Elmbridge Borough Council Level 1 Strategic Flood Risk Assessment

Elmbridge Borough Council

Project number: 60565750
Final
February 2019

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	Sep 2018	Draft	19/09/2018	Sarah Kelly	Regional Director
2	Dec 2018	Final	05/12/2019	Emily Craven	Associate
3	Feb 2019	Final amended	21/02/2019	Peter Mansell	Technical Director
4.	Sept 2019	Schedule added to Appendix A	05/09/2019	Sarah Kelly	Regional Director

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Abbreviations

ACRONYM	DEFINITION
AOD	Above Ordnance Datum
AIMS	Asset Information Management System
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
CLG	(Department for) Communities and Local Government
Defra	Department for Environment, Flood and Rural Affairs
EBC	Elmbridge Borough Council
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act 2010
GIS	Geographical Information System
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
RAMSAR	RAMSAR Sites
ROFSW	Risk of Flooding from Surface Water
RTD	River Terrace Deposits
S&G	Sand and Gravel
SCC	Surrey County Council
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPZ	Source Protection Zone
SuDS	Sustainable Drainage Systems
SSSI	Site of Special Scientific Interest

Glossary

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. For fluvial events a 20% increase in river flow is applied and for rainfall events, a 30% increase. These climate change values are based upon information within the NPPF and Planning Practice Guidance.
Culvert	A channel or pipe that carries water below the level of the ground.
Design flood	A flood event of a given AEP 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% AEP (1 in 100 chance each year), or tidal flooding with a 0.5% AEP (1 in 200 chance each year).
Flood Incident Register	A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
Exception Test	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).
Flood Modeller	A 1D hydraulic modelling software package.
Flood Resilience	Measures that minimise water ingress and promotes fast drying and easy cleaning, to prevent any permanent damage.
Flood Resistant	Measures to prevent flood water entering a building or damaging its fabric. This has the same meaning as flood proof.
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.
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.
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.
RAMSAR Site	Wetlands of international importance, designated under the RAMSAR Convention
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.
Source Protection Zone (SPZ)	Defined areas in which certain types of development are restricted to ensure that groundwater sources remain free from contaminants.
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.
TUFLOW	A modelling package for simulating depth averaged 2D free-surface flows and is in widespread use in the UK and elsewhere for 2D inundation modelling.

1. Introduction and user guide

1.1 Introduction

1.1.1 In its role as the Local Planning Authority (LPA), Elmbridge Borough Council (EBC) is currently preparing documents that will form part of the new Local Plan for Elmbridge and develop the vision for future development across the Borough.

1.1.2 EBC faces the challenge of meeting the need for new development within a constrained land supply inclusive of areas already identified to be at risk of river (fluvial) flooding associated with a number of different watercourses including the Thames, Mole, Ember, Rythe and Wey. Furthermore, there is the potential risk arising from more localised flooding from surface water generated by heavy rainfall, elevated groundwater, existing drainage systems as well as artificial sources including several reservoirs.

1.2 Approach to Flood Risk Management

1.2.1 The National Planning Policy Framework[1] (NPPF) and associated Planning Practice Guidance[2] (PPG[2]) for Flood Risk and Coastal Change emphasise the active role LPAs such as EBC should take to ensure that flood risk is assessed, avoided, and managed effectively and sustainably throughout all stages of the planning process. The overall approach for the consideration of flood risk set out in Section 1 of the PPG[2] can be summarised as follows:

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

Assess flood risk

1.2.3 The NPPF[1] outlines that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and LPAs should use the findings to inform strategic land use planning. Figure 1-1 overleaf, reproduced from the PPG[2], illustrates how flood risk should be taken into account in the preparation of the Local Plan by EBC.

1.2.4 For sites in areas at risk of flooding, or with an area of 1 hectare or greater, developers must undertake a site-specific Flood Risk Assessment (FRA) to accompany planning applications (or prior approval for certain types of permitted development).

Avoid flood risk

1.2.5 EBC 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.

1.2.6 In plan-making this involves applying the Sequential Test, and where necessary the Exception Test to Local Plans, as described in Figure 1-1.

1.2.7 In decision-taking this involves applying the Sequential Test and if necessary the Exception Test for specific development proposals.

[1] Revised National Planning Policy (2018) https://www.gov.uk/government/collections/revised-national-planning-policy-framework
[2] Planning Practice Guidance (2014) https://www.gov.uk/government/collections/planning-practice-guidance

Manage and mitigate flood risk

1.2.8 Where alternative sites in areas at lower risk of flooding are not available, it may be necessary to locate development in areas at risk of flooding. In these cases, EBC and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development, and will not increase flood risk overall. EBC 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).

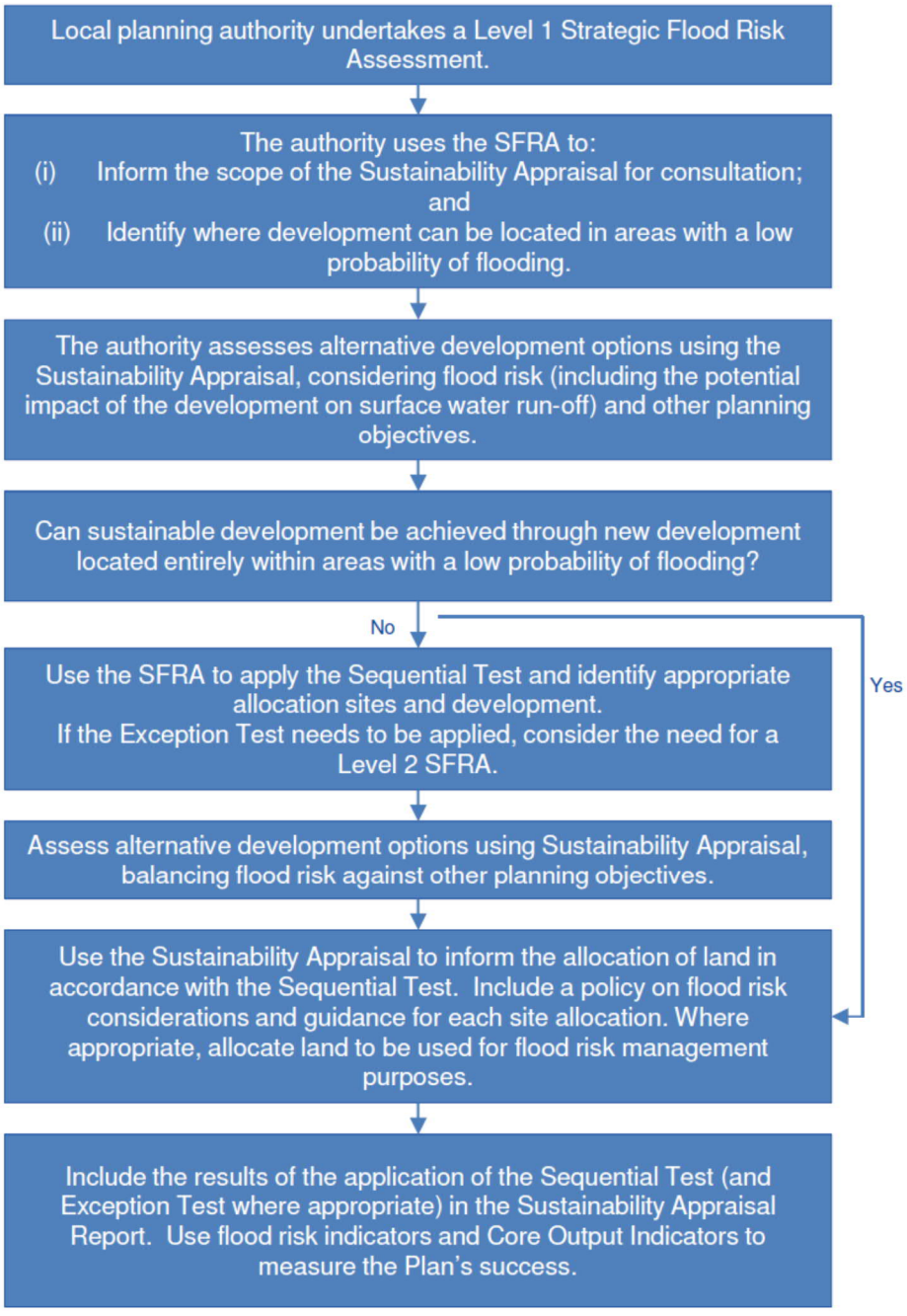


Figure 1-1 Taking flood risk into account in the preparation of a Local Plan (PPG[2]for Flood Risk and Coastal Change, p6)

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 EBC to inform the preparation of the Elmbridge 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:

- Refine information on the areas that may flood taking into account all sources of flooding and the impacts of climate change;
- Inform the Sustainability Appraisal process, so that flood risk is fully taken into account at the plan making stage
- Inform the application of the Sequential and, if necessary, Exception Tests in the allocation of future development sites, as required by the NPPF[1], and planning application process;
- Identify the requirements for site-specific Flood Risk Assessments;
- Inform the preparation of flood risk policy and guidance;
- Determine the acceptability of flood risk in relation to emergency planning capability; and,
- 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 This document forms a Level 1 SFRA which has been carried out to support the completion of the Sequential Test by EBC and inform the allocation of sites within the Local Plan. Documents recording the application of the Sequential Test will be published as a separate document on the Council's website. Should the Sequential Test indicate that land outside flood risk areas cannot appropriately accommodate all necessary development; a further Level 2 SFRA will be undertaken to consider the detailed nature of flood risk within each zone and support the application of the Exception Test.

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

Policy Documents	
Revised National Planning Policy Framework	https://www.gov.uk/government/collections/revised-national-planning-policy-framework
Elmbridge Core Strategy Policy CS26: Flooding	http://www.elmbridge.gov.uk/planning/policy/corestrategydpd.htm
Elmbridge Development Management Plan – DM6: Landscape and Trees; DM13: Riverside development and uses	http://www.elmbridge.gov.uk/planning/policy/dmp.htm
Guidance Documents	
Planning Policy Guidance – Flood Risk and Coastal Change	https://www.gov.uk/government/collections/planning-practice-guidance
Environment Agency Standing Advice	https://www.gov.uk/flood-risk-assessment-standing-advice#vulnerable-developments-standing-advice
Flood risk assessments: climate change allowances	https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
Local Documents and Strategies	
Flood Risk Supplementary Planning Document and supporting documents	http://www.elmbridge.gov.uk/planning/sdps/flood-risk/
Thames Catchment Flood Management Plan	https://www.gov.uk/government/collections/catchment-flood-management-plans
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
EBC Multi-Agency Flood Plan	EBC internal document.
Elmbridge Preliminary Flood Risk Assessment	https://www.surreycc.gov.uk/people-and-community/emergency-

(PFRA) and PFRA Addendum	planning-and-community-safety/flooding-advice/more-about-flooding/the-preliminary-flood-risk-assessment https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/698714/PFRA_Surrey_County_Council_2017.pdf
Surrey County Council Sustainable drainage systems (SuDS) planning advice	https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/suds-planning-advice

1.5 User Guide

1.5.1 It is anticipated that the SFRA will have a number of end users, with slightly different requirements. This Section describes how the SFRA should be used and how to navigate the report and mapping deliverables.

1.5.2 The EBC SFRA report is set out as follows:

Methodology

Assessing Flood Risk

Avoiding Flood Risk

Managing and Mitigating Flood Risk

Guidance for Site-Specific FRAs

Spatial Planning and Development Management Recommendations

Appendix A Settlement Area Schedules

Appendix B Borough Scale Mapping

Appendix C Fluvial Flood Zone Mapping

Appendix D Modelled Flood Outlines

Appendix E Historic Flood Incidents

Appendix F Surface Water Flood Risk Mapping

Appendix G Data Register

Strategic Planning and Policy

1.5.3 The chief purpose of the SFRA for EBC, in accordance with the NPPF[1], is to provide a strategic overview of flood risk within the Borough to enable effective risk-based strategic planning for the future through the preparation of the Local Plan. As part of the SFRA, a number of policy recommendations and development management measures have been prepared to inform the development of the Elmbridge Local Plan and in day-to-day decision making.

Applying the Sequential Test

1.5.4 The NPPF[1] 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[1] is to steer new development to areas with the lowest probability of flooding. Section 3 and the supporting mapping Appendices B – F 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 EBC is a Category 1 Responder under the Civil Contingencies Act 2004[3] and therefore has a responsibility, along with other organisations, for developing emergency plans, contingency plans and business continuity plans to help reduce, control or ease the effects of an emergency.

1.5.6 The complex nature of flooding and the consequences that arise require a comprehensive and often sustained response from a wide range of organisations, and as such EBC has prepared a Multi-Agency Flood Plan[4] (MAFP) to allow all responding parties to work together on an agreed coordinated response to severe flooding.

1.5.7 The SFRA deliverables, particularly Section 3 and the Settlement Area schedules in Appendix A, can be used by the EBC Emergency Planning team as a useful resource providing up to date information about flood risk. The SFRA should be reviewed by the team to ensure that the findings are incorporated into their understanding of flood risk and future revisions of the MAFP.

Preparing site-specific Flood Risk Assessments

1.5.8 For those preparing site-specific Flood Risk Assessments (FRAs) for individual development sites, the strategic review provided by the SFRA provides a useful starting point.

1.5.9 Section 4 provides guidance on the application of the Sequential Test for sites that have not been tested by the LPA, as well as details on when the Exception Test is required and how to apply it.

1.5.10 Section 5 provides guidance on flood risk mitigation and management measures that should be considered for individual developments and Section 6 provides guidance for preparing site-specific FRAs including when FRAs are required and what they should address depending on the scale of development and level of flood risk.

1.5.11 The Settlement Area schedules in Appendix A provide an overview of the key issues within each Settlement Area and set the tone for the approach to flood risk management that is required by EBC.

Assessing Planning Applications

1.5.12 Planning and development officers who are reviewing FRAs as part of the planning application process should consult Appendix A of the SFRA to provide the background for flood risk in a particular Settlement Area. Sections 5 and 6 and 7 build on the guidance presented in the PPG[2]and Environment Agency Standing Advice and can 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 This SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. The Environment Agency review and update the Flood Map for Planning (Rivers and Sea)[5] on a quarterly basis and a rolling programme of detailed flood risk mapping is underway.

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

[3] HMSO 2004 *Civil Contingencies Act 2004*.
[4] EBC, 2014, *Multi-Agency Flood Plan, Internal Document, Living Draft*.
[5] Refer to Section 3.3 for further detail.

2. Methodology

2.1 Overview

2.1.1 Under Section 10 of NPPF[1], the risk of flooding from all sources must be considered as part of an SFRA, including flooding from rivers (fluvial), land (overland flow and surface water), groundwater, sewers and artificial sources. Flooding from the sea is not relevant to the study area.

2.1.2 The methodology for the appraisal of flood risk from these sources is outlined below; Section 2.2 describes the approach to consultation and identifies the stakeholder organisations that have been involved, Section 2.3 provides a description of the datasets used to assess the risk of flooding from each source, further details of which are included within the data register in Appendix G.

2.2 Consultation

Duty to Cooperate

2.2.1 Under the Localism Act 2011[6], there is now a legal duty on LPAs to co-operate with one another, County Councils and other Prescribed Bodies to maximise the effectiveness within which certain activities are undertaken as far as they relate to a 'strategic matter'.

2.2.2 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 each matters 'functional geography' and identify those LPAs and Prescribed Bodies that need to be constructively and actively engaged.

2.2.3 The Council prepared and consulted on a Scoping Statement[7] as part of the background work required to prepare the Elmbridge Local Plan. Flood risk is identified as a strategic matter and specific engagement activities are proposed with a number of adjoining LPAs and Prescribed Bodies both in relation to the preparation of the SFRA and the Local Plan. Before commencing work on the SFRA, EBC also explored the potential for undertaking the work jointly with adjoining Boroughs.

2.3 Data Collection

2.3.1 The following 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. Further details are provided in Appendix G.

LiDAR Topographic Survey

2.3.2 Appendix B Figure B1 shows the topography of the Borough based on LiDAR data and provides a useful basis for understanding surface water flood risk in the area.

2.3.3 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 25cm and 2 metres. The data covering Elmbridge has a spatial resolution of 1m. The Environment Agency's LiDAR data archive contains digital elevation data derived from surveys carried out since 1998.

Appendix B, Figure B1

[6] HMSO, 2011, *Localism Act 2011*. http://www.legislation.gov.uk/ukpga/2011/20/contents/enacted
[7] Development Plan Document Duty to Cooperate Scoping Statement
http://www.elmbridge.gov.uk/EasySiteWeb/GatewayLink.aspx?alId=2468

Detailed River Network

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

Appendix B, Figure B4
Appendix C, Figures C1-C13
Appendix D, Figures D1-D14
Appendix E, Figures E1-E4

Highways Drainage Ditches

2.3.5 Surrey County Council (SCC) has provided a GIS layer detailing highways drainage ditches in the study area. These are included in Appendix B Figure B4.

Appendix B, Figure B4
Appendix D, Figures D1-D13

'Flood Map for Planning (Rivers and Sea)'

2.3.6 The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF[1] 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 2-1 and presented on the Flood Map for Planning (Rivers and Sea) available on the Environment Agency website. These Flood Zones have been presented in Figures C1 – C13.

Table 2-1 Fluvial Flood Zones (extracted from the PPG[2]-)

Flood Zone	Flood Zone Definition for River Flooding	Probability of Flooding
Flood Zone 1	Land having a less than 1 in 1,000 chance of river flooding each year (0.1% annual probability). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	**Low**
Flood Zone 2	Land having between a 1 in 100 and 1 in 1,000 chance of river flooding each year (between 1% and 0.1% annual probability).	**Medium**
Flood Zone 3a	Land having a 1 in 100 or greater chance of river flooding each year (greater than 1% annual probability).	**High**
Flood Zone 3b	Land where water has to flow or be stored in times of flood, or land purposely designed to be flooded in an extreme flood event (0.1% annual probability). Defined by the LPA. Not separately distinguished from Flood Zone 3a on the Flood Map for Planning (Rivers and Sea).	**Functional Floodplain**

2.3.7 The 'Flood Map for Planning (Rivers and the Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain. The 'Flood Map for Planning (Rivers and Sea)' dataset is available on the Environment Agency website[8] and is the main reference for planning purposes as it contains the Flood Zones which are referred to in the NPPF[1].

2.3.8 The 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling (JFLOW) and is routinely updated and revised using results from the Environment Agency's ongoing programme of more detailed river catchment studies. The studies can include topographic

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

surveys and hydrological and/or hydraulic modelling as well as incorporating information from recorded flood events.

Appendix C, Figures C1-C13

2.3.9 It should be noted that a separate map is available on the Environment Agency website which is referred to as 'Risk of Flooding from Rivers and Sea'[9]. This map takes into account the presence of flood defences and so describes the actual chance of flooding, rather than the chance if there were no defences present. While flood defences reduce the level of risk they do not completely remove it as they can be overtopped or fail in extreme weather conditions, or if they are in poor condition. As a result the maps may show areas behind defences which still have some risk of flooding. This mapping has been made available by the Environment Agency as the primary method of communicating flood risk to members of the public, however for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information.

Hydraulic Modelling Studies

2.3.10 Table 2-2 provides a summary of the hydraulic modelling studies that have been undertaken for the Main Rivers in Elmbridge and used to inform the Flood Map for Planning (Rivers and Sea). The type of model (1D or 2D) is also specified, along with the corresponding available outputs for each model.

Table 2-2 Hydraulic models for Main Rivers in Elmbridge

Watercourse	Modelling Study
Lower Wey	Capita AECOM, River Wey Flood Alleviation Schemes Lower Wey (Byfleet/Weybridge) Modelling (2018) Available outputs: flood extent, flood depth, velocity and hazard for each AEP event. . **The extents from this model are still in draft format and are subject to amendments by the Environment Agency.**
Lower Mole (Esher railway bridge to confluence with Thames at Molesey)	Halcrow Group Ltd, Environment Agency Thames Region, (March 2009) Lower Mole Flood Risk Study Final Study Report. 1D model. Available outputs: flood extent for each annual exceedance probability (AEP) event.
Middle Mole (From Sidlow in Reigate to Esher railway bridge)	CH2M, (April 2018) Leatherhead & Middle Mole Flood Alleviation Scheme. Available outputs: flood extent, flood depth, and velocity for each AEP event. **The extents from this model are still in draft format and are subject to amendments by the Environment Agency.**
Dead River	JBA Consulting, Environment Agency Thames Region (April 2013) Dead River and Surbiton Stream Flood Risk Mapping Study. 1D-2D model. Available outputs: flood extent, flood depth, velocity and hazard rating for each AEP event.
Lower Thames (Hurley to Teddington)	PBA, Jacobs, Atkins, Environment Agency Thames Region (November 2007) Lower Thames Flood Risk Mapping Project TH724 Hydraulic Modelling Report Issue No. 5.1. 1D-2D model. Available outputs: flood extent, flood depth, and velocity for each AEP event. NB: The Environment Agency is currently remodelling this section of the River Thames. The outputs from this study should be used to update the Flood maps included with Appendix C and D.
River Rythe	Jackson Hyder, Environment Agency (April 2016) Environment Agency River Rythe Modelling Report 1D-2D model. Available outputs: flood extent, extent of flooding from the blockage of Key Debris Screens and the extent of flooding from the blockage of the Thames Water Flood Relief Culvert

2.3.11 It should be noted that the scope of these modelling studies typically covers flooding associated with Main Rivers, and therefore Ordinary Watercourses that form tributaries to the Main Rivers may not always be included in the model. Modelling of Ordinary Watercourses available on the Flood Map for Planning (Rivers and Sea) may be the result of the national generalised JFLOW modelling carried out

[9] Environment Agency 'Risk of Flooding from Rivers and Sea' http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=237038&y=161974&scale=1

by the Environment Agency and may need to be refined when determining the probability of flooding for an individual site and preparing a site-specific FRA. Further detail is provided in Section 6.3.

Appendix C, Figures C1 C13

Appendix D, Figures D1-D13

Functional Floodplain (Flood Zone 3b)

2.3.12 The Functional Floodplain is defined in the NPPF[1] as 'land where water has to flow or be stored in times of flood'. The Functional Floodplain (also referred to as Flood Zone 3b), is not separately distinguished from Flood Zone 3a on the Flood Map for Planning. Rather the SFRA is the place where LPAs should identify areas of Functional Floodplain in discussion with the Environment Agency.

2.3.13 The PPG[2] states that the identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability AEP of 1 in 20 (5% AEP) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration. The guidance goes on to say that 'areas which would naturally flood with an annual probability of 1 in 20 (5% AEP) or greater, but are prevented from doing so by existing infrastructure or solid buildings will not normally be defined as functional floodplain'.

2.3.14 Areas with an annual probability of 1 in 20 (5% AEP) or greater flood extents have been delineated. Within this outline, undeveloped areas, where water has to flow or be stored in times of flood, are defined as functional floodplain and protected from non-compatible development.

2.3.15 In Elmbridge there are some areas within the 1 in 20 (5%) or greater flood extent that are already developed and are prevented from flooding by the presence of existing infrastructure or solid buildings. Whilst these areas will be subject to frequent flooding, it may not be practical to refuse all future development. As such, and in accordance with the PPG[2], existing building footprints, where they can be demonstrated to exclude floodwater, will not be defined as Functional Floodplain. The land surrounding these buildings are important flow paths and flood storage areas and properties within these areas will be subject to frequent flooding; therefore care must be given to the future sustainability of such development.

2.3.16 The approach to development within these areas recognises the importance of pragmatic planning solutions that will not unnecessarily 'blight' areas of existing development, the importance of the undeveloped land surrounding them and the potential opportunities to reinstate areas which can operate as functional floodplain through redevelopment to provide space for floodwater and reduce risk to new and existing development.

Flood Zone 3b in Elmbridge

Land with an annual probability of flooding of 1 in 20 (5% AEP) associated with the River Thames, Wey, Mole, Rythe and Dead River has been used by EBC as a starting point for defining the Functional Floodplain and presented in Appendix C Figures C1-C13.

Flood Zone 3b– Functional Floodplain

Undeveloped land

The Functional Floodplain as defined in this SFRA by EBC comprises **undeveloped land** within the 1 in 20 annual probability (5% AEP) flood outline. These areas should be safeguarded from any development. Where Water Compatible or Essential Infrastructure cannot be located elsewhere, it must:

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

Developed land

Within the outline of the 1 in 20 annual probability (5% AEP) flood outline there are areas of existing development which are prevented from flooding by the presence of existing infrastructure or solid buildings. In these **developed areas**, existing building footprints, where it can be demonstrated that they exclude floodwater, will not be defined as Functional Floodplain and the planning requirements associated with Flood Zone 3b will not apply.

As a guide, these areas include:

- Wey Road and Round Oak Road, Weybridge;
- The Crescent and Felix Lane, Walton-on-Thames;
- Wheatley's Eyot, Walton-on-Thames;
- Beastey's Eyot, Walton-on-Thames;
- Shaw Drive, Walton-on-Thames
- Molesey Drive, Walton-on-Thames
- Immediately upstream of Sunbury Weir, Walton-on-Thames;
- Monks Avenue, East and West Molesey
- Thames Ditton Island, Thames Ditton.
- Station Road and Winston Drive, Stoke D'Abernon

The land surrounding these buildings are important flow paths and flood storage areas and properties within these areas will be subject to frequent flooding; therefore care must be given to the future sustainability of such development.

Where redevelopment is proposed in **developed areas**, schemes should not increase the vulnerability classification of the site. All schemes must result in a net reduction in flood risk and ensure that floodplain storage and flow routes are not affected. This can be achieved through a combination of on and off-site measures including:

- Reducing the land use vulnerability;
- Seeking opportunities to ensure there is no increase or achieve a reduction in the number of people at risk (e.g. avoiding conversions and rebuilds of properties that result in an increase in the number of residential dwellings);
- Maintaining or reducing built footprint
- Raising finished floor levels;
- Reducing surface water runoff rates and volumes from the site;
- Increasing floodplain storage capacity and creating space for flooding to occur by restoring functional floodplain;
- Reducing impedance to floodwater flow and restoring flood flow paths;
- Incorporating flood resilient and/or resistance measures;
- Ensuring development remains safe for users in time of flood (this may refer to the timely evacuation of properties prior to the onset of flooding in accordance with an individual Flood Warning and Evacuation Plan for the site).

Proposals for the change of use or conversion to a use with a higher vulnerability classification will not be permitted.

Basement, basement extensions or conversions of basements to a higher vulnerability classification will not be permitted.

Where minor development is proposed, schemes should not affect floodplain storage or flow routes through the incorporation of raised finished floor levels, voids, and where possible the provision of direct or indirect floodplain compensation, flood resilience measures, the removal of other non-floodable structures or replacement of impermeable surfaces with permeable and improved surface water drainage through the implementation of SuDS features such as water butts/rainwater harvesting, living roofs, infiltration trenches/soakaways and below ground attenuation tanks in line with CIRIA guidance on SuDS.

The consideration of whether a site is 'developed' or 'undeveloped' will be considered on a case-by-case basis as part of the planning application process, having regard to the presence of existing buildings on the site and the existing routing of floodwater through the site during times of flood.

Climate Change

2.3.17 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. The climate change allowances in England were updated in 2016. These allowances are shown for the Thames River Basin District below in Table 2-3.

Table 2-3 Recommended contingency allowances for net sea level rises (Net sea level rise (mm per year) relative to 1990)

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

2.3.18 As part of the more recent hydraulic modelling studies for the fluvial watercourses in Elmbridge, simulations have been run for the 1 in 100 year (1% AEP) including the implications of climate change based on these allowances. It should be noted that whilst the modelling of the AEP events to generate the NPPF[1] Flood Zones (and Flood Map for Planning) do not account for the presence of flood defences, the simulations including an allowance for climate change do include the presence of existing flood defences. These simulations are available for the Upper End, which includes the River Wey and Middle Mole. The most extreme climate change scenario has been mapped for these watercourses, which is shown in Table 2-3 to be the 1% AEP plus 70%.

2.3.19 Updated climate change allowances are not available for the Lower Thames, Dead River, Lower Mole and River Rythe. The available climate change modelled extents for these watercourses are the 1% AEP plus 20%. These have been displayed on the Flood Mapping included within Appendix D.

Appendix D, Figures D1-D13

Risk of Flooding from Surface Water

2.3.20 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 probability events: 1 in 30 year (3.33% AEP), 1 in 100 year (1% AEP), and 1 in 1,000 year (0.1% AEP). 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 EBC as GIS layers. This dataset is also available nationally on the Environment Agency website, and is referred to as 'Risk of Flooding from Surface Water'[10].

2.3.21 The ROFSW provides all relevant stakeholders, such as the Environment Agency, EBC, SCC (as the Lead Local Flood Authority (LLFA)) and the public access to information on surface water flood risk which is consistent across England and Wales[11]. The modelling helps the Environment Agency take a strategic overview of flooding, and assists SCC in their duties relating to management of surface water flood risk and the preparation of the Local Flood Risk Management Strategy. For the purposes of this SFRA, the mapping allows an improved understanding of areas within EBC administrative area which may be at risk of flooding from surface water.

2.3.22 The ROFSW mapping has a 2m model resolution and includes the representation of buildings, flow routes along roads, and modifications to include structural features such as flyovers. A range of storm scenarios have been considered and the modelling incorporates local mapping, knowledge and flood incidents. 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 a number of 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.

Preliminary Flood Risk Assessment

2.3.23 The Preliminary Flood Risk Assessment[12] (PFRA) and subsequent PFRA Addendum (2017)[13] prepared by SCC in accordance with the requirements of the Flood Risk Regulations 2009 provides a high level review of flooding across the County and identifies areas of significant surface water flood risk based on a broad scale national dataset.

Geology and Groundwater Datasets

2.3.24 Table 2-4 details the datasets that were supplied for the SFRA by the Environment Agency and the Areas Susceptible to Groundwater Flooding (Environment Agency) regarding the underlying geology, the presence of groundwater and the risk of groundwater flooding.

Table 2-4 Geology and Groundwater Flood Risk Datasets

Source	Dataset Title	Figure No
1	Superficial geology (British Geological Survey)	Figure B3
2	Bedrock geology (British Geological Survey)	Figure B2
3	Aquifer Type (Environment Agency)	-
4	Groundwater Vulnerability Classification (Environment Agency)	-

[10] Environment Agency Risk of Flooding from Surface Water Map https://flood-warning-information.service.gov.uk/long-term-flood-risk/
[11] Environment Agency (2013) 'What is the updated Flood Map for Surface Water?'
[12] Surrey County Council, June 2011, Preliminary Flood Risk Assessment http://www.surreycc.gov.uk/view?a=188801
[13] Surrey County Council, 2017, Preliminary Flood Risk Assessment Addendum https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/698714/PFRA_Surrey_County_Council_2017.pdf

5	Groundwater Source Protection Zones (Environment Agency)	-
6	Areas Susceptibility to Groundwater Flooding (Environment Agency)	Figure B5
7	SuDS drainage potential – depths to water table (BGS)	-
8	SuDS drainage potential – infiltration constraints summary (BGS)	Figure B6
9	SuDS drainage potential – drainage summary (BGS)	-

2.3.25 In order to provide a strategic assessment of the risk of groundwater flooding in Elmbridge, the following two stage assessment was undertaken using the data sources in Table 2-4.

2.3.26 The initial stage included a review the GIS layers of the BGS superficial geology (Source 1) and bedrock geology (Source 2), the Environment Agency aquifer type (Source 3), groundwater vulnerability (Source 4) and source protection zones maps (Source 5). The next stage was to use the GIS layer produced by the Environment Agency showing areas susceptible to groundwater flooding (Source 6) on the basis of geological and hydrogeological conditions. A description of each of these datasets is provided below.

Geology (Sources 1 and 2)

2.3.27 The BGS datasets provide a high level identification of the superficial deposits and bedrock geology across the Borough. 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.

Aquifer Type (Source 3)

2.3.28 Aquifers are underground layers of water-bearing permeable rock or drift deposits from which groundwater can be extracted. The Environment Agency datasets have been used to identify the presence of aquifers within Elmbridge to inform the understanding of sources of groundwater and the potential for related groundwater flood risk.

Groundwater Vulnerability Classification (Source 4)

2.3.29 Groundwater Vulnerability Classifications are an Environment Agency dataset that broadly show the extents of aquifers in the Borough. Where aquifers are highly vulnerable, they often have a more permeable covering and, together with dry valley and watercourse networks, potential groundwater flooding areas can be identified.

Source Protection Zone (Source 5)

2.3.30 The Environment Agency defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. Due to the strategic nature of this report, Environment Agency records of smaller abstractions have not been reviewed at this stage. Understanding of potentially vulnerable groundwater sources can be important when selecting appropriate SuDS for a particular area, refer to Section 5.10 for further information.

Susceptibility to Groundwater Flooding (Source 6)

2.3.31 ‘Areas Susceptible to Groundwater Flooding’ is a dataset produced by the Environment Agency showing areas susceptible to groundwater flooding (Source 6) on the basis of geological and hydrogeological conditions. This layer is split into 1km grid squares that are divided into four classes that represent the proportion of the area at risk of flooding:

- <25%
- >25%-50%
- 50%-<75%

- >75%

2.3.32 The highest risk areas are those with 50%-75% and >75% of the 1km area at risk of flooding from Groundwater.

Appendix B, Figure B5

Infiltration SuDS Suitability (Sources 7, 8 and 9)

2.3.33 The BGS has also produced a dataset of infiltration SuDS suitability mapping. The GIS layers from this dataset that was used included the 'Infiltration Constraints Summary' (Source 8) identifying areas with very significant constraints, areas with opportunities for bespoke infiltration SuDS and areas probably compatible for infiltration SuDS and areas thought to be highly compatible for infiltration SuDS), as described further below.

- 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.

Appendix B, Figure B6

'Risk of Flooding from Reservoirs'

2.3.34 The Environment Agency dataset 'Risk of Flooding from Reservoirs' identifies areas that could be flooded if a large[14] reservoir were to fail and release the water it holds. This dataset has been reviewed on the Environment Agency website[15] to inform the SFRA.

Historic Flooding Records

2.3.35 Records of past flood incidents have been provided by a number of the stakeholder organisations for use within the SFRA. The quality of this information is varied as described in Table 2-5. It is noted that no historic records of groundwater flooding have been provided by any of the stakeholders as part of the SFRA.

Table 2-5 Historic Datasets

Source	Description / Limitations
Elmbridge Borough Council (EBC)	Identification of 33 road locations where there have been incidents of flooding during the years 1970, 1987, 1988, 1993, 1994, 1995, 1996, 1997, 2000, 2001, 2002, 2003 and 2014. This data does not identify whether the flooding was internal or external (i.e. flooding of gardens) or the exact source of flooding. However all the locations are in close proximity to Main Rivers and therefore the source is assumed to be fluvial flooding from Main Rivers. This dataset is included on Figures E1-E4 (Appendix E) and the road names are listed in Appendix G. It should be noted that references to road names and the mapping in Appendix G does not mean the whole road has experienced flooding.
Environment Agency	The Environment Agency has provided an extract from their historic flooding database. The database includes records of confirmed and unconfirmed reports of flooding. These incidents are from the years 2000, 2003 and 2014 and provide details of the source and date of occurrence. Properties on 9 roads in the Borough were affected. The Environment Agency have also provided a GIS layer of the historic flood map which shows the extent of fluvial flooding that has been experienced. However the GIS layer does not contain information on the date of the flood event. These datasets are included in Figures E1-E4 (Appendix E). As well as these datasets, hydraulic modelling reports for the modelling studies for each of the main rivers has been provided by the Environment Agency, and these contain details regarding the dates of past flood events, as described in Section 3.10.

[14] A large reservoir is one that holds over 25,000 cubic metres of water, equivalent to approximately 10 Olympic sized swimming pools.
[15] Environment Agency, Long term flood risk assessment https://flood-warning-information.service.gov.uk/long-term-flood-risk/

Surrey County Council (SCC)	SCC has provided a GIS layer of 'wetspots' throughout the Borough. 'Wetspot' is a term used by SCC as the LLFA to describe the location of a surface water flood 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. These datasets are included on Figures D1-D13 (Appendix D) and the road names are listed in Appendix G. SCC has also provided its Historic Flooding Incidents, External Property Flooding and Internal Property Flooding datasets which show the location of historic flooding by road. The 'Historic Flooding Incident' records of historic Flooding start from 2013 however many records of flooding are unknown. No date of flooding is available for the External and internal flooding incidents. Records of Highways enquires have also been provided by SCC. Records of enquiries begin in 2014. These datasets are included in Appendix E Figures E1-E4.
Thames Water	TWUL has provided an extract from their Flood Register for the study area. Due to data protection requirements the data has not been provided at individual property level; rather the register comprises the number of properties within 4 digit postcode areas that have experienced flooding either internally or externally within the last 10 years. It should be noted that records only appear on the register where they have been reported to TWUL, and as such they may not include all instances of sewer flooding. These records are mapped in Appendix B, Figures B7 and B8.

Flood Warning Areas

2.3.36 The Environment Agency operates a free Flood Warning Service[16] 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 Elmbridge.

Appendix B, Figure B9

Emergency Rest Centres

2.3.37 EBC has provided a GIS layer detailing the rest centres with the Borough which are designated in the Multi-Agency Flood Plan.

Appendix B, Figure B9

Flood Risk Management Measures

2.3.38 The Environment Agency has provided an extract from the Asset Information Management System (AIMS) which contains details of flood defence assets associated with Main Rivers in Elmbridge. As part of the modelling for the Middle Mole, a GIS layer has been provided identifying areas benefiting from flood defences. This information is shown on the Flood Map for Planning (Rivers and Sea).

2.3.39 The Thames Catchment Flood Management Plan is a high level plan developed by the Environment Agency that provides an overview of flood risk in the wider Thames catchment and sets out preferred plan for sustainable flood risk management over the next 50 to 100 years[17].

Appendix C, Figures C1-C13

[16] Environment Agency Flood Warning Service https://www.gov.uk/sign-up-for-flood-warnings
[17] Thames River Basin District – Flood Risk Management Plan - https://www.gov.uk/government/publications/thames-river-basin-district-flood-risk-management-plan

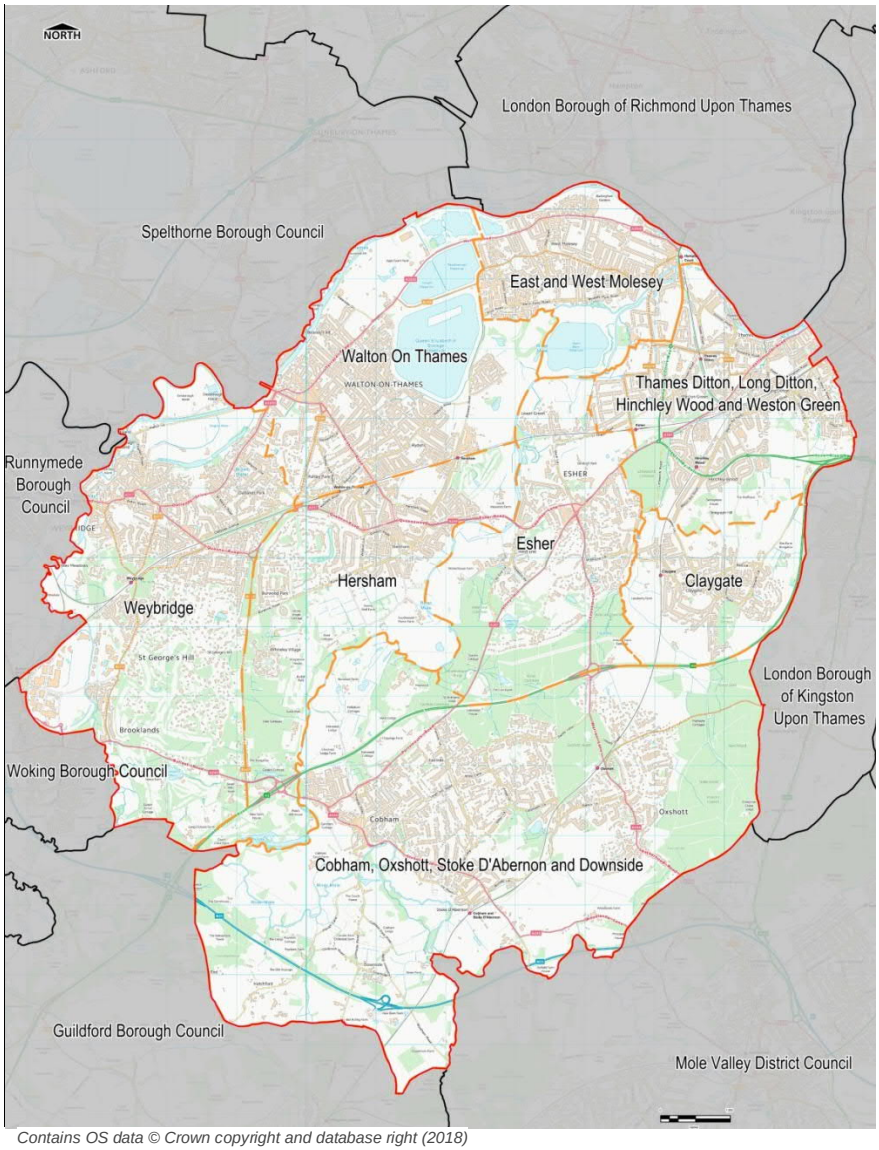
3. Assessing Flood Risk

3.1 Overview

3.1.1 Using the datasets identified in Section 2, this Section provides a strategic assessment of the flood risk across the Borough from each source. Schedules presenting this information specific to each of the 8 Settlement Areas are included in Appendix A.

3.2 Area

3.2.1 Elmbridge covers an area of approximately 96km^2 and contains 8 Settlement Areas as identified in Figure 3-1 which are used for planning purposes. There are 2 Main Settlement Areas of Weybridge and Walton-on-Thames located in the west and north of the Borough respectively; 4 Suburban Settlement Areas of Esher; Hersham; Thames Ditton, Long Ditton, Hinchley Wood and Weston Green; and East and West Molesey; the Suburban Village of Claygate in the east of the Borough; and the Service Centre and Rural Fringe of Cobham, Oxshott, Stoke D'Abernon and Downside in the south.



Contains OS data © Crown copyright and database right (2018)

Figure 3-1 EBC Settlement Areas

3.3 Character

3.3.1 Elmbridge is a Surrey Borough located in the South East region, immediately to the south west of London. Much of the urban area in the north of the Borough is a continuation of the built-up area of suburban London linking through to more rural areas in the south. Elmbridge is bordered to the north by the River Thames and the administrative areas of the Spelthorne Borough and the Royal Borough of Richmond upon Thames; to the east by the London Borough of Kingston upon Thames; to the south by Mole Valley District and Guildford Borough; and to the west by Woking and Runnymede Boroughs.

3.3.2 Elmbridge has a unique position as a highly desirable area as a result of its location as a Surrey Borough in close proximity to London and its high quality environment. As a result of good accessibility by rail and road to Central London, and within easy reach of Heathrow and Gatwick Airports, the M25 and the M3, land values are high and development pressure intense.

3.4 Topography

3.4.1 The River Thames flows eastwards along the northern edge of the Borough where the land is low lying at levels of approximately 5-10m Above Ordnance Datum (AOD). The northern half of the Borough is largely low lying and flat and levels gradually rise to 20-30m AOD towards the settlements of Hersham, Esher and Claygate. As the name suggests, the area of St George's Hill in Weybridge is at a higher elevation, but the west of the Borough drops down again to the floodplain of the River Wey (10-20mAOD). Levels rise again in the south east of the Borough up to approximately 60-70m AOD towards the urban area of Oxshott and the surrounding rural land that drains into the Rythe.

Appendix B, Figure B1 Topography

3.5 Geology

3.5.1 The geology of the Borough comprises a covering of superficial deposits over approximately 50% of the area. This is mainly in the northern parts of the Borough and a stretch running along the line of the River Ember and the River Mole to the south. There are also two small isolated areas of superficial deposits around the Weybridge/Hersham and Cobham settlement areas.

3.5.2 The superficial deposits in the area include Quaternary age river terrace deposits, alluvium and head. The main gravels terraces are the Kempton Park Gravels Formation and Taplow Gravels Formation in the northern part of the Borough and Main River valleys. The two isolated areas of gravels are Lynch Hill Gravel Formation (in Weybridge/Hersham) and Boyn Hill Gravel Formation (in Cobham) where both active and restored gravel pits exist.

3.5.3 The bedrock geologies include Eocene age Bagshot Formation, Claygate Member (upper part of London Clay Formation) and the rest of London Clay Formation. These are the oldest rocks found in the Borough at outcrop. The youngest rocks are the small isolated patches of Camberley Sand Formation and Windlesham Formation, found mainly in the Weybridge area around St George's Hill.

3.5.4 The London Clay comprises clayey silt beds grading to silty fine-grained sand, this is found beneath the superficial deposits in the northern part of the Borough and at the surface along the western and southern parts of the Borough. The upper sandier part of the London Clay Formation is known as the Claygate Member to distinguish its coarser-grained nature. This is present in the central part of the Borough and along the western side of the Borough. In the Weybridge, Hersham, Cobham and Esher settlement areas, the Claygate Member is overlain by Bagshot Formation. This formation is characterised by fine grained yellow orange brown quartz sand with frequent clay laminations, some silt layers, and flint pebble beds in the upper horizons.

3.5.5 In general, most of bedrock within the Borough is flat lying and there are few faults identified at the surface.

Appendix B, Figure B3 Superficial Geology, Figure B2 Bedrock Geology

3.6 Aquifers

3.6.1 The bedrock underlying the western part of the Borough including Weybridge, Hersham and Cobham is designated a Secondary A aquifer. This is defined by the Environment Agency as a permeable layer capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers. The remainder of the Borough to the east is designated unproductive strata which is rock strata with low permeability that has negligible significance for water supply or river base flow.

3.6.2 The superficial deposits present along the corridor of the River Wey, River Thames and River Mole are classified as Principal and Secondary A aquifer. According to Environment Agency definitions, a principal aquifer is defined as having intergranular permeability, which can provide a high level of water storage, and support water supply and/ or river base flow on a strategic scale.

3.6.3 The Environment Agency defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. There is only one small area defined as a SPZ in the Borough which is Desborough Island adjacent to the River Thames to the north of Weybridge,

3.7 Groundwater Vulnerability

3.7.1 In a similar manner to the geological conditions and aquifer designations, the corridor adjacent to the River Thames, River Mole and River Wey has a Major Aquifer High and Intermediate designation on the Groundwater Vulnerability mapping.

3.8 Main Rivers

3.8.1 There are five Main Rivers present within the Borough.

- The **River Wey** flows north along the western edge of the Borough. The catchment of the Wey lies within Hampshire and Surrey and has a total area of approx. 904 km^2. It falls approximately 190m in level, and is approximately 104 km in length from its source in Hampshire to the confluence with the Thames near Weybridge urban centre. The Lower Wey is navigable from its confluence with the Thames up to Godalming. It includes a number of navigation channels separate from the Main River, with water levels regulated by structures such as locks and weirs. Through the urban area of Weybridge, the natural channels have been engineered and canalised to varying degrees[18].
- The **River Mole** and its tributaries have a catchment of approximately 487km^2.
  - The Mole rises in the North Sussex Hills near Rusper and flows into the River Thames at Molesey, near Hampton Court.
  - The Middle Mole extends from where the Salford Stream tributary meets the River Mole, just upstream of Sidlow Bridge in the Reigate and Banstead District, to the Esher Railway Bridge. The catchment of the Middle Mole covers approximately 270km^2.
  - The Lower Mole extends from Esher Railway Bridge downstream to its confluence with the River Thames at Molesey, near Hampton Court. The catchment covers an area of approximately 11km^2. The Lower Mole has been extensively modified by the construction of the Lower Mole Flood Alleviation Scheme between 1977 and 1991. The Dead River is the main tributary of the Lower Mole.
  - The **River Ember** is a channel of the River Mole which flows around the east of Island Barn Reservoir before flowing northeast, parallel to the Lower Mole channel towards their confluence with the Thames, just south of Hampton Court Bridge.
- The **Dead River** flows in a north-easterly direction from Walton-on-Thames, round the Queen Elizabeth II Storage Reservoir and through West Molesey, where it joins the River Mole. The Dead River is the only significant tributary of the Lower Mole. The Dead River drains a

[18] Mott MacDonald, Environment Agency Thames Region (December 2009) *Lower Wey Remodelling and ABD Flood Mapping Study, Hydrology Report.*

catchment of approximately 5km^2, 50% of which is urbanised. It has one small tributary in the upper reaches, which is approximately 0.25km long.

- The **River Rythe** rises near Oxshott, in the Prince's Coverts woodland and flows northwards, through Claygate and along the edge of Hinchley Wood. The river then follows the Portsmouth Road towards Thames Ditton, and runs into the River Thames near Ferry Road, forming the boundary between Kingston and Thames Ditton. The River Rythe drains a total catchment area of approximately 19km2, 50% of which is urbanised.
- The **Lower Thames** flows along the northern boundary of the Borough between Weybridge and Thames Ditton. The Lower Thames floodplain is relatively broad and flat and the river itself contains several islands. The normal tidal limit of the River Thames occurs at Teddington Weir, approximately 5km downstream from Thames Ditton (TQ 1675 7149), but on a high tide, the tidal influence can extend as far back upriver as Molesey Weir.

Appendix B, Figure B4 Watercourses and Water Bodies

3.9 Ordinary Watercourses

3.9.1 As well as Main Rivers there are a number of smaller Ordinary Watercourses[19] 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. There are some small sections of culverted watercourse around Stoke D'Abernon in the south of the Borough. Figure B4 also identifies drainage ditches that are maintained by SCC as highways drainage ditches.

Appendix B, Figure B4 Watercourses and Water Bodies

3.10 Flooding from Rivers

3.10.1 A large proportion of the Borough is located in areas that have a Medium and High probability of flooding from rivers (i.e. Flood Zones 2 and 3). The floodplain of the Lower Thames affects the northern and north east fringe of the Borough including Walton, Molesey and Thames Ditton. Weybridge and the western edge of the Borough are within the floodplain of the River Wey. The River Mole and the River Rythe flow northwards through the Borough and the floodplains associated with these watercourses affect the settlements of Cobham, Stoke D'Abernon, Downside, Esher, Claygate, West End, Hersham, Walton and Molesey.

3.10.2 Across Elmbridge:

- **76%** (68km^2) is defined as **Flood Zone 1 Low Probability** of flooding from rivers.
- **20%** (20km^2) is defined as **Flood Zone 2 Medium Probability** of flooding from rivers.
- **3%** (3km^2) is defined as **Flood Zone 3a High Probability** of flooding from rivers.
- **8%** (8km^2) is defined as **Flood Zone 3b (Developed or Undeveloped areas).**

3.10.3 Across the Elmbridge Urban Areas;

Table 3-1 Percentage of urban area in a Flood Zone

Settlement Area	Flood Zone	Flood Zone percentage	Area (km^2)
Weybridge	Flood Zone 1 Low Probability	79%	6.1km^2
	Flood Zone 2 Medium Probability	5%	0.38km^2
	Flood Zone 3a High	12%	0.92km^2

[19] 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.

	Probability		
	Flood Zone 3b (Developed areas).	4%	0.3km^2
Walton-on-Thames	Flood Zone 1 Low Probability	90%	5.42km^2
	Flood Zone 2 Medium Probability	5%	0.28km^2
	Flood Zone 3a High Probability	4%	0.18km^2
	Flood Zone 3b (Developed areas).	2%	0.14km^2
Hersham	Flood Zone 1 Low Probability	90%	3.52km^2
	Flood Zone 2 Medium Probability	8%	0.31km^2
	Flood Zone 3a High Probability	0%	0km^2
	Flood Zone 3b (Developed areas).	2%	0.06km^2
Cobham, Oxshott, Stoke D'Abernon and Downside	Flood Zone 1 Low Probability	89.5%	7.35km^2
	Flood Zone 2 Medium Probability	8%	0.62km^2
	Flood Zone 3a High Probability	0.5%	0.04km^2
	Flood Zone 3b (Developed areas).	2%	0.17km^2
East and West Molesey	Flood Zone 1 Low Probability	48%	1.84km^2
	Flood Zone 2 Medium Probability	35%	1.36km^2
	Flood Zone 3a High Probability	11%	0.43km^2
	Flood Zone 3b (Developed areas).	6%	0.22km^2
Esher	Flood Zone 1 Low Probability	48%	1.84km^2
	Flood Zone 2 Medium Probability	35%	1.36km^2

	Flood Zone 3a High Probability	11%	0.43km^2
	Flood Zone 3b (Developed areas).	6%	0.22km^2
Thames Ditton, Long Ditton, Hinchley Wood and Weston Green	Flood Zone 1 Low Probability	63%	3.42km^2
	Flood Zone 2 Medium Probability	28%	1.53km^2
	Flood Zone 3a High Probability	6%	0.34km^2
	Flood Zone 3b (Developed areas).	2%	0.11km^2
Claygate	Flood Zone 1 Low Probability	99.7%	1.79km^2
	Flood Zone 2 Medium Probability	0.22%	0.004km^2
	Flood Zone 3a High Probability	0.22%	0.004km^2
	Flood Zone 3b (Developed areas).	0.05%	0.002km^2

3.10.4 Of the land identified as Flood Zone 3b, there are important areas of undeveloped functional floodplain, including Ditton Field, Desborough Island and Hurst Park adjacent to the River Thames; The Bull Dogs and Trinity Island, land to the south of Brooklands adjacent to the River Wey; and the relatively wide floodplain of the Middle Mole which comprises rural land. Areas along the River Rythe include land to the east and north of Oxshott and Littleworth Common

Appendix C, Figures C1-C13

Dry Islands

3.10.5 The floodplain in Elmbridge, particularly along the River Thames and River Wey, is relatively flat and broad. There may be small areas within the floodplain where the ground levels are slightly higher and which are therefore less likely to flood than the land around them. These areas are typically referred to as ‘dry islands’. These areas can sometimes be identified by looking at the Flood Zone map; for example an area of Flood Zone 1 or 2, surrounded by land designated as Flood Zone 3. When considering the flood risk to these areas, the risk to the surrounding area should be taken into account.

Climate Change

3.10.6 The results of the hydraulic modelling studies for the main rivers suggest that climate change will not markedly increase the extent of river flooding within most areas of the Borough. However there are a few places where the extent of flooding is noticeably increased, including flooding from the Lower Thames in West Molesey and to the north of Thames Ditton; flooding from the Dead River in Walton on Thames and West Molesey; flooding from the Lower Mole in Lower Green and East Molesey; flooding from the Middle Mole in the east of Hersham and south of Stoke D’Abernon; flooding associated with the River Wey close to the Brooklands Industrial Estate and flooding from the River Rythe close to the west and north of Oxshott and to the north of Hinchley Wood.

3.10.7 It is important to note that these areas, as well as those areas that are *currently* at risk of flooding may be susceptible to more frequent, more severe flooding in future years. It is essential therefore 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 to the property.

3.10.8 For this reason, all of the development management recommendations set out in Section 5 require all floor levels, access routes, drainage systems and flood mitigation measures to be designed with an allowance for climate change; and the potential impact that climate change may have over the lifetime of a proposed development should be considered as part of a site-specific FRA. This provides a robust and sustainable approach to the potential impacts that climate change may have upon the Borough over the next 100 years, ensuring that future development is considered in light of the possible increases in flood risk over time.

Historic Flooding

3.10.9 Elmbridge has a long history of flooding from the rivers present within its study area, as described below.

3.10.10 Lower Wey: Flooding in the Lower Wey catchment has been reported as early as the late 1800s. Notable flooding occurrences within the catchment have been reported in 1900, 1947, 1968, 1979, 1985, 1987, 1990, 2000, 2003, 2006, 2007 and 2008 and 2014. The flooding occurrence in the Lower Wey is influenced by the geology, and the rapid rate of urbanisation within the study area[20].

3.10.11 Lower Thames: Since 1947 there have been relatively few large flood events in the Lower Thames catchment. Recent events of note occurred in September 1968, (although this was confined mainly to the River Mole and the River Wey), June 1971 and November 1974. In the 1990s there were few large out-of-bank flood events. The largest recent flood events occurred in January 2003 and January / February 2014. Other smaller floods occurred in February 1990, December 1992, January 1994, December 1996 and November-December 2000[21].

3.10.12 Middle Mole: Flooding has been reported historically from the Middle Mole and the residential areas of Cobham and Esher have a history of repeated flooding. The following occurrences have been recorded[22]:

- March 1947: Severe flooding caused by heavy rain falling onto the snow that had blighted much of the country throughout the bitter winter of 1947. This caused disastrous flooding for the towns near the River Thames.
- September 1968: Widely accepted to have been the worst ever recorded in this area with disastrous consequences in the Mole catchment. Flooding followed the wettest September on record in which parts of the county received a third of their annual rainfall. This was compounded by torrential rain over the weekend of the 14th - 15th September which caused flooding problems made worse by the saturated soil. The event hit the towns of Esher and Molesey in the Lower Mole valley badly. In this area the flood was presumed to be a 1 in 200 year event. Further upstream the damage was also considerable; several bridges were destroyed including Downside Bridge at Cobham and Boxhill Bridge near Dorking January 1980: Reported to be the worst since 1968 and described as an emergency which lasted 24 hours before the flood waters in the Wey at Guildford and the Mole in Dorking returned to normal.
- February 1990: The Surrey Advertiser stated that 'Two men died, thousands of families suffered damage to cars and property and insurance companies braced for more claims than in 1987' as a result of torrential rain and storm force winds.
- October 1993: Flood levels on the road into Brockham rose to their highest level since December 1979 and the road at Borough Bridge was closed. Floods also affected Dorking and Betchworth.

[20] Mott MacDonald, Environment Agency Thames Region (December 2009) Lower Wey Remodelling Flood Study, Modelling Report.
[21] PBA, Jacobs, Atkins, Environment Agency Thames Region (November 2007) Lower Thames Flood Risk Mapping Project TH724 Hydraulic Modelling Report Issue No. 5.1.
[22] Mott MacDonald, Environment Agency Thames Region, (December 2007) Middle Mole Flood Mapping Study Final Report.

- December 1994: An overnight deluge caused the River Mole to rise by 3 m and flood Mill Road in Cobham. Recorded as the second largest in terms of flow at both Castle Mill and Esher Gauging stations.
- Autumn 2000: The worst floods since the 1968 event; reported as the wettest autumn on record in the UK and many rivers in Surrey burst their banks. Gauging stations on the Mole recorded the highest flows since 1968; with the flow at Esher reaching 115 m^3/s. Extensive areas of rural land in Elmbridge were affected.
- December 2013: During the severe weather experienced in December 2013, the Middle Mole burst its banks at Cobham, resulting in flooding of the rural floodplain and adjacent properties.

3.10.13 Lower Mole: Since the completion of the Lower Mole Flood Alleviation Scheme in 1991 there have been no out-of-bank flood events on the Lower Mole or Ember[23].

3.10.14 Dead River: The Environment Agency, EBC or SCC has no records of any flood events on the Dead River.

3.10.15 River Rythe- Records of flooding within the floodplain of the River Rythe are presented in the Environment Agency's Historic Flood Map. The date of flooding is unknown.

3.10.16 Records of flooding supplied by the Environment Agency, EBC and SCC have been mapped in Appendix C Figures C1-C13

Appendix C, Figures C1-C13

Flood Risk Management Schemes

3.10.17 The Environment Agency Asset Information Management System (AIMS) contains details of flood defence assets associated with Main Rivers. This information is presented in Appendix C Figures C1-C13. This dataset shows that the majority of the watercourses are not formally defended but may be informally protected by high ground on either side of the watercourse.

3.10.18 **Byfleet and Weybridge Proposed Scheme:** The Environment Agency, along with key professional partners, is developing a scheme to reduce flood risk within Byfleet and Weybridge. Within the EBC administrative area, the Environment Agency is concentrating on the centre of Byfleet and Wey Road in Weybridge. The Environment Agency is currently at the business case stage, assessing the preferred options to reduce flood risk to the area, and ensuring that the scheme is both economically and technically viable.

3.10.19 **Lower Mole Flood Alleviation Scheme:** The Lower Mole Flood Alleviation Scheme (FAS) was constructed in response to the 1968 flood event, when up to 10,000 properties along the River Mole were subject to flooding. The FAS has been operational since the early 1980's, and offers protection to several thousand houses along the lower reach of the River Mole.

3.10.20 The FAS is considered to have a standard of protection in excess of the 1 in 100 year (1% AEP) event. Formal flood defences including earth embankments and concrete flood walls are present along both banks of the River Mole from West End in Esher downstream to the confluence with the River Thames. These defences form part of the Lower Mole Flood Alleviation Scheme. The Flood Map for Planning (Rivers and Sea) shows that these defences generate an Area Benefiting from Defences for Flood Zone 3 in the Esher and Hersham Settlement Areas. These areas are also shown in Figures C-5 and C-11 in Appendix C.

3.10.21 In 2017, the Environment Agency completed an Asset Management Plan (AMP) for the Lower Mole FAS. The aim of the AMP was to collate existing information on the condition of the range of assets that constitute the FAS, and to undertake any further inspections of the assets where this information was not currently available.

3.10.22 The reporting from the AMP sets out a clear plan for future interventions to sustain the current standard of protection offered by the FAS for the next 100 years. The AMP also sets out a timeline for

[23] Halcrow Group Ltd, Environment Agency Thames Region, (March 2009) Lower Mole Flood Risk Study Final Study Report.

these future works, allowing for forward planning and investment to ensure that the standard of service the FAS offers is not compromised.

3.10.23 The business case for these works is currently being progressed, and there is an expectation that works are likely to commence prior to 2021 and will take a number of years to complete.

3.10.24 **Dead River:** The Environment Agency has undertaken an Initial Assessment (IA) for the Dead River catchment to identify possible strategic flood risk reduction options along this watercourse. This project is still at a very early stage, and no specific locations have been identified for any flood risk reduction works. The next stages of this project will involve engagement with other Risk Management Authorities in order to develop an understanding the risk of flooding from multiple sources, and to work in partnership with others to bring forward any feasible options for further appraisal.

3.10.25 **River Rythe:** The Environment Agency has undertaken an IA for the River Rythe catchment to identify possible strategic flood risk reduction options along this watercourse. This project is still at a very early stage, and no specific locations have been identified for any flood risk reduction works. The next stages of this project will involve engagement with other Risk Management Authorities in order to develop an understanding the risk of flooding from multiple sources, and to work in partnership with others to bring forward any feasible options for further appraisal.

3.10.26 **Thames Catchment Flood Management Plan (CFMP):** The CFMP[24] provides an overview of the flood risk in the Thames catchment and sets out the preferred plan for sustainable flood risk management over the next 50 to 100 years. It identifies flood risk management policies to assist all key decision makers in the catchment including LPAs who can use the plan to inform spatial planning activities and emergency planning. The CFMP sets out the preferred policy for different sub-areas of the catchment that have been identified by their physical characteristics. There are 4 areas that cover the Elmbridge Borough and these are described further in Table 3-2.

Table 3-2 Catchment Flood Management Plan

Lower Thames and Byfleet & Weybridge – 'Heavily populated floodplain'. **Preferred Policy P5 Areas of moderate to high flood risk where we can generally take further action to reduce flood risk'.**

Environment Agency's Proposed Actions:

- *We will deliver the actions recommended in Flood Risk Management Strategies for the Wey and Lower Thames once they are approved.*
- *In the short-term, we will encourage partners to develop policies, strategies and initiatives to increase the resistance and resilience of all new development at risk of flooding. We will also look at protecting land that may be needed to manage flood risk in the future, and work with partners to identify opportunities for this and to recreate river corridors in urban areas.*
- *In the longer-term, we need land and property owners to adapt the urban environment to be more flood resilient. This includes the refurbishment of existing buildings to increase resilience and resistance to flooding.*
- *We need to promote the management of flood consequences. By working with our partners we will improve public awareness and local emergency planning, for example identifying critical infrastructure at risk and producing community flood plans.*

Lower Mole – Places with significant flood defences'. **Preferred Policy P3 Areas of low to moderate flood risk where we are generally managing existing flood risk effectively'.**

Environment Agency's Proposed Actions:

- *We will continue to maintain the Lower Mole and Maidenhead Windsor and Eton Flood Alleviation Schemes.*
- *We will work closely with Local Authorities to ensure that we are well prepared to respond to the consequences of flooding from other sources and extreme events.*
- *We will work with our partners to ensure that any future development in these areas results in a reduction in the overall flood risk.*
- *We will continue to make sure the recommendations in Strategic Flood Risk Assessments and Local Development Framework policies create the potential to reduce flood risk through adaptation of places at*

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

risk, and retaining open spaces in the floodplain.

Middle Mole 'Chalk and downland catchments'.

Preferred Policy P3 Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

Environment Agency's Proposed Actions:

- *We want to maintain the existing capacity of the river systems in developed areas to reduce the risk of flooding from more frequent events. We will work with our partners to identify opportunities to make the existing systems more efficient (for example, where there are significant restrictions to flow from undersized culverts or bridges).*
- *We will work with Local Planning Authorities to retain the remaining floodplain for uses that are compatible with flood risk management and put in place polices that lead to long-term adaptation of urban environments in flood risk areas.*
- *We will continue to increase public awareness, including encouraging people to sign-up for the free Floodline Warnings Direct service.*

3.10.27 River Thames Scheme: The River Thames Scheme will reduce flood risk to people living and working near the Thames. Between 2020 and 2025 the Environment Agency plan to build a new flood channel alongside the River Thames to reduce flood risk to 15,000 properties in communities in Datchet, Wraysbury, Egham, Staines, Chertsey, Shepperton, Weybridge, Sunbury, Molesey, Thames Ditton, Kingston and Teddington.

3.10.28 The channel is almost 15KM in length and will be built in 3 sections. The scheme includes widening of the Desborough Cut and increasing the capacity of weirs at Sunbury, Molesey, and Teddington by installing additional weir gates.

3.10.29 15,000 homes and 2,400 businesses will be better protected from flooding. Road, rail, power and water networks will be more resilient. The Environment Agency plan to create 106 hectares of new public open space and 23km of new pathways as well as improvements to biodiversity for wildlife through the creation of 250 hectares of new habitat.

3.10.30 Construction of the new channel provides an opportunity to create habitats for wildlife and recreation activities including walking, cycling, boating and angling.

3.10.31 The scheme is estimated to cost £588 million based upon the latest design work. The Environment Agency has identified funding sources of £354 million – more than half the funding required for the construction of the scheme. This includes government investment of more than £290 million and partnership funding of more than £60 million.

3.10.32 The Environment Agency is working with our partners, government departments, business and industry to secure the remaining funding.

3.10.33 The Environment Agency is reviewing their approach for supporting residents in managing and reducing flood risk to communities which will still remain at a high risk of flooding following completion of the flood channel. This work is being carried out at a community level, considering options for providing permanent or temporary community level defences, for those communities where it is viable.

Residual Risk

3.10.34 It is important to recognise that the risk of flooding from the rivers in Elmbridge 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.

3.10.35 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[1]

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.

3.10.36 Steps should be taken to manage these residual risks through the use of flood warning and evacuation procedures, as described in Section 5.11.

3.11 Flooding from Surface Water

3.11.1 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 quickly off land and result in localised flooding.

3.11.2 Appendix F Figures F1 – F13 present the Risk of Flooding from Surface Water (ROFSW) mapping for the EBC study area in combination with historical surface water flooding data recorded by SCC.

Appendix D, Figures D1-D13

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

- Surface water flood risk in Thames Ditton is highlighted in the PFRA, where there are also a number of the highest priority SCC wetspots;
- Ponding of surface water along the low-lying floodplain of the Middle Mole, including areas such as Cobham Park;
- Flooding along the roads sloping down from Fairmile towards Cobham and Stoke D'Abernon and the residential areas at the bottom of this high ground;
- Flooding in Weybridge centre including the recreation ground and playing fields;
- Ponding of surface water along Brooklands Road and Locke King Road south of Weybridge town centre;
- Surface water flooding in the residential area between Burwood Park and Hersham;
- Ponding along the River Rythe floodplain at Hare Lane Green in Esher;
- Ponding of surface water adjacent to the railway embankments in Long Ditton and Hinchley Wood; and
- Extensive surface water flooding in Walton-on-Thames along the roads and residential area to the south of the Queen Elizabeth II Reservoir.

3.11.4 According to historic records provided by the Highways Agency, during two incidents in December 2012 and December 2013, traffic was diverted off the A3 via the M25 roundabout and back on due to surface water on the carriageways. In two incidents in January 2014 and February 2014 flooding occurred on the A3 as a result of an overflowing lake on Surrey Wildlife Trust property adjacent to the A3 during an extended period of wet weather. All of these incidents were confined to the Highways Agency network.

Climate Change

3.11.5 The RoFSW 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% AEP, and therefore it is possible to use with caution the 0.1% AEP outline as a substitute dataset to provide an indication of the implications of climate change.

3.12 Flooding from Groundwater

3.12.1 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.

Appendix B, Figure B5 Susceptibility to Groundwater Flooding

3.12.2 Reference to the Environment Agency dataset 'Areas Susceptible to Groundwater Flooding' in Appendix B Figure B5 identifies that some areas are not considered to be at risk of groundwater flooding e.g. along the south eastern and western part of the EBC area.

3.12.3 In broad terms there is limited potential for groundwater flooding in the central part of the Borough including Weybridge urban area, Esher and Cobham. The potential for groundwater flooding is greater in Hersham, Walton-on-Thames and East and West Molesey where the underlying geological conditions are more permeable.

3.13 Flooding from Sewers

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

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

3.13.2 Sewer systems are typically designed and constructed to accommodate rainfall events with an annual probability of 1 in 30 (3.3% AEP) or greater. Therefore, rainfall events with an annual probability less than 1 in 30 (3.3% AEP) would be expected to result in surcharging of some of the sewer system. While TWUL, as the sewerage undertaker within Elmbridge, recognise the impact that more extreme rainfall events may have, it is not cost beneficial to construct sewers that could accommodate every extreme rainfall event.

2. *The system becomes blocked by debris or sediment:*

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

3. *The system surcharges due to high water levels in receiving watercourses:*

3.13.4 Within the study area there is potential for surface water outlets to become submerged due to high river levels. When this happens, water is unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will overflow into streets and potentially into houses. Where the local area is served by 'combined' sewers i.e. containing both foul and storm water, if rainfall entering the sewer 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.

Appendix B, Figure B7 Internal Sewer Flooding Incidents

Appendix B, Figure B8 External Sewer Flooding Incidents

3.13.5 Appendix B Figures B7 and B8 show the outputs from the flood incident register that has been supplied by Thames Water. It should be noted that these are flooding incidents that have been reported to TWUL by the home owners. There are obviously incidents that do not get reported and therefore will not show on the register. Incidents of sewer flooding can be retrospectively reported to TWUL via their website – http://thameswater.co.uk/help-and-advice/9782.htm. This dataset identifies that 1-28 properties have been affected by internal flooding in the Borough. External flooding has affected 1-18 properties.

3.14 Flooding from Reservoirs

3.14.1 There are four large water supply reservoirs present within the Borough, the Queen Elizabeth II Storage Reservoir, Bessborough Reservoir and Knight Reservoir all located within Walton-on-Thames, and Island Barn Reservoir in East and West Molesey. In addition, the Queen Mary Reservoir is located in neighbouring Spelthorne Borough to the north of Elmbridge. TWUL is responsible for the management of these reservoirs and ensuring all required safety standards are met.

3.14.2 The Environment Agency dataset 'Risk of Flooding from Reservoirs' identifies areas that could be flooded if a large[25] reservoir were to fail and release the water it holds. The mapping shows the part of the Borough to the north of the railway line to be at risk from the five reservoirs identified above, including Walton-on-Thames and East and West Molesey and Thames Ditton.

3.14.3 The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The PPG[2] encourages LPAs to identify any impounded reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment it is located within, and / or whether emergency draw-down of the reservoir will add to the extent of flooding.

3.14.4 Reservoirs in the UK have an extremely good safety record. The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected and essential safety work is carried out. These reservoirs therefore present a minimal risk.

3.14.5 EBC is responsible for working with members of the Local Resilience Forum (LRF) to develop emergency plans for reservoir flooding and ensuring communities are well prepared.

Appendix B, Figure B4 Watercourses and Waterbodies

[25] A large reservoir is one that holds over 25,000 cubic metres of water, equivalent to approximately 10 Olympic sized swimming pools.

4. Avoiding Flood Risk

4.1 Sequential Approach

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 6.

4.1.2 The sequential approach is a decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to sites at higher risk. This will help avoid the development of sites that are inappropriate on flood risk grounds. The subsequent application of the Exception Test where required will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability 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 and within sites. 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.

4.2 Applying Sequential Test – Plan-Making

4.2.1 As the LPA, EBC must demonstrate that throughout the site allocation process a range of possible sites have been considered in conjunction with the flood risk and vulnerability information from the SFRA, and that the Sequential Test, and where necessary the Exception Test, has been applied.

4.2.2 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 2-1 and mapped in Appendix C (and the Environment Agency's Flood Map for Planning (Rivers and Sea)). Flood risk vulnerability classifications, as defined in the PPG[2] are presented in Table 4-1. The NPPF[1] 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.

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

4.2.4 The flow diagram presented in Figure 4-1 illustrates how the Sequential Test process should be applied to identify the suitability of a site for allocation, in relation to the flood risk classification.

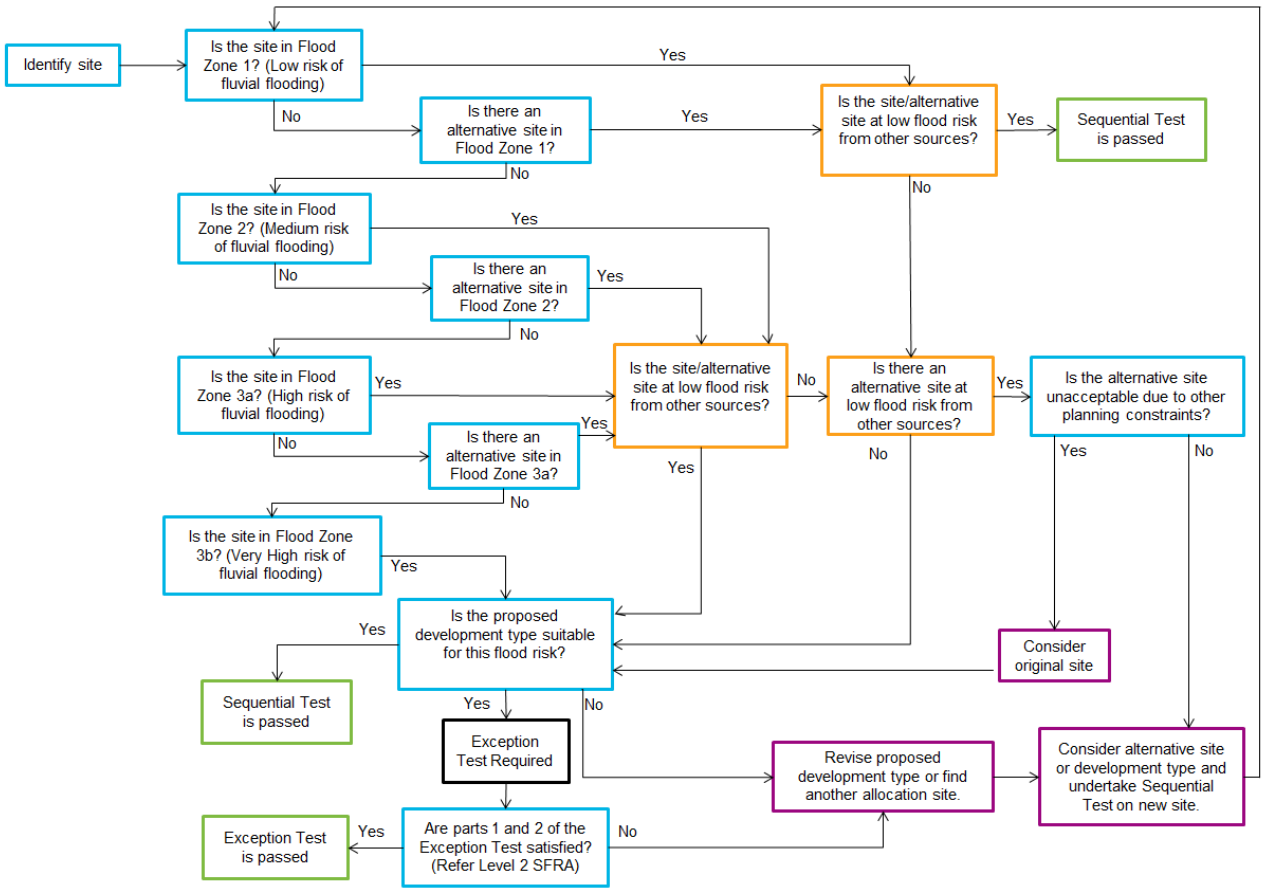


Figure 4-1 Application of Sequential Test for Plan-Making

Table 4-1 Flood Risk Vulnerability Classification (PPG[2])

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 electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”).
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding.

Vulnerability Classification	Development Uses
	• Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

4.2.5 NPPF[1](paragraph 163) 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 4-2 Flood Risk Vulnerability and Flood Zone 'Compatibility' (Planning Practice Guidance-PPG[2], 2014)

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

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

* In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and 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.

[1]There are some areas within Flood Zone 3b that are already developed and are prevented from flooding by the presence of existing infrastructure or solid buildings. Whilst these areas will be subject to frequent flooding it may not be practical to refuse all future development. In recognition of this, EBC has put in place an approach to prevent the unnecessary blight of these areas. See Section 2 for further details.

4.2.7 The recommended steps in undertaking the Sequential Test are detailed below. This is based on the Flood Zone and Flood Risk Vulnerability and is summarised in Table 4-2.

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

4.2.8 The information required to address many of these steps is provided in the accompanying maps presented in Appendix B–F. When preparing a Local Plan a database of the potential allocation sites across Elmbridge should be generated and information for each site populated using the GIS layers presented in the maps. This database can be used by EBC 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. The location and identification of potential development should be recorded.
3. The Flood Zone classification of potential development sites should be determined based on a review of the Flood Map for Planning (Rivers and Sea). Where these span more than one Flood Zone, all zones should be noted, preferably using percentages.
4. The design life of the development should be considered with respect to climate change:
    - 100 years – up to 2115 for residential developments; and
    - 75 years – up to 2090 for commercial / industrial developments, or other time horizon specific to the non-residential use proposed.
5. Identify existing flood defences serving the potential development sites. However, it should be noted that for the purposes of the Sequential Test, Flood Zones ignoring defences should be used.
6. Highly Vulnerable developments to be accommodated within the Borough should be located on those sites identified as being within Flood Zone 1. If these cannot be located in Flood Zone 1, because the identified sites are unsuitable or there are insufficient sites in Flood Zone 1, sites in Flood Zone 2 can then be considered. If sites in Flood Zone 2 are inadequate then additional sites in Flood Zones 1 or 2 may need to be identified to accommodate development or opportunities sought to locate the development outside the Borough.
7. Once all Highly Vulnerable developments have been allocated to a development 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 Flood Zone 1. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate More Vulnerable development, sites in Flood Zone 3a can be considered. More Vulnerable developments in Flood Zone 3a will require application of the Exception Test.
8. 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 Flood Zone 1, continuing sequentially with Flood Zone 2, then 3a. Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.
9. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied.
10. 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.
11. 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. By undertaking the Exception Test, 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 type is Highly Vulnerable, More Vulnerable, Less Vulnerable or Essential Infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test.

Windfall Sites

4.2.10 Windfall sites are those which have not been specifically identified within in the Local Plan process or they are below the site size threshold to be considered. 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 of windfall development that would be acceptable or not in Sequential Test terms.

4.3 Applying Sequential Test – Planning Applications

4.3.1 It is necessary to undertake a sequential test for a planning application if both of the following apply:

- The proposed development is in Flood Zone 2 or 3.
- A sequential test hasn't already been done for a development of the type you plan to carry out on your proposed site (check with EBC).

4.3.2 The Environment Agency publication 'Demonstrating the flood risk Sequential Test for Planning Applications[26]' 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).
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan.
- State the method used for comparing flood risk between sites; for example the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources.
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s).
- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- Where necessary, as indicated by Table 4-2, apply the Exception Test.
- Apply the Sequential approach to locating development within the site, as described in Section 5.2.

4.3.3 It should be noted that it is for EBC, 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.

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

4.3.4 Ultimately, after applying the Sequential Test, EBC 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 (see Section 6) and is necessary regardless of whether the Exception Test is required.

Sequential Test Exemptions

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

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

4.4 Exception Test

4.4.1 The purpose of the Exception Test is to ensure that, following the application of the Sequential Test, new development is only permitted in Flood Zone 2 and 3 where flood risk is clearly outweighed by other sustainability factors and where the development will be safe during its lifetime, considering climate change.

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.*

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 determine Part 1) of the Exception Test, applicants should assess their scheme against the objectives within the Sustainability Appraisal (SA) Framework as set out in the SCC Waste Local Plant[27] and reproduced in Table 4-3 overleaf.

4.4.5 In order to demonstrate satisfaction of Part 2) of the Exception Test, the measures presented within Section 5 should be applied and demonstrated within a site-specific FRA as detailed in Section 6.

[27] SCC, Environmental & Sustainability Report, https://www.surreycc.gov.uk/__data/assets/pdf_file/0010/150013/SWLP-E-and-SR-Preliminary-Draft-12-17.pdf

Table 4-3 SCC Sustainability Appraisal Framework Objectives[28] (December 2017)

Sustainability Appraisal Objective
Strategic Objective 1: To make sure enough waste management capacity is provided to manage the equivalent amount of waste produced in Surrey.
Strategic Objective 2: To encourage development which supports sustainable waste management in line with national targets for recycling, recovery & composting.
Strategic Objective 3: To manage landfill as an option of last resort, but one that is important for managing residual waste that cannot be treated in any other way.
Strategic Objective 4: To retain & make best use of existing sites for waste development through supporting redevelopment & enhancement of facilities
Strategic Objective 5: To direct new facilities to locations that have been identified as suitable for waste development.
Strategic Objective 6: To encourage innovation & new technologies which provide opportunities to minimise the negative impacts & enhance the positive impacts of waste development on communities & the environment
Strategic Objective 7: To keep waste movement by road to minimum practicable levels & support options for sustainable transport.
Strategic Objective 8: To work closely with our partners such as Surrey Waste Partnership, District & Borough councils & other WPAs to deliver the SWLP.

[28] https://www.surreycc.gov.uk/__data/assets/pdf_file/0010/150013/SWLP-E-and-SR-Preliminary-Draft-12-17.pdf

5. Managing and Mitigating Flood Risk

5.1 Overview

5.1.1 The NPPF[1] appreciates that it may not always be possible to avoid locating development in areas at risk of flooding. This Section provides guidance on the range of measures that could be considered in order to manage and mitigate flood risk. These measures should be considered when preparing a site-specific FRA as described in Section 6; Table 6-2 sets out which of these measures would need to be considered as part of proposals for householder developments, extensions and new developments.

5.1.2 As noted in Section 3.10, 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 (up to 2115) for residential developments; and
- 75 years (up to 2090) for commercial / industrial developments, or other time horizon specific to the non-residential use proposed.

5.2 Development Layout and Sequential Approach

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

5.2.1 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.

5.3 Finished Floor Levels

All More Vulnerable and Highly Vulnerable development within Flood Zones 2 and 3 should set Finished Floor Levels 300mm above the known or modelled 1 in 100 year (1% AEP) flood level including an allowance for climate change.

5.3.1 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 to a freeboard level above the design flood level.

5.3.2 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 EBC should be approached using their respective pre-application enquiry services to discuss options for a reduction in the minimum internal ground floor levels provided flood resistance measures are implemented up to an agreed level. There are also circumstances where flood resilience measures should be considered first. These are described further below. For both Less

and More Vulnerable developments where internal access to higher floors is required, the associated plans showing the access routes and floor levels should be included within any site-specific FRA.

5.3.3 Table 5-1 provides an overview of the requirements for finished floor levels for development in Elmbridge.

Table 5-1 Finished Floor Levels

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 EBC 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 and resistance techniques to be included in accordance with 'Improving the flood performance of new buildings' CLG (2007). OR, Floor levels within the extension will be set 300mm above the known or modelled 1 in 100 year river flood event (1% AEP) 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 EBC 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 in accordance with 'Improving the flood performance of new buildings' CLG (2007).
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 in 100 year (1% AEP) flood level 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 either 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 (refer to Section 5.6). Such refuges will have to be permanent and accessible to all occupants and users of the site and a FWEP should be prepared to document the actions to take in the event of a flood (refer Section 5.11).	
Basements	Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units are not be 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 in 100 year (1% AEP) flood level including climate change must be provided for all other basements, basement extensions and conversions.	All basements, basement extensions and conversions must have internal access to a higher floor situated 300mm above the 1 in 100 year (1% AEP) flood level including climate change.

5.4 Flood Resistance 'Water Exclusion Strategy'

5.4.1 There is a range of flood resistance and resilience construction techniques that can be implemented in new developments to mitigate potential flood damage. The Department for Communities and Local Government (DCLG) have published a document *'Improving the Flood Performance of New Buildings,*

Flood Resilient Construction[29], the aim of which is to provide guidance to developers and designers on how to improve the resistance and resilience of new properties to flooding through the use of suitable materials and construction details. Figure 5-1 provides a summary of the Water Exclusion Strategy (flood resistance measures) and Water Entry Strategy (flood resilience measures) which can be adopted depending on the depth of floodwater that could be experienced.

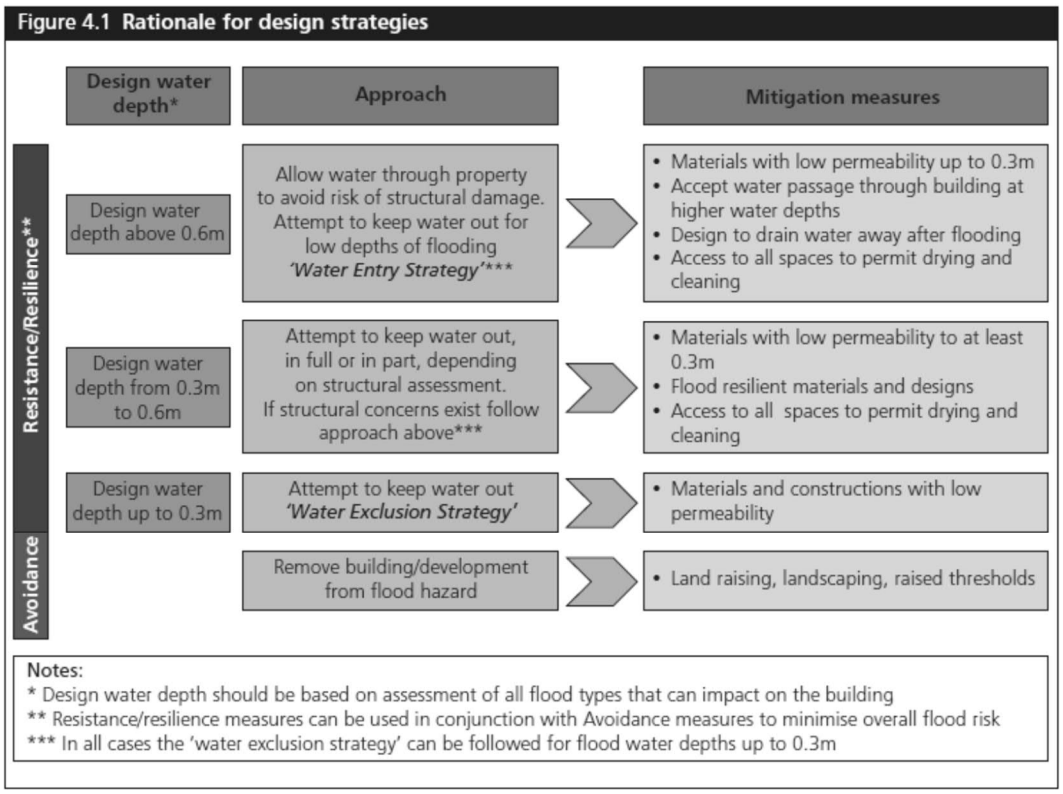


Figure 5-1 Flood Resistant / Resilient Design Strategies, Improving Flood Performance, CLG 2007

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

In areas at risk of flooding of low depths (<0.3m), implement flood resistance measures such as:

- Using materials and construction with low permeability.
- Land raising (without leading to displacement).
- Landscaping e.g. creation of low earth bunds (subject to this not increasing flood risk to neighbouring properties).
- Raising thresholds and finished floor levels e.g. porches with higher thresholds than main entrance.
- Flood gates with waterproof seals.
- Sump and pump for floodwater to remove waste faster than it enters.

5.4.3 There are a range of property flood protection devices available on the market which are designed specifically to resist the passage of floodwater (Figure 5-2 and Figure 5-3). 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 devises such as air vent covers, if left

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

in place by occupants as a precautionary measure, may compromise safe ventilation of the building in accordance with Building Regulations.

Figure 5-2 Examples of flood barriers, air bricks and non-return valves

Figure 5-3 Example of flood gates

5.5 Flood Resilience 'Water Entry Strategy'

5.5.1 For flood depths greater than 0.6m, it is likely that structural damage could occur in traditional masonry construction due to excessive water pressures. In these circumstances, the strategy should be to allow water into the building, but to implement careful design in order to minimise damage and allow rapid re-occupancy. This is referred to as the Water Entry Strategy. These measures are appropriate for uses where temporary disruption is acceptable and suitable flood warning is received.

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

In areas at risk of frequent or prolonged flooding, implement flood resilience measures such as:

- Use materials with either, good drying and cleaning properties, or, sacrificial materials that can easily be replaced post-flood.
- Design for water to drain away after flooding.

- Design access to all spaces to permit drying and cleaning.
- Raise the level of electrical wiring, appliances and utility metres.
- Coat walls with internal cement based renders; apply tanking on the inside of all internal walls.
- Ground supported floors with concrete slabs coated with impermeable membrane.
- Tank basements, cellars or ground floors with water resistant membranes.
- Use plastic water resistant internal doors.

5.5.3 Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in '*Improving the Flood Performance of New Buildings, Flood Resilient Construction*'[30].

Structures

5.5.4 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.

5.6 Safe Access and Egress

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

5.6.2 A safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g. within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances. This is of particular importance when contemplating development on sites located on dry islands (as described in Section 3.10). A safe access route is an important part of emergency planning and should be included within an evacuation plan (see Section 5.11).

5.6.3 Guidance prepared by the Environment Agency[31] 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 management is clarified in the above mentioned publication.

Table 5-2 Hazard to People Rating *(HR=d x (v +0.5) +DF)* (Table 8.2 FD2320/TR2)[32]

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

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

[30] CLG, 2007, Improving the Flood Performance of New Buildings, Flood Resilient Construction. http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf?bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=flood_performance.pdf
[31] Environment Agency, HR Wallingford, May 2008, Supplementary note on Flood hazard ratings and thresholds for development planning and control purpose. Clarification of Table 13.1 FD2320/TR2 and Figure 3.2 FD2321/TR1. http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2321_7400_PR_pdf.sflb.ashx
[32] DEFRA, Environment Agency, March 2006, Flood Risks to People Phase 2 FD2321/TR2 Guidance Document.

- 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.

In all these cases, a 'dry' access/egress is a route located above the 1 in 100 year (1% AEP) flood level including an allowance for climate change.

Safe Refuge

5.6.4 In exceptional circumstances, dry access above the 1 in 100 year (1% AEP) flood level including climate change may not be achievable. In these circumstances the Environment Agency and EBC should be consulted to ensure that the safety of the site occupants can be satisfactorily managed. This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed egress route. 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.

5.7 Floodplain Compensation Storage

All new development within Flood Zone 3 must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

5.7.1 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 betterment with respect to floodplain storage.

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

5.7.3 As depicted in Figure 5-4 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 be in the immediate vicinity, in the applicant's ownership and linked to the site[33]. Floodplain compensation must be considered in the context of the 1 in 100 year (1% AEP) 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 C62434.

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

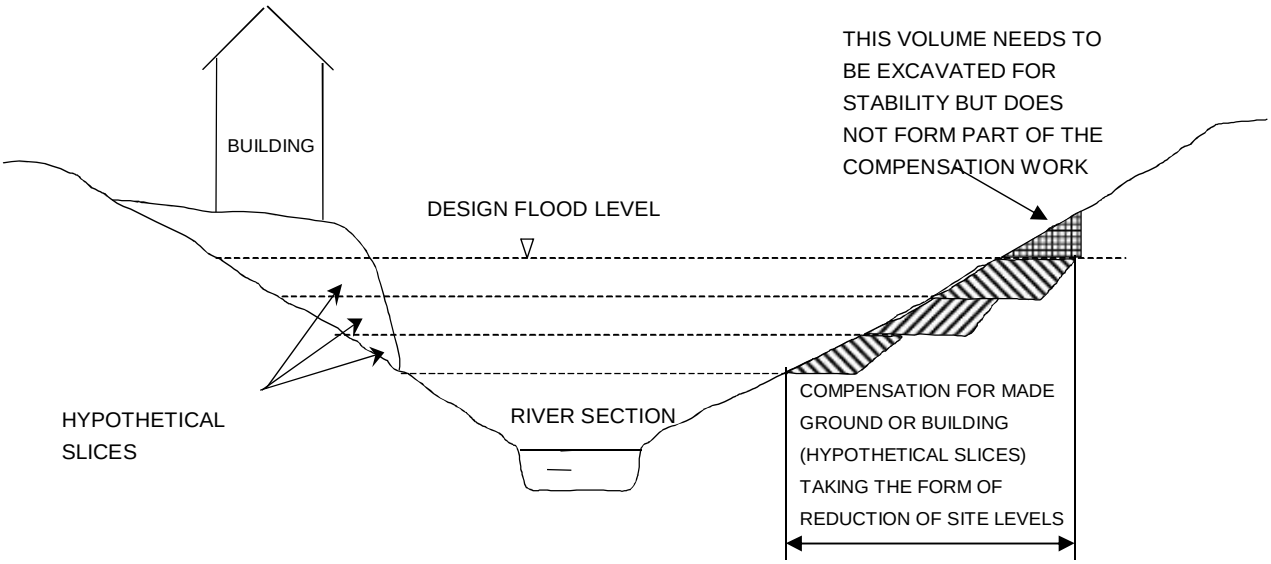


Figure 5-4 Example of Floodplain Compensation Storage (Environment Agency 2009)

5.7.4 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.

Flood Voids

5.7.5 The use of under-floor voids with adequate openings beneath the raised finished floor levels can be considered for development in Flood Zone 2 and 3. They are generally considered to provide indirect compensation or mitigation, but not true compensation for loss of floodplain storage. The use of under-floor voids will typically require a specific planning condition alongside the approved plans as well as a maintenance plan for them to remain open for the lifetime of the development to be enforced by the Local Planning Authority. Sole reliance on the use of under-floor voids to address the loss of floodplain storage capacity is generally not acceptable on undeveloped sites or for individual properties.

5.7.6 Should it not be possible to achieve all the level for level compensation required, the Environment Agency may consider that the remainder be provided through the use of under-floor voids instead. The amount of level for level compensation would need to be maximised and any under-floor voids would need to be appropriately designed and kept clear to enable them to function effectively.

5.7.7 Ideally, void openings should be a minimum of 1m long and open from existing ground levels to at least the 1 in 100 year (1% AEP) plus climate change flood level. By setting finished floor levels at 300mm above the design flood level, there is usually enough space provision for voids below. There should be a minimum of 1m of open void length per 5m length of wall. Void openings should be provided along all external walls of the proposed extension. If security is an issue, 10mm diameter vertical bars set at 100mm centres can be incorporated into the void openings. The Environment Agency is likely to seek confirmation from EBC through a planning condition that the voids be maintained in a free and open condition for the lifetime of the development.

Car Parks

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

of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary.

5.8 Flood Routing

All new development in Flood Zones 2 and 3 should not adversely affect flood routing and thereby increase flood risk elsewhere.

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

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

5.8.1 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.

5.8.2 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.

5.8.3 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.

5.9 Riverside Development

Retain an 8 metre wide undeveloped buffer strip alongside Main Rivers and explore opportunities for riverside restoration. Retain a 5 metre wide buffer strip alongside Ordinary 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.

5.9.1 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 will seek a 5 metre wide undeveloped buffer strip to be retained alongside Ordinary Watercourses.

5.9.2 Under Section 109 of the Water Resources Act 1991 and/or Environment Agency Byelaws, any works within 8 metres of any statutory Main River (both open channels and culverted sections), on or near a flood defence structure or in a floodplain requires an Environment Agency Flood Risk Activity Permit under the Environmental Permitting regulations. Whilst Flood Defence Consents are dealt with outside of the planning process, since requirements of the consenting process in relation to flood risk, biodiversity and pollution may result in changes to development proposals or construction methods, the Environment Agency aims to advise on such issues as part of its statutory consultee role in the planning process. Should proposed works not require planning permission from the Local Planning Authority, the Environment Agency should be consulted regarding permission to do work on or near a river, flood or sea defence by contacting enquiries@environment-agency.gov.uk.

5.9.3 As of 6 April 2012 responsibility for the consenting of works by third parties on Ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) has transferred from the Environment Agency to the LLFA, SCC. SCC is now responsible for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. This includes any works (including temporary) within 8 metres that affect flow within the channel (such as in channel structures or diversion of watercourses). Enquiries and applications for ordinary watercourse consent can be found on the SCC website[35].

5.10 Surface Water Management

All major[36] developments and other development should not result in an increase in surface water runoff, and where possible, should demonstrate betterment in terms of rate and volumes of surface water runoff.

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 published by DCLG and Department for the Environment, Food and Rural Affairs (DEFRA)[37]. In line with the Elmbridge Core Strategy, SuDS must be implemented for sites in Flood Zone 2 and 3. SuDS must be considered for sites in Flood Zone 1.

5.10.1 Suitable surface water management measures should be incorporated into new development designs in order to reduce and manage surface water flood risk to, and posed by the proposed development. This should ideally be achieved by incorporating (SuDS).

5.10.2 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. Where possible SuDS solutions for a site should seek to:

1. Reduce flood risk (to the site and neighbouring areas),
2. Reduce pollution, and
3. Provide landscape and wildlife benefits.

5.10.3 Generally the aim should be to discharge surface water run-off as high up the following hierarchy of drainage options as reasonably practicable:

1. Into the ground (infiltration)
2. To a surface water body
3. To a surface water sewer, highway drain, or another drainage system
4. To a combined sewer

5.10.4 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[38] 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 base flows of local watercourses, but where groundwater sources are vulnerable or there is risk of contamination, infiltration techniques are not suitable.

[35] https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/ordinary-watercourse-consents
[36] Major development – 10 or more dwellings and 1000 sqm floor space
[37] Sustainable drainage systems: non-statutory technical standards - https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards; PPG Flood Risk and Coastal Change - http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/reducing-the-causes-and-impacts-of-flooding/why-are-sustainable-drainage-systems-important/
[38] CIRIA C697 SuDS Manual. https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

- **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.

5.10.5 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 5-3 has been reproduced from the SuDS Manual, CIRIA C697 and outlines typical SuDS techniques.

5.10.6 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.

Table 5-3 Typical SuDS Components (Y; primary process. * some opportunities, subject to design)

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		Y		

Technique	Description	Conveyance	Detention	Infiltration	Harvesting
	similar to a standard roof (CIRIA C697).				
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

5.10.7 The use of infiltration techniques is highly dependent on the underlying ground conditions. As part of this SFRA, an assessment of the suitability of using infiltration SuDS techniques across the Borough has been undertaken using the detailed BGS Infiltration SuDS Map. Detail about this dataset is provided in Section 2.3.

Appendix B, Figure B6 Infiltration SuDS Map

Appendix A Settlement Area Schedules

5.10.8 In broad terms, areas along the Main River valleys and the northern parts of EBC area have the greatest constraints on the use of SuDS, and in particular in those areas where the depth to the water table is less than 3m below the ground surface.

5.10.9 The areas with most potential for widespread use of infiltration SuDS are those in the centre and west of the Borough (Esher and Weybridge) which are underlain by Bagshot Formation, a permeable sandy material and where the depth to the water table is greater than 5m below the ground surface.

5.10.10 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

5.10.11 A set of non-statutory Technical Standards have been published, to be used in conjunction with supporting guidance in the PPG[2], which set the requirements for the design, construction, maintenance and operation of sustainable drainage systems (SuDS).

5.10.12 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 (1% AEP) 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 (1% AEP) 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 (1% AEP), 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 (1% AEP), 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 (1% AEP) rainfall event in any part of: a 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 (1% AEP) rainfall event are managed in exceedance routes that minimise the risks to people and property.

5.10.13 From 6 April 2015, all major development[39] should include provision for SuDS. The LLLFA is a statutory consultee for these schemes and a Model Surface Water Drainage Statement will need to be completed and signed by a competent drainage engineer to accompany any planning application[40]. This must be cross-referenced within an FRA where appropriate.

5.10.14 Guidance on the evidence required to comply with the technical standards of SuDS in developments is available from SCC on their website[41]. 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. The LLFAs of South East England have also produced a useful document outlining the process for integrating SuDS into developments[42]. For smaller schemes (including minor development) located within Flood Zones 2 and 3, SuDS will need to be addressed as part of an FRA and will be assessed by EBC.

5.11 Flood Warning and Evacuation Plans

5.11.1 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.

[39] Major development as defined in the Town and County Planning (Development Management Procedure) (England) Order 2010
[40] SuDS Planning Advice - https://www.surreycc.gov.uk/__data/assets/pdf_file/0006/116169/SuDS-Advice-Note-2017.pdf
[41] https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/suds-planning-advice
[42] Water, People, Places: A guide for master planning sustainable drainage into development – https://www.susdrain.org/files/resources/other-guidance/water_people_places_guidance_for_master_planning_sustainable_drainage_into_developments.pdf

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

For sites in Flood Zone 1 that are located on 'dry islands' (as described in Section 3.10), it may also be necessary to prepare a Flood Warning and Evacuation Plan to determine potential egress routes away from the site through areas that may be at risk of flooding during the 1 in 100 year (1% AEP) flood event including an allowance for climate change.

The Environment Agency has a tool on their website to create a Personal Flood Plan[43]. 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.

5.11.2 Flood Warning and Evacuation Plans should include:

How flood warning is to be provided, such as:

- availability of existing flood warning systems (refer Table 5-4);
- 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.)

5.11.3 Details of what could be included in a Personal Flood Plan are provided by the Environment Agency using their tool[43].

5.11.4 There is no statutory requirement for the Environment Agency or the emergency services to approve evacuation plans. EBC will assess the suitability of the plan during the application, this should be done in consultation. An informative drawing the attention to the plan should be attached to any forthcoming decision notice. The responsibility to enact the plan in the event of a flood incident lies with the occupant.

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

5.12 Flood Warning Areas and Emergency Rest Centres

Appendix B, Figure B9 Flood Warning Areas and Rest Centres

5.12.1 There are 18 flood warning areas within the Borough, as shown in Figure B9 and Table 5-4. The Environment Agency issues flood warnings to residents and businesses that have registered for the service in these specific areas when flooding is expected.

Table 5-4 Environment Agency Flood Warning Areas (refer to Figure B9)

Watercourse	Environment Agency Flood Warning Area (Name)
River Wey	Properties closest to the River Wey between Walsham Meadow and Byfleet town
	River Wey at Weybridge
	River Wey at Wisley and Byfleet
Thames	Properties closest to the River Thames at Sunbury
	Properties closest to the River Thames from Platts Eyot to Hampton Court Bridge
	Properties closest to the River Thames from Shepperton Lock to Beasley's Ait
	River Thames at East and West Molesey
	River Thames at Hampton Court
	River Thames at Hampton and Hampton Wick
	River Thames at Shepperton and Lower Halliford
	River Thames at Sunbury
	River Thames at Thames Ditton
	River Thames at Thames Ditton Island
	River Thames at Walton
Mole	River Mole at Esher and East Molesey
	River Mole at Leatherhead and Fetcham
	River Mole at Stoke D'Abernon, Cobham and South Hersham
Rythe	The River Rythe between Oxshott and Thames Ditton

5.12.2 EBC has 7 emergency rest centres as identified in Appendix B, Figure B9 in the urban areas of Weybridge (Churchfield Road), Walton (Manor Road), East Molesey (Bishops Fox Way), Thames Ditton (Mercer Close), Claygate (Elm Road), Hersham (Queen's Road) and Cobham (Oakdene Road). It should be noted that although these have been identified as emergency rest centres, whether each of the centres are operational during a flood event is dependent upon the locations and extent of flooding across the Borough at that particular time. The Multi Agency Flood Plan prepared by EBC will provide more detail on the appropriate use of each rest centre.

Appendix B, Figure B9 Flood Warning Areas and Rest Centres

Appendix A Settlement Area Schedules

6. Guidance for Site-Specific FRAs

6.1 What is a Flood Risk Assessment?

6.1.1 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 according to paragraph 100 of the NPPF[1] and PPG[2]. An FRA must be prepared by a suitably qualified and experienced person and must contain all the information needed to allow EBC to satisfy itself that the requirements have been met.

6.2 When is a Flood Risk Assessment required?

The NPPF (paragraph 163) states that a site-specific FRA is required in the following circumstances:

- Proposals for new development (including minor development[44] 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)[45].
- 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.

6.3 How detailed should a FRA be?

6.3.1 The PPG[2]states that site-specific FRAs should be proportionate to the degree of flood risk, the scale and nature of the development, its vulnerability classification (Table 4-1) and the status of the site in relation to the Sequential and Exception Tests. Site-specific FRAs should also make optimum use of readily available information, for example the mapping presented within this SFRA and available on the Environment Agency website, although in some cases additional modelling or detailed calculations will need to be undertaken. For example, where the development is an extension to an existing house (for which planning permission is required) which would not significantly increase the number of people present in an area at risk of flooding, EBC 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 EBC 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.

6.3.2 As a result, the scope of each site-specific FRA will vary considerably. Table 6-1 presents the different levels of site-specific FRA as defined in the CIRIA publication C624[46] 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

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

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

[46] CIRIA, 2004, Development and flood risk – guidance for the construction industry C624.

risk elsewhere and where possible, reduce flood risk overall. Failure to provide sufficient information will result in applications being refused.

Table 6-1 Levels of Site-Specific Flood Risk Assessment

Description
Level 1 Screening study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information. The screening study will ascertain whether a FRA Level 2 or 3 is required. Typical **sources of information** include: • EBC SFRA • Flood Map for Planning (Rivers and Sea) • Environment Agency Standing Advice • NPPF[1] Tables 1, 2 and 3
Level 2 Scoping study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include: • An appraisal of the availability and adequacy of existing information; • A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; and • An appraisal of the scope of possible measures to reduce flood risk to acceptable levels. The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development. Typical **sources of information** include those listed above, plus: • Local policy statements or guidance. • Lower Thames Catchment Flood Management Plan. • Surrey County Council PFRA and Local Flood Risk Management Strategy (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
Level 3 Detailed study to be undertaken if a Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include: • Quantitative appraisal of the potential flood risk to the development; • Quantitative appraisal of the potential impact of the development site on flood risk elsewhere; and • Quantitative demonstration of the effectiveness of any proposed mitigations measures. Typical **sources of information** include those listed above, plus: • Detailed topographical survey. • Detailed hydrographic survey. • Site-specific hydrological and hydraulic modelling studies which should include the effects of the proposed development. • Monitoring to assist with model calibration/verification. • Continued consultation with the LPA, Environment Agency and other flood risk consultees.

Environment Agency Data Requests

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

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

6.3.4 Products 1 – 6 can be used to inform a Level 2 FRA. In some cases, it may be appropriate to obtain Product 7 and to use as the basis for developing a site-specific model for a proposed development as part of a Level 3 FRA. This can be requested via either their National Customer Contact Centre via enquiries@environment-agency.gov.uk or by telephone on 03708 506 506.

Modelling of Ordinary Watercourses

6.3.5 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).

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

6.4.1 The PPG[2] 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.

6.5 Flood Risk Assessment Checklist

6.5.1 Table 6-2 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. As described in Section 6.3, 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. This will be a validation requirement once the Council has updated its validation checklist and proposals that are submitted without the completed Checklist will be regarded as invalid.

Table 6-2 Site-Specific Flood Risk Assessment Checklist (building on guidance in PPG[2])

What to Include in the FRA		Source(s) of Information
1.Site Description		
Site address	-	-
Site description	-	-
Location plan	*Including geographical features, street names, catchment areas, watercourses and other bodies of water*	*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, Figure B1* *Site Survey*

What to Include in the FRA		Source(s) of Information
Geology	*General description of geology local to the site.*	*SFRA Appendix B, Figure B2, B3* *Ground Investigation Report*
Watercourses	*Identify Main Rivers and Ordinary Watercourses local to the site.*	*SFRA Appendix B, Figure B4*
2. Assessing Flood Risk		
The level of assessment will depend on the degree of flood risk and the scale, nature and location of the proposed development. Refer to Table 5-1 regarding the levels of assessment. Not all of the prompts listed below will be relevant for every application.		
Flooding from Rivers	*Provide a plan of the site and Flood Zones.* *Identify any historic flooding that has affected the site, including dates and depths where possible.* *How is the site likely to be affected by climate change?* *Determine flood levels on the site for the 1% AEP (1 in 100 chance each year) flood event including an allowance for climate change.* *Determine flood hazard on the site (in terms of flood depth and velocity).* *Undertake new hydraulic modelling to determine the flood level, depth, velocity, hazard, rate of onset of flooding on the site.*	*SFRA Appendix C* *Environment Agency Flood Map for Planning (Rivers and Sea).* *Environment Agency Products 1-7.* *New hydraulic model.*
Flooding from Land	*Identify any historic flooding that has affected the site.* *Review the local topography and conduce a site walkover to determine low points at risk of surface water flooding.* *Review the Risk of Flooding from Surface Water mapping.* *Where necessary, undertake modelling to assess surface water flood risk.*	*SFRA Appendix F.* *Topographic survey.* *Site walkover.* *Risk of Flooding from Surface Water mapping (EA website).* *New modelling study.*
Flooding from Groundwater	*Desk based assessment based on high level BGS mapping in the SFRA.* *Ground survey investigations.* *Identify any historic flooding that has affected the site.*	*SFRA Appendix B, Figure B2, B3, B5.* *Ground Investigation Report*
Flooding from Sewers	*Identify any historic flooding that has affected the site.*	*Refer SFRA Section 3.13, Appendix B Figures B7 and B8.* *Where appropriate an asset location survey can be provided by Thames Water Utilities Ltd http://www.thameswater-propertysearches.co.uk/*
Reservoirs, canals and other artificial sources	*Identify any historic flooding that has affected the site.* *Review the Risk of Flooding from Reservoirs mapping.*	*Risk of Flooding from Reservoirs mapping (EA website). Refer SFRA Section 3.14.*
3. Proposed Development		
Current use	*Identify the current use of the site.*	-
Proposed use	*Will the proposals increase the number of occupants / site users on the site such that it may affect the degree of flood risk to these people?*	-
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*
Avoiding Flood Risk (not applicable for households/small scale developments)		
Sequential Test	*Determine whether the Sequential Test is required.* *Consult EBC to determine if the site has been included in the Sequential Test.* *If required, present the relevant information to EBC to enable their determination of the Sequential Test for the site on an individual basis.*	*SFRA Section 4.3*

What to Include in the FRA		Source(s) of Information
Exception Test	*Determine whether the Exception Test is necessary.* *Where the Exception Test is necessary, present details of:* *Part 1) how the proposed development contributes to the achievement of wider sustainability objectives as set out in the EBC Sustainability Appraisal Scoping Report.* *(Details of how part 2) can be satisfied are addressed in the following part 5 'Managing and Mitigating Flood Risk'.)*	*SFRA Table 4-2* *Refer to Elmbridge SA Scoping Report sustainability objectives presented in SFRA Table 4-3.*

Managing and Mitigating Flood Risk

Section 5 of the SFRA presents measures to manage and mitigate flood risk and when they should be implemented. Where appropriate, the following should be demonstrated within the FRA to address the following questions:

How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime?

How will you ensure that the proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?

Are there any opportunities offered by the development to reduce flood risk elsewhere?

What flood-related risks will remain after you have implemented the measures to protect the site from flooding (i.e. residual risk) and how and by whom will these be managed over the lifetime of the development (e.g. flood warning and evacuation procedures)?

Development Layout and Sequential Approach	*Plan showing how sensitive land uses have been placed in areas within the site that are at least risk of flooding.*	*SFRA Section 5.2*
Finished Floor Levels	*Plans showing finished floor levels in the proposed development in relation to Ordnance Datum taking account of indicated flood depths.*	*SFRA Section 5.3*
Flood Resistance	*Details of flood resistance measures that have been incorporated into the design. Include design drawings where appropriate.*	*SFRA Section 5.4*
Flood Resilience	*Details of flood resilience measures that have been incorporated into the design. Include design drawings where appropriate.*	*SFRA Section 5.5*
Safe Access / Egress	*Provide a figure showing proposed safe route of escape away from the site and/or details of safe refuge. Include details of signage that will be included on site.* *Where necessary this will involve mapping of flood hazard associated with river flooding. This may be available from Environment Agency modelling, or may need to be prepared as part of hydraulic modelling specific for the proposed development site.*	*SFRA Section 5.6*
Floodplain Compensation Storage	*Provide calculations or results of a hydraulic modelling study to demonstrate that the proposed development provides compensatory flood storage and either will not increase flood risk to neighbouring areas or will result in an overall improvement. This should be located and designed to achieve level for level and volume for volume compensation, should be provided on land that is in hydrological continuity with the site within the applicant's ownership and subject to appropriate maintenance regimes for its lifetime. Include cross sectional drawings clearly showing existing and proposed site levels.*	*SFRA Section 5.7*
Flow Routing	*Provide evidence that proposed development will not impact flood flows to the extent that the risk to surrounding areas is increased. Where necessary this may require modelling.*	*SFRA Section 5.8*
Riverside Development Buffer Zone	*Provide plans showing how a buffer zone of relevant width will be retained adjacent to any Main River or Ordinary Watercourse in accordance with requirements of the Environment Agency or Surrey County Council.*	*SFRA Section 5.9*
Surface Water Management	*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*	*Surrey County Council website - https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-*

What to Include in the FRA		Source(s) of Information
	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 management arrangements*	*about-flooding/suds-planning-advice* *SFRA Section 5.10*
Flood Warning and Evacuation Plan	*Where appropriate reference the Flood Warning and Evacuation Plan or Personal Flood Plan that has been prepared for the proposed development (or will be prepared by site owners).*	*SFRA Section 5.11*

6.6 Pre-application Advice

6.6.1 At all stages, EBC, 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.

6.6.2 The Environment Agency, Surrey County Council and EBC each offer pre-application advice services which should be used to discuss particular requirements for specific applications.

- EBC http://www.elmbridge.gov.uk/planning/preapp/
- SCC https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/suds-planning-advice
- Environment Agency https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

6.6.3 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. This has also been included in Table 7-1.

7. Flood risk policy and development management approach

7.1 Overview

7.1.1 In order to encourage a holistic approach to flood risk management and ensure that flooding is taken into account at all stages of the planning process, this Section builds on the findings of the SFRA to set out the approach that EBC are adopting in relation to flood risk planning policy and with respect to development management decisions on a day-to-day basis.

7.1.2 Section 7.2 sets out the overarching policy approach for planning decisions within each of the NPPF[1] Flood Zones and with respect to a number of specific types of planning application. Section 7.3 presents a guide to the measures that should be considered for different types of proposed development within each of the NPPF[1] Flood Zones.

7.2 Policy Approach

7.2.1 The overall approach for development in each NPPF[1] Flood Zone is set out below:

Flood Zone 3b Functional Floodplain)

7.2.2 The Functional Floodplain as defined in this SFRA by EBC comprises undeveloped land within the 1 in 20 year (5% AEP) flood outline. These areas should be safeguarded from any development.

7.2.3 Where Water Compatible or Essential Infrastructure cannot be located elsewhere, it must:

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

7.2.4 Within the outline of the 1 in 20 year (5% AEP) flood extent there are areas of existing development which are prevented from flooding by the presence of existing infrastructure or solid buildings. In these developed areas, existing built footprints, where it can be demonstrated that they exclude floodwater, will not be defined as 'Functional Floodplain' and the planning requirements associated with Flood Zone 3b do not apply. The undeveloped land surrounding these buildings are important flow paths and flood storage areas and properties within these areas will be subject to frequent flooding; therefore care must be given to the future sustainability of any development.

7.2.5 The consideration of whether a site is 'developed' or 'undeveloped' will be considered on a case-by-case basis as part of the planning application process, having regard to the presence of existing buildings on the site and the existing routing of floodwater through the site during times of flood.

7.2.6 Where redevelopment is proposed in developed areas, schemes should not increase the vulnerability classification of the site. All schemes must result in a net reduction in flood risk and ensure that floodplain storage and flow routes are not affected. This can be achieved through a combination of on and off-site measures including:

- Reducing the land use vulnerability;
- Seeking opportunities to ensure there is no increase or achieve a reduction in the number of people at risk (e.g. avoiding conversions and rebuilds of properties that result in an increase in the number of residential dwellings);
- Maintaining or reducing the built footprint

- Raising finished floor levels;
- Reducing surface water runoff rates and volumes from the site;
- Increasing floodplain storage capacity and creating space for flooding to occur by restoring functional floodplain;
- Reducing impedance to floodwater flow and restoring flood flow paths;
- Incorporating flood resilient and/or resistance measures;
- Ensuring development remains safe for users in time of flood (this may refer to the timely evacuation of properties prior to the onset of flooding in accordance with an individual Flood Warning and Evacuation Plan for the site).

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

7.2.8 Where minor development is proposed, schemes should not affect floodplain storage or flow routes through the incorporation of raised finished floor levels, voids and where possible direct or indirect floodplain compensation, flood resilience measures, the removal of other non-floodable structures or replacement of impermeable surfaces with permeable, improved surface water drainage through the implementation of SuDS features such as rainwater harvesting, living roofs, infiltration trenches/soakaways and below ground attenuation tanks in line with CIRIA guidance on SuDS.

Flood Zone 3a High Probability

7.2.9 Flood Zone 3a High Probability comprises land having a 1 in 100 year (1% AEP)or greater. Where development is proposed opportunities should be sought to:

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

Flood Zone 2 Medium Probability

7.2.10 Flood Zone 2 Medium Probability comprises land having between a 1 in 100 year (1% AEP) and 1 in 1000 (0.1% AEP) of flooding from fluvial watercourses. Where development is proposed in areas of Flood Zone 2, the planning policy approach is similar to Flood Zone 3a. Opportunities should be sought to:

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

Flood Zone 1 Low Probability

7.2.11 Flood Zone 1 Low Probability comprises land having a less than 1 in 1000 year (0.1%) AEP of flooding from fluvial watercourses. Where development over 1ha is proposed or there is evidence of flooding from another localised source in areas of Flood Zone 1, opportunities should be sought to:

- Ensure that the management of surface water runoff from the site is considered early in the site planning and design process;

- Ensure safe access and egress and create space for flooding to occur;
- Ensure that proposals achieve an overall reduction in the level of flood risk to the surrounding area, through the appropriate application of sustainable drainage techniques.

Cumulative Impact of Minor and Permitted Development

7.2.12 The PPG[2]advises that minor developments (as defined in Section 6.2) are unlikely to result in significant flood risk issues unless:

- they would have an adverse effect on a watercourse, floodplain or its flood defences;
- they would impede access to flood defence and management facilities; or
- where the cumulative impact of such developments would have a significant impact on local flood storage capacity or flood flows.

7.2.13 In parts of Elmbridge there is potential for both minor development as well as permitted development to be considered to be having a cumulative impact on flood risk in the local area as a result of impacts on local flood storage capacity and flood flows. Given the small scale of the development in the context of the wider fluvial catchments it is not possible to undertake modelling to confirm the impact of such development. This is a particular concern in the areas of Weybridge, Molesey and Thames Ditton where areas of existing development lie within the 1 in 20 year (5% AEP) flood outline.

7.2.14 **It is recommended that EBC consider making an Article 4 direction[47] to remove national permitted development rights for developed areas of land within Flood Zone 3b where cumulative impact is considered to be a problem e.g. the River Wey floodplain in the Weybridge Settlement Area. The removal of permitted development rights will ensure that a planning application and site-specific FRA will be required for *any* development in these areas.**

7.2.15 FRAs for all minor development within Flood Zone 3 should demonstrate that the proposal is safe and will not increase flood risk elsewhere by not impeding the flow of flood water, reducing storage capacity of the floodplain. Details of flood mitigation measures to reduce the impact of flooding on the proposed development and ensure that the proposed development does not result in an increase in maximum flood levels within adjoining properties should be provided. This may be achieved by ensuring (for example) that the existing building footprint is not increased, that overland flow routes are not truncated by buildings and/or infrastructure, hydraulically linked compensatory flood storage is provided within the site (or upstream), and/or the incorporation of floodable voids. It is acknowledged that full compensation may not be possible on all minor developments, however, an applicant must be able to demonstrate that every effort has been made to achieve this and provide full justification where this is not the case.

Changes of Use

7.2.16 Where a development undergoes a change of use and the vulnerability classification of the development changes, there may be an increase in flood risk. For example, changing from industrial use to residential use will increase the vulnerability classification from Less to More Vulnerable (Table 4-1).

7.2.17 For change of use applications in Flood Zone 2 and 3, applicants must submit a FRA with their application. This should demonstrate how the flood risks to the development will be managed so that it remains safe through its lifetime including provision of safe access and egress and preparation of Flood Warning and Evacuation Plans where necessary.

7.2.18 As changes of use are not subject to the Sequential or Exception tests, EBC should consider when formulating policy what changes of use will be acceptable, having regard to paragraph 157 (6th bullet) of the NPPF[1] and taking into account the findings of this SFRA. This is likely to depend on whether developments can be designed to be safe and that there is safe access and egress.

[47] An article 4 direction is a direction under article 4 of the General Permitted Development Order which enables the Secretary of State or the local planning authority to withdraw specified permitted development rights across a defined area.

Basement Extensions

7.2.19 Basements extensions may involve either the extension of an existing habitable basement under a house, or the construction of a completely new basement. It is becoming increasingly popular to construct basements which extend beyond the footprint of the host property and under the amenity area.

7.2.20 In accordance with the recommendation for EBC to consider the removal of permitted development rights in Flood Zone 3, EBC should require that all basement development in Flood Zone 3 seeks planning permission. Applications should be supported by a FRA as well as other reports and evidence formulating a Basement Impact Assessment (BIA). Table 7-1 identifies which management and mitigation measures will need to be addressed as part of a FRA for a basement extension, these are briefly described below.

7.2.21 In accordance with the PPG[2], self-contained dwellings or bedrooms at basement level in Flood Zone 3 should not be permitted due to the vulnerability of users. Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units are not acceptable in Flood Zone 3b. Basements for other uses in Flood Zone 3a and 2 may be granted provided there is a safe means to escape via internal access to higher floors 300mm above the 1 in 100 year (1% AEP) flood level including an allowance for climate change.

7.2.22 An FRA must provide details of an appropriate sustainable urban drainage system for the site and investigation to determine whether a perimeter drainage system or other suitable measure is necessary to ensure any existing sub-surface water flow regimes are not interrupted.

7.2.23 Basement development may affect groundwater flows, and even though the displaced water will find a new course around the area of obstruction this may have other consequences for nearby receptors e.g. buildings, trees. Emerging evidence shows that even where there are a number of consecutively constructed basement developments, the groundwater flows will find a new path. EBC may therefore require a Hydrology Report to be submitted with proposals. This report should be prepared by a structural engineering or hydrology firm that is fully accredited by the main professional institute(s) and therefore whose advice we would accept as independent.

7.2.24 The FRA must also address the impact of the proposed extension on the ability of the floodplain to store floodwater during the 1 in 100 year (1% AEP) event including allowance for climate change and where necessary provide compensatory floodplain storage on a level for level, volume for volume basis.

7.3 Development Management Measures

7.3.1 Table 7-1 sets out the measures that should be considered for different types of propose development within each NPPF[1] Flood Zone. Before consulting Table 7-1, refer to Table 4-1 to determine the vulnerability classification of the proposed development.

Table 7-1 Development Management Measures Summary Table

	All Development	Minor development				Other development				SFRA section
	Flood Zone 3b (Undeveloped – Functional Floodplain)	Flood Zone 3b (Developed)	Flood Zone 3a	Flood Zone 2	Flood Zone 1	Flood Zone 3b (Developed)	Flood Zone 3a	Flood Zone 2	Flood Zone 1	
Proposed Development Types	Flood Zone 3b (Undeveloped Functional Floodplain) should be protected from any new development. Only Essential Infrastructure or Water Compatible development may be permitted.	'Developed land' within Flood Zone 3b relates solely to existing buildings that are impermeable to flood water. Some minor development proposals may be considered. Change of use to a higher vulnerability classification is not permitted.	Land use should be restricted to Water Compatible or Less Vulnerable development. More Vulnerable development can be considered. Highly Vulnerable development is not appropriate.	Land use should be restricted to Water Compatible, Less Vulnerable or More Vulnerable development. Highly Vulnerable development can be considered.	No restrictions.	'Developed land' within Flood Zone 3b relates solely to existing buildings that are impermeable to flood water. Some re-development proposals may be considered. Change of use to a higher vulnerability classification is not permitted.	Land use should be restricted to Water Compatible or Less Vulnerable development. More Vulnerable development can be considered.	Land use should be restricted to Water Compatible, Less Vulnerable or Mole Vulnerable development. Highly Vulnerable development can be considered.	No restrictions.	Section 4.2 Table 4-2.
Basements	Not permitted.	Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units are not permitted.	Self-contained residential basements and bedrooms at basement level are not permitted. All basements, basement extensions and basement conversions may be considered. Regard will be had to whether the site is also affected by groundwater flooding.		No restrictions.	Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units are not permitted.	Self-contained residential basements and bedrooms at basement level are not permitted. All basements, basement extensions and basement conversions may be considered. Regard will be had to whether the site is also affected by groundwater flooding.		No restrictions.	Section 7.2
Flood Risk Assessment	Yes – for Essential Infrastructure	Yes – key outcomes must be: • How the development is likely to be affected by current or future flooding from any source • What measures are proposed to deal with these effects and risks are appropriate • Development does not increase the risk of flooding elsewhere by not impeding the flow of water or reducing storage capacity. It is acknowledged that full compensation may not be possible in all cases, but justification must be given. • Whether the development is safe for its lifetime			Required if site > 1 hectare, or there is evidence of a localised flood source.	Yes – key outcomes must be • How the development is likely to be affected by current or future flooding from any source • What measures are proposed to deal with these effects and risks are appropriate • Development results in an improvement to flood risk by not impeding the flow of water, reducing storage capacity or increasing the number of properties at risk of flooding • Evidence to support the application of the Sequential Test, where appropriate • Whether the development is safe for its lifetime and passes the Exception Test, if applicable			Required if site > 1 hectare, or there is evidence of a localised flood source.	Section 6.2
Sequential Test	Not required.	Not required	Not required	Not required	N/A	Yes – if not addressed at the Local Plan level and development type is not included in the list of exemptions			N/A	Section 4.2
Exception Test	Yes – required for Essential Infrastructure.	Not required	Not required	Not required	N/A	Yes – required for More Vulnerable development and Essential Infrastructure		Yes – required for Highly Vulnerable development	N/A	Section 4.3
Sequential approach to site planning	N/A	Yes	Yes	Yes	Yes – with respect to flooding from other sources.	Yes	Yes	Yes	Yes – with respect to flooding from other sources.	Section 5.2
Finished Floor Levels	N/A	For More Vulnerable development, floor levels should be set 300mm above modelled 1 in 100 year (1% AEP) flood level including an allowance for climate change. Floor levels may not need to be raised for new non-residential (Less Vulnerable) development as such development can be designed to be floodable. However, it is strongly recommended that internal access is provided to upper floors (first floor or mezzanine) to provide safe refuge. Sleeping accommodation should be restricted to first floor or above to ensure 'safe place'. Apply sequential approach within the building.			No minimum level specified. Floor levels should take account of any localised flood risk from surface water ponding.	For More Vulnerable development, floor levels should be set 300mm above modelled 1 in 100 year (1% AEP) flood level including an allowance for climate change. Floor levels may not need to be raised for new non-residential (Less Vulnerable) development as such development can be designed to be floodable. However, it is strongly recommended that internal access is provided to upper floors (first floor or mezzanine) to provide safe refuge. Sleeping accommodation should be restricted to first floor or above to ensure 'safe place'.			No minimum level specified. Floor levels should take account of any localised flood risk from surface water ponding.	Section5.3

	All Development	Minor development				Other development				SFRA section
	Flood Zone 3b (Undeveloped – Functional Floodplain)	Flood Zone 3b (Developed)	Flood Zone 3a	Flood Zone 2	Flood Zone 1	Flood Zone 3b (Developed)	Flood Zone 3a	Flood Zone 2	Flood Zone 1	
		Where permitted, basements will require internal access to a floor 300m above the 1 in 100 year (1% AEP) AEP flood event including an allowance for climate change.				Apply sequential approach within the building. Where permitted, basements will require internal access to a floor 300m above the 1 in 100 year (1% AEP) flood event including an allowance for climate change.				
Flood Resistance	N/A	Yes – typically applied in areas of flood depths <0.3m and between 0.3m and 0.6m where no structure concerns	Yes – typically applied in areas of flood depths <0.3m and between 0.3m and 0.6m where no structure concerns	Yes – typically applied in areas of flood depths <0.3m and between 0.3m and 0.6m where no structure concerns	Yes – with respect to surface water flood risk.	Yes - typically applied in areas of flood depths <0.3m and between 0.3m and 0.6m where no structure concerns	Yes - typically applied in areas of flood depths <0.3m and between 0.3m and 0.6m where no structure concerns	Yes - typically applied in areas of flood depths <0.3m and between 0.3m and 0.6m where no structure concerns	Yes – with respect to surface water flood risk.	Section 5.4
Flood Resilience	N/A	Yes – typically applied in areas of flood depths >0.6m.	Yes - typically applied in areas of flood depths >0.6m.	Yes - typically applied in areas of flood depths >0.6m.	Yes – with respect to surface water flood risk.	Yes - typically applied in areas of flood depths >0.6m.	Yes - typically applied in areas of flood depths >0.6m.	Yes - typically applied in areas of flood depths >0.6m.	Yes – with respect to surface water flood risk.	Section 5.5
Safe access/ egress	N/A	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 is low • If a dry route is not possible, a route for vehicles where the flood hazard is low • Safe refuge for people 'Dry' access/egress is a route located above the 1 in 100 year (1% AEP) flood event including an allowance for climate change.			Safe means of escape must be provided in relation to risk of flooding from other sources.	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 is low • If a dry route is not possible, a route for vehicles where the flood hazard is low • Safe refuge for people 'Dry' access/egress is a route located above the 1 in 100 year (1% AEP) flood event including an allowance for climate change.			Safe means of escape must be provided in relation to risk of flooding from other sources.	Section 5.6
Floodplain compensation storage	N/A	Yes - Development must not result in a net loss of flood storage capacity in relation to the 1% annual probability) flood event including allowance for climate change. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage. It is recognised that full compensation storage may not always be viable for minor development. In these cases justification must be provided and measures taken to mitigate loss of floodplain storage i.e. through measures to allow the passage of floodwater or provide storage (refer to 'flood voids', and 'flow routing' below).		Not required.		Yes - Development must not result in a net loss of flood storage capacity in relation to the 1in 100 year (1% AEP) flood event including allowance for climate change. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage. Where possible floodplain compensation should be provided on a level for level, volume for volume basis. It is recognised that full compensation storage will not be viable for sites wholly within Flood Zone 3. In these cases justification must be provided and measures taken to mitigate loss of floodplain storage i.e. through measures to allow the passage of floodwater or provide storage (refer to 'flood voids', and 'flow routing' below).		Not required.		Section 5.7
Flood voids	N/A	Yes – where it is not possible to provide floodplain compensation storage or full compensation cannot be achieved, flood voids can be used to provide mitigation. Flood voids should be appropriately designed and kept clear to enable them to function effectively.		Not required.		Yes – where it is not possible to provide floodplain compensation storage or full compensation cannot be achieved, flood voids can be used to provide mitigation. Void openings should be a minimum of 1m long and open from existing ground levels to at least the 1 in 100 year (1% AEP) plus climate change level. Minimum of 1m void length per 5m wall. Require maintenance plan and apply condition to ensure voids remain open for the lifetime of the development.		Not required.		Section 5.7
Flow routing	N/A	Yes - Minor development and new development should not adversely affect flood routing and thereby increase flood risk elsewhere. Opportunities should be sought within the site design to make space for water, such as: • Removing boundary walls or replacing with other boundary treatments such as hedges, fences (with gaps). • Considering alternatives to solid wooden gates, or ensuring that there is a gap beneath the gates to allow the passage of floodwater. • On uneven or sloping sites, consider lowering ground levels to extend the floodplain without creating ponds. The area of lowered ground must remain connected to the floodplain to allow water to flow back to river when levels recede. • Create under-croft car parks or consider reducing ground floor footprint and creating an open area under the building to allow flood water storage. • Where proposals entail floodable garages or outbuildings, consider designing a proportion of the external walls to be committed to free flow of floodwater.								Section 5.8

	All Development	Minor development				Other development				SFRA section
	Flood Zone 3b (Undeveloped – Functional Floodplain)	Flood Zone 3b (Developed)	Flood Zone 3a	Flood Zone 2	Flood Zone 1	Flood Zone 3b (Developed)	Flood Zone 3a	Flood Zone 2	Flood Zone 1	
Riverside development		Yes – Retain an 8m wide buffer strip alongside Main Rivers and seek opportunities for riverside restoration. Retain a 5m wide buffer strip alongside Ordinary Watercourses. All new development within 8m of a Main River or Ordinary Watercourse will require consent from the Environment Agency or Surrey County Council (as LLFA) respectively.								Section 5.9
Surface water management	N/A	Proposed development should not result in an increase in surface water runoff, and where possible, should demonstrate betterment in terms of rate and volumes of surface water runoff. Proposed development should implement Sustainable Drainage Systems (SuDS) in accordance with the requirements of the 'Non-statutory technical standards for sustainable drainage systems'[48], to reduce and manage surface water runoff to and from proposed developments. Requirements within the non-statutory technical standards for Greenfield and previously developed sites are as follows: **Previously developed site** **Peak Flow Control Volume**: 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 (1% AEP) 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**: Where reasonably practicable, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year (1% AEP), 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. Where this is not reasonably practicable, the runoff volume must be discharged at a rate that does not adversely affect flood risk. **Greenfield site** 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 (1% AEP) rainfall event should never exceed the peak greenfield runoff rate for the same event. Where reasonably practicable, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year (1% AEP), 6 hour rainfall event should never exceed the greenfield runoff volume for the same event. Where this is not reasonably practicable, the runoff volume must be discharged at a rate that does not adversely affect flood risk.								Section 5.10
Flood Warning and Evacuation Plan	N/A	Yes - The Environment Agency has a tool on their website to create a Personal Flood Plan[49]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details. For minor development, it is recommended that the use of this tool to create a Personal Flood Plan will be appropriate.		Yes - In areas of known surface water flood risk, it may be appropriate to prepare a Personal Flood Plan using the Environment Agency tool on their website.		Yes – Flood Warning and Evacuation Plan (FWEP) required to include details of how flood warnings will be provided, what will be done to protect the development and its contents, and how safe occupancy and access to and from the development will be achieved.			Yes - It may be necessary in the following cases: -Sites of particularly significant surface water flood risk. -Where the site is located within a dry island (i.e. the area surrounding the site and/or any potential egress routes away from the site may be at risk of flooding during the 1 in 100 year (1% AEP)) flood event including an allowance for climate change even if the site itself is not).	Section 5.11
Planning conditions	N/A	Conditions to secure the implementation of measures set out in the FRA. Condition to prevent conversion of a non-habitable basement to a habitable space at a later date. Condition to keep voids clear.		Conditions to secure the implementation of measures set out in the FRA.		Conditions to secure the implementation of measures set out in the FRA. Condition to prevent conversion of a non-habitable basement to a habitable space at a later date. Condition to keep voids clear.			Conditions to secure the implementation of measures set out in the FRA.	Section 7.2

[48] Defra, March 2015, Non-statutory technical standards for sustainable drainage systems. https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards
[49] Environment Agency Tool 'Make a Flood Plan'. https://www.gov.uk/government/publications/personal-flood-plan

	All Development	Minor development				Other development				SFRA section
	Flood Zone 3b (Undeveloped – Functional Floodplain)	Flood Zone 3b (Developed)	Flood Zone 3a	Flood Zone 2	Flood Zone 1	Flood Zone 3b (Developed)	Flood Zone 3a	Flood Zone 2	Flood Zone 1	
Permitted development rights	N/A	Consider the removal of permitted development rights on a case-by-case basis having regard to the remaining amount of development that could be achieved without planning permission and the level of risk.			N/A	Remove permitted development rights.			N/A	Section 7.2
Consult the Environment Agency[50] and/or Lead Local Flood Authority	N/A	Consult the Environment Agency: - If development (including boundary walls) is within 20m of the top of bank of a Main River, consult Environment Agency on flood defence requirements. Consult the Lead Local Flood Authority: -If development is within 8 m of an Ordinary Watercourse		Consult Environment Agency: - If application site >1 hectare - If development (including boundary walls) is within 20m of the top of bank of a Main River, consult Environment Agency on flood defence requirements. Consult the Lead Local Flood Authority: -If development is within 8 m of an Ordinary Watercourse	Consult Environment Agency; - If application site > 1 hectare. - If development (including boundary walls) is within 20m of the top of bank of a Main River, on flood defence requirements. Consult the Lead Local Flood Authority: -If development is within 8m of an Ordinary Watercourse	Consult the Environment Agency: -On all applications -If development (including boundary walls is within 20m of a Main River, consult Environment Agency on flood defence requirements. -Change of use where flood risk vulnerability classification has changed to more vulnerable or highly vulnerable or from water compatible to less vulnerable Consult Lead Local Flood Authority: -If development is 'major', consult on 'Surface Water Drainage Statement' -If development is within 8m of an Ordinary Watercourse		Consult the Environment Agency: - If application site >1 hectare. -Essential infrastructure. -Highly vulnerable. -More Vulnerable and it's a landfill or waste facility or is a caravan site. -Less Vulnerable and it's one of the following: land or building used for agriculture or forestry; a waste treatment site; a mineral processing site, as waste water treatment plant or a sewage treatment plant. - If development (including boundary walls) is within 20m of the top of bank of a Main River, consult Environment Agency on flood defence requirements. Consult the Lead Local Flood Authority: -If development is 'major' consult on 'Surface Water Drainage Statement'. -If development is within 8m of an Ordinary Watercourse.	Consult Environment Agency ; -Application site > 1 hectare. -If development (including boundary walls) is within 20m of the top of bank of a Main River. Consult the Lead Local Flood Authority: -If development is 'major' consult on 'Surface Water Drainage Statement'. -If development is within 8m of an Ordinary Watercourse	Section 6.6

[50] Government guidance for LPAs regarding when to consult the Environment Agency https://www.gov.uk/flood-risk-assessment-local-planning-authorities.

Appendix A Settlement Area Schedules

A strategic assessment of the flood risk from all sources has been undertaken for each of the eight Settlement Areas in Elmbridge. The findings are presented in the following schedules.

The schedules should be read with reference to the figures in Appendix B, C, D, E and F. The schedules have been presented in the following order (as viewed from west to east across the Borough):

- Weybridge (Main Settlement Area),
- Walton-on-Thames (Main Settlement Area),
- Hersham (Suburban Settlement Area),
- Cobham, Oxshott, Stoke D'Abernon and Downside (Service Centre and Rural Fringe),
- East and West Molesey (Suburban Settlement Area),
- Esher (Suburban Settlement Area),
- Thames Ditton, Long Ditton, Hinchley Wood and Weston Green (Suburban Settlement Area), and
- Claygate (Suburban Village).

Weybridge

General Information

Area	Weybridge covers an area of **15.8km^2**	
Character[51]	Weybridge is located in the west of Elmbridge, adjoining the boroughs of Runnymede, Spelthorne and Woking. It is the second largest settlement in the Borough supporting a population of approximately 29,837[52]. The north of the Settlement Area comprises high density residential development, in St George's Hill in the south; the density of residential dwellings is much lower. Alongside the residential neighbourhoods, the settlement also contains the majority of the Borough's commercial floor space. Brooklands and Wintersells Road Industrial Parks and 'The Heights' business park to the south of the settlement area are strategic areas for employment uses. The businesses in this area provide jobs not only for the residents of Elmbridge but also for those living in adjacent boroughs and beyond. The area also has a large out-of-town retail park, two large hotels and two popular visitor attractions: Mercedes Benz World and Brooklands Museum.	
Topography	The western edge of the Settlement Area is low lying land adjacent to the floodplain of the River Wey. The land rises towards the urban area of Weybridge (25-45mAOD), and St George's Hill (75mAOD) in the eastern part of the Settlement Area.	Figure B1
Geology	Superficial (*Source 1*) - the Settlement Area is underlain by superficial deposits – either Lynch Hill Gravel Member (Sand & Gravel (S&G)) or small area of S & G of unknown age (e.g. St Georges Hill). In some areas of Weybridge, no superficial deposits are present. Bedrock (*Source 2*) - the Settlement Area is underlain by Bagshot Formation (Sand).	Figures B2, B3
Aquifer Type	The superficial deposits are classified as either a secondary A aquifer or as unproductive strata (*Source 3*). According to Environment Agency definitions, a secondary aquifer is defined as a permeable layer capable of supporting water supplies a local rather than strategic scale and in some cases forming an important source of base flow to rivers. Unproductive strata are rock strata (see bedrock) or drift deposits with low permeability that has negligible significance for water supply or river base flow. The underlying bedrock is classified as a secondary A aquifer or unproductive strata. An important factor which influences this classification in Elmbridge is the limited thickness of the layers, in particular the Bagshot Formation in the Weybridge area.	-
Groundwater Vulnerability Classification and Source Protection Zone	The superficial deposits give the settlement area a minor aquifer medium or high category of risk vulnerability (*Source 4*). The Environment Agency defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. There are no SPZs within this settlement area (*Source 5*). The Environment Agency records of smaller abstractions have not been reviewed at this stage.	-
Main Rivers	The River Wey flows north along the western edge of the Settlement Area and through the Brooklands industrial park area. The catchment of the Wey lies within Hampshire and Surrey and has a total area of approximately 904 km^2. It falls approximately 190 m in level, and is approximately 104 km in length from its source in Hampshire to the confluence with the Thames near Weybridge. The Lower Wey is navigable from its confluence with the Thames up to Godalming. It includes a number of navigation channels separate from the Main River, with water levels regulated by structures such as locks and weirs. Through the urban area of Weybridge, the natural channels have been engineered and canalised to varying degrees[53]. After the confluence with the River Wey at Weybridge, the River Thames flows east along the northern part of the Settlement Area. The Desborough Channel, located in the north of the Settlement Area, is an artificial channel that was cut in the 1930s to improve flow and ease navigation along the Thames. The cut takes the river on a straight course between Weybridge and Walton and its construction created Desborough Island.	Figures B4, C1, C2

[51] Extracted from the Consultation Settlement ID Plans http://consult.elmbridge.gov.uk/consult.ti/Draft_ID_Plans/consultationHome
[52] https://www.nomisweb.co.uk/reports/localarea?compare=1119885117
[53] Mott MacDonald, Environment Agency Thames Region (December 2009) *Lower Wey Remodelling and ABD Flood Mapping Study, Hydrology Report.*

Weybridge

Ordinary Watercourses	The Engine River flows east parallel to the Desborough Channel and the River Thames in the north of the Settlement Area. Several tributaries of the River Wey flow west from the urban area to their confluence with the River Wey.	Figure B4, C1, C2

Flood Risk

Flooding from Rivers	*Flood Zones* The Settlement Area is located within Flood Zones 1, 2, and 3 as follows: • Flood Zone 1: 10.4 km^2 (65%) • Flood Zone 2: 2.3 km^2 (15%) • Flood Zone 3: 1.7 km^2 (11%) • Flood Zone 3b: 1.4 km^2 (9%) *Functional Floodplain* 9% of the Settlement Area (1.4km^2) is shown to be at risk during the 1 in 20 year (5% AEP) flood event. These areas include the developed areas of Wey Road, Wey Meadows, Brooklands Museum and parts of Brooklands Road, as well as the undeveloped areas of Plough Bridge Farm, Brooklands Community Park, Trinity Island and Bulldog Island. These areas are defined by EBC as Flood Zone 3b Functional Floodplain, with the exception of developed areas which are prevented from flooding by the presence of existing infrastructure or solid buildings – these areas are not considered Functional Floodplain. Section 3.10 provides further information. *Climate Change* Land close to Brooklands Industrial Estate is shown to be at risk during the 1 in 100 year (1% AEP) AEP flood event including an allowance for climate change. *Historic Records* The floodplain of the River Wey is very constrained in this area and EBC and the Environment Agency hold records of flooding adjacent to the River Wey. Further south, incidents have also been recorded along Connaught Drive, Brooklands Road, Davis Road, Dorney Grove, Walton Lane (Desborough Island), Church Walk and Eyston Drive. Notable flooding occurrences within the Wey catchment have been reported in 1900, 1947, 1968, 1979, 1985, 1987, 1990, 2000, 2003, 2006, 2007, 2008 and 2013-14. The flooding occurrence in the Lower Wey is influenced by the geology, and the rapid rate of urbanisation within the study area. Floods have been exacerbated by the high runoff generated, coupled with the considerable amount of debris carried into drains and streams, leading to blockages and a reduction in the capacity of the watercourses. This has eventually led to the Wey overflowing its banks, and drains being unable to cope with the excess water leading to widespread flood inundation. *Flood Defences* The Environment Agency AIMS dataset identifies that high ground is present along the edge of the River Wey channel as well as adjacent to the River Thames and Desborough Cut.	Figures C1, C2 Figures D1, D2
Flooding from Land	The ROFSW identifies a higher risk of surface water flooding in the natural topographic low points in the Settlement Area. Flow paths follow the natural drainage of the local area, ponding in lower lying areas adjacent to the River Wey and adjacent to embanked railway lines. *Historic Records* SCC have identified a number of locations known 'wetspots' which are susceptible to surface water flooding located in Weybridge and Brooklands.	Figures F1, F2
Flooding from Groundwater	The majority of the Settlement Area is classed as low risk i.e. limited potential for groundwater flooding to occur (*Source 6*). The majority of the area is likely to have a groundwater table >5m below the ground surface (*Source 7*). In the central part of Weybridge, the water tables may be <3m below the surface, but this is overlying permeable Bagshot Formation and hence there in unlikely to be any infiltration impedance.	Figure B5
Flooding from Sewers	The TWUL Register identifies that internal flooding has affected 1-5 properties in the St George's Hill area and external flooding has affected 1-7.	Figures B7, B8

Weybridge

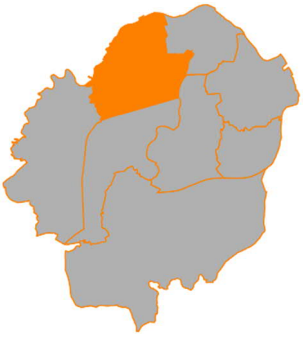
Reservoirs, canals, other artificial sources	Small waterbodies in the Weybridge Settlement Area include; Broad Water Lake near Templemere, north of Weybridge; Silver Mere set in the grounds of the Silvermere Golf Course; and Warrens Pond, off Warreners Lane near St George's Hill. The Environment Agency dataset 'Risk of Flooding from Reservoirs' shows that the northern fringe of the Settlement Area and the areas along the edge of the River Wey could be flooded if a reservoir was to fail.	Figure B4

Managing and Mitigating Flood Risk

Flood Warning Areas	The Environment Agency Flood Warning Areas relevant to the Settlement Area are: 'River Thames at Walton', 'River Thames at Ham Court', 'River Wey at Weybridge', 'River Wey at Wisley and Byfleet' and 'Properties closest to the River Wey between Walsham Meadow and Byfleet town'.	Figure B9
Rest Centres	EBC has a designated primary rest centre in Weybridge centre, near Churchfields Recreation Ground. Depending on the type and extent of flooding in the local area, this may be available for use as an emergency rest centre. The Multi Agency Flood Plan should be consulted for further information.	Figure B9
Infiltration SuDS Suitability	The majority of the settlement area is likely to be suitable for the application of infiltration SuDS (*Sources 8 and 9*). In the central Weybridge area, where the water table is <3m below the ground surface, there may be opportunities for bespoke infiltration SuDS.	Figure B6
Site-specific FRA Guidance	Section 5 provides detailed guidance on measures to manage and mitigate flood risk, and Section 6 provides guidance on preparation of site-specific FRAs.	Section 6
Policy Recommendations	Section 7 provides spatial planning and development management recommendations for the Borough.	Section 7

Walton-on-Thames

General Information

Area	Walton-on-Thames covers an area of **10.9km^2**.	
Character[54]	Walton-on-Thames is the largest settlement in Elmbridge. The settlement is in the northwest of the Borough with the River Thames forming the northern border. It has one of the two bridges crossing the River Thames into the Borough and is a key crossing point for traffic travelling to and from the M3 to the north. Walton town centre is the largest centre in the Borough and one that has grown in recent years, primarily through the development of The Heart, a comprehensive mixed-use town centre scheme. In addition to Walton Town Centre, there are local centres at Walton Halfway, located close to Walton Station and at Terrace Road to the north of Walton Town Centre. The character of the area is predominantly residential. There is a mix of densities including some areas of higher density development as well as pockets of lower density. Open spaces within the urban area are limited. However, greenbelt to the north and west of the settlement and the River Thames on the eastern boundary offer valuable opportunities for informal recreation.	
Topography	The Settlement Area is located predominantly within the low-lying floodplain of the River Thames, at approximately 0-12mAOD. Some sites along the Thames frontage have steep banks down to the river. The land rises in the south west corner of the Settlement Area to approximately 26mAOD.	Figure B1
Geology	Superficial *(Source 1)* - the Settlement Area is underlain by River Terrace Deposits (RTD). The named formations are the Kempton Park Gravel Formation (Sand & Gravel (S&G)) and Taplow Gravel Formation (S&G). Bedrock *(Source 2)* - the Settlement Area is underlain by Bagshot Formation (Sand), Claygate Member (London Clay Formation (LCF) – Sand, Silt and Clay) and LCF (Silt and Clay) in different parts of the area.	Figures B2, B3
Aquifer Type	The River Terrace Deposits are classified as a principal aquifer *(Source 3)*. According to EA definitions, a principal aquifer is defined as having intergranular permeability, can provide a high level of water storage, can support water supply and/ or river base flow on a strategic scale. The underlying bedrock is classified as unproductive aquifer.	-
Groundwater Vulnerability Classification and Source Protection Zone	The River Terrace Deposits covering the surface give the Settlement Area a major aquifer high category of risk vulnerability (Source 4). The EA defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. There are no SPZs within the Settlement Area. The EA records of smaller abstractions have not been reviewed at this stage.	-
Main Rivers	The River Thames flows along the northern edge of the Settlement Area. The Lower Thames floodplain is relatively broad and flat and the river itself contains several islands. The normal tidal limit of the River Thames occurs at Teddington Weir, approximately 5km downstream from Thames Ditton (TQ 1675 7149), but on a high tide, the tidal influence can extend as far back upriver as Molesey Weir. The Dead River passes around the southern edge of Queen Elizabeth II Storage Reservoir to its confluence with the River Mole. The Dead River drains a catchment of approximately 5km^2, 50% of which is urbanised. The Lower Mole extends from Esher Railway Bridge downstream along the south eastern edge of the Walton-on-Thames Settlement Area to its confluence with the River Thames at Molesey, near Hampton Court. The catchment covers an area of approximately 11km^2. The Lower Mole has been extensively modified by the construction of the Lower Mole Flood Alleviation Scheme between 1977 and 1991.	Figures B4, C3, C4

[54] Extracted from the Consultation Settlement ID Plans http://consult.elmbridge.gov.uk/consult.ti/Draft_ID_Plans/consultationHome

Walton-on-Thames

Ordinary Watercourses	An ordinary watercourse flows from Rydens allotments, along Rydens Lane to join the Dead River. There is also a tributary of the Dead River to the rear of Regency Gardens adjacent to the Queen Elizabeth II Storage Reservoir. There is a SCC highways ditch along Hurst Road in the north east of the Settlement Area.	Figure B4, C3, C4

Flood Risk

Flooding from Rivers	*Flood Zones* The Settlement Area is located within Flood Zones 1, 2, and 3 as follows: Flood Zone 1: 8.4km^2 (79%) Flood Zone 2: 1.5km^2 (13%) Flood Zone 3: 0.3km^2 (2%) Flood Zone 3b: 0.7km^2 (6%) *Functional Floodplain* 6% of the Settlement Area (0.7km^2) is shown to be at risk during the 1 in 20 year (5% AEP) flood event. This comprises the fringe of the Settlement Area along the River Thames frontage, as well as land to the west of Queen Elizabeth II Storage Reservoir near Ambleside Avenue and Regency Gardens. Areas within the 5% flood outline are defined by EBC as Flood Zone 3b Functional Floodplain, with the exception of developed areas which are prevented from flooding by the presence of existing infrastructure or solid buildings – these areas are not considered Functional Floodplain. Section 3.10 provides further information. *Climate Change* The extent of flooding in the area of Walton-on-Thames south west of the Queen Elizabeth II Storage Reservoir is shown to increase during the 1 in 100 year (1% AEP) flood event including an allowance for climate change. *Historic Records* EBC and the Environment Agency hold records of fluvial flooding along the edge of the River Thames and within central Walton-On-Thames. *Flood Defences* The Environment Agency Asset Information Management Systems (AIMS) identifies the presence of high ground adjacent to the Lower Mole, Dead River and River Thames in this location. Embankments are also present along the edge of the Lower Mole.	Figures C3, C4 Figures D3, D4
Flooding from Land	The ROFSW identifies a higher risk of surface water flooding in the natural topographic low points in the Settlement Area. Areas identified to be at particular risk include Cottimore Lane and Cottimore Avenue and the area around the junction between the A244 and the B256 near Walton Library. *Historic Records* SCC has identified a number of small roads as known 'wetspots' which are susceptible to surface water flooding.	Figures F3, F4
Flooding from Groundwater	The majority of the Settlement Area is classed as high risk i.e. potential for groundwater flooding to occur at the surface (Source 6). This is because much of the area is covered by Kempton Park Gravel Formation. In this area, the groundwater table is predicted to be <3m below the ground surface based on *Source 7*. A factor in influencing this risk is that the beneath the River Terrace Deposits lies the London Clay Formation Including Claygate Member). In those areas with less River Terrace Deposits and underlain by Bagshot Formation, the mapping by the BGS indicates limited potential for groundwater flooding to occur. The groundwater table in these areas are likely to be >5m below the ground surface (Source 7).	Figure B5
Flooding from Sewers	During the last 10 years external flooding has affected between 2 and 10 properties in south of the Settlement Area. There are no records of internal sewer flooding	Figures B7, B8
Reservoirs, canals, other artificial sources	There are 3 large reservoir bodies in the Settlement Area: Bessborough Reservoir, Knight Reservoir (each designated SSSI, SPA, RAMSAR) and Queen Elizabeth II Storage Reservoir. There are also several smaller water bodies including the Molesey Reservoirs Nature Reserve and water bodies associated with disused workings in the east of the Settlement Area with Island Barn	Figure B4

Walton-on-Thames

	Reservoir located just outside to the north east. The Environment Agency dataset 'Risk of Flooding from Reservoirs' shows that the majority of the Settlement Area could be flooded if a reservoir was to fail and release the water they hold.	

Managing and Mitigating Flood Risk

Flood Warning Areas	The Warning Areas relevant to the Walton Settlement Area are: 'Properties closest to the River Thames from Shepperton Lock to Beasley's Ait', 'River Mole at Esher and East Molesey', and 'River Thames at Walton'.	Figure B9
Rest Centres	EBC has a designated primary rest centre in Walton centre, on Manor Road. Depending on the type and extent of flooding in the local area, this may be available for use as an emergency rest centre. The Multi Agency Flood Plan should be consulted for further information.	Figure B9
Infiltration SuDS Suitability	In *Sources 8 and 9*, the majority of the Settlement Area is likely to suffer very significant constraints in the widespread use of infiltration SuDS. This is especially in the areas underlain by the London Clay Formation. Use of attenuation SuDS must be considered in these areas. Infiltration SuDS may be applicable in the areas underlain by Bagshot Formation, although confirmation would be needed in specific locations to determine the depth to the water table. This would be particularly the case for property with below ground surface elements.	Figure B6
Site-specific FRA Guidance	Section 5 provides detailed guidance on measures to manage and mitigate flood risk, and Section 6 provides guidance on preparation of site-specific FRAs.	Section 6
Policy Recommendations	Section 7 provides spatial planning and development management recommendations for the Borough.	Section 7

Hersham

General Information

Area	Hersham covers an area of **10.3km^2**	
Character[55]	Hersham lies in the centre of the Walton, Weybridge and Esher triangle and is primarily a residential area containing supporting a population of around 12,500[56]. The majority of housing is detached or semi-detached and is at a relatively high density, although the area does include Burwood Park, one of the Borough's three Special Low Density Areas. The urban area is bounded by Green Belt to the east with the settlement boundary following the River Mole. Within the greenbelt is Whiteley Village a historic model village that was built in 1907 devoted to the provision of housing for older people of limited means. The majority of buildings here are listed and the village has been designated a Conservation Area.	
Topography	The eastern part of the Settlement Area is low lying land, adjacent to the River Mole floodplain. The land rises steeply to the west towards St George's Hill in the Weybridge Settlement Area, and areas such as Burwood Park and Whiteley Village are located at approximately 30-50mAOD.	Figure B1
Geology	Superficial *(Source 1)* - The Settlement Area is underlain by River Terrace Deposits. The named formations are the Kempton Park Gravel Formation (Sand & Gravel (S&G)) and Taplow Gravel Formation (S&G). Bedrock *(Source 2)* -The Settlement Area is underlain by Claygate Member (upper part of the London Clay Formation – Sand, Silt and Clay).	Figures B2, B3
Aquifer Type	In *Source 3*, the superficial deposits are classified as a principal aquifer. According to EA definitions, a principal aquifer is defined as having intergranular permeability, can provide a high level of water storage, can support water supply and/ or river base flow on a strategic scale. The underlying bedrock is classified as a secondary A aquifer. According to EA definitions, a secondary aquifer is defined as a permeable layer capable of supporting water supplies on a local rather than strategic scale and in some cases forming an important source of base flow to rivers. An important factor which influences this classification in Elmbridge is the limited thickness of the layers, in particular the Claygate Member in the Hersham area.	-
Groundwater Vulnerability Classification and Source Protection Zone	In *Source 4*, the River Terrace Deposits covering the surface give the Settlement Area a major aquifer high and intermediate category of risk vulnerability. The EA defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. In Source 5, there are no SPZs within this Settlement Area. The EA records of smaller abstractions have not been reviewed at this stage.	-
Main Rivers	The River Mole forms the eastern boundary of the Settlement Area. The River Mole and its tributaries have a catchment of approximately 487km^2. The Mole rises in the North Sussex Hills near Rusper and flows into the River Thames at Molesey, near Hampton Court. The Middle Mole extends from where the Salford Stream tributary meets the River Mole in Reigate and Banstead Borough, to the Esher Railway Bridge. The catchment of the Middle Mole covers approximately 270km^2.	Figure B4; Figures C5, C6
Ordinary Watercourses	A tributary of the Dead River flows from Bell Farm Junior School northwards towards Walton on Thames. Tributaries of the Mole drain eastwards from the Seven Hills Estate and Whiteley Village.	Figure B4; Figures C5, C6

Flood Risk

Flooding from Rivers	*Flood Zones* The Settlement Area is located within Flood Zones 1, 2, and 3 as follows: • Flood Zone 1: 6.8km^2 (66%) • Flood Zone 2: 2.5km^2 (24%)	Figures C5, C6 Figures D5,D6

[55] Extracted from the Consultation Settlement ID Plans http://consult.elmbridge.gov.uk/consult.ti/Draft_ID_Plans/consultationHome
[56] https://www.nomisweb.co.uk/reports/localarea

Hersham

	• Flood Zone 3: 0km^2 (0%) • Flood Zone 3b: 1.0km^2 (10%) *Functional Floodplain* 10% of the Settlement Area (10km^2) is shown to be at risk during the 1 in 20 year (5% AEP) flood event. This comprises the rural land adjacent to the River Mole along the eastern boundary of the Hersham Settlement Area. Areas within the 1 in 20 year (5% AEP) flood outline are defined by EBC as Flood Zone 3b Functional Floodplain, with the exception of developed areas which are prevented from flooding by the presence of existing infrastructure or solid buildings – these areas are not considered Functional Floodplain. Section 3.10 provides further information. *Climate Change* The extent of flooding associated with the River Mole is shown to increase slightly during the 1 in 100 year (1% AEP) flood event including an allowance for climate change, mainly affecting rural land associated with Willow Tree Farm and Southwood Manor Farm, where the course of the River Mole meanders. *Historic Records* The Environment Agency Historic Flood Map shows the extent of flooding from a range of sources. The map shows flooding within the Horsham Settlement area however the source is unknown. *Flood Defences* The Environment Agency Asset Information Management Systems (AIMS) dataset identifies that as part of the Lower Mole Flood Alleviation Scheme earth embankments and concrete walls are present along the right and left banks of the Lower Mole in the north of the Hersham Settlement Area. The area between Esher Road and the Mole channel as well as Winterhouse Farm is formally identified as an area benefitting from flood defences on the Flood Map for Planning (Rivers and Sea).	
Flooding from Land	The ROFSW identifies a higher risk of surface water flooding in the natural topographic low points in the Settlement Area and where particular barriers present an obstruction behind which surface water can collect. The mapping identifies the potential for garden and highway flooding in the north of the Settlement Area and parts of Burwood Park and West End. Ponding is also modelled to occur adjacent to ordinary watercourses in the south of the Settlement Area. *Historic Records* SCC has identified a number of small roads as known 'wetspots' which are susceptible to surface water flooding.	Figures F5, F6
Flooding from Groundwater	In *Source 6*, the majority of the Settlement Area is classed as high risk in the eastern area and low risk in the western and southern areas. This is because much of the area is covered by Kempton Park Gravel Formation and Taplow Gravel Formation. In this area and based on *Source 7*, the groundwater table is predicted to be <3m below the ground surface. A factor in influencing this risk is that beneath the River Terrace Deposits lies the London Clay Formation Including Clay Member).	Figure B5
Flooding from Sewers	There is 1 record of internal flooding and 1 record of external property flooding in the Hersham Settlement Area.	Figures B7, B8
Reservoirs, canals, other artificial sources	There are two small lakes within the Settlement Area, The Lake, and Broad Water in Burwood Park. The water supply reservoirs including Queen Elizabeth II Reservoir, Island Barn Reservoir, Bessborough Reservoir and Knight Reservoir are located to the north of the Settlement Area. The Environment Agency dataset 'Risk of Flooding from Reservoirs' shows the area that could be flooded if one of these reservoirs were to fail and release the water it holds. The extent of flooding is shown to extend into the northern part of the Hersham Settlement Area.	Figure B4
Managing and Mitigating Flood Risk		
Flood Warning Areas	The Warning Area relevant to the Settlement Area is: 'River Mole at Esher and East Molesey', 'River Mole at Stoke D'Abernon, Cobham and South Hersham'.	Figure B9

Hersham

Rest Centres	EBC has a designated primary rest centre in Hersham Centre, on Queen's Road. Depending on the type and extent of flooding in the local area, this may be available for use as an emergency rest centre. The Multi Agency Flood Plan should be consulted for further information.	Figure B9
Infiltration SuDS Suitability	In *Sources 8 and 9*, the northern part of the Settlement Area is likely to suffer very significant constraints in the use of infiltration SuDS. This is especially in the areas underlain by the Claygate Member Formation. The western part of the Settlement Area, where the water table is <3m below the ground surface, there may be opportunities for bespoke infiltration SuDS. In the southern part of Settlement Area, these areas are generally highly compatible for infiltration SuDS.	Figure B6
Site-specific FRA Guidance	Section 5 provides detailed guidance on measures to manage and mitigate flood risk, and Section 6 provides guidance on preparation of site-specific FRAs. Modelling for the Lower Mole does not include all the Ordinary Watercourse tributaries in the catchment. For development sites in close proximity to Ordinary Watercourses it is likely that modelling will be required in order to determine the probability of flooding and local flood levels to inform the site-specific FRA.	Section 6
Policy Recommendations	Section 7 provides spatial planning and development management recommendations for the Borough.	Section 7

Cobham, Oxshott, Stoke D'Abernon and Downside

General Information

Area	Cobham, Oxshott, Stoke D'Abernon and Downside cover a large area of **30.6km^2**.	
Character[57]	Cobham, Oxshott, Stoke D'Abernon and Downside are located in the south of the Borough and are separated from the rest of Elmbridge by the A3 as well as by extensive areas of Green Belt. This acts as an important recreational resource with locations such as Oxshott Heath, Fairmile Park and Cobham Park being popular with both residents and visitors alike. Cobham, Oxshott, Stoke D'Abernon and Downside Village are four distinctly different areas. Whilst recognising that they share a variety of common characteristics, their individuality is of primary importance to the local community. The vast majority of development in the area is residential.	
Topography	Fairmile and Oxshott located in the eastern part of the Settlement Area are located on high land, at approximately 45-75mAOD. The land falls away to the west towards Stoke D'Abernon (40mAOD) and Cobham (20mAOD) towards the floodplain of the River Mole (15-20mAOD). The land rises again towards Downside and Pointer's Green (30mAOD) where the M25 passes through the Settlement Area and Hatchford (50mAOD).	Figure B1
Geology	Superficial *(Source 1)* - The Settlement Area is underlain by superficial deposits – either Taplow Gravel Formation (Sand & Gravel) or alluvium. Bedrock *(Source 2)* - The Settlement Area is underlain by Bagshot Formation (Sand) and Claygate Member (London Clay Formation – Sand, Silt and Clay).	Figures B2, B3
Aquifer	In *Source 3,* the superficial deposits are classified as either a principal aquifer or secondary A aquifer. According to EA definitions, a principal aquifer is defined as having intergranular permeability, can provide a high level of water storage, can support water supply and/ or river base flow on a strategic scale. A secondary A aquifer is defined as a permeable layer capable of supporting water supplies a local rather than strategic scale and in some cases forming an important source of base flow to rivers The underlying bedrock is classified as a secondary A aquifer. An important factor which influences this classification in Elmbridge is the limited thickness of the layers, in particular the Bagshot Formation and Claygate Member.	-
Groundwater Vulnerability Classification and Source Protection Zone	In *Source 4*, the superficial deposits give the Settlement Area a range of risk vulnerabilities from Principle aquifer high to secondary aquifer. The EA defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. In Source 5, there are no SPZs within this Settlement Area. The EA records of smaller abstractions have not been reviewed at this stage.	-
Main Rivers	The River Mole and its tributaries have a catchment of approximately 487km^2. The Mole rises in the North Sussex Hills near Rusper and flows into the River Thames at Molesey, near Hampton Court. The Middle Mole extends from where the Salford Stream tributary meets the River Mole in the Reigate and Banstead District, to the Esher Railway Bridge. The catchment of the Middle Mole covers approximately 270km^2. The Middle Mole enters the Settlement Area close to Stoke D'Abernon bridge, where it passes beneath the M25. The Middle Mole then meanders through the Settlement Area towards Hersham. The River Rythe flows south to north from Oxshott to its confluence with the River Thames adjacent to Ferry Road. It flows through the developed areas of Oxshott, Claygate, Hinchley Wood, Esher and Thames Ditton. The River Rythe drains a total catchment area of approximately 19km^2, 50% of which is urbanised.	Figure B4; Figures C7, C8, C9
Ordinary Watercourses	There are numerous ordinary watercourses in the Settlement Area that drain into the Rythe or Mole. Several large tributaries join the River Mole in this Settlement Area, draining the areas of Fairmile and Oxshott in the east and Hatchford and May's Green in the southwest. There are also a number of SCC highways ditches in the Settlement Area.	Figure B4; Figures C7, C8, C9

[57] Extracted from the Consultation Settlement ID Plans http://consult.elmbridge.gov.uk/consult.ti/Draft_ID_Plans/consultationHome

Cobham, Oxshott, Stoke D'Abernon and Downside

Flood Risk

Flooding from Rivers	*Flood Zones* The Settlement Area is located within Flood Zones 1, 2, and 3 as follows: • Flood Zone 1: 20.6km^2 (67%) • Flood Zone 2: 6km^2 (20%) • Flood Zone 3: 0.2km^2 (0.65%) • Flood Zone 3b: 3.8km^2 (12%) *Functional Floodplain* 12% of the Settlement Area (3.8km^2) is shown to be at risk during the 1 in 20 year (5% AEP) flood event. This comprises the rural land within the relatively wide floodplain of the Middle Mole. Areas within the 1 in 20 year (5% AEP)flood outline are defined by EBC as Flood Zone 3b Functional Floodplain, (with the exception of areas which are prevented from flooding by the presence of existing infrastructure or solid buildings – these areas are not considered Functional Floodplain). Section 3.10 provides further information. *Climate Change* The extent of flooding associated with the Middle Mole and River Rythe is shown to marginally increase during the 1 in 100 year (1% AEP) flood event including an allowance for climate change. *Historic Records* The Environment Agency Historic Flood Map shows the extent of flooding from a range of sources. The map shows flooding within the Cobham, Oxshott, Stoke D'Abernon and Downside Settlement area however the source is unknown. *Flood Defences* The Middle Mole is not formally defended. The Environment Agency Asset Information Management Systems (AIMS) dataset identifies high ground on either side of the watercourse. Some of the tributaries of the River Mole near Stoke D'Abernon are culverted for short sections. No defences are present along the River Rythe.	Figures C7, C8, C9 Figures D7, D8 and D9
Flooding from Land	The ROFSW identifies a higher risk of surface water flooding in the natural topographic low points in the Settlement Area and where particular barriers present an obstruction behind which surface water can collect. The mapping identifies surface water flood risk in the low-lying land adjacent to the River Mole and River Rythe. The mapping also identifies the potential for surface water to pond in a number of areas around the settlement area. *Historic Records* SCC has identified a number of small roads as known 'wetspots' which are susceptible to surface water flooding.	Figures F7, F8, F9
Flooding from Groundwater	The majority of the Settlement Area is classed as low risk of flooding. Parts of the Settlement area along the River Mole floodplain are at high risk of Groundwater Flooding.	Figure B5
Flooding from Sewers	1-6 properties have been affected by external flooding. There is 1 record of properties affected by internal flooding across the Settlement Area.	Figures B7, B8
Reservoirs, canals, other artificial sources	There are no known significant water bodies within the Settlement Area. The Environment Agency dataset 'Risk of Flooding from Reservoirs' which shows the area that in the event of this waterbody releasing the water it holds, the mapping shows that water would follow the course of the Mole and cause flooding of the Mole floodplain.	Figure B4

Managing and Mitigating Flood Risk

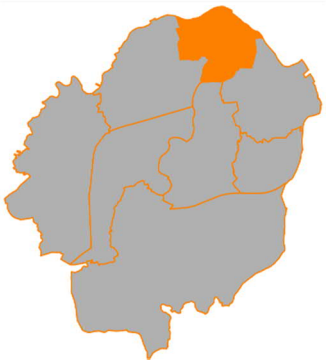
Flood Warning Areas	The Flood Warning Area of relevance to this area is: 'River Mole at Stoke D'Abernon, Cobham and South Hersham' and 'The River Rythe between Oxshott and Thames Ditton'.	Figure B9
Rest Centres	EBC has a designated primary rest centre in Cobham Centre, on Oakdene Road. Depending on the type and extent of flooding in the local area, this may be available for use as an emergency rest centre. The Multi Agency Flood Plan should be consulted for further information.	Figure B9

Cobham, Oxshott, Stoke D'Abernon and Downside

Infiltration SuDS Suitability	In *Sources 8 and 9*, the area around the River Mole floodplain is likely to suffer very significant constraints in the use of infiltration SuDS. The main built-up area around Cobham is likely to be high compatible for infiltration. In the rest of Settlement Area, there may be opportunities for bespoke infiltration SuDS. Although confirmation would be needed in specific locations to determine the depth to the water table.	Figure B6
Site-specific FRA Guidance	Section 5 provides detailed guidance on measures to manage and mitigate flood risk, and Section 6 provides guidance on preparation of site-specific FRAs. Modelling and flood zone mapping for the Lower Mole does not include all the ordinary watercourse tributaries in the catchment. For development sites in close proximity to these watercourses it is likely that modelling will be required in order to determine the probability of flooding and specific flood levels to inform a site-specific FRA.	Section 6
Policy Recommendations	Section 7 provides spatial planning and development management recommendations for the Borough.	Section 7

East and West Molesey

General Information

Area	East and West Molesey covers an area of **5.9km^2** comprising **76% urban area** and **24% Green Belt**.	
Character[58]	The Settlement Area of East and West Molesey is in the northeast of the Borough bordering the London Boroughs of Richmond and Kingston, which lie on the opposite side of the River Thames. Its role within the settlement hierarchy is as a suburban Settlement Area, and whilst it is primarily residential in character there are two substantial areas currently designated as Strategic Employment Land – Molesey Industrial Estate and Imber Court Trading Estate both of which support a range of light industrial, storage, distribution and service industries. The general character of the residential area is varied, ranging from predominantly Victorian houses in the east to 1960s housing in the west. In total there are 5355 dwellings[59] and a population approaching 13,000[60]. A particular feature of the area is the amount of social housing and ex-local authority owned properties in West Molesey.	
Topography	The Settlement Area is largely flat, located adjacent to the River Thames at approximately 5-10mAOD.	Figure B1
Geology	Superficial (*Source 1)* - The Settlement Area is underlain by superficial deposits – either Kempton Park Gravel Formation (Sand & Gravel (S&G)) or alluvium. Bedrock *(Source 2)* - The Settlement Area is underlain by London Clay Formation (Silt and Clay).	Figures B2, B3
Aquifer Type	In *Source 3*, the superficial deposits are classified as a principal aquifer. According to EA definitions, a principal aquifer is defined as having intergranular permeability, can provide a high level of water storage, can support water supply and/ or river base flow on a strategic scale. The underlying bedrock is classified as unproductive strata. According to EA definitions, unproductive strata are rock strata or drift deposits with low permeability that has negligible significance for water supply or river base flow.	-
Groundwater Vulnerability Classification and Source Protection Zone	In *Source 4*, the superficial deposits give the Settlement Area a major aquifer high category of risk vulnerability. The EA defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. In Source 5, there are no SPZs within this Settlement Area. The EA records of smaller abstractions have not been reviewed at this stage.	-
Main Rivers	The River Thames flows along the northern edge of the Settlement Area. The Lower Thames floodplain is relatively broad and flat and the river itself contains several islands. The normal tidal limit of the River Thames occurs at Teddington Weir, approximately 5km downstream from Thames Ditton (TQ 1675 7149), but on a high tide, the tidal influence can extend as far back upriver as Molesey Weir. The Dead River flows eastwards south of the Molesey Industrial Estate to join the River Mole in the west. The Dead River is the only significant tributary of the Lower Mole. The Dead River drains a catchment of approximately 5km^2, 50% of which is urbanised. The Lower Mole extends from Esher Railway Bridge downstream, round the western side of Island Barn Reservoir, to its confluence with the River Thames at Molesey. The River Ember is a channel of the River Mole which flows around the east of Island Barn Reservoir before flowing northeast, parallel to the Lower Mole channel towards their confluence with the Thames. The Lower Mole catchment covers an area of approximately 11km^2 and has been extensively modified by the construction of the Lower Mole Flood Alleviation Scheme between 1977 and 1991.	Figure B4; Figure C10
Ordinary Watercourses	There is an ordinary watercourse adjacent to the River Ember channel and Island Barn Reservoir.	Figure B4; Figure C10

[58] Extracted from the Consultation Settlement ID Plans http://consult.elmbridge.gov.uk/consult.ti/Draft_ID_Plans/consultationHome
[59] Dwelling stock by Council Tax Band (VOA)
[60] Resident Population Estimates 2010 (ONS)

Flood Risk

Flooding from Rivers	*Flood Zones* The Settlement Area is located within Flood Zones 1, 2, and 3 as follows: • Flood Zone 1: 3.68km^2 (62%) • Flood Zone 2: 1.57km^2 (26%) • Flood Zone 3: 0.43km^2 (8%) • Flood Zone 3b: 0.22km^2 (4%) *Functional Floodplain* 4% of the Settlement Area (0.22km^2) is shown to be at risk during the 5% (1 in 20 year) annual probability flood event. These areas include the developed areas of Wolsey Road and River Bank. Areas within the 5% (1 in 20 year) annual probability flood outline are defined by Elmbridge BC as Flood Zone 3b Functional Floodplain, with the exception of developed areas which are prevented from flooding by the presence of existing infrastructure or solid buildings – these areas are not considered Functional Floodplain. Section 3.10 provides further information. *Climate Change* The extent of flooding associated with the River Thames around Hampton Court Station is shown to increase during the 1% (1 in 100 year) annual probability flood event including an allowance for climate change. The extent of flooding associated with the Lower Mole and Ember channels is also shown to increase. *Historic Records* Elmbridge BC hold records of fluvial flooding associated with the River Thames at Hurst Road, Bridge Road and Graburn Road. *Flood Defences* The Environment Agency Asset Information Management Systems (AIMS) dataset identifies the presence of high ground along the River Thames in this location. The Lower Mole has been modified by the construction of the Lower Mole Flood Alleviation Scheme between 1977 and 1991 which comprises embankments along the reach of the Lower Mole adjacent to Island Barn Reservoir and a 0.6km length of flood defence wall further downstream.	Figure C10
Flooding from Land	The Settlement Area is flat and low lying. The ROFSW identifies small pockets of surface water flood risk along highways in natural topographic low points of adjacent to buildings and higher ground. Surface water is also shown to pond adjacent to the Thames and Mole watercourses. *Historic Records* SCC have identified the following locations as known 'wetspots' which are susceptible to surface water flooding: Feltham Avenue, St Peter's Road, Cannon Road, Walton Road and Matham Road.	Figure F10
Flooding from Groundwater	In *Source 6*, the majority of the Settlement Area is classed as high risk i.e. >=75% of the 1km square at risk of groundwater flooding. Some areas close by the River Thames are classed as medium risk i.e. >=50-<75%. This is because much of the area is covered by Kempton Park Gravel Formation. In the high-risk areas and based on *Source 7*, the groundwater table is predicted to be <3m below the ground surface and the medium risk areas to be 3-5m below the ground surface. A factor in influencing this risk is that the beneath the River Thames Deposits lies the London Clay Formation.	Figure B5
Flooding from Sewers	During the last 10 years external sewer flooding has affected 1 property in each of the postcode areas. In this same location between1-28 properties have also been affected by internal sewer flooding.	Figures B7, B8
Reservoirs, canals, other artificial sources	The Island Barn water supply reservoir is located in the south of the Settlement Area. The reservoir has an area of 0.5km^2 and is managed by TWUL. Bessborough, Knight and Queen Elizabeth II Reservoirs are also located close to the Settlement Area. The Environment Agency dataset 'Risk of Flooding from Reservoirs' shows that the whole of the East and West Molesey Settlement Area could be flooded if these reservoirs were to fail and release the water they hold. The Molesey Reservoirs Nature Reserve is also located in the north of the Settlement Area adjacent to the River Thames and comprises two former gravel pits.	Figure B4

Managing and Mitigating Flood Risk

Flood Warning Areas	The Warning Areas relevant to the Settlement Area are: 'River Thames at East and West Molesey' and 'River Mole at Esher and East Molesey'.	Figure B9
Rest Centres	Elmbridge BC has a designated primary rest centre in Molesey centre, on Bishops Fox Way. Depending on the type and extent of flooding in the local area, this may be available for use as an emergency rest centre. The Multi Agency Flood Plan should be consulted for further information.	Figure B9
Infiltration SuDS Suitability	In *Sources 8 and 9*, the majority of the Settlement Area is likely to suffer very significant constraints in the widespread use of infiltration SuDS. This is especially in the areas where the water table is <3m below the ground surface. In the areas where the water table is 3-5m below the ground surface, there may be opportunities for bespoke infiltration SuDS. Local confirmation would be required of depth to the water table before design is considered.	Figure B6
Site-specific FRA Guidance	Section 5 provides detailed guidance on measures to manage and mitigate flood risk, and Section 6 provides guidance on preparation of site-specific FRAs.	Section 6
Policy Recommendations	Section 7 provides spatial planning and development control recommendations for the Borough.	Section 7

Esher

General Information

Area	Esher covers an area of **9.3km²**	
Character[61]	Esher is located in the centre of the Borough and is one of the smaller settlements. The town is surrounded by open space with the south of the settlement area containing Esher Commons, the largest of the Borough's three Sites of Special Scientific Interest (SSSI) and Claremont Landscape Gardens. To the north is the internationally renowned Sandown Park Racecourse. These local assets, alongside the relatively low density of the existing development, interspersed with the village greens at Esher, Hare Lane and West End, all contribute to the character and high quality environment of this area. 	
Topography	The central and eastern part of the Settlement Area, including the urban centre of Esher, Claremont Park and Esher Common are located on high land (35-50mAOD). The land falls away to the west towards the River Mole floodplain where levels are approximately 10-15mAOD.	Figure B1
Geology	Superficial *(Source 1)* - The Settlement Area is underlain by superficial deposits – either small area of Black Park Gravel Member (Sand &Gravel) or no deposits. Bedrock *(Source 2)* - The Settlement Area is underlain by Bagshot Formation (Sand) and Claygate Member (upper part of London Clay Formation – Sand, Silt and Clay).	Figures B2, B3
Aquifer Type	In *Source 3*, the superficial deposits are classified as Principle and Secondary A aquifers. The underlying Claygate Member bedrock is classified as a Secondary A aquifer or unproductive strata. According to EA definitions, a secondary aquifer is defined as a permeable layer capable of supporting water supplies a local rather than strategic scale and in some cases forming an important source of base flow to rivers. An important factor which influences this classification in Elmbridge is the limited thickness of the layers, in particular the Bagshot Formation and Claygate Member.	-
Groundwater Vulnerability Classification and Source Protection Zone	In *Source 4*, the superficial deposits give the Settlement Area a major aquifer high and intermediate category of risk vulnerability. The EA defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. In Source 5, there are no SPZs within this Settlement Area. The EA records of smaller abstractions have not been reviewed at this stage.	-
Main Rivers	The River Mole flows northwards along the western edge of the Esher Settlement Area. The Middle Mole extends from where the Salford Stream tributary meets the River Mole, just upstream of Sidlow Bridge in the Reigate and Banstead District, to the Esher Railway Bridge and its catchment covers approximately 270km². The Lower Mole extends from Esher Railway Bridge downstream to its confluence with the River Thames at Molesey, near Hampton Court. The catchment covers an area of approximately 11km². The Lower Mole has been extensively modified by the construction of the Lower Mole Flood Alleviation Scheme between 1977 and 1991. The Dead River is the main tributary of the Lower Mole. The Rythe flows northwards through Abrook Common and the eastern part of the Settlement Area. This watercourse rises near Oxshott, in the Prince's Coverts woodland and flows northwards, through Claygate and along the edge of Hinchley Wood. The river then follows the Portsmouth Road towards Thames Ditton, and runs into the River Thames near Ferry Road, forming the boundary between Kingston and Thames Ditton.	Figures B4, C11
Ordinary Watercourses	Tributaries of the Mole drain areas such as Esher Common, West End Common and the River Mole Business Park/Sandown Industrial Estates in the north of the Settlement Area. Tributaries of the Rythe drain the eastern part of Esher Common and Claremont Park.	Figure B4, C11

[61] Extracted from the Consultation Settlement ID Plans http://consult.elmbridge.gov.uk/consult.ti/Draft_ID_Plans/consultationHome

Flood Risk

Flooding from Rivers	*Flood Zones* The Settlement Area is located within Flood Zones 1, 2, and 3 as follows: • Flood Zone 1: 6.8km^2 (73%) • Flood Zone 2: 1.7km^2 (18%) • Flood Zone 3: 0 km^2 (0%) • Flood Zone 3b:0.8 km^2 (9%) 9.3 *Functional Floodplain* 9% of the Settlement Area (0.8km^2) is shown to be at risk during the 1 in 20 year (5% AEP) flood event. This comprises the rural land adjacent to the River Mole west of West End. Areas within the 1 in 20 year (5% AEP) flood outline are defined by EBC as Flood Zone 3b Functional Floodplain, with the exception of developed areas which are prevented from flooding by the presence of existing infrastructure or solid buildings – these areas are not considered Functional Floodplain. Section 3.10 provides further information. *Climate Change* The extent of flooding associated with the River Mole is shown to increase during the 1 in 100 year (1% AEP) flood event including an allowance for climate change, affecting the area of Lower Green. *Historic Records* EBC hold records of fluvial flooding from the Rythe on Hare Lane, Raleigh Drive and Littleworth Road. *Flood Defences* The Environment Agency Asset Information Management Systems (AIMS) dataset identifies the presence of high ground either side of the River Rythe and River Mole. Embankment is present to the north of the Settlement Area, along the River Mole.	Figures B4, C11 Figures D11
Flooding from Land	The ROFSW identifies a higher risk of surface water flooding in the natural topographic low points in the Settlement Area and where particular barriers present an obstruction behind which surface water can collect. Surface water is modelled to pond adjacent to the Rythe watercourse, in the open land in West End, in Drake's Close, Riverside Drive, Lammas Lane and Wolsey Road. *Historic Records* SCC has identified a number of small roads as known 'wetspots' which are susceptible to surface water flooding.	Figure F11
Flooding from Groundwater	In *Source 6*, the majority of the Settlement Area is predominantly classed as low risk for groundwater flooding to occur. This coincides with an area in which the groundwater table is expected to be >5m below the ground surface based on *Source 7*. In the northern and along the western fringe of the Settlement Area, there is a potential for groundwater flooding at the surface (High risk). In *Source 7*, these areas where there is a potential for groundwater flooding coincide with areas of superficial deposits in which the water table may be <3m below the ground surface.	Figure B5
Flooding from Sewers	Internal flooding has affected 4 properties in the Settlement Area. External flooding has affected 18 properties in the Settlement Area.	Figures B7, B8
Reservoirs, canals, other artificial sources	There are no large surface water bodies within the Settlement Area. A smaller waterbody, Claremont Lake, is located in the Claremont Landscape Gardens. The Environment Agency dataset 'Risk of Flooding from Reservoirs' shows that the area that could be flooded if one of these reservoirs within the Borough were to fail and release the water it holds extends as far as the railway line that passes east-west through the north of the Settlement Area .	Figure B4

Managing and Mitigating Flood Risk

Flood Warning Areas	The Warning Area relevant to the Settlement Area is: 'River Mole at Esher and East Molesey', 'River Mole at Stoke D'Abernon, Cobham and South Hersham' and 'The River Rythe between Oxshott and Thames Ditton'.	Figure B9
Rest Centres	There is no formally designated primary rest centre in the Esher Settlement Area. The rest centres in Hersham centre and Claygate centre are in close proximity to Esher. Depending on the type and extent of flooding in the local area, these centres may be available for use as emergency rest	Figure B9

	centres. The Multi Agency Flood Plan should be consulted for further information.	
Infiltration SuDS Suitability	In *Sources 8 and 9*, the majority of the Settlement Area is likely to be suitable for the application of infiltration SuDS. In the northern and western areas, where the water table is <3m below the ground surface, there are likely to very significant constraints on the application of SuDS.	Figure B6
Site-specific FRA Guidance	Section 5 provides detailed guidance on measures to manage and mitigate flood risk, and Section 6 provides guidance on preparation of site-specific FRAs.	Section 6
Policy Recommendations	Section 7 provides spatial planning and development management recommendations for the Borough.	Section 7

Thames Ditton, Long Ditton, Hinchley Wood and Weston Green

General Information

Area	Thames Ditton, Long Ditton, Hinchley Wood and Weston Green covers an area of **8.7km^2**	
Character[62]	The Settlement Area of Thames Ditton, Long Ditton, Hinchley Wood and Weston Green, is situated in the northeast of the Borough bordering the London Boroughs of Richmond and Kingston. The River Thames forms the boundary to the north with rural Green Belt to the south. Whilst the majority of the built environment has in the past been developed at a higher density than other areas of Elmbridge, reflecting its location on the edge of London, the majority of all dwellings are still either detached or semi-detached houses. The area has convenient road and rail access to and from London and is served by three rail stations at Esher, Hinchley Wood and Thames Ditton. 	
Topography	The northern part of the Settlement Area is low lying land adjacent to the River Thames, at 5-10mAOD. Land rises steeply south of Hinchley Wood to levels of up to 50mAOD at the Surbiton Golf Course and the southern part of Long Ditton.	Figure B1
Geology	Superficial *(Source 1)* -, The Settlement Area is underlain by superficial deposits –either Kempton Park Gravel Formation (Sand & Gravel (S&G)), Langley Silt Member (Clay and Silt) or alluvium. Bedrock *(Source 2)* - The Settlement Area is underlain by London Clay Formation (Silt and Clay).	Figures B2, B3
Aquifer Type	In *Source 3*, the superficial deposits are classified as either a Principal Aquifer or Secondary Aquifer undifferentiated. According to EA definitions, a principal aquifer is defined as having intergranular permeability, can provide a high level of water storage, can support water supply and/ or river base flow on a strategic scale. A secondary aquifer undifferentiated has been assigned in cases where it is not been possible to attribute whether either category A (general formation) or B (localised features) provides the flow mechanisms. The underlying bedrock is classified as unproductive strata. According to EA definitions, unproductive strata are rock strata or drift deposits with low permeability that has negligible significance for water supply or river base flow.	-
Groundwater Vulnerability Classification and Source Protection Zone	In *Source 4*, the superficial deposits give the Settlement Area a major aquifer high category of risk vulnerability. The EA defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. In Source 5, there are no SPZs within this Settlement Area. The EA records of smaller abstractions have not been reviewed at this stage.	-
Main Rivers	The River Rythe rises near Oxshott, in the Prince's Coverts woodland and flows northwards, through Claygate and along the edge of Hinchley Wood. The river then follows the Portsmouth Road towards Thames Ditton, and runs into the River Thames near Ferry Road, forming the boundary between Kingston and Thames Ditton. The Lower Thames forms the boundary along the eastern edge of the Settlement Area. The Lower Thames floodplain is relatively broad and flat and the river itself contains several islands. The normal tidal limit of the River Thames occurs at Teddington Weir, approximately 5km downstream from Thames Ditton (TQ 1675 7149), but on a high tide, the tidal influence can extend as far back upriver as Molesey Weir.	Figures B4, C12
Ordinary Watercourses	There are several drains and ordinary watercourses throughout the Settlement Area that are tributaries of the Rythe and drain areas including Surbiton Golf Course and Long Ditton in the east of the Settlement Area. There is an ordinary watercourse that flows from Weston Green northwards to the confluence of the River Mole and River Thames near Ditton Field.	Figures B4, C12

[62] Extracted from the Consultation Settlement ID Plans http://consult.elmbridge.gov.uk/consult.ti/Draft_ID_Plans/consultationHome

Thames Ditton, Long Ditton, Hinchley Wood and Weston Green

Flood Risk

Flooding from Rivers	*Flood Zones* The Settlement Area is located within Flood Zones 1, 2, and 3 as follows: • Flood Zone 1: 5km^2 (57%) • Flood Zone 2: 2.1km^2 (24%) • Flood Zone 3: 0.5km^2 (6%) • Flood Zone 3b: 0.2km^2 (2%) *Functional Floodplain* 2% of the Settlement Area (0.2km^2) is shown to be at risk during the 1 in 20 year (5% AEP) flood event. Areas within the 1 in 20 years (5%AEP) flood outline are defined by EBC as Flood Zone 3b Functional Floodplain, with the exception of developed areas which are prevented from flooding by the presence of existing infrastructure or solid buildings – these areas are not considered Functional Floodplain. Section 3.10 provides further information. *Climate Change* The extent of flooding associated with the River Thames is shown to increase slightly during the 1 in 100 year (1% AEP) flood event including an allowance for climate change. The extent of flooding from the Lower Mole is also shown to increase, affecting parts of Lower Green north of the railway line. *Historic Records* EBC and the Environment Agency hold records of flooding associated with the River Thames on Aragon Avenue, Queen's Road, Alexandra Road, River Bank, Riversdale Road, Thames Ditton Island. *Flood Defences* The Environment Agency Asset Information Management Systems (AIMS) dataset identifies high ground on either side of the River Thames and the River Rythe.	Figures B4, C12 Figure D12
Flooding from Land	The ROFSW identifies a higher risk of surface water flooding in the natural topographic low points in the Settlement Area and where particular barriers present an obstruction behind which surface water can collect. Surface water is modelled to pond adjacent to the Kingston By-pass and Hinchley Way, along Claygate Lane and adjacent to the railway embankment. *Historic Records* SCC has identified a number of roads as known 'wetspots' which are susceptible to surface water flooding.	Figure F12
Flooding from Groundwater	In *Source 6*, the central part of the Settlement Area is at high risk. Some areas close by the River Thames are classed as medium risk i.e. potential for groundwater flooding of property situated below ground surface. These areas coincide with the Kempton Park Gravel Formation. The London Clay Formation which underlies the Kempton Gravel Park will play an important role in the risk rating. In the southwest of Settlement Area, there are small areas of low risk.	Figure B5
Flooding from Sewers	Internal flooding has been recorded at 2-4 properties in the post code areas. Between 4 and 18 properties have been affected by external sewer within the settlement area. The PFRA identifies that during periods of high water levels in the River Thames there can be issues relating to sewage surcharge in this area.	Figures B7, B8
Reservoirs, canals, other artificial sources	There are no large surface water bodies within the Settlement Area. There are small ponds in the ground of The Manor House and Ditton Common off Alma Road. The water supply reservoirs including Queen Elizabeth II Reservoir, Island Barn Reservoir, Bessborough Reservoir and Knight Reservoir are located to the west of the Settlement Area. The Environment Agency dataset 'Risk of Flooding from Reservoirs' shows that part of the north west part of the Settlement Area could be flooded if one of these reservoirs were to fail and release the water it holds.	Figure B4

Managing and Mitigating Flood Risk

Flood Warning Areas	The Warning Areas relevant to the Settlement Area are: 'River Thames at Thames Ditton', 'The River Rythe between Oxshott and Thames Ditton' and 'River Mole at Esher and East Molesey'.	Figure B9

Thames Ditton, Long Ditton, Hinchley Wood and Weston Green

Rest Centres	EBC has a designated primary rest centre in Thames Ditton Centre, on Mercer Close. Depending on the type and extent of flooding in the local area, this may be available for use as an emergency rest centre. The Multi Agency Flood Plan should be consulted for further information.	Figure B9
Infiltration SuDS Suitability	In *Sources 8 and 9*, the central part of the Settlement Area is likely to suffer very significant constraints in the widespread use of infiltration SuDS. This is especially in the areas where the water table is <3m below the ground surface. In the other parts, there may be opportunities for bespoke infiltration SuDS, although this will depend on confirmation of the depths to the water table. Where water levels are found to be <3m below the surface, this may restrict use of SuDS.	Figure B6
Site-specific FRA Guidance	Section 5 provides detailed guidance on measures to manage and mitigate flood risk, and Section 6 provides guidance on preparation of site-specific FRAs. Modelling for the Lower Mole does not include all the Ordinary Watercourse tributaries in the catchment. For development sites in close proximity to these watercourses it is likely that modelling will be required in order to determine the probability of flooding and the flood levels to inform the site-specific FRA.	Section 6
Policy Recommendations	Section 7 provides spatial planning and development management recommendations for the Borough.	Section 7

Claygate

General Information

Area	Claygate covers an area of **4.7km^2** comprising **40% urban area** and **60% Green Belt**.	
Character[63]	Claygate is a small suburban village with only 2,577 dwellings[64] and a population of nearly 7,000[65]. It is surrounded by Green Belt that gives a distinct character to the village. The area is predominately residential with two retail areas. One focused around the village green on the High Street and Church Road and the other at the Parade, the main shopping area adjacent to the station. There is also one small area currently designated as Strategic Employment Land at Claygate House, Littleworth Lane. 	
Topography	The eastern part of the Settlement Area comprises high land, at approximately 40-70mAOD. The western fringe is low lying, where the River Rythe flows north. Levels in this area are between 15-20mAOD.	Figure B1
Geology	Superficial *(Source 1)* - The Settlement Area is mainly free of any superficial deposits. Bedrock *(Source 2)* - The Settlement Area is underlain by Claygate Member (upper part of London Clay Formation (LCF) – Sand, Silt and Clay) and LCF (Silt and Clay).	Figures B2, B3
Aquifer Type	In *Source 3*, the surface is classified as unproductive strata. According to EA definitions, unproductive strata are rock strata (see bedrock) or drift deposits with low permeability that has negligible significance for water supply or river base flow. The underlying bedrock is classified as either a secondary A aquifer or unproductive strata. According to EA definitions, a secondary A aquifer is defined as a permeable layer capable of supporting water supplies on a local rather than strategic scale and in some cases forming an important source of base flow to rivers. An important factor which influences this classification in Elmbridge is the limited thickness of the layers, in particular the Claygate Member in the Claygate area.	-
Groundwater Vulnerability Classification and Source Protection Zone	In *Source 4*, the surface is made up of different bedrocks giving the Settlement Area a range of risk vulnerabilities from minor aquifer high and intermediate (Claygate Member) to non-aquifer (LCF). The EA defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. In Source 5, there are no SPZs within this Settlement Area. The EA records of smaller abstractions have not been reviewed at this stage.	-
Main Rivers	The Rythe flows northwards between Esher and Claygate in the west of the Settlement Area. One of the branches of the Rythe rises in the Prince's Coverts woodland to the south of the Settlement Area, and then flows northwards through Claygate to join the main branch of the river.	Figures B4, C13
Ordinary Watercourses	The north eastern corner of the Claygate Settlement Area is drained by a collection of drainage ditches that feed into a tributary of the Hogsmill River. The Hogsmill River passes through Kingston upon Thames and joins the River Thames near Kingston High Street.	Figures B4, C13

[63] Extracted from the Consultation Settlement ID Plans http://consult.elmbridge.gov.uk/consult.ti/Draft_ID_Plans/consultationHome
[64] Dwellings by Council Tax Band (VOA)
[65] Resident Population Estimates 2010 (ONS)

Claygate

Flood Risk

Flooding from Rivers	*Flood Zones* The Settlement Area is located within Flood Zones 1, 2, and 3 as follows: • Flood Zone 1: 4.4km^2 (94%) • Flood Zone 2: 0.2km^2 (4%) • Flood Zone 3: 0.1km^2 (2%) 94% of Claygate is defined as Flood Zone 1. 6% (0.3km^2) is within Flood Zones 2 or 3, which is all within the greenbelt area along the western edge of the Settlement Area near Milbourne Lodge Senior School. *Functional Floodplain and Climate Change* Modelling of the 1 in 20 year (5% AEP) flood event, and the impact of climate change is not currently available for the River Rythe. *Historic Records* EBC has records of fluvial flooding affecting Hare Lane and Rayleigh Drive. *Flood Defences* The Rythe is not formally defended. The Environment Agency Asset Information Management Systems (AIMS) dataset identifies high ground on either side of the watercourse.	Figure C13 Figure D13
Flooding from Land	The ROFSW identifies a higher risk of surface water flooding in the natural topographic low points in the Settlement Area and where particular barriers present an obstruction behind which surface water can collect. The mapping identifies surface water flood risk in the natural low points along the floodplain of the Rythe as well as to the east of the railway line near Horringdon Farm and in Wingham Court to the north of the village. *Historic Records* SCC have identified the following locations as known 'wetspots' which are susceptible to surface water flooding: Oaken Lane, Gordon Road, The Avenue, The Parade, Foley Road, Church Road, Coverts Road, and Littleworth Road.	Figure F13
Flooding from Groundwater	In *Sources 8 and 9*, most of Settlement Area is likely to have opportunities for bespoke infiltration SuDS. In Source 7, the water table may in certain locations have water tables <3m below ground surface. Local confirmation would be required of depth to the water table before design is considered.	Figure B5
Flooding from Sewers	During the last 10 years 1-5 properties have experienced internal flooding and 1-5 properties have experienced external flooding in the Claygate Settlement Area.	Figures B7, B8
Reservoirs, canals, other artificial sources	There are no known significant water bodies in the Settlement Area. The water supply reservoirs including Queen Elizabeth II Reservoir, Island Barn Reservoir, Bessborough Reservoir and Knight Reservoir are located to the north of the Settlement Area. The Environment Agency dataset 'Risk of Flooding from Reservoirs' shows the area that could be flooded if one of these reservoirs were to fail and release the water it holds. The extent of flooding is shown not to extend as far as the Claygate Settlement Area. There is a small waterbody known as Barwell Court Lake (owned by Rysaffe Trustee Company (C.I.) Ltd) immediately to the south of the Settlement Area that is included in the Environment Agency mapping; in the event of this watercourse releasing the water it holds, the water would follow the path of the Rythe and cause flooding in the Rythe floodplain in Claygate.	Figure B4

Managing and Mitigating Flood Risk

Flood Warning Areas	The Environment Agency operates a Flood Warning Service for areas at risk of fluvial flooding from Main Rivers. There is currently no specific Flood Warning Area associated with the River Rythe; however this may be revised following the completion of modelling study. The Flood Warning Area for the downstream catchment, into which the River Rythe drains, is 'River Thames at Thames Ditton'.	Figure B9
Rest Centres	EBC has a designated primary rest centre in Claygate Centre, on Elm Road. Depending on the type and extent of flooding in the local area, this may be available for use as an emergency rest centre. The Multi Agency Flood Plan should be consulted for further information.	Figure B9

Claygate

Infiltration SuDS Suitability	In *Source 6*, only in the eastern part of the built-up area around Claygate is classed as low risk i.e. limited potential for groundwater flooding to occur. This area coincides with an area of Claygate Member (upper part of the London Clay Formation) and from which springs may issue forth at the contact with underlying rest of the London Clay Formation.	Figure B6
Site-specific FRA Guidance	Section 5 provides detailed guidance on measures to manage and mitigate flood risk, and Section 6 provides guidance on preparation of site-specific FRAs. For sites located within or close to the floodplain of the River Rythe, results from the latest modelling study will need to be obtained from the Environment Agency to determine the probability of fluvial flooding and specific flood levels to inform a site-specific FRA.	Section 6
Policy Recommendations	Section 7 provides spatial planning and development management recommendations for the Borough.	Section 7

Appendix B Borough Scale Mapping

Figure B1	LiDAR Topographic Survey
Figure B2	BGS Superficial Geology
Figure B3	BGS Bedrock Geology
Figure B4	Watercourses and Surface Water Bodies
Figure B5	Areas Susceptible to Groundwater Flooding
Figure B6	BGS Infiltration SuDS Suitability Map (Detailed)
Figure B7	Internal Sewer Flooding
Figure B8	External Sewer Flooding
Figure B9	Flood Warning Areas and Rest Centres

Appendix C Fluvial Flood Zone Mapping

Figure C1	Fluvial Flood Zones: Weybridge (View 1)
Figure C2	Fluvial Flood Zones: Weybridge (View 2)
Figure C3	Fluvial Flood Zones: Walton-on-Thames (View 1)
Figure C4	Fluvial Flood Zones: Walton-on-Thames (View 2)
Figure C5	Fluvial Flood Zones: Hersham (View 1)
Figure C6	Fluvial Flood Zones: Hersham (View 2)
Figure C7	Fluvial Flood Zones: Cobham, Oxshott, Stoke D'Abernon and Downside (View 1)
Figure C8	Fluvial Flood Zones: Cobham, Oxshott, Stoke D'Abernon and Downside (View 2)
Figure C9	Fluvial Flood Zones: Cobham, Oxshott, Stoke D'Abernon and Downside (View 3)
Figure C10	Fluvial Flood Zones: East and West Molesey
Figure C11	Fluvial Flood Zones: Esher
Figure C12	Fluvial Flood Zones: Thames Ditton, Long Ditton, Hinchley Wood and Weston Green
Figure C13	Fluvial Flood Zones: Claygate

Appendix D Modelled Flood Outlines

Figure D1	Modelled Flood Outlines: Weybridge (View 1)
Figure D2	Modelled Flood Outlines: Weybridge (View 2)
Figure D3	Modelled Flood Outlines: Walton-on-Thames (View 1)
Figure D4	Modelled Flood Outlines: Walton-on-Thames (View 2)
Figure D5	Modelled Flood Outlines: Hersham (View 1)
Figure D6	Modelled Flood Outlines: Hersham (View 2)
Figure D7	Modelled Flood Outlines: Cobham, Oxshott, Stoke D'Abernon, Downside (View 1)
Figure D8	Modelled Flood Outlines: Cobham, Oxshott, Stoke D'Abernon, Downside (View 2)
Figure D9	Modelled Flood Outlines: Cobham, Oxshott, Stoke D'Abernon, Downside (View 3)
Figure D10	Modelled Flood Outlines: East and West Molesey
Figure D11	Modelled Flood Outlines: Esher
Figure D12	Modelled Flood Outlines: Thames Ditton
Figure D13	Modelled Flood Outlines: Claygate

Appendix E Historic Flooding Incidents

Figure E1 Historic Flood Incidents (View 1)
Figure E2 Historic Flood Incidents (View 2)
Figure E3 Historic Flood Incidents (View 3)
Figure E4 Historic Flood Incidents (View 4)

Appendix F Surface Water Flood Risk Mapping

Figure F1 Risk of Flooding from Surface Water: Weybridge (View 1)
Figure F2 Risk of Flooding from Surface Water: Weybridge (View 2)
Figure F3 Risk of Flooding from Surface Water: Walton-on-Thames (View 1)
Figure F4 Risk of Flooding from Surface Water: Walton-on-Thames (View 2)
Figure F5 Risk of Flooding from Surface Water: Hersham (View 1)
Figure F6 Risk of Flooding from Surface Water: Hersham (View 2)
Figure F7 Risk of Flooding from Surface Water: Cobham, Oxshott, Stoke D'Abernon, Downside (View 1)
Figure F8 Risk of Flooding from Surface Water: Cobham, Oxshott, Stoke D'Abernon, Downside (View 2)
Figure F9 Risk of Flooding from Surface Water: Cobham, Oxshott, Stoke D'Abernon, Downside (View 3)
Figure F10 Risk of Flooding from Surface Water: East and West Molesey
Figure F11 Risk of Flooding from Surface Water: Esher
Figure F12 Risk of Flooding from Surface Water: Thames Ditton
Figure F13 Risk of Flooding from Surface Water: Claygate

Appendix G Data Register

	Dataset Description	Source	Format	Benefits / Limitations
Fluvial	Flood Map for Planning (Rivers and Sea) Flood Zones 2 and 3	Environment Agency Geostore* (*available to the public on the Environment Agency website)	GIS Layer	A quick and easy reference that can be used as an indication of the probability of flooding from Main Rivers. The original Flood Map was broad scale national mapping typically using JFLOW modelling software that is generally thought to have inaccuracies. This is regularly updated with the result of new modelling studies. For those rivers where there is no updated modelling, the Flood Zones from JFLOW modelling may not provide an accurate representation of probability of flooding. Typically watercourses with a catchment area less than 3km^2 are omitted from Environment Agency mapping unless there is a history of flooding affecting a population. Consequently there will be some locations adjacent to watercourses that on first inspection, suggest there is no flood risk.
	Detailed River Network (DRN)	Environment Agency Geostore	GIS Layer	Identification of the river network including Main Rivers and Ordinary Watercourses for which the Environment Agency and Surrey County Council have discretionary and regulatory powers.
	Modelled flood outlines for River Wey	Environment Agency	GIS Layer	Detailed and calibrated hydraulic model outlines that have been mapped using LiDAR (1m and 2m resolution). The Environment Agency applies the outcomes from these detailed modelling studies to update the Flood Map for Planning (Rivers and Sea) on a quarterly basis. Some watercourses have not been modelled (e.g. some of the tributaries of other the Main Rivers). The flood risk from these is based on broad scale JFLOW modelling and therefore the flood risk from these cannot be as accurately assessed.
	Modelled flood outlines for River Thames	Environment Agency	GIS Layer	
	Modelled flood outlines for Lower Mole	Environment Agency	GIS Layer	
	Modelled flood outlines for Middle Mole	Environment Agency	GIS Layer	
	Modelled flood outlines for Dead River	Environment Agency	GIS Layers	
	Modelled flood outlines for River Rythe	Environment Agency	GIS Layers	
	Asset Information Management System (AIMS) for the Borough	Environment Agency	GIS Layer	Shows where there are existing defences, structures, heights, type and design standard. However many fields contain default values.
Surface Water	'Risk of Flooding from Surface Water' dataset	Environment Agency Geostore	GIS Layer	Provides an indication of the broad areas likely to be at risk of surface water flooding, i.e. areas where surface water would be expected to flow or pond. This dataset does not show the susceptibility of individual properties to surface water flooding.
	GIS layer of any highways ditches and other ordinary watercourses	SCC	GIS Layer	Identifies ditches that are maintained by Surrey County Council in their role as Highways Authority.
	'Wet spots' dataset	SCC	GIS Layer	The wetspot database is continually updated to produce a comprehensive map and record of all the reported wetspots in Surrey. Information from Surrey risk management authorities informs the database. SCC currently prioritises capital works at wetspots throughout the county based on a number of factors. These factors include safety, internal property flooding, social impact and duration of flooding.
Ground water	GIS layers of the geology across the borough	EBC	GIS Layer	Illustrates bedrock and superficial geology across the Borough.

	Dataset Description	Source	Format	Benefits / Limitations
	Groundwater Vulnerability Classifications	Environment Agency Geostore	GIS Layer	Broadly shows extents of aquifers in the Borough. Where aquifers are highly vulnerable, they often have a more permeable covering and, together with dry valley and watercourse networks, potential groundwater flooding areas can be identified. Dataset used in assessment described in Sec 3.5.
	GIS layer of Source Protection Zones	Environment Agency Geostore	GIS Layer	Shows the areas where the groundwater is protected by the Environment Agency. The designation may not consider fractures in the strata at a greater radius where pollutants could reach the source protection zone.
	Aquifer Designation Maps for Bedrock and Superficial	Environment Agency Geostore	GIS Layer	A polygon shapefile that shows aquifer designations for bedrock aquifers. The designations identify the potential of the geological strata to provide water that can be abstracted and have been defined through the assessment of the underlying geology.
	GIS layer of bedrock and superficial geology	British Geological Survey	GIS Layer	A polygon shapefile that shows aquifer designations for superficial aquifers. The designations identify the potential of the geological strata to provide water that can be abstracted and have been defined through the assessment of the underlying geology.
	GIS layer 'Infiltration SuDS Map'	British Geological Survey	GIS Layer	Dataset produced by the BGS of relevance to professionals who make decisions on SuDS design, construction and approval. The maps will help: (1) make preliminary decisions on the suitability of the subsurface for infiltration SuDS; (2) make preliminary decisions on the type of infiltration SuDS that will likely be appropriate; (3) assess SuDS planning applications to determine whether the necessary factors have been considered; and (4) determine whether infiltration SuDS could be appropriate where a non-infiltrating SuDS technique has been proposed.
	GIS layer 'Susceptibility to Groundwater Flooding'	British Geological Survey	GIS Layer	Dataset produced by BGS showing areas susceptible to groundwater flooding on the basis of geological and hydrogeological conditions. Suitable for broad scale assessment such as the SFRA.
Sewer	Register of sewer flooding incidents, by post code area.	Thames Water	MS Word Doc	Indicates post code areas that may be prone to flooding as have experienced flooding in the last 10 years due to hydraulic incapacity. However, given that TWUL target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding. It should be noted that these are flooding incidents that have been reported to TWUL by the home owners. This will not account for any incidents that don't get reported and therefore do not show on the register. Incidents of sewer flooding can be retrospectively reported to TWUL via their website – http://thameswater.co.uk/help-and-advice/9782.htm.
Historic Flooding	Highways Enquiries	SCC		Identifies locations where SCC has received enquiries or had reported problems relating to their highways.
	Internal Records of Property Flooding	SCC		Historic records of internal property flooding in the Borough. The date and source of flooding is unknown.
	External Records of Property Flooding	SCC		Historic records of external property flooding in the Borough. The date and source of flooding is unknown.

	Dataset Description	Source	Format	Benefits / Limitations
	Historic Flooding Incidents	SCC		Historic records of fluvial flooding in the Borough. These incidents are from the Winter 2013/2014 and provide details of the source and date of occurrence.
	Historic Flood Records	EBC	GIS Layer Excel Sheet Email	Identifies road locations where properties have experienced flooding in the past and are therefore likely to experience flooding in the future without intervention. This data does not identify whether the flooding was internal or external (i.e. flooding of gardens) and the exact source of flooding. However all the locations are in close proximity to Main Rivers and therefore the source is assumed to be fluvial flooding from Main Rivers.
	Fluvial Flood Records	Environment Agency	.csv file	Historic records of fluvial flooding in the Borough. These incidents are from the years 2000, 2003 and 2014 and provide details of the source and date of occurrence. Properties on 9 roads in the Borough were affected.
	Historic Flood Map	Environment Agency Geostore	GIS Layer	A single GIS layer showing the extent of fluvial historic flood events created using best available information at time of publication. However, some of the data is based on circumstantial and subjective evidence. There is not always available metadata, e.g. date of flood event.
Other	LiDAR data (DTM, ASCII)	Environment Agency Geomatics Group	GIS ASCII	Provides a useful basis for understanding local topography and the surface water flood risk in the area. Spatial resolution of 1m. Accuracy of +/- 0.25m. The Environment Agency's LiDAR data archive contains digital elevation data derived from surveys carried out since 1998.
Emergency Planning	GIS layer of emergency planning rest centres for the borough	EBC	GIS Layer	Locates the rest centres in the Borough and their level of risk in relation to surface water flooding.
	Flood Warning Areas	Environment Agency Geostore	GIS Layer	Indicates which areas are covered by the flood warning system.
	National Receptor Database (NRD)	Environment Agency Geostore	GIS Layer	Spatial dataset which contains a number of layers categorised into the themes of Buildings, Transport, Utilities, Land Use, Agriculture, Heritage, Environment and Miscellaneous. Each information theme contains a number of relevant data layers.
Planning	OS Mapping of Elmbridge administrative area (1:10K, 1:50K, OS Master Map)	OS via EBC	GIS Layer	Provides background mapping to other GIS layers. Designed for use at 1:50K and 1:10K scales.
	GIS layer of administrative boundary	EBC	GIS Layer	Defines the administrative area of the Borough for mapping purposes.
	GIS layer of post code boundaries	EBC	GIS Layer	Delineates post code boundaries for the Borough. Enables mapping of Thames Water datasets which are provided by post code sector.
	GIS layer of 8 Settlement Areas	EBC	GIS Layer	Defines the 8 Settlement Areas across the Borough.
	Aerial photography	EBC	GIS Raster	Provides useful background information and understanding of the study area. Flown in 2010.

Dataset Description	Source	Format	Benefits / Limitations
Greenbelt areas in the Borough	EBC	GIS Layer	Delineates areas of greenbelt in the Borough that can aid identification of floodplain areas that should be safeguarded from development.
Urban areas in the borough	EBC	GIS Layer	Delineates urban areas in the Borough to inform Settlement Area schedules.

Historic Flood Records

Source Organisation	Road Names
EBC	Identification of 33 road locations where there have been incidents of flooding during the years 1970, 1987, 1988, 1993, 1994, 1995, 1996, 1997, 2000, 2001, 2002, 2003 and 2014. This data does not identify whether the flooding was internal or external (i.e. flooding of gardens) and the exact source of flooding. However all the locations are in close proximity to Main Rivers and therefore the source is assumed to be fluvial flooding from Main Rivers. This dataset is included on Figures C1-C13 (Appendix C) and the road names are listed below: *Garricks Ait, Hampton Court Crescent, Hurst Road, Riverbank, Riverside, Molember Road, Feltham Avenue, Beasleys Ait, Felix Lane, Wheatley's Eyot, Albany Reach, Alexandra Road, Aragon Avenue, Queens Road, Riverbank, Thames Ditton Island, Carlton Road, Vicarage Fields, Waterside Drive, Dorney Grove, Walton Lane (inc Desborough Island), Church Walk, Glencoe Road, Radnor Road, The Willows, Wey Road, Whittets Ait, Brooklands Road, Connaught Drive, Davis Road, Eyston Drive, A246, Dunfee Way, Drake's Close, Rayleigh Drive, Hare Lane, Littleworth Road, Couchmore Avenue, Portsmouth Road, Riversdale Road.*
SCC	SCC has provided a GIS layer of 'wetspots' throughout the Borough. 'Wetspot' is a term used by SCC as the LLFA to describe the location of a surface water flood 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 a number of 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. This dataset is included on Figures D1-D13 (Appendix D) and the road names are listed below: Ashley Road, Balfour Road, Blundel Lane, Bookham Road, Brooklands Road, Burhill Road, Burwood Road, Burwood Road, Byfleet Road, Church Road, Coverts Road, Fairbourne, Fairmile Lane, Fairoak Lane, Farm Road, Feltham Avenue, Foley Road, Gordon Road, Grotto Road, Hanger Hill, Hansler Grove, Hare Lane, Heathside, Hersham Road, Horsley Road, Hurst Road, Lebanon Drive, Littleworth Road, Littleworth Road, Matham Road, Mill Road, Mills Road, Molesey Road, Molesey Road, Oaken Lane, Oatlands Chase, Oatlands Drive, Old Heath Road, Pantile Road, Park Lawn Road, Plough Lane, Portmore Park Road, Portsmouth Road, Princes Road, Prospect Road, Queens Road, Rydens Road, Sandy Lane, Sheath Lane, Speer Road, St Peters Road, Station Road, Stoke Road, Stonebanks, Tartar Road, Temple Market, Terrace Road, The Avenue, The Parade, Walton Lane, Walton Road, Watts Road, West End Lane, Wey Road, Winterdown Road, Woodlands Lane, Woodstock Lane South. SCC has also provided records of their Highways Enquiries GIS layer which identifies locations where SCC has received enquiries or had reported problems relating to their highways. SCC has also supplied their records of internal and external flooding GIS layers which contain road locations of flooding. The source and date of flooding is unknown. SCC's Historic Flooding Incidents GIS layer shows the road locations affected by Winter 2013/2014 flooding.

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