are several large water bodies including flooded sand pits at Colney, the University of East Anglia Broad, Whitlingham Broad, Surlingham Broad, and Rockland Broads. Along the eastern side of the District there are marshland areas adjoining the River Yare around Surlingham and Rockland Broads.

A map of the key watercourses is included in Figure 1-2 and in the Geo-PDF mapping in Appendix A.

The primary flood risk in the District is along the key watercourses and tidal flooding around the Broads in the northeast of the District. Key watercourses posing the highest flood risk include the River Wensum and River Yare that flow west to east along the northern border of the District, the River Tiffey that flows through Wymondham, the River Tas, the River Chet, and the River Waveney that flows along the southern and eastern border of the District.

The Flood Zone maps for the South Norfolk District are provided in Appendix A: Geo-PDFs, split into Flood Zones 2, 3a, and 3b. Section 3.2.1 describes how the fluvial and tidal Flood Zones have been derived for this SFRA. The flood risk associated with the major locations in the South Norfolk District are detailed in Appendix E.

4.4 Surface water flood risk

Surface water runoff is most likely to be caused by intense downpours e.g., thunderstorms. At times, the amount of water falling can completely overwhelm the drainage network, which is not designed to cope with extreme storms. The flooding can also be complicated by blockages to drainage networks, sewers being at capacity and/ or high-water levels in watercourses that cause local drainage networks to back up.

The EA Risk of Flooding from Surface Water mapping (RoFSW) shows that several communities are at risk of surface water flooding. The mapping shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys and can pond in low-lying areas. Whilst in the majority of cases the risk is confined to roads, there are notable prominent run-off flow routes around properties, e.g., properties situated at the foot of surrounding hills. The RoFSW mapping for the South Norfolk District is shown in the Geo-PDF mapping in Appendix A.

4.5 Tidal flood risk

Tidal flood risk is assessed based on Extreme Still Water Sea Levels (ESWSL), plus an allowance for the interaction of wind and waves. An ESWSL is the level the sea is expected to reach during a storm event for a particular magnitude of flood event as a result of the combination of astronomical tides and meteorological surges. It is conventional to assess the magnitude of these events by referring to 'still' water, and then to make additional allowances for the effect of waves, wind, and swell. The astronomical tide levels are primarily generated by the gravitational effects of the sun and the moon. Surge events are the result of meteorological conditions where low atmospheric pressure causes the sea level to be increased to a higher level than during more average or high atmospheric pressure conditions. The wave heights and swells are influenced by the strength, direction and persistence of the wind and the profile of the nearshore.

Tidal flooding is caused by extreme tide levels exceeding ground and/or defence levels. Tidal flooding often also occurs by wave overtopping of defences. Flood Zones 1, 2, and 3 delineate areas at low risk, medium risk, and high risk respectively from both tidal and fluvial flooding. Flood Zones do not take into account the effects of flood defences (with the exception of the functional floodplain Flood Zone 3b), and as such provides a worst-case assessment of flood risk. For example, Flood Zone 3a and 2 represent the area that would be flooded in the 0.5% AEP and 0.1% AEP tidal event in the absence of defences, respectively. Although South Norfolk District is landlocked, the River Waveney, which flows along the District's southern border, is considered a tidally influenced watercourse. This is also the case for the River Wensum and River Yare, which flow along the District's northern border. The tidal extents of these watercourses are provided in Table 4-3. Combined fluvial and tidal flooding is likely to occur along these reaches. Additional impacts of tidal influence include rivers not being able to flow freely at high tide (called tide-locking). This may affect any location up to the tidal limit of the rivers.

Table 4-3 Tidal extents

Watercourse	Upstream Tidal Limit
River Waveney	Geldeston
River Wensum	New Mills in Norwich
River Yare	Trowse Mills

4.6 Sewer flooding

Sewer flooding occurs when intense rainfall/river flooding overloads sewer capacity (surface water, foul or combined), and/or when sewers cannot discharge to watercourses due to high water levels.

Sewer flooding can also be caused by blockages, collapses, equipment failure or groundwater leaking into sewer pipes.

Since 1980, the Sewers for Adoption guidelines mean that new surface water sewers have been designed to have capacity for a 3.3% AEP rainfall event, although until recently this did not apply to smaller private systems. This means that sewers can be overwhelmed in larger rainfall and flood events.

New developments should not cause additional pressures on existing sewers due to the requirements to maintain greenfield runoff rates. However, increases in rainfall as a result of climate change can lead to existing sewers becoming overloaded, although this can be reduced through the use of well-designed SuDS to reduce surface water runoff.

Anglian Water is responsible for the management of public sewers and drains that manage foul, surface water and combined flows. Anglian Water's DG5 data was used to identify potential records of sewer flooding. The total number of recorded incidents identified in the DG5 in South Norfolk has been displayed using truncated postcodes to avoid identifying specific streets or properties, as shown in Table 4-4. The postcode districts across South Norfolk are shown in Figure 4-3. It should be noted that sewer flooding incidents can vary in severity and can occur for a variety of reasons, such as blockage and damage by third parties.

Table 4-4: Sewer flooding incidents recorded by Anglian Water (May 2013 until October 2023).

Postcode	Number of recorded incidents October 2023-March 2024	Number of recorded incidents 2020-2023	Number of recorded incidents 2015-2019	Number of recorded incidents 2010-2014	Total flooding incidents
IP20 0	0	2	7	6	15
IP20 9	1	9	6	9	25
IP21 4	10	12	25	39	86
IP22 2	1	0	2	6	9
IP22 4	11	14	36	22	83
IP22 5	1	3	2	4	10
NR14 6	2	10	17	36	65
NR14 7	2	15	24	35	76
NR14 8	4	9	31	42	84
NR15 1	9	8	18	19	54
NR15 2	11	13	30	30	84
NR16 1	7	3	10	10	30
NR18 9	1	0	9	33	43

Postcode	Number of recorded incidents October 2023-March 2024	Number of recorded incidents 2020-2023	Number of recorded incidents 2015-2019	Number of recorded incidents 2010-2014	Total flooding incidents
NR34 0	0	0	0	15	15
NR35 2	3	15	15	9	42
NR4 6	1	1	8	9	19
NR4 7	4	2	16	27	49
NR5 0	2	8	34	35	79
NR8 5	3	14	24	23	64
NR9 3	20	3	24	36	83
NR9 4	3	6	34	38	81
NR9 5	0	0	3	2	5

Figure 4-3: Postcode districts across South Norfolk District.

4.7 Groundwater flooding

In general, less is known about groundwater flooding than other sources and availability of data is limited. Groundwater flooding can be caused by:

- High water tables, influenced by the type of bedrock and superficial geology.
- Seasonal flows in dry valleys, which are particularly common in areas of chalk geology.
- Rebounding groundwater levels, where these have been historically lowered for industrial or mining purposes.
- Where there are long culverts that prevent water easily getting into watercourses.

Groundwater flooding is different to other types of flooding. It can last for days, weeks, or even months and is much harder to predict and warn for. Monitoring does occur in certain areas, for example where there are major aquifers or when mining stops.

Groundwater flooding can also interact with and exacerbate other sources of flooding. Anglian Water has indicated that in Norfolk, high-water tables and cumulative rainfall from consecutive storms has in the past infiltrated into their sewer networks and resulted in water being unable to drain. This has led to tankers being deployed to a number of communities for up to several weeks to pump away excess water from their sewer network, exacerbated by groundwater flooding and surface water flooding. This is likely to occur more frequently in future as a result of climate change.

Two datasets were used to assess potential areas that are likely to be at higher risk of groundwater flooding:

- The EA's Areas Susceptible to Groundwater Flooding (AStGWF) dataset, showing the degree to which areas are susceptible to groundwater flooding based on geological and hydrogeological conditions. It does not show the likelihood of groundwater flooding occurring, i.e., it is a hazard, not risk, based dataset.
- The JBA Groundwater Emergence map, showing the risk of groundwater flooding to both surface and subsurface assets, based on predicted groundwater levels.

In this SFRA, a three-stage approach has been adopted to assess the risk of groundwater flooding:

1. Firstly, the AStGWF dataset was used to identify grid squares that are most susceptible to groundwater flooding. Based on this dataset, any areas with greater than 50% susceptibility to groundwater flooding were taken forward for further analysis. This resulted in 130 out of 567 grid squares being taken

forward, most of which are located along the paths of the River Yare, River Tiffey, River Tas, Frenze Beck, and River Waveney.

2. Of the areas identified in the above, the JBA Groundwater Emergence Map was used to locate areas where this groundwater is most likely to emerge. For this assessment, areas where groundwater levels are predicted to be within 0.5m of the surface were identified and taken forward.
3. For locations that met both of the above parameters, the 0.1% AEP surface water extent from the EA's RoFSW map was used to ascertain where any groundwater emerging in these locations is most likely to flow.

The results of this assessment are summarised in Appendix E. It should be noted that this assessment only identifies areas likely to be at risk of groundwater emergence and where this water might flow. It does not predict the likelihood of groundwater emerging or attempt to quantify the volumes of groundwater that might be expected to emerge in a given area. The JBA Groundwater Emergence map and the EA AStGWF dataset for South Norfolk District are provided in Appendix A. In high-risk areas, a site-specific risk assessment for groundwater flooding may be required to fully inform the likelihood of flooding.

4.8 Reservoir Flooding

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoirs Act 1975, available on the Government website here, and are on a register held by the EA. The level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low. Some reservoirs are designated as high risk by the EA, where an uncontrolled release of water could put people's lives at risk and are subject to increased inspection and maintenance requirements. However, this designation does not mean they are at a high risk of flooding.

Flooding from reservoirs occurs following partial or complete failure of the control structure designed to retain water in the artificial storage area. Reservoir flooding is very different from other forms of flooding; it may happen with little, or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate but is extremely low compared to flooding from other sources. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

The EA hold mapping showing what might happen if reservoirs fail. Developers and planners should check the Long-Term Risk of Flooding website before using the reservoir data shown in this SFRA to make sure they are using the most up to date mapping. The EA provide two flooding scenarios for the reservoir flood maps: a ‘dry-day’ and a ‘wet-day’. The ‘dry-day’ scenario shows the predicted flooding which would occur if the dam or reservoir fails when rivers are at normal levels. The ‘wet-day’

scenario shows the predicted worsening of the flooding which would be expected if a river is already experiencing an extreme natural flood. It should be noted that these datasets give no indication of the likelihood or probability of reservoir flooding.

The current mapping shows that there are two reservoirs located within the South Norfolk District. There are a further two reservoirs located outside South Norfolk District but whose flood extents affect the study area. Details of these reservoirs are shown in Table 4-5. Section 8.4.4 provides further considerations for developing in the vicinity of reservoirs. The reservoir flood mapping for both the 'dry-day' and 'wet-day' scenarios in South Norfolk District has been provided in the Geo-PDFs in Appendix A. The EA maps represent a credible worst-case scenario. In these circumstances it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential.

Table 4-5: Reservoirs which affect South Norfolk District.

Reservoir	Northing and Easting	Reservoir owner	Local Authority Area	LLFA	Risk Category	Does the reservoir impact the study area in the 'dry-day' scenario ?
Reeders Reservoir	639035, 296013	The Trustees of No 2 Settlement	South Norfolk	Norfolk County Council	High risk	Yes
Ditchingham Lake	632314, 292545	Ditchingham Farms Ltd	South Norfolk	Norfolk County Council	Not high risk	Yes
Haveringland Lake	615750, 321200	HH Country Park Ltd	Broadland District	Norfolk Country Council	High risk	No
Heighingham Large Deposit Reservoir	618315, 311175	Anglian Water Services	Norwich City	Norfolk County Council	High risk	No
Hill Farm Reservoir (Easton	613197, 312038	Easton Estate	Kings Lynn	Norfolk County	High Risk	Yes

Reservoir	Northing and Easting	Reservoir owner	Local Authority Area	LLFA	Risk Category	Does the reservoir impact the study area in the 'dry-day' scenario ?
Estate)				Council		

As above, the risk of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage.

- Developers should seek to contact the reservoir owner to obtain information which may include:
  - reservoir characteristics: type, dam height at outlet, area/volume, overflow location;
  - operation: discharge rates/maximum discharge;
  - discharge during emergency drawdown; and
  - inspection/maintenance regime.
- Developers should apply the sequential approach to locating development within the site.
- Consult with relevant authorities regarding emergency plans in case of reservoir breach.
- The reservoir owners are contacted to confirm the Reservoir Risk Designation (if determined) and the inspection and maintenance regime of the reservoir.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond.
- It should also be understood that the “risk category” of a reservoir is set by the potential damage and loss of life in circumstances where there is a breach or an extreme flood event. Accordingly, it is possible that allocation of new development downstream of an existing reservoir could potentially change the risk category and result in a legal requirement (under the Reservoirs Act 1975) to improve the structural and hydraulic capacity of the dam. As the cost of implementing such works can be substantial consideration should be given to considering the implications and whether it would be more appropriate to place development in alternative locations not associated with such risk.
- The EA online Reservoir Flood Maps contain information on the extents following a reservoir breach (note: flood extents are not included for smaller reservoirs or

for reservoirs commissioned after the reservoir modelling programme began in October 2016). For proposed sites located within the extents, consideration should be given to the extents shown in these online maps.

- In addition to the risk of inundation, those considering development in areas affected by breach events should also assess the potential hydraulic forces imposed by the rapid flood event and check that that the proposed infrastructure fabric can withstand the loads imposed on the structures by a breach event.

4.9 Flood alerts and flood warnings

The EA is the lead organisation for providing warnings of river flooding. Flood Warnings are supplied via the Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3.

There are currently seven Flood Alert Areas (FAA) and 14 Flood Warning Areas (FWAs) covering South Norfolk District. Flood Alerts are issued when there is water out of bank for the first time anywhere in the catchment, signalling that 'flooding is possible', and therefore Flood Alert Areas usually cover the majority of main river reaches. Flood Warnings are issued to designated Flood Warning Areas (i.e. properties within the extreme flood extent which are at risk of flooding), when the river level hits a certain threshold; this is correlated between the FWA and the gauge, with a lead time to warn that 'flooding is expected'.

The FAAs and FWAs are listed in Appendix D and included in the Geo-PDF mapping in Appendix A.

4.10 Summary of flood risk in South Norfolk District

A table summarising all sources of flood risk to key settlements in South Norfolk District can be found in Appendix E.

For this summary, the District has been delineated into five Character Areas. The Character Areas are detailed below and shown in Figure 4-4:

- Character Area 1 is located in the north-western corner of the District, and covers the wards of Hingham & Deopham, Wicklewood, Easton, Old Costessey, and all Wymondham Wards. Although predominantly rural, key urban centres in the Character Area include Hingham, and Wymondham. The primary watercourse in the area is the River Tiffey.
- Character Area 2 is located in the centre of the District, and covers the wards of Mulbarton & Stoke Holy Cross, Bunwell, Forncett, Stratton, Hempnall, and Newton Flotman, Although predominantly rural, key urban centres in the Character Area include Long Stratton, Stoke Holy Cross, and Cringleford; The primary watercourse in the area is the River Tas.

- Character Area 3 is located in the north-east of the District, and covers the wards of Poringland, Framinghams & Trowse, Rockland, Brooke, Loddon & Chedgrave, and Thurlton, Although predominantly rural, key urban centres in the Character Area include Poringland, and Loddon. The primary watercourses in the area are the River Chet, and Well Beck.
- Character Area 4 is located in the south-east of the District, and covers the wards of Beck Vale, Dickleburgh & Scole, Harleston, Ditchingham & Earsham, and Thurlton, Although predominantly rural, key urban centres in the Character Area include Ditchingham, Kirby Cane, and Harleston. The primary watercourses in the area are Broome Beck and Starston Brook.
- Character Area 5 is located in the south of the District, and covers the wards of Bressingham & Burston, Beck Vale, Dickleburgh & Scole, and Diss & Roydon, Although predominantly rural, the key urban centre in the Character Area is Diss. The primary watercourses in the area are Frenze Beck and Dickleburgh Stream.

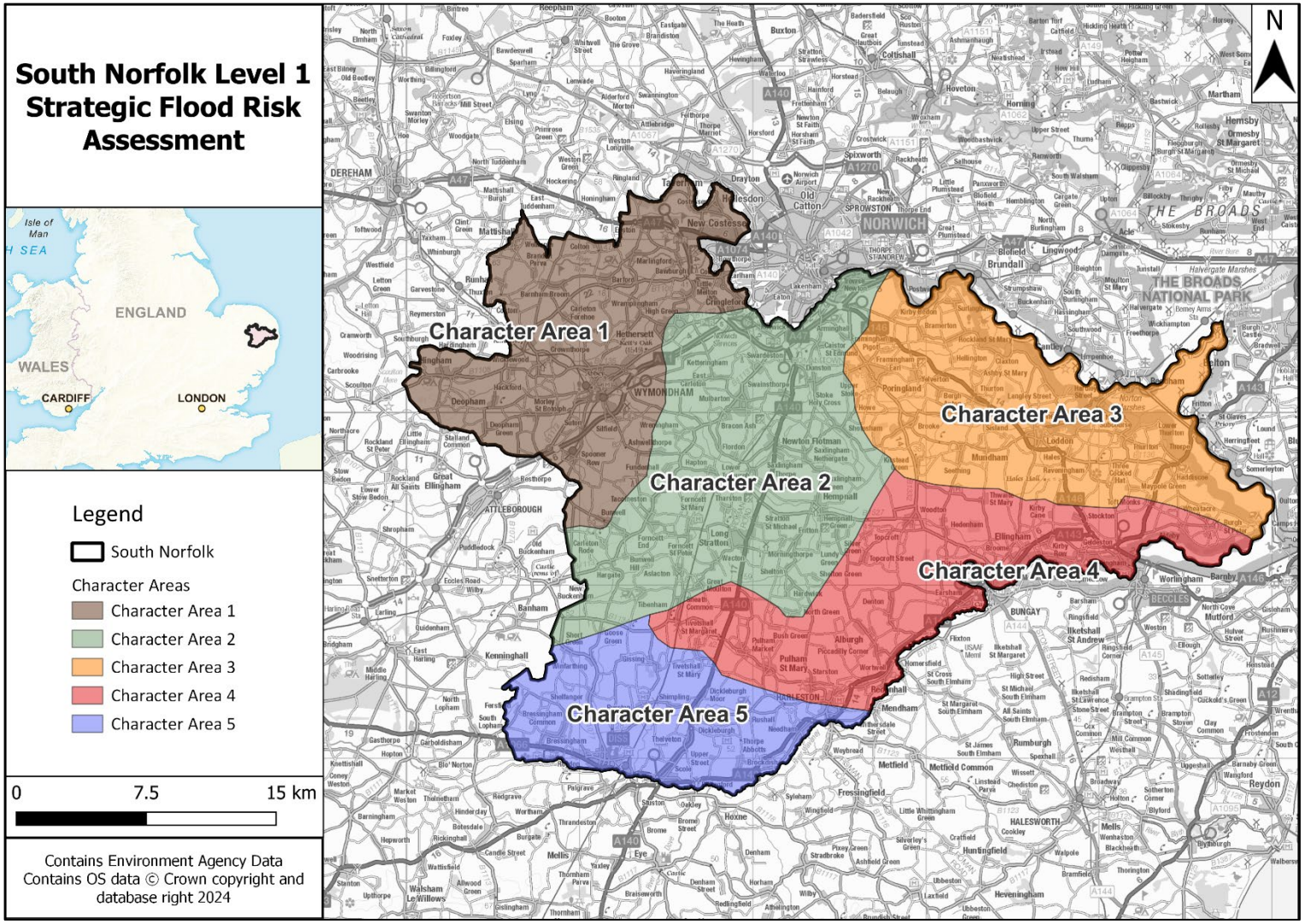


Figure 4-4: Character Areas used to summarise the flood risk across the South Norfolk District.

5 Impact of Climate Change

Climate change projections show an increased chance of warmer, wetter winters and hotter, drier summers with a higher likelihood of more frequent and intense rainfall. This is likely to make severe flooding happen more often.

The NPPF sets out that flood risk should be managed over the lifetime of a development, taking climate change into account. This section sets out how the impact of climate change should be considered.

5.1 Revised climate change guidance

The Climate Change Act 2008 creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050. This was updated in June 2019 under the Climate Change Act 2008 (2050 Target Amendment) Order to a 100% reduction (or net zero) by 2050. The full Act is available on the Government website here and the amendment order is available on the Government website here.

In 2018, the government published new UK Climate Projections (UKCP18). The EA used these projections to update their climate change guidance for new developments with regards to updated fluvial and rainfall allowances. The EA published updated climate change guidance for fluvial risk in July 2021 on how allowances for climate change should be included in both strategic and site-specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development and considers risk allowances on a management catchment level, rather than a river basin level. The guidance was further updated in May 2022 to address the changes to the requirements for rainfall allowances.

Before undertaking a detailed FRA, developers should check the government website for the latest guidance.

5.1.1 Applying the climate change guidance

To apply the appropriate climate change guidance to a site, the following information is required:

- The vulnerability of the development – see Annex 3 in the NPPF.
- The likely lifetime of the development – in general 75 years is used for commercial development and 100 for residential, but this needs to be confirmed in an FRA. For development that will have an anticipated lifetime significantly beyond 100 years a higher allowance is required.

- The Management Catchment (assigned by the EA) that the site is located in - South Norfolk District is located in the Broadland Rivers Management Catchment.

Developers should consider the following when deciding which allowances to use to address flood risk for a development or local plan allocation:

- 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).
- The 'built in' resilience measures used, for example, raised floor levels.
- The capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

Developers should refer to the EA guidance when considering which climate change allowances to use, available on the government website here.

5.2 Relevant allowances for South Norfolk District

Table 5-1 shows the updated peak river flow allowances that apply in South Norfolk District for fluvial flood risk for the Broadland Rivers Management Catchment. These allowances supersede the previous allowances by River Basin District. Where the previous climate allowances were within an agreeable percentage difference of the updated guidance (taking into account local characteristics) in discussion with the EA, these were not re-run.

The range of allowances are based on percentiles which describe the proportion of possible scenarios that fall below an allowance level:

- The central allowance is based on the 50th percentile (exceeded by 50% of the projections in the range).
- The higher central allowance is based on the 70th percentile (exceeded by 30% of the projections in the range).
- The upper end allowance is based on the 95th percentile (exceeded by 5% of the projections in the range).

Table 5-1: Peak river flow allowances for South Norfolk District.

Management Catchment	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Broadland Rivers	Upper end	27%	27%	44%

Management Catchment	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Broadland Rivers	Higher central	14%	10%	20%
Broadland Rivers	Central	8%	3%	11%

Table 5-2 shows the updated rainfall intensity allowances that apply in South Norfolk District. These allowances supersede the previous country wide allowances. These allowances should be used for site-scale applications and for surface water flood mapping in small catchments (less than 5km²) and urbanised drainage catchments.

Table 5-2: Peak rainfall intensity allowances for small and urban catchments for South Norfolk District.

Management Catchment	Allowance category	Total potential change anticipated for '2050s' (2022 to 2060) 3.3% AEP	Total potential change anticipated for '2050s' (2022 to 2060) 1% AEP	Total potential change anticipated for '2070s' (2061 to 2125) 3.3% AEP	Total potential change anticipated for '2070s' (2061 to 2125) 1% AEP
Broadland Rivers	Upper end	40%	45%	*40%**	*40%**
Broadland Rivers	Central	20%	20%	20%	20%

* In some locations the allowance for the 2050s epoch is higher than that for the 2070s epoch. If so, and development has a lifetime beyond 2061, use the higher of the two allowances. This SFRA has used the 40% uplift as this was readily available, however any future work should use the latest uplifts.

5.3 Representing climate change in the Level 1 SFRA

Representation of climate change within the SFRA was discussed with the EA. Where previous climate change runs were within a marginal change of the updated climate change allowances, these were agreed with the EA and used. This is due to the marginal change in allowance and subsequent results.

5.3.1 Fluvial Climate Change

The following models and allowances were used to represent the 2080s Central climate change estimate for the 1% AEP event:

- Gillingham Strategic Model - 1% AEP plus 11% climate change (fluvial only)

The following models and allowances were used to represent the 2080s Higher Central climate change estimate for the 1% AEP event:

- BKE3 - 1% AEP plus 25% climate change
- DIS3 - 1% AEP plus 25% climate change
- Gillingham Strategic Model - 1% AEP plus 20% climate change (fluvial only)
- GNLP1055 - 1% AEP plus 25% climate change
- GNLP2168 - 1% AEP plus 25% climate change
- River Tiffey - 1% AEP plus 25% climate change
- River Yare - 1% AEP plus 25% climate change
- River Tud - 1% AEP plus 20% climate change
- River Waveney - 1% AEP plus 25% climate change
- Upper Wensum and Wensum Norwich - 1% AEP plus 20% climate change
- Broome Beck- 1% AEP plus 25% climate change
- Bungay Tin- 1% AEP plus 25% climate change
- Frenze Beck- 1% AEP plus 25% climate change

The following models and allowances were used to represent the 2080s Higher Central climate change estimate for the 0.1% AEP event:

- River Yare - 0.1% AEP plus 25% climate change
- Upper Wensum and Wensum Norwich - 0.1% AEP plus 20% climate change
- River Waveney - 1% AEP plus 25% climate change
- River Tud - 0.1% AEP plus 20% climate change
- Broome Beck - 0.1% AEP plus 25% climate change
- Bungay Tin - 0.1% AEP plus 25% climate change
- Frenze Beck - 0.1% AEP plus 25% climate change
- Gillingham Strategic Model - 0.1% AEP plus 20% climate change (fluvial only)

For the 0.1% AEP (Flood Zone 2) plus climate change scenario in areas where no detailed model outputs are available, there is no flood extent which could be suitably used as a proxy. It is therefore recommended that developers undertake detailed modelling as part of their detailed site assessment as part of the planning application process when preparing FRAs.

For all other watercourses, a proxy approach was implemented as follows:

- 1% AEP (Flood Zone 3a) plus climate change
  - where hydraulic modelling was available, 0.1% AEP outline was used as an indicative climate change extent. Where not available, Flood Zone 2 was used. This is appropriate given the Upper End climate change estimates are often similar to the 0.1% AEP/ Flood Zone 2 extents.

- 3.3% AEP (Flood Zone 3b) plus climate change scenario
    - where hydraulic modelling was available, 1% AEP outline was used as an indicative climate change extent. Where not available, Flood Zone 3a was used.

Appendix B details the models used in this assessment.

5.3.2 Surface Water Climate Change

Modelled Climate Change uplifts for the 1% AEP event were available for this SFRA and are presented in in Appendix A: GeoPDFs as 'Surface Water Extent plus Climate Change' for the following event and scenario:

- 1% AEP plus 40% Climate Change

These uplifts to the surface water map were produced in 2020 for the Greater Norwich SFRA. Since then, the Broadland Rivers Management Catchment peak rainfall allowances have been updated and recommends up to 45% climate change uplift for the 2050s upper end allowance. The EA guidance states that development with a lifetime beyond 2061 should use the higher of the allowances. However, it was determined that results of the additional 5% climate change uplift would be marginal and not required for the purposes of strategic planning and informing the sequential test.

The updated climate change allowances using the 45% climate change uplift where appropriate should be used to inform any site-specific flood risk assessment.

5.3.3 Climate Change within Flood Risk Assessments

Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing FRAs, using the percentage increases which relate to the proposed lifetime and the vulnerability classification of the development. In areas where no modelling is present, this may require development of a 'detailed' hydraulic model, using channel topographic survey. Developers should consult the EA to provide further advice on how best to apply the new climate change guidance.

It is important to note that although the flood extent may not increase noticeably on some watercourses, the flood depth, velocity, and hazard may increase compared to the 1% AEP current-day event.

When undertaking a site-specific FRA, developers should:

- Confirm which national guidance on climate change and new development applies by visiting the Government website here.
- Apply this guidance when deciding the allowances to be made for climate change, having considered the potential sources of flood risk to the site (using this SFRA), the vulnerability of the development to flooding and the proposed

lifetime of the development. If the site is just outside the indicative climate change extents in this SFRA, the impact of climate change should still be considered because the site may be affected should the more extreme climate change scenarios materialise.

- Refer to Section 8 which provides further details on climate change for developers, as part of the FRA guidance, and the SFRA User Guide in Appendix C.

5.4 Impacts of climate change in South Norfolk District

This section explores which areas of the South Norfolk District are most sensitive to increases in flood risk due to climate change. It should be noted that areas that are already at high risk will also become at increasing risk in future and the frequency of flooding will increase in such areas.

It is recommended that the Council works with other RMAs to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the District.

The climate change extents for both fluvial and surface water flood risk are also shown in Appendix A: GeoPDF mapping.

5.4.1 Impact of climate change on fluvial flood risk

Climate change modelled flood extents can be compared to the 1% AEP flood extent (Flood Zone 3a), and where no detailed modelling exists, compared against Flood Zone 2, for an indication of areas most sensitive to climate change.

In general, the impact of climate change on fluvial flood extents across South Norfolk District is shown to be relatively limited, with minimal increases in extent. Key areas of increased risk are:

- Along the River Waveney in the southwest side of Diss, particularly impacting roads and properties along Fair Green and Denmark Lane.
- Along the River Tas through Forncett St Peter, impacting properties along Low Road and Station Road, and along the southeast border of Norwich, particularly around Loddon Road.
- Along the River Yare through Bawburgh, impacting properties along Harts Lane, along the southeast boundary of Barford, and to the west of Barnham Broom around Mill Road.
- Along the River Tiffey along the southern edge of Wymondham, impacting White Horse Street, Briton Way, Wymondham Abbey Station, and the Mid-Norfolk heritage railway line.
- Along the River Wensum to the north of Costessey, impacting properties along the north side of West End Road.

It should be noted that this only provides an indication of areas at increased flood risk based on flood extents. In some areas, the extents may be relatively similar but there might be considerable increases in depth, velocity, and hazard. This would need to be investigated further within a Level 2 SFRA or site-specific FRA.

5.4.2 Impacts of climate change on surface water flood risk

The 1% AEP surface water event with a 40% climate change uplift can be compared to the present day 1% AEP extent for an indication of areas most sensitive to climate change. The 40% uplift was used in this SFRA as it was readily available and is considered appropriate for a strategic level assessment of risk. As stated in Section 5.3.2, the updated climate change allowances using the 45% climate change uplift where appropriate should be used to inform any future work, including site-specific flood risk assessments.

Areas in South Norfolk District most sensitive to changes in surface water flood risk are typically in areas of low-lying topography on the floodplains of the main watercourses. In particular the following areas are sensitive to increased surface water flooding due to climate change:

- Frenze Beck
- River Waveney, particularly between Frenze Beck and Ocean Pit
- River Yare, particularly at its confluence with the River Tiffey and around Marlingford.
- River Tud south of Queen's hills and Costessey
- River Tiffey around Kimberley Lake, Swans' Harbour, and the unnamed drainage features south of Bawburgh Road.
- The Broads in the east of the study area

5.4.3 Impacts of climate change on groundwater flood risk

There is no technical modelling data available to assess climate change impacts on groundwater. It would depend on the flooding mechanism, historic evidence of known flooding and geological characteristics, for example prolonged rainfall in a chalk catchment. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding.

A high likelihood of groundwater flooding may mean infiltration SuDS are not appropriate and groundwater monitoring may be recommended.

5.4.4 Adapting to climate change

The PPG Climate Change guidance contains information and guidance for how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites so that the risks are understood over the development's lifetime.
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development.
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.
- Promoting adaptation approaches in design policies for developments and the public realm, for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses.
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity, and amenity, for example by leaving areas shown to be at risk of flooding as public open space.
- Considering the Standard of Protection (SoP) of defences and sites for future development, in relation to sensitivity to climate change. NCC and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option, such as at the defence locations mentioned in Section 6; and
- It is recommended that the differences in flood extents from climate change are compared by NCC when allocating sites, to understand how much additional risk there could be, where this risk is in the site, whether the increase is marginal or activates new flow paths, whether it affects access/ egress and how much land could still be developable overall. Recommendations for development are made for the levels of risk in the SFRA User Guide in Appendix C.

It should be noted that whilst climate change allowances can be attributed to other forms of flooding it is fundamental that the cumulative impacts of climate change including consistent periods of high rainfall and extreme storm events are stated as likely to become more prevalent in the longer term leading to increased risks of groundwater flooding in susceptible areas.

6 Flood alleviation schemes and assets

This section provides a summary of existing flood alleviation schemes and assets in South Norfolk District. Planners should note the areas that are protected by defences where further work to understand the actual and residual flood risk through a Level 2 SFRA may be beneficial. Developers should consider the benefit they provide over the lifetime of a development in a site-specific FRA.

6.1 Asset management

RMAs hold databases of flood risk management and drainage assets according to their jurisdiction as follows:

- The EA holds a national database that is updated by local teams.
- The LLFA holds a database of significant local flood risk assets, required under Section 21 of the FWMA (2010).
- Highways Authorities hold databases of highways drainage assets, such as gullies and connecting pipes.
- Water Companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.
- The databases include assets RMAs directly maintain and third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA contains full information on the location, condition, and ownership of all the assets in their area. They take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.

Developers should collect the available asset information and undertake further survey as necessary to present an understanding of current flood risk and the existing drainage network in a site-specific FRA.

6.2 Standards of Protection

- Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP SoP means that the flood risk in the defended area is reduced to at least a 1% chance of flooding in any given year.
- Over time the actual SoP provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change. The understanding of SoP may also change over time as RMAs undertake more detailed surveys and flood modelling studies.

- It should be noted that the EA's on-going hydraulic modelling programme may revise flood risk datasets and, therefore, the SoP offered by flood defences in the area may differ from those discussed in this report.
- Developers should consider the SoP provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

Different authorities have responsibilities relating to maintenance of flood risk assets.

- The EA and local authorities have permissive powers to maintain and improve main rivers and ordinary watercourses, respectively. The ultimate responsibility for maintaining watercourses rests with the landowner.
- Highway's authorities have a duty to maintain public roads, making sure they are safe, passable and that the impacts of severe weather have been considered. They are also responsible for maintaining sections of watercourses where they are crossed by highways.
- Water companies have a duty to effectually drain their area. What this means in practise is that assets are maintained to common standards and improvements are prioritised for the parts of the network that do not meet this standard e.g. where there is frequent highway or sewer flooding.
- NCC as the LLFA has permissive powers and limited resources are prioritised and targeted to where they can have the greatest effect.

There is potential for the risk of flooding to increase in areas where flood alleviation measures are not maintained regularly. Breaches in raised flood defences are most likely to occur where the condition of a flood defence has degraded over time. Drainage networks in urban areas can also frequently become blocked with debris and this can lead to blockages at culverts or bridges.

It is important that the authorities work in partnership to maintain flood risk assets and manage flood risk across the South Norfolk District.

Developers should not assume that any defence, asset, or watercourse is being or will continue to be maintained throughout the lifetime of a development. They should contact the relevant RMA about current and likely future maintenance arrangements and make future users of the development aware of their obligations to maintain watercourses.

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the EA for condition is provided in Table 6 1.

Table 6-1: Grading system used by the EA to assess flood defence condition

Grade	Rating	Description
1	Very good	Cosmetic defects that will have no effect on performance.
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that have potential to deteriorate and significantly reduce performance of the asset. Further investigation required.
5	Very poor	Severe defects resulting in significant or complete performance failure.

Source: One Business Condition Assessment Manual – EA 2023

6.4 Major flood risk management assets in South Norfolk

The EA retired the Flood Map for Planning 'Areas Benefiting from Defences' (ABD) dataset in December 2022. This dataset will no longer be available on online mapping. Instead, a developer can enter an address on the EA website here to get information about their specific site and request flood risk assessment data for planning (also known as Product 4).

The EA now provide a dataset called the 'Reduction in risk of flooding from rivers and sea' which provides areas that are offered some level of reduced flood risk from defences, but with no defined SoP.

In the South Norfolk District, several areas are shown to have reduced flood risk due to defences including significant areas along the course of the River Waveney, River Chet, River Yare, and in several small areas along the River Tas and River Tiffey.

The EA 'AIMS' (Asset Information Management System) flood defence dataset gives further information on all flood defence assets within the South Norfolk District. Table 6-2 details the locations which benefit from flood defences within the 'AIMS' dataset. For further details of specific defences, developers should refer to the dataset, available to download from the EA website here. Additionally, the AIMS dataset can be viewed in Appendix A: GeoPDF Mapping.

Table 6-2: Locations shown in the EA 'AIMS' dataset.

Watercourse	Location	Type	Design SoP (AEP)	Condition Rating (1-5)
River Yare	Along the course of the River Yare in the northwestern area of the South	Natural High Ground	5%	3-4

Watercourse	Location	Type	Design SoP (AEP)	Condition Rating (1-5)
	Norfolk District.			
River Tiffey	Along the majority of the River Tiffey in the South Norfolk District. The upper end of the watercourse does not fall into this area.	Natural High Ground	5%	2-4
Unnamed tributary of the River Tiffey	Along the course of an upstream unnamed tributary of the River Tiffey south of Wyndham.	Natural High Ground	5%	2-4
Unnamed tributary of the River Yare	Along the course of a tributary of the River Yare.	Natural High Ground	5%	2-3
River Tas	Along the majority of the River Tas in the South Norfolk District. The upper end of the watercourse does not fall into this area.	Natural High Ground	5%	2-3
Unnamed tributary of the River Tas	Flowing through Shotesham	Natural High Ground	5%	3
Unnamed tributary of the River Tas	Flowing through Saxlingham Nethergate	Natural High Ground	5%	3
Unnamed tributary of the River Tas	Flowing through Hempnall and Tasburgh	Natural High Ground	5%	3
The Beck	Flows to the south of Rockland St Mary	Natural High Ground	10%	2
Carleton Beck	Flows southeast of Claxton	Natural High Ground	10%	N/A
River Chet	Flows through the northeast of the	Natural High Ground	5-10%	3-4

Watercourse	Location	Type	Design SoP (AEP)	Condition Rating (1-5)
	District			
River Chet	Flows through the northeast of the District	Embankment	0-10%	3
Unnamed tributary of the River Chet	Flows north of Hales.	Natural High Ground	0-10%	3-4
River Waveney	Flowing along the eastern and southern District boundary.	Embankment	1-10%	1-4
Landspring Beck	South of Haddiscoe	Natural High Ground	10%	N/A

6.5 Existing and future flood alleviation schemes

Below are the current and potential future schemes led by the EA, NCC, and Anglian Water.

6.5.1 Norfolk Strategic Flood Alliance

The Norfolk Strategic Flooding Alliance (NSFA) was founded in February 2021 following significant surface water flooding issues in December 2020. The NSFA brings together all agencies and partners involved in planning for and responding to flooding in Norfolk. The NSFA Strategy is available on their website, here.

The NSFA action plan includes work on individual sites across Norfolk and looking at working out costed solutions to address flood risk and identify potential funding at each site. Key sites identified within South Norfolk include A140 Long Stratton, and Brockdish. A full list of sites is available on the NSFA website.

6.5.2 Broadland Flood Alleviation Project

The EA completed the £140 million Broadland Flood Alleviation project from February 2001 through to May 2021. This project has improved flood defences, maintenance, and emergency response services in the tidal areas of the River Yare, River Bure and River Waveney. The project's achievements include:

- Improved flood protection – 1700 properties and 5 previously undefended communities are now better protected from flooding. Over 240 kilometres of flood banks have been upgraded and 36 kilometres of banks realigned inland. Major transport links such as the A47 and Norwich/Great Yarmouth/Lowestoft railway lines are also better protected.

- Agriculture and land management – around 30,000 hectares of land are now at less risk of being breached by flood waters. This includes 24,000 hectares of prime agricultural land and 28 Sites of Special Scientific Interest. Over 3 kilometres of overhead electric cables were moved underground.
- Angling, navigation, and recreation – over 5 kilometres of public moorings and 5 slipways were upgraded, new angling platforms provided, and 100 kilometres of public footpaths improved.
- Greener flood defences – by removing previously constructed hard edges, 28 kilometres of soft reeded fringes were created. These 'green defences' have new flood banks further back than before to allow the restoration of a traditional Broadland reed fringe.
- Carbon saving – reclaimed materials were utilised with some 7.5 kilometres of steel sheet and timber piles reused. Materials have also been processed and stockpiled for reuse at later dates.
- Benefits to biodiversity – there was a 200 percent increase in the number of nationally endangered water voles during the course of the project. The thousands of biological records created by the project were passed to County Records Centres to contribute to the natural knowledge of the area. Since 2014, NCC has spent nearly half a million pounds to reduce the risk of surface water flooding across the District. This includes upgrading existing highways drainage systems and installing new infrastructure.

Further information about this scheme can be found on the Government website here.

6.6 Actual and residual flood risk

A Level 2 SFRA (for strategic allocations) or developer site-specific FRA will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail (although it should be noted that Zone 3b is based on the actual flood risk).

6.6.1 Actual flood risk

This is the risk to the site considering existing flood mitigation measures and any planned to be provided through new development. Note that it is not likely to be acceptable to allocate developments in existing undefended areas on the basis that they will be protected by developer works, unless it can be demonstrated there is a wider community benefit.

The assessment of the actual risk should consider that:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.

- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for this to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development. Over time the effects of climate change will erode the present-day SoP afforded by defences and so commitment is needed to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained and where necessary, land secured and safe-guarded that is required for affordable future flood risk management measures.
- By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources.

6.6.2 Residual risk

Residual risk is the risk that remains after the effects of flood risk infrastructure have been considered. It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

- The effects of a larger flood than defences were designed to alleviate (the 'design flood'). This can cause overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming amount of water.
- Failure of the defences or flood risk management measures, such as breaches in embankments or walls, failure of flood gates to open or close or failure of pumping stations.

It is the responsibility of the developer to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed.

This SFRA does not assess the probability of failure other than noting that such events are very rare. However, in accordance with NPPF, all sources of flooding need to be considered. If a breach or overtopping event were to occur, then the consequences to people and property could be high. Developers should be aware that any site that is at or below defence level, may be subject to flooding if an event occurs that exceeds the design capacity of the defences, or the defences fail, and this should be considered in a detailed FRA.

The assessment of residual risk should consider:

- The flood hazard, depth and velocity that would result from overtopping or breach of defences. Flood gate or pumping station failure and/ or culvert blockage (as appropriate). The EA can provide advice at site-specific development level for advice on breach/ overtopping parameters for flood models.

- The design of the development to take account of the highest risk parts of the site e.g. allowing for flood storage on parts of the site and considering the design of the development to keep people safe, such as sleeping accommodation above the flood level.
- A system of warning and a safe means of access and egress from the site in the event of a flood for users of the site and emergency services.
- Climate change and/ or policy-dependent residual risks (such as those that may be created, if necessary, future defence improvements are required, or those associated with any managed adaptive strategies).

6.6.3 Overtopping

The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest level of the defence. The Defra and EA Flood Risks to People guidance document, available from the Government website here, provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

Any sites located next to defences or perched ponds/ reservoirs, may need overtopping modelling or assessments at the site-specific FRA stage, and climate change needs to be taken in to account.

6.6.4 Defence breach

A breach of a defence occurs when there is a failure in the structure and a subsequent ingress of flood water.

Where defences are present, risk of breach events should be considered as part of the site-specific FRA. Flood flows from breach events can be associated with significant depths and flow velocities in the immediate vicinity of the breach location and so FRAs must include assessment of the hazards that might be present so that the safety of people and structural stability of properties and infrastructure can be appropriately considered. Whilst the area in the immediate vicinity of a breach can be subject to high flows, the whole flood risk area associated with a breach must also be considered as there may be areas remote from the breach that might, due to topography, involve increased depth hazards.

Considerations include the location of a breach, when it would occur and for how long, the depth of the breach (toe level), the loadings on the defence and the potential for multiple breaches. There are currently no national standards for breach assessments and there are various ways of assessing breaches using hydraulic modelling. Work is currently being undertaken by the EA to collate and standardise these methodologies. It is recommended that the EA are consulted if a development site is located near to a flood defence, to understand the level of assessment required and to agree the approach for the breach assessment.

7 Cumulative impact of development and strategic solutions

7.1 Cumulative Impact Assessment

Under the NPPF, strategic policies and their supporting SFRAs, are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (Paragraph 166), rather than just to or from individual development sites.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe. Similarly, the effect of the loss of surface water flow paths, surface water ponding and infiltration can also give rise to cumulative effects and potentially exacerbate surface water flood risk.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, and appropriate consideration is given to surface water flow paths and storage proposals should normally not increase flood risk downstream.

Catchments within the study area that have the potential to influence existing flood risk issues in neighbouring Local Authorities were identified, as well as catchments in the study area that may be influenced by development in catchments in neighbouring Local Authorities. Historic flood incidents, the current and predicted increase in surface water and fluvial flood risk to properties and cross boundary issues in each catchment were assessed to identify the catchments at greatest risk.

Local planning policies can also be used to identify areas where the potential for development to increase flood risk is highest and identify opportunities for such new development to positively contribute to decreases in flood risk downstream.

Once the proposed development had been assessed against fluvial flood risk, surface water flood risk, historic flooding incidents, and the potential increased development area, the CIA identified eight high risk catchments within, or partially within South Norfolk District:

- Tas (Head to Tasburgh)
- Starston Brook
- Waveney (u/s Frenze Beck)
- Yare (u/s confluence with Tiffey – Lower)
- Tiffey (u/s Wymondham STW)
- Chet

- Frenze Beck
- Broome Beck

It should be noted that the general risk of cumulative impacts of development across the catchment is low due to the small extent of proposed development compared with catchment area. These rankings provide a relative assessment of the catchments within South Norfolk District and are not comparable across other boroughs/districts.

It is recommended that the NCC work closely with neighbouring local authorities to develop complementary Local Planning Policies for catchments that drain into and out of the South Norfolk District to other local authorities to minimise cross boundary issues of cumulative impacts of development.

The CIA can be found in Appendix F.

7.2 Natural Flood Management (NFM)

NFM is used to protect, restore, and re-naturalise the function of catchments and rivers to reduce flood risk. A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes in order to store or slow down flood waters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). Techniques and measures, which could be applied in the South Norfolk District include:

- Creation of offline storage areas
- Re-meandering streams (creation of new meandering courses or reconnecting cut-off meanders to slow the flow of the river)
- Targeted woodland planting
- Reconnection and restoration of functional floodplains
- Restoration of rivers and removal of redundant structures, i.e. weirs and sluices no longer used or needed
- Installation or retainment of large woody material in river channels
- Improvements in management of soil and land use
- Creation of rural and urban SuDS

To maximise the benefits of NFM, it is important that land which is likely to be needed for NFM is protected by safeguarding land for future flood risk management infrastructure. This is particularly important for infrastructure that reduces the risk of flooding to large amounts of existing development, or where options for managing risk in other ways are limited to achieve multiple benefits for flood risk and the environment.

In 2017, the EA published an online evidence base to support the implementation of NFM and maps showing locations with the potential for NFM measures. These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in

which to locate them. The EA evidence directory can be found on the Government website here.

Water Sensitive Farming is a collaborative initiative between Norfolk Rivers Trust and the Broadland Rivers and Cam and Ely Ouse catchment partnerships. The initiative aims to promote sustainable farming practices to improve soil health, water quality, and the efficient use of water. The practices may also provide benefits in flood risk reduction. Further information is available on the Catchment Based Approach website.

Norfolk Rivers Trust, in partnership with the EA and NCC, has completed a restoration project to improve habitat within the Yare Valley. The work focused on a stretch of the River Yare that runs through Earlham Park and University East Anglia. Although this stretch of the River Yare is not located within the South Norfolk District, it aims to benefit sections that do flow through South Norfolk. The measures included -

- Reconnecting the river with its floodplain to allow for water to be held in the surrounding grazing meadows.
- Improving morphological diversity with the placement of in-channel woody debris.
- Using bundles of hazel to repair heavily eroded riverbanks, while providing designated access points to prevent further erosion and reduce the amount of mud entering the river.
- Wetland creation to store water and filter surface run-off, thus improving the quality of the water before it flows into the river.

8 Flood risk management requirements for developers

This section provides guidance on site-specific FRAs. These are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted with Planning Applications and should demonstrate how flood risk will be managed over the development's lifetime, considering climate change and vulnerability of users.

The report provides a strategic assessment of flood risk within South Norfolk District. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk and the actual and residual risk, SoP, and safety at a site are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of watercourses to verify flood extents (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the exception test can be satisfied.

A detailed FRA may show that a site, windfall or other, is not appropriate for development of a particular vulnerability or even at all. The sequential and exception tests in the NPPF apply to all developments and an FRA should not be seen as an alternative to proving these tests have been met.

8.1 Principles for new development

8.1.1 Apply the sequential and exception tests

Developers should refer to Section 3 for more information on how to consider the sequential and exception tests. For allocated sites, NCC should use the information in this SFRA to apply the Sequential test. For windfall sites a developer must undertake the Sequential test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the sequential test should the exception test then be applied if required.

Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test will need to be applied as proposals at the application stage will need to demonstrate flood risk is not increased elsewhere and is safe.

Developers should also apply the sequential approach to locating development within the site. The following questions should be considered:

- can risk be avoided through substituting less vulnerable uses or by amending the site layout?

- can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
- can the site layout be varied to reduce the number of people, the flood risk vulnerability or the building units located in higher risk parts of the site?

8.1.2 Consult with statutory consultees at an early stage to understand their requirements

Developers should consult with the EA, NCC as LLFA, and Anglian Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and foul and surface water drainage assessment and design. It should be noted that some of these consultees may need to charge for advice requested by developers or landowners.

NCC as LLFA also have a Guidance Document for developers which should be considered at an early stage. This can be downloaded from their website, here.

8.1.3 Consider the risk from all sources of flooding and that they are using the most up to date flood risk data and guidance

The SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific FRA. At a site level, developers will need to check before commencing on a more detailed FRA that they are using the latest available datasets. Developers should apply the most up-to-date climate change guidance (last updated in May 2022) and consider climate change adaptation measures.

8.1.4 Confirm that the development does not increase flood risk elsewhere

Section 9 sets out these requirements for taking a sustainable approach to surface water management. Developers should also confirm that mitigation measures do not increase flood risk elsewhere and that floodplain compensation is provided where necessary.

8.1.5 Make the development safe for future users

Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered. Developers should consider both the actual and residual risk of flooding to the site, as discussed in Section 3.

Further flood mitigation measures may be needed for any developments in an area protected by flood defences, where the condition of those defences is ‘fair’ or ‘poor’, and where the SoP is not of the required standard. Section 8.3 discusses the range of mitigation, resistance, and resilience measures that should be considered to make development safe.

8.1.6 Enhance the natural river corridor and floodplain environment through new development

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted. Where possible, developers should identify and work with partners to explore all avenues for improving the wider river corridor environment. Developers should open up existing culverts and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings. Section 9 provides guidance and information on the use of SuDS and blue-green infrastructure.

8.1.7 Consider and contribute to wider flood mitigation strategy and measures in the area and apply the relevant local planning policy

Wherever possible, developments should seek to help reduce flood risk in the wider area, e.g. by contributing to a wider community scheme or strategy for strategic measures, such as defences or NFM or to mitigate wider flood risk on a development site. Developers must demonstrate in an FRA how they are contributing towards this vision.

8.2 Requirements for site-specific Flood Risk Assessments

8.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- Proposals on sites of one hectare or greater in Flood Zone 1.
- Proposals for new development (including minor development such as non-residential extensions, alterations which do not increase the size of the building or householder developments and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the EA) (see Section 9.4.5 for more information on critical drainage problems).
- Land identified in this SFRA as being at increased flood risk in the future.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

8.2.2 Objectives of a site-specific FRA

Site-specific FRAs should be proportionate to the degree of flood risk and the scale, nature, and location of the development.

Site-specific FRAs should establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source.
- Whether a proposed development will increase flood risk elsewhere.
- Whether the measures proposed to deal with the effects and risks are appropriate.
- The evidence, if necessary, for the LPA to apply the sequential test; and
- Whether, if applicable, the development will be safe and pass the exception test.

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the EA and NCC as the LLFA. Guidance and advice for developers on the preparation of site-specific FRAs is available from the following websites with hyperlinks provided:

- Standing Advice on Flood Risk (EA)
- Flood Risk Assessment for Planning Applications (EA); and
- Site-specific Flood Risk Assessment: Checklist (NPPF PPG, Defra)
- NCC LLFA Statutory Consultee for Planning Guidance Document

Guidance for LPAs for reviewing FRAs submitted as part of planning applications has been published by Defra in 2015 and is available on the Government website here.

Guidance should be sought from the LPA, EA, and NCC as LLFA at the earliest possible stage, and opportunities should be taken to incorporate environmental enhancements and reduce flooding from all sources both to and from the site through development proposals. Developers should seek to go beyond managing the flood risk and support reduction of wider flood risk, whilst enhancing and conserving the natural environment. Further advice can be found at: Flood risk and coastal change - GOV.UK (www.gov.uk).

8.2.3 Site layout and design

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. Early engagement with the EA, NCC as LLFA and Anglian Water is advised.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land uses away from Flood Zones to higher ground and lower flood risk areas, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. Higher risk areas can also be retained and enhanced as natural green space. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning.

Waterside areas, or areas along known flow routes, can act as green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should provide safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

In the case of surface water overland flow routes, if the areas cannot be avoided, the LLFA expects sufficient information to be provided to demonstrate how this overland flow route will be managed within the site without creating a risk to people or property and not increasing the risk elsewhere. The LLFA suggests that public open space is the most appropriate land use for this purpose. If roads or car parks are intended to be used, then the hazard posed should be fully considered, emergency access and egress be assessed, and the drainage of the impermeable areas be sized to accommodate the additional runoff and not increase off-site flows.

When designing sites, developers should consider the Hierarchy of Drainage, aiming to discharge surface water runoff as high up the drainage hierarchy as reasonably practicable. Further information is provided in 9.2.1.

8.2.4 Modification of ground levels

Any proposal for modification of ground levels will need to be assessed as part of a detailed FRA.

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken as raising land above the floodplain could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624, available to download from the CIRIA website here.

Where proposed development results in a change in building footprint, the developer should confirm that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to check that it would not cause increased ponding or build-up of surface runoff on third party land. Consideration should be given to the impact of raising ground levels on adjacent properties, particularly the impact of raising ground levels on surface water runoff from a site, with potential to increase surface water flood risk.

Applicants should note that changes to manhole cover levels on public sewers may increase / displace flood risk which will therefore require careful consideration with Anglian Water. Applicants should not assume that any alteration to a public sewer, including diversion, will be acceptable as this could have adverse flood risk consequences. Anglian Water welcome discussion on changes to manhole cover levels, connections and sewer diversions through their pre-planning engagement enquiries with Anglian Water.

For all developments regardless of any identified sewer flood risk that is identified on or near to the site, it is good practice for the finished floor levels and manhole cover levels (including those that serve private drainage runs) to be higher than the manhole cover level at the point of connection to the receiving sewer. Where the ground level of the site is below the ground level at the point where the drainage connects to the public sewer, care must be taken to ensure that the proposed development is not at increased risk of sewer surcharge.

8.2.5 Raised floor levels

If raised floor levels are proposed, these should be agreed with NCC as LLFA and the EA. The minimum Finished Floor Level (FFL) may change dependent upon the vulnerability and flood risk to the development.

The EA advises that minimum finished floor levels should be set 300mm above the 1% AEP plus climate change peak flood level, where the appropriate new climate change allowances have been used (see Section 5.2 for the climate change allowances). An additional allowance may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA. Lowering existing FFLs below the existing levels within the 1% AEP plus climate change floodplain would not be acceptable and should be discouraged.

The LLFA advise that the minimum FFL should not be less than 300mm for the 1% AEP (plus relevant climate change allowance) surface water event. Where properties are identified to be at residual risk in events greater than the 1% AEP plus climate change the LLFA would expect as a minimum that FFLs throughout the development are recommended to be set to a minimum of 300mm freeboard above the anticipated flood levels from any source of flooding. Where there is uncertainty in flood levels the LLFA expect this freeboard level to be increased to 600mm. Further information is

available in the LLFA Developer Guidance Document. FFLs must also be set at least 150mm above the proposed ground level.

New development offers opportunities to improve the resilience of buildings.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels. Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 and areas at risk of surface water flooding in the surface water flood zone B should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the exception test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

Where the ground level of a site is below the ground level at the point where the drainage connects to the public sewer, care must be taken to ensure that the proposed development is not at an increased risk of sewer surcharge. It is good practice for the finished floor levels and manhole cover levels (including those that serve private drainage runs) to be higher than the manhole cover level at the point of connection to the receiving sewer. Alternatively, mitigation measures may need to be incorporated into the proposals to protect against sewer surcharge.

8.2.6 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain.

Where development is located behind, or in an area benefitting from defences, the residual risk of flooding must be considered.

8.2.7 Making space for water

The PPG sets out a clear aim in Flood Zone 3 to create space for flooding by restoring functional floodplain. Generally, development should be directed away from these areas.

The provision of a buffer strip to ‘make space for water’ allows additional capacity to accommodate climate change and means access to the watercourse, structures and defences is maintained for future maintenance purposes. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology, and having to construct engineered riverbank protection. Any watercourse crossings should ensure that flood risk is not impacted. A buffer strip of 8m is required from any main river

(16m if tidal influence). Where flood defences are present, these distances should be taken from the toe of the defence.

Building adjacent to riverbanks can cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult. Any development in these areas will likely require Flood Risk Activity Permits from the EA alongside any permission. There should be no built development within these distances from main rivers / flood defences (where present). Further advice and guidance on Flood Risk Activity Permits is available on the Government website here.

Work on or near all other watercourses will require an Ordinary Watercourse Consent, either through the IDB in the area or NCC as LLFA. Further advice on required permissions is available on the Government website here.

All new development close to rivers should consider the opportunity to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality, and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

8.3 Resistance and resilience measures

The consideration of resistance and resilience measures should not be used to justify development in inappropriate locations. However, having applied planning policy, there may be some instances where development (such as essential infrastructure) is permitted in high flood risk areas.

In these cases, the above measures should be considered before resistance and resilience measures are relied on. The effectiveness of these forms of measures are often dependant on the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. The proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate. Available resistance and resilience measures include:

- Permanent barriers which can include built up doorsteps, rendered brick walls and toughened glass barriers.
- Temporary barriers which consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.

- Community resistance measures which include demountable defences that can be deployed by local communities to reduce the risk of water ingress to several properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.
- Flood resilience measures which aim to limit any permanent damage, prevent the structural integrity of the building being compromised and make the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuitry installed at a higher level and water-resistant materials for floors, walls, and fixtures.

Guidance on flood resilient and flood resistant construction techniques is available on the government website, here.

The use of resistance and resilience measures does not change the requirement for setting appropriate FFLs, as discussed in Section 8.2.5.

There are also opportunities for 'change of use' developments to be used to improve the flood resistance and resilience of existing development, which may not have been informed by a site-specific flood risk assessment when it was first constructed.

It should be noted that the construction of older, historic structures may not be suitable to incorporate flood resistance measures into the structure without the potential to harm the structure.

8.4 Reducing flood risk from other sources

8.4.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and so many conventional flood mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1% AEP plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland so that flood risk is not increased downstream.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off a site. Developers should provide evidence that this will not be a significant risk. Other underground works, such as basements, may also need to be assessed as part of a site-specific FRA in certain prone areas susceptible to groundwater issues.

It is important to note the impacts of groundwater infiltration into sewer networks and other issues that can arise, including network capacity issues, that can lead to sewer flooding incidents. Foul and surface water drainage assessments will therefore need to address these issues as a priority in locations where sewer networks are susceptible to groundwater flood risk.

8.4.2 Surface water flooding

It is important that a Surface Water Drainage Strategy (often undertaken as part of an FRA) shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk.

Consideration must also be given to attenuation and flow ensuring that flows during the 1% AEP plus climate change storm event are retained within the site if any flap valves shut. This should be demonstrated with suitable modelling techniques.

When redeveloping existing buildings, the installation of some permanent or temporary floodproofing and resilience measures could protect against both surface water and sewer flooding.

In accordance with the NPPF, developers must demonstrate maintenance and management plans for the lifetime of any proposed surface water management systems/assets.

8.4.3 Sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage to understand the risk of sewer flooding, ensure that development does increase the risk of sewer flooding and to ensure that any proposed sewerage arrangements (including resistance/resilience measures) are appropriate..

When redeveloping existing buildings, there are likely to be opportunities to reduce sewer flood risk and improve resilience through installation of permanent or temporary floodproofing and resilience measures.

Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly maintained.

8.4.4 Reservoirs

As discussed in Section 4.8, the risk of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage:

- Developers should contact the reservoir owner for information on:
    - the Reservoir Risk Designation

- reservoir characteristics: type, dam height at outlet, area/volume, overflow location
- operation: discharge rates / maximum discharge
- discharge during emergency drawdown; and
- inspection / maintenance regime.

- The EA online Reservoir Flood Maps contain information on the predicted extents following a reservoir breach both when rivers are at normal levels and in conjunction with rivers in flood conditions (note: only for those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975). Consideration should be given to the extents shown in these online maps. Depths and velocities were also prepared as part of this study but have not been made publicly available.
- The GOV.UK website on Reservoirs: owner and operator requirements provides information on how to register reservoirs, appoint a panel engineer, produce a flood plan, and report an incident.

Developers should use the above information to:

- Apply the sequential approach to locating development within the site.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond, and whether in fact it is appropriate to place development immediately on the downstream side of a reservoir.
- Assess the potential hydraulic forces imposed by sudden reservoir failure event and check that that the proposed infrastructure fabric could withstand the structural loads.
- Develop site-specific Emergency Plans and/ or Off-site Plans if necessary and make the future users of the development aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand.

The potential implications of proposed development on the risk designation of the reservoir should also be considered, as it is a requirement that in particular circumstances where there could be a danger to life, that a commitment is made to the hydraulic capacity and safety of the reservoir embankment and spillway. The implications of such an obligation should be identified and understood before new development is permitted, to ensure it can be achieved.

8.5 Emergency planning

The Civil Contingencies Act 2004 lists Local Authorities, the Environment Agency and emergency services as Category 1 responders. Category 1 responders are responsible for reducing, controlling, and mitigating the effects of emergencies in both response and recovery phases.

The National Planning Policy takes this into account by seeking to avoid inappropriate development in areas of flood risk and considering the vulnerability of new developments to flooding.

The 2023 NPPF (Paragraph 173) requires site level FRAs to demonstrate that “any residual risk can be safely managed; and safe access and escape routes are included where appropriate, as part of an agreed emergency plan”. Therefore, the LLFA will require evidence to be submitted that an agreed emergency plan will be required to demonstrate a viable development that does not increase flood risk onsite or elsewhere. Further information is available in the LLFA's Developer Guidance.

In accordance with the NPPF, SFRAs, PFRAs and SWMPs can be used in the preparation and execution of a flood emergency plan as they can indicate areas that may be at risk of flooding. These can be provided as part of an FRA or as a separate document. Decisions regarding whether an Emergency Plan is required sits with the LPA, with advice from their Emergency Planning Teams, the EA and LLFA.

According to the PPG, an emergency plan is needed wherever emergency flood response is an important component of making a development safe; this includes the free movement of people during a ‘design flood’ and potential evacuation during an extreme flood.

Emergency plans are essential for any site with transient occupancy in areas at risk of flooding, such as holiday accommodation, hotels, caravan, and camping sites (PPG Paragraph 043).

Emergency Plans should consider:

- The type of flood risk present, and the extent to which advance warning can be given in a flood event.
- The number of people that would require evacuation from the area potentially at risk.
- The vulnerability of site occupants.
- The impact of the flooding on essential services e.g., electricity, gas, telecommunications, water supply and sewerage.
- Safe access and egress for users and emergency services.

Further information is available from the following documents / websites with hyperlinks provided:

- The National Planning Policy Guidance
- 2004 Civil Contingencies Act
- Defra (2014) National Flood Emergency Framework for England
- FloodRe
- The EA and Defra’s Standing Advice for FRAs
- SNC's 'Flooding and drainage' website page
- EA’s ‘How to plan ahead for flooding’

- Sign up for Flood Warnings with the EA
- The National Flood Forum
- GOV.UK 'Prepare for flooding' page
- ADEPT Flood Risk Plans for new development
- Norfolk Strategic Flooding Alliance

8.5.1 Flood forums and community resilience

The Norfolk Local Resilience Forum provide Emergency Planning information about risks to the community, warn of hazardous conditions, such as flooding, snow, and drought, and provide information on preparing for emergency situations. Information is available from their website here.

9 Surface water management and SuDS

This section provides guidance and advice on managing surface water runoff and flooding.

9.1 Roles of the Lead Local Flood Authority and Local Planning Authority in surface water management

NCC as the LLFA is a statutory planning consultee. They provide technical advice on surface water drainage strategies and designs put forward for major development proposals, to confirm that onsite drainage systems are designed in accordance with the current legislation and guidance.

When considering planning applications, the LLFA will provide advice to the Planning Department on the management of surface water. The LPA should satisfy themselves that the development's proposed minimum standards of operation are appropriate and, using planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the lifetime of the development. The LLFA also have a freely available Guidance Document which is available to download from their website, here.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the pre-application or master-planning stage. To further inform development proposals at the master-planning stage, pre-application submissions are accepted by NCC. This will assist with the delivery of well designed, appropriate, and effective SuDS.

Currently the use of SuDS is driven through planning policy. Schedule 3 of the FWMA 2010 is expected to be implemented in 2024 following a government review making SuDS mandatory for new developments in England. Schedule 3 will provide a framework for the approval and adoption of drainage systems, a SuDS Approving Body (SAB) within unitary and county councils, and national standards on the design, construction, operation, and maintenance of SuDS for the lifetime of the development. However, limited information about the implementation of Schedule 3 is currently available and no fixed timescales have been published at the time of writing.

9.2 Sustainable Drainage Systems (SuDS)

SuDS are water management practices which aim to enable surface water to be drained in a way that mimics (as closely as possible) the run-off and drainage prior to site development. The primary benefits of SuDS can be categorised under four distinct themes. These are highlighted in Figure 9-1 and are referred to as the four pillars of SuDS design.

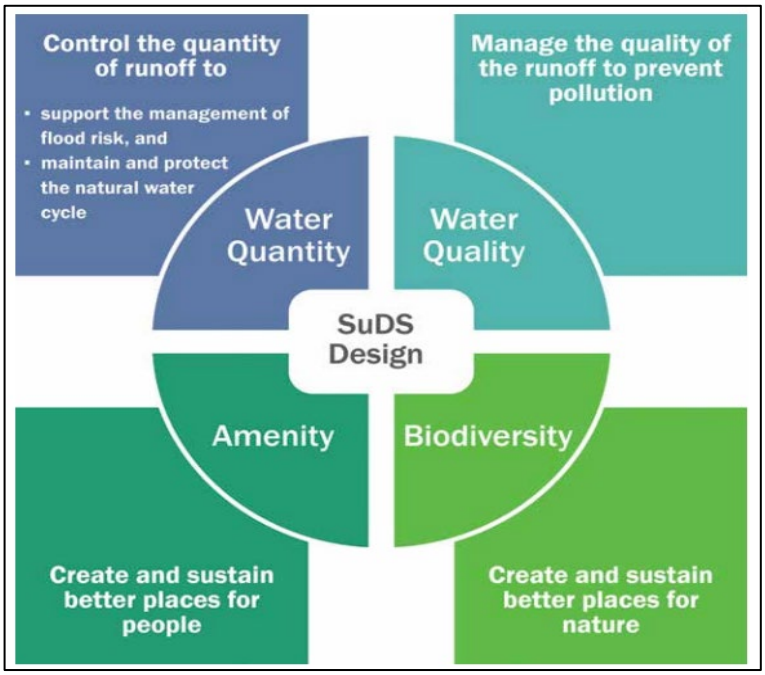


Figure 9-1 The four pillars of SuDS design

There are a number of ways in which SuDS can be designed to meet surface water quantity, water quality, biodiversity, and amenity goals. Given this flexibility, SuDS are generally capable of overcoming or working alongside various constraints affecting a site, such as restrictions on infiltration, without detriment to achieving these goals. As well as implementing SuDS within new developments, they can also often be retrofitted into existing developments.

The inclusion of SuDS within developments should also be seen as an opportunity to enhance ecological and amenity value as well as promote Green Infrastructure by incorporating above ground facilities into the landscape development strategy. SuDS must be considered at the outset and during preparation of the initial conceptual site layout to ensure that enough land is given to design spaces that will be an asset to the development as opposed to an ineffective afterthought. For SuDS Management Trains to work effectively appropriate techniques need to be selected based on the objectives for drainage and site-specific constraints. SuDS Management Trains are discussed further in Section 9.2.3. It is recommended that on all developments source control is implemented as the first stage of a management train allowing for improvements in water quality and reducing or eliminating runoff from smaller, more frequent, rainfall events.

It is a requirement for all new major development proposals that SuDS for management of runoff are put in place, unless there is clear evidence that this would be inappropriate (NPPF Paragraph 175). Where possible, SuDS that offer multiple benefits should be given priority. The developer is responsible for ensuring the design,

construction, and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and existing drainage arrangements is essential.

9.2.1 Hierarchy of Drainage

NPPF and the PPG state that "Where possible, preference should be given to multi-functional sustainable drainage systems, and to solutions that allow surface water to be discharged according to the following hierarchy of drainage options:

1. Into the ground (infiltration)
2. To a surface waterbody
3. To a surface water sewer, highway drain or another drainage system
4. To a combined sewer"

Within South Norfolk, the LLFA's preferred approach to drainage within a site is to consider the hierarchy of drainage within the Guidance on Norfolk County Council's Lead local flood authority role as statutory consultee to planning[1]:

1. Surface water runoff is collected for use.
2. Discharge into the ground via infiltration.
3. Discharge to a watercourse or other surface waterbody.
4. Discharge to a surface water sewer, highway drain or another drainage system discharging to a watercourse or other surface waterbody.
5. Discharge to a combined sewer."

9.2.2 Types of SuDS system

There are many different SuDS techniques that can be implemented in attempts to mimic pre-development drainage (Table 9-1). Techniques can include soakaways, infiltration trenches, permeable pavements, grassed swales, green roofs, ponds, and wetlands and these do not necessarily need to take up a lot of space. The suitability of the techniques will be dictated in part by the development proposal and site conditions. Advice on best practice is available from the Environment Agency and the Construction Industry Research and Information Association (CIRIA) e.g. the **CIRIA SuDS Manual C753 (2015**)

Table 9-1 Example SuDS Techniques and potential benefits

SuDS Technique	Flood Reduction	Water Quality Treatment & Enhancement	Landscape and Wildlife Benefit
Over-sized pipes/tanks	Yes	No	No

1 https://www.norfolk.gov.uk/article/38642/Information-for-developers

SuDS Technique	Flood Reduction	Water Quality Treatment & Enhancement	Landscape and Wildlife Benefit
Storm cells	Yes	No	No
Living roofs	Yes	Yes	Yes
Constructed wetlands	Yes	Yes	Yes
Balancing ponds	Yes	Yes	Yes
Detention basins	Yes	Yes	Yes
Retention ponds	Yes	Yes	Yes
Filter strips and swales	Yes	Yes	Yes
Soakaways	Yes	Yes	Yes
Infiltration trenches and basins	Yes	Yes	Yes
Permeable surfaces and filter drains	Yes	Yes	No
Gravelled areas	Yes	Yes	No
Solid paving blocks	Yes	Yes	No
Porous pavements	Yes	Yes	No
Tanked systems	Yes	No	No

9.2.3 SuDS management

SuDS should not be used individually but as a series of features in an interconnected system designed to capture water at the source and convey it to a discharge location. Collectively this concept is described as a SuDS Management Train (see Figure 9-2). The number of treatment stages required within the Management Train depends primarily on the source of the runoff and the sensitivity of the receiving waterbody or groundwater. A drainage strategy will need to demonstrate that an appropriate number of treatment stages are delivered.

SuDS components should be selected based on design criteria and how surface water management is to be integrated within the development and landscaping setting. By using a number of SuDS features in series it is possible to reduce the flow and volume of runoff as it passes through the system as well as minimising pollutants which may be generated by a development. In accordance with the NPPF, the developer must put in place maintenance and management plans for the lifetime of the surface water assets.

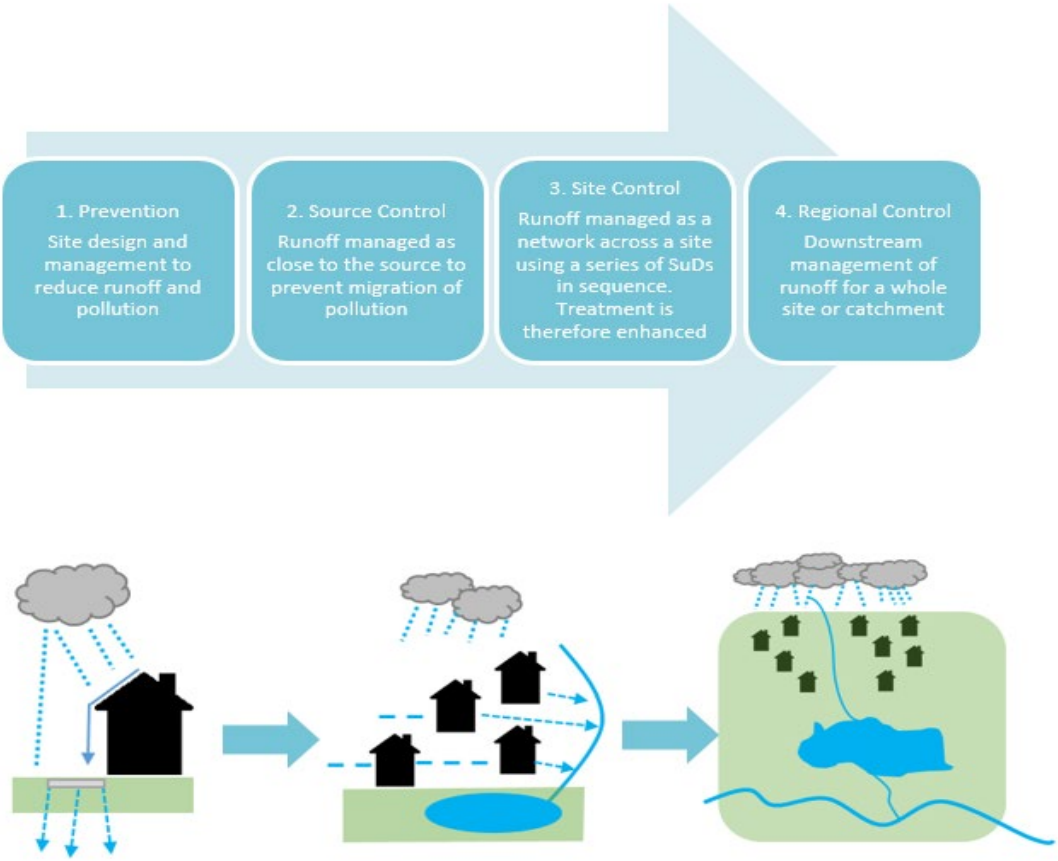


Figure 9-2 The SuDS management train

9.2.4 Treatment

A key part of the four pillars of SuDS is to provide the maximum improvement to water quality through the use of the "SuDS management train". To maximise the treatment within SuDS, CIRIA recommends the following good practice is implemented in the treatment process:

6. Manage surface water runoff close to source: This makes treatment easier due to the slower velocities and also helps isolate incidents rather than transport pollutants over a large area.
7. Treat surface water runoff on the surface: This allows treatment performance to be more easily inspected and managed. Sources of pollution and potential flood risks are also more easily identified. It also helps with future maintenance work and identifying damaged or failed components.
8. Treat a range of contaminants: SuDS should be chosen and designed to deal with the likely contaminants from a development and be able to reduce them to acceptably low levels.

9. Minimise the risk of sediment remobilisation: SuDS should be designed to prevent sediments being washed into receiving water bodies or systems during events greater than what the component may have been designed.
10. Minimise the impact of spills: SuDS should be designed to be able to trap spills close to the source or provide robust treatment along several components in series.

The number of treatment stages required depends primarily on the source of the runoff. A drainage strategy will need to demonstrate that an appropriate number of treatment stages are delivered. This involves determining a pollutant hazard score for each pollutant type. An index is then used to determine the treatment potential of different SuDS features for different pollutant types. This is known as the mitigation index. The Total SuDS mitigation index should be equal or greater than the pollution hazard score to deliver adequate treatment.

9.2.5 Overcoming SuDS constraints

The design of a SuDS system will be influenced by a number of physical and policy constraints. These should be taken into account and reflected upon during the conceptual, outline, and detailed stages of SuDS design. Table 9-2 details some possible constraints and how they may be overcome.

Table 9-2 Example SuDS design constraints and possible solutions

Considerations	Solution
Land availability	SuDS can be designed to fit into small areas by utilising different systems. For example, features such as permeable paving and green roofs can be used in urban areas where space may be limited.
Contaminated soil or groundwater below site	SuDS can be placed and designed to overcome issues with contaminated groundwater or soil. Shallow surface SuDS can be used to minimise disturbance to the underlying soil. The use of infiltration should also be investigated as it may be possible in some locations within the site. If infiltration is not possible linings can be used with features to prevent infiltration.
High groundwater levels	Non-infiltrating features can be used. Features can be lined with an impermeable lining or clay to prevent the ingress of water into the feature. Additional, shallow features can be utilised which are above the groundwater table.
Steep slopes	Check dams can be used to slow flows. Additionally, features can form a terraced system with additional SuDS components such as ponds used to slow flows.
Shallow slopes	Use of shallow surface features to allow a sufficient gradient. If the gradient is still too shallow, pumped systems may be considered as a last resort.

Considerations	Solution
Ground instability	Geotechnical site investigation should be done to determine the extent of unstable soil and dictate whether infiltration would be suitable or not.
Sites with deep backfill	Infiltration should be avoided unless the soil can be demonstrated to be sufficiently compacted. Some features such as swales are more adaptable to potential surface settlement.
Open space in floodplain zones	Design decisions should be done to take into consideration the likely high groundwater table and possible high flows and water levels. Features should also seek to not reduce the capacity of the floodplain and take into consideration the influence that a watercourse may have on a system. Factors such as siltation after a flood event should also be taken into account during the design phase.
Future adoption and maintenance	The Local Planning Authority should check that development proposals have clear arrangements for on-going maintenance over the development's lifetime, through the use of planning conditions or planning obligations.

For SuDS techniques that are designed to encourage infiltration, it is imperative that the water table is low enough and a site-specific infiltration test is conducted early on as part of the design of the development. Infiltration should be considered with caution within areas of possible subsidence or sinkholes. Where sites lie within or close to Groundwater Source Protection Zones (GSPZs) or aquifers, further restrictions may apply, and guidance should be sought from the LLFA and the Environment Agency. GSPZs are detailed further in Section 9.4.2.

9.3 Sources of SuDS guidance

9.3.1 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) provides guidance on planning, design, construction and maintenance of SuDS. The manual is divided into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document. The manual can be downloaded from the CIRIA website here.

9.3.2 Non-Statutory Technical Guidance, Defra (March 2015)

Non-Statutory Technical guidance provides non-statutory standards on the design and performance of SuDS. It outlines peak flow control, volume control, structural integrity, flood risk management and maintenance and construction considerations. This guidance can be accessed on the Government website here.

9.3.3 Non-statutory Technical Guidance for Sustainable Drainage Practice Guidance, LASOO (2016)

The Local Authority SuDS Officer Organisation (LASOO) produced their practice guidance in 2016 to give further detail to the Non-Statutory technical guidance. This guidance is available on the SUS Drain website here.

9.3.4 Water Industry Design and Construction Guidance

The Design and Construction Guidance (DCG), part of a new Codes for Adoption covering the adoption of new water and wastewater infrastructure by water companies, contains details of the water sector's approach to the adoption of SuDS and can be accessed here.

9.3.5 Local Authority SuDS Guidance

NCC have a guidance document on their LLFA role as statutory consultee to planning, which was updated in April 2024. The guidance document can be downloaded from their website here. This document aims to outline planning policy with regard to surface water drainage and provide guidance for developers on the information required by the LLFA in relation to SuDS on major planning applications. Further information on drainage design standards is also available on the NCC website here.

9.4 Other surface water considerations

9.4.1 Groundwater Vulnerability Zones

The EA published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise of the underlying bedrock. The map shows the vulnerability of groundwater at a location based on the hydrological, hydro-ecological and soil properties within a one-kilometre grid square.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas. Groundwater vulnerability maps can be found on Defra's interactive mapping.

9.4.2 Groundwater Source Protection Zones (GSPZ)

The EA also defines Groundwater Source Protection Zones (GSPZs) near groundwater abstraction points. These protect areas of groundwater used for drinking water. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. GSPZs can be viewed on Defra's interactive mapping. Three main zones are defined as follows:

- Inner protection zone (Zone 1) - areas from where pollution can travel to the groundwater source within 50 days or is at least a 50m radius.
- Outer protection zone (Zone 2) - areas from where pollution can travel to the groundwater source within 400 days or lies within the nearest 25% of the total catchment area (whichever is largest).
- Total catchment (Zone 3) - the total area needed to support removal/discharge of water from the groundwater source.

Online mapping shows there are currently four GSPZ's which lie partially or wholly within the South Norfolk District. Where a site is located in a GSPZ used for public water supply, applicants should engage with Anglian Water to understand any concerns and any necessary mitigating measures to manage the risk of development to public water supply.

9.4.3 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process.

NVZs can be viewed on the EA's website here. There are nine pre appeal NVZ 2021 to 2024 areas affecting the South Norfolk District:

- Surface Water S394 - Hempnall Beck NVZ
- Surface Water S399 - River Chet NVZ
- Surface Water S396 - River Waveney NVZ
- Surface Water S395 - Tas NVZ
- Surface Water S397 - Tud NVZ
- Surface Water S400 - Yare NVZ
- Eutrophic Water EL147 - Rockland Broad Eutrophic lake NVZ
- Eutrophic Water EL127 - Lound Mill Water & Fritton Lake Eutrophic lake NVZ
- Groundwater G79 - Norwich Crag and Gravels

Currently, information on the 2021 to 2024 NVZs post-appeal is unavailable. Landowners can appeal an NVZ designation once notified if their land (or part of it):

- Does not drain into water that has been identified as polluted.
- Drains into water that should not be identified as polluted.

9.4.4 Nutrient Neutrality

In March 2022, Natural England and the Department for Levelling Up Housing and Communities issued advice surrounding development that could cause adverse impacts on nutrient pollution. Such development includes, but is not limited to:

- Any development comprising overnight accommodation (such as new homes, tourist attractions etc).
- Any form of permitted development under planning legislation which would give rise to new overnight accommodation.
- Any development not involving overnight accommodation, but which may have non-sewerage water quality implications.

In addition, the Habitats Regulation (2017) states that planning authorities are required to make sure development does not have adverse impacts on protected habitats before granting permission. Further information around nutrient neutrality is available on the Council website here.

9.4.5 Critical Drainage Areas

Areas with Critical Drainage Problems (ACDPs) is land formally notified to the LPA by the EA as having critical drainage problems. Within ACDPs, proposed development may present increased risks of flooding both on and off site if the surface water runoff is not effectively managed. A dataset containing ACDPs is available to download from the EA website here. There are currently no ACDPs identified within the South Norfolk District.

10 Summary and recommendations

Parts of South Norfolk District are at risk of flooding from the following sources: fluvial, surface water, groundwater, sewers, reservoir inundation, and overtopping/ breaches. This study has shown that the most significant sources of flood risk in the District are fluvial and surface water.

Summary of flood risk in South Norfolk District:

- Fluvial: The primary fluvial flood risk to the north of the District is the River Wensum and River Yare, which flow west to east along the northern border; similarly, the River Waveney flows south to north-east along the south-eastern border. Their confluence at Burgh Flats is at particular flood risk due to the low-lying marshland. Tributaries of the River Yare, including the River Tiffey, Dyke Beck, River Tas, and Well Beck also pose risk to the north of the District; while tributaries of the River Waveney, including Broome Beck, Starston Beck, and the Frenze Beck, pose fluvial flood risk to the south.
- Surface water: The Risk of Flooding from Surface Water map shows a number of prominent overland flow routes that are largely channelled by the topography of surrounding watercourses. This includes the River Tiffey, River Tas, River Chet, and Frenze Beck in particular. There are also areas with additional flow paths and surface water ponding; for example, where water is impounded at road or rail embankments and in low-lying areas. There are also considerable flow routes along highways in major urban centres such as Wymondham, Poringland, Lond Stratton, and Diss.
- Climate change: Areas at risk of flooding today are likely to become at increased risk in the future and the frequency of flooding will also increase in such areas, because of climate change. Flood extents will increase; in some locations, this may be minimal, but flood depth, velocity and hazard may have more of an impact due to climate change. It is recommended that SNC work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development when developing climate change plans and strategies for South Norfolk District.
- Sewer: Anglian Water provides water services and sewerage services across the entirety of the District. Anglian Water have provided details of historic sewer flooding across the District.
- Groundwater: The Areas Susceptible to Groundwater Flooding map shows that in general, areas with greater than 50% susceptibility to groundwater flooding are located along main fluvial flow routes. This includes the River Wensum and River Yare along the northern border of the District, and the River Waveney along the southern and eastern borders. Furthermore, the floodplains of the River Tiffey and River Tas in the north, and Frenze Beck and Dickleburgh Stream in the

south, also have a greater than 50% susceptibility to groundwater flooding. The JBA Groundwater Emergence Map emulates this, with similar areas experiencing emergence levels within 0.5m of the surface, with the addition of the east of the District. The Risk of Flooding due to Surface Water map suggests that any groundwater emerging in these areas is likely to be channelled by the low-lying topography of the River Tiffey and River Tas in the north-west, the River Chet and Broome Beck in the east, and the Frenze Beck and Dickleburgh Stream in the south.

- Reservoirs: There is a potential risk of flooding from reservoirs both within the South Norfolk District and those outside. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach along the northern and south-eastern borders of the District, and this risk should be considered in any site-specific FRAs (where relevant).
- Defences: The EA AIMS dataset provides information on flood defence assets across the District. The primary defence type across the study area is 'Natural High Ground', located along both banks of main watercourses such as the River Wensum and River Yare, River Tiffey, River Tas, Frenze Beck, and Dickleburgh Stream. Additional engineered defences including a wall, embankments, and demountable defences also line parts of the River Yare, River Waveney, and Broome Beck. The condition of these defences varies from poor to good, with the Standard of Protection (SoP) varying between the defences.

10.1 Recommendations

10.1.1 Sequential approach to development

The NPPF supports a risk-based and sequential approach to development and flood risk in England, so that development is located in the lowest flood risk areas where possible; it is recommended that this approach is adopted for all future developments within the study area.

New development and re-development of land should wherever possible seek opportunities to reduce overall level of flood risk at the site, for example by:

- Reducing volume and rate of runoff through the use of SuDS.
- Relocating development to areas with lower flood risk.
- Creating space for flooding.
- Considering Green Infrastructure within the mitigation measures for surface water runoff from potential development and consider using areas at risk of flooding as public open space.
- Considering the potential cumulative impact of development on flood risk.

10.1.2 Site-specific flood risk assessments

Site specific FRAs are required to be produced by developers to provide a greater level of detail on flood risk and any protection provided by defences and, where necessary, demonstrate the development passes part b of the Exception Test.

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), inform development zoning within the site and prove, if required, whether the Exception Test can be passed. The assessment should also identify the risk of existing flooding to adjacent land and properties to establish whether there is a requirement to secure land to implement strategic flood risk management measures to alleviate existing and future flood risk. Any flood risk management measures should be consistent with the wider catchment policies set out in the CFMP, FRMPs and LFRMS.

Developers should consult with the LPA, NCC as LLFA, the EA and Anglian Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

10.1.3 Sequential and Exception tests

The SFRA has identified that parts of the study area are at high risk of flooding. Therefore, it is expected that several proposed development sites will be required to pass the Sequential and, where necessary, Exception Tests in accordance with the NPPF.

The LPA should use the information in this SFRA when deciding which development sites to take forward in their LPU. It is the responsibility of the LPA to be satisfied that the Sequential Test has been satisfied.

10.1.4 Council review of planning applications

The LPA should consult the EA's 'Flood Risk Assessment: Local Planning Authorities', last updated February 2022, when reviewing planning applications for proposed developments at risk of flooding.

The LPA will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases, also contact non-statutory consultees (e.g. Anglian Water) that have an interest in the planning application.

Anglian Water are currently not a statutory consultee for planning applications, however they should be consulted on major planning applications to ensure they can respond to any specific issues that may arise in terms of foul and surface water drainage assessments, network and treatment capacity, and impacts on their assets.

10.1.5 Drainage strategies and SuDS

Planners should be aware of the conditions set by the LLFAs for surface water management. The enactment of Schedule 3 of the FWMA means that there will be mandatory standards for delivery and adoption of SuDS in new developments.

SuDS design should demonstrate how constraints have been considered and how the design provides multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure, and the enhancement of historical features.

Planning applications for phased developments should be accompanied by a drainage strategy, which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase. Applicants will need to demonstrate a holistic and co-ordinated approach to both foul and surface water drainage and the management of flood risk.

Use of the SuDS management train to prevent and control pollutants to prevent the 'first flush' polluting the receiving waterbody.

SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and should be supported by an appropriately detailed maintenance and operation manual.

10.1.6 Residual risk

Residual risk is the risk that remains after mitigation measures are considered. The residual risk includes the consideration of flood events that exceed the design thresholds of the flood defences or circumstances where there is a failure of the defences, e.g. flood bank collapse. Residual risks should be considered as part of site-specific FRAs.

Further, any developments located within an area protected by flood risk management measures, where the condition of those defences is 'fair' or 'poor', where the standard of protection is not of the required standard or where the failure of the intended level of service gives rise to unsafe conditions should be identified.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage. They should seek to contact the reservoir owner to obtain information and should apply the sequential approach to locating development within the site. Developers should also consult with relevant authorities regarding emergency plans in case of reservoir breach.

Consideration should be given to the potential for safe access and egress in the event of rapid inundation of water due to a breach with little warning.

10.1.7 Reduction of flood risk through site allocations and appropriate site design:

- To locate new development in areas of lowest risk, in line with the sequential test, by steering sites to Flood Zone 1 from the Flood Map for Planning and avoiding where possible areas with a higher risk of surface water flooding and by

avoiding any other sources of flooding. If a sequential test is undertaken and a site at flood risk is identified as the only appropriate site for the development, the exception test shall be undertaken. If development can't be avoided in the higher risk surface water Zone (Zone B), then part "b" of the exception test should be satisfied.

- After application of the exception test, a sequential approach to site design will be used to reduce risk. Any re-development within areas of flood risk which provide other wider sustainability benefits will provide flood risk betterment and made resilient to flooding.
- Identification of long-term opportunities to remove development from the floodplain and to make space for water.
- Ordinary watercourses not currently afforded flood maps should be modelled to an appropriate level of detail to enable a sequential approach to the layout of the development.
- Confirm development is 'safe', dry pedestrian egress from the floodplain and emergency vehicular access should be possible for all residential development. If at risk, then an assessment should be undertaken to detail the flood duration, depth, velocity, and flood hazard rating in the 1% AEP plus climate change flood event, in line with FD2320.
- Raise residential and commercial finished floor levels 600mm above the 1% AEP plus climate change flood level. Protect and promote areas for future flood alleviation schemes.
- Identify opportunities for brownfield sites in functional floodplain to reduce risk and provide flood risk betterment.
- Identify opportunities to help fund future flood risk management through developer contributions to reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

10.1.8 Promote SuDS to mimic natural drainage routes to improve water quality

- SuDS design should demonstrate how constraints have been considered and how the design provides multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure, and the enhancement of historical features.
- Planning applications for phased developments should be accompanied by a drainage strategy, which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase.
- Use of the SuDS management train to prevent and control pollutants to prevent the 'first flush' polluting the receiving waterbody.
- SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and

should be supported by an appropriately detailed maintenance and operation manual.

10.1.9 Reduce surface water runoff from new developments and agricultural land

- Space should be provided for the inclusion of SuDS on all allocated sites, outline proposals and full planning applications.
- Promote biodiversity, habitat improvements and Countryside Stewardship schemes help prevent soil loss and to reduce runoff from agricultural land.
- Identify opportunities to maintain and enhance permeable surfaces and greenspaces to help reduce surface water runoff whilst promoting other benefits, including biodiversity and wellbeing.

10.1.10 Enhance and restore river corridors and habitat

- Assess condition of existing assets and upgrade, if required, to confirm that the infrastructure can accommodate pressures/flows for the lifetime of the development.
- Natural drainage features should be maintained.
- Identify opportunities for river restoration/enhancement to make space for water.
- A presumption against culverting of open watercourses except where essential to allow highways and/or other infrastructure to cross, in line with CIRIA's Culvert design and operation guide, (C689) and to restrict development over culverts.
- There should be no built development within 8m from the top of a watercourse or main river for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement.

10.1.11 Mitigate against risk, improved emergency planning and flood awareness

- Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.
- For a partial or completely pumped drainage system, an assessment should be undertaken to assess the risk of flooding due to any failure of the pumps to be assessed. The design flood level should be determined if the pumps were to fail; if the attenuation storage was full, and if a design storm occurred.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 1% AEP rainfall event, inclusive of climate change and urban creep.
- Consideration and incorporation of flood resilience measures up to the 0.1% AEP event.

- Produce and implement robust emergency (evacuation) plans for major developments.
- Increase awareness and promote sign-up to the EA Flood Warnings Direct (FWD) within South Norfolk District.

10.2 Site screening

10.2.1 Purpose of site screening

This Level 1 SFRA has identified potential development sites across South Norfolk District which fall within areas of flood risk. Due to these findings, a Level 2 SFRA will be required to further assess the flood risk at those sites proposed for development to inform the exception test.

10.2.2 Methodology

To identify the sites to be taken forward for Level 2 assessment, the following screening process was undertaken:

- All promoted sites were screened through JBA's FRISM software to identify fluvial, surface water, and reservoir risks to the site.
- SNC identified the sites assessed as potentially suitable for development through including those proposed for allocation in the VHCAP.
- A high-level assessment of flood risk was then undertaken using the sites put forward by SNC as potentially suitable for development:
    - Any sites located within the Flood Zones were highlighted for Level 2 assessment.
    - Any sites located within the 1% AEP plus 40% climate change surface water flood extent were visually assessed to determine whether the site can be developed around the areas of risk. If this is not the case, these were also highlighted for Level 2 assessment. Potential access issues were also highlighted during this process.
    - For any sites not promoted for Level 2 assessment, the groundwater and reservoir risks were assessed at these sites, and further sites were highlighted for Level 2 assessment.

10.2.3 Level 2 SFRA assessment

A consultation with SNC was then undertaken to discuss and finalise the sites requiring Level 2 assessment.

The ranking criteria undertaken is as follows:

- Sites at higher risk from fluvial flooding
- Sites at higher risk from surface water flooding

- Sites where particular groundwater or reservoir flooding issues are identified.

Sites requiring a Level 2 assessment will be assessed on a site-by-site basis in the Level 2 SFRA report, to inform the requirement for the exception test.

Appendices

A Interactive Flood Risk Mapping and User Guide

B Data sources used in the SFRA

C SFRA User Guide

D Flood Alerts and Flood Warnings

E Summary of flood risk across South Norfolk District

F Cumulative Impact Assessment (CIA)

JBA consulting

Offices at

Bristol
Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Leeds
Limerick
Newcastle upon Tyne
Newport
Peterborough
Portsmouth
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
1 Broughton Park
Old Lane North
Broughton
SKIPTON
North Yorkshire
BD23 3FD
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
ISO 27001:2013
ISO 45001:2018