



**Uttlesford Strategic Flood
Risk Assessment**

March 2008

FINAL REPORT



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REVISION HISTORY

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CONTRACT

This report describes work commissioned by Uttlesford District Council under contract dated 24th May 2007. Uttlesford District Council's representative for the contract was Melanie Jones. Francesca Hurt and Tony Green of JBA Consulting carried out the work.

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PURPOSE

This document has been prepared solely as a Strategic Flood Risk Assessment for Uttlesford District Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by Uttlesford District Council for the purposes for which it was originally commissioned and prepared.

ACKNOWLEDGMENTS

The considerable help provided by the Environment Agency and Uttlesford District Council in providing information is gratefully acknowledged.

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SUMMARY

This report is a Strategic Flood Risk Assessment (SFRA) for Uttlesford District Council.

This SFRA has been prepared in accordance with current best practice, Planning Policy Statement 25 Development and Flood Risk (PPS25).

The SFRA is a planning tool that enables the council to select and develop sustainable site allocations away from vulnerable flood risk areas. The assessment focuses on the existing site allocations within the district but also sets out the procedure to be followed when assessing additional sites for development in the future. The SFRA will assist each council to make the spatial planning decisions required to inform the Local Development Framework (LDF).

A thorough review of existing information, and additional modelling work, was used to identify the level of flood risk at present within the District from fluvial and other sources. The SFRA identified that the significant source of flood risk within the Uttlesford District was fluvial, with only a few incidences of groundwater, and sewer flooding.

The fluvial flood risk suffered by the District was delineated into four flood zones in line with PPS25:

- Zone 1: Low Probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of flooding in any year (<0.1%). The percentage coverage of this flood zone 1 within the District is 96.7%
- Zone 2: Medium Probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of flooding (1% - 0.1%) in any year. The percentage coverage of this flood zone 2 within the District is 0.6%
- Zone 3a: High Probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of flooding (>1%) in any year. The percentage coverage of this flood zone within the District is 0.4%
- Zone 3b: The Functional Floodplain. This zone comprises land where water has to flow or be stored in times of flood. Equivalent to the 1 in 20 annual probability of flooding in any year (5%). The percentage coverage of this flood zone within the District is 2.3%

The SFRA also contains:

- An overview of flood risk issues for each of the District's Growth Options;
- Recommended policies to aid the councils in managing the flood risk within the District;
- An outline of requirements for detailed Flood Risk Assessments (FRAs); and
- Advice on Sustainable Drainage Systems (SuDS) and mitigation measures to consider as part of a development proposal.

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ABBREVIATIONS

CC	Climate Change
CIRIA	Construction Industry Research and Information Association
COW	Critical Ordinary Watercourse
DEFRA	Department for the Environment, Food and Rural Affairs
DEM	Digital Elevation Model
DIA	Drainage Impact Assessment
DPD	Development Plan Documents
DDF	Depth Duration Frequency
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FWD	Floodline Warnings Direct
ha	Hectare
JBA	Jeremy Benn and Associates
LDD	Local Development Document
LDF	Local Development Framework
LiDAR	Light Detection and Ranging
LPA	Local Planning Authority
mAOD	Metres above Ordnance Datum
NFCDD	National Fluvial and Coastal Defence Database
OS	Ordnance Survey
PPG4	Planning Policy Guidance Note 4
PPG25	Planning Policy Guidance Note 25
PPS1	Planning Policy Statement 1
PPS3	Planning Policy Statement 3
PPS12	Planning Policy Statement 12
PPS25	Planning Policy Statement 25
RPB	Regional Planning Bodies
SA	Sustainability Appraisal
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SPG	Supplementary Planning Guidance
SUDS	Sustainable Drainage System
UDP	Unitary Development Plan

GLOSSARY

Actual Risk		The risk posed to development situated within a defended area (i.e. behind defences), expressed in terms of the probability that the defence will be overtopped, and/or the probability that the defence will suffer a structural failure, and the consequence should a failure occur
Brownfield		Brownfield (sites or land) is a term in common usage that may be defined as 'development sites or land that has previously been developed'. Prior to PPS25 the term 'Brownfield' was used in Governmental Guidance and Statements, but in PPS25 has been replaced with 'Previously-developed land' See 'Greenfield'.
Core Strategy	CS	This is the strategic vision of the area and is a central pillar of the Local Development Framework, comprising: A vision; Strategic objectives; A spatial land use strategy; Core policies and; A monitoring and implementation framework. The Core Strategy is a Development Plan Document which will determine overall patterns of future development, identifying broad locations where future growth or conservation will take place. All other Development Plan Documents should be in broad conformity with the Core Strategy Document. The Core Strategy is a mandatory document, and a timetable for production is set out within the Local Development Scheme.
Defended Area		An area offered a degree of protection against flooding through the presence of a flood defence structure
DG5 register	DG5	Register held by water companies on the location of properties at risk of sewage related flooding problems
Development Plan Documents	DPDs	These documents have Development Plan Status and consequently form part of the statutory development plan for the area. A DPD will be subject to a independent examination. Typical documents that will have DPD status include the Core Strategy, Site-specific Allocations of Land, Proposals Map, and Area Actions Plans (where needed).
Extreme Flood Outline	EFO	Flood 'zone' maps released by the Environment Agency depict anticipated 0.1% (1 in 1000 year) flood extents in a consistent manner throughout the UK
Flood Risk Management		The introduction of mitigation measures (or options) to reduce the risk posed to property and life as a result of flooding. It is not just the application of physical flood defence measures

Formal Defence		A flood defence asset that is maintained by the Environment Agency
Flood Estimation Handbook	FEH	Provides current methodologies for estimation of flood flows for the UK
Floodplain		Any area of land over which water flows or is stored during a flood event or would flow but for the presence of defences
Flood Risk Assessment	FRA	A detailed site-based investigation that is undertaken by the developer at planning application stage
Fluvial Flooding		Flooding caused by the overtopping of river or stream banks
Freeboard		A 'safety margin' to account for residual uncertainties in water level prediction and/or structural performance, expressed in mm
Functional Floodplain		An area of land where water has to flow or be stored in times of flood (fluvial, not tidal).
Greenfield		Greenfield (sites or land) is a term in common usage that may be defined as 'development sites or land that has not previously been developed'. Prior to PPS25 the term 'Greenfield' was used in Governmental Guidance and Statements, but in PPS25 has been replaced with 'Undeveloped land' See 'Brownfield'.
Informal Defence		A structure that provides a flood defence function, however is not owned nor maintained by the Environment Agency
JFLOW		2-Dimension hydraulic modelling package developed by JBA
Local Development Framework	LDF	The Local Development Framework is made up of a series of documents that together will form part of the Development Plan. Broadly Local Development Framework documents fall into two categories: Development Plan Documents Supplementary Planning Documents
Measure		A deliverable solution that will assist in the effective management (reduction) of risk to property and life as a result of flooding, e.g. flood storage, raised defence, effective development control and preparedness, and flood warning
Mitigation		The management (reduction) of flood risk
Probability	1%	A measure of the chance that an event will occur. The probability of an event is typically defined as the relative frequency of occurrence of that event, out of all possible events. Probability can be expressed as a fraction, % or a decimal. For example, the probability of obtaining a six with a shake of a fair dice is 1/6, 16% or 0.166. Probability is often expressed with reference to a time period, for example,

		annual exceedance probability
Rapid Inundation Zone		An area immediately behind defences which, should they fail, will generate a combination of high velocities and flood depths that would cause a risk to life.
Residual Risk		The risk that inherently remains after implementation of a mitigation measure (option)
Return Period		The expected (mean) time (usually in years) between the exceedance of a particular extreme threshold. Return period is traditionally used to express the frequency of occurrence of an event, although it is often misunderstood as being a probability of occurrence.
Risk		The threat to property and life as a result of flooding, expressed as a function of probability (that an event will occur) and consequence (as a result of the event occurring)
Standard of Protection	SoP	The return period to which properties are protected against flooding
Strategic Flood Risk Assessment	SFRA	The assessment of flood risk on a catchment-wide basis for proposed development in a District
Strategic Flood Risk Management	SFRM	Considers the management of flood risk on a catchment-wide basis, the primary objective being to ensure that the recommended flood risk management 'measures' are sustainable and cost effective
Supplementary Planning Documents	SPD	Supplementary Planning Documents or SPD support DPDs in that they may cover a range of issues, both thematic and site specific. Examples of SPD may be design guidance or development briefs. SPD may expand policy or provide further detail to policies in a DPD. They will not be subject to independent examination.
Sustainability Appraisal	SA	A Sustainability Appraisal is a systematic process to predict and assess the economic, environmental and social effects likely to arise from DPDs and SPDs, enabling each document to be tested and refined, ensuring that it contributes towards sustainable development.
Sustainable (Urban) Drainage System	SUDS	Current 'best practice' for new urban development that seeks to minimise the impact upon the localised drainage regime, e.g. through the use of pervious areas within a development to reduce the quantity of runoff from the site
Uncertainty		A reflection of the (lack of) accuracy or confidence that is considered attributable to a predicted water level or flood extent

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1 INTRODUCTION

1.1 Overview

In May 2007 JBA Consulting was commissioned by Uttlesford District Council to undertake a Strategic Flood Risk Assessment (SFRA) for the district.

This SFRA has been prepared in accordance with Planning Policy Statement 25 Development and Flood Risk (PPS25)¹ and guidance on current best practice in 'A Practice Guide Companion to PPS25 Living Draft'.

The SFRA is a planning tool that enables the council to select and develop sustainable allocations away from vulnerable flood risk areas. The assessment focuses on the existing allocations within the districts but also sets out the procedure to be followed when assessing additional sites for development in the future. The SFRA will assist the council to make the spatial planning decisions required to inform their Local Development Framework (LDF).

1.2 Study Objectives

Current policy requires local authorities to demonstrate that due regard has been given to the issue of flood risk as part of the planning process. It also requires that flood risk is managed in an effective and sustainable manner. To this end, the key objectives of the Uttlesford SFRA are:

- To investigate and identify the extent of flood risk to the area. This assessment will enable the council to steer development away from those areas that are at highest risk, ensuring that areas allocated for development can be developed in a safe, cost effective and sustainable manner
- To supplement current flood policy guidelines and to provide a straightforward risk based approach to development control in the local area. This is aimed at both the council and developers.
- To contribute to the Local Development Framework LDF.
- The SFRA is a reference document to which all parties involved in planning and flood risk can reliably turn to for initial advice. The SFRA should be reviewed regularly in light of emerging policy directives and improved understanding of flood risk.

1.3 Study Area

The Uttlesford District is situated in the west of the County of Essex. Its main towns are Great Dunmow, Saffron Walden and Stansted Mountfitchet.

The District is under continuous development pressure as a consequence of the proximity to London, Stansted International Airport and development of the M11 corridor.

Uttlesford District contains tributaries for three major catchments: Great Ouse, Thames, and North Essex. The main rivers within Uttlesford include the River Bourne, River Can, River Pant, River Stort, River Roding, River Chelmer, River Cam, River Granta, Ugley Brook, Bourne Brook, Pincey Brook, Stansted Brook, Stebbing Brook and The Slade. As a consequence the SFRA will need to consider downstream implications of development and land use change.

The area is prone to localised flooding within Great Dunmow, Saffron Walden, Stansted Mountfitchet, Great Hallingbury, Great Canfield, Berden, Maunden, Great Chesterford, Newport and Hatfield Broad Oak. A fluvial flood event occurred as recently as June 2007 in Ashdon.

¹ Communities and Local Government. 2006 *Planning Policy Statement 25: Development and Flood Risk*. December 2006. http://www.communities.gov.uk/pub/955/PlanningPolicyStatement25DevelopmentandFloodRisk_id1504955.pdf

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2 THE PLANNING FRAMEWORK

2.1 Introduction

The purpose of this section of the report is to identify and outline those high level documents which must be taken into account in preparing this SFRA, from a national to local level. The documents which have been reviewed include national planning legislation and the East of England Plan.

2.2 National Policy Guidance

2.2.1 Planning and Compulsory Purchase Act

The SFRA has been prepared in a period during which planning authorities have been implementing the provisions of the Planning and Compulsory Purchase Act 2004 and accompanying planning guidance, including PPS 1 Delivering Sustainable Development and PPS 12 Local Development Frameworks. This affected all tiers of the planning system and has necessitated major changes at both the regional and local level which will impact on the way in which planned development is reflected in the regional strategy and delivered locally.

2.2.2 PPS25 Development and Flood Risk

In December 2006 the Government published PPS25: Development and Flood Risk.

The aims of PPS25 is to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. The key planning objectives are that "Regional planning bodies (RPBs) and local planning authorities (LPAs) should prepare and implement planning strategies that help to deliver sustainable development by:

- Identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;
- Preparing Regional or Strategic Flood Risk Assessments (RFRAs/SFRAs) as appropriate, either as part of the Sustainability Appraisal of their plans or as a freestanding assessment that contributes to that Appraisal;
- Framing policies for the location of development which avoid flood risk to people and property where possible and manage any residual risk, taking account of the impacts of climate change;
- Only permitting development in areas of flood risk when there are no suitable alternative sites in areas of lower flood risk (i.e. the sequential test has been passed) and the benefits of the development outweigh the risks from flooding (i.e. where applicable, the exception test has been passed);
- Safeguarding land from development that is required for current and future flood management e.g. conveyance and storage of flood water and flood defences;
- Reducing risk to and from new development through location and the sequential approach to site design, incorporating sustainable drainage systems (SUDS);
- Using opportunities offered by new development to reduce the causes and impacts of flooding e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SUDS; recreating functional floodplain and setting back defences;
- Working effectively with the Environment Agency and other stakeholders to ensure that best use is made of their expertise and information so that decisions on planning applications can be delivered expeditiously; and
- Ensuring spatial planning supports flood risk management policies and plans; River Basin Management and emergency planning."

In addition to setting out the roles and responsibilities for LPAs and RPBs, PPS25 identifies that landowners also have a primary responsibility for safeguarding their land and other property against natural hazards such as flooding. Those promoting sites for development are also responsible for:

- Demonstrating that the sites are consistent with PPS25 and Local Development Documents (LDDs);
- Providing a Flood Risk Assessment (FRA) demonstrating whether the proposed development: is likely to be affected by current or future flooding; satisfies the LPA that the development is safe; and identifies management and mitigation measures.

PPS25 also reiterates the amendment made on 1 October 2006 to Article 10 of The Town and Country Planning (General Development Order) 1995 which states that the Environment Agency are to be a Statutory Consultee on all applications for development in flood risk areas. The introduction of PPS25 enables local authorities to make a direction under Article 4 of the Town and Country Planning (General Permitted Development) Order 1995. This will enable Local Authorities to remove permitted development rights where those rights threaten to have a direct, significant and adverse effect on a flood risk area, or its flood defences and their access, or the permeability and management of surface water, or flood risk to occupants.

A Practice Guide Companion to PPS25 Living Draft

The Government has produced a consultation companion guide to PPS25 during February 2007. The practice guide provides guidance on the implementation of the policy set out in PPS25. The guide provides further guidance on the preparation of SFRA's and FRA's, the Sequential and Exception Test, outlines potential mitigation measures e.g. SUDS and risk management techniques. The consultation will end during August 2007.

2.2.3 Other Planning Policy Statements

PPS1 *Delivering Sustainable Development* published in February 2005 sets out the overarching planning policies for the delivery of sustainable development across the planning system and sets the tone for other PPSs that will follow. PPS1 explicitly states that development plan policies should take account of flooding, including flood risk. It proposes that new development in areas at risk of flooding should be avoided. Planning authorities are also advised to ensure that developments are "*sustainable, durable and adaptable*" including taking into account natural hazards such as flooding.

Whilst not directly relevant to the development of a SFRA, it is important to recognise that the exercise takes place within the context of other planning policy statements, some of which also require sequential testing of site allocations and development proposals. PPS3 *Housing*, PPG4 *Industrial and Commercial Development and Small Firms* and PPS6 *Planning for Town Centres* are intrinsic within the planning process, and therefore an understanding of the constraints faced as a result of this additional policy guidance is imperative.

2.3 Regional Policy

2.3.1 Regional Planning Guidance for the South East

The Regional Planning Guidance for the South East (RPG9) covers the period up to 2016, and outlines the development requirement for each sub-region of the South East. Uttlesford District falls within the London-Stansted-Cambridge Sub-Region

London-Stansted-Cambridge Sub-Region

- The London-Stansted-Cambridge sub-region has been identified as a potential growth area which could accommodate major sustainable growth.
- London Stansted Airport has a planned growth to 15 million passengers per annum and is a major freight mover.
- Housing allocations to support employment growth at the airport have been made in both the Essex and Hertfordshire Structure Plans. These have been predominantly in Bishop's Stortford, Braintree, Harlow and some of the smaller towns in Uttlesford District (Essex).
- There are good north-south transport links by both road and rail, with fast links to London and direct services to Cambridge, the midlands and north. East-west communications are less well-developed but Improvements to the A120 are programmed.

2.3.2 The East of England Plan

Under the Planning and Compulsory Purchase Act 2004, RPG9 is to be replaced by a new Regional Spatial Strategy, entitled the East of England Plan. The East of England Plan has been prepared by the East of England Regional Assembly (EERA). The plan will cover the period up to 2021 but sets a vision, objectives and core strategy for the longer term. The public examination of the Draft Plan was held between November 2005 and March 2006 and the Secretary of State's proposed changes were published in December 2006. The final RSS is due to be adopted/published early in 2008.

Policies and proposals outlined in the latest draft which affect Uttlesford are:

- Achievement of job growth contributing to meeting the target of 42,000 jobs for Uttlesford, Harlow, Chelmsford, Braintree and Maldon
- Development of Stansted Airport to be informed by the 2003 Air Transport White Paper
- Hatfield Forest is identified as an asset of regional significance for the retention, provision and enhancement of green infrastructure
- The Cambridge Sub-Region is an area which should continue to develop as a centre of excellence for higher education and research. Saffron Walden is in this sub-region.
- London to Stansted corridor including access to Stansted Airport is identified as an area likely to come under increasing transport pressure where further study is required.
- The Gypsy and Traveller site review suggests 12-15 new pitches may be required in Uttlesford
- Supply of 8,000 new homes for Uttlesford up to 2021 with a requirement to plan for housing delivery for 15 years from the date of adoption of the Core Strategy at a rate of 430 homes a year

The East of England Plan requires the District to make a minimum dwelling provision of 8,000 homes between 2001 and 2021 and to plan for a continuous delivery of housing for at least 15 years from the date of adoption. The exact location and form of this development will be identified in the Local Development Framework. The Council is currently preparing the Core Strategy which sets out the strategic framework for the delivery of this housing. The Core Strategy is to be adopted in 2009 and therefore assuming the annual average rate of completion is rolled forward the Council needs to make a minimum provision of 9290 homes between 2001 and 2024. Taking into account the number of homes already completed, unimplemented planning permission on urban/settlement expansion sites and other sites that the Council is confident will be built within the plan period, an outstanding requirement to be identified in the Core Strategy of 3824 homes results. Allowing an additional 10% for sites which may not come forward means that the preferred growth option needs to make provision for 4200 homes

2.3.3 Catchment Flood Management Plans

The Catchment Flood Management Plan (CFMP) is high level policy document covering entire catchments. 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 (CFMP) areas: the Great Ouse CFMP, the Thames CFMP and the North Essex CFMP. The Thames, Great Ouse and the North Essex CFMP's are ongoing and as yet only the Thames CFMP has released future management policies. The future flood risk management policy messages of the Thames CFMP are as follows:

- Use the Sequential Test to locate new development in least risky areas, giving highest priority to Flood Zone 1.
- If an Sequential Test is undertaken and a site in a floodplain is identified as only site for development, after application of Exception Test use sequential approach to site design and seek opportunities to reduce risk (e.g. change to a less vulnerable land use, reduce footprint, replace existing building with a development on stilts, make space for water).
- Build resilience into a site's design (e.g. flood-proofing, raised floor levels).
- Ensure development is 'Safe'. For residential developments to be classed as 'safe' dry access without crossing through the floodplain will be required.
- Preserve existing undeveloped river corridors from further development to help attenuate flood waters.

- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip. This will make space for water and additional capacity to accommodate climate change.
- Look at opportunities for river restoration/enhancement as part of a development to make space for water and to reduce the legacy costs associated with the maintenance of hard engineering structure.
- Assess condition of existing assets (e.g. bridges, culverts, river walls) and renew so that its lifetime is commensurate with lifetime of the development. Enhancement opportunities should be sought when renewing assets e.g. deculverting, bioengineered river walls, raising bridge soffits to take into account climate change. More sustainable solutions to flood risk management will be easier and less costly to maintain and ultimately less expensive to replace.
- Presumption against further culverting and building over of culverts. All new developments with culverts running through their site should seek to deculvert rivers for flood risk management and conservation benefit.
- Remove permitted development rights in areas where side extensions and out-houses pose a flood risk management problem.
- SUDS required on all new development.
- All sites greater than 1 ha in size require the following:
 - o SUDS,
 - o Greenfield discharge rates,
 - o 1 in 100 year on-site attenuation taking into account climate change.
 - o On land allocations in the SFRA space shall be set-aside for SUDS.
- Define the functional floodplain, protect Greenfield functional floodplain from future development. Develop appropriate flood risk management policies for the Brownfield functional floodplain, focusing on risk reduction.
- Remaining greenfield floodplain is our greatest flood risk management asset, protect remaining greenfield floodplain from future development.
- Look at opportunities to make space for water to accommodate climate change.
- Use SFRA to inform emergency planning process.
- Use SFRA to educate local people to improve flood awareness.
- A longer-term approach to managing flood risk in this catchment is needed. To manage flood risk in the future long-term land use planning will need to consider the following:
 - o Undertake land swaps to remove vulnerable development from the floodplain and free up land for flood storage.
 - o Look at opportunities to retrofit flood-proofing measures onto existing developments at risk of flooding.
 - o Change the vulnerability classification of existing developments in areas at risk of flooding.
 - o Develop a long-term plan to restore/deculvert rivers.

2.4 Local Planning Policy

2.4.1 Introduction

Following the introduction of the Planning and Compulsory Purchase Act 2004, the way in which development plans are prepared is changing. With the aim of speeding up and simplifying plan preparation and improving community involvement, development plans in their current form are to be abolished and replaced with a new development plan system, the Local Development Framework (LDF).

The new PPS 25 provides the overarching national guidance with respect to development and flood risk, emphasising the need to effectively manage flood risk within the planning system, rather than relying on reactive solutions to flooding. This includes a responsibility for LPAs to reduce flood risk to people and property as a result of new development. It also identifies the preparation of SFRAs as a key process in the understanding and management of flood risk for planning purposes.

It is widely recognised that flood risk is one of a whole raft of policy constraints placed upon the local planning system. Development must facilitate the socio-economic needs of a community, and spatially must sit within an existing framework of landscape and infrastructure. For this reason, a

balance must be sought between development need and the risk it may pose upon existing and future dwellers of the area as a result of flooding.

The upcoming LDF will supersede the 2005 adopted Local Plan, which outlined areas for future development and development policies. The Local Plan identified a number of sites in areas all across the District suitable for residential, commercial or employment development

The Uttlesford Core Strategy is a Development Plan Document (DPD) and will be one of the key documents in the Local Development Framework (LDF). The Issues and Options stage of the Core Strategy outlines nine options for growth.

Table 2.1: Growth Options outlined in Uttlesford Core Strategy

Growth Option	Details
1a	Concentrate all development at Saffron Walden
1b	Concentrate all development at Great Dunmow
1c	Concentrate all development at Stansted Mountfitchet
1d	Concentrate development in the largest centres
1e	Concentrate development in a single new settlement
2a	Distribute development over a range of settlements
2b	Distribute development along the West Anglian Rail Corridor
2c	Distribute all the development in villages around the District
2d	Distribute development along the A120 corridor and at Great Dunmow

Following consultation on the Issues and Options the Council decided at the Environment Committee on the 4th September 2007 that further consultation would be held on options 1d, and two variations of 2a but that it's preferred option would be for the majority of the growth to be delivered through a new settlement of 3,000 new homes between Elsenham and Henham with 750 homes in the towns and larger villages and 250 homes in the smaller villages.

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3 STRATEGIC FLOOD RISK ASSESSMENT - OVERVIEW

The SFRA is a planning tool that can be used to inform the spatial planning process. This process is shown in Figure 3.1.

LPAs should give preference, in line with PPS25 guidelines, to locating new development in Flood Zone 1 wherever possible. If there are no reasonably appropriate Flood Zone 1 sites, allocations should be made in Zone 2 first, considering flood risk vulnerability of land uses. Only where there are no reasonably available sites in Flood Zone 1 or 2 should Zone 3 allocations be made. In order to demonstrate that there are no lower risk sites available the Sequential Test needs to be carried out.

The information provided in the SFRA should allow the LPAs to carry out the Sequential Test.

Figure 3.1: The SFRA Process

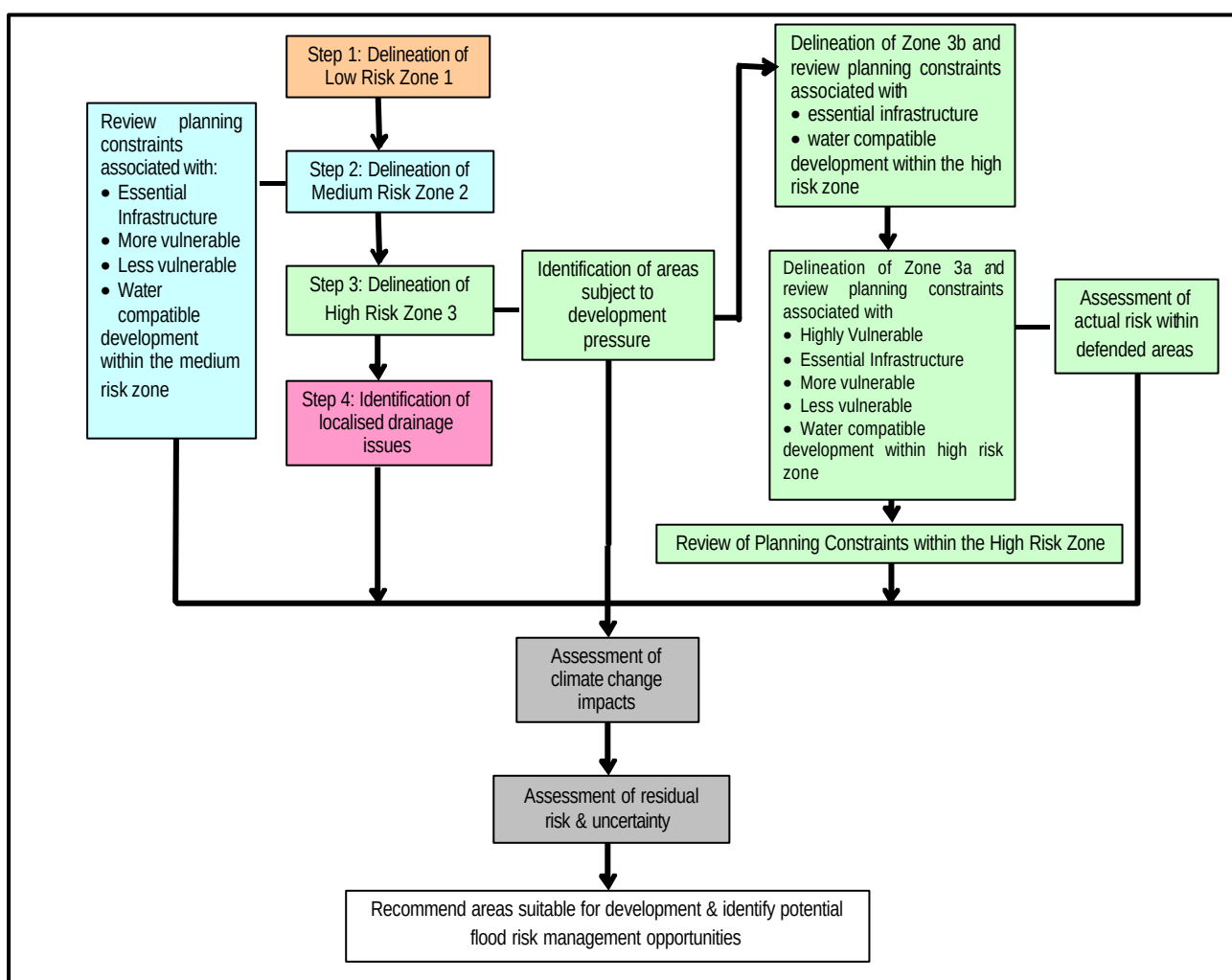


Table 3.1 sets out the flood risk vulnerability of development types and is used in conjunction with Table 3.2 to determine development type to the appropriate Flood Zone. The matching of development type to the degree of flood risk ensures right development in the right location. The different descriptions of the development classifications are shown in Table 3.1.

Table 3.1: Flood Risk Vulnerability Classification

Essential Infrastructure	Essential transport infrastructure and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	- Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations and emergency dispersal points. - Basement dwellings, caravans, mobile homes and park homes intended for permanent residential use. - Installations requiring hazardous substances consent.
More Vulnerable	- Hospitals, residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. - Buildings used for dwellings, student halls of residence, drinking establishments, nightclubs, hotels and sites used for holiday or short-let caravans and camping. - Non-residential uses for health services, nurseries and education. - Landfill and waste management facilities for hazardous waste.
Less Vulnerable	- Buildings used for shops, financial, professional and other services, restaurants and cafes, offices, industry, storage and distribution, and assembly and leisure. - Land and buildings used for agriculture and forestry. - Waste treatment (except landfill and hazardous waste facilities), minerals working and processing (except for sand and gravel). - Water treatment plants and sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	- Flood control infrastructure, water transmission infrastructure and pumping stations. - Sewage transmission infrastructure and pumping stations. - Sand and gravel workings. - Docks, marinas and wharves, navigation facilities. - MOD defence installations. - Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. - Water-based recreation (excluding sleeping accommodation). - Lifeguard and coastguard stations. - Amenity open space, nature conservation and biodiversity, outdoor sports and recreation. - Essential sleeping or residential accommodation for staff required by uses in this category, subject to a warning and evacuation plan.

Notes:

- 1) This classification is based partly on DEFRA/Environment Agency research on Flood Risks to People (FD2321/TR2) and also on the need of some uses to keep functioning during flooding.
- 2) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.
- 3) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

Source: PPS25 Table D2

Table 3.2: Flood Risk Vulnerability and Flood Zone Compatibility

Vulnerability classification		Essential Infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test	✓	✓
	Zone 3a	Exception Test	✓	x	Exception Test	✓
	Zone 3b	Exception Test	✓	x	x	x

Key:

- ✓ Development is appropriate
- x Development should not be permitted

Source: PPS25 Table D3

Where the Exception Test is required, all three elements have to be passed before a development is allocated or permitted. For the Exception Test to be passed:

- a. *It must demonstrate that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;*
- b. *The development should be on developable previously-developed land or, if it is not on previously developable land, that there are no reasonable alternative sites on developable previously-developed land; and*
- c. *A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

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4 STRATEGIC FLOOD RISK ASSESSMENT - APPROACH

The approach to the SFRA is as follows:

4.1.1 Data Collection

A critical phase in the project delivery is the collection and review of existing information. An SFRA is based on existing knowledge of flood risk within the District, provided by the Environment Agency (EA), the Council and Water Companies.

A summary of data sources used in this assessment is provided below:

- Areas likely to be developed in the Local Development Framework (LDF)
- Historical records of flooding including cause and extent
- Known and perceived flood risk issue areas, including Flood Zone Maps and details of flood risk areas associated with groundwater and surface water drainage issues.
- Catchment topography (LiDAR (Light Detection and Ranging) data, SAR (Synthetic Aperture radar) data and Ordnance Survey (OS) Mapping)
- Existing studies and investigations for the Rivers and Ordinary Watercourses within Uttlesford
- DG5 Sewer Flooding Records

4.1.2 Assessment of Flood Risk

The primary objective is to assess and categorise, in accordance with Table D.1 of PPS25, flood risk within the developing areas. In general, the following considerations have been addressed as part of the flood risk assessment process:

- Identification of known and/or perceived flood risk areas, including the nature of the flooding problem (e.g. river, canal, sewer, and groundwater flooding; surface water flooding and local under-capacity drainage; culvert blockage).
- Review of current Flood Zone Map.
- Define Functional Floodplain and review impacts of climate change - to achieve this flood mapping of around 60 km of different rivers derived using detailed hydraulic models was compiled with the results of additional runs of the flood zone mapping tool 'JFLOW' for 170 km of river as described in section 6.3.
- Identification of significant structures (bridges, culverts, embankments, outfalls etc) that will influence local hydraulics.
- Identification of formal and informal flood defences.

4.1.3 Assess the suitability of SUDS

There are many different SUDS techniques which can be implemented. The relative suitability of different areas for the different SUDS techniques will be identified using a combination of factors including assessments based on topography, underlying geology, soil properties and infiltration.

4.1.4 Establishment of Guidance for LPA and Developers at Planning Application Stage

Concise and pragmatic guidance has been developed to assist the council and developers to ensure that the outcomes and recommendations of the SFRA are followed through to the planning application and implementation stage.

It is imperative to ensure that the requirements placed upon developers at planning application are robust and fit for purpose. Similarly, the ownership, roles and responsibilities of the LPA and Environment Agency as appraisal bodies must also be clearly understood to ensure that the intent of the SFRA and planning process are not lost.

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5 DATA COLLECTION

5.1 Flood Zone Maps

The Environment Agency Flood Zone Maps predict the high (fluvial 1% probability) and medium (fluvial 0.1% probability) flood risk zones across all of England and Wales. They have been prepared using a consistent methodology based on the national digital terrain model (NextMap), derived river flows (Flood Estimation Handbook (FEH)) and two dimensional flood routing. The flood zone maps are continually updated in locations where more detailed flood mapping studies have been undertaken.

The Flood Zone Maps do not take account of flood defences and, therefore, represent a theoretical extent of flooding. The actual extent of flooding is mitigated by flood defences. However, there are no known defences within the Uttlesford District and therefore the Flood Map is representative of the area.

Allocations and other developing areas that are situated wholly or partially within the Flood Zone 2 or 3 must be critically reviewed to assess the degree of flood risk posed directly to or by the proposed development.

Maps 1, 2 and 3 show the flood map of the Uttlesford District.

5.2 Flood Defences

There are no formal flood defences in place within the Uttlesford District.

5.3 Topography

Remotely sensed ground level data (LiDAR) have been made available for use in the SFRA by the Environment Agency. This information is in the form of a land surface level grid with a 2m grid resolution. The nominal vertical accuracy of LiDAR data is typically ± 0.25 m. LiDAR data are not available for the whole district; therefore SAR data was used to complete the topographic data for the area.

Map 4 shows the topography of the Uttlesford District.

5.4 Hydraulic Models

There are Environment Agency ISIS Models of the River Chelmer, River Cam, River Roding and River Slade within the study area, from which the Environment Agency provided outlines for a range of return periods. It should be noted that the 100 year outline from the Cam and Chelmer have already been used to update the Flood Zone Map. Table 5.1 provides an overview of each of the models used.

JBA had access to the automated process of flood estimation, routing and mapping using JFLOW which were used to derive the original flood zones. This technique was then applied to model the 20 year and 100 year plus climate change return period outlines where more detailed hydraulic models were unavailable.

Table 5.1: Summary of Hydraulic models available within Uttlesford

Watercourse	Upstream Extent	Downstream Extent	Model Developed By	Year
River Cam	Henham	Byron's Pool	Halcrow (ISIS)	2004
River Chelmer	Thaxted	Beeleigh Falls	Black & Veatch (ISIS)	2005
River Slade (Thaxted Slade)	Leisure centre at Peaslands Road	Confluence with Kings Slade	JBA (ISIS)	2007
River Slade (Kings Slade)	Upstream of Elizabeth Way	Confluence with River Cam	JBA (ISIS)	2007
River Slade (Madgate Slade)	Catons Lane	Confluence downstream of New Pond Lane	JBA (ISIS)	2007
River Roding	Molehill Green	Passingford Bridge	PBA, Jacobs, Atkins (ISIS)	2003

5.5 Historical Flooding

Historical flooding events and issues have been identified and assessed utilising a number of information sources as identified in Table 5.2. In addition to the details in Table 5.2 it is understood that the areas of Berden, Great Canfield, Great Hallingbury, Hatfield Broad Oak, and Newport are also liable to flood², although there are no details of specific flood events available.

² Uttlesford DC. Community Risk Register.

Table 5.2: Historical Flood Events within Uttlesford

Date	River	Town/Village Affected	Details of Flood Event
10 th November 1875 ³	Slade	Saffron Walden	1.02 inches of rain fell in two to three hours during the night and resulted in flooding.
5 th August 1917 ³	Slade	Saffron Walden	3.08 inches of rain recorded in 2 hours caused much flooding.
19 th September 1960 ³	Slade	Saffron Walden	Police worked late into night placing warning traffic lights on flooded roads; houses in some villages completely covered by flood water. 'Remarkable' rainfall in Framlingham, Suffolk of 1.5 inches in 45 minutes.
June 1987 ⁶	Bourne	Ashdon	9 residential properties affected
July 1987 ⁶	Bourne	Ashdon	8 residential properties affected
August 1987 ⁶	Bourne	Ashdon	4 residential properties affected
October 1987 ⁶	Bourne	Ashdon	5 residential properties affected
October 2001 ⁴	Cam and Granta	Great Chesterford, Littlebury and Newport	3 properties and 4 garages affected in great Chesterford. 4 properties in Littlebury affected. 4 properties in Newport affected.
October 2001 ⁴	The Slade	Saffron Walden and Little Walden	19 properties affected in Saffron Walden, 5 properties affected in Little Walden
October 2001 ⁴	Chelmer	Great Dunmow	10 Houses flooded. Riverside Close no. 2-7, water level 51.159 mAOD Churchend no.1-2 The Six Bells and Falcons, water level 53.084 and 53.223 mAOD
October 2001 ⁶	Bourne	Ashdon	18 properties affected
2002	Stort	Clavering and Langley Lower Green	Post flood reports have been compiled by the EA Hatfield.
14 th June 2007 ⁶	Bourne	Ashdon	Affected Church Hill Road (not shown to be in Flood Zone 3)
Not Specified	Ugley Brook ⁵	Stansted Mountfitchet	Backing up from culverted section affects Gall End Lane and Lower Street.
Not Specified	Trib of Pant ⁶	Great Sampford	Properties in Sparepenny Lane South, Parsonage Farm Lane, Watson's Close, and Monk's Corner affected.
Not Specified	Stort ⁶	Maunden	Properties in The Street, Pinchpools Road, Watts Yard, and Mallows Green Road affected.
Not Specified	Cam ⁶ Wicken Water ⁶	Newport	Properties in Water Lane, Cambridge Road, white Horse Lane, and the sewerage works affected. Properties at the back of Bury water Cottages affected.
Not Specified	Slade	Saffron Walden	Properties in Bridge End, Friends Walk, St John's Close and Rowntree Way affected.
Not Specified	Stansted Brook ⁶	Stansted Mountfitchet	Properties at either end of Blythwood Gardens, and properties in Lower Street affected.
Not Specified	Trib of Pincey Brook ⁶	Takeley	Properties in Roseacres, South Road, Jack's Lane and Warren Close affected.
Not Specified	Trib of Chelmer ⁶	Thaxted	Properties in Copthall Lane and Mill Lane/Dunmow Road affected.
Not Specified	Cam ⁶	Great Chesterford	Properties in Cambridge Road, Ickleton Road, Walden Road, Sewerage Pumping Station and Playing Field affected.
Not Specified	Trib of Cam ⁶	Elsenham	Properties in Old Mead Road affected.
Not Specified	Stort ⁶	Clavering	Properties in The Druce, High Street, Middle Street, and Colehill Lane affected.

³ JBA (2007) River Slade Standard of Protection Study. On behalf of the Environment Agency.

⁴ Black and Veatch (2005) River Chelmer Strategy Study. Hydraulic Modelling of the River Chelmer: Thaxted to Beeleigh Falls. On Behalf of the Environment Agency.

⁵ Atkins (2002) Ugley Brook Priority Study. On behalf of the Environment Agency.

⁶ Uttlesford DC, personal communication of known flooded areas.

5.6 Former Critical Ordinary Watercourses

The Department for the Environment, Food and Rural Affairs (DEFRA) defined a Critical Ordinary Watercourses (COW) as “a watercourse that is not classified as ‘main river’ but which the Environment Agency and other operating authorities agree is critical because it has the potential to put at risk from flooding large numbers of people and property”. In order to be designated a COW the watercourse must have historically caused significant flooding.

The Government has required Local Authorities to transfer the responsibility for COWs to the Environment Agency. The Environment Agency has enmained the COWs as far as the existing downstream main river. Nevertheless, the location of former COWs does still give an indication of areas where known flood risk prevails.

Uttlesford contained a number of ordinary watercourses which were designated critical. The, now enmained, COWs located within the study area are:

- Debden Green - Tributary of R Chelmer - the Old Post Office to Chelmer, Debden Road
- Great Dunmow - Tributary of R Chelmer - Footbridge at Ash Grove to by-pass embankment
- Great Dunmow - Tributary of R Chelmer - r/o 95 Godfrey Way - r/o The Maltings
- Saffron Walden - Kings Slade - Elizabeth Way to confluence with River Cam
- Saffron Walden - Thaxted Slade - Peaslands Road to confluence with Kings Slade.
- Saffron Walden - Madgate Slade - Catons Lane to confluence at New Pond Lane
- Saffron Walden – Audley End Loop
- Takeley - Tributary of Pincey Brook- r/o St Valery to Parsonage Road

5.7 Identification of Other Sources of Flooding

In addition to fluvial flood risk, alternative sources of flooding including groundwater, overland flow and drainage systems also need to be considered when planning development. Although explicit consideration of these sources of flooding is not a requirement for flood zone allocation, local drainage issues have the potential to cause substantial damage and distress. When considering development proposals, known drainage and surface water problems need to be taken into account.

5.7.1 Groundwater Flooding

The risk of flooding from groundwater is subject to uncertainty as it is dependent upon the conditions at any location for any given time. Consequently, there is a lack of understanding and data available with regards the risk of groundwater flooding.

The geology of Uttlesford District is Chalk, overlain with Boulder Clay, in the north with some exposed chalk towards the centre of Saffron Walden, the groundwater levels in this area are between 20 and 50m below ground level. The geology of the south of Uttlesford is Boulder Clay overlying Kesgrave Sands, Glacial Gravels, and London Clay.

A recent DEFRA study⁷ into groundwater flooding produced maps of major aquifers and groundwater emergence zones. It showed the north of Uttlesford being covered by a Chalk aquifer, within which were emergence zones which followed the courses of the Rivers Cam, Pant, and part of the Stort near the district boundary.

The British Geological Survey website (http://www.bgs.ac.uk/britainbeneath/haz_flooding.html) provided analysis on the risk of groundwater flooding suffered by areas across the UK. Uttlesford was shown to primarily fall within a lower risk area.

Both the Defra study and the BGS analysis provide information at a national scale and are indicative for the area, they are not detailed assessments.

⁷ Defra (2004) Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study (LDS 23)

No records of historical groundwater flooding were found within the Anglian EA Region of Uttlesford. Within the Thames EA Region of Uttlesford there have been two incidences of groundwater flooding recorded:

1. Debden Green - Water in pit in garden, poor till drainage - 01/05/2000
2. Hatfield Broad Oak - Clay and London Clay Drainage problem - 11/10/2001

Map 6 shows the location of the chalk aquifer and groundwater flooding incidences within the Uttlesford District.

5.7.2 Sewer Flooding

Thames Water and Anglian Water were able to provide information regarding sewer flooding events over the past ten years on a broad scale. The information was provided on postal area basis, no specifics were provided as this went against the data protection of their customers. The DG5 data showed four properties affected in CB11 (Saffron Walden), one property affected in CM22 (Bishops Stortford) and one property affected in CM23, within the past 10 years. Map 7 shows the distribution of these sewer flooding events across Uttlesford.

5.7.3 Flooding from Canals, Reservoirs and other Artificial Sources

There are no known reservoirs, canals or major lakes within Uttlesford. However, there are a number of culverts across the District. Where the watercourses within the District have been culverted there remains a risk of blockage or under capacity, which can result in the backing up of water and flooding. This can be exacerbated in culverts with Trash Screens which are not regularly maintained.

From the Environment Agency's National Flood and Coastal Defence Database (NFCDD) the following culverts were identified:

- Birchanger Culvert, on Great Hallingbury Brook.
- Culvert under Railway, near Elsenham, on Stansted Brook.
- Culvert under Railway, Canfield End, on River Roding.
- Culvert under railway, Takeley Street, on Pincey Brook.
- Culvert under M11, Hallingbury, on Woodside Green Brook.
- Culvert at Gall End Road, Stansted Mountfitchet, on Ugley Brook u/s of confluence with Stansted Brook.
- Culvert at High Street, Clavering, on Stickling Green Brook.
- Culvert at Littlebury Mill, on River Cam.

The location of these culverts within Uttlesford is shown on Map 7.

A 2007 report³ into the Standard of Protection of the River Slade identified that the River Slade has a number of significant structures along it including two long culverts on the Thaxted Slade, two long culverts on the Kings Slade and a culvert on the Madgate Slade. Blockage scenarios on each of these culverts were run for the 1 in 100 year event.

There are some known issues with the structural integrity of the Elizabeth Way culvert on the Slade in Saffron Walden. There is a 60m length of the Elizabeth Way culvert in need of replacement due to collapse. Concerns exist over the old brick arch culvert on the Kings Slade beneath the town centre from Common Hill and Swan Meadow. One section, beneath Cross Street has recently been replaced by Essex County Council.

A 2002 report⁵ investigated the flooding which occurs along Gall End Lane and Lower Street in Stansted Mountfitchet from the Ugley Brook Culvert. The first of three sections which make up the culvert is 825mm in diameter which can result in capacity exceedances during certain rainfall events; this can be further exacerbated as a result of trash screen blockages with detritus. The study indicated that the area around the culvert has a Standard of Protection of 1 in 10 years (it is only protected against floods with a 10% or more chance of occurring each year).

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6 FLOOD RISK IN UTTLESFORD

6.1 Introduction

The guidance detailed below has been developed to provide a clear, concise and consistent means of assessing the feasibility and sustainability of sites and to determine appropriate flood risk mitigation measures where required. The framework will aid LPAs and others to assess flood risk associated with allocations and potential development sites. It will also allow policies on flood risk to be included in the LDD's, which draw upon national guidance for consistency, but provide the local detail and interpretation of these national policies.

PPS25 aims to direct development to lower flood risk sites wherever possible. "The aims of planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages in the planning process to avoid **inappropriate** development in areas at risk of flooding, and to direct development away from areas at higher risk"¹ Only when the Sequential Test has been employed and new development is, **exceptionally**, necessary and no other lower risk sites have been shown to be available should the Exception Test be applied.

The guidance focuses on the technicalities of flood risk management rather than the other planning issues an LPA must consider in selecting allocations. It should, therefore, be assumed that:

- These other planning issues have been considered separately
- For land to be allocated within the high risk zone, the full range of planning issues has been evaluated.

It should also have been determined through the SEA (Strategic Environmental Assessment) and SA (Strategic Assessment) that the land is the most suitable for development.

Table 3.1, Chapter 3, highlights the type of development considered appropriate for each Flood Zone, whether the development is or is not permitted, whether the development is only permitted when the Exception Test is passed, and whether a site specific Flood Risk Assessment is required. **This SFRA does not preclude the need for site specific flood risk assessments.**

This chapter will present the guidance for Flood Zone 3b; Flood Zone 3a (including defended and undefended areas, public safety and rapid inundation, and the feasibility of flood risk mitigation); Flood Zone 2; and Flood Zone 1. It will then discuss issues relating to flood risk from other sources.

6.2 Over view of Fluvial Flood Risk in Uttlesford

Table 6.1 shows the extent (in percentages) of the district within each flood zone, and the extent (in percentages) of the three main urban conurbations within each flood zone.

Table 6.1: Extent of Fluvial Flood Risk within Uttlesford

Risk	% of Uttlesford District	% of Great Dunmow	% of Saffron Walden	% of Stansted Mountfitchet
Zone 1	96.7	96.6	97.3	96
Zone 2	0.6	0.8	0.1	1.3
Zone 3a	0.4	0.3	0.9	0.3
Zone 3b	2.3	2.3	1.7	2.4

6.3 Delineation of Flood Risk Zones

PPS25 divides the country into three basic flood zones, Flood Zones 1, 2, 3a and 3b, corresponding to areas of low, medium, and high flood risk, and functional floodplain, respectively.

6.3.1 Flood Zone 1 – Low Probability

Flood Zone 1 equates to a flood event with less than a 0.1% chance of occurring in any given year (1 in 1000 year event).

In accordance with PPS25, all development (essential infrastructure, highly vulnerable, more vulnerable, less vulnerable and water-compatible development) is allowed in Flood Zone 1. All development proposals should consider the following about the sites:

- Their vulnerability to flooding from other sources as well as from river and sea flooding
- Their potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water runoff.

An FRA is required for development proposals in Flood Zone 1 where the site is 1 hectare or more. The FRA for a site in Flood Zone 1 can be brief unless there are particular issues regarding the points outlined above or any other local considerations which require particular attention.

Controls will be required to ensure that proposed developments do not result in a worsening of existing flooding conditions. Surface water runoff would be expected to be controlled on site to maintain or improve on predevelopment rates. Controls can include the implementation of SUDS techniques.

6.3.2 Flood Zone 2 – Medium Probability

Flood Zone 2 equates to a flood event which has a between a 0.1% and 1% chance of occurring in any given year (between a 1 in 1000 and 1 in 100 year event).

Flood Zone 2 is considered suitable for water-compatible, less vulnerable, more vulnerable and essential infrastructure. Highly vulnerable development is only allowed where the Exception Test is passed.

All development proposals must consider the following information about the sites:

- Their vulnerability to flooding from other sources as well as from river and sea flooding
- Their vulnerability to flooding over the lifetime of the development
- Their potential to increase flood risk elsewhere through the addition of hard surfaces, the effect of the new development on surface water run-off, and the effect of the new development on depth and speed of flooding to adjacent and surrounding property
- A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account, including flood defences, flood resilient and resistant design, escape / evacuation, effective flood warning and emergency planning) are acceptable.

Where development is implemented, floor levels should be situated, as a minimum, above the 0.1% AEP tidal levels with sufficient freeboard to account for inherent uncertainties with respect to flood level prediction and potential climate change scenarios. Proposed developments should include the appropriate application of sustainable drainage techniques so as to maintain, or preferably reduce the existing runoff and flood risk in the area. A site based flood risk assessment should be undertaken at the planning application stage to facilitate the delineation and definition of the 0.1% AEP flood envelope.

6.3.3 Flood Zone 3a – High Probability

Flood Zone 3a equates to a flood event with a greater than a 1% chance of occurring in any given year (1 in 100 year event).

PPS25 states that the water-compatible uses and less vulnerable development are allowed in this Flood Zone, following testing within the sequential process. According to PPS25 highly vulnerable development is not permitted. Essential infrastructure and more vulnerable development need to

pass the Exception Test, while essential infrastructure should be designed and constructed to remain operational and safe for users in times of flood.

According to PPS25, developers and local authorities should implement the following policy aims:

- Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;
- Relocate existing development to land in zones with a lower probability of flooding; and
- Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

6.3.4 Flood Zone 3b – The Functional Floodplain

Flood Zone 3b equates to a flood event with a 5% chance of occurring in any given year (1 in 20 year event).

In PPS25 only the water-compatible uses are allowed in this Flood Zone. Essential Infrastructure can be permitted after the exceptions test is passed. According to PPS25, developers and local authorities should:

- Reduce overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and
- Relocate existing development to land with a lower probability of flooding.

In addition, according to PPS25, essential infrastructure should:

- Remain operational and safe for users in times of flood;
- Result in no net loss of floodplain storage;
- Not impede water flows; and
- Not increase flood risk elsewhere.

6.3.5 Climate Change

PPS25 has recommended precautionary sensitivity ranges for peak river flows in light of climate change. For the years 1990 to 2025 PPS25 states that a 10% increase in the peak river flow can be expected, rising to a 20% increase for the years 2025 and 2115.

For this SFRA a 20% increase in the 100 year event has been chosen to represent the possible future effects of climate change.

The potential impacts of climate change will not only affect the peak river flows, but also potentially increase the peak rainfall intensity. For the years 1990 to 2025 PPS25 recommends a precautionary sensitivity for peak rainfall intensity of a 5% increase, rising to a: 10% increase for the years 2025 and 2055; 20% increase for the years 2055 and 2085; 30% increase for the years 2085 and 2115. This may exacerbate localised drainage problems. This SFRA only assesses current conditions (see Section 6.5.1) the effects of this rise in rainfall intensity as a result of climate change are not considered. However, it is important that the detailed Flood Risk Assessment and Drainage Impact Assessment consider the effect of climate change on rainfall intensity as well as peak river flow.

6.4 Modelling of Fluvial Flood Risk

The Environment Agency's published Flood Zone Maps provide the delineation between flood zones 1, 2 and 3a. The Flood Zone Maps were prepared in a consistent manner across the whole of the UK and provide an estimation of the extent of flooding for both the 1% and 0.1% events (Flood zones 3a and 2 respectively). To obtain the outline for the 5% event (Flood Zone 3b), and the 1% event plus climate change, new modelling was undertaken.

Uttlesford District has four rivers which have been modelled in detail, River Chelmer, River Cam, River Roding and River Slade. Consequently, these rivers have detailed outlines for Flood Zone 3b and climate change which were utilised. The other 170km of rivers within the District, where the catchment is greater than 3km², which did not have detailed modelled outlines available had to be

modelled using the standard JFLOW modelling technique, which was used to derive the original Flood Zones.

JBA's 2D raster inundation model, JFLOW, was used to model the flood extent. JFLOW can route flood water across the floodplain from specified inflow points. The ground data used to represent the floodplain was filtered LiDAR, combined with Nextmap where there was no LiDAR coverage and resized to a 5m grid.

Maps 9, 13, 16, 19, 21, 23, 25 and 27 show the distribution of each flood zone across key urban areas within Uttlesford.

From Maps 10, 14, 17, 20, 22, 24, 26 and 28 it is clear that as a result of the topography there is very little difference in the flood extent as a result of climate change.

Where the topography is not as detailed, the areas where only SAR data is available, misalignments in the flood zones can occur. This is noticeable in Maps 16 and 20, but is unfortunately unavoidable given the lack of detailed topography data.

In conjunction with this report the council will be provided with a district wide layer of delineation of flood zones 3a (present day and climate change) and 3b (functional floodplain) in GIS form.

6.5 Other Sources of Flood Risk

In addition to fluvial flood risk, alternative sources of flooding including flooding from surface water, sewers and groundwater within the Uttlesford District as described in Annex C of PPS25. Table 6.2 summarises the data collected and the effect of each source in Uttlesford. The following sections describe each source in more detail.

Table 6.2: Summary of Flooding from Other Sources in Uttlesford

Type of Flooding	Data Collected	Effect in Uttlesford
Surface Water Flooding	Surface Water modelling with JFLOW	Non-main river drainage paths and areas where water may pond in heavy rain have been identified.
Groundwater Flooding	Groundwater flooding incidents since 2001 (Environment Agency) GIS layer of aquifers	Not a major source of flood risk in Uttlesford
Sewer Flooding	DG5 sewer flooding data (Thames Water)	Not a major source of flood risk in Uttlesford
Flooding from canals, reservoirs and other artificial sources	No known canals or reservoirs within the district. But there are a number of culverts.	Culverts across the district present a flood risk in Uttlesford as a consequence of blockage or collapse

6.5.1 Surface Water Modelling

There is little quantitative information on surface water flooding in the District. JFLOW was therefore used to model the effect of an intense storm to indicate surface water flow routes and locations where surface water may accumulate and cause flooding. Surface water flooding is likely to occur in urban areas; therefore surface water modelling for this SFRA has focused the three main urban centres (Great Dunmow (Map 15), Saffron Walden (Map 11) and Stansted Mountfitchet (Map 18)).

The FEH design rainfall prediction for a 100 year event for a 'representative' catchment in each area was obtained from the DDF rainfall model. A summer storm profile (representing rapid urban runoff) was applied to give a hyetograph. The 10 year storm was subtracted from this hyetograph, to represent the capacity of the drainage/sewerage system to remove surface water. Table 6.3 shows the representative catchments that were used. Storm profiles were entered into JFLOW as a rainfall inflow. The ground model used was filtered LiDAR, combined with Nextmap where there was no LiDAR coverage and resized to a 5m grid.

The surface water modelling undertaken for Uttlesford provide an indication of the drainage paths and ponded areas surface water would cover as a result of a 1 in 100 year rainfall event. If development is proposed along these indicative drainage paths or in areas of indicative ponding it would be recommended that a drainage impact assessment (DIA) is undertaken even if they are less than 1 hectare in size. The DIA would also assess the most suitable SUDS technique to be used to ensure there are no increase and preferably a decrease in surface water runoff.

Table 6.3: Details of Catchments used in Surface Water Modelling

Area	Representative catchment in FEH CD	Grid reference	Total 100 year rainfall (mm)	Peak 100 year rainfall (mm)
Saffron Walden	The Slade	553300 238550	60.1	13.7
Great Dunmow	Oak Spring	563650 221600	64.5	13.5
Stansted Mountfitchet and Stansted Airport	Stansted Brook	550950 238550	70.4	9.75

6.5.2 Groundwater

The risk of groundwater flooding is very dependent on local conditions at any given time. Groundwater levels rise during wet winter months, and fall again in the summer when effective rainfall is low and extractions are higher. In very wet winters, rising groundwater levels may lead to the flooding of normally dry land, as well as reactivating flow in streams that only flow for part of the year.

The north of Uttlesford is covered by a Chalk aquifer (Map 6), which alongside seasonal variations in groundwater level, indicates that the area could be prone to groundwater flooding incidents. However this area has the geology of Chalk overlain with Boulder Clay, with some exposed chalk towards the centre of Saffron Walden, the groundwater levels in this area are between 20 and 50m below ground level, and therefore are not known to present a risk of groundwater flooding.

No records of historical groundwater flooding were found within the Anglian EA Region of Uttlesford. Within the Thames EA Region of Uttlesford there have been two incidences of groundwater flooding recorded (Map 6).

The conclusion of this SFRA is that the Uttlesford District is at low risk from groundwater flooding, as is shown by the very few recorded groundwater flooding events in the area. Therefore groundwater flooding is not thought to be a significant flood risk within Uttlesford.

6.5.3 Sewer Flooding

Within the past 10 years Sewer Flooding has only affected six properties within the Uttlesford District (Map 7), four properties were affected in CB11 (Saffron Walden), one property was affected in CM22 (Bishops Stortford) and one property was affected in CM23. This is very low compared to other urban areas and it was concluded that sewer flooding does not currently represent a significant flood risk within Uttlesford.

6.5.4 Culvert Blockage

Where the watercourses within the District have been culverted there remains a risk of blockage or under capacity, which can result in the backing up of water and flooding. This can be exacerbated in culverts with Trash Screens which are not regularly maintained.

The detailed modelling of culvert blockage is beyond the scope of this SFRA. However, the 2007 SOP study on the River Slade³ modelled blockage of the culverts along The Slade, Saffron Walden for the 1 in 100 year event. Map 12 shows the outline produced by this blockage model.

The Ugley Brook culvert in Stansted Mountfitchet has been studied⁵ with regards improving the culvert and has also been highlighted as being at risk capacity exceedance which would be exacerbated further by blockage of the trash screens.

There are some known issues with the structural integrity of the Elizabeth Way culvert on the Slade in Saffron Walden. There is a 60m length of the Elizabeth Way culvert in need of replacement due to collapse. Concerns exist over the old brick arch culvert on the Kings Slade beneath the town centre from Common Hill and Swan Meadow. One section, beneath Cross Street has recently been replaced by Essex County Council.

There is a risk of flooding from culvert blockage across the district, as such maintenance regimes and replacement (where required) should continue to be undertaken to minimise this risk. In addition, it is important that the detailed site specific Flood Risk Assessments consider culvert blockage, and where appropriate model blockage scenarios to determine actual risk.

6.6 Critical Infrastructure Potentially at Risk of Flooding

From the existing modelled flood outlines for Uttlesford it has been noted that there are two areas of the railway line which have the potential to be flooded; the areas around Stansted Mountfitchet Station and Newport Station. There is also one section of the M11 around Paynsden Wood, Quendon which has the potential to be flooded. Figure 6.2, 6.3 and 6.4 show the three areas affected and the 100 year flood extent.

These are only indications of flooding potential, further detailed modelling and assessment of culvert capacity (where appropriate) would be required to fully determine the implications and mitigation required.

In addition, some infrastructure which could be critical in the event of a flood has been identified as a potential flood risk. These are shown in Map 8 and include:

- Little Hallingbury, Bishops Stortford, Felsted (LR Chelmer), Great Dunmow, Saffron Walden and Clavering Sewage Treatment Works.
- Maunden Primary School
- Radwinter Telephone Exchange
- Saffron Walden Fire and Police Station

Figure 6.1: 100 Year Flood extent across the railway line around Stansted Mountfitchet

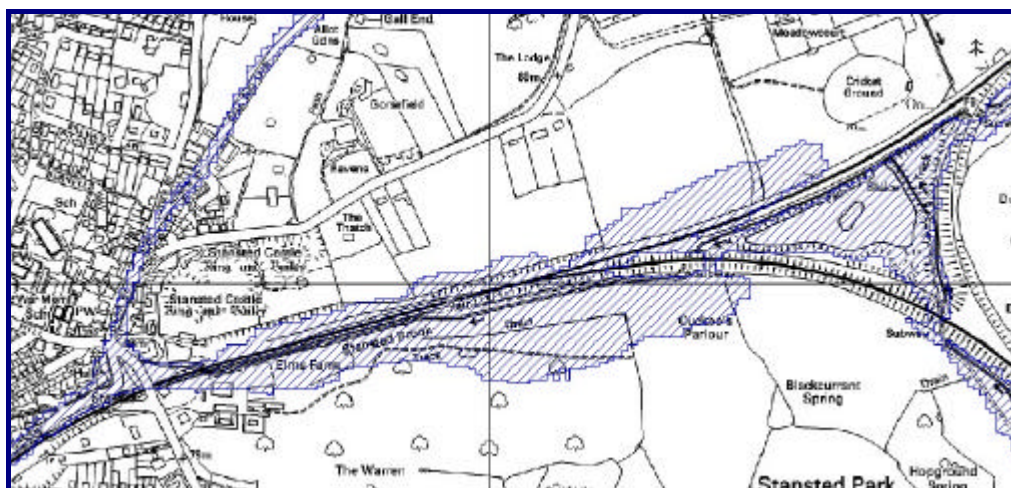


Figure 6.2: The railway line around Newport

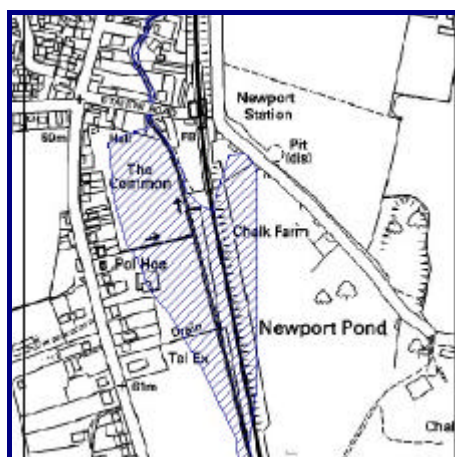
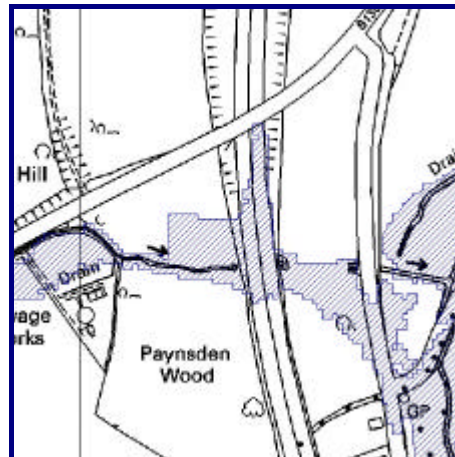


Figure 6.3: The M11



7 FLOOD RISK WITHIN THE URBAN CENTRES OF UTTLESFORD

There are three main urban centres within the Uttlesford District, Saffron Walden, Great Dunmow and Stansted Mountfitchet. These areas are the most developed, heavily populated and are assumed to be subject to future development pressure. Therefore a more detailed look at which areas of these urban centres are at flood risk has been undertaken.

7.1 Saffron Walden

7.1.1 Fluvial Flood Risk

Saffron Walden is at flood risk from the River Slade. The River Slade is a highly modified water course; it consists of three branches, the north and east of which converge at the sewerage works, whereas the east and the south converge at the corner of Audley Road and East Street. The Slade travels through much of Saffron Walden within a culvert.

Over 97% of the parish of Saffron Walden is located in Flood Zone 1, with Flood Zone 2 covering 0.1 % of the area.

Only 1.6% of the parish is located within the functional floodplain (Flood Zone 3b):

- The north branch of The Slade's functional floodplain covers the areas adjacent to the B1052 Little Walden Road from Little Walden down to Rookes, and the Bridge End Gardens and Farm.
- The east branch of The Slade mostly stays within the capacity of the channel/culvert during a 1 in 20 year event, however functional floodplain does cover the area around the confluence with the southern branch (East Street between Audley Road and Thaxted Road) and areas adjacent to the common specifically the Police Station Car Park (which has a history of flooding).
- The southern branch of The Slade's functional floodplain is only around Farmadine House where it meets the eastern branch, for the rest of the branch the 1 in 20 year flow is contained within the channel/culvert.

A further 0.9% in Flood Zone 3a:

- Flood Zone 3a along most of the north branch is only about a 1m wider than Flood Zone 3b. The only exception to this is the area along Bridge Street where the culvert would exceed capacity and floods Bridge Street and adjoining houses (which have suffered in the past), The Eight Bells Inn and a wider area of Bridge End Farm.
- Flood Zone 3a is much more expansive for the eastern Slade. The culvert capacity is exceeded therefore Flood Zone 3a covers the sewerage treatment works and the roads and adjoining land of: East Street from Hollyhock Road (in the east); Hill Street/George street down to Abbey Lane; part of the High Street Between George Street and Park Lane; New Pond Lane, Freshwell Lane and Gardens.
- Flood Zone 3a along the southern branch of The Slade again mostly remains within the capacity of the channel/culvert, and only comes out around Farmadine House where it covers a much wider area between Audley Road and Thaxted Road.

As there is such a small proportion of the parish within Flood Zones 2, 3a, and 3b (Map 9), it should be possible to direct all future development into Flood Zone 1, as preferred by PPS25. It should be reiterated that development in Flood Zone 1 will need address the issue of increasing surface water runoff and hence flood risk.

7.1.2 Surface Water Flood Risk

Surface Water Modelling for Saffron Walden (Map 11) indicated drainage paths rainfall may take and areas susceptible to surface water ponding.

The main drainage paths shown by the modelling follow the course of The Slade. As well as the Slade the following are major drainage paths:

- From Hunter's Way & St John's Close, through Saffron Walden County High School, to The Slade at Hanover Place.
- From Byrd's Farm, through Fair Leas and Little Walden Road, to The Slade.
- From Byrd's Farm, across Little Walden Road, to The Slade.
- Down De Vigier Avenue and The Spike.
- Along the Radwinter Road.
- From Brick Kiln Ley's Farm, Herberts and the track above Southgates Industrial Park, through the Lord Butler Leisure Centre and down Thaxted Road.
- Gold Street
- Jordan Close through RA Butler County Primary and Infants School.

Indicative areas susceptible to the ponding of Surface Water include:

- The Paddock and Bridge End Orchard
- Lord Butler Leisure Centre
- Elizabeth Way from Hadley Court to Cavendish Court
- Bridge End Gardens and Farm
- Freshwell Gardens

7.1.3 Brief Planning Overview of Local Plan (2005) Development Sites

Most development sites are not at fluvial flood risk. The two exceptions are: the site adjacent to Thaxted Road and Radwinter Road a small part of which is in flood zone 3a; and the proposed site between The Slade and Little Walden Road part of which is in both flood zone 3a and 3b.

However nearly all the development areas are located around the surface water drainage paths, highlighting the need for new developments to have a FRA/DIA and use SUDS so as to maintain or reduce surface water runoff.

7.2 Great Dunmow

7.2.1 Fluvial Flood Risk

Great Dunmow is at flood risk from the River Chelmer.

Over 96% of the parish of Great Dunmow is located in Flood Zone 1, with Flood Zone 2 covering 0.8 % of the area.

Only 2.2% of the parish is located within the functional floodplain (Flood Zone 3b). Areas within Flood Zone 3b include:

- Gardens of Ford Cottages on the Braintree Road.
- Braintree Road
- Riverside
- Sewerage Treatment Works
- Churchend

A further 0.3% is in Flood Zone 3a. Flood Zone 3a along most of the Chelmer through Dunmow is only about 1m wider than Flood Zone 3b. Churchend, around the bridge over the Chelmer is the only exception to this where Flood Zone 3a is about 10m wider than 3b.

As there is such a small proportion of the parish within Flood Zones 2, 3a, and 3b (Map 13), it should be possible to direct all future development into Flood Zone 1, as preferred by PPS25. It should be reiterated that development in Flood Zone 1 will need address the issue of increasing surface water runoff and hence flood risk.

7.2.2 Surface Water Flood Risk

Surface Water Modelling for Great Dunmow (Map 15) indicated drainage paths rainfall may take and areas susceptible to rainfall ponding.

The main drainage paths shown by the modelling follow the course of tributaries of the River Chelmer from Ash Grove (from Canada Cottages, Stortford Road and Ash Grove), from Godfrey Way and the Hoblong's Brook. In addition the following are major drainage paths:

- Along the Parish Boundary from Hoglands Wood, through the Fish pond, to Brookfield Farm.
- Along Waldgrooms through the Doctor's Pond to the River Chelmer.
- From Merks Hill Wood Reservoir

Indicative areas susceptible to the ponding of Surface Water include:

- Doctor's Pond and other ponds in the area
- Area between Ash Grove and Lower Mill Field
- Land north-east of the Sewerage Works
- Land Adjacent to the A130 from The Forge to Hoblong's Cottage
- Cricket Ground
- Floodplain throughout Churchend

7.2.3 Brief Planning Overview of Local Plan (2005) Development Sites

Most development sites are not at fluvial flood risk. The one exception is the site around Riverside part of which is in flood zone 3a and 3b.

The Land Adjacent to the A130 from The Forge to Hoblong's Cottage, which is susceptible to the ponding of surface water is also highlighted as a development area.

Nearly all the other development areas are located around the surface water drainage paths, highlighting the need for new developments to have a FRA/DIA and use SUDS so as to maintain or reduce surface water runoff.

7.3 Stansted Mountfitchet

7.3.1 Fluvial Flood Risk

Stansted Mountfitchet is at risk of flooding from the Stansted Brook and the Ugley Brook.

96% of the parish of Stansted Mountfitchet is located in Flood Zone 1, with Flood Zone 2 covering 1.3 % of the area.

Only 2.4% of the parish is located within the functional floodplain (Flood Zone 3b):

- Ugley Brook's functional floodplain covers Lower Street and Station Road
- Stansted Brook's functional floodplain covers: the Railway line in and out of Stansted Mountfitchet Station; Waterside; Water Lane; Riverside Business Park; Stoney Common Road; and Brookview.

A further 0.3% in Flood Zone 3a. Flood Zone 3a along the Stansted Brook and the Ugley Brook is only about a 1m wider than Flood Zone 3b.

As there is such a small proportion of the parish within Flood Zones 2, 3a, and 3b (Map 16), it should be possible to direct all future development into Flood Zone 1, as preferred by PPS25. It should be reiterated that development in Flood Zone 1 will need address the issue of increasing surface water runoff and hence flood risk.

7.3.2 Surface Water Flood Risk

Surface Water Modelling for Stansted Mountfitchet (Map 18) indicated drainage paths rainfall may take and areas susceptible to rainfall ponding.

The main drainage paths shown by the modelling follow the course of the two Brooks. In addition the following are major drainage paths:

- From The Mountfitchet High School along manor and Stoney Common Road.
- From Bentfield Gardens through Silver Street.
- Along St John's Crescent through St Mary's C of E primary School.
- From Brickyard Plantation

- Through Aubrey Buxton Nature Reserve

Indicative areas susceptible to the ponding of surface water occur between Stansted Mountfitchet station and the cricket ground along and adjacent to the Stansted Brook and railway line.

7.3.3 Brief Planning Overview of Local Plan (2005) Development Sites

Most development sites are not at fluvial flood risk. The one exception is the area adjacent to the station car park part of which is in flood zone 3a and 3b.

However nearly all the development areas are located around the surface water drainage paths, highlighting the need for new developments to have a FRA/DIA and use SUDS so as to not increase or to reduce surface water runoff to Greenfield rates.

8 DEVELOPMENT CONTROL CONSIDERATIONS

When making future development control decisions the council will:

- Consult Table D.1 and D.2 of PPS25 and sections 6.3 of this SFRA
- Identify whether the site is at risk from 'other sources' of flooding using the criteria in Section 9.4.
- Seek opportunities to reduce the overall levels of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

This section will provide guidance on development control issues which should be considered and how they can be achieved, including SuDS and mitigation measures.

It must be made clear that this SFRA does not preclude the need for site specific flood risk assessments. Guidance for FRAs is given in Chapter 9.

8.1 Approach to Greenfield and Brownfield Floodplain

Uttlesford District contains significant areas of undeveloped greenfield land which act as functional floodplain. It is strongly recommended that these areas be protected from development and maintained as functional floodplain.

On brownfield sites, buildings, unless permeable to floodwaters, are not considered to be part of the functional floodplain. Land/infrastructure around these buildings is considered to be functional. If proposed, brownfield floodplain redevelopment must not exceed the existing footprint of the site as the land around these sites is considered to be functional. In addition, where brownfield redevelopment is proposed opportunities to apply the policy aims of PPS25 should be sought, whereby under a hierarchy of examination the following options are explored:

- Remove buildings and restore the natural floodplain.
- Change the land use to a less vulnerable classification.
- Change the layout and form of the development (e.g. reducing the building footprint).
- Preserve flow routes.
- Improve conveyance/storage, e.g. replacing solid building with building on stilts.

Brownfield redevelopments within the functional floodplain must also be fully flood resilient to minimise damage and enable quick recovery from flooding.

It should be noted that this only applies to regeneration in functional floodplain areas. In Zone 3a, whilst the same policy aims are included in PPS25, there is a greater presumption that redevelopment can occur, applying the Exception Test where necessary, except where the residual risks are significant.

8.2 Environment Agency Buffer Strip Requirements

The Environment Agency currently have requirements for all watercourses to have a buffer strip of undeveloped land adjacent to them to provide access, habitat and 'make space for water'.

Within Uttlesford the specific buffer strip requirements are:

- Main rivers – the Thames Region require an 8m, and the Anglian Region a 9m, wide undeveloped buffer strip along each side of main rivers. Developers are also asked to explore opportunities for river restoration on the back of development.
- Culverted main rivers – the EA require a minimum of a 4m buffer strip along each side of culverted rivers. Building over culverts is not acceptable, and all new developments with culverts running through their site should seek to de-culvert rivers for flood risk management and conservation benefit

- Ordinary watercourses - the EA require a 5 metre undeveloped buffer strip along each side of such watercourses.

8.3 Developer Contributions to Future Flood Risk Management

If future (re)developments are located within flood risk areas it would be reasonable to expect the developer to contribute towards mitigation and/or relief measures which will reduce the overall risks of flooding which are consistent with the objective of protecting and enhancing the environment.

8.4 Meeting Part C of the Exception Test

Where allocations remain in high risk flood zone 3, following the sequential test and part a and b of the exception test, the development still needs to meet part c of the exception test:

A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Safe access and egress

Safe access/egress in a flood event will minimise the impact upon the emergency services in the event of an evacuation. 'Safe' will be a function of depth and velocity of water surrounding the development and along access/egress routes, and also the time it takes for the flood to reach the site relative to the time it would take to evacuate the site.

'Safe' access should remain dry for residential developments and 'more' and 'highly vulnerable' uses and should preferably be dry for other uses such as educational establishments and 'less vulnerable' land use classifications. Dry escape for residential dwellings should be up to the 1 in 100 year event (the event with a 1% chance of occurring each year) taking into account climate change.

Overall reduction in flood risk

To ensure developments reduce flood risk overall, they need to make sure that:

- That the development was 'safe'.
- That a site was designed sequentially.
- That floor levels were raised 300mm above the 1 in 100 year climate change flood level.
- Flood flow routes were not impeded.
- Floodplain storage capacity was not reduced, and where necessary compensated for on a level for level basis outside of the floodplain.

8.5 Sequential 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. Future developments may cover all three Flood Zones. Most large development proposals include a variety of land uses of varying vulnerability to flooding.

The Practice Guide to PPS25⁸ states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use to higher ground, while more flood-compatible development (e.g. parking, recreational space) can be located in more high risk areas.

Low-lying waterside areas, or areas along known surface water flow routes, can be 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 Communities and Local Government, February 2007, *Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft.'* Consultation Paper. p85.

8.6 Raising Floor Levels

The raising of floor levels within a development avoids damage occurring to the interior, furnishings and electrics in time of flood. Ideally floor levels should be raised to a height of 300mm above the water level occurring as a result of a 1 in 100 year plus climate change event (the event with a 1% chance of occurring each year plus a 20% increase for climate change). This 300mm height that the floor level is raised is referred to as the 'freeboard'. Raising floor levels is not considered an option where this would reduce flood storage, unless compensatory storage is provided (to avoid increasing flood risk elsewhere).

Where the raising of floor levels is not possible the development should incorporate flood resilience measures (see Section 8.8).

It should be noted that the application of these measures does not negate the need for the sequential test and exception test (where applicable) to be passed.

8.7 Flood Warning and Evacuation

PPS25 recommends that warning and evacuation arrangements should be in place for managing flood risks to developments in high risk areas. Sites within these high risk areas may be eligible to receive warning of potential flooding through the Environment Agency's (FWD) Floodline Warnings Direct. It is recommended that the developers make new owners of the property aware of this so they can sign up to FWD if it is available. Information on the availability of FWD can be obtained from the local Environment Agency office.

Safe access and egress for evacuation and the emergency services is required for any new development in Flood Zone 3. Dry access and egress, in the 1 in 100 year event (the event with a 1% chance of occurring each year), is required for residential developments and 'more' and 'highly vulnerable' uses. Safe dry access/egress in a flood event will minimise the impact upon the emergency services in the event of an evacuation.

The Local Authority is designated a category 1 responder under the Civil Contingencies Act 2004. In an event of an emergency coordination with the other category 1 responders (including the emergency services and the Environment Agency) is essential to guarantee the safety of residents. In light of the information provided in this SFRA, including critical infrastructure identified as being at flood risk, it is recommended that Uttlesford District Council review their Emergency Plan with respect to flooding. Where significant new population is being added to a flood risk area formal consultation with the council's Emergency Planning team is required. Emergency/evacuation plans should be in place for all properties, large and small, at risk of flooding; those developments which house vulnerable people (i.e. care homes and schools) will require more detailed plans. Emergency/evacuation plans should be written in consultation with the council's Emergency Planning Team. Detailed emergency/evacuation plans for developments should undergo consultation not only with the Council's Emergency Planning team but also the Emergency Services so they know what is expected of them in the event of an emergency.

8.8 Flood Resilience

Flood resilience reduces the consequences of flooding and increases the ability of people or buildings affected to recover from flooding.

When developing basements or property with a risk of flooding the following should be considered to make the building resilient to flooding:

- New electrical circuitry installed higher level with power cables being carried down from the ceiling not up from the floor level.
- Water-resistant materials for floors, walls and fixtures.

Resilience measures will be specific to the nature of flood risk, and as such will be informed and determined by the FRA.

The 2003 'Preparing for Floods' document published by the Office of the Deputy Prime Minister and the 2007 Communities and Local Government document 'Improving the Flood performance of New Buildings – Flood Resilient Construction' provides further details on resilience measures.

It should be noted that the application of these measures does not negate the need for the sequential test and exception test (where applicable) to be passed.

8.9 Flood Resistance

Flood Resistance measures aim to prevent or minimise the amount of water that may enter a property in the event of a flood. The measures chosen will depend on the nature of the flood risk. Some of the more common measures include:

Temporary Flood Barriers

Temporary barriers consist are 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. The Environment Agency provides a list of manufacturers, with the Kitemark, of temporary defences on their website www.environment-agency.gov.uk/floodline.

Permanent Flood Barriers

Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers.

It should be noted that the application of these measures does not negate the need for the sequential test and exception test (where applicable) to be passed.

8.10 Sustainable Urban Drainage Systems

Sustainable Urban Drainage Systems (SUDS) are management practices which enable surface water to be drained in a more sustainable manner.

Ideally the local planning authority should work closely with the Environment Agency, sewage undertakers and developers to enable surface-water runoff from new developments to be controlled as near to the source as possible (ideally within the boundaries of the development site). Within the EA's Thames Region both greenfield and brownfield developments greater than 1 ha in size should aim to achieve greenfield runoff rates and attenuation of up to the 1 in 100 year plus climate change event. Within the EA's Anglian Region greenfield and brownfield developments greater than 1 ha in size should not increase runoff, where there is a need for betterment brownfield developments should aim for greenfield runoff rates, in addition the 1 in 100 year plus climate change event should be attenuated. These criteria should be achieved through the implementation of Sustainable Urban Drainage Systems techniques, constructed within the boundaries of the development site.

A FRA will be required in each instance to design appropriate mitigation measures and demonstrate that the development will not adversely affect existing flooding conditions. The FRA should define and address the constraints that will govern the design of the drainage system. The design, construction and ongoing maintenance regime of such a scheme must be carefully defined, and a clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential. Additionally, it is imperative that the water table is low enough and a site specific infiltration test is undertaken. Where sites lie within or close to source protection zones further restrictions may be applicable, and guidance should be sought from the Environment Agency.

There are many different SUDS techniques which can be implemented. The decision to which technique can be implemented depends on (but not limited to) topography, geology (soil permeability), and available area. The soils within Uttlesford mainly consist of those which suffer impeded drainage, yet there are outcrops of freely draining soils which occur within the River Valleys of the District (Map 5). Table 8.1 show the SUDS Hierarchy set out by the Environment Agency to show the most sustainable SUDS techniques. In addition, Table 8.2 outlines a series of matrices, as outlined by the CIRIA guidance, to aid in the selection of the most appropriate SUDS technique.

SUDS are already in use within the Uttlesford District for example recent additions include use of swales along the new A120 and the balancing ponds at the new developments of Prior's Green, Takeley (Figure 8.1) and Woodlands Park, Great Dunmow. One of the issues with SUDS has been the question of maintenance and adoption. Uttlesford DC have adopted suitable schemes in new developments and have positively encouraged their use.

Figure 8.1: Balancing pond at Prior's Green Takeley.



Table 8.1: The SUDS Hierarchy

Most Sustainable Least Sustainable	SUDS technique	Flood Reduction	Pollution Reduction	Landscape and Wildlife Benefit
	Living roofs	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - Soakaways - Infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains - Gravelled areas - Solid paving blocks - Porous pavements	✓	✓	
	Tanked systems - Over-sized pipes/tanks - Storm cells	✓		

Source Environment Agency (2006)

Table 8.2: SUDS Selection Matrices

		Land Use Selection Matrix								Site Characteristics Selection Matrix										Hydraulic Control Matrix					
		Low density	Residential	Local Roads	Commercial	Hotspots	Construction Site	Brownfield	Contaminated Land	Impermeable	Permeable	0-2ha	>2ha	0-1m	>1m	0-5%	>5%	0-1m	1-2m	Low	High	Runoff Volume Reduction	Suitability for flow rate control (probability (return period))		
SUDS Group	Technique																					0.5 (1/2 yr)	0.1-0.3 (10-30 yr)	0.001 (100 vr)	
Retention	Retention Pond	Y	Y	Y ^a	Y ^b	Y ^b	Y ^c	Y	Y ^b	Y	Y ¹	Y	Y ⁵	Y	Y	Y	Y	Y	Y	N	Y	L	H	H	H
	Sub Surface Storage	Y	Y	Y	Y	Y	Y ^c	Y	Y	Y	Y	Y	Y ⁵	Y	Y	Y	Y	Y	Y	Y	Y	L	H	H	H
Wetland	Shallow Wetland	Y	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y ²	Y ⁴	Y ⁴	Y ⁶	Y ²	Y ²	Y	N	Y	Y	N	Y	L	H	M	L
	Extended Detention	Y	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y ²	Y ⁴	Y ⁴	Y ⁶	Y ²	Y ²	Y	N	Y	Y	N	Y	L	H	M	L
	Pond / Wetland	Y	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y ²	Y ⁴	Y ⁴	Y ⁶	Y ²	Y ²	Y	N	Y	Y	N	Y	L	H	M	L
	Pocket Wetland	Y	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y ²	Y ⁴	Y ⁴	N	Y ²	Y ²	Y	N	Y	Y	Y	Y	L	H	M	L
	Submerged Gravel	Y	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y ²	Y ⁴	Y ⁴	Y ⁶	Y ²	Y ²	Y	N	Y	Y	N	Y	L	H	M	L
	Wetland Channel	Y	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y ²	Y ⁴	Y ⁴	Y ⁶	Y ²	Y ²	Y	N	Y	Y	N	Y	L	H	M	L
	Infiltration Trench	Y	Y	Y ^a	Y ^b	N	N	Y	Y ^d	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	Y	H	H	H	L
	Infiltration Basin	Y	Y	Y ^a	Y ^b	N	N	Y	Y ^d	N	Y	Y	Y ⁵	N	Y	Y	Y	Y	N	N	Y	H	H	H	H
Infiltration	Soak Away	Y	Y	Y ^a	Y ^b	N	N	Y	Y ^d	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	Y	H	H	H	L
Filtration	Surface Sand Filter	N	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y	Y	Y	Y ⁵	N	Y	Y	N	N	Y	N	Y	L	H	M	L
	Sub Surface Sand Filter	N	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y	Y	Y	N	N	Y	Y	N	N	Y	Y	Y	L	H	M	L
	Perimeter Sand Filter	N		Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	L	H	M	L
	Bioretention / Filter	Y	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y	Y	Y	N	N	Y	Y	N	Y	Y	N	Y	L	H	M	L
	Filter Retention	Y	Y	Y ^a	Y ^b	Y ^b	N	Y	Y ^b	Y	Y ¹	Y	N	N	Y	Y	N	Y	Y	Y	Y	L	H	H	L
	Detention	Detention Basin	Y	Y	Y ^a	Y ^b	Y ^{a,b}	Y ^c	Y	Y ^b	Y	Y ¹	Y	Y ⁵	N	Y	Y	Y	N	Y	N	Y	L	H	H
Open channels	Conveyance Swale	Y	Y	Y ^a	Y ^b	Y ^b	Y ^c	Y	Y ^b	Y	Y	Y	N	N	Y	Y	N ³	Y	N	N	Y	M	H	H	H
	Enhanced Dry Swale	Y	Y	Y ^a	Y ^b	Y ^b	Y ^c	Y	Y ^b	Y	Y	Y	N	N	Y	Y	N ³	Y	N	N	Y	M	H	H	H
	Enhanced Wet Swale	Y	Y	Y ^a	Y ^b	Y ^a	Y ^c	Y	Y ^b	Y ²	Y ⁴	Y	N	Y	Y	Y	N ³	Y	N	N	Y	L	H	H	H
	Green Roof																								
Source control	Rain Water Harvesting	Y	Y	N	Y ^b	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y				M	M	H	L
	Permeable Pavement	Y	Y	N	Y ^b	Y ^a	N	Y	Y ^b	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	H	H	H	L

Y – Yes N – No L – Low M – Medium H – High.

1. with liner 2. with surface base flow 3. unless follows contours 4. with liner and constant surface base flow, or high ground water table.

5. possible, but not recommended 6. where high flows are diverted around SUDS component.

a. may require two treatment train stages depending on type of road and receiving water sensitivity.

b. may require three treatment train stages on receiving watercourse sensitivity.

c. will require draw-down and rehabilitation following construction activities, prior to use as a permanent drainage system.

d. providing designs prevent mobilisation of contamination.

Source: CIRIA (2007)

9 GUIDANCE FOR THE COMPLETION OF DETAILED FRAS

9.1 Introduction

In accordance with current planning policy guidance, the planning process encourages only sustainable development in areas vulnerable to flooding. This includes adopting a precautionary approach to decisions based on estimates of the present and future impact of flood risks. The Uttlesford SFRA focuses on delivering a strategic assessment of flood risk within the area. This SFRA is not intended to be a prescriptive document, but a planning tool to guide future sustainable development away from vulnerable flood risk areas. The first document that local planners should refer to when considering future planning applications is the Environment Agency's National Standing Advice to Local Planning Authorities for Planning Applications – Development and Flood Risk, England (June 2004).

Prior to development, site specific assessments will need to be undertaken to ensure that all forms of flood risk, at a site, are fully addressed. It is normally the responsibility of the developer to provide a FRA with an application. However, an LPA can decide to commission a detailed, site-specific FRA to help them decide upon allocations in the high risk zone. The SFRA cannot provide this level of site specific information.

The aim of a Flood Risk Assessment (FRA) is to demonstrate that proposed development will not be at risk to flooding during the design event. This includes assessment of mitigation measures required to safely manage flood risk. The FRA also needs to demonstrate that the proposed development will not increase flood risk either upstream or downstream of the site. All sources of flood risk, including, fluvial, surface water runoff and drainage need to be considered.

Flood Risk Assessments for proposed development in the District should follow the approach recommended by:

- The Environment Agency (see its *National Standing Advice to Local Planning Authorities for Planning Applications – Development and Flood Risk in England* (June 2004);
- DEFRA/Environment Agency, 2005. *Flood Risk Assessment Guidance for New Development Phase 2: Framework and guidance for Assessing and Managing Flood Risk for New Development – Full Documentation and Tools*. R&D Technical Report FD2320/TR2;
- PPS25 and its Practice Guide Companion.

All proposed development sites require at least an initial assessment of flood risk. A detailed FRA will be required for all developments that fall in the medium and high flood risk zones (flood zones 2 and 3) and other sites where significant flood risk is identified. A FRA will be required for sites in Flood Zone 1 which are greater than 1 ha in size or have been identified as being at flood risk.

Development will not be permitted where the Flood Risk Assessment does not demonstrate:

- That the sequential test has been passed;
- That the development satisfies part c of the exception test, and is therefore considered safe for the lifetime of development;
- How flood risk to the development and flood risk to others will be managed over the lifetime of the development;
- That it takes into account climate change;
- That it identifies opportunities to reduce the probability and consequences of flooding.
- That the rate of surface water runoff is the same or less than before the new development occurred.

This section will present the guidance for the council and developers on the requirements of a FRA for development in proposals in Flood Zones 1, 2, 3a and 3b.

Sections 9.2 – 9.3 provide the guidance for the developers on what needs to be included in a FRA, the information in these sections will also be used by the council as a check list when they assess FRAs. Section 9.4 provides guidance on how to assess fluvial flood risk as part of an FRA and will also be used by the council as a check when assessing FRAs. Section 9.5 provides guidance on

how to assess flood risk from other sources and what is required from a FRA which includes an assessment of flood risk from other sources. The guidance in this section can be used by the council as a guide to when they should be requesting an FRA in relation to flood risk from other sources. Section 9.6 and 9.7 provide additional guidance for FRAs relating to critical infrastructure and FRAs carried out in the Environment Agency's Thames Region.

9.2 Flood risk assessments for Flood Zone 2 & 3

A detailed FRA must be undertaken by a suitably qualified professional. It is required to provide evidence that the Sequential Test, and if required the Exception Test, have been passed. It is **strongly** recommended that the Sequential Test compatibility rating, and, if necessary, the first two parts of the exception test be satisfied before the FRA is commenced. The FRA then needs to demonstrate that the proposals will achieve Part 'c' of the Exception Test – “a *Flood Risk Assessment must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*”

The FRA should:

- **Consider all sources of flooding** (e.g. surface water, sewer, and groundwater), not just fluvial flood risk (see Section 9.4 and 9.5). (The details and maps provided identify areas at risk from other sources of flooding which should be investigated in more detail).
- Assess the effect of **climate change** on flood risk.
- Demonstrate that the proposals will **achieve Part 'c' of the Exception** Test where necessary (see Section 8.4).
- Ensure that **development is safe**, for example that:
 - o Safe access and egress from the proposed development to safe ground can be assured (see Section 8.4).
- Ensure that where possible **flood risk is reduced** overall, for example that:
 - o Floodplain storage capacity is not reduced, and where necessary is compensated for on a level for level basis outside of the floodplain.
 - o The site is designed sequentially (see Section 8.5)
 - o Mitigation measures are provided in response to identified flood risk (see Sections 8.5 – 8.8)
 - o Use of SuDS (see Section 8.10)
- Ensure that **flood risk is not increased elsewhere**, for example that:
 - o Flood flow routes, surface water overland flow paths, are preserved (The surface water modelling maps provided can be used as an indication of the location of these flow paths)
 - o Demonstrate the ability to meet the following drainage requirements to avoid increasing flood risk elsewhere (see Section 8.10):
 - Greenfield discharge rates
 - ?Attenuation up to the 1% annual probability event plus climate change
 - Use of SuDS
- Demonstrate how the risk of flooding will be managed;
 - o Include an Emergency Planning Statement detailing flood warning and excavation measures, where applicable.
- Ensure any proposed flood risk management measures will be sufficiently funded so the site can be developed and occupied safely throughout its proposed lifetime.
- Demonstrate that where proposed developments are adjacent to a river or ordinary watercourse they have been set back allow for the future access and maintenance (see Section 8.2).

The FRA must consider the design events up to and including the extreme fluvial flood event with a 0.1% chance of occurring each year (1 in 1000 year return period), including the impact of climate change.

Further information on the details to be provided within the FRA can be found in the Environment Agency's FRA Guidance Note 3 (<http://www.pipernetworking.com/floodrisk/fra3.html>), CIRIA report 624 (Development and flood risk: Guidance for the construction industry), and the PPS25 Practice Guide. A useful checklist is provided in Appendix C of the PPS25 Practice Guide.

Advice on making development safe, avoiding increase to flood risk elsewhere, and reducing flood risk overall are given in the following sections, and in the Practice Guide to PPS25.

9.2.1 Minor Extensions within Flood Zones 2 & 3

For householder extensions and minor non domestic extensions of less than 250m² within flood zones 3 a brief FRA would be required. This FRA would be a short statement with a focus on the mitigation measures (raising floor levels or flood proofing).

Further Information on the details to be provided within the FRA can be found in the Environment Agency's FRA Guidance (<http://www.pipernetworking.com/floodrisk/minor.html>) and Guidance Note 2 (<http://www.pipernetworking.com/floodrisk/fra2.html>).

9.3 Flood Risk Assessment/Drainage Impact Assessments for Flood Zone 1

9.3.1 Developments >1ha

Flood Risk/Drainage Assessments are required where proposed development is within flood zone 1 and over 1ha. The potential impact upon areas and receiving watercourses downstream, following the increase in runoff as a result of increase in impermeable area, needs careful consideration.

A detailed FRA must be undertaken by a suitably qualified professional. It should:

- **Consider all sources of flooding** (e.g. surface water, sewer, and groundwater), not just fluvial flood risk (see Section 9.4 and 9.5). (The details and maps provided identify areas at risk from other sources of flooding which should be investigated in more detail).
- Assess the effect of **climate change** on flood risk.
- Where flood risk from other sources is identified:
 - o Ensure that development is **safe** (see Section 8.4);
 - o Ensure that where possible **flood risk is reduced** overall, through sequential design, flood resilience, flood resistance, and the use of SuDS (see Sections 8.5-8.10).
 - o Where flood risk is identified recommend the specific mitigation measures to be used.
- Assess the impact of a proposed development upon surface water drainage following an increase in impermeable area, including the **potential impact upon areas and receiving watercourses downstream, recommend the approach to control surface water discharge** and ensure that **flood risk is not increased** elsewhere, for example that:
 - o Flood flow routes, **surface water overland flow paths, are preserved** (The surface water modelling maps provided can be used as an indication of the location of these flow paths)
 - o Demonstrate the ability to meet the following drainage requirements to avoid increasing flood risk elsewhere (see Section 8.10):
 - Greenfield runoff rates
 - Attenuation up to the 1% annual probability event plus climate change
 - Use of SuDS techniques
- Recommend the approach to control surface water discharge
- Demonstrate how the risk of flooding will be managed;

- o Include an Emergency Planning Statement detailing flood warning and excavation measures, where applicable.
- Ensure any proposed SuDS techniques and flood risk management measures will be sufficiently funded so the site can be developed and occupied safely throughout its proposed lifetime.

Opportunities for developing an Integrated Water or Drainage Management Strategy across development site boundaries should be explored, and a catchment led approach should be adopted. This approach has been recognised in the recent consultation paper by DEFRA, *Making Space For Water*. An integrated approach to controlling surface water drainage can lead to a more efficient and reliable surface water management system as it enables a wider variety of potential flood mitigation options to be used. In addition to controlling flood risk, integrated management of surface water has potential benefits, including improved water quality and a reduction of water demand through grey water recycling.

Integrated drainage systems may be considered suitable for catchments where other development is being planned or constructed, and where on-site measures are set in isolation of the systems and processes downstream.

Sites in Flood Zone 1 should also be risk assessed against the other sources of flooding which are not considered within the flood zone maps.

The FRA should then conclude with an assessment of the scale of the impact, and the recommended approach to controlling surface water discharge from a proposed development.

Further Information on the details to be provided within the FRADIA can be found in the Environment Agency's FRA Guidance Note 1 (<http://www.pipernetworking.com/floodrisk/fra1.html>), CIRIA report 624 (Development and flood risk: Guidance for the construction industry), and the PPS25 Practice Guide.

9.3.2 Developments <1ha

Flood Risk/Drainage Assessments are only required for proposed development less than 1ha in flood zone 1, when the proposed site is in an area which has a known drainage problems. If this is the case then a detailed FRA is required, as described in section 9.4.1.

The details and maps provided identifying areas at risk from other sources of flooding can be used to highlighted higher risk areas. If these areas are proposed to be developed the Council should request a site specific FRA to investigate the risks further. Where proposed sites are near a culvert at risk of blockage, the developer would be required to model culvert blockage scenarios as part of the FRA to establish actual flood risk.

For those proposed developments where there is not a known drainage issue then a detailed FRA is not required. Nevertheless, the proposed development should include the appropriate application of sustainable drainage techniques so as to maintain, or preferably reduce, the existing runoff and flood risk in the area.

Further Information on the best practice advice with regards sustainable drainage can be found in the Environment Agency's Guidance (<http://www.pipernetworking.com/floodrisk/operational.html>).

9.4 How to Assess Fluvial Flood Risk

Fluvial flood risk in Uttlesford is described in Section 6.2-6.4 and chapter 7 of the SFRA. If the site is within fluvial Flood Zone 2 or 3, water levels for extreme fluvial events across the site from adjacent watercourse or watercourses should be determined by a hydraulic model, at a level of detail deemed fit for purpose for the location by the Environment Agency.

The existing hydraulic models of the rivers Cam, Chelmer, Roding and Slade can be purchased from the Environment Agency for use in an FRA. The extents of these models are provided in Table 5.1. If the watercourse is not covered by these models, then a modelling study should be undertaken by a qualified flood risk management professional.

The fluvial events with a 1%, 1% plus climate change and 0.1% probability of occurring in any given year should be modelled as part of the FRA. The site layout should then be designed

sequentially based on flood risk (see Section 8.5). Mitigation and safe access should be provided up to the 1% annual probability plus climate change water level.

The required precautionary climate change allowances for peak river flows are given in Table B.2 of PPS25, and must be modelled for an FRA. These are: 10% added to peak river flow up to 2025, and 20% thereafter to 2115. The appropriate period for climate change assessment is the designed lifetime of the development.

If any river restoration or de-culverting is planned as part of the development then it should be modelled. The FRA should demonstrate that changes will not increase (and preferably will reduce) water levels across the site.

9.5 How to Assess Flood Risk from Other Sources

The Council should be aware of the areas of Uttlesford that are at risk from culvert blockage, surface water, sewer, and groundwater flooding. Flood risk from 'other sources' in Uttlesford is described in Section 6.5 of the SFRA. The Council and developers should refer to Maps 6, 7, 11, 12, 15 and 18 to assess whether the site may be susceptible to flooding from culvert blockage, surface water, sewer and groundwater flooding.

Guidelines to use to determine whether the proposed development is at risk are:

- Is the site within 100m of a known surface water flooding incident or where surface water flooding is shown as being 0.2m or deeper, shown as yellow, orange or red on Map 11, 15 and 18 (see also Section 6.5.1).
- Is the site within 100m of a known sewer flooding incident or within an affected post code area as shown on Map 7 (see also Section 6.5.3)
- Is the site inside or within 250m of the chalk aquifer or within 250m of a groundwater flooding incident as shown on Map 6 (see also Section 6.5.2).
- Is the site within 100m of the upstream extent of a culvert.

If these areas are proposed to be developed the Council should request a site specific FRA considering all sources of flooding so as to:

- Ensure that the development will not make flooding any worse, and if possible reduce the level of flood risk. e.g. by preserving surface water flow routes
- Ensure that suitable mitigation measures against flooding from other sources are included in the development.

Within the FRA the level of risk at the site will need to be quantified in greater detail by a qualified flood risk management professional using appropriate local data:

- The capacity of the existing drainage system and any planned improvements.
- The nature and behaviour of local aquifers.

After initial scoping, the need for drainage or groundwater modelling using appropriate software should be sensibly assessed depending on the severity of the problem. Any existing surface water flow routes (including routes that groundwater flooding takes overland) must be preserved by the development. Mitigation against the likely depths of flooding should be provided up to the 1% annual probability plus climate change event. Some suggested methods are given in Section 8. The required precautionary climate change allowances for peak rainfall intensity are given in Table B.2 of PPS25, and must be modelled for an FRA. These are: 5% added to peak rainfall intensity up to 2025, 10% to 2055, 20% to 2085 and 30% to 2115. The appropriate period for climate change assessment is the designed lifetime of the development.

Where proposed sites are near a culvert at risk of blockage, the developer would be required to model culvert blockage scenarios as part of the FRA to establish actual flood risk. Advice should be sought from the Environment Agency as to which blockage scenarios will need to be modelled.

9.6 Critical Infrastructure

If Critical/Essential infrastructure is to be located in flood risk areas an FRA must demonstrate that it has been designed to remain operational throughout the duration of a flood.

9.7 Additional Considerations for FRAs within Thames Environment Agency Region

In addition to the above guidance if the proposed development is sited within the Thames Region the following need to be considered where appropriate:

- For developments proposed in the Clavering and Maunden area the Flood Zones need to be reassessed, preferably through detailed hydraulic modelling.
- For development proposals around the area of the Ugley Brook culvert the Flood Zones need to be reassessed, preferably through detailed hydraulic modelling, as well a detailed assessment of culvert blockage scenarios up to and including a 75% blockage.

10 FLOOD RISK ASSESSMENT OF GROWTH OPTIONS

The Uttlesford Core Strategy – Policy Choices and Options for Growth (2007), outlines nine options for growth:

1. 1a - Concentrate all development at Saffron Walden
2. 1b - Concentrate all development at Great Dunmow
3. 1c - Concentrate all development at Stansted Mountfitchet
4. 1d - Concentrate development in the largest centres
5. 1e - Concentrate development in a single new settlement
6. 2a - Distribute development over a range of settlements
7. 2b - Distribute development along the West Anglian Rail Corridor
8. 2c - Distribute all the development in villages around the District
9. 2d - Distribute development along the A120 corridor and at Great Dunmow

Following an initial consultation four growth options were highlighted and put forward for the next consultation:

1. Distribute development between the District's main three settlements.
2. Distribute development across a hierarchy of settlements. The settlements identified were considered key service centres as defined in the EEP.
3. Distribute development across a similar hierarchy of settlements with significantly less development at Little Canfield and significant increase in development at Elsenham as the start of a new settlement.
4. 3000 dwellings in a new settlement to the north east of Elsenham. 750 dwellings in larger towns and 250 dwellings in villages.

The description of the growth options in the Core Strategy do not allow a detailed assessment to be made of each of them. However, the four preferred options do have more details with regards location of planned development

Assessments, mostly broad scale but detailed where possible, of each growth option's flood risk issues have been made based on location, catchment conditions, history of flooding, and flood zone coverage and are provided in Table 10.1. Each growth option has been given a coloured rating to represent its potential to increase flood risk within Uttlesford if it were developed without any mitigation or SuDS measures.

For all growth options proposed it should be possible to avoid developing within flood zones 2 and 3, therefore eliminating all but the very extreme fluvial flood risk. The surface water modelling highlighted areas within the three main urban centres which could be at risk from surface water ponding. This risk must be considered when developing, and measures should be put in place to mitigate against the risk.

The main issue with all developments is their ability to increase surface water runoff. For each of the growth options outlined the use of SuDS and mitigation measures should enable runoff rates to be maintained or lowered so as to not increase the risk within Uttlesford. Therefore the coloured rating could also offer an indication of the amount of mitigation that would be required for each growth option.

Table 10.1: Assessment of each Growth Option with reference to Flood Risk within the Uttlesford District

Growth Option	Location of Development	Flood Zones 2 & 3 avoidable	Other Sources of Flooding	History of Flooding	Possible downstream flood risks	Suitability for SUDS
1a - Concentrate all development at Saffron Walden	Redevelopment sites within the town, active employment and Greenfield sites, south east of the town.	✓	Culvert blockage, sewer flooding, and potential for surface water flooding	Fluvial flooding in: 1875, 1917, 1960, 2001. 4 sewer flooding events	Saffron Walden: development over surface water drainage paths has potential to increase surface water runoff and cause the capacity of the Slade to be exceeded.	Storage/ Infiltration (location dependant)
1b - Concentrate all development at Great Dunmow	Employment land at Chelmsford Road, greenfield sites south and south west of the town.	✓	Land between Chelmsford Road and 1) Ash Grove and 2) A130 have been identified as being at potential risk of surface water flooding. The ordinary watercourses (Chelmer tributaries) have potential to flood.	Fluvial flooding in: 2001 but <u>not</u> in the proposed development area.	There are no major towns or villages immediately downstream of Great Dunmow at flood risk.	Storage/ Infiltration (location dependant)
1c - Concentrate all development at Stansted Mountfitchet	Land north of the village	✓	Small area with potential to suffer surface water flooding around Walpole Farm.	Backing up from Ugley Brook culvert section affects Gall End Lane and Lower Street.	Stansted Mountfitchet: development over surface water drainage paths has potential to increase surface water runoff and cause the capacity of the Ugley Brook to be exceeded.	Storage/ Infiltration (location dependant)
1d - Concentrate development in the largest centres (Option 1*)	As 1a - 1c	✓	As 1a - 1c	As 1a - 1c	As 1a - 1c	As 1a - 1c
1e - Concentrate development in a single new settlement	East of Stebbing	✓	-	×	There are no major towns or villages immediately downstream of Stebbing at flood risk.	Storage
	Elsenham - Henham: Land north east of Elsenham. <i>(Option 4 – preferred option*)</i>	✓	There is a potential for surface water flooding and flooding from culvert blockage, this would need further investigation.	Fluvial flooding in Old Mead Road, from a tributary of the River Cam.	Newport & Stansted Mountfitchet: increase surface water runoff into the River Cam and the Stansted Brook respectively. Elsenham: topography in the west slopes towards Elsenham, causing a potential risk of surface water flooding	Storage/ Infiltration (location dependant)
	Vicinity of Stansted Airport	✓	-	×	There are no major towns or villages immediately downstream of Stansted Airport at flood risk.	Storage/ Infiltration (location dependant)
2a - Distribute development over a range of settlements (Option 2 & 3*)	Saffron Walden - Redevelopment sites within the town, active employment and Greenfield sites between Radwinter Road and Thaxted Road.	✓	As 1a	As 1a	As 1a	Storage/ Infiltration (location dependant)

	Great Dunmow - Employment land at Chelmsford Road, land at Ongar Road and land to the west between the B1256 and the Flitchway	✓	As 1b	As 1b	As 1b	
	Stansted Mountfitchet – as 1c	✓	As 1c	As 1c	As 1c	
	Elsenham – Land west and/or east of Elsenham and South of Stansted Rd.	✓	As 1e	As 1e	As 1e	
	Newport - west of London Road and North of Bury Water Lane	✓	There is a potential for surface water flooding, although there are no known incidences, this would require further investigation.	Properties at the back of Bury water Cottages, in Water Lane, Cambridge Road, white Horse Lane, and the sewerage works affected.	Development potentially increases surface water runoff into the Wicken Water and River Cam, increasing flood risk.	
	Thaxted - east of Wedow Road	✓	There is a potential for surface water flooding and flooding from culvert blockage, this would need further investigation.	Properties in Copthall Lane and Mill Lane/Dunmow Road affected.	Development potentially increases surface water runoff into the ordinary watercourse (tributary of River Chelmer), increasing the flood risk posed downstream, and upstream following culvert blockage or exceedance of capacity.	
	Great Chesterford - London Road and south of The Elms	✓	There is a potential for surface water flooding, although there are no known incidences, this would require further investigation.	Properties in Cambridge Road, Ickleton Road, Walden Road, Sewerage Pumping Station and Playing Field affected.	Development potentially increases surface water runoff into the River Cam, increasing flood risk.	
	Priors Green, Little Canfield/Takeley - north and/or east of Priors Green	✓	-	Properties in Takeley (Roseacres, South Road, Jack's Lane and Warren Close) affected.	Development potentially increases surface water runoff into the River Roding, increasing flood risk.	
2b - Distribute development along the West Anglian Rail Corridor	West Anglia Rail Corridor: as for 2a for Stansted Mountfitchet, Elsenham, Newport and Great Chesterford	✓	-	Fluvial Flooding 2001 - 11 properties in Great Chesterford, Newport and Littlebury ?	Development along the West Anglia Rail Corridor follows the course of the River Cam. There is potential to increase flood risk from R.Cam downstream i.e.: Great Chesterford etc, by increasing surface water runoff.	Storage/ Infiltration (location dependant)
2c - Distribute all the development in villages around the District	Unknown	✓	✓ (Some parts)	✓ (Some parts)	Will be dependent on the settlements chosen	Storage/ Infiltration (location dependant)
2d - Distribute development along the A120 corridor and at Great Dunmow	Land along the A120 corridor, Oakwood Park, Priors Green and Woodlands Park.	? ✓	-	Properties in Takeley affected.	There are no major towns or villages immediately downstream of A120 or Great Dunmow	Storage/ Infiltration (location dependant)
	Great Dunmow		As 1b	As 1b		

Key: High Medium Low Potential of each growth option to increase flood risk within the Uttlesford District or to neighbouring areas.

* Options highlighted in preferred options consultation.

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11 RECOMMENDATIONS/RECOMMENDED POLICIES

The development of the new LDF provides an ideal opportunity for the **Council to review and update their policies on flood risk** and to ensure consistency with national guidance and regional planning policy. These policies should be informed by the information provided in this SFRA.

The following recommendations should be taken forward to form policies within the Council's LDF:

- When assessing the suitability of land for development **the Council will consider both PPS25 and the SFRA**. The CFMP policy messages outlined in section 2.3.3 have been incorporated within the SFRA in the form of guidance and recommendations/recommended policies.
- The Council will apply the sequential test and exception test as set out in Annex D of PPS25. The Council will apply the vulnerability classification outlined in PPS25 when determining the appropriate development usage of different sites. If essential infrastructure must locate in a flood zones 2 and 3 it will need to be designed to incorporate sufficient mitigation measures, be safe and where possible remain operational during a flood.
- Given the small percentage of the District which is contained with Flood Zones 2 and 3 it is highly recommended a policy is put in place stating that the **Council will object in principal to new development within both Flood Zones 2 and 3**, protecting the remaining greenfield floodplain from future development maintaining it as a flood risk management asset. It is unlikely proposals in these zones would pass the sequential test due to the large proportion of land within Uttlesford which resides in Flood Zone 1.
- If **brownfield floodplain redevelopment** is proposed the Council should push for the removal of buildings and restoration of the natural floodplain. Where this is not practical the site redevelopment **must not exceed, and should where possible reduce, the overall building footprint**. Additionally the land use of the site should be **changed to a land use with a less vulnerable classification**. Brownfield redevelopments within the functional floodplain **must be fully flood resilient** to minimise damage and enable quick recovery from flooding.
- PPS 25 requires that new development does not exacerbate flood risks elsewhere. This is particularly important in Uttlesford given its location at the top of many river catchments. All proposed development sites will be required to maintain or improve on existing runoff from the site by achieving greenfield runoff rates. Consequently **SUDS should be applied where appropriate**, and where it is not considered applicable this should be explained in the FRA/DIA. There is a presumption of application for all new developments, but it is recognised that sometimes SuDs are not always applicable. For smaller developments SUDS could consist of green roof or rainwater harvesting techniques. (The council must maintain an accurate record of SUDS installed, those adopted and maintenance required.)
- The Council will require a **site specific flood risk assessment** (as outlined in Section 9) to be submitted with all planning applications unless they are for developments <1ha located in Flood Zone 1, where there are no existing drainage issues.
- In light of the information provided in this SFRA, including critical infrastructure identified as being at flood risk, it is recommended that the **Council review their Emergency Plan with respect to flooding and raise awareness amongst residents on the measures which can be taken to mitigate against future flooding events** within the District. For existing developments which suffer flooding or remain at risk opportunities should be sought to retrofit flood resilience and resistance measures (as outlined in section 8).
- Development proposals adjoining the main rivers, ordinary watercourses and culverts should be **set back** in accordance with the guidelines in Section 8.2.
- Opportunities should be sought to **restore/deculvert rivers**.

The Uttlesford District SFRA has been prepared in accordance with current best practice, Planning Policy Statement 25 Development and Flood Risk (PPS25) and other high level planning, policy and guidance documents. The SFRA is a planning tool that enables each council to select and develop sustainable site allocations away from vulnerable flood risk areas.

The SFRA utilises and builds upon existing knowledge of flood risk within the District. The Environment Agency regularly review and update their Flood Maps (on a quarterly basis) and undergo a series of detailed flood risk mapping studies. These improvements to the existing knowledge of flood risk within the District may over time alter the predicted flood extents outlined. Such alterations could affect future development control decisions within these areas. Therefore it is imperative that the SFRA is reviewed regularly in light of improved understanding of flood risk within the District and any future policy directives.

MAPS

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