www.jbaconsulting.com

Southend-on-Sea Level 1 Strategic Flood Risk Assessment

Final report

A1-C01

Prepared for	Date
Southend-on-Sea City Council	14/08/2026

Document Status

Issue date	14 August 2026
Issued to	Claire Victory
BIM reference	RUR-JBA-XX-XX-RP-Z-0001
Revision	A1-C01
Prepared by	Elsa Holm BAEcon (Hons) Assistant Analyst Sarah Hambling BSc (Hons) MSc Senior Analyst
Reviewed by	Thomasin Shorrock BA (Hons) MCIWEM C.WEM Chartered Principal Analyst
Authorised by	Thomasin Shorrock BA (Hons) MCIWEM C.WEM Chartered Principal Analyst

Carbon Footprint

The format of this report is optimised for reading digitally in pdf format. Paper consumption produces substantial carbon emissions and other environmental impacts through the extraction, production and transportation of paper. Printing also generates emissions and impacts from the manufacture of printers and inks and from the energy used to power a printer. Please consider the environment before printing.

Accessibility

JBA aims to align with governmental guidelines on accessible documents and WGAG 2.2 AA standards, so that most people can read this document without having to employ special adaptation measures. This document is also optimised for use with assistive technology, such as screen reading software.

Contract

JBA Project Manager	Sarah Hambling
Address	1 Broughton Park, Old Lane North, Broughton, Skipton, BD23 3FD
JBA Project Code	2026s0109

This report describes work commissioned by Southend-on-Sea City Council by an instruction dated 2 January 2026. The Client's representative for the contract was Claire Victory of Southend-on-Sea City Council. Elsa Holm and Sarah Hambling of JBA Consulting carried out this work.

Purpose and Disclaimer

Jeremy Benn Associates Limited ("JBA") has prepared this Report for the sole use of Southend-on-Sea City 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 Southend-on-Sea City 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.

JBA disclaims any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to JBA's attention after the date of the Report.

The methodology adopted and the sources of information used by JBA in providing its services are outlined in this Report. The work described in this Report was undertaken between February and May 2026 and is based on the conditions encountered and the information available during the said period. The scope of this Report and the services are accordingly factually limited by these circumstances.

Acknowledgements

We would like to acknowledge the assistance of Southend-on-Sea City Council, Environment Agency, Anglian Water, Essex County Council, Castle Point Borough Council, Rochford Council, and Essex County Fire and Rescue Service.

Copyright

© Jeremy Benn Associates Limited 2026

Contents

List of Figures

List of Tables

Abbreviations

ADEPT	Association of Directors of Environment, Economy, Planning and Transport
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
BNG	Biodiversity Net Gain
CaBA	Catchment Based Approach
CC	Climate Change
CCMA	Coastal Change Management Area
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
CIA	Cumulative Impact Assessment
CIRIA	Construction Industry Research and Information Association
DCG	Design and Construction Guidance
Defra	Department for Environment, Food and Rural Affairs
DG5 Register	Register of properties at risk of sewer flooding
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
ESWSL	Extreme Still Water Sea Levels
EU	European Union
FAA	Flood Alert Area
FCERM	Flood and Coastal Erosion Risk Management
FFL	Finished Floor Level
FFR	Flood Risk Regulation
FMfP	Flood Map for Planning
FRA	Flood Risk Assessment
FRAP	Flood Risk Activity Permit
FWA	Flood Warning Area
FWMA	Flood and Water Management Act
GI	Green Infrastructure
GSPZ	Groundwater Source Protection Zone
HFM	Historic Flood Map
JBA	Jeremy Benn Associates
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging

LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	metres Above Ordnance Datum
NaFRA2	National Flood Risk Assessment 2
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NVZ	Nitrate Vulnerable Zone
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RBD	River Basin District
RBMP	River Basin Management Plan
REUL	Retained EU Law
RMA	Risk Management Authority
RNLI	Royal National Lifeboat Institution
SFRA	Strategic Flood Risk Assessment
SHELAA	Strategic Housing and Economic Land Availability Assessment
SMP	Shoreline Management Plan
SoP	Standard of Protection
SPA	Special Protection Area
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
WCS	Water Cycle Study
WFD	Water Framework Directive

Definitions

1D model: One-dimensional hydraulic model.

2D model: Two-dimensional hydraulic model.

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

Brownfield: A previously developed parcel of land.

Climate Change (CC): Long term variations in global temperature and weather patterns caused by natural and human actions.

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

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

Green infrastructure (GI): 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.

Greenfield: An undeveloped parcel of land.

Lead Local Flood Authority (LLFA): 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 (EA). They are usually the larger rivers and streams. The EA has permissive powers (not duties) to carry out maintenance and improvement works on main rivers).

Major development: Defined in the National Planning Policy Framework (NPPF) 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 provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015 (gov.uk).

Natural Flood Management (NFM): Techniques that work with nature to reduce the risk of flooding for communities.

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.

Permissive powers: Authorities have the power to undertake flood risk management activities, but not a duty to do so. This will depend on priorities in flood risk management.

Return period: 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 Management Authority (RMA): The EA; 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.

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.

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.

Sustainable Drainage Systems (SuDS): 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.

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 planning policies for Southend-on-Sea. The review process will result in the Southend New Local Plan. This Strategic Flood Risk Assessment (SFRA) uses the best available information, including input from key stakeholders, and applies the latest national planning policy and guidance, including:

- National Planning Policy Framework (NPPF) (gov.uk), last updated in December 2024.
- Planning Practice Guidance (PPG): Flood risk and coastal change (gov.uk) updated in September 2025.
- The latest Environment Agency climate change guidance (gov.uk) (updated in July 2021 and May 2022).
- The Environment Agency 'How to prepare a strategic flood risk assessment' (gov.uk) guidance, last updated in August 2025.
- The Association of Directors of Environment, Economy, Planning and Transport (ADEPT) 'Strategic flood risk assessment good practice guidance' (adeptnet.org.uk).

Introduction

To support the review and the New Local Plan for Southend-on-Sea City Council (referred to hereafter as the Council), 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 risks may be mitigated against.
- To inform decisions in the emerging Southend New Local Plan, including informing the sustainability appraisal, 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 the Council in the preparation of the Southend New Local Plan.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the Southend New 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 FRAs, including those at risk from sources other than river flooding, or at risk of flooding in the future due to climate change, 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 the study area and flood risk

This SFRA covers the unitary authority area of Southend-on-Sea, hereafter referred to as the study area. Southend-on-Sea is a coastal city located in south-eastern Essex, north of the Thames Estuary. The study area encompasses a number of distinct towns and suburbs, including Leigh-on-Sea, Shoeburyness, Eastwood, Prittlewell, Westcliff-on-Sea, Southchurch, Chalkwell, and Thorpe Bay. Southend-on-Sea is almost exclusively urban and has one of the highest urban densities in England, outside of London. There are several parks and golf courses throughout the study area, and a few areas of greenbelt land, the largest situated in the northeast.

Flood risk from all sources has been assessed in this SFRA. Parts of the study area are shown to be at risk of flooding from the following sources: fluvial, tidal, surface water, sewer, ground water, and reservoir. This study has shown that the most significant sources of flood risk across the study area are fluvial, tidal, surface water, and sewer. The points below summarise the findings:

Fluvial: The Main Rivers flowing within the study area are Eastwood Brook, Prittle Brook, Mucking Hall Brook, and Willingale Brook. In the west of the study area, the fluvial flood risk is from Prittle Brook and Eastwood Brook. Willingale Brook, and an ordinary watercourse named C-X Ditch, have flood risk extents that impact Southchurch and Shoeburyness in the east of the study area. In these locations tidal water from the Thames Estuary backs up the channels, contributing to the flows. The fluvial extents for Mucking Hall Brook follow the channel of watercourse through Garon Park Golf Complex.

Fluvial flood risk is discussed in Section 4.4 and the flood extents are shown in the mapping in Appendix C.

Tidal and coastal: Almost the entire southern and eastern coastline are at tidal flood risk, with the flood extents covering much of the beach areas and parts of the directly adjacent roads. Along the southern coastline this includes parts of Chalkwell Esplanade, Western Esplanade, Marine Parade, and the B1016. There is tidal flood risk in the northeast of the study area, around Suttons Road and East Beach, as well as the area south of Leigh-on-Sea Railway Station and around Chalkwell Avenue. Some of the largest areas of tidal flood risk are by Willingale Brook and C-X Ditch. The flood risk here is combined fluvial and tidal, as water from the Thames Estuary backs up the channels.

Tidal flood risk is discussed in Section 4.4, and the flood extents are shown in the mapping in Appendix C.

Surface Water: The EA's Surface Water Spatial Planning Dataset highlights that there is widespread surface water flood risk across the study area. Several surface water flow paths follow the topography of the existing watercourses, and there are several areas at risk from isolated ponding. Additionally, surface water flow routes are also present roads and along parts of the railway tracks, highlighting risk to transport networks while also posing a risk to buildings which water can be routed to. In the 3.3% Annual Exceedance Probability (AEP) event, the most significant surface water flow routes develop in Leigh-on-Sea, Eastwood, and south of London Southend Airport, particularly around Rochford Road, which serves as a key access route to the airport. In the 1% and 0.1% AEP events, there are also significant flow paths that develop in North Shoebury, Southchurch, and between Royal Artillery Way.

Surface water flood risk is discussed in Section 4.4.3 and the flood extents are shown in the mapping in Appendix F.

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, due to 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. This SFRA provides an assessment of the impacts of climate change on fluvial, tidal, and surface water flood risk.

The approach to climate change is discussed in Section 5. The fluvial and tidal climate change flood extents are shown in the mapping in Appendix E, and the surface water climate change mapping is shown in Appendix K.

Sewer: Anglian Water provides wastewater and sewerage services across the study area and have provided details of historic sewer flooding across the study area. Between 2022 and 2026, the DG5 dataset provided shows 420 georeferenced internal and external sewer records of property flooding.

Sewer flood risk is discussed in Section 4.7.

Groundwater: The JBA Groundwater Emergence Map shows groundwater levels are either at or very near (within 0.025m of) the ground surface in several locations across the study area. This includes in Eastwood, along much of Prittle Brook, by Sutton Road Cemetery, and near the Bournes Green Roundabout. Groundwater levels are between 0.025m and 0.5m below the ground surface in the east of the study area in Shoeburyness and North Shoebury. These groundwater levels are also found in the north of the study area, including by Green Lane, St Thomas More High School, and Garon Park Golf Complex. Over 70% of the study area is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

There is no national risk-based groundwater flood dataset of a suitable resolution to inform the areas at risk from groundwater flooding; however, emergence mapping when considered in conjunction with topography and surface water flow paths can indicate areas where groundwater is likely to emerge, and the flow paths it may take once above the ground. Groundwater flood risk is discussed in Section 1.1 and the JBA emergence map is shown in Appendix G.

Reservoirs: There are no reservoirs located within the study area, and one located outside the study area which presents a potential risk of flooding within the study area. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is 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 Planning Practice Guidance (PPG): Flood risk and coastal change. Reservoir flood risk is discussed in Section 4.10.

Defences

The EA Asset Information Management System (AIMS) dataset provides information on flood defence assets across the study area. There are a number of coastal flood walls and embankments along the southern and eastern coastlines, as well as several coastal flood gates.
Further information on defences across the study area is available in Section 6.4 and shown in the mapping in Appendix I.

How to use this report

The SFRA provides recommendations regarding all sources of flood risk across the study area, which can be used to inform policy on flood risk within the emerging Southend New Local Plan. 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, for both allocations and individual planning applications (Appendix B) and provides guidance on how to apply the Exception Test.

This SFRA is a strategic assessment of flood risk and does not replace the need for site-specific FRAs, where required. The SFRA provides guidance for the development industry and development management officers to establish when an FRA is required and to assess whether site-specific FRAs meet the required quality standard (Section 7). This should be used alongside the EA's FRA Guidance (gov.uk). The SFRA can be used to help identify which locations and development may require emergency planning provision.

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 across the study area are listed in Section 4.3. This can be used to supplement local knowledge regarding areas worst affected by flooding. Ongoing and proposed flood alleviation schemes planned within the study area are outlined in Section 6.5 and Section 8.6 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

Table 1-1 sets out the contents of the SFRA and how users should use the information provided through the document and appendices.

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.

Sewer flooding incidents are not shown on the mapping as the information is confidential and cannot be used to identify individual properties. Direct consultation with the relevant wastewater company will be required to ascertain if there is any site-specific risk from a public sewer.

1 Introduction

1.1 Purpose of a Strategic Flood Risk Assessment

Southend-on-Sea City Council as the Local Planning Authority (LPA) are responsible for producing a Local Plan, determining planning applications, enforcement in response to breaches of planning control, and supporting neighbourhood planning.

The Council are currently compiling the evidence base to support the development of its new Local Plan which will cover the period up to 2045. The Southend New Local Plan preferred approach with options consultation closed on 30 September 2025. The Regulation 19 consultation is scheduled to take place in September 2026, with submission for independent examination expected by 30 December 2026.

As set out in the NPPF (Paragraph 171) "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."

In 2026, the Council commissioned a new Level 1 Strategic Flood Risk Assessment (SFRA) to reflect the latest legislation and guidance, and to inform the updates to the Southend New Local Plan. This SFRA replaces the previous South Essex Level 1 SFRA, undertaken in 2018, for the Southend-on-Sea City Council area.

1.2 Relevance of the SFRA

The 'How to prepare a Strategic Flood Risk Assessment guidance' (gov.uk) (last updated in August 2025), sets out the requirements that the LPA must address within their SFRA and has been used to undertake this Level 1 SFRA.

This SFRA has been developed using the best available information, supplied at the time of preparation. Appendix A details the information supplied for the preparation of this SFRA. Over time new information will become available to inform planning decisions:

- The EA regularly reviews its hydrology, hydraulic modelling, and flood risk mapping.
- The EA published the new national flood risk mapping (NaFRA2) in early 2025 but further updates and additional datasets are expected later in 2026.
- Other datasets used to inform this SFRA may also be updated periodically and following the publication of this SFRA, new information on flood risk may be provided by Risk Management Authorities (RMAs).

Links have been provided for relevant guidance documents and policies published by other RMAs such as the Lead Local Flood Authority (LLFA) and the Environment Agency (EA). When using the SFRA to prepare FRAs it is important to check that the most up to date information is used.

As the data available for SFRAs and the relevant legislation is continually changing, an SFRA should be updated to reflect changes where applicable and reasonably practicable. Under any changes in guidance or legislation, the implications on the SFRA should be considered and a review undertaken where this is deemed reasonably necessary.

1.3 Levels of SFRA

The PPG: Flood risk and coastal change (gov.uk) identifies two levels of SFRA.

Level 1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. 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 if relevant, or if an LPA believe they may receive high numbers of applications in flood risk areas on sites not identified in the Local Plan. In these circumstances the assessment should consider the detailed nature of the flood characteristics from all sources, both now and in the future.

This report fulfils the requirements of a Level 1 SFRA.

1.4 Local Plan Area

This SFRA covers the unitary authority area of Southend-on-Sea, hereafter referred to as the study area. Southend-on-Sea is a coastal city located in south-eastern Essex, north of the Thames Estuary. The study area encompasses a number of distinct towns and suburbs, including Leigh-on-Sea, Shoeburyness, Eastwood, Prittlewell, Westcliff-on-Sea, Southchurch, Chalkwell, and Thorpe Bay.

Southend-on-Sea is almost exclusively urban and has one of the highest urban densities in England, outside of London. According to data from the Office for National Statistics (planningpolicy.southend.gov.uk), the most densely populated parts fall within Southend Central, Westcliff, and a pocket of higher density within Southchurch. Higher population densities are also found in parts of Leigh-on-Sea, around the District Centre, and in Shoebury. There are several parks and golf courses throughout the study area, and a few areas of greenbelt land, the largest situated in the northeast.

The study area is bordered by two other authorities, shown in Figure 1-1.

- Castle Point Borough
- Rochford District

Wastewater and sewerage services are provided by Anglian Water, and Essex and Suffolk Water is the principal water supplier. Some developments within the study area may be supplied by New Appointment and Variations suppliers. Locations where these companies supply can be found on the UK Parliament website (parliament.uk).

Southend-on-Sea City Council is the LLFA across the entire study area.

Eastwood Brook, Prittle Brook, and Mucking Hall Brook are statutory main rivers within the study area that flow northwards and converge with the River Roach. Prittle Brook also has a culverted flood relief channel that diverts excess flows into the Thames Estuary during flood events. Willingale Brook, a statutory main river, and C-X Ditch, an ordinary watercourse, flow southwards and discharge into the Thames Estuary. The watercourses within the study area are shown in Figure 1-2.

Southend has an extensive coastline influenced by a large tidal range and is bordered by the Thames Estuary to the south and the North Sea to the east. The coastline is characterised by several popular sandy and shingle beaches, such as Shoebury Common, Bell Wharf Beach, and Chalkwell Beach. The southern seafront is urbanised with several tourist attractions and features Southend Pier, which is the world's longest pleasure pier at 2.14km. There are also a number of flood walls and flood gates along the southern and eastern coastlines, for further details see Section 6. The southern coastline is within a Special Protection Area (SPA) named Benfleet and Southend Marshes. This area consists of saltmarshes, mudflats, cockle shell banks, and grassland that are productive habitats for internationally important wintering wildfowl and waders.

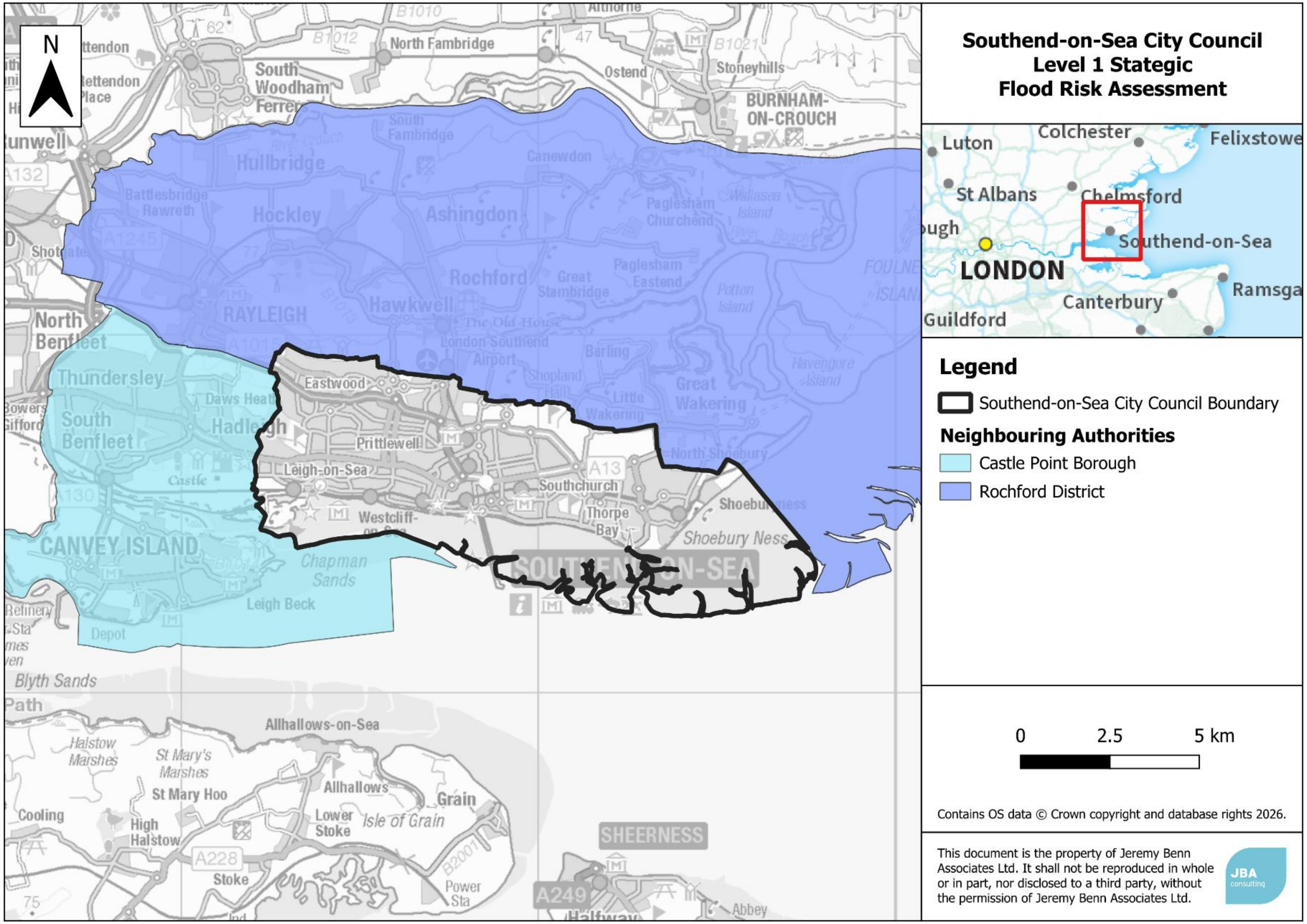


Figure 1-1: Southend-on-Sea authority area and its neighbouring authorities.

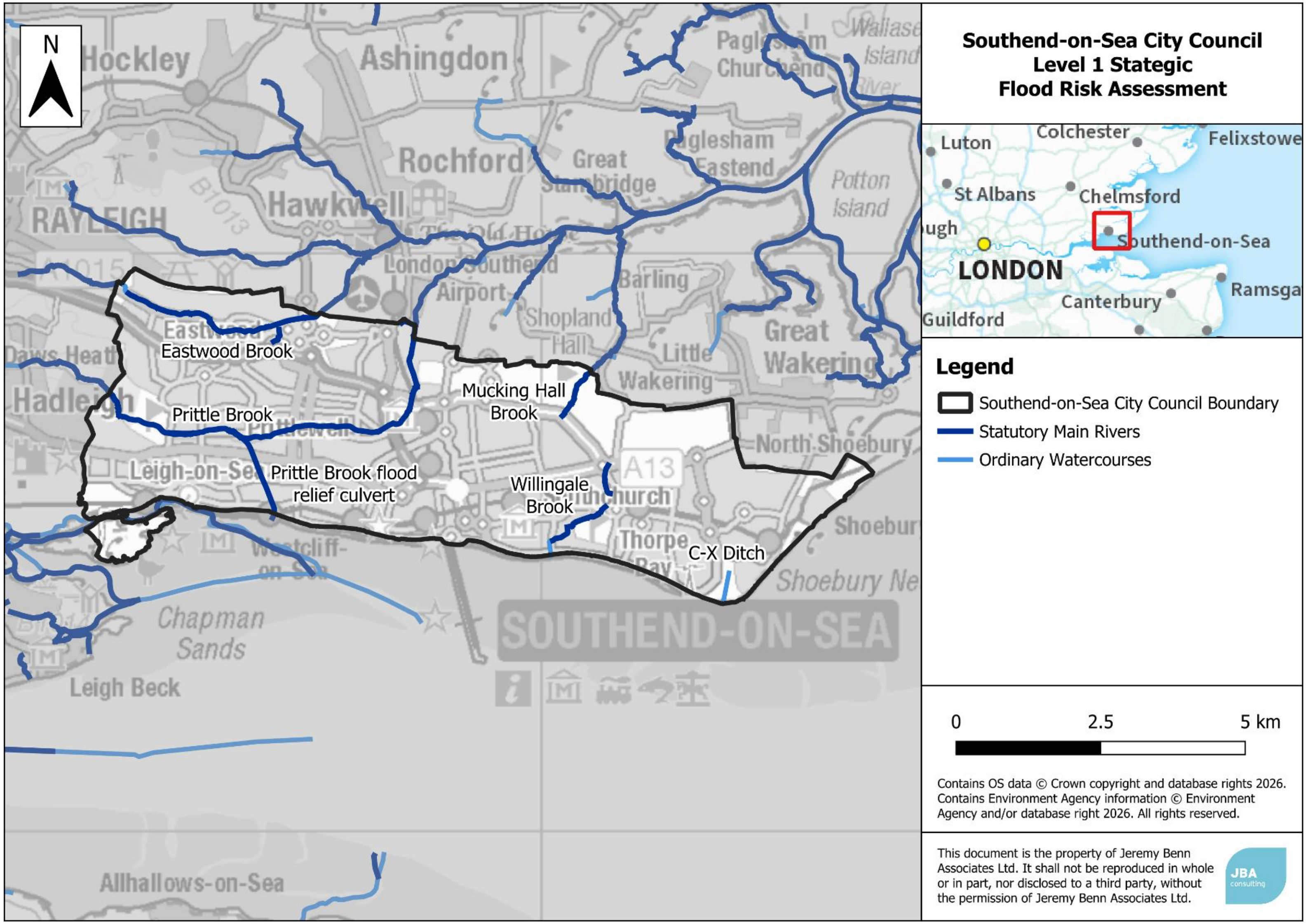


Figure 1-2: Main rivers and ordinary watercourses within the study area.

1.5 Consultation

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

- Southend-on-Sea City Council LLFA
- EA
- Anglian Water

In addition, the following parties were consulted through data requests during the preparation of this SFRA:

- Essex County Council
- Castle Point Borough Council
- Rochford Council
- Essex County Fire and Rescue Service

1.6 Structure of This Report

Table 1-1 sets out the contents and structure of this Level 1 SFRA report and appendices, and how to use each section.

Table 1-1: Report contents and how to use each section.

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, and the Local Plan Area. It also details the organisations involved in the SFRA.	Users should refer to this section for general information and context.
2. Policy and strategy for flood risk management	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. Sequential and Exception Tests	This section provides an overview of national planning policy, application of the sequential approach, and the Sequential/Exception Test process. It provides guidance for the Councils 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	This section introduces the concept of flood risk and provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding incidents and flood risk from all sources, as well as characteristics that influence flood risk including topography, geology and soils.	This section should be used to understand all sources of flood risk across the study area including where has flooded historically.

Section	Contents	How to use
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 risk infrastructure	This section provides a summary of current flood defences and asset management and future planned schemes.	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. Flood risk management requirements for developers	This section contains guidance for developers on FRAs, considering flood risk from all sources, and principles of managing flood risk in developments.	Developers should use this section to understand requirements for FRAs and what conditions/guidance documents should be followed, as well as mitigation options.
8. Principles for site design and master planning	This section contains guidance for developers on principles of managing flood risk in developments through site design and master planning.	Developers should use this section to understand what should be considered within the site design and master planning stages of a development.
9. Surface water management and SuDS	This section provides an overview of Sustainable Drainage Systems (SuDS), including signposting to relevant guidance, as well as guidance for developers on surface water drainage strategies, considering any 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. Flood warning and emergency planning	This section provides an overview of the requirements for Emergency Plans, include any local emergency planning arrangements, and an overview of the available flood alerts and warnings.	Developers should use this section to understand requirements for emergency planning.

Section	Contents	How to use
11. Cumulative Impact Assessment	This section details the Cumulative Impact Assessment (CIA), which identifies which catchments are most likely to be sensitive to increased flood risk as a result of future development.	Planners should use this section to help develop policy recommendations for the cumulative impact of development
12. Strategic flood risk solutions	This section sets out wider strategic solutions that may offer potential to reduce flood risk across the study area, including Natural Flood Management (NFM). It also details current partnership working opportunities within the study area.	Planners should use this section to help develop policy recommendations for strategic flood risk solutions to reduce flood risk across the study area. Developers should use this section to consider options for strategic solutions and NFM techniques.
13. Summary, recommendations and next steps	This section summarises sources of flood risk in the study area and outlines planning policy recommendations. It also sets out the next steps.	Developers and planners should use this as a summary of the SFRA. Developers should refer to the Level 1 SFRA recommendations when considering site specific assessments.
Appendix A	Details the data used to inform the SFRA, including when the data was provided, any associated licensing, and where the data can be obtained from.	Planners and developers should use this appendix to understand what data has been used in the SFRA, whether it has since been updated, and where to access the latest data from.
Appendix B	Sets out the methodology for the Sequential Test, including how each source of flood risk should be considered.	Planners should use this appendix to inform the application of the Sequential Test.
Appendix C - K	Provides the flood risk mapping for the SFRA with an accompanying user guide detailing the information shown within the mapping.	Planners and developers should use these maps to identify key areas of flood risk from different sources.

2 Policy and Strategy for Flood Risk Management

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

There are different organisations in and around the study area 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 RMAs is available in Annex A of the National Flood and Coastal Erosion Risk Management Strategy (FCERM) (gov.uk) for England. The Local Government Association (gov.uk) also provide further information on the roles and responsibilities for managing flood risk.

The National flood risk standing advice for local planning authorities (gov.uk) provides advice on when to consult the EA.

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, and general supervision	Main River (e.g., Prittle Brook and Eastwood Brook) 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
Southend-on-Sea City Council 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
Southend-on-Sea City Council as the Coastal Protection Authority	Responsible for developing a Shoreline Management Plan (SMP)	Carrying out coast protection work (including constructing and maintaining works)	Non-statutory consultee for major developments

Risk Management Authority	Strategic Level	Operational Level	Planning role
Anglian Water	Asset Management Plans, supported by Periodic Reviews (business cases), develop Drainage and Wastewater Management Plans (DWMPs)	Public sewers and some reservoirs	Non-statutory consultee
Highways Authorities - National Highways for motorways and trunk roads and Southend-on-Sea City Council for non-trunk roads	Highway drainage policy and planning	Highway drainage	Statutory consultee regarding highways design standards and adoptions

2.1.1 Riparian Ownership

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' (gov.uk).

While riparian owners have a right to protect their property and are responsible for maintaining the section of watercourse they own, many works on or near a watercourse require a Flood Risk Activity Permit (gov.uk), for Main Rivers, or Ordinary Watercourse Consent (southend.gov.uk) for an ordinary watercourse.

When it comes to undertaking works to reduce flood risk, the EA, and Southend-on-Sea City Council 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 Key Legislation for Flood and Water Management in the Study Area

2.2.1 Flood and Water Management Act (2010)

The Flood and Water Management Act (2010) (gov.uk) was passed in April 2010 following the recommendations made within the Pitt Review (2009) following the flooding in 2007. It aims to create a simpler and more effective means of managing both flood risk and coastal erosion, establishing the 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.

2.2.2 Water Framework Directive (2000)

The European Water Framework Directive (WFD) (2000) was transposed into English Law by the Water Environment Regulations (2017) (gov.uk). The WFD aims to deliver improvements across Europe in the management of water quality and water resources. This is enforced through a series of plans called River Basin Management Plans (RBMPs). The study area falls within the Anglian RBMP (gov.uk).

2.2.3 Environmental Permitting

The Environmental Permitting Regulations (2016) (gov.uk) sets out where developers will need to apply for additional permission (as well as planning permission) to undertake works to a Main River. This includes flood risk activities, for example:

- On or within 8 metres of a non-tidal main river and on or within 16 metres of a tidal main river.
- On or within 8 metres of a non-tidal flood defence structure or culvert and on or within 16 metres of a tidal flood defence structure or culvert.
- Involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert; and
- In a floodplain more than 8 metres from the riverbank, culvert or flood defence structure and you don't already have Planning Permission.

Environmental permits may also be required from the EA to discharge runoff, trade effluent or sewage into a main river. They may also be required in relation to groundwater activities, where there may be a risk of groundwater contamination.

The Land Drainage Act (1991) (gov.uk) sets out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an Ordinary Watercourse. The Council have published advice on their website about making changes to watercourses (southend.gov.uk).

2.2.4 Byelaws

Land Drainage Byelaws outline legal obligations and responsibilities when undertaking works on or close to a watercourse, for the purpose of preventing flooding, or mitigating any damage caused by flooding.

The study area is covered by the Anglian region flood defence and land drainage byelaws (gov.uk), enforced by the EA. These byelaws apply to activities around main rivers, flood defences and floodplains.

2.2.5 Additional Legislation

Additional legislation relevant to development and flood risk in the study area include:

- Town and Country Planning Act (1990) (gov.uk), Water Industry Act (1991) (gov.uk), Land Drainage Act (1991) (gov.uk), Environment Act (1995) (gov.uk), which set out the regulations for development on land in England and Wales.
- The Environment Act 2021 (gov.uk) requires developers to provide Biodiversity Net Gain (BNG) and for LPAs to develop Local Nature Recovery Strategies. Strategic site allocations in Local Plans which present opportunities for BNG or areas for habitat improvement/creation identified by the Local Nature Recovery Strategies could have parallel opportunities to contribute to reduced flood risk from a range of sources.
- Other environmental legislation such as the Habitats Directive (1992) (gov.uk), Environmental Impact Assessment Directive (2014) (gov.uk), and The Environmental Assessment of Plans and Programmes (Amendment) Regulations 2020 (gov.uk) which apply as appropriate to strategic and site-specific developments to guard against environmental damage.
- The Planning and Compulsory Purchase Act (2004) (gov.uk) Section 19(1A) which requires LPAs to include in their Local Plans 'policies designed to secure that the development and use of land in the local planning authority's area contribute to the mitigation of, and adaptation to, climate change.'
- The Planning and Infrastructure Act 2025 (gov.uk) which aims to speed up and streamline the delivery of new homes and critical infrastructure through delivering a faster and more certain consenting process for critical infrastructure, introducing a more strategic approach to nature recovery, improving certainty and decision-making in the planning systems, unlocking land and securing public value for large scale investment, and introducing effective new mechanisms for cross-boundary strategic planning.

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 the study area.
- 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. Any requests for access to these documents should be directed to their respective authors.

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

Policy level	Document, lead author and date	Contextual information	Policy and measures	Development design requirements	Next update due
National	Flood and Coastal Management Strategy (EA) 2020 (gov.uk)	Yes	Yes	No	2026
National	National Planning Policy Framework updated in December 2024 (gov.uk)	Yes	Yes	Yes	-
National	Planning Practice Guidance (PPG): Flood risk and coastal change (gov.uk) updated in September 2025	Yes	Yes	Yes	-
National	Building Regulations Part H (MHCLG) 2010 (gov.uk)	Yes	No	Yes	-
National	National standards for sustainable drainage systems (SuDS)	Yes	No	No	-
National	South East Marine Plan (gov.uk)	Yes	Yes	No	-
Regional	South Essex Catchment Flood Management Plan (EA) 2009 (gov.uk)	Yes	Yes	No	-
Regional	Anglian River Basin District River Management Plan (EA) 2022 (gov.uk)	Yes	Yes	No	2028
Regional	Anglian River Basin District Flood Risk Management Plan (EA) 2022 (gov.uk)	Yes	Yes	No	-
Regional	Anglian Water Water Resources Management Plan (anglianwater.co.uk)	Yes	No	No	-
Regional	Anglian Water Drainage and Wastewater Management Plan (anglianwater.co.uk)	Yes	No	No	-
Regional	Climate change guidance for development and flood risk (EA) last updated May 2022 (gov.uk)	Yes	No	Yes	-
Regional	Essex and South Suffolk Shoreline Management Plan 8 (environment.data.gov.uk)	Yes	Yes	No	-

Policy level	Document, lead author and date	Contextual information	Policy and measures	Development design requirements	Next update due
Local	Southend-on-Sea Borough Council Preliminary Flood Risk Assessment (2011) (webarchive.nationalarchives.gov.uk)	Yes	No	No	-
Local	Southend-on-Sea Borough Council Preliminary Flood Risk Assessment Addendum (2017) (gov.uk)	Yes	No	No	-
Local	Southend-on-Sea Local Flood Risk Management Strategy 2015 (southend.gov.uk)	Yes	Yes	No	-
Local	Southend-on-Sea Surface Water Management Plan 2015 (southend.gov.uk)	Yes	Yes	No	-
Local	The SuDS Design Guide for Essex 2020 (essexdesignguide.co.uk)	Yes	No	Yes	-
Local	Essex Thames Gateway Water Cycle Study 2009 (planningpolicy.southend.gov.uk)	Yes	Yes	No	-

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

The National Flood and Coastal Erosion Risk Management Strategy for England (gov.uk) provides the overarching framework for future action by all RMAs to tackle flooding and coastal erosion in England. 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.

The Strategy was laid before parliament in July 2020 for formal adoption and published alongside a Policy Statement for Flood and Coastal Erosion Risk Management (gov.uk).

The EA is expected to update the National Strategy in 2026, with a focus on resilience and adaptation over the coming years. It is anticipated this will take the form of a review of the existing strategy, rather than a full replacement. It is important that the content of the SFRA is reviewed once the Strategy update is published so that changes in approach are captured in the delivery of the Local Plan.

2.3.2 National Planning Policy Framework and Planning Practice Guidance

The National Planning Policy Framework (NPPF), last updated in December 2024, sets out the Government's planning policies for England and how these should be applied. The National Planning Practice Guidance (PPG) adds further context to the NPPF and should be used in conjunction. The PPG is also a material consideration when taking decisions on planning applications.

At the time of writing, a consultation (gov.uk) has recently been completed on the proposed reforms and further changes to the NPPF and the government are currently analysing the feedback. The draft consultation version contains amendments to the structure of the NPPF, in addition to changes to reflect the recent updates to the PPG.

2.3.3 South East Marine Plan

There are 11 marine plan areas across England, and each has a marine plan in place, some of which cover multiple areas. The Marine Management Organisation (MMO) is responsible for preparing the marine plans. The marine plan sets out priorities and directions for future development within the plan and helps marine users understand the best locations for their activities including where new developments may be appropriate.

The study area lies within the south east inshore marine plan area and is covered by the South East Marine Plan. Further information on the plan policies and guidance can be found on the Marine Plans Explorer (gov.uk).

2.3.4 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.

There are six pre-defined national policies provided in the CFMP guidance, and these are applied to specific locations through the identification of 'Policy Units'. These policies are intended to cover the full range of long-term flood risk management options that can be applied to different locations in the catchment.

The Local Plan area is covered by the South Essex CFMP (gov.uk).

2.3.5 Preliminary Flood Risk Assessment and Flood Risk Management Plans

The Flood Risk Regulations (FRRs) 2009 transposed the European Union (EU) Floods Directive into UK law setting the requirement for Member States to complete an assessment of flood risk, known in England as a Preliminary Flood Risk Assessment (PFRA). This information was then used to identify areas where there is a significant risk of flooding (Flood Risk Areas), where States had to undertake Flood Risk and Hazard Mapping and produce Flood Risk Management Plans. This cycle was repeated on a six-yearly basis.

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 FRRs 2009 which transposed the EU Floods Directive into legislation. This is because much of the FRRs duplicated existing domestic legislation, namely the Flood and Water Management Act 2010.

The Government expects to see continued implementation of the Flood Risk Management Plans 2021-2027, with funding for this still in place over the six-year period.

Southend-on-Sea is included within the South Essex Flood Risk Area. This area was identified in the 2011 PFRA and remained for the FRRs second planning cycle according to the Southend-on-Sea Borough Council PFRA Addendum (2017) (gov.uk).

The study area lies within the South Essex Catchment Flood Risk Management Plan and the Anglian River Basin Flood Risk Management Plan. The objectives and measures for the second cycle Flood Risk Management Plans 2021-2027 are available on the Flood Plan Explorer (gov.uk).

2.3.6 Drainage and Wastewater Management Plans

Water and sewage companies must produce a Drainage and Wastewater Management Plan (DWMP), covering a minimum of 25 years, which looks at current and future capacity, pressures, and risks to their networks such as climate change and population growth. They detail how a company plans to work with RMAs and drainage asset owners to manage future pressures. The company providing wastewater and sewerage services for the study area is Anglian Water.

Anglian Water's first 'Cycle 1' DWMP (anglianwater.co.uk) was published in May 2023, setting out how their wastewater systems and drainage networks will be maintained and extended over the next 25 years. The DWMP's main objectives are to strengthen drought and flood resilience, support sustainable economic and housing growth, achieve carbon neutrality by 2030, and work collaboratively to enhance ecological quality.

As a part of the plan, Anglian Water undertook Baseline Risk and Vulnerability Assessments, supporting the review of growth and climate change impacts including against storm overflow performance, internal and external sewer flooding, and the risk of flooding in a 1 in 50 year storm. The assessments identified increased risk of flooding as one of the highest threats to the region. Anglian Water's medium-term strategy (by 2035) for Southend is to increase the network capacity, with a longer term focus (by 2050) of a 25% infiltration reduction.

2.3.7 Climate Change Guidance

The EA Flood risk assessments: climate change allowances guidance (gov.uk) provides guidance for LPAs, developers, and their agents on how climate change allowances should be applied in flood risk assessments. Climate change allowances and guidance specific to the study area are detailed in Section 5.

2.3.8 Local Flood Risk Management Strategy

Local Flood Risk Management Strategies (LFRMS) set out how the LLFA will manage local flood risk i.e. surface water runoff, groundwater, and ordinary watercourses, for which they have a responsibility as LLFA and the work that other RMAs are doing to manage flood risk across the study area.

The Southend-on-Sea Local Flood Risk Management Strategy (southend.gov.uk) was published in November 2015 and has six key objectives that set out how flood risk will be reduced and managed:

- Improve understanding of flood risk including likely effects of climate change.
- Encourage future development to provide a betterment to flood risk.
- Pursue flood risk management measures using a risk based approach that provide multiple social, economic and environmental benefits to the borough.
- Raise awareness of flood risk and available management measures to communities, residents and businesses.
- Use knowledge of flooding to inform the emergency response.
- Continue to manage local flood risk and coastal flooding and erosion.

2.3.9 Policy and Guidance for SuDS

The 2024 NPPF states that: 'Applications which could affect drainage on or around the site should incorporate sustainable drainage systems to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal.' (Paragraph 182) 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 181).

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

- SuDS Manual (C753) (ciria.org), published in 2007 and updated in 2015.
- Defra National standards for sustainable drainage systems (SuDS) (gov.uk), June 2025.
- Building Regulations Part H (MHCLG) (gov.uk), 2010.
- The SuDS Design Guide for Essex 2020 (essexdesignguide.co.uk)

Further information on SuDS requirements and design considerations can be found in Section 9.

2.3.10 Water Cycle Studies

Water Cycle Studies (WCSs) 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.

Wallingford HydroSolutions has been commissioned by Southend-on-Sea City Council to undertake a WCS to support the council's emerging Local Plan 2025-2045. Southend Water Recycling Centre (WRC) is forecast to have sufficient treatment capacity throughout the plan period under all growth scenarios assessed. Rochford WRC is forecast to exceed its permitted DWF by the end of the plan period, although this is largely driven by growth within Rochford District. The only Local Plan site expected to drain to Rochford WRC is Airport Business Park (EA051), which is anticipated to be largely completed before capacity constraints arise.

Prior to this, the Essex Thames Gateway WCS Scoping report (planningpolicy.southend.gov.uk) was published in 2009. This is a joint study by Southend-on-Sea City Council (previously Borough Council), Essex County Council, Rochford District Council, Castle Point Borough Council, and Basildon Borough Council (previously District Council). Following the publication of the initial scoping study, at the time Southend-on-Sea City Council did not progress to the outline WCS with the other authorities, as its Core Strategy had already been adopted.

2.3.11 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location and establish a long-term action plan to manage surface water in a particular area. They are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning, and future developments.

Southend-on-Sea City Council's SWMP (southend.gov.uk) was published in November 2015 and was used to inform the Southend-on-Sea LFRMS and Flood Risk Management Plan. The analysis included in this SWMP shows that 3,100 residential properties could be at risk of surface water flooding in a 1% Annual Exceedance Probability (AEP) event, and 10,200 properties could be at risk in a 0.1% AEP event. An assessment of flood risk from groundwater, sewers, and ordinary watercourses were also undertaken as part of this SWMP. The areas identified to be at more significant risk were delineated into six Critical Drainage Areas (CDAs), which are discussed further in Section 9.5.4.

2.3.12 Shoreline Management Plans

Shoreline Management Plans (SMPs) form part of Defra's strategy for flood and coastal defence. They provide a large-scale assessment of risks associated with coastal evolution and present the policy framework to address these risks in a sustainable manner. The SMP policies defined by Defra are:

- **Hold the line** - maintain or upgrade protection from flooding or erosion by holding the shoreline in broadly the same position
- **No active intervention** - maintain or encourage a more natural coastline, which may involve discussing adaptation to the risk from flooding or erosion
- **Managed realignment** - change the position of the shoreline in a controlled way, such as by slowing erosion or creating areas of habitat to help manage flooding
- **Advance the line** - actively move shoreline defences significantly seawards

The SMPs set short (0 to 20 years), medium (20 to 50 years), and long term (50 to 100 years) coastal management policies for the next 100 years for specific lengths of coastline. Not all policies are guaranteed funding and over time the EA along with other partners will identify the cost.

The SMPs are currently undergoing a refresh due to changes in evidence, guidance, and policy since they were initially approved in 2016. The refresh aims to:

- Provide guidance on how SMPs can incorporate new knowledge, legislation, and guidance.
- Improve overall quality, deliverability, and consistent application of key principles across SMPs but recognising local nuances.
- Ensure SMPs remain technically robust but adaptable to future change.
- Promote the principle that SMPs should be ‘living’ and provide a clearly defined route-map with actions to be ‘epoch-2 ready’ (epoch 2 is roughly from 2030) and enable delivery of the policies over the coming decades.

The study area lies within the Essex and South Suffolk SMP 8 (environment.data.gov.uk) and falls within Management Unit J. The policy for the study area's coastline is to continue the current management approach, which is to 'Hold the Line' in the short, medium, and long term.

2.3.13 Neighbourhood Plans

A neighbourhood plan is a document produced by a local community that sets out planning policies for their area and can be used to:

- Protect local green spaces;
- Encourage better designed places;
- Bring forward housing that meets local needs.

Neighbourhood planning groups can use the information in this SFRA to assess the risk of flooding to sites within their community. The government has also published guidance on neighbourhood planning (gov.uk), explaining the neighbourhood planning system and considerations required.

There are currently no neighbourhood plans covering the study area.

3 Sequential and Exception Tests

This section summaries national planning policy for development and flood risk and the application of the Sequential and Exceptions Tests for both planners and developers.

3.1 National Planning Policy Framework and Guidance

The NPPF (December 2024) (gov.uk) sets out the Government's planning policies for England. 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 171).

The Flood Risk and Coastal Change PPG (gov.uk), last updated September 2025, sets out how the policy should be implemented. Diagram 1 in the PPG (Paragraph: 007 Reference ID: 7-007-20220825) sets out how flood risk should be considered in the preparation of Local Plans.

3.2 The Sequential Test

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. Figure 3-1 summarises the Sequential Test. The LPA will apply the Sequential Test to Local Plan allocations. A Sequential Test Dataset Guidance document can be found in Appendix B.

As set out in the Preparing a Flood Risk Assessment Standing Advice for all other developments, evidence must be supplied to the LPA, with a planning application, that the development has passed the test if any proposed building, access and escape route, land-raising or other vulnerable element will be:

- In Flood Zone 2 or 3;
- in Flood Zone 3b and your development is not incompatible;
- within Flood Zone 1 and the Flood Map for Planning (FMfP) shows it is at increased risk of flooding from rivers or sea during its lifetime;
- within Flood Zone 1 and the FMfP shows it is at risk of flooding from surface water;
- within Flood Zone 1 and the SFRA shows it will be at increased risk of flooding during its lifetime; or
- subject to sources of flooding other than rivers or sea.

The requirements for developers are set out in the FRA Standing Advice (gov.uk).

The LPA should 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/Employment Land Availability Assessments.

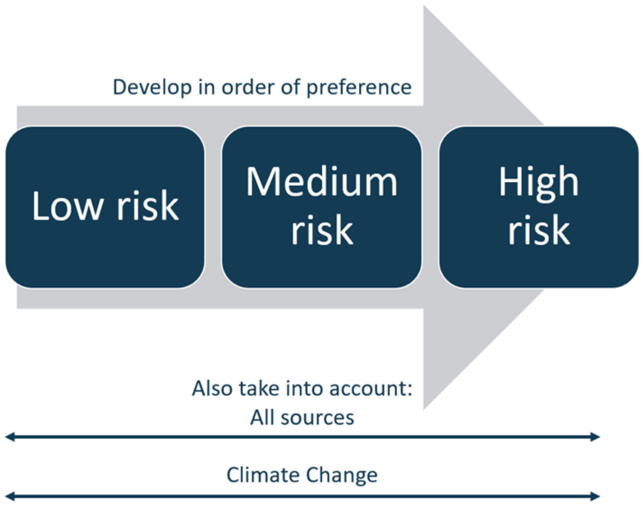


Figure 3-1: The Sequential Test.

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 (gov.uk) (Paragraph: 079 Reference ID: 7-079-20220825) shows whether, having applied the Sequential Test first, the vulnerability of development is not compatible with a particular Flood Zone and where the Exception Test is required to determine the suitability of that vulnerability of development to the Flood Zone.

Figure 3-2 illustrates the Sequential Test as a process flow diagram using the information contained in this SFRA to assess potential development sites against areas of flood risk 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. Appendix B addresses the use of flood risk information in the performance of the Sequential Test.

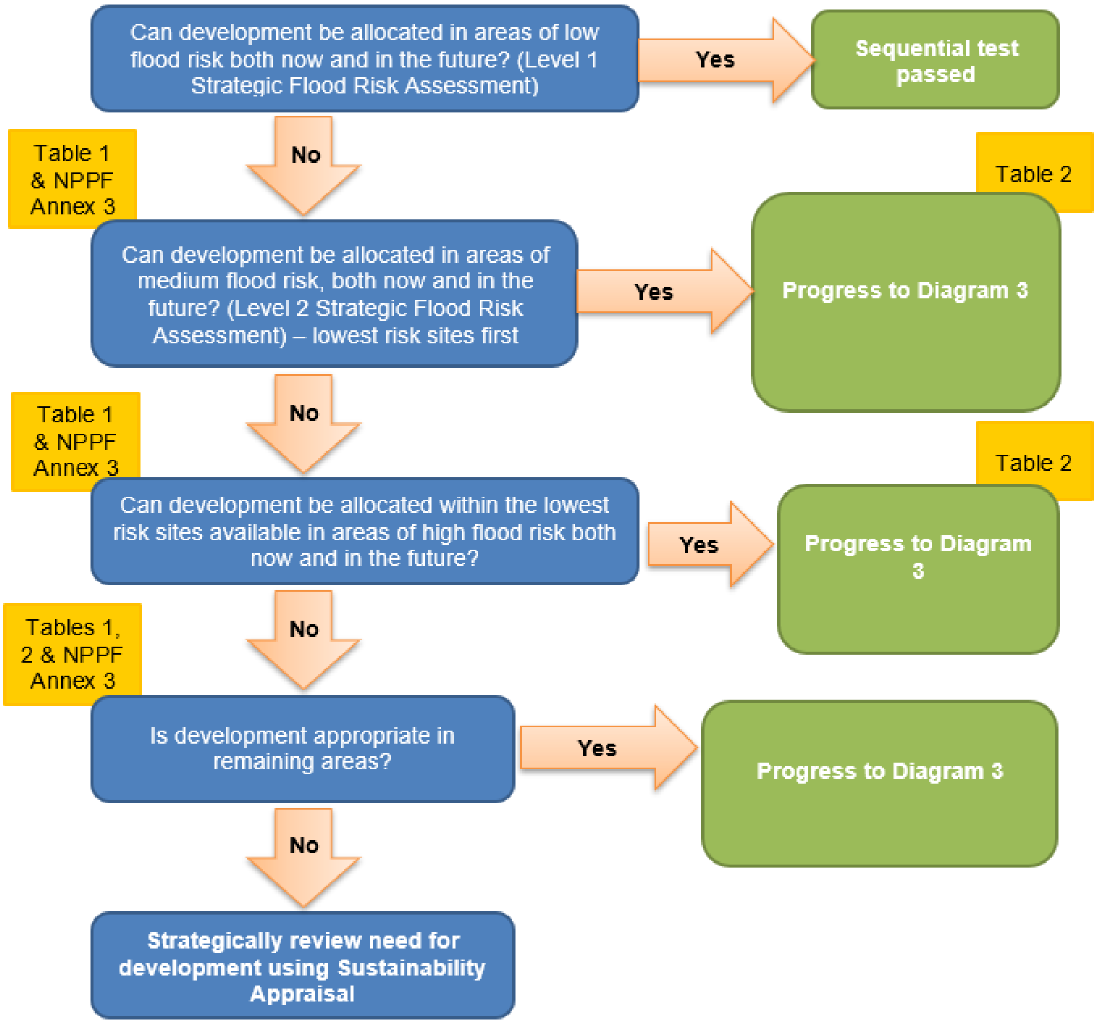


Diagram 2 of PPG: Flood Risk and Coastal Change (paragraph 026, Reference ID 7-026-20220825) Revised August 2022.

Figure 3-2: Application of the Sequential Test for plan preparation.

3.2.1 The Risk-Based Approach

Paragraph 172 of the NPPF states that *"All plans should apply a sequential, risk-based approach to the location of development – taking into account **all sources of flood risk** and the **current and future impacts of climate change** – so as to avoid, where possible, flood risk to people and property".*

Appropriate mapping should be prepared for the sequential test to enable logical comparison of the flood risk from different sources at alternative locations, both now and in the future, as this is fundamental to establishing a logical "risk sequence".

Appendix B describes the implications of including different sources of flooding both now and in the future in the Sequential Test. It also highlights matters to be considered, including certain circumstances where the Sequential Test would not be required, and identifies a preferred approach.

3.3 The Exception Test

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. Diagram 3 of the PPG (gov.uk) (Paragraph: 033 Reference ID: 7-033-20220825) summarises the Exception Test (Figure 3-3).

Table 2 of the PPG (gov.uk) sets out the requirements for the Exception Test but does not reflect the need to avoid flood risk from sources other than rivers and the sea. There is no guidance on how to consider other sources of flood risk. The Exception Test should only be applied, following the application of the Sequential Test, in the following instances:

- 'Essential infrastructure' in Flood Zone 3a or 3b.
- 'Highly vulnerable' development in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b).
- 'More vulnerable' development in Flood Zone 3a (this is NOT permitted in Flood Zone 3b).

While the Exception Test is not explicitly required for sites at risk from other sources of flooding, the LPA should follow a similar principle where sites are proposed that are at risk from other sources of flooding, carefully weighing up the wider benefits of development against the risk, ensuring that site users can be kept safe through the lifetime of the development and ensuring residual risk can be safely managed.

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.

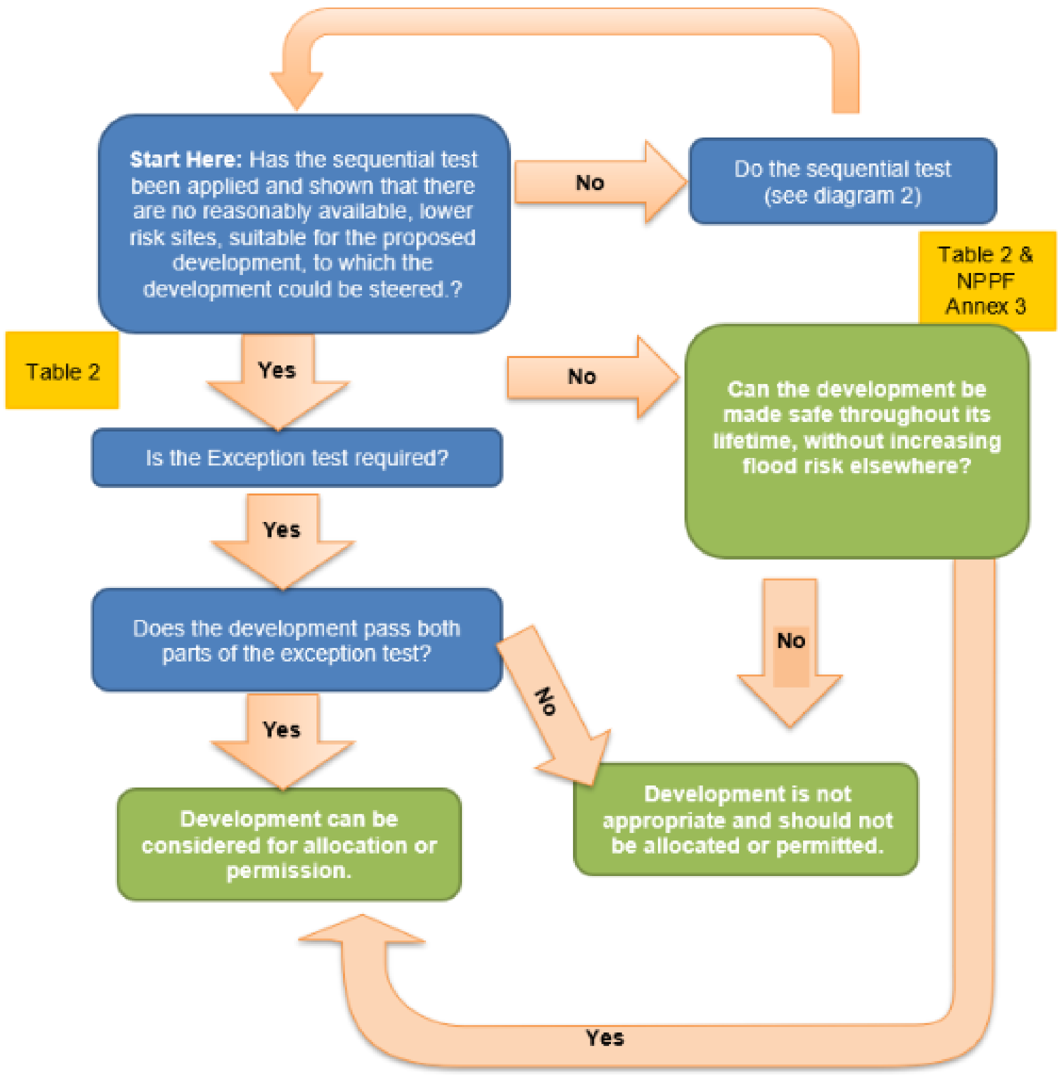


Diagram 3 of PPG: Flood Risk and Coastal Change (paragraph 033, Reference ID 7-033-20220825) Revised August 2022.

Figure 3-3: Application of the Exception Test to plan preparation.

There are two parts to demonstrating a development passes the Exception Test that should be considered by the LPA when allocating development sites, and developers when required (see Section 3.4.2 for Exception Test requirements for individual planning applications).

Part A: Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.

The LPA will need to set out the criteria used to assess the Exception Test and provide clear advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, 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.

Wider sustainability objectives should be considered, such as those set out in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, Green Infrastructure (GI), housing, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

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

Part B: 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 undefended and residual risk and how this will be managed over the lifetime of the development.

3.4 Applying the Sequential Test and Exception Test to Individual Planning Applications

3.4.1 Applying the Sequential Test

The LPA are responsible for considering the extent to which Sequential Test considerations have been satisfied.

Developers should consult with the LPA in the first instance before commencing on a site-specific FRA to determine the Sequential Test requirements for their site. 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, groundwater, reservoir, sewer flooding).

It should also be noted that residential sub-divisions are exempted from the definition of minor development and therefore, by default, should also be subject to the Sequential Test.

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. Following the September 2025 update to the PPG a proportionate approach should be taken in applying the Sequential Test in areas of surface water flood risk. Where a site-specific flood risk assessment demonstrates clearly that the proposed layout, design, and mitigation measures would ensure that occupiers and users would remain safe from current and future surface water flood risk for the lifetime of the development (therefore addressing the risks identified e.g. by the EA flood risk mapping), without increasing flood risk elsewhere, then the Sequential Test need not be applied.

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 but is not restricted to:

- 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.

3.4.2 Applying the Exception Test

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.

For developments that have not been allocated in the Local Plan or where the Sequential Test was not applied at the development plan stage and new information becomes available that identifies a flood risk, developers must undertake the Sequential and Exception Tests 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.

The applicant will need to provide information that the application can pass both parts of the Exception Test.

4 Understanding Flood Risk

This section explores what flood risk is, key sources of flooding in the study area, and the factors that affect flooding including topography, soils, and geology.

This is a strategic summary of the risk in the study area to inform the application of the Sequential and Exceptions Tests. 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. Information in this section should not be used to inform flood risk at a property-level.

4.1 Defining Flood Risk

Part 1 of the Flood and Water Management Act 2010 (FWMA) (gov.uk) defines the risk of a potentially harmful event (such as flooding) as:

'a risk in respect of an occurrence assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences.'

Figure 4-1 sets out this definition of risk.

Figure 4-1: Conceptual model depicting how risk can be defined.

4.1.1 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% AEP 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.

4.1.2 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).

4.1.3 Source-Pathway-Receptor Model

Flood risk can be assessed using the Source-Pathway-Receptor model (Figure 4-2) where:

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

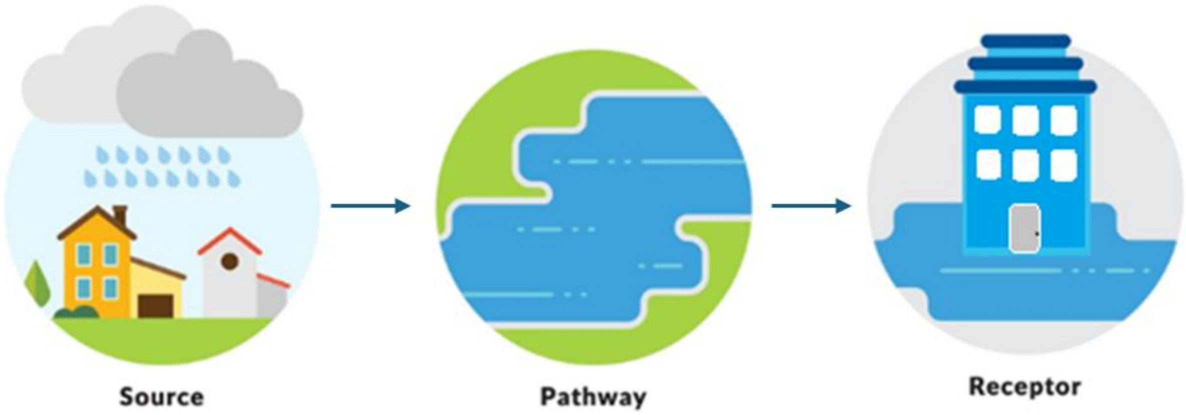


Figure 4-2: Source-Pathway-Receptor model.

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.

4.2 Topography, Geology, and Soils

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

The National LIDAR Programme (gov.uk) provides elevation data at 1m spatial resolution for all of England. Figure 4-3 shows the topography of the study area. Generally, higher ground is located in the west and slopes downwards towards the east.

In the central western area, elevated land encompasses Belfairs Park and Golf Course and extends eastwards towards St Thomas More High School. In the northwest of the study area, higher ground lies between Rayleigh Road and the northern boundary. The residential streets in the southwest of the study area are also situated on higher ground, with a band of elevated land sloping eastwards through Westcliff-on-Sea towards the centre of Southend-on-Sea. The highest point in the study area is 62.4 mAOD and is located at the western boundary near Woodside.

Lower-lying areas, where the elevation is generally below 10 mAOD, are found in North Shoebury, Shoeburyness, and in the south of Southchurch. The topography is also lower in the north of the study area around London Southend Airport. The study area is bordered by the Thames Estuary in the south and the North Sea in the east, and lower ground extends along the entire seafront. The minimum elevation is below sea level at -0.2 mAOD by Genting Casio on Western Esplanade.

4.2.2 Geology

Bedrock geology for the majority of the study area is London Clay Formation comprised of clay, silt, and sand. Several areas in the western part of the study area are underlain by Claygate Member, also comprised of clay, silt, and sand. Overall, this bedrock geology is likely to exhibit highly variable permeability.

Part of the study area is underlain by river terrace deposits comprising of sand and gravel. This includes parts of Shoeburyness, North Shoebury, central Southend-on-Sea up to London Southend Airport, and parts of the west of the study area. There are tidal flat deposits, comprised of clay and silt, along areas near the shore as well as in the north by the airport. Parts of the centre and west of the study area are underlain by head, comprising of clay and silt, with some areas also including sand and gravel.

A map detailing the extents of this bedrock and further superficial geology across the study area can be viewed online in the British Geology Society Geology Viewer (bgs.ac.uk).

The EA also provides mapping of different types of aquifers, 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. There are no principal aquifers in the study area. There are a few areas by the western border where there is a 'Secondary A' aquifer designation. These comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers. However, the majority of the study area is underlain by unproductive strata that are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them. The aquifer designations across the study area for bedrock geology are shown in Figure 4-4.

4.2.3 Soils

Part of the centre and east of the study area is underlain by freely draining slightly acid loamy soils. Slightly acid loamy and clayey soils with impeded drainage are found in most of the west of the study area. Along parts of the coast, including by Two Tree Island, Southchurch Park, Gunners Park, and the land around Boyce Road, there are loamy and clayey soils of coastal flats with naturally high groundwater. Surrounding Gunners Park to the north are loamy soils with naturally high groundwater.

In the west of the study area, along the northwest boundary as well as between Belton Way West and Marine Parade in the southwest, there are slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. The area between Belfairs Park Drive and Hickling Close by the western boundary is underlain by slowly permeable seasonally wet acid loamy and clayey soils, which have impeded drainage. There are also slightly acid loamy and clayey soils with impeded drainage in a small area by Olive Avenue by the western boundary. There are saltmarsh soils surrounding Two Tree Island in the southwest of the study area.

Overall, there are numerous areas where soils are seasonally wet or with naturally high groundwater. These areas are likely to have reduced permeability, which may impact potential infiltration and would need to be considered within any SuDS design (see Section 9 for further information on SuDS). Soils across the study area are shown in Figure 4-5. The British Geological Survey website (bgs.ac.uk) provides data on soils across the study area.

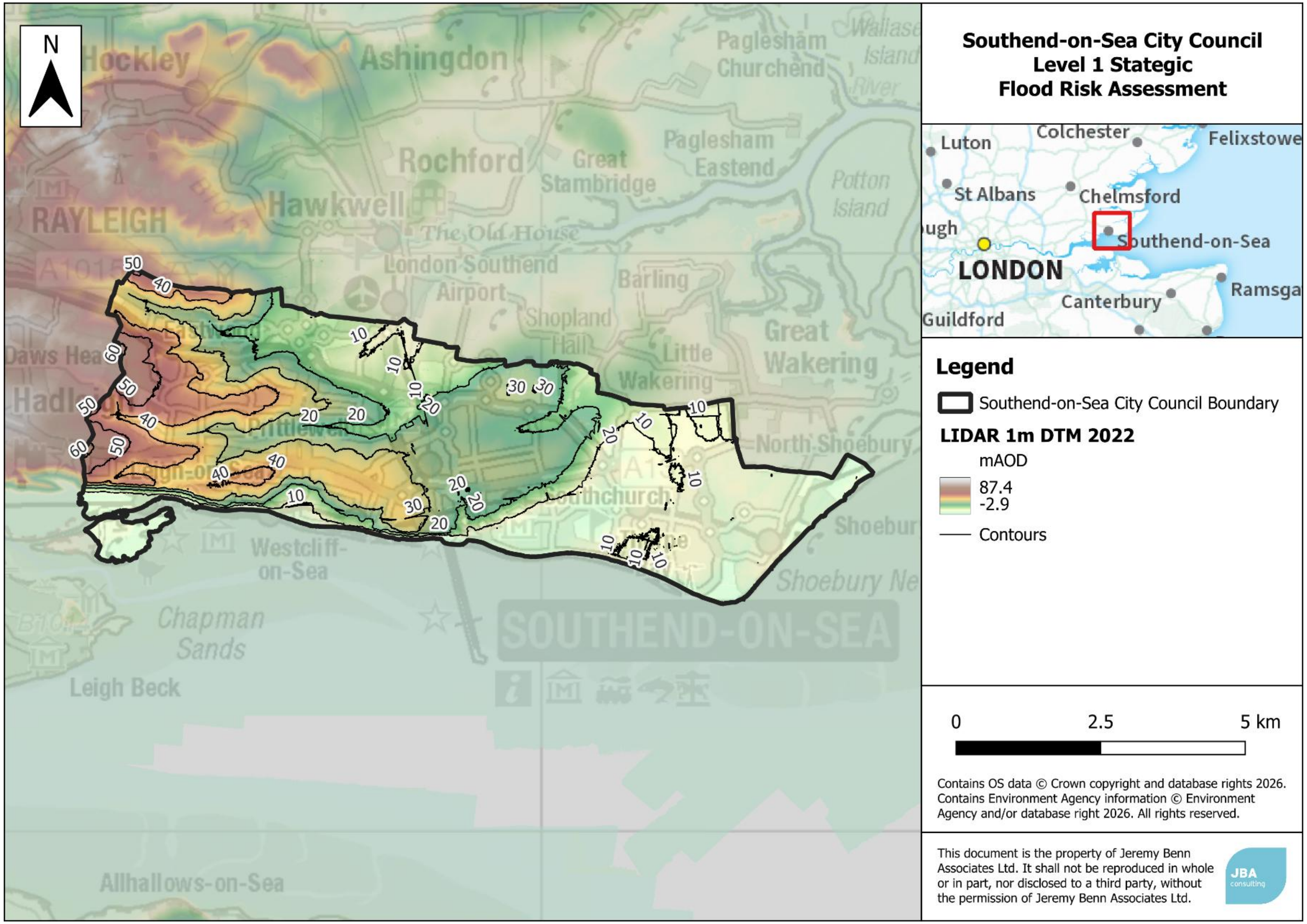


Figure 4-3: EA 1m LiDAR data showing the topography across the study area.

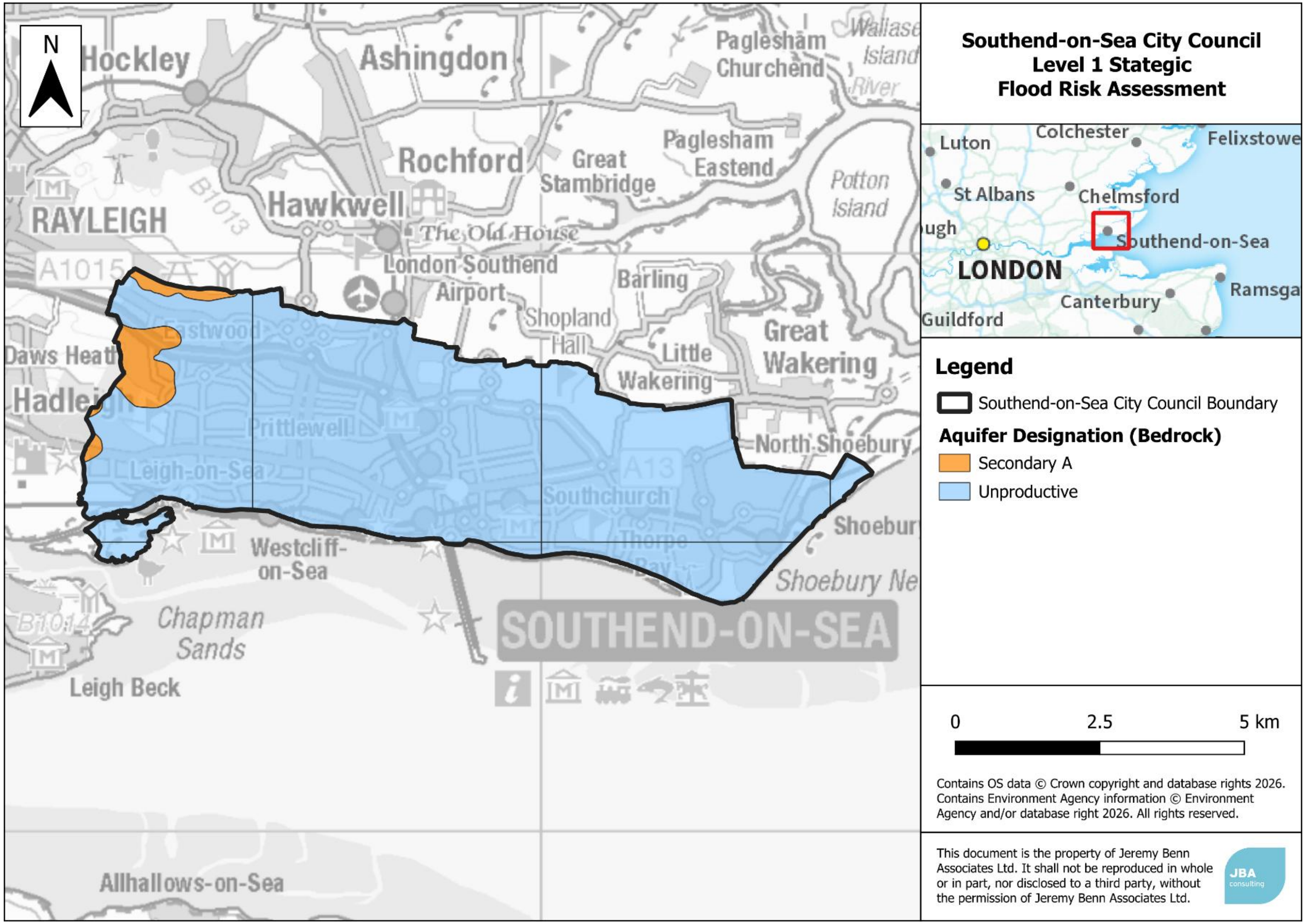


Figure 4-4: Aquifer designations based on bedrock geology across the study area.

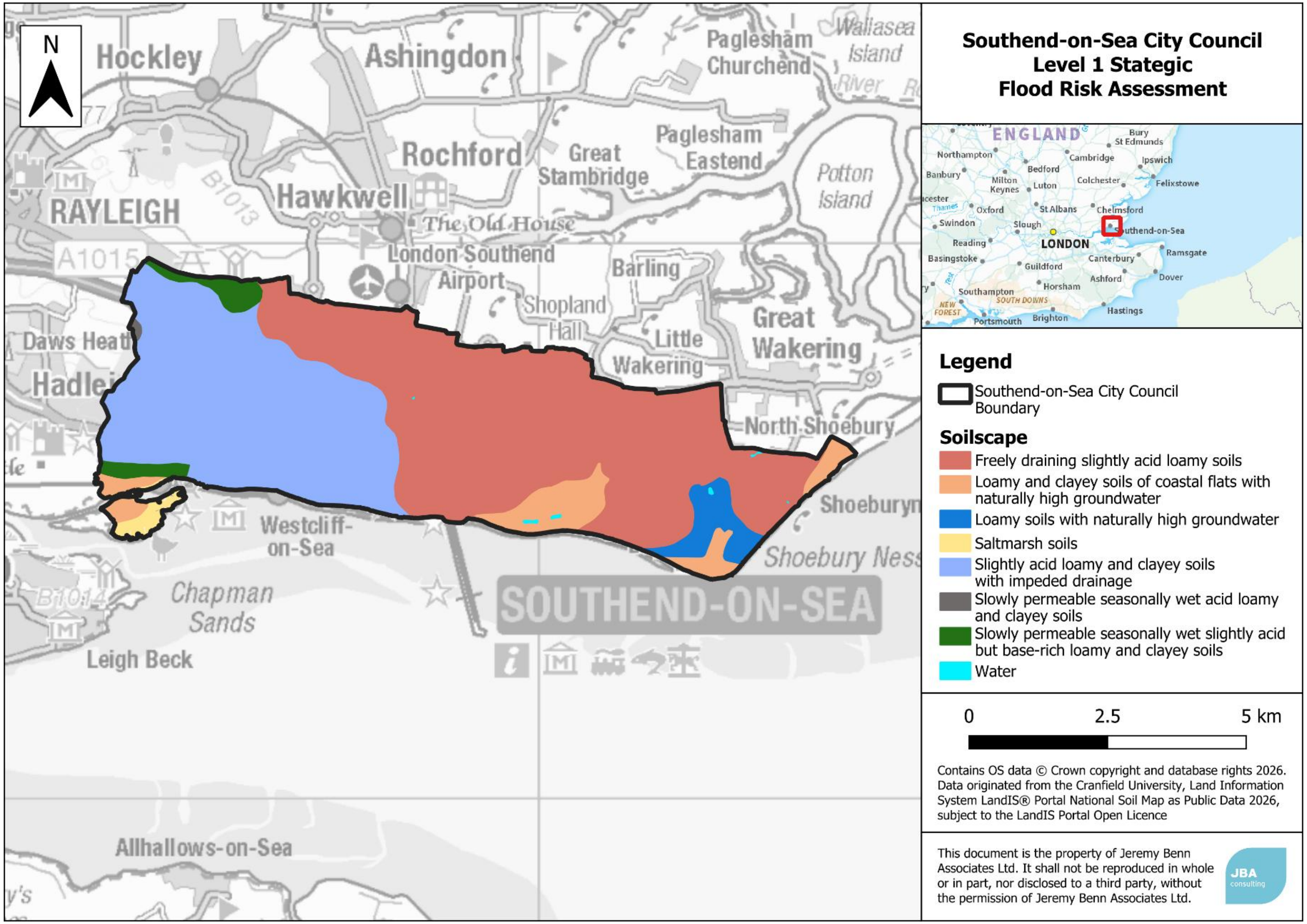


Figure 4-5: Soils across the study area.

4.3 Historical Flooding

The EA's Historic Flood Map (HFM) shows areas of land that have been previously subject to flooding in the area. This includes flooding from rivers, the sea and groundwater springs but excludes surface water. The HFM shows a flood extent that reaches along the entire seafront from Belton Gardens to Southchurch Park. The HFM also includes an area of Hadleigh Castle Country Park and Two tree Island, as well as an area by Gunners Park up to Shoebury Park. In addition, the map extents cover the northeast corner of the study area by the shore, south of Cherrytree Chase. The EA's Recorded Flood Outlines dataset shows that these extents are from the North Sea flood of 31 January 1953.

The Essex County Fire and Rescue Service stated that they have recorded 23 external flooding incidents within the Southend-on-Sea District between 2011 and 2024. One of these incidents occurred at the boundary to the Castle Point Local Area District but is likely to have happened within Southend-on-Sea.

Southend-on-Sea City Council as the LLFA under the Flood and Water Management Act (2010) is responsible for undertaking flood investigations under Section 19, where deemed appropriate. Southend-on-Sea City Council's flood reports (southend.gov.uk) are available on their website.

Historic flooding records provided in Table 4-1 and has been informed by data from the HFM, Section 19 Reports, and the SWMP 2015. The HFM outlines for the study area are shown in Figure 4-6, alongside the approximate points of the 23 external flooding incidents provided by The Essex County Fire and Rescue Service.

Table 4-1: Historic flooding records.

Date	Area affected	Information source	Cause(s) of flooding
31 January 1953	The entire seafront from Belton Gardens to Southchurch Park. An area of Hadleigh Castle Country Park and Two Tree Island, as well as an area by Gunners Park up to Shoebury Park. The northeast corner of the study area by the shoreline, south of Cherrytree Chase.	HFM	Major tidal surge, caused by a combination of a high spring tide, low pressure and severe winds.
1968	Specific areas unknown.	SWMP 2015	Flood event that resulted in major channel improvements to Prittle Brook.
Between 1998 and	Eastern Esplanade	SWMP 2015	Groundwater flooding of a basement reported to the Council, potentially due to a

Date	Area affected	Information source	Cause(s) of flooding
2005			perched groundwater table within the Blown Sand deposits.
24 August 2013	Widespread flooding with 255 incidents recorded. The main clusters of flooding incidents were in Eastwood, Chalkwell, and Marine Parade and Eastern Esplanade.	Section 19 Report	Intense rainfall coinciding with a high spring tide. In Eastwood, flooding was driven by rapidly rising river levels in Eastwood Brook combined with surface water runoff. Prittle Brook appeared to flood within Priory Park, with water backing up on Victoria Avenue. Around Chalkwell and Marine Parade and Eastern Esplanade, there was tide-locked and surcharging sewers. There were also localised flooding incidents due to blocked road gullies.
11 October 2013	20 recorded incidents of flooding across the study area, two of which were confirmed to be internal property flooding on Chalkwell Esplanade.	Section 19 Report	Heavy rainfall coincided with high tides. Issues related to asset maintenance impeded the inflow of water into highway gullies and restricted flows from drainage network outfalls.
January 2014	Rebels Lane area, with a six week obstruction of the road.	SWMP 2015	Intense rainfall over the winter and obstruction within a local land drainage channel.
20 July 2014	Mainly flooding in the west of the study area, with 30 incidents of flooding recorded including internal flooding of Southend General Hospital.	Section 19 Report	Intense rainfall leading to lifted or surcharging manholes. Maintenance issues restricted drainage at the Queensway underpass and Harp House Roundabout. Eastwood Brook overtopped and resulted in flooding at Glenwood Avenue. Along Prittle Brook, high water level restricted the discharge of surface water outfalls, resulting in water backing up the network within the Cavendish Gardens area.

Date	Area affected	Information source	Cause(s) of flooding
19 September 2014	Particularly the central seafront area of Marine Parade and Eastern Esplanade. In total, 63 incidents of flooding were recorded.	Section 19 Report	Widespread flooding predominantly caused by exceptionally intense rainfall. Flood mechanisms included the exceedance of the drainage network capacity, surcharging of the drainage network, maintenance issues, and tide-locking.
Unknown	Near to the Victoria Station and West of Leigh-on-Sea.	SWMP 2015	Two basement flooding incidents, potentially from groundwater.
N/A	Eastern Esplanade, Marine Parade, and Hartington Road	SWMP 2015	Sewer flooding hotspot. Surcharging sewers recorded, with flooding exacerbated by tide locking of the gravity drained outfalls.
N/A	Prince Avenue and Rochford Road	SWMP 2015	Sewer flooding hotspot. Several reports of lifted manhole covers and surcharging sewers within the road channels, suggesting a possible capacity issue within the network
N/A	Ness Road and Campfield Road	SWMP 2015	Sewer flooding hotspot. Surcharging manholes associated with restricted discharges to the ordinary watercourses within Gunners Park.
N/A	Chalkwell Avenue	SWMP 2015	Sewer flooding hotspot. Recurrent flooding of the manhole located beneath the railway crossing.
20 October 2021	Victoria Road area	Section 19 Report	Intense rainfall resulting in external flooding with foul effluent surcharging. Flood mechanisms included tide locking and sewer capacity issues.
20 October 2021 and 20 February 2022	The immediate area surrounding the junction of Glenwood Avenue and Rayleigh	Section 19 Report	On 20 October 2021, localised, intense rainfall and debris blockages within the Eastwood Brook caused fluvial flooding. For this event, there was one

Date	Area affected	Information source	Cause(s) of flooding
	Road.		internal and one external reported incident of property flooding on Rayleigh Road. On 22 February 2022, intense rainfall caused Eastwood Brook to overtop the channel resulting in internal flooding on Rayleigh Road. There were three reports of properties internally flooding on Rayleigh Road.

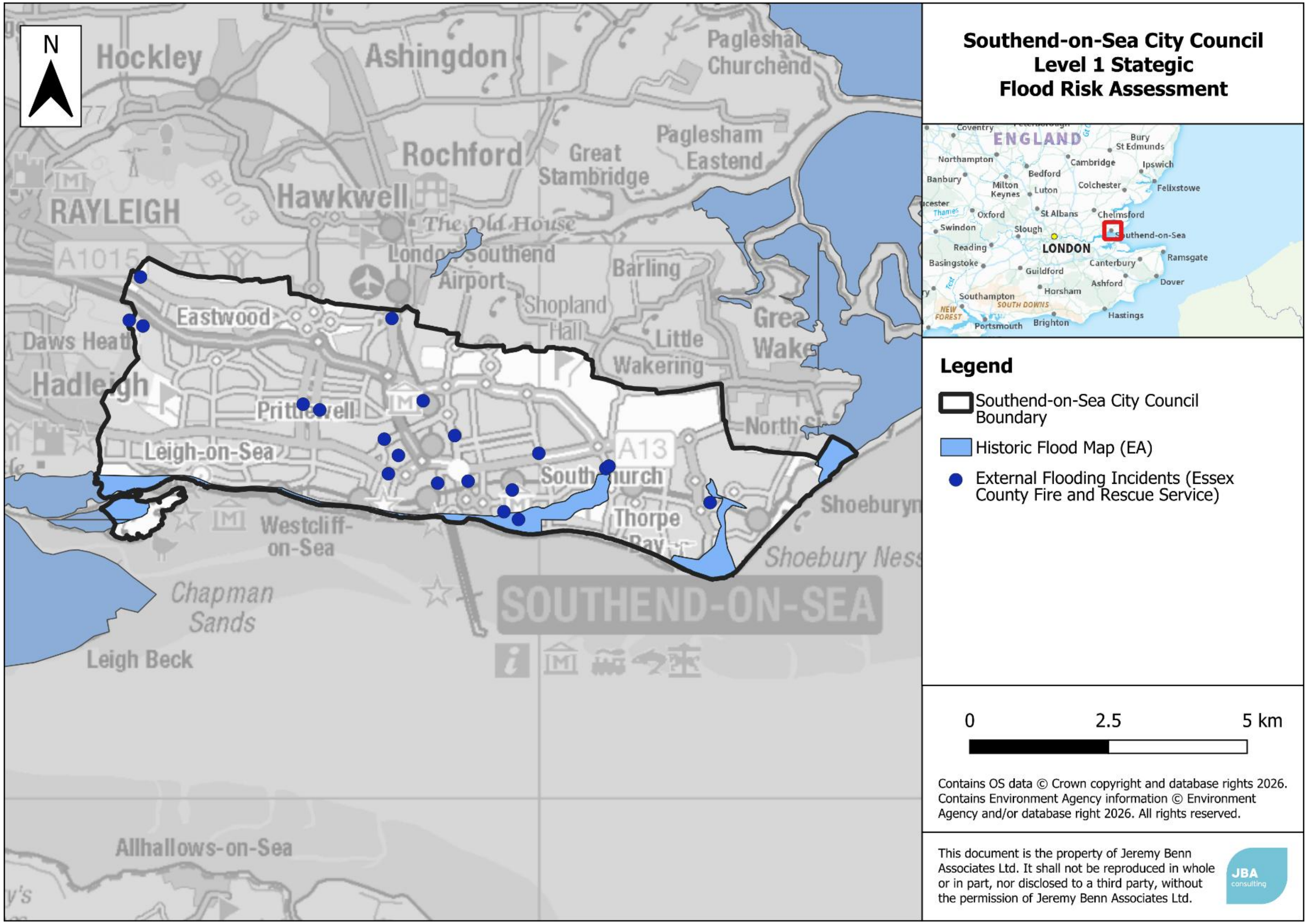


Figure 4-6: Historic flooding across the study area.

4.4 Fluvial and Tidal Flood Risk

4.4.1 Flood Zones

Fluvial and tidal flood risk across the study area is assessed using Flood Zones. The definition of the Flood Zones is provided below. The Flood Zones do not consider defences, except when defining the functional floodplain. This is important for planning long-term developments as 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:** land with less than a 0.1% chance of flooding from rivers or the sea in any given year.
- **Flood Zone 2: Medium risk:** land with between a 1% and 0.1% chance of flooding from rivers or between a 0.5% and 0.1% chance of flooding from the sea in any given year.
- **Flood Zone 3: High risk:** land with greater than a 1% chance of flooding from rivers or greater than a 0.5% chance of flooding from the sea in any given year.
- **Flood Zone 3b: Functional Floodplain:** land where water has to flow or be stored in times of flood. This is defined as land having a 3.3% or greater chance of flooding from rivers or the sea in any given year with any existing flood risk management infrastructure operating effectively. 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. Annex 3 of the NPPF (gov.uk) provides information on flood risk vulnerability.

Important note on Flood Zone information in this SFRA

The Flood Zone maps for the study area are provided in Appendix C.

These have been derived from the EA's FMfP (gov.uk) and four detailed hydraulic modelling received from the EA. Table 4-2 shows the details for each model.

Table 4-2: Details of hydraulic models provided by the EA for use within the SFRA.

Model name	Year	Model type	Included in the FMfP?
Prittle Brook	2016	Fluvial 1D-2D	Yes
Eastwood and Noblesgreen	2017	Fluvial 1D-2D	Yes
Crouch and Roach Coastal	2018	Tidal 2D	Yes
Thames OM12	2022	Tidal 1D	No

Flood Zones 2 and 3a within this SFRA show the same extent as the online EA's FMfP. This incorporates latest detailed hydraulic models in the table above, with the exception of the Thames OM12 model as this is a 1D-only model and is therefore not represented within the FMfP. It should be noted that the EA Flood Zone 2 also incorporates accepted recorded flood outlines.

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.

Flood defences should be considered when delineating the functional floodplain. The EA's Risk of Flooding from Rivers and Sea 3.3% AEP defended extent (which incorporates latest model data) has been used to delineate Flood Zone 3b.

EA SFRA guidance (gov.uk) states that 'You may not need to designate functional floodplain in locations where evidence shows flooding would be prevented by existing… buildings… however it may be simpler to include existing buildings and use local policies to control the redevelopment or changes of use that may be acceptable'. The LPA should 'use local policies or guidance to explain the approach you will take when buildings are demolished in functional floodplain. It may be reasonable to assume that sites revert to functional floodplain when buildings have been demolished for more than a year'. However, this depends on the characteristics of the site and should be discussed and agreed with the EA and LPA on a site-by-site basis.

In this SFRA, existing buildings and infrastructure within the functional floodplain have not been removed from the outline on the assumption that floodwater ingress may occur.

4.4.2 Fluvial Flood Risk

The fluvial flood risk mapping for the study area can be found in Appendices C and D.

The Main Rivers flowing within the study area are:

- Eastwood Brook
- Prittle Brook
- Mucking Hall Brook
- Willingale Brook.

Eastwood Brook, Prittle Brook, and Mucking Hall Brook flow northwards and converge with the River Roach. In the 1970s, Anglian Water installed a culverted flood relief channel from Prittle Brook that diverts excess flows into the Thames Estuary during flood events. Willingale Brook, and an ordinary watercourse called C-X Ditch, in the southeast of the study area flow south and discharge into the Thames Estuary. In addition, there are several ponds and unnamed drains within the study area. Leigh Creek is not located directly within the study area boundary but flows between Two Tree Island and Leigh-on-Sea in the southwest. A map of the key watercourses is included in Figure 1-2.

In the west of the study area, the fluvial flood risk is from Prittle Brook and Eastwood Brook. Flood Zone 3b is mainly contained to these channels, but Eastwood Brook overtops around St Lawrene Court, as well as by Glenwood and Grovewood Avenue travelling towards Southend Arterial Road (A127). Prittle Brook overtops into Priory Park. Flood Zone 3a shows increased extents for Eastwood Brook that cover areas by Kingsgate Court, between

Willow Close and Brooklands Avenue, and around Eastwoodbury Lane Playing fields and Laurence Industrial Estate. Flood Zone 3a shows the fluvial extents from Prittle Brook overtopping in Priory Park encroaching onto Victoria Avenue and an area north of Fairfax Drive. The areas at risk increase in Flood Zone 2, including along the majority of Eastwood Brook. For Prittle Brook, the largest areas at fluvial risk in Flood Zone 2 include along the watercourse between Chase High School and Victoria Avenue, as well as Ekco Park, Thornford Gardens, and Warners Bridge Park.

Willingale Brook and C-X Ditch also have significant flood extents. Tidal water from the Thames Estuary backs up the channels, contributing to the flows. The risk here is discussed further in Section 4.4.3. The extents for Mucking Hall Brook are broadly comparable across Flood Zones 3b, 3a, and 2, following the watercourse's floodplain through Garon Park Golf Complex.

The impacts of climate change on fluvial flooding are discussed in Section 5.2.

4.4.3 Tidal Flood Risk

The tidal flood risk mapping for the study area can be found in Appendix C.

Tidal flood risk can be assessed using Extreme Still Water Sea Levels (ESWSL). An ESWSL is the level the sea is expected to reach during a storm event for a particular magnitude tidal flood event as a result of the combination of tides and surges. As these levels are based on ‘still’ water, the effect of short-term fluctuations in sea level associated with wind and swell waves are not included in these predictions but should be considered at locations where wind and wave effects are influential.

Almost the entire southern and eastern coastline are at tidal flood risk, with the flood extents covering much of the beach areas and parts of the directly adjacent roads. Along the southern coastline this includes parts of Chalkwell Esplanade, Western Esplanade, Marine Parade, and the B1016.

Flood Zone 3b also covers an area in the northeast of the study area, near Butts Road. The area at risk in the northeastern increases significantly in Flood Zone 3a and 2. Flood Zone 3b covers parts Leigh Golf Range. The tidal flood risk in Flood Zone 3a and 2 also covers much of the area south of Leigh-on-Sea Railway Station and encroaches more than 300m north up Chalkwell Avenue and parts of the surrounding streets.

Some of the largest areas of risk are by Willindale Brook and C-X Ditch. The risk here is combined fluvial and tidal, as water from the Thames Estuary backs up the channels. By the Willingale Brook, Flood Zone 3b covers part of Southchurch Park, and the streets south of the park. Flood Zone 3a also covers parts of Thorpe Hall Golf Course and the area west of Southchurch Park. Flood Zone 2 covers a large area in Southchurch from the coastline to Bournes Green Roundabout, which includes many of the streets south of Woodgrange Drive.

By C-X Ditch, Flood Zone 3b cover part of Gunners Park and Shoebury Common Road (B1016). Flood Zone 3a covers almost the entirety of Gunners Park and extends north to

Towerfield Road. Flood Zone 2 expands outwards further to Campfield Road, Shoebury Park, and along the railway track.

4.4.4 Wave Overtopping

In exposed locations along the coast, and within the major estuaries, landward flooding is more likely to occur as a consequence of wave overtopping than inundation. Wave overtopping is a term, which encompasses a number of complex physical processes, which result in the transfer of water from the sea onto the coastal floodplain. The amount of wave overtopping that occurs during an extreme event is dependent on the local water depth, the properties of incoming waves and the geometry of local flood defences. Wave overtopping is one of the principal mechanisms of flooding for the coastal frontage.

4.4.5 Tide Locking

Tide locking occurs when watercourses are unable to discharge over the high tide period, which can result in watercourses exceeding bank capacity and flooding within the catchment. Drainage systems that discharge via gravity can also become tide locked, where an outfall is submerged by high water levels.

Restricted discharge due to high tides was one of the main flood mechanisms for the 24 August 2013 event impacting Chalkwell, Eastern Esplanade, and Marine Parade (see Section 4.3).

4.5 Coastal Erosion Risk

In coastal locations the risk of flooding is linked to the stability of the coastline. If the coast is eroding, then the potential effect is that tidal flood defences near to the sea will be lost and flood risk will increase. To maintain an appropriate standard of safety from flooding it is sometimes necessary to implement works to slow down or stop the rate of coastal erosion and so maintain the integrity of the tidal defences.

4.5.1 Coastal Change

The NPPF defines Coastal Change Management Areas (CCMAs) as areas identified in a Local Plan as likely to be affected by physical change to the shoreline through erosion, coastal landslip, permanent inundation, or coastal accretion.

The PPG states a CCMA will only be defined where rates of shoreline change are significant over the next 100 years, taking account of climate change. They will not need to be defined where the accepted SMP policy is to hold or advance the line (maintain existing defences or build new defences) for the whole period covered by the plan, subject to evidence of how this may be secured. The policy for the study area's coastline is to 'Hold the Line' across all time periods.

Based on the available SMP evidence, there is no requirement for the Southend Local Plan to identify or define a CCMA over the plan period to 2045. However, at this current time, no evidence has been provided on how funding to maintain the 'Hold the Line' approach across the plan period has been secured, and developers seeking to develop in areas benefiting from coastal defences should begin discussions with the LPA, EA, and LLFA, on the commitment to maintain/improve the SoP offered by the current coastal defences.

4.6 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's Surface Water Spatial Planning Dataset, released in May 2026, has been used to assess surface water risk within this SFRA. These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the EA, and any potential developers to focus their management of surface water flood risk. The data is now shown within the EA's FMfP (gov.uk) and provides a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water. The Surface Water Spatial Planning Dataset should not be used to understand flood risk for individual properties but is suitable for high level assessments such as SFRAs for local authorities.

4.6.1 Summary of Surface Water Flood Risk Across the Study Area

The EA's Surface Water Spatial Planning Dataset for the study area can be found in Appendix F.

The EA's Surface Water Spatial Planning Dataset highlights that there is widespread surface water flood risk across the study area. Several surface water flow paths follow the topography of the existing watercourses, and there are several areas at risk from isolated ponding. Additionally, surface water flow routes are present on roads and along parts of the railway tracks, highlighting risk to transport networks while also posing a risk to buildings which water can be routed to. In the 3.3% AEP event, there are large surface water flow routes in Leigh-on-Sea, Eastwood, and south of London Southend Airport, particularly around Rochford Road, which serves as a key access route to the airport. In the 1% and 0.1% AEP events, there are also significant flow paths that develop in North Shoebury, Southchurch, and between Royal Artillery Way.

The impacts of climate change on surface water flooding are discussed in Section 5.3.

4.7 Sewer Flood Risk

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.

As discussed in Section 2.3.10, the WCS completed by Wallingford HydroSolutions does not show any major sewage treatment capacity issues during the Local Plan period 2025-2045.

Anglian Water is the wastewater and sewerage company responsible for the management of the sewerage networks across the study area. Anglian Water provided a DG5 register, which includes the number of internal and external sewer records of property flooding. The incidents with available georeferenced data are listed in Table 4-3 and mapped in Figure 4-7. This dataset shows 420 sewer flooding incidents occurred between 2022 and 2026.

Table 4-3: Sewer flooding incidents recorded by Anglian Water between 2022 and 2026.

Postcode (truncated)	Number of recorded incidents (2022-2026)
SS9 1	32
SS9 2	18
SS9 3	21
SS9 4	30
SS9 5	44
SS0 7	28
SS0 8	17
SS0 9	38
SS1 1	7
SS1 2	50
SS2 4	37
SS2 5	14
SS2 6	33
SS3 8	12
SS3 9	39

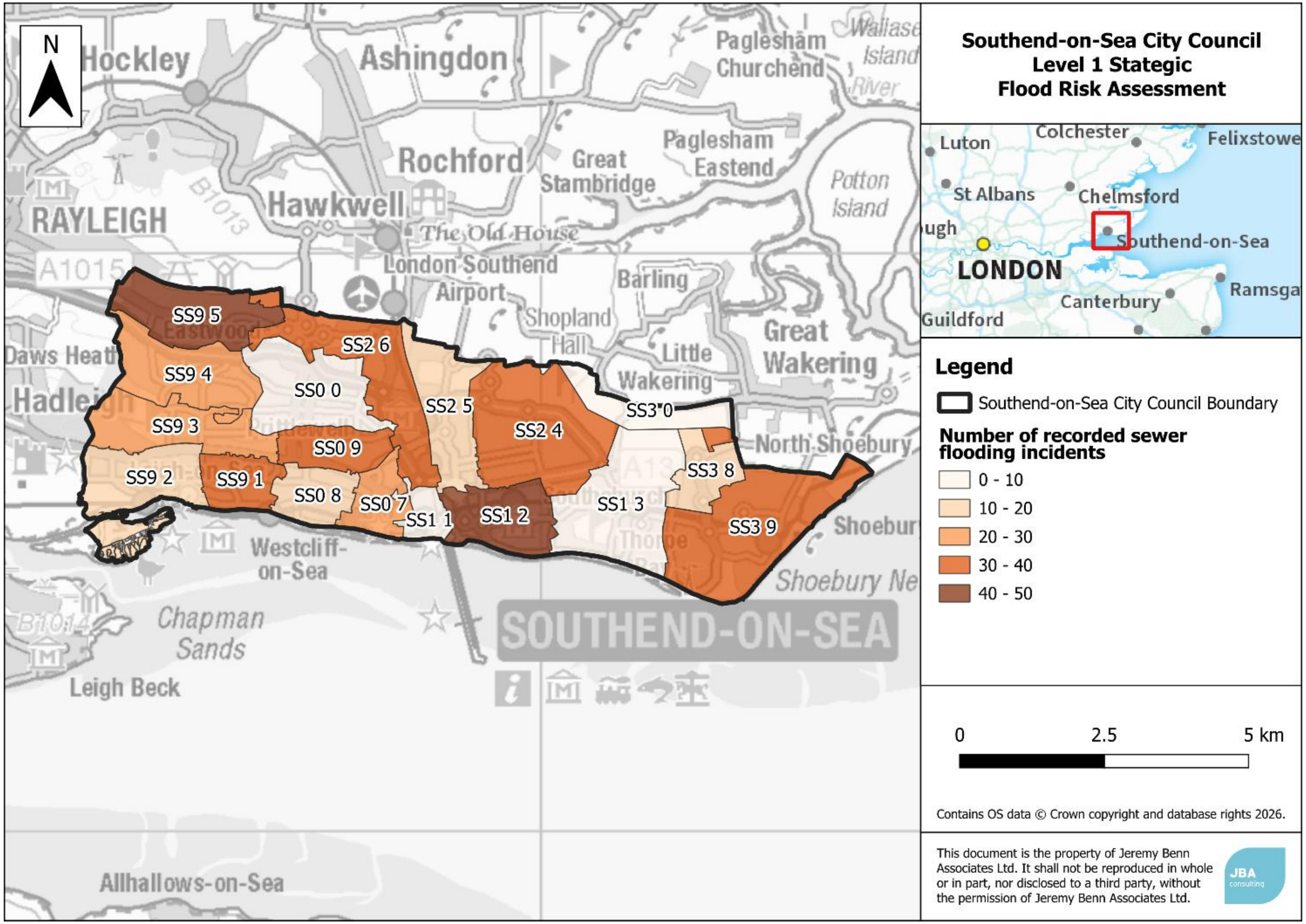


Figure 4-7: Prevalence of historic sewer flooding incidences between 2022 and 2026 provided by Anglian Water.

4.8 Groundwater Flood Risk

In general, less is known about groundwater flooding than other sources of flooding 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.
- Perched aquifers underlain by impermeable geology, particularly in low lying areas.

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.

The JBA Groundwater Emergence map shows the likelihood of groundwater emergence posing a risk to both surface and subsurface assets, based on predicted groundwater levels during a 1% AEP event. This divides groundwater emergence into five categories (Table 4-4).

Table 4-4: JBA Groundwater Emergence Map category descriptions.

Category	Potential risk
Groundwater levels are either at or very near (within 0.025m of) the ground surface.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
Groundwater levels are between 0.025m and 0.5m below the ground surface.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
Groundwater levels are between 0.5m and 5m below the ground surface.	There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
Groundwater levels are at least 5m below the ground surface.	Flooding from groundwater is not likely.
No risk.	This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

It should be noted that this dataset only identifies areas likely to be at risk of groundwater emergence and does not allow prediction of the likelihood of groundwater flooding or quantification of the volumes of groundwater that might be expected to emerge in a given area.

4.8.1 Summary of Groundwater Emergence Risk Across the Study Area

The JBA Groundwater Emergence map is shown in Appendix G.

The JBA Groundwater Emergence Map shows groundwater levels are either at or very near (within 0.025m of) the ground surface in several locations across the study area. This includes in Eastwood, along a large part of Prittle Brook, by Sutton Road Cemetery, and near the Bournes Green Roundabout. Based on the EA's Surface Water Spatial Planning mapping and topography of the study area, it is likely that any groundwater that emerges in Eastwood will flow towards Aviation Way south of Eastwood Brook, will pool in situ where it emerges around Sutton Road Cemetery, and will flow south to Thorpe Hall Golf Course from Bournes Green Roundabout.

Groundwater levels are between 0.025m and 0.5m below the ground surface in the east of the study area in Shoeburyness and North Shoebury. These groundwater levels are also found in the north of the study area, including by Green Lane, St Thomas More High School, and Garon Park Golf Complex. Over 70% of the study area is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

4.9 Residual Risk

Residual risk comes in two main forms (PPG: Flood Risk and Coastal Change Paragraph: 041):

- Residual risk from flood risk management infrastructure.
- Residual risk to a development once any site-specific flood mitigation measures are taken into account.

Examples of residual flood risk from flood risk management infrastructure include:

- A breach of a raised flood defence, blockage of a surface water conveyance system or failure of a pumped drainage system;
- Failure of a reservoir; and
- A flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot accommodate.

This SFRA does not assess the probability of failure. However, in accordance with the 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. 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.

Examples of residual flood risk to a development include:

- The depth of internal flooding predicted after any raising of land or floor levels;

- The flood hazard to which people would be exposed on access or escape routes after they have been raised; and
- A failure of flood forecasting or flood warning and the risks associated with people not receiving warnings or acting upon them.

4.10 Reservoir Flood Risk

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoirs Act 1975 (gov.uk) 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.

Reservoirs have a designated "risk category" set by the potential damage and loss of life in circumstances where there is a breach or an extreme flood event. Reservoirs designated as high risk are subject to increased inspection and maintenance requirements. However, this designation does not mean they are at a high risk of flooding. Allocation of new development downstream of an existing reservoir could potentially change the risk category and result in a legal requirement 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 whether it would be more appropriate to place development in alternative locations not associated with such risk.

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 (gov.uk) 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 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.

4.10.1.1 Summary of Reservoir Flood Risk Across the Study Area

The current mapping shows that there are no reservoirs located within the study area. There is one reservoir in Hadleigh (detailed in Table 4-5) located in Castle Point Borough that poses a risk to a minor part of the study area by the boundary, southwest of Leigh Golf Range. The reservoir location is shown in Figure 4-8.

Table 4-5: Reservoirs with flood extents that impact the study area.

Reservoir	Easting and Northing	Reservoir owner	Risk Category	Local Authority	Does reservoir impact study area in 'dry day' scenario?
Hadleigh Plungers (Open Water Swimming)	580206, 186728	Essex County Council	High	Castle Point Borough	Yes

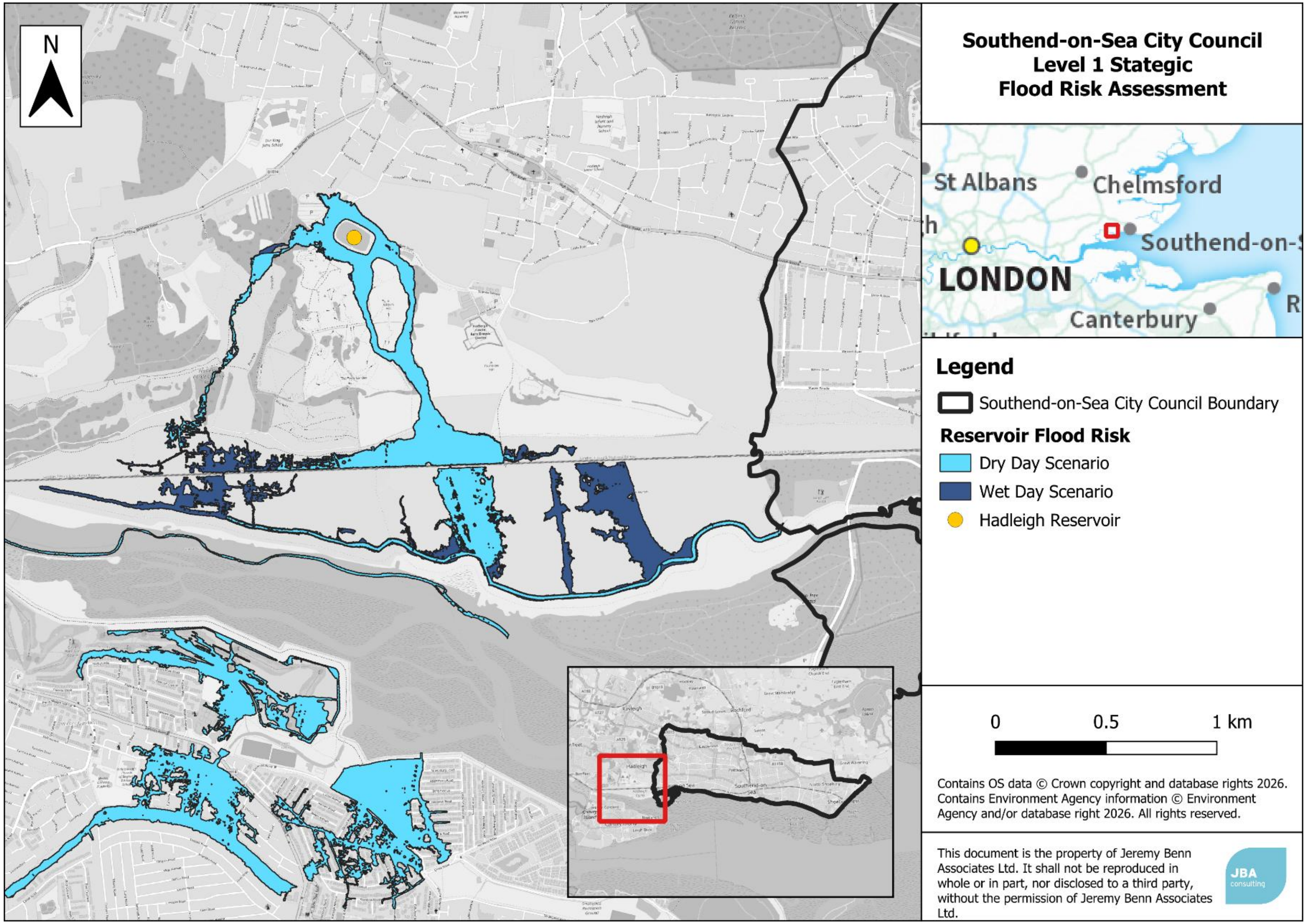


Figure 4-8: Hadleigh Reservoir and the associated flood risk.

4.11 Combined Sources of Flood Risk

The sections above set out the various sources of flooding, which all individually present a flood risk within the study area. However, it is important to note that there is also the likelihood of increased or altered flood risk as a result of different sources of flooding interacting within the study area.

As the watercourses in the study area discharge to the Thames Estuary or to the River Roach, which are both tidally influenced, there is potential for joint probability fluvial-tidal flood events to occur. The EA FMfP considers this joint risk, which is seen in the Flood Zone mapping for Willingale Brook and C-X Ditch that discharge to the Thames Estuary. Given the tidal location of the study area, there is also the potential for tide-locking of outfalls to occur, increasing the risk of surface water and sewer flooding. Tide-locking has been identified as a key flood risk mechanism in previous historic flood events (see Section 4.3).

Given the urbanised nature of the study area, it is likely that surface water and sewer interactions may cause increased risk in the study area. In periods of heavy rainfall, increased surface water entering the sewer system in areas of combined sewers can result in both surface water and foul sewer flooding.

5 Impact of Climate Change

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 Climate Change Guidance

The Climate Change Act 2008 (legislation.gov.uk) 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 (legislation.gov.uk) to a 100% reduction (or net zero) by 2050.

In 2018, the Met Office published new UK Climate Projections (UKCP18) (gov.uk). The EA used these projections to update their guidance on climate change allowances for new developments for river flow (July 2021) and rainfall intensity (May 2022). This includes information on how these allowances should be included in both SFRAs and 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 management catchments for the study area are shown in Figure 5-1.

Developers should check Flood risk assessments: climate change allowances (gov.uk) for the most recent guidance before undertaking a detailed FRA.

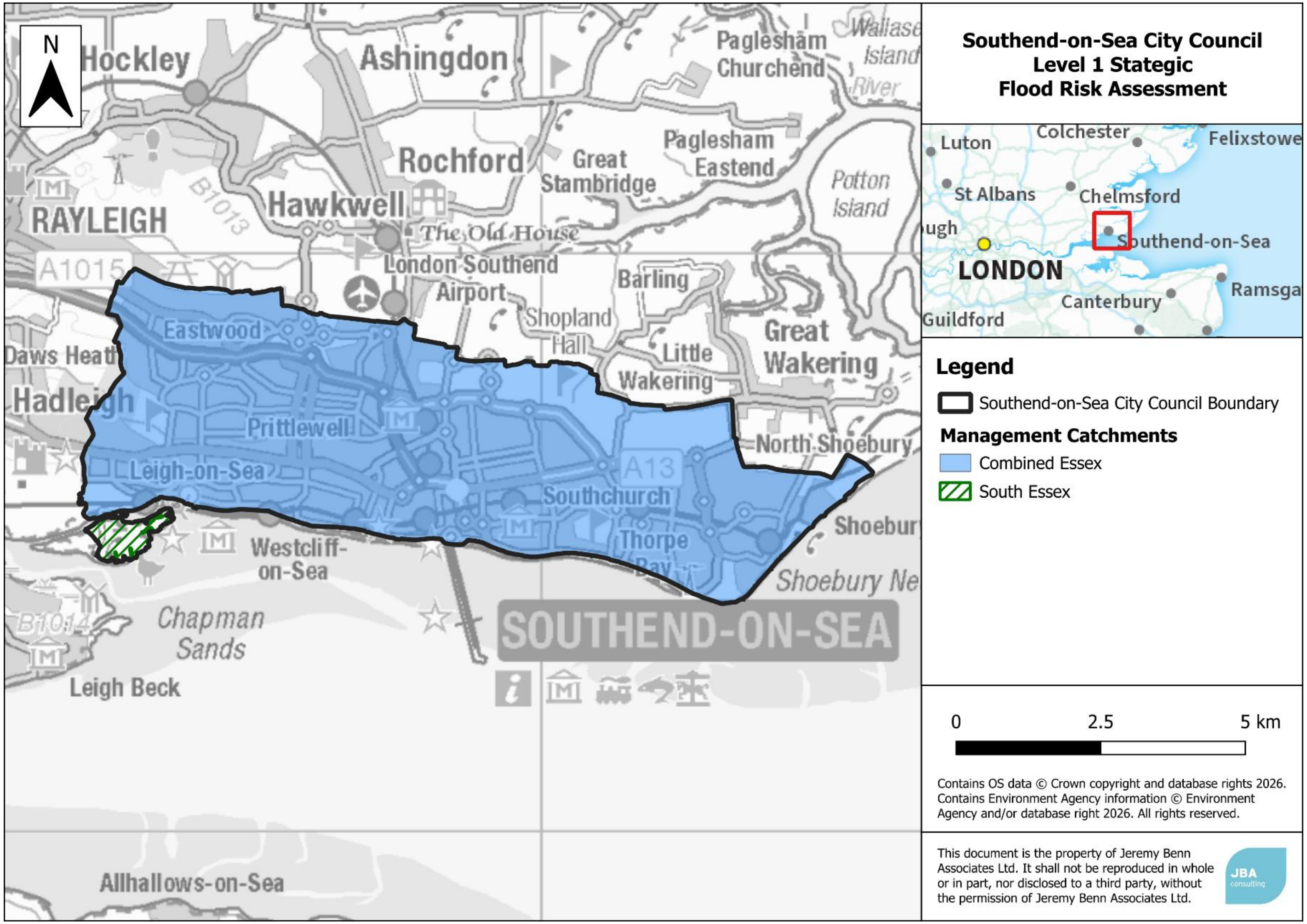


Figure 5-1: Management Catchments (assigned by the EA) across the study area.

5.2 Peak River Flows

Climate change is expected to increase the frequency, extent and impact of flooding, reflected in peak river flows. Wetter winters and more intense rainfall may increase fluvial flooding and surface water runoff and there may be increased storm intensity in summer. Rising river levels may also increase flood risk.

The peak river flow allowances (gov.uk) provided in the guidance show the anticipated changes to peak flow for the management catchment within which the subject watercourse is located. 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).

These allowances (increases) are provided in the form of figures for the total potential change anticipated, for three climate change periods:

- The '2020s' (2015 to 2039).
- The '2050s' (2040 to 2069).
- The '2080s' (2070 to 2125).

The time period used in the assessment depends upon the expected lifetime of the proposed development. Residential development should be considered for a minimum of 100 years, whilst the lifetime of a non-residential development depends upon the characteristics of that development, but a period of at least 75 years is likely to form a starting point for assessment. Further information on what is considered to be the lifetime of development is provided in the PPG (gov.uk).

5.2.1 Peak River Flow Allowances

The majority of the study area is located within the Essex Combined Management Catchment for peak river flow allowances. Two Tree Island in the southwest of the study area is located within the South Essex Management Catchment. Table 5-1 and

Table 5-2 display the peak river flow allowances that apply to the study area for each respective Management Catchment.

Table 5-1: Peak river flow allowances for the Essex Combined 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 2125)
Upper end	27%	37%	72%

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 2125)
Higher Central	13%	16%	38%
Central	7%	8%	25%

Table 5-2: Peak river flow allowances for the South Essex Combined 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 2125)
Upper end	22%	27%	48%
Higher Central	11%	11%	26%
Central	6%	5%	17%

5.2.2 Which Peak River Flow Allowance to Use?

The EA guidance states that both the central and higher central allowances should be assessed in SFRAs.

The Flood Zone and flood risk vulnerability classification (gov.uk) should be considered when deciding which allowances apply to the development or the plan. Specific guidance for which climate change allowance estimates should be applied can be found in the EA climate change guidance (gov.uk).

5.2.3 Representation of Fluvial Climate Change within the Level 1 SFRA

The EA's Risk of Flooding from Rivers and Sea 3.3% AEP defended climate change modelling has been used for Flood Zone 3b in this assessment. For Flood Zone 3a and 2, the 1% and 0.1% AEP undefended climate change modelling has been used respectively. These climate change scenarios are based on the 'Central' allowance for the 2080s epoch (2070-2125) for risk of flooding from rivers.

5.2.4 Implications of Climate Change for Fluvial Risk Across the Study Area

The sensitivity of an area to climate change can be analysed through comparison between present day design flood event extents and design flood events extents with modelled climate change uplifts applied.

Areas identified as most sensitive to fluvial impacts of climate change are around Willingale Brook and C-X Ditch that discharge into the Thames Estuary. These watercourses are tidally influenced, and there is potential for joint probability fluvial-tidal flood events to occur. The climate change extents are significant for these watercourses, covering large parts of Southchurch, North Shoebury, and Shoeburyness.

Areas along Eastwood Brook most sensitive to fluvial impacts of climate change include:

- **Flood Zone 3b**: between Willow Close and Brookland Avenue, as well as south of Rayleigh Road (A1015) between Clyst Court and the Bellhouse.
- **Flood Zone 3a:** around Cockethurst Park and extending to the area surrounding Eastwoodbury Lane, as well as along most the banks of the watercourse as it runs parallel to Rayleigh Road.
- **Flood Zone 2:** south of the watercourse between Whitehouse Road and Cherry Orchard Way, and the east of Laurence Industrial Estate. Areas sensitive to climate change also includes both sides of the riverbank north of Eastwood Primary and the David Lloyd gym, and the area adjacent to Brunel Road and north of Faraday Road.

Areas along Prittle Brook most sensitive to fluvial impacts of climate change include:

- **Flood Zone 3b:** along the watercourse by Belfairs Park and Golf Course parallel to Vardon Drive, as well as in Priory Park and on Victoria Avenue.
- **Flood Zone 3a:** an area primarily north of the watercourse that stretches between Springfield Drive Allotments and Shakespear Avenue.
- **Flood Zone 2:** the south of Warners Bridge Park, a large stretch by the watercourse from Chase High school to Eastwood Road, particularly south of Darlinghurst Academy.

There is only minor sensitivity to fluvial impacts of climate change around Mucking Hall Brook.

5.3 Peak Rainfall Intensities

Climate change is predicted to result in wetter winters and increased summer storm intensity in the future. This increased rainfall intensity will affect land and urban drainage systems, resulting in surface water flooding, due to the increased volume of water entering the systems. The EA have developed a peak rainfall allowances map (gov.uk) which shows anticipated changes in peak rainfall intensity which can be used for site-scale applications (like urban drainage design) and surface water flood mapping in small catchments (<5km^2).

The guidance suggests that direct rainfall modelling may not be suited to larger (>5km^2) catchments with rural land use. In these instances, the guidance states that the fluvial flood risk affected by climate change should be assessed using uplifts from peak river flow allowances (Section 5.2).

5.3.1 Peak Rainfall Intensity Allowances for the Study Area

The majority of the study area is located within the Essex Combined Management Catchment for peak rainfall allowances. Two Tree Island in the southwest of the study area is located within the South Essex Management Catchment. Table 5-3 shows the peak rainfall allowances that apply to the study area for both Management Catchments.

Table 5-3: Peak rainfall intensity allowances for small and urban catchments for the Essex Combined and the South Essex Management Catchments.

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
Upper end	35%	45%	35%	40%
Central	20%	20%	20%	25%

5.3.2 Which Peak Rainfall Intensity Allowance to Use?

Rainfall intensity climate change uplifts should be applied to both the 3.3% and 1% AEP events. The recommended epoch and use of either the central or upper end allowances should be based on the design lifetime of the proposed development. Further details are provided within the EA climate change guidance (gov.uk). For FRAs and SFRAs the upper end allowance should be used. The EA guidance recommends that the upper end allowance is considered for both the 3.3% and 1% AEPs for the 2070's epoch (2061 to 2125), unless the allowance for the 2050's epoch (2022 to 2060) is higher, in which case this should be used. This is appropriate for development with a lifetime beyond 2100. For development with a shorter lifetime the central allowance can be used.

5.3.3 Representation of Surface Water Climate Change within the Level 1 SFRA

The EA published new FMfP surface water climate change extents on 28 May 2026. Climate change extents are available for the 3.3%, 1%, and 0.1% AEP events for the upper end allowance for the 2070's epoch (2061-2125). This data has been used to assess the implications of climate change on surface water risk across the study area. The surface water climate change extents are shown in Appendix K.

5.3.4 Implications of Climate Change for Surface Water Risk Across the Study Area

Comparing surface water present day and climate change extents show that there is increased risk of surface water flooding in the future across the entire study area. The 3.3% AEP climate change extents are similar to the 1% AEP present day extents, and the 1% AEP climate change extents are similar to the 0.1% AEP present day extents.

There are many new areas of isolated ponding, together with additional flow paths that are largely confined to road surfaces yet run along almost the full length of the affected roads, as is the case on the parallel streets between Westbourne Grove and Victoria Avenue. The extents of the largest surface water flow routes have also increased, including in North Shoebury, Leigh-on-Sea, Eastwood, and south of London Southend Airport. Some of the areas identified as the most sensitive to surface water impacts of climate change is in

Southchurch, with significant increase in extents in Southchurch Park and across Thorpe Hall Golf Course, as well as by C-X Ditch in the south of Shoeburyness.

5.4 Sea Level Rise

Increasing global temperatures are leading to ocean warming. This is resulting in sea level rise from two different mechanisms: as the oceans warm seawater expands and the melting of ice over land is resulting in further water adding to the ocean.

5.4.1 Sea Level Rise Allowances for the Study Area

The study area is located within the Anglian River Basin District (RBD). Table 5-4 shows the sea level rise allowances that apply to the study area.

Table 5-4: Sea level allowances for the Anglian RBD for each epoch in mm for each year (based on a 1981 to 2000 baseline). The total sea level rise for each epoch is in brackets.

Allowance category	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Upper end	7 (245)	11.3 (339)	15.8 (474)	18.1 (543)	1.60
Higher central	5.8 (203)	8.7 (261)	11.6 (348)	13 (390)	1.20

5.4.2 Which Sea Level Rise Allowance to Use?

FRAs and SFRAs should assess both the higher central and upper end allowances. The H++ climate change allowance (gov.uk) should be applied where it is appropriate to apply a credible maximum scenario (gov.uk). Further details are provided within the EA climate change guidance (gov.uk).

5.4.3 Representation of Climate Change within the Level 1 SFRA

The EA's Risk of Flooding from Rivers and Sea 3.3% AEP defended climate change modelling has been used for Flood Zone 3b in this assessment. For Flood Zone 3a and 2, the 1% and 0.1% AEP undefended climate change modelling has been used respectively. These climate change scenarios are based on the 'Upper End' allowance for risk of flooding from the sea, accounting for cumulative sea level rise to 2125.

5.4.4 Implications of Climate Change for Tidal Risk Across the Study Area

The sensitivity of an area to climate change can be analysed through comparison between present day design flood event extents and design flood events extents with modelled climate change uplifts applied. It should be noted that there is a residual risk in the defended areas, should the defences breach or overtop. Further details on defences within the study area can be found in Section 6.

Areas in the study area identified as most sensitive to tidal impacts of climate change from the modelled outputs include:

- Two Tree Island, which is almost entirely covered by the climate change extents,
- a significant area in northeast, where the undefended climate change extents stretch westwards from the shoreline past friars Primary School and Nursery to just beyond Cunningham Close.
- around Willingale Brook and C-X Ditch that discharge into the Thames Estuary, with extents covering large parts of Southchurch, North Shoebury, and Shoeburyness. These watercourses are tidally influenced, and there is potential for joint probability fluvial-tidal flood events to occur.

5.5 Groundwater

The effect of climate change on groundwater flooding, and those watercourses where groundwater has a large influence on winter flood flows, is much more uncertain than other types of flooding. Milder, wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months.

There is currently no available data on groundwater flooding in relation to climate change; however, the potential risk should still be considered. The effect of climate change on groundwater levels for sites in areas where groundwater is known to be an issue should be considered at the planning application stage.

5.6 Adapting to Climate Change

PPG: Climate Change (gov.uk) Paragraph 003 (Reference ID: 6-003-20140612) contains information and guidance for how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change. Paragraph 005 (Reference ID: 6-005-20140306) also provides considerations for the LPA on dealing with the uncertainty of climate risks and accounting for climate change in a realistic way within developments.

6 Flood Risk Infrastructure

This section provides a summary of existing flood alleviation schemes and assets in the study area. Planners should note the areas that are protected by defences where further work to understand the undefended 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.

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.

6.3 Maintenance

Different authorities have responsibilities relating to maintenance of flood risk assets, set out in Table 6-1. It is important that the authorities work in partnership to maintain flood risk assets and manage flood risk across the study area.

Table 6-1: Flood risk asset maintenance responsibilities based on the FWMA (2010).

Authority	Asset maintenance responsibilities
EA	Permissive powers to maintain and improve main rivers, ultimate responsibility for maintaining watercourses rests with the landowner.
Local Authorities	Permissive powers to maintain and improve ordinary watercourses, ultimate responsibility for maintaining watercourses rests with the landowner.
LLFA	Permissive powers, limited resources are prioritised and targeted to where they can have the greatest effect
Highways Authorities	Duty to maintain public roads, making sure they are safe, passable, and the impacts of severe weather have been considered. Responsible for maintaining sections of watercourses where they are crossed by highways.
Water Companies	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 sewer flooding.
Riparian Owners	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.

There is potential for the risk of flooding to increase in areas where assets and watercourses 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.

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.

6.4 Major Flood Risk Management Assets in the Study Area

The EA retired the FMfP Areas Benefiting from Defences dataset in December 2022. The Areas Benefiting from Defences dataset was replaced with the Reduction in Risk of Flooding from Rivers and Sea due to Defences dataset, which was created to support spatial planning, incident response, and determining FRAPs. The dataset was designed to act as a prompt to find out more about the flood defences in a particular area of interest.

This dataset has been temporarily discontinued and is due to be superseded by new information following updates to some of the national flood risk products.

The EA 'AIMS' (Asset Information Management System) flood defence dataset gives further information on flood defence assets within the study area. The LLFA also provided the location of a number of their defence assets, which are listed in Table 6-2.

Table 6-3 details the locations which benefit from formal flood defences within the 'AIMS' dataset. Developers should refer to the AIMS Spatial Flood Defences dataset (gov.uk) for further information on specific flood defences. The EA 'AIMS' dataset and the LLFA defences are shown in Appendix I.

Table 6-2: Defences provided by the LLFA.

Watercourse /Coastline	Location	Type	Maintainer
Thames Estuary	A redundant floodgate sealed inside the building at Osborne Bros café, on Old Leigh High Street.	Flood gate - Redundant sealed inside building	LLFA
Thames Estuary	Two metal flood gates by Old Leigh High Street, near Strand Wharf. One is located by Mikes Boatyard and the other by the Old Custom House.	Flood gate - metal	LLFA
Thames Estuary	A road hump by The Mayflower on Old Leigh High Street.	Road hump	LLFA
Thames Estuary	A metal flood gate between the Royal National Lifeboat Institution (RNLI) and Adventure Island on Marine Parade.	Flood gate - metal	LLFA
Thames Estuary	A flood gate inside the building at Pebbles One on Marine Parade.	Flood gate - inside building	LLFA
Thames Estuary	A flood gate inside the building at Wish You Were Here restaurant and takeaway, on Eastern Esplanade.	Flood gate - inside building	LLFA
Thames Estuary	A metal flood gate opposite Gas Works car park, on Eastern Esplanade.	Flood gate - metal	LLFA
Thames Estuary	A flood gate inside the building by The Beach Club and Billy Hundreds, on Eastern Esplanade.	Flood gate - inside building	LLFA
Thames Estuary	There are two flood gates inside the building at Ocean Beach, on Eastern Esplanade.	Flood gate - inside building	LLFA

Watercourse /Coastline	Location	Type	Maintainer
Thames Estuary	Barge Pier, on Barge Pier Road.	Flood gate - timber stoplogs	LLFA
North Sea	There is a timber stoplog flood gate by Quick Fire Battery, on Barge Pier Road.	Flood gate - timber stoplogs	LLFA
North Sea	There is a timber stoplog flood gate by Experimental Casemates, on Barge Pier Road.	Flood gate - timber stoplogs	LLFA

Table 6-3: Defences shown in the EA 'AIMS' data set.

Watercourse /Coastline	Location	Type	Maintainer
Thames Estuary	Coastal flood wall running along the shorefront from Adventure Island at Marine Parade to Thorpe Esplanade near Lynton Road.	Wall	Private individual, company, or charity
Thames Estuary	Tidal flood gate southeast of Forge Way, on the flood wall running along Eastern Esplanade.	Flood gate	Local Authority
Thames Estuary	Coastal flood wall running along the shorefront from the Thorpe Bay Yacht Club slipway to the old barge pier south of Gunners Park.	Wall	Private individual, company, or charity
North Sea	Coastal flood wall extending along the shorefront between points in line with Rossiter Road and I Butts Road.	Wall	Private individual, company, or charity
North Sea	Embankment extending along the shorefront between points in line with I Butts Road and Cherrytree Chase.	Embankment	Private individual, company, or charity
North Sea	Tidal flood gate on the coastal flood wall extending along the shorefront between points in line with Rossiter Road and I Butts Road.	Flood gate	Other public body
Leigh Creek	Embankment running along Leigh Golf Range to partway along High Street.	Embankment	EA

6.5 Existing and Future Flood Alleviation Schemes

The Thames Estuary 2100 (TE2100) plan (gov.uk) is a strategic plan for adapting to rising sea levels in the estuary. Parts of the study area, including the entire southern shoreline, are covered by the TE2100 plan. Most of the study area under the plan is within the policy unit Leigh Old Town and Southend-on-Sea which plans to 'take further action to keep up with climate and land use change so that flood risk does not increase' (Policy 4). An area in the southwest, south of Belton Way East, is covered by the Hadleigh Marshes policy unit. This aims to 'take action to maintain flood defences at their current level, accepting that the flood risk will increase' (Policy 3).

The Southend Highway Flood Reduction and Resilience Improvement Scheme (southend.gov.uk) is a drainage improvement scheme focusing on the Central Seafront area, Shoeburyness, and access to London Southend Airport. The scheme is funded through the Highways Maintenance Challenge Fund (Tranche 2). The Council has not published a specific start or completion date, and works are expected to be delivered in phases as part of the city’s wider highways and drainage programmes.

The Better Queensway project (southend.gov.uk) plans to improve roads and build new houses, with highway work starting in December 2025. Infrastructural upgrades also include underground attenuation tanks able to hold up to 750,000 litres of water. The aim is to reduce pressure on the wider network to lower the risk of surface water flooding towards the seafront and sewerage spills into the estuary.

Southend-on-Sea City Council is working with Anglian Water to reduce flood risk via an urban regeneration programme (anglianwater.co.uk), through the 10-year Advanced Water Industry National Environment Programme (A-WINEP) (anglianwater.co.uk). It aims to deliver combined sewer overflow spill and flood reduction through nature-based urban regeneration, including the widescale roll-out of SuDS interventions. The programme follows on from Catchment to Coast, one of 25 Defra funded projects in the Flood and Coastal Resilience Innovation Programme, aimed at making Southend and Thurrock more resistant to flooding, erosion, and drought.

7 Flood Risk Management Requirements for Developers

This section provides guidance on site-specific FRAs and other principles for managing flood risk in new development.

7.1 Early Consultation with Statutory and Non-Statutory Consultees

Developers should consult with the EA, the 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 data and/or advice requested by developers or landowners.

Anglian Water should be consulted regarding sustainable points of connection to their network. This refers to the point of connection onto the sewer network that presents no significant additional risk or that presents a risk that can be mitigated, either by planned investment or developer funded enhancements. Anglian Water actively encourages developers to submit pre-planning enquiries for both surface water and foul drainage connections and provides advice on how to apply and the appropriate guidance (anglianwater.co.uk) to review before their submission.

7.2 Site-Specific FRAs

7.2.1 What is a Site-Specific FRA?

A site-specific FRA is carried out by (or on behalf of) a developer to assess the flood risk to and from a development site and should accompany a planning application where required (see Section 7.2.2). It is recommended that the assessment is undertaken by a suitably qualified person. The assessment should demonstrate how flood risk will be managed now and over the development's lifetime, taking both climate change and the vulnerability of users into account.

The developer should check whether they are required to apply the Sequential Test prior to commencing with a site-specific FRA.

The objectives of a site-specific FRA are to 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 these effects and risks are adequate and appropriate.
- The nature of residual risk and whether this can be safely managed.
- The evidence, if necessary, for the LPA to apply the Sequential Test.

- The evidence, if applicable, to show whether the development will be safe and pass the Exception Test.

7.2.2 When is an FRA Required?

As set out in Flood risk assessments: applying for planning permission (gov.uk), a site-specific FRA is required for all development (including minor development and changes of use) proposed:

- In Flood Zones 2, 3, or 3b.
- Within Flood Zone 1 with a site are of 1 hectare or more.
- Within the 'Flood Zones plus Climate Change' extent shown on the EA FMfP.
- Within Flood Zone 1 and the EA FMfP shows it is at risk of flooding from surface water.
- In areas with critical drainage problems.
- Within Flood Zone 1 where this SFRA shows it will be at increased risk of flooding during its lifetime.
- That increases the vulnerability classification and may be subject to sources of flooding other than rivers or sea.

7.2.3 What Level of Detail is Needed in 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. The SFRA can be used by developers as a starting point to identify the initial flood risk to a site however a pre-application consultation is key to define the scope of the FRA and identify data requirements, making sure that latest available datasets are used.

7.2.4 Guidance for FRAs

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the EA and 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 (gov.uk)
- Flood Risk Assessment for Planning Applications (gov.uk); and
- Site-specific Flood Risk Assessment: Checklist (gov.uk)

Guidance should be sought from the EA and the LPA 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 opportunities to reduce the causes and impacts of flooding, whilst enhancing and conserving the natural environment. PPG: Flood risk and coastal change (gov.uk) Paragraphs 062 - 067 provide further information. Potential strategic solutions to consider are detailed in Section 12.

7.2.5 Emergency Planning

Safe access and escape routes from the site should be provided. The developer should seek to incorporate an Emergency Plan and a safe refuge point if the development site has been identified to be at risk of flooding. The local authority and Emergency Services should be consulted when designing an Emergency Plan. For further details on emergency planning, see Section 10.

8 Principles for Site Design and Master Planning

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.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land uses away from high-risk areas 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. The nature of risk to water quality also needs to be considered and mitigated to ensure that accumulated hydrocarbons and other vehicle related pollutants are not released to the aquatic environment.

Waterside areas, or areas along known flow routes, can act as GI, 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.

8.1 SuDS

SuDS are an integral element of site design, and 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. For more information, see Section 9.

8.2 Modification of Ground Levels

Modifying ground levels to raise the land above the design 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 flood level 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 analysis 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 by gravity). 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). Appendix A3 of the CIRIA Publication C624 (ciria.org) provides guidance on how to address floodplain compensation.

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.

Any proposal for modification of ground levels within areas of flood risk will need to be discussed at an early stage with the EA and its impacts assessed as part of a detailed FRA.

8.3 Raised Floor Levels

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

Developers should refer to the Preparing a flood risk assessment: standing advice (gov.uk) for the latest guidance on FFLs but generally the EA advises the minimum finished floor levels should be set 600mm above the 1% AEP fluvial plus climate change and 0.5% AEP tidal plus climate change peak flood levels, where the appropriate climate change allowances have been used. 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 fluvial and 0.5% AEP tidal plus climate change floodplain would not be acceptable and should be discouraged. New development offers opportunities to improve the resilience of buildings.

Building design and raised floor levels is the only way to fully reduce groundwater flood risk, through ensuring FFLs are raised above predicted groundwater levels considering known groundwater issues.

Allocating the ground floor of a building for less vulnerable, non-residential, or non-habitable 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 of flood defences). This risk can be reduced by use of multiple storey construction and raised areas that provide a point of refuge. However, access and escape routes may still be an issue, particularly when flood duration covers many days.

Similarly, the use of basements should be avoided in areas of flood risk. Habitable uses of basements within Flood Zone 3 and areas at high risk of surface water flooding should not be permitted, whilst basement dwellings (classed as 'highly vulnerable') in Flood Zone 2 will be required to pass the Exception Test.

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.

8.4 Development and Raised Defences

8.4.1 Undefended and Residual Risk

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, both the undefended risk and residual risk of flooding must be considered by the developer and demonstrated that they can be safely managed. The assessment of the risk should consider:

- Improvements required to the level of protection afforded by existing defences for future development.
- The future commitment to maintain the current SoP of any existing defences.
- Any disparities between the proposed level of commitment to maintain the current SoP and the level of protection required to support future development.
- The effects of climate change on the future SoP afforded by the defences and the associated maintenance and upgrade commitments required.
- Any land required to be safeguarded for affordable future flood risk management measures.

8.4.2 Breach Assessment

The assessment of the residual risk from a breach event should consider an assessment of the hazards that might be present from flood flows from a breach event, considering depth and flow velocities, so that the safety of people and structural stability of properties and infrastructure can be appropriately considered.

Considerations should 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 various ways of assessing breaches using hydraulic modelling. EA LIT56413 Breach of Defences Guidance (2021) (planning.org.uk) provides some guidance for breach assessment. It is recommended that the EA is 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.

8.4.3 Overtopping Assessment

The assessment of the residual risk from overtopping of defences should consider the risk which 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 (gov.uk) provides standard flood hazard ratings based on the distance from the defence and the level of overtopping. Overtopping modelling or assessments should be undertaken for any sites located next to defences or perched ponds/reservoirs, accounting for climate change.

8.4.4 Developer Contributions

In some cases, and following the application of the Sequential Test, it may be appropriate for the developer to contribute to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS).

8.5 Buffer Strips

The provision of a buffer strip 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. A buffer strip of 8m is required from any non-tidal main river and 16m from tidal main rivers. Where flood defences are present, these distances should be taken from the landward 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. FRAPs (gov.uk) from the EA or Ordinary Watercourse Consent from the LLFA are likely to be required for development in these areas alongside any planning permission. There should be no built development within these distances from main rivers/flood defences (where present).

8.6 Property Flood Resilience (PFR)

PFR includes a range of measures that can be installed around the perimeter of a building to reduce the risk of internal flooding. PFR can also be used within a building, to minimise the damage done if internal flooding still occurs. PFR aims to help households and businesses reduce the damage caused by flooding, helping to speed up recovery and reoccupation.

PFR encompasses two main elements:

- Resistance - Resistance measures are installed around the perimeter of a building. These measures aim to reduce the amount of water entering the building, reducing the damage caused internally. Examples include flood doors/barriers, automatic airbricks, and non-return valves.
- Resilient Adaptation (Recoverability) - Adaptions made within a property, which aim to reduce the damage caused if internal flooding still occurs.

The consideration of resistance measures and resilient adaptation should not be used to justify development in inappropriate locations. However, having applied planning policy there may be some instances where development is permitted in high flood risk areas where application of resistance and resilience measures may be required.

There may also be 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 FRA when it was first constructed.

Further information and guidance on best practice can be found in the following locations:

- Department for Communities and Local Government Improving the Flood Performance of New Buildings: Flood Resilient Construction (gov.uk)
- CIRIA Property Flood Resilience Code of Practice (ciria.org)
- EA Flood resilience construction of new buildings (gov.uk)

9 Surface Water Management and SuDS

9.1 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) are management practices which enable surface water to be drained in a more sustainable manner and to mimic the local natural drainage. The inclusion of SuDS within developments is an opportunity to enhance ecological and amenity value, and promote GI, incorporating above ground features into the development landscape strategy.

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 the LPA. This will assist with the delivery of well designed, appropriate, and effective SuDS. Applicants are also encouraged to engage with Anglian Water to discuss their surface water proposals, especially where adoption is proposed.

9.2 Sources of SuDS guidance

9.2.1 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) (ciria.sharefile.com) 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.

9.2.2 National Standards for SuDS

Previously SuDS guidance was developed to sit alongside the PPG and provide non-statutory standards as to the expected design and performance for SuDS.

As of June 2025, the Defra National standards for sustainable drainage systems (SuDS) (gov.uk) were brought in to comply with principles laid out in Section 9.4. Whilst remaining as a non-statutory specification, these now form a material consideration for LPAs when assessing planning applications. These standards aim to reflect and reinforce good practice and use of SuDS as detailed in Section 9.4.1, reflecting the four pillars of SuDS design.

The national standards contain two sets of standards. The first type (Standard 1) is known as the hierarchy standard and gives criteria for the prioritisation of final runoff destinations. The other standards (Standards 2-7) detail the minimum requirements of design criteria that surface water drainage systems should satisfy alongside how they are to be appropriately built, maintained, and operated.

9.2.3 Design and Construction Guidance

The Design and Construction Guidance (DCG) (water.org.uk), 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.

9.2.4 Local SuDS Guidance

The Sustainable Drainage Systems Design Guide For Essex (essexdesignguide.co.uk) is a webpage dedicated to offer information on LLFAs standards for the design of sustainable surface water drainage in Essex. It provides guidance on the planning, design, and delivery of SuDS schemes, and is primarily intended for use by developers, designers, and consultants.

Anglian Water also provides guidance on the design of SuDS (anglianwater.co.uk), which must be considered where developers are seeking adoption of the proposed SuDS by Anglian Water.

9.3 Roles of the LLFA and LPA

Southend-on-Sea City Council as the LLFA are 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 drainage/flood risk engineering team will provide advice to the LPA 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.

In its respective roles as LLFA and LPA, Southend-on-Sea City Council should:

- Promote the use of SuDS for the management of run off;
- Ensure their policies and decisions on applications support and compliment the building regulations on sustainable rainwater drainage, giving priority to infiltration over watercourses and then sewer conveyance;
- Incorporate favourable policies within development plans;
- Adopt policies for incorporating SuDS requirements into the Local Plan; and
- Encourage developers to utilise SuDS whenever practical, if necessary, through the use of appropriate planning conditions.

9.3.1 Schedule 3 of the Flood and Water Management Act (2010)

Currently the implementation of SuDS is driven through planning policy. If Schedule 3 of the FWMA 2010 is enacted, it 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. There is currently no confirmed timetable for the implementation of Schedule 3.

9.4 Considerations for SuDS Design

9.4.1 Four Pillars of SuDS Design

SuDS are designed to maximise the opportunities and benefits that can be secured from surface water management practices. SuDS design should consider the four pillars of SuDS (Figure 9-1): water quantity, water quality, amenity, and biodiversity.

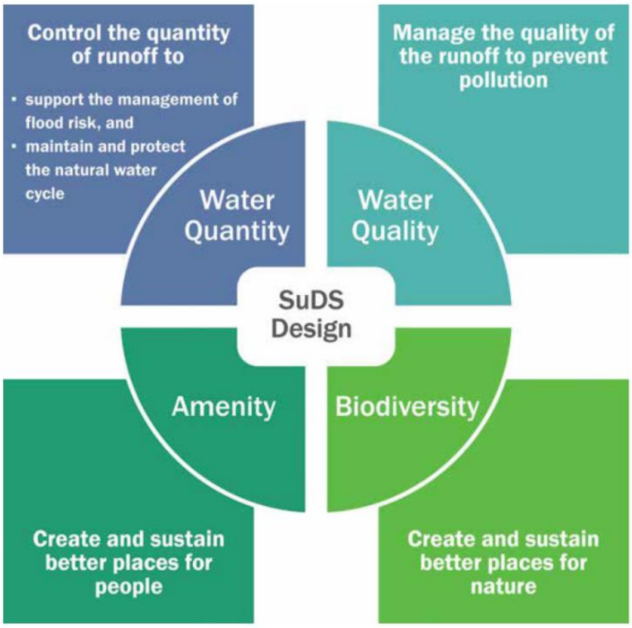


Figure 9-1: Four pillars of SuDS design (The SuDS Manual C753, 2015).

Given the flexible nature of SuDS, they can be used in most situations within new developments as well as being retrofitted into existing developments. SuDS can also be designed to fit into most spaces, for example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

It is a requirement that *'applications which could affect drainage on or around the site should incorporate sustainable drainage systems to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal. These should provide multifunctional benefits wherever possible, through facilitating improvements in water quality and biodiversity, as well as benefits for amenity'* (NPPF Paragraph 182).

It is important that SuDS are maintained for the lifetime for the development so that features can function as designed. Consideration should be given to enhancing SuDS to achieve biodiversity net gain.

9.4.2 Types of SuDS System

There are many different SuDS techniques that can be implemented in attempts to mimic pre-development drainage. Techniques can include soakaways, infiltration trenches, permeable pavements, grassed swales, green roofs, ponds and wetlands. Many of which 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 EA and the Construction Industry Research and Information Association (CIRIA) e.g. the CIRIA SuDS Manual C753 (2015).

9.4.3 SuDS Management Train

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.

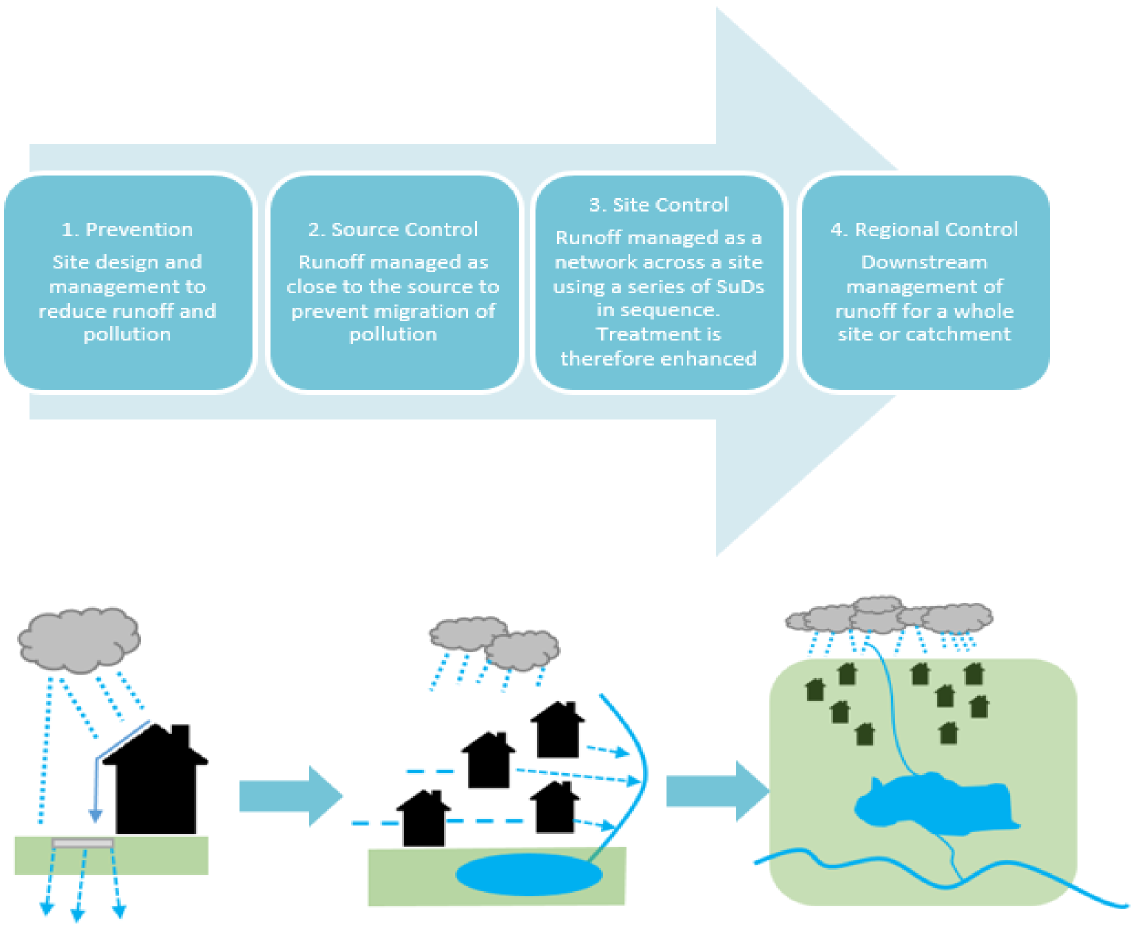


Figure 9-2: SuDS Management Train.

9.4.4 SuDS Considerations

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 9-1 details some possible constraints and how they may be overcome. Anglian Water has a SuDS Adoption Manual (anglianwater.co.uk) covering the design,

construction, and adoption of SuDS, and includes Anglian Water's local practices and working examples. As mentioned in Section 9.2.4, the SuDS design guidance must be considered where developers are seeking adoption of the proposed SuDS by Anglian Water.

Bedrock geology for the study area is comprised of clay, silt, and sand, which is likely to exhibit highly variable permeability (see Section 4.2.2). There are also numerous areas where soils are seasonally wet or with naturally high groundwater. These areas are likely to have reduced permeability, which may impact potential infiltration and would need to be considered within any SuDS design.

Drainage from new development sites or redeveloped sites should be designed in line with the drainage hierarchy (PPG: Flood Risk and Coastal Change Paragraph: 056 Reference ID: 7-056-20220825) which initially promotes the use of infiltration prior to considering alternative drainage. For SuDS techniques that are designed to encourage infiltration, it is imperative that the water table is low enough to receive surface run-off waters. Most types of SuDS will be suitable in areas with permeable bedrock including features such as soakaways and infiltration basins. In areas with more impermeable geology, off-site discharge in accordance with the drainage hierarchy may be required to discharge surface water runoff from the site. In some cases, above-ground features such as attenuation ponds may be practical with a managed outlet or discharge point. Infiltration should be considered with caution within areas of possible subsidence or sinkholes.

A site-specific infiltration test will need to be conducted early on as part of the design of the development in order to determine the impact of groundwater levels on the effectiveness of the drainage system. Groundwater monitoring is also encouraged and may be required in some locations.

Anglian Water do not support permeable surfacing over their existing assets. This can create issues with maintenance and repair activities and may compromise the effective operation of the SuDS feature. Where Anglian Water has existing underground assets within a site, the design layout should incorporate these assets within roads or public open spaces, avoiding overlaying permeable surfaces above their assets. In addition, utilising SuDS as part of rainwater harvesting for non-potable reuse in homes (garden irrigation/toilet flushing) and businesses should also be identified as a potential solution.

Where sites lie within the 'Secondary A' aquifer in the west of the site (Section 4.2.2), further restrictions may be applicable, and guidance should be sought from the LLFA and the EA.

Table 9-1: Example SuDS design constraints and possible solutions

Constraints	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 line or clay to prevent the egress 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 can be considered as a last resort.
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. Facts such as siltation after a flood event should also be taken into account during the design phase.
Future adoption and maintenance	The LPA should ensure development proposals, through the use of planning conditions or planning obligations, have clear arrangements for on-going maintenance over the development's lifetime.

9.5 Other Surface Water Considerations

9.5.1 Groundwater Vulnerability Zones

The 2015 EA published groundwater vulnerability 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 (defra.gov.uk).

9.5.2 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 (defra.gov.uk). 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 no GSPZ within the study area.

9.5.3 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 interactive mapping (data.gov.uk).

There is one NVZ (Surface Water S427 - River Roach, Nobles Ditch and Eastwood Brook 2025 to 2028) in the north west of the study area, that covers an area around Nestuda Way and Cherry Orchard Way, while also running along part of the northwestern boundary.

9.5.4 Critical Drainage Areas

Local Authorities can also choose to designate CDAs within their authority area. In 2020, Essex County Council revised the South Essex SWMP CDAs. Out of 35 CDAs, four extend beyond the Essex County Council administrative boundary into the Southend study area. These four CDAs are named Eastwood, Southend On Sea, Garon Park, and Little Wakering. These cross-boundary CDAs should be used for this Level 1 SFRA to identify sites which may be at multiple or interlinked sources of flood risk during a severe rainfall event. The CDAs are shown in the mapping in Appendix J.

There are also six CDAs currently designated within the study area, that were identified in the Southend-on-Sea SWMP 2015. These areas include Eastwood Brook, Prittle Brook, Temple Sutton, Southchurch, Shoebury, and Chalkwell.

The purpose of defining CDAs is to prioritise locations for flood risk management and mitigation measures, so that future development and planning decisions consider these high-risk zones. Essex County Council advise that where new development is located within a CDA, opportunities should be taken to deliver betterment over existing greenfield rates to reduce flood risk to existing residential properties where this is practical to do so. This should be undertaken in accordance with the NPPF and The Sustainable Drainage Systems Design Guide For Essex (essexdesignguide.co.uk).

Any development within these CDAs will need demonstrate an adequate surface water drainage system which is maintainable for the lifetime of the development within a site-specific FRA. Developers will need to provide details of the long term maintenance of the surface water drainage system. Developers should collaborate with the LLFA to identify all sources of flood risk, help reduce risk to existing communities, and explore grant funding opportunities for these wider improvements. Furthermore, growth allocations should take CDAs into account when assessing site suitability for development, ensuring that flood risk is properly managed and mitigated during planning.

10 Flood Warning and Emergency Planning

10.1 NPPF Requirements

The NPPF Flood Risk Vulnerability and Flood Zone "incompatibility" table (gov.uk) seeks to avoid inappropriate development in areas at risk from all sources of flooding. It is essential that any development which will be required to remain operational during a flood event is located in the lowest flood risk zones to ensure that, in an emergency, operations are not impacted upon by flood water, or that such infrastructure is resistant to the effects of flooding such that it remains serviceable/operational during 'Upper End' allowance events, as defined in the Environment Agency's Climate Change allowances (gov.uk).

The outputs of this SFRA should be compared and reviewed against any Emergency Plans and continuity arrangements. This includes the nominated rest and reception centres (and prospective ones), so that evacuees are outside of the high-risk Flood Zones and will be safe during a flood event.

10.2 Emergency Planning

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

The 2024 NPPF (Paragraph 181) 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."

In accordance with the NPPF, documents including 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 flood risk and coastal change guidance, 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: Flood risk and coastal change 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 escape routes for users and emergency services (Section 10.2.1).

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

- The National Planning Policy Guidance (gov.uk)
- Civil Contingencies Act 2004 (legislation.gov.uk)
- Defra's National Flood Emergency Framework for England (2014) (gov.uk)
- FloodRe (floodre.co.uk)
- EA and Defra’s Standing Advice for FRAs (gov.uk)
- EA’s ‘How to plan ahead for flooding’ (gov.uk)
- Sign up for Flood Warnings with the EA (gov.uk)
- The National Flood Forum (nationalfloodforum.org.uk)
- 'Prepare for flooding' (gov.uk)
- ADEPT Flood Risk Plans for new development (adeptnet.org.uk)
- EA's Community Flood Plan (2023) (gov.uk)
- EA's Personal Flood Plans (2023) (gov.uk)

10.2.1 Safe Access and Escape Routes

Safe access and escape routes will need to be demonstrated during the design flood event. Access requirements are set out in the PPG: Flood Risk and Coastal Change (gov.uk) Paragraph: 047 Reference ID: 7-047-20220825.

As part of an FRA, the developer should review the acceptability of the proposed access in consultation with the LLFA and the EA. Site and plot specific velocity and depth of flows should be assessed against standard hazard criteria to ensure safe access and escape routes can be achieved.

10.3 Local Arrangements for Managing Flood Risk

Southend-on-Sea City Council is a partner in the Essex Resilience Forum (essexprepared.co.uk). This Local Resilience Forum is a multi-agency partnership established under the Civil Contingencies Act 2004 that works together to prepare for, respond to, and recover from major emergencies and incidents. They identify risks, maintain the Community Risk Register, undertake training and exercising, coordinate response and recovery, and communicating with the public before, during, and after emergencies and provide advice to communities.

Southend-on-Sea City Council has an evacuation plan, and the Essex Resilience Forum has a multi-agency evacuation plan, as well as a strategic multi-agency flood plan.

There are three designated emergency rest centres within the study area. The locations of these are shown in Table 10-1.

Table 10-1: Emergency rest centres in Southend-on-Sea.

Rest Centre	Address	Post code	Easting	Northing
Tickfield Industrial Estate	Tickfield Avenue, Southend-on-Sea	SS2 6LL	588031	186749
Leigh on Sea Community Centre	73 Elm Rd, Southend-on-Sea, Leigh-on-Sea	SS9 1SP	584131	186084
Garon Park	Eastern Ave, Southend-on-Sea	SS2 4FA	589679	187494

10.4 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 service, to homes and business within Flood Zones 2 and 3. The EA Sign up for Flood Warnings (gov.uk) page provides information on how to sign up for these warnings.

There are currently four Flood Alert Areas (FAA) and five Flood Warning Areas (FWAs) covering the study area:

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 FAAs usually cover the majority of main river reaches.

Flood Warnings are issued to designated FWAs (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 included in the mapping in Appendix H.

11 Cumulative Impact Assessment

11.1 Introduction

The cumulative impact of development should be considered at both the Local Plan making stage and the planning application and development design stages.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume from any source, 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/exceedance paths from sewers, surface water ponding and infiltration can also give rise to cumulative effects and potentially exacerbate flood risk. There are also risks of development causing modified flow regimes from sites creating an alignment in peak flows in downstream watercourses and resulting in greater flood risk as a result of the development.

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 flow paths and storage proposals should normally not increase flood risk downstream.

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.

There is currently no national guidance available for assessing the cumulative impacts of development. Given the small size of the study area, the following sections provide an overview of the flood risk within each of the catchments that impact the study area and potential cumulative impacts of development and recommendations to mitigate these. Broadscale recommendations applicable across the whole study area are set out in Section 13.2.7.

11.2 Assessment of Cross-Catchment Issues

There are two fluvial WFD cross-boundary catchments that cover the west of the study area, namely Prittle Brook and Eastwood Brook catchments. These catchments are examined in detail in the following sections.

The remainder of the study area, in the east and southwest, does not fall within any WFD catchments. In these areas the main risks are from tidal and surface water sources. An analysis of surface water risk has been carried out using detailed watershed boundaries, identifying the catchments most likely to be sensitive to increased risk of surface water flooding in the future. Future development within and outside of the study area, as well as climate change, has the potential to affect flood risk to existing development and the surrounding areas, depending on the effectiveness of SuDS and drainage implementation.

The nature of tidal flooding means that development is unlikely to impact upon this flood risk. Southend-on-Sea is highly urbanised and given its coastal location, there are very limited cases where development would be likely to increase downstream flood risk. Nevertheless, tidal flood risk must still be taken into account in consideration of appropriate development sites. The priority within Southend-on-Sea is using development of brownfield sites to provide betterment wherever possible.

11.3 Prittle Brook Catchment

11.3.1 Catchment Overview

Figure 11-1 shows the Prittle Brook catchment boundary, the main river, and the proposed development sites.

The Prittle Brook catchment lies in the western half of the study area, as well as in the north of Castle Point Borough and in the south of Rochford District. The catchment covers Southend Airport, much of Hadleigh, southern Eastwood, Leigh-on-Sea north of Marine Parade, as well as Prittlewell and an area extending southwards to Southend Victoria station. The majority of the catchment is urban but includes a number of green spaces, including West Wood and Belfairs Nature reserve upstream in Castle Point Borough, as well as Priory Park and Warners Bridge Park further downstream in the study area.

11.3.2 Historic Flooding

The EA's Historic Flood Map and Recorded Flood Outlines do not show any records of flooding within the Prittle Brook catchment. However, Section 19 reports show that on 24 August 2013 Prittle Brook is reported to have flooded within Priory Park, with water backing up on Victoria Avenue. Additionally, on 20 July 2014 it is suspected that high water levels in Prittle Brook restricted the discharge of surface water outfalls into the watercourse, resulting in water backing up the network and surcharging at low lying manholes within the Cavendish Gardens area.

11.3.3 Fluvial Flood Risk

The fluvial flood risk within the catchment follows the path of Prittle Brook from its source by West Wood in Castle Point Borough. The watercourse flows east through the study area to Prittlewell, then continues north past Southend Airport before joining River Roach outside of the catchment boundary, north of Sutton. Prittle Brook also has a culverted flood relief channel, that starts just south of Manchester Drive Allotments, that diverts excess flows into the Thames Estuary during flood events.

11.3.4 Surface Water Flood Risk

Surface water flood risk across the catchment is distributed widely along natural topographic depressions and channels, as is the case across West Wood and Belfairs Nature Reserve in Castle Point Borough. There are several areas at risk from isolated ponding across the residential areas, and surface water flow routes are also present on roads and along parts of the railway tracks in the east of the catchment.

11.3.5 Recommendations

As the main areas of risk are distributed across the catchment, there is the potential for measures in the upper catchment such as nature-based solutions and preservation and enhancement of natural surface water storage mechanisms, to reduce the surface water flood risk to these areas.

Most of the proposed sites within the catchment are partially or entirely on brownfield land, and therefore there is potential for development to provide betterment through the use of SuDS and water storage/retention measures through a carefully planned drainage strategy that aims to reduce runoff rates as much as possible. The drainage strategy should be considered at an early stage of master planning to make sure it is well integrated. SuDS attenuation for non-potable uses should be prioritised, following the drainage hierarchy within the new national SuDS standard. This aligns with Anglian Water's Surface Water Risk Management Guidance (anglianwater.co.uk). In Section 2 of this guidance, scenarios 7 and 10 specifically relate to combined sewers. Anglian Water will use opportunities presented by new development to reduce exposure to pollution risk in the existing sewer network. As such, they expect new development to exploit all practicable opportunities to reduce surface water flow to the combined sewer network, in terms of volume and discharge flow rate.

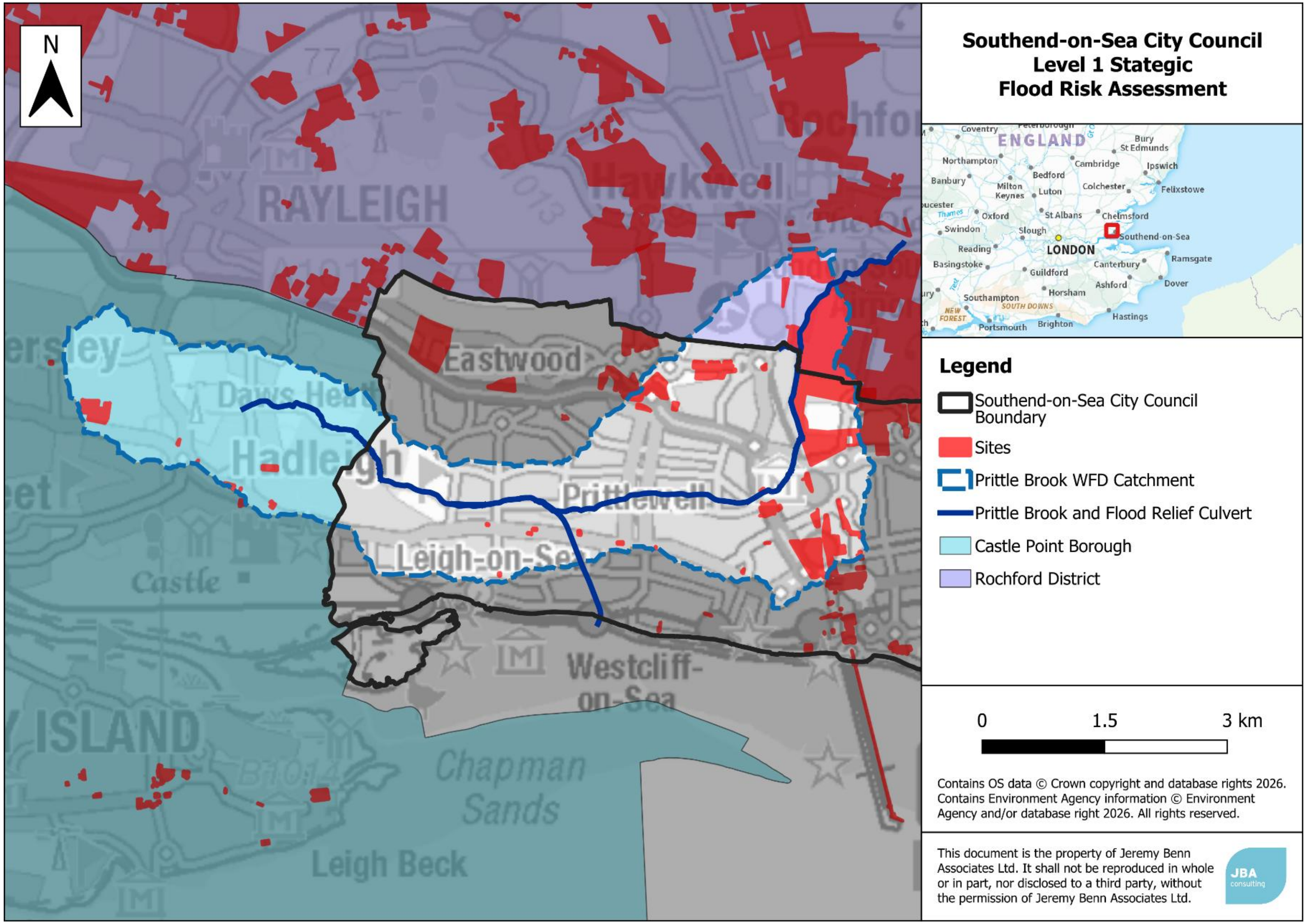


Figure 11-1: Prittle Brook catchment boundary, statutory mains rivers, and the proposed development sites.

11.4 Eastwood Brook Catchment

11.4.1 Catchment Overview

Figure 11-2 shows the catchment boundary, the main river, and the proposed development sites.

The Eastwood Brook catchment lies in the northwest of the study area, as well as in the northeast of Castle Point Borough and in the southwest of Rochford District. The catchment covers part of Southend Airport, the Eastwood suburb, and the south of Rayleigh. The majority of the catchment is urban but includes a number of green spaces in the west, including Tile Wood and Pound Woods.

11.4.2 Fluvial Flood Risk

The fluvial flood risk within the catchment follows the course of Eastwood Brook, which originates south of Brook Road in Rochford District. The watercourse flows east through Eastwood before continuing north through Southend Airport and joining River Roach at Rochford Hundred Golf Club. Eastwood Brook is culverted underneath Glenwood Avenue and Grovewood Avenue, and the fluvial flood risk mapping shows flood extents covering large parts of these roads. There is also a tributary to Eastwood Brook culverted underneath Eastwoodbury Lane. The fluvial flood risk mapping shows that in the event of a blockage water could back up and flow east onto Eastwoodbury Lane.

11.4.3 Historic Flooding

The EA's Historic Flood Map and Recorded Flood Outlines do not show any records of flooding within the Eastwood Brook catchment. However, Section 19 flood investigation reports show that Eastwood Brook overtopped on 24 August 2013. Eastwood Brook also overtopped on 20 July 2014 and resulted in flooding at Glenwood Avenue, as water overtopped the channel at the head of the culvert beneath Glenwood Avenue and Grovewood Avenue.

There are also two Section 19 flood investigation reports that describe flooding due to Eastwood Brook overtopping in 2021 and 2022, impacting the immediate area surrounding the junction of Glenwood Avenue and Rayleigh Road. On 20 October 2021, fluvial flooding is suspected to have been caused by localised, intense rainfall and debris blockages within the Eastwood Brook. For this event, there was one internal and one external reported incident of property flooding on Rayleigh Road. On 22 February 2022, intense rainfall caused Eastwood Brook to overtop the channel, resulting in internal flooding on Rayleigh Road. In 2022, there were three reports of properties internally flooding on Rayleigh Road.

11.4.4 Surface Water Flood Risk

Surface water flood risk across the catchment is distributed widely along natural topographic depressions and channels, as is the case across Tile Wood and Pound Woods. There are several areas at risk from isolated ponding across the residential areas, and surface water flow routes present on roads. The largest surface water flow path in the catchment travels northwards approximately 2.5km from Irvington Close to Laurence Industrial Estate.

11.4.5 Recommendations

As the main areas of risk are distributed across the catchment, there is the potential for upstream measures, such as SuDS implementation and preservation and enhancement of natural surface water storage mechanisms, to reduce the risk to these areas. SuDS attenuation for non-potable uses should be prioritised, following the drainage hierarchy within the new national SuDS standard.

Most of the proposed sites within the catchment are partially or entirely on brownfield land, and therefore there is potential for development to provide betterment through the use of SuDS and water storage/retention measures. This aligns with Anglian Water's Surface Water Risk Management Guidance (anglianwater.co.uk). In Section 2 of this guidance, scenarios 7 and 10 specifically relate to combined sewers. Anglian Water will use opportunities presented by new development to reduce exposure to pollution risk in the existing sewer network. As such, they expect new development to exploit all practicable opportunities to reduce surface water flow to the combined sewer network, in terms of volume and discharge flow rate.

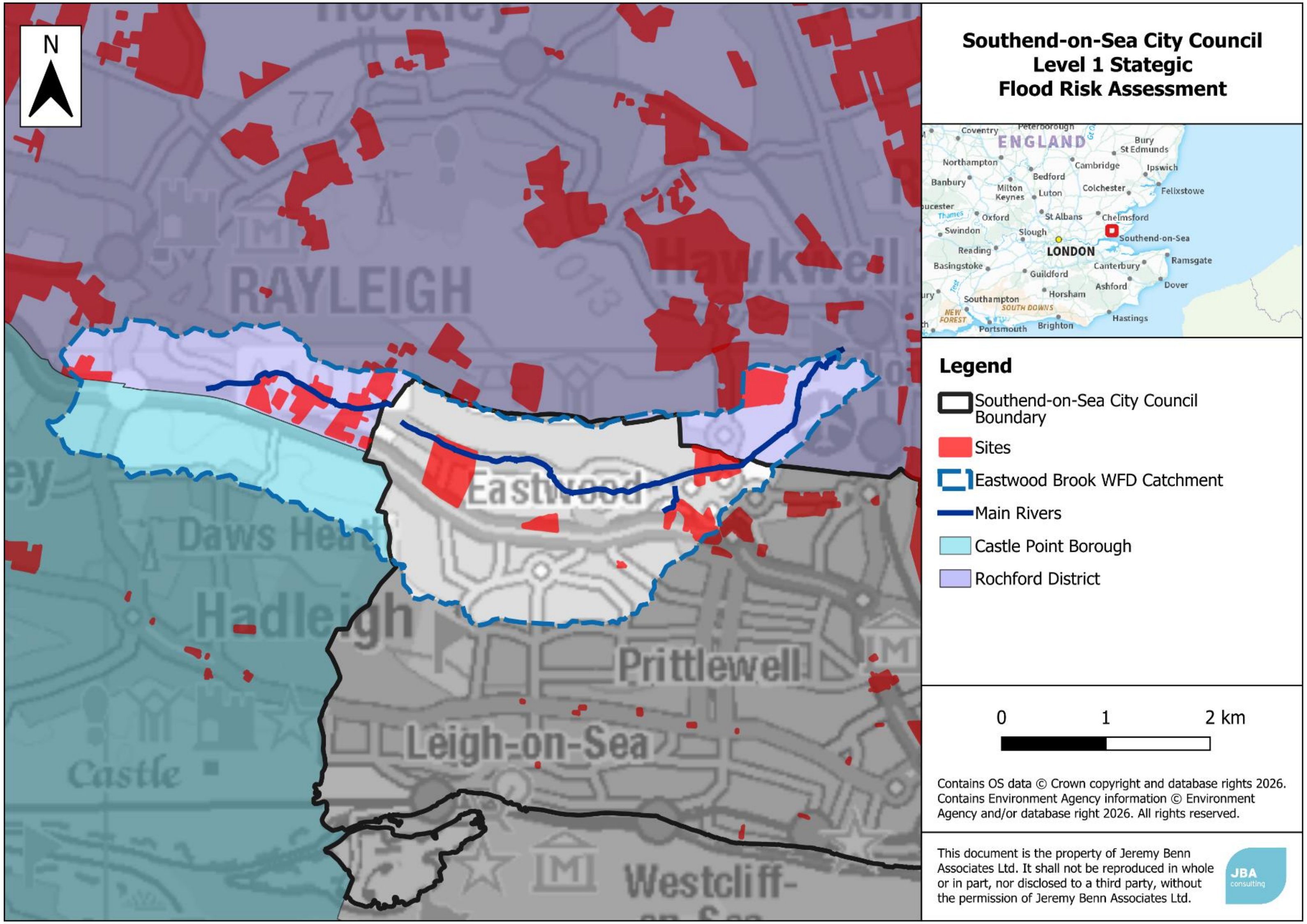


Figure 11-2: Eastwood Brook catchment boundary, statutory mains rivers, and the proposed development sites.

11.5 Surface Water Catchments

It is important to understand which catchments are most sensitive to increases in flood flows which may theoretically be caused by new development. Predicted surface water flood risk was assessed using the following datasets:

- Total area of buildings within the 1% AEP surface water flooding extent for each detailed watershed catchment.
- Total area of buildings within the 0.1% AEP surface water flooding extent for each detailed watershed catchment.

The difference in the area of buildings at risk in these two datasets has then been used to identify which catchments are more sensitive to increases in surface water flooding. The results of this assessment are shown in Figure 11-3.

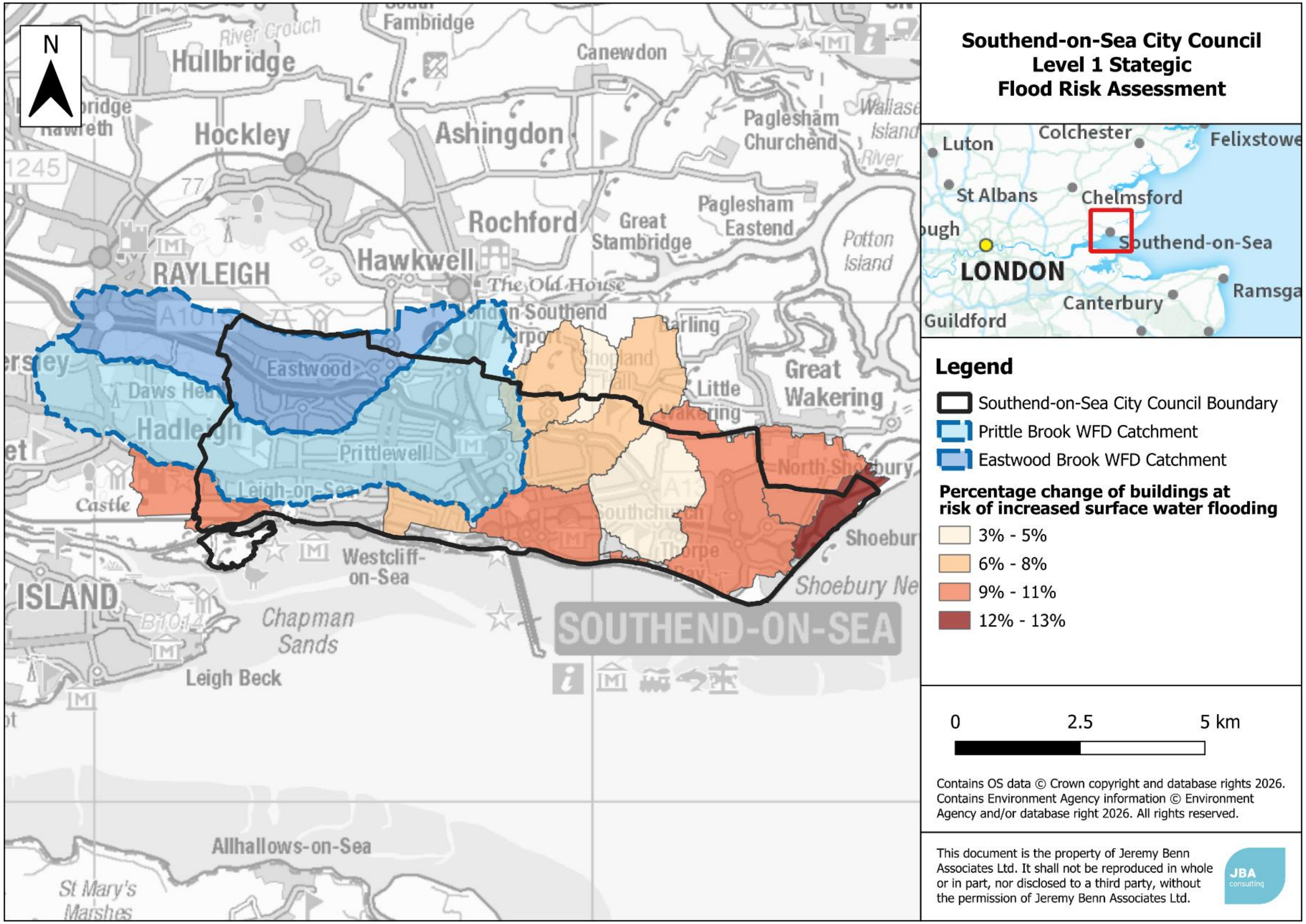


Figure 11-3: Results of the surface water risk increase sensitivity assessment.

11.5.1 Recommendations

Figure 11-3 shows that the catchment identified as having highest sensitivity to increased risk is located by the coastline north of Shoeburyness. There are also two adjacent catchments with high sensitivity, in North Shoebury and Great Wakering, as well as one west of Leigh-on-Sea and one covering Southchurch and the centre of Southend-on-Sea.

As most of the catchments are urbanised, future improvements will rely on the redevelopment of brownfield sites to achieve betterment and mitigate flood risk. Where greenfield development is proposed, such as green belt allocations in the north of the study area, developments should be used as an opportunity to enhance the existing river corridor. Natural drainage features should be maintained, and opportunities identified for river restoration/enhancement to make space for water.

12 Strategic Flood Risk Solutions

Strategic flood risk solutions may offer a potential opportunity to reduce flood risk in the study area. Section 11 considers the cumulative impacts of development across the study area and the catchments which are most sensitive to these impacts, and as such where strategic flood risk solutions may be most beneficial.

Where possible developments should seek to help reduce flood risk in the wider area. The following sections outline different options which could be considered for strategic flood risk solutions. Any strategic solutions should ensure they are consistent with wider catchment policy and the local policies.

It is important that the ability to deliver strategic solutions in the future is not compromised by the location of proposed development. When assessing the extent and location of proposed development, consideration should be given to the requirement to secure land for flood risk management measures that provide wider benefits.

12.1 Partnership Working

Flood risk to an area or development can often be attributed to multiple different sources, including fluvial, surface water and/or groundwater, which can become intertwined. Where complex flood risk issues are highlighted, it is important that all stakeholders are actively encouraged to work together to identify issues and provide suitable solutions.

12.1.1 Catchment Based Approach

The Catchment Based Approach (CaBA) (catchmentbasedapproach.org) was introduced by the Government in 2013 to establish catchment partnerships throughout England to jointly deliver improved water quality and reduce flood risk, directly supporting achievement of many of the targets set out within the Government's 25-year Environment Plan. CaBA partnerships are actively working in all 100+ river catchments across England and cross-border with Wales.

The Essex Rivers Hub, hosted by the Essex and Suffolk Rivers Trust, covers the majority of the study area. Essex Rivers Hub's vision is that their *'water environments are resilient to the changing climate and population growth, are richer in biodiversity, support a thriving economy and contribute to the wellbeing of the citizens in the Essex Rivers Hub catchment.'* Their aims and objectives are further set out in their Catchment Plan (essexrivershub.org.uk).

Your Tidal Thames (YTT), co-hosted by Thames21 and Thames Estuary Partnership, covers Two Tree Island in the southwest of the study area. Their vision is for a *'tidal Thames that is more accessible, greener and more connected to the wider London landscape and the sea. A river that benefits people, businesses and wildlife.'* The YTT Catchment Plan is in the process of being updated. Actions that the partnership are working to meet are set out in the Thames RBD river basin management plan (gov.uk).

12.1.2 Additional Partnership Working Examples

Further examples of partnership working highlighted in this SFRA includes the following projects:

- Thames Estuary 2100 (TE2100) plan (gov.uk) discussed in Section 6.5.
- The Council and Anglian Water working together on a 10-year programme to reduce flooding (southend.gov.uk), discussed in Section 6.5.
- Catchment to Coast (catchmenttocoast.uk) discussed in Section 12.3.2.

12.2 Biodiversity Net Gain

Biodiversity Net Gain (BNG) is a strategy to develop land and contribute to the recovery of nature. It is making sure the habitat for wildlife is in a better state than it was before development. BNG has been applicable since November 2023 for developments in the Town and Country Planning Act 1990, unless exempt, and has been applicable to small sites since April 2024. Further information is available on the Government BNG webpage (gov.uk). Strategic flood risk solutions can help developments achieve BNG requirements.

12.3 Natural Flood Management

Development can provide opportunities to work with natural processes to help reduce flood and erosion risk, benefit the natural environment and reduce costs of schemes. This is known as NFM, a process whereby action is taken to mitigate flood risk by protecting, restoring and emulating natural processes. This approach aims to reduce flow volumes and delay the arrival of peak flood flows downstream.

Techniques and measures, which could be applied in the study area include:

- Living Sea Walls and biogenic/geogenic reefs
- Beach and sand dune regeneration
- Saltmarsh restoration
- 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 (Section 12.4).
- Restoration of rivers and removal of redundant structures, i.e. weirs and sluices no longer used or needed (Section 12.5).
- Installation or retainment of large woody material in river channels.
- Improvements in management of soil and land use.
- Creation of 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 the land. 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.

It is important to recognise the value of maintenance or restoration of natural riparian zones, such as grasslands, which protect the soils from erosion and 'natural' meadows which can tolerate flood inundation. The use of GI throughout river corridors can also play a vital role in enhancing the river environment as well as safeguarding land from future development, protecting people and buildings from flooding and reducing flood risk downstream.

12.3.1 Working with Natural Processes

The EA published their updated evidence base in February 2025 for Working with natural processes to reduce flood risk 2024 (gov.uk) to support the implementation of NFM, with 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 measures that may work in a catchment and the best places in which to locate them. The maps have identified runoff attenuation features in and around Sutton Road Cemetery, as well as floodplain reconnection potential along parts of Prittle Brook and Willingale Brook. Floodplain woodland potential has been identified by Eastwoodbury Lane Playing Fields, and along Prittle Brook in Warners Bridge Park, Priory Park, by Darlinghurst Academy, and south of Manchester Drive Allotments. Finally, several areas of wider catchment woodland potential have been identified by the greenbelt land in the northeast, by Leigh Gold Range and Two Tree Island, around Eastwoodbury Lane Playing Fields and St Laurence Park, in Priory Park, and around Manchester Drive Allotments and St Thomas More High School.

12.3.2 Ongoing NFM Schemes

Catchment to Coast is a Defra-funded project within the Flood and Coastal Resilience Innovation Programme (FCRIP). The project has adopted a catchment-based approach and is trialling nature-based solutions to address flooding and coastal erosion risk across Southend-on-Sea, Thurrock, and parts of Castle Point. These innovative measures include saltmarsh regeneration, rain gardens, using leaky dams, installing a floating barrier island and deploying exotiles and exowalls. More information on the different measures being trialled can be found on the Catchment to Coast website (catchmenttocoast.uk),

Websites that provide further information about ongoing NFM schemes and community works include the Rivers Trust NFM National Map (theriverstrust.hub.arcgis.com). Currently, this map does not show any NFM schemes within the study area.

12.4 Catchment and Floodplain Restoration

Floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, and by creating space for naturally functioning floodplains working with natural processes.

Although the restoration of floodplain is difficult in previously developed areas where development cannot be rolled back, the following measures should be adopted:

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible. Buffering areas around watercourses to provide an opportunity to restore parts of the floodplain.
- Removing redundant structures to reconnect the river and the floodplain.
- Applying the sequential approach to avoid new development within the floodplain.

12.5 Structure Removal and/or Modification

Structures, both within watercourses and adjacent to them can have significant impacts upon rivers including alterations to the geomorphology and hydraulics of the channel through water impoundment and altering sediment transfer regime, which over time can significantly impact the channel profile including bed and bank levels, alterations to flow regime and interruption of biological connectivity, including the passage of fish and invertebrates.

Many artificial in-channel structures (examples include weirs and culverts) are often redundant and/or serve little purpose and opportunities exist to remove them where feasible. The need to do this is heightened by climate change, for which restoring natural river processes, habitats and connectivity are vital adaptation measures. However, it also must be recognised that some artificial structures may have important functions or historical/cultural associations, which need to be considered carefully when planning and designing restoration work.

In the case of weirs, whilst weir removal should be investigated in the first instance, in some cases it may be necessary to modify a weir rather than remove it. For example, by lowering the weir crest level or adding a fish pass. This will allow more natural water level variations upstream of the weir and remove a barrier to fish migration.

There is also the potential for negative localised flood risk impacts associated with weir removal or modification. A robust hydraulic assessment, including hydraulic modelling, is likely to be required as part of any planning or FRAP application to demonstrate that there is no associated increase in flood risk.

Developers should open up existing culverts where possible and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings.

12.6 Bank Stabilisation

Bank erosion should be avoided, and landowners are encouraged to avoid using machinery and vehicles close to or within the watercourse unless in the circumstances where machinery and vehicles are required for watercourse maintenance such as desilting. Care should be taken not to destabilise the banks.

There are several techniques that can be employed to restrict the erosion of the banks of a watercourse. In an area where bankside erosion is particularly bad and/or vegetation is unable to properly establish, ecologically sensitive bank stabilisation techniques, such as willow spiling, can be particularly effective. Live willow stakes thrive in the moist environment and protect the soils from further erosion allowing other vegetation to establish and protect the soils. Other approaches include the planting of brash or small trees, large wood, large trees and root wads.

12.7 Green Infrastructure

GI is a planned and managed network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and rural fringe and consist of:

- Open spaces – parks, woodland, nature reserves, lakes.
- Linkages – river corridors and canals, and pathways, cycle routes and greenways.
- Networks of “urban green” – private gardens, street trees, verges and green roofs.

The identification and planning of GI is critical to achieving sustainable growth. It merits forward planning and investment as much as other socio-economic priorities such as health, transport, education and economic development. GI is also central to climate change action and planning policy. With regards to flood risk, green spaces can be used to manage storm flows and free up water storage capacity in existing infrastructure to reduce risk of damage to urban property, particularly in city centres and vulnerable urban regeneration areas. GI can also improve accessibility to waterways and improve water quality, supporting regeneration and improving opportunity for leisure, economic activity and biodiversity.

Developers should identify flood risk corridors or areas and integrate them in to the master planning, wherever possible, rather than relying on underground pipes and storage. This will provide opportunities for amenity and multiple other benefits.

The Essex Green Infrastructure Strategy (2020) (essexdesignguide.co.uk) provides a vision and objectives for the future of GI delivery in Essex.

Southend-on-Sea City Council is working with Anglian Water to reduce flood risk via an urban regeneration programme (anglianwater.co.uk), through the 10-year Advanced Water Industry National Environment Programme (A-WINEP) (anglianwater.co.uk), as discussed in Section 6.5. This programme may create wider opportunities to enhance GI. However, Anglian Water expects new development to manage surface water risk within the development site itself through appropriate drainage measures, predominantly through use of SuDS in accordance with the drainage hierarchy.

13 Summary, Recommendations, and Next Steps

13.1 Summary of Flood Risk Across the Study Area

Table 13-1 provides a high-level summary of the sources of flood risk and key areas of risk within the study area. These have been used to inform the recommendations in Section 13.2.

Table 13-1: High-level summary of flood risk from all sources.

Flood risk source	Summary of risk
Fluvial	• The major watercourses flowing within the study area are Eastwood Brook, Prittle Brook, Mucking Hall Brook, Willingale Brook, and C-X Ditch. • In the west of the site, the fluvial flood risk is from Prittle Brook and Eastwood Brook. Willingale Brook and C-X Ditch also have large flood extents, as tidal water from the Thames Estuary backs up the channels, contributing to the flows. The fluvial extents for Mucking Hall Brook follow the watercourse's floodplain through Garon Park Golf Complex. • Areas identified as most sensitive to fluvial impacts of climate change are around Willingale Brook and C-X Ditch, both of which discharge into the Thames Estuary and are tidally influenced. For Flood Zone 3b, Eastwood Brook most sensitive to fluvial impacts of climate change between Willow Close and Brookland Avenue, as well as south of Rayleigh Road (A1015) between Clyst Court and the Bellhouse. Areas along Prittle Brook most sensitive to fluvial impacts of climate change in Flood Zone 3b include along the watercourse by Belfairs Park and Golf Course parallel to Vardon Drive, as well as in Priory Park and on Victoria Avenue. There is only minor sensitivity to fluvial impacts of climate change around Mucking Hall Brook. • There are historical records of Eastwood Brook and Prittle Brook overtopping, as well as high water levels in Prittle Brook restricting the discharge of surface water outfalls.

Flood risk source	Summary of risk
Tidal	• Almost the entire southern and eastern coastline are at tidal flood risk, with the flood extents covering much of the beach areas and parts of the directly adjacent roads. Along the southern coastline this includes parts of Chalkwell Esplanade, Western Esplanade, Marine Parade, and the B1016. There is tidal flood risk in the northeast of the study area, around Suttons Road and East Beach, as well as the area south of Leigh-on-Sea Railway Station and around Chalkwell Avenue. Some of the largest areas of risk are by Willingale Brook and C-X Ditch. The risk here is combined fluvial and tidal, as water from the Thames Estuary backs up the channels. • Areas in the study area identified as most sensitive to tidal impacts of climate change from the increase in flood extent include Two Tree Island and a significant area in northeast. In this northeastern area, the undefended climate change extents stretch westwards from the shoreline past friars Primary School and Nursery to just beyond Cunningham Close. Sensitive areas are also identified around Willingale Brook and C-X Ditch that discharge into the Thames Estuary, with extents covering large parts of Southchurch, North Shoebury, and Shoeburyness. These watercourses are tidally influenced, and there is potential for joint probability fluvial-tidal flood events to occur. • Several historic flood incidents have been recorded that were caused by intense rainfall coinciding with a high spring tide, as well as flooding being exacerbated by tide locking.
Surface water	• There is widespread surface water flood risk across the study area. Several surface water flow paths follow the topography of the existing watercourses, and there are several areas at risk from isolated ponding. • In the 3.3% AEP event, there are large surface water flow routes in Leigh-on-Sea, Eastwood, and south of London Southend Airport, particularly around Rochford Road, which serves as a key access route to the airport. In the 1% and 0.1% AEP events, there are also significant flow paths that develop in North Shoebury, Southchurch, and between Royal Artillery Way. • There is increased risk of surface water flooding in the future across the entire study area due to climate change. There are many new areas of isolated ponding, together with additional flow paths. The extents of the largest surface water flow routes also increase. • Historic flooding records shows interactions between different flood sources, including incidents of surface water runoff combining with

Flood risk source	Summary of risk
	high river levels, and tide locking causing restricted the discharge from surface water outfalls. There are also cases of increased surface water entering into combined sewers systems, resulting in both surface water and foul sewer flooding.
Sewer	• Between 2022 and 2026, Anglian Water's DG5 dataset shows 420 georeferenced internal and external sewer records of property flooding. • A number of Section 19 reports also mention instances of surcharging sewers and sewer capacity issues, including on 24 August 2013 and 20 October 2021.
Groundwater	• The JBA Groundwater Emergence Map shows groundwater levels are either at or very near (within 0.025m of) the ground surface in several locations across the study area. This includes in Eastwood, along a large part of Prittle Brook, by Sutton Road Cemetery, and near the Bournes Green Roundabout. • Groundwater levels are between 0.025m and 0.5m below the ground surface in the east of the study area in Shoeburyness and North Shoebury. These groundwater levels are also found in the north of the study area, including by Green Lane, St Thomas More High School, and Garon Park Golf Complex. • Over 70% of the study area is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits. • Three historical incidents have been noted of basements flooding potentially due to groundwater, by Eastern Esplanade, near to the Victoria Station, and West of Leigh-on-Sea.
Reservoir	• There are no reservoirs located within the study area. There is one reservoir in Hadleigh, located in Castle Point Borough, that poses a risk to a minor part of the study area by the boundary, southwest of Leigh Golf Range

13.2 Recommendations from SFRA Findings

13.2.1 Drainage Strategies and SuDS

Planners should be aware of the conditions set by the LLFA for surface water management. The future enactment of Schedule 3 of the FWMA means that there will be mandatory standards for delivery and adoption of SuDS in new developments, however, this has not yet been enacted.

Sustainable drainage in line with the new national SuDS standards should be considered and implemented where possible for all new development. The drainage hierarchy within the new national SuDS standards should be followed which includes collection for non-potable use as priority 1. 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.

Runoff rates from all development sites must be limited to greenfield rates (including brownfield sites) unless it can be demonstrated that this is not practicable. If it is demonstrated that greenfield rates are not practicable then the runoff rates should be restricted to the closest rate that is practicable but not exceeding the existing brownfield runoff rate. Given the widespread surface water risk and urbanised nature of the study area, brownfield development should be used as an opportunity to reduce existing flood risk issues.

SuDS must be designed appropriately for the area. The geology underlaying the study area is likely to have highly variable permeability, and infiltration testing must be undertaken to determine whether infiltration rates are suitable for the use of infiltration SuDS. Where sites lie within or close to aquifers in the west of the study area, there may be restrictions on infiltration SuDS and guidance should be sought from the LLFA and the EA. Due to the high urban density within the study area, SuDS components requiring larger open green spaces may not be suitable. Rather, there may be opportunities for integrated SuDS features, such as green roofs, rainwater harvesting systems, permeable paving, and tree pits.

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. Developers are strongly advised to undertake pre-planning engagement with the EA, LLFA and Anglian Water.

SuDS should be designed based on the SuDS management train to prevent and control pollutants to prevent the ‘first flush’ polluting the receiving waterbody.

SuDS should 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.

13.2.2 Critical Drainage Areas

Developers should use the mapping in Appendix J to identify if the site is within a CDA.

Any development within these CDAs will need demonstrate an adequate surface water drainage system which is maintainable for the lifetime of the development within a site-specific FRA. Developers will need to provide details of the long term maintenance of the surface water drainage system.

Developers should collaborate with the LLFA to identify all sources of flood risk, help reduce risk to existing communities, and explore grant funding opportunities for these wider improvements. Furthermore, growth allocations should take CDAs into account when assessing site suitability for development, ensuring that flood risk is properly managed and mitigated during planning.

Developers should refer to the Southend-on-Sea SWMP 2015 (southend.gov.uk) and liaise with the LLFA to understand where land should be safeguarded for flood risk management infrastructure, such as flood storage areas and pumping systems.

13.2.3 Residual Risk

Residual risk is the risk that remains after mitigation measures are considered. All residual risks to a site should be considered during the planning stage as part of site-specific FRAs including:

- Defence breach or overtopping:
  - Large parts of the study area are protected by tidal flood defences, including sea walls and tidal flood gates.
  - Development located behind flood defences must be carefully considered, with particular attention to ongoing maintenance requirements, the potential for overtopping or defence failure, as well as still water levels.
  - A site-specific FRA should include breach modelling, in line with EA guidance, to assess the risk to the site. If the defences were to fail, a site could be affected by very fast flowing and hazardous water within minutes of a breach developing (depending on the size of the breach and the location of the site in relation to the breach), causing danger to life.
- Reservoir breach or overtopping: this is not relevant across most of the study area, but there is limited reservoir flood risk in the southwest corner of the study area.
- Blockages or failure of infrastructure such as culverts.

13.2.4 Safe Access and Escape Routes

Safe access and escape routes will need to be demonstrated at all development sites. If raised access routes are required, an assessment must be made to check this will not displace floodwater elsewhere.

For development sites at significant tidal flood risk, a Flood Warning and Evacuation Plan may be required to be prepared which considers the likely onset and duration of flooding, including during a breach scenario, and demonstrates how residents can safely be evacuated and/or shelter safely in situ during the design event.

Emergency vehicular access should be possible during times of flood. If at risk, then as assessment should be made to detail the flood duration, depth, velocity, and flood hazard rating in the fluvial 1% AEP plus climate change and tidal 0.5% AEP plus climate change flood events, in line with FD2320.

Where development is located behind, or in an area benefitting from defences, consideration should be given to the potential safety of the development, FFLs and for safe access and escape routes in the event of rapid inundation of water due to a defence breach with little warning.

13.2.5 River Restoration and Habitat Improvement

Where greenfield development is proposed, such as green belt allocations in the north of the study area, developments should be used as an opportunity to enhance the existing river corridor. Natural drainage features should be maintained, and opportunities identified for river restoration/enhancement to make space for water.

Opportunities should be identified to maintain and enhance permeable surfaces and greenspaces to help reduce surface water runoff whilst promoting other benefits, including biodiversity and wellbeing.

There should be no built development within 8m from the top of a watercourse or main river, or within 16m for tidal main rivers, for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement.

Culverting of open watercourses should be avoided 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.

13.2.6 Emergency Planning and Flood Awareness

Improved emergency planning and flood awareness provide an opportunity to mitigate against flood risk. The following recommendations should be considered:

- The Council should work with emergency planning colleagues through the Essex Resilience Forum to identify areas at highest risk and locate most vulnerable receptors. For major developments, robust emergency (evacuation) plans should be produced and implemented.
- Increased flood awareness and sign-up to the EA Flood Warnings (gov.uk) should be promoted across the study area.
- In addition to the statutory consultation on flood risk, the EA should be consulted on any proposed development within existing FWAs to ensure that adequate

flood warning procedures and evacuation processes are in place and that RMAs are not put under any additional burden.

- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.
- In the 1% and 0.1% AEP events, there is surface water flooding along much of Sutton Road, which may impact access from Southend Fire Station.

13.2.7 Recommendations from the CIA

The NPPF (Paragraph 181) states that "when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere". This places a requirement on the applicant to demonstrate the proposal 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 or elsewhere.

The following recommendations have been made following the CIA:

- The Council should work closely with neighbouring local authorities to develop complementary local planning policies for the Prittle Brook and Eastwood Brook catchments that drain into and out of the study area to other local authorities in order to minimise any cross boundary issues of cumulative impacts of development.
- Most of the development proposed within the Prittle Brook and Eastwood Brook catchments is brownfield and therefore there is potential for development to provide betterment through the use of SuDS and water storage/retention measures.
- As most of the study area is urbanised, future improvements will rely on the redevelopment of brownfield sites to achieve betterment and mitigate flood risk. Where greenfield development is proposed, such as green belt allocations in the north of the study area, developments should be used as an opportunity to enhance the existing river corridor. Natural drainage features should be maintained, and opportunities identified for river restoration/enhancement to make space for water.

13.3 Requirements for a Level 2 SFRA

Following the application of the Sequential Test, where sites cannot be appropriately accommodated in low-risk areas, the Council will apply the NPPF's Exception Test. In these circumstances, a Level 2 SFRA may be required, to assess in more detail the nature and implications of the flood characteristics.

As part of this Level 1 SFRA, an initial site screening exercise using site boundaries and flood risk data has been undertaken for the Council to help inform the application of the Sequential Test and subsequent potential requirement for a Level 2 SFRA.

13.4 SFRA Report Recommendations

13.4.1 Updates to SFRA

SFRAs are high-level strategic documents and, as such, do not go into detail on an individual site-specific basis. This SFRA has been developed using the best available information, supplied at the time of preparation.

Over time, new information will become available to inform planning decisions. When using the SFRA to prepare FRAs it is important to check that the most up to date information is used.

The EA regularly reviews its hydrology, hydraulic modelling, and flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA. This is particularly important for sites along the Thames Estuary, where there are ongoing modelling and mapping updates as part of the TE2100 project.

The EA published the new national flood risk mapping (NaFRA2) in early 2025 but further updates and additional datasets are expected later in 2026.

Other datasets used to inform this SFRA may also be updated periodically and following the publication of this SFRA, new information on flood risk may be provided by RMAs.

.

Appendices

A Data Sources Used in this SFRA

B Guide for Using Available Flood Risk Data in Applying the Sequential Test

C SFRA Mapping - Flood Zones

D SFRA Mapping - Functional Floodplain

E SFRA Mapping - Fluvial and Tidal Climate Change

F SFRA Mapping - Surface Water

G SFRA Mapping - Groundwater Emergence

H SFRA Mapping - Flood Warning and Flood Alert Areas

I SFRA Mapping - Flood Defences

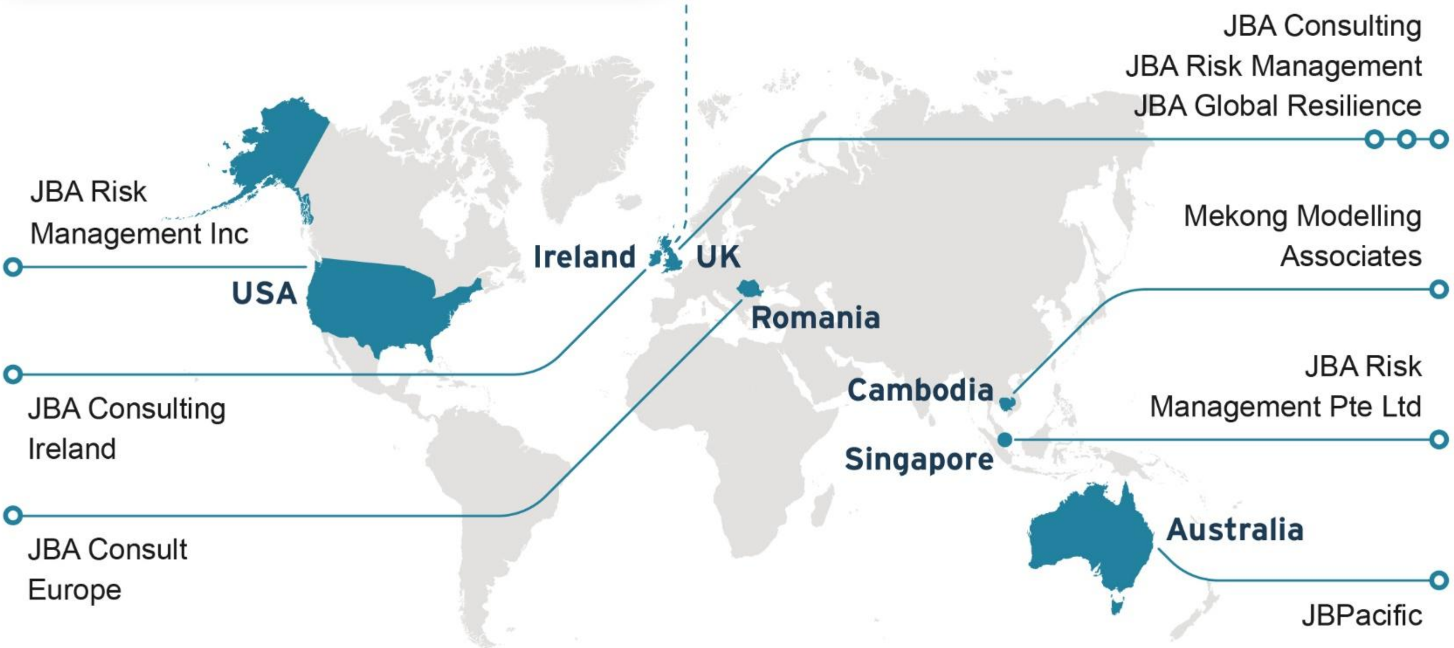
J SFRA Mapping - Critical Drainage Areas

K SFRA Mapping - Surface Water Climate Change www.jbaconsulting.com

JBA consulting

Our Offices

Bristol
Coleshill
Cork
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Leeds
Limerick
Newcastle
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 on

Jeremy Benn Associates Limited
Registered in England
3246693

JBA Group Ltd is certified to
ISO 9001:2015
ISO 14001:2015
ISO 27001:2022
ISO 45001:2018