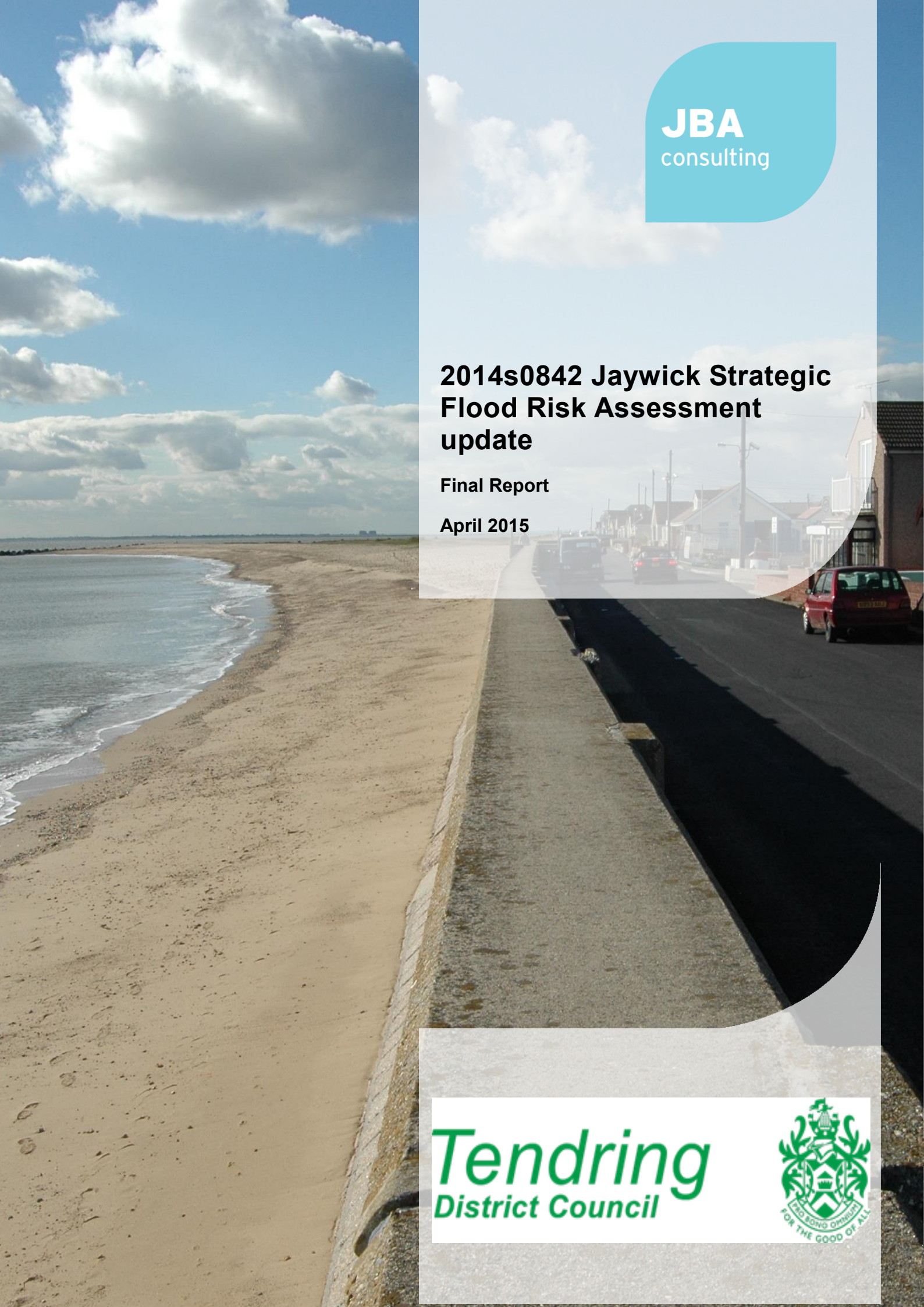


2014s0842 Jaywick Strategic Flood Risk Assessment update

Final Report

April 2015

Tendring District Council

This page is intentionally left blank

Tendring District Council Project Manager

Richard Matthams
Planning Department
Tendring District Council
Council Offices
Thorpe Road
Weeley
Essex
CO16 9AJ

JBA Project Manager

Claire Gardner
The Library
St Philip's Courtyard
Church Hill
Coleshill
Warwickshire
B46 3AD

Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft Report v1.0		**Richard Matthams (Tendring District Council) Mike Badger (Tendring District Council) Graham Robertson (Environment Agency)**
Final Draft Report v1.0	**Amendments based on comments from Tendring District Council and the Environment Agency**	**Richard Matthams (Tendring District Council) Mike Badger (Tendring District Council) Graham Robertston (Environment Agency)**
Final Report v1.0	**Further amendments based on comments from Tendring District Council and the Environment Agency**	**Richard Matthams (Tendring District Council) Mike Badger (Tendring District Council) Graham Robertson (Environment Agency)**

Contract

This report describes work commissioned by Jaywick District Council. Jaywick District Council's representative for the contract was Richard Matthams. Claire Gardner, Patricia Reyes-Firpo and Sophie Dusting of JBA Consulting carried out this work.

Prepared by	Sophie Dusting BSc Analyst
	Claire Gardner BSc MSc MCIWEM C.WEM Chartered Senior Analyst
Reviewed by	Alastair Dale BSc PGDip MIAHR Director

Purpose

This document has been prepared as a Final Report for Tendring District Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Tendring District Council.

Acknowledgements

We would like to acknowledge the assistance of Richard Matthams, Mary Foster and Mike Badger (Tendring District Council) and Graham Robertston, Rebecca Brown, Tom Izzard, and David Welsh (Environment Agency) for their support and assistance with this study.

Aerial photography used in the report was courtesy of Mike Page.

Carbon Footprint

A printed copy of the main text in this document will result in a carbon footprint of 751g if 100% post-consumer recycled paper is used and 955g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Executive Summary

Introduction

This Jaywick Strategic Flood Risk Assessment (SFRA) 2014 Update report is prepared to replace the document "Jaywick Strategic Flood Risk Study Final Report, May 2008". This report updates work that was included in the previous SFRA and provides appropriate supporting evidence for the Tendring District Council's Local Plan

The SFRA will also provide evidence to inform site level Flood Risk Assessments or bespoke Flood Risk Assessment (FRA) guidance produced by Tendring District Council, as well as provided a clear evidence base for a community emergency plan.

Since the previous SFRA there have been a number of changes to the planning guidance and new legislation that includes the Localism Act (2011). Planning policy is now defined in March 2012 National Planning Policy Framework (NPPF) which should be used in conjunction with the Planning Practice Guidance (March 2014).

In addition, the provisions of the Flood and Water Management Act (2010) have been substantially commenced under a programme that was initiated by Defra in April 2010. Also the Flood Risk Regulations came into force in December 2009 (these regulations transposed the EU 'Floods Directive' into UK law).

The purpose of this SFRA update is to

- provide information that reflects the changes to planning, policy and guidance since the previous SFRA;
- provide a detailed assessment of the flood hazard within the Flood Zones;
- provide information on existing defences and flood risk management measures;
- allow a sequential approach to site allocation to be undertaken within a flood zone;
- allow development of the policies and practices required to ensure that development in Flood Zones 2 and 3 satisfies the requirements of the Exception Test; and
- to examine how existing flood risk could change relative to each time epoch of the South Suffolk and Essex Shoreline Management Plan (SMP)

SFRA Objectives

There are two levels of SFRA:

1. Level One: where flooding is not a major issue and where development pressures are low. The Assessment should be sufficiently detailed to allow application of the Sequential Test
2. Level Two: where land outside flood risk areas cannot appropriately accommodate all the necessary development and the NPPF's Exception Test needs to be applied. The Assessment should consider the detailed nature of the flood characteristics within a flood zone

As the risk of flooding is a significant issue in Jaywick this SFRA contains information that is appropriate for a Level Two assessment.

SFRA outputs

This version of the SFRA delivers

- an appraisal of current condition of flood defence infrastructure;
- an appraisal of the probability and consequences of overtopping or failure of flood risk management infrastructure, including the current agreed land use planning allowances for climate change;
- definition and mapping of the functional floodplain;
- definition and mapping of
    - flood depth;
    - flood velocity;
    - flood hazard; and

- time to inundate

- Maps showing the distribution of flood risk across all flood zones from all sources of flooding;
- advice on appropriate policies for sites which could satisfy the first part of the Exception Test and on the requirements that would be necessary for a site-specific flood risk assessment supporting a planning application for an application to pass the second part of the Exception Test;
- advice on the preparation of site-specific flood risk assessments for sites of varying risk across the flood zones; and
- recommendations to inform policy, development control and technical issues.

Summary and conclusions

The Jaywick SFRA update has considered all sources of flooding, including sea, fluvial, pluvial, groundwater, and sewer flooding, within the Jaywick area:

- An assessment of the flood defences in the area has been undertaken, including defence condition and the residual risk
- Flood risk has been assessed on all sites. Guidance for the requirements for a site specific Flood Risk Assessment is provided (Section 3, 7 and 8 and Appendix I)
- The updated Flood Map for Surface Water is provided, indicating the likelihood of surface water flooding in the Jaywick area
- Flooding from the sea has been considered through a range of overtopping and breach scenarios. Outlines, depths, velocities and hazard maps have been provided along with animations showing the rate of rise of depth and hazard in the area over time
- Emergency planning considerations, including provision of safe access and egress, have been provided, along with advice for the preparation of community and individual flood response plans

Flood risk

The SFRA update has shown that, at the current point in time, the flood defences currently protect the majority of the study area in the design event (0.5% AEP), with the exception for east of the counterwall by Belsize Avenue, at Broadway and at the golf course east of The Close where the defences are overtopped by wave overspill. These areas appear to coincide with stretches of the coastline where the beach is less wide in between the fish tail groynes. Over time, due to climate change, the flood defence standard of protection against overtopping will decline. It is expected that overtopping in the 0.5% AEP scenario will become worse and more widespread, with the defences at Seawick significantly increasing in the 2055 scenario compared to the current baseline. Overtopping of defences at Jaywick becomes worse during the 2055 scenario; the locations remain the same as the current scenario but the extent of flooding is larger. In the 2112 scenario all defences along the coast between west Clacton on Sea and Point Clear will be overtopped, resulting in extensive flooding.

Although the area is defended, there is a residual risk of high hazard to the areas behind these defences should a section of defence fail or breach when subjected to a surge tide. In some areas the defence condition is classed as Poor. Breach scenarios have shown that the counterwall provides protection to Jaywick and areas to the east of the counterwall from breaches of defences at Colne Point and west of Brooklands. However, a breach located by Tower Caravan Park to the east of the counterwall will have significant impacts on the extent and depth and flooding and hence the flood hazard.

Mitigation measures could reduce the impact of flooding or increase the ability of people affected but these are potentially costly. It should also be ensured that mitigation measures do not exacerbate flooding to development elsewhere.

The security of safe access and egress in the future is an issue for the area, with many of the main access/egress routes flooded in the 0.5% AEP climate change scenarios and the 0.1% AEP scenarios. The main route out of Brooklands and Jaywick village is particularly at risk, often remaining flooded for long durations. Flood defence crest levels would have to be increased or access routes raised to offset this problem arising through floodwaters overtopping the defences more frequently in the future.

In the event of a breach, access/egress routes become cut off rapidly. The depth and duration of flooding to access/egress routes is dependent upon the location of the breach and the tide level. Model scenarios showed primary routes flooded over 30 hours for the modelled three tide scenario; however, in reality the duration may be longer due to subsequent tide cycles and length of time taken to repair a breach.

Planning implications

Under the NPPF, the area should not be selected for new development unless the Exception Test can be passed. In order to pass the Exception Test, development will have to a) demonstrate that the development provides wider sustainability benefits to the community that outweigh flood risk and b) 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.

New development should not increase the overall flood risk in the area. Whilst raising land is a possibility, it has significant cost implications and practical difficulties close to existing developments. It also has the potential to make flooding worse to development elsewhere by altering flow routes and reducing the land area available for flood storage. Where this is the case the same flood volume will need to be accommodated on a smaller land footprint which could affect flood levels, pathways and the rates and characteristics of the flooding.

Access and egress for development needs to be considered, and improvements to planning for emergency access and egress will be needed.

Use of SFRA data

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

The Environment Agency regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed site-specific Flood Risk Assessment.

This version of the SFRA is a living document and should be periodically updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by the District Council, Essex County Council (in its role as Lead Local Flood Authority), the Highways Authority, Anglian Water and the Environment Agency.

The Environment Agency are currently producing a detailed 1D-2D model of the Jaywick Ditch, the results of which are expected after June 2015. The outlines produced by this detailed model will supersede the outlines provided in this SFRA. All site related flood risk assessments after June 2015 should refer to the Environment Agency's modelling for evaluating fluvial flood risk from the Jaywick Ditch.

It is recommended that Tendring District Council, the Environment Agency and other Category 1 responders work with the local community to build awareness and resilience to flooding and its associated risks. The evidence base provided by this SFRA will help inform a Community Emergency Response Plan for flooding and will also help to inform site level Flood Response Plans and Flood Risk Assessment s to support applications for new developments or plot level re-builds.

This page is intentionally left blank

Contents

List of Figures

List of Tables

Abbreviations and Glossary of terms

Term	Definition
1D model	One-dimensional hydraulic model
2D model	Two-dimensional hydraulic model
ABI	Association of British Insurers
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Cumecs	The cumec is a measure of flow rate. One cumec is shorthand for cubic metre per second; also m^3/s.
Defra	Department for Environment, Food and Rural Affairs
DPD	Development Plan Documents
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
FMfSW	Flood Map for Surface Water
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FRA	Flood Risk Assessment - A site specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
FZ	Flood Zones
Ha	Hectare
Indicative Flood Risk Area	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
LDDs	Local Development Documents
LDF	Local Development Framework
LFRMS	Local Food Risk Management Strategy
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
mAOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NPPF	National Planning Policy Framework
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
OS NGR	Ordnance Survey National Grid Reference
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir

Term	Definition
	Michael Pitt, which provided recommendations to improve flood risk management in England.
PPG	Planning Practice Guidance (NPPF)
PPS25	Planning and Policy Statement 25: Development and Flood Risk
R-Code	Programming language and software environment for statistical computing and graphics
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
uFMfSW	Updated Flood Map for Surface Water
WFD	Water Framework Directive

1 Introduction

1.1 Introduction

This updated version of the Jaywick Strategic Flood Risk Assessment (SFRA) 2014 replaces the document "Jaywick Strategic Flood Risk Study Final Report, May 2008". The updated report has been prepared to replace the work that was included in the previous SFRA and provide appropriate supporting evidence for the Tendring District Council's Local Plan[1]. The SFRA update will also provide evidence to inform site level Flood Risk Assessments or bespoke Flood Risk Assessment (FRA) guidance produced by Tendring District Council, as well as provided a clear evidence base for a community emergency plan.

Since the previous SFRA there have been a number of changes to the planning legislation and policy, including the Localism Act (2011) and the March 2012 National Planning Policy Framework (NPPF)[2] with supporting Planning Practice Guidance (March 2014)[3]. In addition, the provisions of the Flood and Water Management Act (2010) have been substantially commenced under a programme that was initiated by Defra in April 2010 and the Flood Risk Regulations came into force in December 2009 (these regulations transposed the EU 'Floods Directive' into UK law).

The purpose of this SFRA update is to

- provide information that reflects the changes to planning, policy and guidance since the previous SFRA;
- provide a detailed assessment of the flood hazard within the Flood Zones;
- provide information on existing defences and flood risk management measures;
- allow a sequential approach to site allocation to be undertaken within a flood zone;
- allow development of the policies and practices required to ensure that development in Flood Zones 2 and 3 satisfies the requirements of the Exception Test; and
- to examine how existing flood risk could change relative to each time epoch of the South Suffolk and Essex Shoreline Management Plan (SMP)

1.2 Study area

Jaywick is a seaside village on the east coast of England, in Essex. The main urban areas in Jaywick include Jaywick Village, Brooklands, Grasslands, Tudor Estate and Seawick (Figure 1-2). The village was originally intended as a holiday resort for Londoners. However, over time people have moved into the areas and it has become a permanent settlement.

The watercourses in the area are small and the various ditches and creeks reflect the natural state of the area as a coastal marsh prior to the construction of the sea defences.

[1] Tendring District Council Local Plan: Proposed Submission Draft (Tendring District Council, November 2012)

[2] National Planning Policy Framework (Department for Communities and Local Government, March 2012)

[3] National Planning Policy Framework Planning Practice Guidance: Flood Risk and Coastal Change (Department for Communities and Local Government, March 2014)

The coastal boundary for the study extends from the higher land at Point Clear along the coast to Clacton-on-Sea. Sea defences exist along the entire length of the coastline in the study area.

1.3 SFRA objectives

The Planning Practice Guidance advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

1. Level One: where flooding is not a major issue and where development pressures are low. The Assessment should be sufficiently detailed to allow application of the Sequential Test
2. Level Two: where land outside Zones 2 and 3 cannot appropriately accommodate all the necessary development creating the need to apply the NPPF's Exception Test. In these circumstances the Assessment should consider the detailed nature of the flood characteristics within a flood zone

As the risk of flooding is a significant issue in Jaywick the updated SFRA provides a Level 2 assessment.

1.4 SFRA outputs

This version of the SFRA delivers

- an appraisal of current condition of flood defence infrastructure;
- an appraisal of the probability and consequences of overtopping or failure of flood risk management infrastructure, including an allowance for climate change;
- definition and mapping of
    - flood depth;
    - flood velocity;
    - flood hazard; and
    - time to inundate
- maps showing the distribution of flood risk across all flood zones from all sources of flooding;
- maps showing time of inundation for a range of breach scenarios
- advice on appropriate policies for sites which could satisfy the first part of the Exception Test and on the requirements that would be necessary for a site-specific flood risk assessment supporting a planning application for an application to pass the second part of the Exception Test;
- advice on the preparation of site-specific flood risk assessments for sites of varying risk across the flood zones; and
- recommendations to inform policy, development control and technical issues.

1.5 SFRA user guide

Table 1-1 summarises the contents of this report.

Table 1-1: SFRA Report Contents

Section	Contents
1. Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultation performed
2 The Planning Framework and Flood Risk Policy	Includes information on the implications of recent changes to planning and flood risk policies and legislation.
3. How flood risk is assessed	Provides an overview of flooding and risk and flood zones. Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development.
4. Understanding flood risk in Jaywick	Provides an overview of the characteristics of all

Section	Contents
	sources of flooding affecting the Jaywick area.
5. Analysis of flood risk	Provides an analysis of the overtopping and breach scenarios assessed as part of the SFRA.
6. Flood risks at sites	Summary of risk to sites. Tabulated information and maps summarising risks to sites located within the study area, including development and emergency planning considerations
7. Mitigation measures	Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Considers various mitigation measures and their limitations.
8. Emergency planning in Jaywick	Provides an overview of emergency planning requirements and implications for development in Jaywick. Provides information on the development of community and individual flood response plans. Considers issues relating to safe access and egress and evacuations.
9. Summary and Conclusions	Reviews SFRA and its implications.

1.6 Approach

1.6.1 General assessment of flood risk

The flood risk management hierarchy underpins the risk based approach and is the basis for making all decisions involving development and flood risk. When using the hierarchy, account should be taken of

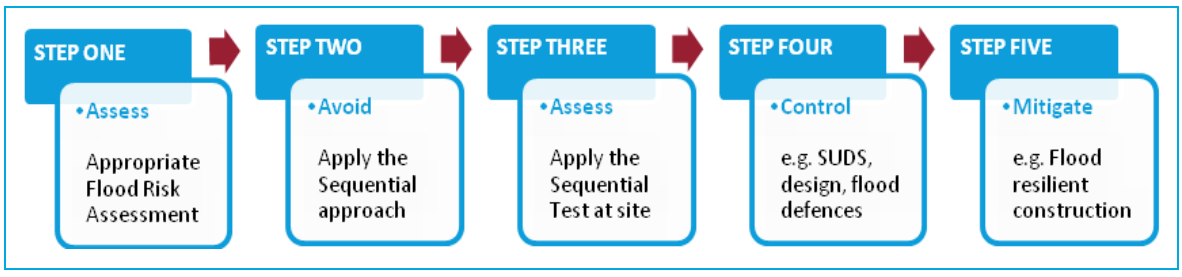
- the nature of the flood risk (the ***source*** of the flooding);
- the spatial distribution of the flood risk (the ***pathways*** and areas affected by flooding);
- climate change impacts; and
- the degree of vulnerability of different types of development (the ***receptors***).

Developments should reflect the application of the Sequential Test using the maps produced for this SFRA. The information in this SFRA should be used as evidence and, where necessary, reference should also be made to relevant evidence in other documents referenced in this report. The Flood Zone maps and flood risk information on other sources of flooding contained in this SFRA should be used where appropriate to apply the Sequential Test.

Where other sustainability criteria outweigh flood risk issues, the decision making process should be transparent. Information from this SFRA should be used to justify decisions to allocate land in areas at high risk of flooding.

The flood risk management hierarchy is summarised in Figure 1-1.

Figure 1-1: Flood Risk Management Hierarchy

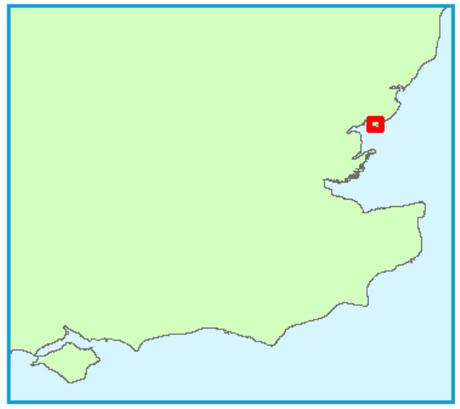


1.6.2 Technical assessment of flood hazards

Coastal flood risk within Jaywick has been assessed by updating the 2D hydraulic model developed as part of the 2008 SFRA. The model was amended to include up to date defence and topographic data as well as new information on tidal time series curves, wave overtopping information and predicted extreme sea water levels.

Information on other sources of flooding has also been assessed.

Figure 1-2: Study area



Legend

Main river

0 0.2 0.4 0.8 1.2 1.6 km

2 The planning framework and flood risk policy

2.1 Introduction

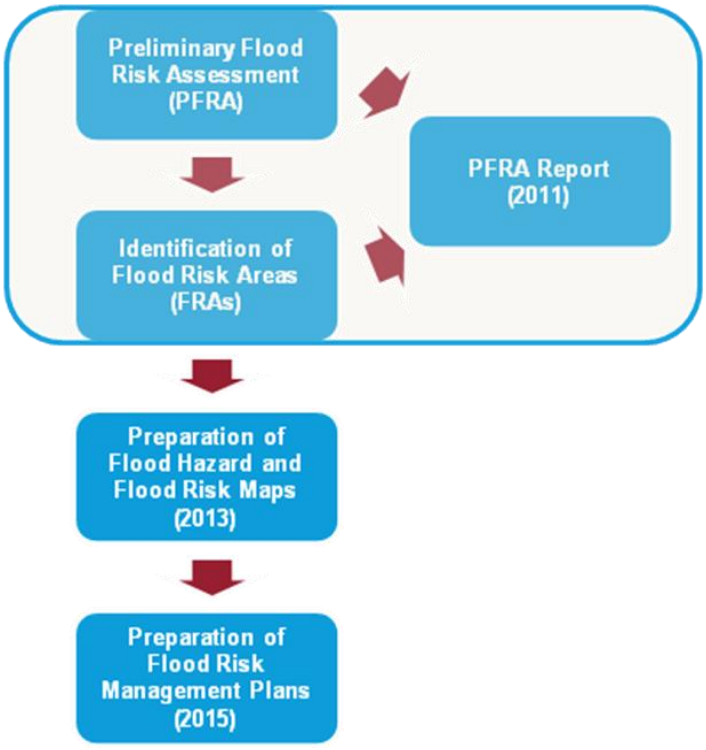
The purpose of the planning system is to contribute to the achievement of sustainable development (paragraph 6, NPPF). The over-arching aim of planning policy on development and flood risk is to ensure that flood risk is taken into account at all stages of the planning process. The purpose of this section of the report is to provide information on the main changes to the planning framework, flood risk responsibilities and flood risk policy since the 2008 SFRA was published. These changes have been taken into account in preparing this SFRA update.

2.2 Flood Risk Regulations (2009) and Flood and Water Management Act (2010)

The Flood Risk Regulations transpose the EU "Floods Directive" into UK law and place responsibility upon all Lead Local Flood Authorities (LLFAs) to manage local flood risk. Under the Regulations the Environment Agency is responsible for flooding from rivers, the sea and reservoirs with Lead Local Flood Authorities (in this instance Essex County Council) being responsible for local and all other sources of flooding.

Figure 2-1 sets out the requirements and timescales for implementing the requirements of the Directive.

Figure 2-1: Flood Risk Regulation Requirements



Lead Local Flood Authorities prepared the PFRA reports in accordance with the regulations and Essex County Council (ECC) published the document that covers the local authority area in 2011. The purpose of the PFRA was to identify areas where the local flood risk (primarily surface water and ground water flooding) was significant and in those circumstances it would then be necessary to prepare a Flood risk Management Plan and Hazard Mapping in accordance with the Regulations. The PFRA prepared by ECC did not identify any areas where local flood risk was significant.

The Environment Agency did not prepare a PFRA as they exercised an 'exception' that was permitted under the Regulations. Having exercised this exception the Environment Agency will have to prepare Flood Hazard and Flood Risk Maps and Flood Risk Management Plans for rivers, the sea and reservoirs.

The Flood and Water Management Act (FWMA) received Royal Assent in April 2010. The FWMA aims to create a simpler and more effective means of managing the risk of flood and coastal erosion and is one of the principle outcomes contributing to the implementation of Sir Michael Pitt's recommendations following his review of the 2007 floods.

The FWMA also called for the establishment of a SUDS Approving Body (SAB) to be set up in county, county borough or unitary local authorities. However, after consultation, an alternative approach has been adopted in which sustainable drainage systems are delivered via changes to the planning system rather than having a separate consulting regime of SABs. In March 2015, the following proposed change was given in response to the consultation. These changes came into effect from 6 April 2015.

- LLFAs will have a statutory role as a consultee, assessing and commenting of surface water drainage proposals, including sustainable drainage for major developments (10 properties or more).

Essex County Council has produced a SuDS Design Guide. This guide reflects local circumstances and aims to guide SuDS design in Essex and is found at http://www.essex.gov.uk/Environment%20Planning/Environmental-Issues/local-environment/flooding/View-It/Pages/Sustainable-drainage-systems.aspx.

2.2.1 Essex Preliminary Flood Risk Assessment (PFRA)

In the first instance, the regulations required Essex County Council (as the LLFA) to prepare and publish a Preliminary Flood Risk Assessment (PFRA) on past and future flood risk from local sources of flooding. The Regulations also require the LLFA to identify significant Flood Risk Areas. The PFRA reports on significant past and future flooding from all sources except Main Rivers, the sea and reservoirs (covered by Environment Agency) and sub-standard performance of the adopted sewer network (under the remit of Anglian Water).

The Essex PFRA does not include reference to flooding specific to Jaywick or the surrounding area.

2.3 Localism Act (2011)

The Localism Act was given Royal Assent on 15 November 2011 with the purpose of moving the balance of decision making from central government back to councils, communities and individuals.

Additionally Provision 110 of the Act places a duty to cooperate on local authorities in relation to planning of sustainable development. This duty to cooperate requires local authorities to "engage constructively, actively and on an ongoing basis in any process by means of which development plan documents are prepared so far as relating to a strategic matter"[4].

The Localism Act also provides new rights to allow local communities to shape new development by coming together to prepare neighbourhood plans. This means local people can decide where new homes and businesses should go and what they should look like. Local planning authorities will be required to provide technical advice and support as neighbourhoods draw up their proposals.

2.4 National Planning Policy Framework

The National Planning Policy Framework (NPPF) was issued on 27 March 2012 to replace the previous documentation, as part of reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. It replaces most of the Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs).

The NPPF is a source of guidance for local planning authorities to help them prepare Local Plans and for applicants preparing planning submissions. Paragraph 100 of the NPPF states "Local Plans should be supported by a strategic flood risk assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as Lead Local Flood Authorities and Internal Drainage Boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change"[2].

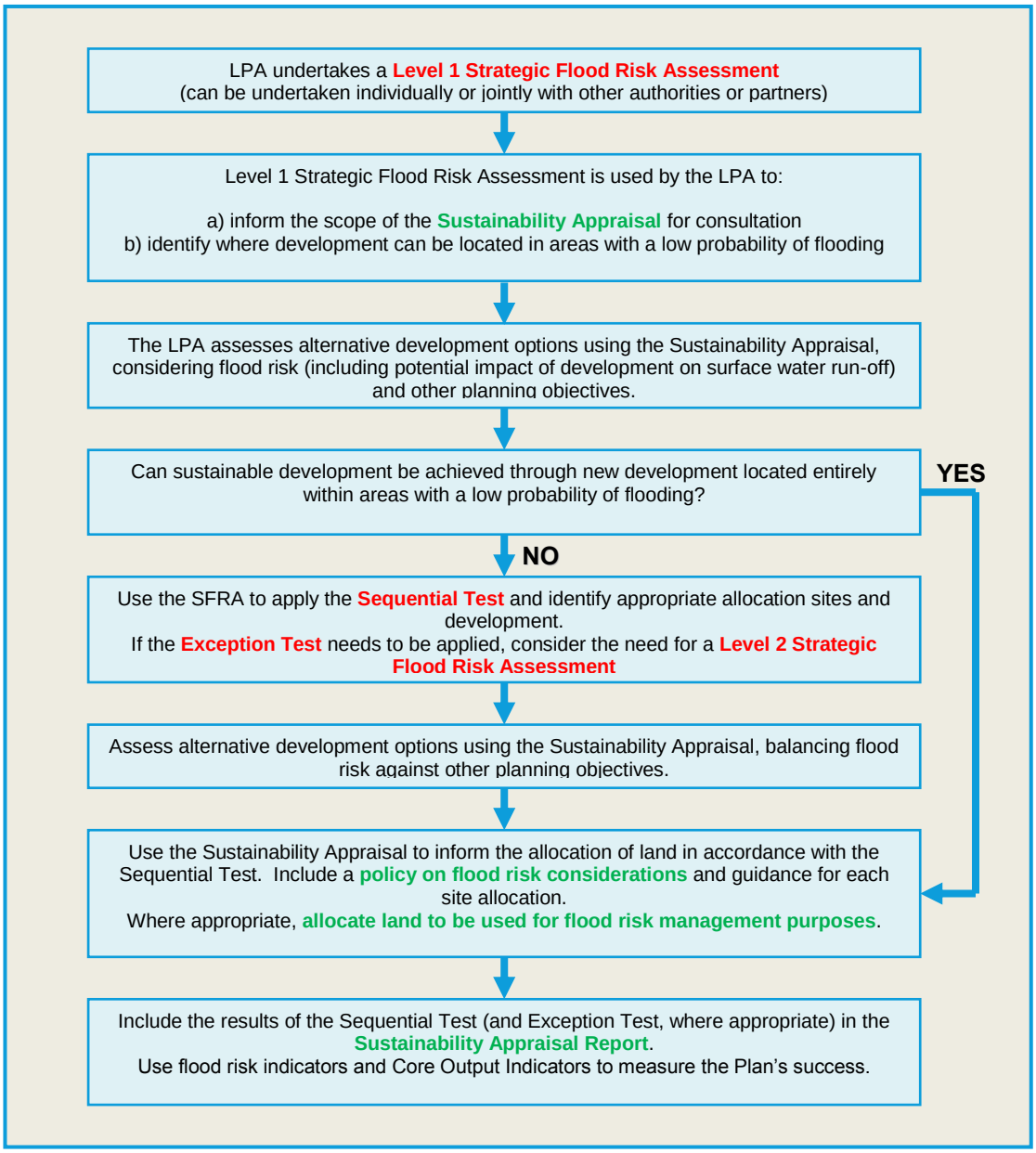
[4] Localism Act 2011: Section 110. http://www.legislation.gov.uk/ukpga/2011/20/section/110

Paragraph 100 sets out aspirations for local planning authorities and developers to 'use opportunities arising from development to reduce the causes and impacts of flooding' and 'to protect land that is important for current and future flood management'. This is particularly relevant for redevelopment and future ability to deliver improved flood defence infrastructure at Jaywick.

In March 2014 Planning Practice Guidance on flood risk was published alongside the NPPF[2] and sets out how the policy should be implemented. This guidance was updated in March 2015 to bring it up to date with the latest advices on SUDS and consultation.

Diagram 1 in the Planning Practice Guidance also sets out how flood risk should be taken into account in the preparation of Local Plans (Figure 2-2).

Figure 2-2: Flood risk and the preparation of Local Plans†



† Based on Diagram 1 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-021-20140306) March 2014

2.5 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location and are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in an area and should influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments. At the time of the publication of this SFRA update, no SWMP has been published that covers Jaywick.

2.6 Association of British Insurers Guidance on Insurance and Planning in Flood Risk Areas for Local Planning Authorities in England

The Association of British Insurers (ABI) and the National Flood Forum have published guidance for local authorities on planning in flood risk areas. The guidance aims to help local authorities in England when producing local plans and dealing with planning applications in flood risk areas. The guidance complements the National Planning Policy Framework. The key recommendations from the guidance are[5]

- ensure strong relationships with technical experts on flood risk;
- consider flooding from all sources, taking account of climate change;
- take potential impacts on drainage infrastructure seriously;
- ensure that flood risk is mitigated to acceptable levels for proposed developments;
- make sure Local Plans take account of all relevant costs and are regularly reviewed
- not more than 1% annual probability of flooding is necessary to give developments a good chance of accessing flood cover at a competitive price;
- developments should only be approved if the flood risk is acceptable (not more than a 1% annual probability) not just in the present, but for their full anticipated lifetime, taking account of climate change projections; and
- it is vital that those ultimately owning any new developments are able to access insurance. Building insurance underpins mortgage lending – to the extent that a failure to access insurance usually means no mortgage. If insurance is not available, a property may become impossible to buy or sell.

2.7 Implications for Tendring District Council

The new and emerging responsibilities under the Flood and Water Management Act and the Flood Risk Regulations are summarised in Table 2-1.

Figure 2-3 shows the key strategic planning links for flood risk and associated documents. It shows how the Flood Risk Regulations and Flood and Water Management Act, in conjunction with the Localism Act's "duty to cooperate", introduce a wider requirement for the exchange of information and the preparation of strategies and management plans.

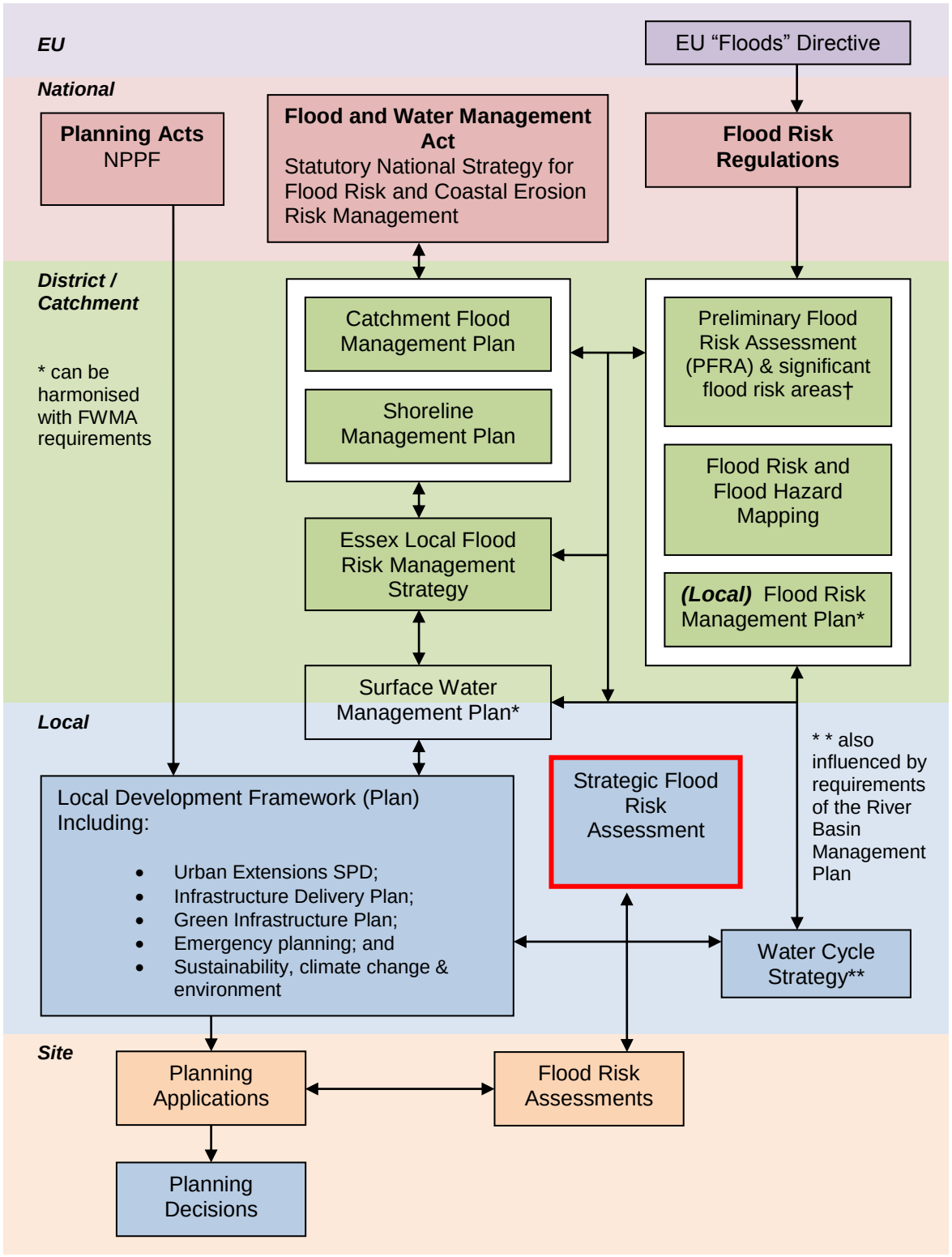
SFRAs contain information that should be referred to in responding to the Flood Risk Regulations and the formulation of local flood risk management strategies and plans. SFRAs are also linked to the preparation of Catchment Flood Management Plans (CFMPs), Shoreline Management Plans (SMPs), Surface Water management plans (SWMPs) and water cycle strategies (WCSs) as well as the Essex County Council Local Flood Risk Management Strategy.

[5] Guidance on Insurance and Planning in Flood Risk Areas for Local Planning Authorities in England (Association of British Insurers and National Flood Forum, April 2012)

Table 2-1: Roles and Responsibilities in Essex

Risk Management Authority (RMA)	Strategic Level	Operational Level
Environment Agency	National Statutory Strategy Reporting and supervision (overview role)	Main rivers, sea, reservoirs • Preliminary Flood Risk Assessment (per River Basin District) • Identify Significant Flood Risk Area • Flood Risk and Hazard Maps • Flood Risk Management Plan Enforcement authority for Reservoirs Act 1975
Lead Local Flood Authority (Essex County Council)	Input to national strategy. Formulate and implement local flood risk management strategy.	Surface water, groundwater, other sources of flooding • Prepare and publish a PFRA • Identify Flood Risk Areas • Prepare Flood Hazard and Flood Risk Maps • Prepare Flood Risk Management Plans
Lower Tier authorities (Tendring District Council)	Input to National and Local Authority Plans and Strategy (e.g. Local Development Framework Documents) • Jaywick Regeneration Strategy	• Ordinary watercourse • Approval of surface water management for new developments and planning applications

Figure 2-3: Strategic planning links and key documents for flood risk



† See Table 2-1 for roles and responsibilities for preparation of information

2.7.1 Tendring District Local Plan (2012)

The 2012 Tendring District Local Plan Proposed Submission Draft[6] sets out 'priority areas for regeneration' including the Brooklands, Grasslands and 'the Village' area of Jaywick (Policy COS10).

The policy describes how the NPPF provides councils with more freedom to apply planning policies to better reflect local circumstances and, sets out how the council, Environment Agency and other partners have agreed a more practical approach to planning through the lifting of some planning restrictions and having more flexible policies aimed at encouraging developers "to provide high-quality, resilient and innovative new homes in the area and allowing householders to improve their properties' safety and resilience, whilst resisting poor quality and unsafe single-storey development".

2.7.2 Essex and South Suffolk Shoreline Management Plan 2 (2010)

Shoreline Management Plans (SMPs) are high-level policy documents in which the organisations that manage the shoreline set out their long-term plans. SMPs are an important part of Defra's strategy for managing flooding and coastal erosion.

There are four pre-defined policies that describe the intent for management of the shoreline:

1. Hold the Line – means holding the existing defence line by maintaining or changing the standard of protection
2. Advance the Line – means building new defences seaward of the existing defence line
3. Managed Realignment – means allowing or enabling the shoreline to move, with associated management to control or limit the effect on land use and environment
4. No Active Intervention – means no investment in coastal defences or operations.

Jaywick is covered by Policy Development Zone C4 of Management Unit C (Tendring Peninsula) of the SMP. In the short and medium term, the intent is to hold the existing frontline defences as they currently exist (Hold the Line). After 2055 the intent is less fixed and depends on the development of the Local Development Framework in the coming years. Therefore, the SMP proposes a dual policy of Managed Realignment or Hold the line. The SMP states that any policy implemented will ensure a commitment to continued appropriate flood defence for the communities and associated socio economic features at Jaywick and will also ensure continued use of the area for leisure, recreation and tourism[7].

2.7.3 North Essex Catchment Management Plan (2009)

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

There are six pre-defined national policies provided in the CFMP guidance and these are applied to specific locations through the identification of 'Policy Units'. These policies are intended to cover the full range of long term flood risk management options in the catchment that can be applied to different locations.

The six national policies are

1. no active intervention (including flood warning and maintenance). Continue to monitor and advise;
2. reducing existing flood risk management actions (accepting that flood risk will increase over time);
3. continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline);
4. take further action to sustain the current level of flood risk (responding to the potential increases in risk from urban development, land use change and climate change);
5. take action to reduce flood risk (now and/or in the future); and

[6] Tendring District Local Plan Proposed Submission Draft (Tendring District Council, November 2012)

[7] Essex and South Suffolk Shoreline Management Plan 2: Final version 2.4 (October 2010)

6. take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

Jaywick is covered by the North Essex CFMP. The Policy Unit of importance to Jaywick is Policy Unit 8 (Harwich and Clacton-on-Sea), to which Policy 3 has been applied. The SFRA will help contribute to this policy by enabling the Council to make informed decisions about the location of future development, as well as identifying where future flood risk management measures may be required.

3 How flood risk is assessed

3.1 Definitions

The following definitions are used in the assessment of flood risk:

3.1.1 Flood

Section1 (subsection 1) of the FWMA defines a flood as:

'any case where land not normally covered by water becomes covered by water'.

Section1 (subsection 2) states 'it does not matter for the purposes of subsection (1) whether a flood is caused by –

(a) Heavy rainfall

(b) A river overflowing or its banks being breached

(c) A dam overflowing or being breached

(d) Today waters

(e) Groundwater, or

(f) Anything else (including any combination of factors).

Note: Source does not include the following – flood from any part of a sewerage system, unless caused by an increase in the volume of rainwater, entering or affecting the system, or a flood caused by a burst water main.

3.1.2 Flood Risk

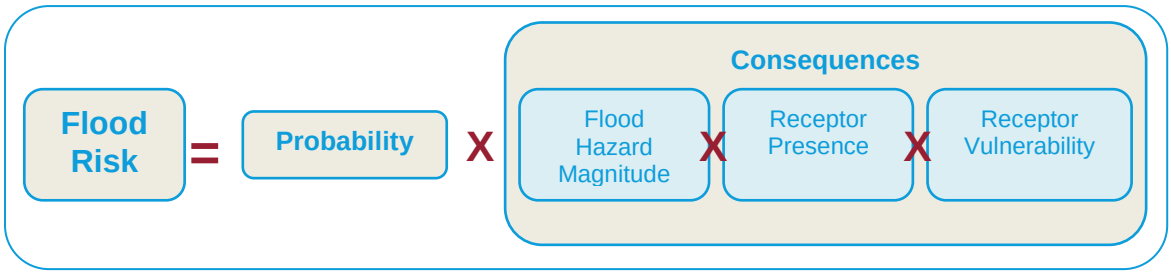
Section 3(subsection 1) of the FWMA defined flood risk as:

'a risk in respect of an occurrence assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences.'

Thus it is possible to define flood risk as:

Flood Risk = (Probability of a flood) x (Scale of the Consequences)

On that basis it is useful to express the definition as follows:



Using this definition it can be seen that

- **increasing the probability or chance of a flood being experienced increases the flood risk.** In situations where the probability of a flood being experienced increases gradually over time, for example due to the effects of climate change, then the severity of the flood risk will increase (flooding becomes more frequent or has increased effect); and
- **the scale of the consequences can increase the flood risk:**
    - Flood Hazard Magnitude: If the direct hazard posed by the depth of flooding, velocity of flow, the speed of onset, rate of rise in flood water or duration of inundation is increased, then the consequences of flooding, and therefore risk, is increased
    - Receptor presence: The consequences of a flood will be increased if there are more receptors affected, for example with an increase in extent or frequency of

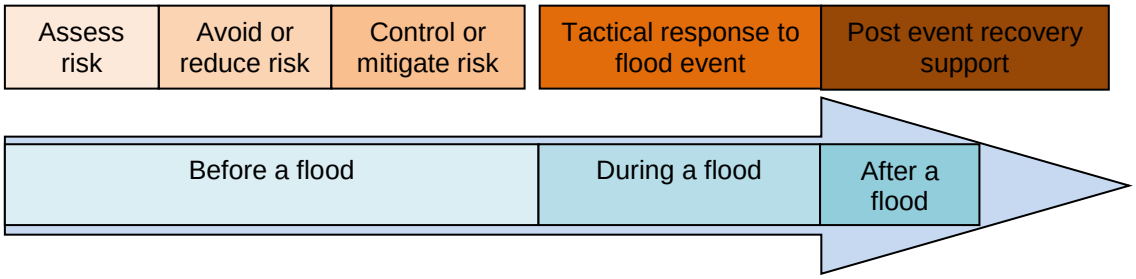
flooding. Additionally, if there is new development that increases the probability of flooding (for example, increase in volume of runoff due to increased impermeable surfaces) or increased density of infrastructure then consequences will also be increased

- Receptor vulnerability: If the vulnerability of the people, property or infrastructure is increased then the consequences are increased. For example, old or young people are more vulnerable if there is a flood, or some types of property being more vulnerable to damage and becoming unsafe if affected by flooding, or property does not provide refuge levels above potential inundation levels. conversely some critical infrastructure can give rise to significant harmful consequences if affected by flooding, e.g. water or electricity supply

3.2 Using SFRA risk information

This SFRA contains information that can be used at strategic, operational and tactical levels as shown by Figure 3-1.

Figure 3-1: Uses of SFRA information



The assessment of flood risk in the SFRA is primarily based on the following three types of information

3.2.1 Flood Zones

The SFRA includes maps that show the flood zones. These zones describe the land that would flood if there were no defences present. The NPPF Guidance identifies the following Flood Zones, see Table 3-1.

Table 3-1: Flood Zone descriptions

Probability		Description
Zone 1	Low	This zone comprises land assessed as having less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
Zone 2	Medium	This zone comprises land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (0.1% - 1%) or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.1% – 0.5%) in any year.
Zone 3a	High	This zone comprises land assessed as having greater than 1 in 100 annual probability of river flooding (>1.0%) or greater than 1 in 200 annual probability of flooding from the sea (>0.5%) in any year.
Zone 3b	Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain should take account of local circumstances.

The preference when allocating land is, whenever possible, to place all new development on land in Zone 1. Since the Zones identify locations that are not reliant on flood defences, placing

development on Zone 1 land means that in future there is no future commitment to spending money on flood banks or flood alleviation measures and not committing future generations to costly long term expenditure that would become increasingly unsustainable as the effects of climate change increase.

3.2.2 Actual Flood Risk

If it has not been possible for all future development to be situated in Zone 1 then a more detailed assessment is needed to understand the implications of locating proposed development in Zones 2 or 3. This is accomplished by considering information on the "actual risk" of flooding. The assessment of actual risk takes account of the presence of flood defences and provides a picture of the safety of existing and proposed development. It should be understood that the standard of protection afforded by flood defences is not constant and it is presumed that the required minimum standards for new development are

- residential development should be protected against flooding with an annual probability of river flooding of 1% (1 in 100 year chance of flooding) in any year; and
- residential development should be protected against flooding with an annual probability of tidal (sea) flooding of 0.5% (1 in 200 year chance of flooding) in any year.

In addition the National Flood Forum and Association of British Insurers advice on standards and probability of flooding should also be considered (see Section 2.6)

The assessment of the actual risk should take the following issues into account:

- the level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated
- the flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth then it will be a priority for the Flood Risk Management Strategy to be reviewed
- the standard of safety must be maintained for the intended lifetime of the development (assumed to be 100 years for residential development). Over time the effects of climate change, and the residual structural lifetime of an aging flood defence, will erode the present day standard of protection afforded by defences, and so commitment is needed to invest in the maintenance and upgrade of defences if the present day levels of protection are to be maintained.
- the assessment of actual risk can include consideration of the magnitude of the hazard posed by flooding. By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources at individual locations within the floodplain. This assessment will be needed in circumstances where consideration is given to the mitigation of the consequences of flooding or where it is proposed to place lower vulnerability development in areas that are at risk from inundation.

For information on defences reference should be made to the Environment Agency's Asset Information Management System (AIMS) which contains details on the standard of protection of defences.

3.2.3 Residual Risk

The residual risk refers to the risks that remain in circumstances where measures have been taken to alleviate flooding. It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be

- the effects of a flood with a magnitude greater than that for which the defences or management measures have been designed to alleviate (the 'design flood' – 0.5% annual exceedance probability). This can result in over topping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming discharges; or
- failure of the defences or flood risk management measures to perform their intended duty. This could be breach failure of flood embankments, failure of flood gates to operate in the intended manner or failure of pumping stations.

The assessment of residual risk demands that attention be given to the vulnerability of the receptors and the response to managing the resultant flood emergency. Information provided in this SFRA provides part of the evidence base the council will use to carry out the Exception Test and determine whether a development can considered to be 'safe'. Attention should also be paid to the characteristics of flood emergencies and the roles and responsibilities during such events. Additionally for breach and overtopping events consideration should be given to the structural safety of the dwellings or structures that could be adversely affected by significant flood flows or flood depths.

3.3 The Sequential risk-based approach

In the case of Jaywick, it is not possible for all new development to be allocated on Zone 1 land that is not at risk from flooding. In these circumstances the Flood Zone maps that show the extent of inundation assuming that there are no defences do not provide an appropriate level of detailed information to inform decisions on land use. In circumstances where it is necessary to allocate land in Zones 2 or 3 a greater understanding of the scale and nature of the flood risks are required. To achieve this, more detailed coastal modelling has been undertaken, including depth, hazard and velocity outputs.

When deciding on the ability to manage flood risk for new development located in Zone 2 and 3 consideration must be given to a wide range of issues. The issues to be addressed include how any evacuation of the occupants would be handled, how the new development fits in with the existing flood management provision and, in circumstances where flooding is experienced how quickly the wider area would recover and return to normal. These issues should be considered as part of a community emergency plan.

At some of the locations it could be found that Flood Risk Management measures are more easily integrated alongside proposed new development to address the flood risk issues, usually as a consequence of the prevailing natural or artificial topography. In these circumstances the Flood Risk Management proposals could be deployed without causing a significant alteration to the design and its place setting. However, even in these circumstances it should be recognised that Flood risk Management Measures at one location can have the potential to cause an alteration to the flood risk to adjacent property or in the flood cells on the opposite bank by changing flow paths or altering the extent of land available to accommodate a volume of flood water. This could contravene clear policy advice set out in paragraphs 100, 102 and 103 of the NPPF.

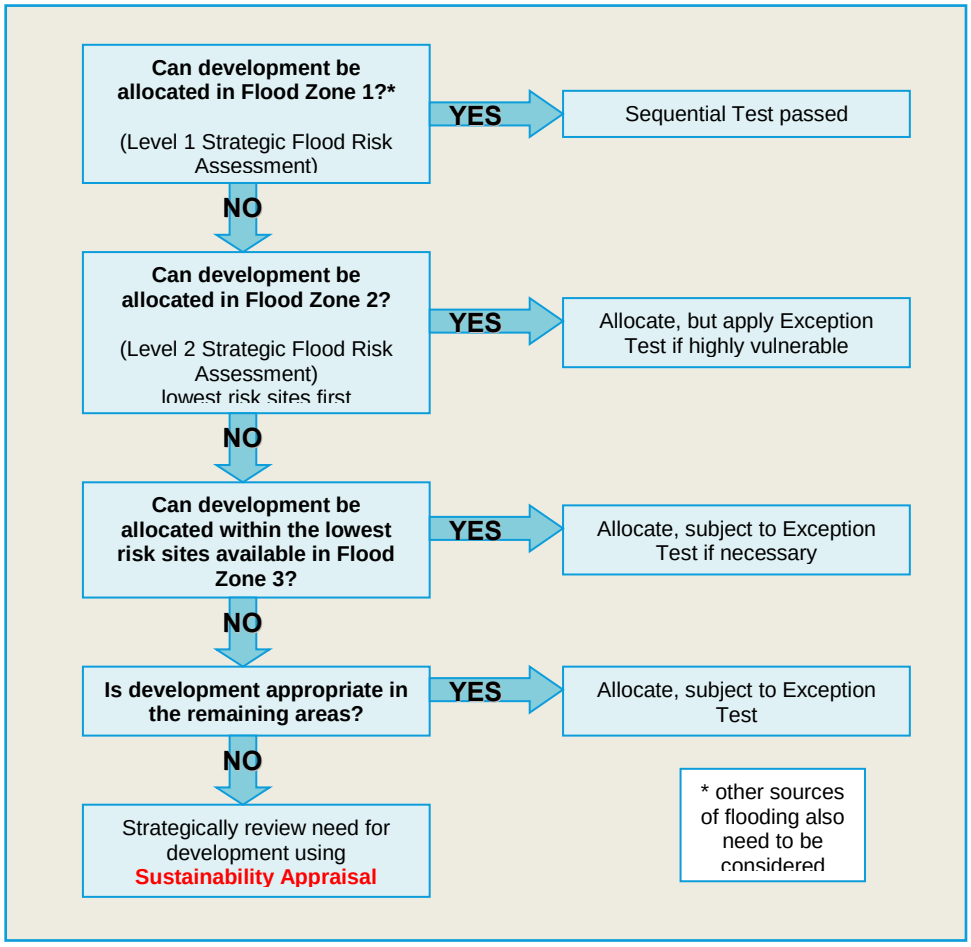
3.4 Applying the Sequential Test and Exception Test in the preparation of a Local Plan

When preparing a local plan, the Local Planning Authority should demonstrate it has considered a range of site allocations, using Strategic Flood Risk Assessments to apply the Sequential and Exception Tests where necessary.

The Sequential Test should be applied to the whole local planning authority area to increase the likelihood of allocating development in areas not at risk of flooding. The Sequential Test can be undertaken as part of a local plan sustainability appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of strategic housing land or employment land availability assessments. NPPF Planning Practice Guidance for Flood Risk and Coastal Change describes how the Sequential Test should be applied in the preparation of a Local Plan (Figure 3-2).

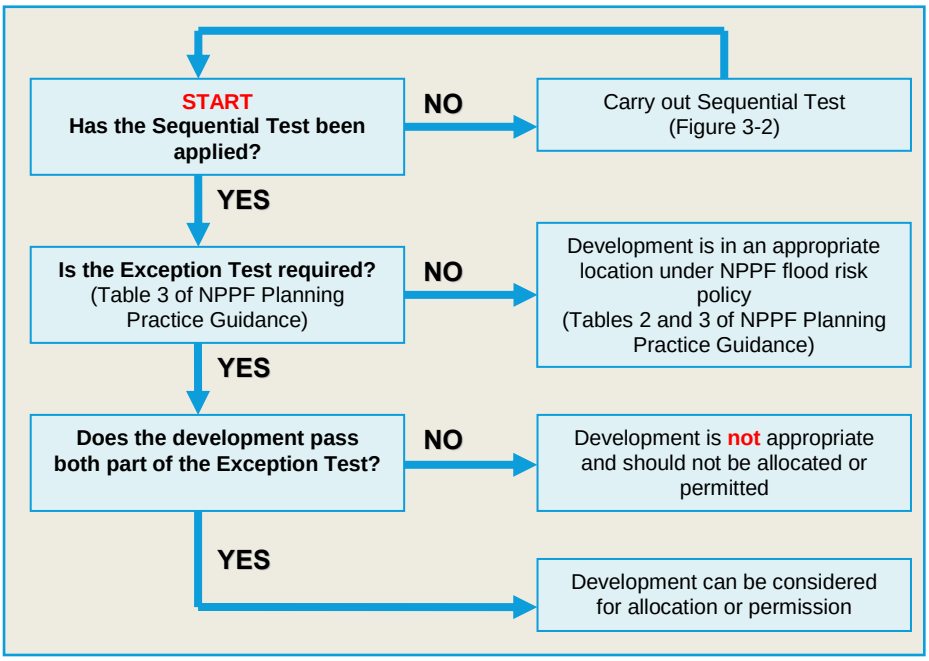
The Exception Test should only be applied *following* the Sequential Test and as set out in Table 3 of the NPPF Planning Practice Guidance: Flood Risk and Coastal Change. Diagram 2 in the NPPF Planning Practice Guidance for Flood Risk and Coastal Change describes how the Exception Test should be applied in the preparation of a Local Plan (Figure 3-3).

Figure 3-2: Applying the Sequential Test in the preparation of a Local Plan†



† Based on Diagram 2 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 020, Reference ID: 7-021-20140306) March 2014

Figure 3-3: Applying the Exception Test in the preparation of a Local Plan†



† Based on Diagram 3 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 028, Reference ID: 7-021-20140306) March 2014

3.5 Applying the Sequential Test and Exception test to individual planning applications

Diagram 3 in the NPPF Planning Practice guidance describes how the Exception Test should be applied and is shown as Figure 3-3 in the SFRA. In addition the Guidance[8] sets out how developers and planners need to consider flood risk to, and from, the development site, following the broad approach of assessing, avoiding, managing and mitigating flood risk. A checklist for Site Specific Flood Risk Assessments is provided in Paragraph 68 of the Guidance.

A site-specific flood risk assessment should be carried out to assess flood risk to, and from a development. The assessment should demonstrate how flood risk will be managed over a development's lifetime, taking climate change and the user vulnerability into account.

The NPPF Planning Practice Guidance sets out the following objectives for a site specific Flood Risk Assessment (FRA). An FRA should 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 required) the Sequential Test; and
- whether the development will be safe and pass the Exception Test (where applicable)

3.5.1 Sequential Test

The Sequential Test must be performed by the local planning authority when considering the placement of future development and for planning application proposals. The sequential approach to locating development should be followed for all sources of flooding. The Flooding and Coastal Change Planning Practice Guidance to the NPPF gives detailed instructions on how to perform the test.

The Sequential Test does not need to be applied for individual developments under the following circumstances

- the site has been identified in development plans through the prior application of the Sequential Test; or
- applications for minor development or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site).

The Sequential Test does not normally need to be applied for individual developments under the following circumstance

- development proposals in Flood Zone 1 (unless the SFRA for the area, or any other recent information, indicates there may be flooding issues now or in the future).

For developments that do not fall under the above categories, local circumstances must be used to define the area of application of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). The criteria used to determine the appropriate search area relate to the catchment area for the type of development being proposed. For some sites this may be clear, in other cases it may be identified by other Local Plan policies[8]. A pragmatic approach should be taken when applying the Sequential Test.

Local planning authorities, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied, and will need to be satisfied that the proposed development would be safe and not lead to increased flood risk elsewhere.

The information provided in this SFRA can be used to

8 NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 033, Reference ID: 7-056-20140306) March 2014

- identify the area to be assessed (including alternatives) on the Flood Zone Maps that are provided with this assessment;
- establish the risk of flooding from other sources; and
- follow the instructions given in the Planning Practice Guidance.

3.5.2 Exception Text

If, following application of the Sequential Test, it is not possible for the development to be located in areas with a lower probability of flooding then the Exception Test must be applied, if appropriate. The aim of the Exception Test is to ensure that more vulnerable property types, such as residential development can be implemented safely and are not located in areas where the hazards and consequences of flooding are inappropriate. For the Test to be satisfied, both of the following elements have to be accepted for development to be allocated or permitted:

1. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared

   Local planning authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied, and provide advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the local planning authority should consider whether the use of planning conditions and/or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused[9]

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

   The site specific flood risk assessment should demonstrate that the site will be safe and the people associated with the development will not be exposed to hazardous flooding from any source. The following should be considered:[10]

   - The design of any flood defence infrastructure
   - Access and egress
   - Operation and maintenance of any flood defences
   - Design of development to manage and reduce flood risk wherever possible
   - Resident awareness
   - Flood warning and evacuation procedures
   - Any funding arrangements required for implementing measures
   - The characteristics of flooding at and around the development, should it occur

The NPPF and Planning Practice Guidance provide detailed information on how the Test can be applied.

3.6 Cumulative impact of development

When allocating land for development, consideration must be given to the potential cumulative impact of the loss of floodplain or flood cell storage volume. The effect of the loss of volume should be assessed, at both the development and elsewhere within the catchment or cell and, if required, the scale and scope of appropriate mitigation should be identified[2]. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk the cumulative effect of multiple developments may be more severe.

Application of the flood risk management hierarchy should be used before measures such as land raising or new defences are considered[2]. Developers should also consider how development can be used to provide flood risk benefits downstream or within a flood cell.

[9] NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 037, Reference ID: 7-056-20140306) March 2014

[10] NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 038, Reference ID: 7-056-20140306) March 2014

3.7 Possible responses to flooding

3.7.1 Assess

The first response to flooding must be to understand the nature and frequency of the risk. The assessment of risk is not just performed as a "one off" during the process, but rather the assessment of risk should be performed during all subsequent stages of responding to flooding.

3.7.2 Avoid

The sequential approach requires that the first requirement is to avoid the hazard. If it is possible to place all new growth in areas at a low probability of flooding then the flood risk management considerations will relate solely to ensuring that proposed development does not increase the probability of flooding to others. This can be achieved by implementing SUDS systems and other measures to control and manage run-off. In some circumstances it might be possible to include measures within proposed growth areas that reduce the probability of flooding to others and assist existing communities to adapt to the effects of climate change. In such circumstances the growth proposals should include features that can deliver the necessary levels of mitigation so that the standards of protection and probability of flooding are not reduced by the effects of climate change. In Jaywick, consideration should be given not only to the peak flows generated by new development but also to the volumes generated during longer duration storm events. This is an issue that is important in Jaywick due to the potential for tide locking of gravity sluice outfalls at the end of existing drainage channels.

3.7.3 Substitute, Control and Mitigate

These responses all involve management of the flood risk and thus require an understanding of the consequences (the magnitude of the flood hazard and the vulnerability of the receptor).

There are opportunities to reduce the flood risk by lowering the vulnerability of the proposed development. For instance changing existing residential land to commercial uses will reduce the risk provided that the residential land can then be located on land in a lower risk flood zone.

Flood risk management responses in circumstances where there is a need to consider growth or regeneration in areas that are affected by a medium or high probability will include

- strategic measures to maintain or improve the standard of flood protection so that the growth can be implemented safely for the lifetime of the development (must include provisions to invest in infrastructure that can adapt to the increased chance and severity of flooding presented by climate change);
- design and implement measures, such as raised floor levels, so that the proposed development includes features that enables the development and its users to adapt to the increased probability and severity of flooding whilst ensuring that new communities are safe and that the risk to others is not increased (preferably reduced); and
- flood resilient measures, such as the provision of refuge areas above potential flood levels, that reduce the consequences of flooding to development and its users so that the magnitude of the consequences is reduced. Such measures would need to be considered alongside improved flood warning, evacuation and welfare procedures so that occupants affected by flooding could be safe for the duration of a flood event and rapidly return to properties after an event had been experienced.

  It should be noted that the Flood and Coastal Risk Management Grant in Aid (FCRMGiA) funding arrangements introduced in 2011 do not make government funds available for any new development implemented after 2012, this includes plot level rebuilds. Accordingly it is essential that appropriate funding arrangements are established for new development proposed in locations where a long term investment commitment is required to sustain Flood Risk Management measures. The strategic investment commitment is required so that in future the Flood Risk Management measures can be maintained and afforded for the lifetime of the development, since the available funds from FCRMGiA will potentially not reflect the scale of development that is benefitting. This is essential for Jaywick. Large scale redevelopment is likely to reduce the deprivation factor that supplements the central Government GiA calculator; this will mean, in future, the cost of new flood defence infrastructure will have to be sought through local contributions.

4 Understanding flood risk in Jaywick

4.1 Historical flooding

The previous version of the Jaywick SFRA published in 2008 included an assessment of historical flooding in Jaywick. A summary of recorded flood events in Jaywick are provided in Table 4-1.

Table 4-1: Historical flooding in Jaywick

Date	Source of flooding	Location affected
1730	Tidal	Jaywick
December 1936		
1938		
1944		
1946		
August 1948		
March 1949		
January 1953	Tidal (breach)	Central St Osyth Marsh, Lee-over sands, Seawick and Jaywick
December 1978	Tidal and fluvial/wave overtopping	Jaywick, excluding Brooklands and Grasslands
December 1982	Tidal	Jaywick
December 2013	Tidal	East Coast of England

4.1.1 December 2013

Since the previous SFRA was published there has only been one significant flood event in Jaywick. In December 2013, a significant tidal surge along the east coast of England was predicted to cause severe coastal flooding and resulted in the evacuation of Jaywick. Although there were no reports of flooding to property in Jaywick, it was observed that defences were close to overtopping. The 2013 surge was not associated with the strong onshore winds as had been experienced during the 1953 surge and if the wind strength and direction had been more severe it is likely that the defences would have been overtopped. The peak of the surge did not coincide with the time of the astronomical high tide in this area. If it had, there would have been more significant overtopping of the defences and an increased risk of breach.

The high tide levels give rise to a risk of flooding due to failure of the defences which could pose a risk to life. If the defences did fail it may not be feasible to evacuate the community in the short time available before the onset of flooding (a breach in the defence to the east of the counterwall would result in flooding to the Tower Caravan Park and areas of Grasslands within 15 minutes of the breach).

Note: the feasibility of evacuating the community would depend upon the location of the breach.

4.2 Main sources of flood risk

4.2.1 Tidal flood risk

Most of the land at Jaywick, Brooklands, Grasslands, Seawick and the St Osyth marshes would be at risk from tidal flooding were it not for the presence of the defences in place along the coast. The area is in Flood Zones 2 and 3 which represents the area that would be flooded in the 0.5% AEP and 0.1% AEP tidal surge if there were no defences. The risk is evidenced by the observed events of 1953 when extensive areas were flooded due to overtopping and breaching of the defences (previously the defences offered a lower standard of protection). In the year 1978 there was also some flooding due to wave overtopping at Jaywick.

The probability of a failure of the sea defences occurring is reduced by the actions of the Environment Agency in maintaining the defences and beach but there remains a residual risk from tidal flooding. An assessment of the 'residual' risk is essential for planning purposes. A more detailed assessment, with more attention to likely locations of defence failure is detailed in Section 5.

4.2.2 Fluvial flood risk

Fluvial flooding in the Jaywick area is caused when high flows occur following rainfall at a time of high tide during which there is limited discharge to the sea due to tide locking of gravity outfalls and sluices.

The Environment Agency provided the location of main rivers, and in the Jaywick area there are only relatively small ditches from which the fluvial flood extent is not currently shown on Environment Agency mapping due to the dominance of tidal flooding in the area. Jaywick ditch drains Jaywick Village and Grasslands and then flows to a confluence with Bonds ditch before draining to the sea through a flapped outfall. The St Osyth ditch connects with Bonds ditch draining Seawick via a sluice through the counterwall to the Jaywick side and the main outfall is to the Colne Estuary controlled by Leewick sluice.

A separate outfall serves the Brooklands ditch which drains the Brooklands area and outfalls directly to the sea and is not linked to any other ditches. Outfalls of all these ditches are controlled by flap gates backed up by a manual sluice in case of failure.

There was flooding from the Jaywick ditch in 1978 when the ditch was draining wave overtopping of the seawall. The extent and significance of the flooding along the Jaywick ditch was not severe and only a few properties were flooded. Since this event significant improvements have been made to the flood defences, reducing the risk of wave overtopping. However, the event does serve to demonstrate the potential importance of the volume of overtopping flows from tidal events contributing to the severity of fluvial events. It will be important when preparing FRAs to consider the implications and residual risks associated with joint probability events.

There is a potential for blockage of such structures by debris, both from natural and human sources. Small culverts are most at risk from blockage, and those with trash screens (if they are not cleared during the event), but even larger culverts can get blocked quite rapidly as debris accumulates. Poor maintenance and damage to the structures by the owners can exacerbate blockage problems. Any blockage that does occur as a result of debris accumulation will cause water levels to be raised upstream of the structure and consequently increase flood risk in these locations. Community flood awareness and resilience programmes should promote awareness of the vulnerability of these structures to debris accumulation and blockage, and the need to discourage and report instances of fly-tipping or other activities that may exacerbate the risk of flooding to Tendring District Council and the Environment Agency.

4.3 Other sources of flood risk

4.3.1 Surface water

Flooding from surface water runoff is usually caused by intense rainfall that may only last a few hours and usually occurs in lower lying areas, often where the drainage system is unable to cope with the volume of water. Surface water flooding problems are inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding.

The updated Flood Map for Surface Water (uFMfSW) predominantly follows topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas. It should be noted that, because of its broad-scale nature, wherever possible these mapped outlines should be used in conjunction with other sources of local flooding information to confirm the presence of a surface water risk.

The uFMfSW is provided in Appendix F. The uFMfSW shows the flooding that takes place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which

a. is on the surface of the ground (whether or not it is moving); and
b. has not yet entered a watercourse, drainage system or public sewer.

The updated Flood Map for Surface Water will pick out natural drainage channels, low areas in the floodplain, and flow paths between buildings, but it will only indicate flooding caused by local rainfall.

4.3.2 Groundwater

In comparison to fluvial flooding, current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. There is currently no one organisation with responsibility to respond to groundwater flooding, therefore the risks and mechanisms of groundwater flooding are poorly reported. However, under the Flood and Water management Act (2010), LLFAs have powers to undertake risk management functions in relation to groundwater flood risk. Groundwater level monitoring records are available for areas on Major Aquifers. However, for lower lying valley areas, which can be susceptible to groundwater flooding caused by a high water table in mudstones, clays and superficial alluvial deposits, very few records are available.

The Areas Susceptible to Ground Water Flooding (AStGWf) map is provided in Appendix G. The AStGWf is a strategic scale map showing groundwater flood areas on a 1km square grid. The data was produced to annotate indicative Flood Risk Areas for PRFA studies and allow the LLFAs to determine whether there may be a risk of flooding from groundwater.

The map indicates the proportion of each 1km grid square which geological and hydrogeological condition show that groundwater might emerge. It doe s 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 AStGWf data should be used only in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. The data can however help to identify areas for assessment at a local scale where finer resolution datasets exist

4.3.3 Sewers

Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system. Infiltration, entry of soil or groundwater into the sewer system via faults within the fabric of the sewerage system, is another cause of sewer flooding. Infiltration is often related to shallow groundwater, and may cause high flows for prolonged periods of time.

Since 1980, the Sewers for Adoption guidelines have meant that most new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year, although until recently this did not apply to smaller private systems. This means that, even where sewers are built to current specification, they are likely to be overwhelmed by larger events of the magnitude often considered when looking at river or surface water flooding (e.g. a 1 in 100 chance of occurring in a given year). Existing sewers can also become overloaded as new development adds to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep).

Sewage disposal has been a problem at Jaywick in the past, with mains sewerage to the Brooklands and Grasslands area only implemented in 1981.

A scheme to prevent Jaywick's sewers from flooding commenced in 2014, where 100-metres of surface water sewer was replaced and upgraded to protect houses in Park Square West[11].

[11] http://www.clactonandfrintongazette.co.uk/news/10959847.__250k_scheme_to_prevent_Jaywick_sewers_flooding/

4.4 The impact of climate change

4.4.1 Fluvial and coastal flooding

The effect of increased sea levels, increased storminess and increased precipitation tends to be a noticeable increase in the mapped flood extent. However, climate change does not just affect the extent of flooding. It is important to remember that even where the extent does not significantly increase; flooding is likely to become more frequent under a climate change scenario. For example, what is currently an event with a 2% probability of occurring (1 in 50 chance) in any one year, may increase to say a 5% probability (1 in 20 chance) under climate change conditions.

The impact of an event with a given probability is also likely to become more severe. For example depths, velocities, hazard and therefore risk to people will increase for the 'design events' that must be accommodated in the future. Although qualitative statements can be made as to whether extreme events are likely to increase or decrease over the UK in the future, there is still considerable uncertainty regarding the magnitude of these changes locally. Further details regarding the uncertainties in predicting the impacts of climate change can be found in

- Environment Agency (2011) Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities. September 2011; and
- UK Climate Projections (UKCP09)

The local planning authority and those carrying out flood risk assessments should consider the 'Climate Change Allowances for Planners' guidance document produced by the Environment Agency[12] to support the NPPF. This document has been used for the climate change estimates and modelling undertaken for this study.

4.4.2 Surface Water

Climate change is predicted to increase rainfall intensity in the future by up to 30%. This will increase the likelihood and frequency of surface water flooding, particularly in impermeable urban areas, and areas that are already susceptible. In addition the increase in mean sea level will reduce the time over which existing fluvial drainage systems can discharge by gravity to the sea. This increased 'tide locking' of outfalls could potentially increase the risk of flooding unless appropriate provision is made.


© Aerial photography courtesy of Mike Page

4.4.3 Groundwater

The effect of climate change on groundwater flooding problems, and those watercourses where groundwater has a large influence on winter flood flows is more uncertain. Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels more during the summer months.

4.5 Flood defences and structures

Since the 1953 flood there have been significant improvements to the flood defences along the Jaywick Coastline including improvements to the sea wall as well as installation of fish tail groynes, reefs and beach profiling. These improvements had the purpose of reducing the risk of wave overtopping in the area.

12 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296964/LIT_8496_5306da.pdf

The Environment Agency Asset Information Management System (AIMS) shows that there are manmade sea defences all along the coast from Point Clear, East bank of Colne Estuary, to Clacton-on-Sea. There are also inland fluvial defences along the ditches.

Generally the top level of the sea defences ranges from 4.5m to 5.4m AOD. The crest of the sea wall levels defending the Brooklands area varies between 4.57m and 5.36m AOD.

A counterwall separates Seawick and Grasslands and runs north from the beach to Cockett Wick Farm. In 1953 multiple breaches in the embankment at Point Clear caused flood water to flow across St Osyth Marsh and flood Jaywick from behind. The construction of the counterwall aims to prevent similar flooding should a similar breach occur. AIMS records show the crest level of the counterwall is set at 3.35AOD. St Osyth ditch crosses the counter wall before joining Bonds ditch. The flow of St Osyth ditch through the counter wall is controlled by a sluice gate.

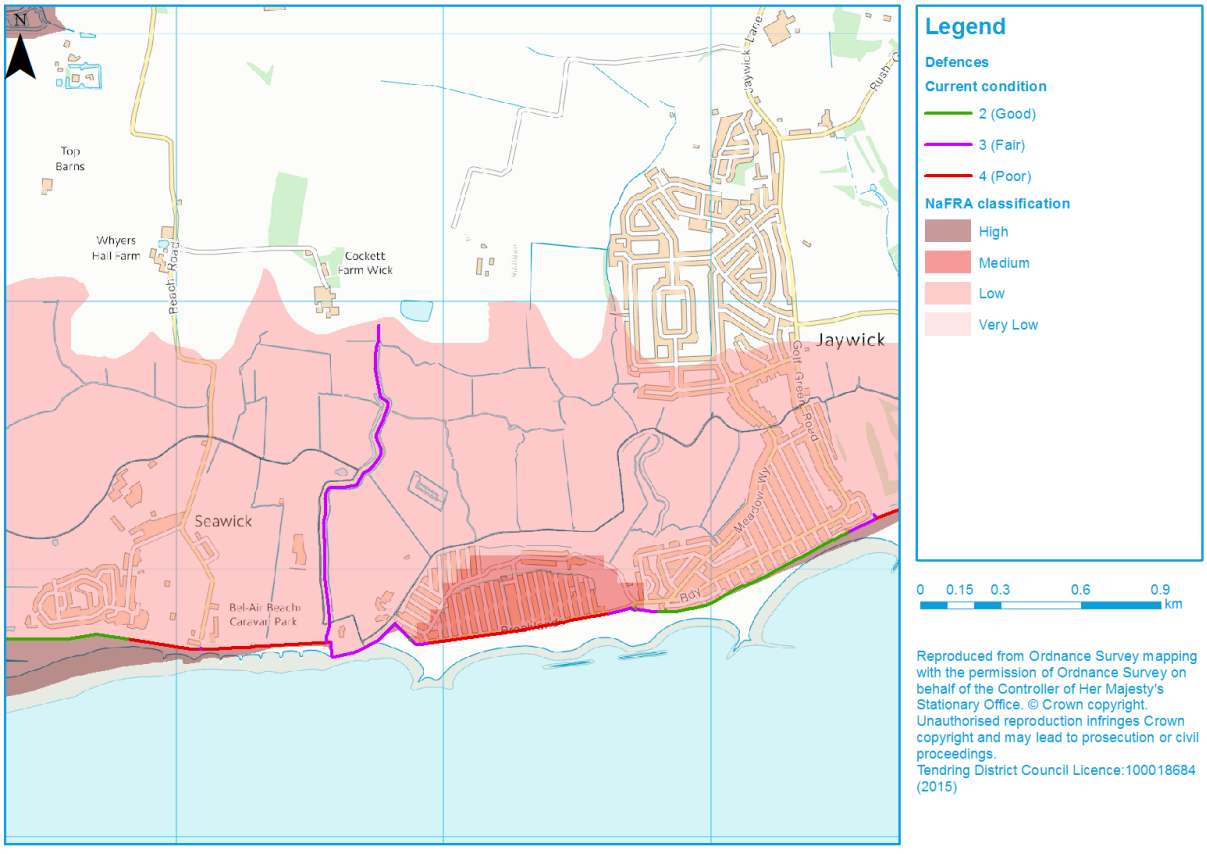
Structures include sluice gates, flood gates, pedestrian and vehicle access over the defences and they are also used for flood defence purposes. Structures in the sea include rock reefs and groynes.

A summary of the asset condition grading system used by the Environment Agency is provided in Table 4-2. The flood defences along the study area shoreline fall into three defence condition categories – Good, Fair and Poor (Figure 4-1). The defences classed as 'Poor' are located along the seafront in front of Brooklands and at Seawick.

Table 4-2: Defence asset condition rating

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no effect on performance.
2	Good	Minor defects that will not reduce the overall performance of the assets.
3	Fair	Defects that could reduce performance of assets.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required
5	Very Poor	Severe defects resulting in complete performance failure.
Source: Condition Assessment Manual – Environment Agency 2006		

Figure 4-1: Flood defence location, condition and NaFRA classification



4.5.1 National Flood Risk Assessment (NaFRA) mapping

Flood defences reduce, but do not completely remove, the risk of flooding. They are built to withstand a flood of a certain magnitude but can be overtopped or fail either in extreme weather conditions or due to poor condition.

The National Flood Risk Assessment gives an indication, at a national level, of the likelihood, and consequences, of areas of land flooding from rivers and the sea. The likelihood of flooding has been calculated using predicted water levels and taking the location, type and condition of any flood defences into account.

The NaFRA maps do not include other forms of flooding such as from highway drains, sewers, overland flow or rising groundwater.

The mapping is categorised into four different classes for likelihood of flooding. These classes are shown in Table 4-3.

Table 4-3: NaFRA classifications

NaFRA Class	Description
Very Low	These areas have a chance of flooding of less than 1 in 1,000 (0.1%).
Low	These areas have a chance of flooding of between 1 in 1,000 (0.1%) and 1 in 100 (1%).
Medium	These areas have a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).
High	These areas have a chance of flooding of greater than 1 in 30 (3.3%).

Figure 4-1 shows the NaFRA mapping at Jaywick. The areas at highest and medium risk correspond to locations seawards of the sea defences (at Seawick) or behind defences with a low condition class (at Brooklands). The remainder of Jaywick is classed as low risk.

5 Analysis of flood risk

5.1 Introduction

The modelling undertaken for this SFRA update generates a large volume of information for each scenario considered. The following sections summarise the key findings for the Jaywick area as a whole, whilst predicted results specific to each proposed development area are provided in site specific summary tables in Appendix I. Predicted flood outlines, hazard and depth maps for each modelled scenario are provided in Appendices A to C.

Hazard Rating is based on FD2321. Further information on the hazard rating used in this study is provided in Appendix H.

Time to inundation mapping of breach model results have also been provided as part of this study (Appendix E).

Evacuation routes were also assessed within the modelling to identify which access roads are predicted to be affected by flooding, at what depths and for how long a duration.

A technical summary of the modelling undertaken for this SFRA is provided in Appendix **Error! Reference source not found.**.

5.2 Overtopping

Overtopping modelling was run for the following scenarios:

- 0.5% annual exceedance probability (AEP) tide occurrence for
  - current day;
  - climate change (sea level rise) to year 2023;
  - climate change (sea level rise) to year 2055; and
  - climate change (sea level rise) to year 2112.
- 0.1% probability tide occurrence for
  - current day;
  - climate change (sea level rise) to year 2023;
  - climate change (sea level rise) to year 2055; and
  - climate change (sea level rise) to year 2112.

5.2.1 Current day

The model results for the 0.5% AEP scenario show the majority of the area is well protected by the defences, the main exceptions being points just east of the counterwall by Belsize Avenue, at Broadway and at the golf course east of The Close, all of which show flooding as a result of wave overspill (overtopping). These locations appear to correspond to where there the beach is less wide in front of the defences, between the fish tail groynes. There is only minor wave overtopping west of the counterwall, affecting Club Parade at Bel-Air Estate.

Where the sea overtops by Belsize Avenue the flood water is predicted to follow a northwards path, flooding Tower Caravan Park and the area north of Grasslands. The estimates show flood water does not reach property in Grasslands until approximately two hours after the sea wall is first overtopped.

Where is overtops at Broadway, flooding affects parts of Beach Way, Broadway, Meadow Way, Gorse Way, Yew Way, St Christophers Way, Beach Close and Fern Way

The Tower Caravan Park has the highest predicted flood depths and hazard, followed by the golf course with depths typically ranging between 0.001 to 0.5 m.

Approximate flooding durations for key access routes for the current day scenarios are shown in Table D-1. No access or egress routes are affected by flooding greater than 0.25m in the 0.5% AEP scenario, and the hazard to these routes is classed as very low hazard.

The 0.1% AEP current day event shows similar predicted overtopping locations and flow routes, although flood extents are greater, notably west of the counterwall with flooding to Seawick, due to more extensive wave overspill (overtopping) of defences compared to the 0.5% AEP current day scenario.

The golf course has the highest predicted flood depths and hazard with depths typically ranging between 0.5 to 2.0 m. Elsewhere depths tend to be in the range of 0.001 to 0.5 m.

The majority of the access routes are flooded to depths less than 0.25, with the exception of Meadow Way. This key access/egress route for Brooklands is predicted to be flooded to a depth of between 0.25 – 0.5 m for approximately 18 hours during the modelled three tide cycle. Although the main access route for Seawick is flooded in the 0.1% AEP scenario, the flooding depths do not get deeper than 0.25m during the modelled scenario. The hazard class for all access routes in the 0.1% AEP scenario is very low hazard.

5.2.2 Climate change (sea level rise)

Climate change estimates have been based on the current guidance supporting the NPPF 'Climate Change for Planners' produced by the Environment Agency in September 2013.

Model results for the 0.5% AEP climate change scenarios (sea level rise) show similar flow routes to the current day. However, the extent of flooding, the speed at which flooding occurs and the depth and level of hazard is increased. Approximate flooding durations for key access routes for the current day scenarios are shown in Table D-2 and Table D-3.

Although Brooklands is not flooded in the climate change to 2055 scenario, the main access/egress route for this area, Meadow Way, is flooded to a depth of 0.25 – 0.5 m for over 19.5 hours in the modelled three tide cycle. This has implications for the safe evacuation of properties in this area.

The extent of flooding increases significantly in the climate change to 2055 scenario with depths increasing to 0.001 to 0.1 m in places. However, the main access/egress route for Seawick, Beach Road, is not flooded to depths greater than 0.25m during the modelled three tide scenario.

The most significant increase in the extent of flooding is seen in the climate change to 2112 scenario in which flooding occurs to the majority of the study area. Notably, the Brooklands area of Jaywick is now at risk, with depths of 1.0 to 3.0 m, and all key access/egress routes are now flooded. The key access route for Brooklands and Jaywick village, Meadow Way, is flooded to a depth of 2.0 m for approximately 18.5 hours during the modelled three tide cycle, having significant implications for the safe evacuation of these areas.

The 0.1% AEP climate change (sea level rise) model results show similar trends to the 0.5% AEP climate change. However, the 2055 and 2112 scenarios show a significantly larger flood extent and depths west of the counterwall, largely as a result of increased overtopping of flood defences at Colne Point and St Osyth Marsh. These events also result in significant increases in flood depths and hazard to Brooklands and Jaywick Village.

During the 0.1% AEP climate change scenarios, not only will access roads flood to greater depths (over 2.5 metres in some cases) but that they will be flooded for longer (over approximately 18 hours for deeper depths and approximately 31 hours for more shallow depths over the modelled three tide cycle), having implications for evacuation and emergency response. Meadow Way is flooded to depths greater than 2.0 m for over 18 hours and Beach Way, the only access/egress route out of Seawick, is flooded to depths greater than 1.5 m for over 18 hours during the modelled three tide scenario.

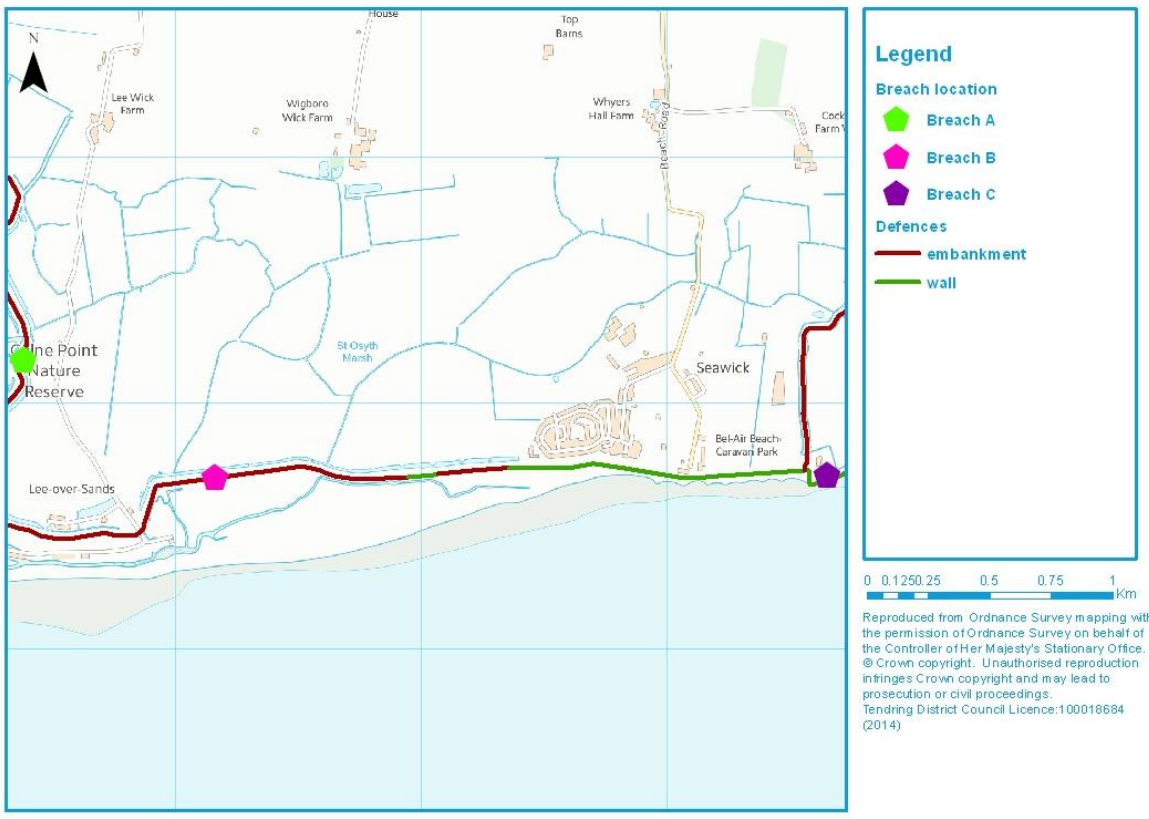
5.3 Defence breach

The following three breaching locations were identified for the study:

- Breach A: soft estuarine defence in Colne Point and Point Clear
- Breach B: soft coastal defence n Seawick to Colne Point (Lee-over-Sands)
- Breach C: hard defence wall in Brooklands

These breach locations were used in the 2008 SFRA and were chosen at that time based on the condition of the sea defences, and where ground levels behind the defences were lowest. This selection gives a conservative estimate of breach flows as it will generate more significant inflow volumes. Breach widths were based on those used in the 2008 SFRA.

Figure 5-1: Breach locations



Breach modelling was carried out for the following scenarios:

- Scenario One: Tide level equivalent to flood defence crest height
- Scenario Two: Tide level equivalent to Flood Warning return period threshold
- Scenario Three: Tide level equivalent to Severe Flood Warning return period threshold

The breaches have been modelled individually (i.e. multiple breaches have been assumed not to occur).

Approximate flooding cut off durations for key access routes for the breach scenarios compared to a similar event with no breach are shown in Table D-4 to Table D-6.

5.3.1 Scenario One: tide level equivalent to flood defence crest height

In the event of a breach at location A the area to the west of the counterwall will be exposed to very hazardous flood flow with predicted depths of over 2.0 metres in places. Isolated properties at Lee-over-Sands will be at significant risk and there will be considerable increases in flood depths in Seawick (over one metre higher) compared to the same magnitude event with no breach.

A breach at location B will have a similar impact although the extent and depth of flooding would be less due to differing flow routes and topography in the vicinity of the breach.

Breach at locations A or B will have negligible or no effect on the level of flood risk east of the counterwall. Flooding in this location is a result of overtopping of defences to the east of the counterwall.

A breach at location C will have little impact on flood levels west of the counterwall but will have a significant impact on the level of flood risk east of the counterwall at Jaywick. Compared to the same magnitude event with no breach, the extent of flooding from a breach would extend further east, flooding Brooklands, Broadway, Meadow Way, southern parts of the Tudor Estate and the golf course to greater depths. All main access/egress routes out of Jaywick from Grasslands, Brooklands and Broadway will be flooded to depths of between 0.25 to 0.5 m for approximately 19 hours during the modelled three tide cycle. In an actual event this duration may be longer due to subsequent tide cycles and the length of time take to repair the breach. Hazard mapping

in this scenario shows the area immediately behind the defence, Tower Caravan Park, is classed as danger for all, with Brooklands, Grasslands and areas around Meadow Way classed as danger for most. During this scenario much of the area will already be flooded due to wave overtopping before the breach occurs, with the remainder of the area flooding within two hours of the breach.

5.3.2 Scenario Two: tide level equivalent to Flood Warning return period threshold

In the event of a breach at locations A or B the area to the west of the counterwall will be exposed to hazardous flood flow with depths of over one metre in places. Isolated properties at Lee-over-Sands will be at risk and there will be a slight increase in flood depths in Seawick compared to the same magnitude event with no breach.

Properties at Lee-on-Sands will flood within 0.25 to 0.5 hours of a breach at location A and 0.25 to one hour of a breach at location B, whilst Seawick will flood within 5 to 15 hours of a breach at locations A or B. Parts of the main access/egress route for Lee-on-Sands will be flooded to 0.5 to 1.0 m within 0.25 hours of a breach at locations A or B. The flood hazard to Lee-on-Sands and the access road (Beach Road) is classed as danger for most if a breach occurred at location A. If a breach occurred at location B the hazard would be less; although parts of Lee-on Sands would have a hazard classed as danger to most, the majority of the area, and Beach Road, would have a hazard classed as very low hazard.

However, a breach at locations A or B will have no effect on the level of flood risk east of the counterwall; flooding in this area is a result of overtopping of defences east of the counterwall.

A breach at location C will have no impact on flood levels west of the counterwall but will have a significant impact on the level of flood risk east of the counterwall at Jaywick. Compared to the same magnitude event with no breach, a breach would flood Tower Caravan Park to considerable greater extent and depth. Additionally the flooding would extend to the Grasslands area, the western area of Broadway and parts of the Tudor Estate, which would have been unaffected in the same magnitude event with no breach. The flood hazard for these areas would be classed as danger for most.

The access/egress route for Tower Caravan to Brooklands will be affected by flooding within 0.25 hours of the breach and Lotus Way is affected within one to two hours of the breach. Brooklands remains free from flooding during the scenario, whilst Broadway is flooded to depths of 0.25 to 0.5 m for approximately four hours. Meadow Way is flooded to depth of 0.25 to 0.5 m for approximately 5.5 hours, although this does not occur until five to 15 hours of the breach. Although the flood hazard to Lotus Way is classed as danger for most, the level of hazard to Meadow Way is very low hazard. Brooklands Road is unaffected. Although Golf Green Road floods after 15 hours of the breach the depth of flooding does not get deeper than 0.25m and the hazard is classed as very low hazard.

5.3.3 Scenario Three: tide level equivalent to Severe Flood Warning return period threshold

In the event of a breach at locations A or B the area to the west of the counterwall will be exposed to hazardous flood flow with depths of over one metre in places. Isolated properties at Lee-over-Sands will be at risk, with depths greater than for scenario two. Hazard in this area is classed as danger for most, with some pockets of danger to all in the event of a breach at location A. A breach at this magnitude event will have a larger impact on Seawick and the Bel-Air Estate, with flood hazard increasing to danger to some in some locations. In addition, Hutley's Caravan Park and the Bel-Air Beach Caravan Park will be at risk from a breach in location A. Hazard classes at Lee-on-Sands are similar for a breach at location B.

Properties at Lee-on-Sands will flood within 0.25 to 0.5 hours of a breach at location A and 0 to 0.5 hours of a breach at location B, whilst Seawick will flood within 5 to 15 hours of a breach at location A. The majority of Seawick is unaffected by flooding from a breach at location B as is the main access/egress route. Parts of the main access/egress route for Lee-on-Sands will be flooded to 0.25 to 1.0 m within 0.25 hours of a breach at locations A or B. Part of Beach Road has a hazard classed as danger for all in the event of a breach at location A.

A breach at locations A or B will have no effect on the level of flood risk east of the counterwall; flooding east of the counterwall is due to overtopping of defences.

A breach at location C will have similar impacts on flood risk to the east of the counterwall as that seen in Scenario Two. However, whilst the extent of flooding is similar, the depth of flooding will

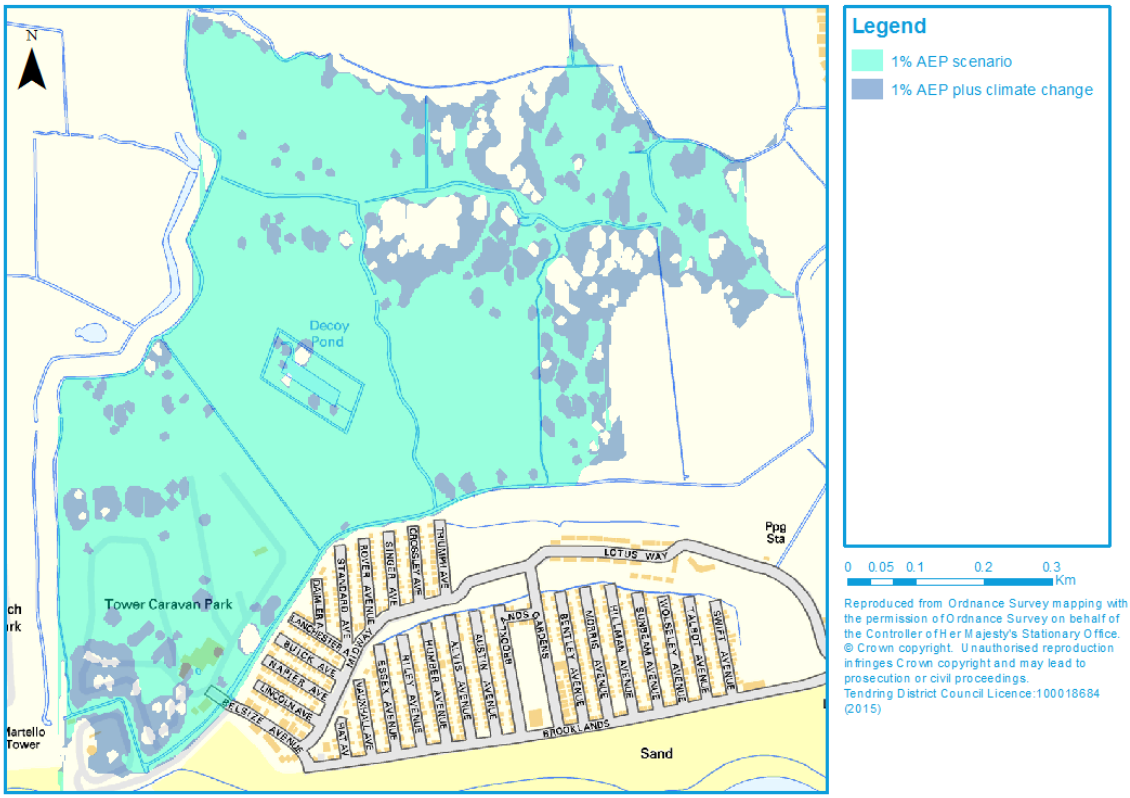
be greater than in scenario two. The flood hazard to these areas is classed as danger for most, with the area of Tower Caravan Park directly behind the breach location being classed as danger for all.

A breach at location C has significant implications for access and egress with all the main routes out of Jaywick affected by flood water. Broadway is flooded to depths of 0.5 to 0.75 m for approximately 5.5 hours in the modelled three tide scenario; whist Meadow Way is flooded to depths of 0.25 to 0.5 m for approximately 15.75 hours and 0.75 to 1.0 m for approximately four hours. Lotus Way is also affected by flooding (hazard class of danger for most), but Brooklands provides an alternative route. Meadow Way is mostly classed as danger for some, with some smaller stretches classed as danger for most.

5.4 Fluvial flooding

The Jaywick Ditch runs from Clacton in a westerly direction to a flapped outfall structure near to the counterwall. The 2008 SFRA included an assessment of fluvial risk from Jaywick Ditch. The assessment determined that the Tower Caravan Park and the area of land to the rear of Grasslands may flood from a 1% AEP fluvial event during a mean spring tide, both current and in the future. No flooding is predicted to affect the main residential areas of Grasslands and Brooklands.

Figure 5-2: Current and future scenario fluvial flooding event



5.4.1 Note on modelling

A number of assumptions were made in the 2008 model of the Jaywick Ditch. These included

- No river channel survey was available; channel widths and floodplain details were obtained using LIDAR and bed levels were estimated from a site visit.
- Hydrology inflows were calculated using the FEH Rainfall-Runoff method

Important Note: updating the fluvial model was not included within the scope of this study. The Environment Agency are currently producing a detailed 1D-2D model of the Jaywick Ditch, the results of which are expected after June 2015. The outlines produced by this detailed model will supersede the outlines provided in this SFRA. All site related flood risk assessments after June 2015 should refer to the Environment Agency's modelling for evaluating fluvial flood risk from the Jaywick Ditch.

5.5 Screening of sites

The site summary tables in Appendix I provide a summary assessment of the flood risk to the key sites in Jaywick in more detail, including risk from the sea, fluvial and surface water. Maximum depths, velocities and hazard within each site for each scenario are provided as well as an indication of the rate of rise. Note, the rate of rise relates to one point within the site and that the rate of rise may very across the site.

The tables also consider potential access and egress issues, as well as some factors that need to be considered for planning.

6 Mitigation measures and possible flood risks

6.1 Introduction

In accordance with the Flood Risk Management Hierarchy described in Figure 1-1 Mitigation measures should be seen as a last resort to address flood risk issues. Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised, only then should mitigation measures be considered.

The fact that mitigation measures are discussed in this SFRA should not be taken as a presumption that the Sequential Test is not necessarily satisfied. The mitigation measures are included to provide additional support and a more comprehensive picture of the implications of allocating land in Zones 2 and 3. In circumstances where mitigation measures are required it will be essential for submissions in support of proposed development to include assessments of flood depths and velocities during the preparation of detailed hydrological and hydraulic modelling carried out as part of a formal FRA. Development proposals should consider flood risk and safety issues at the site and the immediate surrounding area as well as the availability of safe access and egress to ensure the development remains safe should flooding occur.

Often the determining factor in deciding whether a particular development is appropriate is the practical feasibility, financial viability and long term maintenance implications of flood risk mitigation rather than technical limitations. Detailed technical assessments are required in the FRA to assess the practical feasibility, together with a commercial review by the developer of the cost of the mitigation works and how contributions will be made for their long term maintenance. At the SFRA stage, broad assumptions must be made regarding the feasibility of flood risk mitigation to highlight sites with greater development potential. The formulation of measures that not only provides an appropriate standard of protection to new development, but also reduces the risk to existing communities will be an important consideration.

Attention must also be paid to the provision of safe access and egress during flood events including climate change and how this is linked to flood warning and emergency evacuation where necessary. The Emergency Services and local authority should be consulted on the evacuation and rescue capabilities and any advice or requirements included.

There should be no interruption to flood flows or loss of flood storage as a result of any proposed development. Flood storage compensation may be appropriate for sites on the edge of the existing floodplain or within a flood cell.

Whilst it might be possible to identify appropriate flood mitigation measures for some sites, it is worth noting that in some instances the findings of individual FRAs may determine that the risk of flooding to a proposed development is too great and mitigation measures are not feasible or appropriate. In these instances, the development is likely to be subject to an objection by the Environment Agency.

Mitigation methods must be sufficient to ensure the second part of the Exception Test can be met. An allowance for climate change over the lifetime of the development must be also considered. The measures chosen will depend on the nature of the flood risk. The National Flood Forum and Association of British Insurers Guidance on minimum standard of protection against internal flooding to new properties should also be considered (section 2.6).

6.2 Potential mitigation measures

6.2.1 General approach

The measures must wherever possible contribute to a wider reduction in flood risk for the existing community. In addition to the identification of site specific measures consideration should be given to the potential adverse effect on third parties. As well as identifying technical measures those promoting mitigation must also provide appropriate evidence to demonstrate the commitment to their delivery and long term maintenance.

In addition to the immediate risk consideration should also be given to the medium and longer term consequences of flooding. Whilst it might be possible; to provide safe access and egress to properties this will be of limited use if there are is no power, water supply or waste disposal facilities. The vulnerability of occupants and their ability to cope with the aftermath and long term effects, including health should also be addressed.

6.2.2 Redevelopment of site layout or design

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

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use to higher ground, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. However vehicular parking in floodplains should be based on nature of parking, flood depths and hazard including evacuation procedures and flood warning.

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

6.2.3 Modification of ground levels

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the risk is entirely from tidal flooding and the land does not act as conveyance for flood waters. However, care must be taken at locations where raising ground levels could adversely affect existing communities and property.

In most areas of fluvial flood risk, conveyance or flood storage in flood cells would be reduced by raising land above the floodplain, adversely impacting on flood risk downstream or on neighbouring land. Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Ground raising will change the localised characteristics of flooding, not just tidal but fluvial also. Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land.

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

Impacts of ground raising on localised flood characteristics will need to be considered as part of the details site-specific flood risk assessment to ensure there is no increase in flood risk to existing development.

Impacts of individual plot level raising, when considered in isolation, may appear to be relatively minor; however, the cumulative impact of plot level raising in the area may have more significant impacts. The local planning authority should consider the impact of plot level raising, both in isolation and cumulatively, when assessing planning applications that propose ground raising as a mitigation measure, in relation to the flood risk in the area, to ensure the risk is not exacerbated.

6.2.4 Improvements to primary coastal defences

The level of the crest of the sea wall could be raised with time to reduce the flood risk from any overtopping in the area. The concrete sea walls that are present along the main Jaywick frontage may require work to provide a standard of protection sufficiently high enough to counter wave impacts into the future.

The policy set out in the Essex and South Suffolk SMP is for, in the short and medium term, to hold the existing frontline defences as they currently exist (Hold the Line). After 2055 the intent is less fixed and depends on the development of the Local Development Framework in the coming years. Periodic reviews of the SMP policy will be required to account for the changing strategic re-development of the area and for the sustainability of an adequate level of flood protection taking into account climate change and sea level rise.

6.2.5 Secondary flood defences and raising of the counterwall

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

provided where raised defences remove storage from the floodplain or flood cell. It would be preferable for schemes to involve an integrated flood risk management solution.

Temporary or demountable defences are not acceptable forms of flood protection for a new development but might be appropriate to address circumstances where the consequences of residual risk are severe. In addition to the technical measures the proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate.

Additional secondary defences in the form of roads or flood banks could be used to form more compartments limiting the extent of a breach, such as the existing counterwall between Jaywick and Seawick. The area around Brooklands and Grasslands, for example, could be further compartmentalised.

The disadvantage of compartmentalising in this way is that should a breach into the compartment occur then flood levels would increase significantly as flood water would be unable to readily spread elsewhere. If it is proposed to break down the flood cells into smaller compartments then detailed consideration must be given to the change in risk and the implications for existing communities.

Developer contributions

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

Defra's Flood and Coastal Risk Management Grant in Aid (FCRMGiA)[13] can be obtained by operating authorities to contribute towards the cost of a range of activities including flood risk management schemes that help reduce the risk of flooding and coastal erosion. Some schemes are only partly funded by FCRMGiA and therefore any shortfall in funds will need to be found from elsewhere when using Resilience Partnership Funding, for example local levy funding, local businesses or other parties benefitting from the scheme.

For new development in locations without existing defences, or where development is the only beneficiary, the full costs of appropriate risk management measures for the life of the assets proposed must be funded by the developer.

However, the provision of funding by a developer for the cost of the necessary standard of protection from flooding or coastal erosion does not mean the development is appropriate as other policy aims must also be met. Funding from developers should be explored prior to the granting of planning permission and in partnership with the local planning authority and the Environment Agency.

The appropriate route for the consideration of strategic measures to address flood risk issues is the Local flood Risk Management Strategy (LFRMS)prepared by the Lead Local flood Authority. The LFRMS should describe the priorities with respect to local flood risk management, the measures to be taken, the timing and how they will be funded. It will be preferable to be able to demonstrate that strategic provisions are in accordance with the LFRMS, can be afforded and have an appropriate priority.

It should be noted that on-going re-development will proportionally reduce the contributions from central Government for future flood defence infrastructure improvements and enhancements. Therefore, developer contributions can help reduce the financial contribution required from other public sector contributors, such as Tendring District Council, to offset the reduction in Flood Defence Grant in Aid contribution expected in the coming years.

The Environment Agency is committed to working in partnership with Developers to reduce flood risk. Where assets are in need of improvement or a scheme can be implemented to reduce flood risk, the EA request that Developers contact them to discuss potential solutions. The Partnerships and Strategic Overview Team who manage these partnerships can be contacted by calling **03708 506 506 (Mon-Fri, 9am - 5pm).**

[13] Principles for implementing flood and coastal resilience funding partnerships (Environment Agency, 2012)

6.2.6 Additional openings through the counterwall

The existing sluice gate through the counterwall could be open or closed to reduce flood risk, or modified to allow westerly flow only. More openings in the form of sluice gates or culverts could be provided through the counterwall to divert flow between compartments.

6.2.7 Building design

One of the most common methods of mitigating flood risk, if avoidance is not practicable, is to people is to ensure habitable floor levels are raised above the maximum flood water level. The raising of floor levels within a development avoids damage occurring to the interior, furnishings and electrics in times of flood. If it has been agreed with the Environment Agency that, in a particular instance, the raising of floor levels is acceptable, they should be raised to 300mm above the maximum water level caused by a 0.5% AEP event plus 100 years climate change. Safe refuge should also be provided for more extreme events.

This additional height that the floor level is raised to is referred to as the "freeboard". The feasibility of raising floor levels will be dependent on the depths of floodwater experienced.

Allocating the ground floor of a building for less vulnerable use (e.g. garage, utility areas, public space) is an effective way of raising living space above flood levels.

The Environment Agency does not consider that putting a building on stilts to be an acceptable means of flood mitigation for new development. However it may be allowed in special circumstances if it replaces an existing solid building, as it can improve flood flow routes. In these cases attention should always be paid to safe access and egress and a legal agreement should be entered into to ensure the ground floor use is not changed.

Safe access routes should be provided that are located above design flood levels and avoid flow paths. Acceptable routes will be dependent on flood velocities and the risk of debris within flood water as well as the water depth.

Two or three storey properties

Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water, such as that experienced during a breach. This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route. Access and egress would still be an issue, particularly when flood duration covers many days.

6.2.8 Resistance and resilience

Flood resistance stops water entering a building, flood resilience accepts that water will enter premises but through design will minimise damage and allow re-occupancy quickly. The NPPG Planning Practice Guidance states resistance and resilience measure should not be used to justify development in inappropriate locations. The Guidance describes how they are unlikely to be suitable as the only mitigation measure but may be suitable in some circumstance, for example

- Water-compatible and less vulnerable uses where temporary disruption is acceptable and an appropriate flood warning is provided
- Instances where the use of an existing building is to be changes and it can be demonstrated that no other measure is practicable
- As a measure to manage residual flood risk

There may be instances where flood risk remains to a development. For example, where the use is water compatible, where an existing building is being changed, where residual risk remains behind defences, or where floor levels have been raised but there is still a risk at the 0.1% annual probability. In these cases (and for existing development in the floodplain), additional measures can be put in place to reduce damage in a flood and increase the speed of recovery. These measures should not be relied on as the only mitigation method.

Resistance

The NPPF Planning Practice Guidance states flood resistant construction can be used to prevent or minimise entry of water into a building where there is a short duration of flooding outside with water depths of 0.6 m or less. These measures should be used with resilience measures as effectiveness may be dependent upon occupiers mobilising the measures, or the measures may be breached.

Temporary barriers

Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water. The NPPF Planning Practice Guidance states that temporary or demountable defences are not appropriate for new developments,

Permanent barriers

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

Resilience

The 2007 Department for Communities and Local Government report, 'Improving the Flood Performance of New Buildings: flood resilient construction', provided guidance on how to improve resilience of new properties in low or residual risk areas through use of appropriate materials and construction.

Wet-proofing

Interior design to reduce damage caused by flooding, for example

- electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level;
- water-resistant materials for floors, walls and fixtures; and
- non-return valves to prevent waste water from being forced up bathrooms, kitchens or lavatories.

If redeveloping existing basements, new electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level to minimise damage if the development floods.

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

6.3 Reducing flood risk from other sources

6.3.1 Surface water and sewer flooding

Where new development is in an area where the public sewerage network does not currently have sufficient spare capacity to accept additional development flows it is recommended that the developer discusses such issues with the water utility company at the earliest possible stage. The development should improve the drainage infrastructure to reduce flood risk on site. It is important however that a drainage impact assessment shows that this will not increase flood risk elsewhere, and the drainage requirements regarding runoff rates and SuDS for new development are met.

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

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

6.3.2 Groundwater

Groundwater flooding has a very different flood mechanism to any other and for this reason many conventional flood defence and mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design, ensuring floor levels are raised above the water levels caused by a 1% annual probability fluvial / 0.5% annual probability tidal plus climate

change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

When redeveloping existing buildings it may be acceptable to install pumps in basements as a resilience measure. However for new development this is unlikely to be considered an acceptable solution.

6.4 Sustainable Urban Drainage Systems

Sustainable Urban Drainage Systems (SuDS) are management practices which enable surface water to be drained in a way which mimics, as closely as possible, the run-off prior to site development. The choice of flow management facilities within a single site is heavily influenced by constraints including (but not limited to)

- topography;
- geology (soil permeability);
- available area;
- former site use;
- proposed site use;
- groundwater conditions; and
- future adoption and maintenance possibilities.

The design, construction and ongoing maintenance regime of such a scheme must be carefully defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and existing drainage arrangements is essential.

For infiltration SuDS techniques it is imperative that the water table is low enough and a site-specific infiltration test is undertaken. Where sites lie within or close to groundwater protection zones or aquifers further restrictions may be applicable, and guidance should be sought from the Environment Agency.

There are many different SuDS techniques which can be implemented. The suitability of the techniques will be dictated in part by the development proposal and site conditions. Advice on best practice is available from the Environment Agency and the Construction Industry Research and Information Association (CIRIA).

The inclusion of SuDS within developments should be seen as an opportunity to enhance ecological and amenity value, and promote Green Infrastructure, incorporating above ground facilities into the development landscape strategy. SuDS must be considered at the outset, during preparation of the initial site conceptual layout to ensure that enough land is given to design spaces that will be an asset to the development rather than an after-thought.

All new developments will require planning approval from both the SAB and the local planning authority. The Environment Agency will be a statutory consultee when delivering SuDS for any proposed discharge of surface water into a watercourse. Essex County Council will be a statutory consultee for surface water management for developments of 10 or more units. Surface water management for smaller scale development will be the responsibility of Tendring District Council. Essex County Council has produced a SuDS Design Guide. This guide reflects local circumstances and aims to guide SuDS design in Essex and is found at http://www.essex.gov.uk/Environment%20Planning/Environmental-Issues/local-environment/flooding/View-It/Pages/Sustainable-drainage-systems.aspx.

7 Emergency planning in Jaywick

7.1 Flood warning systems

Flood warnings supplied by the Environment Agency's Floodline Warnings Direct service can be provided to homes and businesses within Flood Zones 2 and 3. Developers should encourage those owning or occupying developments, where flood warnings can be provided, to sign up to receive them. This applies even if the development is defended to a high standard.

Figure 7-1: Flood warning codes

	**Flood Alerts** are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. It is issued earlier than a flood warning, to give customers advice notice of the possibility of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.
	**Flood Warnings** warn people of expected flooding and encourage them to take action to protect themselves and their property.
	**Severe Flood Warnings** warn people of expected severe flooding where there is a significant threat to life.
Warnings no longer in force	Informs people that river or sea conditions begin to return to normal and no further flooding is expected in the area. People should remain careful as flood water may still be around for several days.

The Environment Agency's Flood Warning Service covers the Jaywick and St Osyth areas. The warning area is named 'the Essex Coast from Clacton to St Peters Flat'. A map of the Flood Warning Area is provided in Appendix K. The Environment Agency's thresholds for issuing warnings are taken from the reference location at Clacton-on-Sea (Table 7-1).

Table 7-1: Flood warning threshold levels

Warning	Threshold level (mAOD)	Equivalent AEP event at Jaywick
Flood Warning	3.3	20%
Severe Flood Warning	3.7	4%

The Environment Agency checks all the flood defence assets in the area to determine whether they need to be closed if a Flood Alert is issued.

Given the difficulty in detecting and monitoring the formation of a breach and the short time that it would take for flooding to commence, there is little that can be done to improve the current warning system, except for changing the emergency response and carrying out more precautionary evacuations of vulnerable residents when the risk of a defence breach is high. Consideration of precautionary evacuations is important in the drafting and preparation of community and property level flood response plans.

7.2 NPPF and emergency planning

7.2.1 Flood Warning and Evacuation Plans

A consideration for any new development is how to make it safe from flood risk over the developments lifetime (including the likely impacts of climate change). The NPPF Planning Practice Guidance outlines the main options and considerations for making a development safe; this includes flood warning and evacuation plans (these can also be referred to as flood plans or flood response plans etc)[14]. Flood warning and evacuation plans should detail actions to assist residents / building users in preparing and responding to the risk of flooding and remaining safe, as well as defining procedures in the event an evacuation is required.

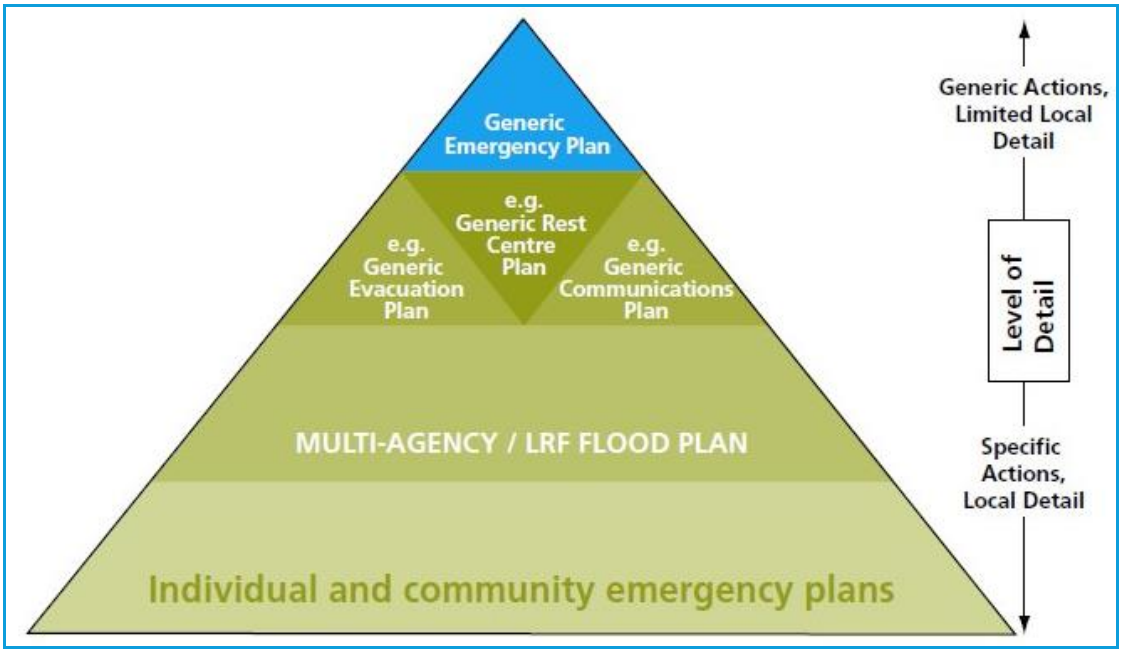
The practicality of safe evacuation from an area will depend on[15]

- the type of flood risk present, and the extent to which advance warning can be given in a flood event;
- the number of people that would require evacuation from the area potentially at risk;
- the adequacy of both evacuation routes and identified places that people could be evacuated to (and taking into account the length of time that the evacuation may need to last); and
- sufficiently detailed and up to date evacuation plans being in place for the locality that address these and related issues.

It is a requirement under the NPPF that a flood warning and evacuation plan is prepared for sites at risk of flooding used for holiday or short-let caravans and camping and are important at any site that has transient occupants (e.g. hostels and hotels)[14].

Flood warning and evacuation plans can be prepared at a personal, site specific, community \ group level (see Figure 7-2 types of emergency plans), in consultation with the local planning authority and emergency services.

Figure 7-2: Types of emergency plans



Source: DEFRA (2011) Detailed Guidance on Developing Multi-Agency Flood Plans[16]

[14] NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 056, Reference ID: 7-056-20140306) March 2014

[15] NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 057, Reference ID: 7-057-20140306) March 2014

[16] DEFRA (2011) Detailed Guidance on Developing Multi-Agency Flood Plans, Figure 12.1 How a MAFP fits with other emergency plans, page 3.

7.2.2 Access and egress

The NPPF Planning Practice Guidance outlines how developers can ensure safe access and egress to and from development in order to demonstrate that development satisfies the second part of the Exception Test[17]. Access considerations should include the voluntary and free movement of people during a 'design flood' (for Jaywick this equates to tidal flooding with a 0.5% AEP scenario) as well as for the potential of evacuation before a more extreme flood. The access and egress must be functional for changing circumstances over the lifetime of the development. The NPPF Planning Practice Guidance sets out that[17]

- access routes should allow occupants to safely access and exit their dwellings in design flood conditions. In addition, vehicular access for emergency services to safely reach development in design flood conditions is normally required; and
- where possible, safe access routes should be located above design flood levels and avoid flow paths. Where this is unavoidable, limited depths of flooding may be acceptable providing the proposed access is designed with appropriate signage etc to make it safe. The acceptable flood depth for safe access will vary as this will be dependent on flood velocities and risk of debris in the flood water.

The depth, velocity and hazard mapping and visualisations from this SFRA update should help inform the provision of safe access and egress routes.

7.3 Site and Community Level Flood Response Plans

This section reviews the outputs of the SFRA and how these relate to site and community level flood response plans. The discussion also follows the Environment Agency's guidance and templates on community flood plans (references shown in the below box).

A Community Flood Response Plan is developed and owned by the community, using local knowledge and experience in flood risk management.

"Working together as a community or group to complete a plan will help you respond quickly when flooding happens. It can help you decide what practical actions to take before and during a flood, helping reduce the damage flooding can cause."[18]

Site level Flood Response Plans can be prepared as part of a Flood Risk Assessment, following advice from the Environment Agency, local authorities or insurers. Individual property flood response plans can also be prepared more informally, by the discretion of the home owner \ resident. Site level plans should also indicate what actions should not be taken without the approval of emergency services.

Guidance documents for preparation of flood response plans

- Environment Agency (2011) Flooding – minimising the risk, flood plan guidance for communities and groups https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292939/LIT_5286_b9ff43.pdf
- Environment Agency (2011) Community Flood Plan template
- Environment Agency Personal flood plans http://apps.environment-agency.gov.uk/flood/151256.aspx
- Flood Plan UK 'Dry Run' - A Community Flood Planning Guide http://www.floodplanuk.org/userfiles/file/AVI10_40%20Floodplan%20Guide.pdf

In addition to the NPPF requirements, there are further legal obligations placed on the 'occupiers of premises'. Occupiers of premises have a duty of care to all visitors as stated under the provisions of the 'Occupiers' Liability Act 1957'. This duty of care includes dangers to the state of the premises and making all persons aware of the dangers to the site. Flooding can be classified as a danger and, therefore, the occupiers of premises in Jaywick should ensure that all visitors to the premises are made aware of the flood risk.

Tendring District Council and the Environment Agency may also place additional requirements for flood warning and evacuation plans submitted as part of a Flood Risk Assessment and should be consulted at the earliest opportunity when such a plan is being prepared.

[17] NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 039, Reference ID: 7-056-20140306) March 2014

[18] Environment Agency (2011) Flooding – minimising the risk, flood plan guidance for communities and groups, page 1.

Table 7-2 outlines the steps for developing a site and community flood response plan. Note that this has been produced for guidance purposes only as part of the SFRA and is not an exhaustive list.

7.3.1 Tendring District Council's Peacetime Emergency Plan

Tendring District Council's Peacetime Emergency Plan for Jaywick (August 2007) includes evacuation of Jaywick during floods to Frobisher County Primary School which is sited on high ground. During emergency services, all the accessible roads connecting Jaywick to a possible safe site should be free from flood risks as the entire area lies within Flood Zone 2 and 3.

It is recommended that the Emergency Plan should take into account the findings of this updated Strategic Flood Risk Assessment.

7.4 Jaywick Flood Warning and Evacuation Considerations

The type of flood risk at Jaywick has implications on the scope of the flood warning and evacuation plans. Consequently, the flood warning and evacuation plans need to

- detail procedures in the event of no prior warning or unforeseen flood events and in the event of advanced warning; and
- detail evacuation procedures in the event of flooding and no flooding (also referred to as 'wet' and 'dry' evacuations).

There are two main mitigating strategies to reduce risk to life in a major floor event. These are containment and evacuation. When preparing the flood response plans, the two mitigation strategies will need to be explored to see if they are suitable for the locations at risk of flooding.

7.4.1 Containment

Containment is where those within a building are moved to higher floors so that they are above of flood level and wait for food waters to recede. If rapid inundation of Jaywick was to occur and warnings were not issued in sufficient time, the only safe option for the members of public in the flood risk areas would be containment. This is where residents must move to their highest point of their homes. The emergency services can then be contacted to inform them of their location. When the tide recedes it is expected a safer rescue can be undertaken, reducing risk to life. Many of the properties in Jaywick are single storey and were never intended to be permanent residences. Therefore, the option of containment for Jaywick is unlikely to be viable as in many properties there is not access to higher floors and some properties may suffer damage from floating debris.

7.4.2 Evacuation

Evacuation is where those in the building are moved out of the building that is at risk and relocated in temporary accommodation, for example rest centres set up by Tendring District Council Emergency Planners. Once the chosen emergency procedures are finalised and any access / egress route has been chosen and built, it is of paramount importance that the residents of Jaywick are aware of its purpose. Information should be provided to instruct them of which roads they should use before a flood occurs. Information leaflets and evacuation route signposts have been used for other flood risk developments.

Evacuation was the chosen strategy adopted by emergency responders during the December 2013 tidal surge in which a Severe Flood Warning was issued. This approach received a positive community response with residents across the whole of Jaywick evacuated, either staying with friends or relatives or at rest centres set up in Clacton on Sea.

A key factor in the evacuation of Jaywick is the availability of a safe access and egress route. There is only one main route out of the village which can become cut off in flood events. Safe access and egress in Jaywick is discussed in further detail in Section 7.5.

Table 7-2: Preparing a site and community response plan

Section No.	Section Name	Actions	SFRA Outputs
1	Locations at risk of flooding	Identify the source(s) of flooding – ensure the main flood risks are stated clearly	All SFRA Outputs
		Identify locations at risk of flooding	All SFRA Outputs
		Identify vulnerable groups within the community	n\a
2	Define the criteria for activating the plan	Identify the level of flood warning that is available for each location considered at risk of flooding	See section 7.1 of the SFRA report
		Identify the triggers for activating the plan during scenarios when there is prior warning and unforeseen events \ no prior warning	
		Identify the triggers for activating separate components of the plan i.e. 'dry' and 'wet' evacuation procedure	
		Define who activates the plan	n\a
3	Establish actions to be taken before a flood	Identify the direction of flooding for each location at risk of flooding	Visualisation of flow routes. See animations provided with the SFRA report
		Include details of existing defences and flood management schemes	See section 4.5 of the SFRA report
		Define local flood actions of individuals \ the community including: • The priority of each action • The person(s) responsible for undertaking each action • The triggers for undertaking each action • The equipment and time required to undertake each action	n\a
4	Establish actions to be taken during a flood	List the contact details of local volunteers \ flood wardens that could be contacted in an incident (including out of hours \ evening)	n\a
		List important organisations (with contact details) that may be required to provide assistance or contacted during an incident (including out of hours)	n\a
		Identify available resources within the community and organisation identified above	n\a
		List vulnerable people, properties and locations where early assistance may be required	n\a
		Define local flood actions of individuals \ the community including: • The priority of each action • The person(s) responsible for undertaking each action • The triggers for undertaking each action • The equipment and time required to undertake each action	n\a
		Agree and detail specific arrangements between the organisations and the community	n\a
		Where possible, identify the location of emergency evacuation rest centres and local flood co-ordination centres	
5	Establish actions to be taken after a flood	List individuals and companies \ reputable contractors whose help may be needed after a flood and if required, formalise contracts and contingency measures	n\a
		Define local flood actions of individuals \ the community including: • The priority of each action • The person(s) responsible for undertaking each action • The triggers for undertaking each action • The equipment and time required to undertake each action	n\a
6	Define when the plan is to be closed \ local response stood-down	Define when the plan is to be closed \ local response stood-down after an incident Establish who is responsible for closing down the plan	n\a
7	Define communication methods	Establish the means of reporting incidents	n\a
		Details the methods of passing on information	n\a
		Define how individuals, the community and relevant organisations will be notified when: • the plan / parts of the plan are activated e.g. using the three Jaywick warning sirens to warn local communities to evacuate • emergency rest centres and local flood co-ordination centres are activated • organisations assistance are required • keeping all stakeholders informed before, during and after an incident	n\a

7.5 Access and egress issues in Jaywick

7.5.1 Lead times and time required to evacuate

Estimating the time it will take to evacuate large numbers of people during a major flood is difficult. Many factors affect evacuation times such as demographics, time of day, time of year, weather conditions and the proximity of the emergency services. A 2008 report on access and egress improvements in Brooklands and Grasslands for Tendring District Council investigated evacuation times[19]. Based on discussions with representatives from Essex Fire and Rescue, Essex Constabulary, Tendring District Council Emergency Planning Department, the following evacuation times were compiled (Table 7-3) as part of the 2008 study. These evacuation times aimed to safely evacuate people out of Jaywick prior to a major flood event. All times were estimates, but provide an insight into the duration it would take.

Table 7-3: Evacuation Times

Time of year	Day	Night
Winter	6 – 9 hours	8 – 11 hours
Summer	6 – 10 hours	7 – 12 hours

Simulations of the effect of breaches in the sea defences at Jaywick shows access is a significant issue should a breach occur, the time for warning and evacuation would be short and subsequent drainage time could be long with poor access into the area.

The baseline modelling for the 0.5% AEP scenario shows there is no flooding of primary access/egress routes. However, modelling shows if a breach were to occur in the defence wall at Brooklands (location C) at a tide level equivalent to the Flood Warning threshold, Lotus Way would flood within 15 minutes of a breach and Meadow Way would flood within 5 to 15 hours of a breach. Although Brooklands and Broadway are not shown to flood, these routes lead to Meadow Way which is shown to flood to a depth of 0.25m for 5.5 hours of the model simulation run time. Modelling shows a breach to the west of the counterwall may also cause potential access and agress issues with Lee-over-Sands becoming cut off within 15 minutes of a breach at location A.

Modelling shows if a breach were to occur in the defence wall at Brooklands (location C) at a tide level equivalent to the Severe Flood Warning threshold, it would result in similar access and egress issues as for the tide level equivalent to the Flood Warning threshold. However, in this event, Meadow Way would be flooded to a depth of 0.25m for over 15 hours.

Lee-over-Sands would again be cut off within 15 minutes of a breach at location A. Additionally the Seawick area would have between two and 15 hours of a breach before access routes become cut off.

The vulnerability of the area in the event of a breach and the subsequent access and egress issues that may result should be considered by planners and those developing emergency plans or local real time emergency response, particularly the need to consider the evacuation of the area following the issuing of a coastal flood warning or severe flood warning for this section of the coast.

7.5.2 Likelihood of access and egress being lost in a flood event

Information on the depths and duration of flooding to the main access and egress routes for each of the modelled scenarios is provided in Appendix D. The majority of flooding to these routes is within a few hours or less from the breach occurrence. Further details on the time to inundation are shown in the maps in Appendix E.

7.5.3 Existing and potential access routes

The key issue relating to the access routes at Jaywick is that the all roads close to the coast are within the Flood Zones 2 and 3 (see maps in Appendix A and discussion of flood risk in Section 5). In addition, not all roads are suitable for emergency vehicles i.e. the roads are not wide enough to support the emergency vehicles. A number of options were considered as part of the

[19] Tendring District Council. Access and Egress: Improvements in Brooklands and Grasslands (JBA Consulting, March 2008)

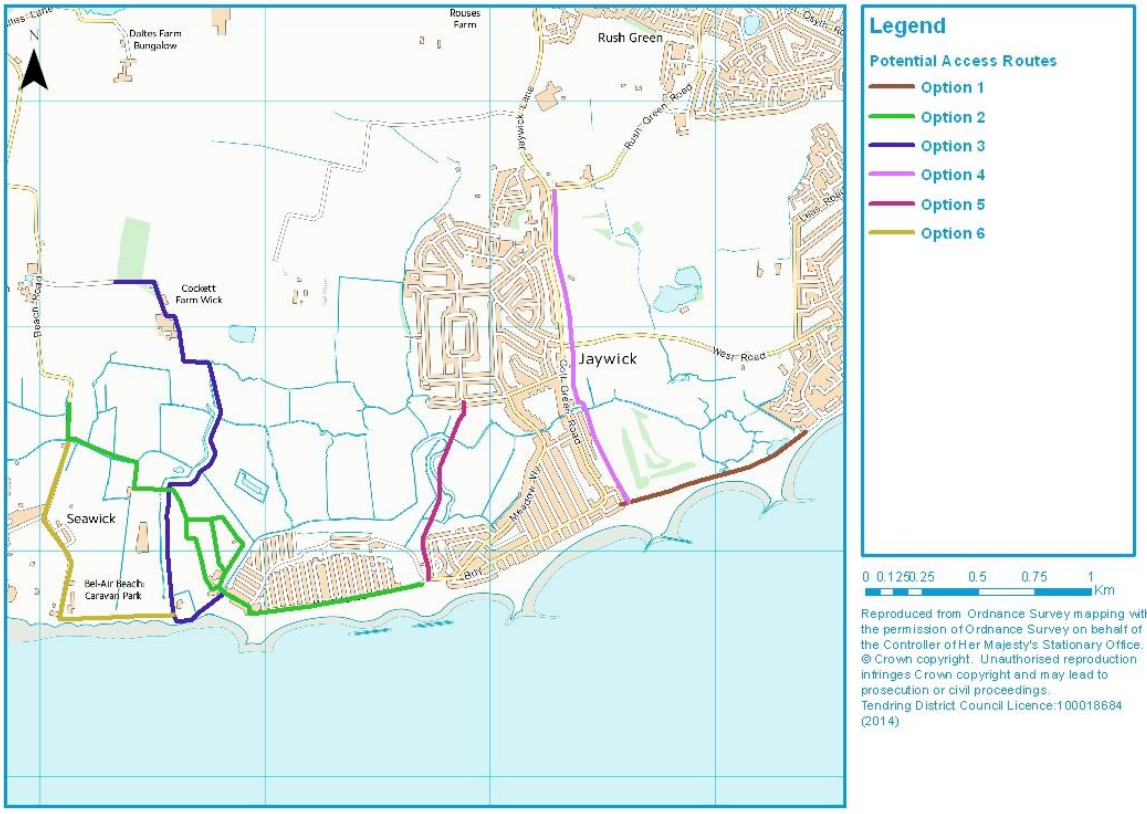
2007 SFRA and the 2008 Emergency Access and Egress Report. These options have been assessed against the updated mapping undertaken as part of this SFRA update.

In addition to flood considerations, other work would be required to ensure these options were suitable to provide safe access and egress including

- construction of new roads/tracks where none currently exist;
- road improvements (widened, improved surface);
- features to allow routes to pass over the counterwall or ditches; and
- route raising to ensure it is kept dry in a flood event.

More detail regarding these options for emergency access are found in the 2008 Emergency Access and Egress Report[19].

Figure 7-3: Options for potential emergency access roads



Option 1: Broadway to the Seawall to Clacton-on-Sea

This route would be an emergency access/egress route only, following an existing road at Broadway, cutting down an access path by The Close onto the sea wall. The route would then follow the sea wall, past the Martello Tower, to Selsey Avenue in Clacton.

The updated mapping shows this route would flood in the design (0.5% AEP) event.

Option 2: Brooklands to Tower Caravan Park to Beach Road

This route would be an emergency access/egress route only, following Brooklands Road onto Belsize Avenue into the Tower Caravan Park. From the caravan park the route would head north, passing over the counterwall. It would head to the north of the Bel-Air Beach Caravan Park, meeting an existing track before heading on to Beach Road.

The updated mapping shows overtopping of the sea wall west of Belsize Avenue resulting in flooding to the Tower Caravan Park from the sea in the design (0.5% AEP) event.

Option 3: Existing counterwall path

This route would be an emergency access/egress route only, running along the length of the counterwall along a pre-existing path. North of the counterwall the route would pass through Cockett Wick Farm and onto the Cockett Wick Lane. South of the counterwall the route would pass the Martello Tower before joining the sea wall and heading onto Brooklands Road.

The updated mapping shows, other than a small amount of overtopping of the defences onto the counterwall at the sea front, this route would not be affected by flooding in the design (0.5% AEP) event.

Option 4: New raised access route parallel to Rush Green Road, East Jaywick

This route would be an emergency access/egress route only, consisting of a bank parallel to the existing road but at a higher level, giving access between West Road and the Jaywick Seawall. The access would pass part of the golf green, staying close to the perimeter.

The updated mapping shows this route would not be at risk from the sea in the current day. However, the route may be at risk in the future due to climate change, with the model results showing flooding to this area in a 0.5% AEP plus climate change to 2112 scenario.

Option 5: New raised access route to Tudor Estate, Jaywick

This route would be an emergency access/egress route only, running along a new embankment from Broadway up to Aragon Close in the Tudor Estate.

The updated mapping shows sea flooding along this potential route in a 0.5% AEP plus climate change to 2055 scenario.

Option 6: Seawick route

This route would be an emergency access/egress route only from Seawick, following along the length of beach road before reaching the sea wall. The route then follows the seawall, passing the Martello Tower and joining Belsize Avenue, Grasslands.

The updated mapping shows in overtopping and flooding to this route from the sea in a 0.5% AEP plus climate change to 2055 scenario.

Assessment of options

Provision of a new permanent road above flood levels, for example Option 4 or 5, would be expensive due to the high embankment required over a long length (over 3km) Figure 7-3. Raising the existing road (Golf Green Road) would be difficult to link around existing property and a further raised link to the Brooklands/Grassland estates would be needed.

Restricted emergency use options such as Options 1-3 and 6, are possible though they could be inaccessible depending on overtopping or where a breach occurred. The counterwall bank would need significant widening and possibly straightening as the current route has a number of sharp bends if Option 3 were adopted.

Option 1 would require adapting the access route behind the sea wall through to Clacton. Although the route could be vulnerable to overtopping at the peak of a tide, the time when access due to overtopping would be limited given the protection offered by the offshore breakwaters and beach. It would not be desirable to use the route for normal access but utilised only for emergency vehicles is an alternative. There are three locations where current arrangements would need to be improved to make the route suitable. Considering these in turn from Clacton

- the access road along the sea wall falls below the expected peak flood level mid way between Clacton and Jaywick;
- at the Jaywick end of the access road there is currently no suitable connection between existing roads and the sea wall access, and changes in level would need ramps; and
- the sea front road between Brooklands and Jaywick village also falls below potential flood level and higher access along the sea wall is narrow and without good connection to existing roads.

This page is intentionally left blank

8 Summary and conclusions

8.1 Summary

The Jaywick SFRA update has considered all sources of flooding, including sea, fluvial, pluvial, groundwater, and sewer flooding, within the Jaywick area:

- An assessment of the flood defences in the area has been undertaken, including defence condition and the residual risk
- Flood risk has been assessed on all sites. Guidance for the requirements for a site specific Flood Risk Assessment is provided (Section 3, 7 and 8 and Appendix I)
- The updated Flood Map for Surface Water is provided, indicating the likelihood of surface water flooding in the Jaywick area
- Flooding from the sea has been considered through a range of overtopping and breach scenarios. Outlines, depths, velocities and hazard maps have been provided along with animations showing the rate of rise of depth and hazard in the area over time
- Emergency planning considerations, including provision of safe access and egress, have been provided, along with advice for the preparation of community and individual flood response plans

8.2 Flood risk

The SFRA update has shown that, at the current point in time, the flood defences currently protect the majority of the study area in the design event (0.5% AEP), with the exception for east of the counterwall by Belsize Avenue, at Broadway and at the golf course east of The Close where the defences are overtopped by wave overspill. These areas appear to coincide with stretches of the coastline where the beach is less wide in between the fish tail groynes. Over time, due to climate change, the flood defence standard of protection against overtopping will decline. It is expected that overtopping in the 0.5% AEP scenario will become worse and more widespread, with the defences at Seawick significantly increasing in the 2055 scenario compared to the current baseline. Overtopping of defences at Jaywick becomes worse during the 2055 scenario; the locations remain the same as the current scenario but the extent of flooding is larger. In the 2112 scenario all defences along the coast between west Clacton on Sea and Point Clear will be overtopped, resulting in extensive flooding.

Although the area is defended, there is a residual risk of high hazard to the areas behind these defences should a section of defence fail or breach when subjected to a surge tide. In some areas the defence condition is classed as Poor. Breach scenarios have shown that the counterwall provides protection to Jaywick and areas to the east of the counterwall from breaches of defences at Colne Point and west of Brooklands. However, a breach located by Tower Caravan Park to the east of the counterwall will have significant impacts on the extent and depth and flooding and hence the flood hazard.

Mitigation measures could reduce the impact of flooding or increase the ability of people affected but these are potentially costly. It should also be ensured that mitigation measures do not exacerbate flooding to development elsewhere.

The security of safe access and egress in the future is an issue for the area, with many of the main access/egress routes flooded in the 0.5% AEP climate change scenarios and the 0.1% AEP scenarios. The main route out of Brooklands and Jaywick village is particularly at risk, often remaining flooded for long durations. Flood defence crest levels would have to be increased or access routes raised to offset this problem arising through floodwaters overtopping the defences more frequently in the future.

In the event of a breach, access/egress routes become cut off rapidly. The depth and duration of flooding to access/egress routes is dependent upon the location of the breach and the tide level. Model scenarios showed primary routes flooded over 30 hours for the modelled three tide scenario; however, in reality the duration may be longer due to subsequent tide cycles and length of time taken to repair a breach.

8.3 Planning implications

Under the NPPF, the area should not be selected for new development unless the Exception Test can be passed. In order to pass the Exception Test, development will have to a) demonstrate that the development provides wider sustainability benefits to the community that outweigh flood risk and b) 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.

New development should not increase the overall flood risk in the area. Whilst raising land is a possibility, it has significant cost implications and practical difficulties close to existing developments. It also has the potential to make flooding worse to development elsewhere by altering flow routes and reducing the land area available for flood storage. Where this is the case the same flood volume will need to be accommodated on a smaller land footprint which could affect flood levels, pathways and the rates and characteristics of the flooding.

Access and egress for development needs to be considered, and improvements to planning for emergency access and egress will be needed.

8.4 Use of SFRA data

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

The Environment Agency regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed site-specific Flood Risk Assessment.

This version of the SFRA is a living document and should be periodically updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by the District Council, Essex County Council (in its role as Lead Local Flood Authority), the Highways Authority, Anglian Water and the Environment Agency.

The Environment Agency are currently producing a detailed 1D-2D model of the Jaywick Ditch, the results of which are expected after June 2015. The outlines produced by this detailed model will supersede the outlines provided in this SFRA. All site related flood risk assessments after June 2015 should refer to the Environment Agency's modelling for evaluating fluvial flood risk from the Jaywick Ditch.

It is recommended that Tendring District Council, the Environment Agency and other Category 1 responders work with the local community to build awareness and resilience to flooding and its associated risks. The evidence base provided by this SFRA will help inform a Community Emergency Response Plan for flooding and will also help to inform site level Flood Response Plans and Flood Risk Assessments to support applications for new developments or plot level re-builds.