Final Report

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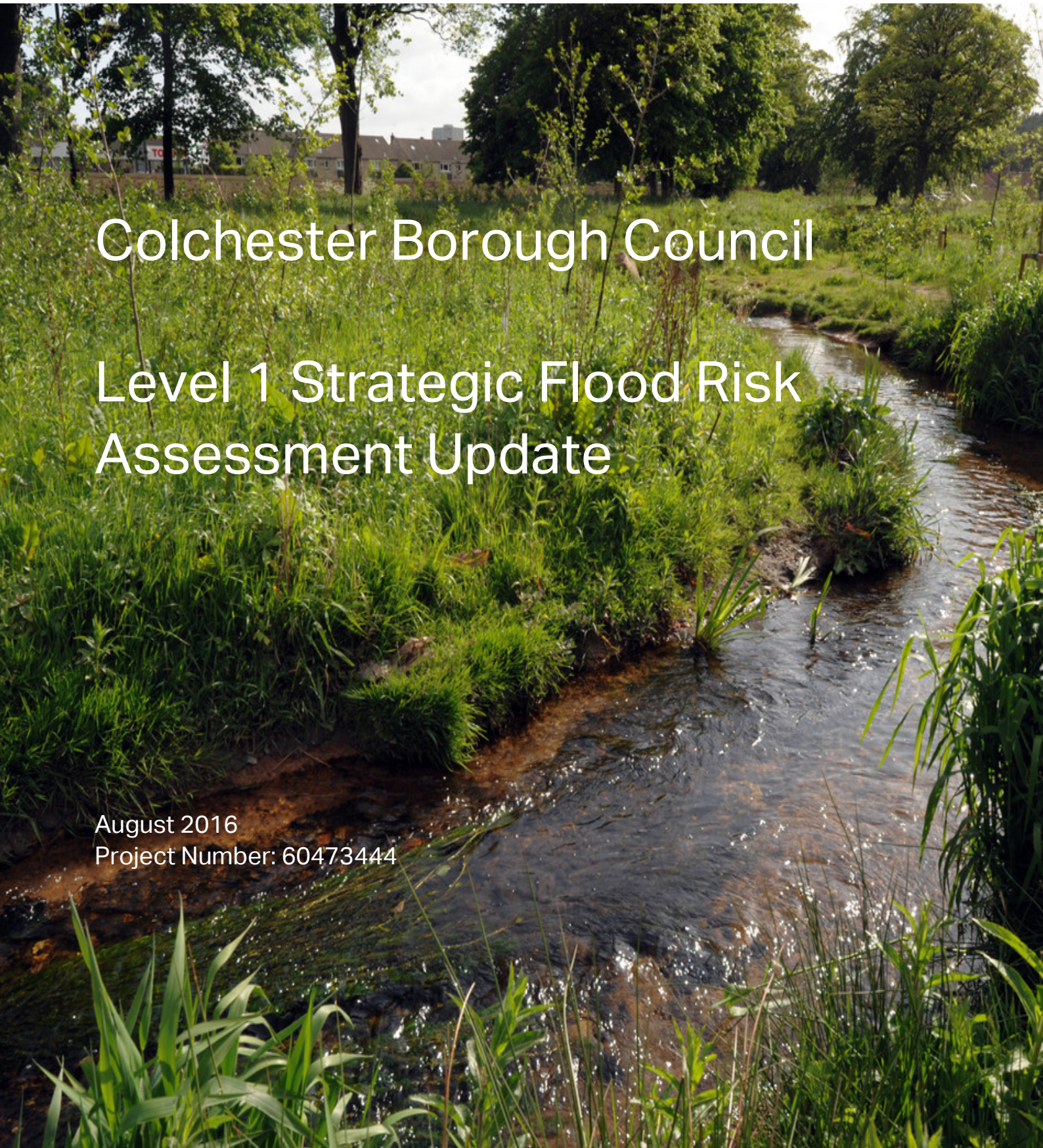

Colchester Borough Council

Level 1 Strategic Flood Risk Assessment Update

August 2016
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List of Acronyms

ABD	Areas Benefiting from Defences
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
AIMS	Asset Information Management System
AWS	Anglian Water Services
BC	Borough Council
BGS	British Geological Survey
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Flood and Rural Affairs
DRN	Detailed River Network
ECC	Essex County Council
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act 2010
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
NPPF	National Planning Policy Framework
RBD	River Basin Borough
PPG	Planning Policy Guidance
RoFSW	Risk of Flooding from Surface Water mapping
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

Glossary of Terms

Glossary	Definition
Annual exceedance probability (AEP)	Chance of occurrence in any one year, expressed as a percentage. For example, a 1% annual probability event has a 1 in 100 chance of occurring in any given year.
Areas Benefitting from Defences (ABD)	Hatched areas on the Environment Agency Flood Map for Planning (Rivers and Sea) behind flood defences, which, if the flood defences were not present, would flood, in the event of a river flood with a 1 per cent (1 in 100) chance of happening each year, or a flood from the sea with a 0.5 per cent (1 in 200) chance of happening each year.
Asset Information Management System (AIMS)	Environment Agency management system of assets associated with main rivers including defences, structures and channel types. Information regarding location, standard of service, dimensions and condition.
Aquifer	A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water.
Catchment Flood Management Plan (CFMP)	A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
Civil Contingencies Act	This Act delivers a single framework for civil protection in the UK. As part of the Act, Local Resilience Forums must put into place emergency plans for a range of circumstances, including flooding.
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions. For fluvial events a 20% increase in river flow is applied and for rainfall events, a 30% increase. These climate change values are based upon information within the NPPF and Planning Practice Guidance (PPG).
Culvert	A channel or pipe that carries water below the level of the ground.
DG5 Register	A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
Exception Test	A method set out in the NPPF to help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available. The two parts to the Test require proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.
Flood and Water Management Act (FWMA)	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 Floods; the aim of which is to clarify the legislative framework for managing local flood risk (flooding from surface water, groundwater and ordinary watercourses) in England.
Flood Defence	Infrastructure used to protect an area against flooding such as floodwalls and embankments.
Resilience measures	Measures designed to reduce the impact of water that enters property and businesses and to promote fast drying and easy cleaning; for example raising electrical appliances, installing tiled flooring.
Resistance measures	Measures to prevent flood water entering a building or damaging its fabric, for example the use of flood guards. This has the same meaning as flood proofing.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Flood Zone	Areas defined by the probability of river and sea flooding, ignoring the presence of defences. Flood Zones are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's web site.
Fluvial	Relating to the actions, processes and behaviour of a watercourse (river or stream).
Freeboard	The height of a flood defence crest level (or building level) above a particular design flood level.

Glossary	Definition
Functional Floodplain	Land where water has to flow or be stored in times of flood. It is defined by LPAs within SFRAs. Functional floodplain (also referred to as Flood Zone 3b) is not separately distinguished from Zone 3a on the Environment Agency Flood Map for Planning.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Lead Local Flood Authority (LLFA)	As defined by the Flood and Water Management Act, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area. Essex CC is the LLFA for Colchester BC.
Local Planning Authority (LPA)	Body that is responsible for controlling planning and development through the planning system.
Main river	Watercourse defined on a 'main river map' designated by Defra. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities for main rivers. However overall responsibility for maintenance lies with the riparian owner.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
National Planning Policy Framework (NPPF)	The National Planning Policy Framework was published on 27 March 2012. It is a framework which sets out the Government's planning policies for England and how these are expected to be applied.
Ordinary watercourse	A watercourse that does not form part of a main river. This includes "all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows" according to the Land Drainage Act 1991.
Planning Practice Guidance (PPG)	The PPG is a web-based resource published by DCLG in March 2014 to provide guidance on the application of the NPPF.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account.
Return Period	The average time period between rainfall or flood events with the same intensity and effect.
Risk	Risk is a factor of the probability or likelihood of an event occurring multiplied by consequence: Risk = Probability x Consequence. It is also referred to in this report in a more general sense.
Sequential Test	An approach to future site planning whereby new development is directed towards areas with the lowest probability of flooding before consideration of higher risk areas. The Sequential Test helps ensure that development can be safely and sustainably delivered and developers do not waste their time promoting proposals which are inappropriate on flood risk grounds.
Sewer Flooding	Flooding caused by a blockage or overflowing of a sewer or urban drainage system.
Surface Water	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer.
Surface Water Management Plan (SWMP)	A plan which outlines the preferred surface water management strategy in a given location. In this context surface water flooding describes flooding from sewers, drains, groundwater and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall.
Sustainable drainage systems (SuDS)	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Topographic survey	A survey of ground levels.

Executive Summary

The Local Planning Authority (LPA), Colchester Borough Council (BC), is currently preparing documents that will support the development of the new Local Plan and set the vision for future development across the Borough to 2033 and beyond. Colchester BC faces the challenge of meeting the need for new development within some areas that have already been identified at risk of tidal and fluvial flooding, as well as areas that are increasingly at risk from surface water flooding associated with heavy rainfall events.

The National Planning Policy Framework (NPPF) and associated Planning Practice Guidance (PPG) for Flood Risk and Coastal Change emphasise the active role Local Planning Authorities (LPAs) such as Colchester BC should take to ensure that flood risk is assessed, avoided, and managed effectively and sustainably throughout all stages of the planning process.

Assess Flood Risk

Section 4 of this Level 1 Strategic Flood Risk Assessment (SFRA) and the supporting mapping in Appendix A provide a strategic overview of flood risk across the Borough from all sources based on readily available datasets. A strategic assessment of the risk of flooding has been provided for the tidal Blackwater and Colne estuary; fluvial watercourses including the River Colne, River Stour, Layer Brook and Roman River; flooding from ordinary watercourses, surface water, groundwater, as well as reservoirs and the existing drainage infrastructure.

A site assessment database was provided to Colchester BC detailing 395 potential development sites identified by Colchester BC through their Call for Sites. For each site, an assessment of the risk of flooding, based on the datasets presented in the Level 1 SFRA, has been undertaken and provided to Colchester BC to enable the direct comparison of sites in the application of the Sequential Test.

Avoid Flood Risk

The outputs of the Level 1 SFRA and the guidance presented in Section 5 should be used by Colchester BC to apply the Sequential Test to future site selection, so that development is, as far as reasonably possible, located where the risk of flooding from all sources is lowest, taking account of climate change, and the vulnerability of future users to flood risk.

Manage and Mitigate Flood Risk

Where alternative sites in areas at lower risk of flooding are not available, it may be necessary to locate development in areas at risk of flooding. In these cases, Colchester BC and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development, and will not increase flood risk overall. Colchester BC and developers should seek flood risk management opportunities (e.g. safeguarding land), and to reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems). Guidance on measures to manage and mitigate flood risk, and preparing site specific Flood Risk Assessments is provided in Sections 6 and 7.

Level 2 Strategic Flood Risk Assessment

Following completion of the Sequential Test, it may still be necessary to consider locating development in areas at risk of flooding, and in such cases the Exception Test may need to be applied. An increased scope Level 2 SFRA will be prepared to provide Colchester BC with further detail regarding the flood risk at these sites, and guidance on the issues that would need to be addressed for the Exception Test to be satisfied at each site.

Living Document

The Level 1 SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. The Environment Agency is currently revising the hydraulic modelling for the River Colne and River Stour, which will improve the current knowledge of flood risk within the Borough, and may marginally alter predicted flood extents within parts of the Borough in the future. The models for the River Stour will also take account of the revised climate change allowances published by the Environment Agency in February 2016.

New information may influence future development control decisions within these areas. Therefore it is important that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk within the Borough.

1 Introduction and Background

1.1 Terms of Reference

AECOM Infrastructure and Environment UK Ltd ('AECOM') has been commissioned by Colchester Borough Council (BC) to review and revise the Level 1 and 2 Strategic Flood Risk Assessment (SFRA) for its administrative area. This report comprises the Level 1 SFRA.

1.2 Project Background

The National Planning Policy Framework[1] (NPPF) and associated Planning Practice Guidance (PPG) for Flood Risk and Coastal Change (PPG)[2] emphasise the active role Local Planning Authorities (LPAs) should take to ensure that flood risk is understood and managed effectively and sustainably throughout all stages of the planning process. The NPPF outlines that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and LPAs should use the findings to inform strategic land use planning.

In 2007 Scott Wilson (now AECOM) was commissioned by the Mid Essex Area Liaison Group (MEAL) to undertake a Strategic Flood Risk Assessment (SFRA)[3] on behalf of the LPAs of Braintree District Council, Colchester Borough Council, Chelmsford Borough Council (now City Council) and Maldon District Council.

Since the preparation of these reports there have been a number of further changes in legislation and guidance relating to planning and flood risk. The introduction of the Localism Act in 2011 was intended to create a planning system oriented around consideration of local planning issues. Planning Policy Statements (PPS), covering all aspects of national planning policy have since been replaced by the NPPF. The accompanying technical guidance document relating to flood risk, originally derived from the PPS documents has also been recently replaced by the Planning Practice Guidance (PPG). Furthermore, the wider planning system has been subject to considerable change since 2008 with the withdrawal of the previous regional planning framework and the revocation of Regional Spatial Strategies (RSS) in 2010.

The Flood and Water Management Act (FWMA) attained royal assent in 2010, with the intention of enabling the provision of more effective flood management following the flooding of July 2007. As such, Essex County Council (ECC) is designated a Lead Local Flood Authority (LLFA) and has significant duties and powers in relation to flooding from local sources, specifically surface water, groundwater and ordinary watercourses. The Environment Agency retains responsibility for leading and coordinating the management of flood risk associated with main rivers and the sea.

As well as legislative and planning policy changes, a number of new and revised datasets have been made available since the release of the previous SFRA. Environment Agency flood risk mapping has been revised for the tidal and main river watercourses in Colchester and updated national surface water flood risk mapping has been released by the Environment Agency for use by LPAs in SFRAs. In addition, new modelling of the Blackwater and Colne estuary has enabled the development of a revised model as part of the SFRA to assess the residual risk of flooding in Colchester associated with a breach of the Colne Barrier.

The purpose of the revised Level 1 SFRA is to collate and analyse the most up to date readily available flood risk information for all sources of flooding, to provide an overview of flood risk issues across the Borough. This will be used by Colchester BC to inform the application of the Sequential Test for future site allocations. The revised Level 2 SFRA provides more detailed information regarding the nature of flood risk to enable further assessment of those sites where the Exception Test may be required. The Level 2 deliverables include the results of the Colne Barrier breach modelling to determine the residual risk to the area. It is also intended that the revised SFRA deliverables will assist prudent decision-making on flood risk issues by Development Management Officers on a day-to-day basis.

[1] Department for Communities and Local Government. 2012. *National Planning Policy Framework*. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[2] Department for Communities and Local Government. 2014. *Planning Practice Guidance: Flood Risk and Coastal Change.* Available at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
[3] Scott Wilson, 2007, Mid Essex Strategic Flood Risk Assessment.

1.3 Approach to Flood Risk Management

The NPPF sets stringent tests to protect people and property from flooding which all LPAs are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed. The main steps to be followed can be summarised as **Assess**, **Avoid** and **Manage and Mitigate** flood risk. These steps are set out below, and are designed to ensure that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.

Assess Flood Risk	As the LPA, Colchester BC should undertake a **SFRA** to fully understand the flood risk in the area to inform Local Plan preparation. For sites in areas at risk of flooding, or with an area of 1 hectare or greater, developers must undertake a **site-specific Flood Risk Assessment** (FRA) to accompany planning applications (or prior approval for certain types of permitted development).
Avoid Flood Risk	Colchester BC should apply the **sequential approach** to site selection so that development is, as far as reasonably possible, located where the risk of flooding from all sources is lowest, taking account of climate change and the vulnerability of future users to flood risk. In **plan-making this involves applying the Sequential Test**, and where necessary the **Exception Test** to Local Plans, as described in Figure 1-1. In **decision-taking this involves applying the Sequential Test** and if necessary the **Exception Test** for specific development proposals.
Manage and Mitigate	Where alternative sites in areas at lower risk of flooding are not available, it may be necessary to locate appropriate development in areas at risk of flooding. In these cases, Colchester BC and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development, and will not increase flood risk overall. Colchester BC and developers should seek flood risk management opportunities (e.g. safeguarding land), and to reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems).

1.4 Level 1 SFRA Deliverables

The Level 1 SFRA Report has been structured as follows:

- Section 1: Description of Study Area and Partner Organisations
- Section 2: Legislative and Planning Policy Context
- Section 3: Level 1 Assessment Methodology
- Section 4: **Level 1 Assessment** of Flood Risk
- Section 5: **Avoiding** Flood Risk – Applying the Sequential Approach
- Section 6: **Managing and Mitigating** Flood Risk
- Section 7: Guidance for preparing site specific Flood Risk Assessments
- Section 8: Next Steps
- Appendix A: Figures

Section 4 provides the Level 1 strategic assessment of flood risk from all sources across the Borough. The figures included within Appendix A should be referred to when reading this Section.

Section 5 provides guidance on the application of the Sequential Test by Colchester BC when allocating future development sites as part of the plan-making process, as well as by developers promoting development on windfall sites. The strategic assessment of flood risk presented in Section 4 will inform the Sequential Test carried out by Colchester BC. The datasets presented in Section 4 have also been used to prepare a site assessment database (supplied separately to Colchester BC), detailing the flood risk at each of their potential development sites to enable comparison of sites throughout the application of the Sequential Test.

Sections 6 and 7 provide guidance on the measures that can be used to manage and mitigate flood risk on future development sites, as well as when a site-specific FRA is required, and the scope of the assessment required.

Section 8 presents the next steps for Colchester BC following completion of the Level 1 SFRA.

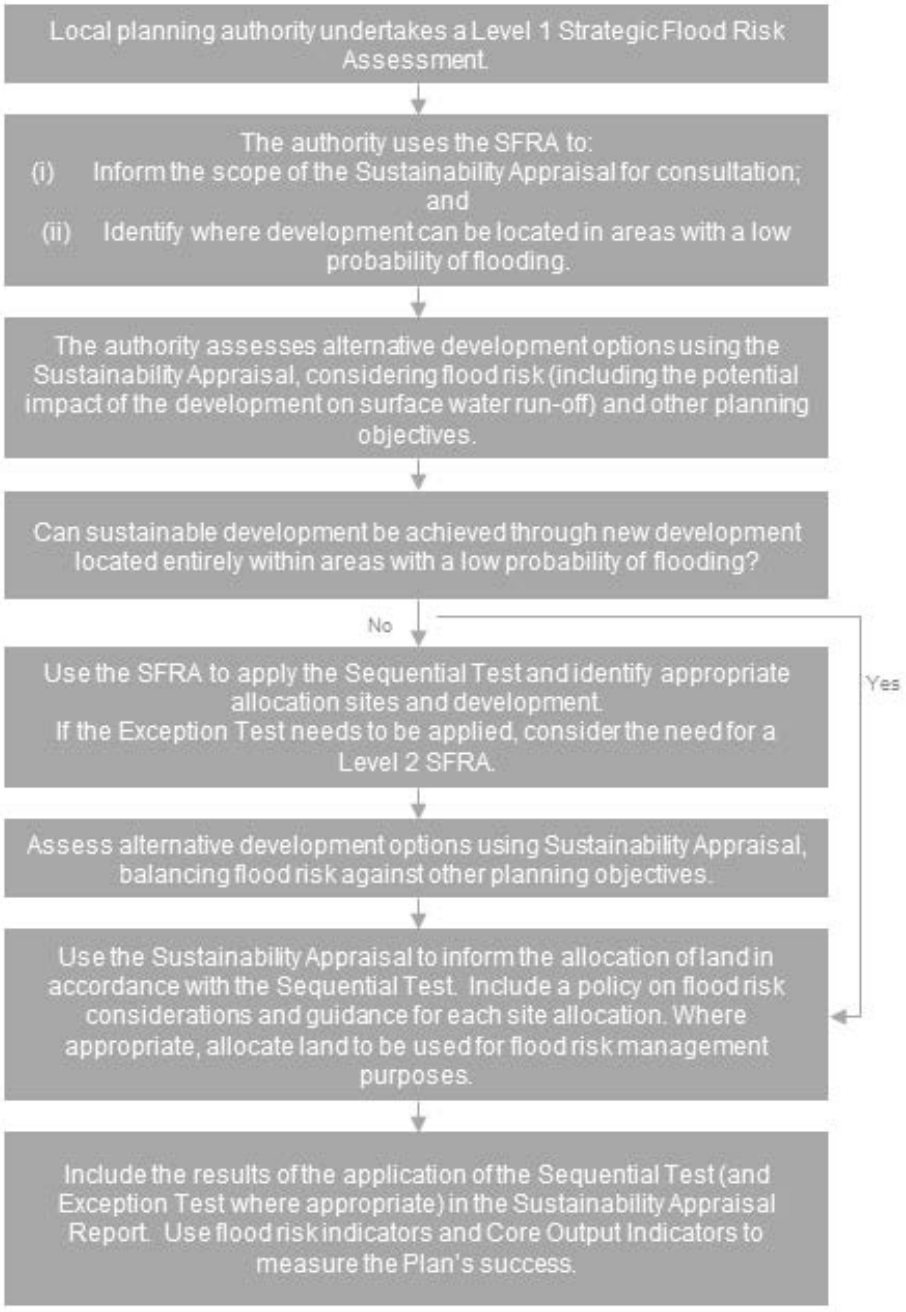

Figure 1-1 Taking flood risk into account in the preparation of a Local Plan (PPG, p6)

1.5 Partner Organisations

There are several organisations involved in development and flood risk management across the study area. These are identified below.

Colchester Borough Council is the Local Planning Authority (LPA) for the study area, responsible for long term strategic planning of future development through the preparation of Local Plans, as well as for determining planning applications within the Borough. In accordance with the FWMA and subsequent communication from Central Government, from 6th April 2015, Colchester BC is required to ensure that SuDS are implemented for all major developments where appropriate, and that through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

Essex County Council is designated the Lead Local Flood Authorities (LLFA) under the Flood and Water Management Act 2010 (FWMA), and has a duty to lead and coordinate the management of local flood risk, which includes flood risk from surface water, groundwater and ordinary watercourses. The LLFA is a statutory consultee for surface water drainage and will be required to assess applications for the provision of surface water drainage for all major development.

Environment Agency has a strategic overview role for all sources of flooding and coastal erosion which includes developing strategic plans, providing evidence and advice to inform Government policy and providing a framework to support local delivery.

Within Colchester, the Environment Agency has operational powers for managing flood risk associated with main rivers and responsibility for reservoirs and is a statutory consultee for any development, other than minor development, proposed within Flood Zone 2 or 3 or within 20m of a main river. Any works within 8m of the bank of a fluvial main river or defence structure or culvert, or 16m of a tidal main river, or sea defence structure requires an Environmental Permit from the Environment Agency. The Environment Agency is continually improving and updating their flood map for main rivers and has permissive powers to carry out flood defence works, maintenance and operational activities for these main rivers. However, overall responsibility for maintenance lies with the riparian owner.

As part of taking a strategic overview for all sources of flooding the Environment Agency are involved in strategic flood risk mapping projects, such as the national mapping of surface water flood risk. The Environment Agency also has a key role in allocation of funding for flood and coastal erosion risk management projects.

Anglian Water Services has a duty as a statutory body to provide clean and waste water services to the study area and is responsible for the management, maintenance and operation of flood control structures. Water Companies are defined as a Risk Management Authority (RMA) within the FWMA and are responsible for flood risk management functions in accordance with the Water Resources Act 1991 and the Land Drainage Act 1991. AWS is responsible for surface water drainage from development via adopted sewers and for maintaining trunk sewers into which many of the highway drainage in the study area connects.

Highways Agency has responsibilities (under the Highways Act 1980) for the effectual drainage of surface water from adopted roads along red routes insofar as ensuring that drains, including kerbs, road gullies and ditches and the pipe network which connect to the sewers, are maintained. In relation to the SFRA, the Highways Agency was consulted to provide details of any known historic and recent flood risks along the highways in the Borough, areas that are susceptible to flooding, flood mitigation measures that have already been put in place and maintenance regimes.

1.6 Study Area

1.6.1 Location

The study area of Colchester Borough is shown in **Appendix A Figure 1**, together with the location of the principal watercourses and reservoirs. Colchester Borough forms part of the County of Essex, and is bordered by the local authorities of Braintree to the west, Tendring to the east, Babergh to the north and Maldon to the south.

1.6.2 Human Geography

The Borough of Colchester covers over 333 km^2 and has a population of 180,420. The town of Colchester is the Borough's largest conurbation, with a population of just over 100,000. There are a number of smaller towns and villages within the Colchester Borough, notably West Mersea, Tiptree, Wivenhoe and West Bergholt.

As shown in **Appendix A Figure 1**, the southern boundary of the Borough broadly follows the northern bank of the Blackwater Estuary. The eastern boundary of the Borough is defined by the course of the River Colne until the river reaches Wivenhoe. From here, the border heads inland, to the east of Colchester until it reaches the River Stour in the north. The Stour forms the northern border of the Borough with the western boundary being located inland, running south, across the Colne Valley, until it reaches Tiptree in the south.

1.6.3 Physical Geography

The south of the Borough is characterised by the estuarine systems of the Rivers Colne and Blackwater. Landscape features of this area include Mersea Island and various creeks and channels, including Pyefleet Channel, Strood Channel, Geedon Marshes and Creek and Fingringhoe Creek.

The River Colne flows from its source in Great Yeldham, to the north west of Colchester. From here it flows southeast, along the Colne Valley, and enters the northwest of the town of Colchester. From here, it flows in a more southerly direction and is influenced by tidal fluctuations. The river then flows past the town of Wivenhoe and begins to show features that are typical of a tidal watercourse such as salt marshes, creeks and mudflats. The River Colne converges with the Blackwater Estuary at Mersea Island and Brightlingsea.

The River Colne has four main tributaries, which are;

- Roman River;
- Bourne Brook;
- Toppesfield Brook; and
- Layer Brook

In addition to these, there are a number of smaller tributaries, creeks and brooks, particularly within the tidal reaches of the watercourses.

As with the other coastal areas in the region, the tidal-influenced areas of the River Colne contain important estuarine ecosystems. Of these ecosystems, some are considered to be of high ecological importance and therefore are protected by various environmental designations. Such areas include Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and Special Areas for Conservation (SACs). In addition, the Colne Estuary falls within part of the European Marine Site that stretches along the Mid Essex Coastline. The Mid Essex SAC starts 200m south of the Wivenhoe Tidal Barrier.

There are a number of environmental designations within the Colchester area. The Colne Estuary is designated as a SPA and a Ramsar site due to the presence of the following species: Hen Harrier, Avocet, Golden Plover, Little Tern, Brent Goose and Redshank, associated with the salt marshes, mudflats, boulder and cobble shores, sand dunes, improved grasslands, reed beds, coastal lagoons, and grazing marshes. The Colne Estuary is also designated as a SSSI and is flanked by several Wildlife Sites (former SINC's) and Local Nature Reserves. The Essex Estuaries are classified as SAC, due to their Atlantic salt meadows, mudflats, sandflats and River and Estuary Systems[3].

2 Legislative and Planning Policy Context

2.1 Introduction

This Section provides an overview of the legislative and national and local planning policy context specific to the Level 1 SFRA Update for Colchester BC. The information presented in the SFRA should be used by Colchester BC to establish robust policies in relation to flood risk as part of their emerging Local Plan.

2.2 Flood and Water Management Act

In response to the severe flooding across large parts of England and Wales in summer 2007, the Government commissioned Sir Michael Pitt to undertake a review of flood risk management. The Pitt Review – Learning Lessons from the 2007 Floods and subsequent progress reviews outlined the need for changes in the way the UK is adapting to the increased risk of flooding and the role different organisations have to deliver this function.

The Flood and Water Management Act 2010 (FWMA), enacted by Government in response to The Pitt Review, designated unitary authorities, such as Essex County Council (ECC), as Lead Local Flood Authority (LLFA). As LLFA, ECC has responsibilities to lead and co-ordinate local flood risk management. Local flood risk is defined as the risk of flooding from surface water runoff, groundwater and small ditches and watercourses (collectively known as ordinary watercourses).

The FWMA also formalises the flood risk management roles and responsibilities for other organisations including the Environment Agency, water companies and highways authorities. The responsibility to lead and co-ordinate the management of tidal and fluvial flood risk remains that of the Environment Agency.

2.2.1 National Strategy for Flood and Coastal Erosion Risk Management

In accordance with the FWMA, the Environment Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England[4]. This Strategy provides a framework for the work of all flood and coastal erosion risk management authorities.

The National FCERM Strategy sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. It sets the context for, and informs the production of local flood risk management strategies by LLFAs, which will in turn provide the framework to deliver local improvements needed to help communities manage local flood risk. It also aims to encourage more effective risk management by enabling people, communities, business and the public sector to work together to:

- ensure a clear understanding of the risks of flooding and coastal erosion, nationally and locally, so that investment in risk management can be prioritised more effectively;
- set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the remaining risks;
- encourage innovative management of risks taking account of the needs of communities and the environment;
- ensure that emergency responses to flood incidents are effective and that communities are able to respond properly to flood warnings; and,
- ensure informed decisions are made on land use planning.

The Environment Agency's 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities'[5] guidance is a supporting note for the National FCERM Strategy. The 2016 version of the document reflects an assessment completed by the Environment Agency between 2013 and 2015 using UKCP09 data, to produce more representative climate change allowances for river flood flows and extreme rainfall for each of the river basin districts in

[4] Environment Agency (2011) National Strategy for Flood and Coastal Erosion Risk Management in England. https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england

[5] Environment Agency (2016) Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516116/LIT_5707.pdf

England. It is essential that land use planning decisions consider the impact of a changing climate, where appropriate, both now and into the future.

2.2.2 Local Flood Risk Management Strategy

As the LLFA, ECC has a statutory duty to develop, maintain, apply and monitor a strategy for local flood risk management in their respective administrative areas. ECC has prepared a draft Local Flood Risk Management Strategy (LFRMS)[6] which is currently undergoing public consultation.

The aim of ECC's LFRMS is "to work with organisations, businesses and communities to manage flood risks and, where it is practicable, affordable and sustainable to do so, to reduce risks to life, property and livelihoods that may arise from local surface runoff, ordinary watercourse and groundwater flooding". The LFRMS will seek to implement the following strategic objectives:

1. Determine and communicate Local Flood Risk – Undertake projects to determine and understand the risks of flooding from surface run-off, ordinary watercourses and groundwater. Increase public awareness through the publication of clear and consistent information about local flood risk.
2. Partnership Working - Work with all Risk Management Authorities (RMAs) and other stakeholders to coordinate flood risk management roles, responsibilities and activities. Share best practice; raise the profile of RMAs working within Essex and assist organisations in ensuring their plans and projects take proper account of all flood risk.
3. Partnership Programmes and Projects - Identify, secure and optimise resources to develop and deliver measures to manage flood risk. Assist organisations to establish and update long-term plans to manage flood risk.
4. Riparian Responsibilities - Work with Risk Management Authorities to encourage and where necessary enforce the management and maintenance of privately owned flood management structures and ordinary watercourses and minimise unnecessary constrictions and obstructions within local drainage networks.
5. Flood Risk and Development - Ensure that planning authorities are properly informed about local flood risk, that there is a consistent approach to the consideration of flood risk management in new development and that new developments seek to reduce existing flood risk and contribute to the achievement of sustainable development.
6. Water Framework Directive - Support the implementation of the 'Water Framework Directive' by ensuring that watercourse morphology, water quality and ecological status are not harmed by activities that are controlled by, or undertaken by, owners, occupiers and managers of Flood and Coastal Erosion Risk Management infrastructure. Facilitate measures to improve morphology, water quality and ecological status whenever it is practicable and necessary to do so.
7. Support Water and Sewerage Company infrastructure - Work closely with water and sewerage companies to minimise flood risks associated with their infrastructure and promote the development and management of sustainable water resources.

2.2.3 Surface Water Management Plan

ECC has coordinated a Surface Water Management Plan (SWMP) for the town of Colchester[7]. A Surface Water Management Plan (SWMP) is produced by the LLFA in partnership with the local authorities and other flood risk management authorities. The SWMP outlines the predicted risk and preferred surface water management strategy for a given area. SWMPs focus on areas of highest surface water flood risk identified in Essex County Council Local Flood Risk Management Strategy.

SWMPs considers flooding from sewers, drains, groundwater, and runoff from land, small water courses and ditches that occurs as a result of heavy rainfall. This is varied though the use of local knowledge and flood records for an area. Areas where the flood risk is considered to be most significant are identified with the SWMP as Critical Drainage Areas (CDAs)[8].

A four phase approach has been undertaken in line with Defra's SWMP technical guidance documentation (2010). The most cost effective measures of managing surface water flood risk are recommended, accompanied by a long term action plan. It is important to recognise that flooding within the study area is not confined to just the CDAs, and

[6] Essex County Council, Capita Symonds, URS (2013) Essex County Council Draft Local Flood Risk Management Strategy. https://www.essex.gov.uk/Publications/Documents/Local_Flood_Risk_Management_strategy.pdf
[7] Capita Symonds (2013) Town of Colchester Surface Water Management Plan.
[8] CDAs as defined within the SWMP, the definition of which may differ from that referred to within the NPPF.

therefore, there are opportunities for generic measures to be implemented through the establishment of a policy position.

2.3 Flood Risk Regulations

As well as the duties under the Act to prepare a LFRMS, LLFAs have legal obligations under the EU Floods Directive, which was transposed into UK Law through the Flood Risk Regulations 2009 ('the Regulations').

2.3.1 Preliminary Flood Risk Assessment

Under the Regulations, all LLFAs were required to prepare a Preliminary Flood Risk Assessment (PFRA) report. This is a high level screening exercise to identify areas of significant risk as 'Indicative Flood Risk Areas' across England where 30,000 people or more are at risk from flooding.

A PFRA was prepared for ECC in 2011. The PFRA seeks to provide a high level overview of flood risk from local flood sources and includes flooding from surface water (i.e. rainfall resulting in overland runoff), groundwater, ordinary watercourses (smaller watercourses and ditches) and canals. It excludes flood risk from main rivers, the sea and reservoirs, as these are assessed nationally by the Environment Agency. The PFRA report looks at past flooding and where future flooding might occur across the area and the consequences it might have to people, properties and the environment. The report provides a useful baseline for the County to inform their LFRMS as well as the preparation of this revised Level 1 SFRA.

2.4 Anglian River Basin District Flood Risk Management Plan

Under the EU Floods Directive and UK Flood Risk Regulations, LLFAs must prepare FRMPs in formally identified Flood Risk Areas where the risk of flooding from local sources is significant (i.e. surface water, groundwater, ordinary watercourses). The Environment Agency is required to prepare FRMPs for all of England covering flooding from main rivers, the sea and reservoirs.

As such, the Anglian River Basin District FRMP has been published by the Environment Agency and sets out the proposed measures to manage flood risk in the Anglian River Basin District from 2015 to 2021 and beyond. This document draws on existing policies and actions within reports and plans which have been prepared in the past such as the Catchment Flood Management Plans (CFMP) and Shoreline Management Plans.

The Anglian River Basin District covers 27,890 km^2 from Lincolnshire in the north to Essex in the south, and Northamptonshire in the west to the East Anglian coast. The river basin district comprises eleven 'management' catchments and each of these catchments has a Catchment Flood Management Plan (CFMP) and/or Shoreline Management Plan which set out the policies for the sustainable management of flood risk, taking climate change into account. The Colchester Borough covers three sub-areas within the North Essex CFMP each with their individual policy, which are outlined in Table 2-1 below[9], and areas within three of the Essex and South Suffolk Shoreline Management Plan[10] Management Units, the policies for which are outlined in Table 2-2.

Table 2-1 Summary of CFMP Policies for Colchester

North Essex CFMP
Sub-area 1 Blackwater and Chelmer, Upper Reaches and Coastal Streams – Policy 2 "Areas of moderate flood risk where we can generally reduce existing flood risk management action".
The area of the Colchester Borough that lies in this sub-area is towards the coast around Mersea Island. Here, Policy 2 is preferred as there are few people and properties at risk in this largely rural area. Those who are at risk are located in isolated towns and villages scattered throughout the region. The current and future (2100) number of people and properties at risk during a 1% annual probability river flood (taking into account current flood defences) are 48 and 25 respectively. In general, overall flood risk management activities will be reduced in this area; however where flood risk is more concentrated (i.e. in villages and towns) existing actions to manage flooding may be continued. Reducing action will enable the limited resources to be targeted to other areas of the catchment where the risks are greater, to ensure the best value for money. This preferred approach will also help reinstate the natural routine of the riverine and coastal system, which is beneficial for wetland and aquatic habitats. Flood warning is an important way of managing the consequences of flooding in this area. Therefore LLFAs will work with the relevant partners to maintain and develop emergency response plans for critical infrastructure and transport links at risk from flooding.

[9] Environment Agency, 2014. *Anglian River Basin District Flood Risk Management Plan*
[10] Environment Agency, 2010, Essex and South Suffolk Shoreline Management Plan 2 http://eacg.org.uk/smp8.asp

Sub-area 2 Lower Blackwater and Upper and Mid Tributaries, Mid Colne and Stour – Policy 3 "Areas of low to moderate flood risk where we are generally managing existing flood risk effectively".

The settlements in this sub-area have been built in the floodplain and as a result have a history of flooding. In the past flood defences have been constructed and maintenance work carried out on the rivers to reduce flood risk. Although flood risk is not expected to increase significantly in the future it is still feasible and effective to continue with the current level of flood risk management as there is a concentration of people and property within the floodplain. For the majority of this area this will be achieved by continuing existing flood risk management activities, however, there may be alternative and more appropriate ways to manage flood risk at the current level.

Proposed Actions

- Continue with the current flood risk management activities.
- Work with partner to develop emergency response plans for critical infrastructure and transport links at risk from flooding.
- Continue maintenance of Abberton Reservoir. Essex and Suffolk Water must carry out their duties under the Reservoirs Act.
- Work with planners to influence the location, layout and design of new and redeveloped property. Ensure that only appropriate development in allowed on the floodplain through the application of NPPF.

Sub-area 6 Colchester – Policy 4 "Areas of low, moderate or high flood risk where we are already managing the flood risk effectively by where we may need to take further actions to keep pace with climate change".

This sub-area includes the urban area of Colchester. The River Colne has defences through Colchester. Colchester is also protected against tidal surge and flooding by the Colne Barrier, which was constructed in 1994. Currently there are 171 properties at risk from the 1% annual probability river flood. There is no agricultural land at risk of flooding, but some parts of the A133 are at risk of flooding in the 1% annual probability river flood. The table below details flood risk to people and property in this sub-area during a 1% annual probability river flood (EA, 2009).

	Current	**Future (2100)**
Number of people at risk	338	890
Number of properties at risk	171	453

Historically, flood defences have been constructed to reduce the probability of flooding. In the future the protection given by these defences may decline as future flooding is forecast to become more intense due to climate change, resulting in increased flood risk to people and property. It is therefore important to maintain the current level of flood risk reduction by upgrading the existing flood defences through the town. This will reduce the risk from overtopping of the defence in the future.

The risk of flooding cannot be completely removed. Other measures need to be taken to manage the consequences of flooding. Flood awareness plans should be produced to encourage people to sign up to and respond to flood warnings. In the long term, flood risk management planning needs to be linked closely with regeneration and redevelopment, so that policies can be put in place to create green corridors, and to incorporate flood resilience measurers into the location, layout and design of development.

Proposed Actions

- Investigate the feasibility of improving the existing defences to manage future flood risk in the town.
- Continue with the flood warning service including the maintenance of flood warning infrastructure.
- Develop a flood awareness plan to encourage people to sign up to, and respond to flood warnings. The flood awareness plan will inform people about the risk of defences breaching and the necessary actions they can take to protect themselves and their property from this.
- Work with partners to develop an emergency response plan for critical infrastructure and transport links at risk of flooding.
- Encourage planners to develop policies for new development and regeneration (including commercial sites) to incorporate resilience measures so that the location, layout and design of development can help to reduce flood risk. Planners should prevent inappropriate development in the floodplain using measures set out in the NPPF ensuring that any new develop does not increase risk to existing development. Any new development or regeneration should provide opportunities to improve the river environment and make space for water.

Table 2-2 Policies for Shoreline Management Plan Management Units (Essex and South Suffolk SMP, 2010)

Essex and South Suffolk Shoreline Management Plan 2 Policies
Management Unit D – Colne Estuary
The overall intent of management for the Colne Estuary is to sustain and support the viability of communities, tourism and commercial activities while creating new intertidal habitats and focusing flood risk management on frontages where it is most needed. The policy to achieve this intent is to maintain flood defence to the majority of the defended land, including all dwellings and key infrastructure at risk of flooding, whilst also allowing coastal and estuarine processes to act in a less constrained manner by realigning defences that are under pressure, and / or where the value of the protected features is unlikely to justify continued maintenance.
The frontages where the existing flood defences will continue to be held at their current alignment are Point Clear, Brightlingsea,

South of Wivenhoe, Colne Barrier, Fingringhoe and Langenhoe and Langenhoehall Marsh. However, at St Osyth Creek, Flag Creek and West Marsh (PDZs D1b, D2, D3 and D5) the defences are under pressure. Landward realignment at these frontages would create a more sustainable situation by reducing the pressure on defences and moving towards a more natural estuary and creek evolution with increase of tidal prism and intertidal area. All dwellings and infrastructure will remain protected, which will require moving some of the defences to a more sustainable sheltered position, possibly in the form of counterwalls. At Wivenhoe and Inner Colne west bank (PDZ D6b and D8a) the defences are not necessarily under pressure. However, they only protect features of limited economic value or the economic benefits are for a finite period, As a result it is unlikely that continued maintenance is justified.
Management Unit E – Mersea Island The overall intent of management for Mersea Island is to sustain and support the viability of communities, tourism and commercial activities especially the important shellfisheries in the area, while creating new intertidal habitats and focusing flood and erosion risk management on frontages where it is most needed. The policy to achieve this intent is to maintain flood and erosion defence to all dwellings, key infrastructure and tourism facilities at risk of flooding and erosion, combined with a gradual increase of natural processes by realigning defences that are under pressure. The frontages where the existing flood and erosion defences will continue to be held at their current alignment are West Mersea, Pyefleet Channel and parts of the sea facing frontage between West and East Mersea. However, at East Mersea seaward frontage and landward of the Strood Channel (PDZs E2 and E4a) the defences are under pressure, and a landward realignment would create a more sustainable situation by reducing the pressure on defences and moving towards a more natural coast with increase of tidal prism and intertidal area. All dwellings and infrastructure would remain protected, which will require moving some of the defences to a more sustainable sheltered position, possibly in the form of counterwalls. Realignment is proposed for the seaward frontage between North Barn and West Mersea (PDZ E2) and North Mersea (Strood Channel) (PDZ E4a) in epoch 2. For West Mersea (E3) and North Mersea (E4), the SMP's broad scale economic analysis supports an intent to maintain or upgrade the standard of protection, including taking into account impacts of climate change.
Management Unit F – Blackwater Estuary The overall intent of management for the Blackwater Estuary is to sustain and support the viability of communities, tourism and commercial activities while creating new intertidal habitats and focusing flood and erosion risk management on frontages where it is most needed. The policy to achieve this intent is to maintain flood and erosion defence to all dwellings, key infrastructure and tourism facilities at risk of flooding and erosion, whilst also allowing coastal and estuarine processes to act in a less constrained manner by realigning defences that are under pressure and / or where the value of the protected features is unlikely to justify continued maintenance. The frontages where the existing flood defences will continue to be held at their current alignment include Salcott Creek on the border of Colchester BC.

2.5 National Planning Policy Framework

The NPPF is a framework within which councils and local people can produce local and neighbourhood plans that reflect the needs and priorities of their communities. The overall approach of the NPPF to flood risk is broadly summarised in Paragraph 103:

"When determining planning applications, LPAs should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- *within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location, and*
- *development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems."*

Further detail regarding the Sequential and Exception Tests is included in Section 5 of this report.

2.5.1 NPPF Guidance SuDS Policy (April 2015)

Sustainable Drainage Systems (SuDS) are an approach to managing rainwater and surface water that replicates natural drainage, the key objectives being to manage flow rate and volume of runoff to reduce risk of flooding and water pollution. From 6th April 2015, LPAs such as Colchester BC are required to ensure that SuDS are implemented for all major developments where appropriate, and that through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

As the LLFA, ECC is a statutory consultee for SuDS applications. The ECC will need to be consulted on the drainage elements of planning applications for major development to ensure they conform to necessary national and local SuDS standards.

2.6 Local Planning Policy

Colchester BC has a Local Plan in place that is applicable until 2021; however the adoption of the New Local Plan is scheduled for 2017/2018 and consultation on the draft Local Plan (Preferred Options) is scheduled for summer 2016[11].

Historically Colchester BC has provided approximately 830 houses per year since the 1970s. The new Objectively Assessed Need (OAN) target raises this to approximately 920 houses per year until 2033. To achieve this, a new Local Plan is being prepared for the Borough to plan for the delivery of new housing in Colchester and across larger towns and villages in the Borough. In addition, new documents will be developed jointly with neighbouring Braintree and Tendring Councils, to plan for growth in 2 new garden settlements to the east and the west of Colchester.

2.7 Summary

Figure 2-1 provides a summary of the documents that have been reviewed within this section. The figure demonstrates that the main driver for the SFRA is the NPPF, and that documents and plans prepared by both the Environment Agency and Essex CC under the requirements of the Flood and Water Management Act and the Flood Risk Regulations, provide key inputs to inform the preparation of the revised SFRA and Local Plan.

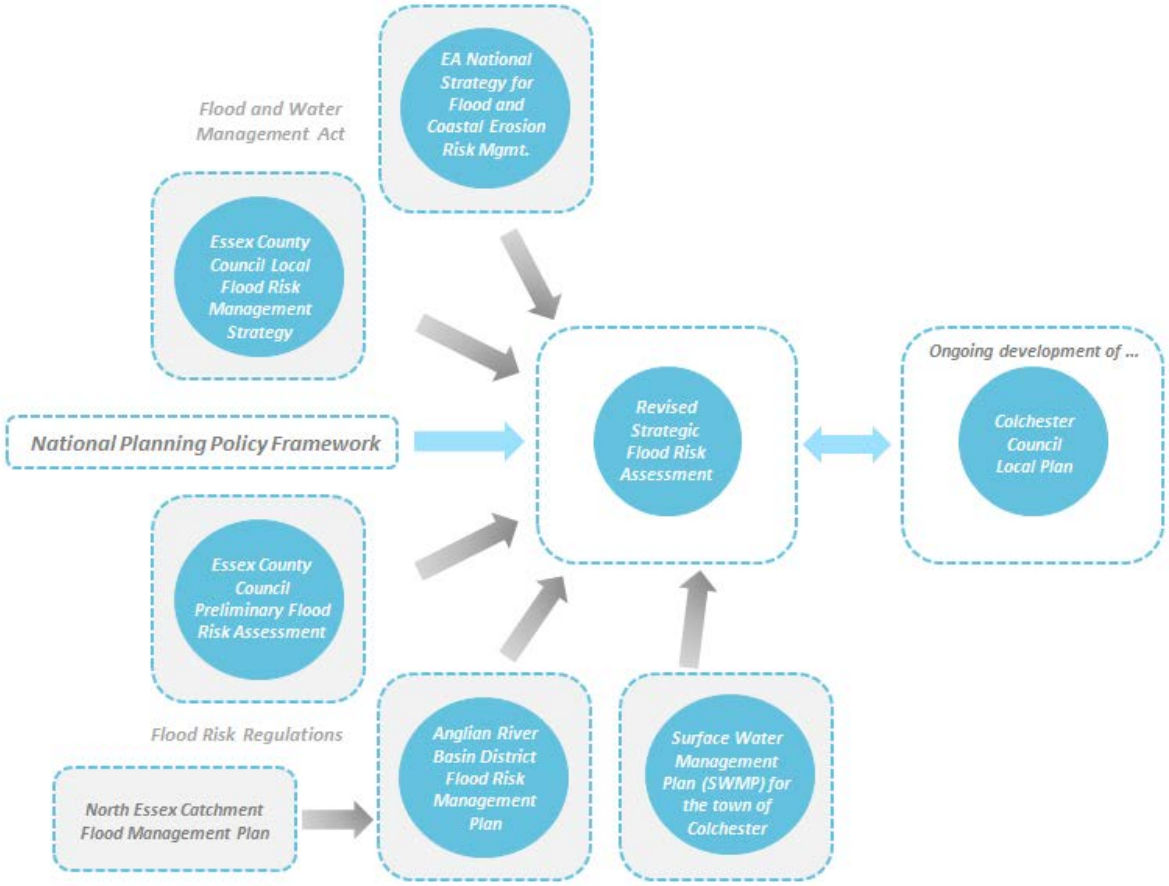

Figure 2-1 Summary of Legislative and Planning Context

[11] http://www.colchester.gov.uk/localplan

3 Level 1 SFRA Methodology

The Level 1 SFRA is a desk-based study, using readily available existing information and datasets to enable the application of the Sequential Test, and to identify where the Exception Test, and therefore an increased scope Level 2 SFRA, may be required. The main tasks in preparing the Level 1 SFRA are described below.

3.1.1 Establishing relationships and understand the planning context

An inception meeting was held with members of the project team, Colchester BC and the Environment Agency to aid collaborative working and to facilitate the free exchange of available information and datasets. Colchester BC provided an overview of the current planning context with respect to the preparation of the New Local Plan and the main flood risk issues in the area were identified and discussed.

3.1.2 Gathering data and analysing it for suitability

Under Section 10 of the NPPF, the risk of flooding from all sources must be considered as part of a Level 1 SFRA, including flooding from tidal sources, rivers (fluvial), land (overland flow and surface water), groundwater, sewers and artificial sources. In order to provide this assessment of all sources of flooding in the study area, an extensive set of datasets was requested from a number of organisations, including Colchester BC, Essex CC (as the LLFA and Highways Authority), the Environment Agency, Anglian Water and the Highways Agency.

Datasets and information gathered as part of the preparation of the first iteration of the SFRA have been retained where appropriate. The datasets are described further in Section 4, including detail regarding appropriate uses and limitations, and how they have been used within the Level 1 SFRA.

3.1.3 Producing strategic flood risk maps, GIS deliverables and a technical report

A series of GIS maps have been produced using the data gathered during the study. The mapping deliverables are summarised in Table 3-1 and should be referred to when reading Section 4 'Level 1 Assessment of Flood Risk' which provides an overview of flood risk across the Borough.

Table 3-1 Strategic Flood Risk Maps

Figure No.	Figures Title and Content
Figure 1	Study Area *(Administrative boundaries, watercourses, water bodies, development sites)*
Figure 2A -2J	Tidal and Fluvial Flood Extent Mapping *(Modelled flood extents, watercourses, flood defences, historic records of fluvial flooding, emergency rest centres)*
Figure 3A-3D	River Colne Climate Change Mapping *(Modelled flood extents, watercourses, flood defences, historic records of fluvial flooding, emergency rest centres)*
Figure 4A-4D	Risk of Flooding from Surface Water *(RoFSW, watercourses, Critical Drainage Areas, historic records of flooding)*
Figure 5	Groundwater Flooding *(Areas susceptible to groundwater flooding (AStGWF) dataset, historic records of groundwater flooding)*
Figure 6	Flood Warning Areas *(Flood Warning Areas, Emergency Rest Centres)*

3.1.4 Site Assessment Database

As a result of their site identification process, including the Call for Sites, Colchester BC has identified 395 potential development sites. In order to facilitate the application of the Sequential Test to these sites, the Level 1 SFRA also included the preparation of a site database containing flood risk information for each site to enable the comparison of sites. The database uses the GIS datasets to provide an assessment of the risk of flooding from all sources, as well as an indication of historic records of flooding in the areas and was provided to Colchester BC for their use.

4 Level 1 Strategic Assessment of Flood Risk

4.1 Introduction

This Section provides the strategic assessment of the flood risk across the Borough of Colchester from each of the sources of flooding outlined in the NPPF. For each source of flooding, the datasets used for the assessment are described, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This section should be read in conjunction with the mapping in Appendix A.

Table 4-1 provides an overview of the flood sources in the Colchester study area, which are discussed in turn in the following sub sections. The study area includes both tidal (estuary) and fluvial (river) watercourses. The River Colne is the main pathway of tidal flooding which can result from a storm surge, high spring tides or both events combined over undefended land. The upstream extent of the River Colne presents the main fluvial risk to the area; the River Stour, Layer Brook and Roman River are located in more rural areas, where there are fewer receptors at risk of flooding.

There is also risk of flooding in the study area from other forms of flooding including groundwater, surface water and the arterial drainage network and artificial sources. It is understood that flooding from surface and the arterial drainage network are the most likely sources of risk, but, in the past, have not consistently affected specific areas. Anecdotal evidence from conversations with officers within Colchester BC suggests that any such incidents are more often than not associated with blockages of ditches or sewers.

The topography of the Borough of Colchester is considered flatter than those of the neighbouring LPAs, which reduces the ability to generate significant quantities of overland flow from the surrounding fields. Nevertheless, this flood source and any of the remaining sources of flood risk (i.e. groundwater, the arterial drainage network and pluvial flooding) should not be discounted and should be considered in more detail as part of a site-specific Flood Risk Assessments (FRA).

Table 4-1 Summary of Flood Sources and Pathways in Colchester

Forms of Flooding	Source	Pathway
Tidal	Extreme tides or surge events along Blackwater Estuary or Colne.	Floodplain ponding / conveyance / breach and overtopping.
Fluvial	River Colne, Roman River, Layer Brook River Stour.	Floodplain ponding / conveyance / breach and overtopping of defences.
Surface Water	Runoff during heavy rainfall events.	In built-up areas, runoff from areas of hard standing; in rural areas flow paths from fields.
Groundwater	Perched within alluvial deposits.	Rising water level.
Arterial Drainage Network	Urban runoff.	Surcharged sewers.
Reservoirs*	Abberton, Ardleigh, Gosfield Lake, Feeringbury Farm, Halstead Flood Alleviation Reservoir, Preston's Lake, Wick Lane Reservoir, Park Lane 1 (ID122), Brick Kiln Reservoir, Thorington Street, Langham Raw Water, Stanton's Farm.	Failure of reservoir infrastructure.

**Some of these waterbodies are located in neighbouring Districts or Boroughs, but are shown to pose a risk of flooding to the Colchester BC administrative area. Further detail is provided in Section 4.7.*

4.2 Tidal Flooding

4.2.1 Sources

Tidal flooding can result from a storm surge, high spring tides or both events combined over undefended land. In the case of land protected from flooding by sea defences, residual tidal flooding can occur through overtopping of defences, a breach or failure in the sea defences or a failure of mechanical barriers.

The southern edge of the Borough is formed by the tidal estuaries of the Rivers Blackwater and Colne. The coastline of the Borough is extensive and includes the area around Mersea Island and numerous other creeks that advance inland. The upper tidal limit of the River Colne is at the East Mills control structure, to the east of Colchester town centre. The Roman River, a tributary of the River Colne, is therefore also tidally influenced.

4.2.2 Flood Zones

The NPPF uses Flood Zones to define the probability of tidal and fluvial flooding, ignoring the presence of defences. The Flood Zones are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's website[12], which is the main reference for planning purposes. The flood zone definitions for tidal flooding are presented in Table 4-2 and shown in **Appendix A Figures 2 and 2J**.

Table 4-2 Tidal Flood Zone Definitions (extracted from the NPPG, 2014)

Flood Zone	Tidal Flood Zone Definition	Probability of Flooding
Flood Zone 1	Land having a less than 0.1% Annual Exceedance Probability (AEP) (1 in 1,000 annual probability) of tidal flooding. Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 0.5% AEP (1 in 200 annual probability) and 0.1% AEP (1 in 1,000 chance each year) of tidal flooding. Shown as light blue on the Flood Map.	Medium
Flood Zone 3a	Land having a 0.5% AEP (1 in 200 annual probability) or greater of tidal flooding. Shown as dark blue on the Flood Map.	High

4.2.1 Flood Defences

The 'Flood Map for Planning (Rivers and Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain. In reality, much of Colchester is defended against tidal flooding.

Tidal flood defences along the River Colne protect the surrounding area from tidal flooding and prevent tidal waters utilising the natural flow paths and network of drainage channels within the Borough. In the event of a breach in the flood defences, the low-lying areas in the south of the Borough and drainage channels would provide pathways for floodwater into the greater floodplain area.

The Borough of Colchester possesses fairly extensive defences to manage flood risks from tidal inundation; these include tidal defence walls in built-up areas such as Colchester town and Wivenhoe; earth embankments in more rural locations such as around Mersea Island; as well as the Colne Barrier at Wivenhoe.

The Colne Barrier protects areas upstream, in particular the town of Colchester, from flooding caused by tidal surges. The barrier is 8m high and 130m wide, with a navigation opening of 30m. The main mechanism consists of two mitre gates that operate in a similar method to those used as locks on canals and rivers. The threshold levels for manning and operating the barrier are 3.1 and 3.2mAOD respectively.

4.2.2 Historic Records

The oldest record of flooding in Essex is from a tidal event in 1099. Since then, the most significant recorded tidal flood event occurred in 1953. The event was caused by exceptional weather conditions, resulting in a storm surge affecting most of Eastern England and Essex in particular. This resulted in a death toll of over 300 people.

[12] Environment Agency Flood Map for Planning (Rivers and Sea) http://apps.environment-agency.gov.uk/wiyby/37837.aspx

During the progress meeting held at the commencement of the SFRA update in September 2015, with the Environment Agency, AECOM and Colchester BC, flooding issues were highlighted in West Mersea. In the east of West Mersea, a failure of the sea wall was experienced during the high winds of 2014, following a tidal surge in December 2013, which was designated a 1 in 30 year event (3.33% AEP). A new counter wall is currently being installed. It has been identified that there is insufficient economic justification for further defence work in this area. The use of beneficial dredging on the foreshore is being considered. The eastern point of the island did receive some money to allocate mitigation; this has been identified on the NaFRA.

More recently, Essex CC holds two records of tidal flooding incidents in Colchester town in September 2011. Both lasted around 45 minutes and were the result of a silted flap valve that flooded an area of 200mm x 150m^2 on both occasions. The main inconvenience was the flooded highway, which was unpassable for some vehicles.

The Hythe area adjacent to the Colne experiences tide locking at surface water discharge points, resulting in localised surface water flooding. There are reports of an incorrectly installed flap valve, owned by Anglian Water, in this location.

There is a history of flooding affecting Haven Road in Colchester in the area where it is crossed by Distillery Lane. The flooding is generally associated with high tides and is exacerbated during periods of heavy rain when the surface water outlet becomes tide locked. Due to the fact that the road is lower than tide level, it will always be at risk of flooding. The flow in the area is also controlled by the Distillery Pond, which drains a large upstream catchment. The outlet arrangements for this pond are reported to be inadequate; therefore it is envisaged that to reduce the risk of flooding in Haven Road a pumping station would be required. A decision must be made about the level of protection which is required - a great level of protection comes at a greater cost[13].

4.2.3 Residual Risk – Failure of Colne Barrier

Most of the future proposed development in Colchester town is located upstream of the Colne Barrier and therefore protected from flooding by the flood defence network and the operation of the barrier at Wivenhoe.

Consultation with the Environment Agency Asset Performance team identified that the Barrier has backup systems and procedures for every possible eventuality, and therefore a failure of the asset is not considered to be foreseeable. In the unlikely event one did happen then probability would suggest it happens on the very lowest of tides for which the barrier closes the most frequently. The two counter walls which tie the barrier into high ground also have defences to the front and rear and a review of the design confirms they provide enough resilience to overtopping.

However there remains a *residual* risk of tidal flooding in this area in the event of a failure of the Colne Barrier. Further assessment of this residual risk has been undertaken as part of the Level 2 SFRA.

4.3 Flooding from Rivers

4.3.1 Sources

The Environment Agency 'Detailed River Network' dataset has been used to identify watercourses in the study area and their designation (i.e. main river or ordinary watercourse). The main fluvial flood source in the Colchester Borough is the River Colne, which flows approximately from north west to south east through the Borough and has four main tributaries; Roman River, Bourne Brook, Toppesfield Brook and Layer Brook. The Roman River is the largest tributary and this drains from the west in an easterly direction, converging with the River Colne estuary at Rowhedge, to the south of Colchester town.

The majority of the streams and ditches located throughout the Borough eventually discharge into the River Colne. The tidal influence of the River Colne extends inland as far as East Mills. Some of the smaller streams near the extremity of the southern boundary discharge directly into the sea, whilst to the north, where numerous streams flow in a northerly direction across the Colchester Borough discharge into the River Stour.

The geology of an area imposes significant control upon the hydrological response of a catchment to a rainfall event. Within the Borough of Colchester, the London Clay Formation dominates the local geology of the area. This formation is exposed along the sides of some river valleys and in southern areas of the Borough, and is extensively found at the ground surface. The dominance of clay solid geology will, in general, cause the river systems to respond quickly to rainfall, i.e. water is routed quickly into the river channels via overland flow as infiltration will be limited due to the impermeable nature of the solid geology. Rivers in this area will rise and fall rapidly in response to rainfall events.

[13] Fenland Hydrotech 2013. *Flooding in Haven Road*

4.3.2 Flood Control and Defence Structures

There are a number of flow control structures situated along the length of the Colne and its tributaries, which protect the surrounding areas from fluvial and tidal flooding. Examples include the flow control structures at East Mill and Middle Mill as well as the Colne Barrier. The structures at Middle Mill consist of a series of sluices designed to control downstream water levels and flows. The East Mills structure forms a large sluice gate that was originally constructed to prevent upstream tidal inundation (an operation now largely unused due to the more recent Colne Barrier). East Mills also allows controlled discharge of fluvial flows as well as providing amenity and resource benefits by retaining water for recreation and for the Ardleigh Reservoir.

The Colne Barrier was constructed to prevent tidal surge inundation of Wivenhoe and Colchester. This has significant impacts on fluvial flow in the Colne during tide locked conditions, where it can cause backing up of fluvial flow. During an extreme scenario (i.e. a 1 in 100 year return period fluvial flow coinciding with a closure of the Barrier), it has been estimated that water levels could rise by up to 1 metre behind the Barrier[14]. This could cause some minor flooding in undefended areas upstream of the Barrier, particularly in Wivenhoe.

4.3.3 Historic Records

There is considerable anecdotal evidence regarding fluvial flooding in the area following severe rainfall events in the Colne catchment. Records of fluvial flooding on the River Colne date back to 1790; several occurrences of overtopping and breaches of the river banks are recorded between Langley Mill and Adams Mill. Flooding was recorded on the Colne in 1903, 1939, 1947, 1959, 1979, 1987 and in 2000 and 2001[15]. These events were of varying scale and severity and mostly caused by high rainfall events. The events in 2000 and 2001 however effected the wider catchment with the worse effected areas being Halstead and Great Yeldham. Colchester itself experienced limited flooding during these events, with just six properties being affected, as a result of the extensive flood defences in the area.

Records of flooding from rivers held by Essex CC are presented in **Appendix A Figures 2A-2J.** Records of flooding associated with ordinary watercourses are considered in Section 4.4.

4.3.4 Flood Zone Maps

The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF seeks to assess the probability of flooding from rivers and sea by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 4-4 and presented on the 'Flood Map for Planning (Rivers and Sea)' available on the Environment Agency website.

Table 4-3 Fluvial Flood Zones (extracted from the NPPG, 2014)

Flood Zone	Fluvial Flood Zone Definition	Probability of Flooding
Flood Zone 1	Land having a less than 0.1% Annual Exceedance Probability (AEP) (1 in 1,000 annual probability). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	**Low**
Flood Zone 2	Land having between a 1% AEP (1 in 100 annual probability) and 0.1% (1 in 1,000 chance of flooding in any given year).	**Medium**
Flood Zone 3a	Land having a 1% AEP or greater (1 in 100 annual probability).	**High**
Flood Zone 3b	**Land where water has to flow or be stored in times of flood, usually with an annual probability of 5% (1 in 20) or greater in any year, or land purposely designed to be flooded in an extreme flood event (0.1% AEP). The identification of the functional floodplain takes into account local circumstances.**	**Functional Floodplain**

4.3.5 Flood Map for Planning (Rivers and Sea)

The 'Flood Map for Planning (Rivers and Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain. The 'Flood Map for Planning (Rivers and Sea)' dataset is available on the

[14] HR Wallingford, 2003. *Colne Barrage: Groundwater Related Issues.* Report no. EX 4783
[15] Environment Agency, 2006. *North Essex Catchment Management Plan. Environment Agency Publication*

Environment Agency website[16] and is the main reference for planning as it contains Flood Zones 1, 2 and 3a which are referred to in the NPPF and presented in Table 4-3.

The 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling (JFLOW). It is routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys, hydrological and/or hydraulic modelling as well as previous flood events.

It should be noted that a separate map is available on the Environment Agency website which is referred to as 'Risk of Flooding from Rivers and Sea'[17]. This map takes into account the presence of flood defences and so describes the actual probability of flooding, rather than the probability if there were no defences present. While flood defences reduce the level of risk they do not completely remove it as they can be overtopped or fail, for example, in extreme weather conditions or if they are in poor condition. As a result the maps may show areas behind defences to still have some risk of flooding. This mapping has been made available by the EA as the primary method of communicating flood risk to members of the public, however, for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information.

4.3.6 Functional Floodplain (Flood Zone 3b)

The Functional Floodplain is defined in the NPPF as 'land where water has to flow or be stored in times of flood'. The Functional Floodplain (also referred to as 'Flood Zone 3b'), is not separately distinguished from Flood Zone 3a on the Flood Map for Planning. The NPPG states that the extent of the Functional Floodplain should be identified by the LPAs within the SFRA in discussion with the EA and LLFA.

The NPPG states that the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood during a 5% AEP or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% AEP) flood, should provide a starting point for consideration and discussions to identify the functional floodplain. Further to this, the NPPG does not provide any additional guidance on how to define the functional floodplain.

The NPPG states that 'area which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be defined as functional floodplain'. There may be opportunities to reinstate areas which can operate as functional floodplain through the use of previously developed land adjacent to watercourses to provide space for flood water to reduce the risk to new and existing development.

The NPPG recognises the importance of pragmatic planning solutions that will not unnecessarily 'blight; areas of existing urban development. It may not be practical to refuse all future development within existing urban areas falling within land which would flood during a 5% AEP event, therefore careful consideration must be given to future sustainability.

Colchester BC has reviewed the 5% AEP flood extent along the River Colne and Stour, and used this to define the extent of Flood Zone 3b Functional Floodplain. A review of the fluvial flood extents across the Borough shows that the areas within the functional floodplain are largely undeveloped land (**Appendix A Figures 2A-2J, 3A-3D**). There are some developments within the Functional Floodplain, which are detailed below:

River Colne

- A few properties along The Street, which intersects Colchester Road, in Wakes Colne;
- Properties on Ford Street, in Fordstreet;
- Properties along Spring Lane, east of the Spring Lane roundabout where the A12 joins the A123;
- Between Rotary Way and Victoria Chase in Colchester; and,
- Cricket ground and Castle Park, to the south of Sportsway.

River Stour

- Properties on Mill Lane in Dedham; and,
- Isolated properties including Boxted Mill, Island Cottage, Fenn House and Bowdens Lane.

4.3.7 Climate Change

A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change may increase peak rainfall intensity and river flow,

[16] Environment Agency Flood Map for Planning (Rivers and Sea) http://apps.environment-agency.gov.uk/wiyby/37837.aspx
[17] Environment Agency 'Risk of Flooding from Rivers and Sea' http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=237038&y=161974&scale=1

which could result in more frequent and severe flood events. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime.

In February 2016 the Environment Agency published revised guidance on climate change allowances in an update to the document 'Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities'[18]. This version of the document reflects an assessment completed by the Environment Agency between 2013 and 2015 using UKCP09 data, to produce more representative climate change allowances for river basin districts across England. The allowances for the Anglian river basin district are of relevance to Colchester and are set out in Table 4-4.

Table 4-4 Peak river flow allowances for Anglian river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Anglian	Upper end (90th)	25%	35%	65%
	Higher central (70th)	15%	20%	35%
	Central (50th)	10%	15%	25%

In order to determine which range of allowance should be assessed for a proposed development or plan, the flood zone and vulnerability classification should be considered, as set out below.

In Flood Zone 2

- essential infrastructure – use the higher central and upper end to assess a range of allowances
- highly vulnerable – use the higher central and upper end to assess a range of allowances
- more vulnerable – use the central and higher central to assess a range of allowances
- less vulnerable – use the central allowance
- water compatible – use none of the allowances

In Flood Zone 3a

- essential infrastructure – use the upper end allowance
- highly vulnerable – development should not be permitted
- more vulnerable – use the higher central and upper end to assess a range of allowances
- less vulnerable – use the central and higher central to assess a range of allowances
- water compatible – use the central allowance

In Flood Zone 3b

- essential infrastructure – use the upper end allowance
- highly vulnerable – development should not be permitted
- more vulnerable – development should not be permitted
- less vulnerable – development should not be permitted
- water compatible – use the central allowance

As part of the hydraulic modelling studies for the Rivers Colne and Stour, simulations have been run for the 1% annual probability (1 in 100 year event) including a standard percentage increase in river flow to account for the implications of climate change. This is typically applied as a 20% increase to fluvial flows based on previous climate change guidance. As a result, results assessing a full suite of allowances such as those presented in Table 4-4 are not currently available. The Environment Agency has confirmed that there is no current intention to update existing modelling studies to include additional outputs in the short term.

The Environment Agency is currently undertaking analysis of the 1D modelling with a view to publishing basic levels for climate change that will need to be considered for small scale development (circa <9 residential properties), in areas of growth. One such area of growth is along the Colne floodplain.

[18] Environment Agency, February 2016, Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516116/LIT_5707.pdf

It is anticipated that future studies will take account of the new allowances, however in the interim period there will be greater emphasis on site specific FRAs to include for additional modelling scenarios to determine the future risk with respect to climate change.

River Colne Climate Change Analysis

In order to inform this SFRA, analysis of the River Colne 1D hydraulic model has been undertaken to determine whether any of the available modelled design events could be used to provide an indication of the impact of climate change. Analysis of the inflow data for the 1% AEP, 1% AEP including climate change and 0.1% AEP events for the defended model scenario was undertaken. The analysis of peak flows for each of the inflows shows that:

- For the existing 1% AEP event (defended) including an allowance for climate change, the analysis of the peak inflows shows that a **30%** increase in flows has been applied.
- For the 1000 year event (defended), the increase in flow varies between **78% - 92%** across the inflows.

The new climate change allowances state that for More Vulnerable development in Flood Zone 3a, the higher central and upper end allowances should be used to assess a range of allowances. This correlates to the 35% and 65%.

Based on this inflow analysis, and given the fact that Colchester BC have no development sites proposed along the fluvial River Colne corridor, the following approach has been adopted for the purpose of the SFRA:

- Use the existing 1 in 100 year plus CC scenario to provide an indication of the 'higher central' allowance.
- Use the existing 1 in 1000 year scenario to provide an indication of the 'upper end' for the 2080s, and as a sensitivity scenario.

This provides a conservative approach for development along the floodplain. This approach has been discussed and agreed with Colchester BC and the Environment Agency. The flood extents are shown in **Appendix A Figure 3A-3D.**

River Stour

At this stage, no growth is proposed along the River Stour floodplain. It is also understood that this model is currently being revised as part of the Environment Agency's programme and new outputs will include consideration of a range of climate change scenarios in accordance with the new guidance. No further analysis has therefore been provided at this stage.

4.4 Flooding from Surface Water

Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run quickly off land and result in localised flooding. The NPPG states that an SFRA should identify areas at risk from surface water flooding and drainage issues, taking account of the surface water flood risk mapping published by the Environment Agency as well as other available information.

4.4.1 Historic Records

During the progress meeting between the Environment Agency, AECOM and Colchester BC in September 2015, several locations were highlighted as having surface water flooding issues. For practical purposes, flooding from ordinary watercourses has been also been included in this section. Records of flooding from surface water and ordinary watercourses held by Essex CC are presented in Table 4-5 and **Appendix A Figure 4A-4D.**

The Hythe

The Hythe area was identified in the Colchester SWMP as a Critical Drainage Area (CDA). The modelling predicts substantial risk of flooding in the area downstream of Distillery Pond, with potential for in excess of 1.5m depth in isolated areas during a 1 in 100 year event (1% chance of occurring any given year). The location has a long history of internal flooding to multiple properties.

The Hythe area adjacent to the River Colne is reported to experience tide locking at surface water discharge points. Investigations have indicated the tidal flap value is not operating correctly; this issue is being addressed by the installation a new chamber with a non-return valve fitted on the downstream end. Insufficient capacity and condition of the existing outfall from Distillery Pond also require further investigation.

Essex CC, Colchester BC and Anglia Water are working in partnership to investigate issues in the area. Essex CC should be consulted for the latest information by those considering development in this area.

Marks Tey

Flooding at this location has led to the internal flooding of at least one property and one commercial property on more than one occasion (in 2008 and 2009) and the gardens/outhouses of a large number of properties. Additionally there is regular highway flooding of Mott's Lane, Godmans Lane and Wilsons Lane. Following heavy and prolonged rainfall events, surface water is observed overtopping the banks of two ordinary watercourses[19].

The flooding is likely to be due to the constricted nature of the two ordinary watercourses which enter a sewer system within the developed area of Marks Tey before opening back into an open channel. The condition of the majority of the open sections of ordinary watercourse and at least one culvert within the flood investigation area is poor and should be cleared, cleansed and where applicable re-graded.

Sheepen Place Ditch

In 2001 the area of Sheepen Place experienced property flooding and the water had to be pumped out over the defences into the River Colne. The cause of flooding was the result of flood levels in the Colne preventing the water from discharging under gravity.

The Environment Agency is investigating the flooding in this location, where high levels of siltation are experienced as a result of the retained water level of Middle Mill restricting drainage through the flapped outfall.

London Road

In addition, surface water flooding issues were identified on London Road, Stanway.

Table 4-5 Essex CC Surface Water Flooding Records

Date	Location	Type	Severity	Cause
01/05/2012	Marks Tey	Unknown	Unknown	Ditch
01/05/2012	Salcott	Unknown	Sand bags needed	Ditch
01/05/2012	Colchester	Infrastructure failure	200mm Sand bags required	Outfall from pond
01/05/2012	Colchester	Infrastructure failure	1 day 250mm	Blocked culvert
01/05/2012	West Bergholt	Other watercourses	1 day 300mm	Ditch
01/05/2012	Colchester	Other watercourses	450mm x 100m^2 2 days Sand bags required	Ditch
01/05/2012	Chappel	Infrastructure failure	2 days 250mm x 150m^2 Sandbags required 1 property affected	Broken culvert
03/05/2012	Colchester	Infrastructure failure	Unknown	Soakaway
03/05/2012	Eight Ash Green	Infrastructure failure	1 day 200mm x 500m^2 2 properties affected	Blocked culvert
03/05/2012	Marks Tey	Other watercourses	1 day 150mm Sand bags required	Ditch
31/05/2012	Marks Tey	Other watercourses	1 day 150mm Sand bags required	Ditch
22/06/2012	Unknown	Infrastructure failure		Pond overflowing/possible blocked ditches
08/08/2012	Marks Tey	Other watercourses	Sewage on Patio Problem since 1999	Ordinary watercourse/ highway

[19] Essex County Council, 2013. *Marks Tey Flood Investigation Report*

Date	Location	Type	Severity	Cause
14/11/2012	Unknown	Other watercourses		Ordinary watercourse
24/08/2013	Tiptree	Other watercourses	12 inches in house Sandbags required	Lack of maintenance of ditch/culvert
05/11/2013	West Bergholt	Unknown	Unknown	Unknown
24/12/2013	Marks Tey	Surface Water	15cm from outbuilding at old school that continued to 25/12	Surface Water from the Road
17/01/2014	Marks Tey	Other watercourses	Water on driveway	Ordinary watercourse
01/02/2014	West Bergholt	Unknown	Unknown	Unknown
06/12/2014	Marks Tey	Other watercourses	Unknown	Surface water/ordinary watercourse
20/07/2014	Thorpe Le Soken	Unknown	Unknown	Also flooded 24 August 2014
19/07/2011	Colchester Town	Infrastructure failure	Pedestrians cannot use pavement due to 2m arc of water	Highways drain
08/08/2012	Marks Tey	Ordinary watercourse/highway	Sewage on patio	Problem since 1999
14/11/2012	Colchester	Ordinary watercourse		
24/08/2013	Tiptree	Other watercourses	12 inches in house	Lack of maintenance to ditch
17/01/2014	Marks Tey	Ordinary watercourse	Floodwater on driveway	Unknown

4.4.2 Risk of Flooding from Surface Water

The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying those areas at risk of surface water flooding during three annual probability events: 1 in 30 year (3.33% annual probability), 1 in 100 year (1% annual probability and 1 in 1000 year (0.1% annual probability). The latest version of mapping is referred to as the Risk of Flooding from Surface Water (RoFSW) (formerly the 'updated Flood Map for Surface Water' (uFMfSW)) and the extents have been made available to Colchester BC as GIS layers. This dataset is also available on the Environment Agency website.

The RoFSW provides all relevant stakeholders, such as the Environment Agency, Colchester BC and the public access to information on surface water flood risk which is consistent across England and Wales[20]. The modelling helps the Environment Agency take a strategic overview of flooding, and assists Essex CC (as the LLFA) in their duties relating to management of surface water flood risk. For the purpose of this SFRA, the mapping allows an improved understanding of areas within Colchester BC administrative area which may have a surface water flood risk.

The modelling represents a significant improvement on previous mapping, namely the FMfSW (2010) and the Areas Susceptible to Surface Water Flooding (AStSWF) (2009), for example:

- Increased model resolution to 2m grid,
- Representation of buildings and flow routes along roads and manual editing of the model for structural features such as flyovers,
- Use of range of storm scenarios, and
- Incorporation of appropriate local mapping, knowledge and flood incident records.

However, it should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas,
- It does not show the susceptibility of individual properties to surface water flood records, and
- As with all models, the RoFSW is affected by a lack of, or inaccuracies in available data.

The datasets provide a picture of surface water flooding across the Borough and identify that incidents are widespread across most part of the Borough. The following areas are shown to be at particular risk, although the following by no means exhaustive:

[20] Environment Agency, 2013. *'What is the updated Flood Map for Surface Water?'*

- Surface water is shown to pond in natural low points within the fluvial floodplains of the River Colne and the River Stour.
- Within the built up area of Colchester, surface water flood risk is concentrated along the course of existing drains and small watercourses.
- The south of the Borough has a greater extent of surface water flood risk, notably in Layer Breton adjacent to the Abberton Reservoir.
- There are extensive patches of surface water flood risk (low and medium risk) just north of Mersea Island particularly at the confluences of main river and ordinary watercourse confluences.

4.4.3 Climate Change

The RoFSW mapping does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However a range of three annual probability events have been undertaken, 3.3%, 1% and 0.1% and therefore, in the absence of additional information, the 0.1% AEP event can be used as a substitute dataset to provide a worst case scenario and an indication of the implications of climate change.

4.4.4 Colchester Surface Water Management Plan

As part of the Colchester SWMP[21] , rainfall modelling studies were undertaken across urban area for the town of Colchester for five rainfall event return periods. The results were used to identify Critical Drainage Areas (CDAs) are identified that denote an area or catchment where multiple or interlinked sources of flood risk cause flooding during a severe rainfall event, affecting houses, businesses and/or infrastructure. Nine CDA where identified across the study area and total of 3,000 properties are predicted to be at risk for 1 in 100 year rainfall event, deeper than 0.1m. The dominant mechanisms for surface water flooding can be broadly divided into the following categories:

- Watercourse valleys (current and historical) – areas particularly susceptible to overland flow are formed by narrow corridors associated with topographical valleys which present the routes of 'lost' rivers;
- Topographical low lying areas – more susceptible to surface water flooding, particularly where there are obstructions
- Road and rail embankments – discrete surface water flooding along the upstream side of raised rail and road embankments
- Topographic low points – areas which are topographical low points and result in small, discrete areas of deep surface water ponding
- Surface water sewer flood risk – areas of extensive deep surface water flooding as an influence of sewer flooding mechanisms alongside pluvial and groundwater sources
- Fluvial/tidal flood risk – where deep surface water flooding is the influence of fluvial and tidal flooding mechanisms (in addition to pluvial, groundwater and sewer flood sources).

There are a number of opportunities for mitigation measures within the town of Colchester SWMP study area. The ongoing maintenance of the drainage network and small scale improvements are already underway as part of normal operations. As flooding is not just confined to the CDAs there are opportunities for generic measures to be implemented as part of policy, for example, rainwater harvesting technology, swales, permeable paving to name a few.

Pluvial modelling within the SWMP has signified that flooding is strongly associated with historic watercourse valleys, which impacts a number of regionally important infrastructure assets. In the short to medium term Colchester SWMP recommends that ECC and CBC:

- Engage with local residents helping them to be aware of their responsibilities for their own property drainage (especially in CDAs)
- Prepare a communication strategy for raising awareness of surface water flood risk between different audiences and between stakeholders and the public.
- Improve maintenance regimes to target areas affected regularly or those with known blocked gully/culvert/watercourse issues.

The long-term Action Plan for ECC and Risk Management Authorities will assist them in their roles under the FWMA (2010) to lead in the management of surface water flood risk across the town of Colchester SWMP study area. The purpose of the Action Plan is to:

- Outline the actions required to implement the preferred options
- Identify the key stakeholders responsible for managing the action
- Prioritise the action and provide a timescale

[21] Capita Symonds (2013) Town of Colchester Surface Water Management Plan.

Outputs from the Colchester SWMP are incorporated into Essex CC's Capital Flood Programme to progress for further investigations.

4.5 Flooding from Groundwater

Groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground.

4.5.1 Sources

The London Clay dominates the underlying geology of the Colchester area and is generally regarded to be impermeable, therefore acting as a barrier to uprising water tables thus the risk of groundwater flooding is considered to be fairly low. However, areas in and around the river valleys, in particular the Colne valley at Colchester, with geology containing drift deposits of alluvium and glacial sands, some groundwater may be found. It is believed that this groundwater is sourced from infiltrated rainwater that cannot permeate the upper layers of the London Clay. As a result, this infiltrated water follows the natural slop of the clay stratum to provide some baseflow to the watercourses such as the Colne. These groundwaters have the potential to experience fluctuations in volume. However, the risk of groundwater flooding is considered to be less than the risk posed by fluvial flooding[6].

Within the town of Colchester and in particular the tidal reaches of the Colne, groundwaters are believed to be in hydraulic continuity with tidal fluctuations of the river. Observations in previous studies indicate that the groundwater levels fluctuate with the tide. However, the fluctuations were believed to be in the region of 1m during a spring tide event, suggesting that the groundwater is somewhere confined thus reducing its flood inundation potential.

The presence of London Clay throughout the Borough is anticipated to form an impenetrable barrier to any groundwater at depth, limiting the risk from this source.

4.5.2 Historic Records

There is no record of previous event being attributed to groundwater flooding in the Borough.

4.5.3 Areas Susceptible to Groundwater Flooding

As part of the SFRA, an assessment of the risk of groundwater flooding needs to be considered; however, a quantified assessment of risk from groundwater flooding is difficult to undertake, especially on a strategic scale. This is due to lack of groundwater level records, the variability in geological conditions and the lack of predictive tools (such as modelling) that can be used to make assessments of groundwater flow and risk of groundwater flooding following rainfall events.

The Environment Agency Areas Susceptible to Groundwater Flooding (AStGWF) dataset is a strategic scale map showing groundwater flood areas on a 1km square grid. The Environment Agency has provided information with the data and guidance for using it, which is summarised below.

The AStGWF dataset has been prepared primarily as part of the PFRA process, to allow LLFAs across England and Wales such as Essex CC to obtain a broad feel for the wider areas which might be at risk from groundwater flooding.

The data has used the top two susceptibility bands of the BGS 1:50,000 Groundwater Flood Susceptibility Map and therefore covers consolidated aquifers and superficial deposits. It does not take account of the chance of flooding from groundwater rebound. It shows the proportion of each 1m square where geological and hydrogeological conditions show that groundwater might emerge. The susceptible areas are represented by one of four area categories showing the proportion of each 1km square that is susceptible to groundwater emergence. It does not show the likelihood of groundwater flooding occurring.

The dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The datasets has a number of limitations, as follows:

- The AStGWF dataset has not been formally assessed as appropriate for any other use than the PFRA;

- The data should not be interpreted as identifying areas where groundwater is actually likely to flow or pond, thus causing flooding, but may be of use to LLFAs in identifying, where, for example, further studies may be useful;

- The AStGWF should not be used as the sole evidence for any specific flood risk management, land use planning or other decision at any scale. The data may however help to identify areas for assessment at a local scale where finer resolution datasets exist.

The AStGWF dataset has been mapped in **Appendix A Figure 5**. It highlights that the susceptibility to groundwater flooding correlates to the river corridors and the corresponding variations in geology. There are 1km squares with greater proportions of groundwater emergence along the river corridors.

4.6 Flooding from Sewers

During heavy rainfall, flooding from the sewer system may occur if:

(1) The rainfall event exceeds the capacity of the sewer system drainage system:

Sewer systems are typically designed and constructed to accommodate rainfall events with a 3.3% AEP or less. Therefore rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While Anglian Water Services (AWS), as the sewerage undertaken for Colchester, are concerned about the frequency of extreme rainfall events, it is not economically viable to build sewers that could cope with every extreme rainfall event. This is likely to become a more common occurrence in future due to climate change and an increase in the number and intensity of convective storms. It is now a widely accepted phenomenon that one of the main effects of climate change in the South East will be a higher intensity rainfall and more frequent winter storms, which will increase the risk of flooding from all sources.

(2) The system becomes blocked by debris or sediment:

Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris (e.g. litter).

(3) The system surcharges due to high water levels in receiving water courses:

Within the study area there is potential for surface water outlets to become submerged due to high river levels. When this happens, water is unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will overflow into streets and potentially into houses. Where the local area is served by 'combined' sewers i.e. containing both foul and storm water, if rainfall entering the sewer system exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will contain untreated sewage.

4.6.1 Historic Records

To date, no data has been received from Anglian Water to inform the SFRA. Records of sewer flooding held by Essex CC are presented in Table 4-6 and **Appendix A Figures 4A-4D**.

Table 4-6 ECC Sewer Flooding Records

Date	Location	Type	Severity	Cause
01/05/2012	Colchester	Infrastructure failure	1 day 250mm	Blocked culvert
01/05/2012	Chappel	Infrastructure failure	2 days 250mm x 150m^2 Sandbags required 1 property affected	Broken culvert
19/07/2011	Colchester Town	Infrastructure failure	Pedestrians cannot use pavement due to 2m arc of water	Highways drain

4.7 Flooding from Reservoirs, Canals and Other Artificial Sources

4.7.1 Risk of Flooding from Reservoir Mapping

The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The NPPG encourages LPAs to identify any impounded reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment it is located within, and / or whether emergency draw-down of the reservoir will add to the extent of flooding.

There is no record of reservoir flooding in Colchester BC; however, there are several reservoirs in the wider study area which could pose a risk to Colchester BC which have been identified from the Environment Agency's Risk of Flooding from Reservoirs mapping and are listed in Table 4-8.

Reservoir flooding is extremely unlikely to happen; there has been no loss of life from reservoir flooding in the UK since 1925. All large reservoirs are regularly inspected and supervised by reservoir engineers under the enforcement authority for the Reservoirs Act 1975 in England. If a reservoir were to breach, a large volume of water would come cascading down the surrounding valleys with very little warning. People living and working in these areas would be at great danger; therefore it is necessary to plan in advance an emergency strategy should such event occur. The Risk of Flooding from Reservoirs mapping are available online and can be further interrogated to provide information on the likely expected depths and velocities at a particular sites, which can be used to inform whether a plan is necessary, and what it should contain.

Table 4-7 Reservoirs which may pose a residual risk of flooding to the Colchester Borough[22]

Reservoir	Location	NGR	Undertaker	Area at risk of inundation
Halstead Flood Alleviation Reservoir	Halstead (Braintree DC)	580922, 231271	Environment Agency	Colne floodplain
Gosfield Lake	Gosfield (Braintree DC)	577620, 229183	O'Shea, Turp, Symons	Colne floodplain
Preston's Lake	South of Pebmarsh (Braintree DC)	585585, 231695	JWP Nott Farms	Colne Floodplain
Brick Kiln Reservoir	West Bergholt	597522, 228654	Pattinson	Adjacent to A12, floodplain of a tributary of the River Colne.
Abberton	Layer de la Haye (Colchester BC)	598780, 219734	Northumbrian Water Ltd	Marsh land to the south
Abberton Central & Western Arm	Layer de la Haye (Colchester BC)	598901, 219790	Essex & Suffolk Water Ltd	Roman River floodplain
Bockingham Hall	Bockingham Hall Farm, nr Copford Green (Colchester BC)	593060, 221890	Cottrell Fund - Round 1969 Settlement	Roman River floodplain
Ardleigh	Ardleigh (Tendring DC)	603487, 228024	Ardleigh Reservoir Committee	Salary Brook floodplain
Park Lane 1 (ID122)	South of Langham (Colchester BC)	602191, 230466	P G Rix (Farms) Ltd	Salary Brook floodplain
Wick Lane Reservoir	Ardleigh, Tendring DC)	604142, 229398	Ardleigh Reservoir Committee	Salary Brook floodplain
Langham Raw Water	Near Langham (Colchester BC)	602220, 234070	Essex & Suffolk Water Ltd	River Stour floodplain
Thorington Street	Thorrington Street (Barbergh DC)	601282, 234868	Trustees of the Tendring Estate	River Stour floodplain

4.7.2 Distillery Pond

Colchester BC undertook an investigation[23] into the reoccurring flooding affecting Haven Road where it is crossed by Distillery Lane. The flooding is general associated with high tides, and is exacerbated during periods of heavy rainfall. The investigation was carried out to identify reasons for the flooding in order to provide a robust solution to the problem.

The study discovered that the road is below tide level, and will therefore always be at risk of tidal flooding. Flows in the area are dominated by flows from Distillery Pond, which drains a large upstream catchment and the outlet of this pond is reported to be inadequate. In order to reduce the flooding in this area, it is considered that a pumping station is required and the level of protection will depend on how much capital is available to invest in mitigation. Even so, there

[22] Environment Agency (2015) Risk of Flooding from Reservoirs Mapping available online http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=reservoir#x=357683&y=355134&scale=2

[23] Colchester Borough Council (2013) Flooding in Haven Road.

can be no guarantee that the defences will not be overtopped by a greater-than-expected storm. The whole system is vulnerable to failure of the outlet flap valve. Siltation in the harbour remains an issue and will make any future operation of any system increasingly difficult. If the level of the main river becomes higher than the outfall pipe, the system will become even more prone to blockage.

Based on the above conclusions from the study several recommendations were made. The Environment Agency should be contacted in order to establish if Distillery Pond should be covered by the Reservoirs Act 1975. If so, this will enable legal powers to demand improvements in the interest of safety. The preferred option is to route Distillery Pond overflow directly into the River Colne, however this would poses several challenges. If the overflow is discharged through the Haven Road drainage system then the council must consider the level of protection is wishes to provide Haven Road. In any event, the Distillery Pond outlets should be upgraded. The ownership of Western verge of Haven Road and the existing chamber should be established. A new offline pumping station should be constructed in the quay, connected to the manhole in the Kawasaki garage, which will only operate when the system in surcharged. To reduce the risk of the outlet flap failing an in-line valve should be installed in the Kawasaki manhole and the existing flap should be replaced.

4.8 Emergency Planning

4.8.1 Flood Warning Areas

The Environment Agency provides a free Flood Warning Service[24] for many areas at risk of flooding from rivers and the sea. In some parts of England the Environment Agency may be able to provide warnings when flooding from groundwater is possible. The Environment Agency has provided a GIS layer of Flood Warning Areas in the study area which are presented in **Appendix A Figure 6.** The Environment Agency Flood Warning Areas in the Borough are identified in Table 4-8.

Table 4-8 Flood Warning Areas in Colchester (Environment Agency 2015)

Flood Warning Area	Watercourse / Estuary
Blackwater North Bank	Essex Coast
Tidal River Colne at Point Clear and Saint Osyth Creek.	Tidal Colne Estuary
Tidal River Colne from Brightlingsea to the Colne Barrier	Tidal River Colne
The Tidal River Colne upstream of the Colne Barrier	Tidal River Colne
West Mersea, The Strood and adjacent marshland	Tidal River Colne, North Sea
East Mersea	North Sea
Salcott cum Virley	Blackwater Estuary
Tollesbury and adjacent marshland	Blackwater Estuary
River Stour from Boxted to Dedham	Stour
River Colne from Halstead to Lexden	Colne
Riverside properties in Colchester, including the cricket ground	Colne
River Colne, through Colchester	Colne
North and South banks of the Stour Estuary from Shotley Gate to and including Brantham	Tidal River Stour
River Stour upstream of Cattawade Barrage	River Stour
River Stour from Sudbury to Boxted, inclusive	Stour
River Box from Boxford to Thorrington Street, inclusive	Box
River Brett from, and including Lavenham to Higham	Brett

4.8.2 Emergency Rest Centres

Colchester BC's designated emergency rest centres are mapped in **Appendix A Figure 6** and summarised in Table 4-9.

[24] Environment Agency Flood Warning Service http://apps.environment-agency.gov.uk/wiyby/37835.aspx

Table 4-9 Emergency Rest Centres (Colchester Council 2015)

Emergency Rest Centre	NGR (X)	NGR (Y)
Colchester Leisure World	599984	225993
Gilberd School	600742	228148
Stanway School	595552	224320
Phillip Morant School	597764	224295
Thurstable School	589507	216994
Thomas Lord Audley School	599951	222902
University of Essex	602927	223898
MICA Centre – West Mersea	600978	212680
Orpen Hall – West Bergholt	595903	227827
William Loveless Hall – Wivenhoe	603876	221837
Tiptree Parish Hall	589644	216018
Victory Hall – Stanway	595394	224483
Marks Tey Parish Hall	591330	223584
Hythe Community Centre	601343	224605

5 Avoiding Flood Risk – Applying the Sequential Test

5.1 Sequential Approach

This Section guides the application of the Sequential Test and Exception Test in the Plan-making and planning application processes. Not all development will be required to undergo these tests, as described below, but may still be required to undertake a site specific FRA, guidance about which is included in Section 7.

The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to sites at higher risk. This will help avoid the development of sites that are inappropriate on flood risk grounds. The subsequent application of the Exception Test, where required, will ensure that new developments in areas of particular flood risk will only occur where flood risk is clearly outweighed by other sustainability drivers and where development can be made safe from flooding and not increase the risk of flooding elsewhere.

The sequential approach can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new developments (except Water Compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

5.2 Applying the Sequential Test – Plan-Making

As the LPA, Colchester BC must demonstrate that throughout the site allocation process a range of possible sites have been considered in conjunction with the flood risk and vulnerability information from the SFRA, and that the Sequential Test, and where necessary the Exception Test, has been applied. Figure 5-1 illustrates an approach for applying the Sequential Test that Colchester BC could adopt in the allocation of sites as part of the preparation of their Local Plan.

The NPPF acknowledges that some areas will (also) be at risk of flooding from sources other than fluvial and tidal. All sources must be considered when planning for new development including: flooding from land or surface water runoff; groundwater; sewers; and artificial sources. If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

In order to ensure that the Sequential Test takes account of flood risk from all sources, Table 5-1 provides a suggested flood risk classification based on available datasets.

The Sequential Test should be undertaken by Colchester BC and accurately documented to ensure decision processes are consistent and transparent. A site assessment database provided to the Council will enables direct comparison of sites based on the flood risk datasets presented within this Level 1 SFRA.

Table 5-1 Flood Risk Classifications for Sequential Test

Risk	Source of Flooding				
	Tidal / Fluvial	Surface Water	Groundwater	Sewer	Reservoir
Low	Flood Zone 1	RoFSW Very Low	AStGWF (<25%)	Anglian Water to assess the sewer network for each site	Use EA Flooding from Reservoirs map
Medium	Flood Zone 2	RoFSW Low to Medium	AStGWF (25-50%) AStGWF (50-75%) AStGWF (>75%)		N/A
High	Flood Zone 3a	RoFSW High	Historic records of groundwater flooding		N/A
Very High	Flood Zone 3b	N/A	N/A		N/A

Note: This categorisation has been developed based on an understanding of the scale and accuracy of the particular datasets available (e.g. catchment scale fluvial modelling, national surface water or national scale groundwater mapping), and the nature/severity/ability to mitigate against the different sources of flooding. The purpose of this method is to enable Colchester BC to consider other sources of flooding during the application of the Sequential Test, not solely Flood Zones.

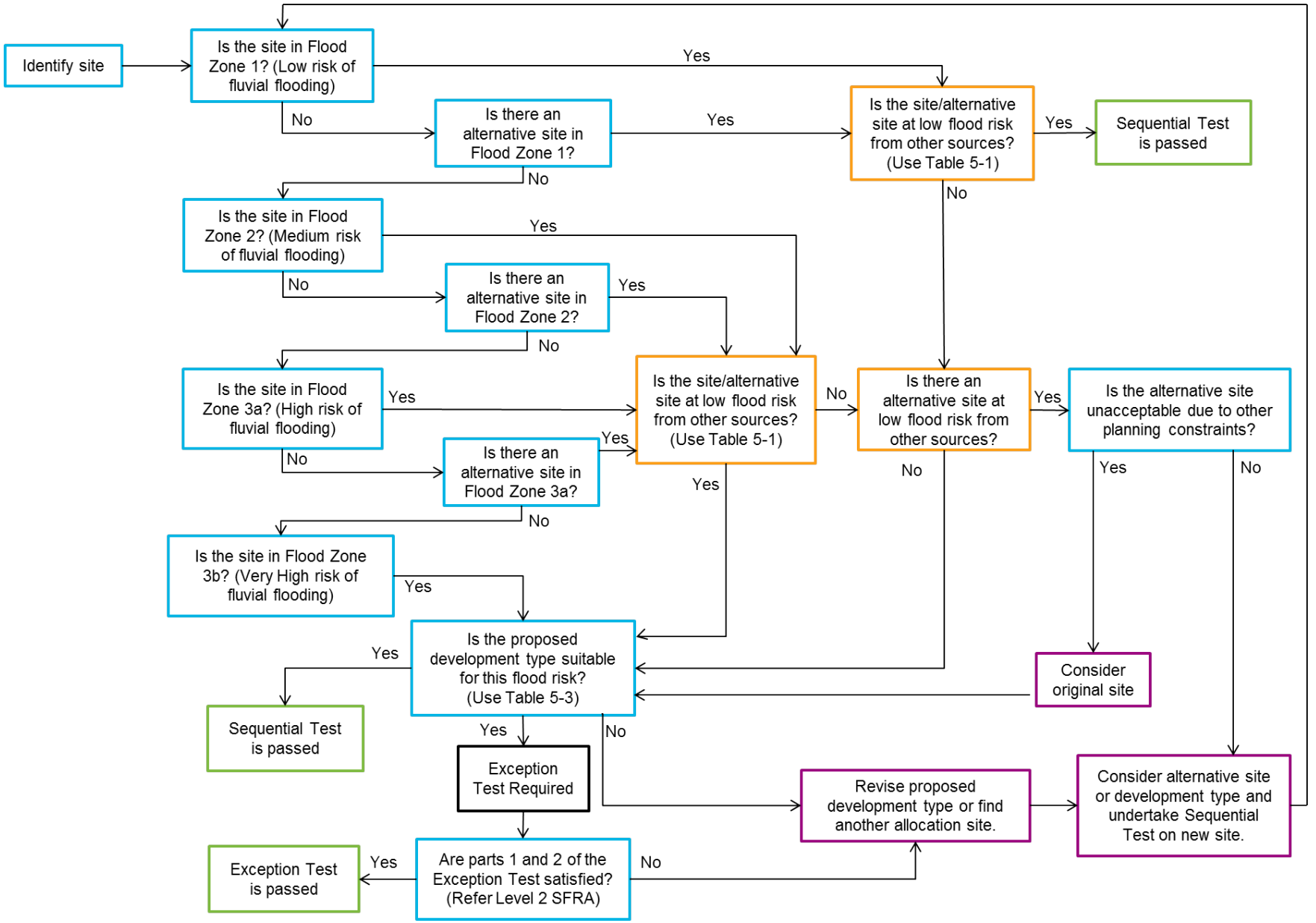

Figure 5-1 Application of Sequential Test for Plan-Making

The Sequential Test requires an understanding of the Flood Zones in the study area, the risk from other sources of flooding, and the vulnerability classification of the proposed developments. Flood Zone definitions are provided in Table 4-3 and mapped in the figures in **Appendix A** (and the Flood Map for Planning (Rivers and Sea) on the Environment Agency website). Flood risk vulnerability classifications, as defined in the PPG are presented in Table 5-2.

Table 5-2 Flood Risk Vulnerability Classification (PPG, 2014)

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure").
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", 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 working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • 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 and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 5-3 Flood Risk Vulnerability and Flood Zone 'Compatibility' (PPG, 2014)

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test Required	✓	✓
	3a	Exception Test Required	✓	×	Exception Test Required	✓
	3b	Exception Test Required	✓	×	×	×
Recurrent flood source e.g. surface water*, groundwater, sewer flooding.		Further investigation required (as part of a FRA) regardless of any requirement for the Exception Test.				

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

*including areas identified at surface water flood hazard in the town of Colchester SWMP hazard mapping.

The recommended steps in undertaking the Sequential Test are detailed below. This is based on the Flood Zone and Flood Risk Vulnerability. Table 5-3 indicates the compatibility of different development types with the Flood Zones.

5.2.1 Recommended stages for LPA application of the Sequential Test in Plan-Making

The information required to address many of these steps is provided in the accompanying GIS layers and maps presented in **Appendix A**.

a. Assign potential developments with a vulnerability classification (Table 5-2). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.

a. The location and identification of potential development should be recorded.

b. The Flood Zone classification of potential development sites should be determined based on a review of the Flood Map for Planning (Rivers and Sea). Where these span more than one flood zone, all zones should be noted.

c. The risk of flooding from other sources should also be identified, based on readily available datasets and local information.

d. Identify existing flood defences serving the potential development sites. (However, it should be noted that for the purposes of the Sequential Test, flood zones ignoring defences should be used).

e. The design life of the development should be considered with respect to climate change:

- 100 years – up to 2116 for residential developments; and
- Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.

f. Highly Vulnerable developments to be accommodated within the LPA area should be located in those sites identified as being within Flood Zone 1 and at low risk of flooding from other sources. If these cannot be located in areas of low flood risk, because the identified sites are unsuitable or there are insufficient sites in areas of low risk, sites in Flood Zone 2 can then be considered. Highly Vulnerable developments in Flood Zone 2 will require application of the Exception Test. If sites in Flood Zone 2 are inadequate then the LPA may have to identify additional sites in Flood Zones 1 or 2 to accommodate development or seek opportunities to locate the development outside their administrative area. Within each flood zone Highly Vulnerable development should be directed, where possible, to the areas at lowest risk from all sources of flooding. It should be noted that Highly Vulnerable development is not appropriate in Flood Zones 3a and 3b.

g. Once all Highly Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as More Vulnerable. In the first instance More Vulnerable development should be located in any unallocated sites in Flood Zone 1 and at low risk of flooding from other sources. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate More Vulnerable development, sites in Flood Zone 3a can be considered. More Vulnerable developments in Flood Zone 3a will require application of the Exception Test. As with Highly Vulnerable development, within each flood zone More Vulnerable development should be directed to

areas at lowest risk from all sources of flooding. It should be noted that More Vulnerable development is not appropriate in Flood Zone 3b.

h. Once all More Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located in any remaining unallocated sites in Flood Zone 1 and at low risk of flooding from other sources, continuing sequentially with Flood Zone 2, then Flood Zone 3a. Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.

i. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied.

j. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however it is appreciated that Water Compatible development by nature often relies on access and proximity to water bodies.

k. Where the development type is Highly Vulnerable, More Vulnerable, Less Vulnerable or Essential Infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test.

5.2.2 Windfall Sites

Windfall sites are those which have not been specifically identified as available in the Local Plan process. They comprise previously-developed sites that have unexpectedly become available. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development, based on past trends and expected future trends. It is recommended that the acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms.

5.3 Applying the Sequential – Individual Applications

If development is proposed in Flood Zone 2 or 3, and the Sequential Test has not already been carried out for the site for the same development type at the Local Plan level, then it is necessary to undertake a Sequential Test for the site. The Environment Agency publication 'Demonstrating the Flood Risk Sequential Test for Planning Applications'[25] sets out the procedure as follows:

- Identify the geographical area of search over which the test is to be applied; this could be the District area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area identified for regeneration in Local Plan policies).
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan.
- State the method used for comparing flood risk between sites; for example the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources.
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s).
- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- Where necessary, as indicated by Table 4.2, apply the Exception Test.
- Apply the Sequential approach to locating development within the site (as described in Section 6.2).

It should be noted that it is for LPAs, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence to the LPA what area of search has been used when making the application. Ultimately Colchester BC needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere.

[25] Environment Agency, April 2012, 'Demonstrating the flood risk Sequential Test for Planning Applications', Version 3.1

5.3.1 Sequential Test Exemptions

It should be noted that the Sequential Test does not need to be applied in the following circumstances:

- Individual developments proposed on sites which have been allocated in development plans through the Sequential Test.
- Minor development, which is defined in the NPPF as:
    - minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m^2;
    - alterations: development that does not increase the size of buildings e.g. alterations to external appearance;
    - Householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats;
- Change of Use applications, unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site;
- Development proposals in Flood Zone 1 (land with a low probability of flooding from rivers or the sea) unless the SFRA, or other more recent information, indicates there may be flooding issues now or in the future (for example, through the impact of climate change);

5.4 Exception Test

The purpose of the Exception Test is to ensure that where it may be necessary to locate development in areas at risk of flooding, new development is only permitted in Flood Zone 2 and Flood Zone 3 where the flood risk is clearly outweighed by other sustainability factors and where the development will be safe during its lifetime, considering climate change.

The NPPF states that for the Exception Test to be passed:

– *Part 1 - "It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by the SFRA where one has been prepared; and*

– *Part 2 - A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall."*

Both elements of the test will have to be passed for development to be allocated or permitted.

In order to determine Part 1) of the Exception Test, applicants should assess their scheme against the Sustainability Appraisal objectives as set out in the Local Plan Sustainability Appraisal Scoping Report (Colchester BC 2014) and reproduced in Table 5-4.

In order to demonstrate satisfaction of Part 2) of the Exception Test, relevant measures, such as those presented within Section 6, should be applied and demonstrated within a site-specific FRA as detailed in Section 7. Further assessment of those sites within Colchester BC which require the Exception Test is provided in the Level 2 SFRA.

Table 5-4 Colchester BC Sustainability Appraisal Objectives[26]

Objectives	Assessment Criteria	Indicators	SEA Themes
1. To provide a sufficient level of housing to meet the objectively assessed needs of the Borough to enable people to live in a decent, safe home which meets their needs at a price they can afford	Will it deliver the number of houses needed to support the existing and growing population?	The number of net additional dwellings	Material assets Climatic factors
	Will it provide more affordable homes across the Borough?	Affordable housing completions	
	Will it deliver a range of housing types to meet the diverse needs of the Borough?	Percentage of residential completions that are two or three bedroom properties	
	Will it deliver well designed and sustainable housing?	Number of zero-carbon homes completed	
2. To ensure that development is located sustainably and makes efficient use of land	Will it promote regeneration?	Number of new homes completed at ward level within Growth/ Regeneration Areas Amount of new employment development completed at ward level in Growth/Regeneration Areas	Material assets Landscape
	Will it reduce the need for development on greenfield land?	Percentage of new and converted dwellings on previously developed land	
	Will it provide good accessibility by a range of modes of transport?	% of new development within 30 minutes of community facilities	
	Will densities make efficient use of land?	Amount of development > 30 dwellings per hectare	
	Will a mix of uses be provided?		
3. To achieve a prosperous and sustainable economy that improves opportunities for local businesses to thrive, creates new jobs and improves the vitality of centres	Will it improve the delivery of a range of employment opportunities to support the growing population?	Amount of floorspace developed for employment, sqm	Material assets Population Cultural heritage
	Will it maintain an appropriate balance between different types of retail uses and other activities in the Borough's centres?	Amount of completed retail, office and leisure development delivered in the town centre Amount of completed retail, office and leisure development across the Borough	
	Will it support business innovation, diversification, entrepreneurship and changing economies?	Amount of floorspace developed for employment, sqm	
	Will it support tourism, heritage and the arts?	Amount of completed retail, office and leisure development delivered in the town centre Amount of completed retail, office and leisure development	
	Will it help sustain the rural economy?	Number of jobs created in rural areas	
4. To achieve more sustainable travel behaviour, reduce the need	Will it reduce the need to travel?	% of new residential development within 30 minutes of public transport time of a GP, hospital, primary and secondary school, employment and a major retail	Population Climatic factors

[26] Colchester Borough Council (2014) Local Plan Sustainability Appraisal Scoping Report

Objectives	Assessment Criteria	Indicators	SEA Themes
to travel and reduce congestion		centre	Air Human health
	Will the levels of sustainable travel increase?	Percentage of journeys to work by walking and cycling and percentage of journeys to work by public transport	
	Will it improve sustainable transport infrastructure and linkages?	Percentage of journeys to work by walking and cycling and percentage of journeys to work by public transport	
5. To build stronger, more resilient sustainable communities with better education and social outcomes	Will it provide equitable access to education, recreation and community facilities?	Financial contributions towards community facilities	Population Human health Biodiversity Flora Fauna
	Will it place pressure on school places, including early years?	N/A	
	Will existing open spaces be protected & new open spaces be created?	Contributions received towards open space	
	Will it improve the skills of the Borough's population?	Number of people qualified to level 2 Number of people qualified to level 4	
6. To improve and reduce inequalities in health and wellbeing and tackle crime issues by keeping our communities safe and promoting community cohesion	Will it reduce actual crime and fear of crime?	All crime – number of crimes per 1000 residents per annum	Population Human health
	Will it provide equitable access to employment opportunities?	% of new residential development within 30 minutes of public transport time of a GP, hospital, primary and secondary school, employment and a major retail centre	
	Will it encourage healthy lifestyles?	Number of people participating in sport	
7. To conserve and enhance the townscape character, and the heritage and cultural assets of the Borough	Will it protect and enhance the heritage and cultural assets of the Borough?	Number of listed buildings demolished Number of locally listed buildings demolished New Conservation Area Appraisals adopted New and extended Conservation Areas Number of Buildings at Risk	Cultural heritage including architectural and archaeological heritage
	Will it create a high quality and coherent public realm linking the town's assets and spaces; connecting the heritage and contemporary?	N/A	
	Will it protect and enhance the historic character of the Town Centre?	N/A	
8. To value, conserve and enhance the natural environment, natural resources and the biodiversity of the Borough	Will it maintain and enhance the landscape character of the borough?	N/A	Landscape Biodiversity Flora Fauna Soil Water
	Will it protect and enhance designated areas of the countryside and coastal environment?	Amount of development in designated areas Number of SSSIs in favourable condition	
	Will it protect and improve biodiversity?	Amount of development in designated areas Number of SSSIs in favourable condition Area of land offset for biodiversity	
	Will it improve environmental quality in terms of water, air and soil quality?	Quality of Rivers (number achieving ecological good status) Number of Air Quality Management Areas Contaminated land brought back into beneficial use, hectares	
9. To make efficient use of energy and reduce, reuse or recycle waste	Will it reduce pollution and greenhouse gas emissions?	Total CO2 emissions	Climatic factors Air
	Will it support the delivery of renewable energy schemes?	Renewable Energy Installed by Type	
	Will it help to reduce, reuse and recycle resources and minimise waste?	Amount of domestic waste recycled	

Objectives	Assessment Criteria	Indicators	SEA Themes
10. To reduce climate change impacts, support mitigation, encourage adaptation and protect water quality	Will it reduce the risk of flooding?	Number of planning permissions granted contrary to the advice of the Environment Agency on either flood defence grounds or water quality	Climatic factors Water Soil Biodiversity Flora Fauna
	Will it deliver effective SUDS and improve drainage?	Number of SUDS schemes approved by ECC	
	Will it affect the amount of water available for extraction?	N/A	
	Will it promote water efficiency and reduce water usage levels per household?	Number of zero carbon homes delivered	
	Will it improve water quality?	Number of SUDS schemes approved by ECC	
	Does it conform to River Basin Management Plan Objectives?	N/A	

6 Managing and Mitigating Flood Risk

6.1 Overview

The NPPF appreciates that it may not always be possible to avoid locating development in areas at risk of flooding. This Section provides guidance on the range of measures that could be considered in order to manage and mitigate flood risk. Subject to the Sequential Test being passed for a particular site, these measures should be considered when preparing a site-specific FRA, as described in Section 7.

It is essential that the development control process influencing the design of future development within the Borough carefully mitigates the potential impact that climate change may have upon the risk of flooding. As a result mitigation measures should be designed with an allowance for climate change over the lifetime of the proposed development as follows:

- 100 years (up to 2115) for residential developments; and
- 75 years (up to 2090) for commercial / industrial developments, or other time horizon specific to the non-residential use proposed.

6.2 Development Layout and Sequential Approach

A sequential approach to site planning should be applied within new development sites.

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. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas (considering all sources of flooding) e.g. residential elements should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on lower ground with a higher probability of flooding.

In areas at residual risk of tidal flooding, lower vulnerability uses can be placed at ground floor level, with users of greater vulnerability (e.g. residential uses) placed at first floor level and above, although ideally ground floor levels would be raised above the design flood level, with suitable justification being provided where this is not achievable.

6.3 Riverside Development

Retain at least an 8 metre wide undeveloped buffer strip alongside main rivers and explore opportunities for riverside restoration. In areas at risk of tidal flooding, development must be set back 16m from tidal defences. Any proposed development within 8m of a main river watercourse or 16m of a tidal flood defence will require an environmental permit from the Environment Agency.

Retain a 3 metre buffer strip on at least one side of an ordinary watercourse. Any development that could impact the flow within an ordinary watercourse will require consent from Essex County Council (as LLFA).

The Environment Agency is likely to seek at least an 8 metre wide undeveloped buffer strip alongside fluvial main rivers and 16 metre set back from tidal defences for maintenance purposes. The Environment Agency would also ask developers to explore opportunities for riverside restoration as part of any development.

As of 6th April 2016, the Water Resources Act 1991 and associated land drainage byelaws have been amended and flood defence consents will now fall under the Environmental Permitting (England and Wales) Regulations 2010. Any works within 8m of a main river will be subject to the Environmental Permitting Regulations (EPR). Further details and guidance are available on the GOV.UK website[27]. The Environment Agency can be consulted regarding permission to do work on or near a river, flood or sea defence by contacting enquiries@environment-agency.gov.uk.

[27] https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.

Essex CC will seek to ensure that development is set back by at least 3m on one side of an ordinary watercourse for ongoing maintenance purposes. As of 6th April 2012 responsibility for the consenting of works by third parties on ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) has transferred from the Environment Agency to the LLFA, Essex CC. Essex CC is now responsible for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. This includes any works (including temporary) that will affect the cross sectional area of the channel (such as in channel structures or diversion of watercourses). It is advised that Essex CC is consulted early of proposed alterations. Enquiries and applications for ordinary watercourse consent should be emailed to watercourse.regulation@essex.gov.uk with 'Ordinary Watercourse Consent Application' as the subject title, or sent to Flood & Water Management Team, County Hall, Market Road, Chelmsford CM1 1QH.

Essex CC, as the LLFA, will only approve culverting of ordinary watercourse where deemed necessary, this is explained further in Essex CC culverting policy. They will be minded to reject applications for culverting in areas identified as being in Flood Zone 2 or 3a/3b and/or in an area of surface water flooding identified within the Environment Agency Flood Maps for Surface Water, due to the potential of proposed works increasing flood risk. Exceptions to this policy will only be considered if the applicant is able to demonstrate that, on the balance of probabilities, the proposed development would not increase flood risk. Where Essex CC is made aware of breaches to other legislation then it will make the appropriate organisation aware of this.

6.4 Floodplain Compensation Storage

In areas at risk of fluvial flooding, all new development within the 1% AEP flood extent including an allowance for climate change (for the lifetime of the development) must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

Where proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the fluvial floodplain to store water, and should seek opportunities to provide betterment with respect to floodplain storage. Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced and flood risk is not increased elsewhere

As depicted in Figure 6-1, floodplain compensation must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary. Where a suitable area of land for compensation is not within the site boundary, it must be in the immediate vicinity, in the applicant's ownership and hydraulically linked to the site[28]. Floodplain compensation must be considered in the context of the 1% annual probability (1 in 100 annual probability) flood level including an allowance for climate change. When designing a scheme flood water must be able to flow in and out and must not pond. An FRA must demonstrate that there is no loss of flood storage capacity and include details of an appropriate maintenance regime to ensure mitigation continues to function for the life of the development. Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C62429.

[28] In hydrological connectivity.
[29] CIRIA January 2004, CIRIA Report 624: Development and Flood Risk - Guidance for the Construction Industry

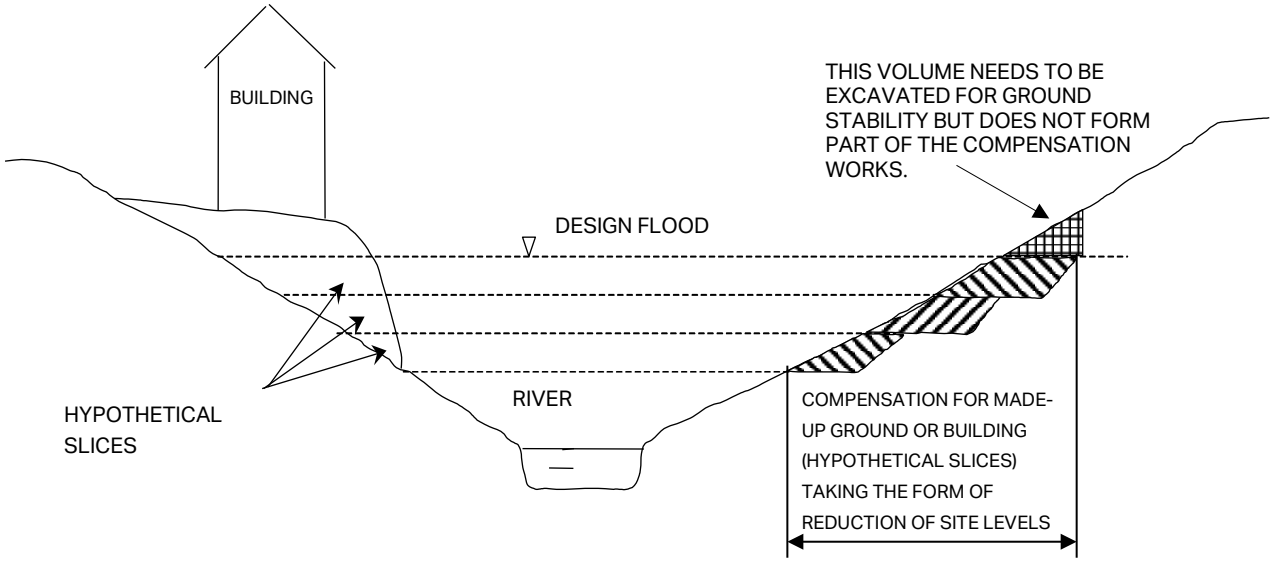

Figure 6-1 Example of Floodplain Compensation Storage (Environment Agency 2009)

The requirement for no loss of floodplain storage means that it is not possible to modify ground levels on sites which lie completely within the floodplain (when viewed in isolation), as there is no land available for lowering to bring it into the floodplain. It is possible to provide off-site compensation within the local area e.g. on a neighbouring or adjacent site, or indirect compensation, by lowering land already within the floodplain, however, this would be subject to detailed investigations and agreement with the Environment Agency to demonstrate (using an appropriate flood model where necessary) that the proposals would improve and not worsen the existing flooding situation or could be used in combination with other measures to limit the impact on floodplain storage.

6.5 Finished Floor Levels

Where developing in areas of flood risk is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) and Highly Vulnerable land uses, is to ensure internal floor levels are raised a freeboard level above the design flood level.

The relevant design flood level will vary depending on the source of flooding that the site is at risk from, as set out below.

Areas at risk of fluvial flooding

In areas at risk of fluvial flooding from main rivers and smaller watercourses, finished floor levels (FFL) should be set at least 300mm above the 1% AEP event flood level including a suitable allowance for climate change, or above ground level, whichever is more precautionary. It should be noted that land raising to achieve raised FFL should only be permitted if it can be provided in such a way that does not increase flood risk to surrounding areas.

Areas at risk of tidal flooding

In the southern part of the Borough, land adjacent to the Blackwater and Colne estuary is identified to be at risk of tidal flooding. In these areas, FFLs should be set at least 300mm above the flood level for the 0.5% AEP event including an allowance for climate change over the lifetime of the development.

Areas at residual risk of tidal flooding

Much of Colchester town centre is protected from tidal flooding by the presence of the Colne Barrier and is therefore at *residual* risk of tidal flooding in the event of a failure of the barrier or overtopping of defences. In these areas, FFL should be set at least 300mm above the flood level for the 0.5% AEP event including an allowance for climate change over the lifetime of the development.

Areas at risk of surface water flooding

In these areas, FFLs should be set above at least 300mm above the ground level or the modelled flood level where surface water modelling has been undertaken.

In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. In these cases, the Environment Agency and/or Colchester BC should be approached to discuss whether or not there are options for a reduction in the minimum internal ground floor levels, provided flood resistance measures are implemented up to an agreed level. There are also circumstances where flood resilience measures should be considered first. These are described further below. For both Less and More Vulnerable developments where internal access to higher floors is required, the associated plans showing the access routes and floor levels should be included within any site-specific FRA.

6.6 Flood Resistance 'Water Exclusion Strategy'

There are a range of flood resistance and resilience construction techniques that can be implemented in new developments to mitigate potential flood damage from fluvial or surface water flooding. The Department for Communities and Local Government (CLG) have published a document 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[30], the aim of which is to provide guidance to developers and designers on how to improve the resistance and resilience of new properties to flooding through the use of suitable materials and construction details. Figure 6-2 provides a summary of the Water Exclusion Strategy (flood resistance measures) and Water Entry Strategy (flood resilience measures) which can be adopted depending on the depth of fluvial floodwater or surface water flooding that could be experienced.

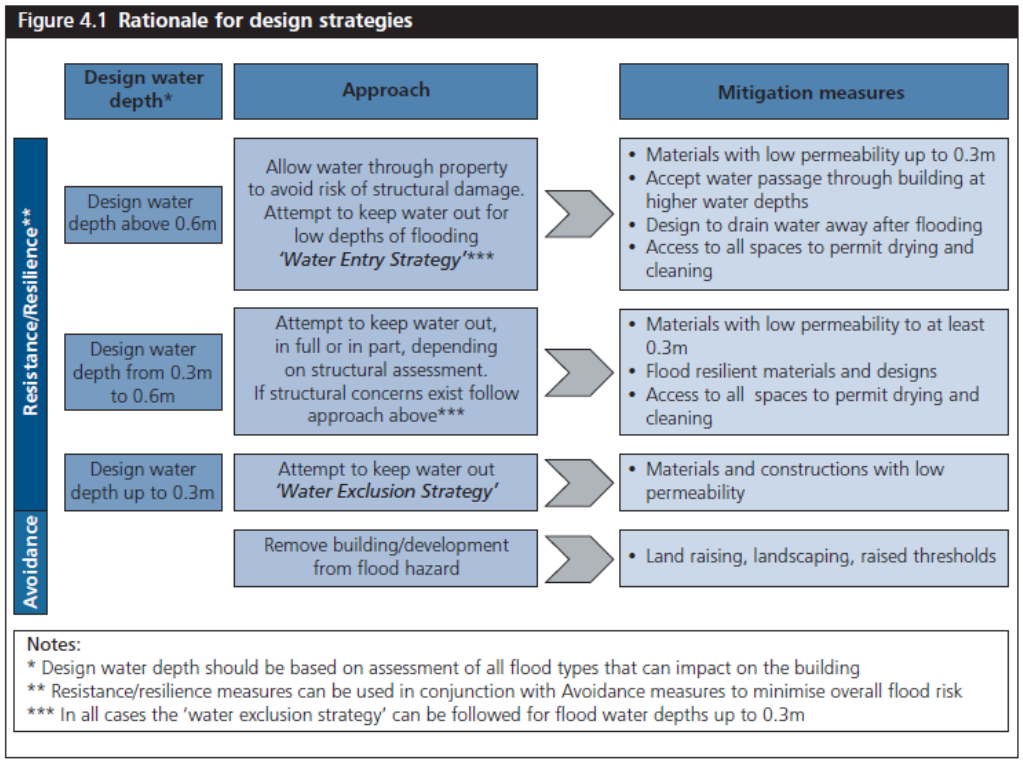

Figure 6-2 Flood Resistant / Resilient Design Strategies, Improving Flood Performance, CLG 2007

Resistance measures are aimed at preventing water ingress into a building (Water Exclusion Strategy); they are designed to minimise the impact of fluvial or surface water floodwaters directly affecting buildings and to give occupants more time to relocate ground floor contents. These measures will probably only be effective for short duration, low depth flooding, i.e. less than 0.3m, although these measures should be adopted where depths are between 0.3m and 0.6m and there are no structural concerns.

In areas at risk of fluvial or surface water flooding of low depths (<0.3m), the following flood resistance measures could be considered:

- Using materials and construction with low permeability.
- Land raising.
- Landscaping e.g. creation of low earth bunds (subject to this not increasing flood risk to neighbouring properties).

[30] CLG (2007) *Improving the Flood Performance of New Buildings, Flood Resilient Construction*

- Raising thresholds and finished floor levels e.g. porches with higher thresholds than main entrance.
- Flood gates with waterproof seals.

Property flood protection devices are available on the market, designed specifically to resist the passage of floodwater (Figure 6-3 and Figure 6-4). These include removable flood barriers and gates designed to fit openings, vent covers and stoppers designed to fit WCs. These measures can be appropriate for preventing water entry associated with fluvial flooding as well as surface water and sewer flooding.

Figure 6-3 Examples of flood barriers, air bricks and non-return valves

Figure 6-4 Example of flood gates

6.7 Flood Resilience 'Water Entry Strategy'

For flood depths greater than 0.6m, it is likely that structural damage could occur in traditional masonry construction due to excessive water pressures. In these circumstances, the strategy should be to allow water into the building, but to implement careful design in order to minimise damage and allow rapid re-occupancy. This is referred to as the Water Entry Strategy. These measures are typically used to mitigate fluvial or surface water flooding and are appropriate for uses where temporary disruption is acceptable and suitable flood warning is received. It should be noted that these measures are used to minimise rather than prevent flooding, and the length of time spent out of the building during the 'clear-up' period may still be lengthy.

Materials should be used which allow the passage of water whilst retaining their structural integrity and they should also have good drying and cleaning properties. Alternatively sacrificial materials can be included for internal and external finishes; for example the use of gypsum plasterboard which can be removed and replaced following a flood event. Flood resilient fittings should be used to at least 0.1m above the design flood level. Resilience measures are either an integral part of the building fabric or are features inside a building that will limit the damage caused by floodwaters.

In areas at risk of frequent or prolonged fluvial or surface water flooding, the following flood resilience measures could be implemented:

- Use materials with either, good drying and cleaning properties, or, sacrificial materials that can easily be replaced post-flood.
- Design for water to drain away after flooding.
- Design access to all spaces to permit drying and cleaning.
- Raise the level of electrical wiring, appliances and utility metres.

- Coat walls with internal cement based renders; apply tanking on the inside of all internal walls.
- Ground supported floors with concrete slabs coated with impermeable membrane.
- Tank basements, cellars or ground floors with water resistant membranes.
- Use plastic water resistant internal doors.

Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[31].

6.8 Structures

Structures such as (bus, bike) shelters, park benches and refuse bins (and associated storage areas) located in areas with a high flood risk should be flood resilient and be firmly attached to the ground and designed in such a way as to prevent entrainment of debris which in turn could increase flood risk and/or breakaway posing a danger to life during high flows associated with fluvial or surface water flooding. Care should also be taken that these structures do not block flow paths and/or cause an increased risk to adjacent areas.

6.9 Safe Access and Egress

Safe access and egress is required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out any necessary duties during periods of flood.

Areas at risk of fluvial or tidal flooding

Within areas at risk of fluvial flooding, a safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g. within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances. This is of particular importance when contemplating development on sites located on 'dry islands'.

Guidance prepared by the Environment Agency[32] uses a calculation of flood hazard to determine safety in relation to flood risk. Flood hazard is a function of the flood depth and flow velocity at a particular point in the floodplain along with a suitable debris factor to account for the hazard posed by any material entrained by the floodwater. The derivation of flood hazard is based on the methodology in Flood Risks to People FD2320, the use of which for the purpose of planning and development control is clarified in the above mentioned publication.

Table 6-1 Hazard to People Rating (HR=d x (v +0.5) + DF) (Table 13.1 FD2320/TR2)

Flood Hazard	Hazard Rating	Description
Low	Less than 0.75	Very low hazard – Caution
Moderate	0.75 to 1.25	Dangerous for some – includes children, the elderly and the infirm
Significant	1.25 to 2.0	Dangerous for most – includes the general public
Extreme	More than 2.0	Dangerous for all – includes the emergency services

For developments located in areas at risk of fluvial flooding or at residual risk of tidal flooding, safe access / egress must be provided for new development as follows in order of preference:

- Safe dry route for people and vehicles.
- Safe dry route for people.
- If a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause risk to people.
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles. However the public should not drive

[31] CLG, 2007, Improving the Flood Performance of New Buildings, Flood Resilient Construction. http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf?bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=flood_performance.pdf
[32] Environment Agency, HR Wallingford, May 2008, Supplementary note on Flood hazard ratings and thresholds for development planning and control purpose. Clarification of Table 13.1 FD2320/TR2 and Figure 3.2 FD2321/TR1. http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2321_7400_PR_pdf.sflb.ashx

vehicles in floodwater.

- In all these cases, a 'dry' access/egress is a route located above the 1% annual probability flood level (1 in 100 **annual probability**) including an allowance for climate change for fluvial flooding, and above the 0.1% AEP annual probability flood level (1 in 1000 **annual probability**) for tidal flooding.

Areas at risk of surface water flooding

With respect to other sources of flooding, consideration should be made of likely surface water ponding. As recommended in the CIRIA 635 Designing for Exceedance in Urban Drainage – Good Practice (Table 12.3), provision should be made to ensure that flood depths do not exceed 100mm to keep water within a kerb height and to reduce the likelihood of bow waves from vehicles driving through water affecting others, for example housing to the side of a car park.

6.10 Safe Refuge

In exceptional circumstances, dry access above the 1% annual probability (1 in 100 annual probability) flood level including climate change for fluvial flooding may not be achievable. Similarly, in areas at residual risk of tidal flooding, flood depths and extents can be significant and dry access may not be achievable.

In these circumstances the Environment Agency and Colchester BC should be consulted to ensure that the safety of the site occupants can be satisfactorily managed. This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed egress route. A suggested definition of a safe place of refuge is a dry, habitable space, internally accessible and accessible at all times. For example, this may entail the designation of a safe place of refuge on an upper floor of a building, from which the occupants can await the flood levels to subside or be rescued by emergency services. It should be noted that sole reliance on a safe place of refuge is a last resort, and all other possible means to evacuate the site should be considered first. Provision of a safe place of refuge will not guarantee that an application will be granted.

6.11 Car Parks

Where car parks are specified as areas for the temporary storage of surface water and fluvial floodwaters, flood depths should not exceed 300mm given that vehicles may be moved by water of greater depths. Where greater depths are expected, car parks should be designed to prevent the vehicles from floating out of the car park. Signs should be in place to notify drivers of the susceptibility of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary.

6.12 Flood Routing

All new development, whether at risk of fluvial flooding, at risk of surface water flooding or at risk of groundwater flooding at the surface, should not adversely affect flood routing and thereby increase flood risk elsewhere. Opportunities should be sought within the site design to make space for water, such as:

- Removing boundary walls or replacing with other boundary treatments such as hedges, fences (with gaps).
- Considering alternatives to solid wooden gates, or ensuring that there is a gap beneath the gates to allow the passage of floodwater.
- On uneven or sloping sites, consider lowering ground levels to extend the floodplain without creating ponds. The area of lowered ground must remain connected to the floodplain to allow water to flow back to the river when levels recede.
- Create under-croft car parks or consider reducing ground floor footprint and creating an open area under the building to allow flood water storage.
- Where proposals entail floodable garages or outbuildings, consider designing a proportion of the external walls to be committed to free flow of floodwater.

In order to demonstrate that 'flood risk is not increased elsewhere', development in the floodplain will need to prove that flood routing is not adversely affected by the development, for example giving rise to backwater affects or diverting floodwaters onto other properties.

Potential overland flow paths should be determined and appropriate solutions proposed to minimise the impact of the development, for example by configuring road and building layouts to preserve existing flow paths and improve flood

routing, whilst ensuring that flows are not diverted towards other properties elsewhere. Flow paths in Greenfield areas should be maintained. Where this is not the case, developers should assess the increased risk of flooding through the change in flow path, i.e. through the consideration of change in surface roughness resulting in increased velocity of floodwater and increase in the hazard rating associated with the potential flooded area.

Careful consideration should be given to the use of fences and landscaping walls so as to prevent causing obstruction to flow routes and increasing the risk of flooding to the site or neighbouring areas.

It will also be necessary to consider how these areas or features will be maintained over the lifetime of the development, which may require the removal of permitted development rights in certain locations.

6.13 Flood Warning and Evacuation Plans

Evacuation is where flood alerts and warnings, such as those provided by the Environment Agency associated with fluvial and tidal flooding, enable timely actions by residents or occupants to allow evacuation to take place unaided, i.e. without the deployment of trained personnel to help people from their homes, businesses and other premises. Rescue by the emergency services is likely to be required where flooding has occurred and prior evacuation has not been possible.

For all developments (excluding minor developments and change of use) proposed in areas at risk of fluvial or tidal flooding, a Flood Warning and Evacuation Plan should be prepared to demonstrate what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate their development will not impact on the ability of the local authority and the emergency services to safeguard the current population.

The Environment Agency has a tool on their website to create a Personal Flood Plan[33]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details. Where proposed development comprises non-residential extension <250m^2 and householder development (minor development), it is recommended that the use of this tool to create a Personal Flood Plan will be appropriate.

Flood Evacuation Plans should also be prepared for sites located next to surface water flowpaths, or where there is another source of flood risk affecting the site.

Flood Warning and Evacuation Plans should include:

<u>How flood warning is to be provided, such as:</u>

- availability of existing flood warning systems (refer Table 4-8);
- where available, rate of onset of flooding and available flood warning time; and
- how the flood warning is given.

<u>What will be done to protect the development and contents, such as:</u>

- How easily damaged items (including parked cars) or valuable items (important documents) will be relocated;
- How services can be switched off (gas, electricity, water supplies);
- The use of flood protection products (e.g. flood boards, airbrick covers);
- The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc.; and
- The time taken to respond to a flood warning.

<u>Ensuring safe occupancy and access to and from the development, such as:</u>

- Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate;
- Safe access route to and from the development;
- If necessary, the ability to maintain key services during an event;
- Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible; and
- Expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.)

[33] Environment Agency Tool 'Make a Flood Plan'. https://www.gov.uk/government/publications/personal-flood-plan

There is no statutory requirement for the Environment Agency or the emergency services to approve evacuation plans. Colchester BC is accountable via planning condition or agreement to ensure that plans are suitable. This should be done in consultation with emergency planning staff at Essex CC.

7 Guidance for preparing site-specific FRAs

7.1 What is a Flood Risk Assessment?

A site-specific FRA is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and where possible will reduce flood risk overall in accordance with paragraph 100 of the NPPF and PPG. An FRA must be prepared by a suitably qualified and experienced person and must contain all the information needed to allow Colchester BC to satisfy itself that the requirements have been met.

7.2 When is a Flood Risk Assessment required?

The NPPF states that a site-specific FRA is required in the following circumstances:

- Proposals for new development (including minor development[34] and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency)[35].
- Proposals of 1 hectare or greater in Flood Zone 1.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

However, for all proposals (including those less than 1 hectare within Flood Zone 1), a Flood Risk Assessment may still be required, to assess the risk of flooding from local sources, i.e. surface water, groundwater and ordinary watercourses. For example, a FRA for a small site may identify surface water flow paths that will need to be carefully managed throughout the proposed development to ensure that the development will be made safe, will not increase flood risk elsewhere, and where possible will reduce flood risk overall. The need for this report is likely to be identified when preparing the drainage proposals for the site.

All major applications must be accompanied by a drainage strategy to enable assessment by the LLFA in their role as a statutory consultee to the planning process. Drainage Strategies are typically referred to within FRAs to demonstrate how surface water will be effectively managed on site to mitigate surface water flooding on the site and surrounding area.

7.3 How detailed should a FRA be?

The PPG states that site-specific FRAs should be proportionate to the degree of flood risk, the scale and nature of the development, its vulnerability classification (Table 5-2) and the status of the site in relation to the Sequential and Exception Tests. Site-specific FRAs should also make optimum use of readily available information, for example the mapping presented within this SFRA and available on the Environment Agency website, although in some cases additional modelling or detailed calculations will need to be undertaken. For example, where the development is an extension to an existing house (for which planning permission is required) which would not significantly increase the number of people present in an area at risk of flooding, Colchester BC would generally need a less detailed assessment to be able to reach an informed decision on the planning application. For a new development comprising a greater number of houses in a similar location, or one where the flood risk is greater Colchester BC may require a more detailed assessment, for example, the preparation of site-specific hydraulic modelling to determine the flood risk to and from the site pre and post-development, and the effectiveness of any management and mitigation measures incorporated within the design.

[34] According to the PPG, minor development means:
minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m^2.
alterations: development that does not increase the size of buildings e.g. alterations to external appearance.
householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

[35] Consultation has confirmed that there are no areas with critical drainage problems identified by the Environment Agency.

As a result, the scope of each site-specific FRA will vary considerably. Table 7-1 presents the different levels of site-specific FRA as defined in the CIRIA publication C62436 and identifies typical sources of information that can be used. Sufficient information must be included to enable the Council and where appropriate, consultees, to determine that the proposal will be safe for its lifetime, not increase flood risk elsewhere and where possible, reduce flood risk overall. Failure to provide sufficient information will result in applications being refused.

With respect to proposals for surface water management, Essex CC has a SuDS checklist available online[37], which should be used to ensure that developers are submitting all relevant information required by the LLFA to determine whether surface water flood risk is being fully addressed.

[36] CIRIA, 2004, Development and flood risk – guidance for the construction industry C624.
[37] https://www.essex.gov.uk/Environment%20Planning/Environment/local-environment/flooding/View-It/Pages/Sustainable-drainage-systems.aspx

Table 7-1 Levels of Site-Specific Flood Risk Assessment

Description
Level 1 Screening study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information. The screening study will ascertain whether a FRA Level 2 or 3 is required. Typical sources of information include: • Strategic Flood Risk Assessment (SFRA) • Flood Map for Planning (Rivers and Sea) • Environment Agency Standing Advice • NPPF Tables 1, 2 and 3
Level 2 Scoping study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include: • An appraisal of the availability and adequacy of existing information; • A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; and • An appraisal of the scope of possible measures to reduce flood risk to acceptable levels. • The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development. Typical sources of information include those listed above, plus: • Local policy statements or guidance. • Catchment Flood Management Plan. • Essex County Council PFRA and LFRMS. • Data request from the EA to obtain result of existing hydraulic modelling studies relevant to the site and outputs such as maximum flood level, depth and velocity. • Consultation with EA/ECC/sewerage undertakers and other flood risk consultees to gain information and to identify in broad terms, what issues related to flood risk need to be considered including other sources of flooding. • Historic maps. • Interviews with local people and community groups. • Walkover survey to assess potential sources of flooding, likely routes for floodwaters, the key features on the site including flood defences, their condition. • Site survey to determine general ground levels across the site, levels of any formal or informal flood defences.
Level 3 Detailed study to be undertaken if a Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include: • Quantitative appraisal of the potential flood risk to the development; • Quantitative appraisal of the potential impact of the development site on flood risk elsewhere; and • Quantitative demonstration of the effectiveness of any proposed mitigations measures. Typical sources of information include those listed above, plus: • Detailed topographical survey. • Detailed hydrographic survey. • Site-specific hydrological and hydraulic modelling studies which should include the effects of the proposed development. • Monitoring to assist with model calibration/verification. • Continued consultation with the LPA, Environment Agency and other flood risk consultees.

7.3.1 Environment Agency Data Requests

The Environment Agency offers a series of 'products' for obtaining flood risk information suitable for informing the preparation of site-specific FRAs as described on their website https://www.gov.uk/planning-applications-assessing-flood-risk.

- Products 1 – 4 relate to mapped deliverables including flood level and flood depth information and the presence of flood defences local to the proposed development site;
- Product 5 contains the reports for hydraulic modelling of the main rivers;
- Product 6 contains the model output data so the applicant can interrogate the data to inform the FRA.
- Product 7 comprises the hydraulic model itself.

Products 1 – 6 can be used to inform a Level 2 FRA. In some cases, it may be appropriate to obtain Product 7 and to use as the basis for developing a site-specific model for a proposed development as part of a Level 3 FRA. This can be requested via either their National Customer Contact Centre via enquiries@environment-agency.gov.uk or the Essex Norfolk Suffolk Customers and Engagement Team via ensenquiries@environment-agency.gov.uk.

7.3.2 Modelling of Ordinary Watercourses

It should be noted that the scope of modelling studies undertaken by the Environment Agency typically cover flooding associated with main rivers, and therefore ordinary watercourses that form tributaries to the main rivers may not always be included in the model. Where a proposed development site is in close proximity to an ordinary watercourse and either no modelling exists, or the available modelling is considered to provide very conservative estimates of flood extents (due to the use of national generalised JFLOW modelling), applicants may need to prepare a simple hydraulic model to enable more accurate assessment of the probability of flooding associated with the watercourse and to inform the site-specific FRA. This should be carried out in line with industry standards and in agreement with the Environment Agency and Essex County Council (as the LLFA).

7.3.3 Essex County Council Data Requests

Essex CC offers an Information Request facility to inform the preparation of site-specific FRAs and will respond to two types of request; basic and detailed:

- Basic requests will provide applicants with all historic flood incidents relating to their site along with any known issues relating to any watercourse/flood risk assets present. They will also confirm whether the site falls within a Critical Drainage Area (CDA) and if any flood investigations have been conducted within a 5 mile radius.
- Detailed requests will provide applicants with all of the above along with any engineer judgement or commentary relating to their site.

7.4 What needs to be addressed in a Flood Risk Assessment?

The PPG states that the objectives of a site-specific flood risk assessment are to establish:

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

7.5 Pre-application advice

At all stages, Colchester BC, and where necessary the Environment Agency, Essex CC and/or the Statutory Water Undertaker may need to be consulted to ensure the FRA provides the necessary information to fulfil the requirements for planning applications.

Essex CC offers a pre-application service whereby engineering/officer advice is given to applicants relating to their specific site.

- Ordinary Watercourse Consent Pre-application advice will allow applications to obtain engineering advice relating to their application along with guidance on the information that needs to be submitted.

- The Essex County Council Sustainable Drainage Systems Team also offers a pre-application service whereby planning advice is provided to ensure applications meets all requirements before submission.

The **Environment Agency** offer one free 'preliminary opinion' for development proposals. This will highlight the types of issues that the application should address. A request for a preliminary opinion can be made using the form at: https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Further detailed advice, including a review of an FRA, is offered as part of a charged for cost recovery service. Information on this is available at: https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals

Colchester BC generally does not provide advice on FRAs, rather, as part of the preliminary application process the Council direct developers to specialist advisers including the Environment Agency and Essex CC in their capacity as LLFA. Where advice is provided, Colchester BC charges for pre-application advice; charges reflect the officer time involved and are kept to a minimum. As a consequence, Colchester BC does not absorb other charging regimes, such as Essex CC's or the Environment Agency's , within their own costs but instead offer opinions where they can as the LPA and direct customers onto other organisations that they may need to talk to, including on matters such as flooding and highways issues.

8 Flood Risk Management Policy Recommendations

8.1 Overview

In order to encourage a holistic approach to flood risk management and ensure that flooding is taken into account at all stages of the planning process, this Section builds on the findings of the Level 1 SFRA to set out key recommendations for consideration by Colchester BC in relation to flood risk planning policy and with respect to development management decisions on a day-to-day basis.

8.2 Policy Considerations

It is recommended that the following flood risk objectives are taken into account by Colchester BC during the policy making process. Guidance on how these objectives can be met throughout the development control process for individual development sites is included within Section 6.

8.2.1 Seeking Flood Risk Reduction through Spatial Planning and Site Design

- Use the Sequential Test to locate new development in areas of lowest risk, giving highest priority to areas within Flood Zone 1 and at low risk of flooding from other sources. Locating new development away from the most vulnerable flood risk areas would minimise the cost of installing and maintaining new flood defences and land drainage measures.
- Use the Sequential Test within development sites to inform site layout by locating the most vulnerable elements of a development in the lowest risk areas. For example, the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide an effective means of flood risk management as well as providing connected green spaces with consequent social and environmental benefits.
- Avoid development immediately downstream of flood storage reservoirs which will be at high hazard areas in the event of failure.
- Seek opportunities for new development to achieve reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features.
- Identify long-term opportunities to remove development from the floodplain through land swapping, whereby existing development is removed from the floodplain and the site returned to provide its original flood storage function.
- Build resilience into a site's design (e.g. flood resistant or resilient design, raised floor levels).
- Ensure development is 'safe'. For residential developments to be classed as 'safe', dry pedestrian egress out of the floodplain and emergency vehicular access should be possible. Dry pedestrian access/egress should be possible for the 1 in 100 annual probability return period event including an allowance for climate change for fluvial flooding, or the 1 in 1000 annual probability return period associated with tidal flooding.

8.2.2 Reducing Surface Water Runoff from New Developments

- All sites require the following:
    - Use of SuDS (where possible use of strategic SuDS should be made).
    - A SuDS treatment train should be utilised to assist in surface water runoff reduction.
    - Discharge rates should be restricted to Greenfield runoff rates.
    - 1 in 100 annual probability attenuation of surface water, taking including an allowance for climate change.
- Space should be specifically set aside for SuDS and used to inform the overall layout of development sites.
- Surface water drainage proposals should have a clear plan for the long term maintenance and adoption of the systems, prior to approval of any planning permission in line with national planning policy.
- Large potential development areas (such as the Essex University site and the potential Garden Settlements in Marks Tey and East Colchester) should be planned with a holistic approach to the provision of SuDS. This will

need to be on an integrated and strategic scale and where necessary will require the collaboration of all developers involved in implementing a specific expansion area or site.

- Careful assessment of the potential impact of surface water drainage from new developments will be necessary in areas with constrained drainage networks, particularly those networks that are dependent upon sewers and culverted watercourses with limited capacity.
- In particular areas, Essex CC have identified the following specific requirements apply:
    - Developments located in Critical Drainage Areas (CDAs) or Local Flood Risk Zones (LFRZs), developments of more than one property, or with an area greater than 0.1 hectare should all seek betterment to a Greenfield runoff rate.
    - Development within Critical Drainage Areas (CDAs) should be avoided where possible or provide betterment to the system.
    - All developments in urban areas (excluding minor house extensions less than 50m^2) which relate to a net increase in impermeable area are to include at least one 'at source' SuDS measure. This is to assist in reducing the peak volume of runoff discharging from the site.
    - Proposed 'brownfield' redevelopments should restrict to 1 in 1 Greenfield where possible but provide at least 50% betterment on existing brownfield rates.
- Developers should consult the Essex CC SuDS Design Guide[38] to help guide development and ensure suitable SuDS are included as part of all schemes.

8.2.3 Enhancing and Restoring the River Corridor

- Those proposing development should look for opportunities to undertake river restoration and enhancement as part of a development to make space for water. Enhancement opportunities should be sought when renewing assets (e.g. de-culverting, the use of bio-engineered river walls, raising bridge soffits to take into account climate change).
- Further culverting and building over culverts should be avoided. Where practical, all new developments with culverts running through their site should seek to de-culvert rivers for flood risk management and conservation benefit. Any culverting or works affecting the flow of a watercourse requires the prior written consent of either the Environment Agency (for main rivers), or Essex CC (for ordinary watercourses) under the terms of the Environmental Permitting Regulations 2010 and the Flood and Water Management Act 2010. These regulatory bodies seek to avoid culverting, and their consent for such works will not normally be granted except as a means of access.
- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip for development by all watercourses including those where the Flood Zone does not exist.

8.2.4 Protecting and Promoting Areas for Future Flood Alleviation Schemes

- Protect Greenfield functional floodplain from future development (our greatest flood risk management asset) and reinstate areas of functional floodplain which have been developed (e.g. reduce building footprints or relocate to lower flood risk zones).
- Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.
- The objective of a CDA should be considered within the development to ensure new development does not hinder mitigation proposals.

8.2.5 Improving Flood Resilience and Emergency Planning

Where flooding affects only a limited number of properties, it is unlikely that measures to improve flood defences will attract priority funding. Instead it may be necessary to place greater reliance on making properties that are at risk more resilient to flooding. Similarly, steps should be made to improve the resilience of properties and infrastructure that is at risk of surface water flooding, through:

- Seeking to improve the emergency planning process using the outputs from the SFRA.

[38] Essex County Council, December 2014, Sustainable Drainage Systems Design Guide
https://www.essex.gov.uk/Environment%20Planning/Environment/local-environment/flooding/View-It/Pages/Sustainable-drainage-systems.aspx

- For areas at risk of fluvial and tidal flooding, encouraging all those within existing Flood Zone 3a and 3b (residential and commercial occupiers) to sign up to Flood Warning Service operated by the Environment Agency.

- Ensuring robust emergency (evacuation) plans are implemented for new developments.

- Considering locations where flood resistant and resilient measures, such as those presented in Sections 6.6 and 6.7 can be retrofitted to properties at risk of surface water or fluvial flooding.

8.3 Development Management Considerations

8.3.1 Flood Zone 3b Functional Floodplain

The Functional Floodplain has been defined within this SFRA for the River Colne and River Stour using the defended 5% AEP flood extent. These areas should be safeguarded from development, with exemptions where development could reduce flood risk overall or improve floodplain storage. Should modelling be undertaken for other watercourses in the study area, the same definition should be used to delineate the extent of the functional floodplain along the watercourse.

Only Water Compatible developments are permitted in Flood Zone 3b, and Essential Infrastructure developments require the Exception Test (refer to Table 5-3). Where Water Compatible or Essential Infrastructure development cannot be located elsewhere, it must:

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

Proposals for the change of use or conversion to a use with a higher vulnerability classification should not be permitted. Basements, basements extensions, conversions of basements to a high vulnerability classification or self-contained units should not be permitted.

Where minor development is proposed, schemes should not affect floodplain storage or flow routes through the incorporation of the following mitigation measures in line with CIRIA guidance on SuDS:

- Raised finished floor levels;
- Voids and where possible;
- Direct or indirect floodplain compensation;
- Flood resilience measures;
- The removal of other non-floodable structures;
- Replacement of impermeable surfaces with permeable;
- Improved surface water drainage through the implementation of SuDS features such as water butts/rainwater harvesting;
- Living roofs;
- Infiltration trenches/soakaways; and
- Below ground attenuation tanks.

Drainage attenuation ponds and other SuDS storage features are not considered to be Water Compatible and should therefore not be located within Flood Zone 3b.

8.3.2 Flood Zone 3a High Probability

Flood Zone 3a High Probability comprises land having a 1% (1 in 100 annual probability) or greater probability of fluvial flooding, or a 0.5% (1 in 200 annual probability) or greater probability of tidal flooding. Water Compatible and Less Vulnerable developments are considered appropriate in Flood Zone 3a; Essential Infrastructure and More Vulnerable developments require the Exception Test and Highly Vulnerable development should not be permitted in this flood zone (refer to Table 5-3). Where development is proposed opportunities should be sought to:

- Relocate existing development to land in zones with a lower probability of flooding;
- 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;
- Ensure it remains safe for users in times of flood; and
- Create space for flooding to occur by restoring natural floodplain and flood flow paths and by identifying, allocating and safeguarding open space for flood storage.

8.3.3 Flood Zone 2 Medium Probability

Flood Zone 2 Medium Probability comprises land having between a 1% (1 in 100 annual probability) and 0.1% (1 in 1000) annual probability of flooding from fluvial watercourses, or between a 0.5% (1 in 200 annual probability) and 0.1% annual probability of tidal flooding. Water Compatible, Essential Infrastructure, Less Vulnerable and More Vulnerable developments are considered appropriate in the Flood Zone 2, and Highly Vulnerable development requires the Exception Test (refer to Table 5-3). Where development is proposed in areas of Flood Zone 2, the planning policy approach is similar to Flood Zone 3a. Opportunities should be sought to:

- Relocate existing development to land in zones with a lower probability of flooding;
- 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;
- Ensure it remains safe for users in times of flood; and
- Create space for flooding to occur by restoring natural floodplain and flood flow paths and by identifying, allocating and safeguarding open space for flood storage.

8.3.4 Flood Zone 1 Low Probability

Flood Zone 1 Low Probability comprises land having a less than 0.1% (1 in 1000 annual probability) annual probability of flooding from tidal or fluvial watercourses including ordinary watercourses. All development vulnerability classifications are considered appropriate in Flood Zone 1 (refer to Table 5-3). Where development over 1ha is proposed or there is evidence of flooding from another localised source in areas of Flood Zone 1, opportunities should be sought to:

- Identify any surface water flow paths present on the site to inform appropriate site use and layout design;
- Apply the sequential approach within the development site;
- Ensure that the management of surface water runoff from the site is considered early in the site planning and design process;
- Ensure that proposals achieve an overall reduction in the level of flood risk to the surrounding area, through the appropriate application of sustainable drainage techniques.

8.3.5 Areas at risk of Surface Water Flooding

Areas are identified to be at risk of surface water flooding using the hazard mapping available in the town of Colchester SWMP, local historic flood event information, or using the national RoFSW mapping available online. Where development is proposed in areas at risk of surface water flooding, opportunities should be sought to:

- Relocate existing development to land with a lower probability of surface water flooding;
- Apply the sequential approach within the development site;
- Ensure that the management of surface water runoff from the site is considered early in the site planning and design process;
- 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; and,
- Ensure it remains safe for users in times of flood.

8.3.6 Changes of Use

Where a development undergoes a change of use and the vulnerability classification of the development changes, there may be an increase in flood risk. For example, changing from industrial use to residential use will increase the vulnerability classification from Less to More Vulnerable (Table 5-2).

For change of use applications in Flood Zone 2 and 3, applicants must submit a FRA with their application. This should demonstrate how the flood risks to the development will be managed so that it remains safe through its lifetime

including provision of safe access and egress and preparation of Flood Warning and Evacuation Plans where necessary.

As changes of use are not usually subject to the Sequential or Exception Tests (unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site), Colchester BC could consider when formulating policy what changes of use will be acceptable, having regard to paragraph 157 (6th bullet) of the NPPF and taking into account the findings of this SFRA. This is likely to depend on whether developments can be designed to be safe and that there is safe access and egress.

9 Next Steps

9.1 Overview

This Level 1 SFRA provides a strategic overview of the flood risk in Colchester BC from all sources of flooding based on readily available datasets, local knowledge and historic information supplied by the stakeholders. The mapping and information in Section 4 has been used to assess 395 potential development sites across the Borough identified through Colchester BC's Call for Sites to enable a robust consideration of flood risk throughout the drafting of the new Local Plan for the Borough.

9.2 Sequential Test

The information, mapping and database in this report should be used by Colchester BC to apply the Sequential Test and identify any sites where the Exception Test may be required. The guidance presented in Section 5 should be used to facilitate the application of the Sequential Test and the process should be carefully documented by Colchester BC.

9.3 Level 2 Strategic Flood Risk Assessment

Following the application of the Sequential Test, it is likely that Colchester BC may identify development sites in areas of flood risk where future development is required. Where More Vulnerable development is proposed in areas of Flood Zone 3, or Highly Vulnerable development in Flood Zone 2, an increased Level 2 SFRA is required to help determine whether the NPPF Exception Test can be passed. The Level 2 SFRA will provide further detail regarding the flood risk at each of the potential development sites, including consideration of the residual risk of tidal flooding facing Colchester town centre in the event of a breach of the Colne Barrier at Wivenhoe.

9.4 Living Document

The Level 1 SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. The Environment Agency is currently revising the hydraulic modelling for the River Colne and River Stour, which will improve the current knowledge of flood risk within the Borough, and may marginally alter predicted flood extents within parts of the Borough in the future. The models for the River Stour will also take account of the revised climate change allowances published by the Environment Agency in February 2016, and in time, it is anticipated that climate change modelling will become available for the River Colne as well.

New information may influence future development control decisions within these areas. Therefore it is important that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk within the Borough.

Appendix A. Figures

About AECOM

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