Uttlesford District Council Level 1 Strategic Flood Risk Assessment

Final Report

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Revision history

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Contract

This report describes work commissioned by Luke Mills, on behalf of Uttlesford District Council by an email dated 12th April 2021. Louise Goode, Emily Jones, Joanne Chillingworth, Alex Clark and Dularee Goonetilleke of JBA Consulting carried out this work.

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Purpose

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Acknowledgements

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- Uttlesford District Council
- Environment Agency
- Essex County Council
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- Planners at the neighbouring authorities

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Executive summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the production of the new Local Plan. This is a Level 1 Strategic Flood Risk Assessment (SFRA) and it will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

Introduction

This Level 1 Strategic Flood Risk Assessment (SFRA) updates the 2016 Level 1 SFRA. This study will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk and provides a comprehensive and robust evidence base to support the new Uttlesford District Council Local Plan. The key objectives are:

- To update the Council's 2016 SFRA, taking into account the most recent policy and legislation in the National Planning Policy Framework.
- To collate and analyse the latest available information and data for current and future (i.e. climate change) flood risk from all sources, and how these may be mitigated.
- To inform decisions in the emerging Local Plan, including the selection of development sites and planning policies.
- To provide evidence to support the application of the Sequential Test for the allocation of new development sites, to support the Council's preparation of the Local Plan.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the emerging Local Plan.
- To provide advice for applicants carrying out site-specific Flood Risk Assessments and outline specific measures or objectives that are required to manage flood risk.

Summary of flood risk in Uttlesford District

- There are numerous recorded flooding incidents across the district. Areas include, but are not limited to, Ashdon, Clavering, Debden, Elsenham, Great and Little Chesterford, Great and Little Dunmow, Great Sampford, Hatfield Heath, Little Hallingbury, Little Walden, Newport, Saffron Walden, Sewards End, Stansted Mountfitchet, Stebbing, Takeley and Thaxted. Sources of past flooding have been predominantly from main rivers, ordinary watercourses and surface water.

- There are three major river catchments within the Uttlesford district: Great Ouse, North Essex and Thames. The main rivers associated with fluvial flooding in the Great Ouse catchment are the River Cam and associated tributaries such as The Slade, Flufen Slade, Debden Water amongst others. Flooding occurs along the course of the rivers, mainly affecting Saffron Walden and Newport. The North Essex catchment has the River Chelmer, Pant, Can and Stebbing Brook amongst others. The Chelmer passes through areas such as Great Dunmow where there is greater risk. The Thames catchment's main rivers include the Stort, Roding, Stansted and Pincey Brook to name some. The main areas of fluvial flood risk are along the River Stort and Pincey Brook, near Stansted Airport and Stansted Mountfitchet. A large number of the rivers across the district flow through rural catchments with smaller villages. Overall, flood extents across the district are generally confined with little difference between Flood Zone 2 and 3, due to the narrow floodplains in the upper reaches with the district being home to the source of these rivers.

- Surface water risk largely follows the topography of the watercourses. There are a few areas where there are additional smaller flow paths, and minor areas of ponding. Surface water is also often impounded by roads or rail embankments, such as at Stansted Mountfitchet and the M11. Areas identified with high-risk surface water extents (30-year event) are Saffron Walden Clavering, Great Dunmow, Manuden, Radwinter, Takeley, Thaxted and Stansted Mountfitchet. Other areas within Uttlesford District that have been identified as having a surface water flooding problem through the flood history review include Little Hallingbury and Little Dunmow.
- Data from Anglian Water and Thames water shows that sewer flooding is limited and very localised.
- Areas at risk of flooding today are likely to become at increased risk in the future and the frequency of flooding will also increase in such areas as a result of climate change. Flood extents are likely to increase; in most locations, this may not be by very much as the floodplain topography is confined, but flood depth, velocity and hazard may have more of an impact due to climate change. It is recommended that the Council works with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the district.
- The JBA Groundwater Flood Risk Map shows that, in general, the majority of the Uttlesford District is not susceptible to groundwater flooding. However, there are areas where groundwater varies from 5m below ground level, to some areas where it is less than 0.025m below ground level. This appears to be in line with the flood extents of the River Stort, Stansted Brook, Bourne Brook, and the River Cam and its tributaries of Wicken Water, The Slade, Flufen Slade, Debden Water and an unnamed tributary. Therefore, along the course of these rivers and their surrounding floodplains, the risk of flooding from groundwater is relatively high. There are also smaller pockets of areas where groundwater is 0.5 – 5m below ground level along the River Chelmer and Pant.
- There are no canals in the Uttlesford District, therefore there is no risk of canal overtopping or breach.
- There is a potential risk of flooding from four reservoirs, both inside and outside the district boundary, but there are no records of flooding from reservoirs in the study area. The level and standard of inspection and maintenance required under the Reservoirs Act 1975 means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant).

How to use this report

Planners

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

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

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

Developers

This SFRA provides guidance for the application of the Sequential and Exception Tests at a site level and for detailed site-specific Flood Risk Assessments.

For sites that are not strategic allocations, developers will need to use this SFRA to help apply the Sequential Test. For all sites, whether strategic allocations or windfall sites, developers will need to apply the Exception Test and use information in a site-specific Flood Risk Assessment to inform this test at planning application stage.

When assessing sites not identified in the Local Plan (windfall sites), developers should use evidence provided in this SFRA to apply the Sequential Test as well as providing evidence to show that they have adequately considered other reasonably available sites.

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

Developers can use the information in this SFRA, alongside site-specific research to help scope out what additional work will be needed in a detailed Flood Risk Assessment. To do this, they should refer to Chapter 5, Appendix A (Interactive PDF mapping) and Appendix B (Data sources used in the SFRA). At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances, last updated by the Environment Agency in 2021), inform Masterplanning and prove, if required, whether the Exception Test can be passed. As part of the Environment Agency's updated guidance on climate change, which must be considered for all new developments and planning applications, developers will need to undertake a detailed assessment of climate change as part of the planning application process when preparing FRAs.

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

Flood Risk Assessments will need to identify how flood risk will be mitigated to ensure the development is safe from flooding. In high-risk areas, the Flood Risk Assessment will also need to consider emergency arrangements, including how there will be safe access and egress from the site.

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

Cumulative impacts

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

Neighbourhood plans

The SFRA provides information on the sources of flooding and the variation in the risk across the district, which organisations are involved in flood risk management and their latest strategic plans, current plans for major flood defences, the requirements for detailed Flood Risk Assessments and to inform the site selection process.

Neighbourhood planners can use this information to assess the risk of flooding to sites within their community, using Chapter 5, the sources of flooding in Uttlesford District and the flood mapping in the appendices. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas.

These maps highlight on a broadscale where flood risk from fluvial, surface water, groundwater and the effects of climate change are most likely. These maps are useful to provide a community level view of flood risk but may not identify if an individual property is at risk of flooding or model small scale changes in flood risk. Local knowledge of flood mechanisms will need to be included to complement this broadscale mapping. Similarly, all known recorded historical flood events for the district are listed in Section 5.1 and this can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned by Essex County Council are outlined in Section 6.4 and Section 8.4 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

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Abbreviations and definitions

Term	Definition
1D model	One-dimensional hydraulic model
2D model	Two-dimensional hydraulic model
AEP	Annual Exceedance Probability – The probability (expressed as a percentage) of a flood event occurring in any given year.
AStGWf	Areas Susceptible to Groundwater flooding
Brownfield	Previously developed parcel of land
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CDA	Critical Drainage Area - A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Cumecs	A measure of flow rate. One cumec is shorthand for cubic metre per second; also m^3/s.
Defra	Department for Environment, Food and Rural Affairs
Design flood	This is a flood event of a given annual flood probability, which is generally taken as "fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year)"
DTM	Digital Terrain Model
DPD	Development Plan Document
EA	Environment Agency
EU	European Union
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.
FCERM	Flood and Coastal Erosion Risk Management
FEH	Flood Estimation Handbook
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Map for Planning	The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.

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

RFCC's	Regional Flood and Coastal Committee
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	Operating authorities who's remit and responsibilities concern flood and / or coastal risk management.
RoFfSW	Risk of Flooding from Surface Water (formerly known as the Updated Flood Map for Surface Water (uFMfSW))
Sequential Test	Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.
SPD	Supplementary Planning Document
SPZ	(Groundwater) Source Protection Zone
Stakeholder	A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
WFD	Water Framework Directive – Under the WFD, all waterbodies have a target to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP) by a set deadline. River Basin Management Plans (RBMPs) set out the ecological objectives for each water body and give deadlines by when objectives need to be met.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

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

JBA Consulting completed the first Level 1 Strategic Flood Risk Assessment (SFRA) for Uttlesford District Council in 2016.

The Council require an up-to-date SFRA in order to support the development of their Local Plan and future selection of site allocations, as well as for use for future development management and policy decisions. The SFRA will form part of the evidence base and provide the opportunity to bring together the latest flood risk datasets from all the relevant Risk Management Authorities (UDC, Essex County Council (ECC) as Lead Local Flood Authority (LLFA) and Highways Authority, Anglian Water and Thames Water and the Environment Agency (EA)).

This SFRA replaces the Level 1 SFRA published by the Council in 2016 and will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

1.2 Local Plan

The Uttlesford District New Local Plan will update the local planning policy framework currently set by the Core Strategy (2013) and the Delivery Development Plan Document (DPD) (2019) and will look forward to at least 2036. The aim of the Local Plan is to establish a planning framework for future development, identifying how much land is available and where such land should be provided for new homes and employment, alongside associated infrastructure.

1.3 Levels of SFRA

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

- **Level 1**: where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient detail to enable application of the Sequential Test.
- **Level 2**: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all necessary development, creating the need to apply the National Planning Policy Framework's (NPPF) Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This is a Level 1 SFRA with the aim of providing guidance to planners and developers on flood risk and to enable the application of the Sequential Test.

The key objectives are:

- Critically review and update the 2016 SFRA, taking into account the latest flood risk information and any updates to legislation and policy.
- Provide an individual flood risk analysis of the Areas of Search identified within the district as part of the Local Plan preparation.

- Provide mapping showing the Flood Zones for planning and flood risk from other sources in accordance with the provision of national flood risk guidance.

1.4 SFRA outputs

- Identification of policy and technical updates.
- Identification of any strategic flooding issues which may have cross boundary implications.
- Appraisal of all potential sources of flooding, including main river, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals.
- Review of historic flooding incidents.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- Mapping showing distribution of flood risk across all Flood Zones from all sources of flooding including climate change allowances.
- Assessment of the potential increase in flood risk due to climate change.
- Flood Risk Assessment guidance for developers.
- Assessment of surface water management issues, how these can be addressed through development management policies and the application of Sustainable Drainage Systems.
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.

1.5 SFRA study area

Uttlesford District (Figure 1-1) is situated in the west of Essex County. Its main towns are Great Dunmow and Saffron Walden. The district is relatively rural but is under continuous development pressure as a consequence of the proximity to London, Stansted International Airport and development of the M11 corridor.

Figure 1-2 also shows the neighbouring Authorities surrounding Uttlesford District.

Uttlesford District is at the watershed of three major river catchments: Great Ouse (River Cam, The Slade, River Bourn); Thames (River Roding, Pincey Brook, River Stort, Bourne Brook, Stansted Brook, Ugley Brook), and North Essex (River Pant, River Chelmer, Stebbing Brook, River Ter, River Can). As a consequence, the SFRA will need to consider downstream impacts of development and land use change.

Many of the settlements across Uttlesford have experienced flooding in the past, including (but not limited to) Arkesden, Ashdon, Berden, Birchanger, Clavering, Debden, Elsenham, Great Chesterford, Great Dunmow, Great Sampford, Hadstock, Hatfield Heath, Hazelend, Hempstead, Henham, Howe Green, Littlebury, Little Hallingbury, Little Walden, Manuden, Newport, Quendon, Radwinter, Saffron Walden, Sewards End, Stansted Mountfitchet, Stebbing, Takeley, Thaxted, Wendens Ambo, Ugley, White Roding, Wicken Bonhunt and Wimbish. Sources of past flooding have been predominantly from main rivers, ordinary watercourses and surface water.

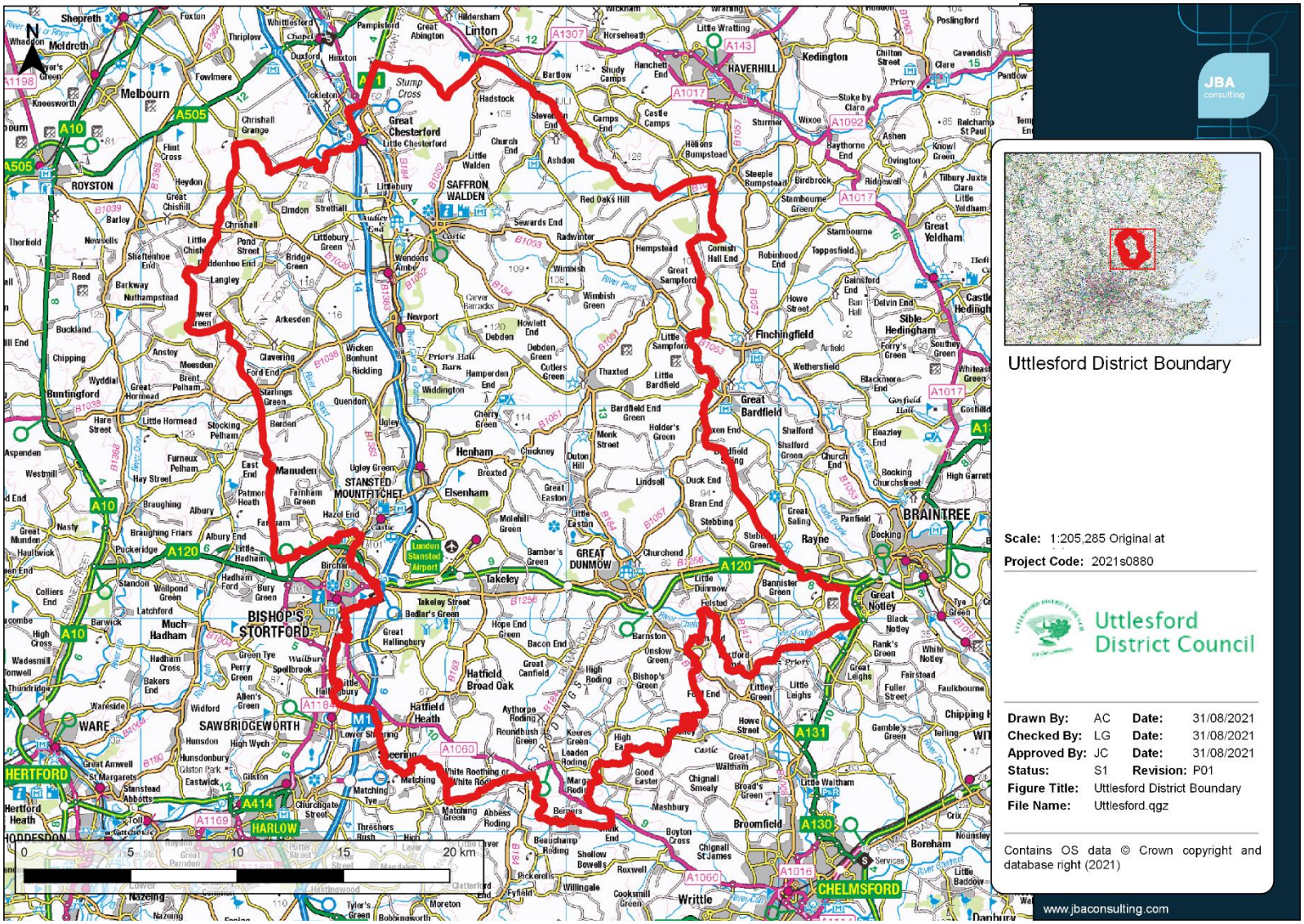


Figure 1-1: Uttlesford District Council study area

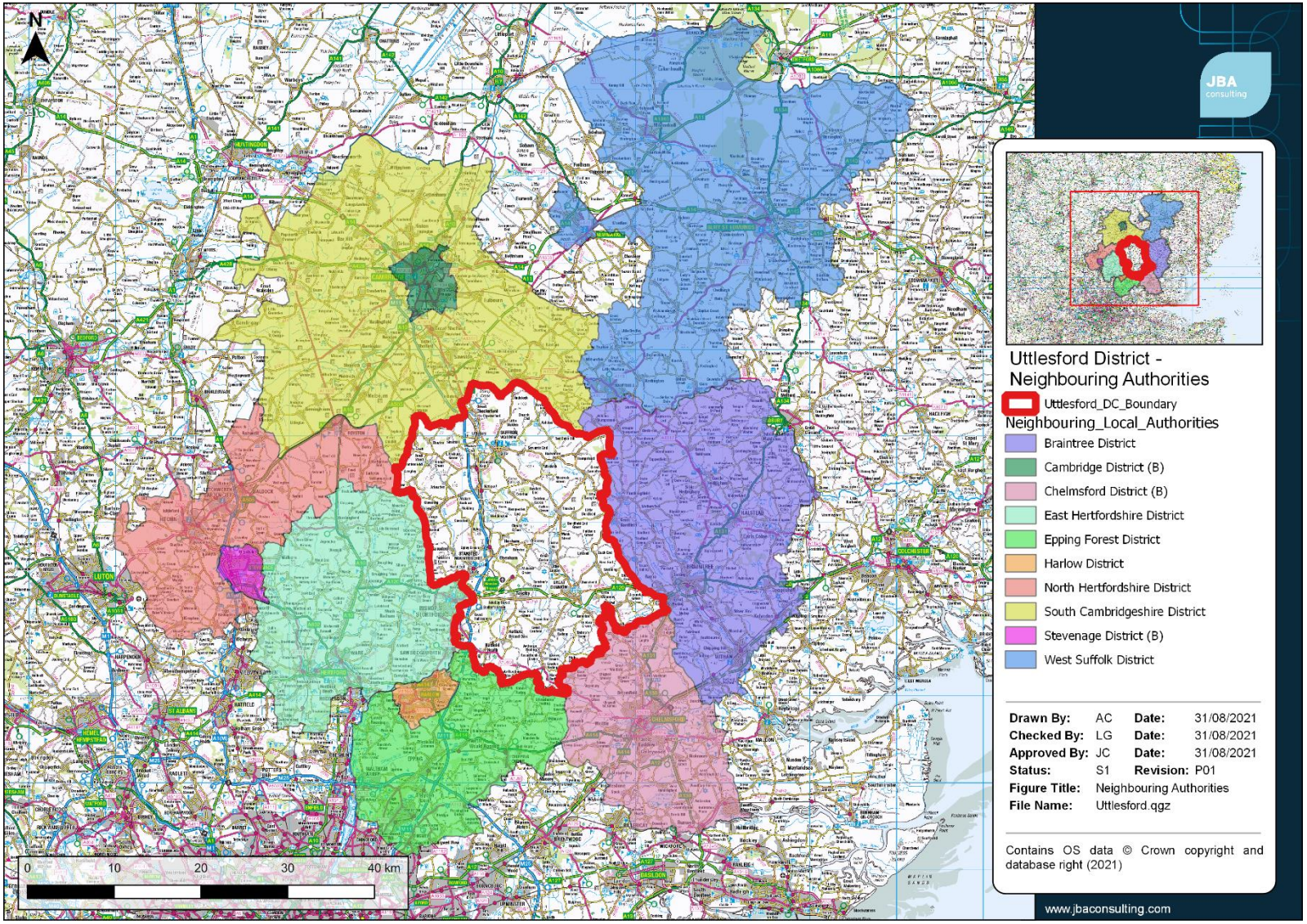


Figure 1-2: Neighbouring local authorities

Uttlesford District consists of a number of watercourses flowing away from the centre of the district to beyond its boundary. The principal watercourses in the Uttlesford District are:

- The River Cam (or Granta) in the north of the district
- The River Pant in the east of the district
- The River Chelmer and Stebbing Brook in the southeast of the district
- The River Roding, River Stort, Pincey Brook and Stansted Brook in the south and west of the district.

There are numerous tributaries to these watercourses including smaller Ordinary Watercourses and unnamed drains. A summary of the principal watercourses within the Uttlesford District are provided in Appendix A.

Uttlesford is one of the driest parts of the UK, with an average annual rainfall of 500 mm.

Figure 1-3 shows a map of the key watercourses within Uttlesford District.

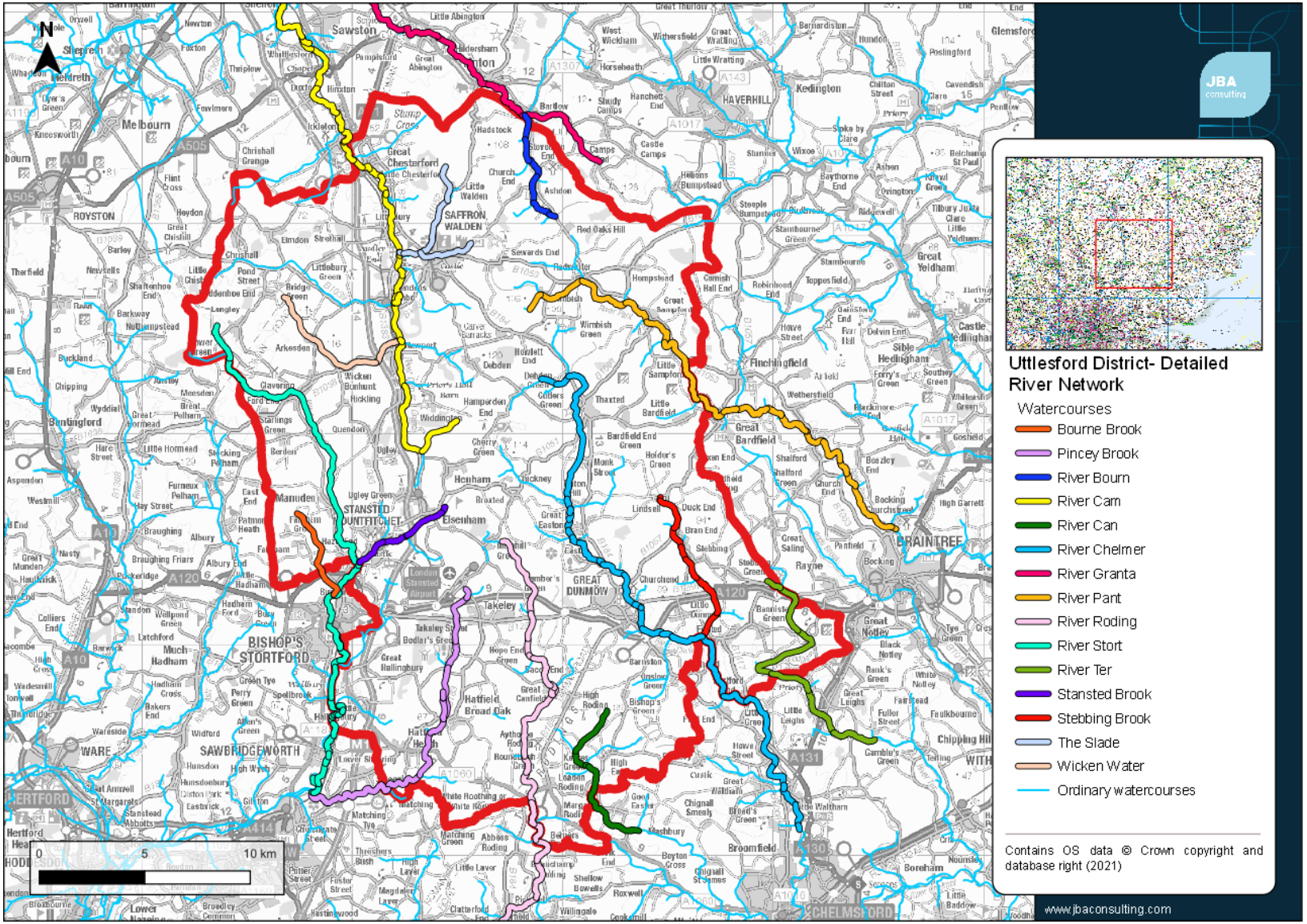


Figure 1-3: Key Watercourses

1.6 Consultation

The following parties (external to Uttlesford District Council) were consulted to inform the SFRA:

- Essex County Council
- Environment Agency
- Thames Water
- Anglian Water
- Essex Fire and Rescue Service
- Neighbouring authorities:
    - Braintree District
    - South Cambridgeshire District
    - North Hertfordshire District
    - East Hertfordshire District
    - Epping Forest District
    - Chelmsford District
    - Cambridge District, Harlow District and Stevenage District are also located nearby, enveloped within one or more of the neighbouring authorities above.

1.7 Use of SFRA data

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

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

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

Key reference material such as external guidance documents/ websites are provided in **green** throughout the SFRA.

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

On the date of publication, the SFRA contains the latest flood risk information. Over time, new information will become available to inform planning decisions, such as updated hydraulic models (which then update the Flood Map for Planning), flood event information, new defence schemes and updates to policy and legislation. Developers should check the online **Flood Map for Planning** (https://flood-map-for-planning.service.gov.uk/) in the first instance to identify any major changes to the Flood Zones.

1.8 Structure of this report

Section	Contents	How to use
Executive Summary	Focuses on how the SFRA can be used by planners, developers and neighbourhood planners	Summarises the Level 1 findings and recommendations.
1. Introduction	Provides a background to the study, the Local Plan stage the SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA Provides a short introduction to how flood risk is assessed and the importance of considering all sources Includes this table of the contents of the SFRA	For general information and context.
2. Flood risk policy and strategy	Sets out the relevant legislation, policy and strategy for flood risk management at a national, regional and local level.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	Provides an overview of both national and existing Local Plan policy on flood risk management This includes the Flood Zones, application of the Sequential Approach and Sequential/Exception Test process. Provides guidance for the Council and Developers on the application of the Sequential and Exception Test for both allocations and windfall sites, at allocation and planning application stages.	Users should use this section to understand and follow the steps required for the Sequential and Exception Tests.
4. Impact of climate change	Outlines the latest climate change guidance published by the Environment Agency and how this was applied to the SFRA Sets out how developers should apply the guidance to inform site specific Flood Risk Assessments	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
5. Understanding flood risk in Uttlesford District	Provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding incidents, flood risk from all sources and flood warning arrangements.	This section should be used to understand all sources of flood risk in the district, including where has flooded historically. This section may also help identify any data gaps, in conjunction with Appendix B.
6. Flood alleviation schemes and assets	Provides a summary of current flood defences and asset management and future planned schemes. Introduces actual and residual flood risk.	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site-specific stage.
7. Cumulative impact of development and strategic solutions	This section provides a summary of the catchments with the highest flood risk and development pressures, considers opportunities for strategic flood risk solutions and makes recommendations for	Planners should use this section to help develop policy recommendations for the cumulative impact of development.

	local planning policy based on these.	
8. Flood risk management for developers	Guidance for developers on Flood Risk Assessments, considering flood risk from all sources	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed, as well as mitigation options.
9. Surface water management and Sustainable Drainage Systems	An overview of Sustainable Drainage Systems, Guidance for developers on Surface Water Drainage Strategies, considering any specific local standards and guidance for Sustainable Drainage Systems (SuDS) from the Lead Local Flood Authority.	Developers should use this section to understand what national, regional and local SuDS standards are applicable. Hyperlinks are provided.
10. Summary and recommendations	Summarises sources of flood risk in the study area and outlines planning policy recommendations	Developers and planners should use this as a summary of the SFRA. Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.
Appendices	• Appendix A: Interactive flood risk maps • Appendix B: Data sources used in the SFRA • Appendix C: SFRA User Guide • Appendix D: Flood Alert and Flood Warning Areas • Appendix E: Summary of flood risk across the district • Appendix F: Full history of flood risk across the district	Planners should use these appendices to understand what data has been used in the SFRA, to inform the application of the Sequential and Exception Tests, as relevant, and to use these maps and tabulated summaries of flood risk to understand the nature and location of flood risk.

1.9 Understanding flood risk

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

1.9.1 Sources of flooding

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

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

- Groundwater - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- Infrastructure failure - reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

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

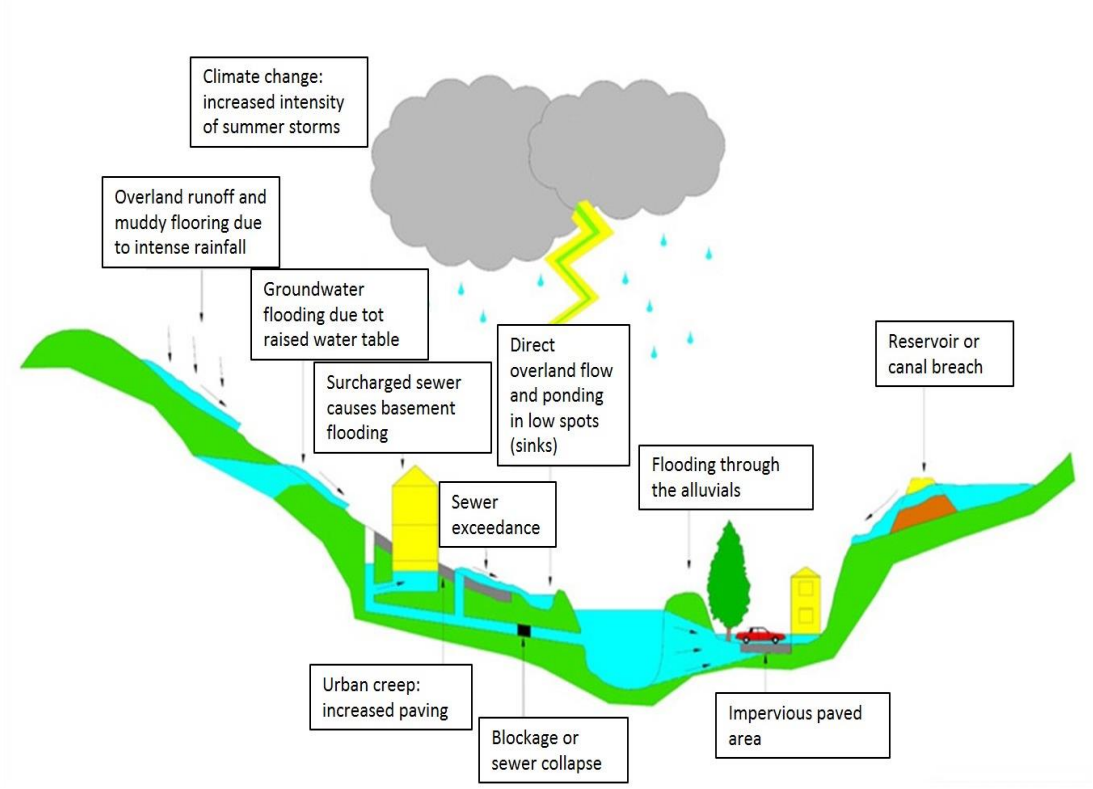


Figure 1-4: Flooding from all sources

1.10 Likelihood and consequence

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

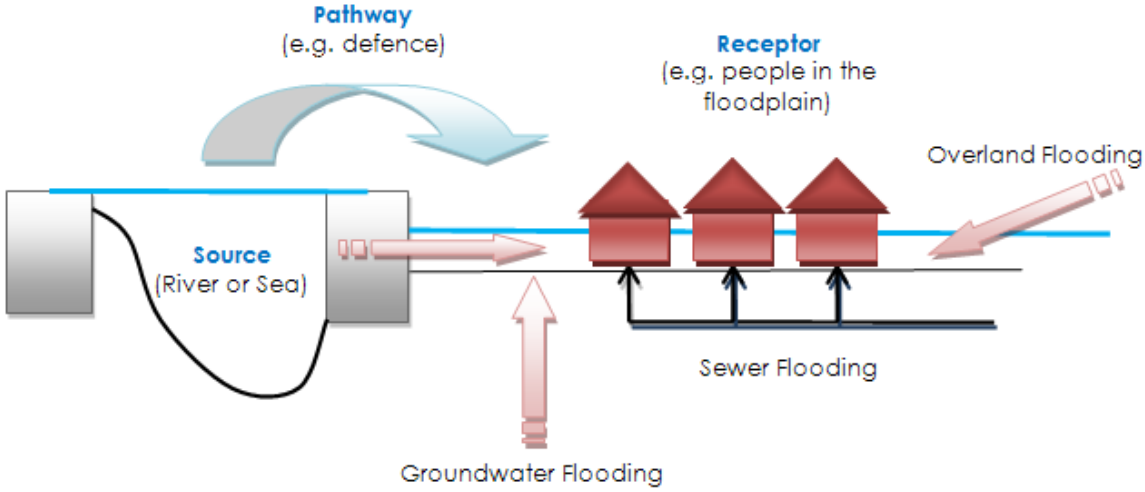


Figure 1-5: Source-Pathway-Receptor Model

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

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

1.11 Likelihood

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

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

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

1.12 Consequence

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

Flood risk = Probability of flooding x Consequences of flooding

1.13 Risk

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

2 Flood risk policy and strategy

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

2.1 Roles and responsibilities for Flood Risk Management in Uttlesford District

There are different organisations that cover Uttlesford District that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are shown in Table 2-1 with a summary of their responsibilities.

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

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

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

Risk Management Authority	Strategic Level	Operational Level	Planning role
Environment Agency	• Strategic overview for all sources of flooding • National Strategy • Reporting and general supervision	• Main rivers (e.g. River Soar) • Reservoirs	• Statutory consultee for development in Flood Zones 2 and 3
Essex County Council as Lead Local Flood Authority (LLFA)	• Preliminary Flood Risk Assessment • Local Flood Risk Management Strategy	• Surface Water • Groundwater • Ordinary Watercourses (consenting and enforcement) • Ordinary watercourses (works)	• Statutory consultee for major developments
Uttlesford District Council as Local Planning Authority	• Local Plans as Local Planning Authorities	• Determination of Planning Applications as Local Planning Authorities • Managing open spaces under District Council ownership	• As left
Thames and Anglian Water	• Asset Management Plans, supported by Periodic Reviews (business cases) • Develop Drainage and Wastewater management plans	• Public sewers	• Non-statutory consultee
Highways Authorities *Highways England (motorways and trunk roads)* *Uttlesford District Council (for non-trunk roads)*	• Highway drainage policy and planning	• Highway drainage	• Internal planning consultee regarding highways design standards and adoptions

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in the Uttlesford District:

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

2.3 Relevant flood risk policy and strategy documents

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

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

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

Scale	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
National	**Flood and Coastal Management Strategy** (see section 2.5.1) (Environment Agency) 2020	No	Yes	No	Due to be reviewed in 2026
National	**National Planning Policy Framework and Guidance** (MHCLG) 2021 (see section 3.1)	No	No	Yes	-
National	**Building Regulations Part H** (MHCLG) 2010 (see section 2.5.8)	No	No	Yes	-
Regional	**Anglian River Basin District Flood Risk Management Plan** (Environment Agency) 2016 (see section 2.5.5)	Yes	Yes	No	2021/22
Regional	**Anglian River Basin Management Plan** (Environment Agency) 2016 (see section 2.5.3)	No	Yes	No	2021/22
Regional	**Thames River Basin District Flood Risk Management Plan** (Environment Agency) 2016 (see section 2.5.5)	Yes	Yes	No	2021/22
Regional	**Thames River Basin Management Plan** (Environment Agency) 2016 (see section 2.5.3)	No	Yes	No	2021/22
Regional	**Drainage and Wastewater Management Plan** (Thames and Anglian Water) due 2022/23	Yes	Yes	Yes	2022/23
Regional	**Climate Change guidance for development and flood risk** (see section 4.1) (Environment Agency) 2021	No	No	Yes	2021/22 for rainfall allowances
Local	**Essex County Council – The Sustainable Drainage Systems Design Guide for Essex** (see section 9.3.6) (ECC)	No	No	Yes	-
Local	**Essex Local Flood Risk Management Strategy** (ECC) 2018 (see section 2.5.6)	Yes	Yes	No	2022
Local	**Uttlesford District Water Cycle Study** (2017) (see section 2.5.7)	Yes	No	Yes	-

2.4 Key legislation for flood and water management

2.4.1 Flood Risk Regulations (2009)

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

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

The Flood Risk Regulations required Essex County Council (as the LLFA) to prepare and publish a PFRA on past and future flood risk from local sources of flooding. The 2011 **Essex County Council PFRA** reports on significant past and future flooding from all sources except from Main River and Reservoir, which are covered by the Environment Agency, and sub-standard performance of the adopted sewer network (covered under the remit of Thames Water and Anglian Water). The Regulations also require the LLFA to identify significant Flood Risk Areas. Of the ten national indicative Flood Risk Areas that were identified by the Environment Agency, there is one (Basildon) that falls within the administrative area of Essex County Council. However, this area does not fall within Uttlesford District. There was an update to this document in 2017, stating that there were no changes to the assessment of risk as established in the 2011 assessment.

2.4.2 Flood and Water Management Act (FWMA) 2010

The Flood and Water Management Act was passed in April 2010. It aims to improve both flood risk management and the way we manage our water resources.

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

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

2.4.3 Water Framework Directive & Water Environment Regulations

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

Uttlesford District lies within the Anglian River Basin District and Thames River Basin District.

2.5 Key national, regional and local policy documents and strategies

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

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

The Strategy has been split into 3 high level ambitions: climate resilient places; today's growth, and infrastructure resilient in tomorrow's climate and a nation ready to respond and adapt to flooding and coastal change.

Measures include:

- Updating the national river, coastal and surface water flood risk mapping
- Improving the understanding of long-term investment needs for flood and coastal infrastructure,
- Trialling new and innovative funding models,
- Flood resilience pilot studies,
- Developing an adaptive approach to the impacts of climate change,
- Seeking nature-based solutions towards flooding and erosion issues,
- Integrating natural flood management into the new Environmental Land Management scheme,
- Considering long term adaptive approaches in Local Plans,
- Maximising the opportunities for flood and coastal resilience as part of contributing to environmental net gain for development proposals,
- Investing in flood risk infrastructure that supports sustainable growth,
- Aligning long term strategic planning cycles for flood and coastal work between stakeholders,
- Mainstreaming property flood resilience measures and 'building back better' after flooding,
- Consistent approaches to asset management and record keeping,
- Updating guidance on managing high risk reservoirs in light of climate change,
- Developing critical infrastructure resilience,
- Education, skills and capacity building, research, innovation and sharing of best practise measures,
- Supporting communities to plan for flood events,
- Develop world leading ways of reducing the carbon and environmental impact from the construction and operation of flood and coastal defences,
- Development of digital tools to communicate flood risk and transforming the flood warning service and increasing flood response and recovery support.

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

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

2.5.2 Updated Strategic Flood Risk Assessment guidance

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

2.5.3 River Basin Management Plans (RBMP)

Uttlesford falls partly within the **Anglian River Basin District RBMP** and the **Thames River Basin District RBMP** managed by the EA, both have been updated since the first cycle in 2009. The latest versions of both management plans were published in December 2015 and they are currently being updated, out for consultation. These plans highlight the importance of restoring wildlife and water quality, preventing deterioration of water health and quality whilst achieving effective flood risk management measures within the districts. The plans include an assessment of river basin characteristics, a review of the impact on human activity, statuses of water bodies, and an economic analysis of water use and progress since the first plan in 2009.

2.5.4 Flood Risk Management Plans (FRMP)

Flood Risk Management Plans are part of the six-year cycle of assessment, mapping and planning required under the Flood Risk Regulations. The Environment Agency led the development of the **Anglian FRMP** and **Thames FRMP** which were both published in 2016 and are currently being updated, out for consultation until January 2022. The FRMPs summarise the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations.

2.5.5 Catchment Flood Management Plans (CFMP)

Catchment Flood Management Plans are a high-level strategic plan providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management. They aim to set policies for sustainable flood risk management for the whole catchment covering the next 50 to 100 years.

Uttlesford is part of three different Catchment Flood Management Plan areas written in 2009: the **Great Ouse CFMP**, the **Thames CFMP** and the **North Essex CFMP**. CFMPs split their catchments into sub areas with similar flood risk

management types and assign one of six policies to each sub area. Table 2-3 summarises the policy statements relating to Uttlesford for each CFMP.

Table 2-3 CFMP Policies

CFMP	Sub Area	Policy
Great Ouse	Bedford Ouse rural and eastern rivers	Policy 3 - Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.
Thames	Towns and villages in open floodplain (north and west)	Policy 6 - Areas of low to moderate flood risk where we will take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits.
North Essex	Blackwater and Chelmer, upper reaches and coastal streams	Policy 2 - Areas of low to moderate flood risk where we can generally reduce flood management actions.

Action and objectives are then identified for each sub area based on the policy assigned. These actions have been summarised in Table 2-4. Despite the different policies, all areas have been identified as rural areas of low to moderate risk and therefore there are some common themes in the actions, most notably the need to work with LPAs to ensure that floodplain is protected from development, and to maintain or improve local flood warning services.

Table 2-4 CFMP Actions

CFMP	Policy	Summary of main actions
Great Ouse	Policy 3	Investigate opportunities to reduce levels of flood risk management on Main Rivers Continue with current levels of flood risk management on Ordinary Watercourses Improve flood warning service Work with partners to develop emergency response plans for critical infrastructure/transport Take opportunities to use mineral extraction sites to store water Investigate land use change Develop environmental enhancement projects to improve river state/habitats
Thames	Policy 6	Maintain existing capacity of the system Identify locations where storage of water could benefit communities Work with LPAs to retain the floodplain for flood storage and adapt the urban environment to flood risk Continue flood warning service Help local communities manage flood risk (e.g. flood resilience)
North Essex	Policy 2	Reduce flood risk management activities e.g. channel maintenance Investigate land use change Work with LPAs to reduce the number of properties in the floodplain Continue flood warning service and maintain flood warning infrastructure Work with partners to develop emergency response plans for critical infrastructure/transport

2.5.6 Essex Local Flood Risk Management Strategy (LFRMS)

The **Essex Local Flood Risk Management Strategy** was published in 2015 and updated in 2018. The Strategy sets out how Essex County Council will manage flood risk from surface water runoff, groundwater and ordinary watercourses for which they have a responsibility as LLFA and the work that other Risk Management Authorities are doing to manage flood risk in the district.

As the new National Strategy was published in 2020, LLFAs will need to update their Local Strategies so that they reflect how national objectives for flood risk management will be delivered locally.

The Strategy notes that the Council will seek to deliver sustainable drainage systems (SuDS) as part of new development in its roles as statutory consultee for major planning applications and non-statutory consultee for non-major planning applications.

The flood risk information in the PFRA has been used to prioritise areas of locally important flood risk and assigned them into three tiers in order to prioritise flood risk management actions (Tier 1 - more than 1,000 people at risk, Tier 2 - 500-1,000 people at risk and Tier 3 - less than 500 people at risk). Within Uttlesford, Saffron Walden has been identified as a Tier 2 area due to its surface water risk and flood history, and Clavering, Great Dunmow, Manuden, Radwinter, Takeley, Thaxted and Stansted Mountfitchet have been identified as Tier 3 areas.

Flood risk management actions included in the Local Flood Risk Management Strategy have been split into two categories, county-wide strategic actions and site level specific actions. County-wide strategic actions with the aim of following the guiding principles and meeting the overall objectives of this strategy and of the Environment Agency's national strategy, focus on:

- Improving understanding of local flood risk through Surface Water Management Plans (SWMPs) and recording and reporting flood incidents
- Adapting spatial planning policy to reflect local flood risk
    - Introduction of a robust Sustainable Drainage System (SuDS) framework (Essex County Council have produced a SuDS Design and Adoption Guide and put in place interim guidance on SuDS)
    - Inclusion of local flood risk concerns in all future Strategic Flood Risk Assessments
    - Provision of new guidance to supplement the NPPF provisions for flood risk Management
- Raising community awareness
- Establishing a working framework with other RMAs (Risk Management Authority) through Essex Partnership for Flood Management and collaborative working
- Providing a policy for regulation of works on Ordinary Watercourses including consenting and enforcement
- Proactively seeking funding to deliver capital works schemes
- Addressing the skills gap in Local Authorities through recruitment and training

Site-level specific management actions could be implemented within locally important flood risk areas in order to translate the aims of the overall strategic actions onto a local scale. These are to be mainly delivered by lower tier councils such as Uttlesford District Council and communities, supported by Essex County Council, and include:

- Implementing sustainable drainage and source control measures
- Managing overland flow paths
- Reviewing land management methods
- Reviewing asset management and maintenance methods
- Achieving wider environmental benefits

- Investigating local flooding issues and identify significant features
- Implementing surface water flood forecasting and flood warning
- Encouraging implementation of flood resilience measures and property protection schemes
- Establishing community flood groups

Since then, the strategy published in 2013 was updated in 2018. The Strategy has 9 objectives around making Essex a safe place to live and work; in terms of flood risk, this means informing people.

The strategy also has 7 measures on how they will achieve this:

1) Investigating floods – Investigation on what has happened in local flooding, providing access grants to local residents to protect their property.
2) Mapping local flooding – recording structures or features that form part of the local drainage system, including their ownership and condition for public viewing. This information can be used in flood modelling and future flood alleviation schemes.
3) Looking after watercourses – Management of planning and activities near or on ordinary watercourses to ensure drainage is still effective.
4) Planning for future floods – Flood modelling to prepare for future scenarios and see who is most likely to be affected by flooding. Carrying out PFRAs and a SWMP. They also highlight the need for emergency evacuation plans, keeping watercourses clear, safely diverting flood water and potential for new flood infrastructure.
5) Influencing new development and drainage – Ensuring there is a decrease in the risk of surface water flooding by providing advice on the management of surface water by the means of SuDS within developments with specific guidelines.
6) Building new flood defences – After identifying communities at risk of flooding, they will consider whether new flood defences provide a value for money solution and potential schemes to implement any plans.
7) Advice on applying for a community grant or a homeowner grant known as PRF schemes.

This document highlights a wide range of flood risk management functions.

2.5.7 Water Cycle Studies Phase 2

Water Cycle Studies (WCS) assist councils to select and develop sustainable development allocations in locations where there is minimal impact on the environment, water quality, water resources, infrastructure, and flood risk. WCS provide the required evidence, and an agreed strategy, to ensure that planned growth occurs within environmental constraints (and, where possible, contributes to environmental improvements), with the appropriate infrastructure in place in a timely manner so that planned allocations are deliverable. This is undertaken by identifying areas where there may be conflict between any proposed development, the requirements of the environment and by recommending potential solutions to these conflicts.

The Council has previously prepared a Stage 1 (Scoping and Outline Strategy) (2010) and Stage 2 (Detailed Strategy) (2012) WCS. The WCS is now out of date as it was prepared in relation to a previous Local Plan that did not proceed to adoption. However, it did highlight that there were potential constraints to

development related to sewer capacity or wastewater treatment in some areas, including Great Dunmow, Newport, Saffron Walden, Great Chesterford and Thaxted.

The latest WCS covering Uttlesford district is the **Uttlesford District Water Cycle Study** published in April 2018. This will assist the Council in selecting and developing sustainable development allocations where there is minimal impact on the environment, water quality, water resources, infrastructure and flood risk.

2.5.8 LLFAs, surface water and SuDS

The 2019 NPPF states that: 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Para 165). When considering planning applications, local planning authorities should consult the 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 Uttlesford District are:

- **Local Flood Risk Management Strategy**
- **Essex County Council – The Sustainable Drainage Systems Design Guide for Essex**
- **The 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 2021 NPPF states that flood risk should be managed "using opportunities provided by new development to reduce causes and impacts of flooding." As such, Uttlesford District Council expects SuDS to be incorporated on minor development as well as major development.

2.5.9 Surface Water Management Plans (SWMP)

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

There are currently no SWMPs covering Uttlesford District. Saffron Walden has been identified by Essex County Council as a Tier 2 area, to be completed in the future. Clavering, Great Dunmow, Manuden, Radwinter, Takeley, Thaxted and Stansted Mountfitchet have been identified as Tier 3 areas. Any future SWMPs carried out for these areas must be considered by the Local Plan.

3 Planning policy for flood risk management

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

3.1 National Planning Policy Framework and Guidance

The revised **National Planning Policy Framework (NPPF)** was published in July 2021, replacing the 2019 version. The NPPF sets out Government's planning policies for England. It must be taken into account in the preparation of local plans and is a material consideration in planning decisions. The NPPF defines Flood Zones, how these should be used to allocate land and flood risk assessment requirements, although the 2021 update states that the Sequential and Exception Tests aim to steer development towards areas of the lowest risk of flooding from any source of flooding (not just fluvial). The NPPF states that:

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

Planning Practice Guidance on flood risk was published in July 2021 and sets out how the policy should be implemented. **Diagram 1 in the NPPG** sets out how flood risk should be considered in the preparation of Local Plans.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas. A risk-based approach sets out requirements in a way that is proportionate to the risk present. Therefore, in the context of a strategic flood risk assessment, recommendations made are proportionate to the level of risk present on site. This risk-based approach informs the Sequential Test set out below.

3.2.1 The Flood Zones

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

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

The Flood Zones are:

- **Flood Zone 1 – Low probability:** less than a 0.1% chance of river and sea flooding in any given year.
- **Flood Zone 2 – Medium probability:** between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year.
- **Flood Zone 3a – High probability:** greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. Excludes Flood Zone 3b.

- **Flood Zone 3b – Functional Floodplain:** land where water has to flow or be stored in times of flood. SFRAs identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. It may be required to consider climate change on the functional floodplain; this would need hydraulic modelling to confirm extents and therefore it is recommended that this is considered in a Flood Risk Assessment and a suitable approach is agreed with the EA.

Important note on Flood Zone information in this SFRA

The Flood Zones (Flood Zone 2 and 3a) in the Appendix A Geo-PDFs are the same as those shown on the Environment Agency's **'Flood Map for Planning'** (which incorporates latest EA modelled data), where available.

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

Functional floodplain (Flood Zone 3b) is identified as land which would flood with an annual probability of 1 in 20 years, where detailed hydraulic modelling exists. The 1 in 20-year defended modelled flood extents have been used to represent Flood Zone 3b, where available from the Environment Agency. For areas outside of the detailed model coverage, or where no outputs were available, Flood Zone 3a can be used as a conservative indication. Further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b where no detailed modelling exists.

3.2.2 The Sequential Test

Firstly, land at the lowest risk of flooding from all sources, should be considered for development i.e land in Flood Zone 1 with no surface water or other sources of flood risk. In line with the NPPF, the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk. A test called the 'Sequential Test' is applied ensure land at lowest risk of flooding is considered first. Figure 3-1 summarises the Sequential Test. The LPA will apply the Sequential Test in determining their spatial strategy and potential site allocations as well as to any strategic allocations within their Local Plan. For all other developments, in Flood Zones 2 and 3 (or in Flood Zone 1 on land with other flooding/drainage issues), developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test.

The Sequential Test should apply to all forms of flood risk and consider flooding issues at present and in the future, resulting from climate change. For example, a site may currently be within Flood Zone 1, but may not be suitable if it is at high risk of flooding in the future as a result of climate change[1].

The LPA should work with the Environment Agency to define a suitable area of search for the consideration of alternative sites in the Sequential Test. A local

1 Planning Practice Guidance, Para 033, Reference ID: 7-033-20140306: https://www.gov.uk/guidance/flood-risk-and-coastal-change#aim-of-Sequential-Test

planning authority should demonstrate through evidence that it has considered a range of options in the site allocation process, using the Strategic Flood Risk Assessment to apply the Sequential Test and the Exception Test where necessary. This can be undertaken directly or, ideally, as part of the sustainability appraisal. Where other sustainability criteria outweigh flood risk issues, the decision-making process should be transparent with reasoned justifications for any decision to allocate land in areas at high flood risk in the sustainability appraisal report. The Sequential Test can also be demonstrated in a free-standing document, or as part of the Housing and Economic Land Availability Assessment.

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development, the Flood Zone it is proposed for, and the risk to the site from other sources of flooding. **Table 2 of the NPPG** defines the vulnerability of different development types to flooding. **Table 3 of the NPPG** shows whether, having applied the Sequential Test first, that vulnerability of development is suitable for that Flood Zone and where further work is needed.

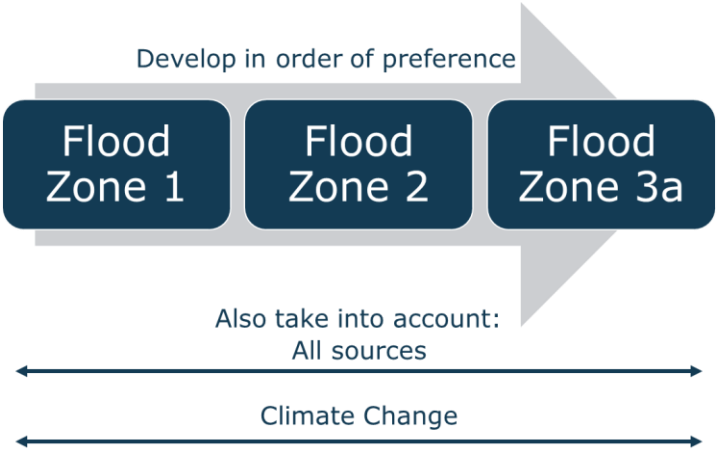


Figure 3-1: The Sequential Test

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

It is the role of the Local Planning Authority to apply the Sequential Test to strategic allocations, for example sites allocated as part of the Local Plan. For sites not allocated in the Local Plan, the sequential test should be undertaken by the developer. In either case, it is recommended that Figure 3-2 is referred to as a guide for undertaking this. It should be noted that the 2021 NPPF indicates that the Sequential Test should apply to all forms of flood risk rather than just fluvial or tidal sources.

This is a stepwise process, but a challenging one, as a number of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded. In addition, the risk of flooding from other sources and the impact of climate change must be considered when considering which sites are suitable to allocate. The SFRA User Guide in Appendix C shows where the Sequential and Exception Test may be required for the datasets assessed in this SFRA, and how to interpret different levels of concern with the datasets, recommending what development might be appropriate in what situations.

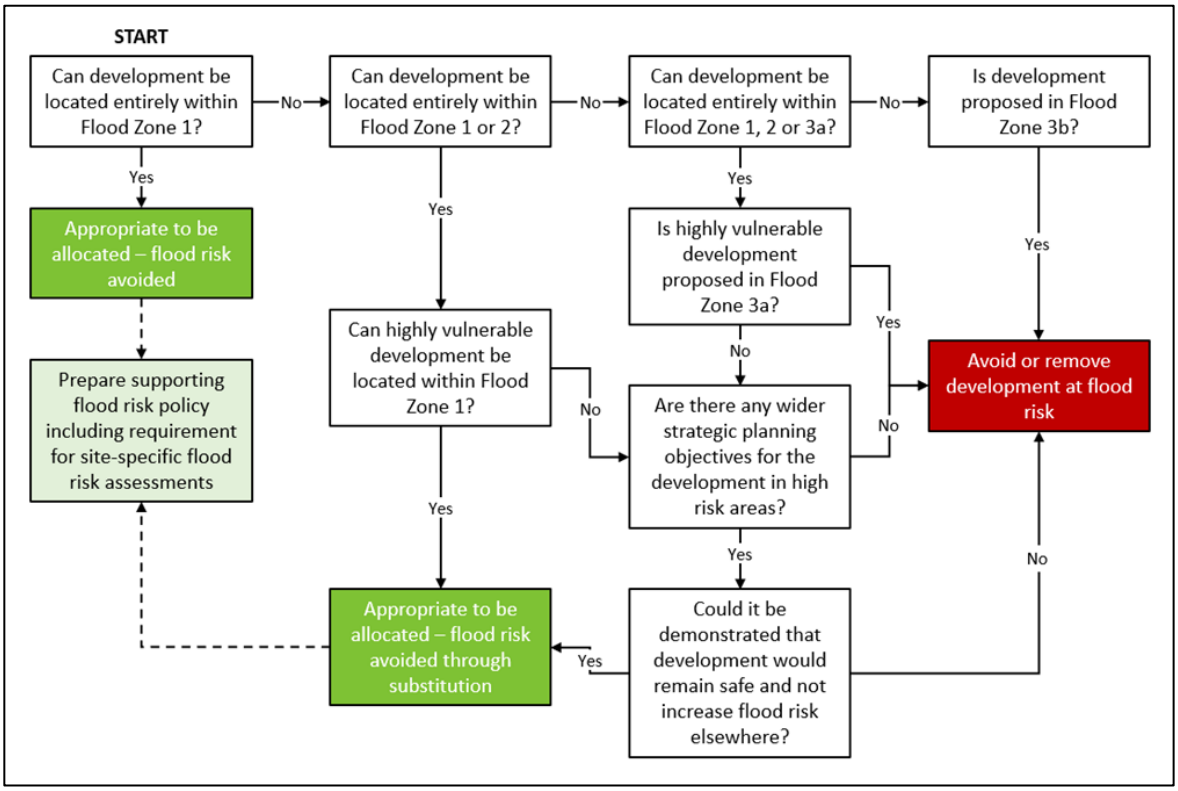


Figure 3-2: Local Plan sequential approach to site allocation

3.2.3 The Exception Test

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

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

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

Figure 3-3 summarises the Exception Test.

For sites allocated within the Local Plan, the Local Planning Authority should use the information in the Level 2 SFRA to inform the Exception Test. At planning application stage, the developer must design the site such that it is appropriately flood resistant and resilient in line with the recommendations in National and Local Planning Policy and supporting guidance and those set out in this SFRA. This should demonstrate that the site will still pass the flood risk element of the Exception Test based on the detailed site level analysis.

Following the application of the Sequential Test, where it is not possible to allocate development on sites at low risk of flooding, the Exception Test may be required to support the principle of development. The Level 2 SFRA considers this for strategic allocations, other sites should prepare an exception test and present this information to the Local Planning Authority for approval. This Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should look into in more detail to inform the Exception Test for windfall sites.

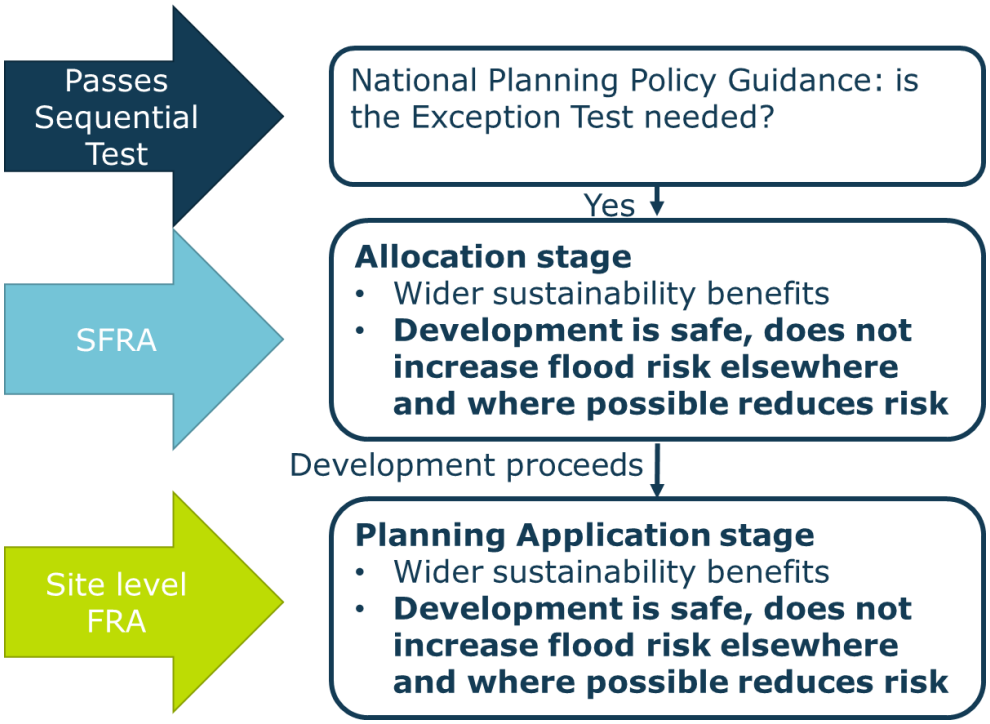


Figure 3-3: The Exception Test

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

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

Local planning authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

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

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

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

A Level 2 SFRA is likely to be needed to inform the Exception Test in these circumstances for strategic allocations. At Planning Application stage, a site-specific Flood Risk Assessment will be needed. Both would need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

3.2.4 Making a site safe from flood risk over its lifetime

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

- The actual risk is the risk to the site considering existing flood mitigation measures. The fluvial 1% chance flood in any year event is a key event to consider because the National Planning Policy Guidance refers to this as the 'design flood' against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed.
- Safe access and egress should be available during the design flood event. Firstly, this should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.
- Residual risk is the risk that remains after the effects of flood defences have been taken into account and/ or from a more severe flood event than the design event. The residual risk can be:
  - The effects of an extreme 0.1% chance flood in any year event. Where there are defences this could cause them to overtop, which may lead to failure if this causes them to erode; and/or
  - Structural failure of any flood defences, such as breaches in embankments or walls.

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

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

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

3.3.1 Sequential Test

Uttlesford District Council, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied.

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

- A strategic allocation and the test has already been carried out by the LPA
- A change of use (except to a more vulnerable use)
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m^2); or

- A development in Flood Zone 1, unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).

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

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

The sources of information on reasonably available sites may include:

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

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

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

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

3.3.2 The Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding, the Exception Test must then be applied if required (as set out in Table 3 of the NPPG). Developers are required to apply the Exception Test to all applicable sites (including strategic allocations).

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

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

  Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

  Applicants should detail the suitability issues the development will address and how doing it will outweigh the flood risk concerns for the site e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

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

The site-specific Flood Risk Assessment should demonstrate that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:

- The design of any flood defence infrastructure
- Access and egress
- Operation and maintenance
- Design of the development to manage and reduce flood risk wherever possible
- Resident awareness
- Flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event; and
- Any funding arrangements required for implementing measures.

4 Impact of climate change

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

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

4.1 Revised Climate Change Guidance

The Climate Change Act 2008 creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050.

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency has translated these projections into published **updated climate change guidance in 2021** on how allowances for climate change should be included in both strategic and site specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development. However, it is anticipated that the Environment Agency's guidance will shortly be revised again to account for changes to peak rainfall allowances. At the time of writing this report, the updated peak rainfall allowances have not yet been released.

Developers should check on the government website for the latest guidance before undertaking a detailed Flood Risk Assessment.

4.2 Applying the climate change guidance

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

- The vulnerability of the development – see the **NPPG**
- The likely lifetime of the development – in general 60 years is used for commercial development and 100 for residential, but this needs to be confirmed in an FRA
- The River Basin that the site is in – Uttlesford District is situated in the Anglian and Thames River Basin Districts
- The Management Catchment that the site is in – see the **guidance**
- Likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s)
- The 'built in' resilience measures used, for example, raised floor levels
- The capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach

4.3 Relevant allowances for Uttlesford District

Table 4-1 shows the peak river flow allowances that apply in Uttlesford District for fluvial flood risk. Table 4-2 shows the peak rainfall intensity allowances that apply in Uttlesford District for small catchments (less than 5km^2) and urban catchments for surface water flood risk. Catchments which are larger than 5km^2 or are rural should use Table 4-1 for peak rainfall intensity. Both the central and upper end allowances should be considered to understand the range of impact.

Table 4-1: Peak river flow allowances for the Anglian and Thames River Basin Districts

RBD	Catchment Management Basin	Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Anglian	Cam and Ely Ouse	Upper end	21%	22%	45%
		Higher central	7%	5%	19%
		Central	2%	-2%	9%
	Combined Essex	Upper end	27%	37%	72%
		Higher central	13%	16%	38%
		Central	7%	8%	25%
Thames	Roding, Bean and Ingrebourne	Upper end	31%	38%	64%
		Higher central	20%	21%	36%
		Central	15%	14%	26%
	Upper Lee	Upper end	23%	27%	59%
		Higher central	9%	7%	22%
		Central	3%	-1%	10%

Click for Source

Table 4-2: Peak rainfall intensity allowances for small and urban catchments

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Click for Source

4.4 Representing climate change in the Level 1 SFRA

A pragmatic approach to climate change was proposed to the EA for the Uttlesford L1 SFRA. As the centre of the authority area forms a catchment boundary for three major basins, this means the watercourses are in their headwaters where the topography is very confined, meaning generally narrow floodplains with little difference seen between FZ2 and FZ3 extents (climate change usually sits between these events).

It was proposed to the EA that no new climate change modelling would be carried out for the L1 SFRA based on the following justifications:

- For all EA models provided, there is at least one existing climate change model output, and for one model there are the three 2080s pre-July 2021 allowances.
- The majority of updated 2021 catchment climate change allowances are lowered (the only increase is Chelmer Upper End, though the focus for FRAs is now on the Central allowance in the new guidance).
- There is a minor difference between FZ3 and FZ2 extents. Modelling climate change would show minimal difference as the extents would fall between these scenarios – all watercourses are in their headwaters with confined topography, and therefore negligible difference would be seen in the mapping. This approach was agreed in the previous L1 SFRA, and allowances have since decreased further, meaning FZ2 is a conservative indication.
- Climate change flows in the 2016 L1 SFRA were compared and were contained within the 1,000-year event (FZ2) and now the flows are lower again with latest guidance.
    - "*The majority have a 'climate change' flood outline for the 100 year +20% event, with the exception of the two studies of the River Cam and its tributaries (including The Slade), which both used +25%. These outlines reasonably represent the 'Central' allowance for both river basin districts. Analysis of the 1,000-year flow estimation points for these studies (most studies usually include a 1000 year event) shows the average increase for each model is between +39% and +79% above the 100 year flows. These outlines can therefore be used as an approximation for the 'Upper end' estimate for most areas. The exception is the River Stort catchment, which is probably more representative of the 'Higher central' estimate. Following discussion with the Environment Agency it was decided to take a precautionary approach based on the assumption that the current Flood Zone 2 outline (1 in 1,000-year flood extent) represents a future Flood Zone 3a taking into account climate change*."
- The focus in the latest guidance for vulnerability of developments is on Central allowance. The previous 20% climate change covers majority of the models' Central allowances conservatively.
- The Council are not proposing to develop in areas of fluvial flood risk.

It was agreed that this approach is acceptable for the Upper Roding, Upper Middle Stort, Stort Tribs, Stansted Mountfitchet, Chelmer and Cam models. However, for the Blackwater model, concerns were raised as to whether the existing climate change runs were sufficient for the updated uplifts. Checks were undertaken on comparative flows to see whether the allowances were covered by the 0.1% AEP or 0.1% AEP + climate change event. Following checks, the 100-year +25%, +38% and +72% climate change uplifts were run and mapped for the Blackwater model only.

It was agreed with the Council that if new settlements/ significant urban extensions are proposed in flood risk areas, the Upper End allowance would be required to be modelled as part of a Level 2 SFRA. At time of writing, Uttlesford District Council are in the early stages of their 'call for site's process and, at present, do not believe development will occur in flood risk areas.

For any sites not covered by the EA's detailed modelling, Flood Zone 2 was used as an indicative climate change extent. This is appropriate given the Upper End climate change extents are often similar to the Flood Zone 2 extents.

The 1,000-year surface water extent can also be used as an indication of surface water risk, and risk to smaller watercourses, which are too small to be covered by the EA's Flood Zones.

Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing Flood Risk Assessments, 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 EA 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.

In summary, the climate change outputs on the GeoPDF maps for the SFRA may be from:

- 'Modelled climate change allowances': Climate change allowances previously modelled.
- 'Indicative Climate Change (FZ2)': Flood Zone 2, which is used outside of the areas covered by specific flood models and should be considered to be indicative.

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 100-year current-day event.

When undertaking a site-specific Flood Risk Assessment, developers should:

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

4.5 Impact of climate change on flood risk

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

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

4.5.1 Impact of climate change on fluvial flood risk

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

In general, there is little difference across the district between Flood Zone 2 and 3 as the district forms a natural catchment watershed, meaning the watercourses are fairly narrow and confined topographically in their upper reaches.

Areas in the district most sensitive to fluvial impacts of climate change are settlements along the River Stort e.g. Clavering, Saffron Walden on the Slade and other areas are more rural with no properties.

4.5.2 Impact of climate change on surface water flood risk

In the absence of modelling surface water risk with climate change uplifts, the 1,000-year surface water flood extent can be used as an indication of climate change (as well as for smaller watercourses; some of which are not included in the Flood Zones).

In general, surface water risk across the district is generally low as the district forms a natural catchment watershed, meaning land steeply falls away from the centre and any surface water will run off and converge towards the watercourses, which are fairly narrow and confined topographically. Areas in the district most sensitive to changes between the 100-year and 1,000-year surface water extents are located away from the confined river floodplains, which show little difference between flood events. Also, areas where there are topographic impoundments, such as roads/ rail, where water can spread.

4.5.3 Impact of climate change on groundwater flood risk

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

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

4.6 Adapting to climate change

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

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime.
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development.
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses; and
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity, for example by leaving areas shown to be at risk of flooding as public open space.

- Considering the standard of protection of defences and sites for future development, in relation to sensitivity to climate change. The Council and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option, such as at the defence locations mentioned in Chapter 6.

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

5 Understanding flood risk in Uttlesford District

This chapter explores the key sources of flooding in the district and the factors that affect flooding including topography, soils and geology. The main sources of flooding are from watercourses, surface water and sewers.

This is a strategic summary of the risk in Uttlesford District. Developers should use this chapter to scope out the flood risk issues they need to consider in greater detail in a site-specific Flood Risk Assessment to support a Planning Application.

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

5.1 Historical flooding

Essex County Council's (LLFA) Historic Flooding Incidents and Asset Register includes recorded historical flood events within Uttlesford District. There is a history of documented flood events, with the main sources being fluvial and surface water. Table 5-1 highlights the most significant historic flood events. A full history of flooding incidents within the district is in Appendix F.

Table 5-1: Historic flooding incidents held by Essex County Council

Location	Date	Additional information recorded
Great Dunmow, Wimbish, Elmdon	23 July 2016	Persistent rain brought return of flooding to villages and a number of properties flooded.
Clavering, Berden, Manuden, Wimbish	23 November 2014	Persistent rain brought return of flooding to villages affected in February 2014.
Saffron Walden, Newport, Wendens Ambo, Debden, Stansted, Arkesden, Ashdon, Quendon, Henham, Stansted Mountfitchet.	7 February 2014	Widespread flooding through District (particularly north west).
Ashdon	14 June 2007	14 properties flooded and roads blocked.
Widespread across the district	January 2003	70 flood incidents reported for 1st to 3rd January
Clavering, Manuden, Stansted Mountfitchet, Great Chesterford, Littlebury, Newport, Saffron Walden, Little Walden, Great Dunmow, Ashdon	October 2001	Widespread flooding across the district. At least 95 flood incidents reported.
Ashdon	Summer 1987	48 properties including 21 residential properties flooded in 3 separate events.
Saffron Walden	19 September 1960	Police worked late into night placing warning traffic lights on flooded roads; houses in some villages completely covered by flood water

Location	Date	Additional information recorded
Saffron Walden	5 August 1917	3.08 inches of rain recorded in 2 hours caused much flooding.
Saffron Walden	10 November 1875	1.02 inches of rain fell in two to three hours during the night and resulted in flooding.

In addition to the Historic Flooding Incidents and Assets Register, Essex Fire and Rescue Service were contacted to provide their recorded flooding data, which contains the responses of the Fire and Rescue Service to incidents involving flooding or rescue from water within Uttlesford District. No additional information was provided.

5.2 Topography, geology, soils and hydrology

The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of run-off reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface runoff, whereas more permeable rock such as limestone and sandstone may result in a more subdued response. Uttlesford District covers an area approximately 641 km^2 and has a population of approximately 79,000 (2011 census). The largest urban areas within Uttlesford are Great Dunmow and Saffron Walden. Outside of the main towns the district is relatively rural with a number of dispersed villages. Map 2 gives an overview of the study area.

5.2.1 Topography

The topography and landscape of Uttlesford (Map 2) is a result of the region being located at the headwaters of three separate river catchments.

Uttlesford District is characterised by the highest elevations being through the centre of the northern half of Uttlesford between Stansted Mountfitchet and Saffron Walden. This forms part of the watershed between the Anglian and Thames River Basin Districts. These fall towards the lower-lying river valleys that all flow out of the district around the boundary. Elevations range from ~140m-100m AOD along central watershed, to 34m AOD in the north where the River Cam flows out of the district. The chalk hills in the northwest rise to 140m AOD and the land slowly falls in height towards the southeast where clay soils dominate. The land is cut by river valleys running north towards Cambridgeshire (River Cam (or Granta)), southeast towards the centre of the county (River Chelmer and River Pant), and south towards the Thames river basin (Pincey Brook, River Roding, River Stort and Stansted Brook). There are also a number of valleys formed by the tributaries to these Main Rivers. The valleys are steep, with the lowest elevations within the region located in the River Cam and River Chelmer valleys (approximately 35m AOD) and the highest area of the district, at the headwaters of the River Stort in the northwest of the district rising to approximately 147.0m AOD.

The topography of the district is shown in Figure 5-1.

5.2.2 Geology

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

Superficial (at the surface) deposits in Uttlesford District, shown in Figure 5-3, consist of glacial sand and gravel in the river valley networks and widespread diamicton (till) deposits on the valley sides and higher elevations. Although diamicton commonly refers to unsorted glacial deposits, it can be formed by a number of processes including deposition by current and ancient river networks, landslides and debris flows.

The underlying geology in the Uttlesford District, shown in Figure 5-4, is split into two distinct regions. To the north of the region the bedrock is composed of White Chalk of Cretaceous age and to the south the bedrock is composed of the London Clay formation, a mixture of clay, silt, sand and gravel. There is band of Lambeth Group bedrock between the two main bedrock types within the district. Geology information can be viewed on the **British Geological Society website**.

5.2.3 Soils

As a result of the superficial deposits the soils on the valley sides and higher elevations are loamy and clayey soils which suffer from impeded drainage. Within the river valleys of the district the soils are more freely draining loamy soils. Soil information can be viewed on the **Soilscapes website.**

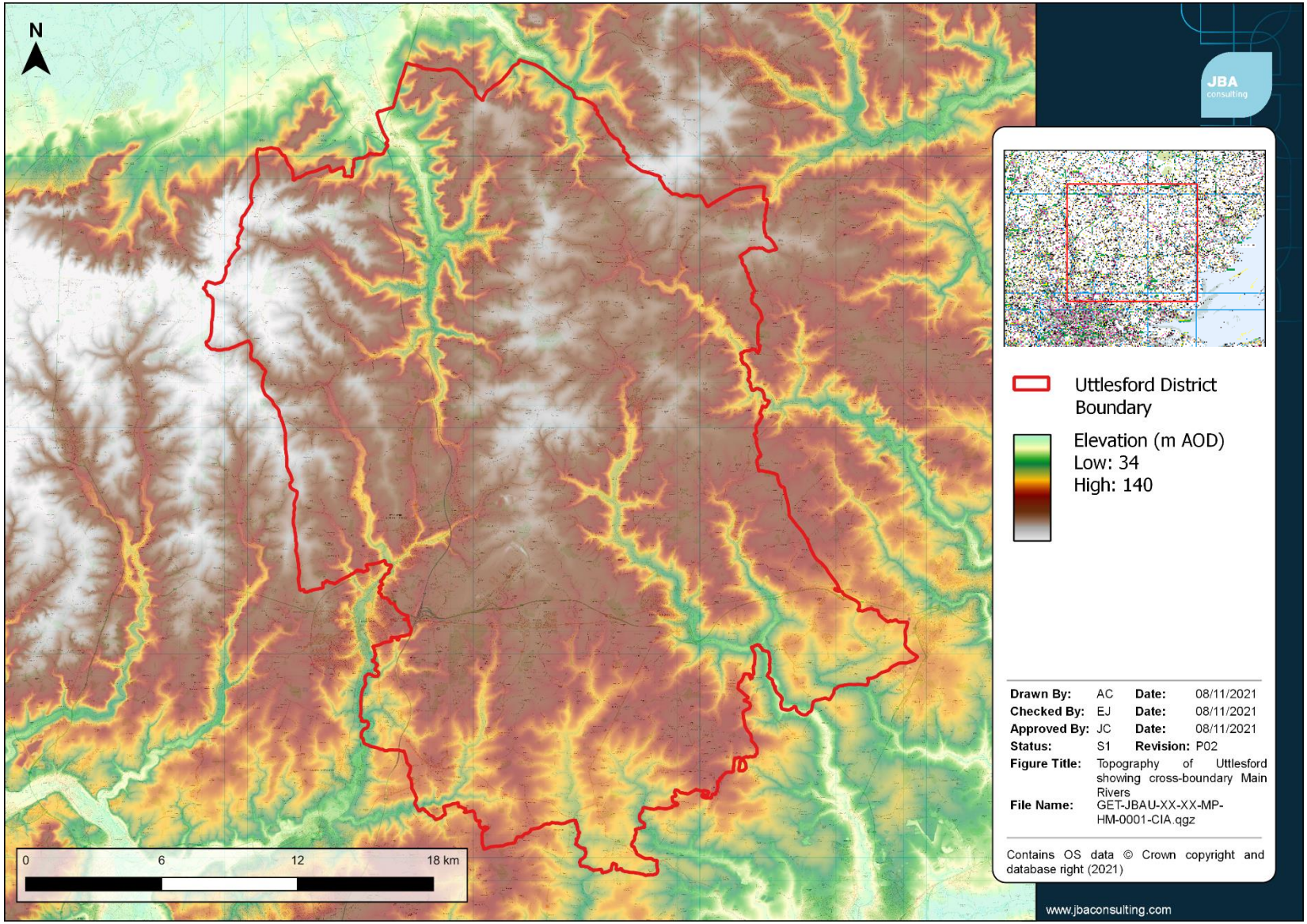


Figure 5-1: Topography of the district

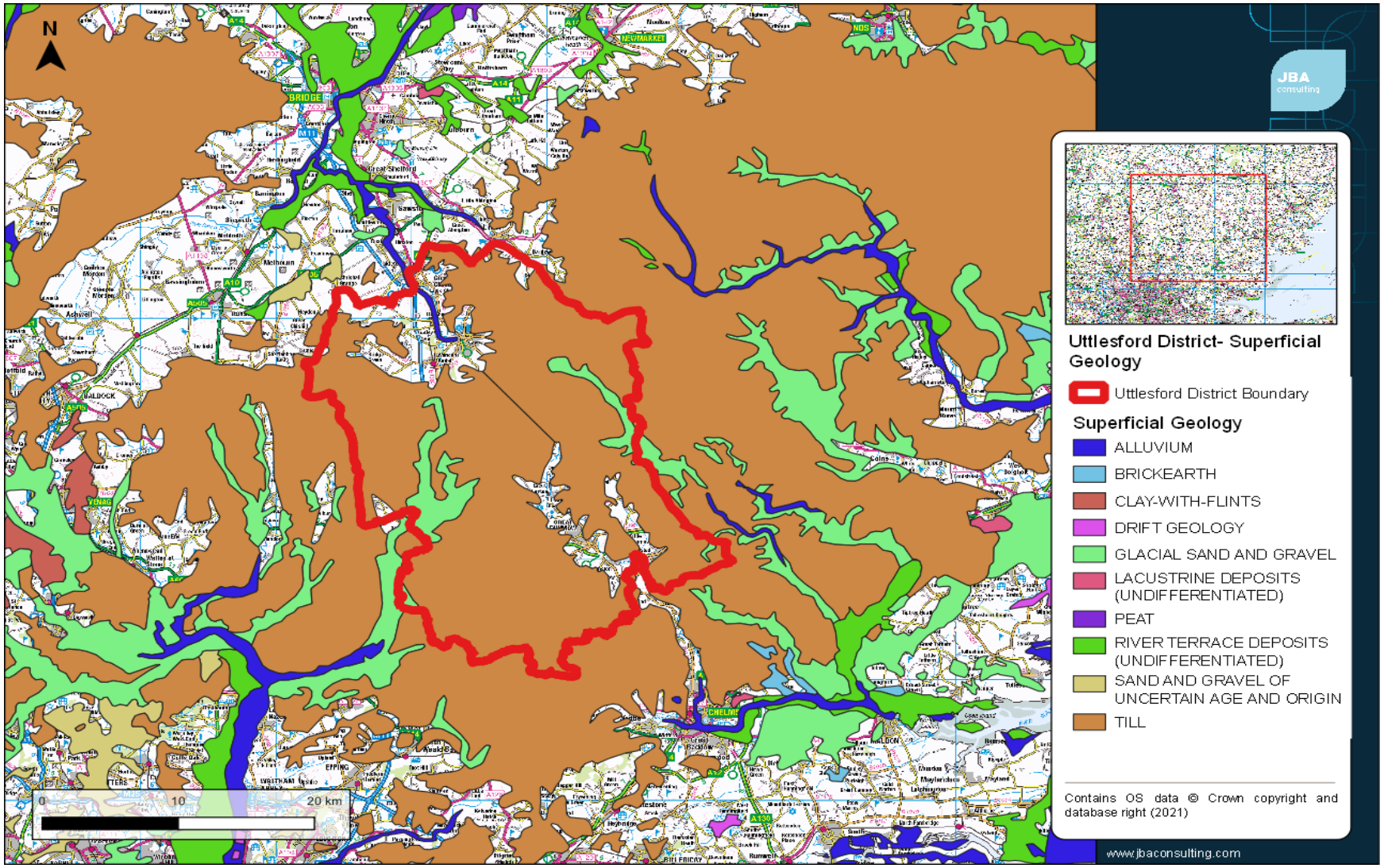


Figure 5-2: Superficial geology of the district

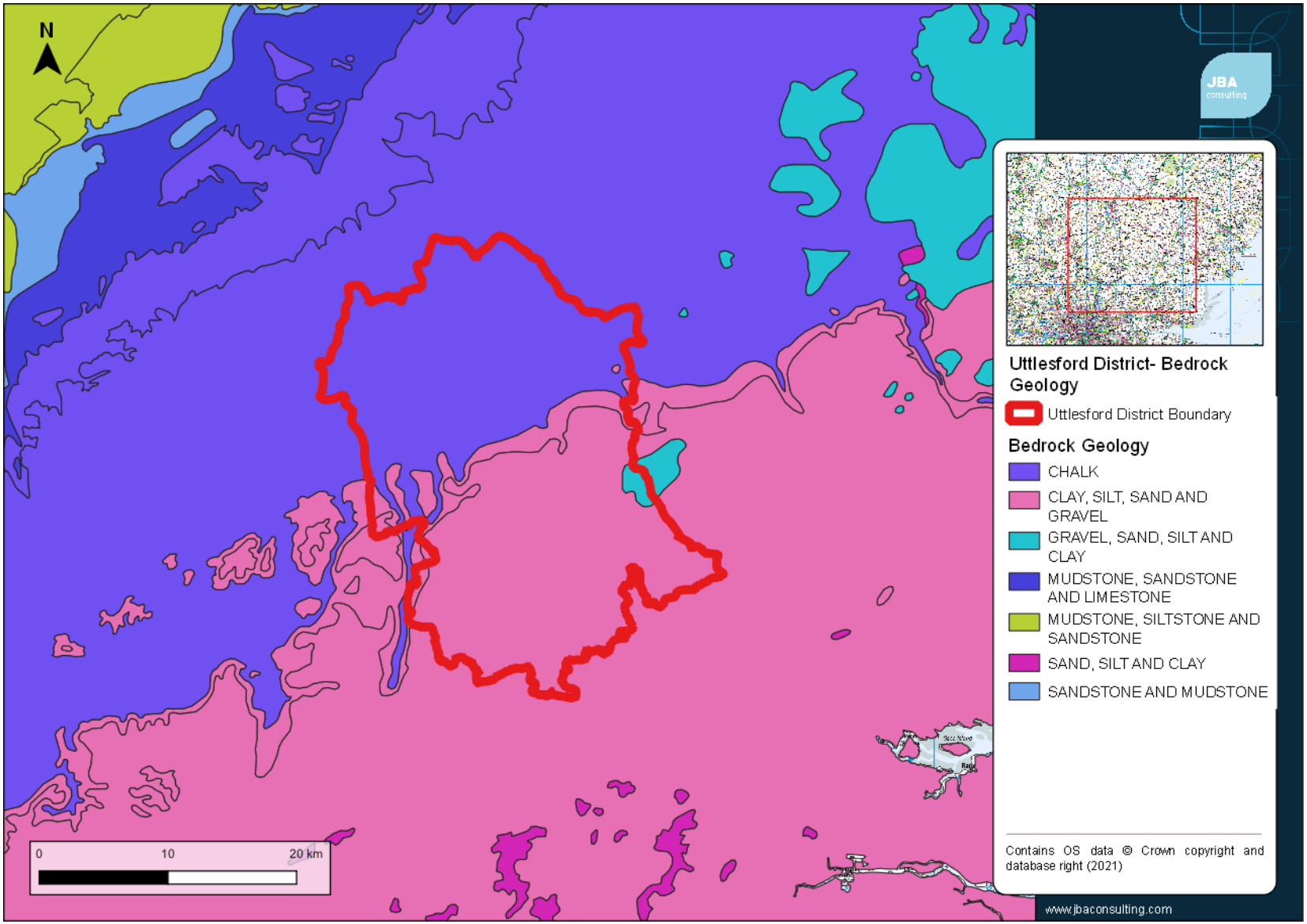


Figure 5-3: Bedrock geology of the district

5.3 Hydrology

Uttlesford District consists of a number of watercourses flowing away from the centre of the district to beyond its boundary. The principal watercourses in the Uttlesford District are:

- The River Cam (or Granta) in the north of the district
- The River Pant in the east of the district
- The River Chelmer and Stebbing Brook in the southeast of the district
- The River Roding, River Stort, Pincey Brook and Stansted Brook in the south and west of the district.

There are numerous tributaries to these watercourses including smaller Ordinary Watercourses and unnamed drains. A summary of the principal watercourses within the Uttlesford District are provided in Figure 1-3.

Uttlesford is one of the driest parts of the UK, with an average annual rainfall of 500 mm

5.4 Fluvial flood risk

The primary fluvial flood risk in the Uttlesford District belong in the three larger catchment areas: the Great Ouse in the North, the North Essex in the east, and the Thames catchment to the southeast of the district. Fluvial flood risk is shown by the Environment Agency Flood Zone maps.

In the Great Ouse catchment, the main source of fluvial flood risk arises from the River Cam (or Granta) and the River Slade. The River Cam flows south to north from the source near Widdington, where it converges with another tributary of the Cam near Granchester. These watercourses present a fluvial flood risk to larger towns and settlements such as Newport, Wendens Ambo, Audley End, Little Chesterford and Great Chesterford. The River Slade is a tributary to the River Cam and consists of three branches, of which their confluence is at Saffron Walden. The Slade is culverted within Saffron Walden and highly modified. Saffron Walden is one of the areas with the greatest fluvial flood risk within the district. Ordinary watercourses in the Great Ouse catchment include Wicken Water, River Bourn, Fulfen Slade and Debden Water.

Within the North Essex catchment there are several Main Rivers, however the River Chelmer, Pant and Stebbing Brook are the main sources of fluvial flood risk within the area. The River Chelmer flows south from its source near Debden Green to Chelmsford, where it meets the River Can. It flows through the urban areas of Thaxted, Great Easton, Mill End, Little End, Great Dunmow and Little Dunmow. The River Pant flows towards the northwest and southwest towards Braintree where it becomes the River Blackwater. It passes through mostly smaller towns and villages in more rural areas, such as Radwinter and Great and Little Sampford. The Stebbing Brook flows north to south from Lindsell and converges with the River Chelmer at Little Dunmow. The River Pant and Stebbing Brook are also a source of flood risk in the area; however, the consequences of flooding are low as people and properties are located in smaller towns and villages throughout the rural area.

In the Thames catchment the watercourses that present the highest flood risk are the River Stort, Stansted Brook, Ugley Brook and Pincey Brook. The area of the most flood risk is Stansted Mountfitchet as it is where the Stansted and Ugley Brooks converge. Downstream, they converge with the River Stort and Bourne Brook where it flows through Bishop's Stortford in the district of East Hertfordshire. Here, the risk of fluvial flooding is high and regularly also floods upstream in the undeveloped floodplain in Uttlesford District. There are several

other Main Rivers in this catchment, but the risk of fluvial flooding they present to small communities is mostly along the River Roding and Pincey Brook.

5.5 Surface water flooding

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

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

5.6 Sewer flooding

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

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

Since 1980, the Sewers for Adoption guidelines mean that new surface water sewers have been designed to have capacity for a 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.

Historical incidents of flooding are detailed by Thames Water and Anglian Water through their DG5 Register. This database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding. For confidentiality, this data has been supplied on a 4-digit postcode basis. The DG5 register from Thames Water and Anglian Water are shown in Table 5-2 and Table 5-3, respectively.

These outputs indicate areas that may be affected from surface water and sewer flooding, should sewers exceed their capacity and discharge (particularly if this happens due to intense rainfall overwhelming the system). It will also help to identify flooding hotspots, where there is limited capacity, and help inform future schemes and mitigation.

Table 5-2: DG5 recorded incidents – Thames Water

	Register Type		
Postcode area	**Internal flooding to property**	**External flooding to property/areas**	**Grand Total**
CB114	0	2	2
CM226	0	1	1
CM227	1	1	2
CM232	2	0	2
CM233	1	0	1
CM235	1	8	9
CM248	2	11	13
CM6 1	0	1	1
Grand Total	7	24	31

Table 5-3: DG5 recorded incidents - Anglian Water

	Register Type		
Postcode area	**Internal flooding to property**	**External flooding to property/areas**	**Grand Total**
CB1 1	8	3	11
CB1 2	7	8	15
CB1 3	2	27	29
CB1 7	0	1	1
CB1 8	1	8	9
CB1 9	0	14	14
CB10 1	4	11	15
CB10 2	0	26	26
CB11 3	3	17	20
CB11 4	1	15	16
Grand Total	26	130	156

The Thames Water DG5 indicates a total of 31 recorded flood incidents in Uttlesford District. The more frequently flooded postcodes are CM24 8, and CM23 5. The Anglian Water DG5 indicates a much higher number, with 156 recorded flood incidents. The incidents are spread across the district, but the most frequently flooded postcodes are CB1 3 and CB10 2. It is important to recognise the DG5 does not contain information about properties and areas at risk of sewer flooding caused by operational issues such as blockages. Also, the register represents a snapshot in time and will get outdated with properties being added to the register following rainfall events, whilst risk will be reduced in some locations by capital investment in increasing the capacity of the network. As such the summary of the DG5 in this report is not a comprehensive 'at risk register'.

5.7 Groundwater flooding

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

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

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

The JBA Detailed Groundwater Flood Map (5m resolution) for Uttlesford District was obtained for this SFRA, and provided in the Geo-PDFs in Appendix A. In high-risk areas, a site-specific risk assessment for groundwater flooding may be required to fully inform the likelihood of flooding. The categories are as follows in Table 5-34.

The **British Geological Survey** provides further information on groundwater flooding on their website.

Table 5-4: Groundwater flood hazard classification

Groundwater head difference (m)*	Gridcode	Class Label
0 to 0.025	4	Groundwater levels are either at or very near (within 0.025m) of the ground surface. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	3	Groundwater levels are between 0.025m and 0.5m below the ground surface. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	2	Groundwater levels are between 0.5m to 5m below the ground surface. There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.
>5	1	Groundwater levels are at least 5m below ground surface. Flooding from groundwater is not likely.
N/A	0	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

*Difference is defined as ground water surface in mAOD minus modelled groundwater table in mAOD.

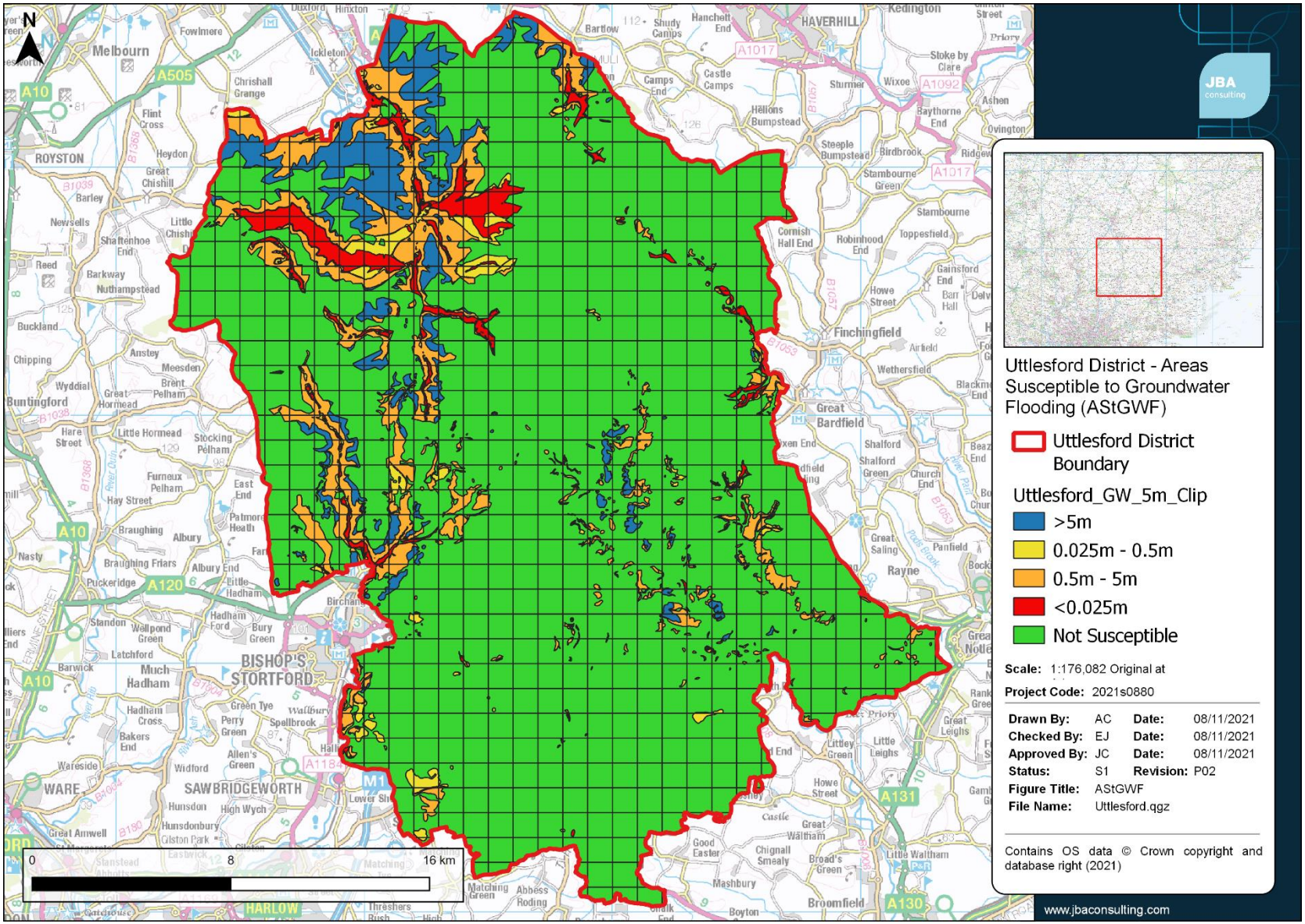


Figure 5-4: JBA Areas Susceptible to Groundwater Flooding map of the district

5.8 Flooding from canals

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

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

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

There are no canals in the Uttlesford district and therefore there is no risk of canals overtopping or breaching.

5.9 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the **Reservoir Act 1975** and are on a register held by the Environment Agency. The level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low.

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

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

The current **flood warning information service** mapping shows that there are no reservoirs located within Uttlesford District but there are four outside the district that could cause flooding within the district. Section 8.7.3 provides further considerations for developing in the vicinity of reservoirs.

Table 5-4: Reservoirs with potential risk to Uttlesford District

Reservoir	Northings and eastings	Reservoir owner	Local Authority Area	Is the reservoir within the study area?
Hanningfield Reservoir	573370, 198417	Essex and Suffolk Water	Essex	No
Abberton Reservoir	597655, 218341	Essex and Suffolk Water and Northumbrian Water Group	Essex	No
Ardleigh Reservoir	603179, 228303	Anglian and Affinity Water	Essex	No
King George's and William Girling's Reservoirs	536996, 195239	Thames Water	Enfield	No

5.10 Flood Alert and Flood Warnings

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

There are currently 10 Flood Alert Areas (FAA) and 7 Flood Warning Areas (FWAs) covering Uttlesford District. Flood Alerts are issued when there is water out of bank for the first time anywhere in the catchment, signalling that 'flooding is possible', and therefore Flood Alert Areas usually cover the majority of Main River reaches. Flood Warnings are issued to designated Flood Warning Areas (i.e. properties within the extreme flood extent which are at risk of flooding), when the river level hits a certain threshold; this is correlated between the FWA and the gauge, with a lead time to warn that 'flooding is expected'.

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

5.11 Summary of flood risk in Uttlesford District

A table summarising all sources of flood risk to key settlements in Uttlesford District can be found in Appendix E, with the full history in Appendix F.

6 Flood alleviation schemes and assets

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

6.1 Asset management

Risk Management Authorities hold databases of flood risk management and drainage assets:

- The Environment Agency holds a national database that is updated by local teams
- The LLFA holds a database of significant local flood risk assets, required under Section 21 of the Flood and Water Management Act (2010)
- Highways Authorities hold databases of highways drainage assets, such as gullies and connecting pipes
- Water Companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.

The databases include assets RMAs directly maintain and third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA contains full information on the location, condition and ownership of all the assets in their area. They take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.

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

6.2 Standards of Protection

Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 100-year SoP means that the flood risk in the defended area is reduced to at least a 1% chance of flooding in any given year.

Over time the actual SoP provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change. The understanding of SoP may also change over time as RMAs undertake more detailed surveys and flood modelling studies.

It should be noted that the Environment Agency's on-going hydraulic modelling programme may revise flood risk datasets and, as a consequence, the standard of protection offered by flood defences in the area may differ from those discussed in this report.

Developers should consider the standard of protection provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

The Environment Agency and local authorities have permissive powers to maintain and improve Main Rivers and Ordinary Watercourses, respectively. There is no legal duty to maintain watercourses, defences or assets and maintenance and improvements are prioritised based on flood risk. The ultimate responsibility for maintaining watercourses rests with the landowner.

Highway authorities have a duty to maintain public roads, making sure they are safe, passable and the impacts of severe weather have been considered. Water companies have a duty to effectually drain their area. What this means in practise is that assets are maintained to common standards and improvements are prioritised for the parts of the network that do not meet this standard e.g. where there is frequent highway or sewer flooding. Essex County Council as LLFA have permissive powers and limited resources are prioritised and targeted to where they can have the greatest effect.

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

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

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

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

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

Source: Condition Assessment Manual – Environment Agency 2006

6.4 Major flood risk management assets in the district

The Flood Map for Planning contains information on 'Areas Benefiting from Defences' (ABD). This shows areas that benefit from the defences that provide a SoP of at least a 100-year river flood event. It does not show areas that benefit from protection for more frequent events. There are no areas in the Uttlesford District shown to be benefiting from defences in the EA's 'ABD' mapping.

However, the Environment Agency 'AIMS' flood defence dataset gives information on all flood defence assets within the district. The following locations benefit from flood defences at a lower (or unknown) standard of protection in the Uttlesford District.

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

Watercourse	Location	Type	Design SOP	Condition Rating
River Stort	Bishops Stortford	Embankment	1000	3
River Stort	Manuden	Embankment	20	3
River Stort	Clavering	Embankment	100	3
River Stort	Gaston Green	Embankment	20	3
River Stort	Spellbrook	Embankment	5	4
River Stort	Clavering	Wall	5	3

6.5 Future flood alleviation schemes

The Environment Agency provided a list of future schemes which would reduce flooding within Uttlesford District as part of the 2016 SFRA. These schemes were:

1. Stansted Mountfitchet Flood Alleviation Scheme - an initial assessment of combined pluvial and fluvial flooding within Stansted Mountfitchet was ongoing.
2. Clavering and Manuden Flood Alleviation Scheme - the issue is an undersized culvert causing the river to surcharge; therefore, a proposed solution is to increase culvert capacity or attenuate high flows.
3. Takeley - Frequent blocking of a culvert was to be remedied by installing a new screen and de-culverting

No information regarding future flood alleviation schemes in the Cambridgeshire and Bedfordshire or Essex Norfolk and Suffolk Environment Agency areas was received. For the latest information on the schemes, contact the Environment Agency.

Essex County Council have recently completed an upgrade to trash screens on the River Slade to reduce flood risk. The project also includes a Phase 2 involving the repair of culverted sections of the watercourse. Essex County Council have also delivered a leaky dam scheme in Thaxted and are working with UDC to upgrade the trash screens here.

6.6 Actual and residual flood risk

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

6.6.1 Actual flood risk

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

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

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

6.6.2 Residual risk

Residual risk is the risk that remains after the effects of flood risk infrastructure have been 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 Flood Risk Assessment.

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.

6.6.3 Overtopping

The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest level of the defence. The Defra and Environment Agency **Flood Risks to People** (http://sciencesearch.defra.gov.uk/Document.aspx?Document=FD2321_3437_TRP.pdf) guidance document provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

Any sites located next to defences or perched ponds/ reservoirs, may need overtopping modelling or assessments at the site-specific FRA stage.

6.6.4 Defence breach

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

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

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

7 Cumulative impact of development and strategic solutions

This section provides a summary of the catchments with the highest flood risk and development pressures and then makes recommendations for local planning policy based on these.

7.1 Introduction

Under the NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRAs), are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (para.156), rather than just to or from individual development sites.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, in theory they should not increase flood risk downstream.

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

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

To understand the impact of future development on flood risk in Uttlesford District, catchments were identified where development may have the greatest impact on flood risk, and where further assessment would be required within a Level 2 Strategic Flood Risk Assessment (SFRA) or site-specific Flood Risk Assessment (FRA). The potential change in developed area within each catchment and communities sensitive to increased risk of surface water flooding, alongside evidence of historic flooding incidents were considered to identify catchments at the highest risk. Where catchments have been identified as sensitive to the cumulative impact of development, the assessment concludes with recommended strategic planning policy suggestions to manage the risk.

7.2 Strategic flood risk solutions

Uttlesford District Council have a vision set forth in their Local Plan for the future management of flood risk and drainage in the district. This concerns flood risk management, alongside wider environmental and water quality enhancements. Strategic solutions may include upstream flood storage, integrated major infrastructure/ FRM schemes, new defences, and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for natural flood management and retrofitting sustainable drainage systems. The Essex Local Flood Risk Management Strategy, Anglian Flood Risk Management Plan and Thames Flood Risk Management Plan set out specific actions for the district.

Chapter 2 sets out the strategic plans that exist for the district. The list below summarises the key outcomes these are seeking to achieve. This vision needs to be delivered by new development alongside retrofitting and enhancing green infrastructure and flood defence schemes in the existing developed area.

The strategic policy vision from the CFMP and RBMPs focus on re-naturalising watercourses, safeguarding the floodplains and the encouraging collaboration and creating new partnerships to reduce the risk of flooding and to enhance the natural environment. Within Uttlesford District, strategic solutions encourage development to:

- Use sustainable flood storage and mitigation schemes to store water and manage surface water runoff in locations that provide overall flood risk reduction as well as environmental benefits.
- Restore Peat Bogs to help reduce peak time runoff and overall peak water levels.
- In areas where flood risk is being managed effectively, there will be a need in the future to keep pace with increasing flood risk as a result of climate change.
- Promote partnership working with all relevant stakeholders in the Anglian and Thames River Basins. This includes working with land managers and farmers to reduce soil erosion from intensively farmed land.
- Assess long-term opportunities to move development away from the floodplain and create green river corridors through Uttlesford District.
- Identify opportunities to use areas of the floodplain to store water during high flows, to reduce long term dependence on engineered flood defences located both within the district and outside the district.
- Safeguard the natural floodplain from inappropriate development.
- Where possible, land management change should be used to reduce run-off rates from the development whilst maintaining or enhancing the capacity of the natural floodplain to retain water. Land management and uses that reduce runoff rates in upland areas should be supported.
- Development should maintain conveyance of watercourses through hamlets and villages, to help reduce the impact of the more frequently experienced floods and to improve the natural environment.
- Use SFRAs to inform future development and minimise flood risk from all sources.
- Implement upstream catchment management e.g. slow the flow and flood storage schemes could be implemented in upper catchments to reduce flooding downstream and across neighbouring authority boundaries; and
- Promote and consider SUDS at the earliest stage of site development.

7.2.1 Opportunities and projects in/ affecting Uttlesford District

Roding, Beam and Ingrebourne (RBI) Catchment Partnership:

The RBI Catchment Partnership is co-hosted by Thames21 and the Thames Chase Trust. It is a collaboration between relevant partners to deliver projects that will improve the health of the area's rivers and wetland environments. It consists of three separate tributary catchments to the River Thames; the River Roding, River Beam and, the most relevant to Uttlesford District, the River Ingrebourne.

Their key objectives are:

- To improve opportunities for recreation across the catchment and in turn raise awareness to a more sustainable use of this resource and ensure it is valued and appreciated.
- To manage flood risk and sustainable drainage; improve connectivity, manage Invasive Non-Native Species (INNS) and litter.
- To improve the way in which water is captured and managed; and to reduce nutrients in our watercourses.
- To work with land managers to improve habitats, and the way in which people can access their rivers and associated green spaces.
- To work with land managers; businesses and funding bodies to create inward investment opportunities for the Roding, Beam & Ingrebourne Catchment.

The partnership has created an **interactive map** that details of a range of project data that is being collated and opportunities for improvements across the catchment, including de-culverting and weir removals, natural flood management studies and pollution control schemes.

River Lea Catchment Partnership:

The River Lea Catchment Partnership is co-hosted by Thames21, the Herts & Middlesex Wildlife Trust, and Groundwork. It is a collaboration between relevant partners to deliver projects that will improve the health of the area's rivers and wetland environments. The Partnership covers the River Lea catchment and its tributaries, of which the River Ash and River Stort are the most relevant to Uttlesford District.

The partnership has created interactive maps for each tributary/ catchment (Ash, Stort) that details of a range of project data that is being collated and opportunities for improvements including water quality improvements, weir removals, natural flood management studies and community engagement.

Cam & Ely Ouse (CamEO) Catchment Partnership:

The CamEO Catchment Partnership is co-hosted by Thames21, the Herts & Middlesex Wildlife Trust, and Groundwork. It is a collaboration between relevant partners to deliver projects that will improve community engagement, land use, water resources, and the health of rivers and groundwater. The Partnership covers the River Lea catchment and its tributaries, of which the River Ash and River Stort are the most relevant to Uttlesford District.

Their key objectives are:

- Encourage community-led management of river catchments by empowering local decision making.
- Farming and land use sectors contribute to, and benefit from, healthy ecosystems.
- Maintain and restore healthy-functioning, biodiverse and resilient ecosystems, and increase 'natural capital' understanding.
- Mitigate the impact of Invasive Non-Native Species (INNS).
- Improve strategic co-operation at the catchment scale in order to maximise resources and facilitate more effective delivery.
- Ensure there is enough water of sufficient quality to support the needs of the environment and wider society.

Combined Essex Catchment Partnership:

The Combined Essex Catchment Partnership is co-hosted by the **Essex Rivers Hub** (which is in-turn hosted by the Essex Wildlife Trust) and the Environment Agency. It is a collaboration between relevant partners to deliver projects that will improve water quality and availability, reduce agricultural pollution, improve navigation and community engagement, biodiversity and land use. The Partnership covers the combined areas of previous catchment partnerships, as well as other catchments relevant to Uttlesford District, such as the River Can, River Chelmer, River Pant and River Ter.

The Essex Forest Initiative:

The Essex Forest Initiative launched in November 2019 with a five-year commitment to plant 375,000 trees across Essex. The scheme is part of wider efforts by Essex County Council to tackle climate change, reduce carbon, promote environmentally friendly infrastructure and protect green spaces.

Uttlesford Nature Recovery Network:

The Uttlesford Nature Recovery Network is collating local knowledge of environmental project work, environmental volunteering and general local environmental knowledge across the district. This is due to be used as evidence base for the review of Uttlesford Districts' natural habitats within the upcoming Local Plan.

Aubrey Buxton Nature Reserve

Aubrey Buxton Nature Reserve is owned by the Essex Wildlife Trust and is located in the Stansted Brook catchment near Stansted Mountfitchet. This reserve contains some of the county's rarest and uncommon species, including Common Spotted-Orchids, Black Poplar, Adder's Tongue Fern, Lesser Lady's Mantle and Great Crested Newts. Circular paths run through the woods and around the ponds, providing ample opportunities to appreciate the wildlife of the area. Natural Flood Management techniques could be encouraged here to aid flood storage and slow surface water flows.

Rushy Mead Nature Reserve

Rushy Mead Nature Reserve is owned by the Essex Wildlife Trust and is located in the Great Hallingbury Brook catchment near Bishop's Stortford. This reserve contains some of the county's rarest species including a strong population or Water Voles. Meandering paths run through the reserve, past dense reedbeds and through mature woodland, providing ample opportunities to appreciate the wildlife of the area. Natural Flood Management techniques could be encouraged here to aid flood storage and partnership working would allow the continued conservation of the Water Voles.

Shadwell Wood Nature Reserve

Shadwell Wood Nature Reserve is owned by the Essex Wildlife Trust and is located in the Granta catchment close to the River Bourn near Ashdon and Saffron Waldon. This reserve contains some of the county's rarest species including Oxlip, Wood Violets, Wood Anemones, Early Purple Orchids, Common Spotted Orchids, Meadowsweet and Sanicle. Numerous circular paths run through the wooded reserve, providing ample opportunities to appreciate the wildlife of the area. Natural Flood Management techniques could be encouraged here to aid flood storage.

Hatfield Forest

Hatfield Forest is owned by the National Trust is located in the Pincey Brook catchment near Takeley. This forest is a designated National Nature Reserve and

SSSI for Butterflies, Beetles and dragonflies, as well as being home to over 4000 species of wildlife including mammals such as Fallow Deer and Muntjac, insects, birds, >650 species of fungi and >320 wildflower species. Large scale Natural Flood Management techniques could be encouraged here to aid flood storage as well as increase instream habitats.

7.3 Assessment of cross-boundary issues

The topographic characteristics of the district are dictated by chalk hills that rise in the northwest, creating the watershed between three separate river catchments. Valleys of the Rivers Cam (or Granta) run north into Cambridgeshire, Rivers Chelmer and Pant flow southeast, and the River Roding, River Stort, Stansted Brook and Pincey Brook flow south towards the Thames River basin. Uttlesford District has boundaries with the following local authority areas:

- Braintree District
- Chelmsford District
- East Hertfordshire District
- Epping Forest District
- North Hertfordshire District
- South Cambridgeshire District

Although Uttlesford District does not have a direct boundary with the following local authority areas, watercourses originating within the district flow through them, and they share surrounding boundaries with some of the neighbouring authorities named above:

- Cambridge District
- Stevenage Borough
- West Suffolk District

Overall flow direction means that the neighbouring authorities of Braintree, Chelmsford, East Hertfordshire, Epping Forest and South Cambridgeshire have the potential to be affected in terms of flood risk by Uttlesford District. Future development both within and outside Uttlesford District can have the potential to affect flood risk to existing communities and surrounding areas, depending on the effectiveness of SUDS and drainage implementation.

Consequently, there are a number of catchments and sub-catchments that exist within Uttlesford District where future development may impact flood risk in the neighbouring local authorities outlined above, particularly where there are existing flood risk issues. Figure 7-2 summarises which catchments drain out of Uttlesford District, where the impact of flood risk downstream should be assessed when considering development. The sources of data used to inform the existing flood risk issues to properties in neighbouring local authorities can be found in Appendix B.

Uttlesford District's new Local Plan is currently being prepared alongside the evidence base and the flood risk and sustainable drainage policies in the adopted Local Plan (January 2005) have therefore not yet been updated to ensure compliance with the NPPF.

The following Local Plans have been adopted by neighbouring local authorities and include policies relevant to flood risk and drainage:

- **Braintree District's Local Plan** 2013 – 2033
- **Chelmsford District's Local Plan** 2013 - 2036

- **East Hertfordshire District's Local Plan** 2011 - 2033
- **Epping Forest District's Local Plan** 2011-2033
- **North Hertfordshire District's Local Plan** 2011 – 2033
- **South Cambridgeshire District's Local Plan** 2018 – 2031
- **Cambridge District's Local Plan** 2018 - 2031
- **Stevenage Borough's Local Plan** 2011 – 2031
- **West Suffolk District's Local Plan** (currently being updated)

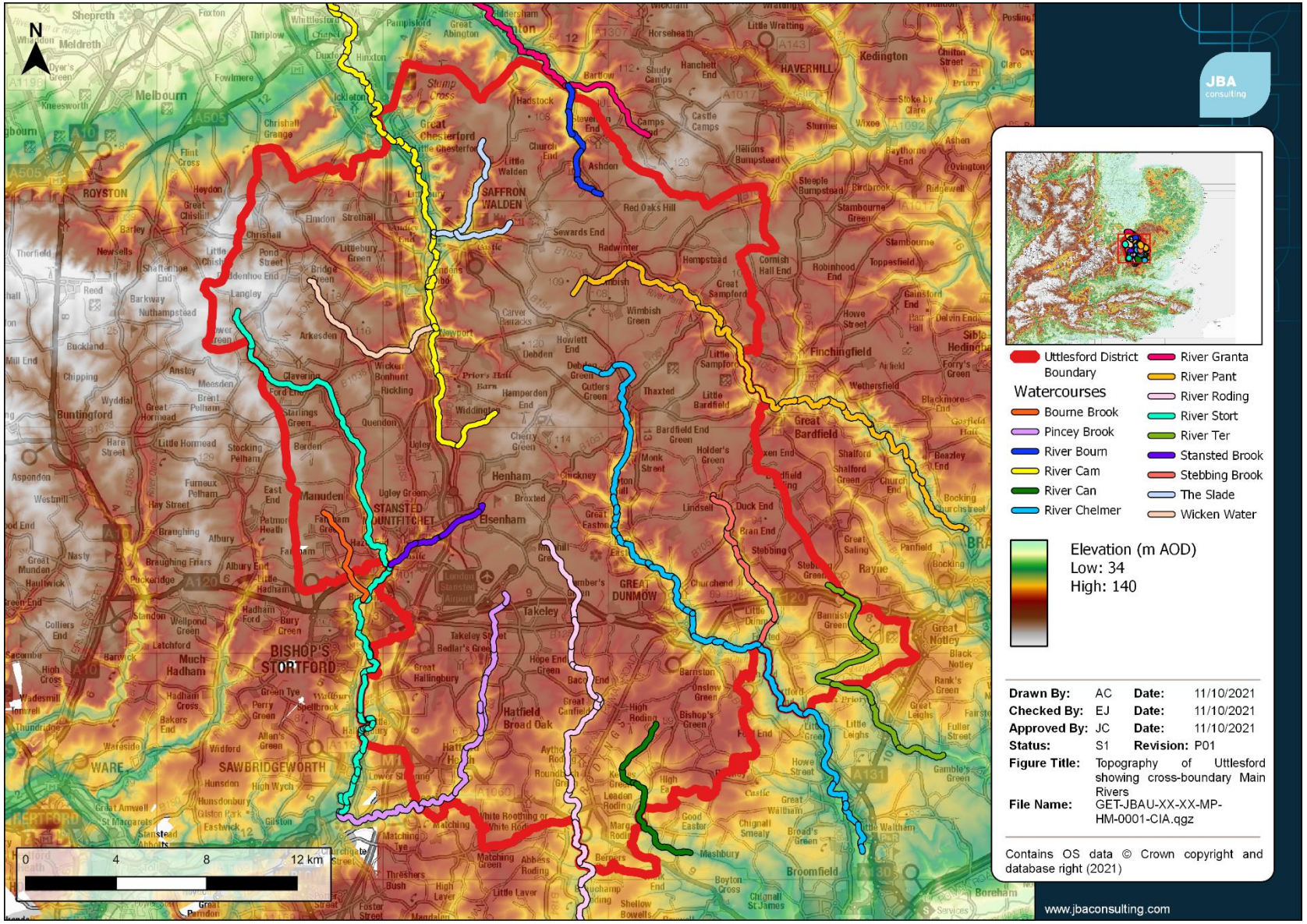
Table 7-1: Summary of catchments that drain into the neighbouring Local Authorities from Uttlesford District

Catchment		Neighbouring downstream authority
River Cam	(U/S Newport)	South Cambridgeshire
	(Newport to Audley End)	
	(Audley End to Stapleford)	
Slade (Tributary of River Cam)		
Wendon Brook (Tributary of River Cam)		
Wicken Water (Tributary of River Cam)		
Debden Water (Tributary of River Cam)		
Granta (Tributary of River Cam)		
Un-named Watercourse (Tributary of River Cam)		
Bumpstead Brook		Braintree
Toppesfield Brook		
River Pant		
River Ter		
River Chelmer	(U/S Gt Easton)	Chelmsford
	(Gt Easton – River Can)	
Stebbing Brook (Tributary of River Chelmer)		
River Can		
Upper Roding (to Cripsey Brook)		Epping Forest
Pincey Brook		
Stort and Navigation, B Stortford to Harlow		East Hertfordshire
Little Hallingbury Brook		
Stanstead Brook		
Stort (at Clavering)		
Stort and Bourne Brook		

Internal centralised districts of Cambridge (within South Cambridgeshire) and Harlow (with Epping Forest and bordering East Hertfordshire) are also drained into by the Rivers Cam and Stort respectively.

Policy recommendations with regards to managing the cumulative impact of development have been made in Section 7.7 and Chapter 10. This will help to ensure there is no incremental increase in flood risk both within and downstream of Uttlesford District.

Figure 7-1: Topography of Uttlesford District study area showing cross-boundary main rivers



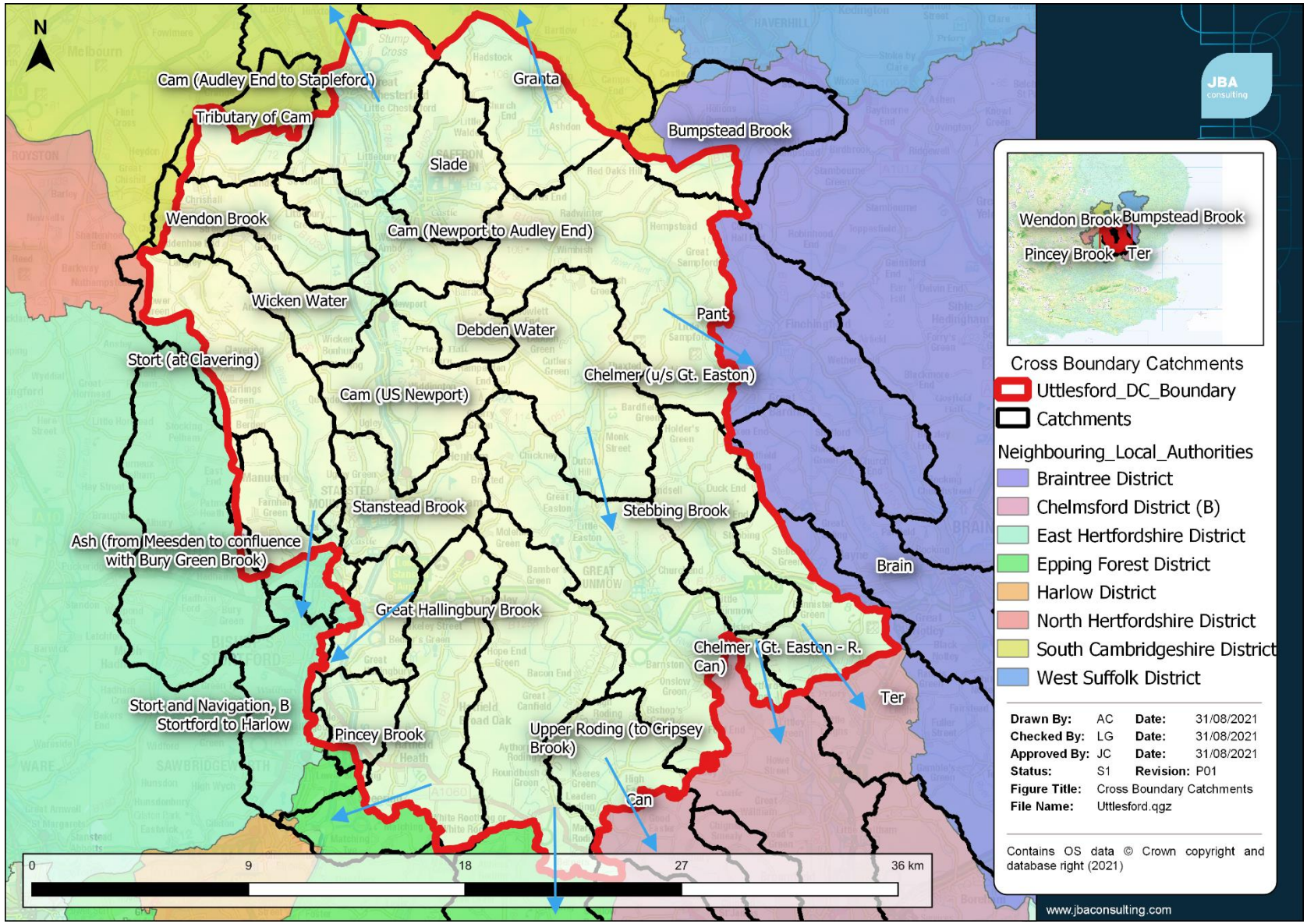


Figure 7-2: Topography of Uttlesford District study area showing cross-boundary catchments

7.4 Cumulative Impact Assessment

To assess the cumulative impact of development across the study area, the surface water flood risk in each catchment was assessed along with evidence of historic flooding incidents. Potential change in developed areas within each catchment from neighbouring authorities was also considered, but no development sites within Uttlesford District were included in the assessment. Analysis of this data facilitated the identification of catchments at the greatest risk of cumulative impacts of an increase in impermeable area within the catchment.

Figure 7-3 shows the methodology used and Table 7-2 summarises the datasets used within the Uttlesford District cumulative development scenario.

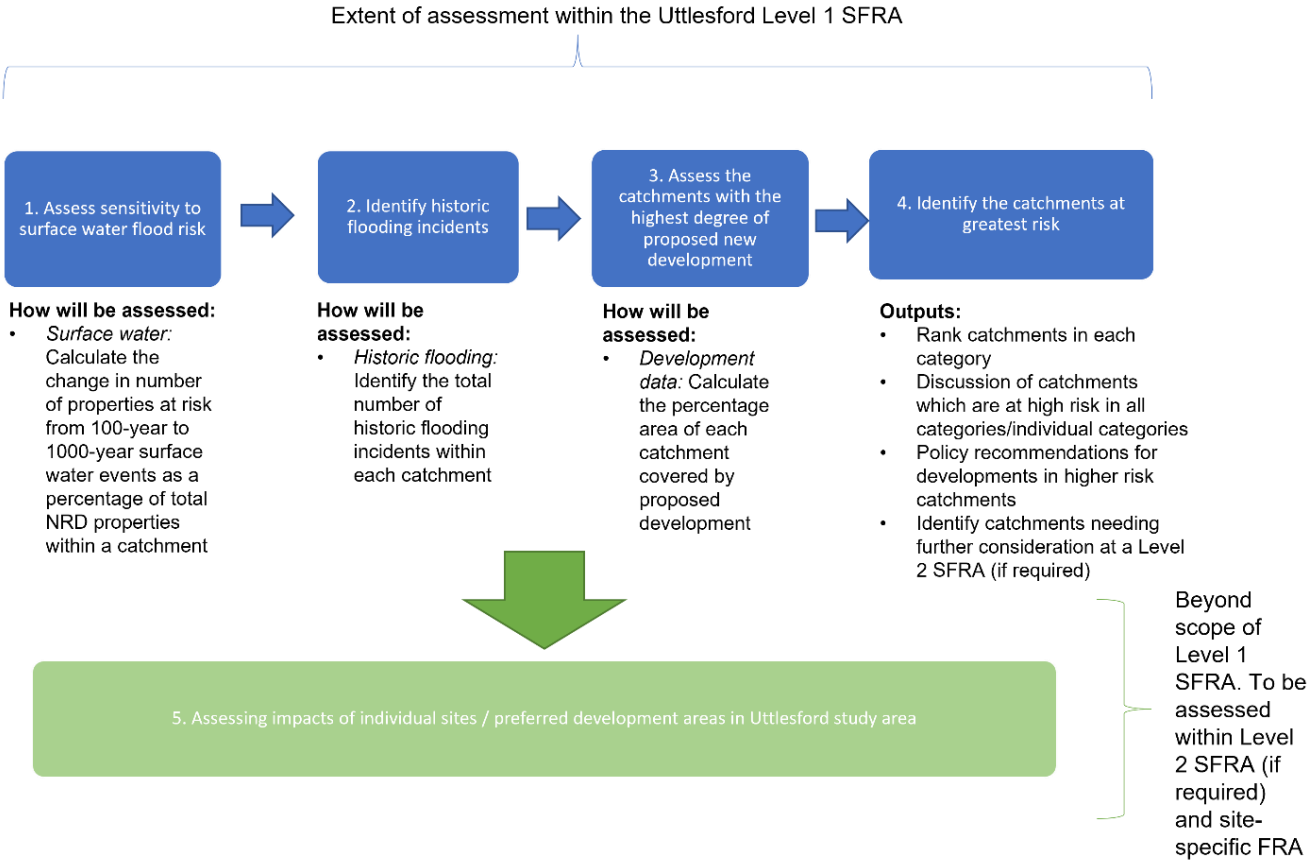


Figure 7-3: Overview of the method used within the Cumulative Impact Assessment

7.5 Cumulative Impact Methodology

7.5.1 Sensitivity to increases in flood flows

This is the measure of the increase in the number of properties at risk of surface water flooding in a 1 in 100-year event to a 1 in 1,000-year event. It is an indicator of where local topography makes an area more sensitive to increases in flood risk that may be due to any number of reasons, including climate change, new development etc. It is not an absolute figure or prediction of the impact that new development will have on flood risk.

The National Receptor Database (NRD) dataset 2014 was used to identify all properties within the Uttlesford District study area.

This data was intersected with the 1,000-year and 100-year surface water flood extents separately to determine the number of properties in each catchment, in each surface water flood extent. The difference between the two values was then taken as a percentage of the total number of properties within the catchment to allow comparison between catchments of different sizes.

7.5.2 Growth in the area

Development sites in neighbouring authorities were assessed as part of this CIA; however, the risk from neighbouring districts' development proposals is negligible as no watercourses flow into Uttlesford. Neighbouring authorities' sites were only assessed against risk from Uttlesford District.

Development within Uttlesford District has the potential to affect flood risk in neighbouring authorities, especially if there are existing flood risk issues. The River Cam drains out of Uttlesford District and through South Cambridgeshire into Cambridge City centre for example.

Areas for future proposed development were received from Uttlesford District Council. The area of new development within each catchment was expressed as a percentage of the total catchment area to determine the potential for increase in flood risk as a result of new development.

7.5.3 Historic flood risk

Historic flood risk was determined using data from Essex County Council. The local Fire and Rescue Service were approached but were unable to provide any additional data at the time of the study. Each point represents a location where it is known there has been at least one flood event (however, the nature and scale of these flood events varies significantly).

Attribute data for each Incident Recording System data point includes the:

- Time
- Date
- Location (grid reference and street name)
- Description of incident

Data was manually filtered to include only incidents where a property was recorded to have flooded internally. A count of each historical flood incident was conducted for each catchment to determine the historic flood risk of the catchments.

A summary of the datasets used to calculate the historic flood risk and the sensitivity to increases in flood flows for each catchment is shown in Table 7-2.

Table 7-2: Summary of datasets used in the cumulative impact assessment

Dataset	Coverage	Source of data	Use of data
Catchment Boundaries	Uttlesford study area	Water Framework Directive Catchments	Surface Water and Development Flood Risk
National Receptor Database (2014)	Uttlesford study area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment
Risk of Surface Water Flooding Mapping	Uttlesford Study Area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment
Future development areas	Uttlesford study area	Uttlesford District Council,	Assessing the impact of proposed future development on risk of flooding.
Historic Flooding Incidents	Uttlesford study area	Essex County Council, Uttlesford District Council	Assessing incidences of historic flooding within the Uttlesford study area.

7.5.4 Ranking the results

The results for each assessment were ranked into High, Medium and Low risk as shown in Table 7-3 below.

Table 7-3: Ranking assessment criteria

Flood risk ranking	% of properties at increased risk of SW flooding	Total number of data points in the UDC Historic Flooding Incidents Register	% Area of Catchment Covered by new development
Low risk	<4%	<10	<1%
Medium risk	4 to 7%	10 to 30	1 to 10%
High risk	>7%	>30	>10%

The ranking results were combined from all three assessments to give an overall High, Medium and Low ranking for all catchments within the district. Each ranking was then totalled to give a final combined ranking, this was done twice, once without the inclusion of Uttlesford DC's proposed development site data (to gain a current baseline), and once including the site data, to provide the development impact ranking. Ranking delineations were given at natural breaks in the results.

However, where a '% properties sensitive to increased risk' figure significantly surpassed catchments ranked higher in the final ranking, those individual results were considered, and the overall ranking increased accordingly (River Can and River Ash increased from Medium to High). This is due to the scale of the catchments in relation to properties at risk.

7.5.5 Assumptions

The assumptions made when conducting the cumulative impact assessment are shown in Table 7-4.

Table 7-4: Assumptions of the cumulative impact assessment

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Surface water flood risk	Total number of properties flooded	Assumption that all properties have been included in the 2014 NRD dataset. It may not include all new build properties.	This was the most up to date and accurate data available.
Historic Flooding incidents	Total number of historic events and severity of flooding	Only flooding incidents recorded that could be georeferenced with XY coordinates to produce GIS files. Each point represents a location where it is known there has been at least one flood incident. The severity of the historic flooding event relating to the point has not been considered, just the total number of points within each catchment where there has been a flood incident.	GIS data provided the most accurate results for the location of historic flooding incidents in Uttlesford District and neighbouring authorities.

The results of the assessment and policy recommendations can be found Chapter 7.6 and Chapter 10.

7.6 Cumulative Impact Assessment Outcomes

The assessment was conducted on the Water Framework Directive (WFD) River Catchments.

The results of the cumulative impact assessment can be summarised to give a rating of Low, Medium, or High risk for each catchment. The rating of each catchment or sub-catchment in each of these assessments were combined to give an overall ranking.

Table 7-5 shows the catchments identified as high risk due to the increased risk of surface water flooding and

Table 7-6 shows the highest risk catchments based on the number of historic flooding incidents recorded.

Table 7-5: Percentage of properties in a catchment sensitive to increased surface water flood risk

Catchment	Properties sensitive to increased surface water flood risk (%)
Stort (at Clavering)	10.24
Wicken Water	9.97
Bumpstead Brook	8.55
Fiddlers Brook	8.24
Chelmer (u/s Gt. Easton)	7.49
Higher Laver Brook	7.16
Debden Water	7.11

Table 7-6: Number of recorded historic flooding incidents within a catchment

Catchment	No. of historic incidents
River Slade	89
River Chelmer (Gt Easton – R. Can)	46
Upper Roding (to Cripsey Brook)	43
River Pant	39
River Brain	39
River Stort (at Clavering)	39

As can be seen from the above tables, there are catchments that are at high risk in both categories. However, the percentage increase of properties sensitive to surface water flood risk figures shown in Table 7-5 are minor when compared to the number of properties at risk. For example, the River Stort (at Claverling) is ranked highest risk with 10.24%, but this only equates to 850 properties, whereas the River Can, which ranks 32nd for increased surface water risk with only 1.43%, actually equates to 8526 properties sensitive to increased surface water risk. Table 7-7 shows the number of properties in each catchment sensitive to increased surface water flood risk and Table 7-8 shows the percentage of the catchments covered by future planned development.

Table 7-7: Number of properties in a catchment sensitive to increased surface water flood risk

Catchment	No. of properties sensitive to increased surface water flood risk
Stort and Navigation, B Stortford to Harlow	595
Stort and Navigation, Harlow to Lee	530
River Brain	419
Chelmer (Gt. Easton – R. Can)	376
River Slade	212
Stort and Bourne Brook	206
River Pant	176

Table 7-8: Percentage of catchment covered by future planned development

Catchment	Area of catchment for development (%)
Little Hallingbury Brook	28.27
Stanstead Brook	25.95
River Cam (Audley End to Stapleford)	17.42
River Slade	15.21
Great Hallingbury Brook	14.98
Pincey Brook	11.15

As can be seen from the above tables, there are catchments that are at high risk in both categories.

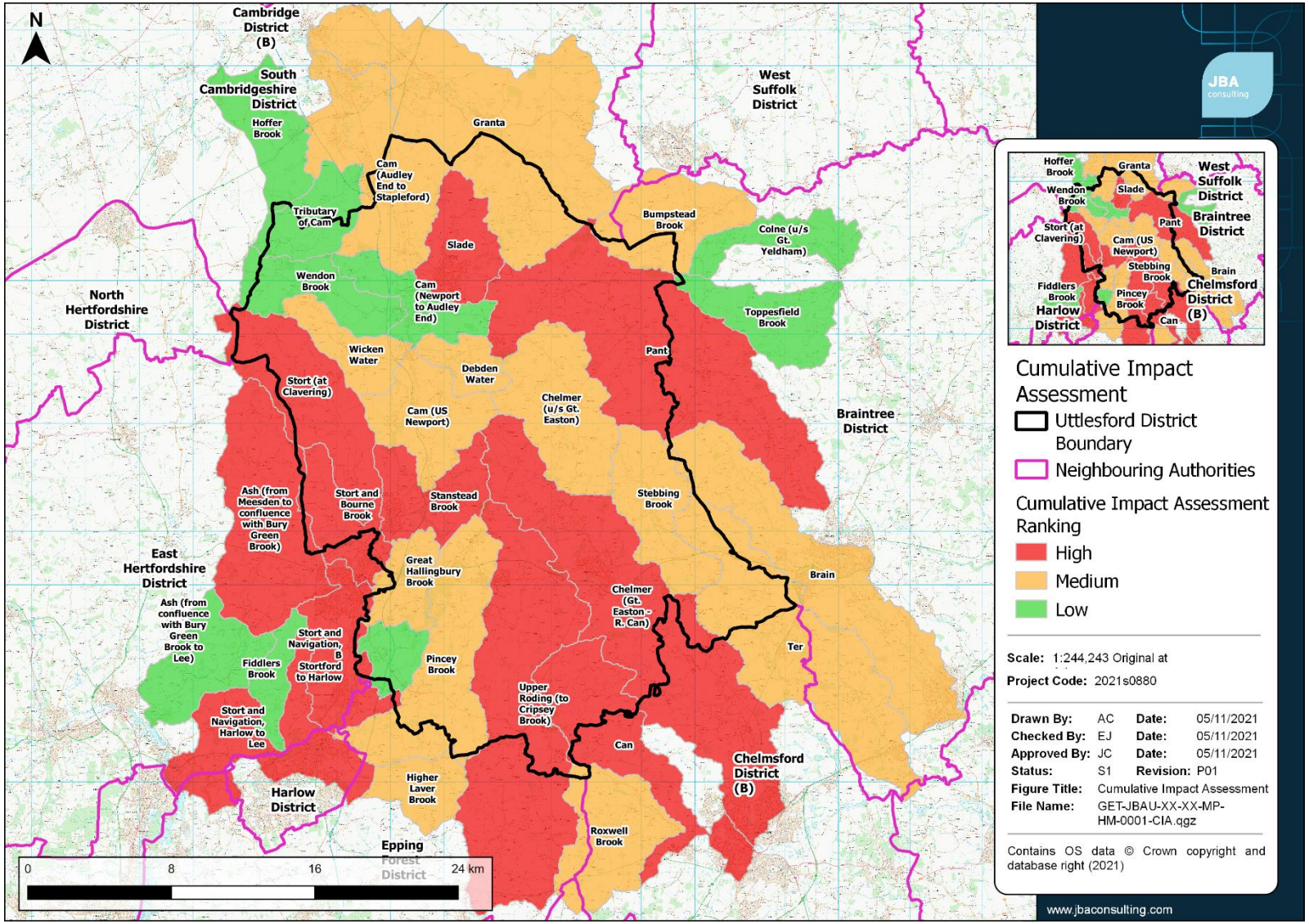
Figure 7-4 shows a map of catchments within Uttlesford District and identifies the highest risk catchments which are the most sensitive to the cumulative impacts of development.

Eleven catchments are identified as highest risk (Red), these are:

- Stort and Navigation, Harlow to Lee
- Stort (at Claverling)
- Stort and Navigation, B Stortford to Harlow
- Chelmer (Gt. Easton – R. Can)
- Upper Roding (to Cripsey Brook)
- Stort and Bourne Brook
- River Pant
- River Slade
- Stanstead Brook
- River Can*
- River Ash (from Meissen to confluence with Bury Green Brook)*

* Escalated from Medium to High Risk on account of the catchments' high percentage of new development area coverage ranking (28.27%, ranked 1st; and 25.95%, ranked 2nd respectively) in that individual ranking assessment.

Figure 7-4: Map showing the results of the cumulative impact assessment for each catchment within Uttlesford District



A further fourteen catchments that fall within or partially within Uttlesford District have been identified as at medium risk (Amber) which include:

- Chelmer (u/s Gt. Easton)
- Brain
- Bumpstead Brook
- Pincey Brook
- Stebbing Brook
- Wicken Water
- Ter
- Granta
- Higher Laver Brook
- Cam (Audley End to Stapleford)
- Cam (US Newport)
- Roxwell Brook
- Great Hallingbury Brook
- Debden Water

The remaining nine catchments within Uttlesford District are identified as at a low risk (Green) from the impacts of cumulative development:

- Fiddlers Brook
- Wendon Brook
- Little Hallingbury Brook
- Toppesfield Brook
- Tributary of Cam
- Colne (u/s Gt. Yeldham)
- Ash (from confluence with Bury Green Brook to Lee)
- Hoffer Brook
- Cam (Newport to Audley Brook)

7.7 Planning Policy Recommendations

The following recommendations have been made for catchments which have been identified as high-risk which flow from predominantly rural areas into neighbouring districts with significant urban areas, including the Rivers Chelmer, Stort, Pant and Upper Roding.

1. That a Level 2 SFRA or detailed local area Strategic Drainage Study be undertaken or commissioned to consider further how the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. Such studies could be used to justify greater restrictions/ enforce through local planning policy development site runoff rates and volumes specific to each catchment that are over and above those required by National and Local SuDS Standards. They could also identify where there are opportunities with allocated sites to provide off-site betterment e.g. online/ offline flood storage and where land should be safeguarded within proposed site allocations to fulfil this purpose.

2. Where appropriate, that the opportunity for Natural Flood Management in rural areas in support of Measure 6 of the **Local FRM Strategy (2018)**, SuDS retrofit in urban areas (supporting Measure 5) and river restoration should be maximised in these catchments (Measure 3).
3. Developers should explore through site-specific FRAs opportunities to provide wider community flood risk benefit through new developments in support of Measure 5 of the Local FRM Strategy (2018). Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered. This may be either by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques, green infrastructure and green-blue corridors, and/or by providing a Partnership Funding contribution towards any flood alleviation schemes. Consultation on the site-specific requirements should be undertaken with Essex County Council as LLFA and the Environment Agency at the earliest opportunity.
4. Developers should contribute to community flood defences where appropriate outside of their red line boundary in these catchments to provide wider benefits and help offset the cumulative impact of development.
5. That the LLFA and other RMAs should use this information to inform a long-term pipeline of flood alleviation studies and schemes to help inform points 2. to 5. above.
6. A Surface Water Drainage Strategy will be required for all developments within these catchments, regardless of development size.

Due to cross-boundary considerations, policy recommendations for these high-risk catchments also include:

1. Uttlesford District Council should work closely with the councils of Chelmsford District, Braintree, Epping Forest District, Harlow District and East Hertfordshire District to ensure that runoff is attenuated through the upper catchments through SuDS implementation to minimise and mitigate flood risk downstream. This could include opportunities for Natural Flood Management techniques in the upper catchment and the installation of storage areas to attenuate water and slow flows downstream.

The following policies are applicable to catchments across the district that have received a medium-risk or low-risk rating in the Cumulative Impact Assessment in order to minimise cumulative impacts:

1. Uttlesford District Council should work closely with neighbouring Local Authorities to develop complementary local planning policies for catchments that drain out of Uttlesford District into and/ or through other local authorities in order to minimise cross boundary issues of cumulative impacts of development.
2. Developers should incorporate SuDS and provide details of adoption, ongoing maintenance and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the district where practicable.
3. Essex County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. These should consider all sources of flooding to

ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.

7.8 Water quality considerations

In addition to cross-boundary issues regarding flood risk, there are also cross-boundary issues relating to water quality. Development or changes to land management practises in the upper catchments of watercourses that flow across boundaries from Uttlesford District can potentially impact on the quality of watercourses within the neighbouring authorities. Development should consider the quality of the water that is released from sites and the impact it may have on the water quality on any receiving waterbodies.

Future development should ensure there is no adverse impact on the quality of watercourses within the Council administrative area or neighbouring districts. Any impacts identified should then be considered in relation to the WFD Ecological, Hydromorphological and Chemical Status of the waterbody and the status objectives. Opportunities to improve the status of watercourses should also be considered. Information can be viewed at the Environment Agency **Catchment Data Explorer** website.

8 Flood risk management requirements for developers

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

The report provides a strategic assessment of flood risk within the district of Uttlesford. 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 watercourses to verify flood extents (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the Exception Test can be satisfied.

A detailed Flood Risk Assessment (FRA) may show that a site, windfall[2] or other, is not appropriate for development of a particular vulnerability or even at all. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not been seen as an alternative to proving these tests have been met.

8.1 Principles for new developments

8.1.1 Apply the Sequential and Exception Tests

Developers should refer to Section 3 for more information on how to consider the Sequential and Exception Tests. For allocated sites, Uttlesford District Council should use the information in this SFRA to apply the Sequential Test. For windfall sites a developer must undertake the Sequential Test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the Sequential Test should the Exception Test then be applied if required. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not be seen as an alternative to proving these tests have been met.

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

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

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

Developers should consult with the Environment Agency, Uttlesford District Council, Essex County Council as LLFA, Anglian Water and Thames Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design.

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

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

The SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific Flood Risk Assessment. At a site level, developers will need to check before commencing on a more detailed Flood Risk Assessment that they are using the latest available datasets. Developers should apply the 2020 Environment Agency climate change guidance and ensure the development has taken into account climate change adaptation measures.

8.1.4 Ensure that the development does not increase flood risk elsewhere

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

8.1.5 Ensure the development is safe for future users

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

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

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

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

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

Wherever possible, developments should seek to help reduce flood risk in the wider area e.g. by contributing to a wider community scheme or strategy for strategic measures, such as defences or natural flood management or by contributing in kind by mitigating wider flood risk on a development site. More information on the contribution developers are expected to make towards achieving the wider vision for FRM and sustainable drainage in the district can be found in Chapter 7.3. Developers must demonstrate in an FRA how they are contributing towards this vision.

8.2 Requirements for site-specific Flood Risk Assessments

8.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1.

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

  An FRA may also be required for some specific situations:
- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1)
- Where evidence of historical or recent flood events have been passed to the LPA
- In an area of significant surface water flood risk.

8.2.2 Objectives of a site-specific FRA

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

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

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

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

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

8.3 Local requirements for mitigation measures

8.3.1 Site layout and design

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

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

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

8.3.2 Modification of ground levels

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

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

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

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

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

8.3.3 Raised floor levels

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

The Environment Agency advises that minimum finished floor levels should be set 600mm above the 100-year plus climate change peak flood level, where the new climate change allowances have been used (see Chapter 4 for the climate change allowances). An additional allowance may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

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

reduced by use of multiple storey construction and raised areas that provide an escape route.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the Exception Test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

8.3.4 Development and raised defences

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

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

8.3.5 Developer contributions

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

8.3.6 Buffer strips

The provision of a buffer strip to 'make space for water', allows additional capacity to accommodate climate change and ensure access to the watercourse, structures and defences is maintained for future maintenance purposes. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection.

Building adjacent to riverbanks can cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult.

8.3.7 Making space for water

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

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

8.4 Resistance and resilience measures

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

Having applied planning policy, there will be instances where developments, such as those that are water compatible and essential infrastructure are permitted in

high flood risk areas. The above measures should be considered before resistance and resilience measures are replied on. The effectiveness of these forms of measures are often dependant on the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. The proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate. Available resistance and resilience measures are shown in Table 8-1.

Table 8-1: Available temporary measures

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

8.5 Reducing flood risk from other sources

8.5.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and so many conventional flood mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1 in 100-year plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

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

8.5.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. It is important that a Surface Water Drainage Strategy (often done as part of a Flood Risk Assessment) shows that

this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

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

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

Consideration must also be given to attenuation and flow ensuring that flows during the 100-year plus climate change storm event are retained within the site if any flap valves shut. This should be demonstrated with suitable modelling techniques.

8.5.3 Reservoirs

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

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

Developers should use the above information to:

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

- Assess the potential hydraulic forces imposed by sudden reservoir failure event and check that that the proposed infrastructure fabric could withstand the structural loads.
- Develop site-specific Emergency Plans and/ or Off-site Plans if necessary and ensure the future users of the development are aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand, similar to the response to the Toddbrook Reservoir incident in Whaley Bridge, Derbyshire, 2019.

8.6 Emergency planning

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

The 2019 NPPF requires site level Flood Risk Assessments to demonstrate that

> *"d) any residual risk can be safely managed; and*
>
> *e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."*

Certain sites will need emergency plans:

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

Emergency Plans will need to consider:

- The characteristics of the flooding e.g. onset, depth, velocity, hazard, flood borne debris
- The vulnerability of site occupants.
- Structural safety
- The impact of the flooding on essential services e.g. electricity, drinking water
- Flood warning systems and how users will be encouraged to sign up for them
- Safe access and egress for users and emergency services
- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.

- A safe place of refuge where safe access and egress and advance warning may not be possible, having discussed and agreed this first with emergency planners. Proposed new development that places an additional burden on the existing response capacity of the Councils will not normally be appropriate.

The LLR Prepared provides Emergency Planning relevant information that is both general and flood specific. This includes practical advice before, during and after flooding has occurred including, preparation, understanding warnings, actions to limit exposure to risk and recovery.

Further information is available from:

- **The National Planning Policy Guidance**
- **2004 Civil Contingencies Act**
- **DEFRA (2014) National Flood Emergency Framework for England**
- **FloodRe**
- The Environment Agency and DEFRA's **Standing Advice for FRAs**
- Essex County Council's **"Emergency Flood Advice"**
- Environment Agency's **"How to plan ahead for flooding"**
- Sign up for **Flood Warnings** with the Environment Agency
- The **National Flood Forum**
- **GOV.UK** - Make a Flood Plan guidance and templates

9 Surface water management and SuDS

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

9.1 Role of the LLFA and Local Planning Authority in surface water management

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

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

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

9.2 Sustainable Drainage Systems (SuDS)

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

SuDS provide a means of dealing with the quantity and quality of surface water and can also provide amenity and biodiversity benefits. Given the flexible nature of SuDS they can be used in most situations within new developments as well as being retrofitted into existing developments. SuDS can also be designed to fit into most spaces. For example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

It is a requirement for all new major development proposals to ensure that sustainable drainage systems for management of runoff are put in place. Likewise, minor developments should also ensure sustainable systems for runoff management are provided. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential.

9.3 Sources of SuDS guidance

9.3.1 C753 CIRIA SuDS Manual (2015)

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

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

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

In February 2021, Defra published its **research project** to review and recommend updates to the Non-Statutory Technical guidance. The proposals have not yet been adopted but would bring the standards in line with current best practice according to the construction industry research and information association (CIRIA) SuDS Manual.

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

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

9.3.4 Essex County Council Flood Risk Management Strategy

Essex County Council's Flood Risk Management Strategy (FRMS) sets out the aims and actions to reduce the impact of local flooding across the area. The FRMS focuses upon local flooding including man-made drainage systems, ordinary watercourses and surface water risk.

9.3.5 Essex County Council Surface Water Management Plans

Essex County Council have completed several Surface Water Management Plans (SWMP) across the county. They aim to understand the risk from local flood sources and outline a long-term action plan to manage these risks. *A SWMP has not been completed within the UDC area.*

9.3.6 Essex County Council SuDS Guidance

Essex County Council provide comprehensive guidance to the design and implementation of SuDS through their **online SuDS Design Guide**. The website provides detailed guidance on the planning, design and delivery of SuDS for developers, designers and consultants. Additional information can be found environment and planning section of Essex County Council's website.

9.4 Other surface water considerations

9.4.1 Groundwater Vulnerability Zones

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

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

9.4.2 Groundwater Source Protection Zones (GSPZ)

The Environment Agency also defines Groundwater Source Protection Zones (GSPZs) near groundwater abstraction points. These protect areas of

groundwater used for drinking water. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. GSPZs can be viewed on **DEFRA's Magic Map**.

Uttlesford District is located outside of a Groundwater Source Protection Zone.

9.4.3 Nitrate Vulnerable Zones

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

Uttlesford District comprises a Surface Water NVZ. The area is covered by the following NVZs:

- Ely and Ouse
- Lower Stour
- River Chlemer
- Colne
- Roding (Cripsey Brook to Loxford Water)
- Lee
- Stansted Mountfichet
- Anglian Chalk
- Clavering
- Sandlings and Chelmsford

NVZs can be viewed on the **Environment Agency's website.**

10 Summary and Recommendations

- There are numerous recorded flooding incidents across the district. Areas include but are not limited to Ashdon, Clavering, Debden, Elsenham, Great and Little Chesterford, Great and Little Dunmow, Great Sampford, Hatfield Heath, Little Hallingbury, Little Walden, Newport, Saffron Walden, Sewards End, Stansted Mountfitchet, Stebbing, Takeley and Thaxted. Sources of past flooding have been predominantly from main rivers, ordinary watercourses and surface water.
- The main rivers associated with fluvial flooding are the Great Ouse catchment are the River Cam and associated tributaries such as The Slade, Flufen Slade, Debden Water amongst others. Flooding occurs along the course of the river mainly affecting Saffron Walden and Newport. The North Essex catchment has the River Chelmer, Pant, Can and Stebbing Brook amongst others. The Chelmer passes through areas such as Great Dunmow where there is greater risk. The Thames catchment's main rivers include the Stort, Roding, Stansted and Pincey Brook to name some. The main areas of fluvial flood risk are along the River Stort and Pincey Brook, near Stansted Airport and Stansted Mountfitchet. A large number of the rivers across the district flow through rural catchments with smaller villages.
- Surface water risk largely follows the topography of the watercourses. There are a few areas where there are additional smaller flow paths, and minor areas of ponding. Surface water is also often impounded by roads or rail embankments, such as at Stansted Mountfitchet and the M11. Areas identified with high-risk surface water extents (30-year event) are Saffron Walden Clavering, Great Dunmow, Manuden, Radwinter, Takeley, Thaxted and Stansted Mountfitchet. Other areas within Uttlesford that have been identified as having a surface water flooding problem through the flood history review include Little Hallingbury and Little Dunmow.
- Data from Anglian Water and Thames water shows that sewer flooding is limited and very localised.
- Areas at risk of flooding are likely to become at increasing risk in the future and the frequency of flooding will increase in such areas as a result of climate change. Flood extents will increase; in some locations, this may not be by very much, but flood depth, velocity and hazard may have more of an impact due to climate change. It is recommended that the Council works with other Risk Management Authorities to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the district.
- The JBA risk of flooding from groundwater map shows that, in general, the majority of the Uttlesford District is not susceptible to groundwater flooding. However, there are areas where groundwater varies from 5m below ground level, to some areas where it is less than 0.025m below ground level. This appears to be in line with the outlines of the River Stort, Stansted Brook, Bourne Brook, and the River Cam and its tributaries of Wicken Water, The Slade, Flufen Slade, Debden Water and an unnamed tributary. Therefore, along the course of these rivers and their surrounding floodplains, the risk of flooding from groundwater is relatively high. There are also smaller pockets of areas where groundwater is 0.5 – 5m below ground level along the River Chelmer and Pant.
- There are no canals in the Uttlesford District, therefore there is no risk of canal overtopping.
- There is a potential risk of flooding from four reservoirs, all outside the district boundary. There are no records of flooding from reservoirs in the study area. The level and standard of inspection and maintenance required under the Reservoirs Act 1975 means that the risk of flooding from reservoirs is relatively low. However,

there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific Flood Risk Assessments (where relevant).

10.1 Recommendations

Reduction of flood risk through site allocations and appropriate site design

- To locate new development in areas of lowest risk, in line with the Sequential Test, by steering sites to Flood Zone 1. If a Sequential Test is undertaken and a site at flood risk is identified as the only appropriate site for the development, the Exception Test shall be undertaken.
- After application of the Exception Test, a sequential approach to site design will be used to reduce risk. Any re-development within areas of flood risk which provide other wider sustainability benefits will provide flood risk betterment and made resilient to flooding.
- Identification of long-term opportunities to remove development from the floodplain and to make space for water.
- Ordinary watercourses not currently afforded flood maps should be modelled to an appropriate level of detail to enable a sequential approach to the layout of the development.
- Ensure development is 'safe', dry pedestrian egress from the floodplain and emergency vehicular access should be possible for all residential development. If at risk, then as assessment should be made to detail the flood duration, depth, velocity and flood hazard rating in the 1 in 100-year plus climate change flood event, in line with FD2320.
- Raise residential and commercial finished floor levels 600mm above the 1 in 100-year plus climate change flood level. Protect and promote areas for future flood alleviation schemes.
- Safeguard functional floodplain from future development.
- Identify opportunities for brownfield sites in functional floodplain to reduce risk and provide flood risk betterment.
- Identify opportunities to help fund future flood risk management through developer contributions to reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

Promote SuDS to mimic natural drainage routes to improve water quality

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

Reduce Surface Water Runoff from New Developments and Agricultural Land

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

Enhance and Restore River Corridors and Habitat

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

Mitigate Against Risk, Improved Emergency Planning and Flood Awareness

- Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.
- For a partial or completely pumped drainage system, an assessment should be undertaken to assess the risk of flooding due to any failure of the pumps to be assessed. The design flood level should be determined if the pumps were to fail; if the attenuation storage was full, and if a design storm occurred.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 100-year rainfall event, inclusive of climate change and urban creep.
- Consideration and incorporation of flood resilience measures up to the 1 in 1,000-year event.
- Ensure robust emergency (evacuation) plans are produced and implemented for major developments.
- Increase awareness and promote sign-up to the Environment Agency Flood Warnings Direct (FWD) within Uttlesford District.

10.1.1 Recommendations from the cumulative impact analysis

The following recommendations have been made for catchments which have been identified as high-risk which flow from predominantly rural areas into neighbouring districts with significant urban areas, including the Rivers Chelmer, Stort, Pant and Upper Roding.

1. That a Level 2 SFRA or detailed local area Strategic Drainage Study be undertaken or commissioned to consider further how the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. Such studies could be used to justify greater restrictions/ enforce through local planning policy development site runoff rates and volumes specific to each catchment that are over and above those required by National and Local SuDS Standards. They could also identify where there are opportunities with allocated sites to provide off-site betterment e.g. online/ offline flood storage and where land should be safeguarded within proposed site allocations to fulfil this purpose.
2. Where appropriate, that the opportunity for Natural Flood Management in rural areas in support of Measure 6 of the **Local FRM Strategy (2018)**, SuDS retrofit in urban areas (supporting Measure 5) and river restoration should be maximised in these catchments (Measure 3).
3. Developers should explore through site-specific FRAs opportunities to provide wider community flood risk benefit through new developments in support of Measure 5 of the Local FRM Strategy (2018). Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered. This may be either by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques, green infrastructure and green-blue corridors, and/or by providing a Partnership Funding contribution towards any flood alleviation schemes. Consultation on the site-specific requirements should be undertaken with Essex County Council as LLFA and the Environment Agency at the earliest opportunity.
4. Developers should contribute to community flood defences where appropriate outside of their red line boundary in these catchments to provide wider benefits and help offset the cumulative impact of development.
5. That the LLFA and other RMAs should use this information to inform a long-term pipeline of flood alleviation studies and schemes to help inform points 2. to 5. above.
6. A Surface Water Drainage Strategy will be required for all developments within these catchments, regardless of development size.

Due to cross-boundary considerations, policy recommendations for these high-risk catchments also include:

1. Uttlesford District Council should work closely with the councils of Chelmsford District, Braintree, Epping Forest District, Harlow District and East Hertfordshire District to ensure that runoff is attenuated through the upper catchments through SuDS implementation to minimise and mitigate flood risk downstream. This could include opportunities for Natural Flood Management techniques in the upper catchment and the installation of storage areas to attenuate water and slow flows downstream.

The following policies are applicable to catchments across the district that have received a medium-risk or low-risk rating in the Cumulative Impact Assessment in order to minimise cumulative impacts:

1. Uttlesford District Council should work closely with neighbouring Local Authorities to develop complementary local planning policies for catchments that drain out of Uttlesford District into and/ or through other local authorities in order to minimise cross boundary issues of cumulative impacts of development.

2. Developers should incorporate SuDS and provide details of adoption, ongoing maintenance and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the district where practicable.
3. Essex County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. These should consider all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.

Appendices

A Interactive Flood Risk Mapping

B Data sources used in the SFRA

C SFRA User Guide

D Flood Alerts and Flood Warnings

E Flood history in the district

F Summary of flood risk across the district

Offices at

Coleshill
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Edinburgh
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