Level 1 Strategic Flood Risk Assessment

Spelthorne Borough Council

Level 1 Report

Project Number 60559796

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Quality information

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Revision History

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Table of Contents

Figures

Tables

Executive Summary

A significant proportion of the Borough of Spelthorne is at risk of flooding from rivers, surface water and groundwater sources. The River Thames and its tributaries, the River Ash and River Colne, are dominant features in the Borough and flooding from these watercourses had occurred a number of times in the last 100 years, most recently in the winter of 2013 – 2014, during which many homes and business were affected. Parts of the Borough are also at risk of surface water flooding and groundwater emergence.

The Environment Agency and Surrey County Council are working together to deliver the River Thames Scheme (RTS) in partnership with other local authorities and interested parties. The RTS will involve the construction of a new flood channel in two sections through Spelthorne and Runnymede to reduce flood risk to properties in communities in Egham, Staines, Chertsey, Shepperton, Weybridge, Sunbury, Molesey, Thames Ditton, Kingston and Teddington.

As the Local Planning Authority (LPA) Spelthorne Borough Council (BC) has the responsibility, in accordance with the National Planning Policy Framework (NPPF)[1], to ensure that flood risk is understood and managed effectively through all stages of the planning process. As such, Spelthorne BC is required to undertake a Strategic Flood Risk Assessment (SFRA) to form part of the evidence base for the preparation of their Local Plan.

The aim of the Level 1 Strategic Flood Risk Assessment (SFRA) is to identify the spatial variation in flood risk across the Borough of Spelthorne from all sources, including rivers, surface water, groundwater, sewers and other artificial sources, thereby facilitating a borough-wide comparison of future development sites with respect to flood risk considerations and the application of the Sequential Test.

AECOM was commissioned in 2018 to review and update the SFRA which was originally prepared in 2006[2]. Further updates were then undertaken in Spring 2021 following the publication of new modelling data for fluvial watercourses; and in Summer 2022 following changes to the climate change guidance issued by the Environment Agency. This version of the SFRA has been revised to reflect changes to the Planning Practice Guidance Flood Risk and Coastal Change[3] that were made in August 2022, as well as comments received from the Environment Agency in May 2023.

The Level 1 SFRA has been prepared in consultation with the Environment Agency and Surrey County Council. The Environment Agency are the risk management authority (RMA) with responsibility for taking the lead in the management of flood risk from the main rivers in the study area and have made key flood risk mapping datasets available for the Level 1 SFRA. SCC, as the Lead Local Flood Authority (LLFA), takes the lead in the management of flood risk from surface water, groundwater and ordinary watercourses, and has prepared a series of Flood Investigation Reports for significant flood events in the Borough.

The Level 1 SFRA provides an overview of the risk of flooding from all sources across Spelthorne Borough, now and in the future, taking account of the impacts of climate change, and assessing the cumulative impact that land use changes and development in the area will have on flood risk. The Level 1 SFRA should be used to inform the development of policies, strategic planning decisions, the application of the Sequential Test, development management and emergency planning.

In the future, climate change is anticipated to have an impact on all sources of flood risk within the Borough. It is important that planning decisions recognise the potential risk that increased runoff poses to property and plan development accordingly to ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development and will not increase flood risk overall.

1 National Planning Policy Framework published March 2012, last updated July 2021. https://www.gov.uk/government/publications/national-planning-policy-framework--2
2 Spelthorne Borough Council (2006) Strategic Flood Risk Assessment. https://www.spelthorne.gov.uk/media/3478/Strategic-Flood-Risk-Assessment-part-1/pdf/Strategic_Flood_Risk_Assessment.pdf
3 Planning Practice Guidance: Flood Risk and Coastal Change, Updated 25 August 2022 https://www.gov.uk/guidance/flood-risk-and-coastal-change

1. Introduction and User Guide

1.1 Introduction

1.1.1 In its role as the Local Planning Authority (LPA), Spelthorne Borough Council (BC) is currently preparing documents that will form part of the new Local Plan and set out a vision and framework for development in the Borough.

1.1.2 The National Planning Policy Framework (NPPF) and accompanying Planning Practice Guidance (PPG)[4] emphasise the responsibilities for LPAs to ensure that flood risk is understood and managed effectively using a risk-based approach through all stages of the planning process. As such, LPAs are required to undertake a Strategic Flood Risk Assessment (SFRA) to support the preparation of their Local Plan.

1.1.3 AECOM was commissioned in 2018 to review and update the SFRA which was originally prepared in 2006[5]. Further updates were then undertaken in Spring 2021, following the publication of new modelling data for fluvial watercourses; and in Summer 2022, following changes to the climate change guidance issued by the Environment Agency. This version of the SFRA has been revised to reflect changes to the PPG for Flood Risk and Coastal Change that were made in August 2022, as well as comments received from the Environment Agency in May 2023.

1.1.4 This update collates the most up to date flood risk information for use by the Spelthorne BC as an evidence base to inform the updated Local Plan and subsequent planning documents. The SFRA has been completed in collaboration with Spelthorne BC, Surrey County Council (SCC), the Environment Agency and Thames Water. This will enable stringent decision making by strategic planning and development management officers on a day-to-day basis.

1.2 Approach to Flood Risk Management

1.2.1 The NPPF and associated PPG for Flood Risk and Coastal Change emphasise the active role LPAs should take to ensure that flood risk is assessed, avoided, controlled, mitigated and managed effectively and sustainably throughout all stages of the planning process. The overall approach for the consideration of flood risk set out in paragraphs 3 and 4 of the PPG is summarised as follows:

1.2.2 This has implications for LPAs and developers as described below.

Assess flood risk

1.2.3 The NPPF outlines that Local Plans should be supported by a SFRA and LPAs should use the findings to inform strategic land use planning. Figure 1-1 illustrates how flood risk should be taken into account in the preparation of the Local Plan by Spelthorne BC.

1.2.4 Where appropriate, for sites in areas at risk of flooding, developers must undertake a site-specific Flood Risk Assessment (FRA) to accompany planning applications (or prior approval for certain types of permitted development, or Technical Details Consent).

1.2.5 Assessments of flood risk should identify sources of uncertainty and how these are accounted for in a mitigation strategy.

[4] Planning Practice Guidance: Flood Risk and Coastal Change, Updated 25 August 2022, https://www.gov.uk/guidance/flood-risk-and-coastal-change
[5] Spelthorne Borough Council (2006) Strategic Flood Risk Assessment. https://www.spelthorne.gov.uk/media/3478/Strategic-Flood-Risk-Assessment-part-1/pdf/Strategic_Flood_Risk_Assessment.pdf

Avoid flood risk

1.2.6 In plan-making, Spelthorne BC should apply the sequential approach to site selection so that development is, as far as reasonably possible, located where the risk of flooding from all sources is lowest, taking account of climate change and the vulnerability of future users to flood risk. This involves applying the Sequential Test and, if needed, the Exception Test, as described in Figure 1-1 and in accordance with PPG Table 2 'flood risk vulnerability and flood zone incompatibility'.

1.2.7 In decision-taking this involves applying the Sequential Test and if necessary, the Exception Test for specific development proposals. Furthermore, *within* individual application sites, the most vulnerable aspects of development must be located in areas of lowest flood risk, including measures to avoid flood risk vertically, unless there are overriding reasons to prefer a different location.

1.2.8 Where the Sequential and Exception Tests have been applied as necessary and not met, development should not be allowed.

Control flood risk

1.2.9 Spelthorne BC and developers can investigate measures to control the risk of flooding affecting the site. Early discussions with relevant flood risk management authorities, and reference to SFRAs and programmes of flood and coastal erosion risk management schemes will help to identify such opportunities.

1.2.10 Spelthorne BC and developers should seek flood risk management opportunities (e.g. safeguarding land), and to reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems).

Mitigate flood risk

1.2.11 After applying measures to avoid and control the risk of flooding, the next step is to mitigate flooding. Spelthorne BC and developers must ensure that development is appropriately flood resilient and resistant. Passive flood resilience and resistance measures should be prioritised over active measures as they are likely to be more effective and more reliable.

Manage flood risk

1.2.12 Spelthorne BC and developers should consider further management measures to deal with any residual risk remaining after avoidance, control and mitigation have been utilised. Residual risks will need to be safely managed to ensure people are not exposed to hazardous flooding. LPAs and developers should provide safe access and escape routes and consider whether adequate flood warning would be available to people using the development.

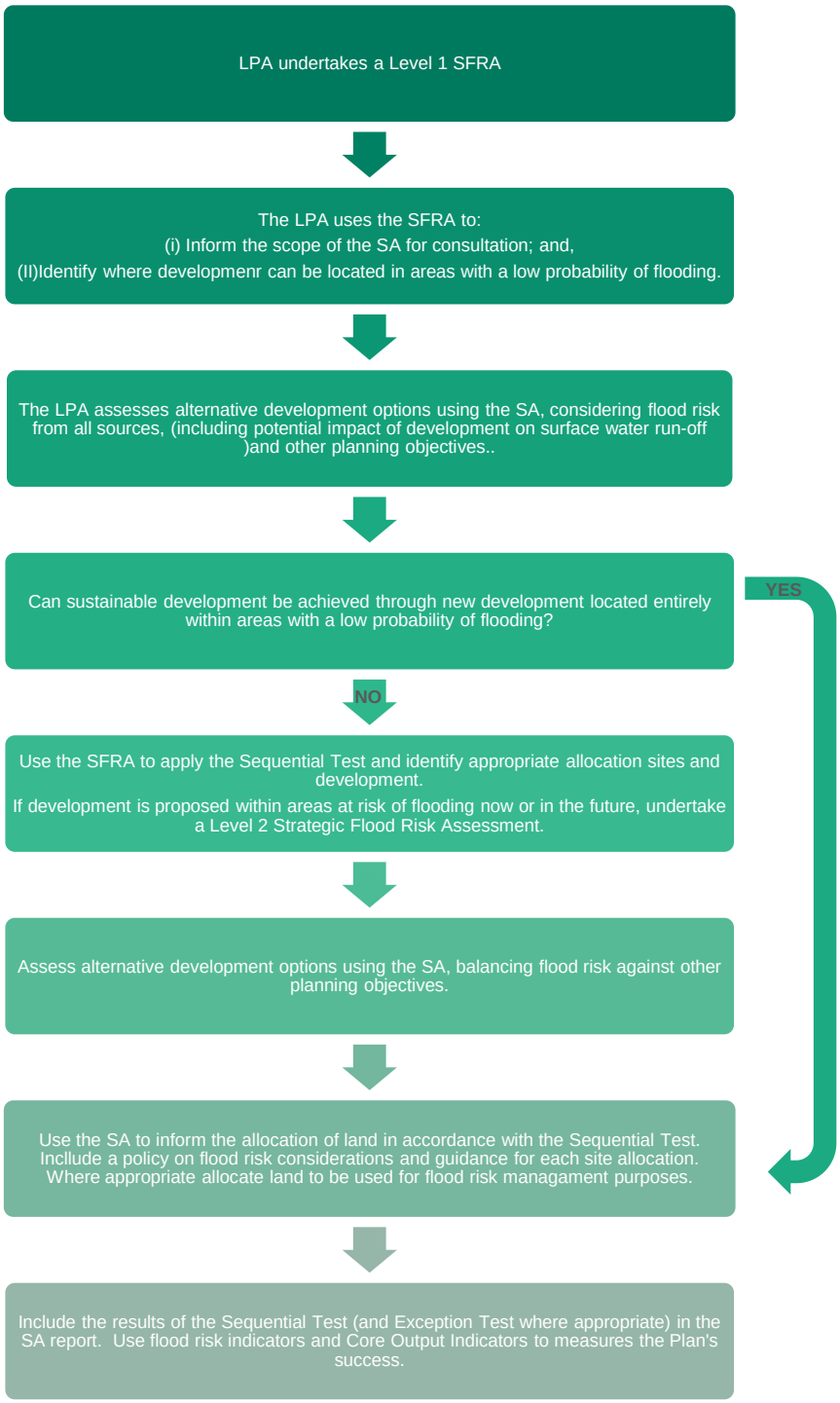


Figure 1-1 Taking flood risk into account in the preparation of strategic policies (Planning Practice Guidance for Flood Risk and Coastal Change Diagram 1)

1.3 Purpose of the SFRA

1.3.1 The purpose of this SFRA is to collate and present the most up to date flood risk information for use by Spelthorne BC to inform the preparation of their Local Plan and prudent decision-making by development management officers on a day-to-day basis.

1.3.2 In order to achieve this, the SFRA will:

- Assess all potential sources of flooding, now and in the future, taking account of the impacts of climate change, based on readily available datasets.
- Inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies.
- Identify existing flood risk management measures as well as areas that need to be adapted to climate change, and areas that need to be safeguarded for future flood risk management features and structures.
- Consider the potential cumulative impact of development and land use change on the risk of flooding in the study area.
- Inform the application of the Sequential and, if necessary, Exception Tests in the allocation of future development sites, as required by the NPPF, and planning application process.
- Identify the requirements for site-specific Flood Risk Assessments.
- Inform the preparation of flood risk policy and guidance and inform policies for land use change.
- Determine the acceptability of flood risk in relation to emergency planning capability.
- Consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and storage for flood water.

1.3.3 It is recommended that Spelthorne BC take an integrated approach to flood risk management when preparing plans, as per NPPF paragraph 161l. This is a collaborative, catchment-based approach delivering coordinated management of water storage, supply, demand, wastewater, flood risk, quality of water and the wider environment.

1.4 Flood Risk Policy and Guidance

1.4.1 There is an established body of policy and guidance documents which are of particular importance when considering development and flood risk. These are identified in Table 1-1.

Table 1-1 Flood Risk Policy and Guidance Documents

National Legislative and Policy Documents		
Flood and Water Management Act (2010)	Provides for a more comprehensive management of flood risk, designating roles and responsibilities for different Risk Management Authorities. Designates Surrey County Council as the Lead Local Flood Authority, with duties and responsibilities for managing local flood risk (defined as flooding from surface water, groundwater and ordinary watercourses).	https://www.legislation.gov.uk/ukpga/2010/29/contents
Flood Risk Regulations (2009)	The Flood Risk Regulations transpose the EU Floods Directive into law in England. It aims to provide a consistent approach to flood risk across Europe.	http://www.legislation.gov.uk/uksi/2009/3042/contents/made
National Planning Policy Framework (Section 14, para. 152-173) July 2021	Sets out government's planning policies for England and how these are expected to be applied. Section 14 relates to meeting the challenge of climate change, flooding and coastal change.	https://www.gov.uk/government/publications/national-planning-policy-framework—2
National Flood and Coastal Erosion Risk Management Strategy for England (Published July 2020, updated June 2022)	The National FCERM Strategy sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. It provides a framework for the work of all flood and coastal erosion risk management authorities to the year 2100.	https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england—2
Regional Flood Risk Policy		
Thames Catchment Flood Management Plan (2009)	Role of the CFMP is to establish flood risk management policies which will deliver sustainable flood risk management for the long term (an Environment Agency Document).	https://www.gov.uk/government/collections/catchment-flood-management-plans
Guidance Documents		
Planning Policy Guidance – Flood Risk and Coastal Change (Revised August 2022)	Describes the planning approach to development within areas at risk of flooding from all sources	http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
Environment Agency Standing Advice	Guidance on information to be included within robust site specific FRAs.	https://www.gov.uk/guidance/flood-risk-assessment-standing-advice
Flood Risk Assessments: Climate Change Allowances (2016) – Revised May 2022.	The guidance provides climate change allowance to consider in flood risk assessments in order to demonstrate how flood risks will managed over the design life of the development.	https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
Local Documents and Strategies		
Spelthorne BC Core Strategy and Policies DPD (adopted 2009); Allocations DPD (2009)	The Core Strategy sets out the existing policies for development within the Borough including policy guidance on flood risk.	https://www.spelthorne.gov.uk/article/17620/Development-Plan-2009
Spelthorne BC Local Plan 2022-2037	The overall vision and framework for future development in the area, addressing needs and opportunities in relation to housing, the economy, community facilities and infrastructure - as well as providing a basis for conserving and enhancing the natural and historic environment, mitigating and adapting to climate change, and achieving well designed places. The emerging Local Plan will set out how the local area will develop over at least the next 15 years and once adopted, will replace the 2009 Development Plan.	https://www.spelthorne.gov.uk/article/17619/Emerging-Local-Plan-2022-2037
SCC Preliminary Flood Risk	In accordance with the Flood Risk Regulations 2009, SCC provided a PFRA to provide a high-level overview of flood risk from local sources for provision to the Environment Agency, ultimately	https://www.surreycc.gov.uk/people-and-community/emergenc

Assessment (PFRA) (2017)	reporting to Europe. The report was prepared in 2011 and subsequently updated in 2017. The PFRA feeds into the Surrey Local Flood Risk Management Strategy.	y-planning-and-community-safety/flooding-advice/more-about-flooding/the-preliminary-flood-risk-assessment
Surrey County Council Local Flood Risk Management Strategy (LFRMS) (2017)	As LLFA, SCC has developed a LFRMS to understand and manage flood risk within the Borough and is responsible for delivering the LFRMS and monitoring progress on the LFRMS action plans. SCC are in the process of updating the LFRMS to be consistent with the National FCERM Strategy. The updated LFRMS document will be published by SCC to the same website when it is complete.	https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/surrey-local-flood-risk-management-strategy
Multi-Agency Flood Plan	Describes the management structures and actions of local responders in response to a flooding event in Spelthorne BC.	*Internal document.*

1.5 User Guide

1.5.1 It is anticipated that this SFRA will have several end users with slightly different requirements; this Section describes how to use the SFRA and how to navigate the report and mapping deliverables. The SFRA Report is set out as follows:

- Section 2 Methodology
- Section 3 Strategic Assessment of Flood Risk
- Section 4 Avoiding Flood Risk – Guidance on Applying the Sequential Test
- Section 5 Measures to Control and Mitigate Flood Risk
- Section 6 Measures to Manage Residual Risk – Emergency Planning
- Section 7 Guidance on the preparation of site specific FRAs
- Appendix A Data Register
- Appendix B Mapping
- Appendix C Surface Water Note (2006)

Strategic Planning and Policy

1.5.2 The main purpose of the SFRA for Spelthorne BC, as explained in the NPPF, is to provide a strategic overview of flood risk within the Borough in order to enable effective risk-based strategic planning for the future, through the preparation of the Local Plan. Section 3 presents the information that should be used by Spelthorne BC to inform their knowledge of flood risk from all sources throughout the Borough.

1.5.3 As part of this SFRA, recommendations are made throughout Sections 4, 5, 6 and 7 for consideration by Spelthorne BC as they develop their Local Plan.

Applying the Sequential Test

1.5.4 The NPPF sets strict tests to protect people and property from flooding which all LPAs are expected to follow. The aim of the Sequential Test, under the NPPF, is to steer new development to areas with the lowest probability of flooding. Section 3 provides the data required to undertake the Sequential Test and Section 4 provides specific guidance on applying both the Sequential and, where appropriate, Exception Tests.

Emergency Planning

1.5.5 Spelthorne BC is a Category One Responder under the Civil Contingencies Act 2004[6] and therefore has a responsibility, along with other organisations, to develop emergency plans to help reduce, control or

[6] HSMO (2004) Civil Contingencies Act. Available from: http://www.legislation.gov.uk/ukpga/2004/36/contents

ease the effects of an emergency. Spelthorne BC has set out its response plan in the Spelthorne BC Emergency Plan[7].

1.5.6 The Emergency Plan sets out generic plans for any emergency event. However, the complex nature of flooding, and its subsequent impacts, often requires a comprehensive and sustained response from a wide range of organisations. As such, Surrey County Council (SCC) has formed a Local Resilience Forum (LRF)[8] to allow all responding parties to work together in a coordinated response to a flood event.

1.5.7 The SFRA deliverables should be used by Spelthorne BC's Emergency Planning team as a source of information about flood risk. The SFRA should be reviewed by the team, such that the findings can be incorporated into their understanding of flood risk.

Preparing Site Specific FRAs

1.5.8 The SFRA can provide a useful starting point to the preparation of site-specific Flood Risk Assessments (FRAs) for individual development sites as follows:

- Section 3 provides an overview of the key issues within the Borough in relation to flood risk.
- Section 4 provides guidance on the application of the Sequential Test for sites that have not yet been tested by the LPA, as well as details on when the Exception Test is required, and how to apply it.
- Sections 5 and 6 provides detail of measures that may need to be implemented to control, manage and mitigate flood risk.
- Section 7 provides specific guidance for preparing site specific FRAs in accordance with the checklist presented in the PPG Flood Risk and Coastal Change.

Assessing Planning Applications

1.5.9 Planning and development management officers who are reviewing site specific FRAs as part of the planning application process should consult Section 3 of the SFRA to provide background for flood risk in the area relating to the planning application. Section 7 can also be used by those assessing applications as a checklist for issues that need to be addressed as part of site specific FRAs.

1.6 Living Document

1.6.1 SFRAs should be adopted as 'living documents' which are reviewed and updated regularly considering new or revised flood modelling studies, changes to the predicted impacts of climate change, local flood management schemes and/or flood risk management plans.

1.6.2 This version of the SFRA is based on the currently published modelled outputs for the River Thames (between Hurley and Teddington, 2019/2020). However, it should be noted that the Environment Agency are currently undertaking revised modelling for the River Thames (between Windsor and Teddington) and in due course they will publish the study and use the outputs to revise Flood Zones 2 and 3 on the Flood Map for Planning (Rivers and Sea)[9] during one of their quarterly updates. Once this study is published, Spelthorne BC will need to review the outputs and determine whether an update to the SFRA is required.

[7] Spelthorne Borough Council (2016) Emergency Plan. Available from: https://www.spelthorne.gov.uk/CHttpHandler.ashx?id=1095&p=0
[8] Surrey County Council (2017) Local Resilience Forum. Available from: https://www.surreycc.gov.uk/__data/assets/pdf_file/0007/87253/Surrey-Major-Incident-Protocol-V12.5-Public-Facing.pdf
[9] Environment Agency, *Flood Map for Planning (Rivers and Sea)* https://flood-map-for-planning.service.gov.uk/

2. Methodology

2.1 Consultation

2.1.1 The Localism Act 2011[10] places a legal duty on LPAs, County Councils and other prescribed public bodies to engage constructively, actively and on an ongoing basis to maximise the effectiveness of local plan preparation in the context of strategic cross boundary matters.

2.1.2 In complying with the duty to cooperate, Government Guidance recommends that LPAs 'scope' the strategic matters of Local Plan documents at the beginning of the preparation process taking account of the 'functional geography' of each matter and identify those LPAs and prescribed bodies that need to be constructively and actively engaged.

2.1.3 The Council prepared and consulted on a Scoping Statement[11]as part of the background work required to prepare the Spelthorne Local Plan. Flood risk is identified as a strategic matter and specific engagement activities are proposed with several adjoining LPAs and Prescribed Bodies, both in relation to the preparation of the SFRA and the Local Plan.

2.1.4 As part of the SFRA, several organisations were contacted, invited to attend an inception meeting, and requested to provide data to inform the SFRA. A summary of the roles of each organization, and their involvement through the SFRA project, is provided in Table 2-1.

Table 2-1 SFRA Stakeholder Organisations and Roles

Stakeholder Organisation	Role with respect to Spelthorne BC SFRA
Spelthorne BC	As an LPA Spelthorne BC has a responsibility to consider flood risk in their strategic land use planning and the development of their Local Plan. The NPPF requires LPAs to undertake a SFRA and to use their findings, and those of other studies, to inform strategic land use planning including the application of the Sequential Test which seeks to steer development towards areas of lowest flood risk prior to consideration of areas of greater risk. Spelthorne BC is also required to consider flood risk and, when necessary, apply the Sequential and Exception Tests when assessing applications for development. During the preparation of the SFRA, Spelthorne BC has provided access to available datasets held by the Council regarding flood risk across the Borough. The SFRA will be used by the Spelthorne BC's Emergency Planning team to ensure that the findings are incorporated into their understanding of flood risk and the preparation of their Multi-Agency Flood Plan (MAFP).
Environment Agency	The Environment Agency is responsible for managing the risk of flooding from Main Rivers and the sea and has a responsibility to provide a strategic overview for all flooding sources and coastal erosion. The Environment Agency has a role to provide technical advice to LPAs and developers on how best to avoid, manage and reduce the adverse impacts of flooding. Part of this role involves advising on the preparation of spatial plans, sustainability appraisals and evidence base documents, including SFRAs as well as providing advice on higher risk planning applications. The Environment Agency undertakes systematic modelling and mapping of fluvial flood risk associated with all Main Rivers in the study area, as well as supporting Lead Local Flood Authorities (LLFA) with the management of surface water flooding by mapping surface water flood risk across England. The Environment Agency has supplied available datasets for use within the SFRA and has undertaken reviews of the draft SFRA project deliverables.
Surrey County Council (SCC)	As the LLFA, under the Flood and Water Management Act (FWMA) SCC has a duty to take the lead in the coordination of local flood risk management, specifically defined as flooding from surface water, groundwater, and ordinary watercourses and to this end has prepared the Local Flood Risk Management Strategy (LFRMS) for Surrey. SCC is responsible for regulation and enforcement on ordinary watercourses and is a statutory consultee for future sustainable drainage systems (SuDS) for major developments in the county, following changes to the Town and Country Planning (Development Management Procedures) (England) Order 2015. SCC is the Highways Authority and therefore has responsibilities for the effectual drainage of surface water from adopted roads insofar as ensuring that drains, including kerbs, road gullies and ditches and the pipe network which connect to the sewers, are maintained. As such, SCC is a key stakeholder in the preparation of the SFRA. SCC has provided current datasets in relation to the assessment of local sources of flooding (surface water, groundwater

[10] HMSO (2011) Localism Act Available from: http://www.legislation.gov.uk/ukpga/2011/20/contents/enacted
[11] Spelthorne Borough Council (2016) Spelthorne Local Plan Duty to Cooperate Scoping Statement Available from: https://www.spelthorne.gov.uk/media/12229/Duty-to-Cooperate-Scoping-Statement/pdf/Duty_to_Cooperate_Scoping_Statement1.pdf

Stakeholder Organisation	Role with respect to Spelthorne BC SFRA
	and ordinary watercourses), has been consulted on the draft project deliverables and will be involved in the implementation of any policy outcomes with respect to sustainable drainage or ordinary watercourse management.
Thames Water Utilities Ltd	Thames Water Utilities Ltd (TWUL) is responsible for surface water drainage from development via adopted sewers and for maintaining public sewers into which much of the highway drainage connects. In relation to the SFRA, the main role that TWUL will play is providing data regarding past sewer flooding.
British Geological Survey	BGS hold several datasets that have informed the SFRA, including superficial and bedrock geology and suitability of infiltration SuDS.
Neighbouring LPAs and other consultees	The following LPAs adjoin Spelthorne BC, the London boroughs of Hillingdon, Hounslow and Richmond, the Berkshire Authorities of Windsor and Maidenhead and Slough and the Surrey authorities of Runnymede and Elmbridge.

2.2 Data Collection and Mapping

2.2.1 The large quantity of information and datasets have been made available by the stakeholder organisations and used to inform the assessment of flood risk from each of the sources presented in Section 3 and Appendix B. Descriptions of the datasets that have been used, along with details of their appropriate use or limitations, are included in Section 3, and a data register is included in **Appendix A Data Register**.

3. Strategic assessment of flood risk

3.1 Overview

3.1.1 Under Section 10 of the NPPF, the risk of flooding from all sources must be considered as part of a SFRA, including flooding from the sea, rivers, land, groundwater, sewers, and artificial sources. The study area is not located within an area at risk of tidal flooding, and thus flood risk from this source will not be considered further as part of this SFRA. This Section provides a strategic assessment of the flood risk across the Borough from each source. Reference should be made to the supporting mapping in Appendix B.

Local Area

3.1.2 Spelthorne borough is located in north west Surrey, south of London Heathrow Airport and 16 miles from central London. It is surrounded by the London boroughs of Richmond, Hillingdon and Hounslow to the north, the Berkshire authorities of Windsor and Maidenhead and Slough to the west and the Surrey authorities of Runnymede and Elmbridge to the south and east respectively. The River Thames forms the southern boundary of the Borough.

3.1.3 Spelthorne is located where the continuous built-up area of London gives way to a more dispersed pattern of urban areas and villages. Spelthorne covers an area of approximately 51 km^2, of which 65% is designated as Green Belt land and 35% is urban area, including the larger centres of Staines-upon-Thames, Ashford, Shepperton and Sunbury. The Local Plan for Spelthorne BC (2022-2037) is based on challenging housing targets of approximately 600 houses per year over the 15 year period.

Topography

3.1.4 Light Detection and Ranging (LiDAR) topographic survey data[12], presented in Appendix B Figure 1, indicates that the Borough of Spelthorne is very flat, and low lying. The highest point of the Borough is approximately 24m Above Ordnance Datum (AOD) near Oaks Road, with the lowest point, 7.5m AOD, located in Lower Sunbury. The flat topography exacerbates the likely susceptibility of many areas of the Borough to flood risk, both from river and surface water flooding.

Appendix B Figure 1 Study Area Topography and Waterbodies.

Geology

3.1.5 Datasets have been obtained from the British Geological Survey (BGS) website to provide a high level identification of the superficial deposits and bedrock geology across the Borough. This is displayed in Appendix B Figures 2 and 3.

Appendix B Figure 2 Bedrock Geology and Figure 3 Superficial Geology.

3.1.6 Bedrock is the consolidated rock underlying the ground surface. Superficial deposits refer to the more geologically recent deposits (typically of Quaternary age) that may be present above the bedrock such as floodplain deposits, beach sands and glacial drift. Underlying geology can influence the presence and nature of groundwater in an area, and therefore potential groundwater flood risk. The geology can also impact on the potential for infiltration based drainage systems.

3.1.7 In general, Eocene clays and sands dominate the surface exposures down to a depth of approximately 120m, with these clays and sands having been overlain more recently by Quaternary deposits of river gravels and sand.

3.1.8 The primary solid deposits are the London Clay Formation and the Woolwich Formation, which is part of the Lambeth Group. These solid deposits overlie the Upper Chalk at depth. Throughout much of the Borough superficial deposits, of varying thicknesses, overlie the solid deposits. Eastern and north-

[12] Light Detection and Ranging (LiDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground. Up to 100,000 measurements per second are made of the ground, allowing highly detailed terrain models to be generated at spatial resolutions of between 25 cm and 2 m. The data covering Spelthorne has a spatial resolution of 1m. The Environment Agency's LiDAR data archive contains digital elevation data derived from surveys carried out since 1998.

eastern areas of the Borough are overlain predominantly by Quaternary drift deposits of the Kempton Park Gravels, the southern region of the Borough is characterised by the Shepperton Gravel Formation and the northern aspects of the Borough are characterised by Taplow Gravels.

Hydrogeology

3.1.9 Aquifers are defined as layers of permeable rock or unconsolidated material (sand, gravel, silt etc.) capable of storing and transporting large quantities of water. The understanding of the behaviour and location of aquifers is important as they can provide an indication of the potential for groundwater flooding.

3.1.10 The Environment Agency describes the London Clay Formation, at depth, as being Unproductive Strata rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. The underlying Upper Chalk formation, however, is a Principal Aquifer, which at depth is afforded protection from contamination within the superficial deposits due to significant deposits of the London Clay between the two strata.

3.1.11 The superficial deposits located across much of the Borough (Appendix B Figure 3) are highly permeable in nature and are classified by the Environment Agency as a Principal Aquifer and described as *layers of rock or drift deposits that have a high intergranular and / or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale.* The majority of the soils across the Borough are classified as having Intermediate to High leaching potential which can readily transmit liquid discharges and therefore potentially transmit a wide range of pollutants[13].

Main Rivers

3.1.12 The Environment Agency dataset 'Detailed River Network' dataset has been used to identify watercourses in the study area, along with their designation (i.e., Main River or Ordinary Watercourse).

Appendix B Figure 1 Topography and Waterbodies.

3.1.13 The River Thames forms the southern boundary of the Borough of Spelthorne. It is along this boundary that many of the key population centres are located and thus a considerable proportion of the Borough is affected by flooding from the River Thames.

3.1.14 The River Colne system, including the River Ash, also poses a risk, albeit affecting fewer properties, within the Borough. These rivers, however, are far more susceptible to flash flooding as a result of localised intense rainfall, with storms of this nature expected to become increasingly common, as a result of changing climate patterns, the potential risk these fluvial systems pose to properties is likely to increase in the future. It is therefore necessary that development is planned accordingly in order that future sustainability can be assured.

Ordinary Watercourses

3.1.15 The Environment Agency dataset 'Detailed River Network' dataset has been used to identify Ordinary Watercourses in the study area.

Appendix B Figure 1 Topography and Waterbodies.

3.1.16 As well as Main Rivers there are a number of smaller Ordinary Watercourses[14] in the Borough, which form tributaries of the Main Rivers. These are smaller streams, ditches and drainage channels, the majority of which are open channel. Additional surface waters which pass through the Borough include the River Wraysbury, Stanwell Moor Ditch, Hithermoor Stream and Bonehead Ditch which form part of the River Colne network; Sweeps Ditch, Engine River, Docket Eddy which feed into the River Thames and Felthamhill Brook and Portlane Brook which flow around the northern side of Sunbury to meet the River Thames.

[13] Spelthorne Borough Council (2017) Contaminated Land Inspection Strategy. Available from: https://www.spelthorne.gov.uk/media/17039/Contaminated-Land-Inspection-Strategy-2017/pdf/CL_Strategy_2017_FINAL.pdf

[14] This includes "all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows" according to the Land Drainage Act 1991.

3.2 Flooding from Rivers

Flood Map for Planning

3.2.1 Flooding from rivers occurs when water levels rise higher than bank levels causing floodwater to spill across adjacent land (floodplain). The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding.

3.2.2 The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 3-1 and presented on the Flood Map for Planning (Rivers and Sea) available on the Environment Agency website. GIS layers of these Flood Zones have been provided by the Environment Agency via the Defra Data Services Platform.

Appendix B Figures 4A-4D Flood Map for Planning.

Table 3-1 Flood Zones (PPG Flood Risk and Coastal Change Table 1)

Flood Zone	Flood Zone Definition for River Flooding	Probability of Flooding
Flood Zone 1	Land having a less than 1 in 1,000 probability of river or sea flooding each year (0.1% AEP). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1 in 100 and 1 in 1,000 probability of river flooding each year (between 1% and 0.1% AEP); or land having between a 1 in 200 and 1 in 1,000 probability of sea flooding (between 0.5% and 0.1% AEP)	Medium
Flood Zone 3a	Land having a 1 in 100 or greater probability of river flooding each year (greater than 1% AEP); or land having a 1 in 200 or greater probability of sea flooding (greater than 0.5% AEP).	High
Flood Zone 3b	Land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise of: • Land having an annual probability of 1 in 30 (greater than 3.3% AEP) of flooding, with existing flood risk management features and structures operating effectively, • Land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). LPAs should define Flood Zone 3b within their SFRA in agreement with the Environment Agency. It is not separately distinguished from Flood Zone 3a on the Flood Map for Planning (Rivers and Sea).	Functional Floodplain

3.2.3 A significant proportion of the Borough is located in areas of Flood Zone 2 and 3 that have a Medium and High probability of flooding from rivers as shown in Appendix B Figures 4A-4D. The floodplain of the Lower Thames affects all but the northern region of the Borough.

3.2.4 The major towns and villages of Ashford, Shepperton, Staines-upon-Thames and Sunbury are all, at least in part, located in regions of Flood Zone 2 and 3, Medium to High probability of river flooding.

Ashford

- Located in the centre of the Borough, the south west portion of this town lies within a region of predominantly Flood Zone 2 (Medium probability), with narrow bands of Flood Zone 3a (High probability) along the A308 and Ashford Road (from the Lower Thames).

Shepperton

- Shepperton lies to the south of the Borough and comprises areas of Flood Zone 2 and 3 (Medium to High probability of flooding from rivers) due to its proximity to the River Thames and River Ash. The southern part of Shepperton, including the High Street, is in Flood Zone 1, Low probability of river flooding. Given the surrounding areas of Flood Zone 2 and 3, there is the potential for ‘dry islands’ to form. There are records of flooding events having occurred throughout the area of Shepperton (Appendix B Figure 4C), primarily along the major roads, for example Russell Road and Ferry Lane.

Staines-Upon Thames

- The part of Staines-upon-Thames which lies within the Borough of Spelthorne is situated in a region of Flood Zone 2 and 3 (Medium to High probability), as a result of being located on the banks of the River Thames. There are several small pockets of land which lie in areas of Flood Zone 1 (Low probability) dispersed throughout this area of higher flood risk, which could potentially lead to the formation of 'dry islands' during certain flood events. Of the four primary towns, Staines-upon-Thames is that with the greatest risk from fluvial flooding.

Sunbury

- The northern part of Sunbury is partially located within Flood Zone 2, Medium probability of flooding from rivers. The southern part of Sunbury is designated Food Zone 1, Low probability of flooding from rivers.

Hydraulic Modelling

3.2.5 As part of the Environment Agency's national programme of coastal and fluvial modelling studies, hydraulic models have been developed for the Main Rivers in the study area, including the River Thames, River Ash, Sweep's Ditch, Pool End Ditch and River Colne. The outputs from these models for the undefended scenarios are used by the Environment Agency to inform the delineation of Flood Zones 2 and 3 presented in the Flood Map for Planning. The definition of Flood Zone 2 also takes account of historic flood outlines. However, there are additional modelled outputs that are of importance for strategic planning. Details of the modelling studies and available outputs are included in Table 3-2.

Table 3-2 Summary of Modelling Studies

Watercourse	Modelling Study
Lower Thames , Sweep's Ditch, Pool End Ditch.	Lower Thames, Jubilee River and River Ash Modelling Study, JBA Consulting, July 2020. Flood extents have been developed for events where the River Thames represents the main source of flooding (Thames dominated) and conversely when the tributaries are the key source of flooding (Tributary dominated). **In Spelthorne BC, the Thames dominated outputs are of primary importance. However the Tributary dominated outputs show a greater risk of flooding in the area between the River Wraysbury and the River Colne, and therefore outputs from both models have been presented within the SFRA.** The following outputs are available: • Defended scenarios for the following AEP events: 50%, 20%, 10%, 5%, 3.33%, 2%, 1.33%, 1%, 0.5%, 0.1%. • Climate change scenarios: 10%, 20%, 25%, 35% and 81% increase in peak flows applied to the 1% AEP modelled event. • Undefended scenarios for the 1% and 0.1% AEP events (to inform the development of Flood Zones 3 and 2 respectively on the Flood Map for Planning (Rivers and Sea) **(Note: the Environment Agency are currently updating the River Thames model. Once published, it will be used to update the Flood Zones on the Flood Map for Planning (Rivers and Sea). Spelthorne BC should obtain the new study when available and review the outputs to determine whether an update to this SFRA is required).**
River Ash	River Ash Modelling Update, JBA Consulting 2019. This project forms part of a wider-arching Lower Thames, Jubilee River and River Modelling study that was completed by JBA Consulting in July 2020, examining river flood risk along two particular tributaries of the River Thames: • The River Ash, a tributary of the River Colne in Staines-Upon-Thames, and • Staines Aqueduct, a man-made channel mainly used for water supply purposes by Thames Water. The following outputs are available: • Defended scenarios for the following AEP events: 50%, 20%, 10%, 5%, 3.33%, 2.5%, 2%, 1.33%, 1%, 0.5%, 0.1%. • Climate change scenarios: 15%, 25%, 35% and 70% increase in peak flows applied to the 1% AEP modelled event. • Undefended scenarios for the 1% and 0.1% AEP events (to inform the development of Flood Zones 3 and 2 respectively on the Flood Map for Planning (Rivers and Sea)).
River Colne	Lower Colne Modelling and Mapping Study, Mott MacDonald, April 2012. • Defended scenarios for the following AEP events: 50%, 20%, 10%, 5%, 2%, 1% and 0.1%. • Climate change scenarios: 20% increase in peak flows applied to the 1% AEP modelled event. • Undefended scenarios for the 1% and 0.1% AEP events (to inform the development of Flood Zones 3 and 2 respectively on the Flood Map for Planning (Rivers and Sea)).

Appendix B Figures 5A-5D – River Thames (Thames dominated) Modelled Outlines.

Appendix B Figures 6A-6D – River Thames (Tributary dominated) Modelled Outlines.

Appendix B Figures 7A-7B – River Ash Modelled Outlines.

Appendix B Figures 8A-8B – River Colne Modelled Outlines.

Flood Zone 3b Functional Floodplain

3.2.6 The Functional Floodplain is defined in the PPG as 'land where water from rivers or the sea has to flow or be stored in times of flood'. The Functional Floodplain (also referred to as Flood Zone 3b), is not separately distinguished from Flood Zone 3a on the Flood Map for Planning. Rather the SFRA is the place where LPAs should identify areas of Functional Floodplain in discussion with the Environment Agency.

3.2.7 The PPG states that the identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, it should include the normal form of the river channel and land that would flood with an annual probability of 1 in 30 (greater than 3.3% AEP), with existing flood risk management features and structures operating effectively. Flood Zone 3b is also defined in the PPG by land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

3.2.8 As detailed in Table 3-2, modelling of the 1 in 30 year event is available for the Lower Thames and River Ash, and this information has been used to map Flood Zone 3b Functional Floodplain within **Appendix B Figure 4A-4D** of this SFRA. For the River Colne, outputs for the 1 in 30 year modelled flood event are not available and therefore the 1 in 50 year extent (2% AEP) has been used to provide a conservative estimate of Flood Zone 3b for the purpose of the SFRA.

3.2.9 Within the mapped extents shown in Appendix B Figure 4A-4D, where it can be demonstrated that existing infrastructure or solid buildings that resist water ingress are not providing a flood storage function, these are not included within the definition of Flood Zone 3b Functional Floodplain and the associated planning requirements do not apply. Recommended requirements for redevelopment in *developed* areas of Flood Zone 3b are included in Section 5.3.

Climate Change

3.2.10 A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change may increase peak rainfall intensity and river flow, which could result in more frequent and severe flood events. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime.

3.2.11 The Environment Agency's online guidance 'Flood risk assessments: climate change allowances'[15] sets out the climate change allowances for peak river flows for specific 'management catchments' and provides advice on applying climate change projections when preparing flood risk assessments. The allowances for the management catchments of relevance to Spelthorne Borough are set out in Table 3-3.

[15] Environment Agency (published 2016 and updated May 2022) Flood risk assessments: climate change allowances. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Table 3-3 Peak river flow allowances for management catchments in Spelthorne (1961 to 1990 baseline)

Management Catchment	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
London Management Catchment	Upper end (95th)	26%	30%	54%
	Higher central (70th)	14%	14%	27%
	Central (50th)	10%	7%	17%
Colne Management Catchment	Upper end (95th)	30%	38%	72%
	Higher central (70th)	16%	16%	35%
	Central (50th)	10%	8%	21%
Maidenhead and Sunbury Management Catchment	Upper end (95th)	32%	45%	81%
	Higher central (70th)	19%	25%	47%
	Central (50th)	14%	17%	35%

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

3.2.13 In Flood Zone 2 or 3a

- essential infrastructure – use the higher central allowance
- highly vulnerable – use the central allowance (development not permitted in flood zone 3a)
- more vulnerable – use the central allowance
- less vulnerable – use the central allowance
- water compatible – use the central allowance

3.2.14 In Flood Zone 3b

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

3.2.15 The peak river flow allowances should be applied to developments and allocations where the SFRA shows an increased risk of flooding in the future. This includes locations that are currently in Flood Zone 1 but might be in Flood Zone 2 or 3 in the future.

3.2.16 If Spelthorne BC considers a development is appropriate, even though it will not follow the flood zone compatibility categories for Flood Zones 2, 3a or 3b, the higher central allowance should be used. Where it is appropriate to apply a credible maximum scenario, the upper end allowance should be used.

3.2.17 The lifetime of the development should also be considered when determining which future climate change allowance time period should be used. The lifetime of a proposed development should be judged based on the characteristics of the development. In the case of residential developments, a minimum lifetime of 100 years should be taken when selecting climate change allowance percentages. For other types of development, the applicant should assess how long they anticipate the development to be in place and justify the lifetime of the development. A minimum of a 75 year lifetime should be used for non-residential developments.

3.2.18 For the purposes of strategic planning, the '2070 to 2115' allowances in Table 3-3 should be used.

3.2.19 As noted in Table 3-2, as part of the modelling study which covered the River Thames, River Ash, Sweep's Ditch and Pool End Ditch, simulations have been run for the 1% AEP event including 10%, 20%, 25%, 35% and 81% climate change allowances.

3.2.20 For the hydraulic modelling of the River Colne (Mott MacDonald, 2012), a 20% increase has been applied to the 1 in 100 year event. Modelling results for the full suite of new allowances, as set out in Table 3-3, are not currently available. It is not currently within the scope of this SFRA to re-run the River Colne model to account for the new climate change allowances. It is therefore proposed to use the 1 in 1000 year outline as a proxy for the climate change outline within this Level 1 SFRA and this has been mapped in **Appendix B Figures 8A-8B.**

Historic Flooding

3.2.21 The Borough has a history of significant flooding events, specifically from the River Thames, with major events occurring in 1894, six between 1900 and 1929, 1947, 1959, 1974 and 2003[16]. A summary of these events is displayed in Table 3-4. In addition to the events in Table 3-4, further significant flood events have occurred in 2009, 2012 and most recently the winter months of 2013-2014.

Table 3-4 River Thames Historic Flood Events

River Thames Flood Event	Approximate Flood Magnitude	Approximate River Thames Flow at Staines (m^3/s)
November 1894	1 in 100	600
February 1900/04	1 in 20	445
January 1915	1 in 20	440
January 1925	1 in 17	425
January 1928	1 in 15	410
December 1929	1 in 18	430
March 1947	1 in 60	535
January 1959	1 in 6	360
November 1974	1 in 4	350
January 2003	1 in 14	390

3.2.22 SCC prepared a Flood Investigation Report[17] for the flooding experienced during the winter 2013-14. The report concluded that the River Thames was the primary source of fluvial flooding within the Borough of Spelthorne which was brought about by the exceptional and unprecedented rainfall that fell over these months. This flooding affected the areas of Shepperton, Littleton and Laleham and Sunbury, resulting in the internal flooding of approximately 130 properties within these areas.

3.2.23 During this event, there was also significant fluvial flooding associated with the River Ash. In February 2014 the level of the upstream section of the River Ash rose dramatically over a short time period in the vicinity of Leacroft and Priory Green, until it began to overtop its banks. This resulted in the fluvial flooding of Leacroft, Leacroft Close, Raleigh Court, Manor Place, Chesnut Manor Close and Priory Green. In some instances, properties were subject to internal flooding. The elevated level of the River Ash lasted for a number of days before receding.

3.2.24 The Environment Agency has provided a GIS layer of the Recorded Flood Outlines dataset (also referred to as the Historic Flood Map) which shows the extent of fluvial flooding that has been experienced and the date. This data is mapped in Appendix B Figure 9A and a description of the areas affected is included in Table 3-5. Figure 9B shows solely the extent of the Winter 2013-2014 flooding for ease of reference.

Appendix B Figure 9A – 9B Recorded Flood Outlines.

[16] Jacobs 2006 Spelthorne BC Level 1 Strategic Flood Risk Assessment.
[17] SCC Flood Investigation Report for Winter 2013/14 Flooding 11-Spelthorne-S19-Report.pdf (surreycc.gov.uk)

Table 3-5 Recorded Flood Outlines (Environment Agency dataset)

Recorded Flood Outline	Approximate Location Affected
1947 March	River Thames – Flooding the majority of the land located between Fordbridge Road and the River Thames. River Ash – Flooding of land adjacent to the River Ash, with the area impacted increasing moving downstream, beginning at Round Copse. River Colne and Bonehead Ditch – Area of land between King George VI and Wraysbury Reservoir impacted due to the channel capacity having been exceeded and the absence of raised flood defences. Wraysbury River – Flooding of the land adjacent to the river, along the stretch of the river between the M25 and the railway line.
1968 September	River Thames – Flooding of the majority of the land west and south-west of Shepperton, with a notable area of land not having been impacted, that within approximately 200m of Halliford Mere Lake. An area of land east of Lower Halliford, surrounding Ash Estates, adjacent to the River Thames was also impacted by this fluvial flooding. River Ash – Similar fluvial flooding extent as that of the 1947 flooding incident.
1988 May	River Thames – Small localised areas of flooding along the Thames in the south of the borough, impacting land within approximately 200m of the river. Four notable areas of flooding. 1. Crossing the M3, west of Thames Side. 2. South of Bridge Road and west of Chertsey Meads. 3. The area surrounding Pharaoh's Island, south of Towpath. 4. Between the B376 and Thames Meadow.
1990 February	River Thames – Similar localised flooding as that experienced in 1988, with the addition of further flooding of Hamhaugh and Lock Island, an area of land protruding approximately 300m east from Dockett Eddy Lane, an area of land east of Sandhills Meadow and a small region east of Fordbridge Road.
1993 October	River Ash – A small area south of the river, approximately 50m wide, between Stainash Crescent and Glebe Road. River Colne and Bonehead Ditch – Regions of flooding throughout Staines Moor, Lower Mill Farm, west of Hithermoor Lake and along Hithermoor Road in Stanwell.
2000 December	River Colne – Area in the south of Staines Moor and Stanwell (specifically along Leylands Lane, Horton Road and Hithermoor Road). Wraysbury River – Between Staines By-Pass and Moor Lane in addition to a small area around Church Lammas, north of Wraysbury Road. River Ash – Area west of Ashford Road and south of Round Copse. Sweep's Ditch – Area of land no more than 100m west of the ditch, south of the B376. River Thames – Similar locations as those impacted by the 1968 floods.
2003 January	River Colne and Bonehead Ditch – Similar areas affected as those in the 2000 flooding incident. River Thames – An extensive area of land impacted north of the river, largely to the south and west of Shepperton, in addition to more localised regions such as areas around Riverside Close, Sandhills Meadow, Ash Estates, Thames Meadow and Nettlefold Place. Sweep's Ditch – Area of land up to 100m west of the ditch, south of the B376. River Ash – Notable regions of localised flooding around Littleton, specifically adjacent to New Road and south of Round Copse.
2009 February	Two small regions of flooding associated with Main Rivers around Stanwell Moor. The northernmost region is located at the intersection between Horton Road and Spout Lane North, with the other located adjacent to the Main River, north of Horton Road.
2009 November	Wraysbury River – Another relatively small flooding incident, this time impacting land adjacent to Wraysbury River, south of the M25 within Staines Moor.
2012 December	Three small, localised regions associated with a Main River which flows towards Wraysbury River. These are located around Church Lammas, between the River Thames and Moor Lane.
2013 December – 2014 February	The Winter 2013/14 floods resulted in extensive flooding throughout the Borough. River Thames – The majority of the land between the river and the B375 was subject to fluvial flooding from the Thames. Further flooding associated with the Thames during this event occurred between the M3 and Shepperton Green, the area surrounding Ash Estates and a region around Pavilion Bungalow. River Ash – Notable flooding along this stretch of the river occurred around Round Copse, Littleton Education Facility, west of the M3, in a large area of Staines-upon-Thames (specifically along Staines By-Pass, Priory Green, Greenlands Road, Birch Green and Church Lammas. Sweeps' Ditch – Large area centred on Laleham Road. Flooding associated with the Wraysbury River, River Colne and Bonehead Ditch is similar to that experienced in previous flooding incidents, with additional flooding occurring around Runnymede Farm.

Flood Defences

3.2.25 Flood defences are typically raised structures that alter natural flow patterns and prevent floodwater from entering property in times of flooding. They are generally categorised as either 'formal' or 'informal' defences. A 'formal' flood defence is a structure that is maintained by its respective owner, regardless of whether it is owned by the Environment Agency. An 'informal' flood defence is a structure that has often not been specifically built to retain floodwater and is not maintained for this specific purpose. Boundary walls and industrial buildings situated immediately adjacent to rivers often act as informal flood defences.

3.2.26 The Environment Agency Asset Information Management System (AIMS) contains details of flood defence assets associated with Main Rivers. This information is presented in **Appendix B Figures 4A-4D.**

3.2.27 Formal raised flood defences have been identified in consultation with the Environment Agency. The defences identified are located mainly on the lower reaches of the Lower Colne system, north of Staines. The main formal raised defences are as follows:

- Raised banks along the Colne Brook – west of Wraysbury Reservoir.
- Raised defence (referred to as Cambridge kennels defence) along the Wraysbury River.
- Raised defences on the Wraysbury River between Pound Mill and Hale Street Bridge.
- Raised defences along both sides of the Staines Bypass Channel linking the Wraysbury River with County Ditch/River Thames.
- Raised defence south of the A30 along Thames Water aqueduct.
- Raised defences at the River Ash offtake from the River Colne.
- Raised defences along the River Colne between the A30 and the railway line, through to the Two Rivers Retail Park.

3.2.28 Although these raised defences may be formally maintained, it is important to reiterate that the risk of flooding can never be fully removed. There will always be a residual risk of flooding, due to (for example) a more extreme event, changing climatic conditions, a structural failure of the constructed flood defence system or flooding behind the defences due to local runoff or groundwater. It is incumbent on both the Council and developers to ensure that the level and integrity of defence provided within developing areas can be assured for the lifetime of the development.

3.2.29 No informal raised flood defences in the form of boundary walls and/or existing buildings, providing protection from flooding, have been identified in the Spelthorne Borough. It is recognised however that infrastructure, including for example road and/or rail embankments, may alter the flow of floodwater throughout the Borough. For the purposes of the SFRA process, these have not been assessed as 'informal' defences. This is because the height and breadth of the embankments are such that the likelihood of a sudden catastrophic failure of the structure (i.e. potentially posing a risk to life) is virtually negligible.

Flood Risk Management Strategies

3.2.30 A Catchment Flood Management Plan (CFMP) is a high-level strategic planning document that provides an overview of the main sources of flood risk and how these can be managed in a sustainable framework for the next 50 to 100 years. The Environment Agency engages stakeholders within the catchment to produce policies in terms of sustainable flood management solutions whilst also considering local land use changes and effects of climate change.

3.2.31 The CFMPs are used to inform and support planning policies, statutory land use plans and implementation of the Water Framework Directive, so that future development in the catchment is sustainable in terms of flood risk. The approach that the Environment Agency would like to see taken to flood risk management within the study area is outlined in the Thames CFMP (2009)[18]. The CFMP aims

[18] Environment Agency (2009) Thames Catchment Flood Management Plan. Available from: https://www.gov.uk/government/publications/thames-catchment-flood-management-plan

to identify flood risk management policies for the catchment and sets out the preferred plan for sustainable flood risk management in the Thames region over the next 50 to 100 years.

3.2.32 The preferred policy for the Spelthorne BC study area in the CMFP is Policy 4: Take further action to sustain the current level of flood risk into the future, responding to the potential increases in risk from urban development, land use change and climate change.

3.2.33 Building upon the flood risk management measures set out in the CFMP, the Environment Agency has provided details of the proposed River Thames Scheme between Datchet and Teddington which will impact flood risk affected communities in Spelthorne.

River Thames Scheme

3.2.34 The goals of the River Thames Scheme[19] are to:

- reduce the risk of flooding for dwellings, businesses and infrastructure,
- improve access to quality green open spaces, connection with wildlife and more sustainable travel network,
- create a network of high quality habitat and achieve biodiversity net gain,
- facilitate sustainable and inclusive economic growth,
- enable delivery and design that contribute to Environment Agency, Surrey County Council and partner climate goals relating to carbon use.

3.2.35 The River Thames Scheme covers an area from Egham to Teddington. The scheme will create two sections of new river channel: the Runnymede Channel Section and Spelthorne Channel Section. These two sections, totalling 5 miles (8.5km) will act as new flow routes for excess water when water levels in the River Thames rise too high. Improvements will be made to the weirs at Sunbury, Molesey and Teddington to increase the amount of flow that can pass through. It is also proposed to lower the riverbed level downstream of the Desborough Cut.

3.2.36 The project will be delivered in partnership by the Environment Agency and Surrey County Council. The present value (PV) cost is £346 million[20] including a 48% contingency and the benefit-cost-ratio (BCR) is 7.97. The scheme will reduce flood risk to 11,000 properties and infrastructure and avoid £2.7 billion of PV damage over 100 years.

3.2.37 All communities between Egham and Teddington will benefit from the River Thames Scheme. This includes the communities downstream of the flood channel, as the weir modifications will reduce water levels between Walton Bridge and Teddington. The degree of benefit will vary along the length of the river. As the flood risk cannot be eliminated completely, some households benefiting from the scheme are also being offered property level products. These products will help to make homes more resistant to flooding. Overall the River Thames Scheme will significantly reduce the likelihood of flooding for the 15,000 properties at a time when climate change is predicted to increase flood risk.

3.2.38 Modifications to Sunbury weir and Desborough Cut will fully mitigate the increase in flow due to the channel operation, and also provide some small scale reduction in the water levels in flood conditions after the channels are built and in operation. Once the scheme is completed, the additional gates proposed at Sunbury weir and the widened Desborough Cut will allow greater flow (up to 4%) through them and reduce the upriver water levels. The capacity improvements to the weirs and Desborough Cut will result in an overall small reduction in flood water levels all the way through the lower reaches of the River Thames, from Walton Bridge to Teddington.

3.2.39 As part of the scheme the Environment Agency has identified approximately 1600 properties that would remain with a flood risk of 1 in 40 years or greater once the flood channel has been constructed. Properties that remain at this higher risk of flooding may be offered Property Level Products to help make their homes more resistant to flooding.

[19] https://www.riverthamesscheme.org.uk/
[20] https://www.gov.uk/government/publications/defra-accounting-officer-assessments/18-march-2022-river-thames-flood-alleviation-scheme-accounting-officer-assessment

Temporary Defences

3.2.40 The Environment Agency has provided details of three temporary defence systems in place in Spelthorne:

3.2.41 **Staines-upon-Thames:** Barriers run along towpath to the west of Thames Side and follow river back around with the curve of the river to penton Hook Road. A further alignment runs south along the towpath from penton hook lock and hooks around Balmoral Grange. There is a final deployment which crosses the fields to the south east of Staines football club. Within the whole deployment there is 1720m barriers needed and will protect approximately 300 properties for a 1 in 30 year event.

3.2.42 **Littleton lakes:** The deployment runs south along Thames side starting near Laleham Abby to Chertsey Lock. The total length is 1400m. It will protect more than 50 residential properties (to its design capability).

3.2.43 **Shepperton Mead Farm:** This temporary defence system starts on Chertsey Road to the east of Dockett Eddy Road and loops around the south of the group of properties and re-joins Chertsey Road to the west. It uses 820m of barrier and protects around 20 properties (to its design capability).

Residual Risk

3.2.44 It is important to recognise that the risk of flooding from the rivers in Spelthorne can never be fully mitigated, and there will always be a residual risk of flooding that will remain after measures have been implemented to protect an area or a particular site from flooding. This residual risk is associated with a number of potential risk factors including (but not limited to):

- A flooding event that exceeds that for which the flood risk management measures have been designed e.g. flood levels above the designed finished floor levels,
- The structural deterioration of flood defence structures (including informal structures acting as a flood defence) over time, and/or,
- General uncertainties inherent in the prediction of flooding.

3.2.45 The modelling of flood flows and flood levels is not an exact science; therefore there are inherent uncertainties in the prediction of flood levels used in the assessment of flood risk. Whilst the NPPF Flood Zones provide a relatively robust depiction of flood risk for specific conditions, all modelling requires the making of core assumptions and the use of empirical estimations relating to (for example) rainfall distribution and catchment response.

3.2.46 Steps should be taken to manage these residual risks using flood warning and evacuation procedures, as described in Section 5.

3.3 Flooding from Surface Water

3.3.1 Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run off land quickly and result in localised flooding. This occurs most commonly in urban areas where water is unable to enter the ground due to the presence of impermeable surfaces.

Risk of Flooding from Surface Water (RoFSW)

3.3.2 The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying those areas at risk of surface water flooding during three annual exceedance probability events: 1 in 30 year (3.33% AEP) (High Risk), 1 in 100 year (1% AEP) (Medium Risk) and 1 in 1,000 year (0.1% AEP) (Low Risk). The latest version of the mapping is referred to as the Risk of Flooding from Surface Water (RoFSW) and the extents have been made available to Spelthorne BC as GIS layers.

Appendix B Figures 11A-11D Risk of Flooding from Surface Water.

3.3.3 The RoFSW provides all relevant stakeholders access to information on surface water flood risk which is consistent across England and Wales. The modelling will help the Environment Agency to take a strategic overview of flooding and assist SCC in their duties relating to management of surface water

flood risk. For the purposes of this SFRA, the mapping allows Spelthorne BC an improved understanding of areas within the Borough which may have a surface water flood risk.

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

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

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

- Use of a single drainage rate for all urban areas,
- It does not show the susceptibility of individual properties to surface water flooding,
- The mapping has significant limitations for use in flat catchments,
- No explicit modelling of the interaction between the surface water network, the sewer systems and watercourses,
- In several areas, modelling has not been validated due to a lack of surface water flood records, and,
- As with all models, the RoFSW is affected by a lack of, or inaccuracies, in available data.

3.3.6 The RoFSW mapping for the Spelthorne BC study area, presented in **Appendix B Figures 11A-D,** illustrates that the risk of surface water flooding is widespread throughout the Borough, primarily along, but not exclusively limited to, road networks. It should be noted that these maps are based on topography and their accuracy is not as robust as fluvial flood maps. They can, however, be used to identify general flow routes.

Historic Records

3.3.7 In their role as the LLFA, SCC has duties to record and investigate flood incidents relating to local sources of flooding, namely flooding from surface water, groundwater and ordinary watercourses. SCC has provided several GIS layers to inform the SFRA that relate to past flood events. These datasets are presented spatially in Appendix A Figures 11A-11D A summary of each dataset as provided below:

- Internal property flooding: road locations along which internal property flooding has been reported to SCC.
- External property flooding: road locations along which external property flooding has been reported to SCC.
- Historical Flooding Incidents: indicative road location along which a flood event has occurred that has been investigated by SCC and a Section 19 Flood Investigation Report has been prepared.
- SCC Wetspots: ‘Wetspot’ is a term used by SCC as the LLFA to describe the location of a surface water flooding incident that has been reported. The wetspot database is continually updated to produce a comprehensive map and record of all the identified wetspots in Surrey. Information from Surrey risk management authorities informs the database. SCC currently prioritises capital works at wetspots throughout the county based on several factors. These factors include safety, internal property flooding, social impact and duration of flooding. Details of these specific factors have not been supplied for the purposes of the SFRA.

3.3.8 SCC publish Flood Investigation Reports for significant flood events in the County. Reference has been made to FIRs detailing incidents in Spelthorne to inform this SFRA.

3.3.9 Using the RoFSW mapping and historic flood records, the risk of surface water flooding has been considered across the Borough and summarised below:

Staines-upon-Thames

- There are some drainage issues which have been identified in this area, however, these are very localised in nature, and in some instances are maintenance related. These localised drainage issues correspond to the heterogeneity of surface water flood risk throughout this area, as illustrated by the RoFSW mapping (Appendix B Figures 11A and B). The highest risk of surface water flooding in this region is primarily located along road networks, most notably the A308, Knowle Green, Moor Lane and Waters Drive. The SCC Flood Investigation Report[21] for flooding in Spelthorne notes that Knightsbridge Crescent is highly susceptible to surface water flooding, with major incidents being reported in 2003 and January-February 2014. The January 2014 incident occurred following a period of extended rainfall (275% compared to an average winter) which resulted in rising groundwater levels and surface water to build-up and begin to flood parts of Knightsbridge Crescent, including the edge of some properties. During this time period surface water flooding was also reported along Wheatsheaf Lane. SCC has also noted 18 wetspots within the Staines area.

Ashford

- Similarly to Staines, there are some localised drainage issues in this area which have the potential to result in low to medium risk surface water ponding in some areas of this region, for example in the land between Fordbridge Road and the A308, and the open land south of Village way as shown in the RoFSW mapping (Appendix B Figure 11B). There is also a high risk of surface water flow pathways forming along many roads within the region, for example along Elgin Avenue, Metcalf Road and Fordbridge Road. SCC has noted 10 wetspots within the Ashford area.

Shepperton

- The RoFSW mapping (Appendix B Figure 11C) indicates that part of this region is at risk from surface water flooding, primarily along major and minor roads, most notably Church Road. The SCC Flood Investigation Report notes that Shepperton was impacted by surface water flooding which arose from the extended period of rainfall between January and February 2014. During this time the underlying clay soils became saturated from the excessive rainfall and overflowing fluvial flood waters, meaning that further rainfall could not infiltrate into the ground, resulting in it flowing as surface water flow. This surface water flooding exacerbated that flooding from the River Thames around Shepperton Lock and Littleton Lane. SCC has noted 12 wetspots within the Shepperton area.

Sunbury

- The RoFSW mapping (Appendix B Figure 11D) illustrates that a large area of Sunbury is at risk from surface water flooding, with ponding being more prevalent, relative to the three other key areas. Key areas at risk of surface water ponding occur along Nursery Road and around Gaflac Sports Ground. Notable high risk surface water flow pathways are located along Hawkewood Road, Wosely Road and Staines Road West. SCC has noted 24 wetspots within the Sunbury area.

3.3.10 Further information on site specific incidents of surface water flooding was recorded during the preparation of the previous SFRA by a member of the Highways and Drainage Department of Spelthorne BC. This has been retained in this SFRA and can be found in **Appendix C Surface Water Conditions**.

Climate Change

3.3.11 The RoFSW mapping does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However, a range of three annual probability events have been undertaken, 3.3%, 1% and 0.1% and therefore it is possible to use with caution the 0.1% outline as a substitute dataset to provide an indication of the implications of climate change.

[21] https://www.surreycc.gov.uk/__data/assets/pdf_file/0020/71930/11-Spelthorne-S19-Report.pdf

3.4 Flooding from Groundwater

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

3.4.2 There are many mechanisms of groundwater flooding which are linked to high groundwater levels and can be broadly classified as:

- Direct contribution to channel flow – where the river channel intersects the water table and groundwater enters the streambed increasing water levels and causing flooding,
- Springs erupting at the surface,
- Inundation of drainage infrastructure – where the infrastructure has eroded over time, and,
- Inundation of low lying property (basements).

3.4.3 The main impacts of groundwater flooding are:

- Flooding of basements of buildings below ground level – this can range from seepage of small volumes of water through walls and temporary loss of services to larger volumes of water, catastrophic loss of belongings and failure of structural integrity,
- Overflowing of sewers and drains – surcharging of drainage networks can lead to overland flows causing localised damage to property. Sewer surcharging can lead to inundation of property by polluted water. However, it is difficult to differentiate between groundwater flooding and other sources (surface water or sewer flooding),
- Flooding of buried services or other assets below ground level – prolonged inundation of buried services can lead to interruption and disruption of supply,
- Inundation of roads, commercial, residential and amenity areas – inundation of hard-standing areas can lead to structural damage and the disruption of commercial activity, and,
- Flooding of ground floors of buildings above ground level – can result in structural damage. In addition, a groundwater flood event will typically have a long duration (compared to other flood sources), adding to the disruptive nature of the flood event.

Areas Susceptible to Groundwater Flooding (AStGWF)

3.4.4 The Environment Agency dataset ‘Areas Susceptible to Groundwater Flooding’ has been provided for the study area. This dataset indicates where groundwater may emerge due to certain geological and hydrogeological conditions. This information is shown as a proportion of 1km grid squares where there is potential for groundwater emergence. The data does not show where flooding is likely to occur, but instead should be used at a strategic level to indicate areas for further investigation. This is due to the coarse nature of the dataset, being based largely on underlying geology, which is a broad-scale dataset.

Appendix B Figure 12 Areas Susceptible to Groundwater Flooding.

3.4.5 According to the Environment Agency’s ‘Areas Susceptible to Groundwater Flooding’ (AStGWF) map (Appendix B Figure 12), a large proportion of the land within and around the perimeter of the Borough is highly susceptible (>=75%) to groundwater flooding

3.4.6 In broad terms, there is a low (>=25% <50%) to medium potential (<50%) for the central region of Spelthorne to be flooded through groundwater mechanisms. However, there is a band of land dissecting the Borough, between the south of Staines-upon-Thames and Chattern Hill which is highly susceptible (>=75%) to groundwater flooding.

3.4.7 The BGS’ ‘Susceptibility to Groundwater Flooding’ map, presented in the Surrey Local Flood Risk Management Strategy (LFRMS) Report[22], also illustrates that there is the potential for groundwater flooding to occur throughout the majority of the Borough, with this mapping also indicating that the majority of this flooding will occur at the surface, rather than below ground level. This mapping also

[22] https://www.surreycc.gov.uk/__data/assets/pdf_file/0005/136724/Surrey-Local-Flood-Risk-Management-Strategy-FINAL_v2.pdf

again suggests that, predominantly, the central and lower regions of the Borough (i.e. west of Shepperton) are situated in regions with limited potential for groundwater flooding to occur, if at all.

3.4.8 As shown in Appendix B Figure 2, the Thames Group formation makes up the bedrock geology for the majority of the Borough. This is a sedimentary bedrock of clay, silt and sand material, having formed approximately 48 to 56 million years ago in the Palaeogene Period. In contrast to the homogeneity of the bedrock, the composition of the overlying superficial deposits varies spatially throughout the Borough, contributing to the spatial differences in groundwater flooding susceptibility.

3.4.9 South of Staines Reservoir is predominantly made up of Kempton Park Gravel Member superficial deposits. These formed up to 2 million years ago in the Quaternary Period when this environment was dominated by rivers. Intertwined throughout this region of Kempton Park Gravel lies small areas of Langley Silt Member deposits. There is a correlation between areas overlain by Kempton Park Gravel and the locations susceptible to groundwater flooding. This may be a result of the higher permeability of gravel, compared to silt, sand and clay material. In the very south of the Borough, between Lateham Road and the River Thames, the superficial deposits are dominated by Shepperton Gravel. Shepperton Gravel Member's lithology is described as gravel with clay and sand, this addition of more clay and sand material, when compared to Kempton Park Gravel, may suggest why the susceptibility to groundwater flooding in this area is lower than that of regions overlain by Kempton Park Gravel.

3.4.10 Therefore, the presence of this permeable superficial geology in direct link with the River Thames, and other watercourses in the Borough, creates pathways for groundwater and the potential for groundwater flooding to occur in Spelthorne, which is exacerbated when water levels in the watercourses are raised.

3.4.11 Groundwater flooding has been observed at several locations throughout Spelthorne, primarily in the towns of Staines-upon-Thames, Shepperton and Sunbury. It has been suggested that previous development within these areas have altered the natural groundwater drainage regime. The construction of reservoirs and backfilling of gravel pits with materials of different permeability to those present originally, could have altered groundwater storage flow paths.

3.4.12 Where flood defences have been constructed to mitigate the risk of fluvial flooding, a residual risk of groundwater flooding may remain. Groundwater can move through floodplain gravels, driven by high water levels in the river, ultimately flooding land behind flood defences. These fluvial flood defences may also impede the natural flow of groundwater into the river, thereby resulting in a backing up of groundwater behind these defences, exacerbating the risk of groundwater flooding

3.4.13 SCC's Flood Investigation Report for Spelthorne indicates that, following the extensive rainfall in January and February 2014, groundwater flooding was widespread throughout the Borough during this time. Rising groundwater levels, coupled with the build-up of surface water, resulted in flooding along Wheatsheaf Lane, Staines-upon-Thames. This flooding was exacerbated by the fact that the ground floor level of many of these properties was lower than that of the road. Fluvial and groundwater flooding was reported along Chertsey Bridge Road, Shepperton, and the surrounding area, resulting in extensive road and internal property flooding. Chertsey Bridge Road was temporarily closed, with Thames Side, Littleton Lane, Sheep Walk, Dockett Eddy Lane, Ferry Lane and Russel Road also closed.

3.4.14 In the summer of 2014 groundwater levels remained above normal levels in the north and western monitoring locations of the Borough. As a result of this, the groundwater fed Littleton north and south levels remained high. Boreholes in the east of the Borough, however, indicated that groundwater levels had returned to normal levels, this indicates that there may be barriers to groundwater flow between the east and west areas, as well as a likely barrier to groundwater flow out to the River Thames.

3.4.15 These barriers are likely to have been put in place in order to enable dry working of the gravels. Being near the river they would always be flooded and have been more difficult to work. The western boreholes and lake margins are also where a more claylike geology is present, so there may be natural barriers marking the edges of the economically recoverable gravels.

3.5 Flooding from Sewers

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

1. **The rainfall event exceeds the capacity of the sewer system/drainage system:** Sewer systems are typically designed and constructed to accommodate rainfall events with a 1 in 30 years (3.33% AEP) or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While Thames Water are concerned about the frequency of extreme rainfall events, it is not economically viable to build sewers that could cope with every extreme rainfall event.
2. **The system becomes blocked by debris or sediment:** Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris.
3. **The system surcharges due to high water levels in receiving watercourses:** Where the local area is served by 'combined' sewers i.e., containing both foul and storm water, if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance, floodwaters will contain untreated sewage.

3.5.2 The majority of Spelthorne BC is served by a Thames Water combined surface and foul water sewer system, which is typically designed and constructed to accommodate rainfall events with a 1 in 30 year (3.33% AEP) event or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system.

3.5.3 Thames Water has provided an extract from their register of flooded properties for the study area. This shows properties that have been affected by sewer flooding (as reported to Thames Water) within the last 20 years. Due to data protection requirements, this data has not been provided at the individual property level; rather the register comprises the number of properties within 4 digit postcode areas that have experienced flooding, either internally or externally, over the last 20 years. It should be noted that it is likely that there have also been unreported sewer flooding incidents in this area over this time period.

3.5.4 Thames Water Sewer Flood records, presented in Table 3-6 and Appendix B Figure 13 indicate that 62 reported sewer flooding incidents, both internal and external, have occurred in Spelthorne over the last 20 years. The majority of the internal flooding events have taken place in the village of Stanwell (TW197) and Shepperton (TW170 and TW179), whilst the reported external events were in the south of Staines-upon-Thames (TW182), Egham Hythe (TW181) and Shepperton (TW170).

Table 3-6 Sewer flooding incidents reported to Thames Water in Spelthorne within the last 20 years

Local Authority	Register Type						
Spelthorne	Internal flooding to property			External flooding property/areas			
Post code area	AI (2 in 10)	BI (1 in 10)	CI (1 in 20)	AE (2 in 10)	BE (1 in 10)	CE (1 in 20)	Grand Total
KT168	0	0	0	0	1	0	1
TW12	0	0	0	0	0	0	0
TW121	0	0	1	0	0	0	1
TW123	0	0	0	0	0	0	0
TW134	0	0	1	0	0	0	1
TW140	0	0	2	0	0	0	2
TW166	0	0	0	0	0	1	1
TW170	0	0	4	0	0	7	11
TW178	0	0	0	0	0	3	3
TW179	0	0	2	1	2	1	6
TW181	0	0	2	0	0	6	8
TW182	0	0	2	0	4	5	11
TW183	0	0	0	0	0	0	0
TW196	0	0	0	0	0	0	0
TW197	0	0	14	0	2	1	17
Grand Total	0	0	28	1	9	24	62

I = Internal property flooding
E = External property flooding
A = 2 or more incident in the last 10 years
B = 1 incident in the last 10 years
C = 1 incident more than 10 years ago but less than 20 years ago

3.5.5 In Staines-upon-Thames, specifically Laleham Road, as reported in SCC Flood Investigation Report, a sewer flooding incident occurred between January and February 2014. During this time the sewerage system was inundated within extensive precipitation, resulting in the surcharging of the combined foul sewer network within this area. In addition to this, during the same precipitation event, the rising groundwater and increasing volume of surface water flooding present resulted in some sewer overflow in parts of Parkside Place, Staines-upon-Thames.

3.6 Flooding from Artificial Sources

3.6.1 An artificial source is any water body which is not covered under other categories and typically includes canals, lakes and reservoirs. The failure of a reservoir or artificial source has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The PPG encourages LPAs to identify any reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment is located within, and/or whether emergency draw-down of the reservoir will add to the extent of flooding.

3.6.2 Approximately 22% of Spelthorne Borough is water, including a water treatment works at Ashford and the following four large reservoirs:

- Wraysbury Reservoir,
- King George VI Reservoir,
- Staines Reservoir, and,
- Queen Mary Reservoir.

3.6.3 The Environment Agency dataset 'Risk of Flooding from Reservoirs'[23] identifies areas that could be flooded if a large reservoir were to fail and release the stored water. The mapping illustrates that almost the entirety of Borough is at risk of flooding from reservoirs, with regions within approximately 1km from a reservoir having the potential to be inundated by over 2m of water. There are two notable small areas of land which are identified to not be at risk of flooding from reservoirs. The first is located west of Upper Halliford, and the second is in the north of the Borough around Lower Mill Farm. These areas are however situated on higher, steeper ground (Appendix B Figure 1).

3.6.4 Reservoirs in the UK have an extremely good safety record. The Environment Agency is the regulatory authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers on an annual basis.

3.6.5 Thames Water is responsible for water supply infrastructure located within the Spelthorne Borough which could cause flooding, should any of the infrastructures fail. This infrastructure includes the large water supply reservoirs located within, and around, the Borough. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. Thames Water confirmed that there is a Reservoir Surveillance Management Process that is externally accredited via the ISO 9000 accreditation. This includes the appointment of a Supervising Panel Engineer and regular inspections of all reservoirs to the requirements of the Reservoirs Act by suitably qualified engineers. In addition to the statutory requirement, Thames Water state that it undertakes inspections of the reservoirs by trained individuals at a frequency agreed by the Supervising Panel Engineer. On this basis the possible risk of failure of these reservoirs is considered to be minimal.

3.7 Assessing the cumulative impact of development

3.7.1 The NPPF states that strategic policies should be informed by a strategic flood risk assessment, and should consider cumulative impacts in, or affecting, local areas susceptible to flooding (paragraph 160).

3.7.2 Development or the cumulative impacts of development may result in an increase in flood risk elsewhere as a result of impacts such as the loss of floodplain storage, the deflection or constriction of flood flow routes or through inadequate management of surface water. The loss of floodplain storage is less likely to be a concern in areas benefitting from appropriate flood risk management infrastructure.

3.7.3 Where flood storage from any source of flooding is to be lost as a result of development, on-site level-for-level compensatory storage, for the 1% AEP flood event accounting for the predicted impacts of climate change over the lifetime of the development, should be provided (refer to Section 5.6). Where it is not possible to provide compensatory storage on site, it may be acceptable to provide it off-site if it is hydraulically and hydrologically linked. Whilst the use of stilts and voids below buildings may be an appropriate approach to mitigating flood risk to the buildings themselves, such techniques should not normally be relied upon for compensating for any loss of floodplain storage. This is because voids do not allow water to freely flow through them, trash screens get blocked, voids get silted up, they have limited capacity, and it is difficult to stop them being used for storing belongings or other materials.

3.7.4 Identification of those areas where changes in land use could potentially increase surface water runoff rates and volumes can strategically aid spatial planning in avoiding areas where significant mitigation of surface water runoff following development may be required. The provision of multifunctional sustainable drainage systems, natural flood management and green infrastructure can also make a valuable contribution to mitigating the cumulative impacts of development on flood risk.

3.7.5 Whilst individual development with appropriate site mitigation measures should not result in measurable local effects with respect to hydrology and flood risk, the cumulative effect of multiple development may be more severe at downstream locations in the catchment. Locations where there are existing flood risk issues will be particularly sensitive to cumulative effects.

3.7.6 The cumulative impact should be considered throughout the planning process, from the allocation of sites within the Local Plan, to the planning application and development design stages.

[23] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

3.8 Assessing cross boundary considerations

3.8.1 The natural catchments within Spelthorne area cross borders between LPA administrative areas. Watercourses, overland flowpaths and groundwater flow routes pass from one LPA to a neighbouring one. Therefore, future development in one LPA has the potential to affect flood risk to existing development and surrounding areas in another LPA area. It is important that LPAs work together and take a catchment approach to consider the wider impacts of any proposed development.

3.8.2 The following LPAs adjoin Spelthorne BC and should work together to discuss the opportunities to reduce the causes and impacts of flooding from all sources: the London Boroughs of Hillingdon, Hounslow and Richmond, the Berkshire authorities of Windsor and Maidenhead and Slough and the Surrey authorities of Runnymede and Elmbridge.

3.8.3 The River Colne flows south into Spelthorne from London Borough of Hillingdon and the borough of Slough. The River Thames flows east through Windsor and Maidenhead and Runnymede prior to passing through Spelthorne and Elmbridge. The Staines Reservoirs Aqueduct and Portlane Brook flow south along the boundary between Spelthorne and London Boroughs of Hounslow and Richmond-upon-Thames.

4. Avoiding Flood Risk – Applying the Sequential and Exception Tests

4.1 Overview

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

4.1.2 The sequential approach is a decision-making tool designed to select sites so that development is, as far as reasonably possible, located where the risk of flooding from all sources is lowest, taking account of climate change and the vulnerability of future users to flood risk. This will help avoid the development of sites that are inappropriate on flood risk grounds. The subsequent application of the Exception Test where required will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability and safety drivers.

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

4.1.4 It is noted that, as set out in Table 2 of the PPG, reproduced in Table 4-1, some development types are not permitted in certain flood zones regardless of the findings of the Sequential Test.

4.2 Applying the Sequential Test for the Local Plan

4.2.1 Figure 4-1 illustrates the approach for applying the Sequential Test that Spelthorne BC should adopt in the allocation of sites as part of the preparation of the Local Plan. The Sequential Test should be undertaken by Spelthorne BC and accurately documented to ensure decision processes are consistent and transparent.

4.2.2 The Sequential Test needs to be applied to the whole LPA area to increase the possibilities of delivering development not exposed to flood risk, both now and in the future. When preparing a Local Plan, the LPA should demonstrate that a range of site allocations have been considered, using the SFRA to apply the Sequential and Exception Tests where necessary.

4.2.3 Where it is not possible to locate development in low-risk areas, the Sequential Test should go on to compare sites within medium risk areas and only where there are no sites in low and medium risk areas, within high-risk areas.

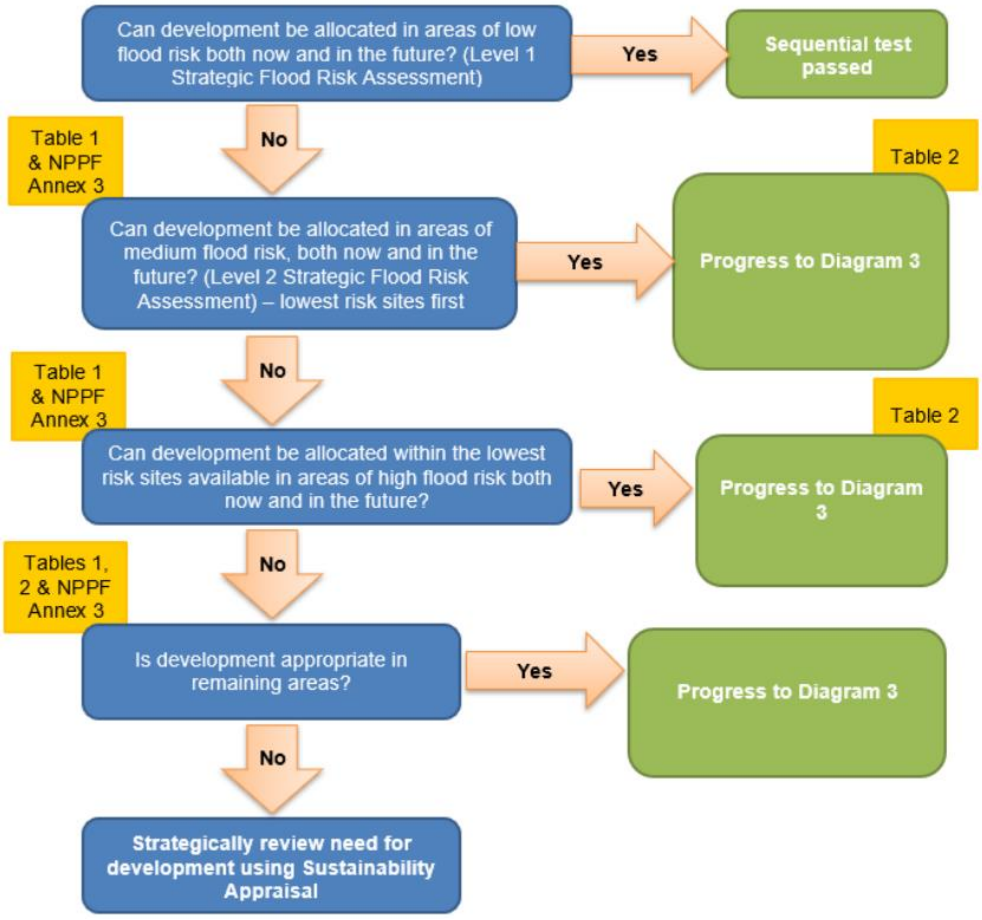


Figure 4-1 Applying the sequential test in the preparation of a Local Plan (PPG Diagram 2)

4.2.4 The Sequential Test requires an understanding of the Flood Zones in the study area and the vulnerability classification of the proposed developments. Flood Zone definitions are provided in Table 3-1 and mapped in the figures in Appendix B (and the Flood Map for Planning (Rivers and Sea) on the Environment Agency website). Flood risk vulnerability classifications, as defined in the PPG are presented in Table 4-1.

4.2.5 NPPF acknowledges that some areas will (also) be at risk of flooding from sources other than fluvial. All sources must be considered when planning for new development including flooding from land or surface water runoff; groundwater; sewers; and artificial sources.

4.2.6 If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

Table 4-1 Flood Risk Vulnerability Classification (NPPF Annex 3)

Vulnerability Classification	Development Uses
Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood. Wind turbines. Solar farms.
Highly Vulnerable	Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. Emergency dispersal points. Basement dwellings. Caravans, mobile homes and park homes intended for permanent residential use. Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”).
More Vulnerable	Hospitals. Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. Non–residential uses for health services, nurseries and educational establishments. Landfill and sites used for waste management facilities for hazardous waste. Sites used for holiday or short-let caravans and camping, subject to a specific emergency plan.
Less Vulnerable	Police, ambulance and fire stations which are not required to be operational during flooding. Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in “more vulnerable”, and assembly and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill and hazardous waste facilities). Minerals working and processing (except for sand and gravel working). Water treatment works which do not need to remain operational during times of flood. Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). Car parks.
Water-Compatible Development	Flood control infrastructure. Water transmission infrastructure and pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel working. Docks, marinas and wharves. Navigation facilities. MOD defence installations. Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. Water-based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific emergency plan.

4.2.7 The NPPF indicates suitability of a development based on its vulnerability and location within a fluvial flood zone as set out in Table 4-2. However, the vulnerability classification of types of development is still relevant in considering flood risk from other sources. For example, a basement dwelling will still be more vulnerable to surface water flooding than an office development.

Table 4-2 Flood Risk Vulnerability and Flood Zone 'Incompatibility' (PPG Table 2)

	Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test Required	✓	✓
	3a †	Exception Test Required †	✓	✗	Exception Test Required	✓
	3b *	Exception Test Required *	✓*	✗	✗	✗

✓ – Exception Test is not required ✗ – Development should not be permitted

† – In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* – In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood
- result in no net loss of floodplain storage
- not impede water flows and not increase flood risk elsewhere

Recommended Stages for LPA Application of the Sequential Test

4.2.8 The recommended steps in undertaking the Sequential Test are detailed below. The information required to address many of these steps is provided in the accompanying maps presented in Appendix B. When preparing a Local Plan a database of the potential allocation sites across Spelthorne should be generated and information for each site populated using the GIS layers presented in the maps. This database can be used by Spelthorne BC when applying the steps below.

1. Assign potential developments with a vulnerability classification (Table 4-1). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.
2. Record the location and identification of potential development.
3. Identify the Flood Zone classification of potential development sites based on the Flood Map for Planning (Rivers and Sea). Where a site is defined within more than one Flood Zone, all zones should be noted, preferably using percentages.
4. Identify the risk of flooding from all other sources of flooding and assign a rating of low, medium or high.
5. Identify the 'design life' of the development with respect to climate change:
   - 100 years for residential developments; and
   - 75 years for commercial / industrial developments, or other time horizon specific to the non-residential use proposed.
6. Identify existing flood defences serving the potential development sites. (However, it should be noted that for the purposes of the Sequential Test, the risk of flooding ignoring defences should be used).
7. Highly Vulnerable developments to be accommodated within the Borough should be located on those sites identified as being within low flood risk areas. If these cannot be located in low flood risk areas because the identified sites are unsuitable or there are insufficient sites in low flood risk areas, sites in medium flood risk areas can then be considered. If sites in medium flood risk areas are inadequate then additional sites in low and medium flood risk areas may need to be identified to accommodate development or opportunities sought to locate the development outside the Borough.
8. Once all Highly Vulnerable developments have been allocated to a site, consideration can be given to those development types defined as More Vulnerable. In the first instance More Vulnerable development should be located on sites in low flood risk areas. Where these sites are unsuitable or there are insufficient sites remaining, sites in medium flood risk areas can be considered. If there

are insufficient sites in low and medium flood risk areas to accommodate More Vulnerable development, sites in high risk areas can be considered. More Vulnerable developments in high risk areas will require application of the Exception Test.

9. Once all More Vulnerable developments have been allocated to a development site, consideration can be given to those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located on sites in low flood risk areas, continuing sequentially with medium flood risk areas, then high risk flood areas. Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.
10. Essential Infrastructure should be preferentially located in the lowest flood risk areas, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied. In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood. Also, in Flood Zone 3b essential infrastructure that has passed the Exception Test should be designed and constructed to remain operational and safe for users in times of flood, result in no net loss of floodplain storage and not impede water flows and not increase flood risk elsewhere.
11. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however it is appreciated that Water Compatible development by nature often relies on access and proximity to water bodies. In Flood Zone 3b Water Compatible infrastructure should be designed and constructed to remain operational and safe for users in times of flood, result in no net loss of floodplain storage and not impede water flows and not increase flood risk elsewhere.
12. On completion of the Sequential Test, consideration may need to be given to the risks posed to a site within a Flood Zone in more detail in a Level 2 SFRA. This more detailed study should consider the detailed nature of flood hazard to allow a sequential approach to site allocation within a Flood Zone. Consideration of flood hazard within a flood zone would include:
    - Flood risk management measures,
    - The rate of flooding,
    - Flood water depth,
    - Flood water velocity.

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

Windfall Sites

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

4.3 Applying the Sequential Test for Planning Applications

4.3.1 The Sequential Test should be applied to 'Major' and 'Non-major development' proposed in areas at risk of flooding. The Environment Agency publication 'Demonstrating the flood risk Sequential Test for Planning Applications[24]' sets out the procedure for applying the sequential test to individual applications as follows:

- Identify the geographical area of search over which the test is to be applied; this could be the Borough area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area). For individual planning applications subject to the Sequential Test, the area to apply the test will be defined by local circumstances relating to the catchment area for the type of development proposed. For nationally or regionally important infrastructure the area of search to which the Sequential Test could be applied will be wider than the local planning authority boundary.
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan. The definition of 'reasonably available sites' is defined within the PPG as sites in a suitable location for the type of development with a reasonable prospect that the site is available to be developed at the point in time envisaged for the development.
- State the method used for comparing flood risk between sites; for example the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources.
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s).
- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- Where necessary, as indicated by Table 4-2, apply the Exception Test.
- Apply the Sequential approach to locating development within the site.

4.3.2 It should be noted that it is for Spelthorne BC, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence what area of search has been used when making the application.

4.3.3 Ultimately, after applying the Sequential Test, Spelthorne BC needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere. This needs to be demonstrated within a FRA and is necessary regardless of whether the Exception Test is required.

4.3.4 **Recommendation:** It is recommended that Spelthorne BC keep an up-to-date register of 'reasonably available' sites, clearly ranked in flood risk preference, and prepare guidance on the appropriate area of search for common development types.

Sequential Test Exemptions

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

- The site has been allocated for development and subject to the test at the plan making stage (provided the proposed development is consistent with the use for which the site was allocated and provided there have been no significant changes to the known level of flood risk to the site, now or in the future which would have affected the outcome of the test).

[24] Environment Agency (2012) Demonstrating the flood risk Sequential Test for Planning Applications, Version 3.1. Available from: http://www.gwfoe.org.uk/wp-content/uploads/2014/01/EA-Sequential-Test-Process-v3.1-April-2012.pdf https://www.gov.uk/guidance/flood-risk-assessment-the-sequential-test-for-applicants

- The site is in an area at low risk from all sources of flooding, unless the Strategic Flood Risk Assessment, or other information, indicates there may be a risk of flooding in the future.
- The application is for a development type that is exempt from the test, as specified in footnote 56 of the NPPF. This includes:
  - Householder development,
  - Small non-residential extensions (with a footprint of less than 250m^2),
  - Changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the Sequential and Exception tests should be applied as appropriate.

4.4 Exception Test

4.4.1 Following the application of the Sequential Test it may be concluded that there are no reasonable available alternative sites in areas of lower risk, and in some cases the Exception Test may be required. Figure 4-2 shows the decision making process and Table 4-1 identifies when the Exception Test is required, based on the flood zone and the vulnerability classification of the proposed development. The Exception Test should only be applied as set out in Figure 4-2 i.e. only if the Sequential Test has shown that there are no reasonably available, lower-risk sites, suitable for the proposed development, to which the development could be steered.

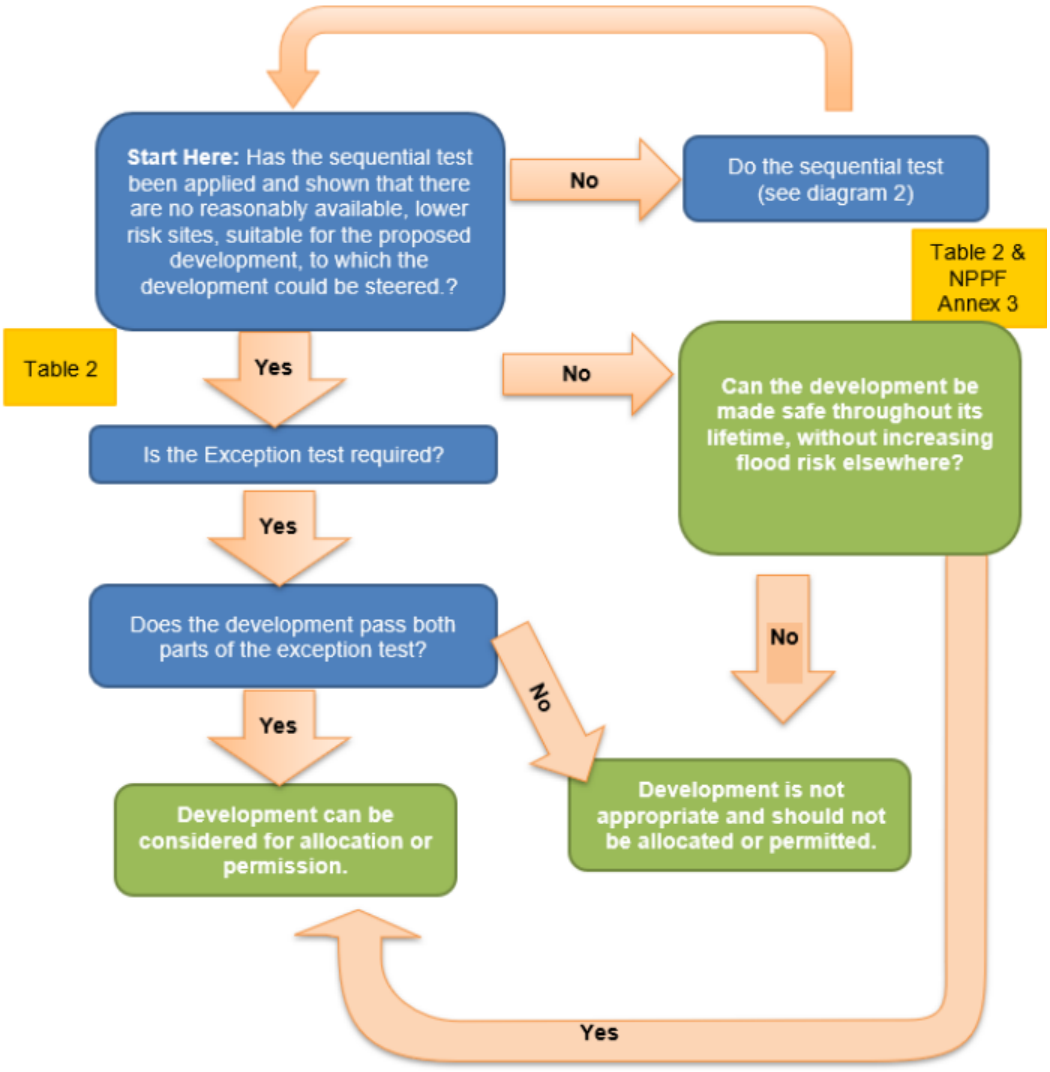


Figure 4-2 Application of the Exception Test in the preparation of a Local Plan (PPG Diagram 3)

4.4.2 For the Exception Test to be passed:

- Part 1 - It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by the SFRA where one has been prepared; and
- Part 2 - A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. If the risk of flooding is not reduced overall, the SFRA must also demonstrate why measures to reduce flood risk overall have not been secured, for example if such measures cannot be identified or are unfeasible.

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

4.4.4 In order to satisfy the first part of the Exception Test, the objectives of the Sustainability Appraisal (SA) can be used to assess each potential development site. The Spelthorne BC SA[25] includes a series of sustainability objectives which allow quantification of the sustainable development of a potential development site.

4.4.5 With respect to the second part of the Exception Test, there are a number of ways a new development can be made safe:

- Avoiding flood risk by not developing in areas at risk of flooding.
- Substituting higher vulnerability land uses for lower vulnerability uses in higher flood risk locations and locating higher vulnerability uses in areas of lower risk on a strategic scale, or on a site basis.
- Providing adequate flood risk management infrastructure which will be maintained for the lifetime of the development.
- Mitigating the potential impacts of flooding through design and resilient construction.
- Managing the remaining residual risk through flood warning and emergency planning measures. appropriate evacuation procedures and flood response infrastructure are in place to manage the residual risk associated with an extreme flood event.

4.4.6 Consideration must also be made to ensure that the risk of flooding elsewhere is not increased and where possible is reduced.

4.4.7 Further guidance on how development could satisfy the second part of the Exception Test is provided in Sections 5 and 6.

[25] Spelthorne Borough Council (May 2022) Spelthorne Sustainability Appraisal Draft Local Plan Spelthorne Takes Shape. Available from: https://www.spelthorne.gov.uk/article/17637/Emerging-Local-Plan-Evidence-Base-and-Supporting-Documents

5. Measures to Control and Mitigate Flood Risk

5.1 Overview

5.1.1 The NPPF appreciates that it may not always be possible to avoid locating development in areas at risk of flooding. This Section provides guidance on the range of measures that could be considered in order to control and mitigate flood risk. These measures should be considered when preparing a site-specific FRA as described in Section 7.

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

- 100 years for residential developments; and,
- 75 years for commercial / industrial developments, or other time horizon specific to the non-residential use proposed

5.2 Development Layout and Sequential Approach

5.2.1 Policy Recommendation: A sequential approach to site planning should be applied *within* new development sites. Location of development must take account of the vulnerability of users.

5.2.2 Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied *within* development sites to locate the most vulnerable elements of a development in the lowest risk areas (considering all sources of flooding) e.g. residential elements should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on lower ground with a higher probability of flooding. Table 2 in the PPG provides a compatibility matrix and determines which types of development are appropriate in areas of flood risk .

5.3 Safeguard land for flood risk management

Riverside Development

5.3.1 **Policy Recommendation:** Safeguard an 8 metre wide undeveloped buffer strip alongside Main Rivers and prioritise opportunities for riverside restoration. Safeguard a 5 metre wide buffer strip alongside Ordinary Watercourses. Prioritise opportunities to de-culvert watercourses. New development within 8m of a Main River or Ordinary Watercourse will require consent from either the Environment Agency or SCC (as LLFA) respectively.

5.3.2 The Environment Agency is likely to seek an 8 metre wide undeveloped buffer strip alongside main fluvial rivers for maintenance purposes and would also ask developers to explore opportunities for riverside restoration as part of any development. SCC would seek a 5 metre wide undeveloped buffer strip to be retained alongside Ordinary Watercourses.

5.3.3 The Environmental Permitting Regulations 2016 require a Flood Risk Activity Permit to be obtained for any activities which will take place[26]:

- on or within 8 metres of a main river
- on or within 8 metres of a flood defence structure or culvert,
- involving quarrying or excavation within 16 metres of any main river, flood defence or culvert,

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

- in a floodplain more than 8 metres from the riverbank, culvert or flood defence structure and for which the applicant does not already have planning permission.

5.3.4 Flood Risk Permits assess the methodology of undertaking the works whilst planning assesses the principle of those works. For any proposed works in, on or near a main river or flood or sea defence, applicants and developers should contact the Environment Agency enquiries@environment-agency.gov.uk.

5.3.5 Responsibility for the consenting of works by third parties on Ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) lies with the LLFA. SCC is responsible for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. This includes any works (including temporary) that affect flow within the channel (such as in channel structures or diversion of watercourses). Enquiries and applications for ordinary watercourse consent should be sent to suds@surreycc.gov.uk. Further information can be found on the SCC website[27].

5.3.6 Consent will be refused if the works would result in an increase in flood risk, a prevention of operational access to the watercourse and/ or an unacceptable risk to nature conservation[28].

Flood Zone 3b Functional Floodplain

5.3.7 Policy Recommendation: Safeguard Flood Zone 3b Functional Floodplain for flood storage.

5.3.8 It is recommended that areas of Flood Zone 3b are safeguarded for flood storage. Only water compatible uses and essential infrastructure, which have passed the exception test, may be permitted in areas of Flood Zone 3b. They should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

5.3.9 In developed areas within the 3.3% AEP flood extent, where it can be demonstrated that existing infrastructure or solid buildings that resist water ingress are not providing a flood storage function, these are not included within the definition of Flood Zone 3b Functional Floodplain and the associated planning requirements do not apply. In these locations, redevelopment should be approached with caution and may be considered subject to the following:

- The vulnerability classification should not be increased, and where possible should be reduced.
- The building footprint should not be increased, and where possible should be reduced.
- The number of occupants should not be increased, and where possible should be reduced.

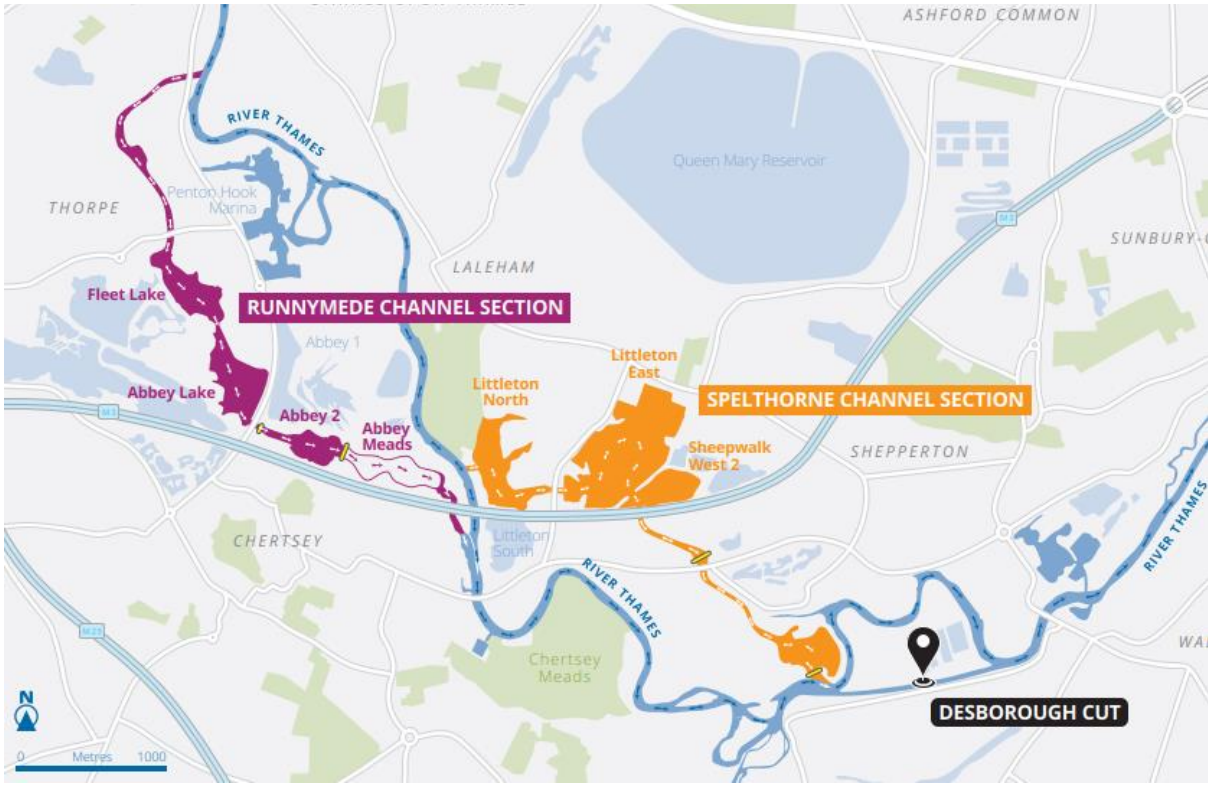
5.3.10 Other provisions for safe development, including finished floor levels, flood resilience measures, access and escape and emergency plan requirements also apply as described in rest of this Section and Section 6.

River Thames Scheme

5.3.11 **Policy Recommendation: Safeguard land required for the River Thames Scheme.** As part of the River Thames Scheme, land should be safeguarded to allow the construction of the flood channel, as well as access to the construction sites. The Spelthorne channel is almost 2 miles (3.2 km) long. It starts between Laleham Sports Ground and the M3 at Thames Side where it enters Littleton North Lake. From there it heads east to join Littleton East Lake and Sheepwalk West 2 Lake before passing under the M3. It then flows south under Chertsey Road/Renfree Way before joining Ferry Lane Lake. It re-joins the Thames opposite D'Oyly Carte Island, upstream of Desborough Island and downstream of Shepperton Weir. The land along this route must be safeguarded for the River Thames Scheme.

[27] https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/ordinary-watercourse-consents
[28] Surrey County Council (2017) Surrey County Council Local Flood Risk Management Strategy. https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/surrey-local-flood-risk-management-strategy

Figure 5-1 River Thames Scheme



Source: https://www.riverthamesscheme.org.uk/scheme/the-channel-sections

Green Infrastructure

5.3.12 Green Infrastructure (GI) is a strategically planned and managed network of natural and semi-natural green (land) and blue (water) spaces that intersperse and connect urban centres, suburbs and rural fringe, consisting of:

- Open spaces e.g. parks, woodland, nature reserves and lakes,
- Linkages e.g. river corridors, canals, pathways, cycle routes and greenways,
- Networks of 'urban green' e.g. private gardens, street trees, verges and green roofs.

5.3.13 The identification and planning of GI is critical to sustainable growth and flood risk management. GI can provide a wide range of ecosystem services, including climate mitigation and adaptation, and is central to climate change action. GI also provides additional green spaces for storm flows, freeing up water storage capacity in existing infrastructure and reducing the risk of damage to urban property, particularly in city centres and vulnerable urban regeneration areas. Additionally, GI can improve accessibility to waterways and water quality, supporting regeneration and improving opportunity for leisure, economic activity and biodiversity.

Natural Flood Management

5.3.14 Natural flood management involves techniques that aim to work with natural hydrological and morphological processes, features, and characteristics to manage the sources and pathways of flood waters. Techniques include the restoration, enhancement and alteration of natural features and characteristics, but exclude traditional flood defence engineering that works against or disrupts these natural processes.

5.3.15 The contribution natural flood management techniques can make to reduce the causes and impacts of flooding will vary greatly from case to case. In some cases, they may be capable of comprehensively addressing flood risk to a site on their own, but in many cases, they will need to be used in a complementary way alongside more conventional flood risk management techniques such as engineered defences. Natural flood management techniques can also contribute to the delivery of biodiversity and environmental net gains and support the implementation of river basin management plans and the public body duty to have regard to them.

5.3.16 There are a number of opportunities available to reduce the causes and impacts of flooding through Working with Natural Processes (WWNP)[29]. This involves implementing measures that help to protect, restore, and emulate the natural functions of catchments, floodplains, rivers, and the coast. WWNP takes many forms and can be applied in urban and rural areas, and on rivers, estuaries, and coasts.

5.3.17 As part of a research project undertaken by the Environment Agency and Flood and Coastal risk Management Research and Development Programme, a series of spatial datasets have been generated for these natural processes[30], identifying their best estimate of locations in the country where the methods can be applied.

Table 5-1 Description of WWNP datasets

Natural Process	Benefits	Most Effective Conditions	Notes
Floodplain Woodland Planting Potential	Slows floodwaters and increases water depth on the floodplain. Reduces flood peaks, delays flood peak timing and desynchronises flood peaks. Enhances sediment deposition on the floodplain.	Middle and lower river reaches of middle to large catchments.	Based upon Flood Zone 2. Information is largely based on modelled data and open constraints data and is indicative rather than specific.
Riparian Woodland Planting Potential (woodlands on land immediately adjoining a watercourse)	Slows flood flows. Reduces sediment delivery to the watercourse. Reduces bankside erosion. Creates below ground storage.	At the reach scale in middle and upper catchments.	Based upon a 50m buffer of available OS Open Data river networks. Information is largely based on open data and is indicative rather than specific.
Wider Catchment Woodland	Intercepts, slows, stores and filters water. Reduces flood peaks, flood flows and frequency.	Small events on small catchments – extent of reduction decreases as flood magnitude increases.	Based upon the 1:50k BGS geology survey and relies upon identifying drift and bedrock geologies that are characteristic of slowly permeable soils. Information is largely based on the 100m gridded version of BGS data and open constraints data and is indicative rather than specific.
Floodplain Reconnection Potential (reconnecting watercourses and floodplains)	Encourages more regular floodplain inundation and flood water storage Decreases the magnitude of flood peaks and reduces downstream flood depths.	High frequency, low return period floods.	Designed to support signposting of areas where there is currently poor connectivity such that flood waters are constrained to the channel and flood waves may therefore propagate downstream rapidly Based upon the Risk of Flooding from Rivers and Seas probability maps and identifies areas of low and very low probability that are close to a watercourse, but do not contain residential property or key services (may contain non-residential property – important to consider).
Runoff Attenuation Features (3.3% and 1% AEP) (includes swales, ponds and sediments traps)	Delays and flattens the hydrograph and reduces peak flow locally for small flood events.	A cluster of features working as a network throughout the landscape.	Based upon the Risk of Flooding from Surface Water datasets and identifies areas of high flow accumulations for the 1% and 3.3% AEP surface water maps. The areas of ponding or accumulation are between 100 and 5000 metres squared and have been tagged where they fall on an area of slope steeper than 6% as gully blocking opportunities

5.3.18 Defra have produced a Woodland Constraints dataset which refines potential locations for WWNP, taking into account roads, rail, urban areas, existing woodland, peat, and water bodies.

[29] Environment Agency and Flood and Coastal Risk Management R&D Programme. (2021) Working with Natural Processes to Reduce Flood Risk. Available from: https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/working-with-natural-processes-to-reduce-flood-risk?web=1&wdLOR=c56AD7DAC-BB7B-471B-94B4-B5C5B91DEEE4

[30] Working with Natural Processes datasets https://environment.data.gov.uk/searchresults;query=wwnp;searchtype=All;page=1;pagesize=20;orderby=Relevancy

5.3.19 The WWNP data does not provide information on design, which may need to consider issues such as drain-down between flood events. It is important to note that land ownership and change to flood risk have not been considered. Locations identified may have more recent building or land use than available data indicates.

5.3.20 **Appendix A Figure 15** provides information from the Environment Agency's 'Working with Natural Processes – Evidence Directory' about where these measures could be applied. This map shows that although there are a lot of existing woodland constraints within Spelthorne Borough, there are also a wide range of opportunities to implement natural processes to alleviate flooding. There are potential opportunities for floodplain woodland planting and riparian woodland planting towards the south of the administrative area between the River Ash and River Thames. Towards the north west of the administrative area, some wider catchment woodland opportunities, riparian woodland planting potential and floodplain reconnection potential are presented in the map. Riparian woodland planting also holds the potential to confer environmental benefits such as improved water quality, Biodiversity Net Gain, wildlife corridors, and carbon sequestration, in unison with natural flood management.

5.3.21 **Policy Recommendation:** Extend and enhance existing Green Infrastructure in the Borough including the implementation of floodplain and riparian woodland planting schemes. Land that is likely to be needed for natural flood management should be safeguarded. Consideration should also be given to any necessary access to that land, and any additional land which may be needed temporarily during construction.

5.3.22 The mapping in Appendix A Figure 15 should be used by Spelthorne BC to support future blue and green infrastructure planning.

5.4 Sustainable drainage systems

5.4.1 Policy Recommendation: Development should not result in an increase in surface water runoff. Surface run-off rates should be limited to greenfield. Sustainable Drainage Systems (SuDS) should be used to reduce and manage surface water run-off to and from proposed developments as near to source as possible in accordance with the requirements of the Technical Standards and supporting guidance[31].

5.4.2 Sustainable drainage systems (or SuDS) are designed to control surface water run off close to where it falls, combining a mixture of built and nature-based techniques to mimic natural drainage as closely as possible, and accounting for the predicted impacts of climate change. Where possible SuDS solutions for a site should seek to provide benefits for:

- Water quantity (reduce flood risk to the site and neighbouring areas),
- Water quality (reduce pollution),
- Biodiversity (wildlife), and,
- Amenity (landscape).

5.4.3 SuDS are typically softer engineering solutions inspired by natural drainage processes such as ponds and swales which manage water as close to its source as possible. Wherever possible, a SuDS technique should seek to contribute to each of the three goals identified below.

5.4.4 The layout and function of drainage systems needs to be considered at the start of the design process for new development, as integration with road networks and other infrastructure can maximise the availability of developable land. This should ideally be achieved by incorporating (SuDS).

5.4.5 Generally the aim should be to discharge surface water run-off as high up the following hierarchy of drainage options as reasonably practicable in accordance with the Building Regulations 2010 Drainage and Waste Disposal Approved Document H[32]:

- Into the ground (infiltration)
- To a surface water body

[31] DEFRA. (2015) Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems. Available from : https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards
[32] Drainage and waste disposal: Approved document H. Building Regulations in England for foul water drainage and disposal. Available from: Drainage and waste disposal: Approved Document H - GOV.UK (www.gov.uk)

- To a surface water sewer, highway drain, or another drainage system
- To a combined sewer

5.4.6 SuDS techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (i.e. natural watercourse or public sewer etc.). The SuDS Manual[33] identified several processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities for storm water control, flood risk management, water conservation and groundwater recharge.

- **Infiltration**: the soaking of water into the ground. This is the most desirable solution as it mimics the natural hydrological process. The rate of infiltration will vary with soil type and condition, the antecedent conditions and with time. The process can be used to recharge groundwater sources and feed baseflows of local watercourses, but where groundwater sources are vulnerable or there is risk of contamination, infiltration techniques are not suitable.
- **Detention/Attenuation**: the slowing down of surface flows before their transfer downstream, usually achieved by creating a storage volume and a constrained outlet. In general, though the storage will enable a reduction in the peak rate of runoff, the total volume will remain the same, just occurring over a longer duration.
- **Conveyance**: the transfer of surface runoff from one place to another, e.g. through open channels, pipes and trenches.
- **Water Harvesting**: the direct capture and use of runoff on site, e.g. for domestic use (flushing toilets) or irrigation of urban landscapes. The ability of these systems to perform a flood risk management function will be dependent on their scale, and whether there will be a suitable amount of storage always available in the event of a flood.

5.4.7 As part of any SuDS scheme, consideration should be given to the long-term maintenance of the SuDS to ensure that it remains functional for the lifetime of the development. Table 5-2 has been reproduced from the SuDS Manual, CIRIA C697 and outlines typical SuDS techniques.

5.4.8 Adoption arrangements for SuDS scheme should be considered for the lifetime of the development. As the LPA, Spelthorne BC will need to consider whether the proposed standard of construction would facilitate adoption and maintenance by an appropriate body such as the water and sewerage company under the Ofwat-approved Sewerage Sector Guidance.

5.4.9 The application of SuDS is not limited to a single technique per site. Often a successful SuDS solution will utilise a combination of techniques, providing flood risk, pollution and landscape/wildlife benefits. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS. It should be noted, each development site must offset its own increase in runoff and attenuation cannot be “traded” between developments.

[33] CIRIA C697 SuDS Manual. Available from: http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

Table 5-2 Typical SuDS Components

Technique	Description	Conveyance	Detention	Infiltration	Harvesting
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.		Y	Y	*
Filter Drains	Linear drains/trenches filled with a permeable material, often with perforated pipe in the base of the trench. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site.	Y	Y		
Filter Strips	Vegetated strips of gently sloping ground designed to drain water evenly from impermeable areas and filter out silt and particulates.	*	*	*	
Swales	Shallow vegetated channels that conduct and/or retain water and can permit infiltration when unlined.	Y	Y	*	
Ponds	Depressions used for storing and treating water.		Y	*	Y
Wetlands	As ponds, but the runoff flows slowly but continuously through aquatic vegetation that attenuates and filters the flow. Shallower than ponds. Based on geology these measures can also incorporate some degree of infiltration.	*	Y	*	Y
Detention Basin	Dry depressions designed to store water for a specified retention time.		Y		
Soakaways	Sub-surface structures that store and dispose of water via infiltration.			Y	
Infiltration Trenches	As filter drains but allowing infiltration through trench base and sides.	*	Y	Y	
Infiltration Basins	Depressions that store and dispose of water via infiltration.		Y	Y	
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation. It is noted that the use of brown/green roofs should be for betterment purposes and not to be counted towards the provision of on-site storage for surface water. This is because the hydraulic performance during extreme events is similar to a standard roof (CIRIA C697).		Y		
Rainwater Harvesting	Storage and use of rainwater for non-potable uses within a building, e.g. toilet flushing. It is noted that storage in these types of systems is not usually considered to count towards the provision of on-site storage for surface water balancing because, given the sporadic nature of the use of harvested water, it cannot be guaranteed that the tanks are available to provide sufficient attenuation for the storm event.	*	*	*	Y

*Y: primary process, * some opportunities subject to design*

Suitability for Infiltration SuDS

5.4.10 The use of infiltration techniques is highly dependent on the underlying ground conditions. As part of this SFRA, the detailed BGS Infiltration SuDS Map has been used to provide an indication of the suitability of using infiltration SuDS techniques across the Borough.

5.4.11 Particular types of sustainable drainage features may not be practicable or appropriate in some locations, such as the use of infiltration techniques from potentially polluting development in areas where groundwater provides a potable supply of water (e.g. Groundwater Source Protection Zone 1). Also, infiltration techniques may not be practicable for areas where the groundwater level is close to the ground surface.

5.4.12 **Appendix B Figure 14** presents the Infiltration SuDS Map, which shows the following areas:

Highly compatible: The subsurface is likely to be suitable for free-draining infiltration SuDS.

Probably compatible for infiltration SuDS: The subsurface is probably suitable for infiltration SuDS, although design may be influenced by the ground conditions.

Opportunities for bespoke infiltration SuDS: The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.

Very significant constraints are indicated: There is a very significant potential for one or more geohazards associated with infiltration.

5.4.13 The coverage across the Borough is quite 'patchy', but the dataset identifies that in parts of Shepperton and Sunbury there may be opportunities for the use of infiltration SuDS. Over the large majority of the urbanised areas of the Borough the dataset identifies constraints for the use of infiltration SuDS. Flow attenuation of surface water released into a waterbody or a sewer could be considered for locations where infiltration is not suitable.

5.4.14 Detention measures are not constrained by geology, though in areas of permeable geology, there will also be a degree of infiltration of runoff taking place.

Technical Standards and supporting guidance

5.4.15 A set of non-statutory Technical Standards[34] have been published, to be used in conjunction with supporting guidance in the PPG, which set the requirements for the design, construction, maintenance and operation of sustainable drainage systems (SuDS).

5.4.16 The Technical Standards that are of chief concern in relation to the consideration of flood risk to and from development relating to peak flow control and volume control are presented below:

Peak flow control

S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event but should never exceed the rate of discharge from the development prior to redevelopment for that event.

Volume control

S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event but should never exceed the runoff volume from the development site prior to redevelopment for that event.

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Flood risk within the development

S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.

S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a

[34] DEFRA. (2015) Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems. Available from : https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards

building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

5.4.17 All major development should include provision for SuDS and, as the LLFA, SCC is a statutory consultee on surface water management drainage issues for all such major developments. In partnership with the 11 LPAs in Surrey, SCC has set out clear advice and guidance documents on their website[35]. This includes a 'Surface Water Drainage Summary Pro-forma' which should be completed in full and accompany the submitted drainage statement and supporting evidence. This must be cross-referenced within an FRA where appropriate.

5.4.18 Applicants are strongly encouraged to discuss their proposals with SCC at the pre-application stage. A request can be made via suds@surreycc.gov.uk.

5.4.19 For smaller schemes located within Flood Zones 2 and 3, SuDS will need to be addressed as part of an FRA and will be assessed by Spelthorne BC.

5.5 Flood Routing

5.5.1 Policy Recommendation: New development should not adversely affect flood routing and thereby increase flood risk elsewhere.

5.5.2 Opportunities should be sought within the site design to make space for water, such as:

- Removing boundary walls or replacing with other boundary treatments such as hedges, post and rail fencing or hit and miss fencing (i.e. vertical slats fixed alternately on each side of horizontal posts).
- Considering alternatives to solid wooden gates or ensuring that there is a gap beneath the gates to allow the passage of floodwater.
- Create under-croft car parks or consider reducing ground floor footprint and creating an open area under the building to allow flood water storage.
- Where proposals entail floodable garages or outbuildings, consider designing a proportion of the external walls to be committed to free flow of floodwater.

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

5.5.4 Potential overland flow paths should be determined and appropriate solutions proposed to minimise the impact of the development, for example by configuring road and building layouts to preserve existing flow paths and improve flood routing, whilst ensuring that flows are not diverted towards other properties elsewhere.

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

5.6 Flood Compensation Storage

5.6.1 Policy Recommendations: All new development should not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

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

[35]SCC SuDS Planning Advice. https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/suds-planning-advice

5.6.3 Similarly, where ground levels may be elevated to raise part of a development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced.

5.6.4 As depicted in Figure 5-2, floodplain compensation must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary. Where land is not within the site boundary, it must be in the immediate vicinity, in the applicant's ownership and hydrologically linked to the site. Floodplain compensation must be considered in the context of the 1% annual probability (1 in 100 year) flood level including an allowance for climate change. When designing a scheme flood water must be able to flow in and out and must not pond. An FRA must demonstrate that there is no loss of flood storage capacity and include details of an appropriate maintenance regime to ensure mitigation continues to function for the life of the development. Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624[36].

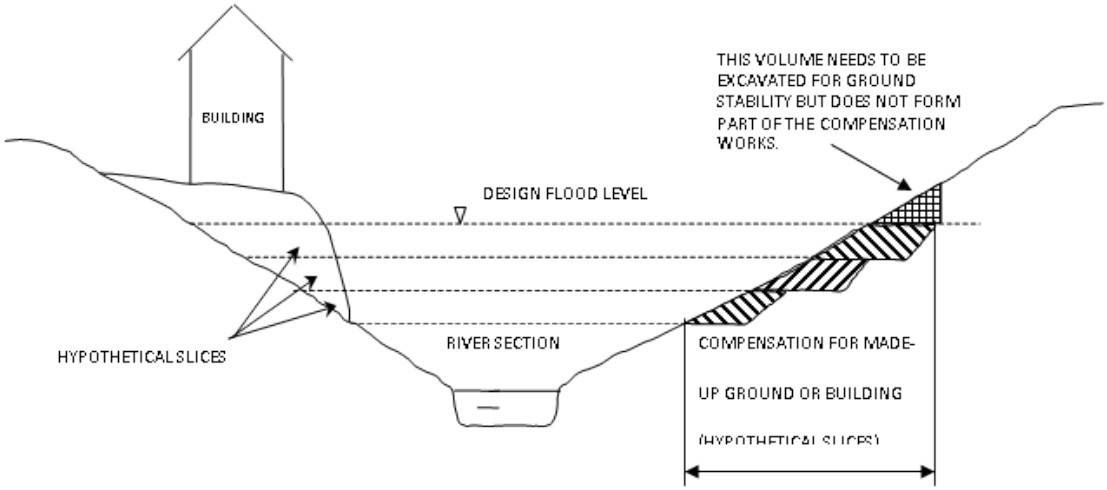


Figure 5-2 Example of Floodplain Compensation Storage (Environment Agency 2009)

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

5.6.6 The use of stilts and voids below buildings should not normally be relied upon for compensating for any loss of floodplain storage. This is because voids do not allow water to freely flow through them, trash screens get blocked, voids get silted up, they have limited capacity, and it is difficult to stop them being used for storing belongings or other materials.

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

5.7 Risk of groundwater flooding

5.7.1 Policy Recommendation: New development should not result in an increased risk of groundwater flooding elsewhere. Where subsurface development is proposed, an impact assessment should be

[36] CIRIA (2004) CIRIA Report 624: Development and Flood Risk - Guidance for the Construction Industry.

undertaken to determine the potential impact on groundwater and identify proposed mitigation measures.

5.7.2 The superficial geology underlying Spelthorne is permeable and in connection with the River Thames and other watercourses. This creates pathways for groundwater to flow through the subsurface and the potential for groundwater flooding to occur, which is exacerbated when water levels in the watercourses are elevated. Additional subsurface development or additional infiltration has the potential to modify groundwater flows, leading to potential flooding elsewhere and/or impacting on groundwater abstractions downstream.

5.7.3 A preliminary Hydrogeological Risk Assessment (HRA) should be undertaken for all proposed developments. The preliminary HRA should identify:

i. the depth and geometry of the penetration of works into the sub-surface from the construction of the proposed development (for example piled foundations, basements, excavation for services). These features can disrupt groundwater flow, alter groundwater levels and therefore increase the risk of groundwater flooding at or around the site.

ii. any changes in drainage, for example impermeable surfaces or infiltration/SuDS systems which could alter groundwater flow patterns and the elevation of the water table.

5.7.4 If the preliminary HRA identifies works below ground and/or changes in drainage a HRA (sometimes called a Basement Impact Assessment) will be required. The scope and detail required for the HRA will vary depending on the scale of sub-surface construction proposed and the local geological and hydrogeological conditions.

5.7.5 The HRA should identify the presence or otherwise of an aquifer and the depth to water table. (In parts of the Spelthorne BC area, an aquifer is present consisting of 5-7 m of river gravel deposits which overlie the impermeable London Clay. The area is known to be at risk of groundwater flooding. In other areas the geology and hydrogeology may be different.

5.7.6 The HRA should therefore be used to determine the geological and hydrogeological setting and whether sub-surface development will reach the water table. The water table will move up and down depending on rainfall; the assessment should consider the highest level. If the development does extend down to the water table it may disrupt groundwater flow in the aquifer by creating a barrier and increase the risk of flooding. The HRA should identify the impact and any required mitigation measures.

5.7.7 In some settings there may be an aquifer at depth and, depending on the proposed depth of the development, this may also have to be assessed. A site specific ground investigation (GI) with trial pits and boreholes should be recommend if there is uncertainty over the geological or hydrogeological conditions at any proposed development site.

5.7.8 The HRA should also identify changes in drainage as these may create additional inflows to ground which can also exacerbate groundwater flood risk.

5.8 Property Flood Resilience

5.8.1 **Policy Recommendation:** Where development or redevelopment is proposed in areas at risk of flooding, flood resilience measures should be implemented.

5.8.2 ‘Property Flood Resilience’ is an approach to building design which aims to reduce flood damage and speed recovery and reoccupation following a flood. It uses a combination of flood resistance and recovery measures and is described in the industry-developed CIRIA Property Flood Resilience Code of Practice[37], which provides advice for both new-build and retrofit. It includes specific guidance for local authority planners.

5.8.3 Resistance and recovery measures are unlikely to be suitable as the only mitigation measure to manage flood risk, but they may be suitable in some circumstances, such as:

[37] Kelly, D, Barker, M, Lamond, J, McKeown, S, Blundell, E and Suttie, E (2020) Guidance on the code of practice for property flood resilience, C790B, CIRIA, London (ISBN: 978-0-86017-895-8) https://www.ciria.org/CIRIA/Resources/Free_publications/CoP_for_PFR_resource.aspx

- Water Compatible and Less Vulnerable uses where temporary disruption is acceptable and the development remains safe.
- Where the use of an existing building is to be changed and it can be demonstrated that the avoidance measures are not practicable, and the development remains safe.
- As a measure to manage residual flood risk from flood risk management infrastructure when avoidance measures have been exhausted.

5.8.4 Flood resistance and recovery measures cannot be used to justify development in inappropriate locations.

5.8.5 Where historic buildings are involved, early consultation with Historic England should be undertaken and their guide[38] on flood resilience for historic properties provides additional information.

Flood Resistance 'Water Exclusion Strategy'

5.8.6 Flood resistant construction can prevent entry of water or minimise the amount that may enter a building where there is short duration flooding with water depth up to approximately 0.6 metres, depending on the building's characteristics. Where measures to exclude water in this way are proposed above this level, advice should be sought from a suitably qualified building surveyor, architect or structural engineer.

5.8.7 There is a range of flood resistance and resilience construction techniques that can be implemented in development to mitigate potential flood damage. Flood resistance measures, or dry-proofing, stops water entering a building up to a safe structural limit. Resistance measures can be passive, such as flood doors which are normally closed; or active, such as air brick covers or removable flood barriers. Passive measures are to be prioritised over active measures.

5.8.8 This form of construction needs to be used with caution and accompanied by measures that will speed-up flood recovery, as effective flood resistance can be difficult to achieve. Hydrostatic pressures exerted by floodwater can cause long-term structural damage, undermine the foundations of a building or cause leakage through the walls, floor or sub-floor, unless the building is specifically designed to withstand such stresses. In addition, temporary and demountable defences are not appropriate for new-build developments.

5.8.9 There are a range of property flood protection devices available on the market, designed specifically to resist the passage of floodwater. These include removable flood barriers and gates designed to fit openings, vent covers and stoppers designed to fit WCs. These measures can be appropriate for preventing water entry associated with fluvial flooding as well as surface water and sewer flooding. The efficacy of such devices relies on their being deployed before a flood event occurs. It should also be borne in mind that devices such as air vent covers, if left in place by occupants as a precautionary measure, may compromise safe ventilation of the building in accordance with Building Regulations.

Flood Recovery 'Water Entry Strategy'

5.8.10 Flood recoverability measures (or wet-proofing), accept that water will enter the building, but through careful design and changes to the construction will minimise damage and allow faster cleaning, drying, repairing and re-occupancy of the building after a flood. Measures are preferably passive, such as the use of resilient building materials, or active such as moving sensitive equipment or belongings to upper floors when flooding is expected.

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

5.8.12 A variety of flood recovery tools can be implemented, such as:

[38] Historic England, April 2015, Flooding and Historic Buildings. https://historicengland.org.uk/images-books/publications/flooding-and-historic-buildings-2ednrev/

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

5.8.13 Structures such as (bus, bike) shelters, park benches and refuse bins (and associated storage areas) located in areas with a high flood risk should be flood resilient and be firmly attached to the ground and designed in such a way as to prevent entrainment of debris which in turn could increase flood risk and/or breakaway posing a danger to life during high flows.

5.9 Finished Floor Levels

5.9.1 Policy Recommendation: Development within Flood Zones 2 and 3 should set Finished Floor Levels 300mm above the known or modelled 1 in 100 annual probability (1% AEP) flood level including the appropriate allowance for climate change and freeboard.

5.9.2 Where developing in Flood Zone 2 and 3 is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) and Highly Vulnerable land uses, is to ensure internal floor levels are raised a freeboard level above the design flood level. Table 5-3 provides an overview of the requirements for finished floor levels for development in Spelthorne.

5.9.3 In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. In these cases, the Environment Agency and/or Spelthorne BC should be approached to discuss options for a reduction in the minimum internal ground floor levels provided flood resistance measures be implemented up to an agreed level. There are also circumstances where flood resilience measures should be considered first. These are described further below. For both Less and More Vulnerable developments where internal access to higher floors is required, the associated plans showing the access routes and floor levels should be included within any site-specific FRA.

Table 5-3 Requirements for Finished Floor Levels in Spelthorne BC

Development Type	Flood Zone 3	Flood Zone 2
Minor development (i.e. non-residential extensions with a floor space <250m^2 and householder developments)	Provide evidence to Spelthorne BC that EITHER, Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development has been incorporated where appropriate. Details of flood proofing / resilience techniques to be included (refer to Section 5.6). OR, Floor levels within the extension will be set 300mm above the known or modelled 1 in 100 annual probability flood level (1%) including climate change. Applicants should provide a plan showing floor levels relative to flood levels. All levels should be stated in relation to Ordnance Datum.	Provide evidence to Spelthorne BC that, Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development has been incorporated where appropriate. Details of flood proofing / resilience and resistance techniques to be included (refer to Section 5.6).
New residential development (More Vulnerable)	Where appropriate, subject to there being no other planning constraints (e.g. restrictions on building heights), finished floor levels should be set a minimum of 300mm above the 1% annual probability flood level (1 in 100 year) including climate change. The design flood level should be derived for the immediate vicinity of the site (i.e. relative to the extent of a site along a watercourse as flood levels are likely to vary with increasing distance downstream) as part of a site-specific FRA. Sleeping accommodation should be restricted to the first floor or above to offer the required 'safe places'. Internal ground floors below this level could however be occupied by Less Vulnerable commercial premises, garages or non-sleeping residential rooms (e.g. kitchen, study, lounge) (i.e. applying a sequential approach within a building).	
New non-residential development (e.g. Less Vulnerable)	Finished floor levels may not need to be raised. For example, Less Vulnerable developments can be designed to be floodable instead of raising floor levels, and this may be beneficial to help minimise the impact of the development on the displacement of floodwater and the risk of flooding to the surrounding area. However, it is strongly recommended that internal access is provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. Such refuges will have to be permanent and accessible to all occupants and users of the site and an Emergency Plan should be prepared to document the actions to take in the event of a flood.	
Basements	Basements, basement extensions, conversions of basements to a higher vulnerability classification or	All basements, basement extensions and conversions must have internal access to a higher floor situated

	self-contained units are not permitted in Flood Zone 3b. Self-contained residential basements and bedrooms at basement level are not permitted in Flood Zone 3a. Internal access to a higher floor situated 300mm above the 1% annual probability flood level (1 in 100 year) including climate change must be provided for all other basements, basement extensions and conversions.	300mm above the 1% annual probability flood level (1 in 100 year) including climate change.

6. Measures to Manage Residual Risk – Emergency Planning

Residual risk describes the risks that remain after taking into account flood risk management infrastructure and/or any site specific mitigation measures that have been applied. The following measures are required to manage the remaining residual risk.

6.1 Flood Warning Areas

6.1.1 The Environment Agency operates a free Flood Warning Service[39] for many areas at risk of flooding from rivers and the sea. In some parts of England the Environment Agency may also be able to tell when flooding from groundwater is possible. The Environment Agency has provided a GIS layer of Flood Warning Areas in Spelthorne. There are 14 flood warning areas within the Borough, as shown in Appendix B Figure 10 and Table 6-1. The Environment Agency issues flood warnings to residents and businesses that have registered for the service in these specific areas when flooding is expected.

Appendix B Figure 10 Environment Agency Flood Warning Areas.

Table 6-1 Environment Agency Flood Warning Areas in Spelthorne

Flood Warning Area Name	Description
River Colne and Frays River at West Drayton and Stanwell Moor	The River Colne and Frays River at West Drayton and Stanwell Moor including Longford and Poyle
River Ash at Ashford and Staines	The River Ash at Ashford and Staines, including Birch Green, Knowle Green, Littleton and Shepperton
River Thames at Chertsey	River Thames at Chertsey including Chertsey Lock, Abbeychase, Chertsey Bridge Road, Thames Close, Hazelbank Road, Mead Lane and Bridge Wharf
River Thames at Hamm Court	River Thames at Hamm Court including Shepperton Lock, Hamhaugh Island, Hamm Court Estate and Dorney Grove
River Thames at Laleham	River Thames at Laleham and Penton Hook including Penton Park, Laleham Reach and Laleham Abbey, Staines Road, The Broadway and Thames Side
River Thames at Shepperton and Lower Halliford	River Thames at Shepperton and Lower Halliford including St. Nicholas Drive, Thamesmead School and Bishop Duppas Park areas
River Thames at Shepperton Green	River Thames in the Shepperton Green village area
River Thames at Staines and Egham	River Thames at Staines and Egham including Bell Weir and Penton Hook Locks, Runnymede, Hythe End, Pooley Green, Thorpe Lea and east Egham
River Thames at Sunbury	River Thames in the Sunbury town area, including Longwood Business Park, Halliford Road areas of Upper Halliford and Sunbury, Lower Hampton Road park, Kenton Court Meadow and Kempton Park Racecourse areas
Properties closest to the River Thames from Shepperton Lock to Beasley's Ait	The River Thames from Shepperton Lock to Beasley's Ait, including Sandhills Meadow, Thames Meadow, Penny Lane and Felix Lane areas
Properties closest to the River Thames between Littleton Lane (Shepperton Green) and Shepperton Lock	River Thames at the Littleton Lane, Chertsey Road and Pool End areas of Shepperton Green as well as Dockett Eddy, Dockett Point and Pharaoh's Island.
Properties closest to the River Thames between Runnymede Pleasure Grounds, Staines and Penton Hook	River Thames between Runnymede Pleasure Grounds, Staines and Penton Hook, including Hythe End Road, Bell Weir Lock, Holm Island, Church Island, Truss Island and Penton Hook Lock areas of Staines

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

Properties closest to the River Thames at Sunbury	River Thames at Sunbury from Wheatley's Eyot to Sunbury Court Island including Wheatley's Eyot, Sunbury Lock Ait, Sunbury Ait, Sunbury Court Island and properties on The Creek, Parke Road, Thames Street and Lower Hampton Road
Colne Brook at Colnbrook	The Colne Brook at Colnbrook including Horton and Wraysbury

6.1.2 Spelthorne BC has designated emergency rest centres across the Borough. Details of these centres have not been provided within the SFRA due to data sensitivity.

6.1.3 Recommendation: Spelthorne BC Emergency Planners should use the findings of the SFRA to inform the next planned review of the Multi-Agency Flood Plan.

6.2 Access and Escape

6.2.1 Policy Recommendation: New development must have safe access / escape during design flood conditions including an allowance for climate change.

6.2.2 Where development may be proposed in areas at risk of flooding, safe access and egress are required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out any necessary duties during periods of flood.

6.2.3 A safe access/escape route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g. within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances (i.e. 1% AEP fluvial flood event and surface water event including an appropriate climate change allowance).

6.2.4 Where access and escape are important to the overall safety of development in areas of flood risk, the local planning authority should consult with emergency planning staff and, where appropriate with the emergency services, unless local standards or guidelines have been put in place in lieu of consultation.

‘Dry Islands’

6.2.5 The extensive area of floodplain within Spelthorne is relatively flat; however, there are certain areas of slightly higher ground which are less prone to flooding than the land around them. During times of flood it is possible that all the land surrounding these areas becomes flooded, resulting in this higher area becoming a ‘dry island’. During prolonged periods of flooding it may prove difficult to provide resources and emergency services to those living in these areas. In order to reduce the flood risk, these ‘dry islands’ should be treated the same as for the level of flood risk in the area surrounding them, regardless of their size. When contemplating development, it is important to study the wider area of the flood map to ensure that there is a dry route to a point outside the floodplain.

6.2.6 Guidance prepared by the Environment Agency[40] uses a calculation of flood hazard to determine safety in relation to flood risk. Flood hazard is a function of the flood depth and flow velocity at a particular point in the floodplain along with a suitable debris factor to account for the hazard posed by any material entrained by the floodwater. The derivation of flood hazard is based on the methodology in Flood Risks to People FD2320, the use of which, for the purpose of planning and development control, is clarified in the abovementioned publication.

Table 6-2 Hazard to People Rating (HR=d x (v +0.5)+DF) (Table 13.1 FD2320/TR2)

Flood Hazard (HR)	Description
Less than 0.75	Very low hazard – Caution
0.75 to 1.25	Dangerous for some – includes children, the elderly and the infirm
1.25 to 2.0	Dangerous for most – includes the general public
More than 2.0	Dangerous for all – includes the emergency services

[40] Environment Agency (2008) Supplementary note on Flood hazard ratings and thresholds for development planning and control purpose. Clarification of Table 13.1 FD2320/TR2 and Figure 3.2 FD2321/TR1. Available from: http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2321_7400_PR_pdf.sflb.ashx

6.2.7 For developments located in areas at risk of fluvial flooding safe access / escape must be provided for new development as follows in order of preference:

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

6.2.8 In all these cases, a 'dry' access/escape is a route located above the 1% annual probability flood level (1 in 100 year) for river flooding and surface water flooding, including an allowance for climate change.

6.2.9 In exceptional circumstances, safe access above the 1% annual probability (1 in 100 year) flood level for river flooding and surface water flooding including climate change may not be achievable. In these circumstances the Environment Agency and Spelthorne BC should be consulted to determine whether the safety of the site occupants can be satisfactorily managed. This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed egress route. For example, this may entail the designation of a safe place of refuge on an upper floor of a building, from which the occupants can be rescued by emergency services. It should be noted that sole reliance on a safe place of refuge is a last resort, and all other possible means to evacuate the site should be considered first. Provision of a safe place of refuge will not guarantee that an application will be granted.

6.3 Emergency Planning

6.3.1 Evacuation is where flood alerts and warnings provided by the Environment Agency enable timely actions by residents or occupants to allow evacuation to take place unaided, i.e. without the deployment of trained personnel to help people from their homes, businesses and other premises. Rescue by the emergency services is likely to be required where flooding has occurred and prior evacuation has not been possible. An emergency plan will be needed wherever emergency flood response is an important component of making a development safe. Emergency plans will be essential for sites at risk of flooding used for holiday or short-let caravans and camping and for any site with transient occupancy (e.g. hostels and hotels).

6.3.2 For all developments (excluding minor developments and change of use) proposed in Flood Zone 2 or 3, an Emergency Plan should be prepared to demonstrate what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate their development will not impact on the ability of the local authority and the emergency services to safeguard the current population.

6.3.3 For sites in Flood Zone 1 that are located on 'dry islands', it may also be necessary to prepare an Emergency Plan to determine potential egress routes away from the site through areas that may be at risk of flooding during the 1% annual probability (1 in 100 year) flood event including an allowance for climate change.

6.3.4 The Environment Agency has a tool on their website to create a Personal Flood Plan[41]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details. Where proposed development comprises non-residential extension <250m^2 and householder development (minor development), it is recommended that the use of this tool to create a Personal Flood Plan will be appropriate.

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

6.3.5 Emergency Plans should include:

- How flood warning is to be provided, such as:
  - Availability of existing flood warning systems,
  - Where available, rate of onset of flooding and available flood warning time, and,
  - How flood warning is given.
- What will be done to protect the development and contents, such as:
  - How easily damaged items (including parked cars) or valuable items (important documents) will be relocated,
  - How services can be switched off (gas, electricity, water supplies),
  - The use of flood protection products (e.g. flood boards, airbrick covers),
  - The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc., and,
  - The time taken to respond to a flood warning.
- Ensuring safe occupancy and access to and from the development, such as:
- Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate,
- Safe access route to and from the development,
- If necessary, the ability to maintain key services during an event,
- Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible, and,
- Expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.)

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

6.3.7 Policy Recommendation: Emergency Plans should be prepared for all development in Flood Zone 2, 3 and within Flood Zone 1 ‘Dry Islands’ to Identify what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate their development will not impact on the ability of the local authority and the emergency services to safeguard the current population.

6.3.8 Where development is proposed or expected in flood risk areas with implications for emergency planning, local planning authorities should work with their emergency planning officers to produce local guidelines setting out requirements for flood warning, evacuation and places of safety, against which individual planning applications can then be judged. These should avoid additional burdens on emergency services, explore opportunities for development proposals to address any shortfall in emergency service and infrastructure capacity, and minimise the need for further consultation at planning application stage.

6.4 Emergency planning considerations for reservoirs

6.4.1 Spelthorne BC plan for civil emergencies based on hazards contained in the Surrey Community Risk Register. The Spelthorne Council Emergency Plan[42] contains information for the Council to be able to respond effectively to major incidents that may affect the borough including reservoir inundation.

6.4.2 Spelthorne BC will need to evaluate the potential damage to buildings or loss of life in the event of dam failure, compared to other risks, when considering development downstream of a reservoir. Spelthorne BC is also advised to consult with the owners/operators of raised reservoirs, to establish constraints upon safe development.

6.4.3 Spelthorne BC should also consider any implications for reservoir safety and reservoir owners and operators caused by new development located downstream of a reservoir, such as the cost of measures to improve the design of the dam to reduce flood risk, the operation of the reservoir, and general maintenance costs, by consulting with reservoir owners and operators on plan and development proposals. Local authorities, as category 1 responders, can access more information about reservoir risk and reservoir owners using the Resilience Direct system. Developers should be expected to cover any additional costs incurred, as required by the National Planning Policy Framework's 'agent of change' policy (paragraph 187). This could be through Community Infrastructure Levy or Section 106 obligations for example.

[42] Spelthorne Council Emergency Plan (Public Version) V8.2. April 2021. https://www.spelthorne.gov.uk/article/16987/Emergency-Plan

7. Preparing Site Specific FRAs

7.1 What is a Flood Risk Assessment?

7.1.1 A site-specific FRA is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and where possible will reduce flood risk overall in accordance with paragraph 163 of the NPPF and supporting PPG. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users. An FRA must be prepared by a suitably qualified and experienced person and must contain all the information needed to allow Spelthorne BC to satisfy itself that the requirements have been met.

7.2 When is a Flood Risk Assessment required?

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

- Proposals for new development (including minor development and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency).
- Proposals in an area within flood zone 1, which was identified in a SFRA as being at increased flood risk in future.
- Proposals of 1 hectare or greater in Flood Zone 1.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

7.3 How detailed should an FRA be?

7.3.1 The PPG states that site-specific FRAs need to be credible, fit for purpose, and proportionate to the anticipated degree of flood risk. Site-specific FRAs need to make optimum use of information already available, including information in Spelthorne BC's Strategic Flood Risk Assessment, and the Environment Agency's Flood Map and surface water flood risk information, although in some cases additional modelling or detailed calculations will need to be undertaken. Flood risk assessments need to include the information set out in the flood risk assessment checklist in the PPG.

7.3.2 A flood risk assessment needs to be appropriate to the scale, nature and location of the development. For example, where the development is an extension to an existing house (for which planning permission is required) which would not significantly increase the number of people present in an area at risk of flooding, Spelthorne BC would generally need a less detailed assessment to be able to reach an informed decision on the planning application. For a new development comprising a greater number of houses in a similar location, or one where the flood risk is greater Spelthorne BC may require a more detailed assessment, for example, the preparation of site-specific hydraulic modelling to determine the flood risk to and from the site pre and post-development, and the effectiveness of any management and mitigation measures incorporated within the design.

7.3.3 As a result, the scope of each site-specific FRA will vary considerably. Table 7-1 presents the different levels of site-specific FRA as defined in the CIRIA publication C624[43] and identifies typical sources of information that can be used. Sufficient information must be included to enable the Council and where appropriate, consultees, to determine that the proposal will be safe for its lifetime, not increase flood risk elsewhere and where possible, reduce flood risk overall. Failure to provide sufficient information will result in applications being refused.

Table 7-1 Levels of site specific FRA

[43] CIRIA (2004) Development and flood risk – guidance for the construction industry C624.

Description

Screening study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information. The screening study will ascertain whether a FRA Level 2 or 3 is required.

Typical sources of information include:

- Spelthorne BC SFRA
- Flood Map for Planning (Rivers and Sea)
- Environment Agency Standing Advice
- NPPF Tables 1, 2 and 3

Scoping study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include:

- An appraisal of the availability and adequacy of existing information,
- A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere, and,
- An appraisal of the scope of possible measures to reduce flood risk to acceptable levels.

The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.

Typical **sources of information** include those listed above, plus:

- Local policy statements or guidance.
- Lower Thames Catchment Flood Management Plan.
- Surrey County Council PFRA and LFRMS.
- Data request from the EA to obtain result of existing hydraulic modelling studies relevant to the site and outputs such as maximum flood level, depth and velocity.
- Consultation with EA/SCC/sewerage undertakers and other flood risk consultees to gain information and to identify in broad terms, what issues related to flood risk need to be considered including other sources of flooding.
- Historic maps.
- Interviews with local people and community groups.
- Walkover survey to assess potential sources of flooding, likely routes for floodwaters, the key features on the site including flood defences, their condition.
- Site survey to determine general ground levels across the site, levels of any formal or informal flood defences

Detailed study to be undertaken if a Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include:

- Quantitative appraisal of the potential flood risk to the development,
- Quantitative appraisal of the potential impact of the development site on flood risk elsewhere, and
- Quantitative demonstration of the effectiveness of any proposed mitigations measures.

Typical **sources of information** include those listed above, plus:

- Detailed topographical survey.
- Detailed hydrographic survey.
- Site-specific hydrological and hydraulic modelling studies which should include the effects of the proposed development.
- Monitoring to assist with model calibration/verification.
- Continued consultation with the LPA, Environment Agency and other flood risk consultees.

Environment Agency Data Requests

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

- **Products 1 – 4** contain maps of modelling outputs including flood level and flood depth information and the presence of flood defences local to the proposed development site.
- **Product 5** is the hydraulic modelling report.
- **Product 6** is the model output data, so the applicant can interrogate the data to inform the FRA.
- **Product 7** is the hydraulic model itself.

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

Modelling of Ordinary Watercourses

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

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

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

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

7.5 Flood Risk Assessment Checklist

7.5.1 Table 7-2 provides a checklist for site-specific FRAs including the likely information that will need to be provided along with references to sources of relevant information. The exact level of detail required under each heading will vary according to the scale of development and the nature of the flood risk. It is expected that this Checklist is completed for all planning applications.

Table 7-2 Site specific FRA Checklist (developed from guidance in PPG)

What to include in the FRA		***Source(s) of Information***
1. Site Description		
Site address	*-*	*-*
Current use of the site	*Identify the current use of the site.*	*-*
Flood Zones	*Identify which Flood Zone the site is within.* *Check the SFRA to identify if the site is within Flood Zone 1 but at increased risk of flooding in future due to climate change.* *Check the SFRA to identify if there are any other sources of flooding that may affect the site now or in the future.*	*Environment Agency Flood Map for Planning (Rivers and Sea).* *SFRA Appendix B*
Location plan	*Including geographical features, street names, catchment areas, watercourses and other bodies of water*	*OS Mapping* *SFRA Appendix B*
Site plan	*Plan of site showing development proposals and any structures which may influence local hydraulics e.g. bridges, pipes/ducts crossing watercourses, culverts, screens, embankments, walls, outfalls and condition of channel*	*OS Mapping* *Site Survey*
Topography	*Include general description of the topography local to the site. Where necessary, site survey may be required to confirm site levels (in relation to Ordnance datum).* *Plans showing existing and proposed levels.*	*SFRA Appendix B* *Site Survey*
Geology	*General description of geology local to the site.*	*SFRA Appendix B* *Ground Investigation Report*
Watercourses	*Identify Main Rivers and Ordinary Watercourses local to the site.*	*SFRA Appendix B*

Status	*Is the development in accordance with the Council's Local Plan?*	*See advice from Spelthorne BC if necessary.*
2. Development proposals		
Proposed use	*Include the development proposal(s) for this site.* *Determine if it involves a change of use of the site and, if so, describe the change.*	-
Vulnerability Classification	*Determine the vulnerability classification of the development.* *Is the vulnerability classification appropriate within the Flood Zone?*	*SFRA Table 4-1* *SFRA Table 4-2*
Estimated lifetime	*What is the expected or estimated lifetime of the proposed development likely to be (e.g. 100 years or 75 years)?*	*PPG Flood Risk and Coastal Change paragraph 006.*
3. Sequential test		
Application of the Sequential Test	*Determine whether the Sequential Test is required.* *Consult Spelthorne BC to determine if the site has been included in the Sequential Test already.* *If required, present the following information to Spelthorne BC to enable their determination of the Sequential Test for the site on an individual basis.*	*SFRA Section 4* *Refer to Local Plan and./or consult Spelthorne BC.*
Search area	*Provide details of the search area you have used.* *Provide justification for choosing this search area.*	-
Alternative sites	*Provide details on the alternative site(s) within the search area you have identified.* *Do you consider the site(s) to be reasonably available and appropriate for the proposed development? If not, what is your justification for this?* *With reference to the relevant strategic and site-specific flood risk assessments, justify if the alternative sites are at lower flood risk than your proposed site.*	-
Wider sustainable objectives	*If you have identified any reasonably available, lower risk site(s), appropriate for the proposed development, do you consider there to be any other wider sustainable development objectives that would make steering the development to these other locations inappropriate? Provide a justification for your response.*	*Refer to the sustainability objectives in Spelthorne BC's Sustainability Appraisal.*
4. Climate Change		
Climate change	*Check how the flood risk at the site is likely to be affected by climate change.*	*SFRA Appendix B.* *Site specific modelling if required.*
5. Site specific flood risk		
Describe the risk of flooding to and from the proposed development over its expected lifetime, including appropriate allowances for the impacts of climate change. Consider flooding from rivers, land, groundwater, sewers and flooding from reservoirs, canals and other artificial sources.		
Main sources of flood risk	*Describe the main source(s) of flood risk to the site (e.g. tidal/sea, fluvial or rivers, surface water, groundwater, other?).*	*SFRA Appendix B* *Historic flooding records (e.g. the historic flood map and local authority section 19 flood investigation reports* ***Flooding from Rivers:*** *Environment Agency Flood Map for Planning (Rivers and Sea).* *Environment Agency Products 1-7.* *New hydraulic model (where EA data not available)* ***Flooding from Land:*** *Topographic survey.* *Site walkover.* *Risk of Flooding from Surface Water mapping (EA website).* *Flooding from Groundwater:* *Ground Investigation Report*
Probability of flooding	*Describe the probability of the site flooding, taking account of the maps of flood risk available from the Environment Agency's Flood Map for Planning, the local planning authority's Strategic Flood Risk Assessment and any further flood risk information.*	
Other sources of flooding	*Are you aware of any other sources of flooding that may affect the site? What are the interactions between different sources of flooding?*	
Design flood	*Provide the expected depth and level for the design flood. See paragraph 002 of the PPG for information on what is meant by a "design flood". If possible, flood levels should be presented in metres above Ordnance Datum.*	

		Flooding from Sewers: *Where appropriate an asset location survey can be provided by Thames Water Utilities Ltd* http://www.thameswater-propertysearches.co.uk/ **Flooding from Reservoirs:** *Risk of Flooding from Reservoirs mapping (EA website)*
Internal flooding	*With any relevant flood risk management infrastructure operating effectively, are properties expected to flood internally in the design flood and to what depth and velocity?* *The nature of any internal flooding resulting from any residual risk should also be specified. Internal flood depths should be provided in metres.*	*Environment Agency Products 1-7.* *Site specific model if required.*
Safety of the development	*Provide details on how the development will be made safe from flooding and the impacts of climate change, for its lifetime, taking residual risk into account.* *Demonstrate how the steps set out in paragraph 004 of the PPG have been followed to develop the strategy for addressing flood risk for the development.*	*SFRA Sections 5 and 6.*
Increase in flood risk off-site	*Provide details on how you will ensure that the development and any measures to protect the site from flooding will not cause any increase in flood risk off-site and elsewhere.* *Have you taken into account the impacts of climate change, over the expected lifetime of the development (e.g. providing compensatory flood storage which has been agreed with the Environment Agency)?*	*SFRA Section 5.*
Reduction of the causes and impacts of flooding	*Provide details on opportunities offered by the development to reduce the causes and impacts of flooding.*	*SFRA Section 5.*
Sources of uncertainty in the assessment of risk	*Describe the sources of uncertainty in the assessment of risk and how have they been accounted for in the proposed strategy for addressing flood risk.*	-
6. Surface Water Management		
SuDS	*Completion of SuDS Proforma for all major development proposals in Flood Zones 1, 2 or 3.* *Details of the following within FRA for all other developments located within Flood Zones 2 and 3:* *Calculations (and plans) showing areas of the site that are permeable and impermeable pre and post-development.* *Calculations of pre and post-development runoff rates and volumes including consideration of climate change over the lifetime of the development.* *Details of the methods that will be used to manage surface water (e.g. permeable paving, swales, wetlands, rainwater harvesting).* *Where appropriate, reference the supporting Outline or Detailed Drainage Strategy for the site.* *Information on proposed maintenance and adoption arrangements.*	*SFRA Section 5* *SCC SuDS planning advice https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/suds-planning-advice*
7. Occupants and users of the development		
Increase of the number of occupants	*Will the development proposals increase the overall number of occupants and/or people using the building or land, compared with the current use?* *If this is the case, by approximately how many will the number(s) increase?*	-
Change of use	*Will the proposals change the nature or times of occupation or use, such that it may affect the degree of flood risk to these people?* *If this is the case, describe the extent of the change.*	-

Vulnerable occupants	*Demonstrate how the occupants and users that may be more vulnerable to the impact of flooding (e.g. residents who will sleep in the building; people with health or mobility issues etc) will be located primarily in the parts of the building and site that are at lowest risk of flooding.* *If not, are there any overriding reasons why this approach is not being followed?*	-
8. Exception Test		
Application of the Exception Test	*Determine whether the Exception Test is necessary.*	*SFRA Table 4-2*
Exception Test	*Where the Exception Test is necessary, present details of:* *a. Would the proposed development provide wider sustainability benefits to the community? If so, with reference to the site-specific flood risk assessment, could these benefits be considered to outweigh the flood risk to and from the proposed development?* *b. How can it be demonstrated that the proposed development will remain safe over its lifetime, taking account of the vulnerability of its users, without increasing flood risk elsewhere?*	*Refer to Spelthorne BC sustainability objectives.*
Reduction of risk overall	*Will it be possible for the development to reduce flood risk overall (e.g. through the provision of new or improved flood defences, or improved drainage)?*	
9. Residual Risk		
Remaining flood related risks	*What flood related risks will remain after the flood risk avoidance, management and mitigation measures have been implemented?*	-
Management of residual risks	*Provide details on how and by whom will these residual risks be managed over the lifetime of the development (e.g. putting in place emergency plans).*	*SFRA Section 6.*
10. Flood risk assessment credentials		
FRA author(s)	*Who has undertaken the flood risk assessment?*	-
FRA completion date	*When was the flood risk assessment completed?*	-

7.6 Pre-application Advice

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

7.6.2 The Environment Agency, SCC and Spelthorne BC each offer pre-application advice services which should be used to discuss particular requirements for specific applications.

- Spelthorne Borough Council https://www.spelthorne.gov.uk/article/2843/Pre-application-advice
- Surrey County Council suds@surreycc.gov.uk
- Environment Agency https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications#contact

7.6.3 The following government guidance sets out when LPAs should consult with the Environment Agency on planning applications https://www.gov.uk/flood-risk-assessment-local-planning-authorities.

Abbreviations

ACRONYM	DEFINITION
AOD	Above Ordnance Datum
AIMS	Asset Information Management System
BC	Borough Council
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
FCERM	Flood and Coastal Erosion Risk Management
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act 2010
GIS	Geographical Information System
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
PPG	Planning Practice Guidance
NPPF	National Planning Policy Framework
RoFSW	Risk of Flooding from Surface Water
SCC	Surrey County Council
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems

Glossary of Terms

GLOSSARY	DEFINITION
1D Hydraulic Model	Hydraulic model which computes flow in a single dimension, suitable for representing systems with a defined flow direction such as river channels, pipes and culverts.
2D Hydraulic Model	Hydraulic model which computes flow in multiple dimensions, suitable for representing systems without a defined flow direction including topographic surfaces such as floodplains
Asset Information Management System (AIMS)	Environment Agency database of assets associated with Main Rivers including defences, structures and channel types. Information regarding location, standard of service, dimensions and condition.
Aquifer	A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water.
Attenuation	In the context of this report - the storing of water to reduce peak discharge of water.
Catchment Flood Management Plan	A high-level plan 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.
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions.
Culvert	A channel or pipe that carries water below the level of the ground.
Design flood	A flood event of a given annual probability against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed. The design event is generally taken as; fluvial flooding likely to occur with a 1% annual probability (1 in 100 chance each year), surface water flooding likely to occur with a 1% annual probability (1 in 100 chance each year), or tidal flooding with a 0.5% annual probability (1 in 200 chance each year).
Exception Test	The exception test should be applied following the application of the sequential test. Conditions need to be met before the exception test can be applied.
Flood Defence	Infrastructure used to protect an area against floods, such as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Property Flood Resilience	An approach to building design which aims to reduce flood damage and speed recovery and reoccupation following a flood. It uses a combination of flood resistance and flood recovery measures
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption).
Flood Zone	Flood Zones show the probability of flooding, ignoring the presence of existing defences
Fluvial	Relating to the actions, processes and behaviour of a watercourse (river or stream).
Freeboard	Height of flood defence crest level (or building level) above designed water level
Functional Floodplain	Land where water has to flow or be stored in times of flood.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Lead Local Flood Authority (LLFA)	As defined by the Flood and Water Management Act, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area, in this case Surrey County Council (SCC).
Light Detection and Ranging (LiDAR)	Airborne ground survey mapping technique, which uses a laser to measure the distance between the aircraft and the ground.
Local Planning Authority (LPA)	Body that is responsible for controlling planning and development through the planning system.
Main River	Watercourse defined on a ‘Main River Map’ designated by Defra. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities for Main Rivers only.

GLOSSARY	DEFINITION
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Ordinary Watercourse	A watercourse that does not form part of a Main River. This includes “all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows” according to the Land Drainage Act 1991.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account.
Risk	Risk is a factor of the probability or likelihood of an event occurring multiplied by consequence: Risk = Probability x Consequence. It is also referred to in this report in a more general sense.
Sequential Test	Aims to steer vulnerable development to areas of lowest flood risk.
Sewer Flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Surface Water	Flooding caused when intense rainfall exceeds the capacity of the drainage systems or when, during prolonged periods of wet weather, the soil is so saturated such that it cannot accept any more water.
Sustainable drainage systems (SuDS)	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Topographic survey	A survey of ground levels.

Appendix A Data Register

Appendix B Figures

Figure 1	Topography and Waterbodies
Figure 2	Bedrock Geology
Figure 3	Superficial Geology
Figure 4A-4D	Flood Map for Planning (Rivers and Sea)
Figure 5A-5D	River Thames – Modelled Flood Outlines
Figure 6A-6D	River Thames Tributaries – Modelled Flood Outlines
Figure 7A-7B	River Ash – Modelled Flood Outlines
Figure 8	River Colne – Modelled Flood Outlines
Figure 9A-9B	Recorded Flood Outlines
Figure 10	Flood Warning Areas
Figure 11A-11D	Risk of Flooding from Surface Water Map
Figure 12	Areas Susceptible to Groundwater Flooding
Figure 13	Thames Water Sewer Flooding Records
Figure 14	Infiltration SuDS Suitability Map
Figure 15	**Working with Natural Processes**

Appendix C Surface Water Conditions Report

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