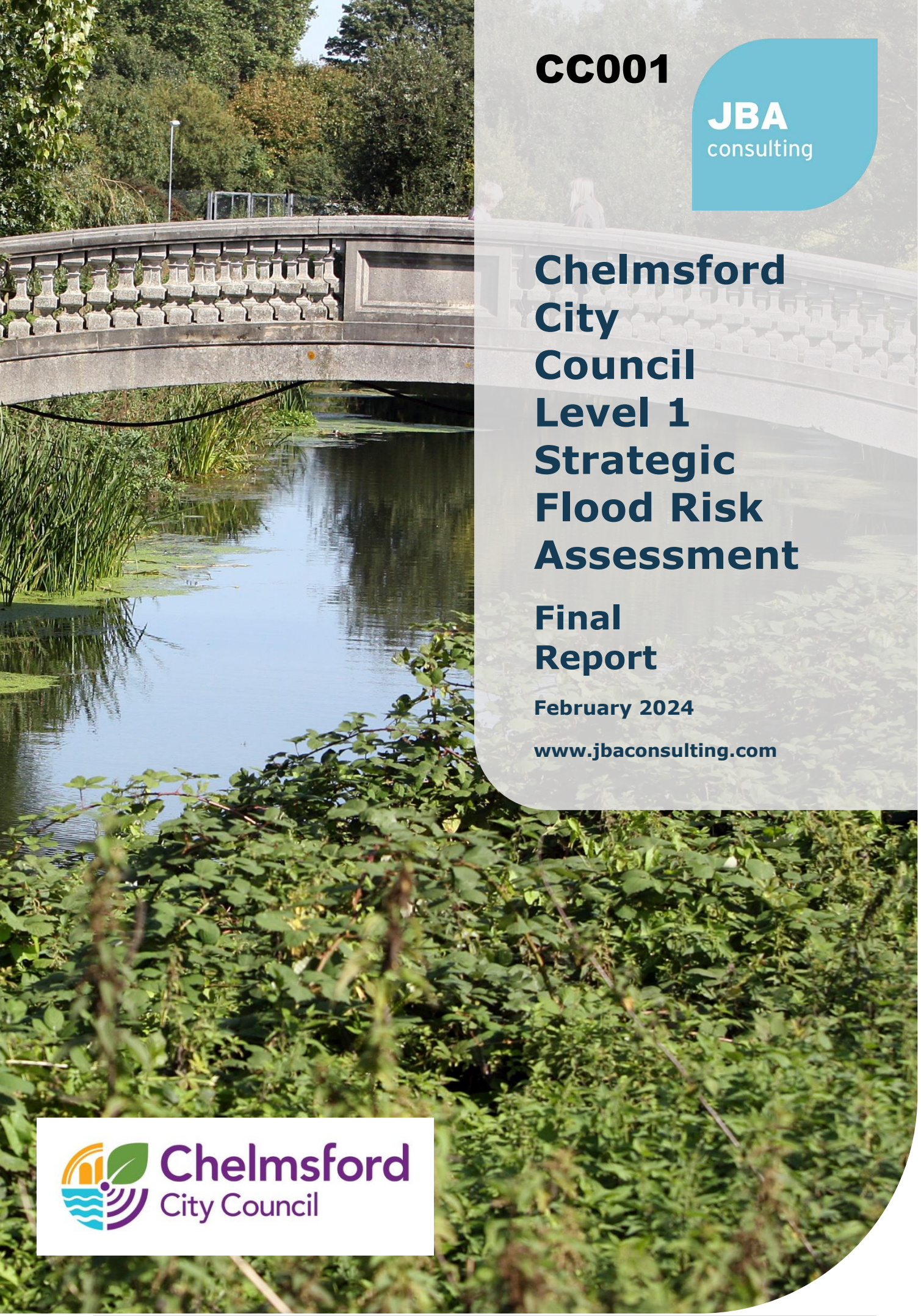

CC001

Chelmsford City Council Level 1 Strategic Flood Risk Assessment

Final Report

February 2024

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Contract

This report describes work commissioned by Emma Till, on behalf of Chelmsford City Council, by a letter dated 2nd February 2022. Ed Mumford, Louise Goode, Freya Nation and Alex Clark of JBA Consulting carried out this work.

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Purpose

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JBA Consulting has no liability regarding the use of this report except to Chelmsford City Council.

Acknowledgements

We would like to acknowledge the assistance of

- Chelmsford City Council
- Environment Agency
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Carbon footprint

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Executive summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the review and update of the Chelmsford Local Plan and associated Planning Policy documents using the best available information. This is a Level 1 Strategic Flood Risk Assessment (SFRA), and it will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

Introduction

To support the Review of the adopted Chelmsford Local Plan, the key objectives of the assessment are:

- To update the Chelmsford Local Plan from 2020, taking into account the most recent policy and legislation in the National Planning Policy Framework (September 2023) and the Flood Risk and Coastal Change Planning Practice Guidance (August 2022).
- To collate and analyse the latest available information and data for current and future (i.e. climate change) flood risk from all sources in combination, and how these may be mitigated.
- To inform decisions in the emerging Local Plan, including the selection of development sites and planning policies.
- To provide evidence to support the application of the Sequential Test for the allocation of new development sites, to support Chelmsford City Council's Review of the 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 emerging Local Plan.
- To provide advice for applicants carrying out site-specific Flood Risk Assessments and outline specific measures or objectives that are required to manage flood risk.
- To provide evidence for those wishing to understand flood risk within an area, neighbourhood or site.

Summary of flood risk in Chelmsford

The main sources of flood risk in Chelmsford are fluvial (rivers), sea and surface water.

- *Fluvial flooding:* There are numerous recorded flooding incidents across Chelmsford, predominantly in the vicinity of the City Centre. The main rivers associated with fluvial flooding are the:
    - River Chelmer and its tributaries, including the River Can which converges with the Chelmer at the City Centre, which pose a flood risk to Chelmsford City Centre as well as land to the east of the city and a number of settlements to the north of the city including Little Waltham and Howe Street,
    - River Wid and its tributaries, which pose a flood risk to land southwest of the city including areas in Writtle,
    - River Can which poses flood risk to western parts of Chelmsford, land to the west of the city and Roxwell village.

- River Crouch and its tributaries (including Rettendon/Fenn Brooks), which are tidal. Whilst there may be a fluvial risk from the River, for most tidal rivers and estuaries water volumes/levels from tidal events far exceed those from fluvial events and are the dominant source of risk. Detailed fluvial modelling has therefore not been undertaken for the River Crouch, and tidal risk from the River Crouch and its tributaries is discussed under 'Coastal Flooding' below.

- *Surface water:* Surface water risk largely follows the topography of smaller watercourses, but there are also additional flow paths and areas of ponding, for example where water is impounded at road or rail embankments. Urban areas are more at risk from surface water flooding. Chelmsford City Council's Administrative Area encompasses the City of Chelmsford as well as the town of South Woodham Ferrers. Several large villages and smaller rural settlements are also located within Chelmsford City Council's Administrative Area. There are a number of settlements where there is surface water flood risk to properties and infrastructure.
- *Coastal flooding:* The River Crouch and it's tributaries Rettendon/Fenn Brooks, to the south of Chelmsford City Administrative Area near South Woodham Ferrers, is tidal. Despite close proximity to the floodplain, the Environment Agency's 2018 Crouch Coastal Model indicates that the risk to the town of South Woodham Ferrers is relatively low, with the 0.1% AEP tidal flood extent in the 2125 epoch higher central scenario just reaching the edge of the town and affecting very few properties. There is an embankment to the west of the town which provides some benefit, and the undefended model outputs suggest that properties in the vicinity of Clements Green Road and the central shopping area of the town may be at risk in the event of a breach during the 0.1% AEP event, although the majority of the town remains unaffected. The area of Battlesbridge north of the Crouch is shown not be at risk in the present day 0.1% AEP event, although it may be at risk in future. The south of the town is at risk from tidal flooding in the present day 1% AEP scenario, although this is outside of Chelmsford City Council's Administrative Area.

  With the exception of a caravan park at Hayes Chase, the remainder of the area within the study area at tidal flood risk is undeveloped land.
- *Flood defences:* Conditions for flood defences range from 1- Very Good to 5- Very Poor. Within the Chelmsford City Administrative Area all flood defences are rated 2- Good to 3- Fair, except along the River Wid where defences are rated 4- Poor and at Fenn Brook where areas of the embankment are rated 5.
- Historic data provided by Essex County Council shows 42 incidents of internal and external flooding to properties within Chelmsford and the study area.
- 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 as a result of climate change. Flood extents will increase; in some locations, this may not be by very much, but flood depth, velocity and hazard may have more of an impact due to climate change. It is recommended that Chelmsford City Council work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the Administrative Area.

- *Groundwater*: The Areas Susceptible to Groundwater Flooding map shows that in general, the majority of the study area is shown to be within the "< 25%" and ">= 25% <50% "classifications with a lower susceptibility to groundwater flooding or has no data available. There are however areas along the main rivers in the study area, particularly towards Chelmsford city centre and surrounding suburbs along the River Chelmer, River Can, River Wid and the Sandon Brook.
- *Canals:* The Chelmer and Blackwater Navigation is a section of the River Chelmer and River Blackwater which has been canalised. The navigation originates on the River Chelmer at Chelmsford City centre and continues east to join the River Blackwater at Heybridge Basin. The navigation has the potential to interact with other watercourses in the area and become a conduit for flow paths during flood events or in a breach scenario.
- *Reservoirs:* There are no records of flooding from reservoirs in the study area and the level and standard of inspection and maintenance required under the Reservoirs Act 1975 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 Flood Risk Assessments (where relevant). Areas identified as being at risk in the event of a reservoir breach/uncontrolled release are areas near to Sandon Brook, River Can, River Wid, River Ter and River Crouch.

How to use this report

Planners

The SFRA provides recommendations regarding all sources of flood risk in the Chelmsford City Council's Administrative Area which can be used to inform policy on flood risk within Local Plans. This includes how the cumulative impact of development should be considered.

It provides the latest flood risk data and guidance to inform the Sequential Test and provides guidance on how to apply the Exception Test. Chelmsford City Council can use this information to apply the Sequential Test to strategic allocations and identify where the Exception Test will also be needed.

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

Developers

This SFRA provides guidance for the application of the Sequential and Exception Tests at a site level and for detailed site-specific Flood Risk Assessments (FRAs). For sites that are not strategic allocations, developers will need to apply the Sequential Test (including consideration of reasonably available alternatives). For the following sites, whether strategic allocations, windfall sites, or other development, developers will need to apply the Exception Test and use information in a site-specific Flood Risk Assessment to inform this test at planning application stage:

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

Whilst the Exception Test is not explicitly required by the NPPF/PPG where a site is at significant risk from other sources of flooding, or where flooding impedes access/egress regardless of whether the site itself is at risk, the NPPF/PPG do require that all sources of flooding are considered both now and into the future. In these circumstances, the Council should carefully weigh up the benefits of developing such sites against the risk, and developers should demonstrate to the Council's satisfaction that the site can be developed in a way that ensures users of the site are safe in the event of a flood from any source, both now and throughout the lifetime of the development.

This is a strategic assessment and does not replace the need for site-specific Flood Risk Assessments where a development is either within Flood Zones 2 or 3, and either greater than a hectare or land identified in an SFRA as being at increased risk in the future, in Flood Zone 1. In addition, a Surface Water Drainage Strategy will be needed for all major developments in any Flood Zone to satisfy Essex County Council, the Lead Local Flood Authority (LLFA).

Developers can use the information in this SFRA, alongside site-specific research to help scope out what additional work will be needed in a detailed Flood Risk Assessment. To do this, they should refer to Section 5, Appendix A (Interactive PDF mapping) and Appendix B (Data sources used in the SFRA). At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances, last updated in May 2022), inform Masterplanning and demonstrate, if required, that the Exception Test is satisfied. As part of the Environment Agency's updated guidance on climate change, which must be considered for all new developments and planning applications, developers will need to undertake a detailed assessment of climate change as part of the planning application process when preparing FRAs.

Developers need to ensure that new development does not increase surface water runoff from a site and should appropriately address the implications of proposals on surface water flow routes and surface storage. Section 9 provides information on the surface water drainage requirements of Essex County Council as LLFA. Sustainable Drainage Systems (SuDS) should be considered at the earliest stages that a site is developed which will help to minimise costs and overcome any site-specific constraints.

Site-specific Flood Risk Assessments will need to identify how flood risk will be mitigated so the development is safe from flooding. In high-risk areas, the Flood Risk Assessment will also need to consider emergency arrangements, including how there will be safe access and egress from the site. Any developments located within an area protected by flood defences and where the standard of protection is not of the required standard (either now or in the future) should be identified and the use of developer contributions considered to fund improvements.

Neighbourhood plans

The SFRA provides:

- Information on the sources of flooding and the variation in the risk across Chelmsford City Council's Administrative Area.
- Identifies the organisations that are involved in flood risk management and their latest strategic plans, current plans for major flood defences.
- The requirements for detailed Flood Risk Assessments and to inform the site selection process.

Neighbourhood planning groups can use this information to assess the risk of flooding to sites within their community, using Section 5, the sources of flooding in Chelmsford City Council's Administrative Area and the flood mapping in the appendices. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas.

Mapping

The SFRA mapping highlights on a broad scale where flood risk from fluvial, coastal, surface water, groundwater and 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 model small scale changes in flood risk. Local knowledge of flood mechanisms will need to be included to complement this broadscale mapping. Similarly, all known available recorded historical flood

events for Chelmsford City Council's Administrative Area are listed in Section 5.1 and this can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned by Essex County Council are outlined in Section 6.6 and Section 8.4 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

Cumulative Impact Assessment

A cumulative impact assessment has been carried out and has identified catchments in Chelmsford City Council's Administrative Area which are more sensitive to the cumulative impact of development and where more stringent policy regarding flood risk is recommended. Any development in these areas should seek to contribute to work that reduces wider flood risk in those catchments.

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Abbreviations and definitions

Term	Definition
1D model	One-dimensional hydraulic model
2D model	Two-dimensional hydraulic model
ABD	Areas Benefiting from Defences
AEP	Annual Exceedance Probability – The probability (expressed as a percentage) of a flood event occurring in any given year.
AStGWF	Areas Susceptible to Groundwater Flooding
Brownfield	Previously developed parcel of land
CC	Climate change - long term variations in global temperature and weather patterns caused by natural and human actions.
CDA	Critical Drainage Area - A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.
CFMP	Catchment Flood Management Plan - A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Defra	Department for Environment, Food and Rural Affairs
Design flood	This is a flood event of a given annual flood probability, which is generally taken as "fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year)"
EA	Environment Agency
ECC	Essex County Council
Exception Test	Set out in the NPPF, the Exception Test is a method used to demonstrate that flood risk to people and property will be managed appropriately, where alternative sites at a lower flood risk are not available. The Exception Test is applied following the Sequential Test.
FAA	Flood Alert Area
FAS	Flood Alleviation Scheme
FCERM	Flood and Coastal Erosion Risk Management
FFL	Finished Floor Level
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Map for Planning	The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.

Term	Definition
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
FWA	Flood Warning Area
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a River
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act
FWS	Flood Warning System
GI	Green Infrastructure – a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and urban fringe
Greenfield	Undeveloped parcel of land
Ha	Hectare
HFRR	Hydraulic Flood Risk Register
IDB	Internal Drainage Board
Indicative Flood Risk Area	Nationally identified flood risk areas based on the definition of 'significant' flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
LFRMS	Local Food Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
m AOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NRD	National Receptor Database
NRIM	National Reservoir Inundation Mapping
NVZs	Nitrate Vulnerability Zones
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.

Term	Definition
RBMP	River Basin Management Plan
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
Riparian owner	A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
RMAs	Risk Management Authorities - operating authorities who's remit and responsibilities concern flood and / or coastal risk management.
RoFSW	Risk of Flooding from Surface Water (formerly known as the Updated Flood Map for Surface Water (uFMfSW))
SEPA	Scottish Environment Protection Agency
Sequential Test	Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SHELAA	Strategic Housing and Economic Land Availability Assessments
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.
SPZ	(Groundwater) Source Protection Zone
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.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWAS	Surface Water Alleviation Schemes
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
UKCP	UK Climate Projections
UU	United Utilities
WFD	Water Framework Directive – Under the WFD, all waterbodies have a target to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP) by a set deadline. River Basin Management Plans (RBMPs) set out the ecological objectives for each water body and give deadlines by when objectives need to be met.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

> ***"Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards."***
>
> (National Planning Policy Framework, paragraph 160)

JBA Consulting were commissioned by Chelmsford City Council to prepare a Level 1 Strategic Flood Risk Assessment (SFRA). This study provides a comprehensive and robust evidence base to support the production of a new Local Plan for Chelmsford City Council's Administrative Area. This document provides an update and replaces the 2017 Chelmsford City Council SFRA.

This 2022 SFRA will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

1.2 Local Plan

The Review of the adopted **Chelmsford Local Plan 2013-2036** aims to establish a planning framework for future development, identifying how much land is available and where such land should be provided for new homes and employment, alongside associated infrastructure.

1.3 Levels of SFRA

The **Planning Practice Guidance** (PPG) identifies the following two levels of SFRA:

- **Level 1**: where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient detail to enable application of the Sequential Test.

  The L1 should be used to attempt to allocate sites in areas of lowest overall flood risk (including other sources of risk).

- **Level 2:** where allocations are proposed in flood risk areas (i.e. from any source now and in the future), or where future windfall pressures in flood risk areas are expected. The L2 SFRA should be detailed enough to identify which development sites have the least risk of flooding and the application of the Exception Test, if relevant. The above text suggests that the L2 SFRA will only be used to assess whether the Exception Test can be passed, and not the Sequential Test.

This Level 1 SFRA is intended to aid Chelmsford City Council in applying the Sequential Test for their site allocations and identifying where the application of the Exception Test may be required as part of a Level 2 SFRA.

1.4 SFRA outputs

- Identification of policy and technical updates.
- Identification of any strategic flooding issues which may have cross boundary implications.

- Appraisal of all potential sources of flooding, including main river, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals.
- Review of historic flooding incidents.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- Mapping showing distribution of flood risk across all Flood Zones from all sources of flooding including climate change allowances.
- Assessment of the potential increase in flood risk due to climate change.
- Flood Risk Assessment (FRA) guidance for developers.
- Assessment of surface water management issues, how these can be addressed through development management policies and the application of Sustainable Drainage Systems.
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.
- Opportunities to reduce the causes and impacts of flooding (it is noted that you may have covered this within the bullet point of "Assessment of strategic flood risk solutions that can be implemented to reduce risks")
- Identification of land likely to be needed for flood risk management features and structures (this is particularly important in central Chelmsford)

1.5 SFRA study area

The study area encompasses the entirety of Chelmsford City Council's Administrative Area. This covers just an area of just under 343km^2 (ONS 2016) and has a population of approximately 168,310 (Census 2011).

Chelmsford City and its surrounding suburbs is the main populated area, with around 60,000 living in the city. This is located in the centre of the Administrative Area. The surrounding area is mostly rural, with the second largest settlement, the town of South Woodham Ferrers, located in the southeast of the Administrative Area. There are also several large villages such as Broomfield, Boreham, Danbury, Great Leighs and Writtle alongside smaller villages. Most of the rural land use is agricultural.

Figure 1-1 and Figure 1-2 show the study area and the neighbouring Local Authorities. There are seven Local Authorities that border Chelmsford City Council's Administrative Area.

The Administrative Area is covered by Essex and Suffolk Water as the main water provider and Anglian Water as the main sewerage provider.

The Administrative Area is covered by Essex County Council as the Lead Local Flood Authority (LLFA). The LLFA is responsible for developing, maintaining, and applying a strategy for local flood risk management in their area and for maintaining a register of flood risk assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses.

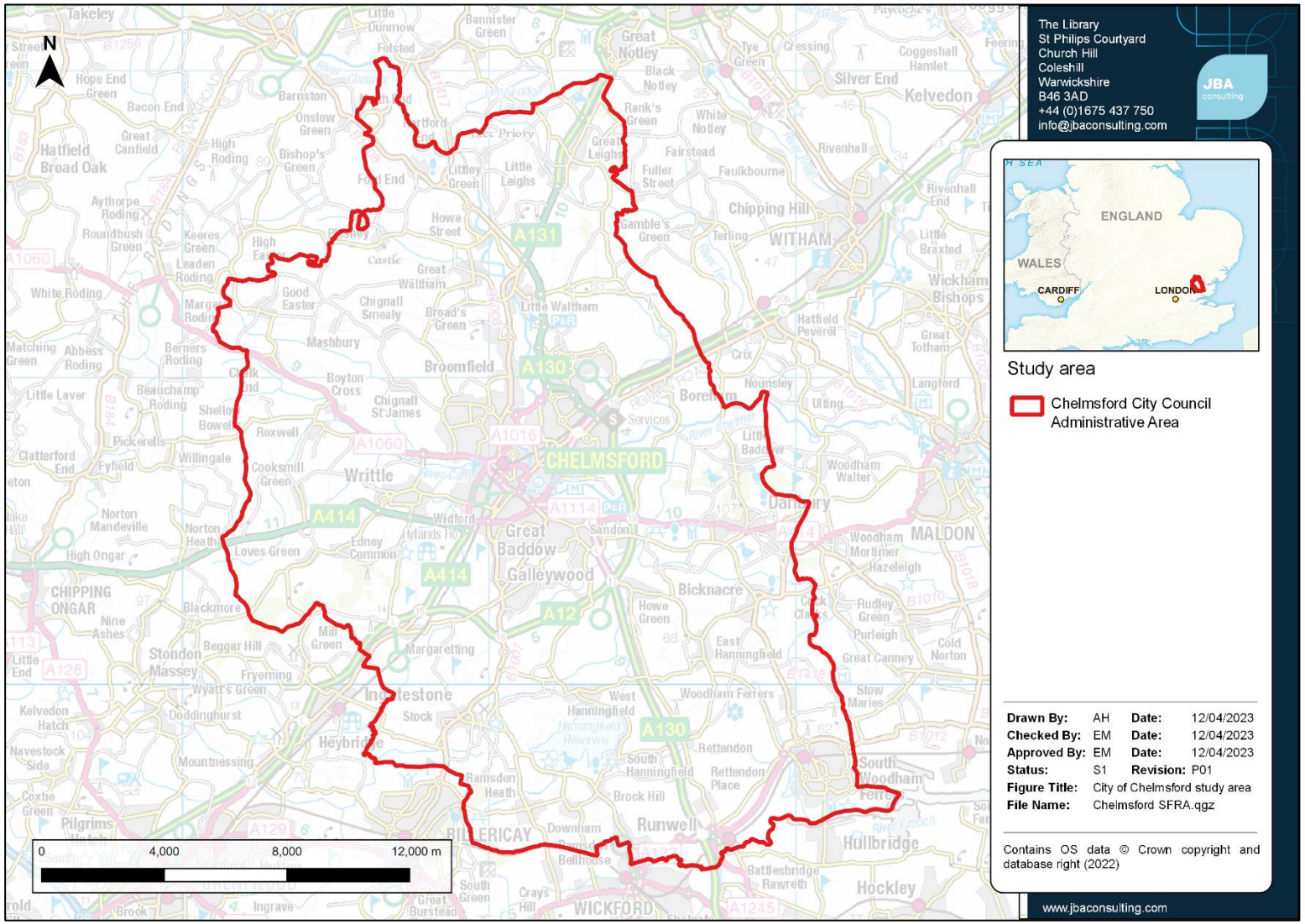


Figure 1-1: City of Chelmsford study area

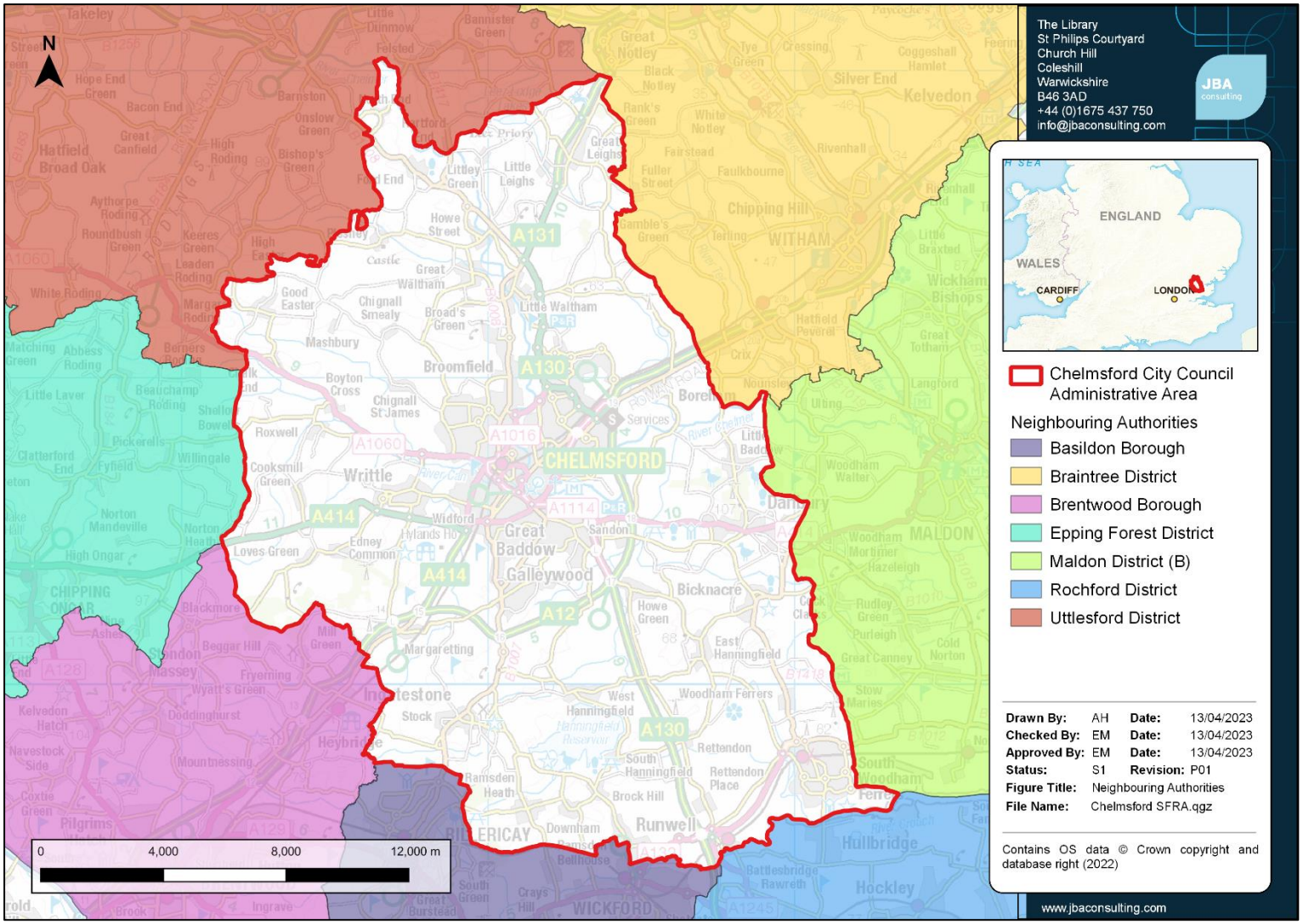


Figure 1-2: Neighbouring local authorities

The area is mostly lowland and relatively flat, and the topography is dominated by the presence of large watercourses flowing through the area. The principal watercourses flowing through Chelmsford City Council's Administrative Area are:

- River Chelmer
- River Can
- River Wid
- River Ter
- Sandon Brook
- River Crouch
- Roxwell Brook
- Walthambury Brook
- Chignall Brook

The River Chelmer flows into Chelmsford through Uttlesford District, flowing south-southeast into Chelmsford. It then flows east through the area, and into the district of Maldon where it meets the River Blackwater, and eventually discharges into the North Sea at Blackwater Estuary.

The River Can flows east and joins the River Chelmer at Chelmsford. The River Wid flows north from Blackmore to converge with the River Can at Writtle.

The River Ter flows southeast, out of Chelmsford and joins the River Chelmer near Ulting.

The River Crouch flows along the southern border of the Administrative Area, past the town of South Woodham Ferrers and through Battlesbridge. The River is tidal as far as Wickford.

Figure 1-3 shows a map of the key watercourses within Chelmsford City Council's Administrative Area.

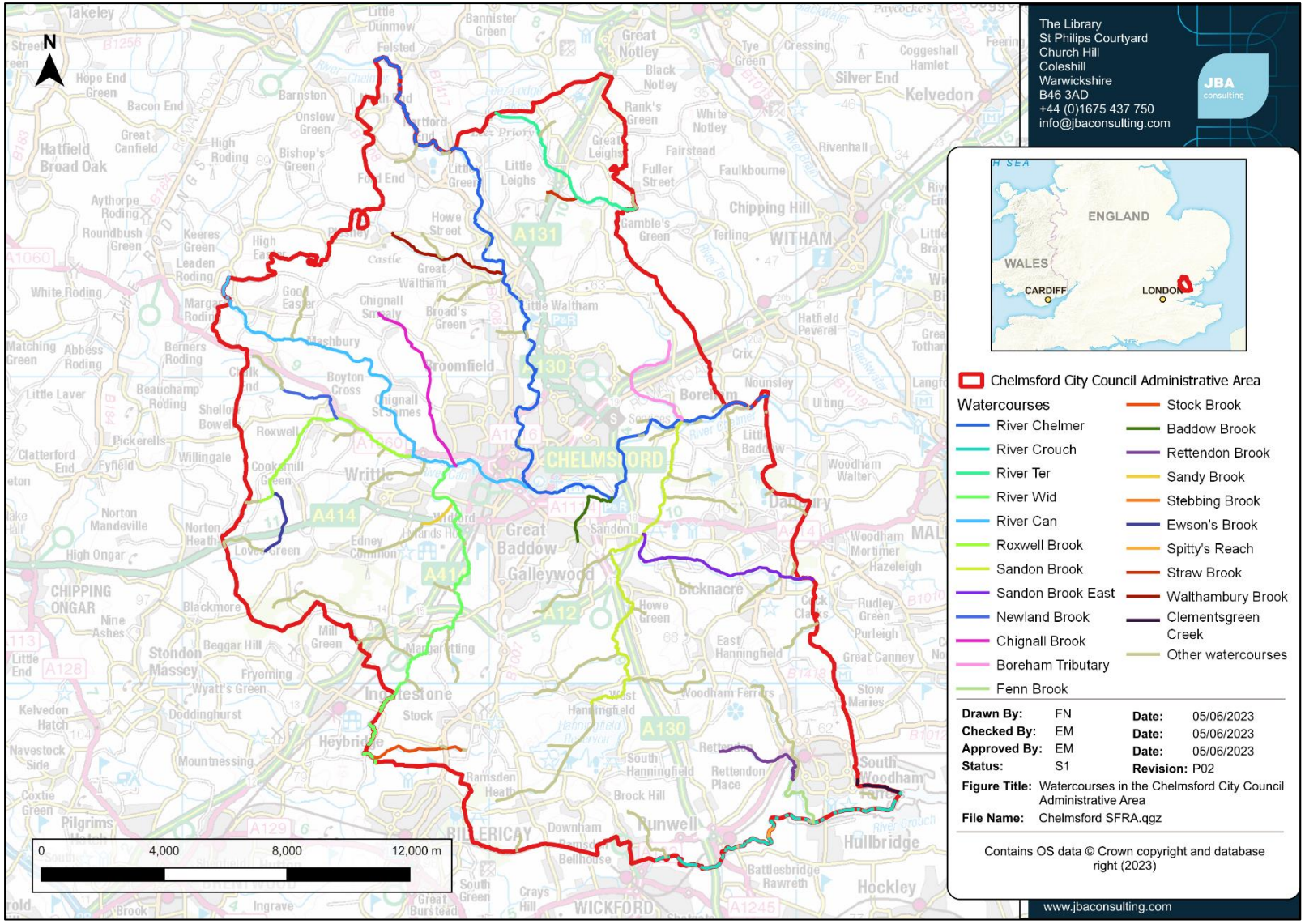


Figure 1-3: Map of the principal rivers and other watercourses

1.6 Consultation

The following parties (external to Chelmsford City Council) were consulted to inform the SFRA:

- Essex County Council
- Environment Agency
- Essex and Suffolk Water
- Anglian Water
- Essex County Fire and Rescue Service
- Neighbouring authorities:
    - Brentwood Borough Council
    - Epping Forest District Council
    - Uttlesford District Council
    - Braintree District Council
    - Basildon Borough Council
    - Rochford District Council
    - Maldon District Council

1.7 Use of SFRA data

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

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

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

> **Key reference material** such as external guidance documents/ websites are provided in **purple** throughout the SFRA, with the weblink in brackets afterwards.

> Advice to users has been highlighted in **amber boxes** throughout the document.

On the date of publication, the SFRA contains the latest available flood risk information. Over time, new information will become available to inform planning decisions, such as updated hydraulic models (which then update the Flood Map for Planning), updated information on other sources of flood risk or evidence showing future flood risks, new flood event information, new defence schemes and updates to policy,

legislation and guidance. Developers should check the online **Flood Map for Planning** in the first instance to identify any major changes to the Flood Zones.

1.8 Structure of this report

Section	Contents	How to use
Executive Summary	Focuses on how the SFRA can be used by planners, developers and neighbourhood planners	Summarises the Level 1 findings and recommendations.
1. Introduction	Provides a background to the study, the Local Plan stage the SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA. Provides a short introduction to how flood risk is assessed and the importance of considering all sources. Includes this table of the contents of the SFRA	For general information and context.
2. Flood risk policy and strategy	Sets out the relevant legislation, policy and strategy for flood risk management at a national, regional and local level.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	Provides an overview of both national and existing Local Plan policy on flood risk management. This includes the Flood Zones, application of the Sequential Approach and Sequential/Exception Test process. Provides guidance for the National Park Authority 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. Impact of climate change	Outlines the latest climate change guidance published by the Environment Agency and how this was applied to the SFRA. Sets out how developers should apply the guidance to inform site specific Flood Risk Assessments	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.

Section	Contents	How to use
5. Understanding flood risk in Chelmsford City Council's Administrative Area	Provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding incidents, flood risk from all sources and flood warning arrangements.	This section should be used to understand all sources of flood risk including where has flooded historically. This section may also help identify any data gaps, in conjunction with Appendix B.
6. Flood alleviation schemes and assets	Provides a summary of current flood defences and asset management and future planned schemes. Introduces actual and residual flood risk.	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site-specific stage.
7. Cumulative impact of development and strategic solutions	This section provides an introduction to the cumulative impact assessment (CIA).	Planners should use this section to help develop policy recommendations for the cumulative impact of development.
8. Flood risk management for developers	Guidance for developers on Flood Risk Assessments, considering flood risk from all sources	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed, as well as mitigation options.
9. Surface water management and Sustainable Drainage Systems	An overview of Sustainable Drainage Systems, Guidance for developers on Surface Water Drainage Strategies, considering any specific local standards and guidance for Sustainable Drainage Systems (SuDS) from the Lead Local Flood Authority.	Developers should use this section to understand what national, regional and local SuDS standards are applicable. Hyperlinks are provided.
10. Summary and recommendations	Summarises sources of flood risk in the study area and outlines planning policy recommendations	Developers and planners should use this as a summary of the SFRA. Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.
Appendices	• Appendix A: Interactive flood risk maps • Appendix B: Data sources used in the SFRA • Appendix C: SFRA User Guide • Appendix D: Flood Alert and Flood Warning Areas • Appendix E: Summary of flood risk across the district • Appendix F: Cumulative Impact Assessment (CIA)	Planners should use these appendices to understand what data has been used in the SFRA, to inform the application of the Sequential and Exception Tests, as relevant, and to use these maps and tabulated summaries of flood risk to understand the nature and location of flood risk.

1.9 Understanding flood risk

This section provides useful background information on how flooding arises and how flood risk is determined.

1.9.1 Sources of flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and in many different ways, as illustrated in Figure 1-4. Major sources of flooding that could potentially affect the Chelmsford study area include:

- Fluvial (rivers) - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- Surface water - surface water flooding covers two main sources including direct run-off from adjacent land (pluvial) and surcharging of piped drainage systems (public sewers, highway drains, etc.).
- Coastal Flooding- inundation of coastal areas/tidal watercourses as a result of high tide levels/storm surges, overtopping by waves, or failure/overtopping of defences.
- Groundwater - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- Infrastructure failure - reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

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

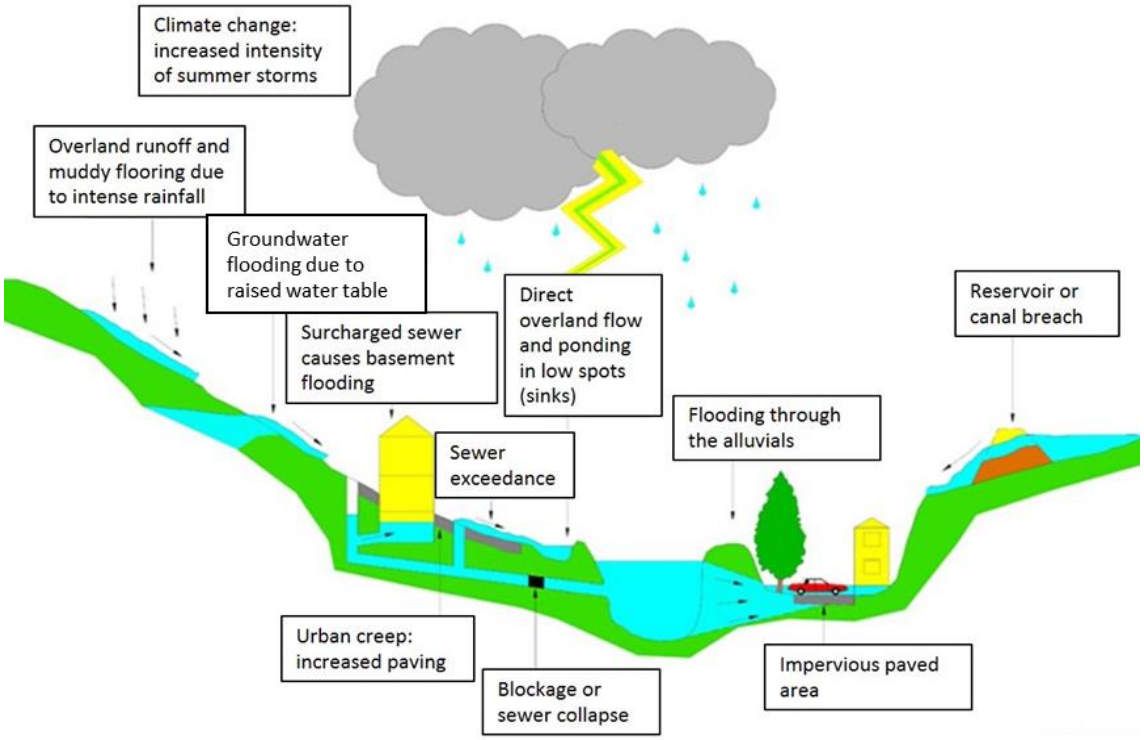


Figure 1-4: Flooding from all sources

1.10 Likelihood and consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown in Figure 1-5. This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. However, it should be remembered that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

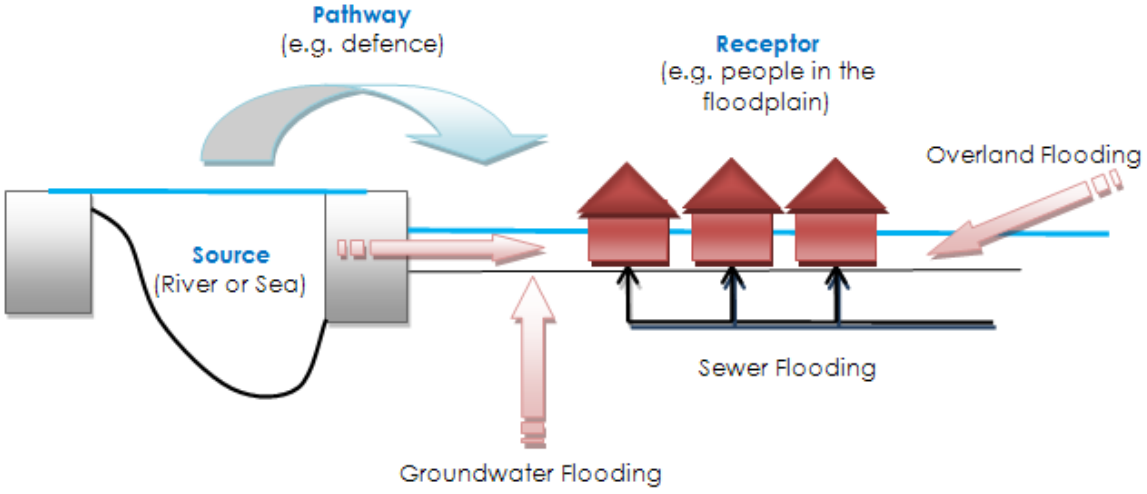


Figure 1-5: Source-Pathway-Receptor Model

The principal sources affecting the study area are rainfall and rivers; the most common pathways are rivers themselves, drains, sewers, overland flows, floodplains and defence assets (for example through overtopping or breach). Receptors can include people, their property and the environment. All these elements must be present for flood risk to arise. Mitigation measures have little or no effect on the magnitude of the sources that cause flooding, but they can block or impede pathways, remove receptors or increase the resilience of receptors.

The planning process is primarily concerned with the appropriate 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 in order to apply this guidance in a logical and consistent manner.

1.11 Likelihood

Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% Annual Exceedance Probability (AEP) indicates there is a 1 in 100 chance every year of the predicted flood level being experienced at a particular location i.e. it has a 1% chance of occurring in any one year, not that it will occur once every hundred years. Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring. For example, a 1% AEP (1 in 100) flood:

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

1.12 Consequence

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) and the vulnerability of receptors (type of development, nature (e.g. age-structure) of the population, presence and reliability of mitigation measures etc). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

1.13 Risk

Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above.

2 Flood risk policy and strategy

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

2.1 Roles and responsibilities for Flood Risk Management within Chelmsford City Council's Administrative Area

There are different organisations that cover Chelmsford City Council's Administrative Area that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are shown in Table 2-1, with a summary of their responsibilities.

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties. Property 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 in the Environment Agency publication **'Owning a Watercourse' (2018).**

When it comes to undertaking works to reduce flood risk, the Environment Agency and Essex County Council as LLFA, have permissive powers and limited resources are prioritised and targeted to where they can have the greatest effect. Permissive powers mean that Risk Management Authorities are permitted to undertake works on watercourses but are not obliged.

Table 2-1: Roles and responsibilities for Risk Management Authorities

Risk Management Authority	Strategic Level	Operational Level	Planning role
Environment Agency	• Strategic overview for all sources of flooding • National Strategy • Reporting and general supervision	• Main rivers (e.g. River Chelmer) • Reservoirs • Category 1 Responder under Civil Contingencies Act 2004	• Statutory consultee for development in Flood Zones 2 and 3
Essex County Council as Lead Local Flood Authority (LLFA)	• Preliminary Flood Risk Assessment • Local Flood Risk Management Strategy	• Surface water • Groundwater • Ordinary Watercourses (consenting and enforcement) • Ordinary watercourses (works) • Section 19 FWMA Flood Investigations and Reporting • Category 1 Responder under Civil Contingencies Act 2004	• Statutory consultee for major developments

Chelmsford City Council as Local Planning Authority	• Local Plans as Local Planning Authorities	• Determination of Planning applications as Local Planning Authorities • Ordinary watercourses (works) • Category 1 Responder under Civil Contingencies Act 2004	• As left
Essex and Suffolk Water Anglian Water	• Asset Management Plans, supported by Periodic Reviews (business cases) • Develop Drainage and Wastewater management plans	• Public sewers • Category 2 Responder under Civil Contingencies Act 2004	• Non-statutory consultee
Highways Authorities *Highways England (motorways and trunk roads)* *Essex County Council (for non-trunk roads)*	• Highway drainage policy and planning	• Highway drainage • Category 2 Responder under Civil Contingencies Act 2004	• Statutory consultee regarding highways design standards and adoptions

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in Chelmsford City Council's Administrative Area:

- **Flood Risk Regulations (2009)** - These transpose the European Floods Directive (2000) into law and require the Environment Agency and LLFAs to produce Preliminary Flood Risk Assessments and identify where there are nationally significant Flood Risk Areas. For the Flood Risk Areas, detailed flood maps and a Flood Risk Management Plan is produced; this is done in a six-year cycle.
- **Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991), Environment Act (1995), Flood and Water Management Act (2010)** – as amended and implemented via secondary legislation. These set out the roles and responsibilities for organisations that have a role in Flood Risk Management.
- The **Land Drainage Act (1991, as amended)** and **Environmental Permitting Regulations (2018)** also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an Ordinary Watercourse, Main River, or within an **IDB district.** Local Land Drainage Bylaws are also applicable within IDB areas.
- The **Water Environment Regulations (2017)** – these transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produce River Basin Management Plans (RBMPs). These aim to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reaches 'good' status.
- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014) and Strategic Environmental Assessment Directive (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

Relevant flood risk policy and strategy documents 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 Flood Risk Assessments within the local area.
- Set the strategic policy and direction for Flood Risk Management (FRM) 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 FRM and drainage in the district.
- Provide guidance and/or standards that informs how a developer should assess flood risk and/or design flood mitigation and SuDS.

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

Scale	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
National	**National Flood and Coastal Erosion Risk Management Strategy** (see section 2.5.1) (Environment Agency) 2020	No	Yes	No	Due to be reviewed in 2026
National	**National Planning Policy Framework** (see section 3) and **Planning practice guidance** (Gov.uk) 2023	No	Yes	Yes	-
National	**Building Regulations Part H** (MHCLG) 2010 (see section 2.5.9)	No	No	Yes	-
Regional	**Anglian River Basin District River Basin Management Plan** (Environment Agency) 2022	Yes	Yes	No	2027
Regional	**Anglian River Basin District Flood Risk Management Plan 2021 to 2027** (Environment Agency) (2021)	Yes	Yes	No	2027

Scale	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
Regional	**North Essex Catchment Flood Management Plan** (Environment Agency) 2009	Yes	Yes	No	-
Local	**Essex and South Suffolk Shoreline Management Plan** (Essex County Council) 2010	Yes	Yes	No	-
Local	**Drainage and Wastewater Management Plan Level 1 Draft Summary** (Anglian Water)	Yes	Yes	Yes	Final DWMP in spring 2023
Local	**Climate Change guidance for development and flood risk** (Environment Agency) 2021	No	No	Yes	-
Local	**The Sustainable Drainage Systems Design Guide for Essex** (Essex County Council) 2020	Yes	No	Yes	-
Local	**Local Flood Risk Management Strategy for Essex** (Essex County Council) 2018	Yes	Yes	No	-
Local	**Essex County Council Preliminary Flood Risk Assessment** (Essex County Council) 2011, updated 2017	Yes	No	No	-
Local	**Chelmsford Local Plan** (Chelmsford City Council) 2020	Yes	Yes	Yes	2025/6

Scale	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
Local	**Chelmsford City Water Cycle Study Phase 1 and 2** (Chelmsford City Council) 2011, updated 2018.	Yes	No	Yes	In progress
Local	**Chelmsford Surface Water Management Plan** (Chelmsford City Council) 2014	Yes	No	Yes	-

2.3 Key legislation for flood and water management

2.3.1 Flood Risk Regulations (2009)

The **Flood Risk Regulations (2009)** translate the EU Floods Directive into UK law. The EU requires Member States to complete an assessment of flood risk (known as a Preliminary Flood Risk Assessment (PFRA)) and then use this information to identify areas where there is a significant risk of flooding. For these Flood Risk Areas, States must then undertake Flood Risk and Hazard Mapping and produce Flood Risk Management Plans.

The Flood Risk Regulations direct the Environment Agency to do this work for river, sea and reservoir flooding. LLFAs must do this work for surface water, Ordinary Watercourse and Groundwater flooding. This is performed over a six-year cycle and the second cycle started in 2017.

The **Essex County Council PFRA** was published in 2011 with an addendum in 2017 with updated flood risk data and information. This greater understanding of flood risk from the LLFA has been updated to include all significant flood events since 2011.

Key outputs of the 2011 PFRA include:

- Properties in Chelmsford and South Woodham Ferrers are most at risk from surface water flooding.
- No past floods with significant consequences were identified, although this is likely due to a lack of robust evidence.
- Overall flood risk is expected to increase as a result of climate change, particularly relating to winter storms (12% increase in winter precipitation from 2011 to 2050). Peak flows are also expected to increase between 8 and 14%.
- Chelmsford was identified as a Surface Water Flood Risk Area in the 2017 update

The **English PFRA (2018)** provides information on significant past and future flood risk from river and sea flooding across all of England, including Chelmsford City Council's Administrative Area. The Anglian River Basin District (RBD) has been identified as the district where flood risk to Special Areas of Conservation is second highest in England. Risk to human health is third highest in England and risk to key services is also third highest in England. The Anglian RBD has the third highest number of Flood Risk Areas in England with 18 identified. Of these 18 areas, none are located within Chelmsford City Council's Administrative Area.

2.3.2 Flood and Water Management Act (FWMA) 2010

The Flood and Water Management Act (FWMA) was passed in April 2010. It aims to improve both flood risk management and the way water resources are managed.

The FWMA has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for 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 Environment Agency.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by LAs and other key partners. The integration and synergy of strategies and plans at national, regional, and local scales, is increasingly important to protect vulnerable communities and deliver sustainable regeneration and growth. Under the FWMA, from 2024 SUDS will be mandatory for most new development.

2.3.3 Water Framework Directive & Water Environment Regulations

The purpose of the Water Framework Directive (WFD), which was transposed into English Law by the Water Environment Regulations (2003), is to deliver improvements across Europe in the management of water quality and water resources through a series of plans called River Basin Management Plans (RBMP), which were last published in 2015 and are currently being updated. Draft updates were published in 2021 and are currently undergoing public consultation.

Chelmsford City Council's Administrative Area is located within the Anglian River Basin District.

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

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

The **National Flood and Coastal Erosion Risk Management Strategy** (FCERM) for England provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. The new Strategy has been in preparation since 2018. The Environment Agency brought together a wide range of stakeholders to develop the strategy collaboratively. The Strategy is much more ambitious than the previous one from 2011 and looks ahead to 2100 and the action needed to address the challenge of climate change.

The Strategy has been split to describe three high level ambitions: climate resilient places, today's growth and infrastructure resilient in tomorrow's climate and a nation ready to respond and adapt to flooding and coastal change. Measures include updating the national river, coastal and surface water flood risk mapping and the understanding of long term investment needs for flood and coastal infrastructure, trialling new and innovative funding models, flood resilience pilot studies, developing an adaptive approach to the impacts of climate change, seeking nature based solutions towards flooding and erosion issues, integrating natural flood management (NFM) into the new Environmental Land Management scheme, considering long term adaptive approaches in Local Plans, maximising the opportunities for flood and coastal resilience as part of contributing to environmental net gain for development proposals, investing in flood risk infrastructure that supports sustainable growth, aligning long term strategic planning cycles for flood and coastal work between stakeholders, mainstreaming property flood resilience measures and 'building back better' after flooding, consistent approaches to asset management and record keeping, updating guidance on managing high risk reservoirs in light of climate change, critical infrastructure resilience, education, skills and capacity building, research, innovation and sharing of best practise, supporting communities to plan for flood events, develop world leading ways of reducing the carbon and

environmental impact from the construction and operation of flood and coastal defences, development of digital tools to communicate flood risk and transforming the flood warning service and increasing flood response and recovery support.

The Strategy was laid before parliament in July 2020 for formal adoption and published alongside a new **National Policy Statement for Flood and Coastal Erosion Risk Management.** The statement sets out five key commitments which will accelerate progress to better protect and better prepare the country for the coming years:

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

2.4.2 Updated Strategic Flood Risk Assessment guidance

There was an update to the **'How to prepare a Strategic Flood Risk Assessment guidance'** in August 2019 , which had some key additions to both Level 1 and Level 2 assessments. There were also minor updates to the guidance in September 2020. The Level 1 assessment is undertaken in accordance with this guidance.

ADEPT, the Environment Agency, and CIWEM have together produced **'Strategic Flood Risk Assessments – A Good Practice Guide'** in November 2021. The guidance provides practical information and advice for LPAs, and others who support them, on how to scope, produce and use an SFRA and has been informed by research undertaken by the EA in 2018-19 (**FRS18204: Using flood risk information in spatial planning**)

2.4.3 River Basin Management Plans

River Basin Management Plans (RBMPs) are used to protect and improve the quality of our water environment. They support the government's framework for the 25-year environment plan and allow local communities to find more cost-effective ways to further improve our water environments. Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques. The Environment Agency manages the RBMPs and must review and update them every six years.

Chelmsford City Council's Administrative Area lies within the Anglian River Basin District.

The first cycle of RBMPs were published in 2009 and then updated in 2015. Updated **RBMP**s were published in October 2022, which are the current version.

2.4.4 Flood Risk Management Plans

Flood Risk Management Plans (FRMPs) are part of the six-year cycle of assessment, mapping and planning required under the Flood Risk Regulations. The first FRMPs

were published in 2016 and they describe actions to manage flood risk across England between 2015 to 2021.

The draft FRMPs for 2021 to 2027 underwent a 3-month public consultation from 22 October 2021 to 21 January 2022 and the latest version published in December 2022.

Chelmsford falls into the **Anglian** FRMP area.

The FRMPs summarise the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations.

2.4.5 Catchment Flood Management Plans

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

Chelmsford City Council's Administrative Area is situated across two Catchment Flood Management Plan areas (North Essex and South Essex).

The south eastern corner of Chelmsford City Council's Administrative Area, around South Woodham Ferrers sits within the **South Essex Catchment Flood Management Plan (CFMP)** and is part of the following sub-area:

- **Sub-area 3 (Rural Dengie Tidal and Northern Crouch catchment)** – this sub-area is rural, though contains a few larger settlements. The Northern Crouch catchment sub-area includes South Woodham Ferrers which is part of Chelmsford City Council's Administrative Area. The flood risk to property is low, in the Northern Crouch catchment sub-area with small effects from climate change on the number of properties at risk. The current flood risk management activities are out of proportion to the level of flood risk. Proposed management is focused on cost-effective ways of managing the risk in the sub-area, reducing bank and channel maintenance in some areas, and focussing more on areas at higher risk of flooding such as villages and towns. There is also a focus on continuing flood warning service by maintaining flood warning infrastructure such as flow gauging stations.

The rest of Chelmsford City Council's Administrative Area sits within the **North Essex Catchment Flood Management Plan (CFMP)** and is part of the following sub-areas:

- **Sub-area 1 (Blackwater and Chelmer, Upper Reaches and Coastal Streams)** – this sub-area covers a large rural area of the River Chelmer and River Blackwater catchment, with the flood risk mainly to a few isolated towns/villages but there is also critical infrastructure at flood risk, including electricity sub-stations and sewage treatment works. Climate change is shown to have little effect on the number of properties at a risk of flooding. There are no formal flood defences in the sub-area and the preferred management option is to reduce current flood risk management actions and to allow the catchment to continue to function in a natural way.
- **Sub-area 4 (River Wid)** - the River Wid flows from Blackmore, north towards Writtle, Chelmsford where it converges with the River Can. In this

sub-area only three properties have been identified as at risk of flooding during a 1% annual probability river flood with climate changing not making a difference to the number of properties at risk. However, the River Wid floodplain has been identified to be an area which can store water during flood events to decrease risk to property and people downstream in Chelmsford. Risk of flooding to people and property in the River Wid Sub-area would not increase due to floodwater storage. Preferred management actions would implement recommendations from the Chelmer flood risk study and Chelmsford Flood Alleviation Scheme Viability Study to develop storage in the River Wid sub-area.

- **Sub-area 5 (Chelmsford)** – this sub-area covers the remainder of Chelmsford City Council's Administrative Area. Chelmsford is a large urban area at the confluence of the Rivers Wid, Can and Chelmer. Flood risk to property and people is high. Climate change and urbanisation are predicted to increase this risk. An existing flood alleviation scheme built in 1964 provides some protection from river flooding. However, to decrease flood risk, it is recommended that a Flood Storage Area is built upstream on the River Wid. Current defences should be maintained and awareness of the flood warning service should be increased.

2.4.6 Essex County Local Flood Risk Management Strategy

The **Essex County Local Flood Risk Management Strategy** (ECLFRMS) sets out how Essex County Council (ECC) will manage flood risk from surface water runoff, groundwater and ordinary watercourses for which they have a responsibility as LLFA and the work that other Risk Management Authorities are doing to manage flood risk. Other duties of ECC include investigating incidences of flooding, maintain a

register of structures which have an effect on flood risk, operate an approval body for SuDS and coordinate activities of relevant agencies.

The Strategy has nine objectives, which are:

- To provide a clear explanation of everyone's responsibilities.
- To make sure people understand their risk of flooding and think about how we communicate this.
- To explain how we assess flood risk in Essex and then prioritise the work we do.
- To clearly set out our work so that communities and businesses can make decisions about how they also manage flood risk.
- To ensure that planning decisions properly consider flooding and the future impact of any development.
- To state how we share information and work with other authorities.
- To ensure that emergency plans and responses to flood incidents are effective and that communities are prepared for flooding.
- To encourage innovative new thinking, considering community needs, while working with the existing natural and built environment.
- To highlight where further detailed information and legislation regarding flooding can be found.

To meet these objectives, ECC has split the Strategy into the following seven measures:

- Investigating Floods
- Mapping local routes for water
- Looking after our watercourses
- Planning for future floods
- Influencing new development and drainage
- Building flood defences
- What more can you do? (e.g. apply for a Community Grant, volunteer with ECC).

2.4.7 LLFAs, surface water and SuDS

The 2023 NPPF states that: 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Para 175). Wherever possible, SUDS should also seek to provide multifunctional benefits. When considering planning applications, local planning authorities should consult the relevant LLFA on the management of surface water in order to satisfy that:

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

Essex County Council's requirements for new developers on SuDS are set out on their website, alongside supporting documents. At the time of writing this SFRA, documents and policies relevant to SuDS and surface water in Chelmsford City Council's Administrative Area are:

- **Flood and Water Management Guide** (ECC)
- **Essex County Council- SuDS new development advice** (ECC)
- **Essex County Council- The Sustainable Systems Design Guide for Essex**
- **SuDS Manual (C753)** published in 2007, updated in 2015
- **DEFRA Non-statutory technical standards for sustainable drainage systems, 2015**
- **DEFRA National Standards for sustainable drainage systems Designing, constructing (including LASOO best practice guidance), operating and maintaining drainage for surface runoff, 2011**
- **Building Regulations Part H (MHCLG) 2010**

The 2023 NPPF states that flood risk should be managed 'using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding' (Para 167c). As such, although incorporating SuDS is only a requirement for major development, it is best practice for all development.

In January 2023, the **Government announced its intention to implement Schedule 3 of the Flood and Water Management Act**, which will designate LLFAs as SuDS Approval Bodies.

2.4.8 Surface Water Management Plans

A Surface Water Management Plan (SWMP) is a study to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from risk from surface runoff, groundwater, and ordinary watercourses. SWMPs are led by a partnership of flood risk management authorities who have responsibilities for aspects of local flooding, including the LLFA, Local Authority, Sewerage Undertaker and other relevant authorities. The purpose of a SWMP is to identify what the local flood risk issues are, what options there may be to prevent them or the damage they cause and who should take these options forward. This is then presented in an Action Plan that the stakeholders and partners agree.

Capita Symonds prepared a **Chelmsford Surface Water Management Plan** on behalf of Essex County Council in 2014. This plan covers the City of Chelmsford as

well surrounding areas identified to be at the highest risk of surface water flooding. This SWMP was undertaken in four stages:

- Phase 1: Preparation
  - Surface water information was collected from key stakeholders
- Phase 2 – Risk assessment
  - Direct rainfall modelling was carried out across the study area for five rainfall event return periods. 12 Critical Drainage Areas (CDAs) were identified from the results
  - Analysis of properties at risk of surface water flooding for a 1% AEP rainfall event was also undertaken. The results predict that 1746 properties in Chelmsford could be at risk of surface water flooding of depth greater than 0.1m during a 1% AEP rainfall event
- Phase 3: Options
  - For each of the CDAs identified, measures to help reduce risk of surface water flooding were proposed. These measures were then shortlisted to give a preferred option for each CDA.
  - Pluvial modelling identified that historic and existing watercourse valleys heavily impact surface water flooding and that this flooding has an impact on important infrastructure assets.
  - Therefore, in the short to medium-term Chelmsford City Council and Essex County Council should work together to:
    - Raise residents' awareness of surface water flood risk and their responsibilities regarding their property's drainage as well as how they can increase their resilience to flooding
    - Inform residents on how they can mitigate surface water flooding in and around their property
    - Communicate and raise awareness of surface water flood risk to different stakeholders (including the public) using a defined communication strategy
    - Improve maintenance regimes, and targeting areas identified to flood regularly or that are known to have blocked gullies / culverts / watercourses
- Phase 4: Implementation and review
  - A long-term action plan established for Essex County Council and other RMAs to implement options identified in phase 3

3 Planning policy for flood risk management

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

3.1 National Planning Policy Framework and Guidance

The revised **National Planning Policy Framework (NPPF)** was published in July 2021, replacing the 2019 version (with the most recent updates in 2023, with only minor implications for flood risk management). The NPPF 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 defines Flood Zones, how these should be used to allocate land and flood risk assessment 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".

Planning Practice Guidance (PPG) on flood risk was published in March 2014 and sets out how the policy should be implemented. **Diagram 1 in the PPG** sets out how flood risk should be considered in the preparation of Local Plans. It was updated on the 25 August 2022, see Section 3.1 for more information.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas. Since July 2021 the approach has adjusted the requirement for the Sequential Test (as defined in Para 168 of the NPPF) so that **all** sources of flood risk are included in the consideration. At the time of preparation of the 2024 SFRA the updated guidance (PPG) has been published, describing a revised approach to the Sequential Test. The requirement for the revised Sequential Test has been addressed by adopting the following approach:

- The test will cease to be based solely on the use of the Zones describing river and sea flood risk, and instead be based on whether development can be located in the lowest risk areas (high-medium-low) of flood risk both now and in the future (the test applied to all sources of flood risk – whereas previously the test was only performed for present day flood risk for the "Flood Zones" i.e. river and sea flood risk).
- Understanding flood risk to sites based on their vulnerability and incompatibility as opposed to whether development is appropriate.
- As there is no available competent risk mapping for other sources of risk that is comparable with that for the sea, rivers and surface water it is not considered appropriate to use such mapping in a strict process that involves comparison of differing levels of flood risk. However, it is important that the potential implications of such risk is assessed in performing the Sequential Test and so reservoir, groundwater and sewer flood risk are addressed during the process of finalising the selection of allocation sites. This process is undertaken in a Level 2 SFRA and involves a more detailed assessment of the implications of reservoir, sewer and

groundwater flood risk to establish that more appropriate locations at lower risk are not available. Consideration is given to all sources of flood risk using the available data to complete the Sequential Test so decisions on the selection of preferred sites for allocation address the potential implications of groundwater, reservoir and sewer flooding. Where necessary this process will identify sites where consideration should be given to satisfying the requirements of the Exception Test.

This process will be described in the future Level 2 SFRA and involves a more detailed assessment of the implications of reservoir, sewer and groundwater flood risk to establish that more appropriate locations at lower risk are not available.

3.2.1 Flood Zones – flood risk from rivers

The definition of the Flood Zones is provided below. The Flood Zones do not take into account defences. This is important for planning long term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

The Flood Zones do not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure. They do not consider climate change. Hence there could still be a risk of flooding from other sources and that the level of flood risk will change over time during the lifetime of a development.

The Flood Zones are:

- **Flood Zone 1: Low risk**: less than a 0.1% chance of river and sea flooding in any given year
- **Flood Zone 2: Medium risk**: between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year
- **Flood Zone 3a: High risk**: greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. Excludes Flood Zone 3b.
- **Flood Zone 3b: Functional Floodplain**: land where water has to flow or be stored in times of flood. SFRAs identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. It may be required to consider climate change on the functional floodplain; this would need hydraulic modelling to confirm extents and therefore it is recommended that this is considered in an FRA and a suitable approach is agreed with the Environment Agency.
    - FZ3b is based on the best available model data
        - 3.3% AEP where available
        - 2% AEP where the 3.3% is not available
    - Where model data is not available, FZ3a (1% AEP) is used as a conservative proxy.

The SFFRA provides a starting point for Flood Zone 3b, however there are likely to be occasions where CCC as LLFA wishes to alter and/or designate areas of Flood Zone 3b in light of new evidence and/or local circumstances. The following principles set out how this should be approached:

- In the first instance, Flood Zones should be defined using the latest available modelling, with a preference for detailed modelling where it exists.
- Where there is reason to believe modelling might be inaccurate or outdated (e.g. following significant changes in the channel, opening of culverts, construction of defences/earthworks etc.), the ideal would be for models to be updated to determine the risk.
- Where modelled outputs are not available for the 30-year Fluvial event (FZ3b), the 100-year event outline or the Environment Agency's Flood Zone 3 should be considered as Flood Zone 3b.
- If defences are proposed (excluding property flood resilience measures which protect only residential properties, but not their curtilage e.g. flood doors), there is a requirement for the developer/landowner to demonstrate through modelling that the risk is not increased elsewhere as a result, therefore the building of a defence alone without supporting modelling is not a reason to alter Flood Zones.
- Where there are known local flooding issues that are not represented in the Environment Agency's Flood Zones (for example due to being on very small watercourses) the Council may decide to designate these areas as flood zones.
- Any development proposals in areas identified as Flood Zones should be accompanied by a site specific FRA supported by detailed modelling to determine the true risk to the site (which may in turn be used to designate appropriate Flood Zones). Ultimately it is for the council to satisfy itself that evidence presented by developers is robust.
- Developers should enter into collaborative discussions with the LPA and Environment Agency where a developer considers there to be ambiguity over the flood zone classifications with Flood Zone 3.

Important note on Flood Zone information in this SFRA

The Flood Zones (Flood Zone 2 and 3a) in the Appendix A Geo-PDFs are shown from the online Environment Agency's **'Flood Map for Planning'** which incorporates modelled data where available. All the models used for this SFRA have been fully incorporated into the Environment Agency Flood Zones.

The Environment Agency Flood Zones do not cover all catchments or ordinary watercourses with areas <3km^2. As a result, whilst the Environment Agency Flood Zones may show an area is in Flood Zone 1, there may be a flood risk from smaller watercourse not shown in the Flood Zones.

Functional floodplain (Flood Zone 3b) is identified as land which would flood with an annual probability of 1 in 30 years (3.3% AEP), where detailed hydraulic modelling exists. The 1 in 30-year, 1 in 50-year (2% AEP) or 1 in 100-year (1% AEP) defended modelled flood extents have been used to represent Flood Zone 3b, where available from the Environment Agency. For areas outside of the detailed model coverage, or where no outputs were available, Flood Zone 3a has been used as a conservative indication. Further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b where no detailed modelling exists, based on the principles set out above.

3.2.2 Flood Zones – surface water risk

To address the requirement that flood risk from **all** sources is included in the Sequential Test a further set of surface water Zone maps has been prepared. It is not possible to prepare Zone maps for reservoir flood risk, sewer flood risk or groundwater flood risk as the appropriate analyses and data are not available. The existing risk information on reservoirs, sewer flooding and groundwater is used in the sequential approach to development at a site in accordance with paragraph 167 of the NPPF (which could in some instances result in alternative sites being considered).

The surface water maps show areas at surface water flood risk based on the extent of the 3.3%, 1%, and 0.1 AEP plus higher central climate change allowance surface water modelling.

This is not strictly the same conceptual risk zone as defined for river and sea flooding (even though it is associated with the same probability) as the mapping is based on different assumptions. However, it does create a product that can accommodate a form of sequential testing, as it would facilitate strategic decisions that directed development to land in a "low risk surface water flood zone (0.1% AEP +CC)", and outside of the "high risk surface water flood zone (3.3% AEP +CC)".

The proposed approach will direct development to areas at low risk in a similar way to the fluvial/tidal Flood Zone 1 and will not preclude development in the surface

water high risk zone, where there are no other site options at a lower risk available, provided that an FRA is performed to demonstrate that the risks in the high-risk zone can be appropriately managed.

The application of the test would require a preference that all proposed development on sites identified for allocation would be placed in the "low risk surface water flood zone". In circumstances where it is not possible to place all proposed development in the "low risk surface water flood zone" or circumstances arose where encroachment could not be avoided then it would be necessary to provide supplementary evidence that the Exception Test could be satisfied. For the purpose of the Local Plan this supplementary exercise could be set out in the Level 2 SFRA and might simply involve more specific requirements with respect to the scope of an FRA. The proposed approach is relatively simple, is not totally aligned with the river and sea zones, but from a practical perspective is strongly aligned with the sequential approach defined in para 167 of the NPPF. For these reasons it is recommended.

3.2.3 Flood Zones – other sources of flooding

It is not possible to prepare zone maps for reservoir flood risk, sewer flood risk or groundwater flood risk as the appropriate analyses and data is not available. The existing risk information on reservoirs, sewer flooding and groundwater is used in the sequential approach to development at a site in accordance with paragraph 167 of the NPPF.

It is recommended that reservoir flooding is included in the Sequential Test. However, it is made clear in the SFRA that the available information is not conceptually similar to the risks pertaining to river and sea flooding.

The Reservoir Flood Map Wet Day Extent will be used to define two zones:

1.

Where reservoir flooding **is** predicted to make fluvial flooding worse.

2.

Where reservoir flooding **is not** predicted to make fluvial flooding worse.

This will also identify locations where proposed development could result in a change to the risk designation of a reservoir. If proposed sites are located in a zone at reservoir risk, it will be necessary to include a more detailed assessment in a Level 2 SFRA to understand the extent to which the flooding could be made worse and to report on the implications with respect to allocating the land for development. On that basis such an approach is recommended.

3.2.4 The Sequential Test

Firstly, land at the lowest risk of flooding and 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 strategic allocations. For all other developments, developers must supply evidence to the LPA, with a Planning application, that the development has passed the test.

The LPA should work with the Environment Agency to define a suitable area of search for the consideration of alternative sites in the Sequential Test. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it

can be demonstrated through a free-standing document, or as part of Strategic Housing Land or Employment Land Availability Assessments.

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone it is proposed for. **Table 2 of the NPPG** defines the flood risk vulnerability and flood zone 'incompatibility' of different development types to flooding.

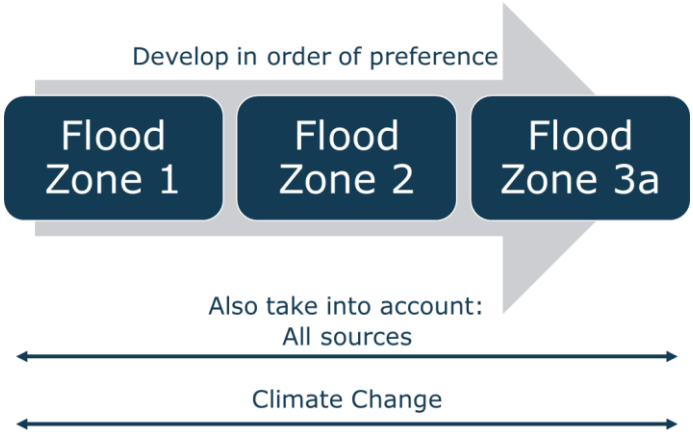
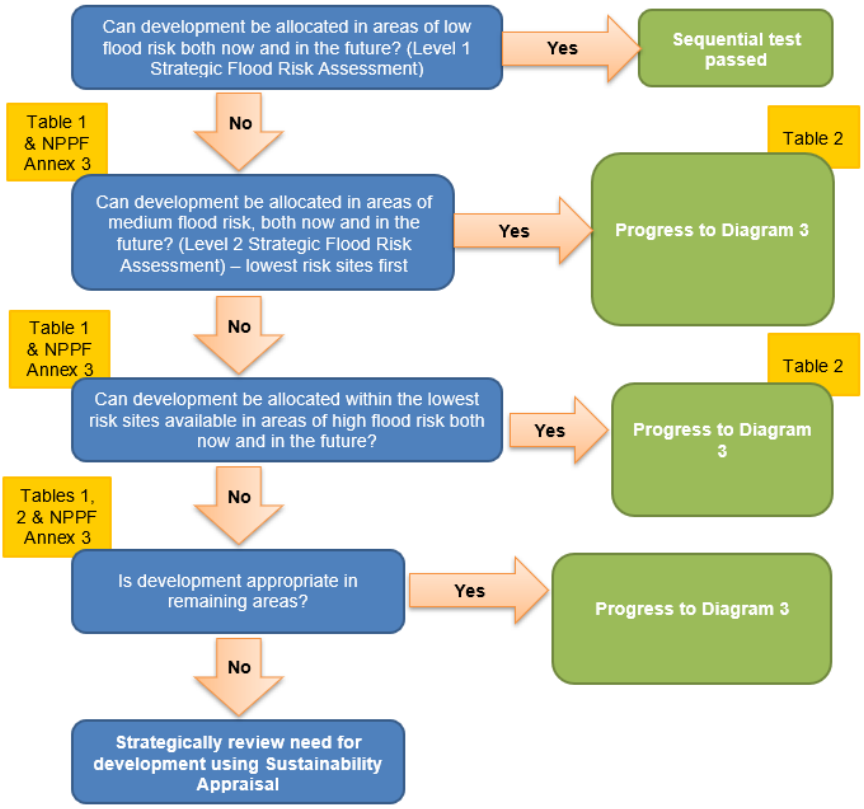


Figure 3-1: The Sequential Test

Figure 3-2 illustrates the Sequential and Exception Tests as a process flow diagram using the information contained in this SFRA to assess potential development sites against the Environment Agency's Flood Map for Planning flood zones and development vulnerability compatibilities.

This is a stepwise process, but a challenging one, as a number 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 latest NPPF states that the risk of flooding from other sources and the impact of climate change must be considered when considering which sites are suitable to allocate. Section 4 provides further details on considering climate change. The SFRA User Guide in Appendix C shows where the Sequential and Exception Test may be required for the datasets assessed in the SFRA, and how to interpret different levels

of concern with the datasets, recommending what development might be appropriate in what situations.



Note - other sources of flood risk should also be considered, as per the 2021 update to NPPF but formal zone mapping is not available (Surface Water Zones 3.3% and 1% AEP extents used to define risk sequentially)*

Figure 3-2: diagram 2 of the Planning Practice guidance- Application of the Sequential Test for plan preparation

3.2.5 The Exception Test

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

The Exception Test should only be applied following the application of the Sequential Test. It applies in the following instances:

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

Whilst the Exception Test is not explicitly required by the NPPF/PPG where a site is at significant risk from other sources of flooding, or where flooding impedes access/egress regardless of whether the site itself is at risk, the NPPF/PPG do require that all sources of flooding are considered both now and into the future. Therefore the Council should carefully weigh up the benefits of developing such sites against

the risk, and satisfy themselves that the site can be developed in a way that ensures users of the site are safe in the event of a flood from any source, both now and throughout the lifetime of the development.

Flood risk issues are not always black and white - the significance of issues requires professional judgement, based on the location, topography and nature (including depth, velocity and hazard) of flooding, rather than simply whether part of a site is within a given flood extent.

Figure 3-3 summarises the Exception Test.

For sites allocated within the Local Plan, the Local Planning Authority (LPA) should use the information in this SFRA to inform the Exception Test. At planning application stage, the developer must design the site such that it is appropriately flood resistant and resilient in line with the recommendations in National and Local Planning Policy and supporting guidance and those set out in this SFRA. This should demonstrate that the site will still pass the flood risk element of the Exception Test based on the detailed site level analysis.

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

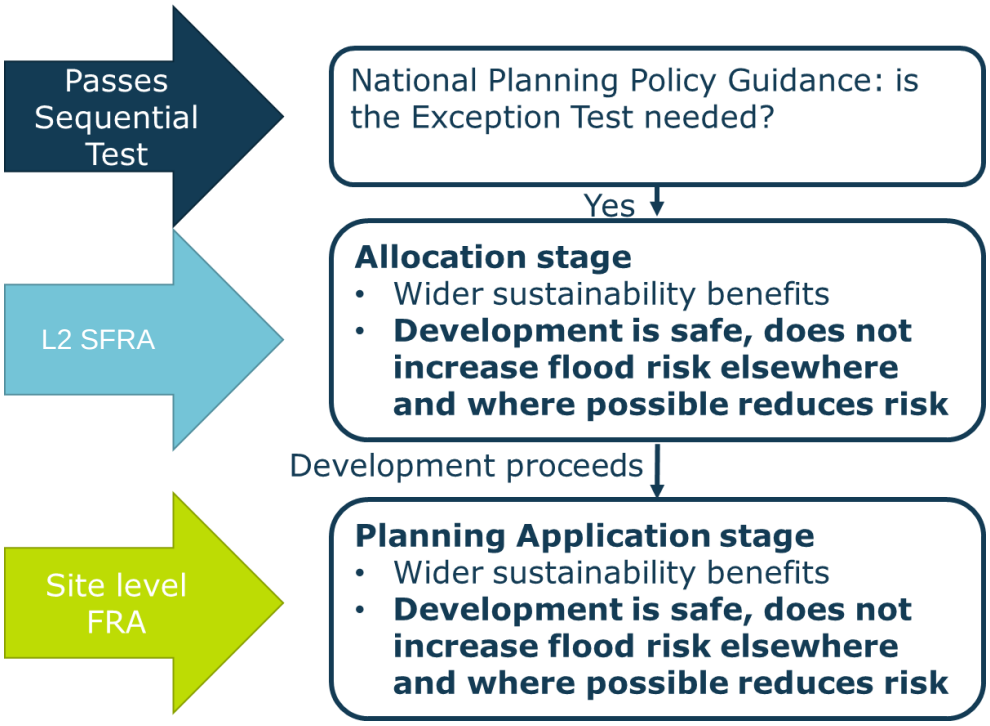


Figure 3-3: The Exception Test

There are two parts to demonstrating a development passes the Exception Test:

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

Local planning authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give 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. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

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

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

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. This is to ensure that there is sufficient evidence that the principle of development can be supported for strategic allocations. At Planning application stage, a site-specific FRA will be needed. Both would need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

3.2.6 Making a site safe from flood risk over its lifetime

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

- The actual risk is the risk to the site considering existing flood mitigation measures. The fluvial 1% chance flood in any year event is a key event to consider because the National Planning Practice Guidance refers to this as the 'design flood' against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed.
- Safe access and egress should be available during the design flood event. Firstly, this should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.

- Residual risk is the risk that remains after the effects of flood defences have been taken into account and/ or from a more severe flood event than the design event. The residual risk can be:
    - The effects of an extreme 0.1% chance flood in any year event. Where there are defences, this could cause them to overtop, which may lead to failure if this causes them to erode; and/or
    - Structural failure of any flood defences, such as breaches in embankments or walls.
    - Examples of other residual risks include blockage of a surface water conveyance system, overtopping of an upstream storage area, failure of a pumped drainage system and/or failure of a reservoir.

Flood resistance and resilience measures should be considered to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage it does, should water enter a property. Emergency plans should also account for residual risk, e.g. through the provision of flood warnings and a flood evacuation plan where appropriate.

In line with the NPPF, the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk.

3.3 Applying the Sequential Test and Exception Test to individual planning applications

3.3.1 Sequential Test

Chelmsford City Council are responsible for considering the extent to which Sequential Test considerations have been satisfied, including considering risk in the future due to climate change.

Developers are required to undertake the Sequential Test to all development sites, unless the site is either:

- A strategic allocation and the test have already been carried out by the LPA;
- A change of use (except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate);
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m^2); or
- A development in Flood Zone 1, unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).

Even if the Sequential Test is not required, a site-specific FRA will still be required for most developments located in a risk zone or greater than one hectare.

The SFRA contains information on all sources of flooding and taking into account the impact of climate change. This should be considered when a developer undertakes

the Sequential Test, including the consideration of reasonably available sites at lower flood risk.

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

The sources of information on reasonably available sites may include:

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

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

Ownership or landowner agreement in itself is not acceptable as a reason not to consider alternatives, although clearly the individual circumstances of locationally-specific enterprises (e.g. rural land-based businesses) will have a limiting effect on the range of alternatives that can reasonably be considered.

The SFRA User Guide in Appendix C shows where the Sequential and Exception Test may be required for the datasets assessed in the SFRA, and how to interpret different levels of concern with the datasets, recommending what development might be appropriate in what situations.

3.3.2 The Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding the Exception Test must then be applied if required (as set out in Diagram 3 of the PPG). Developers are required to apply the Exception Test to all applicable sites (including strategic allocations). The applicant will need to provide information that the application can pass both parts of the Exception Test:

- Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.
    - Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.
    - Applicants should detail the suitability issues the development will address and how doing it will outweigh the flood risk concerns for the site e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

- Demonstrating that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
    - The site-specific FRA should demonstrate that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:
        - The design of any flood defence infrastructure
        - Access and egress
        - Operation and maintenance
        - Design of the development to manage and reduce flood risk wherever possible
        - Resident awareness
        - Flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event; and
        - Any funding arrangements required for implementing measures.

4 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.

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

4.1 Revised climate change guidance

The impact of climate change must be managed over the lifetime of the development. The Climate Change Act 2008 mandates a reduction in carbon emissions of at least 80% below 1990 levels by 2050.

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency used these projections to update their climate change guidance for new developments with regards to updated fluvial and rainfall allowances which were released in July 2021.

The Environment Agency published **updated climate change guidance** for fluvial risk in July 2021 on how allowances for climate change should be included in both strategic and site-specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development and considers risk allowances on a management catchment level, rather than a river basin level. The same approach was then adopted for rainfall allowances in May 2022.

Developers should check the government website for the latest guidance before undertaking a detailed FRA.

4.2 Applying the climate change guidance

To apply the climate change guidance, the following information needs to be known:

- The vulnerability of the development – see the **NPPF**
- The likely lifetime of the development – in general 75 years is used for commercial development and 100 for residential, but this needs to be confirmed in an FRA.
- The River Basin and Management Catchment that the site is in – Chelmsford is located within the Anglian River Basin District. The study area falls within the Combined Essex Management Catchment.
- Likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s)
- The 'built in' resilience measures used, for example, raised floor levels.
- The capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

4.3 Relevant allowances for Chelmsford City Council's Administrative Area

Table 4-1 shows the updated peak river flow allowances that apply in Chelmsford City Council's Administrative Area for fluvial flood risk for the Combined Essex

Management Catchment (last updated in July 2021). These allowances supersede the previous allowances by River Basin District.

Table 4-2 shows the peak rainfall intensity allowances that apply for small catchments (less than 5km^2) and urban catchments for surface water flood risk. Catchments which are larger than 5km^2 or are rural direct rainfall modelling is unlikely to be appropriate, and peak river flow allowances should be used. Both the central and higher central allowances should be considered to understand the range of impact.

Table 4-2 shows the updated rainfall intensity allowances that apply in Chelmsford City Council's Administrative Area for pluvial flood risk for the different Management Catchments (as of May 2022).

Table 4-1 Peak river flow allowances for the Management Catchment in Chelmsford City Council's Administrative Area

Management Catchment	Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Combined Essex Management Catchment	Upper end	27%	37%	72%
	Higher	13%	16%	38%
	Central	7%	8%	25%

Table 4-2: Peak rainfall intensity allowances for small and urban catchments by Management Catchment in Chelmsford City Council's Administrative Area

Management Catchment	Allowance Category	Total potential change anticipated for the '2050s' (2022 to 2060)		Total potential change anticipated for the '2070s' (2061 to 2125)	
		30-year return period	100-year return period	30-year return period	100-year return period
Combined Essex Management Catchment	Upper end	35%	45%	35%	*45%**
	Central	20%	20%	20%	25%

**In some locations the allowance for the 2050s epoch is higher than that for the 2070s epoch. If so, and development has a lifetime beyond 2061, use the higher of the two allowances.*

Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing FRAs, using the percentage

increases which relate to the proposed lifetime and the vulnerability classification of the development.

4.4 Representing climate change in the Level 1 SFRA

Representation of climate change within the SFRA was discussed with the Environment Agency. Climate change allowances have increased since the publication of the previous SFRA. Where previous climate change runs were within +/- 10% of the updated climate change allowances, these were able to be used. For coastal models, climate change allowances are based on predicted sea level rise, rather than a % increase in flows. The following models were provided with the climate change allowances applied as listed for the 1% AEP event:

- Chelmer +25%, +35% and +65%
- Chelmer Tributaries +25%, +35% and +65%
- Wid and Crouch Tributaries +20%, +25%, +35% and +65%
- Bicknacre +20% and +30%
- Sandon Brook +20%
- Rettendon & Fenn Brooks – no climate change allowances
- Crouch +20%
- Crouch and Roach Coastal- +1.11m sea level rise

Additionally, the following scenarios have been run for this SFRA:

- Chelmer 3.3% AEP present day, +25%, +38%, 0.1% AEP+38%
- Wid & Crouch Tributaries 3.3% AEP present day, +25%, +38%
- Sandon Brook 3.3% AEP present day, +25%, +38% and 1% AEP +38%
- Rettendon & Fen Brooks 3.3% AEP present day, +25%, +38% and 1% AEP +38%
- Crouch 3.3% AEP present day, +25%, +38%, 0.1% AEP+38%

Any of the above models that cover development sites of interest within Chelmsford will be re-run for the Level 2 assessment at the latest climate change uplift allowances according to Table 4-1.

Appendix B provides further details of the models used in this assessment.

For any sites not covered by the Environment Agency's detailed modelling or not able to be run for appropriate climate change allowances, Flood Zone 2 was used as an indicative climate change extent. This is appropriate given the Upper End climate change estimates are often similar to the Flood Zone 2 extents; therefore, the difference in effects of climate change would not be substantial.

The 0.1% AEP surface water extent can be used as an indication of surface water risk, and risk to smaller watercourses, which are too small to be covered by the Environment Agency's Flood Zones.

Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing FRAs, using the percentage increases which relate to the proposed lifetime and the vulnerability classification of the development. In areas where no modelling is present, this may require development of a 'detailed' hydraulic model, using channel topographic survey. The

Environment Agency should be consulted to provide further advice for developers on how best to apply the new climate change guidance.

Climate change mapping has been provided in Appendix A: GeoPDFs for areas where there are detailed hydraulic models. The climate change outputs have been presented under:

- 'Climate Change Extent' including central and higher central

For areas not covered by detailed hydraulic models, Flood Zone 2 should be used to provide a conservative indicator for the impacts of climate change.

It is important to note that although the flood extent may not increase noticeably on some watercourses, the flood depth, velocity and hazard may increase compared to the 1 in 100 current-day event.

When undertaking a site-specific FRA, developers should:

- Confirm which national guidance on climate change and new development applies by visiting **GOV.uk.**
- Apply this guidance when deciding the allowances to be made for climate change, having considered the potential sources of flood risk to the site (using this SFRA), the vulnerability of the development to flooding and the proposed lifetime of the development. If the site is just outside the indicative climate change extents in this SFRA, the impact of climate change should still be considered because these may get affected should the more extreme climate change scenarios materialise.
- Refer to Section 8 which provides further details on climate change for developers, as part of the FRA guidance, and the SFRA User Guide in Appendix C.

4.5 Impact of climate change on flood risk

This section explores which areas of Chelmsford City Council's Administrative Area are most sensitive to increases in flood risk due to climate change. It should be noted that areas that are already at high risk will also become at increasing risk in future and the frequency of flooding will increase in such areas.

It is recommended that Chelmsford City Council work with other Risk Management Authorities to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the city.

4.5.1 Impact of climate change on fluvial flood risk

Climate change modelled flood extents (or Flood Zone 2 where no modelling exists) can be compared to the 1 in 100 flood extent (Flood Zone 3a) for an indication of areas most sensitive to climate change.

Areas within Chelmsford City Council's Administrative Area most sensitive to fluvial impacts of climate change, based on flood extents and the number of properties at risk of flooding, are:

- The City Centre, at the confluence of the River Can and River Chelmer
- Fennfields Road in the northwest of South Woodham Ferrers, where flooding from the Rettendon Fenn Brook increases in extent significantly, exacerbated by pooling behind the railway embankment.

4.5.2 Impact of climate change on coastal flood risk

Climate change allowances for coastal risk are based on predicted sea level rise. The Environment Agency's 2018 Crouch and Roach Coastal Model includes climate change allowances based on the UKCP09 95th percentile allowances (1.11m), which have been used in this assessment. This scenario is slightly lower than the latest higher central climate change allowance (1.20m) and it is recommended that the latest allowances are considered as part of a site-specific flood risk assessment where sites are likely to be at tidal flood risk.

This modelling shows that the areas most sensitive to increased tidal flood extents along the River Crouch are generally uninhabited areas outside of Chelmsford City Council's Administrative Boundary. In tidal watercourses, the volumes of water involved in tidal events usually far exceeds that associated with fluvial flows, therefore this is considered the dominant risk.

The areas most sensitive to increased tidal flood risk within the study area are:

- Battlesbridge, where flooding is shown to affect the properties on the north side of the river in the 0.5% AEP event in the 2125 epoch, where they are unaffected in the present day 0.1% AEP event. Flood extents also increase on the south bank, however most properties at risk are already at risk in the present day.
- The vicinity of Fennfields Road in the northwest of South Woodham Ferrers, where tidal flooding from the Rettendon Fenn Brook increases significantly in extent. Only a few properties in the immediate vicinity of the Brook are at risk in the present day 0.1% AEP scenario, whilst in the 0.5% and 0.1% AEP climate change scenarios properties on Fennfields Road and Old Wickford Road are at risk.

Climate change scenario modelling suggest that the embankments west of South Woodham Ferrers provide a Standard of Protection in exceedance of the 1000-year event in the 2125 epoch, although they are officially recorded as having a 200-year standard of protection. In the undefended scenario, flood extents within the town in climate change scenarios are similar to the present day due to flood extents being constrained by the topography.

4.5.3 Impact of climate change on surface water flood risk

The latest climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water dataset to provide an indication of the impact of climate change on surface water risk (as well as for smaller watercourses; some of which are not included in the Flood Zones). In general, surface water is modelled to follow similar paths and patterns in the future as present day, with greater depths and extents. Therefore, areas at risk in the present day are also likely to be at increased risk in future- for Chelmsford, this includes most of the urban areas. There

are many rural areas where surface water flooding is sensitive to climate change– only those areas where there is a risk to properties are listed below.

Areas in Chelmsford City Council's Administrative Area particularly sensitive to climate change impacts on surface water flooding are:

- Chelmer Village, northwest of the City Centre where a flow path increases in extent considerably, affecting a large number of properties.
- East Hanningfield, where a flow path through the village increases significantly in extent.

4.5.4 Impact of climate change on groundwater flood risk

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

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

4.6 Adapting to climate change

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

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime.
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development.
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses; and
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity, for example by leaving areas shown to be at risk of flooding as public open space.
- Considering the standard of protection of defences and sites for future development, in relation to sensitivity to climate change. Chelmsford City Council and developers will need to work with Risk Management Authorities (RMAs) and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option, such as at the defence locations mentioned in Section 6.

- It is recommended that the differences in flood extents from climate change are compared by Chelmsford City Council when allocating sites, to understand how much additional risk there could be, where this risk is in the site, whether the increase is marginal or activates new flow paths, whether it affects access/ egress and how much land could still be developable overall. Recommendations for development are made for the levels of risk in the SFRA User Guide in Appendix C.

5 Understanding flood risk in Chelmsford City Council's Administrative Area

This section explores the key sources of flooding in Chelmsford City Council's Administrative Area and the factors that affect flooding including topography, soils and geology. The main sources of flooding are from watercourses, surface water and sewers.

This is a strategic summary of the risk in Chelmsford City Council's Administrative Area. Developers should use this section to scope out the flood risk issues they need to consider in greater detail in a site-specific FRA to support a Planning application.

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

5.1 Historical flooding

Essex County Council (LLFA) Section 19 reports include recorded historical flood events within Chelmsford City Council's Administrative Area.

There is a history of documented flood events, with the main sources being fluvial and surface water. Table 5-1 highlights the historic flood events recorded by the LLFA's within their Section 19 reports.

Essex County Council also provided a list of locations where they have investigated flooding within Chelmsford City Council's Administrative Area, and these are included in the Table below.

Table 5-1 Historic flood records within Chelmsford City Council's Administrative boundary held by Essex County Council as LLFA

Location	Date	Additional information recorded
Chelmsford City Centre (including surrounding suburbs of Springfield, Great Baddow, Moulsham and Melbourne)	2007; 2008; 2009	15 incidents of external and internal flooding of properties in 2007; 4 incidents in 2008 of internal and external flooding; 3 incidents in 2009 resulting from water overflowing from drains causing internal and external flooding.
Writtle	2007	One incident of external flooding.
Galleywood	2008	One incident of internal property flooding.
Foxwell	2007	One incident of external flooding.
Boreham	2007	No more information is available.
Great Baddow	2009	3 incidents of cars trapped in flood water.
Howe Green	2007	3 incidents of internal property flooding.
Danbury	2008	One incident of internal property flooding.
Bicknacre	2009	Two incidents of internal property flooding.
Rettendon Common	2009	Four incidents of internal property flooding.
South Woodham Ferrers	2008; 2009	3 internal and external incidents of property flooding. One incident of external flooding in 2009.
Great Leighs	2009	Road flooding.

In addition, the Environment Agency's **Historic Flood Map (HFM)** shows areas of land that have been previously subject to fluvial flooding in the area. This includes flooding from rivers, the sea and groundwater springs but excludes surface water. The Historic Flood Map outlines for Chelmsford City Council's Administrative Area are shown in Figure 5-1 and summarised in Appendix E.

Please note this does not include all recorded flood events, such as those from other sources, which Chelmsford City Council and LLFA's have recorded. Some of the historic extents may refer to older historic flood events, prior to flood defence improvements. It is recommended that the HFM is viewed alongside the **Recorded Flood Outline** dataset, in Appendix A mapping.

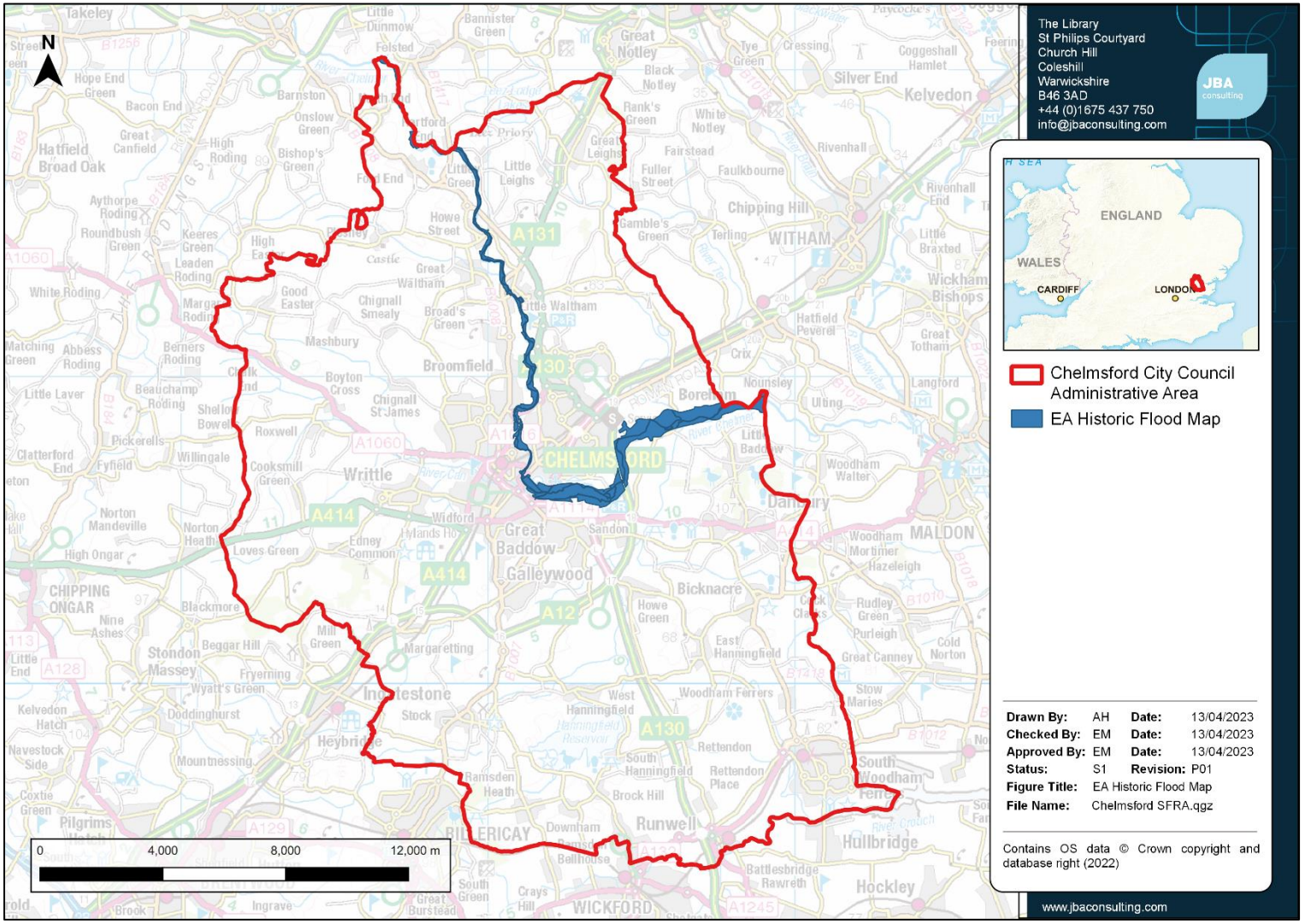


Figure 5-1: City of Chelmsford historic flood outlines from the Environment Agency's Historic Flood Map

5.2 Topography, geology, soils and hydrology

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

5.2.1 Topography

Chelmsford City Council's Administrative Area is generally lowland due to the presence of large river floodplains, varying from around 20-35m AOD within the City. Other areas are flatter due to the presence of river confluences and valleys such as, around Little Waltham, Writtle, Margaretting, Sandon, Boreham and Runwell. Across the rest of the area outside of the low-lying floodplains, topography varies with steady undulating landscapes of about 10-60m AOD.

There are some smaller hilled areas sitting at about 85-95m AOD around Galleywood, Stock and Edney Common in the south of the Council area. There is also an area of higher land towards Danbury to the east of the Council area where elevation is up to 105m AOD.

The topography of the study area is shown in Figure 5-2.

5.2.2 Geology

The geology of the catchment can be an important influencing factor in the way that water runs off the ground surface. This is primarily due to variations in the permeability of the surface material and bedrock stratigraphy.

The bedrock geology of the majority of Chelmsford City Council's Administrative Area is predominantly the London Clay Formation, a mixture of clay, silt and sand.

Around Stock and Galleywood to the south of Chelmsford City Council's Administrative Area there are areas of Bagshot Formation comprising of a sedimentary sandstone bedrock.

Surrounding the Bagshot formation in the south of the area is Claygate Member, a mixture of clay, silt and sand, such as in West and East Hanningfield.

The bedrock geology of the study area is shown in Figure 5-3.

The superficial geology of the study area is dominated by the floodplain and alluvial deposits of the River Chelmer and Can running through the district.

In the north of Chelmsford City Council's Administrative Area, including the city and to the north, west, and southwest of the city, the river floodplains comprise of River Deposits of sand and gravel, Glaciofluvial deposits and alluvium deposits of clay, silt, sand and gravel.

To the north, outside of the floodplains, Lowestoft formation is present which consists of Diamicton.

In Stock and Galleywood to the south there are areas of Stanmore Gravel Formation (sand and gravel) deposits. There are some smaller areas of Brickearth deposits (clay, silt and sand) near Boreham.

The superficial geology of the study area is shown in Figure 5-4

5.2.3 Soils

Soils in the south of Chelmsford City Council's Administrative Area are predominantly slowly permeable, seasonally wet slightly acid but base-rich loamy and clayey soil.

In the south of the Administrative Area (south of Chelmsford City) there are patches of slightly acid loamy and clayey soils with impeded drainage, for example around Galleywood. There are also areas of slowly permeable, seasonally wet acid loamy and clayey soils around areas of slightly higher elevation, such as near Stock.

Within Chelmsford City, in the areas closest to rivers the soils are loamy and clayey floodplain soils with naturally high groundwater. Around most of the city area, soils are mostly freely draining slightly acid loamy soils. In the northern area of the city, soils are similar to those at Galleywood described above.

To the west of the Administrative Area soils are freely draining, lime-rich loamy soils. There are some areas, such as east of Great and Little Waltham, where soils are lime-rich, loamy and clayey soils with impeded drainage.

Along most of the floodplain areas of the River Chelmer and Can, soils are predominantly freely draining, slightly acid and loamy.

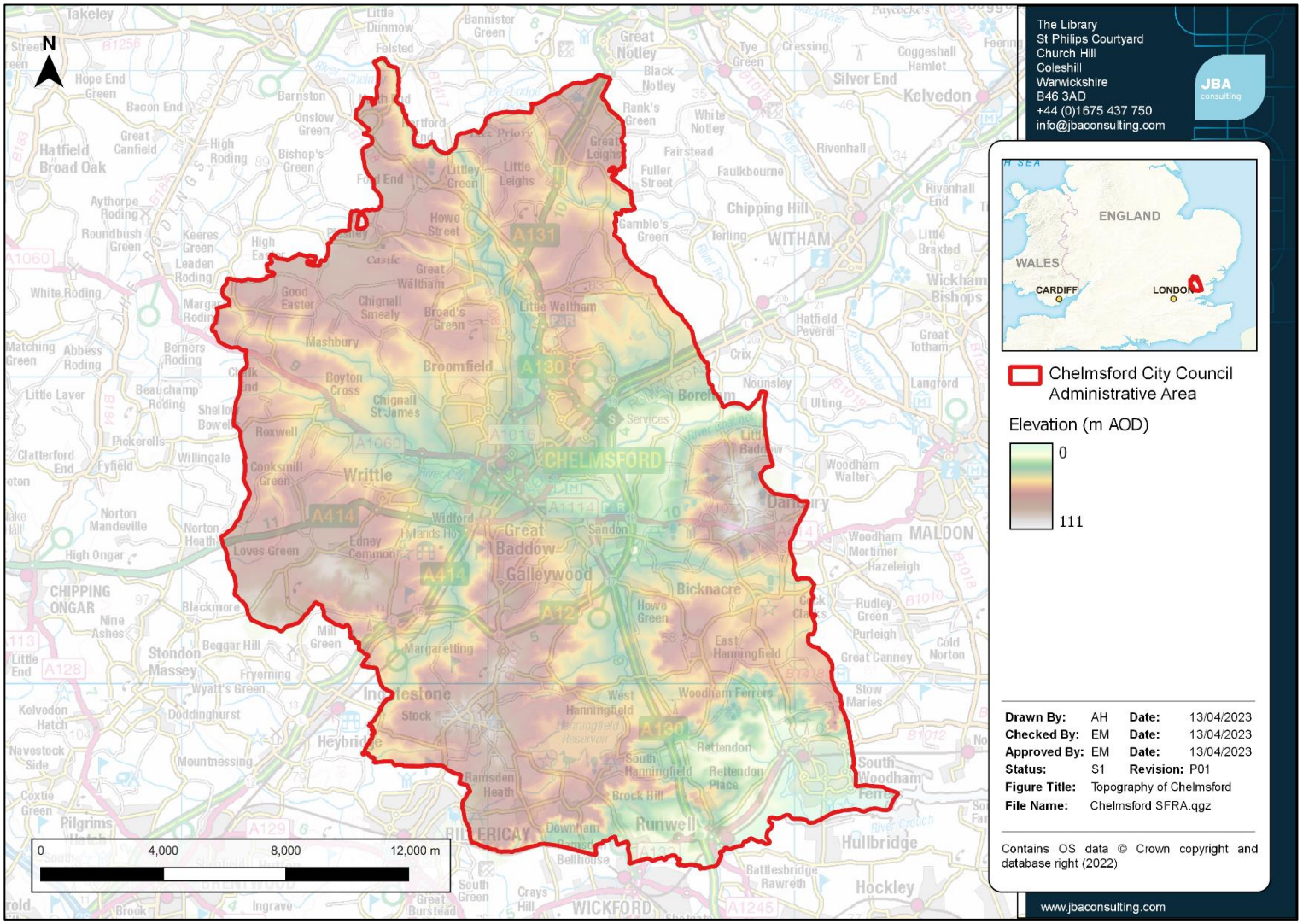


Figure 5-2: Topography of the study area

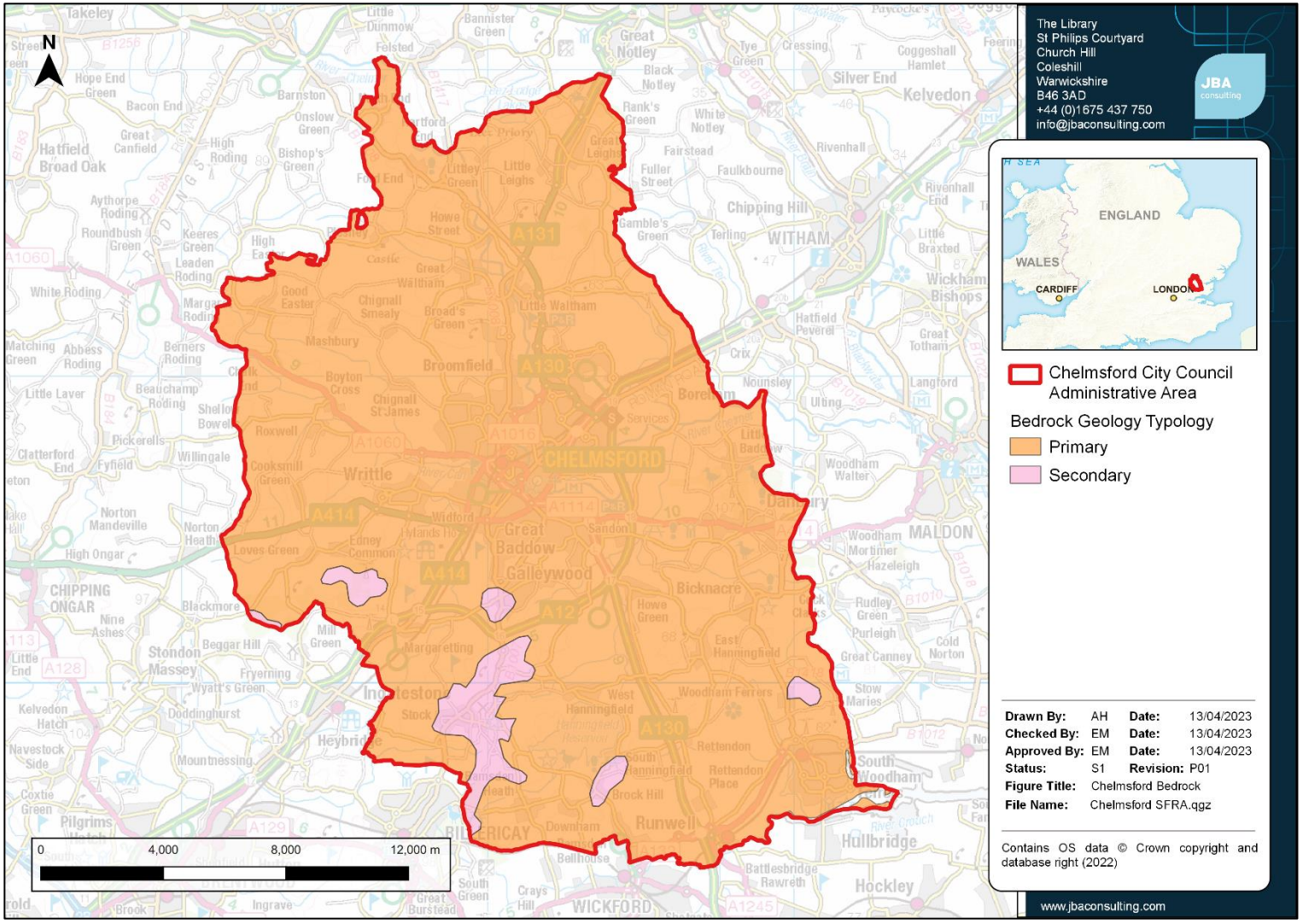


Figure 5-3: Bedrock geology of Chelmsford City Council's Administrative Area

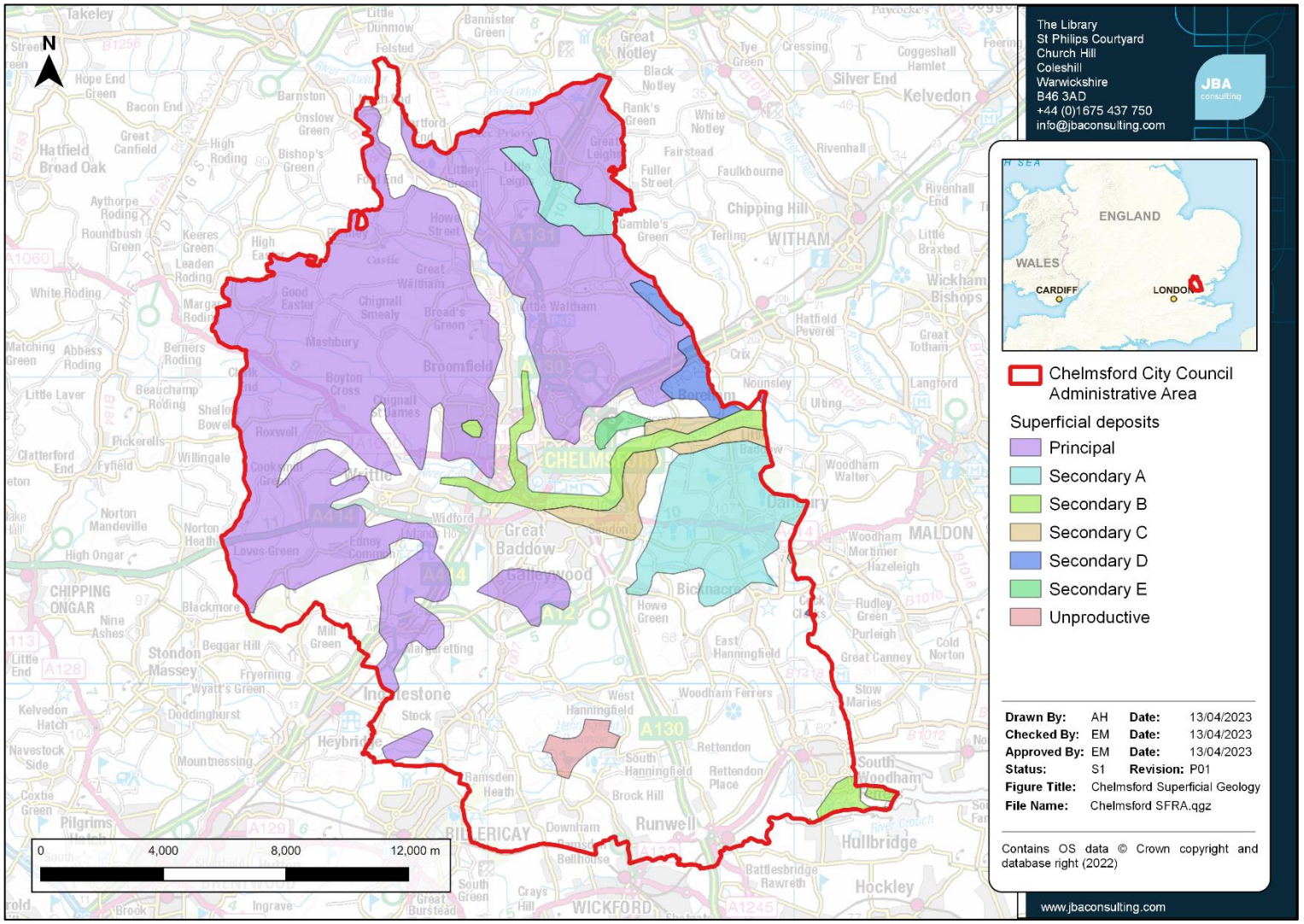


Figure 5-4: Superficial geology of Chelmsford City Council's Administrative Area

5.3 Hydrology

The principal watercourses flowing through Chelmsford City Council's Administrative Area are:

- River Chelmer
- River Can
- River Wid
- River Ter
- River Crouch

There are a number of smaller watercourses and tributaries, including the Roxwell Brook, Chignall Brook, Sandon Brook, Baddow Brook, Butler's Brook and Boreham Tributary amongst others. There are also several ponds and lakes within the study area. A map of the key watercourses is included in Figure 1-3 and Geo-PDF mapping in Appendix A.

5.4 Fluvial flood risk

The area with the highest fluvial flood risk across the area is Chelmsford City Centre, situated at the confluence of three rivers; the River Wid, River Can and River Chelmer.

Since the topography of the area is quite flat, there is increased flood risk to the east of the City Centre, such as at Boreham, as further east is downstream of the watercourses where they then flow into the tidal reach at Blackwater Estuary.

The areas around the watercourses are predominantly rural, however, there are several settlements throughout the council area where there is a risk of fluvial flooding to properties and local roads, such as at Margaretting and Little and Greater Waltham.

The Rettendon and Fenn Brooks are fluvial sources of flood risk before joining with tidal creeks that converge with the Crouch estuary, and there has been historic flooding associated with the Fenn Brook in the vicinity of Old Wickford Road. At the downstream extent of these watercourses, particularly near South Woodham Ferrars, tidal conditions will have a significant influence on the fluvial flood risk.

In addition to flood risk shown by the flood risk mapping, there are a number of small watercourses and field drains which may pose a risk to development.

Flood Zone mapping (where more detailed modelling investigations are not available) has only been prepared for watercourses with a catchment greater than 3km^2. Therefore, whilst these smaller watercourses may not be shown as having flood risk on the flood risk mapping, it does not necessarily mean that there is no flood risk. As part of a site-specific FRA, the potential flood risk and extent of Flood Zones should be refined for these smaller watercourses and this information used as appropriate to perform the Sequential and Exception Tests. The Risk of Flooding from Surface Water (RoFSW) mapping includes small watercourses and so can be used to indicate where this is likely to be an issue. Within the Administrative Area,

these smaller watercourses are predominantly located in the rural areas surrounding the City Centre.

5.5 Surface water flooding

Surface water runoff (or 'pluvial' flooding) 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 Environment Agency Risk of Flooding from Surface Water mapping (RoFSW) shows that a number of communities are at risk of surface water flooding. The mapping shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys and can pond in low-lying areas. Whilst in the majority of cases the risk is confined to roads, there are notable prominent run-off flow routes around properties, particularly within the City area, where surface water flow paths form towards the Rivers Can and Chelmer in the City Centre. There are also areas of significant surface water risk in South Woodham Ferrers, where surface water ponds in low lying areas and behind the railway embankment at Est Bridge Road. The RoFSW mapping for Chelmsford City Council's Administrative Area can be found on the Geo-PDF mapping in Appendix A.

5.6 Coastal Flood Risk

The River Crouch, which flows along the southern border of Chelmsford City Council's Administrative Area, and several of its tributaries are tidal. The main urban area in the vicinity of the River Crouch is South Woodham Ferrers, which is located 400m north of the River Chelmer, just to the west of the Rettendon/Fenn Brook. There is some tidal risk associated with the tidal downstream reach of the Rettendon/ Fenn Brooks in the tidal reach to the west of South Woodham Ferrers. As noted above, tidal conditions will also influence fluvial risk from the watercourses.

Despite the close proximity to these watercourses, tidal risk to the town is relatively low due to the raised elevation compared to the watercourse. In the 1% AEP present day event flooding is shown to just reach the edge of the town, and the flood extent does not increase significantly at this location even during the 0.1% AEP event in the 2125 epoch higher central climate change event. The northwest of the town, including Clements Green Lane and the central shopping area are at lower elevation and are protected by embankments along Clements Green Creek to the east. Undefended model outputs suggest that this area may be at risk in the event of a breach during the 1% AEP event however risk to the majority of the town remains very low.

The area of Battlesbridge north of the Crouch is shown not be at risk in the present day 0.1% AEP event, although it may be at risk in future. The south of the town is at risk from tidal flooding in the present day 1% AEP scenario, although this is outside of Chelmsford City Council's Administrative Area.

The remainder of the area at risk from tidal flooding is predominantly rural agricultural and undeveloped land with very few properties at risk. The only exception is at Hayes Chase, where a caravan park is located on the riverbanks and

is shown to be at risk in the 1% AEP event and above. There is an embankment at the site which is shown to provide some benefit.

5.7 Sewer flooding

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

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

Since 1980, the Sewers for Adoption guidelines mean that new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year, although until recently this did not apply to smaller private systems. This means that sewers will be overwhelmed in larger rainfall and flood events. Existing sewers can also become overloaded as new development adds to the surface water discharge to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

Anglian Water is the water company responsible for the management of the sewer drainage networks across Chelmsford City Council's Administrative Area.

5.8 Groundwater flooding

In general, less is known about groundwater flooding than other sources. Groundwater flooding can be caused by:

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

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

Areas Susceptible to Groundwater Flooding (AStGWF) mapping for Chelmsford City Council's Administrative Area has been provided in the GeoPDFs in Appendix A. The JBA Groundwater flood risk map for Chelmsford City Council's Administrative Area is

also provided in Appendix A. In high-risk areas, a site-specific risk assessment for groundwater flooding may be required to fully inform the likelihood of flooding.

5.9 Flooding from canals

Canals are regulated waterbodies and are unlikely to flood unless there is a sudden failure of an embankment or a sudden ingress of water from a river in areas where they interact closely. Embankment failure can be caused by:

- Culvert collapse
- Overtopping
- Animal burrowing
- Subsidence/ sudden failure e.g. collapse of former mine workings
- Utility or development works close or encroaching onto the footings of a canal embankment.

Flooding from a breach of a canal embankment is largely dictated by canal and ground levels, canal embankment construction, breach characteristics and the volume of water within the canal that can discharge into the lower lying areas behind the embankment. The volume of water released during a breach is dependent on the pound length (i.e. the distance between locks) and how quickly the operating authorities can react to prevent further water loss, for example by the fitting of stop boards to restrict the length of the canal that can empty through the breach, or repair of the breach. The Canal and River Trust monitor embankments at the highest risk of failure.

The only canal located in Chelmsford City Council's Administrative Area is the Canalised section of the River Chelmer which is part of the Chelmer and Blackwater Navigation. The navigation flows through the east of Chelmsford and out towards the Blackwater estuary. There are no recorded overtopping or breach incidents of the Navigation.

5.10 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the **Reservoir Act 1975** and are on a register held by the Environment Agency. 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.

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 Environment Agency hold mapping showing what might happen if reservoirs fail. Developers and planners should check the **Long-Term Risk of Flooding website** before using the reservoir data shown in this SFRA to make sure they are using the most up to date mapping. Existing or new hydraulic models in locations where there are reservoirs should represent the effect of reservoirs, for example the attenuation

effect on flood response, which will either be represented in the hydrology or as part of the model itself.

The Environment Agency 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.

The current mapping shows that there are seven above ground reservoirs located within Chelmsford City Council's Administrative Area: Hanningfield, Great Sir Hughes, Chignall Hall Farm, Lavender Leighs Lower, Lodge Leighs Upper, Margaretting Hall, and Mashbury Hall Farm. Handley Barns Farm is located just outside of the study area border but would impact the study area in the 'dry-day' scenario. Additionally, there is an underground reservoir to the rear of Keene Hall in Galleywood, which is unlikely to pose a risk of flooding. Section 8.5.3 provides further considerations for developing in the vicinity of reservoirs. The reservoir flood mapping for both the 'dry-day' and 'wet-day' scenarios in Chelmsford City Council's Administrative Area has been provided in the Geo-PDFs in Appendix A. A summary of the information is included in Table 5-2.

Areas within Chelmsford identified to be at residual risk from reservoir flooding are broadly areas near to the Sandon Brook, River Can, River Wid, River Ter and River Chelmer.

Table 5-2: Reservoirs with potential risk within Chelmsford City Council's Administrative Area

Reservoir	Northings and eastings	Reservoir owner	LLFA Area	Is the reservoir within the study area?	Does the reservoir impact the study area in the 'dry-day' scenario?
Handley Barns Farm	565257 201763	Private	Essex County Council	No	Yes
Great Sir Hughes	573938 202110	GSH Farming Ltd	Essex County Council	Yes	Yes
Hanningfield	573290 198326	Northumbrian Water Ltd	Essex County Council	Yes	Yes
Hanningfield Treated Water	574434 199147	Northumbrian Water Ltd	Essex County Council	Yes	Yes
Chignall Hall Farm	567088 210028	CJH Farming Limited	Essex County Council	Yes	Yes
Mashbury Hall Farm	565387 211420	CJH Farming Limited	Essex County	Yes	Yes

Reservoir	Northings and eastings	Reservoir owner	LLFA Area	Is the reservoir within the study area?	Does the reservoir impact the study area in the 'dry-day' scenario?
			Council		
Margaretting Hall	566480 200098	Fristling Hall Farms Ltd	Essex County Council	Yes	Yes
Lavender Leighs Lower	571207 218486	Lord Rayleigh's Farms Ltd	Essex County Council	Yes	Yes
Lodge Leighs Upper	570678 218542	Lord Rayleigh's Farms Ltd	Essex County Council	Yes	Yes

5.11 Flood Alert and Flood Warnings

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

There are currently four Flood Alert Areas (FAA) and five Flood Warning Areas (FWAs) covering Chelmsford City Council's Administrative 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 Flood Alert Areas usually cover the majority of Main River reaches. Flood Warnings are issued to designated Flood Warning Areas (i.e. properties within the extreme flood extent which are at risk of flooding), when the river level hits a certain threshold; this is correlated between the FWA and the gauge, with a lead time to warn that 'flooding is expected'.

A list of the Flood Alert and Flood Warning Areas is available in Appendix D. A map of the Flood Alert Areas and Flood Warning Areas is included in the Geo-PDF mapping in Appendix A.

5.12 Summary of flood risk in Chelmsford City Council's Administrative Area

A table summarising all sources of flood risk to key settlements within Chelmsford City Council's Administrative Area can be found in Appendix E.

6 Flood alleviation schemes and assets

This section provides a summary of existing flood alleviation schemes and assets in Chelmsford City Council's Administrative Area. Planners should note the areas that are protected by defences where further work to understand the actual and residual flood risk through a Level 2 SFRA may be beneficial. Developers should consider the benefit they provide over the lifetime of a development in a site-specific Flood Risk Assessment.

6.1 Asset management

- Risk Management Authorities hold databases of flood risk management and drainage assets:
- The Environment Agency 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 Flood and Water Management Act (2010)
- Highways Authorities hold databases of highways drainage assets, such as gullies and connecting pipes
- Water Companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.
- The databases include assets RMAs directly maintain and third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA contains full information on the location, condition and ownership of all the assets in their area. They take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.
- Developers should collect the available asset information and undertake further survey as necessary to present an understanding of current flood risk and the existing drainage network in a site-specific FRA.

6.2 Standards of Protection

- Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 100-year 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 Environment Agency's on-going hydraulic modelling programme may revise flood risk datasets and, as a consequence, the standard of protection offered by flood defences in the area may differ from those discussed in this report.
- Developers should consider the SoP provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

- The Environment Agency and local authorities have permissive powers to maintain and improve Main Rivers and Ordinary Watercourses, respectively. There is no legal duty to maintain watercourses, defences or assets and maintenance and improvements are prioritised based on flood risk. The ultimate responsibility for maintaining watercourses rests with the landowner.
- Highways Authorities have a duty to maintain public roads, making sure they are safe, passable and the impacts of severe weather have been considered. Water companies have a duty to effectually drain their area. What this means in practise is that assets are maintained to common standards and improvements are prioritised for the parts of the network that do not meet this standard e.g. where there is frequent highway or sewer flooding. Essex County Council as LLFA have permissive powers and limited resources are prioritised and targeted to where they can have the greatest effect.
- There is potential for the risk of flooding to increase in areas where flood alleviation measures are not maintained regularly. Breaches in raised flood defences are most likely to occur where the condition of flood defences 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 ensure future users of the development are aware of any obligations on them to maintain assets/watercourses.
- Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the Environment Agency for condition of flood defences is provided in Table 6-1.

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

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

Source: Condition Assessment Manual – Environment Agency 2006

6.4 Major flood risk management assets in Chelmsford City Council's Administrative Area

- The Flood Map for Planning contains information on areas where there is 'Reduction in Risk of Flooding from Rivers and Sea due to Defences'. This replaces the Environment Agency's 'Areas Benefitting from Defences' dataset, which was retired in December 2022. This new dataset shows areas that benefit from defences- areas shown to benefit may still flood, however these areas are shown to experience a reduction in the severity of flooding as a result of defences.
- There are three areas in the Council where a reduction in the risk of flooding due to defences is shown in the Environment Agency's mapping. The western most area is along where the River Can converges with the Chignall Brook near Roxwell Road (A1060) at Chignall Corner. The second area is closer to the city, to the southwest of the train station, along the northern bank of the River Can at Prykes Drive. Embankments along the River Crouch and its tributaries are shown to provide some benefit to parts of South Woodham Ferrers and Hayes Chase.
- The Environment Agency's 'Reduction in Risk of Flooding from Rivers and Sea due to Defences' dataset should not be used in isolation. Any intended reliance on this dataset should also allow for site-specific FRAs to demonstrate whether a site benefits from defences, and the nature of that benefit.
- The Environment Agency 'AIMS' flood defence dataset gives further information on all flood defence assets within the district. The following locations benefit from flood defences at a lower (or unknown) standard of protection in the study area.

Table 6-2: Locations shown in the 'EA AIMS' data set

Watercourse	Location	Type	Design SOP	Condition Rating
River Chelmer	Natural high ground runs along both banks of the length of whole length of the Chelmer in the district. There is a engineered high ground on the eastern bank of the Chelmer near Springfield Road at approximately 165m long. There are embankments near Chaucer road and Myrtle Cottage. There is a flood Wall in Chelmer village, approximately 794m in length, with two flood gates.	Natural and engineered High Ground, Embankments, Flood Wall, Flood Gate	Wall - 100 years; Natural high ground – 10 to 100 years; Embankments – 100 years	Unknown, some embank-ments are Fair
River Can	Natural high ground runs along both banks of the length of whole length of the Can within the district. There is engineered high ground where the Can converges with the Chelmer. Embankments are found further west along the northern bank of the Can in Chelmsford around 1km long. There are a few small sections of flood walls near where the Can converges with the Chelmer, and further west south of Central Park in Chelmsford.	Embankment, Natural and engineered High Ground and Wall	Wall – 100 years; Natural high ground – 20 to 100 years; Engineered high ground – 100 years; Embankments – 100 years	Fair to Good
River Wid	Natural high ground runs along both banks of the Wid along its length within Chelmsford City Council's Administrative Area.	Natural High Ground	10 years	Poor
River Crouch	A tidal embankment runs along the northern bank of the Crouch within the Council's Administrative Area.	Embankment	200 years	Fair
River Ter	Natural high ground runs along both banks of the Brook along its length within Chelmsford City Council's Administrative Area, and also extends part way up the Straw Brook to Braintree Road.	Natural High Ground	10 years	Fair to Good
Roxwell Brook	Natural high ground runs along both banks of the Brook along its length within Chelmsford City Council's Administrative Area up to Cooksmill Green.	Natural High Ground	10 years	Fair to Good

Watercourse	Location	Type	Design SOP	Condition Rating
Sandon Brook and Sandon Brook East	Natural high ground runs along both banks of the Brook along its length within Chelmsford City Council's Administrative Area up to Hanningfield Reservoir	Natural High Ground	10 years	Fair
Newland Brook	Natural high ground runs along both banks of the Brook along its length starting at Boyton Cross to where it converges with the Can.	Natural High Ground	10 years	Fair
Chignall Brook	Natural high ground runs along both banks of the Brook along its length starting just west of Broomfield to where it converges with the Can. There is a section of embankment 265m long on the eastern bank of the Brook near where it converges with the Can.	Natural High Ground, embankment	Natural high ground and embankment – 10 years	Fair to Good
Boreham Tributary	Natural high ground runs along both banks of the Brook along its length starting at Boreham by the bypass to where it converges with the Chelmer	Natural High Ground	10 years	Fair
Fenn and Rettendon Brook	Natural high ground runs along both banks of the Rettendon Brook to where it converges with the Fenn Brook at South Woodham Ferrers. An Embankment runs along the western bank of the lower Rettendon Brook and further down to the Fenn Brook. An embankment also runs along the eastern banks of the Fenn Brook and out of Chelmsford City Council's Administrative Area.	Embankment, Natural High Ground	Natural high ground – 10 years; Embankments – 200 years	Fair to Good with some areas Very Poor
Stock Brook	Natural high ground runs along both banks of the Brook along its length within Chelmsford City Council's Administrative Area	Natural High Ground	10 years	Fair

6.5 Actual and residual flood risk

A Level 2 SFRA (for strategic allocations) or developer site-specific FRA will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail.

6.5.1 Actual flood risk

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

The assessment of the actual risk should take into account that:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for this to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development. Over time the effects of climate change will erode the present-day standard of protection afforded by defences. Therefore, to maintain the current standard of protection a commitment is needed to invest in the maintenance and upgrading of defences. Where necessary, land may need to be secured and safe-guarded where required for affordable future flood risk management measures, including land outside of a development's boundary (e.g. for upstream storage).
- By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources.

6.5.2 Residual risk

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

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

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

This SFRA does not assess the probability of failure other than noting that such events are very rare. However, in accordance with NPPF, all sources of flooding need

to be considered. If a breach or overtopping event were to occur, then the consequences to people and property could be high. Developers should be aware that any site that is at or below defence level, may be subject to flooding if an event occurs that exceeds the design capacity of the defences, or the defences fail, and this should be considered in a detailed FRA.

The assessment of residual risk should take into account:

- The flood hazard, depth and velocity that would result from overtopping or breach of defences. Flood gate or pumping station failure and/ or culvert blockage (as appropriate). The Environment Agency can provide advice at site-specific development level for advice on breach/ overtopping parameters for flood models.
- The design of the development to take account of the highest risk parts of the site e.g. allowing for flood storage on parts of the site and considering the design of the development to keep people safe e.g. sleeping accommodation above the flood level.
- A system of warning and a safe means of access and egress from the site in the event of a flood for users of the site and emergency services.
- Climate change and/ or policy-dependent residual risks (such as those that may be created if necessary, future defence improvements are required, or those associated with any managed adaptive strategies).

6.5.3 Overtopping

The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest level of the defence. The Defra and Environment Agency **Flood risk assessment guidance for new development** provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

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

6.5.4 Defence breach

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

Where defences are present, risk of breach events should be considered as part of the site-specific FRA. Flood flows from breach events can be associated with significant depths and flow velocities in the immediate vicinity of the breach location and so FRAs must include assessment of the hazards that might be present so that the safety of people and structural stability of properties and infrastructure can be appropriately taken into account. The Defra and Environment Agency **Flood risk assessment guidance for new development** provides standard flood hazard ratings based on the distance from the defence and the level of the breach. Whilst the area in the immediate vicinity of a breach can be subject to high flows, the whole flood risk area associated with a breach must also be considered as there may be areas remote from the breach that might, due to topography, involve increased depth hazards.

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

understand the level of assessment required and to agree the approach for the breach assessment.

6.6 Existing and future flood alleviation schemes

6.6.1 Chelmsford Flood Alleviation Scheme

This was a project led by the Environment Agency in partnership with the City Council. Its purpose was to safeguard people and property within the city centre and urban area. The revised project remains at the modelling stage. Any scheme to safeguard the City of Chelmsford will seek to address flood risk across the entire catchment of the River Wid, Can and Chelmer. This will comprise multiple interventions including natural flood management measures, on-line storage, and flood defences.

CCC should look to safeguard land that may be required for these interventions through the Local Plan, in particular land within Chelmsford City and land close to the existing tidal defences along the River Crouch (South Woodham Ferrers and Battlesbridge areas).

Interested parties should contact the Environment Agency and Chelmsford City Council for the latest information on the Scheme.

6.6.2 Chelmsford Flood Resilience Partnership Scheme

Flood risk to the city centre and urban area remains and an alternative approach is being developed. This would also be an Agency led scheme in partnership with the City Council. It is called the Chelmsford Flood Resilience Partnership Scheme.

6.6.3 Surface Water Alleviation Schemes

Essex County Council and Essex Highways undertake improvements to sections of road that experience high levels of surface water flooding.

6.6.4 Natural Flood Management (NFM)

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

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

In 2017, the Environment Agency published an online evidence base to support the implementation of NFM and maps showing locations with the potential for NFM measures. These maps are intended to be used alongside the evidence directory to help practitioners consider the types of measure that may work in a catchment and the best places in which to locate them. There are areas within the study area whereby removing existing defences and reconnecting the floodplain could create areas of potential betterment without causing risk to properties. Areas where such opportunities could potentially be considered includes along the River Chelmer and Can. Areas where tree planting could potentially be considered as an NFM measure are most notably along the River Chelmer, Can and Wid.

6.6.5 Other schemes

The Environment Agency's **Asset Management** map provides an updated indication of schemes that are under construction or have a forecast start date. There are no current schemes in place in the study area.

7 Cumulative impact of development and strategic solutions

This section provides a summary of the Cumulative Impact Assessment (CIA) undertaken for the SFRA. The full CIA methodology and findings are detailed in Appendix F.

7.1 Introduction

Under the NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRAs), are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (para.160). This means considering the cumulative impact of all development, rather than just to or from individual development sites.

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

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

Catchments within the study area that have the potential to influence existing flood risk issues in neighbouring Local Authorities were identified, as well as catchments in the study area that may be influenced by development in catchments in neighbouring Local Authorities. Historic flood incidents, the current and predicted increase in surface water flood risk to properties and cross boundary issues in each catchment were assessed to identify the catchments at greatest risk. Local planning policies can also be used to identify areas where the potential for development to increase flood risk is highest and identify opportunities for such new development to positively contribute to decreases in flood risk downstream.

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.

The CIA ranks catchments as High, Medium or Low Risk. This indicates the likely sensitivity of the catchment to increase flood risk as a result of development- it is not a measure of the current flood risk, and a High risk categorisation does not indicate that development is inappropriate, rather there may be additional considerations required for development in these catchments to ensure that risk is not increased (see Section 7.3 & 7.4).

Three catchments were identified as Low Risk and ten as Medium Risk.

Assessment of the catchments within the study area on the above criteria has identified five High Risk catchments within, or partially within Chelmsford City Council's Administrative Area (Figure 7-1). These are:

- The Chelmer (Great Easton- River Can)
- River Can
- Sandon Brook
- Chelmer (downstream of confluence with the River Can)
- Area southeast of Chelmsford not within a Water Body (WB) catchment (WB_ID-45)

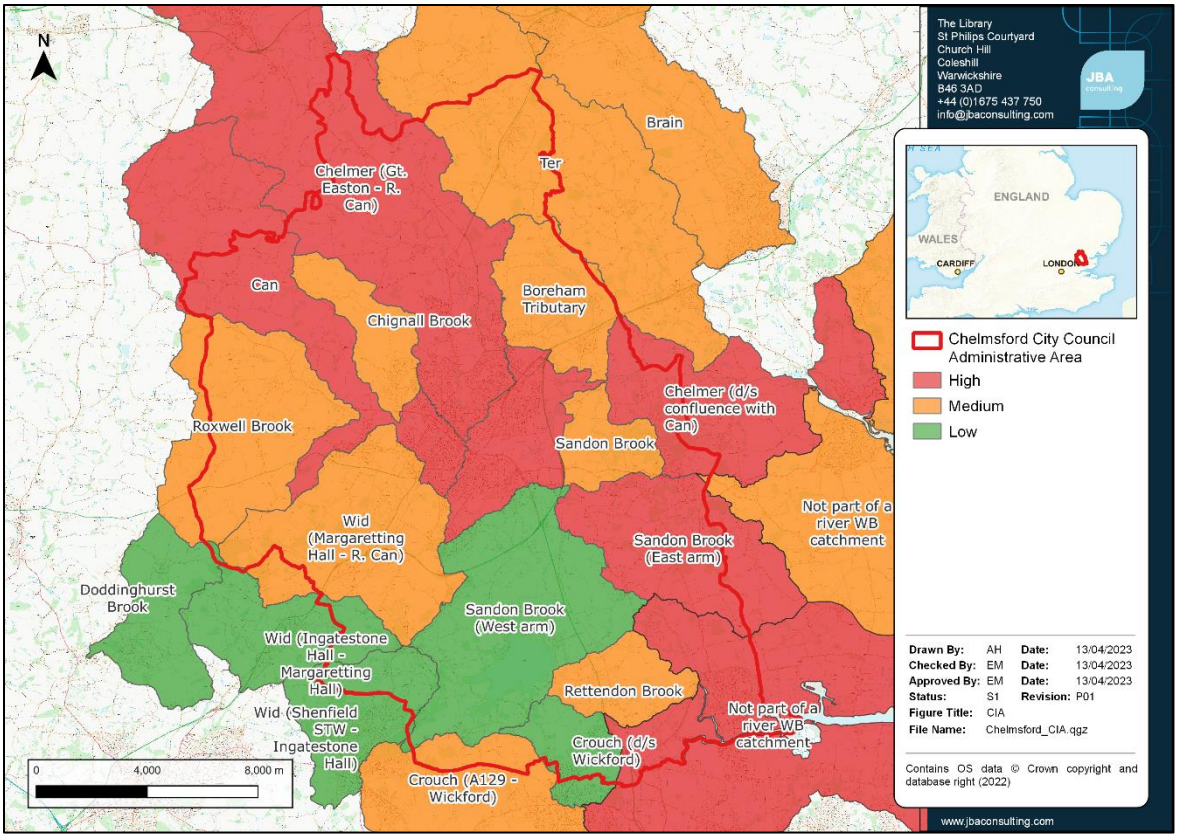


Figure 7-1 Catchments within the Chelmsford Study area and final rankings based on the Cumulative Impact Assessment

WB_ID-45 is one of two tidal zones that encroach into the Chelmsford study area, along the banks of the River Blackwater estuary and, in this case the River Crouch estuary. These do not come within the boundaries of fluvial catchments due to tidal influence. This is not considered within the CIA, however consideration to tidal flooding will be required for any development proposal within these tidal zones.

7.2 Broadscale Recommendations

The broadscale cumulative impact assessment for the study area has highlighted that the potential for development to have a cumulative impact on flood risk is

moderately low across the area. Catchments have been identified as high, medium or low risk.

New development can potentially increase flood risk and thus the need for incremental action and betterment in flood risk terms across all of Chelmsford City Council's Administrative Area is appropriate.

The following policy recommendations therefore apply to all catchments within the study area:

- Chelmsford City Council should work closely with neighbouring local authorities to develop complementary Local Planning Policies for catchments that drain into and out of the Administrative Area to other local authorities in order to minimise cross boundary issues of cumulative impacts of development.
- Developers should incorporate SuDS and provide details of adoption, ongoing maintenance and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure where practicable. Developers should refer to the relevant LLFA guidance (Essex County Council) for the requirements for SuDS in Chelmsford City council's Administrative Area, including Technical and Development Type-specific Guidance for Developers.
    - **Essex County Council Planning Advice and Guidance**

  Further guidance on SuDS can be found in Section 9 of the main SFRA report.
- Essex County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. These should take into account all sources of flooding so that future development is resilient to flood risk and does not increase flood risk elsewhere.
- Where appropriate, the opportunity for Natural Flood Management in rural areas, SuDS retrofit in urban areas and river restoration should be maximised. Culverting should be opposed, and day-lighting existing culverts promoted through new developments.
- Runoff rates from all development sites must be limited to greenfield rates (including brownfield sites). For Brownfield sites, if it is demonstrated that greenfield rates are not practicable then the runoff rates should be restricted to the closest rate that is practicable or flow matching rates. All development (including brownfield sites) falling within a CDA should restrict runoff rates to 1-year greenfield rates. Developers should refer to the relevant LLFA guidance for the requirements for SuDS in Chelmsford City Council's Administrative Area.
- All development proposals should undertake a site-specific FRA. Site-specific FRAs should explore opportunities to provide wider community flood risk benefit through new developments. Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered. This may either be by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques,

green infrastructure and green-blue corridors, and/ or by providing a Partnership Funding contribution towards any flood alleviation schemes.

- Chelmsford City Council should consider requiring developers to contribute to community flood defences outside of their red line boundary to provide wider benefit and help offset the cumulative impact of development. There are proposed and ongoing Flood Alleviation Schemes which may help to reduce fluvial risk in the City Centre, and there may be opportunities for development to support the funding/delivery of these schemes.

Section 8.3 of the main SFRA report details the local requirements for mitigation measures. Catchment-specific recommendations are made for high-risk catchments below.

7.3 Recommendations for high-risk catchments

From analysing the results produced above, high-level recommendations for flood storage and betterment have been proposed for sites in each of the high-risk catchments. These recommendations should be considered by developers as part of a site-specific assessment, but more detailed modelling must be undertaken by the developer to ascertain the true storage needs and potential at each site at the planning application stage. Within the FRA, consideration should be given to the potential cumulative effects of all proposed development and how this affects sensitive receptors.

Developers should also include a construction surface water management plan to support the Construction Drainage Phasing Plan. This should provide information to the Environment Agency, the LLFA and the LPA regarding the proposed management approach during the construction phase to address surface water management during storm events.

For developments in High-Risk catchments, the LLFA and LPA should consult with Local Non-For-Profit organisations such as wildlife trusts, rivers trusts and catchment partnerships to understand ongoing and upcoming projects where NFM, flood storage and attenuation, and environmental betterment may be possible alongside developments and aid in reducing flood risk.

LPAs should work closely with the Environment Agency and the LLFA to identify any areas of land that should be safeguarded for any future flood alleviation schemes and natural flood management features.

The LPAs should explore the potential for development in High-Risk catchments to contribute towards works to reduce flood risk and enable regeneration as well as contributing to the wider provision of green infrastructure.

7.4 Development within Medium risk catchments

Catchments that have been scored an overall ranking of medium, but where development proposals are present, should also consider the following recommendations:

- LPAs should work closely with the Environment Agency and the LLFA to identify any areas of land that should be safeguarded for any future flood alleviation schemes and natural flood management features.

There is the potential for development in these catchments to contribute towards works to reduce flood risk and enable regeneration as well as contributing to the wider provision of green infrastructure.

8 Flood risk management requirements for developers

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

The report provides a strategic assessment of flood risk within Chelmsford City Council's Administrative Area. Prior to the planning stage of any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk and the actual and residual risk and standard of protection and safety at a site are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of watercourses to verify flood extents (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the Exception Test can be satisfied.

A detailed FRA may show that a site, windfall[1] or other, is not appropriate for development of a particular vulnerability or even at all. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not been seen as an alternative to proving these tests have been met.

8.1 Principles for new developments

8.1.1 Apply the Sequential and Exception Tests

Developers should refer to Section 3 of this report for more information on how to consider the Sequential and Exception Tests. For allocated sites, Chelmsford City Council should use the information in this SFRA to apply the Sequential Test. For windfall sites a developer must undertake the Sequential Test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the Sequential Test should the Exception Test then be applied if required.

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

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

[1] 'Windfall sites' is used to refer to those sites which become available for development unexpectedly and are therefore not included as allocated land in a planning authority's development plan.

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

Developers should consult with the Environment Agency, Chelmsford City Council, Essex County Council as LLFA and Essex and Suffolk Water (water supply) or Anglian Water (sewerage) at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design.

8.1.3 Consider the risk from all sources of flooding and use the most up to date flood risk data and guidance

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

8.1.4 Ensure that the development does not increase flood risk elsewhere

Section 9 of this report sets out the requirements for taking a sustainable approach to surface water management. Developers should also ensure mitigation measures do not increase flood risk elsewhere and that floodplain compensation is provided where necessary. Developers should refer to the **Environment Agency climate change guidance** (last updated in May 2022) for the appropriate allowances to calculate floodplain storage compensation.

8.1.5 Ensure the development is safe for future users

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

Further flood mitigation measures may be needed for any developments in an area protected by flood defences, where the condition of those defences is 'fair' or 'poor', and where the standard of protection is not of the required standard.

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

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

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

Wherever possible, developments should seek to help reduce flood risk in the wider area e.g. by contributing to a wider community scheme or strategy for strategic measures, such as defences or NFM or by contributing in kind by mitigating wider

flood risk on a development site. More information on the contribution developers are expected to make towards achieving the wider vision for FRM and sustainable drainage in the district can be found in Section 7.3. Developers must demonstrate in an FRA how they are contributing towards this vision.

8.2 Requirements for site-specific Flood Risk Assessments

8.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1.
- Proposals for new development (including minor development such as non-residential extensions, alterations which do not increase the size of the building or householder developments and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency and LLFA).
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.
- At locations where it is proposed to locate development in a high-risk surface water flood zone.

An FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1)
- Where evidence of historical or recent flood events have been passed to the LPA
- Land identified in an SFRA as being at increased risk in the future.

8.2.2 Objectives of a site-specific FRA

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

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

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the Environment Agency and Chelmsford City Council. Guidance and advice for developers on the preparation of site-specific FRAs include:

- **Standing Advice on Flood Risk** (Environment Agency)

- **Flood Risk Assessment for Planning applications** (Environment Agency); and
- **Site-specific Flood Risk Assessment: CHECKLIST** (NPPF PPG, Defra)

Guidance for local planning authorities for reviewing Flood Risk Assessments submitted as part of planning applications has been published by Defra in 2015 – **Flood Risk Assessment: Local Planning Authorities.**

8.3 Local requirements for mitigation measures

8.3.1 Site layout and design

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from areas of flood risk both now and in the future, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. Whether lower vulnerability development in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning.

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

8.3.2 Modification of ground levels

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

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

When development proposes land raising within a floodplain, in most cases it will reduce the volume of flood storage available. To avoid increases in flood risk elsewhere, compensatory storage options need to be incorporated into development plans and individual planning applications to mitigate for the lost storage volume and ideally, to increase the overall space available for water, in line with helping to increase flood resilience in the face of our changing climate. This should normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624.

The individual effect of not carrying out compensation works for the loss of floodplain storage may appear to be minor but the cumulative effect of multiple ground raising

proposals within a catchment can result in more significant impacts. The EA and Chelmsford City Council will therefore seek the provision of compensatory flood plain storage for ground raising proposals linked to new development proposals even when the impacts, in isolation, are considered to be minor.

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

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

8.3.3 Raised floor levels

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

The Environment Agency advises that minimum finished floor levels should be set 600mm above the 1% AEP plus climate change peak flood level, where the new climate change allowances have been used (see Section 4 for the climate change allowances). Where a proxy for climate change has been used, it is recommended that a site-specific FRA is undertaken to determine the flood level above which the finished floor levels should be raised. 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.

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

Similarly, the use of basements should be avoided. Basement dwellings are considered 'highly vulnerable and therefore should not be permitted within Flood Zone 3 (including an allowance for climate change), whilst basement dwellings in Flood Zone 2 (including an allowance for climate change) will be required to pass the Exception Test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

For sites within flood risk areas, flood risk could be managed with the provision of a raised place of refuge for residents to shelter during flooding- this should be supported by a Flood Warning and Evacuation Plan considering the depth, velocity, hazard, and likely duration of flooding. Where appropriate, it can be preferable for residents to shelter in-situ in a safe place rather than being exposed to hazardous conditions during an evacuation, particularly where the speed of onset of flooding may present challenges to safe evacuation. Refuge areas should be internally accessible, suitably sized and designed, and be located above maximum predicted flood levels. These spaces should be designed to be able to facilitate rescue by emergency services in the event of urgent medical care being required or the duration of flooding is such that residents cannot wait until flooding recedes. Internal places of refuge are unlikely to be appropriate for long duration flooding, accounting

for the potential impact on services like electricity, gas, telecommunications, water supply and sewerage.

Refuge provisions provided should ensure that people will not be exposed to hazardous flooding from any source, now or in the future, including in an extreme flood event and will be an important consideration for the safety of the development and for satisfying Exception Test requirements.

8.3.4 Development and raised defences

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

Where development is located behind, or in an area benefitting from defences, the residual risk of flooding must be considered. If developers propose providing defences for their development, then there should be clear provisions made for the management and upkeep of those defences for the whole of the development's lifetime.

8.3.5 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).

8.3.6 Buffer strips

The provision of a buffer strip to 'make space for water', allows additional capacity to accommodate climate change and ensure 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 Main River (16m if tidal influence). Where flood defences are present, these distances should be taken from the toe of the defence.

Building adjacent to riverbanks can cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult. Any development in these areas will likely require a Flood Risk Permit from the Environment Agency alongside any permission. There should be no built development within these distances from main rivers / flood defences (where present).

8.3.7 Making space for water

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

All new development close to rivers should consider the opportunity to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of

structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

8.4 Resistance and resilience measures

The consideration of resistance and resilience measures should not be used to justify development in inappropriate locations.

Having applied planning policy, there will be instances where developments, such as those that are water compatible and essential infrastructure are permitted in high flood risk areas. The above measures should be considered before resistance and resilience measures are replied on. The effectiveness of these forms of measures are often dependent on the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. Where developments are in areas of surface water risk, passive measures should be favoured over active measures. The proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate. Available resistance and resilience measures are shown in Table 8-1. Developers should refer to the **CIRIA Code of practice for property flood resilience (C790)** which

specifies the standards which should be achieved when delivering Property Flood Resilience (PFR).

Table 8-1: Available temporary measures

Measures	Description
Permanent barriers	Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers
Temporary barriers	Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.
Community resistance measures	These include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.
Flood resilience measures	These measures aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuitry installed at a higher level and water-resistant materials for floors, walls and fixtures.

8.5 Reducing flood risk from other sources

8.5.1 Groundwater

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

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off a site. Developers should provide evidence and ensure that this will not be a significant risk.

8.5.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. It is important that a Surface Water Drainage Strategy (often done as part of an FRA) shows that this will not increase flood risk elsewhere,

and that the drainage requirements regarding runoff rates and SuDS for new development are met.

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

When redeveloping existing buildings, the installation of some permanent or temporary floodproofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly maintained.

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

8.5.3 Reservoirs

As discussed in Section 5.9, the risk of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage:

- Developers should contact the reservoir owner for information on:
  - the Reservoir Risk Designation
  - reservoir characteristics: type, dam height at outlet, area/volume, overflow location
  - operation: discharge rates / maximum discharge
  - discharge during emergency drawdown; and
  - inspection / maintenance regime.
- The Environment Agency online Reservoir Flood Maps contain information on the extents, depths and velocities following a reservoir breach (note: only those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975). Consideration should be given to the extent, depths and velocities shown in these online maps.
- The GOV.UK website on **Reservoirs: owner and operator requirements** provides information on how to register reservoirs, appoint a panel engineer, produce a flood plan and report an incident.
- In addition, developers should consult the **Essex Resilience Forum** about emergency plans.

Developers should use the above information to:

- Apply the sequential approach to locate development within the site.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond, and whether in fact it is appropriate to place development immediately on the downstream side of a reservoir.

- Assess the potential hydraulic forces imposed by sudden reservoir failure event and check that that the proposed infrastructure fabric could withstand the structural loads.
- Develop site-specific Emergency Plans and/ or Off-site Plans if necessary and ensure the future users of the development are aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand.

Development downstream of a reservoir can also have implications on the reservoir. Consideration should be given to the potential implications of proposed development on the risk designation of the reservoir, as it is a requirement that in particular circumstances where there could be a danger to life that a commitment is made to the hydraulic capacity and safety of the reservoir embankment and spillway. The implications of such potential obligations should be identified and understood so that it can be confirmed that these can be met if proposed new development is permitted. It should be noted that there are significant potential cost implications for Reservoir Operators if their risk designation increases, and the Council should consider this carefully when allocating land and considering development proposals, and could consider requiring developers to make a contribution to support any required safety enhancements that may be required if reservoir risk classification is likely to change as a result of development downstream of a reservoir.

The Reservoir Safety team at the Environment Agency (reservoirs@environment-agency.gov.uk) should be contacted by developers and the LPA if there are plans to locate new development downstream of a large reservoir to discuss the potential for a change in that reservoir's risk categorisation as a result of the proposed development(s).

8.6 Emergency planning

Emergency planning covers three phases: before, during and after a flood. Measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding. National Planning Policy takes this into account by seeking to avoid inappropriate development in areas of flood risk and considering the vulnerability of new developments to flooding.

The revised NPPF requires site level FRAs to demonstrate that

"d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."

Certain sites will need emergency plans:

- Sites with vulnerable users, such as hospitals and care homes
- Camping and caravan sites
- Sites with transient occupants e.g. hostels and hotels
- Developments at a high residual risk of flooding from any source e.g. immediately downstream of a reservoir or behind raised flood defences
- Situations where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. at risk of a breach).

Emergency Plans will need to consider:

- The characteristics of the flooding e.g. onset, depth, velocity, hazard, flood borne debris
- The vulnerability of site occupants.
- Structural safety
- The impact of the flooding on essential services e.g. electricity, drinking water
- Flood warning systems and how users will be encouraged to sign up for them
- Safe access and egress for users and emergency services
- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.
- A safe place of refuge where safe access and egress and advance warning may not be possible, having discussed and agreed this first with emergency planners. Proposed new development that places an additional burden on the existing response capacity of Chelmsford City Council will not normally be appropriate.

The Essex Resilience Forum provide Emergency Planning, resilience based, information that is both general and flood specific. This includes practical advice before, during and after flooding has occurred including, preparation, understanding warnings, actions to limit exposure to risk and recovery.

Further information is available from:

- **The National Planning Policy Guidance**
- **2004 Civil Contingencies Act**
- **DEFRA (2014) National Flood Emergency Framework for England**
- **FloodRe**
- The Environment Agency and DEFRA's **Standing Advice for FRAs**
- Essex County Council's **'Check if you're at risk of flooding' map**
- Essex County Council's **'In an emergency'**
- Environment Agency's **'How to plan ahead for flooding'**
- Sign up for **Flood Warnings** with the Environment Agency
- The **National Flood Forum**
- **GOV.UK** - Make a Flood Plan guidance and templates
- **ADEPT Flood Risk Plans for new development**

9 Surface water management and SuDS

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

9.1 Role of the LLFA and LPA in surface water management

In April 2015, Essex County Council as LLFA were made a statutory planning consultee on the management of surface water. They provide technical advice on surface water drainage strategies and designs put forward for major development proposals, to ensure that onsite drainage systems are designed in accordance with the current legislation and guidance.

When considering planning applications, Essex County Council will provide advice to the LPA on the management of surface water. As an LPA, Chelmsford City Council should satisfy themselves that the development's proposed minimum standards of operation are appropriate and ensure, using planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the lifetime of the development.

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

9.2 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are designed to maximise the opportunities and benefits that can be secured from surface water management practices.

SuDS provide a means of dealing with the quantity and quality of surface water and can also provide amenity and biodiversity benefits. This could help to contribute towards any mandatory Biodiversity Net Gain requirements- developers should refer to **GOV.uk** for the latest requirements.

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 for all new major development proposals to ensure that sustainable drainage systems for management of runoff are put in place, unless there is clear evidence that this would be inappropriate (NPPF para.169). Likewise, minor developments should also ensure sustainable drainage systems for runoff management are provided where possible, although not a requirement for minor developments. **From 2024, under the flood and Water Management Act 2010, SUDS will be mandatory for all new built development.**

The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined. A clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential.

The SuDS management train is a useful concept in the development of sustainable drainage systems, focusing on using drainage techniques in series in order to change

the characteristics of runoff across a number of stages, beginning with prevention and then dealing with the runoff at source before focusing on larger downstream site and regional controls. Further information on the SuDS management train concept is available from **susdrain**.

9.3 Sources of SuDS guidance

9.3.1 C753 CIRIA SuDS Manual (2015)

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

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

Non-Statutory Technical Standards provides non-statutory standards on the design and performance of SuDS. It outlines peak flow control, volume control, structural integrity, flood risk management and maintenance and construction considerations.

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

The Local Authority SuDS Officer Organisation produced their **practice guidance** in 2016 to give further detail to the Non-statutory technical guidance.

9.3.4 Chelmsford City Council Planning Policy

Chelmsford City Council leads consultation on planning policy for any works within the Administrative Area. The overarching policies are those based on the **Local Plan** and specific consultation responses can be made through the dedicated **Consultation Portal for Planning Policy**. Additional information on current consultation documents is also available here.

9.3.5 Essex County Council SuDS Guidance

Essex County Council published their dedicated website **The Sustainable Drainage Systems Design Guide for Essex** in 2020. This includes a summary of what SuDS is, the design principle to consider such as volume control, construction and maintenance requirements and, planning application requirements. The website also provides case study examples.

9.3.6 Essex Green Infrastructure Strategy and Principles and Standards

Essex County Council's 2020 Green Infrastructure Strategy seeks to protect, create, and improve green infrastructure for biodiversity and people, improve connectivity and inclusivity by supporting healthier, more active lifestyles; and contribute to economic growth. In 2022 Essex County Council produced **Green**

Infrastructure Principles and Standards to demonstrate good practice and align with other national standards.

9.4 Other surface water considerations

9.4.1 Groundwater Vulnerability Zones

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

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

9.4.2 Groundwater Source Protection Zones (GSPZ)

The Environment Agency 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 Magic Map** under "Land-Based Designations- Non Statutory".

There are several GSPZs surrounding Chelmsford City Council's Administrative Area. The largest area reaches across a large part of south eastern England and covers the whole of the Council area.

Guidance on how GSPZs are defined and considerations needed within them are available on the **DEFRA website**. Particular consideration will be required by developers within GPSZ's where properties are not connected mains drainage, or development proposals otherwise have potential to pollute or harm groundwater (e.g. infiltration SUDS).

9.4.3 Nitrate Vulnerable Zones and nutrient neutrality

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 **Environment Agency's website.** There are currently two areas designated as pre-appeal NVZs (2021-2024) within Chelmsford City Council's Administrative Area. This means they have been designated as Nitrate Vulnerable Zones, but online mapping does not show whether areas have subsequently have been un-designated through the **appeals process.**

Nutrient neutrality means that the amount of a particular nutrient entering the water system as a result of a new development is offset by the removal of an equivalent amount of the nutrient. This means that additional screening of development

proposals is required as excessive runoff could make these problems significantly worse.

10 Summary and Recommendations

This section summarises the risk of flooding from various sources within Chelmsford City Council's Administrative Area, and policy recommendations for managing the risk.

10.1 Summary of Flood Risk in Chelmsford

- *Fluvial flooding:* There are numerous recorded flooding incidents across Chelmsford, predominantly in the vicinity of the City Centre. The main rivers associated with fluvial flooding are the:
    - River Chelmer and its tributaries, including the River Can which converges with the Chelmer at the City Centre, which pose a flood risk to Chelmsford City Centre as well as land to the east of the city and a number of settlements to the north of the city including Little Waltham and Howe Street,
    - River Wid and its tributaries, which pose a flood risk to land southwest of Chelmsford City Council's Administrative Area including areas in Writtle,
    - River Can which poses flood risk to western parts of Chelmsford City Council's Administrative Area, land to the west of the City and Roxwell village.
- *Surface water:* Surface water risk largely follows the topography of smaller watercourses, but there are also additional flow paths and areas of ponding, for example where water is impounded at road or rail embankments. Urban areas are more at risk from Surface Water Flooding. Chelmsford City Council's Administrative Area encompasses the City of Chelmsford as well as the town of South Woodham Ferrers. Several large villages and smaller rural settlements are also located within Chelmsford City Council's Administrative Area. There are a number of settlements where there is surface water flood risk to properties and infrastructure.
- *Coastal flooding:* The River Crouch and it's tributary Rettendon/Fenn Brook, to the south of Chelmsford City Administrative Area near South Woodham Ferrers, is tidal. Despite close proximity to the floodplain, the Environment Agency's 2018 Crouch Coastal Model indicates that the risk to the town of South Woodham Ferrers is relatively low, with the 0.1% AEP tidal flood extent in the 2125 epoch higher central scenario just reaching the edge of the town and affecting very few properties. There is an embankment to the west of the town which provides some benefit, and the undefended model outputs suggest that properties in the vicinity of Clements Green Road and the central shopping area of the town may be at risk in the event of a breach during the 0.1% AEP event, although the majority of the town remains unaffected. The area of Battlesbridge north of the Crouch is shown not be at risk in the present day 0.1% AEP event, although it may be at risk in future. The south of the town is at risk from tidal flooding in the present day 1% AEP scenario, although this is outside of Chelmsford City Council's Administrative Area.

With the exception of a caravan park at Hayes Chase, the remainder of the area within the study area at tidal flood risk is undeveloped land.

- Historic data provided by Essex County Council shows 42 incidents of internal and external flooding to properties within Chelmsford and the study area.
- 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 as a result of climate change. Flood extents will increase; in some locations, this may not be by very much, but flood depth, velocity and hazard may have more of an impact due to climate change. It is recommended that Chelmsford City Council work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the Administrative Area.
- *Groundwater*: The Areas Susceptible to Groundwater Flooding map shows that in general, the majority of the study area is shown to be within the "< 25%" and ">= 25% <50% "classifications with a lower susceptibility to groundwater flooding or has no data available. There are however areas along the main rivers in the study area, particularly towards Chelmsford city centre and surrounding suburbs along the River Chelmer, River Can, River Wid and the Sandon Brook.
- *Canals:* The Chelmer and Blackwater Navigation is a section of the River Chelmer and River Blackwater which has been canalised. The navigation originates on the River Chelmer at Chelmsford City Centre and continues east to join the River Blackwater at Heybridge Basin. The navigation has the potential to interact with other watercourses in the area and become a conduit for flow paths during flood events or in a breach scenario.
- *Reservoirs:* There are no records of flooding from reservoirs in the study area and the level and standard of inspection and maintenance required under the Reservoirs Act 1975 means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific FRAs (where relevant).

10.2 Recommendations

The following policy recommendations are made for the whole of Chelmsford. Policy recommendations related to manging the cumulative impacts of development are made in Chapter 7.

Reduction of flood risk through site allocations and appropriate site design

- To locate new development in areas of lowest risk, in line with the Sequential Test, by steering sites to fluvial/coastal Flood Zone 1 and avoiding where possible surface water high-risk zones, accounting for the impacts of climate change on flood extents. If a Sequential Test is undertaken and a site at fluvial/coastal flood risk is identified as the only appropriate site for the development, the Exception Test shall be undertaken.
- After application of the Exception Test, a sequential approach to site design will be used to reduce risk. Any re-development within areas of flood risk which provide other wider sustainability benefits will provide flood risk betterment and made resilient to flooding.
- Identification of long-term opportunities to remove development from the floodplain and safeguard the functional floodplain from future development to make space for water.
- Ordinary watercourses must be considered during site allocation and design. For ordinary watercourses not currently afforded flood maps, these may need to be modelled to an appropriate level of detail to enable a sequential approach to the layout of the development.
- Ensure development is 'safe', dry pedestrian egress from the floodplain and emergency vehicular access should be possible for all residential development. If at risk, then an assessment should be made to detail the flood duration, depth, velocity and flood hazard rating in the 1% AEP plus climate change flood event, in line with **Flood Risk Guidance for New Development FD2320**.
- Safe refuge areas should be provided wherever there are significant residual risks to developments associated with extreme flood events and/or rapid inundation.
- Raise residential and commercial finished floor levels 600mm above the 1% AEP plus climate change flood level. Protect and promote areas for future flood alleviation schemes.
- Identify opportunities for brownfield sites in functional floodplain to reduce risk and provide flood risk betterment.
- Identify opportunities to help fund future flood risk management through developer contributions to reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

Promote SuDS to mimic natural drainage routes to improve water quality

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

Reduce surface water runoff from new developments and agricultural land

- Space should be provided for the inclusion of SuDS on all allocated sites, outline proposals and full planning applications.
- Promote biodiversity, habitat improvements and **Countryside Stewardship schemes** to help prevent soil loss and to reduce runoff from agricultural land.

Enhance and restore river corridors and habitat

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

Mitigate against risk, improved emergency planning and flood awareness

- Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.

- For a partial or completely pumped drainage system, an assessment should be undertaken to assess the risk of flooding due to any failure of the pumps to be assessed. The design flood level should be determined if the pumps were to fail; if the attenuation storage was full, and if a design storm occurred.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 1%AEP rainfall event, inclusive of climate change and urban creep.
- Consideration and incorporation of flood resilience measures up to the 0.1% AEP event.
- Ensure robust emergency (evacuation) plans are produced and implemented for major developments. Flood warning and evacuation plans should be prepared by developers for all forms of vulnerable developments where buildings or their access routes are within areas at flood risk, other than minor development. Flood Warning and Evacuation plans are also required wherever land uses with transient populations e.g. caravan parks, campsites, are located within areas of flood risk.
- Increase awareness and promote sign-up to the Environment Agency Flood Warnings Direct (FWD) within Chelmsford City Council's Administrative Area.

Appendices (Provided as Separate Documents)

A **Interactive Flood Risk Mapping**

B **Data sources used in the SFRA**

C **SFRA User Guide**

D **Flood Alerts and Flood Warnings**

E **Summary of flood risk across Chelmsford City Council's Administrative Area**

F **Cumulative Impact Assessment (CIA)**

G **Site Screening Outputs & Cover Note**

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ISO 9001:2015
ISO 14001:2015
ISO 27001:2013
ISO 45001:2018