CC010

# Chelmsford City Level 2 Strategic Flood Risk Assessment

## Final Report

May 2024

Prepared for:
Chelmsford City Council

www.jbaconsulting.com

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# Contract

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This report describes work commissioned by Chelmsford City Council, by an instruction dated 2 February 2022. The Client's representative for the contract was Asa Pamphilon of Chelmsford City Council. Rebecca Lee, Tommy Escott, Matha Gurney and Ed Mumford of JBA Consulting carried out this work.

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The methodology adopted and the sources of information used by JBA in providing its services are outlined in this Report. The work described in this Report was undertaken in April 2024 and is based on the conditions encountered and the information available during said period. The scope of this Report and the services are accordingly factually limited by these circumstances.

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## Copyright



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# Contents

## List of Tables

## Abbreviations

| | |
|---|---|
| AEP | Annual Exceedance Probability |
| AIMS | Asset Information Management System |
| AStGWF | Areas Susceptible to Groundwater Flooding |
| CC | Climate Change |
| CCC | Chelmsford City Council |
| Defra | Department for Environment, Food and Rural Affairs |
| DWMP | Drainage and Wastewater Management Plan |
| EA | Environment Agency |
| EU | European Union |
| FMfP | Flood Map for Planning |
| FRA | Flood Risk Assessment |
| FRISM | Flood Risk Metrics |
| FRMP | Flood Risk Management Plan |
| FWA | Flood Warning Area |
| GIS | Geographic Information Systems |
| HELAA | Housing and Economic Land Availability Assessment |
| JBA | Jeremy Benn Associates |
| LiDAR | Light Detection and Ranging |
| LLFA | Lead Local Flood Authority |
| LPA | Local Planning Authority |
| LPU | Local Plan Update |
| mAOD | metres Above Ordnance Datum |
| NPPF | National Planning Policy Framework |
| NVZs | Nitrate Vulnerable Zones |
| PFRA | Preliminary Flood Risk Assessment |
| PPG | Planning Practice Guidance |
| RAG | Red-Amber-Green |
| RBD | River Basin District |
| RBMP | River Basin Management Plan |
| RMAs | Risk Management Authorities |
| RoFSW | Risk of Flooding from Surface Water |
| SFRA | Strategic Flood Risk Assessment |
| SoP | Standard of Protection |
| SuDS | Sustainable Drainage Systems |

| | |
|---|---|
| SWMP | Surface Water Management Plan |
| WFD | Water Framework Directive |

## Definitions

**1D model**: one-dimensional hydraulic model

**2D model**: two-dimensional hydraulic model

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

**Brownfield**: previously developed parcel of land

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

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

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

**Dry island**: Land which may not be at risk of flooding itself but is surrounded by flood risk and therefore may become cut off during a flood event.

**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.

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

**Flood Map for Planning**: The EA Flood Map for Planning (Rivers and Sea) (FMfP) is an online mapping portal which shows the Flood Zones in England. The FMfP shows river and sea flooding across different flood zones (Flood Zones 1, 2 and 3 (being split in to 3a and 3b)) and includes modelled and historic flood outlines. The FMfP does not however take in to account the presence of flood defences or the impacts of climate change.

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

**Flood Risk Regulations**: Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.

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

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

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

**Green Infrastructure**: a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs, and urban fringe.

**Greenfield**: undeveloped parcel of land

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

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

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

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

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

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

**Pluvial flooding**: see surface water flooding.

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

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

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

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

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

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

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

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

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

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

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

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

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

**Toe Line: The level of the lowest part of a structure, generally forming the transition to the underlying ground.**

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

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

# Executive Summary

### Introduction and context

This report provides a comprehensive and robust evidence base on flood risk issues to support the review and update of Chelmsford City Council's planning policies. The review process is known as the Local Plan Update (LPU). This report uses the best available information, including input from key stakeholders. This Level 2 Strategic Flood Risk Assessment (SFRA) for Chelmsford City Council (CCC) supersedes previous targeted Level 2 SFRA work produced by JBA Consulting and published in 2017. The SFRA assesses additional land promoted to CCC for potential development, changes to the proposed development sites within the city, and changes in national planning policy and guidance, up to and including the latest update to the National Planning Policy Framework (NPPF) in December 2023, the update to the Planning Practice Guidance (PPG) in August 2022, and the updates to the EA climate change guidance in July 2021 and May 2022.

### SFRA objectives

The Government's PPG on Flood Risk and Coastal Change advocates a tiered approach to risk assessment involving Level 1 and Level 2 assessments.

The aim of the Level 2 assessment is to build on identified risks from the Level 1 assessment for proposed development sites, to provide a greater understanding of fluvial, surface water, groundwater, and reservoir related flooding risks to the site. From this, CCC and developers can make more informed decisions and pursue development in an effective and efficient manner. The Level 2 assessment also identifies sites for further risk analysis at the site-specific Flood Risk Assessment (FRA) stage.

### Level 2 SFRA outputs

The Level 2 assessment includes detailed assessments of the proposed site options. The Level 2 assessment includes:

- An up-to-date SFRA, taking into account the most recent policy and legislation in the NPPF (2023) and PPG (2022).
- An assessment of all sources of flooding including fluvial flooding, surface water flooding, groundwater flooding, mapping of the functional floodplain and the potential increases in fluvial and surface water flood risk due to climate change, and how these may be mitigated.
- An assessment of existing flood warning and emergency planning procedures, including an assessment of safe access and egress during an extreme event.
- Advice and recommendations on the likely applicability of Sustainable Drainage Systems (SuDS) for managing surface water runoff.
- A comprehensive set of maps presenting flood risk from all sources that can be used as an evidence base for use in the emerging Local Plan.
- Advice on whether the sites are likely to pass the second part of the exception test and the sequential test with regards to flood risk and on the requirements for a site-specific FRA and outline specific measures or objectives that are required to manage flood risk.

As part of the Level 2 SFRA, detailed site summary tables have been produced for the proposed sites at significant flood risk, covering the above. To accompany each site summary table, there is a GeoPDF map, with all the mapped flood risk outputs.

**Summary of Level 2 SFRA**

All sites promoted by CCC (105 sites) were subject to an initial screening through JBA Consulting's FRISM software. The outputs of this screening can be found in Appendix G of the Level 1 SFRA (JBA Consulting, 2024). CCC then identified the sites assessed as potentially suitable for development through the 2022-23 Strategic Housing and Employment Land Availability Assessment (SHELAA) including those proposed for allocation in the Local Plan Review Issues and Options consultation (2022), from all sites promoted as well as newly promoted sites not yet subject to SHELAA assessment.

This resulted in 19 sites being taken forward to a detailed screening exercise, of which the majority compromise previously developed sites located within Chelmsford's City Centre. This identified 9 sites as having significant risk of flooding on the site and a further 10 as having a less significant but still notable risk of surface water flooding or causing access and egress issues. The sites at significant risk were further assessed in detailed site summary tables and the sites at lower but notable risk are assessed further within this report. This SFRA incorporates recent changes to national and local planning policy and considers the cumulative impacts of development across Chelmsford.

Detailed site summary tables setting out the flood risk analysis and NPPF requirements for each site at significant risk of flooding, as well as guidance for site-specific FRAs, have been produced. A broadscale assessment of suitable SuDS has been provided, giving an indication where there may be constraints to certain types of SuDS techniques.

To accompany each site summary table, there is a GeoPDF map, with all the mapped flood risk outputs per site. This is displayed centrally, with easy-to-use ‘tick box’ layers down the right-hand side of the mapping, to allow easy navigation of the data.

The following points summarise the Level 2 assessment:

- Fluvial flooding - the main watercourses associated with fluvial risk to the sites within the Level 2 assessment are the River Chelmer, River Can, River Crouch, and Sandon Brook. There are also other smaller watercourses and drainage channels presenting a fluvial risk to sites across Chelmsford- developers are likely to need to undertake detailed modelling to inform site-specific Flood Risk Assessments for these sites. The sites with the most significant area and severity of fluvial risk are CW1a and CW1d (part of Strategic Growth Site (SGS) 1a), SGS1w and Growth Site (GS)1g.
- Flood Warning Areas (FWAs) - several proposed sites are located within existing EA FWAs. For proposed development within existing EA FWAs, developers should consult the EA to ensure that adequate flood warning procedures and evacuation processes are in place and that Risk Management Authorities (RMAs) are not put under any additional burden.

- Surface water flooding - surface water tends to follow topographic flow routes, for example, along watercourses or isolated pockets of ponding where there are topographic depressions. The majority of sites with a detailed Level 2 summary table are at surface water risk. The degree of flood risk varies with some sites being only marginally affected along their boundaries, whilst other sites are more significantly affected within the site. The sites at most significant surface water risk are CW1d (part of SGS 1a), SGS1y, GS1v, GS1g, and GS17a.
- Access and egress - whilst not at significant flood risk within the site boundary, several sites have potential access and egress issues as a result of fluvial and surface water flooding of the surrounding roads. At these sites, consideration should be made as to how safe access and egress can be provided during flood events, both for people and emergency vehicles. Consideration should also be given to the nature of the risk, for example whether the flooding forms a flow path or bisects the site where access across the site from one side to another may be compromised.
- Climate change - fluvial and surface water climate change mapping indicates that flood extents are predicted to increase. As a result, the depths, velocities, and hazard of flooding may also increase. The significance of the increase will depend on the topography of the site and the climate change percentage allowance used; fluvial extents would be larger than Flood Zone 3, but maximum extents are likely to be similar to Flood Zone 2. Site-specific FRAs should confirm the impact of climate change using latest guidance. It is recommended that CCC work with other RMAs to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the City.
- Historic flooding - 10 sites are shown to fall partially within the EA Historic Flood Map dataset, with the highest percentage coverage at sites CW1a and CW1d (part of SGS 1a), GS1g, and GS1u. The EA Recorded Flood Outlines dataset and CCC recorded flooding incidences also show further historic flooding both on and surrounding several sites.
- Sewer flooding - several sites across Chelmsford have recorded sewer flooding incidents from Anglian Water located in close proximity to the site. One site, GS1z, has a recorded sewer flooding incident within the site boundary.
- Groundwater flooding - a large number of sites across Chelmsford are shown by the Areas Susceptible to Groundwater flooding (AStGWF) map to have a high susceptibility to groundwater flooding with corresponding high ground water levels shown in the JBA emergence map. An appropriate assessment of the groundwater regime for a site should be carried out at the site-specific FRA stage.
- Reservoirs - there are 7 sites assessed within the site summary tables that are shown to be at risk of reservoir flooding during a 'Dry Day' scenario and 14 sites in a 'Wet Day' scenario. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs

is very low. However, there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific FRA (where relevant). Developers will also need to consult the EA and Reservoir owners where sites are identified at risk form a reservoir to determine whether development downstream has implications for the reservoirs risk classification.

- Main Rivers - any sites located where there is Main River (including culverted reaches of Main River) will require an easement of 8m either side of the watercourse from the top of the bank. This may introduce constraints regarding what development will be possible and consideration will need to be given to access and maintenance at locations where there are culverts. Developers will be required to apply for appropriate permits so the activity being carried out over easements does not increase flood risk.
- Defences - many sites within the city centre are in close proximity to existing defences, may benefit from defences in the present day, or are likely to benefit from defences in future. Developers will need to consult with the EA and CCC to determine whether any land within their site boundary needs to be safeguarded for defences in the future. CCC continues to work with the EA to supplement existing flood defences and deliver a new series of catchment-based measures under the Chelmsford Flood Resilience Partnership. Sites affected by flood risk should devise an FRA on the basis that existing city centre flood defences are in place and, if sufficiently advanced, the catchment-based measures identified by the Chelmsford Flood Resilience Partnership project. In either scenario a financial contribution to the Chelmsford Flood Resilience Partnership project would be required. Developers should consider the risk to site from breach or overtopping of defences as part of a site-specific flood risk assessment.
- SuDS - a strategic assessment was conducted of SuDS options using regional datasets. A detailed site-specific assessment of suitable SuDS techniques would need to be undertaken at site-specific level to understand which SuDS option would be best.

At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses so that the potential effects of proposals can be evaluated at site level. The modelling should verify flood extent (including latest climate change allowances), inform development zoning within the site, and prove, if required, whether the exception test can be passed.

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 adopting the sequential approach in line with the recommendations in national and local Planning Policy and supporting guidance and those set out in this SFRA.

For developments that have not been allocated in the Local Plan, developers must undertake the sequential test followed by the exception test (if required) and present this information to the LPA for approval. Developers will need to apply the exception test in the following instances:

- 'More vulnerable' development in Flood Zone 3a
- 'Essential infrastructure' in Flood Zone 3a or 3b
- 'Highly vulnerable' development in Flood Zone 2
- Any development where a higher risk of surface water has been identified and the site does not clearly show that development can be achieved away from the flood risk.

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

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. This is determined as part of this Level 2 assessment for sites allocated within the Local Plan. The Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should investigate in more detail to inform the exception test for windfall sites.

It is recommended that as part of the early discussions relating to development proposals, developers discuss requirements relating to site-specific FRAs and drainage strategies with both the LPA and the Lead Local Flood Authority (LLFA), to identify any potential issues that may arise from the development proposals.

# 1 Introduction

## 1.1 Purpose of the Strategic Flood Risk Assessment

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

As part of a review of the current Chelmsford Local Plan 2013-2036, Chelmsford City Council (CCC) have commissioned a Level 2 SFRA to establish available land that could be allocated for the development of new homes and employment, alongside associated infrastructure. This study follows the Level 1 SFRA completed by JBA in February 2024.

This 2024 Level 2 SFRA will be used to inform decisions on the location of future development and the preparation of land use planning policies for the long-term management of flood risk, reflecting the implications of the August 2022 changes to the PPG. Annex 1 – Updates to the Planning Practice Guidance (25 August 2022) of the Level 1 SFRA report provides more information on the August 2022 changes.

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

## 1.2 Levels of SFRA

The PPG identifies the following two levels of SFRA:

- A Level 1 assessment is required where flooding is not a significant constraint 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 Level 1 SFRA for Chelmsford City Council's Administrative Area has been recently completed (JBA Consulting, 2024) and should be referred to alongside this Level 2 SFRA.
- A Level 2 assessment is required where land in Flood Zone 1 cannot appropriately accommodate all necessary development, or due to wider sustainability benefits (e.g. inner city regeneration) there is the desire to allocate land at higher risk of flooding, creating the need to apply the NPPF’s Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This report and its appendices fulfil the requirements of a Level 2 SFRA. In accordance with the latest 2023 NPPF, the Level 2 SFRA considers the risk of flooding from all sources now and in the future and the implications with respect to the implementation of development at

the proposed allocation sites. This addresses the requirements that the exception test applies to flood risk from any source both now and in the future.

### 1.3 SFRA objectives

The objectives of this Level 2 SFRA are:

- Provide individual flood risk analysis for site options using the latest available flood risk data, thereby assisting CCC in applying the exception test to their proposed site options through the emerging LPU.
- Use available data to provide information and a comprehensive set of maps presenting flood risk from all sources for each site option.
- Where the Exception Test is required, provide recommendations for making the site safe throughout its lifetime to satisfy the flood risk portion of the Exception Test.
- Take into account the most recent policy and legislation in the NPPF, PPG, and LLFA SuDS guidance.

### 1.4 Consultation

SFRAs should be prepared in consultation with other risk management authorities (RMAs). The following parties (external to CCC) have been consulted during the preparation of this Level 2 SFRA:

- Essex County Council (Lead Local Flood Authority)
- Environment Agency
- Essex and Suffolk Water
- Anglian Water.

### 1.5 How to use this report

Table 1-1 below outlines the contents of this report and details how different users can apply this information.

Table 1-1: Outline of the contents of each section of this report

| Section | Contents | How to use |
|---|---|---|
| 1. Introduction | Outlines the purpose and objectives of the Level 2 SFRA | For general information and context. |
| 2. The Planning Framework and Flood Risk Policy | Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study. | Users should refer to this section and the relevant sections of the Level 1 SFRA for any relevant policy which may underpin strategic or site-specific assessments. |
| 3. Sources of | Summarises the data used | Users should refer to this section |

| Section | Contents | How to use |
|---|---|---|
| information used in preparing the Level 2 SFRA | in the Level 2 assessment and GeoPDF mapping. | in conjunction with the site summary tables and GeoPDF mapping to understand the data presented. Developers should refer to this section when understanding the requirements for a site-specific FRA. |
| 4. Impact of Climate Change | Outlines the latest climate change guidance published by the EA and how this was applied to the SFRA. Sets out how developers should apply the guidance to inform site-specific FRAs. | This section should be used alongside the relevant sections of the Level 1 SFRA to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development. |
| 5. Level 2 Assessment Methodology | Summarises the sites taken forward to a Level 2 assessment and the outputs produced for each of these sites. Includes an assessment of flood risk at the 'amber sites' (those sites identified at a lower but still notable flood risk than those requiring a full Level 2 assessment). | This section should be used in conjunction with the site summary tables and GeoPDF mapping to understand the data presented.<br>Developers of 'amber sites' should use this section to understand the flood risk and associated recommendations for their sites. |
| 6. Flood Risk Management Requirements for Developers | Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Refers to relevant sections in the Level1 SFRA for mitigation guidance. | Developers should use this section alongside the relevant sections of the Level 1 SFRA to understand requirements for FRAs, what conditions/ guidance documents should be followed, and information on flood mitigation options. |
| 7. Surface water management and SuDS | Refers to relevant sections in the Level1 SFRA for information on SuDS and surface water management and provides an overview of SuDS suitability across the study area. | Developers should use this section to understand the suitability of SuDS across the study area and refer to the Level1 SFRA for further information on types of SuDS, the hierarchy and management trains information. |

| Section | Contents | How to use |
|---|---|---|
| 9. Summary of Level 2 assessment and recommendations | Summarises the results and conclusions of the Level 2 assessment, and signposts to the Level1 SFRA for planning policy recommendations. | Developers and planners should use this section to see a summary of the Level 2 assessment and understand the key messages from the site summary tables.<br>Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments. |
| Appendix A: GeoPDF mapping and User Guide | Provides interactive PDF mapping for each Level 2 site assessed within a site summary table showing flood risk at and around the site. The associated User Guide provides details of the layers used within the interactive PDF mapping. | Appendix C: GeoPDF mapping and User Guide |
| Appendix B:<br>Site Summary Tables | Provides a detailed summary of flood risk for sites requiring a more detailed assessment, which considers flood risk, emergency planning, climate change, broadscale assessment of possible SuDS, exception test requirements and requirements for site-specific FRAs. | Planners should use this section to inform the application of the sequential and exception tests, as relevant.<br>Developers should use these tables to understand flood risk, access and egress requirements, climate change, SuDS, and FRA requirements for site-specific assessments. |

Hyperlinks to external guidance documents/websites are provided in blue through the SFRA.

### 1.6 SFRA study area

The study area encompasses the entirety of Chelmsford City Council's Administrative Area. This covers an area of just under 343km$^2$ (ONS, 2016) and has a population of approximately 181,500 (ONS Census, 2021).

Chelmsford and its surrounding suburbs are the main populated area, with around 110,000 living in the cities' urban area. 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.

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 - The River Chelmer flows into Chelmsford from 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.
- River Can - 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.
- River Ter - The River Ter flows southeast, out of Chelmsford and joins the River Chelmer near Ulting.
- River Crouch - 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.

Other watercourses include:

- River Wid
- Sandon Brook
- Roxwell Brook
- Walthambury Brook
- Chignall Brook

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.

# 2 The Planning Framework and Flood Risk Policy

This section of the Level 2 SFRA provides an overview of the planning framework, flood risk policy, and flood risk responsibilities. In preparing the subsequent sections of this SFRA, appropriate planning and policy amendments have been acknowledged and considered.

## 2.1 Roles and responsibilities for Flood Risk Management

RMAs are comprised of different organisations that have responsibilities for flood risk management. The RMAs in and around Chelmsford, and their responsibilities, are detailed in Section 2.1 of the Level 1 SFRA report.

## 2.2 Relevant legislation

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

- Flood Risk Regulations (2009) - these transpose the European Floods Directive (2000) into law and require the EA and LLFAs to produce PFRAs and identify nationally significant Flood Risk Areas.
- Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991), Environment Act (1995), and Flood and Water Management Act (2010) – as amended and implanted via secondary legislation. These set out the roles and responsibilities for organisations that have a role in Flood Risk Management.
- The Land Drainage Act (1991, as amended) and Environmental Permitting Regulations (2018) also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an ordinary watercourse or main river.
- The Water Environment Regulations (2017) – these transpose the European Water Framework Directive (WFD) (2000) into law and require the EA to produce River Basin Management Plans (RBMPs). These aim to improve/maintain the water quality of aquatic ecosystems, riparian ecosystems, and wetlands so that they reach 'good' status.
- 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.

## 2.3 Relevant flood risk policy and strategy documents

This section highlights policies and other relevant documents for the CCC area. Hyperlinks are provided to external documents.

- Anglian River Basin District River Basin Management Plan - the EA's most recent review and update of the RBMPs took place in December 2022. RBMPs enable local communities to find more cost-effective ways to further improve water environments.
- Anglian River Basin District Flood Risk Management Plan - the FRMP is a plan to manage significant flood risks within Anglian RBD.
- North Essex Catchment Flood Management Plan - the EA's overview of flood risk across the Thames river catchment and recommended ways of managing it.
- Essex and South Suffolk Shoreline Management Plan (2010)
- Anglian Water Drainage and Wastewater Management Plan (2021)
- Climate change guidance for flood risk assessment (2022) - the EA's guidance was last updated in 2022. New UK Climate Projections (UKCP18) were used to update peak river flow allowances, and these are now based on management catchments rather than RBDs. There has also been a change in how peak river flow allowances should be applied, with a greater focus placed on the 'central' allowance. In May 2022 peak rainfall allowances were updated and are now based on management catchments rather than the previous flat rates for the whole country.
- The Sustainable Drainage Systems Design Guide for Essex (2020)
- Local Flood Risk Management Strategy for Essex (2018) - explains local flood risk sources in Chelmsford and how the council manage flood risk in an integrated and effective way.
- Essex County Council Preliminary Flood Risk Assessment (2011, updated 2017) - a high-level screening exercise which provides an assessment of past flood risk based on historical data from CCC, the EA, Anglian Water, local Parish Councils, Town Councils, and Residents Associations.
- Adopted Chelmsford Local Plan (2020)
- Chelmsford City Water Cycle Study Phase 1 and 2 (2011, updated 2018 for the Adopted Chelmsford Local Plan, 2020) - to assist CCC to select and develop growth proposals that minimise impacts on the environment, water quality, water resources, infrastructure, and flood risk and help to identify ways of mitigating such impacts.
- Chelmsford Surface Water Management Plan (2014, with modelling updates in 2022)

Further details relating to these policies and documents can be found in Section 2.3 of the Level 1 SFRA report.

### 2.3.1 Anglian River Basin District Flood Risk Management Plan

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 RBMPs were published in October 2022, which are the current version.

### 2.3.2 Anglian Water Drainage and Wastewater (DWMP) Management Plan

Water and sewerage companies have a statutory duty under the Environment Act to produce DWMPs. The first plans were published in 2023. DWMPs must cover a minimum period of 25 years, looking at current and future capacity, pressures, and risks to their networks, such as climate change and population growth.

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

Anglian Water published their first DWMP in May 2023, which covers the period from 2025 through to 2050. The plan document is available on their website, here. Further information on the Anglian Water DWMP is available on their website, here.

## 2.4 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. Developers should consult Essex County Council to understand the latest position on SuDS Approval Bodies and the Council's position on SuDS for new development.

### 2.5 Updated Strategic Flood Risk Assessment Guidance

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

# 3 Sources of information used in preparing the Level 2 SFRA

This section outlines the datasets used in assessing the sites in the Level 2 SFRA.

## 3.1 Data used to inform the SFRA

Table 3-1 provides an overview of the data used to inform the appraisal of flood risk for CCC.

Table 3-1: Overview of supplied data for CCC Level 2 SFRA

| Source of flood risk | Data used | Data source |
|---|---|---|
| Historic flooding (all sources) | Historic Flood Map and Recorded Flood Outlines datasets | EA |
| Historic flooding (all sources) | Historic flooding incident reports | CCC and ECC |
| Fluvial (including climate change) | River Chelmer (2020) ISIS/TUFLOW model - Updated climate change allowances for the 3.3% AEP and 0.1% AEP were modelled as part of this SFRA.<br>Chelmer Tributaries (2020) - no additional climate change runs were undertaken as no sites were identified within the model reach.<br>ISIS/TUFLOW model<br>River Crouch (2007) ISIS/TUFLOW model - Updated climate change allowances for the 3.3% AEP and 0.1% AEP were modelled as part of this SFRA.<br>Rettendon Fen (2014) ISIS model - Updated climate change allowances for the 3.3% AEP and 0.1% AEP were modelled as part of this SFRA.<br>Sandon Brook (2015) ISIS model - Updated climate change allowances for the 3.3% AEP and 0.1% AEP were modelled as part of this SFRA. | EA (with JBA Climate Change uplifts) |

| Source of flood risk | Data used | Data source |
|---|---|---|
| Surface Water (including climate change) | Climate change uplifts to the Risk of Flooding from Surface Water dataset were modelled by JBA as part of this SFRA. These are as follows:<br>3.3% AEP +20% and +35%<br>1% AEP +25% and +40%<br>0.1% AEP +25% and +40% | EA and JBA |
| Sewers | Internal and external historic drainage records | Anglian Water |
| Groundwater | Areas Susceptible to Groundwater Flooding dataset | EA |
| Groundwater | JBA Groundwater emergence map | JBA |
| Reservoirs | National Inundation Reservoir Mapping (Long term flood risk map) | EA |
| Flood defences | AIMS Spatial Flood Defences dataset | EA |
| Other datasets | Source Protection Zones<br>Aquifer Designation maps (Bedrock Geology and Superficial Deposits)<br>Detailed River Network<br>Flood Alert and Flood Warning Areas<br>Groundwater Vulnerability<br>Risk of Flooding from Rivers and Sea<br>National Receptor Dataset | EA (via CCC) |

## 3.2 Fluvial Flood Zones

### 3.2.1 Flood Zones 2 and 3a

Flood Zones 2 and 3a, as shown in the Appendix A mapping, show the same extent as the online Environment Agency's Flood Map for Planning (which incorporates latest modelled data) as all modelled data used in this SFRA has been fully incorporated into the EA Flood Zones (although Flood Zone 3a is not shown online). Over time, the online mapping is likely to be updated more often than the SFRA, and SFRA users should check there are no major changes in their area.

The following provides additional information on the FMfP:

- Where flood outlines are not informed by detailed hydraulic modelling, the FMfP is based on generalised modelling to provide an indication of flood risk. Whilst the generalised modelling is generally accurate on a large scale, they are not provided for specific sites or for land where the catchment of the watercourse falls below 3km².

- For watercourses with smaller catchments, the EA's Risk of Flooding from Surface Water (RoFSW) map provides an indication of the floodplain of small watercourses and ditches. It is more accurate in upper to mid river valley locations than lower valley locations near the coast. This is because it does not represent the floodplain for small watercourses as well in largely flat areas.
- Even where more detailed models of Main Rivers have been used by the EA to inform the FMfP, they will be largely based on remotely detected ground model data and not topographic survey. In this area, FMfP does not include all modelled outputs, hence the Level 2 SFRA has derived its own Flood Zones based on latest available data.
- For this reason, the FMfP is not of a resolution to be used as application evidence to provide the details of possible flooding for individual properties or sites and for any sites with watercourses on, or adjacent to the site. Accordingly, for site-specific assessments it will be necessary to perform more detailed studies in circumstances where flood risk is an issue.

### 3.2.2 Flood Zone 3b

Functional floodplain (Flood Zone 3b) is identified as land which would flood with an annual probability of 3.3% AEP (1 in 30 years), where detailed hydraulic modelling exists. The 3.3% AEP modelled flood extents have been used to represent Flood Zone 3b, where available. 3.3% AEP extents were available for the following models:

- River Chelmer
- Chelmer Tributaries
- Rettendon Fen
- Sandon Brook

For areas not covered by detailed EA models (or where suitable outputs were not available), a precautionary approach should be adopted for Flood Zone 3b with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a (or Flood Zone 3b derived from 2D generalised modelling), further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b.

As this is quite a conservative approach, the 5% AEP outputs have also been considered to assess the sensitivity between the 1% AEP and 5% AEP and therefore indicate how accurate the conservative proxy of 1% AEP is to Flood Zone 3b.

If the area of interest is in an area that has seen major changes to the extent of the Flood Zones, having checked the online mapping, developers will also need to remap Flood Zone 3b as part of a detailed site-specific Flood Risk Assessment.

## 3.3 Climate change

The Appendix A mapping included in this SFRA provides an assessment of climate change risk for fluvial and surface water flooding using modelled outputs with the latest climate

change uplifts where available. Section 4 details how climate change has been represented within this Level 2 SFRA.

Developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA, following the climate change guidance set out by the EA, available on the Government website here.

### 3.4 Surface water

Mapping of surface water flood risk in Chelmsford has been taken from the EA's RoFSW mapping. Surface water flood risk is subdivided into the following four categories:

- **High:** An area has a chance of flooding greater than 3.3% AEP (1 in 30) each year.
- **Medium:** An area has a chance of flooding between 1% AEP (1 in 100) and 3.3% AEP (1 in 30) each year.
- **Low:** An area has a chance of flooding between 0.1% AEP (1 in 1,000) and 1% AEP (1 in 100) each year.
- **Very Low:** An area has a chance of flooding of less than 0.1% AEP (1 in 1,000) each year.

The results should be used for high-level assessments such as SFRAs for local authorities. If a particular site is indicated in the EA mapping to be at risk from surface water flooding, a more detailed assessment may be required to illustrate the flood risk more accurately at a site-specific scale. Such an assessment should use the RoFSW in partnership with other sources of local flooding information to confirm the presence of a surface water risk at that particular location.

Detailed modelling using site survey will be necessary where there is a significant risk of surface water flooding. It is the intention that the EA will prepare updated and improved surface water mapping in the course of updating the National Flood Risk Assessment (NaFRA2). It is anticipated that this data will be available in 2024 and at that time it is recommended that the surface water risk assessment is reviewed. It is not anticipated that the updated mapping will fundamentally change the locations identified to be at risk from surface water flooding, but the improved analysis techniques will reduce some of the uncertainties associated with the assessment.

### 3.5 Groundwater

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

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

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

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

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

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

1. Firstly, the AStGWF dataset was used to identify grid squares that are most susceptible to groundwater flooding. Based on this dataset, any areas with greater than 50% susceptibility to groundwater flooding were taken forward for further analysis.
2. Of the areas identified in the above, the JBA Groundwater Emergence map was used to locate areas where this groundwater is most likely to emerge. For this assessment, areas where groundwater levels are predicted to be within 0.5m of the surface level were identified.
3. For locations that met both of the above parameters, a combination of the 0.1% AEP surface water extent from the EA's RoFSW map and EA 1m resolution LiDAR was used to identify where any groundwater emerging in these locations is most likely to flow and this is included in the site table.

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

### 3.6 River networks

Main Rivers are represented by the EA's Statutory Main River layer. Ordinary Watercourses are represented by the EA's Detailed River Network layer. Caution should be taken when using these layers to identify culverted watercourses which may appear as straight lines but, in reality, are not. Developers should check if a Flood Risk Activity Permit (FRAP) or any other permits or permissions will be needed prior to any activities being carried out to any main rivers.

Developers should be aware of the need to identify the route of, and flood risk associated with, culverts. CCTV condition survey will be required to establish the current condition of

the culvert and hydraulic assessments will be necessary to establish culvert capacity of both culverts on site and those immediately offsite that could pose a risk to the site. The risk of flooding should be established using site survey, including the residual risk of culvert blockage.

### 3.7 Flood warning

Flood Warning Areas and Flood Alert Areas are represented by the EA's relevant GIS datasets. The sites affected by Flood Warning and Flood Alert Areas are detailed in the site summary tables in Appendix B.

### 3.8 Reservoirs

The risk of inundation as a result of a breach or failure of a number of reservoirs within the area has been identified from the EA's Long Term Flood Risk Information website. Reservoir risk has been divided into 'Wet Day' and 'Dry Day' extents. The 'Wet Day' extent shows the individual flood extents for all large, raised reservoirs in the event that they were to fail and release the water held when local rivers had already overflowed their banks. The 'Dry Day' extent shows the individual flood extents for all large, raised reservoirs in the event that they were to fail and release the water held when local rivers are at normal levels. Further information can be found on the Defra data download website here.

### 3.9 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.

### 3.10 Historic 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 3-2 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 3-2: Historic flooding in Chelmsford

| Location | Date | Additional information recorded |
|---|---|---|
| Chelmsford City Centre (including surrounding suburbs of Springfield, Great Baddow, Moulsham and Melbourne) | 2007<br>2008<br>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<br>2009 | 3 internal and external incidents of property flooding. One incident of external flooding in 2009. |
| Great Leighs | 2009 | Road flooding. |

## 3.11 Flood defences

Flood defences are represented by the EA's Asset Information Management System (AIMS) Spatial Defences dataset. Their current condition and Standard of Protection (SoP) are based on those recorded in the tabulated shapefile data, which is summarised below:

Table 3-3: Defences detailed in the EA AIMS dataset

| Watercourse | Location | Type | Design SOP | Condition Rating |
|---|---|---|---|---|
| River Chelmer | Natural high ground runs along both banks of the Chelmer along its whole length within Chelmsford City Council's Administrative Area. There is engineered high ground on the eastern bank of the Chelmer near Springfield Road 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 embankments are Fair |
| River Can | Natural high ground runs along both banks of the Can along its whole length within Chelmsford City Council's Administrative Area. 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 and 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 Chelmsford City Council's Administrative Area. | Embankment | 200 years | Fair |

| Watercourse | Location | Type | Design SOP | Condition Rating |
|---|---|---|---|---|
| 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 |
| Sandon Brook | 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 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 Fenn Brook. An embankment also runs along the eastern banks of | Embankment, Natural High Ground | Natural high ground – 10 years; Embankments – 200 years | Fair to Good with some areas Very Poor |

| Watercourse | Location | Type | Design SOP | Condition Rating |
|---|---|---|---|---|
| | Fenn Brook and out of Chelmsford City Council's Administrative Area. | | | |
| 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 |

## 3.12 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).

## 3.13 Depth, velocity, and hazard to people

The Level 2 assessment seeks to map the probable depth and velocity of flooding as well as the hazard to people and use this within the site summary tables.

Where detailed model outputs were available, the 1% AEP plus climate change depth, velocity, and hazard data has been used. In the absence of detailed hydraulic models, flood depth, velocity, and hazard are not available as part of the FMfP dataset so have not been included as part of this Level 2 SFRA and may need to be considered further during a site-specific FRA.

The depth, hazard, and velocity of the 3.3% and 1% AEP plus climate change surface water flood events, produced by uplifting the EA RoFSW map, have been mapped and considered in this assessment.

Hazard to people has been calculated using the below formula as suggested in Defra's FD2321/TR2 "Flood Risk to People". The different hazard categories are shown in Table 3-4. Developers should also test the impact of climate change depths, velocities, and hazard on the site, at FRA stage.

Table 3-4: Defra's FD2321/TR2 "Flood Risks to People" classifications

| Description of Flood Hazard Rating | Flood Hazard Rating | Classification Explanation |
|---|---|---|
| Very Low Hazard/ Caution | <0.75 | "Flood zone with shallow flowing water or deep standing water" |
| Danger For Some (i.e. children) | 0.75 - 1.25 | "Danger: flood zone with deep or fast flowing water" |
| Danger For Most | 1.25 - 2.00 | "Danger: flood zone with deep fast flowing water" |
| Danger For All | >2.00 | "Extreme danger: flood zone with deep fast flowing water" |

As part of a site-specific FRA, developers will need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood depth, velocity, and hazard based on the relevant 1% AEP plus climate change event, using the relevant climate change allowance based on the type of development and its associated vulnerability classification. Not all this information is known at the strategic scale and the level of resolution may not be appropriate to enable site scale assessment of proposed development schemes.

### 3.14 Note on SuDS suitability

The hydraulic and geological characteristics of each site were assessed to determine the factors that potentially constrain schemes for surface water management. This assessment is designed to inform the early-stage site planning process and is not intended to replace site-specific detailed drainage assessments.

The assessment is based on catchment characteristics and additional datasets such as JBA's Groundwater Emergence Mapping and British Geological Survey (BGS) soil maps of England and Wales which allow for a basic assessment of the soil characteristics on a site-

by-site basis. LiDAR data was used as a basis for determining the topography and average slope across each development site. Other datasets used include:

- Historic landfill sites
- Groundwater Source Protection Zones
- Detailed River Network
- Flood Zones derived as part of this Level 2 SFRA.

This data was then collated to provide an indication of particular groups of SuDS systems which might be suitable at a site. SuDS techniques were categorised into five main groups, as shown in Table 3-5. This assessment should not be used as a definitive guide as to which SuDS would be suitable but used as an indicative guide of general suitability. Further site-specific investigation should be conducted to determine what SuDS techniques could be used on a particular development, informed by detailed ground investigations.

Table 3-5: Summary of SuDS categories

| SuDS Type | Technique |
|---|---|
| Source Controls | Green Roof, Rainwater Harvesting, Pervious Pavements, Rain Gardens |
| Infiltration | Infiltration Trench, Infiltration Basin, Soakaway |
| Detention | Pond, Wetland, Subsurface Storage, Shallow Wetland, Extended Detention Wetland, Pocket Wetland, Submerged Gravel Wetland, Wetland Channel, Detention Basin |
| Filtration | Surface Sand Filter, Sub-Surface Sand Filter, Perimeter Sand Filter, Bioretention, Filter Strip, Filter Trench |
| Conveyance | Dry Swale, Under-drained Swale, Wet Swale |

The suitability of each SuDS type for the site options has been described in the summary tables, where applicable. The assessment of suitability is broadscale and indicative only; more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS.

# 4 Impact of Climate Change

The sections below provide an overview of the approach taken to assess the impacts of climate change within this SFRA. For more detailed information about climate change please see Section 4 of the main Level 1 SFRA report.

## 4.1 Revised climate change guidance

The EA published updated climate change guidance for fluvial risk in July 2021 on how allowances for climate change should be included in both SFRA's and site-specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development and considers risk allowances on a management catchment level, rather than a river basin level. The guidance was further updated in May 2022 to address the changes to the requirements for rainfall allowances.

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

## 4.2 Applying the climate change guidance

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

- The vulnerability of the development – see Annex 3 in the NPPF.
- The likely lifetime of the development – in general 75 years is used for commercial development and 100 for residential, but this needs to be confirmed in an FRA. For development that will have an anticipated lifetime significantly beyond 100 years a higher allowance is required.
- The Management Catchment (assigned by the EA) that the site is located in.
    - Chelmsford lies within the Essex Combined Management Catchment (last updated July 2021).

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

- Likely depth, speed, and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s, and 2080s).
- The ‘built in’ resilience measures used, for example raised floor levels.
- The capacity or space in the development to include additional resilience measures in the future, using a ‘managed adaptive’ approach.

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

## 4.3 Relevant allowances for Chelmsford

Table 4-1 shows the updated peak river flow allowances that apply in Chelmsford for fluvial flood risk for the Combined Essex Management Catchment. These allowances supersede the previous allowances by RBD. Where the previous climate allowances were within +/- 5% of the updated guidance, these were not re-run for the purposes of this SFRA.

Table 4-1: Peak river flow allowances for the Essex Combined Management Catchment.

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

Table 4-2 shows the updated rainfall intensity allowances that apply in Chelmsford for surface water flood risk for the Essex Combined Management Catchment. These allowances supersede the previous country wide allowances. These allowances should be used for site-scale applications and for surface water flood mapping in small catchments (less than 5km²) and urbanised drainage catchments.

Table 4-2: Peak rainfall intensity allowances for small and urban catchments for the Essex Combined Management Catchment.

| Management Catchment | Allowance category | Total potential change anticipated for '2050s' (2022 to 2060) 3.3% AEP | Total potential change anticipated for '2050s' (2022 to 2060) 1% AEP | Total potential change anticipated for '2070s' (2061 to 2125) 3.3% AEP | Total potential change anticipated for '2070s' (2061 to 2125) 1% AEP |
|---|---|---|---|---|---|
| Combined Essex Management Catchment | Upper end | 35% | 45% | 35% | 45%* |
| Combined Essex Management Catchment | Central | 20% | 20% | 20% | 25% |

## 4.4 Representing climate change in the Level 2 SFRA

### Fluvial climate change

Representation of climate change within the SFRA was discussed with the Environment Agency. Climate change allowances have increased since the publication of the 2017 level 1 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 the 2024 Level 1 SFRA:

- Chelmer 3.3% AEP present day, +25%, +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%

Climate Change outputs for the 0.1% AEP event for the Chelmer 2010 model could not be produced for this study. At time of writing, the Environment Agency are currently undertaking updates to modelling in this area and developers should consult the Environment Agency to understand the latest available information. If climate change scenarios for the latest allowances for the 0.1% AEP event are not available, developers will need to undertake additional work as part of a site-specific FRA to determine the risk to the site in this scenario.

Any of the above models that cover development sites of interest within Chelmsford have been re-run for the Level 2 assessment and the latest climate change uplift allowances according to Table 4-1. Models that are located away from existing development sites have not been rerun but will still need to be considered by developers for windfall sites.

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.

**Surface water climate change**

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, including central and higher central, have been presented labelled 'Central/Upper CC' for the following extents:

- 3.3% AEP
- 1% AEP
- 0.1% AEP

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.

**Developers**

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

Where the peak river flow allowance is particularly high or the upper end is used, there should be an allowance for encroachment out of Flood Zone 2 and development in these areas should be avoided until proven at a site specific FRA stage.

## 4.5 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 Impact of climate change on the functional floodplain

The potential impacts on Flood Zone 3b (3.3% AEP modelled extent) from climate change may need to be considered at site-specific assessment stage. Modelled flood extents can be compared to the Flood Zone 3a extent, and where no detailed modelling exists, Flood Zone 3a can be compared against Flood Zone 2, for an indication of areas most sensitive to climate change.

Section 3.2.2 of this report and section4.4 of the Level 1 SFRA set out where hydraulic models are available to inform the functional floodplain, and where climate change uplifts have been applied. For areas where detailed hydraulic modelling for the 3.3% AEP event including climate change is not available, developers will need to undertake this as part of a site-specific flood risk assessment to determine the extent of the functional floodplain within their site.

## 4.7 Impact of climate change on sewers

Surface water and fluvial flooding with climate change have the potential to impact on the sewerage system, so careful management of these is needed for development. Due to differing ages of settlements, there will be drainage systems consisting of different types of sewers. Increasing pressures from climate change, urban creep and infill development could impact on the performance of the sewerage system.

## 4.8 Adapting to climate change

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

- Considering future climate risks when allocating development sites so that the risks are understood over the development's lifetime.
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development.
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.
- Promoting adaptation approaches in design policies for developments and the public realm, for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses.
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity, and amenity, for example by leaving areas shown to be at risk of flooding as public open space.
- Considering the SoP of defences and sites for future development, in relation to sensitivity to climate change. CCC and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option.
- It is recommended that the differences in flood extents from climate change are compared by CCC when proposing to allocate sites, to understand how much additional risk there could be, where this risk is within 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.
- Include the use of Natural Flood Management (NFM) techniques where possible to assist in the adaptation to climate change.

# 5 Level 2 Assessment Methodology

This section outlines how sites were screened against flood risk datasets to determine which sites required a Level 2 assessment. It also identifies other sites at lower risk with general recommendations for developers.

## 5.1 Site screening

As part of the screening process CCC identified the sites assessed as potentially suitable for development through the latest Strategic Housing and Employment Land Availability Assessment (SHELAA) including those proposed for allocation in the Local Plan Review Issues and Options consultation (2022), from all sites promoted as well as newly promoted sites not yet subject to SHELAA assessment.

It is important to identify opportunities to reduce the risk of flooding on and off the site(s) through the design of development and the value of compiling ‘development guidelines’ to understand the vision for site(s) and further information on how flood risk from all sources will be managed.

CCC provided 105 sites to take forward to the Level 2 screening assessment (including some sites that were previously allocated). All sites were screened against available flood risk information and spatial data to provide a summary of risk to each site, including:

- The proportion of the site in each Flood Zone derived from detailed hydraulic model outputs where available, and where detailed modelling was unavailable the information is taken from the EA's FMfP (see Section 3.2 for a summary of how the Flood Zones were derived for this SFRA).
- The proportion of the site affected by climate change within the central and higher central allowances for the 1% AEP event where available. See Section 4.4 for a summary of available climate change allowances for use within this assessment.
- Whether the site is shown to be at risk from surface water flooding in the RoFSW mapping for the 3.3%, 1%, and 0.1% AEP events, and the 1% AEP event plus 40% climate change allowance.
- Whether the site is within, or partially within, the reservoir 'Dry Day' or 'Wet Day' flood extents.
- Whether the site is within, or partially within, the Environment Agency (EA) Historic Flood Map dataset.
- Whether the site is within 20m of a watercourse shown within the EA Detailed River Network dataset.
- Whether the AStGWF and JBAs 5m Groundwater Emergence mapping shows the site to be susceptible to groundwater flooding.
- Whether there are any recorded sewer flooding incidents from Anglian Water within the vicinity of the site.

The screening was undertaken using JBA in-house software called “FRISM”. FRISM is an internal JBA GIS package that computes a range of flood risk metrics based on flood and receptor datasets.

The results of the screening provide a quick and efficient way of identifying sites that are likely to require a Level 2 Assessment, assisting CCC with sequential test decision-making so that flood risk is taken into account when considering allocation options.

The screening also provides an opportunity to identify sites which may show to be 100% in Flood Zone 1, but upon visual inspection in GIS, have an ordinary watercourse flowing through or adjacent to them but for which no Flood Zone information is currently available. Although there are no Flood Zone maps available for these watercourses, it does not mean the watercourse does not pose a risk, it just means no modelling has yet been undertaken to identify the risk. The Flood Zones are not provided for specific sites or land where the catchment of the watercourse falls below 3km$^2$. For this reason, the Flood Zones are not of a resolution to be used as application evidence to provide the details of possible flooding for individual properties or sites and for any sites with watercourses on, or adjacent to the site. The RoFSW has been used in these cases because this provides a reasonable representation of the floodplain of such watercourses to use for a strategic assessment, however detailed modelling would be required as part of any site-specific flood risk assessment to support a planning application and site design.

## 5.2 Sites taken forward to a Level 2 assessment

All 105 sites provided by CCC were screened against fluvial, surface water, groundwater, reservoir, and sewer flood risk using available data. A Red-Amber-Green (RAG) system was applied to the sites on the basis, that: 'red' sites needed a Level 2 assessment, 'amber' sites did not need a Level 2 due to lower flood risk but are flagged in this report for developer considerations (recommendations provided in Section 5.3), and 'green' sites that had no/ negligible risk.

CCC reviewed these outputs and carried forward 19 sites flagged as requiring a Level 2 Assessment.

Sites were taken forward if they were at fluvial flood risk or if surface water risk was deemed significant. As there is not comparable risk mapping and limited data available to support a Sequential assessment of risk from other sources of flooding (groundwater, sewer flooding, reservoirs), where a site is identified as at risk from these sources but not fluvial/surface water these have been flagged Amber and noted in Section 5.3. Similarly, where there are concerns for access/egress routes but the site itself is at low risk, these sites have been marked Amber and noted in Section 5.3. In order to assess whether a site was deemed to have significant surface water risk, professional judgment was used based on the extent and location of the surface water issues relative to the site and access and egress; for example, if there was an area of deep ponding, a prominent flow route bisecting a site, immediate constraints to site access at the boundary, potential for highly vulnerable types of development to occupy a site etc.

Two proposed sites (CW1c and CW1e) are in close proximity and share boundaries. From a Local Plan site assessment point of view, they have similar suitability conclusions meaning they can be considered for allocation together and they have been assessed as one site.

Table 5-1 summarises the sites which required a detailed Level 2 assessment based on the above.

Table 5-1: Sites taken forward for Level 2 assessment

| Site Code | Location / Description | Primary reason for Level 2 | % of site within Flood Zone 3a | % of site within Flood Zone 2 | % of site within Flood Zone 1 | % of site in RoFSW 3.3% AEP extent | % of site in RoFSW 1% AEP extent | % of site in RoFSW 0.1% AEP extent |
|---|---|---|---|---|---|---|---|---|
| SGS1a - CW1a | Former Gas Works Wharf Road | Fluvial | 93.8 | 100.0 | 0.0 | 0.8 | 3.4 | 55.3 |
| SGS1a - CW1d | Baddow Road Car Park and Land to the East of the Car Park | Fluvial | 97.6 | 100.0 | 0.0 | 4.8 | 13.4 | 81.6 |
| SGA1a - CW1c / CW1e | Lockside & Travis Perkins Navigation Road Chelmsford | Fluvial | 46.8 | 81.4 | 18.6 | 7.2 | 15.4 | 40.2 |
| SGS1a - CW1f | Navigation Road Sites Chelmsford | Surface Water | 0.0 | 8.2 | 91.8 | 0.0 | 0.1 | 12.2 |
| SGS1d | Riverside Ice and Leisure Land | Fluvial | 58.7 | 72.6 | 27.4 | 23.1 | 41.5 | 59.5 |
| GS1g | Chelmsford Social Club | Fluvial | 99.5 | 100.0 | 0.0 | 18.5 | 53.2 | 99.8 |
| GS1n | Waterhouse Lane Depot & Nursery | Surface Water | 0.0 | 0.0 | 100.0 | 0.0 | 4.6 | 28.8 |
| SGS1w | Meadows Shopping Centre and Meadows Surface Car Park | Fluvial | 87.4 | 100.0 | 0.0 | 0.0 | 0.1 | 20.6 |
| SGS1y | Land between Hoffmans Way and Brook Street (Marriages Mill) | Surface Water | 0.0 | 0.0 | 100.0 | 30.8 | 42.9 | 75.7 |
| SGS1x | Former Kay-Metzeler, Brook Street | Surface Water | 0.0 | 0.0 | 100.0 | 14.2 | 22.0 | 31.7 |
| GS1z | Granary Car Park | Fluvial | 43.3 | 83.4 | 16.6 | 0.5 | 3.4 | 39.3 |
| GS12 | St Giles Moor Hall Lane | Surface Water | 0.0 | 0.0 | 100.0 | 13.2 | 25.1 | 58.6 |
| SGS16a (N) | East Chelmsford Garden Community (Hammonds Farm) | Surface Water | 0.0 | 0.0 | 100.0 | 1.1 | 3.0 | 9.4 |

| Site Code | Location / Description | Primary reason for Level 2 | % of site within Flood Zone 3a | % of site within Flood Zone 2 | % of site within Flood Zone 1 | % of site in RoFSW 3.3% AEP extent | % of site in RoFSW 1% AEP extent | % of site in RoFSW 0.1% AEP extent |
|---|---|---|---|---|---|---|---|---|
| SGS16a (S) | East Chelmsford Garden Community (Hammonds Farm) | Surface Water | 6.7 | 8.1 | 91.9 | 0.1 | 0.5 | 3.4 |
| GS1u | Rivermead, Chelmsford | Fluvial | 24.0 | 60.3 | 39.7 | 0.2 | 2.6 | 8.5 |
| SGS16b | Land adjacent to A12 Junction 18 | Surface Water | 13.6 | 17.3 | 82.7 | 4.7 | 12.9 | 19.4 |
| GS1v | Railway Sidings, Brook Street | Surface Water | 0.5 | 0.5 | 99.5 | 1.4 | 14.1 | 64.1 |
| GS17a | Land North of Abbey Fields, East Hanningfield | Surface Water | 0.0 | 0.0 | 100.0 | 4.2 | 10.2 | 68.4 |

The Flood Zone values quoted show the percentage of the site at flood risk from that Flood Zone/event but also include the percentage of the site at flood risk at a higher risk zone. For example, if 50% of a site is in the Flood Zones, taking each Flood Zone individually, 50% would be in Flood Zone 2 but say only 30% might be in Flood Zone 3a and only 10% in Flood Zone 3b. Flood Zone 1 is the remaining area of the site outside of Flood Zone 2, so Flood Zone 2 + Flood Zone 1 will equal 100%.

### 5.3 Sites with specific flood risk considerations not requiring a full Level 2 assessment

Following screening, some sites were identified to not be at significant risk of flooding requiring a Level 2 assessment, however had specific considerations that would need to be considered by developers either as part of a site-specific flood risk assessment or be addressed through the site design. These are summarised in Table 5-2.

Table 5-2 Sites not at significant flood risk, but with specific considerations that developers should address

| Site Code | Description | Specific Considerations |
|---|---|---|
| Residential Sites | | |
| GS1aa | Coval Lane Car Park | Defences close to site |
| GS1bb | Glebe Road Car Park | Defences close to site |
| SGS1e | Civic Centre Land, Fairfield Road | Defences close to site |
| SGS1f | Eastwood House Car Park, Glebe Road | Defences close to site, some surface water risk but hazard is low and should be manageable on site via appropriate SuDS design. |
| GS1h | Ashby House Car Parks New Street | Defences close to the site, some surface water risk which has the potential to impact access/egress, but most of the site remains low risk. Will require a site specific FRA demonstrating safe access and egress and/or a Flood Warning and Evacuation Plan. |
| GS1i | Rectory Lane Car Park West | Defences close to site |
| GS1k | Former Chelmsford Electrical and Car Wash Brook Street | Defences close to site |
| GS1l | BT Telephone Exchange Cottage Place | Defences close to site |
| GS1m | Rectory Lane Car Park East Rectory Lane | Defences close to site |
| GS1t | Car Park R/O Bellamy Court Broomfield Road | Defences close to the site, some surface water risk, but most of the site remains low risk. Will require a site specific FRA. |

| Site Code | Description | Specific Considerations |
|---|---|---|
| GS1p | British Legion New London Road | Defences close to site |
| SGS3c | East of Chelmsford - Land South of Maldon Road | Surface water flows originate from the site, but site itself is low risk- potential mitigations to help alleviate issues downstream should be considered as part of development. |
| GS3d | East of Chelmsford - Land North of Maldon Road | Defences close to site |
| SGS7b | Great Leighs - Land East of London Road | One area of significant surface water ponding in the north of site, but majority of the site is unaffected. |
| SGS8 | North of Broomfield | Defences close to site |
| Employment Sites | | |
| SGS3b | East Chelmsford - Land North of Maldon Road (Employment) | Defences close to site |
| GS9a | Waltham Road Employment Area | Watercourse flows close to northern boundary of the site. Topography suggests the site is unlikely to be at risk, but this should be confirmed through a site-specific flood risk assessment including modelling. |
| SGS15 | Little Boyton Hall Farm Employment Area | Defences close to site |

For sites where it is noted that defences are close to the site, the site itself is at low risk in undefended model scenarios, but there are defences close to site- developers should confirm there is no risk to the site from breach/overtopping both now and in the future and confirm with CCC/the EA that land within the site boundary will not be required for defences in future.

### 5.4 Site summary tables

As part of the Level 2 SFRA, detailed site summary tables have been produced for the sites listed above in Table 5-1. The summary tables can be found in Appendix A. Each summary table sets out the following information:

- Basic site information.
- Location of the site in the catchment.
- Area, type of site, current land use (greenfield/ brownfield), proposed site use.
- Sources of flood risk.
- Existing drainage features.

- Fluvial – proportion of site at risk including description from mapping/modelling, utilising depth, hazard, and velocity information from detailed hydraulic models where available.
- Surface Water – proportion of site at risk including description from RoFSW mapping using available depth, hazard, and velocity information
- Reservoir flood risk in both the 'Dry Day' and 'Wet Day' scenarios.
- Flood history - historic incidents on or surrounding the site from the EA Recorded Flood Outline and Historic Flood Map datasets and historic incidences provided by CCC and ECC.
- Flood risk management infrastructure.
- Description of residual risk.
- Emergency Planning.
- Flood Warning and Alert Areas.
- Access and egress.
- Fluvial climate change - summary of available climate change allowances and increase in flood extent compared to the 1% AEP event (Flood Zone 3a).
- Surface water climate change - summary of available climate change allowances and increase in flood extent compared to the 1% AEP event.
- Requirements for drainage control and impact mitigation.
- Broadscale assessment of possible SuDS to provide indicative surface water drainage advice for each site assessed for the Level 2 SFRA.
- Groundwater Source Protection Zones.
- Historic landfill sites.
- NPPF Planning implications.
- Exception test requirements.
- Requirements and guidance for site-specific FRA (including consideration of opportunities for strategic flood risk solutions to reduce flood risk).
- Key messages – summarising considerations for the exception test to be passed (where required).
- Mapping information – description of data sources for the mapped outputs used within the assessment.

# 6 Flood Risk Management Requirements for Developers

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

This report alongside the Level 1 SFRA provides a strategic assessment of flood risk in Chelmsford. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk, and any defences at a site, are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourse 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 undertaken for a windfall site may find that the site is entirely inappropriate for development of a particular vulnerability, or even at all.

The EA advise that large development sites and associated new infrastructure may be able to deliver ways to reduce the risk of flooding (from all sources) on the site and also off the site where a stand-alone flood alleviation scheme is not viable. On these sites, early engagement with the EA is recommended. The EA also request that any development close to the edge of the floodplain is set back as much as possible leaving a development buffer, as a precautionary approach.

Developers should refer to the following sections of the Level 1 SFRA report for further information on the requirements for development.

- Section 8.1 - Principles for new developments
  - This section provides guidance for developers on applying the sequential and exception tests, consulting with statutory consultees, considering the risk from all sources of flooding, ensuring development seeks to reduce flooding and is safe for future users, enhancing the natural river environment and floodplain, and contributing to wider flood mitigation strategy within Chelmsford.
- Section 8.2 - Requirements for site-specific Flood Risk Assessments
  - When is an FRA required? (8.2.1)
  - Objectives of a site-specific FRA (8.2.2)
  - Site layout and design (8.3.1)
  - Modification of ground levels (8.3.2)
  - Raised floor levels (8.3.3)
  - Development and raised defences (8.3.4)
  - Developer contributions (8.3.5)
  - Buffer strips (8.3.6)
  - Making space for water (8.3.7)

## 6.1 Flood warning and emergency planning

Appendix D of the Level 1 SFRA details the EA Flood Warning's and Flood Alert's available within Chelmsford at the time of publication. This Level 2 assessment has identified several proposed sites located within existing EA FWAs. For proposed development within existing EA FWAs, developers should consult the EA to ensure that adequate flood warning procedures and evacuation processes are in place and that RMAs are not put under any additional burden.14

Section 8.6 of the Level 1 SFRA report discusses NPPF requirements and what an emergency plan will need to consider and other relevant information on emergency planning. Further information is provided on CCC's 'Emergency Planning Information' page available here.

## 6.2 Reservoirs

This Level 2 SFRA identified 7 sites assessed within the site summary tables that are shown to be at risk of reservoir flooding during a 'Dry Day' scenario and 13 sites in a 'Wet Day' scenario. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is very low. However, there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific FRA (where relevant).

Section 8.5.3 of the Level 1 SFRA report details considerations that developers should follow when allocating development downstream of a reservoir.

## 6.3 Duration and onset of flooding

The duration and onset of flooding affecting a site depends on several factors:

- The position of the site within a river catchment, with those at the top of a catchment likely to flood sooner than those lower down. The duration of flooding tends to be longer for areas lower in river catchments.
- Reservoirs in upper catchments will provide some online flood storage that reduces the flood risk downstream and delays the onset of flooding. At the confluence of the larger watercourses and smaller tributaries, there may be different timings of peak flows, for example smaller tributaries would peak much earlier than watercourses with larger catchments.
- The principal source of flooding: where this is surface water, depending on the intensity and location of the rainfall, flooding could be experienced within 30 minutes of the heavy rainfall event e.g., a thunderstorm. Typically, the duration of flooding for areas at risk of surface water flooding, or from flash flooding from small watercourses, is short (hours rather than days).
- The preceding weather conditions prior to the flooding: wet weather lasting several weeks will lead to saturated ground. Rivers respond much quicker to rainfall in these conditions.

- Whether a site is defended, noting that if the defences were to fail, a site could be affected by very fast flowing and hazardous water within 15 minutes of a breach developing (depending on the size of the breach and the location of the site in relation to the breach), causing danger to life.
- Catchment geology: the permeability of a catchment affects its response time, for example chalk catchments take longer to respond than clay catchments.

Table 6-1 provides guidelines on the typical response time that may be expected for fluvial and surface water flooding. However, these are only broad guidelines, and it is recommended that a site-specific FRA refines this information based on more detailed modelling work where necessary.

Table 6-1: Guidelines on the duration of and onset of flooding

| Principal source of flooding | Duration | Onset |
|---|---|---|
| Surface water | Up to 4 hours | Within 30 minutes |
| Fluvial | Between 4 and 24* hours | Within 2 to 8 hours |

*Depending on where in the catchment a site is located, flooding could be rapid and flashy in the upper catchment (e.g. small tributaries), and slower responding and longer in duration in the lower catchment.

# 7 Surface Water Management and SuDS

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

The Level 1 SFRA summarises guidance and advice on managing surface water runoff and flooding in Section 9. Below is a guide to what is included in sections not expanded on here, for reference alongside this Level 2 SFRA:

- Section 9.1 - Role of the LLFA and LPA in surface water management
- Section 9.2 - Sustainable Drainage Systems (SuDS)
- Section 9.3 - Sources of SuDS guidance
- Section 9.4 - Other surface water considerations covering Groundwater Vulnerability Zones, Groundwater Source Protection Zones, Nitrate Vulnerable Zones (NVZs).

## 7.1 SuDS suitability across the study area

The permeability of the underlying soils can determine the infiltration capacity and percolation capacities. As such, a review of the soil characteristics has been undertaken using Soilscapes online soil maps of England and Wales which allow for a basic assessment of the soil characteristics and infiltration capacity. Soilscapes is not intended as a means for supporting detailed assessments, specific site investigations should be undertaken to determine the soil types across the study area. A high-level assessment of the suitability of SuDS is included in the site tables in Appendix A.

This strategic assessment should not be used as a definitive site guide as to which SuDS would be suitable but rather as an indicative guide of general suitability based solely on soil type. Several other factors can determine the suitability of SuDS techniques including land contamination, the depth and fluctuation of the water table, the gradient of local topography and primary source of runoff etc. When considering NVZs and if areas have pollutants, infiltration may only be suitable where treatment measures are provided, prior to any discharge to surface or groundwaters.

Further site-specific investigation should be conducted to determine what SuDS techniques could be utilised at a particular development. The result of this assessment does not remove the requirements for geotechnical investigation or detailed infiltration testing and does not substitute the results of site-specific assessments and investigations. The LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors. ECC as LLFA have set out their requirements for developers in the ECC SuDS Strategy (2017) which is available here.

# 8 Summary of Level 2 assessment and recommendations

## 8.1 Assessment methods

As part of the Level 2 SFRA 19 sites have been assessed with detailed site summary tables. Additional sites with some surface water issues identified have been grouped due to similarly applicable recommendations and are included in Section 5.3 and Appendix C of this report.

The summary tables set out the flood risk to each site, including Flood Zone coverage, and the modelled extents, depths, velocities, and hazard ratings of fluvial flooding (where hydraulic model data is available) and surface water flooding. Climate change mapping has also been used to indicate the impact which different climate change allowances may have on the sites (where appropriate model runs are available) or using Flood Zone 2 as an indication of climate change. Each table also sets out the NPPF requirements for the site as well as guidance for site-specific FRAs.

A broadscale assessment of suitable SuDS options has been provided giving an indication where there may be constraints to certain sets of SuDS techniques. This assessment is indicative and more detailed assessments should be carried out during the outline site planning stage by the developer to confirm the feasibility of different types of SuDS. It may be possible that those SuDS techniques highlighted as possibly not being suitable can be designed to overcome identified constraints.

Interactive mapping is shown in Appendix C and should be viewed alongside the detailed site summary tables in Appendix A. There are hydraulic model outputs available across large parts of the study area (River Chelmer (2020), Chelmer Tributaries (2020), River Crouch (2007), Rettendon Fen (2014), and Sandon Brook (2015). More information on the models are in Section 3.1), but where models are unavailable, the EA's Flood Zones from the FMfP have been used. Also, where the watercourses are smaller and not represented in the Flood Zones, the RoFSW mapping datasets have been used.

The Level 2 SFRA also identifies the need to consider the implications of allocating land that could potentially be affected by other sources of flooding, including groundwater and reservoir flood risk.

## 8.2 Considering the exception test for the proposed sites in Chelmsford

In principle, it is possible for the majority of sites assessed in the Level 2 SFRA to satisfy the flood risk element of the exception test, for example by:

- Siting development away from the highest areas of risk into Flood Zone 1 (in the majority of sites assessed, the risk is either along a site boundary or the risk is posed by a flow path running through the site, so steering away from this is advised),

- Considering safe access/ egress in the event of a flood (from all parts of the site, if say the site is severed by a flood flow path),
- Using areas in Flood Zone 2 and 3a for the least vulnerable parts of the development in accordance with Table 2 (Flood risk vulnerability and flood zone 'incompatibility') in the PPG. No development at all should be permitted in Flood Zone 3b (aside from essential infrastructure, such as a bridge crossing the lowest points of a site),
- Testing flood mitigation measures if these are to be implemented, to ensure that they will not displace water elsewhere (for example, if land is raised to permit development in one area, compensatory flood storage will be required in another),
- Considering space for green infrastructure in the areas of highest flood risk where this is appropriate,
- No dry islands will be created as a result of development on sites reaching this stage.

Consideration should be given to the surface water risk within Chelmsford as all sources of flooding should be considered in the Sequential Test. Whilst the Exception Test is only explicitly required for sites at fluvial risk, it is important to recognise that there exist sites that are at significant risk of flooding from other sources, and CCC should carefully consider the benefits of developing these high risk sites against the risk. Care should be taken with use of the national EA RoFSW map as it does not account for culverts, structures, channel hydraulics, or sewer capacity, and therefore can provide an overestimated risk. It is recommended that developers investigate surface water risk in more detail at the planning application stage and may need to consider undertaking integrated modelling.

If larger sites are split in future into smaller land parcels for development, and some of those parcels are in areas of flood risk, the exception test may need to be re-applied by the developer at the planning application stage.

At planning application stage, the developer must design the site adopting the sequential approach in line with the recommendations in national and local Planning Policy and supporting guidance and those set out in this SFRA.

## 8.3 Planning policy recommendations

The planning policy recommendations in Section 10.2 of the Level 1 SFRA report still stand for the site allocations and any windfall development that comes forward and should be referred to alongside this report.

## 8.4 Guidance for windfall sites and sites not assessed in Level 2 SFRA

- For sites not represented in the EA's Flood Zones, or where Flood Zones do exist, but no detailed hydraulic modelling is present, it is recommended that developers construct detailed hydraulic models at these sites as part of a site-specific FRA using channel, structure, and topographic survey, to confirm flood risk during the 1% AEP plus climate change 'design event'. Site-specific flood

modelling will likely need to be developed in locations where it is necessary to understand the effects of proposed development schemes on the existing flood flow paths and flood volume storage, in the present day and in the future.

- If a site's extent includes or borders an EA Main River (including a culverted reach of a Main River), an easement of 8m is required from both banks for access and maintenance. Any future development will require a flood risk permit 1 for any activity within 8m of a Main River.
- If an ordinary watercourse is within or immediately adjacent to the site area, consultation with the LLFA (ECC) should be undertaken. If alterations or discharges are proposed to the watercourse, a land drainage consent will be required.
- Where necessary, blockages of nearby culverts may need to be simulated in a hydraulic model to confirm residual risk to the site.
- Surface water risk should be considered in terms of the proportion of the site at risk in the 3.3%, 1%, and 0.1% AEP events (with an appropriate allowance for climate change), whether the risk is due to isolated minor ponding or deeper pooling of water, or whether the risk is due to a wider overland flow route.
- Surface water risk and mitigation should be considered as part of a detailed site-specific FRA and surface water drainage strategy.
- Access and egress should be considered at the site, but also in the vicinity of the site, for example, a site may have low surface water risk, but in the immediate locality, access/egress to and from the site could be restricted for vehicles and/ or people.
- If a site is located within 250m of a landfill site, there could be amenity, dirt, and contamination issues. Sites could be sensitive from the perspective of controlled waters and therefore any redevelopment must ensure there is no pollution risk to the water environment.

## 8.5 Use of SFRA data and future updates

It is important to recognise that this SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

The SFRA should be a 'living document', and as a result should be updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by ECC, Anglian Water, and the EA. Such information may be in the form of:

- New hydraulic modelling results.
- Flood event information following a future flood event.
- Policy/ legislation updates.
- EA flood map updates.

1 Flood risk activities: environmental permits - GOV.UK (www.gov.uk)

- New flood defence schemes, or alleviation schemes.

The EA regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed FRA. The EA are also currently undertaking new nationalised modelling (NaFRA2) which is due to go live in August 2024, although these timescales are subject to change due to the complexities of this project.

It is recommended that the SFRA is reviewed in line with the EA's Flood Zone map updates to ensure latest data is still represented in the SFRA, allowing a cycle of review and a review of any updated data by checking with the above bodies for any new information.

# Appendices (Provided as separate documents)

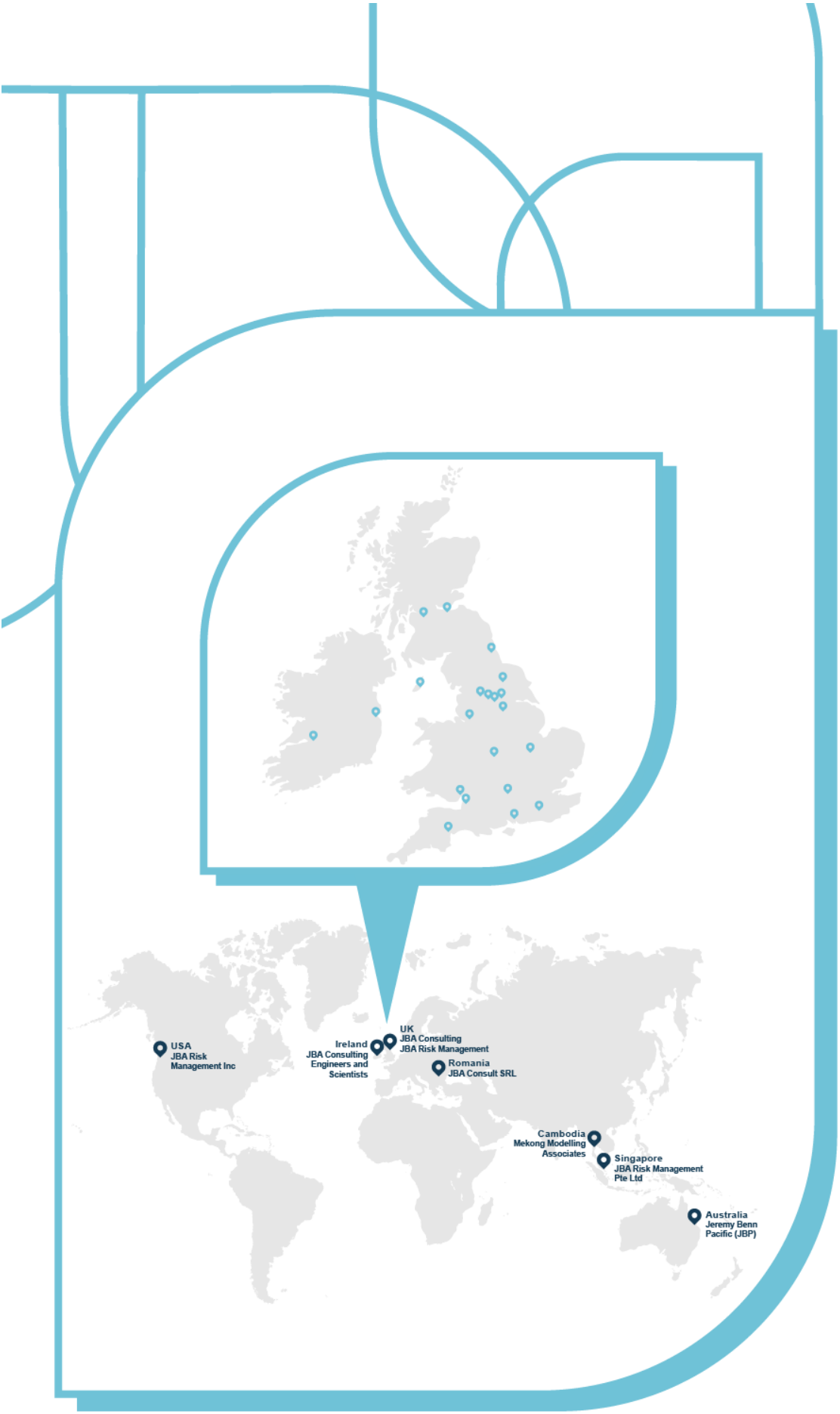
## A Site Summary Tables

## B GeoPDF Mapping

To accompany each site summary table, there is an interactive GeoPDF map, with all the mapped flood risk outputs per site. GeoPDFs should be opened with Adobe. They display the mapping datasets relevant to this report for each site. Datasets shown in the legend can be switched on and off using the tick boxes.

## C User Guide

The accompanying User Guide provides further details about the datasets used within the GeoPDF maps.

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